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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.

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Cover: Urnes brooch, Type 1. ASR 440x528 (Article from Søvsø and Vrångmose, fig. 10, Photo: SJM/HBC).

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Editorial

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

The editorial team is happy to present the 2020 volume of Danish Journal of Archaeology.

Thanks to generous funding from Elisabeth Munksgaard Fonden and Farumgaard-Fonden, we have this year been able to acquire the rights to the back issues of the journal from the previous publisher Taylor & Francis. We are now preparing a major upload for early 2021, which will provide you with open access to all previously published articles, which up until now have been behind a pay wall. This applies to the complete series of the Journal of Danish Archaeology published annually from 1982 to 1991 and in the following years, 1993, 1995, 1997 and 2006. It also applies to Danish Journal of Archaeology, which was published by Taylor & Francis in the period 2012-2018. We will therefore provide open access to approximately 350 articles. The articles involve a range of up-to-date research questions based on archaeological data, methods and theories developed over decades of investigations and fieldwork. They therefore present various priorities within antiquarian frameworks and research interests over almost 40 years of archaeology, primarily in Southern Scandinavia.

The authors in this volume are mainly from Denmark, but also Norway and Sweden, as well as Ireland, Northern Ireland and England. We are happy to introduce nine articles presenting new research, ranging from Neolithic hoarding to resilient land use in a Medieval and Early Modern village.

We begin this volume with a study by Sørensen, Bjernevad and Bye-Jensen of the tradition of hoarding flint axe heads, which is a widespread phenomenon within the early agrarian societies of Northern Europe. Based on detailed analyses of four well-documented hoards from the southern Limfjord area in northern Jutland, Denmark, the authors are able to construct biographies for the deposited axe heads and shed new light upon the hoarding practices of Funnel Beaker societies.

Next, there is a study by Felding et al. of mobility in the Early Nordic Bronze Age (c. 1500-1100 BC) and male social roles. The starting point for this study are two male graves from south-east Jutland and it includes thorough archaeological analyses of the grave goods, radiocarbon dating and strontium isotope analyses. These investigations are combined with regional network analyses, revealing differentiated roles among men within the upper social echelons. The authors are able to distinguish a minimum of three different types of warriors, which reflect social roles in war and society.

The following article by van der Sluis et al. focuses upon a diachronic study of strontium isotope analysis and incremental stable isotope analysis, combined with new ^{14}C dates of human remains from the Limfjord area. The aim of the article is to identify the presence of non-local, as well as local, individuals combined with the socio-economic and cultural changes occurring in the Limfjord area, which is considered a natural communication hub during prehistoric times. This results in a documentation of many local individuals, thus presenting new data for the local strontium isotope baselines within this region, as well as identifying non-local individuals from the Neolithic and later part of the Iron Age and Viking Age. Incremental stable isotope analysis of tooth dentine reveals the individual age at the time of movement. Combining all these methods enables reconstruction of changes in the diet and mobility of the individuals, which can be used to undertake more detailed dissemination of these individual human bibliographies.

In 2002, an excavation at Fuglsøgaard in eastern Jutland uncovered a bog sealed by colluvium. This provided a unique opportunity to study the preserved bog environment. In their article, Mortensen et al. explore the nature of the development of the landscape and the bog, as well as the evidence of peat cutting and ritual practices dating to the Pre-Roman Iron Age that the excavation revealed.

In the next article, Christiansen presents an analysis of Late Iron Age and Medieval changes in settlement patterns and land exploitation based on finds recovered from decades of metal detecting at Nørholm in northern Denmark. The article demonstrates a model for how metal objects recovered from the ploughsoil at metal-rich sites can be used in detailed, chronological mapping and spatial studies.

In the following article, Ulriksen et al. examine the placement of the new ring fortress Borgring. Through a discussion of its architecture and location, compared to contemporary sites and their relation to traditional power centres, the authors argue that the ring fortresses functioned as a symbolic manifestation of a new order in society, which was established during the reign of King Harald Bluetooth.

Next comes a study by Lund of the material qualities of non-iconographic rune stones from the period AD 900-102. The author shows how they link the living, deceased and places in late pagan and early Christian Scandinavia via their material qualities, the spatial aspects of the inscriptions, references to the surrounding landscape and their bodily effects upon their readers.

The article by Søvstø and Jensen investigates recent and very rare discoveries of two jewellers' workshops in respectively Ribe and Aalborg, which

produced small brooches with Christian motives dating to the period c. AD 1050-1150, such as Urnes brooches, bird-shaped brooches and circular animal brooches. The archaeological contextualisation provides new and important insight into production and craftsmanship, Christian organisation, missionary activity, and the distribution and symbolic meaning of these common metal-detector finds over most of Denmark.

In the final article, Lagerås and Magnell explore land use in the Medieval and Early Modern village of Fjellie in southern Sweden, during the period AD 1000–1800. Based upon plant macrofossils, pollen, animal bones and strontium isotopes from three farmsteads in the village, and compared to other villages in the region, they demonstrate a highly resilient and sustainable combination of collective and individual agricultural systems, as well as resource management, throughout the period.

A number of articles are already being worked upon for the next volume 10, 2021, and we encourage authors to submit research articles, as well as debate articles (3000 words) and brief communications (2000 words), on new discoveries and research questions, methods and theories, together with projects from the field, laboratories, libraries and their desks.

We hope you will enjoy this volume!
The editorial team

A biographical study of Neolithic hoarding: A regional case study of Funnel Beaker Culture hoards from the Southern Limfjord area, Denmark

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ABSTRACT

The tradition of hoarding axeheads is a well-known phenomenon within the first agrarian societies on the North European Plain. Unfortunately, the majority of known hoards have been found as stray finds or under circumstances with poor or no documentation, leading to considerable source critical issues. However, in this paper we analyze four hoards that have either been professionally excavated or have had their find circumstances recorded and found within the same geographical area along the southern Limfjord region of Denmark. The detailed contextual information is used as a foundation for interpreting the hoards and to question the oft-repeated dualistic categorization of hoards as wetland or dryland phenomena. The analytical method employed in this study uses micro- and macro-scopic observations to create biographies for the axeheads in order to shed new light on hoarding practices. This approach challenges the previous macro-scale approaches, which has resulted in extensive catalogues and generalized interpretations of the hoarding practice within TRB society. The results in the study provide a detailed insight on production, use-life, exchange and deposition of axeheads in hoards within the TRB. The aim of the paper is to forward this analytical approach and to offer a fresh perspective on the TRB hoards.

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Hoarding; Funnel Beaker Culture; Object biography; Practice theory; Neolithic; Ritual

Introduction

The hoarding practices of the Funnel Beaker Culture (TRB) are well known within the archaeological community and by amateurs alike, due to several major and macro-regional studies since the 1880's, covering a variety of object types like amber, stone axes and bog pots (eg. Ebbesen 1995; Karsten 1994; Koch 1998; Müller 1886; Nielsen 1977; Rech 1979). A central element within these depositional practices is the hoarding of axeheads. Several hundred of such hoards have been found dating to the TRB in Southern Scandinavia, peaking around the Early Neolithic II (c. 3500-3300 BC) (Karsten 1994, 103-104; Nielsen 1977; Rech 1979, 30-40). The wetland depositional context of a majority of the hoards, coupled with the careful arrangement of some hoards and the often unusually large size of the deposited axeheads has often been used to interpret such features as votive offerings (e.g. Brøndsted 1957, 196-197; Olausson 1983; Rech 1979, 78-92; Tilley 1996, 101-2; Wentink 2006, 42).

A large majority of hoards are found as stray finds during activities such as cultivation or peat cutting. Information regarding content and find context are often inadequate and source critical issues abound (Kristiansen 1985; Nielsen 1985). In addition, the macro-regional perspectives, while important and useful, risk overlooking some of the inherent variability within the practice, as individual hoards or regionalized variations have not been the focus. In this paper, we aim to address these two issues within hoarding research by (I) taking a micro-regional perspective on TRB hoarding, and by (II) only addressing hoards that are comparatively well documented. Within the last 18 years, Viborg Museum have excavated two hoards and documented the find spot and circumstances of one additional hoard. Combined with a hoard excavated by Holstebro Museum in 1972, four professionally documented hoards within the same region along the southern border of the Limfjord in Central Jutland are included in this study (Figure 1).

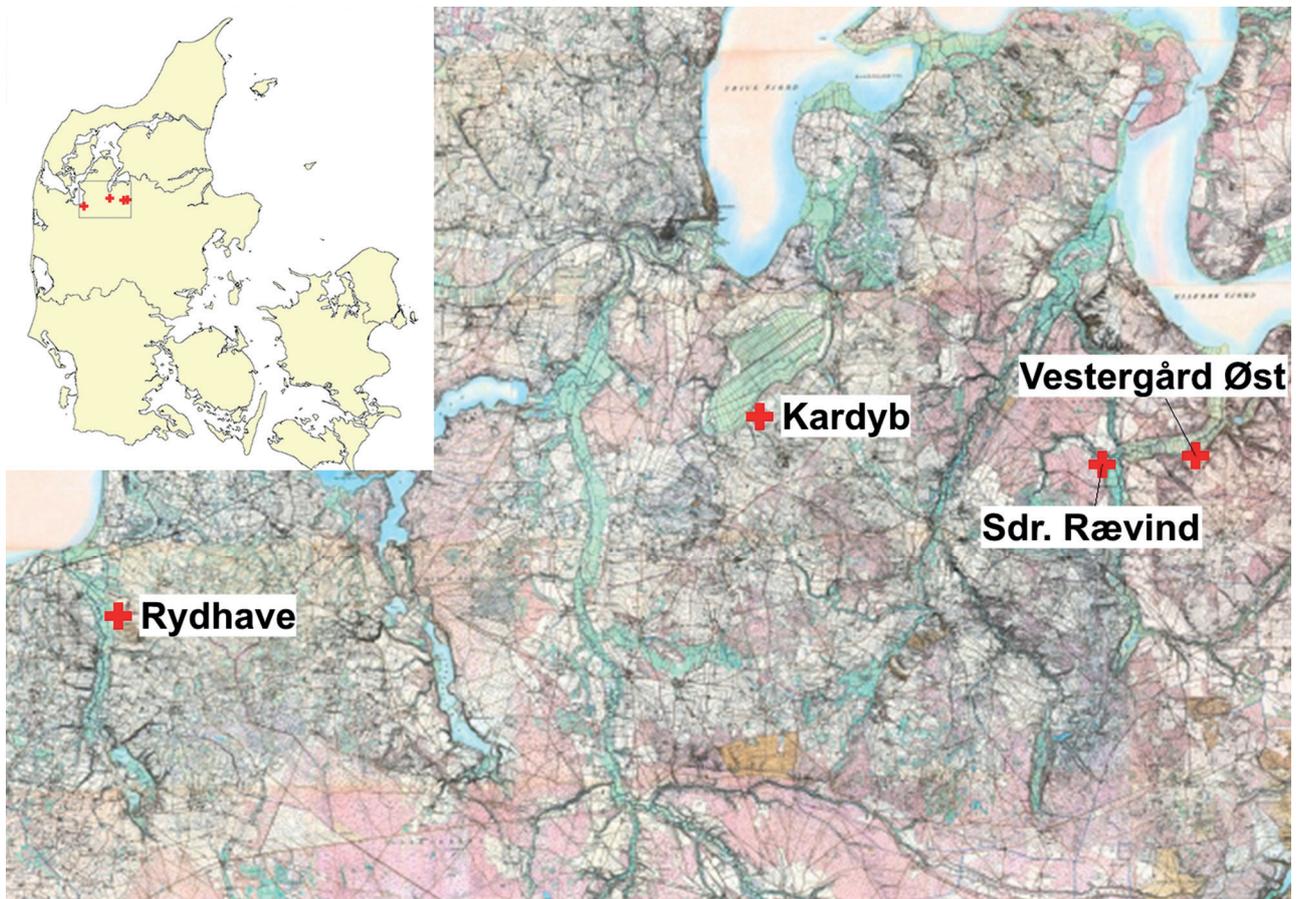


Figure 1. Case study area and distribution of the find spots of the hoards included in this paper. Background: Høje Målebordsblade, drawn before draining was industrialized, thus displaying a more natural extent of wetland areas prior to modern draining (Map: © Styrelsen for Dataforsyning og Effektivisering).

Along with the rich contextual information, all of the hoards are typologically dated approximately within the same chronological frame: the later phase of the Early Neolithic and the first phase of the Middle Neolithic (c. 3500-3100 BC). Beside the valuable contextual information, the knowledge on how the axeheads have been handled since they were found is also very important, as archaeological wear traces can be disturbed through handling, storage or exhibition etc. (Wentink 2006, 59). Thus, the combination of contextual information, a reasonably tight chronology and limited geographic spread provide an excellent inferential foundation for analyzing these hoards. Together, these deposits provide a rare opportunity to add considerable insights into a Neolithic hoarding practice on a regional scale and for a limited time splice. This study aims to release this potential by focusing on detailed lithic analyses with microscopic and macroscopic observations, brought together to create biographies for the axeheads as

well as the assembled hoards. While the approach should be considered new regarding the research of Neolithic hoards in a Danish perspective, similar studies has previously been conducted in the Netherlands (Wentink 2006; Wentink et al. 2011), as well as similar studies performed on Scandinavian Mesolithic hoards (Bjørnevad Forthcoming a; Forthcoming b).

This approach challenges the former line of research into Neolithic axeheads in Danish archaeology, which has had a focus on forming typo-chronologies (Højlund 1975; Nielsen 1977; 1979) or on manufacturing processes (Hansen & Madsen 1983; Madsen 1984). Furthermore, axe hoarding has largely been treated as a part of broader, macro-regional perspectives (e.g. Nielsen 1977; Rech 1979; Sørensen 2014). In seeking overarching patterns, such studies often ignore or downplay regional variability as well as idiosyncrasies within material culture and practice. In the proceeding sections we will begin by outlin-

ing the theoretical and methodological approach used in this paper. After which, we move on to the main corpus of the paper with a description of the case study area, the analyzed hoards and the results of the biographically based analyses. Finally, we summarize and contextualize our results, and by doing so, put forward new interpretations which both adds important nuances to our understanding of the hoarding practices and more broadly it allows us to question some of the previous truisms regarding the Southern Scandinavian Funnel Beaker Culture.

Theoretical and methodological approach: Between things, biographies and practices

The epistemological challenges of studying prehistoric ritual practices have been extensively debated – with varying optimism (e.g. Brück 1999; Fogelin 2007; Fontijn 2002, 13-22; Levy 1982, 12-25). Fully cognizant of the difficulties associated with interpreting prehistoric hoarding, this paper is grounded in practice theory (Bell 1992; 1997; Berggren 2010; Berggren and Stutz 2010; Stutz 2003). Thus, we do not put forward claims as to what the hoards may represent or mean, but instead emphasize the robust identification of actions and the temporality of practice. These hoarding practices, therefore, are not treated as singular events of deposition, but rather as long sequences of acts that make up the entire practice. To better understand the strategies and actions employed during the hoarding practice, and to understand the practices as completely as possible, it is important to study these using a biographical perspective. This perspective is based on an extension of the commonly applied object biography, where objects are perceived to have an inherent cultural biography (Kopytoff 1986) based on different stages and events within their ‘lives’. To better understand the biography of the objects from the hoards, each axehead was analysed macroscopically and microscopically (using a Dino-lite USB portable digital microscope at 20-220x magnification) to identify any observable traces of the manufacturing processes, use, re-use and further treatments of the axeheads prior to deposition. These results

were then interpreted based on prior use-wear studies by Dr. Peter Bye-Jensen and by other researchers (Bye-Jensen 2016, 2019; Jensen 1994; Keeley 1980; Rots 2002; Van Gijn 1990; Van Gijn 2010). This approach allows more detailed observations than those normally gathered in studies on Neolithic axehead hoards from Scandinavia, where the comprehensive studies have focused on generalized patterns or divisions (Karsten 1994; Nielsen 1977; Olausson et al 2012; Rech 1979, 22).

Instead of only focusing on the biography of objects, we here develop a focus on the biography of the deposited assemblage. This biographical approach combines observations about the manufacturing, use, curation, re-use and overall treatment of the individual axeheads, and the assembling of the objects together and their eventual deposition in particular locations as a hoard. The aim is to identify all observable stages of the practice rather than focusing only on the final act and the composition of the hoard. When possible, equal weighting is placed on the treatment of objects prior to deposition as well as the composition and context of these evidently ritualised practices. By deploying an extended biographical approach, we seek to better understand the relative patterning, individualization and variability of societal rules or norms governing practices of production, exchange, use and deposition.

Case study: The southern Limfjord Area

The following section will present the details from the analyses of the axeheads from the hoards as a case study, with a brief overview of the axeheads in Table 1.¹

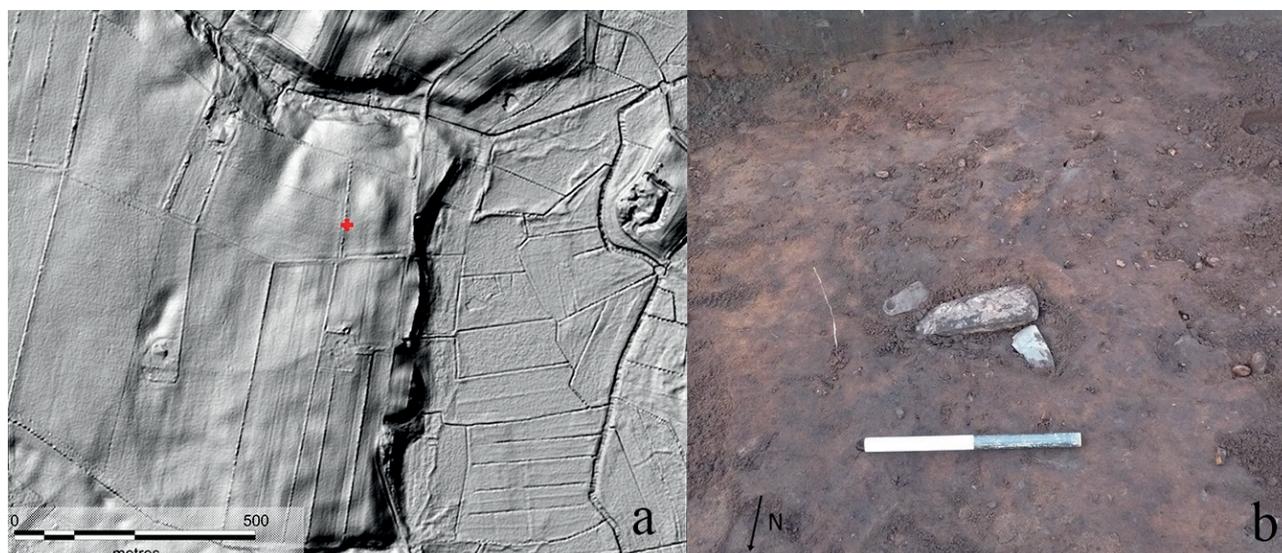
Sønder Rævind

The hoard from Sønder Rævind was found during a trial excavation in 2012 prior to laying a power cable underground.² It was found just below the modern-day plow layer at the edge of a small natural hollow, situated just west of a small hillock (Figure 2 a and b).³ The hollow was about 5-10 cm deep and appeared as a dark brownish layer, which likely derives from decomposed peat. Approximate-

Hoard	Number	Raw Material	Polished	Axehead Type	Length cm	Context
Sønder Rævind	1	Flint		Thin-butted, Type VI	27	Natural hollow, possibly seasonally dry/wet
Sønder Rævind	2	Flint	X	Thin-butted, Type VI	13	Natural hollow, possibly seasonally dry/wet
Sønder Rævind	3	Greenstone	X	Thin-butted with perforated butt, Type III	11	Natural hollow, possibly seasonally dry/wet
Sønder Rævind	4	Greenstone	Partially	Thin-butted, Type IIA	19	Natural hollow, possibly seasonally dry/wet
Kardyb	1	Flint	X	Thin-butted, Type IV	50.5	Peat filled gully
Kardyb	2	Flint	X	Thin-butted, Type IV	(35)	Peat filled gully
Rydhave	1	Flint	X	Thin-butted, Type IV	32.4	Peaty shoreline of a river-valley
Rydhave	2	Flint	X	Thin-butted, Type IV	37.7	Peaty shoreline of a river-valley
Rydhave	3	Flint	X	Thin-butted, Type IV	36.8	Peaty shoreline of a river-valley
Rydhave	4	Flint	X	Thin-butted, Type IV	35.4	Peaty shoreline of a river-valley
Rydhave	5	Flint	X	Thin-butted, Type IV	44	Peaty shoreline of a river-valley
Rydhave	6	Flint	X	Thin-butted, Type IV	34.9	Peaty shoreline of a river-valley
Vestergård Øst	151	Flint		Thin-butted, Type V	18.1	Dryland, possible settlement
Vestergård Øst	152	Flint		Thin-butted, Type V	21.3	Dryland, possible settlement

Table 1. Overview of the axeheads from each hoard presented in the paper. The typology of the flint axeheads are based on Nielsen 1977 and the greenstone axe typology is based on Ebbesen 1984.

Figure 2. Location of the Sønder Rævind hoard with a LiDAR map from 2007 as background. b) Photo of the hoard *in situ*, SR4 had been removed by the machine excavator but was recovered afterwards (Map: © Styrelsen for Dataforsyning og Effektivisering. Photo: Lars Agersnap Larsen, Viborg Museum).



ly 30-40 meters away a small cluster of postholes were found, but no artifacts were found during excavation of the features, making it unclear whether they are contemporary with the hoard (Figure 3).

Given the circumstances being found just on the edge of a small hollow that could have been seasonally wet and dry, means that the hoard could be interpreted to have been deposited in an area that is the combination of a dryland and wetland context. As seen on Figure 2b, the axeheads appear not have been placed in any particular arrangement. However, as the hoard was disturbed by the machine excavator, including the accidental removal of SR4, the original position of only three of the axeheads is known. Of these three undisturbed axeheads, SR1 and SR3 were lying with their edges facing WSW and one SR2 was placed facing SSE.

The hoard consists of a large complete flint axehead, a smaller flint axehead, a small greenstone axehead with perforated butt and a large thin-butted greenstone axehead (Table 1; Figure 4, 5), and is to the authors' knowledge a unique combination of axehead types (cf. Karsten 1994; Larsen 2015, 131-132; Nielsen 1977; Sørensen 2017). Typologically, the hoard can be dated to the transition from the Early Neolithic to the Middle Neolithic TRB culture around 3300-3100 BC (cf. Ebbesen 1984; Nielsen 1977).

The biographies of the axeheads are as varied as their typological composition. SR1, which is entirely unpolished, shows no traces of use. In addition, no traces of weathering from wind, water or sun were observed (cf. Bye-Jensen 2019, Bye-Jensen forthcoming). The lack of weathering suggests that either the axehead was deposited very soon after it was produced, or it was protected from such weathering. The possibility that this axehead was protected from these elements, may be supported by the observation that the edge of the axehead was extremely rounded (Figure 6) and not sharp as should be expected if it had been completely unused; nor would such rounding likely have occurred during any sort of use. Similar observations have been made in the Netherlands, that have been interpreted to have been caused by extensive wrapping and unwrapping in some sort of organic material (Wentink 2008, 156). However, there was no observable rounding on any of the sides or prominent points of

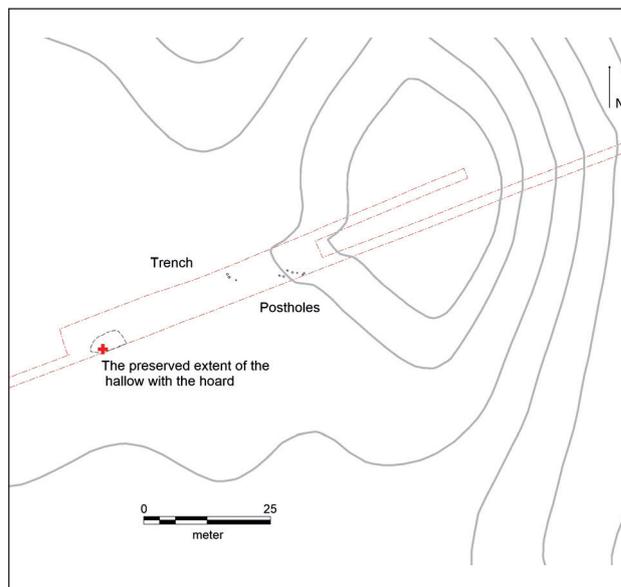


Figure 3. Excavation plan of Sønder Rævind. The features found illustrated, the grey lines illustrating horizontal topographic contour (50 cm). The red cross marks the find-spot (From the original documentation at Viborg Museum).



Figure 4. The flint axeheads from Sønder Rævind. Left: SR1, right SR2 (Photo: Casper Sørensen, Viborg Museum).



Figure 5. The stone axeheads from Sønder Rævind. Left: SR3, right: SR4 (Photo: Casper Sørensen, Viborg Museum).

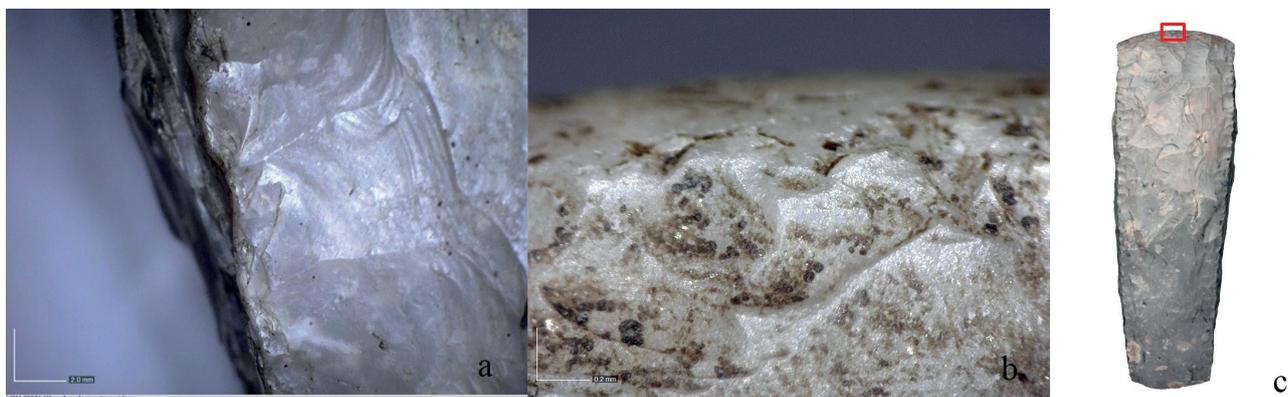


Figure 6. Rounding of blade portion of axehead SR2, 20x (a) and at 200x (b). The location of the micrographs are indicated by the red box on the photo of the entire axehead (c) (Photos: Photos: Mathias Bjørnevad, Aarhus University and Peter Bye-Jensen, Southampton University).

the axehead in this hoard, suggesting that it was not wrapped. Rather, based on these observable traces we hypothesize that the axehead may have been held in a bag (likely dry-hide) and moved repeatedly leading to the observed edge rounding. The location of the rounding suggests that the blade of the axehead was placed facing down in a bag, meaning that it received more contact with greater force than other areas of the axehead, leading to more edge rounding on the blade than elsewhere. Such observations have not been made before in Scandinavia and it would be interesting to see in the future if such traces can be identified elsewhere and can be experimentally reproduced.

SR2 is also a thin-butted flint axehead, but the cross section of this axehead is much thinner than axehead SR1, and also differs by being almost entirely polished. The skewed profile on the narrow sides suggest that the axehead was repeatedly used and re-sharpened. This extensive use of the axe-

head is also attested by the large amount of rounding present along the flake scars near the butt (Figure 7a). The rounding may have been caused by the axehead being held in a socket, that whilst hafted likely had a dryhide 'sock' around the butt of the axehead with each movement of the axehead causing the flint to rub against the socket and wrapping. No obvious traces of use were observed along the re-sharpened edge, which could indicate that it was re-sharpened and reground prior to deposition. Similar traces of re-sharpening of axeheads is seen in the hoard from Rydhave (see below) as well as many of the hoards described in Karsten (1994, 207-360), and even axes found in Dutch megaliths (van Gijn 2010, 175).

Most of the striations from the initial grinding, re-grinding and final polishing are oriented longitudinally. However, a few centimeters from the edge a series of much deeper and wider striations run transversely across a small area of the

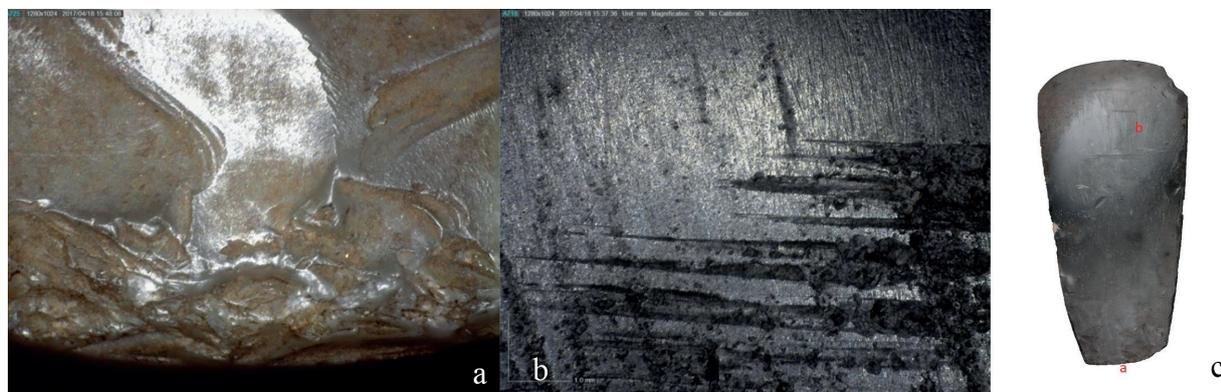


Figure 7. a) Edge rounding on butt of axehead SR2 (50x). b) Fine grinding of the SR2 that is overlain by deep and wide striations running perpendicular across the axehead (25x). c) The location of the respective micrographs are indicated by the red a and b on the photo of the entire axehead (Photo: Mathias Bjørnevad, Aarhus University).

broad side of the axehead (Figure 7b). It is unclear what caused these striations as they are restricted to areas that are highly polished and appear to have been added after the axehead was finely ground. They do not appear to be from use, they also would have no clear functional explanation, nor are they likely to have occurred post-depositionally. Given that this side of the axe was facing down, it is also unlikely that it was caused during recovery. Therefore, we interpret them as one of the last phases of the life of the axehead. We suggest that these striations were added intentionally, with great pressure, using a coarse-grained stone with a small contact area.

SR3 is a small greenstone axehead with perforated butt. The hole shows no evidence of wear from either a pendant or a shaft. These holes have been interpreted to be more symbolic in nature as they do not seem to have had any functional use (Klassen 2014a).

Due to the coarseness of the greenstone, no micro-wear traces of use were observed. However, the edge of the axehead is highly asymmetrical as half of the axehead has been significantly re-ground suggesting that it has been repeatedly used, and then was re-ground. A large crack running on the right corner of the butt extending from roughly midway along the butt ca. 3.5 cm diagonally to the edge of the axehead is also suggestive of its use (Figure 8). In addition, there is some slight damage to the butt possibly due to hard contact with the socket or the haft. As it was not possible to identify micro-wear traces and as there is no edge damage along this re-ground portion, it is not known if the axehead was used after it was re-sharpened or if its treatment was similar to SR2.



Figure 8. Photo of the butt of axe SR4. The large flake scar from an earlier crack is clearly visible, as is the crack in the bottom of the photo (Photo: Casper Sørensen, Viborg Museum).

SR4 is a thin-butted greenstone axehead that, due to the coarseness of the stone, no use-wear traces were identified. However, as the axehead appears to be unfinished and left mostly in its pecked stage, no use-wear traces are to be expected. The unfinished nature of the axehead is indicated by the presence of a 'lip' of stone that has not been removed on one side of the surviving edge (Figure 9a). On the opposing side of the axehead there is a broad curved striation running slightly diagonal to the edge of stone (Figure 9 a and b). Based on the smoothness of this striation it is interpreted that this area of the axehead had been ground in a side-to-side motion. This grinding may have been done to remove the lip, which may have originally been on both sides of the ax-



Figure 9. a) Prominent stone 'lip' on one side of the axehead SR4. b) The slightly curved area of grinding on opposing side of SR4. c) Photograph of the traces of grinding at 20x on SR4 (Photo: Mathias Bjørnevad, Aarhus University).

thead (Figure 9c). The missing corner of the axe near the edge most likely broke off accidentally by the machine excavator.

The Sønder Rævind hoard is remarkably varied in its content, the raw materials and biographies of the axeheads. However, within this variability it is possible to discern a degree of dualism within these same parameters, for example with large unused greenstone and flint axeheads, and small heavily used greenstone and flint axeheads. Furthermore, the small hollow where the hoard was found was probably mostly dry but could seasonally have been flooded and thus been temporarily wetland, which may also be seen as dualistic. Thus, with this level of duality, within the content and the context, the hoard does not seem to have been deposited based on the same structuralized template of the general hoarding practice, as observed in previous studies (cf. Karsten 1994, 171-174; Nielsen 1979; Rech 1979, 16-17).

Kardyb

The hoard from Kardyb was found in 2016 during digging of agricultural drainage ditches.⁴ When the hoard was found, Viborg Museum was contacted and conducted an excavation to search for contextual information and determine if any additional axeheads could be found. The find con-

text of this hoard is a peat-filled gully connected to the former lake, Tastum Sø (Figure 10 a and b).⁵ It was not possible to determine whether it was dug into the peat in a bog, or if the gully still had open water when it was deposited. However, the axeheads were situated in the peat and not the bottom of the bog, making it possible that they were deposited in open water. Based on report from the finders and the location of the break and scars from the machine excavator, they appear to have been deposited lying parallel to each other on the broad sides, aligned by the butts and with the edges pointing east.

The find consists of two thin-butted axeheads that are entirely polished (Figure 11). One axehead, KA1 was complete, while the other, KA2, was accidentally broken by the machine excavator upon discovery. The complete axehead is 50.5 cm long and to the authors' knowledge is the longest stone axeheads in the North Europe⁶, possibly the world. The broken axehead KA2 has a preserved length of 35 cm. Unfortunately, the edge portion of the axehead was not recovered during the subsequent excavation. However, based on the profile of narrow sides the axehead, c. 5-10 cm is missing, giving an estimated total length of 40-45 cm, and thereby still among the longest of axeheads within Southern Scandinavia.

Based on the similarity of the flint, as well as the large chalk inclusions found on both axeheads, the flint probably came from the same source. The

Figure 10. a) Location of the Kardyb hoard with a LiDAR map from 2007 as background. b) The approximate find spot during subsequent excavation by Viborg Museum (Map: © Styrelsen for Dataforsyning og Effektivisering. Photo: Mikkel Kieldsen, Viborg Museum).





Figure 11. The axeheads from Kardyb, left KA1, right KA2 (Photo: Casper Sørensen, Viborg Museum).

axeheads are also almost identical in their form and profile. However, differences in the production techniques of these axeheads may suggest that they were made by two different experienced flint knappers. For example, the negative flake scars left over from the original knapping seen on the body of KA2 are notably deeper and larger than those on KA1. On KA1 very few flake scars are still visible, as they have been ground out, whereas on KA2 many more flake scars are still apparent, especially along the seams of the axehead (See Figure 11 and 12 for a general impression). KA1 is also thicker than the KA2. In addition, the grinding near the butt of KA2 is coarser than seen on the intact axehead. It is possible that these differences in knapping and grinding, but the similarity in overall form and flint material, suggests that these two axeheads were produced by different highly skilled craftspeople that were likely working in close association with each other and had access to the same raw material. Such identification of different craftspeople and the possible situations they were working under is important to understanding the biography of such tools, and the hoards themselves.

The axeheads are completely ground, but they have no traces of further edge polishing. This left the surviving edge more irregular than many axeheads found in hoards that often have their edges more finely polished. After the axeheads had been ground, several flakes were taken off from their butts (Figure 12). Initially this butt flaking seems very similar, but upon closer inspection the angle, thickness, directionality and size of the flakes differ notably, suggesting that it was also done by

different craftspeople, but it seems they were both working off the same mental template about how it should be done and what it should look like at the end. Such flaking of the butt serves no known functional purpose, as it does not produce particularly useable flakes. Nor would there have been any known reason to slightly re-shape the butt, as based on hafted Neolithic axeheads the butt protrudes out of the handle (Becker 1947, 1950; Blinkenberg 1898). Thus, such subtle changes of the shape of the butt would serve no apparent utilitarian purpose. Based on the difference in weathering of these butt removal flake scars and the flake scars elsewhere on the axehead, it is likely that this butt



Figure 12. The butt-ends of the axeheads from Kardyb. Left: KA1, Right KA2 (Photo: Casper Sørensen, Viborg Museum).

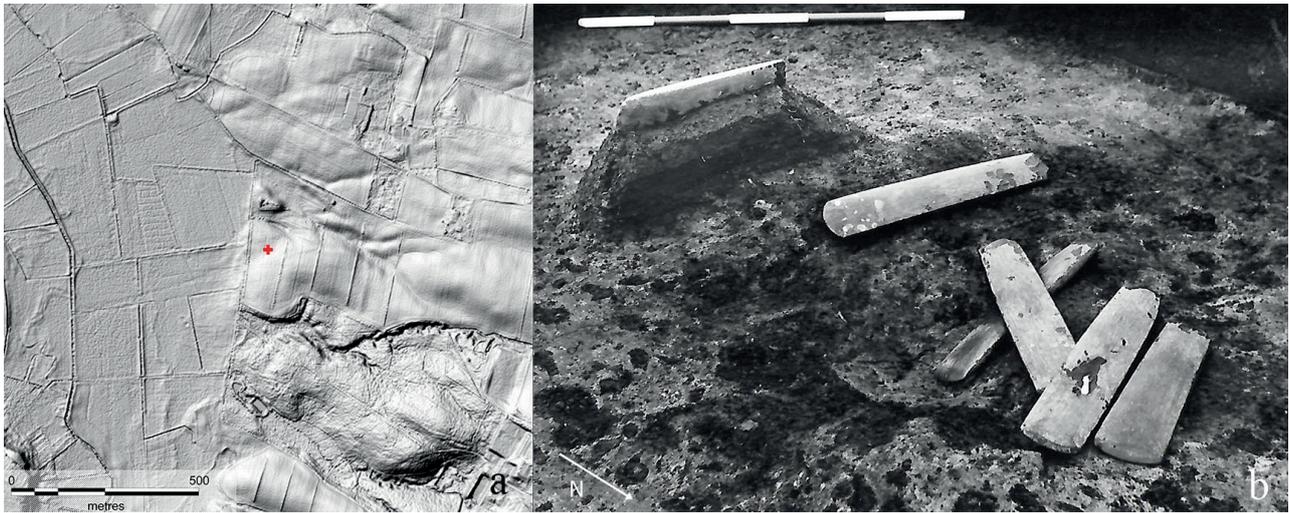


Figure 13. a) Location of the Rydhave hoard with a LiDAR map from 2007 as background. b) Photo of find situation of the Rydhave hoard (Map: © Styrelsen for Dataforsyning og Effektivisering. Photo: Holstebro Museum).

flaking took place significantly later than the initial manufacturing. In the case of the KA1, based on the lack of weathering of the butt removal flakes deems it likely that it took place not long before its deposition. However, the butt flaking scars on KA2 appear more weathered suggesting that this may have occurred at an earlier stage than the intact axe. Thus, although these axeheads were likely produced at circa the same time, their butts were re-worked at seemingly different times suggesting that the temporality of the parallel biographies of these axeheads differs.

The intact axehead KA1 shows no signs of use or re-sharpening along the edge, nor were there any observable hafting traces on either axehead. Thus, it appears that neither axehead was used prior to deposition. Given their extreme size, this result should not be considered surprising. However, as many hoards, even those containing axeheads up to 46 cm, like seen at a nearby hoard of Jegstrup Kjær (Olausson 1983, 28), contain axeheads with traces of use and/or re-sharpening, the oversized nature of such axeheads does not necessary mean that they were not or could not be used.

Unlike other axehead hoards, presented in this paper, which have divergent biographies these axeheads appear to have had parallel and symmetric biographies. Both axeheads were produced in almost identical forms, from the same flint source, albeit perhaps by different craftspeople. Neither of the Kardyb axeheads seems to have been used, but both have had flakes removed from their butts

in similar fashion but seemingly at different times and by different knappers.

Rydhave

The Rydhave hoard (Figure 13) consists of six very similar thin-butted axeheads, found by workers in 1972 when searching for damaged drainpipes with a metal probe.⁷ After finding one of the axeheads, they contacted the local Holstebro Museum, who then excavated a small trench 6m², uncovering the remaining axeheads, which were all situated within a peat layer. Given that no pit-like features were identified, it appears that axeheads were placed directly on the peat. In the original report it was suggested that they were deposited in open water in the small bay present at the time (Skov 1972a; 1972b). The axeheads were found somewhat scattered, all but one lying on the broad sides with the edges facing roughly east (Figure 13b).

At first glance, the axeheads generally appear very similar (Figure 14). This is especially the case for axeheads RY2 and RY4, where the raw material, the overall form and even the amount of cortex preserved on the butt (Figures 14, 15) are remarkably alike. In addition, the similarity in the knapping technique and coarseness of the grinding could suggest that they were produced by the same individual(s). With this near identical production, they have the same point of departure for their biographies. For example, axehead RY2 has clearly

Figure 14. The axeheads from Rydhave, showing both sides and the profile of each axehead. RY1-6 from top to the bottom (Photo: Casper Sørensen, Viborg Museum).

been re-knapped and with one face of the edge re-ground and finely polished, but with the flake scars of the re-knapping still readily visible (Figure 15). On the other hand, axehead RY4 shows no signs of re-working of the edge, has no fine edge polish, and only has a single tiny feathered flake missing from the edge. It is unclear if this edge damage is from use or accidental damage during its life or is post-depositional. Two of the remaining axeheads, RY3 and RY6, have no observable use-wear traces. However, the edge on axehead RY3 has been re-knapped on both sides of the blade, whereas the edge on RY6 appears to have been re-ground.

In the initial report it was noted that three of the axeheads, RY1, RY2, RY6, had hafting traces, visible as isolated bright spots which could be observed in the light with the right viewing angle of the axeheads (Skov 1972a). However, no secure hafting traces were observed during this current analysis. The only possible bright areas were deemed likely to be grease or from the initial grinding of the axeheads. Due to the limited observable modern handling traces on these axeheads, it is unlikely that any use-wear traces, including from hafting, had simply been removed or disturbed since the discovery of the hoard. Thus, we believe that the original observations (Skov 1972a) were erroneous classification of bright spots formed through other processes and there is no direct evidence that any of the axeheads had been hafted.

During up-close inspection of each axehead, it was observed that knapping quality, form and/or the grinding differs between axeheads RY1, RY3, RY5 and RY6 suggesting that these axeheads may not have been made by the same craftspeople or were produced at different times. However, given the overall similarity in the flint, it is likely that all the axeheads were produced from the same flint source. Later on in their life-histories all six of the axeheads, like the aforementioned hoards, also had several flakes taken off from their butts, and once again this knapping took a variety of different forms (Figure 15), for example:



- RY1 – Most of the cortex has been removed with a long flake from one of the narrow sides, but smaller transverse flaking has also been used.
- RY2 – Flaking appears to have been done to leave a large amount of chalk cortex present on the butt. Deep short longitudinal flakes were removed from the butt.
- RY3 – Very coarse flaking is present running longitudinally on the broad sides and running laterally on the narrow side. A chalk inclusion on one side of the axehead has caused the butt not to be knapped in a straight angle.
- RY4 – Flaking appears to have been done to leave a large amount of chalk cortex present on the butt. Long and thin blade-like flakes are taken off from the sides of the axehead and run laterally across the broadside.
- RY5 – The butt has a sharp narrow profile with no remaining cortex, which has been removed with short flakes on the longitudinal direction. The butt has also been knapped on the broad sides.
- RY6 – The cortex on the butt has been removed except for one small area. The flakes on the butt have been knapped from the narrow sides.

All of the axeheads found in this wetland hoard initially appear very similar, however, through up-close analysis of each axehead it became apparent that a remarkable level of differing biographies are observable. Based on differences in the form and production techniques or knapping qualities, it appears that four of these axes may have been produced by different skilled craftspeople, whereas two of the axes appear to have been produced by the same craftspeople(s). There is no direct evidence that any of these axeheads were hafted or used as axes, thus fitting with the general observations that hoarded axeheads were rarely used (eg. Rech 1979, 163). However, some of the axes had their edges re-knapped and/or re-polished, in addition all of the axes had their butts re-knapped after their production. These results suggest that

Figure 15. Close up photos of the both sides of the edges (top) and butts (bottom) from the Rydhave hoard. From left to right: RY1-6. Notice the similarity between RY2 and RY4 (Photo: Casper Sørensen, Viborg Museum).



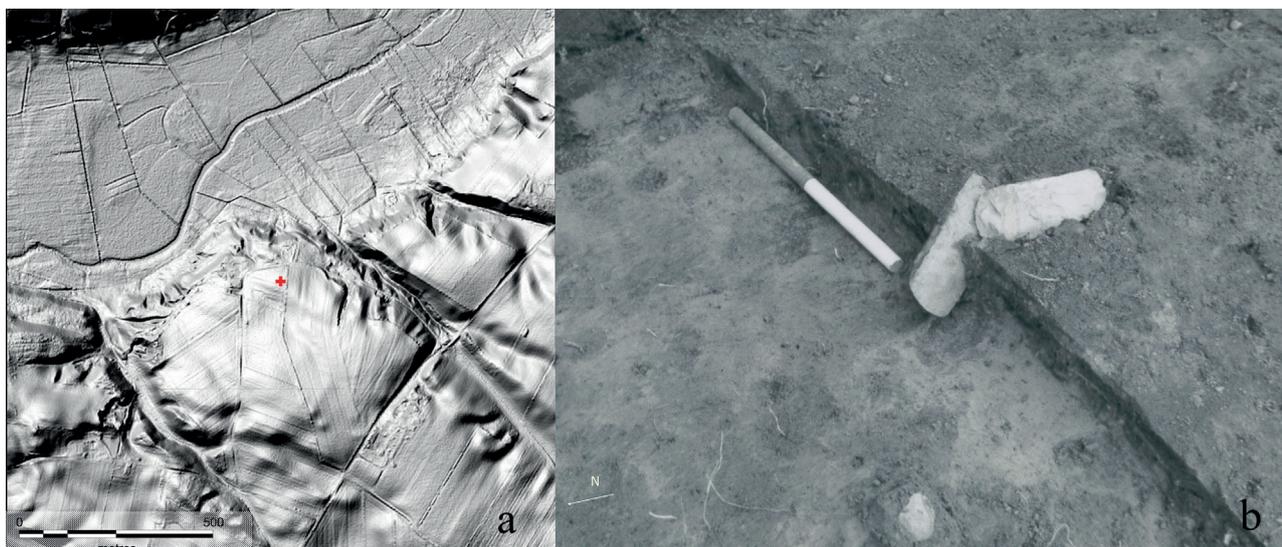


Figure 16. a) Location of the Vestergård Øst hoard with a LiDAR map from 2007 as background. b) The Vestergård Øst axeheads *in situ*. The axehead to the right was initially moved by the machine excavator but was replaced as it was originally deposited to take the photo. This contact with the machine excavator also caused some slight damage to the seam on VØ151. On the left side of the picture, a section of the cultural layer has been dug away to the natural subsoil. The scraper is shown *in situ* in the bottom of the photo (Map: © Styrelsen for Dataforsyning og Effektivisering. Photo: Martin Mikkelsen, Viborg Museum).

although these axeheads may not have had any use as normal axeheads, they did have complex and multi-faceted life-histories that fit general patterns noted elsewhere in this paper, but were also individualized to the particular axehead and the person(s) involved with the treatment of axehead throughout its life.

Vestergård Øst

The hoard from Vestergård Øst (Figure 16 a and b) consist of two unpolished thin-butted axeheads of the same type of flint (Figure 17). The axeheads were found during a trial excavation by the museum prior to the construction of a forest plantation.⁸ The hoard was located in a dryland context, with the axeheads placed parallel in a thin cultural layer, standing on the narrow sides, with the edges pointing north (Figure 16 b). A flint scraper was found close by the axeheads, as well as five smaller flint flakes dispersed in the cultural layer (Figure 18). A settlement site dating from the Late Neolithic or the Bronze Age was found in the same area, with postholes and a storage vessel cutting through the cultural layer with the hoard (Mikkelsen 2001). Thus, this cultural layer predates the Late Neolithic, which

makes it possible that it may reflect a settlement site contemporary with the axeheads.

Both axeheads are produced from the same type of flint, but both the overall shape and curvature of the axeheads are slightly different (Figure 17; 19). The knapping technique also differs, as the flakes along the seams are notably smaller and more neatly knapped on VØ151 than on VØ150 (Figure 19). Furthermore, the directionality of which the flakes along the seams have been taken off differs notably between these two axeheads (Figure 19). This may suggest that the axeheads were produced by differ-

Figure 17. The axeheads from Vestergård Øst. Left: VØ150, right: VØ151 (Photo: Casper Sørensen, Viborg Museum).



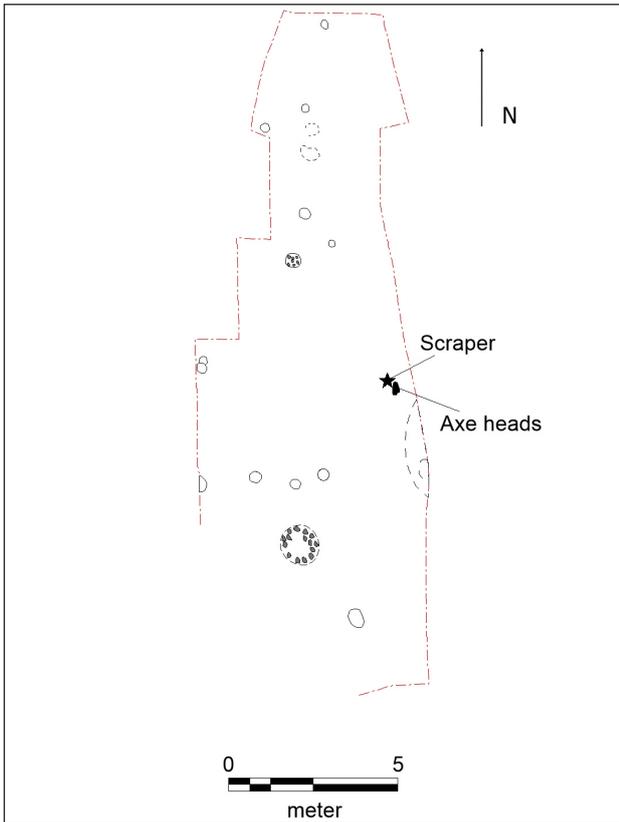


Figure 18. Excavation plan of TRB finds and features as well as undated features from Vestergård Øst. Redrawn plan from the original excavation report (Mikkelsen 2001).

ent knappers. Both axeheads appear unused, with sharp edges, symmetrical profile and no traces of re-sharpening on the edges. This, lack of use-wear is hardly surprising given that it appears that generally unground axeheads were not used (Olausson 1983, 28; Rech 1979).

The overall biography of the hoard is much shorter and less eventful than the other hoards described here. In addition, the seemingly settlement-based dryland context may initially suggest that they are a different practice than the Neolithic wetland hoards. However, like the other hoards, these two axeheads have different observable biographies, not in terms of their use, re-working, source material but instead it appears that they were produced by two different flint knappers. In addition, the placement of both axeheads lying parallel and with the edges facing the same direction, matches a feature seen in a number of other known axehead hoards (Rech 1979, 17-19). Thus, rather than these axeheads representing an entirely different practice as the other TRB hoards, they exemplify the diversity but also the patterning and key features within the hoarding practice.

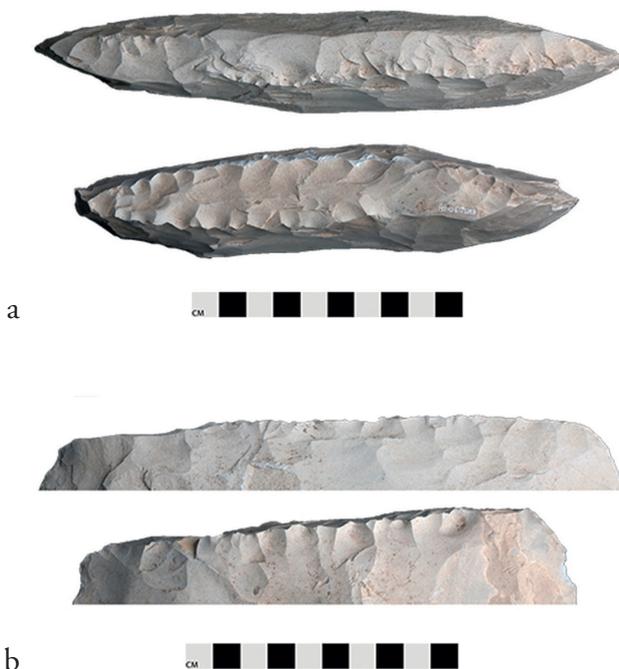


Figure 19. a) Close-up of the difference in knapping technique of the seams of the axeheads from Vestergård Øst. Top: VØ150. Bottom: VØ151. Note that VØ151 appears to be more finely knapped. b) Close-up of the narrow sides of the Vestergård Øst axeheads. Top: VØ150, bottom: VØ151 (Photo: Casper Sørensen, Viborg Museum).

Discussion

Based on the detailed contextual information and results outlined above, we are able to move past many of the source critical issues and to bring out significant details of the practice that may often be overlooked. In the following, different biographical aspects of the hoards will be summed up, discussed and contextualized with the current perceptions of the TRB hoarding practice, in order to highlight the benefits of such an approach to studying TRB hoards.

From object biographies to biographies of hoards and wider social practices

The different analyses of the hoards presented here have resulted in significant new insights into the life histories of the axeheads as well as the biographies of the hoard assemblages. These biographies provide a platform for interpretation of the hoard-

Hoard	Composition	Raw material	Different producers	Degree of finishing	Used vs unused	Re-worked
Sønder Rævind	Two thin-butted axeheads and two stone axeheads (a perforated butted and a thin-butted)	Different flints and stone types	Possibly	Two finished axeheads, and two unfinished axeheads (one unpolished)	Both used and unused	Yes – two axeheads have re-ground edges
Kardyb	Two extremely long polished thin-butted axeheads	Similar	Yes	Both finished	Unused	Yes – butts re-knapped differently
Rydhave	Six very similar polished thin-butted axeheads	Similar	Yes	All finished	Both used and unused	All have had butts re-knapped, some have edges re-knapped and/or re-ground
Vestergård Øst	Two unpolished thin-butted axeheads	Similar	Yes	Both unfinished (unpolished)	Unused	No

Table 2. Summarized overview of the biographies for the hoards.

ing practice as well as some of the social consequences of this practice within the TRB. The biographical observations from this analysis has been summarized to create an overview in Table 2.

The first hoard from Sønder Rævind showed completely different biographies, both regarding the composition and use-life of the axeheads. This variability illustrates how heavily diversified the axeheads can be within the same hoard, where if the axeheads were found as stray finds they most likely would never have been identified as a hoard. Within, this variability, an element of duality is present regarding both material, content and context. There is both a large unused and a small heavily used axehead for the flint as well as the greenstone axeheads. Both the large flint and greenstone axeheads are un-polished, whereas the small flint and stone axehead has been repeatedly ground and polished. In addition, one of the flint and one of the greenstone axeheads has striations ground into the surface after the rest of the axe was complete. The depositional context of this hoard can also be seen as dualistic, as such a small hollow would have likely seasonally transitioned between wet or dry. As this duality is evident through different aspects within this hoard, it appears to have been a deliberate and very conscious choice. Such dualism has not previously been identified as clearly within a single hoard. However, based on the results of this

study, dualism and more generally the combination of contrasting elements and biographies within the same hoard may have been a key, but previously unrecognized aspect of TRB hoarding.

Although the two large axeheads from Kardyb appear very similar, they show subtle differences in the flake scars in both the primary production as well as the secondary re-knapping of the butts, which also appears to have occurred at different times. This could indicate that they were produced in close collaboration, but not necessarily by the same knapper and that they had parallel but temporally distinct secondary modifications. Arguably, similar observations are also present on the Rydhave hoard, where axeheads RY2 and RY4 show such great similarities, that they have been interpreted to be knapped by the same craftsperson, quite possibly in the same workshop flow. Although after being produced by the same flint knapper, their use-life differ as one of them has a re-sharpened edge, showing that it may have been used and then re-worked prior to deposition. The other axeheads from Rydhave differ to a larger degree in both production, use-life and secondary modifications. Unlike, with the other hoards, the two axes from Vestergård Øst do not show any observable differences within their use-lives, raw material sources, or any post-production modifications. Rather their different biographies seem solely manifested by seemingly being produced by different individuals.

A possible explanation of combination of axeheads with different biographies (in terms of: production, use, curation and treatment), is that it may reflect the complex network of exchange and productivity in the Scandinavian TRB. Such networks of exchange have been previously attested by the larger axeheads from the Netherlands which are presumed to come from Southern Scandinavia (Wentink 2006), while exchange of axeheads to Norway also have been documented (Price 2015, 124). The evidence for local and complex networks of production, use, exchange and accumulation in axehead hoards has not previously been identified in detail before in Southern Scandinavian TRB (cf. Knutsson 1988, 77). However, ethnographic studies of tribal societies in Papua New Guinea has documented such intricate networks. Here the procurement and exchange of axeheads is a ritualized and integrated aspect of the cultural practices of different groups. These axeheads play important roles in the economic drivers of society and are used in very complex exchange networks involving commodities, goods and social power. While some axeheads hold a special meaning as, for instance, bride-price or as ceremonial axeheads, it is not uncommon that they were also used for utilitarian work (Højlund 1979; Pétrequin and Pétrequin 2011). These concepts may also be present in the processes underlying some aspects of the hoarding practice. The different use-lives may be ascribed to the different owner's personal choice regarding the use and treatment of the axeheads through time, while the examples of axeheads likely produced by the same knapper illustrate the exchange based on their divergent later biographies. The coming together of the axeheads with different use-lives could also suggest that the practice of hoarding was a communal event, where individuals in society brought together different important objects and where at the end they were assembled together and carefully deposited in the landscape.

Composition, context and topography

Overall, the composition of hoards discussed here largely conform to the well-known picture of TRB hoards (cf. Karsten 1994; Nielsen 1977; Rech 1979). Large polished axeheads were included in the two wetland hoards from Kardyb and

Rydhave, while the hoards from Sønder Rævind and Vestergård Øst that are found in comparatively dryland contexts both contain unpolished axeheads (Table 3). The deposition of both used as well as unused axeheads within the same hoard also fits a general pattern that is observable within southern Scandinavian TRB material (Bjørnevad and Stephansen forthcoming; Karsten 1994, 210-364; Olausson 1983, 28-29), contrary to the common prior assertion that TRB hoards only contain unused axes (e.g. Rech 1979, 163).

However, some of the results of this study do not fit the generalised picture of the composition of TRB hoards. For instance, to the authors' knowledge, the composition of Sønder Rævind stands out as being highly unusual, and if this hoard had not been found *in situ* it is possible that it would have even been considered as hoard. Firstly, the significant difference in the size of the axeheads (11-27 cm) is slightly unexpected, as previously it has been stated that hoards generally contain axeheads that are similar sized (Rech 1979, 20, 39-40). In addition, the majority of greenstone axes from Denmark have been found on Zealand (cf. Ebbesen 1984, 130; Klassen 2014, 201, 204). The inclusion of the greenstone axes in a TRB hoard in the southern Limfjord region is particularly surprising in itself, as generally hoards with greenstone axeheads are found in the areas furthest away from good flint sources. This distribution pattern has been interpreted to indicate that such greenstone axeheads were seen as a possible symbolic replacement of flint axeheads (Ebbesen 1984). This does however not fit with the archaeological material known from the nearby area of the Sønder Rævind hoard, where high quality flint is readily available. As previously stated, the complete axehead from Kardyb is the longest axehead known from Scandinavia, which was found 10.7 km to the west of the hoard from Sønder Rævind. Furthermore, the second largest flint axehead in Scandinavia from Jegstrup Kjær is found 6.4 km to the south east, while a natural occurrence of flint presented by Becker (1993, 124 Fig 8.) is only 9-10 km towards the south west. Thus, in this instance the deposition of the two greenstone axeheads does not appear to have been connected to a scarcity of flint, suggesting that their inclusion within hoard along with two flint axes, held a different significance.

Hoard	Composition	Context	Arrangement
Sønder Rævind	Two flint thin-butted axeheads and two stone axeheads, one with a perforated butt	Natural hollow, possibly seasonally dry/wet and possibly deposited near a settlement	Unclear as the hoard was disturbed but the two in situ large flint and small stone axeheads are facing WSW and the small flint axe SSE, respectively
Kardyb	Two large polished flint thin-butted axeheads	Peat filled gully	Lying parallel in line with edges facing east
Rydhave	Six large polished flint thin-butted axeheads	Peaty shoreline of a river-valley	All lying roughly parallel and pointing roughly east
Vestergård Øst	Two unpolished flint thin-butted axeheads	Dryland, possible settlement	Lying parallel on their narrow sides, with one axe slightly offset. Both axeheads are facing north

Table 3. Overview of the composition, context and arrangement of the hoards included in this paper.

The unusual composition of the Sønder Rævind hoard may be due to the comparatively late date for this hoard, as it is typologically dated to the transition to the Middle Neolithic around 3300-3100 BC. At approximately this stage, the general societal structure seems to also have changed (Sørensen and Nielsen 2018). In addition, many ritual practices changed, including a decrease in the frequency of hoarding (Rech 1979, 19-30), pottery depositions (Koch 1998, 194), human and cattle sacrifices (Sjögren et al. 2017, 116-117), as well as the construction of dolmens and passage graves, cult houses, and causewayed enclosures (Sjögren 2011, 112). Thus, perhaps these wider societal and ritual changes are also mirrored in a change in the composition of some hoards.

The Sønder Rævind hoard also stands out as being unusual in terms of its depositional context, namely being placed in small natural hollow that could have been periodically wet or dry, and that it may have also been deposited nearby to a settlement. This type of depositional context would often be overlooked if it had been found as stray find, given the ephemeral nature of the postholes and the hollow itself and thus likely would have just been considered as dryland find. Similarly, the ephemeral nature of the settlement remains from Vestergård Øst, would likewise not have been noticed if they were found as a stray find – leading the hoard to perhaps be erroneously classified as fitting the classic picture of TRB hoards being extramural in nature. These two finds suggest that perhaps hoards were deposited associated with set-

tlements more often than commonly thought (see also Aarsleff 2011 for another similar example). The apparent near exclusivity of hoards and settlements may instead be skewed due to hoards largely being found as stray finds.

On the other hand, given that the only evidence for these possible settlements are a few artefacts and undated pits and postholes, it could be questioned if these do in fact represent settlements, or if they instead represent other activities that were associated with these locales or the hoarding practice. In the case for the undated postholes nearby to the Sønder Rævind hoard, it is possible that they originate from a palisaded enclosure given the postholes are placed curving around a highpoint of the landscape, that is reminiscent of where some causewayed enclosures have been positioned in Denmark (Klassen 2014b, 23). It is also possible that the few artefacts found nearby to the hoard from Vestergård Øst could have been the remains of wider practices associated with the hoarding event, with such associated practices going previously unnoticed due to the source critical issues discussed above. Without further excavations, these admittedly remain conjecture at this stage. However, they illustrate what type of information may be overlooked when we rely on primarily stray finds of hoards and how this has possibly skewed our understanding of such practices.

This is also further illustrated by the remarkable variability in the topographic placement of the four hoards in this paper (Table 1 and 3). The wet-

land hoards of Kardyb and Rydhavé initially seem to fit what is thought of as the ‘classic’ hoard, however as Kardyb was found in a gully and Rydhavé at a possible beach or open water, the topographical nature of the wetland contexts clearly differ. Vestergård Øst were found at a relatively flat dryland possible settlement context, and differs from the aforementioned hoards as well as Sønder Rævind, where the context could be considered as mixed. The hoard was placed in a natural small hollow, possibly seasonally wet and dry that was located at a highpoint within the landscape. In this sense, the well-documented context of the hoards provides a more detailed account on the circumstances and thereby an interpretation beyond the classic wetland vs. dryland division. Furthermore, the results indicate the extent of the contextual information that is missing from a vast majority of hoards, such as the identification of other possible activities associated with TRB hoarding that may be integral to understanding these practices, the importance of these places and their role within society.

Directionality and arrangement

Another aspect that has been overlooked due to the poor find circumstances of most hoards is a detailed understanding of the arrangement of TRB axe hoards. The arrangement of objects within hoards is a well known feature of Neolithic hoards (Rech 1979, 15-17). The description of the arrangement is often limited to the positioning of the objects in relation to each other, but rarely is the directionality of the axeheads noted. However, as the positioning of the hoards in this paper were either professionally recorded or able to be reconstructed based on the detailed observation of the find circumstances and the artefacts themselves, we are in a better position to gain insights into this aspect of TRB hoarding.

To the authors’ knowledge, the directionality of the objects within hoards, and possible importance of it has not been previously explicitly discussed for Neolithic hoards. However, as directionality of megaliths appears to have been significant (Clausen et al 2008; Clausen 2014; 2016; González-García and Costa-Ferrer 2007, 207; Paulsen 2019) and as hoards often seem carefully placed, it is entirely pos-

sible that directionality of objects within the hoard was also important. In three out of the four hoards discussed in this paper, the axes appear to have been placed lying roughly parallel with each other, a feature that is also observed in a large number of hoards found elsewhere in Southern Scandinavia (Rech 1979, 15-17). Furthermore, in two of the hoards the edges of some or even all of the axeheads were facing east. This directionality fits with the placement of megaliths that also often face easterly (Clausen et al 2008; Clausen 2016, 57, 76; González-García and Costa-Ferrer 2007, 207; Paulsen 2019, 3460). However, due to the small sample size present here, it is difficult to ascertain how significant this trend is, or if it is a localized hoarding feature. In addition, as the axes in the hoard from Vestergård Øst have their edges facing north, and as axeheads in other hoards, outside of this study, are found placed vertical, radiating outwards, or placed in facing opposing directions etc. (Rech 1979, 15-17) it is unclear if it was the directionality, specific positioning or merely the arrangement of the hoards that was the important aspect of the hoarding practice. Thus, future studies should seek to compile a larger dataset of hoards whose arrangement and directionality is known to determine what patterning or variability is present and to contextualize the implications of these observations for understanding the practice at a macro- as well as a micro-scale.

Concluding remarks

The approach used in this paper – combining practice theory, object biography and detailed contextual information – has added a new level of temporality and complexity in the hoarding practices from the TRB and the lives of the objects that are included within them. Hoards cannot be divided up simply to wetland vs dryland, or ritual vs profane, or of ceremonial axeheads vs functional axeheads. Rather, the evidence suggests that this practice is very diverse, with blurred lines, and with considerable individuality in the practice that may go overlooked or downplayed in standard analytical approaches to such hoards. These observations and the interpretation that have been put forward adds to and challenges our understanding of the treatment and role of axeheads, the nature hoard-

ing practices as well as some of the social processes within TRB society.

In closing, it should be noted that the results presented here are not meant to be representative of the practice across the entire southern Scandinavian TRB. The number of hoards discussed in the present paper is small, and the cases all originate from only one small region of Denmark. Instead of seeking generalized claims, we have proffered a novel methodology aimed at interrogating hoarding practices in a detailed and local perspective. This approach offers the possibility of distinguishing and interpreting complex social aspects at the level of the object and the assemblage. Future studies should aim to increase sample size as it would be exciting to apply this methodological framework to an enlarged dataset in order to investigate whether the aspects and patterns can be seen elsewhere and to better understand the variability within this practice on a larger scale.

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Disclosure statement

No potential conflict of interest was reported by the authors.

Notes

1. In the main text, abbreviations for each of the hoards have been used and they are as follows: SR for Sønder Rævind, KA for Kardyb, RY for Rydhavne and VØ for Vestergård Øst. The individual axehead numbers given in the main text corresponds with the numbers used in the original museum records, for example SØ1 refers to Sønder Rævind No. 1.
2. The hoard from Sønder Rævind was found and excavated by Viborg Museum in 2012. It is recorded under the journal no. VSM 09981 at the museum. The reference to the National Database of Monuments and Antiquities is 130114-168. SR1 can be defined as Nielsen's (1977) Type VI, dating to EN I-MN I. SR2 is heavily re-sharpened, and harder to define, but it appears to be either Type IIIA or IV. SR3 is Ebbesen's (1984) Type III dating to MN I-MN IV. SR4 is Ebbesen's (1984) Type IIA dating to EN I-MN Ia. Thus, the hoard can be dated to the transition between EN II-MN I.
3. As this hoard was found just below the plow-layer, there is a possibility that the hoard has been post-depositionally disturbed, thus it is possible that any other objects that may have been deposited with the hoard have been accidentally removed.
4. After the two workers found the hoard with their mechanical excavator, Viborg Museum was contacted, after which a small trial trench was excavated to search for the missing part of the axehead and to look for additional axeheads. Unfortunately the museum was not able to recover the missing axe fragment nor were they able to locate any additional axeheads. The hoard is recorded in the museum under journal number VSM 10368. The hoard was later declared as 'Danefæ' and thus belongs to the state of Denmark, managed by the National Museum of Denmark, where the axeheads are stored. The reference to the National Database of Monuments and Antiquities is 130107-368. The complete axe KA I can be defined as Nielsen's (1977) Type IV. KA2 is broken, but the general appearance of the axe is very similar, and the axe can also be defined as the same type, thus dating the hoard to EN II.
5. Lake Tastum was drained and became dry during cultural intensification in the 19th century (Amstrup 1955).
6. The longest axeheads in Rech's (1979) catalogue are RY5 from the Rydhavne hoard at 44 cm (Cat. no 242) and an axehead from Jegstrup Kær at 46 cm (Cat. No. 258) found due west of Viborg.
7. After one of the axeheads was found, the local museum, Holstebro Museum, was contacted. The museum then excavated a small area around the find spot, uncovering the remaining five axeheads *in situ*. The axeheads are stored in Holstebro

- Museum under the journal number HOL 15058. Reference to the National Database of Monuments and Antiquities is 180206-128. All the axes can be typologically defined as Nielsen's (1977) Type IV, dating to EN I-EN II.
8. The hoard from Vestergård Øst was found during a trial excavation prior to forest plantation, and as such, the hoard along with other archaeological features was recorded under the journal number VSM G213, find number X150 and X151. The hoard is stored at Viborg Museum. The reference to the National Database of Monuments and Antiquities is 130805-145. The axes can be defined as Nielsen's (1977) Type V, dating to EN II.

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Male Social Roles and Mobility in the Early Nordic Bronze Age. A Perspective from SE Jutland

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ABSTRACT

This paper provides a discussion of the increasing amount of mobility data from the Early Nordic Bronze Age (Early NBA), c. 1600-1100 BCE with particular focus on NBA II and III (c. 1500-1100 BCE). As a male-oriented study, the intent is to develop current perspectives on gender roles in the Early NBA in relation to mobility. In order to achieve our aim, we conducted strontium isotope analyses and radiocarbon dating combined with an in-depth archaeological investigation of grave goods obtained from two male burials from the Vejle region, SE Jutland. The results suggest that one of the individuals was local while the other might have moved. To contextualise the case study results, we also conducted network analyses of male gear from burials and ritual deposits on a regional scale, which reveal differentiated roles among men in the upper social echelon. The warrior emerged as an overall identity for high-ranking males whilst differences in male weaponry interestingly suggest that a minimum of three kinds of warriors were distinguished, reflecting social roles in war and society. The overall aim is to demonstrate that robust results regarding gendered mobilities will depend on the combination of several methods, datasets and scales of inquiry.

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Introduction

Archaeological studies have traditionally mapped the dispersal of regionally-specific items using 'male equipment', such as razors (Jockenhövel 1980) and swords (Schauer 1971) or 'female equipment', such as jewellery sets (Wels-Weyrauch 1989) as proxies for the length, frequency and directions of gendered mobility patterns in the past. Overall, some scholars have argued that in the Bronze Age at least some males moved consistently over both short and long distances as a function of raiding, warfare or trade (Kristiansen and Suchowska-Ducke 2015). The mobility of contemporaneous women, by contrast, was thought to have been much more constrained to one-directional movements targeting social, political and/or economic alliances through marriage (Fox 1967; Kristiansen and Larsson 2005, 234). This latter pattern has been dubbed the *Fremde Frauen* phenomenon referring to the seminal study by Albrecht Jockenhövel (1995, 1991; Jockenhövel and Kubach 1994; Wels-Weyrauch 1989) and is visible in Denmark,

for example, in several female graves with equipment deriving from the Lüneberger Heide (eg. Ke1264A in Aner and Kersten 1976; Bergerbrant 2005, 165-170; Zick 1993). Originally based on analysis of the material culture alone (Jockenhövel 1991), evidence for migrating women has found subsequent support through archaeometric analyses of human skeletal material in several regions including, for example, southern Scandinavia, Germany and Italy (Cavazzuti et al. 2019b; Frei et al. 2015, 2017; Knipper et al. 2017; Mittnik et al. 2019; Price et al. 2017; Reiter and Frei 2015). The archaeometric analyses opens up discussion regarding new potential reasons for these women migrating, thereby highlighting the complexity of mobility in Bronze Age society where several 'modes of mobilities' should be considered (Reiter and Frei 2019).

Over the past decade, our knowledge of individual human movement patterns within the European Bronze Age has increased exponentially. Both within Denmark (Frei et al. 2015, 2017, 2019) as well as other parts of Europe (Bergerbrant et al.

2017; Cavazzuti et al. 2019a, 2019b; Knipper et al. 2017; Mittnik et al. 2019), recent studies show that different groups of individuals were mobile, that they moved over both short and long distances and that those movements seem to have followed a variety of different patterns. Interestingly, research in the Lech Valley near Augsburg in southern Germany (Knipper et al. 2017; Mittnik et al. 2019), in the Po valley region of northern Italy (Cavazzuti et al. 2019b) as well as in Scandinavia (Bergerbrant et al. 2017; Frei et al. 2015, 2017, 2019) show a distinct tendency for Bronze Age female in-migrants to join the social group from the outside. By comparison, male mobility patterns have not yet received the same attention in Scandinavia.

A remarkable data source regarding the mobility of young males in Northern Europe during NBA III ca. 1250 BCE comes from the Tollense Valley in Mecklenburg-Vorpommern (Jantzen et al. 2011; Price et al. 2017). As the site is a battlefield, the foreign individuals identified there through isotope analyses were removed from the social domains of family and household. It is, however, highly significant that the associated material culture of Riegsee swords and special bronze fittings for wooden boxes reveal that a portion of these foreign males probably came from southern Central Europe, more specifically a zone spreading from Bohemia over southern Germany to western France (Uhlir et al. 2019, 1226 and fig. 10). Joining a military unit was at that time clearly a career option for some young males who could move over long distances in this manner. The Neckarsulm all-male cemetery from the same period could be understood in a similar way (Knöpke 2009; Wahl and Price 2013).

Founding a new household would be a linked possibility for males willing or compelled to move away from their previous household. Cavazzuti (Cavazzuti et al. 2019a) argues for a non-local warrior chief behind the founding of Frattesina in the Po Valley, hence evoking the kind of social dynamics described by Sahlins (Sahlins 1958, 2008). The foreign male from Frattesina was or became a member of the higher social elite (Cavazzuti et al. 2019a), as it seems to be the case for the elite females from Egtved (Frei et al. 2015) and Skrydstrup (Frei et al. 2017).

The information from the collection of individuals analysed to date seems to support the prevalence of patrilocal-exogamous social networking within this period (Frei et al. 2017; Knipper et al. 2017; Kristiansen and Larsson 2005, 234; Mittnik et al. 2019). However, we need more data in order to accurately assess the potential social roles and status changes (if any) for males, specifically within the contexts of socially-sanctioned and -formulated mobility structures.

It is against this background that we situate our study. In doing so, we acknowledge a recent critique of the interpretation of Early NBA females as far travelled based on their strontium isotope signatures (Thomsen and Andreasen 2019). This work emphasised the potential of modern agricultural liming in regions of western Jutland to affect the strontium isotope bioavailable baseline range for the area of present-day Denmark (Frei and Frei 2011). However, a recent in-depth study of a representative soil-profile from within the area of western Jutland, which has been heavily affected by agricultural liming during several decades, reveals that the strontium derived from the liming is effectively retained near the surface (R. Frei et al. 2019). Based on this evidence, the authors argue that agricultural liming does not contaminate groundwater-supported surface waters rendering the previously established reference map (Frei and Frei 2011) still relevant for past provenance studies (R. Frei et al. 2019). By adding the archaeological contextual evidence to the debate, this paper demonstrates that a compound scalar methodology can sustain that not all individuals were foreign in-migrants, but some very likely were. Below, the mobility and gendered object networks of two recently excavated elite male individuals are examined from the greater region in which the well-known Egtved female was found (see Figure 1). As the two graves were typologically dated to NBA II (c. 1500-1300 BCE), the males from Højgaard (VKH 1842) and Jelling Øst (VKH 3418) are regarded as rough contemporaries for the Egtved female who was buried 1370 BCE (Christensen and Jensen 1991). Mobility is conceptualised here as the human capacity for short-range or long-range movements with or without vehicles to enhance speed.

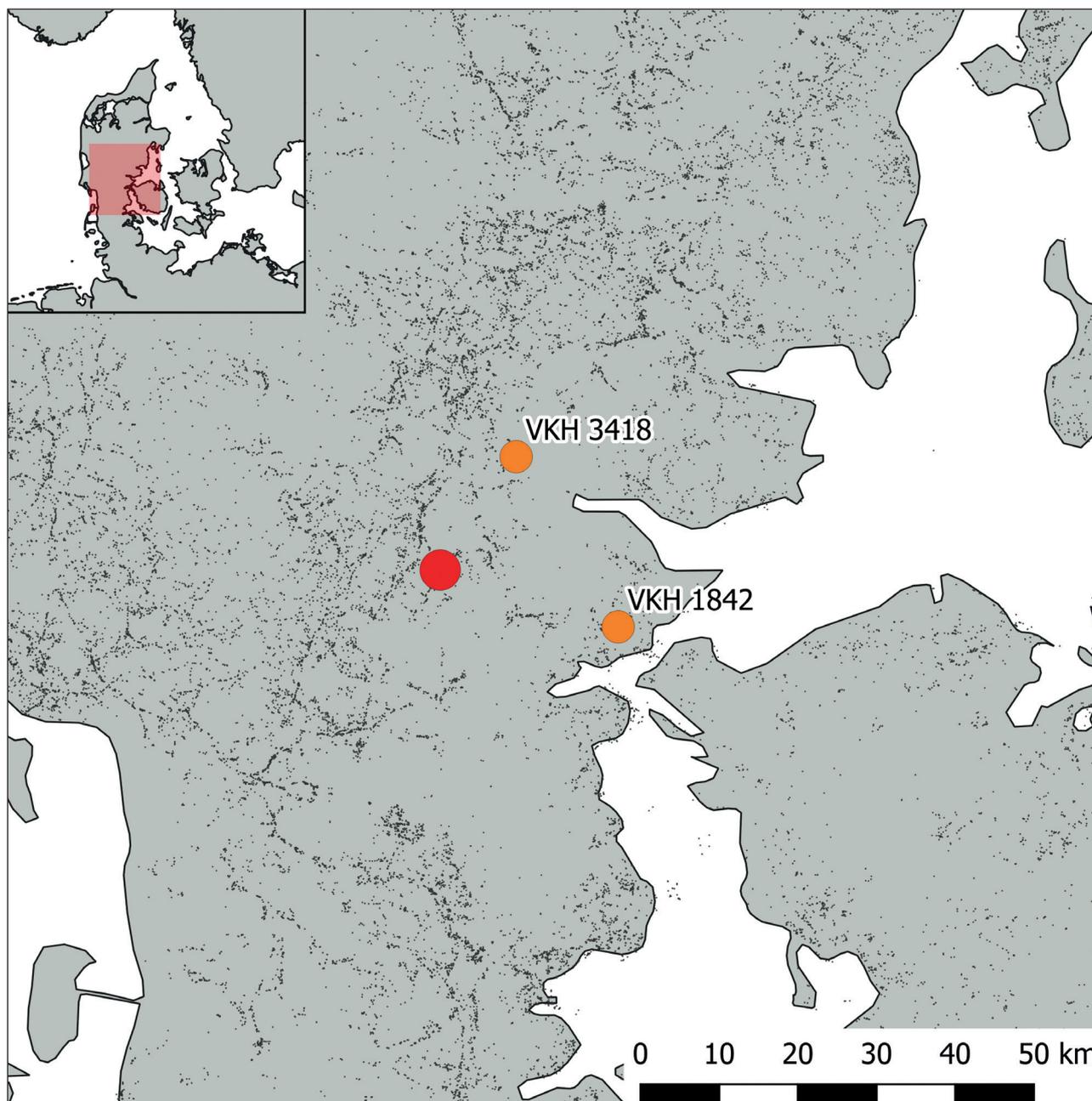


Figure 1. Site location map. VKH 1842 and VKH 3418 marked with orange. The Egtved woman's grave marked with red (Graphic: Louise Felding. Background map: Geodatastyrelsen, WMS-services).

Material – The Archaeological Sites

VKH 1842 Højgaard

The burial mound VKH 1842 Højgaard (Danish adm.no. 170301-26) is situated on a plateau in the Elbo Valley, near to the modern Danish town of Frederica (see Figure 1). The mound was excavated in 2003 by a joint team from Aarhus University, VejleMuseum and Copenhagen University. The excavations uncovered the well-preserved inner core of a Bronze Age burial mound containing a

primary grave of a male K3 (context id 827) that was typologically dated to the NBA II (Laursen et al. 2004).

Grave K3

The male individual was interred in a rectangular oak coffin which was oriented roughly E-W (with the head oriented towards west). The grave measured 2.70 m by 0.85–1.05 m (widest towards west). The last remains of the oak-trunk coffin lid were detectable as a thin cover of the grave. The coffin rested directly on the ground, supported



Figure 2. Sword VKH 1842x11. Grip detail (Photo: Moesgård Museum).

by only a few stones and turf sods. The individual was supine with arms placed along his sides. The feet were close together and held down by a stone placed within the coffin (Laursen et al. 2004).

While in poor condition, the skeletal remains consist of the left femur (without femoral head), 13 teeth, one left humerus and fragments of the mandible. Osteological analysis indicates that the individual was an adult male over 20 years of age (most likely 25-35) with an estimated height of circa 185 cm; there were no visible pathological signs of disease or violence on the remains (Lynnerup 2004).

This individual was laid to rest with his personal items and covered by textile and fur. Of these, the most notable was the ca. 67 cm long plate-hilted sword (VKH 1842x11) with four bronze rivets and preserved horn grip found on the left side of the male body (see Figure 2). The shape of the sword's plate is not visible due to the remains of the horn grip, but x-ray photos of the plate show a rounded shape (Strehle 2010, appendix 2). The shape of the plate and the sword's rounded spiral-ornamented pommel typologically dates the grave to NBA II.

The grave also contained fragmented remains of two-coloured textile found on the upper body near the sword hilt (VKH 1842x11 sample 41, Strehle 2010, 25). In addition, a fur coating could be distinguished in this area, different from the fur lining within the coffin, which was also observed during the careful excavation. The sword was protected by an oak sheath covered with skin and lined with fur and was furthermore wrapped in a piece of textile

(Strehle 2010, 23). The sword, fur and textile fragments were the only preserved grave goods in the grave.

VKH 3418 Jelling Øst

The burial mound Jelling Øst (Danish adm. no. 170401-58) contained three burials (burials A13, A14 and A15) within two visible mound phases (see Figure 3). The graves were all typologically dated within the early NBA. The mound was excavated in 2006, in advance of local development plans by Peter Mohr Christensen of VejleMuseerne. The mound was situated on a plateau on the east side of the modern town of Jelling (see Figure 1).

The primary grave (A13) from the first mound phase was empty; and the excavator suggests that it may date from an earlier period (Christensen 2006). The primary grave in the second mound phase (A14) contained a sword (typologically dated to NBA II) and the poorly-preserved remains of a human adult of unknown sex. Grave A14 is of particular interest for this study and is presented in greater detail below. Unfortunately, the stratigraphic relation of the last grave (grave A15) to the mound phases is unknown. It contained a double cremation burial placed in a full-size grave and included a Nordic metal-hilted knife as the

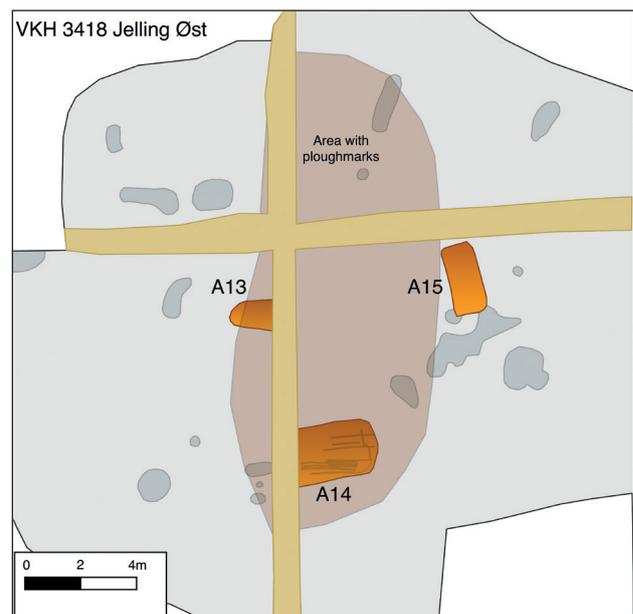


Figure 3. VKH 3418. Site plan of burial mound (Graphics: Louise Felding after Peter Mohr Christensen, VejleMuseerne).

Figure 4. Jaw VKH 3418x15 from grave A14. A total of 13 teeth from the lower jaw were preserved (6 molars, 4 premolars, 1 canine and 2 incisors). From the upper jaw four teeth remained (3 molars and 1 premolar). Strontium isotope samples were taken from M1, M2 and M3 (Photo: Louise Felding, VejleMuseum).



only grave goods, which together suggest a tentative date to NBA III. The excavator also noted dispersed plough marks under the central part of the burial mound. For further descriptions of the burial mound and graves A13 and A15, see the excavation report (Christensen 2006).

Grave A14

The central grave A14 (context id 829) in the second mound phase was built on a stone setting that served as the support for a poorly-preserved oak log coffin. The sparse human remains included 13 teeth, a very poorly preserved lower jaw and a few other skeletal fragments (see Figure 4). Osteological analyses estimated the individual to be an adult aged between 18-25 years but determination of (biological) sex was not possible (Bennike 2007).

The grave contained a ca. 65-70 cm bronze plated hilted sword; the sword plate was loosely trapezoid in shape and included five rivets (Figure 5). Combined with the rounded pommel with spiral ornamentation, this typologically dates the grave to later NBA II (possibly early NBA III, or ca. 1300 BCE) (for typologies see e.g. Montelius 1885; Müller 1882, 1909; Thrane 2006, 495). Although the sword hilt itself was not preserved, organic remains of the horn construction were still visible on the plate.



Figure 5. Sword VKH 3418x14 from grave A14. Plate detail (Photo: Louise Felding, VejleMuseum).

The grave also contained a bronze dress pin (VKH3418x13, see Figure 6) and a thin bronze fragment, possibly from a razor (VKH 3418x10). Based on this assemblage, the grave is considered to belong to a male gendered adult.

The fragmented dress pin has a straight, unornamented body with a slightly tapering and decorated end. The upper part of the pin is fragmented where the head is broken off. The length of the pin is 11,3 cm (including fragmented parts). The

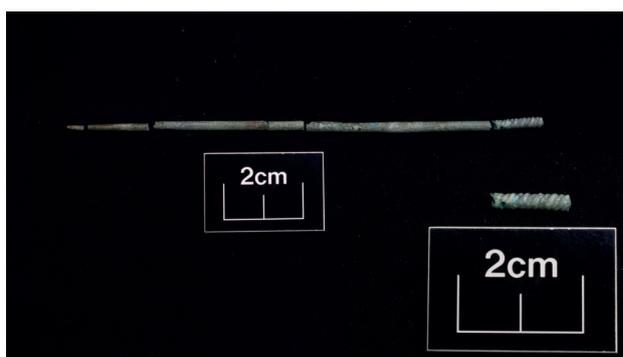


Figure 6. Pin VKH 3418x13 from grave A14 (Photo: Louise Felding, VejleMuseum).

cross section is round towards a square section at the decorated neck area. Because of the fragmented condition of the pin, it is difficult to determine a type with certainty. However, the short, thin and round nature suggests a tradition placed within the middle-late Tumulus culture (Bz C-D), which corresponds to the Montelian later NBA II to early NBA III (around 1300 BCE).

The Wider Archaeological Material

In order to contextualise the high-resolution human mobility data presented in this paper, we conducted a series of analyses on the archaeological material from the Vejle region, which dated to the Early NBA (c. 1600-1100 BCE). The catalogue by Aner, Kersten, Willroth and Koch: *Die Funde der älteren Bronzezeit des nordischen Kreises in Dänemark, Schleswig-Holstein und Niedersachsen. Bd. 9: Vejle Amt* (Aner et al. 1990) forms the basis of the study. Additionally, all registered Early NBA data in VejleMuseerne's archive which were filed after the publication of the catalogue were also added. In total, the analysed data comprises 355 sites from the Early NBA (see Figure 7) and includes burials, ritual depositions and stray finds. The 358 burials in the dataset, hereof 91 from NBA II (Figure 8) and 75 from NBA III (Figure 9), provide the social context and cultural backdrop for the study. The archaeological analyses are based on the early typological chronologies for the NBA developed by Montelius (1885, 1917), Müller (1882, 1909) and Kersten (1936). For the full dataset see Appendix 1 and for further detailed description of this dataset see Appendix 2.

Multiple Methods and Results

The two recently excavated male NBA graves which are the focus of this study are investigated using multi-methodological approaches that centre on the application of a combination of archaeometric, statistical and archaeological analyses. Hence, the focus of our study is to explore the potential of combining these methodologies. Therefore, we refer the readers for details on methodologies to the following works: Millard (2014) for

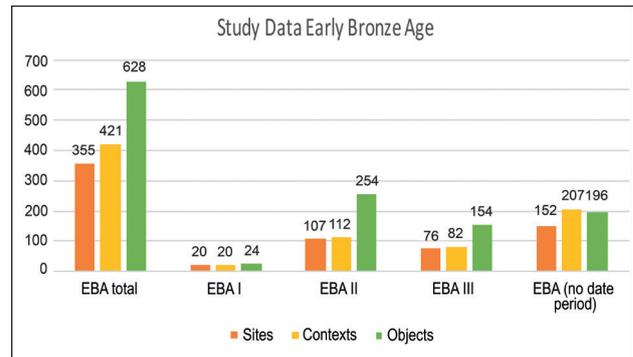


Figure 7. All study data from the Early Bronze Age, Vejle Amt (Graph: Louise Felding).

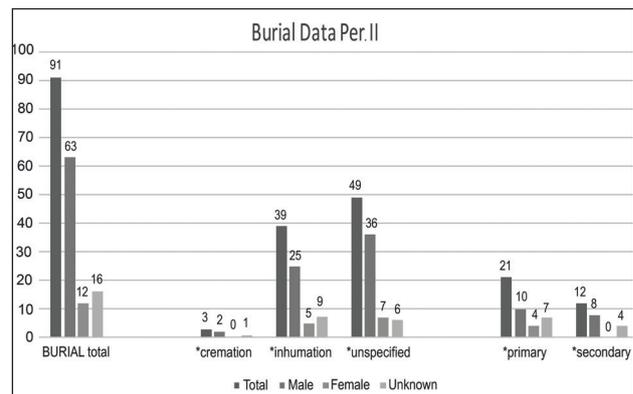


Figure 8. Burial data NBA period II (1500-1300 BCE), Vejle Amt (Graph: Louise Felding).

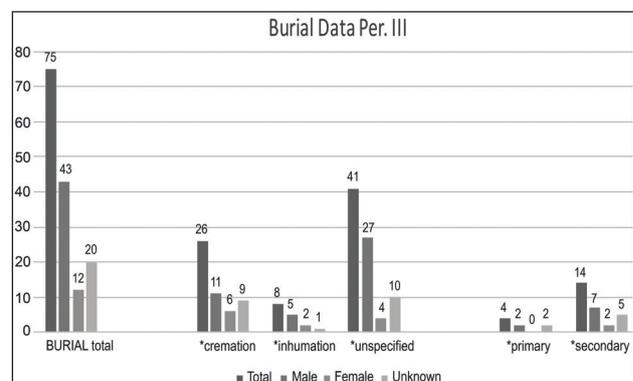


Figure 9. Burial data NBA period III (1300-1100BCE), Vejle Amt (Graph: Louise Felding).

radiocarbon dating, Bentley (2006) and Montgomery (2010) for strontium isotope analyses and Brughmans, Collar and Coward (2016) and Knappett (2011) for network analyses.

AAR	Site	Museum sample id	Material (species)	Context	¹⁴ C age (BP)	Calibration and correction	Calibrated age (BC)
30623	VKH 3418	x14A	Bone, antler/horn	Grave A14	3090 ± 28	Calibration curve: IntCal13 (Atmospheric)	68.2 % probability 1408BC (27.9 %) 1376BC 1348BC (40.3 %) 1304BC 95.4 % probability 1422BC (95.4 %) 1282BC
30624	VKH 1842	x11 sample 41	Textile	Grave K3	3109 ± 25	Calibration curve: IntCal13 (Atmospheric)	68.2 % probability 1420BC (38.8 %) 1383BC 1340BC (29.4 %) 1310BC 95.4 % probability 1434BC (95.4 %) 1296BC

Table 1. AMS dating results from VKH 1842 Højgaard and VKH 3418 Jelling Øst. The ¹⁴C ages are reported in conventional radiocarbon years BP (before present = 1950) in accordance with international convention (Stuiver and Polach 1977:355). Thus, all calculated ¹⁴C ages have been corrected for fractionation so as to refer the result to be equivalent with the standard δ¹³C value of -25 ‰ (wood). Calibrated ages in calendar years have been obtained from the calibration curves in Reimer et. al. (2013) by means of the Oxcal v4.1 calibration programme (Ramsey 2009) using the terrestrial calibration curve, IntCal13. The probability method has been used to calculate the calibrated age ranges corresponding to 68.2 % probability (1 sigma) and 95.4 % probability (2 sigma) with the probability of each range given in brackets (indicating the probability that the true date belongs to the interval in question) (Table and text: Aarhus AMS Centre at Geo-Science Aarhus University).

Radiocarbon Dating

The AMS Centre at Geo-Science of Aarhus University dated two samples (one each from VKH 1842 Højgaard and VKH 3418 Jelling Øst). Neither of the graves contained human remains suitable for dating. Instead, the sample from Højgaard was taken from the textile fragment found in grave K3 (VKH 1842x11 sample 41). The sample from Jelling Øst came from the horn of the sword that was found in grave A14 (VKH 3418x14A). The AMS dating results confirmed the typological dates of the graves within period II of the Early NBA and are presented in more detail in Table 1.

Strontium Isotope Analyses

Method

Strontium isotope analyses conducted on archaeological human remains (e.g. on tooth enamel and/or cremated bone) can provide information on provenance and potential mobility at the individual level (Bentley 2006; Montgomery 2010). The sampling strategy at both sites was based on an assessment of the state of preservation of the human remains. We aimed at sampling several molars in order to identify potential mobili-

ty during early life. In the case of the individual from VKH 1842 Højgaard we were able to sample M1 and M2 as well as a premolar, but no M3. In the case of the individual from VKH 3418 Jelling Øst, we were able to sample all three molars (i.e. M1, M2 and M3).

Tooth enamel samples were pre-cleaned by removing the enamel's surface with a drill bit, and subsequently, a few milligrams of enamel were sampled from each tooth. The tooth enamel samples were dissolved in pre-cleaned 7 ml Teflon beakers (Savillex) in a 1:1 solution of 0.5 ml 6 N HCl (Seastar) and 0.5 ml 30 % H₂O₂ (Seastar). The samples typically dissolved within 5 minutes, after which the solutions were dried on a hotplate at 80 °C. Subsequently, the enamel samples were taken up in a few drops of 3N HNO₃ and then loaded onto disposable 100 µl pipette tip extraction columns into which we fitted a frit which retained a 0.2 ml stem volume of intensively pre-cleaned mesh 50-100 Sr-Spec (TrisKem) chromatographic resin. The elution recipe essentially followed that by (Philip Horwitz et al. 1992) albeit scaled to our needs insofar as strontium was eluted / stripped by pure deionized water and then the eluate 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 Ta₂O₅-H₃PO₄-HF activa-

tor solution and directly loaded onto previously outgassed 99.98 % 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 $^{87}\text{Sr}/^{86}\text{Sr} = 0.710238 \pm 0.000012$ ($n=5$, 2σ), which we compare to the generally accepted value of $^{87}\text{Sr}/^{86}\text{Sr} = 0.710248$ (McArthur et al., 2006).

Baseline

In order to investigate geographical provenance of single individuals applying the strontium isotope system, the baseline range of the isotopic composition of the local bioavailable strontium must be known. Most of Denmark (with the exception of the island of Bornholm) consists of a pre-Quaternary geological basement primarily composed of Tertiary and Cretaceous sediments. These are overlain by glaciogenic sediments deposited during the Ice Ages. The Vejle region is located partially east and partially west of the Maximum glacial advance line (~22.000 B.P.) which delineates the maximum expansion of the ice cover in Jutland during the last Ice Age – the Weichsel Ice Age. Both of the sites investigated herein are located east of this line.

In the last decade several baseline studies have been conducted in present-day Denmark, aiming at shedding light on the bioavailable strontium

isotopic range of this region. While some aim at providing a general overview based on surface water (Frei and Frei 2011) and fauna samples (Frei and Price 2012) others concentrate on in detail baseline investigations within the vicinity of the archaeological site of interest (often including several types of proxies, i.e. plants, soils, water and fauna) (e.g. Frei et al. 2017). These efforts combined have resulted in a baseline for present-day Denmark with strontium isotope signatures that range from $^{87}\text{Sr}/^{86}\text{Sr} \sim 0.708$ to 0.711 (Frei 2012; Frei and Frei 2011, 2013; Frei and Price 2012; Price et al. 2007, 2011). Furthermore, ongoing debates on potential anthropogenic factors such as the use of fertilizers (e.g. Frei and Frei 2011) and agricultural lime (R. Frei et al. 2019) aim at investigating the effects of such additives on the biosphere. These studies show the complexity inherent in the transfer of natural geogenic *vs* agricultural Sr to the biosphere. Nevertheless, the above-mentioned ranges for present-day Denmark seem to be in accordance with the recent bioavailable strontium isotope baseline mapping of > 1200 soil samples from Europe (Hoogewerff et al. 2019).

Results

The results of the strontium isotope analyses are presented in Table 2. The individual from VKH 1842 Højgaard yielded $^{87}\text{Sr}/^{86}\text{Sr}$ that ranged from 0.71011 to 0.71073 while the individual from VKH 3418 Jelling Øst yielded $^{87}\text{Sr}/^{86}\text{Sr}$ that ranged from 0.71080 to 0.71151. The mineralization of

Site: VKH 1842 Højgaard			
Lab Number	Tooth	$^{87}\text{Sr}/^{86}\text{Sr}$	($\pm 2\text{SE}$)
KM121	M2*	0.71055	0.00001
KM122	M1*	0.71011	0.00001
KM123	PM2*	0.71073	0.00001
Site: VKH 3418 Jelling Øst			
Lab Number	Tooth	$^{87}\text{Sr}/^{86}\text{Sr}$	($\pm 2\text{SE}$)
KM124	Low R M3	0.71080	0.00002
KM125	Low L M2	0.71151	0.00001
KM126	Low R M1	0.71128	0.00001

Table 2. Results of $^{87}\text{Sr}/^{86}\text{Sr}$ analyses of tooth enamel from the Højgaard and Jelling Øst individuals.

*Due to preservation conditions, these teeth were identified only to category (Table by Samantha S. Reiter).

human tooth enamel occurs within different times over the life course from childhood to early adolescence (e.g. the mineralization of the enamel of the first molar starts *in utero* and finalizes around the age of 3 years of age, the second molar mineralizes between the ages of c. 2-8 years and the third molar from c. 7-16 years) (Hillson 1996; Montgomery 2010). Thus, through the investigation of several molars it is possible to potentially provide a temporal dimension to individual life stories.

The strontium isotope results of all the three tooth enamel samples from the Højgaard individual fall within the above-mentioned baseline range, suggesting a local origin. However, the strontium isotope results of the first and second molars from the Jelling Øst individual fall just outside the above-mentioned baseline range, while the third molar has a local value. This suggests that this individual might have been of nonlocal origin and may have moved from a place outside present-day Denmark to the region of Vejle. This potential mobility seems to have taken place while this individual was young, as indicated by the difference in strontium isotope ratios between the molars. This result is interesting seen in the light of the young male's dress pin; a foreign piece of jewellery found to have the closest parallels in Lower Saxony several hundred km towards the south.

Network Analysis

Method

Network analysis provides a useful tool to explore large datasets of archaeological assemblages while searching for linked patterns, which are otherwise difficult to comprehend, as networks visually clarify complex relationships that exist between objects and their contexts. This opens a window to examine the relationships that existed between people, objects and the expressed identities (i.e. the social roles and/or gender) of Bronze Age people. Numerous studies of the NBA have pinpointed male and female gender as the primary identities of the period (e.g. Bergerbrant 2007; Holst 2012; Sørensen 1992). Here, we assume that these primary identities were further subdivided by bio-cultural parameters such as age, kinship, status, and

social roles in particular. Although not without challenges, it is possible to recognise and interpret past identities based on objects included in burial rites, ritual depositions (e.g. Brück 2004) and even depicted on rock art (Horn 2017). Indeed, social identities and social roles are essentially relational; one might therefore argue that network analysis is the method best suited to reveal identities hidden in the archaeological material. We hypothesize that just as a shared group identity would be visible through an expression of sameness, so too would contrasting social identities be made visible through marked differences in archaeological assemblages (Sørensen 1997, 94). In other words, we hypothesize that the identities of socially-similar persons should be constructed in comparable ways within a specific regional/cultural setting.

Specifically, network analysis is applied as a relational approach aiming to examine the relationships between the two male graves from VKH 1842 Højgaard and VKH 3418 Jelling Øst and other contemporary burials and ritual deposits from the same region. When placed against the studies conducted on the young females from Egtved (Frei et al. 2015) and Skrydstrup (Frei et al. 2017), the two male individuals from VKH 1842 Højgaard and VKH 3418 Jelling Øst provide valuable insights into gendered Bronze Age identities and how these relate to mobility.

In pursuit of gendered expressions of linked male identities, a network analysis was run based on artefacts potentially relating to expressions of masculine social roles from NBA II and NBA III in Vejle Amt (see Figure 10).

The network produced for this study is a two-mode directed affiliation network created in the open source software *Gephi* (<https://gephi.org/>). The nodes in the graph represent contexts and objects. The size of node is based on *in-degree* and shows the number of edges (i.e. graves) that are joined to that same node (object type). In simple terms, the more graves found with a certain type of object, the larger the node representing this object type becomes in the network graph. The graph presented in Figure 10 is based on data available in Appendix 3, with the application of the force directed Yifan Hu layout algorithm (Hu, 2005). We checked the result by running the analyses several

Archaeological Analyses

The Dress Pin from Jelling Øst in Context

Despite the fragmented nature of the pin from VKH 3418 grave A14, an attempt was made to determine the type by conducting a survey of pins published in the *Prähistorische Bronzefunde Abteilung XIII, Bd. 1-7; 9-11* (Audouze and Courtois 1970; Carancini 1975; Essen 1985; Gedl 1983; Kubach 1977; Laux 1976; Novotná and Novotná 1980; Říhovsky 1983, 1979; Vasic 2003). Similar dress pin types were found from Rheinland-Pfalz (Kubach 1977, catalogue nr. 1195) and Lower Saxony (Laux 1976, catalogue nr. 376). The latter bear close resemblance to the pin found in grave A14 and could, perhaps, indicate long-distance connections, but these observations remain tentative. It is nevertheless worth noting that dress pins are relatively rare during this phase of the NBA and do not form part of the local metalwork repertoire. When dress pins occur in the NBA, they can usually be provenanced to Central-Northern Europe.

As the dress pin from burial A14 Jelling Øst may have come from Lower Saxony, we also conducted a survey of pins from the Vejle region in order to contextualise this discovery.

A total of ten dress pins dating to NBA II and III are known from the study area. Of these, only three could be assigned to type, namely types E, H1 and H2 respectively following the typology of Kersten (1936). All three are typologically dated within NBA II. Two pins belonging to group H (*Radnadel* or wheel-headed pin) were both found in (disturbed) female graves from Gauerlund and Thyregod parishes. The two dress pins are of different subtypes (after Kersten 1936, 31) with different areas of origin: one with the Lüneburg area (NMB253; type H2, Ke 4347; context id 146; Gauerlund parish) and the other possibly from southern Germany (NMB6546; type H1; Ke 4480; context id 364; Thyregod parish). Lastly, dress pin NMB8457 can be identified as type E (*geschwollene Nadel ohne Durchlochung*) (Kersten 1936, 30). It was found in Thyregod parish in a disturbed, supposedly male grave context, which was typologically dated to NBA II (Ke 4481A; context id 365). Pins of type E are also indicative of links to southern Germany (Kersten 1936, 30).

In summary: Although few in number, it is nonetheless significant that the dress pins found in the Vejle region give further evidence for the presence of social and trade networks between Scandinavia and northern and southern Germany; connections that are further supported by analyses of the metals (Ling et al. 2013, 2014, 2019; Melheim et al. 2018; Nørgaard et al. 2019).

Male Appearance in Vejle Amt

In further pursuit of male identities, the theoretical concept of 'appearance' as formulated by Sørensen (1991, 1997, 2004, 2013) is applied. The concept operates with a focus on artefacts; how they were worn and how they were intertwined with the deceased's life-cycle. With this in mind, we examined male individuals from closed burials from NBA II and NBA III from the Vejle region (see Appendix 3).

Present knowledge regarding the location of artefacts as worn on the body and/or placed in the grave is presented in Figures 11 and 12 representing NBA II and NBA III respectively.

Figure 11 represents the sum of our present knowledge of male appearance in NBA II in the Vejle region. From this we see a clear distinction of artefacts worn on the upper and lower body. Drinking vessels were placed at the feet; fibulae and tutuli were most often found around the upper body. The swords (metal hilted, flange hilted and plate hilted) were all found on the left side of the body. Personal items and daggers were primarily found near the waist.

Figure 12 represents the totality of our present knowledge of male appearance in NBA III in the Vejle region and illustrates some slight differences from the previous period. However, as the number of individuals is low, it is not possible to draw any certain conclusions regarding the change of male appearance from NBA II to NBA III. We see that the type of swords included (flange hilted and rod tanged swords) now reflect the period in question (NBA III). Interestingly, none of the swords were found on the left side of body. Instead, they were placed above the deceased's lower body or on the right side. Personal items and toiletries remain focused near the waist. No vessels were recorded in these burials.

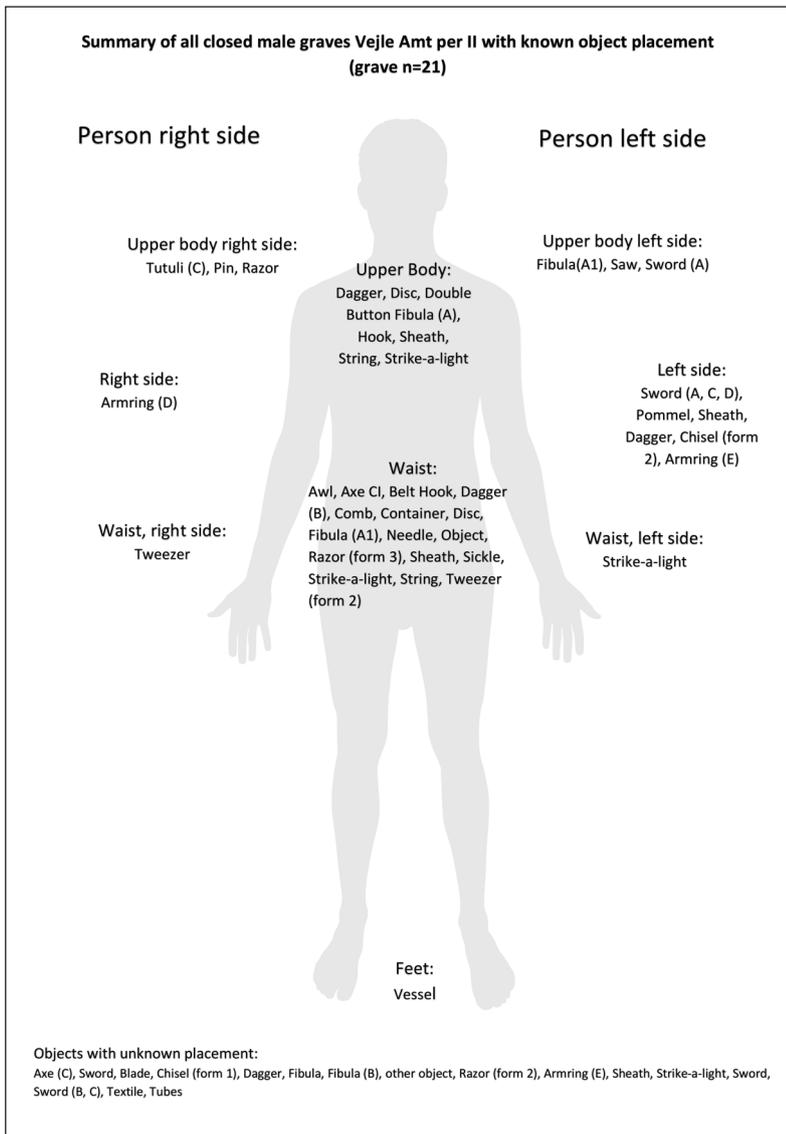


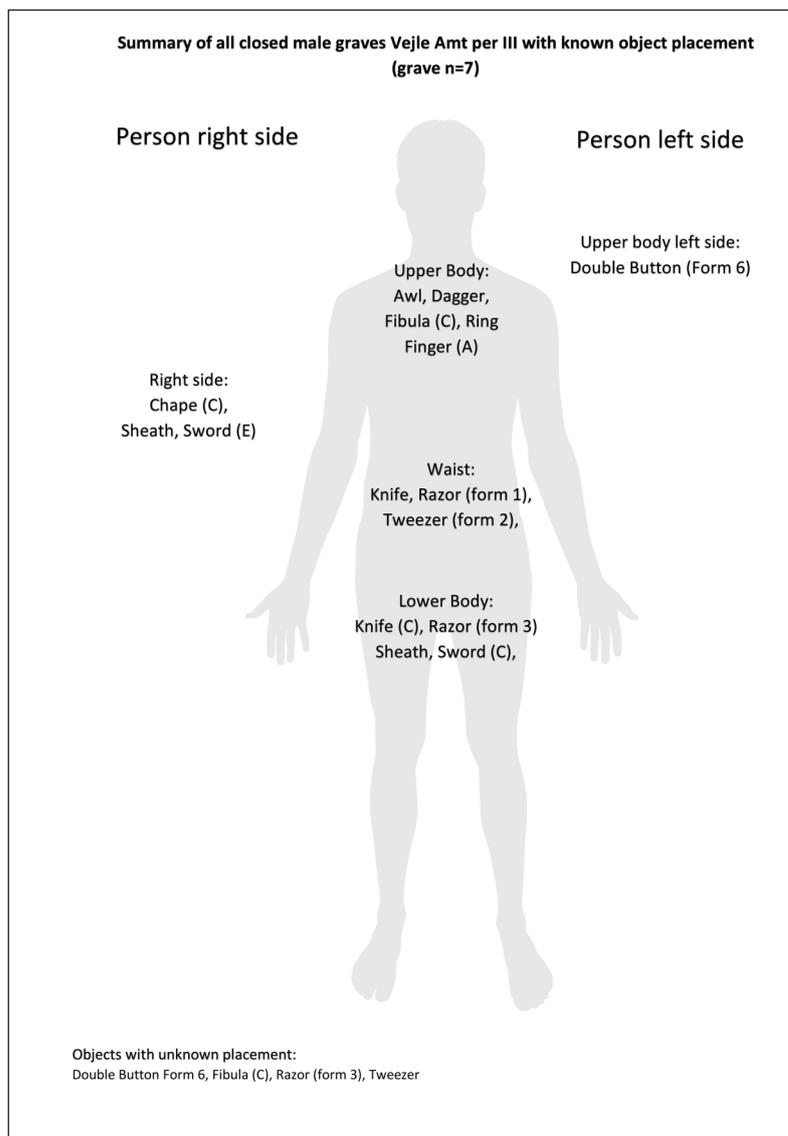
Figure 11. Male appearance NBA II. Summary of all objects with known placement from 21 closed male gendered burials from Vejle Amt typologically dated to period II (1500-1300 BCE) (Graphic: Louise Felding).

The appearance of the male individuals from per. II and III in Vejle Amt seems to point to a general code of male social presentation through artefacts (especially weapons and jewellery). The material presented here is too small to be conclusive, but other studies on contemporary material support a fairly homogenous expressions of male identity in the Early NBA (Bergerbrant 2007; Hansen 2014; Sørensen 1997). The most interesting aspect of this study is again to highlight the diversity of the male identities by including objects emphasising craft skills, which has already been shown through network analyses presented in Figure 10.

However, these practical skills are not clearly expressed in the same way in the appearance of the deceased. Expressing identity through appearance seems to have been focused on expressing social and gender status rather than necessarily expressing vocational skills. This does not mean that vocational

skills were not an integrated part of the person's identity. On the contrary, one would assume that skilled labour was highly regarded. However, tools were not worn as part of the costume in relation to appearance. Instead, they were placed in the grave as goods, presumably to facilitate the practice of learned skills in the after-life. Some craft (and toiletry) items were found near the waist which suggest that they were carried at the belt but in such cases, they would be hidden in a leather pouch or other container and thereby not directly visible to communicate social status or identity through appearance.

Figure 12. Male appearance NBA III. Summary of all objects with known placement from 7 closed male gendered burials from Vejle Amt typologically dated to period III (1300-1100 BCE) (Graphic: Louise Felding).



Discussion

A Network of Violent Beauty?

The term ‘violent beauty’ was coined by Vandkilde (2018) to account for the fact that Copper and Bronze Age Europe holds strong indications that the beautiful warrior, with his trained well-groomed body and shining weaponry, was capable of even extreme violence. Our analyses of the archaeological context from the Vejle region have revealed insights into male identities showing a hierarchical division of social roles related to warfare and leadership. The analyses also indicate craft and domestic skill such as wood working and sewing as important aspects of male identities both in war and peace. As demonstrated in this paper, the distinctive triad of sword, spear and axe points to particular roles amongst prominent males in NBA

society. The twin weapon hoards deposited near each other at Valsømagle (Lake Haraldsted, Sorø) (Aner and Kersten 1976; Ke1097 and Ke1098) lead in the same direction, however at an earlier stage: NBA IB c.1550 BCE. Each hoard is a unit with individualised weapons but at the same time, the two hoards interlink through sword, spear, and axe and through the same cosmology-infused style. The Valsømagle assemblages provide one of the earliest evidences of a military unit staffed with warrior males who undertook differentiated roles. They likely represent two interlinked war bands each including a sword-bearing war leader with his warrior companions in ranked position wielding either spear or axe (see Vandkilde 2018, p. 89 Table 1). The very same pattern of social structure is visible in the network graph (Figure 10) showing the same male social roles in place in the Early NBA in the Vejle region and quite possibly else-

where, too. The data reveal several identities recognised by weapon combinations, albeit with a crucial difference between hoards and graves. All three weapon types can be found together in the hoards. For this reason, hoards are seen as expressions greater than an individual scale, and are interpreted here as war bands. In the burial data, we do not see all three weapon types found together. Instead, separate identities appear marked by the following weapon combinations: sword alone, sword in combination with axe or spear and, finally, axe or spear alone. These observations are supported by rock art data which show the same weapon combinations (Bertilsson 2015; Horn and Potter 2018; Ling and Bertilsson 2017). As an overall observation based on the graves and depositions, we thus emphasise that warriorhood is individually felt and collectively shared.

In the study data from Vejle Amt, we see a distinct separation of the spear and axe, whereas the sword appears more dynamic and ‘connects’ the various male roles. It was possible to carry out an analysis of the sword in combination with other artefacts - weapons and jewellery alike. It is clear that, in some contexts, the sword signalled warriorhood (and leadership of the warrior fraternity of ‘brothers’), but in other contexts, the sword should be seen as having been a representation of a leader with a more political and/ or perhaps religious status. It is even likely that, in many cases, these functions were integrated into one and the same person pointing to the complex relationships between multiple identities and social roles in the Bronze Age.

As demonstrated in Figure 10, we have seen a division between the axe, spear and sword. The remaining larger group of objects are less distinct and heavily intertwined with the sword. This grouping consists of items often labelled personal- and toiletry items. However, this group also contains artefacts that point to crafting and skilled labour. This indicates a different sphere of male identities or roles, which are often overlooked. This aspect of male social roles has recently been demonstrated in a study from the Viking Age (Moen 2019) and a similar trend is now visible in the Bronze Age material from the Vejle region. These observations gain further footing when joined by recent discoveries at the Tollense battlefield which show that some war-

rior males also brought practical small items stored in an organic container interpreted as a ‘toolbox’ (Uhlig et al. 2019). These items of a craft-related nature are, therefore, to be regarded as important for the warrior equipment and, thus, as part of the male warrior identity. Likewise, it supports the idea that male identities were multifaceted and that social roles of a practical nature were involved both in war and social ‘everyday’ life.

Following this line of inquiry, the inclusion of awls in several NBA male graves should perhaps be interpreted as working tools instead of automatically being regarded as tattooing devices (Treherne 1995, 110). Awls are useful tools for working skin, leather and bark (e.g. the bark vessels such as those found in the Egtved woman’s grave). We should perhaps consider whether the awl would have represented skills that were not gender-specific but vocational instead (i.e. practiced by both men and women).

In referencing the seminal work by Treherne (1995), we can say that the male network graph from Vejle Amt (Figure 10) represents a network of ‘violent beauty’ related to male ideologies, identities and roles in the Early NBA. However, the graph does not only show identities related to warfare, status and leadership, but also highlights potentially overlapping arenas of male life-worlds and skilled labour in war and peace.

Gender Structures and Social Roles in Bronze Age Society

Relational analogies (Ravn 1993; Wylie 1985) from Homer’s epic poems the *Iliad* and the *Odyssey* have been used for constructive insights into the gendered structure of Bronze Age societies in Europe (Vandkilde 2006). Especially in the *Iliad*, Homeric societies are depicted as having been structured around war and warriorhood among the princely elite; similar ideals and social relationships are observable in the material culture of the European Bronze Age. Males in the upper social rungs were probably born into the warrior role whilst the warrior institution was a social place for actually building fame and, thus, male status, identity and roles in war (Vandkilde 2006, 523).

Kristiansen quite clearly demonstrates how social identities were constructed in the NBA through selective use of material culture in order to define

different social roles (Kristiansen 1984, 1998, 121-125). Based on sword types and distribution, he categorises three different male social identities in Early NBA society: religious chiefs, warrior chiefs and individuals linked with elite international trading (Kristiansen 2014; Kristiansen and Larsson 2005, 237–243; Kristiansen and Suchowska-Ducke 2015). We would suggest it fitting to refer to war-leaders and socio-political-leaders and, furthermore, consider that these social roles *could* have been held by different individuals *or* perhaps also by the same person. Overall, the multiple identities found emphasize the social complexity of Bronze Age society which is also pointed out by Kristiansen (2007) in his statement that the NBA can be recognised by its decentralised complexity.

Nevertheless, the duality in the proposal of leadership between socio-political leaders and war-leaders is convincingly rooted in the overarching core dualism in the NBA ritual belief system (e.g. Kristiansen and Larsson 2005) and is also apparent in the twin hoards from Valsømagle (Vandkilde 2018). Leadership is, thus, signalled by the sword (both war and political) and, if found with other types of weapons, can probably be related to war-leadership. The spear-sword and axe-sword combination is regarded as having been more powerful and would have separated war-leaders from war companions that ‘only’ bore an axe or a spear.

Male Identities and Mobility in the Bronze Age

A survey of selected artefacts from the Vejle region indicated connections with south and north Germany. It is clear that it is now paramount to investigate the underlying (gendered) social structures that organised the movement of people and goods in the Bronze Age with the note that some forms of movement may have been socially biased. Some people may have moved little during a lifetime, others had the economic backing to invest in long distant journeys at sea (Ling et al. 2018) whilst still others may have been forced to move away from their homes for a variety of reasons.

Several patterns of mobility may be observed within Bronze Age society (Frei et al. 2015, 2017; Knipper et al. 2017; Kristiansen and Larsson 2005; Reiter and Frei 2019; Vandkilde et al. 2015); isotopic signatures can suggest that some individuals, both women and men, travelled and moved to new

locations within their lifetimes (Frei et al. 2019). We argue that, based on these results, we should consider alternative male roles from the ones that have emerged from earlier somewhat idealized accounts (Treherne 1995, see also above). Although maleness might often have been defined through leadership, patrilocality and warriorhood, these were probably not the only routes open to males in the Bronze Age (see also Skogstrand 2010). Based on recent evidence, it seems timely to contemplate additional alternatives for the construction of male identities in the Early NBA.

A recent investigation presenting the results of the largest multidisciplinary human mobility study to date of skeletal remains from present-day Denmark from the 3rd and 2nd millennia BCE indicates a clear shift in mobility patterns in the Early Bronze Age (Frei et al. 2019). This study was based on a combination of strontium isotope and radiocarbon analyses together with anthropological investigations, aiming at exploring potential human mobility patterns during the late Neolithic and Early Bronze Age periods. Overall, their data suggest that, while the majority of individuals investigated were of local origin, the mobility of people seems to have been continuous throughout the 3rd and 2nd millennia BCE, but with a clear shift from around 1600 BCE onwards characterized by a larger variation in the geographical origin of the migrants (Frei et al. 2019). This shift seems to have happened in parallel with a strong increase of metal being imported to the region as well as with an isotopic change in the metal composition as shown by a recent study by Nørgaard et al. (2019). Interestingly, the human mobility study revealed that several male individuals were of nonlocal provenance (Frei et al. 2019). When we combine these previous results with the strontium isotope results presented in this paper, it is apparent that mobility is a relevant factor for both genders in Bronze Age society and that the term ‘*Fremde Männer*’ should be considered and explored further as part of the social dynamics of Early Bronze Age society.

Conclusion

The aim of the present study was to investigate male social roles in relation to mobility using a

multi-methodological approach focusing on archaeological material dating to NBA II and III (1500-1100 BCE), within the Vejle region of SE Jutland, Denmark.

New insights emerged through the application of this combined methodological approach. Archaeological and network analyses of male gear from burials and ritual deposits on a regional scale were combined with detailed results from two case studies using strontium isotope and radiocarbon analyses.

Specifically, the warrior arises as an overall identity for high-ranking males. Differences in their weaponry suggest that a minimum of three kinds of warriors were distinguished. Moreover, this observation is supported by research on the use of swords and spears from both earlier and contemporary contexts (Horn 2013; Horn and Karck 2019; Kristiansen 1984, 2002). These differences surely related to their disparate though coordinated roles in war but likely also permeated the household and other social domains. Furthermore, the strontium isotope results suggest that one of the two individuals on which we conducted strontium isotope analyses was local while the other might have moved.

When combined with other recent investigations, the present paper can indicate a varied pattern of mobility (including non-mobility) within Bronze Age society regardless of gender. Our results reveal complex and gendered socio-dynamics during Early NBA, hence updating and detailing previous studies. Furthermore, it is clear that long-distance travels enabled acquisition of key exogenous resources (such as bronze) that provided a comparative advantage when competing for or maintaining local political power (Earle et al. 2015; Vandkilde 2016). Several social routes were likely available for male elites when engaging in a game for power and prestige. Some routes took place on the local scene as a lynchpin for long-distance networks (such as was the case at Højgaard), while others implied movement and then integration as a highly functioning and -respected elite member of local society (such as it might have been the case for Jelling Øst).

Finally, our study suggests that there is potentially important information to be retrieved when combining network analyses with results from ar-

chaeometric data, thus providing a new platform and multi-methodological tool relevant for understanding prehistoric social structures in relation to mobility.

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Declaration of Interest

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

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Appendices

<i>Appendix 1. Spreadsheet.</i> Total dataset for the Early Bronze Age, Vejle Amt.	26-110
<i>Appendix 2. Text.</i> Metadata on dataset.	111-113
<i>Appendix 3. Spreadsheet.</i> Male gendered contexts per. II and III, Vejle Amt.	114-167

Con- text_ id	Site id	Regional Museum code	Place Name	Site Classifi- cation	Find Year	Coun- try	Adm id	Sb nr.	Parish	Coord_ EAST	Coord_ NORTH	UTM zone	SITE:Notes	Context Name	In Situ	Closed Con- text	Context Classifi- cation	Orien- tation	Hum- an Re- mains	Gender Social	Con- text date by period	Notes	Object_Muse- um_id	Quan- tity	Object date by period	Description_ object	Object Mate- rial	Object Place- ment	Artefact Classifi- cation	Object Sub- type	Eco- fact Classi- fifi- ca- tion
11	40		Palsgård	Loose Find	1964	DK	170101		As	0	0		Single find from per. II Mus nummer maybe NM and not Vejle?		0	0	Unknown		0	Un- known	EBA II	Find un- place un- known	VKH958x4649	1	EBA II	Tutuli with narrow ornamental lines and flat rim. Conical point.	Bronze	N/A	Tutuli_ Group A	Form A01	N/A
19	43	Moesgaard 7249	Palsgård	Burial Mound	0	DK	170101		As	0	0		Nor in situ But found in burial mound near Palsgård with male per. III burial		0	0	Burial_ Unspec	0	Male	EBA III		Moesgaard 7249	1	EBA III	Unsecure context	Bronze		Chape_ Form B B04	Form B04		
20	44	Moesgaard 753	Kirchspiel As	Single Deposi- tion	0	DK	170101		As	0	0		Unknown find place. Bought in Horsens. Probable deposit		0	0	Context_ Wetland	0	N/A	Early Bronze Age	Probable bog depo- sition	Moesgaard 753	1	Early Bronze Age	Bog patina. Massive chisel with signs of wear (abschal- benutzung). enden durch bent neck round sides and blunt edge.	Bronze		Chisel			
22	46	NM26095	Barritskov	Single Deposi- tion	1856	DK	170102		Barrit	0	0		Probable deposit per II		0	0	Unknown	0	Male	EBA II		NM26095		EBA II	Previous Frederik VII nr. 1770 Possible bog patina.	Bronze		Axe_ Group C1			
23	47	NM26240	Barritskov	Single Find	1856	DK	170102		Barrit	0	0		Probably from per. III grave. Unknown location		0	0	Burial_ Unspec	0	Un- known	EBA III	Probably from burial context. Location unknown.	NM26240	1	EBA III	From Fredrik VII collection.	Bronze		Fibula_ Group B, Frag- ment			
26	49	VKH 1130/64	Glud	Single Grave	1930	DK	170104	42	Glud	563288	6186059	ETRS89 32N			1	0	Burial_ Unspec, Grave_ Flat_ Grave	0	Un- known	Early Bronze Age	Grave stones found by plough- ing. Presum- ably flat grave	VKH 1130/64	1	Early Bronze Age	Fragment of dagger blade. Privately owned.	Bronze		Blade, Dagger			
27	50	Glud Museum A470/1957	Tombal- legård	Burial Mound	1880	DK	170104		Glud	0	0		From removed mound.		0	0	Burial_ Unspec	0	Male	EBA II		Glud Museum A470/1957	1	EBA II		Bronze		Axe_ Group D			
28	51	Museum Glud B243/1957	Glud sogn	Loose Find	0	DK	170104		Glud	0	0		Handed in from Hjarnø		0	0	Unknown	0	Un- known	EBA III		Museum Glud B243/1957	1	EBA III	rhombic section	Bronze		Dag- ger_ Group A			

41	63		MKH 1646	Almind	Almind	530974	6158066	ETRS 89	32N	From: matrikel 1A Probable grave	0	0	Burial_ Unspec	0	Male	EBA II	MKH 1646	1		Bronze	Axe_ Group C, Pal- stave_ Work
42	64			Donsmølle	Almind	527945	6158031	ETRS 89	32N	Several mounds nearby (sb 13 A-D)	0	0	Unknown	0	Male	Early Bronze Age	unknown			Bronze	Axe
43	65	NM19888		Møsvrå	Almind	532762	6158016	ETRS 89	32N		0	0	Burial_ Unspec	0	Un- known	Early Bronze Age	NM19888			Gold	Ring_ Finger_ Group A
44	66			Møsvrå	Almind	532574	6158232	ETRS 89	32N		0	0	Context_ Wetland	0	Male	Early Bronze Age	unknown	1		Bronze	Spear Head
45	67			Eltang	Eltang	534779	615422	ETRS 89	32N		0	0	Burial_ Unspec	0	Male	Early Bronze Age	unknown	1		Bronze	Sword
46	68		Moesgaard 5229	Eltang	Eltang	0	0				0	0	Context_ Wetland	0	Male	EBA II	Moesgaard 5229	1			Spear Head Form 6
47	69	NM 368/38		Ejstrup	Harte	516483	6205417	ETRS 89	32N	AK mentions possible deposition. FF: burial mound	0	0	Burial_ Unspec, Grave_ Oak_ Coffin	0	Un- known	Early Bronze Age	NM 368/38	1		Wood	Coffin
48	70			Harte	Harte	0	0			Bought in antiquities store in Odense. Gift to Esbjerg Museum.	0	0	Burial_ Unspec	0	Male	EBA III	Esbjerg 688	1		Bronze	Sword_ Group E
51	72			Højrup	Herslev	537332	6158574	ETRS 89	32N		1	0	Burial_ Unspec, Grave_ Stone_ Built	0	Male	Early Bronze Age	unknown	1		Bronze	Sword
51	72			Højrup	Herslev	537332	6158574	ETRS 89	32N		1	0	Burial_ Unspec, Grave_ Stone_ Built	0	Male	Early Bronze Age	unknown	1		Bronze	Pin
55	74	NM 1118/69		Tolstrup	Herslev	539482	6159411	ETRS89	32N	Diameter: 24 - 25m. Four cup marks in stone perimeter (stones kept at farm).	1	0	Other	0	Un- known	Early Bronze Age	stone 1	1		Stone	Rock Carving
55	74	NM 1118/69		Tolstrup	Herslev	539482	6159411	ETRS89	32N	Diameter: 24 - 25m. Four cup marks in stone perimeter (stones kept at farm).	1	0	Other	0	Un- known	Early Bronze Age	stone 2	1		Stone	Rock Carving

55	74	NM 1118/69	Tolstrup	Burial Mound	1969	DK	170204	13	Herslev	539482	6159411	ETRS89	32N	Diameter: 24 - 25m. Four cup marks in stone perimeter (stones kept at farm).	1	0	Other	0	Un-known	Early Bronze Age	Stone circle around mound (hand-kreds)	stone 3	1	Early Bronze Age	Stone	Rock Carving
55	74	NM 1118/69	Tolstrup	Burial Mound	1969	DK	170204	13	Herslev	539482	6159411	ETRS89	32N	Diameter: 24 - 25m. Four cup marks in stone perimeter (stones kept at farm).	1	0	Other	0	Un-known	Early Bronze Age	Stone circle around mound (hand-kreds)	stone 4	1	Early Bronze Age	Stone	Rock Carving
55	74	NM 1118/69	Tolstrup	Burial Mound	1969	DK	170204	13	Herslev	539482	6159411	ETRS89	32N	Diameter: 24 - 25m. Four cup marks in stone perimeter (stones kept at farm).	1	0	Other	0	Un-known	Early Bronze Age	Stone circle around mound (hand-kreds)	stone 5	1	Early Bronze Age	Stone	Rock Carving
56	75		Hvidsminde	Burial Mound	1908	DK	170205	34	Kolding	532168	6151381	ETRS 89	32N	Earlier id. sb 9.	0	0	Burial_ Unspec_ Grave_ Stone_ Built	0	Male	Early Bronze Age	Now missing	unknown	1	Early Bronze Age	Bronze	Sword
57	76		Kolding	Burial Mound	0	DK	170205	5	Kolding	529431	6150508	ETRS 89	32N	FF placename: Kolding Markjorder	1	0	Burial_ Unspec	0	Male	Early Bronze Age		unknown	1	EBA III	Bronze	Sword_ Group A
58	76		Kolding	Burial Mound	0	DK	170205	5	Kolding	529431	6150508	ETRS 89	32N	FF placename: Kolding Markjorder	0	0	Burial_ Unspec	0	Un-known	Early Bronze Age	North of mound sb 5	NMB2318	1		Bronze	Ring_ Arm
59	77	Museer på Koldinghus udgravning-sprotokol	Kolding	Burial Mound	1908	DK	170205	7	Kolding	529564	6150421	ETRS 89	32N	Investigated 1925 and 1966.	1	0	Burial_ Unspec_ Grave_ Stone_ Built	0	Male	Early Bronze Age		B2586?	1	Early Bronze Age	Bronze	Pin
59	77	Museer på Koldinghus udgravning-sprotokol	Kolding	Burial Mound	1908	DK	170205	7	Kolding	529564	6150421	ETRS 89	32N	Investigated 1925 and 1966.	1	0	Burial_ Unspec_ Grave_ Stone_ Built	0	Male	Early Bronze Age		B2586		Early Bronze Age	Bronze	Fragment_ Sword
60	78	NM 606/68	Kolding	Single Find	1968	DK	170205	11	Kolding	529423	6151044	ETRS 89	32N	Found at highest point at field.	0	0	Burial_ Unspec	0	Un-known	EBA III	Possible burial	NMB15992	1	EBA III	Bronze	Dagger_ Group A
61	79	MKH 2996	Kolding	Burial Mound	1981	DK	170205	8	Kolding	530486	6148200	ETRS 89	32N	For this purpose registered under sb 8. Does not match information in FF for sb 8. Found on Kolding Markjorder II aft. Between matrikel 150b and 154	0	0	Burial_ Unspec	0	Male	EBA III		MKH 2996	1	EBA III	Bronze	Sword_ Group C

108	114	1101/67	VKH 61	Assendrup	Burial Mound	1964	DK	170402	45	Engum	542013	6174944	ETRS 89	32N	Exc. Sb. 38 in VKH archive. FF place-name: Skovhave. Some irregularities with sb number and local VKH nr.	1	0	Burial_Creation, Grave_Oak_Cof-fin, Grave_Stone_Built	E-W	1	Male	EBA III	Dimensions: 2,80m x0,90-1,15m.	x1	1	EBA III	Bronze	Upper_Body	Fibula, Fragment	
108	114	1101/67	VKH 61	Assendrup	Burial Mound	1964	DK	170402	45	Engum	542013	6174944	ETRS 89	32N	Exc. Sb. 38 in VKH archive. FF place-name: Skovhave. Some irregularities with sb number and local VKH nr.	1	0	Burial_Creation, Grave_Oak_Cof-fin, Grave_Stone_Built	E-W	1	Male	EBA III	Dimensions: 2,80m x0,90-1,15m.	x2	1	EBA III	Bronze	Upper_Body	Double Button, Form 6	
108	114	1101/67	VKH 61	Assendrup	Burial Mound	1964	DK	170402	45	Engum	542013	6174944	ETRS 89	32N	Exc. Sb. 38 in VKH archive. FF place-name: Skovhave. Some irregularities with sb number and local VKH nr.	1	0	Burial_Creation, Grave_Oak_Cof-fin, Grave_Stone_Built	E-W	1	Male	EBA III	Dimensions: 2,80m x0,90-1,15m.	x3	1	EBA III	Amber	Lower_Body	Bead, Fragment	
109	115			Bredal	Burial Mound	1855	DK	170402	5	Engum	541069	6178777	ETRS 89	32N		1	0	Burial_Unspec		0	Male	EBA II		NM15309	1	EBA II	Bronze		Sword, Group A	
111	116		VKH 35xV	Engumgård	Loose Find	0	DK	170402		Engum	0	0				0	0	Unknown		0	Male	Early Bronze Age		VKH 35xV	1	Early Bronze Age	Bronze		Blade, Fragment, Sword	
112	117			Tyrsbæk	Single Find	0	DK	170402		Engum	0	0				0	0	Unknown		0	Male	EBA I		unknown	1	EBA I	Cu Alloy	Axe, Group B		
115	119		HOM 361	Hattung	Burial Mound	1988	DK	170403	87	Hattung	547636	6191063	ETRS89	32N		1	1	Burial_Inhumation, Burial_Primary, Grave_Oak_Cof-fin, Grave_Stone_Built	E-W	0	Unknown	EBA II	Dimensions: 2,90 x 0,80-1,20m	HOM 361x1	1	EBA II	Bronze	Right_Side, Waist	Dagger, Fragment	
116	120	NM6837		Gressager	Burial Mound	1842	DK	170404		Hedensted	0	0				0	0	Burial_Unspec		0	Unknown	EBA III		NM6837	1	EBA III	Bronze		Chape, Form B	Form B04

131	129	VKH 525	Løsning	Burial Mound	1982	DK	170406	17	Løsning	542214	6184161	ETRS 89	32N	FF placename: 'Tvillingehøj' Mound in three phases.	Grab C	1	1	Burial_Inhumation, Grave_Chamber, Oak_Cof-fin, Grave_Stone_Built	NW-SE	1	Male	EBA II	Third mound phase = grave nr. 80 Ethelberg-Death house/structure/tent	VKH 525x80B	1	EBA II	Bronze	Waist	Axe_Group CI
131	129	VKH 525	Løsning	Burial Mound	1982	DK	170406	17	Løsning	542214	6184161	ETRS 89	32N	FF placename: 'Tvillingehøj' Mound in three phases.	Grab C	1	1	Burial_Inhumation, Grave_Chamber, Oak_Cof-fin, Grave_Stone_Built	NW-SE	1	Male	EBA II	Third mound phase = grave nr. 80 Ethelberg-Death house/structure/tent	VKH 525x80C-D	2	EBA II	Gold	Right_Side	Ring_Arm_Group D
135	131		Sebberup	Burial Mound	1880	DK	170406	56	Løsning	544053	6182810	ETRS 89	32N	FF placename: 'Vestermark'. Robbed.		1	0	Burial_Unspec		0	Un-known	Early Bronze Age		unknown	1	Early Bronze Age	Gold	missing	Ring
136	132	NM16404	Sebberup	Burial Mound	1857	DK	170406		Løsning	0	0					0	0	Burial_Unspec		0	Male	Early Bronze Age		NM16404	1	Early Bronze Age	Bronze		Blade, Fragment, Sword
137	133		Stubberup	Burial Mound	1890	DK	170406	35	Løsning	543962	6183880	ETRS 89	32N			1	0	Burial_Unspec		0	Male	Early Bronze Age		unknown	1	Early Bronze Age	Bronze	missing	Sword
138	134	HOM 1304-1305	Nørre Al-dumgård	Burial Mound	1957	DK	170407	19	Stenderup	548752	6181439	ETRS 89	32N	FF placename: 'Lindevang'	Grab A	1	1	Burial_Inhumation, Grave_Oak_Cof-fin, Grave_Stone_Built	W-E	0	Male	Early Bronze Age		HOM 1305 B-C	6	Early Bronze Age	Amber	Right_Side, Upper_Body	Bead
138	134	HOM 1304-1305	Nørre Al-dumgård	Burial Mound	1957	DK	170407	19	Stenderup	548752	6181439	ETRS 89	32N	FF placename: 'Lindevang'	Grab A	1	1	Burial_Inhumation, Grave_Oak_Cof-fin, Grave_Stone_Built	W-E	0	Male	Early Bronze Age		HOM 305 B-C	1	Early Bronze Age	Un-known	Right_Side, Upper_Body	Fragment, Ring

138	134		HOM 1304-1305	Norre Al-dumgård	Burial Mound	1957	DK	170407	19	Stenderup	548752	6181439	ETRS 89	32N	FF placename: 'Lindvang'	Grab A	1	1	Burial_Inhumation, Grave_Oak_Cof-fin, Grave_Stone_Built	W-E	0	Male	Early Bronze Age									
138	134		HOM 1304-1305	Norre Al-dumgård	Burial Mound	1957	DK	170407	19	Stenderup	548752	6181439	ETRS 89	32N	FF placename: 'Lindvang'	Grab A	1	1	Burial_Inhumation, Grave_Oak_Cof-fin, Grave_Stone_Built	W-E	0	Male	Early Bronze Age	HOM 1305 A	1	Early Bronze Age	type VI	Flint	Waist	Dagger		
139	134		HOM 1304-1305	Norre Al-dumgård	Burial Mound	1957	DK	170407	19	Stenderup	548752	6181439	ETRS 89	32N	FF placename: 'Lindvang'	Grab B	1	1	Burial_Inhumation, Grave_Oak_Cof-fin, Grave_Stone_Built	W-E	1	Male	Early Bronze Age	HOM 1305 a-b	2	Early Bronze Age	2 fragments of flint dagger.	Flint	N/A	Dagger		
139	134		HOM 1304-1305	Norre Al-dumgård	Burial Mound	1957	DK	170407	19	Stenderup	548752	6181439	ETRS 89	32N	FF placename: 'Lindvang'	Grab B	1	1	Burial_Inhumation, Grave_Oak_Cof-fin, Grave_Stone_Built	W-E	1	Male	Early Bronze Age	HOM 1304c	6	Early Bronze Age		Flint	N/A	Arrow Head		
139	134		HOM 1304-1305	Norre Al-dumgård	Burial Mound	1957	DK	170407	19	Stenderup	548752	6181439	ETRS 89	32N	FF placename: 'Lindvang'	Grab B	1	1	Burial_Inhumation, Grave_Oak_Cof-fin, Grave_Stone_Built	W-E	1	Male	Early Bronze Age	HOM 1305c	1	Early Bronze Age		Ce-ramic	N/A	Vessel		
140	135		Museum Moesgaard katalog nr. 1081	Sønder Aldum	Loose Find	0	DK	170407		Stenderup	0	0				0	0	Unknown				Age EBA III	Moesgård katalog 1081		Age EBA III		Bronze		Sword_Group C			
142	136	NM report nr. 4292		Tyrsted	Burial Mound	1974	DK	170410	20	Tyrsted	551632	6187631	ETRS 89	32N	FF placename: 'Smethøj'		1	1	Burial_Inhumation, Grave_Oak_Cof-fin, Grave_Stone_Built	N-S	1	Male	EBA III	Horsens P 182/74		EBA III		Bronze, Hide, Leather	Lower_Body	Sheath, Sword_Group C		
142	136	NM report nr. 4292		Tyrsted	Burial Mound	1974	DK	170410	20	Tyrsted	551632	6187631	ETRS 89	32N	FF placename: 'Smethøj'		1	1	Burial_Inhumation, Grave_Oak_Cof-fin, Grave_Stone_Built	N-S	1	Male	EBA III	Horsens P 182/72	1	EBA III		Bronze	Upper_Body	Fibula_Group C		
144	137	NMB7204		Urlev	Burial Mound	1870	DK	170411		Urlev	0	0				1	0	Burial_Unspec, Grave_Stone_Built			0	Male	EBA III	NMB7204	1	EBA III		Bronze, Ce-ramic		Dagger_Group C		
145	138			Borkop	Burial Mound	1878	DK	170501	19	Gauer-slund	540296	6166551	ETRS 89	32N	FF placename: 'Galgehøj'		1	0	Burial_Unspec			0	Male	Early Bronze Age	unknown	1	Early Bronze Age	Missing	Bronze		Sword	

165	150	VKH 328	Egved	Burial Mound	1921	DK	170601	109	Egved	517872	6164885	ETRS 89	32N	FF placename: 'Storhøj' (mound of the Egved Girl).	Grab A	1	1	Burial_Creation, Burial_Double, Burial_Inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	W-E	1	Female	EBA II	'The Egved Girl'	NMB11832	1	EBA II		Hide	Above_Cover, Under_Below	N/A	Eco-fact
165	150	VKH 328	Egved	Burial Mound	1921	DK	170601	109	Egved	517872	6164885	ETRS 89	32N	FF placename: 'Storhøj' (mound of the Egved Girl).	Grab A	1	1	Burial_Creation, Burial_Double, Burial_Inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	W-E	1	Female	EBA II	'The Egved Girl'	NMB11833	1	EBA II		Wool	Above_Cover	Blanket	Eco-fact
165	150	VKH 328	Egved	Burial Mound	1921	DK	170601	109	Egved	517872	6164885	ETRS 89	32N	FF placename: 'Storhøj' (mound of the Egved Girl).	Grab A	1	1	Burial_Creation, Burial_Double, Burial_Inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	W-E	1	Female	EBA II	'The Egved Girl'	NMB11850		EBA II	Blond hair.	Hair	N/A	Eco-fact	

165	150	VKH 328	Egved	Burial Mound	1921	DK	170601	109	Egved	517872	6164885	ETRS 89	32N	FF placename: 'Storhøj' (mound of the Egved Girl).	Grab A	1	1	Burial_Cremation, Burial_Double, Burial_Inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	W-E	1	Female	EBA II	'The Egved Girl'	NMB11837	1	EBA II	1	String	Head	Wool	Hairband	
165	150	VKH 328	Egved	Burial Mound	1921	DK	170601	109	Egved	517872	6164885	ETRS 89	32N	FF placename: 'Storhøj' (mound of the Egved Girl).	Grab A	1	1	Burial_Cremation, Burial_Double, Burial_Inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	W-E	1	Female	EBA II	'The Egved Girl'	NMB11845	1	EBA II	1	Vessel	Head, Right_Side	Bark	Bark container by head, contained several object incl. Some fragments of cremated bone of child aged 5-6 (remainer bone found wrapped in textile by her feet).	
165	150	VKH 328	Egved	Burial Mound	1921	DK	170601	109	Egved	517872	6164885	ETRS 89	32N	FF placename: 'Storhøj' (mound of the Egved Girl).	Grab A	1	1	Burial_Cremation, Burial_Double, Burial_Inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	W-E	1	Female	EBA II	'The Egved Girl'	NMB11846	1	EBA II	1	Awl_Group A	Head, Right_Side	Bronze, Wood	Found in bark container by head.	

165	150	VKH 328	Egrved	Burial Mound	1921	DK	170601	109	Egrved	517872	6164885	ETRS 89	32N	FF placename: 'Storhøj' (mound of the Egrved Girl).	Grab A	1	1	Burial_Creation, Burial_Double, Burial_Inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	W-E	1	Female	EBA II	'The Egrved Girl'	NMB11847	1	EBA II	2.40 m long. Found in bark container by head.	Wool	Head, Right_Side	String
165	150	VKH 328	Egrved	Burial Mound	1921	DK	170601	109	Egrved	517872	6164885	ETRS 89	32N	FF placename: 'Storhøj' (mound of the Egrved Girl).	Grab A	1	1	Burial_Creation, Burial_Double, Burial_Inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	W-E	1	Female	EBA II	'The Egrved Girl'	NMB11834	1	EBA II		Wool	Upper_Body	Blouse
165	150	VKH 328	Egrved	Burial Mound	1921	DK	170601	109	Egrved	517872	6164885	ETRS 89	32N	FF placename: 'Storhøj' (mound of the Egrved Girl).	Grab A	1	1	Burial_Creation, Burial_Double, Burial_Inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	W-E	1	Female	EBA II	'The Egrved Girl'	NMB11836	1	EBA II		Wool	Lower_Body	Skirt_ String

165	150	VKH 328	Egved	Burial Mound	1921	DK	170601	109	Egved	517872	6164885	ETRS 89	32N	FF placename: 'Storhøj' (mound of the Egved Girl).	Grab A	1	1	Burial_Creation, Burial_Double, Burial_Inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	W-E	1	Female	EBA II	'The Egved Girl'	NMB11840	1	EBA II	Bronze	Waist	Belt Plate_Group B	Form B02
165	150	VKH 328	Egved	Burial Mound	1921	DK	170601	109	Egved	517872	6164885	ETRS 89	32N	FF placename: 'Storhøj' (mound of the Egved Girl).	Grab A	1	1	Burial_Creation, Burial_Double, Burial_Inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	W-E	1	Female	EBA II	'The Egved Girl'	NMB11844	1	EBA II	Bronze	Head, Left_Side	Ear-ring_Small	
165	150	VKH 328	Egved	Burial Mound	1921	DK	170601	109	Egved	517872	6164885	ETRS 89	32N	FF placename: 'Storhøj' (mound of the Egved Girl).	Grab A	1	1	Burial_Creation, Burial_Double, Burial_Inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	W-E	1	Female	EBA II	'The Egved Girl'	NMB11841	1	EBA II	Bronze	Right_Side	Ring_Arm-band Group B	Not a perfect match for group B. Arm band with spiral hook finish for closing (see parallel with spiral ends: Kc 3530A, Haderlev Amt).

165	150	VKH 328	Egved	Burial Mound	1921	DK	170601	109	Egved	517872	6164885	ETRS 89	32N	FF placename: 'Storhøj' (mound of the Egved Girl).	Grab A	1	1	Burial_Creation, Burial_Double, Burial_Inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	W-E	1	Female	EBA II	'The Egved Girl'	NMB11842	1	EBA II		Bronze	Left Side	Ring-Arm Group A	Form A02
165	150	VKH 328	Egved	Burial Mound	1921	DK	170601	109	Egved	517872	6164885	ETRS 89	32N	FF placename: 'Storhøj' (mound of the Egved Girl).	Grab A	1	1	Burial_Creation, Burial_Double, Burial_Inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	W-E	1	Female	EBA II	'The Egved Girl'	NMB11843	1	EBA II	Horn comb	Horn	Waist	Comb	
165	150	VKH 328	Egved	Burial Mound	1921	DK	170601	109	Egved	517872	6164885	ETRS 89	32N	FF placename: 'Storhøj' (mound of the Egved Girl).	Grab A	1	1	Burial_Creation, Burial_Double, Burial_Inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	W-E	1	Female	EBA II	'The Egved Girl'	NMB11848	1	EBA II	Containing alcohol beverage made of wheat, bogmyrtle, cranberries and honey. See Thomsen for placement for placement (ie. above or under cover).	Bark	Feet	Vessel	

165	150	VKH 328	Egved	Burial Mound	1921	DK	170601	109	Egved	517872	6164885	ETRS 89	32N	FF placename: 'Storhøj' (mound of the Egved Girl).	Grab A	1	1	Burial_Cremation, Burial_Double, Burial_Inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	W-E	1	Female	EBA II	'The Egved Girl'	NMB1849	1	1	Containing the cremated remains of a child aged 5-6.	Wool	Lower_Body, Right_Side	Textile
165	150	VKH 328	Egved	Burial Mound	1921	DK	170601	109	Egved	517872	6164885	ETRS 89	32N	FF placename: 'Storhøj' (mound of the Egved Girl).	Grab A	1	1	Burial_Cremation, Burial_Double, Burial_Inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	W-E	1	Female	EBA II	'The Egved Girl'	NMB 11838-39	2	2	Two pieces of wool cloth wrapped round her feet.	Wool	Feet	Textile
165	150	VKH 328	Egved	Burial Mound	1921	DK	170601	109	Egved	517872	6164885	ETRS 89	32N	FF placename: 'Storhøj' (mound of the Egved Girl).	Grab A	1	1	Burial_Cremation, Burial_Double, Burial_Inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	W-E	1	Female	EBA II	'The Egved Girl'	?	1	1	oak log coffin.	Wood	Above_Cover, Under_Below	Coffin

165	150	VKH 328	Egved	Burial Mound	1921	DK	170601	109	Egved	517872	6164885	ETRS 89	32N	FF placename: 'Storhøj' (mound of the Egved Girl).	Grab A	1	1	Burial_Cre_mation, Burial_Double, Burial_Inhumation, Burial_Primary, Grave_Oak_Cof_in, Grave_Stone_Built	W-E	1	Female	EBA II	'The Egved Girl'	NMB11835	1	EBA II	woolen belt (woven) with tassels at the end.	Wool	Belt
167	151		Egved	Burial Mound	1907	DK	170601	112	Egved	517835	6165125	ETRS 89	32N	FF placename: 'Folhøj'		1	0	Burial_Unspec	0	Male	EBA II		NMB3760	2	EBA II	Gold	Ring_Finger_Group A		
167	151		Egved	Burial Mound	1907	DK	170601	112	Egved	517835	6165125	ETRS 89	32N	FF placename: 'Folhøj'		1	0	Burial_Unspec	0	Male	EBA II		NMB3792	1	EBA II	Bronze	Blade, Fragment, Pommel, meel, Sword		
172	152		Egved	Burial Mound	1907	DK	170601	124	Egved	517574	6160257	ETRS 89	32N	FF placename: 'Holhøj'		1	0	Burial_Unspec	0	Male	Early Bronze Age		unknown	1	Early Bronze Age	Bronze	Sword		
174	153		Egved	Burial Mound	1860	DK	170601	140	Egved	518247	6164991	ETRS 89	32N	The finds could potentially be from sb. 135-139, 142-142 but registered under sb 140.		1	0	Burial_Unspec	0	Male	EBA III		NM19024	1	EBA III	Bronze	Blade, Sword		
174	153		Egved	Burial Mound	1860	DK	170601	140	Egved	518247	6164991	ETRS 89	32N	The finds could potentially be from sb. 135-139, 142-142 but registered under sb 140.		1	0	Burial_Unspec	0	Male	EBA III		NM19025	1	EBA III	Bronze	Pin		
176	154		Egved	Burial Mound	1919	DK	170601	132	Egved	518388	6164730	ETRS89	32N	Possible finds come from sb 134.		1	0	Burial_Unspec, Grave_Stone_Built	0	Male	Early Bronze Age		NM 1-2/19 (daneft)	2	Early Bronze Age	Gold	Ring_Finger_Group A		
176	154		Egved	Burial Mound	1919	DK	170601	132	Egved	518388	6164730	ETRS89	32N	Possible finds come from sb 134.		1	0	Burial_Unspec, Grave_Stone_Built	0	Male	Early Bronze Age		unknown		Early Bronze Age	Bronze	Sword		
178	155	Moesgård 5788	Egved	Single Find	0	DK	170601		Egved	0	0			Found in Egved parish		0	0	Unknown	0	Male	EBA I		Moesgård 5788		EBA I	Missing	Bronze	Axe_Group B	
179	156	Ribe Museum 958	Egved	Burial Mound	0	DK	170601		Egved	0	0					0	0	Burial_Unspec	0	Male	EBA III		Ribe Museum 958x5699	1	EBA III	Bronze	Razor_Form 3		

201 174	822/59	Øster Thorsted	Burial Mound	1958	DK	170601	197	Egved	515674	6161756	ETRS 89	32N	FF placename 'Syhøj' Mound previously robbed. NMB15283-304. Danefax 8/58	1	1	Burial_Inhumation, Primary_Grave_Oak_Cof-fin, Grave_Stone_Built	WNW-ENE	1	Male	EBA II	NM 8/58 (danefax)	1	EBA II	Missing	Gold	Left_Side	Ring_Arm Group A
201 174	822/59	Øster Thorsted	Burial Mound	1958	DK	170601	197	Egved	515674	6161756	ETRS 89	32N	FF placename 'Syhøj' Mound previously robbed. NMB15283-304. Danefax 8/58	1	1	Burial_Inhumation, Primary_Grave_Oak_Cof-fin, Grave_Stone_Built	WNW-ENE	1	Male	EBA II	NMB15286	1	EBA II	Ceramic	Feet	Vessel	

201	174	822/59	Øster Thorsted	Burial Mound	1958	DK	170601	197	Egved	515674	6161756	ETRS 89	32N	FF placename' Syhøj Mound previously robbed. NMB15283-304. Danefø 8/58	1	1	Burial_In- humation, Burial_ Primary_ Grave_ Oak_Cof- fin, Grave_ Stone_ Built	WNW- ENE	1	Male	EBA II		NMB15288	1	EBA II	Leather pouch (stru) con- taining: sickle (NMB15288), pyrite (NMB15288), strike-a-light (NMB15287), razor (NMB15290), tweezer (NMB15291), strandof wood 'wolladen' (NMB15283), sewing needle (NMB15294), awl (NMB15295), glas (NMB15297- 98), needle (NMB15299), wooden needle (NMB15300), bronze string 'bronzetratus' (NMB15301), amber fragments (NMB15289, NMB15303), bone comb (NMB15304)	Leather	Waist	Con- tainer
201	174	822/59	Øster Thorsted	Burial Mound	1958	DK	170601	197	Egved	515674	6161756	ETRS 89	32N	FF placename' Syhøj Mound previously robbed. NMB15283-304. Danefø 8/58	1	1	Burial_In- humation, Burial_ Primary_ Grave_ Oak_Cof- fin, Grave_ Stone_ Built	WNW- ENE	1	Male	EBA II		NMB15288	1	EBA II	Bronze	Waist	Sickle	

201	174	822/59	Øster Thorsted	Burial Mound	1958	DK	170601	197	Egved	515674	6161756	ETRS 89	32N	FF placename 'Syhøj' Mound previously robbed. NMB15283-304. Danefø 8/58	1	Burial_Inhumation, Primary, Grave_Oak_Cof-fin, Grave_Stone_Built	WNW-ENE	1	Male	EBA II			Stone	Waist	Pyrite
201	174	822/59	Øster Thorsted	Burial Mound	1958	DK	170601	197	Egved	515674	6161756	ETRS 89	32N	FF placename 'Syhøj' Mound previously robbed. NMB15283-304. Danefø 8/58	1	Burial_Inhumation, Primary, Grave_Oak_Cof-fin, Grave_Stone_Built	WNW-ENE	1	Male	EBA II	NMB15287	Flint	Waist	Strike-a-light	
201	174	822/59	Øster Thorsted	Burial Mound	1958	DK	170601	197	Egved	515674	6161756	ETRS 89	32N	FF placename 'Syhøj' Mound previously robbed. NMB15283-304. Danefø 8/58	1	Burial_Inhumation, Primary, Grave_Oak_Cof-fin, Grave_Stone_Built	WNW-ENE	1	Male	EBA II	NMB15290	Bronze	Waist	Razor_Form 3	
201	174	822/59	Øster Thorsted	Burial Mound	1958	DK	170601	197	Egved	515674	6161756	ETRS 89	32N	FF placename 'Syhøj' Mound previously robbed. NMB15283-304. Danefø 8/58	1	Burial_Inhumation, Primary, Grave_Oak_Cof-fin, Grave_Stone_Built	WNW-ENE	1	Male	EBA II	NMB15291	Bronze	Waist	Tweezer_Form 2	
201	174	822/59	Øster Thorsted	Burial Mound	1958	DK	170601	197	Egved	515674	6161756	ETRS 89	32N	FF placename 'Syhøj' Mound previously robbed. NMB15283-304. Danefø 8/58	1	Burial_Inhumation, Primary, Grave_Oak_Cof-fin, Grave_Stone_Built	WNW-ENE	1	Male	EBA II	NMB15283	Wool	Waist	String	

Lautitz
cultur razor
(Randsborg og
Christiansen
2006: 22)

'Wollfiden'

201	174	822/59	Øster Thorssted	Burial Mound	1958	DK	170601	197	Egved	515674	6161756	ETRS 89	32N	FF placename: Syhøje' Mound previously robbed. NMB15283-304. Danefax 8/58	1	1	Burial_Inhumation, Primary, Grave_Oak_Cof-fin, Grave_Stone_Built	WNW-ENE	1	Male	EBA II									
201	174	822/59	Øster Thorssted	Burial Mound	1958	DK	170601	197	Egved	515674	6161756	ETRS 89	32N	FF placename: Syhøje' Mound previously robbed. NMB15283-304. Danefax 8/58	1	1	Burial_Inhumation, Primary, Grave_Oak_Cof-fin, Grave_Stone_Built	WNW-ENE	1	Male	EBA II	NMB15289, NMB15303	Amber	Waist	Waist	Waist	Waist	Waist	Waist	
201	174	822/59	Øster Thorssted	Burial Mound	1958	DK	170601	197	Egved	515674	6161756	ETRS 89	32N	FF placename: Syhøje' Mound previously robbed. NMB15283-304. Danefax 8/58	1	1	Burial_Inhumation, Primary, Grave_Oak_Cof-fin, Grave_Stone_Built	WNW-ENE	1	Male	EBA II	NMB15304	Bone	Waist	Waist	Comb	Comb	Comb	Comb	
203	176		Øster Thorssted	Burial Mound	1880	DK	170601	205	Egved	515463	6160659	ETRS 89	32N		1	0	Burial_Unspec		0	Unknown	EBA III	NMB2105	Bronze			Blade, Pommel	Blade, Pommel	Blade, Pommel	Blade, Pommel	
205	177	NM16898	Højen	Burial Mound	1858	DK	170602	2	Højen	531812	6170345	ETRS 89	32N	FF placename: Ridder Stenos Høj	1	0	Burial_Unspec		0	Male	Early Bronze Age		NMB16898	Gold			Ring-Finger	Ring-Finger	Ring-Finger	Ring-Finger
205	177	NM16898	Højen	Burial Mound	1858	DK	170602	2	Højen	531812	6170345	ETRS 89	32N	FF placename: Ridder Stenos Høj	1	0	Burial_Unspec		0	Male	Early Bronze Age		unknown	Bronze			Blade, Sword	Blade, Sword	Blade, Sword	Blade, Sword
207	178	NM 333/48	Rugsted	Burial Mound	1948	DK	170604	59	Ødsted	524348	6166518	ETRS 89	32N		1	0	Burial_Creation, Grave_Stone_Built		1	Unknown	Presumably EBA	NM 333/48	Bronze			Fragment	Fragment	Fragment	Fragment	
208	179		Rugsted	Burial Mound	1862	DK	170604		Ødsted	0	0				0	0	Burial_Unspec		0	Male	Early Bronze Age	Odense Museum 1002	Bronze			Blade, Sword	Blade, Sword	Blade, Sword	Blade, Sword	
209	180		Tudvad	Burial Mound	1906	DK	170604	85	Ødsted	524444	6165253	ETRS 89	32N	sb 85 not found in FF	1	0	Burial_Unspec, Grave_Stone_Built		0	Male	Early Bronze Age	unknown	Bronze			Spear Head	Spear Head	Spear Head	Spear Head	

221	186	HAM 704	Trappendal	Burial Mound	1975	DK	170202	27	Hejls	537681	6136867	ETRS 89	32	FF placename: 'Sejlsøj' old id nr.: 8 (1886). Mound in several phases. House underneath as part primary burial. FINDS: HAM 21827-860.	Grab C	1	1	Burial_Creation, Burial_Double, Burial_Secondary, Grave_Oak_Coffin	WNW-ESE	1	Male	EBA III	= 32 in Boysen and Andersen. Mound phase II.	21851	1	EBA III	Found near small wooden fragments - perhaps sheath for razor.	Bronze	Waist	Razor_Form 1
221	186	HAM 704	Trappendal	Burial Mound	1975	DK	170202	27	Hejls	537681	6136867	ETRS 89	32	FF placename: 'Sejlsøj' old id nr.: 8 (1886). Mound in several phases. House underneath as part primary burial. FINDS: HAM 21827-860.	Grab C	1	1	Burial_Creation, Burial_Double, Burial_Secondary, Grave_Oak_Coffin	WNW-ESE	1	Male	EBA III	= 32 in Boysen and Andersen. Mound phase II.	21852	1	EBA III	Found with small leather fragments (perhaps container for tweezer)	Bronze	Waist	Tweezer_Form 2
221	186	HAM 704	Trappendal	Burial Mound	1975	DK	170202	27	Hejls	537681	6136867	ETRS 89	32	FF placename: 'Sejlsøj' old id nr.: 8 (1886). Mound in several phases. House underneath as part primary burial. FINDS: HAM 21827-860.	Grab C	1	1	Burial_Creation, Burial_Double, Burial_Secondary, Grave_Oak_Coffin	WNW-ESE	1	Male	EBA III	= 32 in Boysen and Andersen. Mound phase II.	21849	1	EBA III		Bronze	Waist	Fragment, Knife
222	186	HAM 704	Trappendal	Burial Mound	1975	DK	170202	27	Hejls	537681	6136867	ETRS 89	32	FF placename: 'Sejlsøj' old id nr.: 8 (1886). Mound in several phases. House underneath as part primary burial. FINDS: HAM 21827-860.	Grab D	1	1	Burial_Creation, Burial_Secondary, Grave_Stone_Built	NE-SW	1	Male	EBA III	= 13 in Boysen and Andersen. Mound phase III.	21827	1	EBA III		Bronze	Lower_Body	Razor_Form 3
222	186	HAM 704	Trappendal	Burial Mound	1975	DK	170202	27	Hejls	537681	6136867	ETRS 89	32	FF placename: 'Sejlsøj' old id nr.: 8 (1886). Mound in several phases. House underneath as part primary burial. FINDS: HAM 21827-860.	Grab D	1	1	Burial_Creation, Burial_Secondary, Grave_Stone_Built	NE-SW	1	Male	EBA III	= 13 in Boysen and Andersen. Mound phase III.	21828	1	EBA III		Bronze	Upper_Body	Awl

223	186	HAAM 704	Trappendal	Burial Mound	1975	DK	170202	27	Hejls	537681	6136867	ETRS 89	32	FF placename: 'Scjlsjof' old id nr.: 8 (1886). Mound in several phases. House underneath as part primary burial. FINDS: HAM 21827-860.	Grab E	1	0	Burial_Creation, Burial_Secondary, Grave_Stone_Built	NNE-SSW	1	Unknown	Early Bronze Age	= 27 in Boysen and Andersen. Mound phase III. Disturbed	21844	1	Early Bronze Age	Bronze		Awl	
224	186	HAAM 704	Trappendal	Burial Mound	1975	DK	170202	27	Hejls	537681	6136867	ETRS 89	32	FF placename: 'Scjlsjof' old id nr.: 8 (1886). Mound in several phases. House underneath as part primary burial. FINDS: HAM 21827-860.	Grab F	1	1	Burial_Creation, Burial_Secondary, Grave_Oak_Coffin, Grave_Stone_Built	NW-SE	1	Male	EBA III		21858	1	EBA III	Bronze		Fibula Group C, Fragment	
228	187	NM 219/24	Trappendal	Burial Mound	1887	DK	170202	32	Hejls	538224	6136385	ETRS 89	32N	FF placename: 'Broetrehof'		1	0	Burial_Unspec, Grave_Stone_Built		0	Unknown	Early Bronze Age	Grave contained skeleton with knife and needle. Now lost.	unknown			lost	Bronze		Knife
228	187	NM 219/24	Trappendal	Burial Mound	1887	DK	170202	32	Hejls	538224	6136385	ETRS 89	32N	FF placename: 'Broetrehof'		1	0	Burial_Unspec, Grave_Stone_Built		0	Unknown	Early Bronze Age	Grave contained skeleton with knife and needle. Now lost.	unknown			now lost	Bronze		Needle
230	188		Trappendal	Burial Mound	1910	DK	170202	42	Hejls	537527	6136445	ETRS 89	32N	FF placename: 'Hejls'	Grab B	1	0	Burial_Secondary, Burial_Unspec		0	Male	EBA II		unknown	1	EBA II	Bronze		Axe_Group C	
230	188		Trappendal	Burial Mound	1910	DK	170202	42	Hejls	537527	6136445	ETRS 89	32N	FF placename: 'Hejls'	Grab B	1	0	Burial_Secondary, Burial_Unspec		0	Male	EBA II		unknown	1	EBA II	Bronze		Sword_Group C	
231	189	NM 736/63; 407/63; 526/64	Trappendal	Burial Mound	1886	DK	170202	44	Hejls	538271	6136124	ETRS 89	32N	FF placename: 'Mindegården'	Grab A	1	0	Burial_Unspec, Burial_Primary, Grave_Stone_Built	W-E	0	Male	EBA III		unknown	1	EBA III	Bronze		Blade, Sword	

231	189	NM 756/63; 407/63; 526/64	Trappendal	Burial Mound	1886	DK	170202	44	Hejls	538271	6136124	ETRS 89	32N	FF placename 'Mindegården'	Grab A	1	0	Burial_Primary_Grave_Stone_Built	W-E	0	Male	EBA III	unknown	1	EBA III	Bronze	Fibula_Group C
232	189	NM 756/63; 407/63; 526/64	Trappendal	Burial Mound	1886	DK	170202	44	Hejls	538271	6136124	ETRS 89	32N	FF placename 'Mindegården'	Grab B	1	0	Burial_Secondary_Grave_Stone_Built	W-E	0	Male	Early Bronze Age	NMB15703	1	Early Bronze Age	Bronze	Blade, Dagger
235	190	NM 512/64	Trappendal	Burial Mound	1964	DK	170202	68	Hejls	538059	6136242	ETRS 89	32N	FF placename 'Teglgården'		1	0	Burial_Cremation_Grave_Stone_Built		0	Male	Early Bronze Age	Unknown	1	Early Bronze Age	Bronze	Blade, Fragment, Sword
236	191	NM 725/63	Trappendal	Single Deposition	1963	DK	170202	63	Hejls	536914	6136446	ETRS 89	32N			1	0	Context_Wetland		0	Male	EBA I	unknown		EBA I	Bronze	Axe_Group B
237	192		Agrup	Single Find	0	DK	170303		Sonder Bjert	0	0			Found in Agrup woods.		0	0	Unknown		0	Male	EBA II	MKH 3466		EBA II	Bronze	Axe, Fragment
238	193		Binderupgård	Burial Mound	0	DK	170303		Sonder Bjert	0	0			Unknown exact location		1	0	Burial_Cremation_Burial_Unspec		1	Male	EBA III	MKH O 2776	1	EBA III	Bronze	Fibula_Group C, Fragment
238	193		Binderupgård	Burial Mound	0	DK	170303		Sonder Bjert	0	0			Unknown exact location		1	0	Burial_Cremation_Burial_Unspec		1	Male	EBA III	MKH O 2777	1	EBA III	Bronze	Fragment, Razor
238	193		Binderupgård	Burial Mound	0	DK	170303		Sonder Bjert	0	0			Unknown exact location		1	0	Burial_Cremation_Burial_Unspec		1	Male	EBA III	MKH O 2778	1	EBA III	Bronze	Sword_Group E
239	194		Skarved	Single Find	0	DK	170303		Sonder Bjert	0	0			Found in Skarvedgård (matrikel 2a, Skarved)		0	0	Unknown		0	Unknown	Early Bronze Age	MKH 3003	1	Early Bronze Age	Bronze	Fibula
240	195	1267/75	Gronninghoved	Burial Mound	1962	DK	170706	15	Vejstrup	536160	6139585	ETRS 89	32N	FF placename: 'Sondergaard' Identical map location (map 1212) with old nr. 4391 in band VIII.		1	1	Burial_Cremation		1	Female	EBA III	NMB16921	1	EBA III	Bronze	Ring-Arm-Group B

241	196	NM 292/33	MKH 3351-53	Gronning-hoved	Burial Mound	1933	DK	170706	19	Vejstrup	535768	6139412	ETRS 89	32N	FF placename 'Skælhøj'. Danefer 5/33 - deposited with Koldinghus Museum. On map 1212 in band VIII identical with old id nr. 4392 (alte nr. 4393 entfällt)	1	0	Burial_Inhumation, Grave_Stone_Built	0	Male	EBA II		NM 5/33; MKH 3351	1	EBA II	dünnen schmalen Goldblech mit abschmalenden und verdickten Enden, auf der Oberfläche zwischen schmalen Rippen zwei Reihen von kleinen her-ausgedrückten Buckelchen	Bronze	Blade, Sword	Ring-Arm-Group E	Form E06	
241	196	NM 292/33	MKH 3351-53	Gronning-hoved	Burial Mound	1933	DK	170706	19	Vejstrup	535768	6139412	ETRS 89	32N	FF placename 'Skælhøj'. Danefer 5/33 - deposited with Koldinghus Museum. On map 1212 in band VIII identical with old id nr. 4392 (alte nr. 4393 entfällt)	1	0	Burial_Inhumation, Grave_Stone_Built	0	Male	EBA II		3352	1	EBA II		Bronze				
241	196	NM 292/33	MKH 3351-53	Gronning-hoved	Burial Mound	1933	DK	170706	19	Vejstrup	535768	6139412	ETRS 89	32N	FF placename 'Skælhøj'. Danefer 5/33 - deposited with Koldinghus Museum. On map 1212 in band VIII identical with old id nr. 4392 (alte nr. 4393 entfällt)	1	0	Burial_Inhumation, Grave_Stone_Built	0	Male	EBA II		NIMB13005	1	EBA II	Oval	Bronze	Pommel			
242	197	NM/B69		Gronning-hoved	Deposition	0	DK	170706		Vejstrup	0	0			Unknown location	0	0	Unknown	0	Male	EBA II		NMB 69	1	EBA II		Bronze	Axe-Group CII			
243	198		Moesgård 5158	Sjælland	Deposition	0	DK	170706		Vejstrup	0	0			Unknown find location. Missing	0	0	Context_ Wetland	0	Male	EBA III		Moesgård Museum 5198	1	EBA III	Missing	Bronze	Dagger-Group C			
249	200	399/08		Ask-jærgårde	Burial Mound	1908	DK	170802	119	Brande	510845	6197103	ETRS 89	32N		Grab E	1	1	Burial_Inhumation, Burial_Secondary_Grave_Oak_Coffin	0	Male	EBA II		B8960	1	EBA II		Bronze	Sword-Group A		

249	200	399/08		Ask-jærgårde	Burial Mound	1908	DK	170802	119	Brande	510845	6197103	ETRS 89	32N		Grab A	1	1	Burial_Inhumation, Burial_Secondary_Grave_Oak_Coffin	W-E	0	Male	EBA II		B8961	1	EBA II	"Tüllenmeißel"	Bronze	Left Side	Chisel Form 2
250	201	NMB13554		Brandholm	Burial Mound	1942	DK	170802	37	Brande	508374	6201505	ETRS 89	32N	FF placename 'Borup'	Grab A	1	0	Other		0	Unknown	Early Bronze Age	Probably remains from a bronze-casting site.	NMB13554	1	Early Bronze Age	material: speckstein mould form: chisel.	Stone		Mould
251	202	302/05		Brandholm	Burial Mound	1905	DK	170802	89	Brande	506948	6197342	ETRS 89	32N		Grab A	1	1	Burial_Inhumation, Burial_Primary_Grave_Oak_Coffin, Grave_Stone_Built	W-E	0	Unknown	EBA II	= B in NM report.	NMB8421	1	EBA II	Traces of wooden sheath	Bronze	Waist	Blade, Dagger
252	203	302/05		Brandholm	Burial Mound	1905	DK	170802	90	Brande	507066	6197862	ETRS 89	32N		Grab A	1	1	Burial_Inhumation, Burial_Primary_Grave_Oak_Coffin, Grave_Stone_Built	W-E	0	Unknown	Early Bronze Age	= B Sarauw	B8420	1	Early Bronze Age		Ceramic		Vessel
254	204	302/05		Brandholm	Burial Mound	1905	DK	170802	92	Brande	506966	6197965	ETRS 89	32N		Grab A	1	1	Burial_Inhumation, Burial_Primary_Grave_Stone_Built	W-E	0	Male	EBA II	= C Sarauw	B8417	1	EBA II		Bronze		Blade, Sword
254	204	302/05		Brandholm	Burial Mound	1905	DK	170802	92	Brande	506966	6197965	ETRS 89	32N		Grab A	1	1	Burial_Inhumation, Burial_Primary_Grave_Stone_Built	W-E	0	Male	EBA II	= C Sarauw	unknown	1	EBA II	traces of leather and wood from sheath. Preserved?	Leather, Wood		Sheath

254	204	302/05	Brandholm	Burial Mound	1905	DK	170802	92	Brande	506966	6197965	ETRS 89	32N	Grab A	1	1	Burial_Inhumation, Burial_Primary, Grave_Stone, Stone_Built	W-E	0	Male	EBA II	= C Sarauw	unknown	1	EBA II	preserved?	Wool	Textile
254	204	302/05	Brandholm	Burial Mound	1905	DK	170802	92	Brande	506966	6197965	ETRS 89	32N	Grab A	1	1	Burial_Inhumation, Burial_Primary, Grave_Stone, Stone_Built	W-E	0	Male	EBA II	= C Sarauw	B8418	1	EBA II		Bronze	Fibula Group B
258	205	302/05	Brandlund	Burial Mound	1905	DK	170802	65	Brande	506168	6198515	ETRS 89	32N	Grab A	1	1	Burial_Primary, Grave_Oak_Cof-fin, Grave_Stone, Stone_Built	WSW-ENE	0	Un-known	EBA III	= C Sarauw	B8424	1	EBA III		Bronze	Wäist
258	205	302/05	Brandlund	Burial Mound	1905	DK	170802	65	Brande	506168	6198515	ETRS 89	32N	Grab A	1	1	Burial_Primary, Grave_Oak_Cof-fin, Grave_Stone, Stone_Built	WSW-ENE	0	Un-known	EBA III	= C Sarauw	B8425	1	EBA III		Bronze	Wäist
258	205	302/05	Brandlund	Burial Mound	1905	DK	170802	65	Brande	506168	6198515	ETRS 89	32N	Grab A	1	1	Burial_Primary, Grave_Oak_Cof-fin, Grave_Stone, Stone_Built	WSW-ENE	0	Un-known	EBA III	= C Sarauw	B8426		EBA III	missing	Bronze	Spiral Roll
258	205	302/05	Brandlund	Burial Mound	1905	DK	170802	65	Brande	506168	6198515	ETRS 89	32N	Grab A	1	1	Burial_Primary, Grave_Oak_Cof-fin, Grave_Stone, Stone_Built	WSW-ENE	0	Un-known	EBA III	= C Sarauw	B8427	2	EBA III	Green-blue glass beads	Glass	Wäist
258	205	302/05	Brandlund	Burial Mound	1905	DK	170802	65	Brande	506168	6198515	ETRS 89	32N	Grab A	1	1	Burial_Primary, Grave_Oak_Cof-fin, Grave_Stone, Stone_Built	WSW-ENE	0	Un-known	EBA III	= C Sarauw	Unknown		EBA III	'Lederschläufe'	Leather	Object

266	209	NM 694/63	Ure	Single Grave	1963	DK	170802	260	Brande	504154	6198614	ETRS 89	32N	FF placename 'Uhre'. FF NM code: 684/63 No sign of burial mound in field.	1	0	Burial_Creation, Grave_Stone_Built	N-S	1	Female	EBA III	Disturbed	B15713	1	EBA III	Bronze	Fibula_Group C
266	209	NM 694/63	Ure	Single Grave	1963	DK	170802	260	Brande	504154	6198614	ETRS 89	32N	'Uhre'. FF NM code: 684/63 No sign of burial mound in field.	1	0	Burial_Creation, Grave_Stone_Built	N-S	1	Female	EBA III	Disturbed	B15713	1	EBA III	Bronze	Ring_Arm_Group A
268	210		Bavnsgård	Burial Mound	1902	DK	170804	2	Give	512788	6193839	ETRS 89	32N	'Uhre'. FF NM code: 684/63 No sign of burial mound in field. No secure grave contexts. Finds from mound.	1	0	Burial_Unspec_Built		0	Un-known	Early Bronze		unknown	1	Early Bronze	Bronze	Double Button
270	211	NM 19959-62	Bavnsgård	Burial Mound	1902	DK	170804	5	Give	511165	6193454	ETRS 89	32N	'Fabelshøj'	Grab B	1	0	Burial_Unspec_Grave_Stone_Built		0	Un-known	Age EBA III	NM19962	1	Age EBA III	Bronze	Dagger_Group E
270	211	NM 19959-62	Bavnsgård	Burial Mound	1902	DK	170804	5	Give	511165	6193454	ETRS 89	32N	'Fabelshøj'	Grab B	1	0	Burial_Unspec_Grave_Stone_Built		0	Un-known	EBA III	NM19962	1	EBA III	Bronze	Dagger_Group A
273	214	NM 362/64	Donneruplund	Single Deposition	1964	DK	170804	308	Give	515452	6190583	ETRS 89	32N	FF placename: 'Hjortsalle'		1	0	Unknown		0	Male	EBA II	NMB15750	1	EBA II	Bronze	Axe_Group CII
274	215		Farre	Burial Mound	1902	DK	170804	101	Give	515202	6184421	ETRS 89	32N			1	0	Burial_Creation, Grave_Stone_Built		1	Un-known	Early Bronze Age	B7889	1	Early Bronze Age	Bronze	Blade, Dagger
274	215		Farre	Burial Mound	1902	DK	170804	101	Give	515202	6184421	ETRS 89	32N			1	0	Burial_Creation, Grave_Stone_Built		1	Un-known	Early Bronze Age	B7890	1	Early Bronze Age	Bronze	Fragment, Pin
275	216		Farre	Burial Mound	1861	DK	170804		Give	0	0			Exact location unknown		0	0	Burial_Unspec_Built		0	Un-known	Early Bronze Age	19804	1	Early Bronze Age	Gold	Ring_Arm_Group E
275	216		Farre	Burial Mound	1861	DK	170804		Give	0	0			Exact location unknown		0	0	Burial_Unspec		0	Un-known	Early Bronze Age	19805	6	Early Bronze Age	Amber	Bead
280	219	V/KH 4783-85	Givskov	Burial Mound	1905	DK	170804		Give	0	0			Exact location unknown. Reference to Koldinghus Museum and Vejle Museum.		0	0	Burial_Unspec		0	Male	EBA I	V/KH 4784	1	Age EBA I	Bronze	Blade, Sword

292	227		Museum Moesgård 5286	Haresø	Burial Mound	1903	DK	170805	160	Givskud	524363	6184049	ETRS 89	32N		Fund Ba	1	0	Burial_In- humation, Buri- al_Sec- ondary	0	Male	EBA III	From west of the mound. Presuma- bly three (male) graves (a-c). Ob- jects not recorded with in- dividuals graves.	Moesgård 5286	1	EBA III	Bronze	Sword_ Group C	
293	227		Museum Moesgård 5286	Haresø	Burial Mound	1903	DK	170805	160	Givskud	524363	6184049	ETRS 89	32N		Fund Bb	1	0	Burial_In- humation, Buri- al_Sec- ondary	0	Male	EBA III	From west of the mound. Presuma- bly three (male) graves (a-c). Ob- jects not recorded with in- dividuals graves.	Moesgård 5286	1	EBA III	Bronze	Blade, Frag- ment, Pom- mel	
294	227		Museum Moesgård 5286	Haresø	Burial Mound	1903	DK	170805	160	Givskud	524363	6184049	ETRS 89	32N		Fund Bc	1	0	Burial_In- humation	0	Male	EBA I	From west of the mound. Presuma- bly three (male) graves (a-c). Ob- jects not recorded with in- dividuals graves.	Moesgård 5286	1	EBA I	Bronze	Spear Head_ Form 3	
295	228			Haresø	Burial Mound	1870	DK	170805	164	Givskud	524390	6183670	ETRS 89	32N				1	0	Burial_In- humation, Grave_ Stone_ Built	0	Male	EBA II	From west of the mound. Presuma- bly three (male) graves (a-c). Ob- jects not recorded with in- dividuals graves.	NMB566	1	EBA II	Gold	Ring_ Arm_ Group E
295	228			Haresø	Burial Mound	1870	DK	170805	164	Givskud	524390	6183670	ETRS 89	32N				1	0	Burial_In- humation, Grave_ Stone_ Built	0	Male	EBA II		NMB567	1	EBA II		Sword_ Group C

316 247	Moesgård 2283	Låge	Burial Mound	1904	DK	170811	24	Sindbjerg	534759	6185880	ETRS 89	32N	FF placename 'Kempshøj'	Grab A	1	0	Male	EBA III	possible cremation?	Moesgård 2283	1	EBA III	Bronze	Sword Group E
317 248		Bowl	Burial Mound	1909	DK	170812	57	Sønder Omme	495432	6189875	ETRS 89	32N		Grab A	1	1	Un-known	EBA III	=C in NM report. Grave robbed in prehistory (robbers hole called 'B' in NM in NM reort).	NMB9294	1	EBA III	Ceramic	Fragment
317 248		Bowl	Burial Mound	1909	DK	170812	57	Sønder Omme	495432	6189875	ETRS 89	32N		Grab A	1	1	Un-known	EBA III	=C in NM report. Grave robbed in prehistory (robbers hole called 'B' in NM in NM reort).	NMB9293	1	EBA III	Bronze	Pin
317 248		Bowl	Burial Mound	1909	DK	170812	57	Sønder Omme	495432	6189875	ETRS 89	32N		Grab A	1	1	Un-known	EBA III	=C in NM report. Grave robbed in prehistory (robbers hole called 'B' in NM in NM reort).	NMB9294	1	EBA III	Bronze	Fibula
317 248		Bowl	Burial Mound	1909	DK	170812	57	Sønder Omme	495432	6189875	ETRS 89	32N		Grab A	1	1	Un-known	EBA III	=C in NM report. Grave robbed in prehistory (robbers hole called 'B' in NM in NM reort).	NMB9296	1	EBA III	Stone	OTH-ER

365	274	Albækgårde	Burial Mound	1906	DK	170813	68	Thyregod	518107	6198135	ETRS 89	32N		Grab A	1	0	Burial_Inhumation, Burial_Primary, Grave_Oak_Cof-fin, Grave_Stone_Built	WNW-ESE	0	Male	EBA II	= B in NM report. Disturbed	NMB8453	1	EBA II	'spitzoval'	Bronze	Left_Side	Pommel
365	274	Albækgårde	Burial Mound	1906	DK	170813	68	Thyregod	518107	6198135	ETRS 89	32N		Grab A	1	0	Burial_Inhumation, Burial_Primary, Grave_Oak_Cof-fin, Grave_Stone_Built	WNW-ESE	0	Male	EBA II	= B in NM report. Disturbed	NMB8455	1	EBA II		OTH-ER	Waist	Pyrite, Strike-a-light
365	274	Albækgårde	Burial Mound	1906	DK	170813	68	Thyregod	518107	6198135	ETRS 89	32N		Grab A	1	0	Burial_Inhumation, Burial_Primary, Grave_Oak_Cof-fin, Grave_Stone_Built	WNW-ESE	0	Male	EBA II	= B in NM report. Disturbed	NMB8456	1	EBA II		Bronze	Right_Side, Upper_Body	Spear Head, Form 5
365	274	Albækgårde	Burial Mound	1906	DK	170813	68	Thyregod	518107	6198135	ETRS 89	32N		Grab A	1	0	Burial_Inhumation, Burial_Primary, Grave_Oak_Cof-fin, Grave_Stone_Built	WNW-ESE	0	Male	EBA II	= B in NM report. Disturbed	NMB8457	1	EBA II		Bronze	Waist	Pin Group E
365	274	Albækgårde	Burial Mound	1906	DK	170813	68	Thyregod	518107	6198135	ETRS 89	32N		Grab A	1	0	Burial_Inhumation, Burial_Primary, Grave_Oak_Cof-fin, Grave_Stone_Built	WNW-ESE	0	Male	EBA II	= B in NM report. Disturbed	NMB8458	1	EBA II	Conical shape	Amber	Waist	Button

365	274		Albekgårde	Burial Mound	1906	DK	170813	68	Thyregod	518107	6198135	ETRS 89	32N		Grab A	1	0	Burial_Inhumation, Burial_Primary_Grave_Oak_Coffin, Grave_Stone_Built	WNV-ESE	0	Male	EBA II	= B in NIM report. Disturbed	NMB8454	1	EBA II	'tillengerit'	Bronze	Waist	OTHER
365	274		Albekgårde	Burial Mound	1906	DK	170813	68	Thyregod	518107	6198135	ETRS 89	32N		Grab A	1	0	Burial_Inhumation, Burial_Primary_Grave_Oak_Coffin, Grave_Stone_Built	WNV-ESE	0	Male	EBA II	= B in NIM report. Disturbed	NMB8454	1	EBA II	Shards of vessel.	Ceramic	N/A	Fragment, Vessel
368	275	NM 533/02	Albekgårde	Burial Mound	1902	DK	170813	72	Thyregod	518014	6197788	ETRS 89	32N		Grab B	1	0	Burial_Inhumation, Burial_Primary_Grave_Oak_Coffin, Grave_Stone_Built	E-W	1	Unknown	Early Bronze Age	head in east	NMB7681a-b	2	Early Bronze Age		Ceramic		Fragment
369	275	NM 533/02	Albekgårde	Burial Mound	1902	DK	170813	72	Thyregod	518014	6197788	ETRS 89	32N		Grab C	0	0	Burial_Inhumation, Burial_Primary_Grave_Oak_Coffin, Grave_Stone_Built	E-W	1	Unknown	Early Bronze Age	= D in NIM report	NMC11703	1	Undated	Sharpening stone Iron Age or Bronze Age?	Stone		OTHER
371	276		Hesselballe	Burial Mound	1862	DK	170814	4	Uldum	535088	6188679	ETRS 89	32N			1	0	Burial_Unspec		0	Unknown	Early Bronze Age		NM20253	1	Early Bronze Age	'knopsfiche'	Bronze		Sickle
372	277		Uldum	Burial Mound	1904	DK	170814	2	Uldum	535308	6188895	ETRS 89	32N			1	0	Burial_Unspec		0	Male	Early Bronze Age		unknown			missing sword or spearhead found.	Bronze		Spear Head, Sword
373	278		Museum Moesgård 3635	Single Deposition	0	DK	170815		Vejle	0	0				0	0	Context_Weiland		0	N/A	Early Bronze Age	Bog patina	Museum Moesgård 3635	1	Early Bronze Age		Bronze		Blade, Dagger	
374	279			Burial Mound	0	DK	170815		Vejle	0	0					0	0	Burial_Unspec		0	Unknown	EBA III		unknown	1	EBA III	Missing	Bronze		Knife, Group C
375	280		Museum Moesgård 5217	Loose Find	0	DK	170815		Vejle	0	0					0	0	Unknown		0	Unknown	Early Bronze Age		Museum Moesgård 5217	1	Early Bronze Age		Bronze		Ring, Arm
376	281			Burial Mound	1897	DK	170816	60	Vester	520123	6196156	ETRS 89	32N			0	0	Burial_Unspec		0	Male	Early Bronze Age		unknown	1	Early Bronze Age	missing	Bronze		Spear Head

378	282		Lindet	Burial Mound	1897	DK	170816	69	Vester	519683	6195519	ETRS 89	32N	FF placename 'Lindet by'	Grab B	1	0	Unknown	Early Bronze Age		unknown	1	Early Bronze Age	Missing	Bronze		Dagger	
382	285		Vesterlund	Burial Mound	1897	DK	170816	47	Vester	520305	6197481	ETRS 89	32N			1	0	Male	Early Bronze Age		unknown	1	Early Bronze Age		Bronze		Sword	
383	286	NM 497/09	Vesterlund	Burial Mound	1908	DK	170816	48	Vester	520444	6196889	ETRS 89	32N	FF placename 'Trehøj'. Three mound phases. Ard marks underneath. Circular post row around mound phase I.	Grab A	1	1	0	Unknown	Early Bronze Age	= E in NM report. Primary burial in mound phase I.	NMB8904	1	Early Bronze Age	'Knopfsichel'	Bronze		Sidde
385	286	NM 497/09	Vesterlund	Burial Mound	1908	DK	170816	48	Vester	520444	6196889	ETRS 89	32N	FF placename 'Trehøj'. Three mound phases. Ard marks underneath. Circular post row around mound phase I.	Grab C	1	0	Female	EBA II	= D in NM report. Signs of older in the grave. Disturbed	NMB8899	1	EBA II		Bronze	Left_Side_Waist	Fibula_Group A	Form A03
385	286	NM 497/09	Vesterlund	Burial Mound	1908	DK	170816	48	Vester	520444	6196889	ETRS 89	32N	FF placename 'Trehøj'. Three mound phases. Ard marks underneath. Circular post row around mound phase I.	Grab C	1	0	Female	EBA II	= D in NM report. Signs of older in the grave. Disturbed	NMB8890	1	EBA II	check for subtype	Bronze	Left_Side_Waist	Fibula_Group A	
385	286	NM 497/09	Vesterlund	Burial Mound	1908	DK	170816	48	Vester	520444	6196889	ETRS 89	32N	FF placename 'Trehøj'. Three mound phases. Ard marks underneath. Circular post row around mound phase I.	Grab C	1	0	Female	EBA II	= D in NM report. Signs of older in the grave. Disturbed	NMB8901	1	EBA II		Bronze	Waist	Blade, Dagger	

428	303	NM 716/05; 523/06	Balle	Burial Mound	1906	DK	170901	24	Bredsten	522224	6174786	ETRS 89	32N		Grab A	1	1	Burial_In- humation, Burial_ Primary, Grave_ Oak_Cof- fin, Grave_ Stone_ Built	W-E	0	Male	EBA II		NMB8525-8526	3	EBA II		Bronze	Left_ Side, Upper_ Body	Tütuli_ Group C
428	303	NM 716/05; 523/06	Balle	Burial Mound	1906	DK	170901	24	Bredsten	522224	6174786	ETRS 89	32N		Grab A	1	1	Burial_In- humation, Burial_ Primary, Grave_ Oak_Cof- fin, Grave_ Stone_ Built	W-E	0	Male	EBA II	Missing Possible arrowhead	unknown	1	EBA II		Bronze	Upper_ Body	Object
428	303	NM 716/05; 523/06	Balle	Burial Mound	1906	DK	170901	24	Bredsten	522224	6174786	ETRS 89	32N		Grab A	1	1	Burial_In- humation, Burial_ Primary, Grave_ Oak_Cof- fin, Grave_ Stone_ Built	W-E	0	Male	EBA II		NMB8529	1	EBA II		Ce- ramic	Feet	Vessel
430	304		Balle	Loose Find		DK	170901		Bredsten	0	0			Unknown location		0	0	Unknown		0	Un- known	Early Bronze Age	Uncertain bog pat- ina men- tioned. Also several burial mounds in area.	NMB18162	1	Early Bronze Age		Ce- ramic		Vessel
430	304		Balle	Loose Find		DK	170901		Bredsten	0	0			Unknown location		0	0	Unknown		0	Un- known	Early Bronze Age	Uncertain bog pat- ina men- tioned. Also several burial mounds in area.	NMB18167	1	Early Bronze Age		Bronze		Fibula

439	310	Gadbjerg	Burial Mound	1961	DK	170902	40	Gadbjerg	520357	6179910	ETRS 89	32N		Grab A	1	1	Burial_Inhumation, Burial_Primary_Grave_Chamber, Grave_Oak_Coffin, Grave_Stone_Built	W-E	0	Female	EBA II	= F in Arbøgger.	NMB15549	1	EBA II		Bronze	Waist	Blade, Dagger, Fragment
440	310	Gadbjerg	Burial Mound	1961	DK	170902	40	Gadbjerg	520357	6179910	ETRS 89	32N		Grab B	1	1	Burial_Inhumation, Burial_Secondary_Grave_Oak_Coffin, Grave_Stone_Built	W-E	0	Un-known	EBA II	= E in Arbøgger	NMB15546	1	EBA II		Bronze		Blade, Dagger
441	310	Gadbjerg	Burial Mound	1961	DK	170902	40	Gadbjerg	520357	6179910	ETRS 89	32N		Grab C	1	1	Burial_Inhumation, Burial_Secondary_Grave_Oak_Coffin, Grave_Stone_Built	S-N	0	Male	EBA III	= H in Arbøgger	NM 15/62	1	EBA III		Gold	Upper_Body	Ring, Finger_Group A
441	310	Gadbjerg	Burial Mound	1961	DK	170902	40	Gadbjerg	520357	6179910	ETRS 89	32N		Grab C	1	1	Burial_Inhumation, Burial_Secondary_Grave_Oak_Coffin, Grave_Stone_Built	S-N	0	Male	EBA III	= H in Arbøgger	NMB15543	1	EBA III		Bronze	Upper_Body	Blade, Dagger

468	327	Jelling	Burial Mound	1890	DK	170904	54	Jelling	527714	6177979	ETRS 89	32N	FF placename 'Jellinge'	1	1	Burial_Cremation, Grave_Stone_Built	W-E	1	Unknown	Early Bronze Age	Possible three cremation burials in one closed context larger stone setting. See abb. 57 (p 99) in Kersten band 9.	NMB4414	1	Early Bronze Age	Bronze, Wood	Dagger_Group C, Sheath
468	327	Jelling	Burial Mound	1890	DK	170904	54	Jelling	527714	6177979	ETRS 89	32N	FF placename 'Jellinge'	1	1	Burial_Cremation, Grave_Stone_Built	W-E	1	Unknown	Early Bronze Age	Possible three cremation burials in one closed context larger stone setting. See abb. 57 (p 99) in Kersten band 9.	NMB4416	1	Early Bronze Age	Flint	Strike-a-light
468	327	Jelling	Burial Mound	1890	DK	170904	54	Jelling	527714	6177979	ETRS 89	32N	FF placename 'Jellinge'	1	1	Burial_Cremation, Grave_Stone_Built	W-E	1	Unknown	Early Bronze Age	Possible three cremation burials in one closed context larger stone setting. See abb. 57 (p 99) in Kersten band 9.	NMB4418	1	Early Bronze Age	Ceramic	Vessel
469	328	Jelling	Burial Mound	1845	DK	170904		Jelling	0	0			unknown location	0	0	Burial_Unspec		0	Male	Early Bronze Age		NMB8488	1	Early Bronze Age	Bronze	Blade, Sword
470	329	Jelling	Burial Mound	1844	DK	170904		Jelling	0	0			unknown location	0	0	Burial_Unspec		0	Male	EBA II		NM11001	1	Early Bronze Age	Bronze	Axe

512	360	NM 405/26	Norup	Single Deposition	1926	DK	170907	125	Norup	519091	6174947	ETRS 89	32N	FF placename 'Norup Skole'	1	1	Unknown	0	Male	EBA II	Mould and palslave that goes together. Presumed deposition	NMB21774	2	EBA II	Mould for palslave (NMB11752)	Ceramic	Mould
512	360	NM 405/26	Norup	Single Deposition	1926	DK	170907	125	Norup	519091	6174947	ETRS 89	32N	FF placename 'Norup Skole'	1	1	Unknown	0	Male	EBA II	Mould and palslave that goes together. Presumed deposition	NMB11752	1	EBA II		Bronze	Axe_ Group C
513	361		Sodover	Burial Mound	1902	DK	170907	110	Norup	521713	6175792	ETRS 89	32N		1	0	Burial_ Unspec	0	Male	EBA III		NMB7538	1	EBA III		Bronze	Sword_ Group C
514	362	NM22330	Torrild	Burial Mound	1865	DK	170907		Norup	0	0			unknown location. Other placename: 'Tudshøj'	0	0	Burial_ Inhumation, Grave_ Stone_ Built	0	Female	EBA III		Kersten a	1	EBA III		Bronze	Dagger_ Group C
514	362	NM22330	Torrild	Burial Mound	1865	DK	170907		Norup	0	0			unknown location. Other placename: 'Tudshøj'	0	0	Burial_ Inhumation, Grave_ Stone_ Built	0	Female	EBA III		Kersten b	1		possibly chape form C	Bronze	Chape_ Form B
514	362	NM22330	Torrild	Burial Mound	1865	DK	170907		Norup	0	0			unknown location. Other placename: 'Tudshøj'	0	0	Burial_ Inhumation, Grave_ Stone_ Built	0	Female	EBA III		Kersten c	1	EBA III		Bronze	Ring_ Arm_ band Group C
514	362	NM22330	Torrild	Burial Mound	1865	DK	170907		Norup	0	0			unknown location. Other placename: 'Tudshøj'	0	0	Burial_ Inhumation, Grave_ Stone_ Built	0	Female	EBA III		kersten d	1	EBA III		Bronze	Frag- ment, Ring_ Neck
514	362	NM22330	Torrild	Burial Mound	1865	DK	170907		Norup	0	0			unknown location. Other placename: 'Tudshøj'	0	0	Burial_ Inhumation, Grave_ Stone_ Built	0	Female	EBA III		kersten e	1	EBA III		Bronze	Frag- ment, Pin
517	363	NM 262/04	Bindeballe	Burial Mound	1905	DK	170908	225	Randbøl	515564	6169858	ETRS 89	32N		1	1	Burial_ Unspec, Grave_ Stone_ Built	1	Male	EBA II		NMB8172	1	EBA II		Bronze	Belt Hook

569	385	NM 170/44	Vandel	Burial Mound	1944	DK	170908	69	Randbøl	512358	6172774	ETRS 89	32N				1	1	Burial_Inhumation, Burial_Primary_Grave_Oak_Coffin, Grave_Stone_Built	WSW-ENE	0	Male	EBA II		NMB13680	EBA II	perlschnur-reihen	Bronze	Upper_Body	Tweezer_Form 1
570	386		Vandel	Burial Mound	1863	DK	170908	72	Randbøl	512214	6173667	ETRS 89	32N				1	0	Burial_Unspec, Grave_Stone_Built, Grave_Stone_Built, Grave_Stone_Cist		0	Male	EBA III		NMB21156	EBA III		Bronze		Sword_Group E
572	387		Vandel	Burial Mound	1930	DK	170908	74	Randbøl	512269	6173673	ETRS 89	32N				1	0	Burial_Unspec		0	Male	Early Bronze Age		unknown	Early Bronze Age	missing	Bronze		Spear Head
572	387		Vandel	Burial Mound	1930	DK	170908	74	Randbøl	512269	6173673	ETRS 89	32N				1	0	Burial_Unspec		0	Male	Early Bronze Age		unknown	Early Bronze Age		Bronze		Axe
573	388		Vandel	Burial Mound	1898	DK	170908	75	Randbøl	512324	6173685	ETRS 89	32N	Could be sb. 72-75 (here registered under sb 75)			1	0	Burial_Unspec		0	Male	EBA III		NMB 6809	EBA III		Bronze		Sword_Group E
574	389		Vandel	Burial Mound	1980	DK	170908	513	Randbøl	511768	6173887	ETRS 89	32N				1	0	Burial_Unspec		0	Unknown	Early Bronze Age		Vandel collection nr. 5	Early Bronze Age	Museum Vandel collection / missing? Described as 'jewelry'	Bronze		Object
575	390		Amt Vejle	Burial Mound	1892	DK	17xxxx			0	0			unknown location			0	0	Burial_Unspec		0	Unknown	Early Bronze Age		Moesgård 2800	Early Bronze Age		Bronze		Blade, Dagger
576	391		Amt Vejle	Single Find	1892	DK	17xxxx			0	0			unknown location			0	0	Unknown		0	Male	EBA II		Moesgård 2911	EBA II		Bronze		Axe_Group C
577	392		Probably Amt Vejle	Burial Mound	0	DK	17xxxx			0	0			unknown location.			0	0	Burial_Unspec		0	Female	EBA III		Kersten a	EBA III		Bronze		Tutuli
577	392		Probably Amt Vejle	Burial Mound	0	DK	17xxxx			0	0			unknown location.			0	0	Burial_Unspec		0	Female	EBA III		Kersten b	EBA III		Bronze		Ring-Arm-band Group B

827	617	VKH 1842	Højgård	Burial Mound	2003	DK	170301	26	Bredstrup	540487	6157651	ETRS	32N	89	32N	Resume: Sb.26. I en groft tværs gennem en overplojet gravhøj blev der påvist flere velbevarede ardsponssystemer samt to høfaser med en samlet diameter på mindst 31 m. Central i den primære høj blev en relativt velbevaret egkistegrav undersøgt. I graven, der indeholdt et grebpladesværd fra ældre bronzealders per. II med bevaret hornfæste og grebknop, lå skeletet af en ca. 190 cm høj mand. Den primære høj, som havde jernindkapslet kerne, var afgrænset af stolper og blev efter noget tid udvidet med en sekundær højfase.	K3	1	1	Burial_Inhumation, Burial_Primary_Grave, Oak_Coffin	W-E	1	Male	EBA II	VKH1842x11	EBA II	Organic remains from grave: textile and fur	Or-ganic	N/A	OTH-ER, Textile	N/A
829	618	VKH 3418	Jelling Øst	Burial Mound	2006	DK	170401	58	Jelling	527522	6179314	ETRS	32N	89	32N	Udgravning af den overplojede gravhøj (Sb. nr. 58.). Der blev undersøgt et område på ca. 500 m ² . Højfylden var bevaret i en højde på 60 cm plus moderne muldlag. I profilen kunne registreres to høfaser med hver sin centralgrav. FF stednavn: 'Haughus'. Desuden registreres en grav i sydkannten af højen. Gravene daterer sig til den ældre og mellemste del af ældre bronzealder.	A14	1	1	Burial_Inhumation, Burial_Secondary_Grave, Oak_Coffin, Grave_Stone, Built	W-E	1	Male	EBA II	VKH3418x9	EBA II	Found in grave fill.	Cer-amic	N/A	Frage-ment	N/A

829	618	VKH 3418	Jelling Øst	2006	DK	170401	58	Jelling	527522	6179314	ETRS 89	32N	<p>Udgravning af den overplojede gravhøj Sb. nr. 58.). Der blev undersøgt et område på ca. 500 m2. Højfylden var bevaret i en højde på 60 cm plus moderne muldlag. I profilen kunne registreres to høfaser med hver sin centralgrav. FF stednavn: 'Haughus'. Desuden registreres en grav i sydkannten af højen. Gravene daterer sig til den ældste og mellemste del af ældre bronzealder.</p>	A14	1	1	Burial_Inhumation, Burial_Scoundary, Grave_Oak_Coffin, Grave_Stone_Built	W-E	1	Male	EBA II	central grave in second mound phase	VKH3418x10	EBA II	Bronze fragments. Possibly razor.	Bronze	Right_Side, Upper_Body	Fragment, Razor	N/A
829	618	VKH 3418	Jelling Øst	2006	DK	170401	58	Jelling	527522	6179314	ETRS 89	32N	<p>Udgravning af den overplojede gravhøj Sb. nr. 58.). Der blev undersøgt et område på ca. 500 m2. Højfylden var bevaret i en højde på 60 cm plus moderne muldlag. I profilen kunne registreres to høfaser med hver sin centralgrav. FF stednavn: 'Haughus'. Desuden registreres en grav i sydkannten af højen. Gravene daterer sig til den ældste og mellemste del af ældre bronzealder.</p>	A14	1	1	Burial_Inhumation, Burial_Scoundary, Grave_Oak_Coffin, Grave_Stone_Built	W-E	1	Male	EBA II	central grave in second mound phase	VKH3418x11	EBA II	Flint	N/A, Object			N/A

829	618	VKH 3418	Jelling Øst	2006	DK	170401	58	Jelling	527522	6179314	ETRS	32N	Udgravning af den overpløjede gravhøj (Sh. nr. 58.). Der blev undersøgt et område på ca. 500 m ² . Højfylden var bevaret i en højde på 60 cm plus moderne muldlag. I profilen kunne registreres to høfjaser med hver sin centralgrav. FF stedsnavn: 'Haughus'. Desuden registreres en grav i sydkannten af højen. Gravene daterer sig til den ældste og mellemste del af ældre bronzetider.	A14	1	1	Burial_Inhumation, Burial_Secondary, Grave_Oak_Coffin, Grave_Stone, Built	W-E	1	Male	EBA II	central grave in second mound phase	VKH3418x13	1	perhaps pin group G	Bronze	Right_Side, Upper_Body	Pin	OTH-ER
829	618	VKH 3418	Jelling Øst	2006	DK	170401	58	Jelling	527522	6179314	ETRS	32N	Udgravning af den overpløjede gravhøj (Sh. nr. 58.). Der blev undersøgt et område på ca. 500 m ² . Højfylden var bevaret i en højde på 60 cm plus moderne muldlag. I profilen kunne registreres to høfjaser med hver sin centralgrav. FF stedsnavn: 'Haughus'. Desuden registreres en grav i sydkannten af højen. Gravene daterer sig til den ældste og mellemste del af ældre bronzetider.	A14	1	1	Burial_Inhumation, Burial_Secondary, Grave_Oak_Coffin, Grave_Stone, Built	W-E	1	Male	EBA II	central grave in second mound phase	VKH3418x14	1		Bronze, Horn	Left_Side	Pommel, Sword, Group D	N/A

830	618	VKH 3418	Jelling Øsr	2006	DK	170401	58	Jelling	527522	6179314	ETRS 89	32N	Udgravning af den overpløjede gravhøj Sb. nr. 58. Der blev undersøgt et område på ca. 500 m ² . Højfylden var bevaret i en højde på 60 cm plus moderne muldlag. I profilen kunne registreres to højfaser med hver sin centralgrav. FF stednavn: 'Haughus'. Desuden registreres en grav i sydkannten af højen. Gravene daterer sig til den ældste og mellemste del af ældre bronzealder.	A15	1	1	1	Burial mound with inhumation grave Early Bronze Age. Cremation Grave Per. III and cremation grave Late Bronze Age.	N-S	1	Un-known	EBA III	Relative dating per. II or Per. III	VKH13418x8	1	EBA III	Bronze	Flint	N/A	N/A	N/A
839	624	VKH 1331	Bystedvej	1987	DK	170502	40	Gåstev	544035	6165644	ETRS89	32N	Burial mound with inhumation grave Early Bronze Age. Cremation Grave Per. III and cremation grave Late Bronze Age.	Grab B	1	1	1	Burial mound with inhumation, Burial Primary, Grave, Stone, Built	Un-known	EBA III	Relative dating per. II or Per. III	VKH1331x2	1	EBA III	Bronze	Flint	N/A	N/A	N/A		
841	625	VKH 1341	Brandlund	1988	DK	170501	57	Gauer-slund	540275	6166598	ETRS 89	32N	Burial mound in two phases. Primary burial per. II. No burial found belonging to second mound phase. Cupmark stone in stone circumference (randstenskegle) belonging to mound phase 2.	A1	1	1	1	Burial inhumation, Burial Primary, Grave, Oak_Cof-fin, Grave, Stone, Built	Male	EBA II	Presumed male.	VKH1341x3	1	EBA II	Leather	Block sample -leather remains, probably leather pouch	Waist	Object	N/A	N/A	
841	625	VKH 1341	Brandlund	1988	DK	170501	57	Gauer-slund	540275	6166598	ETRS 89	32N	Burial mound in two phases. Primary burial per. II. No burial found belonging to second mound phase. Cupmark stone in stone circumference (randstenskegle) belonging to mound phase 2.	A1	1	1	1	Burial inhumation, Burial Primary, Grave, Oak_Cof-fin, Grave, Stone, Built	Male	EBA II	Presumed male.	VKH1341x8	1	EBA II	Leather, Organic	Upper Body	Frag-ment	N/A	N/A		

841	625	VKH 1341	Brandlund	Burial Mound	1988	DK	170501	57	Gauerstund	540275	6166598	ETRS 89	32N	Burial mound in two phases. Primary burial per. II. No burial found belonging to second mound phase. Cupmark stone in stone circumference (randstenskaede) belonging to mound phase 2.	A1	1	1	Burial_Inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	VSV-ØNØ	1	Male	EBA II	Presumed male.	VKH1341x11	1	EBA II		Leather	Feet	Fragment	N/A	Ecofact	
841	625	VKH 1341	Brandlund	Burial Mound	1988	DK	170501	57	Gauerstund	540275	6166598	ETRS 89	32N	Burial mound in two phases. Primary burial per. II. No burial found belonging to second mound phase. Cupmark stone in stone circumference (randstenskaede) belonging to mound phase 2.	A1	1	1	Burial_Inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	VSV-ØNØ	1	Male	EBA II	Presumed male.	VKH 1341x16	1	EBA II	soil sample with artefacts	Organic	Left_Side, Waist	OTHER			
841	625	VKH 1341	Brandlund	Burial Mound	1988	DK	170501	57	Gauerstund	540275	6166598	ETRS 89	32N	Burial mound in two phases. Primary burial per. II. No burial found belonging to second mound phase. Cupmark stone in stone circumference (randstenskaede) belonging to mound phase 2.	A1	1	1	Burial_Inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	VSV-ØNØ	1	Male	EBA II	Presumed male.	VKH1341x21	1	EBA II	Gripplade dagger (gripplade dolk)	Bronze	Left_Side, Waist	Dagger_Group B			
841	625	VKH 1341	Brandlund	Burial Mound	1988	DK	170501	57	Gauerstund	540275	6166598	ETRS 89	32N	Burial mound in two phases. Primary burial per. II. No burial found belonging to second mound phase. Cupmark stone in stone circumference (randstenskaede) belonging to mound phase 2.	A1	1	1	Burial_Inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	VSV-ØNØ	1	Male	EBA II	Presumed male.	VKH1341x22	1	EBA II		Bronze	Left_Side, Waist	Tweezer			

841	625	VKH 1341	Brandlund	1988	DK	170501	57	Gauer- slund	540275	6166598	ETRS 89	32N	Burial mound in two phases. Primary burial per- II. No burial found belonging to second mound phase. Cupmark stone in stone circumference (randsenskaede) be- longing to mound phase 2.	A1	1	1	Burial_In- humation, Burial_ Primary, Grave_ Oak_Cof- fin, Grave_ Stone_ BUILT	VSV- ØNØ	1	Male	EBA II	Presumed male.	VKH1341x26	1	EBA II	Strike-a-light small 1mm wide bronze bands, fragments. Unknown type or function	Flint	Left_ Side, Waist	Strike- a-light String	N/A
841	625	VKH 1341	Brandlund	1988	DK	170501	57	Gauer- slund	540275	6166598	ETRS 89	32N	Burial mound in two phases. Primary burial per- II. No burial found belonging to second mound phase. Cupmark stone in stone circumference (randsenskaede) be- longing to mound phase 2.	A1	1	1	Burial_In- humation, Burial_ Primary, Grave_ Oak_Cof- fin, Grave_ Stone_ BUILT	VSV- ØNØ	1	Male	EBA II	Presumed male.	1341x25	>1	EBA II	Two fibulas	Bronze	Left_ Side, Waist	String	N/A
841	625	VKH 1341	Brandlund	1988	DK	170501	57	Gauer- slund	540275	6166598	ETRS 89	32N	Burial mound in two phases. Primary burial per- II. No burial found belonging to second mound phase. Cupmark stone in stone circumference (randsenskaede) be- longing to mound phase 2.	A1	1	1	Burial_In- humation, Burial_ Primary, Grave_ Oak_Cof- fin, Grave_ Stone_ BUILT	VSV- ØNØ	1	Male	EBA II	Presumed male.	VKH1341x23,24	2	EBA II	Two fibulas	Bronze	Left_ Side, Waist	Fibula_ Group A	Form A01
842	625	VKH 1341	Brandlund	1988	DK	170501	57	Gauer- slund	540275	6166598	ETRS 89	32N	Burial mound in two phases. Primary burial per- II. No burial found belonging to second mound phase. Cupmark stone in stone circumference (randsenskaede) be- longing to mound phase 2.	A10	1	1	Other	N/A	0	N/A	EBA II	Stone circle (rands- tenskaede) with cupmark stone	VKH1341x20	1	EBA II	cupmark stone	Stone	N/A	Rock Carv- ing	N/A
846	626	VKH 1584	Tårup	1992	DK	170304	88	Taulov	539864	6156853	ETRS89	32N	Neolithic megalithic tomb (dolmen) with later added bronze age burial mound.	L	1	1	Burial_ Unspec	E-W	0	Male	EBA I	Burial second- ary to dolmen. Placed in dolmen above chamber.	VKH1584x95	1	EBA I	typological data per. I or II.	Flint	Waist	Dagger	N/A

849	627	VKH 1714	Kragelundsgård	Burial Mound	1996	DK	170501	43	Gauerstund	540431	6166444	ETRS89	32N	Burial mound per. II with two mound phases.	X1	1	1	Burial_Inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	W-E	0	Male	EBA II			Bronze	Left_Side	Sword_Group D	N/A
849	627	VKH 1714	Kragelundsgård	Burial Mound	1996	DK	170501	43	Gauerstund	540431	6166444	ETRS89	32N	Burial mound per. II with two mound phases.	X1	1	1	Burial_Inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	W-E	0	Male	EBA II	x1.1	1	Bronze	Waist	Belt Hook	
849	627	VKH 1714	Kragelundsgård	Burial Mound	1996	DK	170501	43	Gauerstund	540431	6166444	ETRS89	32N	Burial mound per. II with two mound phases.	X1	1	1	Burial_Inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	W-E	0	Male	EBA II	x1.3	1	Stone		Strike-a-light	N/A
849	627	VKH 1714	Kragelundsgård	Burial Mound	1996	DK	170501	43	Gauerstund	540431	6166444	ETRS89	32N	Burial mound per. II with two mound phases.	X1	1	1	Burial_Inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	W-E	0	Male	EBA II	x1.10	1	Flint		Blade	N/A
850	627	VKH 1714	Kragelundsgård	Burial Mound	1996	DK	170501	43	Gauerstund	540431	6166444	ETRS89	32N	Burial mound per. II with two mound phases.	x2	1	1	Burial_Double, Burial_Secondary, Grave_Stone_Built	E-W	0	Unknown	EBA II	x2.1	1	Bronze		Knife	Found in southern part of grave. DK: 'grebspidsk-niv'.

850	627	VKH 1714	Kragelundgård	Burial Mound	1996	DK	170501	43	Gaerulstund	540431	6166444	ETRS89	32N	Burial mound per. II with two mound phases.	x2	1	1	1	Burial_Double, Burial_Secondary, Grave_Stone_Built	E-W	0	Unknown	Male	EBA II		x2.3-6	1	EBA II	Found in NW part of northern grave	Bronze		Dagger_Group A	N/A
859	634	VKH 7397	Saksøse Huse	Single Find	2013	DK	170905	22	Kollerup	526843	6180595	ETRS89	32N	Sent to NM (Danefé). Found by metal detecting within an area of 25m. No burial mound registered on the spot.	unknown	1	0	0	Unknown	N/A	0	Male	Early Bronze Age		VKH7397x1	1	Early Bronze Age	9 fragments of bronze age sword blade	Bronze		Sword	N/A	
859	634	VKH 7397	Saksøse Huse	Single Find	2013	DK	170905	22	Kollerup	526843	6180595	ETRS89	32N	Sent to NM (Danefé). Found by metal detecting within an area of 25m. No burial mound registered on the spot.	unknown	1	0	0	Unknown	N/A	0	Male	Early Bronze Age		VKH7397x2	1	Early Bronze Age	Lance shaped bronze object with eyelet.	Bronze		Object	N/A	
859	634	VKH 7397	Saksøse Huse	Single Find	2013	DK	170905	22	Kollerup	526843	6180595	ETRS89	32N	Sent to NM (Danefé). Found by metal detecting within an area of 25m. No burial mound registered on the spot.	unknown	1	0	0	Unknown	N/A	0	Male	Early Bronze Age		VKH7397x3	1	Early Bronze Age	Possible double button	Bronze		Double Button	N/A	
860	635	VKH 6926	Højbo	Burial Mound	2006	DK	170501	99	Gaerulstund	541920	6168396	ETRS89	32N	burial mound (EBA) with secondary cremation burials, LBA and IA). Mound surrounded by post circle. Settlement also found at the site.	A400	1	1	1	Burial_Inhumation, Burial_Primary, Grave_Stone_Built	E-W	0	Male	EBA II	Grave robbed in prehistory.	VKH6926x273	1	EBA II	Nail - rivet (nagle). From sword.	Bronze		Object	N/A	
860	635	VKH 6926	Højbo	Burial Mound	2006	DK	170501	99	Gaerulstund	541920	6168396	ETRS89	32N	burial mound (EBA) with secondary cremation burials, LBA and IA). Mound surrounded by post circle. Settlement also found at the site.	A400	1	1	1	Burial_Inhumation, Burial_Primary, Grave_Stone_Built	E-W	0	Male	EBA II	Grave robbed in prehistory.	VKH6926x275	1	EBA II	Fragmented bronzetube	Bronze		Tubes	N/A	
860	635	VKH 6926	Højbo	Burial Mound	2006	DK	170501	99	Gaerulstund	541920	6168396	ETRS89	32N	burial mound (EBA) with secondary cremation burials, LBA and IA). Mound surrounded by post circle. Settlement also found at the site.	A400	1	1	1	Burial_Inhumation, Burial_Primary, Grave_Stone_Built	E-W	0	Male	EBA II	Grave robbed in prehistory.	VKH6926x274, 276	1	EBA II	Flint	Flint		OTHER	N/A	

Appendix 2. METADATA

THE DATASET

Period II data

The total dataset from period II (c. 1500- 1300 BCE) comprises of 112 registered archaeological contexts that are characterised by a majority of graves interred in burial mounds. Below a short presentation of the registered burials and depositions.

Burials per. II

A total of 91 burials are recorded in this dataset. When possible, social gender was determined on the basis of the artefact assemblages found in the graves. Of these 91 burials, social gender could be determined in 75 cases: 12 gendered females and 63 gendered males. The remaining 16 graves were not gender specific (see fig. 8).

Sadly, the overall bone preservation is very poor. Only 11 graves with ascribed (social) gender were found to have preserved human remains. Of these, only 1 individual has been osteologically sexed, namely the male burial K3 from VKH 1842 Højgård.

Period II includes 39 inhumation graves and three cremation burials. Due to the lack of human remains the nature of the last 49 graves could not be determined. No urn cremations have been registered from period II.

Wherever possible, it is noted whether a grave was primary or secondary. This category is only relevant for graves in burial mounds and only when stratigraphic relations allow for such observations. Primary burials describe those burials who were the initial burials in a particular mound. In the period II dataset 21 primary burials (10 male, 4 female and 7 unknown gender) and 12 secondary burials (8 male, 0 female and 4 unknown gender) have been recorded.

Depositions per. II

A total of 10 depositions were recorded in the dataset for per. II, hereof 7 single depositions. Three depositions could be ascribed to a wetland context the rest remain unknown. The wetland deposit contained 2 spearheads and 1 octagonal hilted sword whereas the remaining depositions were all palstaves. A total of 7 palstaves are recorded in the data set, four of these are of a North German

type (axe C_II in dataset) and one of Nordic type (axe C_I in dataset). Two palstaves were not assigned to specific type.

Period III data

The data from period III (c. 1300 – 1100 BCE) show the same characteristics as the data from period II. A total of 82 contexts are registered to period III and 75 of these are burials (67 from burial mounds, 3 single graves and 5 burials with unknown context as loose or single finds). Only depositions are recorded to period III and 10 loose/ and or single find (included here are 5 artefacts interpreted as grave finds with no context). Below a short presentation of the registered burials and depositions from the period will follow.

Burials per. III

A total of 75 burials are recorded in this dataset and when possible, social gender has been determined on the basis of the artefact assemblages found in the graves (fig. 9). Of these 75 burials social gender could be determined in 45 cases: 12 gendered females and 43 gendered males. The remaining 20 graves are non-gender specific.

Again, the overall bone preservation is very poor. Only 7 graves with ascribed (social) gender were found to have preserved human remains. Of these, only 3 individuals have been osteologically sexed (context id 142, 221 and 222) and in all 3 cases the social gender and biological sex match male (see appendix 3).

In period III we see a marked reduction in inhumation graves and instead the majority (41 graves) are recorded with uncertain burial rite that could be either inhumation or cremation. Cremation burials that are typologically dated to period III are represented by 26 burials but only 1 urn cremation has been registered in this material. This is the only urn cremation that has been registered to the Early Bronze Age in this study and it is typologically dated to per. III (context id 565; Ke 4590). Inhumation graves dated to period III are represented by 8 graves.

When possible, it has been recorded whether a grave is a primary grave or secondary grave. This category is only relevant for graves in burial mounds and only when stratigraphic relations allow such observations. Primary burials indicate that this was the burial that originated the mound.

Secondary burials are all later burials in the mound. In period III we see a marked reduction of primary graves and the dataset comprise only 4 primary burials (2 male, 0 female and 2 unknown gender) and 14 secondary burials (7 male, 2 female and 5 unknown gender) are recorded. A clear

tendency towards re-use and extending of existing burial mounds is apparent in the burial data for period III.

Not all registered graves in the dataset are found in a closed secure context. These graves are however important for the understanding of the social role and status of the individuals as they represent the 'truest' artefact assemblage as the graves are undisturbed (of course the general conditions for preservation is an important factor also but disregarded here). Only socially gender graves in a secure context are considered for the study.

Depositions per. III

Two deposits typologically dated to period III were recorded from Vejle Amt and both were found in wetland contexts. One deposit contained a single dagger ('*griffangel*' type) and the other a sword blade, a full hilted knife and a spiral finger ring.

All the depositions recorded in the dataset from period II and III have a gendered male expression and generally contained few artefacts.

Notes to figures

Dating: some contexts are determined within NBA periods I, II, III etc. but sometimes only a date to 'Early Bronze Age' has been registered. Therefore the 'Early Bronze Age' is not alone a sum total of EBA I + II + III. A sum total of all Early Bronze Age contexts and objects is therefore: Early Bronze Age + NBA I + NBA II + NBA III.

Con-text id	Con-text Name	Site id	National Museum code	Regional Museum code	Place Name	Site Classification	Find Year	Country	County	Admin Id	Sb nr.	Parish	Coord. EAST	Coord. NORTH	Projection	UTM zone	SITE.Notes	InSitu	Closed Context	Orientation	Human Remains	Gender Social	Context Date by Period	CON-TEXT. Notes	Object_Museum_id	Quantity	Date_By_Period	Description_ object	Object Material	Object Placement	Object Ornament	Artifact Classification	Object Sub-type	Eco-fact Classification	
19		43		Moesgaard 7249	Palsgård	Burial Mound	0	DK	DK	170101		As	0	0			Not in situ But found in burial mound near Palsgård with male per. III burial	0	0	Burial_ Unspec	0	Male	EBA III		Moesgaard 7249	1	EBA III	Unsecure context	Bronze		Lines	Chape- Form B	Form B04		
22		46	NM26095		Barritskov	Single Deposition	1856	DK	DK	170102		Barrit	0	0			Probable deposit per II	0	0	Unknown	0	Male	EBA II		NM26095	1	EBA II	Previous Frederik VII nr.1770 Possible bog patina	Bronze			Ase_ Group CI			
27		50		Glud Museum A470/1957	Tomballegård	Burial Mound	1880	DK	DK	170104		Glud	0	0			From removed mound.	0	0	Burial_ Unspec	0	Male	EBA II		Glud Museum A470/1957	1	EBA II		Bronze		Ribbed	Ase_ Group D			
29		52	NM8072		Hjarnø	Single Deposition	1844	DK	DK	170105		Hjarnø	0	0			Presumed bog deposition due to patina.	0	0	Context_ Wetland	0	Male	EBA II		NM8072	1		Possibly not NMF number?	Bronze		Concentric Circle, Lines	Sword_ Group B			
30		53			Strandhuse	Burial Mound	1947	DK	DK	170107	20	Klæring	6173651	6173651	ETRS89	32N		1	0	Burial_ Inhumation, Grave_ Oak_ Coffin, Grave_ Stone_ Built	0	Male	EBA II	Dis- turbed. 2,65m long x 1,60m wide	NMBI3812	1	EBA II	x1			Right_ Side	Sword_ Group B			
30		53			Strandhuse	Burial Mound	1947	DK	DK	170107	20	Klæring	6173651	6173651	ETRS89	32N		1	0	Burial_ Inhumation, Grave_ Oak_ Coffin, Grave_ Stone_ Built	0	Male	EBA II	Dis- turbed. 2,65m long x 1,60m wide	NMBI3813	1	EBA II	x2	Cer- amic		N/A	Vessel			
34	sb 66	56		Glud Museum A800	Rårup Østermark	Burial Mound	0	DK	DK	170109	66	Rårup	6179847	6179847	ETRS89	32N		0	0	Burial_ Unspec	0	Male	EBA III		Glud Museum A800	1	EBA III		Bronze			Sword_ Group E			
36		58		Glud Museum 2540	Vester-Bisholt	Single Deposition	0	DK	DK	170110	14	Skjold	6187522	6187522	ETRS89	32N	Spindekons Høj Fund fra området nær høi	0	0	Unknown	0	Male	EBA II	Probable deposition	Glud Museum 2540	1			Bronze				Ase_ Group CII		
41		63		MKH 1646	Almind	Loose Find	1927	DK	DK	170201	61	Almind	6158066	6158066	ETRS 89	32N	From matrikel 1A Probable grave	0	0	Burial_ Unspec	0	Male	EBA II		MKH 1646	1		Patstave work	Bronze			Ase_ Group C			

87	Grab A	100	Kongsted	Burial Mound	1909	DK	170301	21	Bredstrup	540327	6157520	ETRS 89	32N	Two mound phases. Stone Age primary Grave. Followed by further BA graves in second mound phase.	1	0	Burial_ Unspec, Grave_ Stone_ Built	0	Male	EBA II	Possible primary grave in BA phases of mound (in mound earlier stone age grave).	NMB8476	1	EBA II	Fragment	Bronze		Dagger
87	Grab A	100	Kongsted	Burial Mound	1909	DK	170301	21	Bredstrup	540327	6157520	ETRS 89	32N	Two mound phases. Stone Age primary Grave. Followed by further BA graves in second mound phase.	1	0	Burial_ Unspec, Grave_ Stone_ Built	0	Male	EBA II	Possible primary grave in BA phases of mound (in mound earlier stone age grave).	NMB8477	1	EBA II	with traces of pyrite on ends	Flint		Strike-a-light
94	Museum Fredericia 83-84	104	Fredericia	Burial Mound	1964	DK	170303	10	Fredericia	548856	6159545	ETRS 89	32N		1	0	Burial_ Cre- mation, Grave_ Stone_ Built	1	Male	EBA III	Possible two male cremation burials	NMB7683	1	EBA III		Bronze		Sword_ Group C
94	Museum Fredericia 83-84	104	Fredericia	Burial Mound	1964	DK	170303	10	Fredericia	548856	6159545	ETRS 89	32N		1	0	Burial_ Cre- mation, Grave_ Stone_ Built	1	Male	EBA III	Possible two male cremation burials	NMB7684	1	EBA III	Lost	Bronze		Blade, Sword
99		108	Daugård	Burial Mound	1964	Dk	170401	5	Daugård	543742	6176361	ETRS 89	32N		1	1	Burial_ Inhu- mation, Burial_ Primary, Grave_ Oak_ Coffin, Grave_ Stone_ Built	1	Male	EBA II	Dis- turbed	Moesgård 1449	1	EBA II	Fragment. Missing?	Bronze	Horse	Razor_ Form 2

142	136	NM report nr. 4292	Tyrsted	Burial Mound	1974	DK	170410	20	Tyrsted	551632	6187631	ETRS 89	32N	FF placename: 'Smedhøj'	1	1	0	Burial_Creation, Grave, Oak_Coffin, Grave_Stone, Built	N-S	1	Male	EBA III	Presumed male	Horsens P 182/74	1	EBA III	Bronze	Low-er_Body	Sword_Group C
144	137	NMB7204	Urlev	Burial Mound	1870	DK	170411		Urlev	0	0				0	Male	EBA III	Presumed male				NMB7204	1	EBA III	Bronze, Ceramic			Dagger_Group C	
149	142	NM 12313	Gauer-slund	Burial Mound	1852	DK	170501	10	Gauer-slund	541436	6166661	ETRS 89	32N		1	0	Burial_Unspec		1	Male	EBA II		NM12313	1	EBA II	Bronze			Sword_Group C
149	142	NM 12313	Gauer-slund	Burial Mound	1852	DK	170501	10	Gauer-slund	541436	6166661	ETRS 89	32N		1	0	Burial_Unspec		1	Male	EBA II		NM12314	1	EBA II	Bronze			Dagger_Group B
149	142	NM 12313	Gauer-slund	Burial Mound	1852	DK	170501	10	Gauer-slund	541436	6166661	ETRS 89	32N		1	0	Burial_Unspec		1	Male	EBA II		NM12315	1	Late Neolithic	Flint			Dagger_Group A
150	143	VKH 446	Garslev	Burial Mound	1878	DK	170502	16	Garslev	543858	6164908	ETRS 89	32N	placename: 'Merteshøj'	0	Male	EBA II		0	Male	EBA II		VKH 446x1	1	EBA II	Bronze			Sword_Group C
164	149		Egved	Burial Mound	1881	DK	170601	98	Egved	517694	6164824	ETRS 89	32N	placename: 'Bjergermandshøj'	1	0	Burial_Unspec		0	Male	EBA II		NMB2968	1	EBA II	Bronze	False Spiral, Lines		Sword_Group A
167	151		Egved	Burial Mound	1907	DK	170601	112	Egved	517835	6165125	ETRS 89	32N	placename: 'Folhøj'	0	Male	EBA II		0	Male	EBA II		NMB3760	2	EBA II	Gold			Ring-Finger_Group A
167	151		Egved	Burial Mound	1907	DK	170601	112	Egved	517835	6165125	ETRS 89	32N	placename: 'Folhøj'	1	0	Burial_Unspec		0	Male	EBA II		NMB3792	1	EBA II	Bronze	Spiral		Pommel
167	151		Egved	Burial Mound	1907	DK	170601	112	Egved	517835	6165125	ETRS 89	32N	placename: 'Folhøj'	1	0	Burial_Unspec		0	Male	EBA II		NMB3792	1	EBA II	Bronze			Blade, Sword
174	153		Egved	Burial Mound	1860	DK	170601	140	Egved	518247	6164991	ETRS 89	32N	The finds could potentially be from sb. 135-139, 142-142 but registered under sb 140.	1	0	Burial_Unspec		0	Male	EBA III		NM19024	1	EBA III	Bronze			Blade, Sword

201	174	822/59	Øster-Thorsted	Burial Mound	1958	DK	170601	197	Egved	515674	6161756	ETRS 89	32N	FF placename 'Sychoje' Mound previously robbed. NMB15283-304. Daneffe 8/58	1	Burial_inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	WNW-ENE	1	Male	EBA II	NMB15288	1	EBA II	Leather pouch (etu) containing: sickle (NMB15288), pyrite (NMB15288), strike-a-light (NMB15287), razor (NMB15290), tweezer (NMB15291), strand of wood 'wollfaden' (NMB15283), sewing needle (NMB15294), awl (NMB15295), glas (NMB15297-98), needle (NMB15299), wooden needle (NMB15300), bronze string (NMB15301), amber fragments (NMB15289, NMB15303), bone comb (NMB15304)	Leather	Waist	Container
201	174	822/59	Øster-Thorsted	Burial Mound	1958	DK	170601	197	Egved	515674	6161756	ETRS 89	32N	FF placename 'Sychoje' Mound previously robbed. NMB15283-304. Daneffe 8/58	1	Burial_inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	WNW-ENE	1	Male	EBA II	NMB15288	1	EBA II	Bronze	Waist	Sickle	

201	174	822/59	Øster Thorssted	Burial Mound	1958	DK	170601	197	Egved	515674	6161756	ETRS 89	32N	FF placename 'Syvhoje' Mound previously robbed. NMB15283-304. Danefæ 8/58	1	1	Burial_Inhumation, Burial, Primary, Grave, Oak_Coffin, Grave_Stone_Built	WNW-ENE	1	Male	EBA II	NMB15288	1	EBA II	Pyrite	Pyrite	Waist	Strike-light
201	174	822/59	Øster Thorssted	Burial Mound	1958	DK	170601	197	Egved	515674	6161756	ETRS 89	32N	FF placename 'Syvhoje' Mound previously robbed. NMB15283-304. Danefæ 8/58	1	1	Burial_Inhumation, Burial, Primary, Grave, Oak_Coffin, Grave_Stone_Built	WNW-ENE	1	Male	EBA II	NMB15287	1	EBA II	Flint	Flint	Waist	Strike-light
201	174	822/59	Øster Thorssted	Burial Mound	1958	DK	170601	197	Egved	515674	6161756	ETRS 89	32N	FF placename 'Syvhoje' Mound previously robbed. NMB15283-304. Danefæ 8/58	1	1	Burial_Inhumation, Burial, Primary, Grave, Oak_Coffin, Grave_Stone_Built	WNW-ENE	1	Male	EBA II	NMB15290	1	EBA II	Bronze	Lausitz cultur razor (Randsborg og Christiansen 2006: 22)	Waist	Razor_Form 3
201	174	822/59	Øster Thorssted	Burial Mound	1958	DK	170601	197	Egved	515674	6161756	ETRS 89	32N	FF placename 'Syvhoje' Mound previously robbed. NMB15283-304. Danefæ 8/58	1	1	Burial_Inhumation, Burial, Primary, Grave, Oak_Coffin, Grave_Stone_Built	WNW-ENE	1	Male	EBA II	NMB15291	1	EBA II	Bronze		Waist	Twizzer_Form 2

221	Grab C	HAM 704	Trappendal	Burial Mound	1975	DK	170202	27	Hejls	537681	6136867	ETRS 89	32	FF placename: 'Sejshøj' old id nr.: 8 (1886). Mound in several phases. House un- derneath as part primary burial. FINDS: HAM 21827-860.	1	1	Buri- al_Cre- ation, Burial_ Double, Buri- al_Sec- ondary, Grave_ Oak_ Coffin	WNV- ESE	1	Male	EBA III	= 32 in Boysen and An- dersen. Mound phase II.	21852	1	EBA III	Found with small leather fragments (perhaps container for tweezer)	Bronze	Waist	Tweez- er_Form 2
221	Grab C	HAM 704	Trappendal	Burial Mound	1975	DK	170202	27	Hejls	537681	6136867	ETRS 89	32	FF placename: 'Sejshøj' old id nr.: 8 (1886). Mound in several phases. House un- derneath as part primary burial. FINDS: HAM 21827-860.	1	1	Buri- al_Cre- ation, Burial_ Double, Buri- al_Sec- ondary, Grave_ Oak_ Coffin	WNV- ESE	1	Male	EBA III	= 32 in Boysen and An- dersen. Mound phase II.	21849	1	EBA III	Fragment	Bronze	Waist	Knife
222	Grab D	HAM 704	Trappendal	Burial Mound	1975	DK	170202	27	Hejls	537681	6136867	ETRS 89	32	FF placename: 'Sejshøj' old id nr.: 8 (1886). Mound in several phases. House un- derneath as part primary burial. FINDS: HAM 21827-860.	1	1	Buri- al_Cre- ation, Buri- al_Sec- ondary, Grave_ Stone_ Bult	NE- SW	1	Male	EBA III	= 13 in Boysen and An- dersen. Mound phase III.	21827	1	EBA III		Bronze	Low- er_ Body	Razor_ Form 3

222	Grab D		HAM 704	Trappendal	Burial Mound	1975	DK	170202	27	Hejls	537681	6136867	ETRS 89	32	FF placename: 'Sejlsøj' old id nr: 8 (1886). Mound in several phases. House un- derneath as part primary burial. FINDS: HAM 21827-860.	1	1	Buri- al_Cre- ation, Buri- al_Sec- ondary, Grave_ Stone_ Built	NE- SW	1	Male	EBA III	= 13 in Boysen and An- dersen. Mound phase III.	21828	1	EBA III		Bronze	Up- per_ Body			
224	Grab F		HAM 704	Trappendal	Burial Mound	1975	DK	170202	27	Hejls	537681	6136867	ETRS 89	32	FF placename: 'Sejlsøj' old id nr: 8 (1886). Mound in several phases. House un- derneath as part primary burial. FINDS: HAM 21827-860.	1	1	Buri- al_Cre- ation, Buri- al_Sec- ondary, Grave_ Oak_ Coffin, Grave_ Stone_ Built	NW- SE	1	Male	EBA III		21858	1	EBA III	Fragment	Bronze				Fibula_ Group C
230	Grab B			Trappendal	Burial Mound	1910	DK	170202	42	Hejls	537527	6136445	ETRS 89	32N	FF placename: 'Hejls'	1	0	Buri- al_Sec- ondary, Burial_ Unspec		0	Male	EBA II		unknown	1	EBA II		Bronze				Axe_ Group C
230	Grab B			Trappendal	Burial Mound	1910	DK	170202	42	Hejls	537527	6136445	ETRS 89	32N	FF placename: 'Hejls'	1	0	Buri- al_Sec- ondary, Burial_ Unspec		0	Male	EBA II		unknown	1	EBA II		Bronze				Sword_ Group C
231	Grab A			Trappendal	Burial Mound	1886	DK	170202	44	Hejls	538271	6136124	ETRS 89	32N	FF place- name 'Mind- egården'	1	0	Burial_ Primary, Grave_ Stone_ Built	W-E	0	Male	EBA III		unknown	1	EBA III		Bronze				Blade, Sword
231	Grab A			Trappendal	Burial Mound	1886	DK	170202	44	Hejls	538271	6136124	ETRS 89	32N	FF place- name 'Mind- egården'	1	0	Burial_ Primary, Grave_ Stone_ Built	W-E	0	Male	EBA III		unknown	1	EBA III		Bronze				Fibula_ Group C
237			MKH 3466	Agtrup	Single Find	0	DK	170303		Sønder Bjert	0	0			Found in Agtrup woods.	0	0	Built Un- known		0	Male	EBA II		MKH 3466	1	EBA II	Fragment	Bronze				Axe

293	Fund Bb	227	Museum Moesgård 5286	Harræso	Burial Mound	1903	DK	170805	160	Givskud	524363	6184049	ETRS 89	32N	1	0	Burial_Inhumation, Burial_Secondary	0	Male	EBA III	From west of the mound. Presumably three (male) graves (a-c). Objects not recorded with individuals graves.	Moesgård 5286	1	EBA III	Missing?	Bronze	Blade
293	Fund Bb	227	Museum Moesgård 5286	Harræso	Burial Mound	1903	DK	170805	160	Givskud	524363	6184049	ETRS 89	32N	1	0	Burial_Inhumation, Burial_Secondary	0	Male	EBA III	From west of the mound. Presumably three (male) graves (a-c). Objects not recorded with individuals graves.	Moesgård 5286	1	EBA III	Missing?	Bronze	Pommel
295		228		Harræso	Burial Mound	1870	DK	170805	164	Givskud	524390	6183670	ETRS 89	32N	1	0	Burial_Inhumation, Grave_Stone_Built	0	Male	EBA II		NMBS66	1	EBA II		Gold	Ring_Arm_Group E
295		228		Harræso	Burial Mound	1870	DK	170805	164	Givskud	524390	6183670	ETRS 89	32N	1	0	Burial_Inhumation, Grave_Stone_Built	0	Male	EBA II		NMBS67	1	EBA II			Sword_Group C
295		228		Harræso	Burial Mound	1870	DK	170805	164	Givskud	524390	6183670	ETRS 89	32N	1	0	Burial_Inhumation, Grave_Stone_Built	0	Male	EBA II		NMBS67	1	EBA II		Bronze	Chape_Form B
295		228		Harræso	Burial Mound	1870	DK	170805	164	Givskud	524390	6183670	ETRS 89	32N	1	0	Burial_Inhumation, Grave_Stone_Built	0	Male	EBA II		NMBS68	1	EBA II	Missing, 'Bronzestange'	Bronze	Object

428	Grab A	303	NM 716/05; 523/06	Balle	Burial Mound	1906	DK	170901	24	Bredsten	522224	6174786	ETRS 89	32N	1	1	Burial information, Burial Primary, Grave, Oak Coffin, Grave, Stone, Built	W-E	0	Male	EBA II		NMB8525-8526	3	EBA II	Bronze	Left Side, Upper Body	N/A	Turuli Group C
428	Grab A	303	NM 716/05; 523/06	Balle	Burial Mound	1906	DK	170901	24	Bredsten	522224	6174786	ETRS 89	32N	1	1	Burial information, Burial Primary, Grave, Oak Coffin, Grave, Stone, Built	W-E	0	Male	EBA II		unknown	1	EBA II	Bronze	Upper Body		Object
428	Grab A	303	NM 716/05; 523/06	Balle	Burial Mound	1906	DK	170901	24	Bredsten	522224	6174786	ETRS 89	32N	1	1	Burial information, Burial Primary, Grave, Oak Coffin, Grave, Stone, Built	W-E	0	Male	EBA II		NMB8529	1	EBA II	Ceramic	Feet	N/A	Vessel
432		305		Soskov	Burial Mound	1898	DK	170901	94	Bredsten	525509	6175311	ETRS 89	32N	0	0	Burial Unspec		0	Male	EBA III		Kersten d / aalborg.3396	1		Bronze			Pin
432		305		Soskov	Burial Mound	1898	DK	170901	94	Bredsten	525509	6175311	ETRS 89	32N	0	0	Burial Unspec		0	Male	EBA III		Kersten e / aalborg.3397	1	Late Bronze Age	Bronze			Knife
433		305		Soskov	Burial Mound	1898	DK	170901	94	Bredsten	525509	6175311	ETRS 89	32N	0	0	Burial Unspec		0	Male	EBA III		Kersten f / aalborg.3398	1	EBA III	Bronze			Razor

456	Grab B	317	NM 288/40	Tørfhøj	Burial Mound	1940	DK	170902	2	Gadbjerg 521595	6181584	ETRS 89	32N	FF place-name 'Tvil-inghøj'	1	1	Burial Primary Grave Oak Coffin Grave Stone Built	W-E	0	Male	EBA II	NMBI3390	1	EBA II	Pyrite	Pyrite	Up- per_ Body	Strike- a- light
456	Grab B	317	NM 288/40	Tørfhøj	Burial Mound	1940	DK	170902	2	Gadbjerg 521595	6181584	ETRS 89	32N	FF place-name 'Tvil-inghøj'	1	1	Burial Primary Grave Oak Coffin Grave Stone Built	W-E	0	Male	EBA II	NMBI3390a	1	EBA II	Amber		Up- per_ Body	Fragment
456	Grab B	317	NM 288/40	Tørfhøj	Burial Mound	1940	DK	170902	2	Gadbjerg 521595	6181584	ETRS 89	32N	FF place-name 'Tvil-inghøj'	1	1	Burial Primary Grave Oak Coffin Grave Stone Built	W-E	0	Male	EBA II	NMBI3390b	1	EBA II	Bronze		Up- per_ Body	Fibula_ Group A
457		318		Tørfhøj	Burial Mound	1861	DK	170902		Gadbjerg 0	0			unknown location	0	0	Burial Unspec		0	Male	EBA III	NMBI9940	1	EBA III	Bronze			Axe
457		318		Tørfhøj	Burial Mound	1861	DK	170902		Gadbjerg 0	0			unknown location	0	0	Burial Unspec		0	Male	EBA III	NMBI9941	1	EBA III	Bronze		Zig_Zag	Dagger
457		318		Tørfhøj	Burial Mound	1861	DK	170902		Gadbjerg 0	0			unknown location	0	0	Burial Unspec		0	Male	EBA III	NMBI9943	1	EBA III	Bronze			Sword_ Group C
459		319		Fårup	Burial Mound	1851	DK	170904		Jelling 0	0			unknown location	0	0	Burial Unspec		0	Male	EBA III	NMBI2257	1	EBA III	Bronze			Sword_ Group C
460		320		Fårupgård	Burial Mound	0	DK	170904		Jelling 0	0			location unknown	0	0	Burial Unspec		0	Male	EBA II	NMB40	1	EBA II	Bronze		Lines	Axe_ Group C
461		321		Fårupgård	Burial Mound	1921	DK	170904	103	Jelling 525281	6177308	ETRS 89	32N		1	0	Burial Unspec		0	Male	EBA II	NMBI1476	1	EBA II	Bronze			Blade
461		321		Fårupgård	Burial Mound	1921	DK	170904	103	Jelling 525281	6177308	ETRS 89	32N		1	0	Burial Unspec		0	Male	EBA II	NMBI1476	1	EBA II	Bronze		Spiral	Sword Pommel
465		325		Jelling	Burial Mound	0	DK	170904	30	Jelling 526678	6180030	ETRS 89	32N	Could be sb 29-44. For this purpose registered under sb 30. Exact location unknown. From 'Mangehøj' (sb 29-44)	0	0	Burial Unspec		0	Male	EBA III	NMBI6805	1	EBA III	Bronze			Sword_ Group C

465	325		Jelling	Burial Mound	0	DK	170904	30	Jelling	526678	6180030	ETRS 89	32N	Could be sb 29-44. For registered under sb 30. Exact location unknown. From 'Mangehoje' (sb 29-44)	0	0	Burial_ Unspec	0	0	Male	EBA III		NMB16807	1	Undated		Un- known		Vessel
465	325		Jelling	Burial Mound	0	DK	170904	30	Jelling	526678	6180030	ETRS 89	32N	Could be sb 29-44. For registered under sb 30. Exact location unknown. From 'Mangehoje' (sb 29-44)	0	0	Burial_ Unspec	0	0	Male	EBA III		NMB16806	1	EBA III		Bronze		Ring_ Arm
467	326		Jelling	Burial Mound	0	DK	170904	31	Jelling	526696	6179972	ETRS 89	32N	Could be sb 29-44. For registered under sb 31. Exact location unknown. From 'Mangehoje' (sb 29-44)	0	0	Burial_ Unspec	0	0	Male	EBA II		unknown	1	EBA II	missing. Further description in Broholm.	Bronze		Sword
470	329		Jelling	Burial Mound	1844	DK	170904		Jelling	0	0			'Mangehoje' (sb 29-44)	0	0	Burial_ Unspec	0	0	Male	EBA II		NM11001	1	Early Bronze Age		Bronze		Axe
471	330	Grab A	Jelling	Burial Mound	1865	DK	170904		Jelling	0	0			unknown location. Burial mound NE of Jelling.	0	0	Burial_ Inhi- mation, Grave_ Cham- ber, Grave_ Stone_ Built	0	0	Male	EBA II		NMB25933	1	EBA II		Bronze		Sword_ Group C
475	333		Jelling	Burial Mound	1861	DK	170904		Jelling	0	0			Prob. Burial mound. Location unknown	0	0	Burial_ Unspec	0	0	Male	EBA II		NMB14073	1	EBA II		Bronze		Sword_ Group B

569	385	NM 170/44		Vandel	Burial Mound	1944	DK	170908	69	Randbøl	512358	6172774	ETRS 89	32N	1	1	1	Burial_Inhuma- tion, Burial_ Primary, Grave_ Oak_ Coffin, Grave_ Stone_ Built	WSW- ENE	0	Male	EBA II			NMB13679	1	EBA II	Fragment	Bronze	Up- per_ Body	Lines	Blade, Dagger	
569	385	NM 170/44		Vandel	Burial Mound	1944	DK	170908	69	Randbøl	512358	6172774	ETRS 89	32N	1	1	1	Burial_Inhuma- tion, Burial_ Primary, Grave_ Oak_ Coffin, Grave_ Stone_ Built	WSW- ENE	0	Male	EBA II			NMB13680	1	EBA II	'perlschnur- reihen'	Bronze	Up- per_ Body		Twizer- er_ Form 1	
570	386			Vandel	Burial Mound	1863	DK	170908	72	Randbøl	512214	6173667	ETRS 89	32N	1	0	0	Burial_ Unspec, Grave_ Stone_ Built, Grave_ Stone_ Cist		0	Male	EBA III			NMB21156	1	EBA III		Bronze			Sword_ Group E	
573	388			Vandel	Burial Mound	1898	DK	170908	75	Randbøl	512324	6173685	ETRS 89	32N	1	0	0	Burial_ Unspec		0	Male	EBA III			NMB 6809	1	EBA III		Bronze			Sword_ Group E	
576	391			Amt Vejle	Single Find	1892	DK	17xxxx			0	0			0	0	0	Un- known		0	Male	EBA II			Moesgård 2911	1	EBA II		Bronze			Axe_ Group C	

827	K3	617	VKH 1842	Højgård	Burial Mound	DK	170301	26	Bredstrup	540487	6157651	ETRS 89	32N	Resume: Sh.26.1 en groft tværs gennem en overløjet gravhøj blev der påvist flere velbevarede ardsporsystemer samt to høfaser med en samlet diameter på mindst 31 m. Centralt i den primære høj blev en relativt velbevaret ege-kiste-grav undersøgt. I graven, der indeholdt et grebpladesværd fra ældre bronzealderen per. II med bevaret hornfæste og grebknop, lå skelettet af en ca. 190 cm høj mand. Den primære høj, som havde jernindkapslet kerne, var afgrænset af stolper og blev efter noget tid udvidet med en sekundær høfase.	1	1	Burial_inhumation, Burial_Primary, Grave, Oak_Coffin	W-E	1	Male	EBA II	VKH1842x11	1	EBA II	'Grebpladesværd': Horn handle	Bronze, Horn	Left_Side	Sword_Group D	N/A
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827	K3	617	VKH 1842	Højgård	Burial Mound	2003	DK	170301	26	Bredstrup	540487	6157651	ETRS 89	32N	Resume: Sh.26. I en groft tværs gennem en overløjet gravhøj blev der påvist flere velbevarede adsporsys- temer samt to højfaser med en sam- let diameter på mindst 31 m. Centralt i den primære høj blev en relativt velbevaret eggestegrav undersøgt. I graven, der indeholdt et greb- ladesværd fra ældre bronzetiders per. II med bevaret hornfæste og grebknop. Lå skellet af en ca. 190 cm høj mand. Den primære høj, som havde jernind- kapslet kerne, var afgrænset af stolper og blev efter noget tid udvidet med en sekundær højfase.	1	1	Burial information, Burial Primary, Grave, Oak Coffin	W-E	1	Male	EBA II	VKH1842x11	1	EBA II	Organic remains from grave, textile and fur	N/A	N/A	N/A	Textile	N/A	Eco- fact
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827	K3	617	VKH 1842	Højgård	Burial Mound	DK	170301	26	Bredstrup	540487	6157651	ETRS 89	32N	Resume: Sh.26.1 en groft tværs gennem en overløjet gravhøj blev der påvist flere velbevarede ardsporsys- temer samt to høfaser med en sam- let diameter på mindst 31 m. Centralt i den primære høj blev en relativt velbevaret egskistegrav undersøgt. I graven, der indeholdt et greb- ladesværd fra ældre bronzælders per. II med bevaret hornfæste og grebknop, lå skelettet af en ca. 190 cm høj mand. Den primære høj, som havde jernind- kapslet kerne, var afgrænset af stolper og blev efter noget tid udvidet med en sekundær hofase.	1	1	Buri- al_inhu- mation, Burial Primary, Grave, Oak- Coffin	W-E	1	Male	EBA II	VKH1842x11	1	EBA II	from sword	Bronze	Left_ Side	Spiral	Pommel
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829	AI4	618	VKH 3418	Jelling Øst	Burial Mound	2006	DK	170401	58	Jelling	527522	6179314	ETRS 89	32N	Udgravning af den overpløjede gravhøj Sb. nr. 58. Der blev undersøgt et område på ca. 500 m2. Højtylken var bevarer i en højde på 60 cm plus moderne muldlag. I profilen kunne registreres to højfaser med hver sin centralgrav. FF stednavn: 'Haughus'. Desuden registreredes en grav i sydkannten af højen. Gravene daterer sig til den ældste og mellemste del af ældre bronzealder.	1	1	Burial_inhimation, Burial_Secondary, Grave_Oak_Coffin, Grave_Stone_Built	W-E	1	Male	EBA II	central grave in second mound phase	VKH3418x9	1	EBA II	Found in grave fill.	Ceramic	N/A	N/A	Fragment	N/A
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829	A14	618	VKH 3418	Jelling Øst	Burial Mound	DK	170401	58	Jelling	527522	6179314	ETRS 89	32N	Udgravning af den overpløjede gravhøj Sh. nr. 38.). Der blev undersøgt et område på ca. 500 m2. Højfylden var bevaret i en højde på 60 cm plus moderne muldlag. I profilen kunne registreres to højfaser med hver sin centralgrav. FF: stednavn: 'Haughus'. Desuden registreredes en grav i sydkanten af højen. Gravene daterer sig til den ældre og mellemste del af ældre bronzealder.	1	1	Burial_inhumation, Burial_Secondary, Grave_Oak_Coffin, Grave_Stone_Built	W-E	1	Male	EBA II	central grave in second mound phase	VKH3418x10	1	EBA II	Bronze fragments. Possibly razor.	Bronze	Right_Side, Upper_Body	Unknown	Razor	N/A
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829	A14	618	VKH 3418	Jelling Øst	Burial Mound	2006	DK	170401	58	Jelling	527522	6179314	ETRS 89	32N	Udgravning af den overpløjede gravhøj Sb. nr. 58. Der blev undersøgt et område på ca. 500 m2. Højtylken var bevarer i en højde på 60 cm plus moderne muldlag. I profilen kunne registreres to højfaser med hver sin centralgrav. FF stednavn: 'Haughus'. Desuden registreredes en grav i sydkannten af højen. Gravene daterer sig til den ældste og mellemste del af ældre bronzealder.	1	1	Burial_inhimation, Burial_Secondary, Grave_Oak_Coffin, Grave_Stone_Built	W-E	1	Male	EBA II	central grave in second mound phase	VKH3418x11	1	EBA II	flint. Waste?	Flint	N/A	Object	N/A
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829	A14	618	VKH 3418	Jelling Øst	Burial Mound	DK	170401	58	Jelling	527522	6179314	ETRS 89	32N	Udgravning af den overpløjede gravhøj Sh. nr. 38.). Der blev undersøgt et område på ca. 500 m2. Højfylden var bevaret i en højde på 60 cm plus moderne muldlag. I profilen kunne registreres to højfaser med hver sin centralgrav. FF: stednavn: 'Haughus'. Desuden registreredes en grav i sydskanten af højen. Gravene daterer sig til den ældre og mellemste del af ældre bronzealder.	1	1	Burial_Information, Burial_Secondary, Grave_Oak_Coffin, Grave_Stone_Built	W-E	1	Male	EBA II	central grave in second mound phase	VKH3418x13	1	EBA II	perhaps pin group G	Bronze	Right_Side, Upper_Body	Lines	Pin	OTHER
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829	AI4	618	VKH 3418	Jelling Øst	Burial Mound	2006	DK	170401	58	Jelling	527522	6179314	ETRS 89	32N	Udgravning af den overpløjede gravhøj Sb. nr. 58. Der blev undersøgt et område på ca. 500 m2. Højtylken var bevarer i en højde på 60 cm plus moderne muldlag. I profilen kunne registreres to højfaser med hver sin centralgrav. FF stednavn: 'Haughus'. Desuden registreredes en grav i sydkannten af højen. Gravene daterer sig til den ældste og mellemste del af ældre bronzealder.	1	1	Burial_inhumation, Burial_Secondary, Grave_Oak_Coffin, Grave_Stone_Built	W-E	1	Male	EBA II	central grave in second mound phase	VKH3418x14	1	EBA II	Horn handle	Bronze, Horn	Left_Side	Sword_Group D	N/A
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829	A14	618	VKH 3418	Jelling Øst	Burial Mound	2006	DK	170401	58	Jelling	527522	6179314	ETRS 89	32N	Udgravning af den overpløjede gravhøj Sh. nr. 38.). Der blev undersøgt et område på ca. 500 m2. Højfylden var bevaret i en højde på 60 cm plus moderne muldlag. I profilen kunne registreres to højfaser med hver sin centralgrav. FF: stednavn: 'Haughus'. Desuden registreredes en grav i sydskanten af højen. Gravene daterer sig til den ældre del af ældre bronzealder.	1	1	Burial information, Burial_Secundary, Grave_Oak_Coffin, Grave_Stone_Built	W-E	1	Male	EBA II	central grave in second mound phase	VKH3418x14	1	EBA II	pommel	Bronze	Left_Side	Spiral	Pommel	
841	A1	625	VKH 1341	Brandlund	Burial Mound	1988	DK	170501	57	Gaerestlund	540275	6166598	ETRS 89	32N	Burial mound in two phases. Primary burial per. II. No burial found belonging to second mound phase. Cup-mark stone in stone circumference (randstenskaede) belonging to mound phase 2.	1	1	Burial information, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	VSV-ØNØ	1	Male	EBA II	Presumed male.	VKH1341x3	1	EBA II	Block sample - leather remains, probably leather pouch	Leather	Waist	Unknown	Object	N/A

841	A1	625	VKH 1341	Brandlund	Burial Mound	1988	DK	170501	57	Gauer-slund	540275	6166598	ETRS 89	32N	Burial mound in two phases. Primary burial per. II. No burial found belonging to second mound phase. Cup-mark stone in stone circumference (randstenskade) belonging to mound phase 2.	1	1	Burial information, Burial Primary, Grave, Oak Coffin, Grave, Stone, Built	VSV- ØNØ	1	Male	EBA II	Presumed male.	VKH1341x8	1	EBA II	Leather, Organic	Upper Body	Unknown	Fragment	N/A
841	A1	625	VKH 1341	Brandlund	Burial Mound	1988	DK	170501	57	Gauer-slund	540275	6166598	ETRS 89	32N	Burial mound in two phases. Primary burial per. II. No burial found belonging to second mound phase. Cup-mark stone in stone circumference (randstenskade) belonging to mound phase 2.	1	1	Burial information, Burial Primary, Grave, Oak Coffin, Grave, Stone, Built	VSV- ØNØ	1	Male	EBA II	Presumed male.	VKH1341x1	1	EBA II	Leather	Feet	Unknown	Fragment	N/A

841	A1	625	VKH 1341	Brandlund	Burial Mound	1988	DK	170501	57	Gaerestlund	540275	6166598	ETRS 89	32N	Burial mound in two phases. Primary burial per. II. No burial found belonging to second mound phase. Cup-mark stone in stone circumference (randstenskaede) belonging to mound phase 2.	1	1	Burial_inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	VSV-ØNØ	1	Male	EBA II	Presumed male.	VKH1341x16	1	EBA II	soil sample with artefacts	Organic	Left_Side, Waist	N/A	OTHER	N/A	Ecofact
841	A1	625	VKH 1341	Brandlund	Burial Mound	1988	DK	170501	57	Gaerestlund	540275	6166598	ETRS 89	32N	Burial mound in two phases. Primary burial per. II. No burial found belonging to second mound phase. Cup-mark stone in stone circumference (randstenskaede) belonging to mound phase 2.	1	1	Burial_inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	VSV-ØNØ	1	Male	EBA II	Presumed male.	VKH1341x21	1	EBA II	Gripplade dagger (gripplade dolk)	Bronze	Left_Side, Waist	Dagger_Group B	N/A		

841	A1	625	VKH 1341	Brandlund	Burial Mound	1988	DK	170501	57	Gauer-slund	540275	6166598	ETRS 89	32N	Burial mound in two phases. Primary burial per. II. No burial found belonging to second mound phase. Cup-mark stone in stone circumference (randstenskade) belonging to mound phase 2.	1	1	Burial_inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	VSV-ØNØ	1	Male	EBA II	Presumed male.	VKH1341x22	1	EBA II	Bronze	Left_Side, Waist	Un-known	Tweezer	N/A
841	A1	625	VKH 1341	Brandlund	Burial Mound	1988	DK	170501	57	Gauer-slund	540275	6166598	ETRS 89	32N	Burial mound in two phases. Primary burial per. II. No burial found belonging to second mound phase. Cup-mark stone in stone circumference (randstenskade) belonging to mound phase 2.	1	1	Burial_inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	VSV-ØNØ	1	Male	EBA II	Presumed male.	VKH1341x26	1	EBA II	Flint	Left_Side, Waist	N/A	Strike-a-light	N/A

841	A1	625	VKH 1341	Brandlund	Burial Mound	1988	DK	170501	57	Gauer-slund	540275	6166598	ETRS 89	32N	Burial mound in two phases. Primary burial per. II. No burial found belonging to second mound phase. Cup-mark stone in stone circumference (randstenskaede) belonging to mound phase 2.	1	1	Burial_Inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	VSV-ØNØ	1	Male	EBA II	Presumed male.	1341x25	2	EBA II	small Imm wide bronze bands, fragments. Unknown type or function	Bronze	Left_Side, Waist	N/A	N/A	String	N/A
841	A1	625	VKH 1341	Brandlund	Burial Mound	1988	DK	170501	57	Gauer-slund	540275	6166598	ETRS 89	32N	Burial mound in two phases. Primary burial per. II. No burial found belonging to second mound phase. Cup-mark stone in stone circumference (randstenskaede) belonging to mound phase 2.	1	1	Burial_Inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	VSV-ØNØ	1	Male	EBA II	Presumed male.	VKH1341x23,24	2	EBA II	Two fibulas	Bronze	Left_Side, Waist	Un-known	Fibula_Group A	Form A01	N/A
849	XI	627	VKH 1714	Kraglundgdgård	Burial Mound	1996	DK	170501	43	Gauer-slund	540431	6166444	ETRS89	32N	Burial mound per. II with two mound phases.	1	1	Burial_Inhumation, Burial_Primary, Grave_Oak_Coffin, Grave_Stone_Built	W-E	0	Male	EBA II		XI.4.5,6,7,8, 9,11,12	2	EBA II	several fragments (registered as 2 because it is more than 1)	Bronze	Left_Side	Un-known	Sword_Group D	N/A	

860	A400	635	VKH 6926	Højbo	Burial Mound	2006	DK	170501	99	Gauer-slund	541920	6168396	ETRS89	32N	burial mound (EBA with secondary cremation burials, LBA and IA). Mound surrounded by post circle. Settlement also found at the site.	1	1	Burial_Inhumation, Burial_Primary, Grave_Stone_Built	E-W	0	Male	EBA II	Grave robbed in prehistory.	VKH6926x275	1	EBA II	Fragmented bronzetube	Bronze	Un-known	Tubes	N/A
860	A400	635	VKH 6926	Højbo	Burial Mound	2006	DK	170501	99	Gauer-slund	541920	6168396	ETRS89	32N	burial mound (EBA with secondary cremation burials, LBA and IA). Mound surrounded by post circle. Settlement also found at the site.	1	1	Burial_Inhumation, Burial_Primary, Grave_Stone_Built	E-W	0	Male	EBA II	Grave robbed in prehistory.	VKH6926x274, 276	1	EBA II	Flint	Flint	N/A	OTH-ER	N/A
860	A400	635	VKH 6926	Højbo	Burial Mound	2006	DK	170501	99	Gauer-slund	541920	6168396	ETRS89	32N	burial mound (EBA with secondary cremation burials, LBA and IA). Mound surrounded by post circle. Settlement also found at the site.	1	1	Burial_Inhumation, Burial_Primary, Grave_Stone_Built	E-W	0	Male	EBA II	Grave robbed in prehistory.	x277	1	EBA II	charcoal	Organic	N/A	N/A	Eco-fact
860	A400	635	VKH 6926	Højbo	Burial Mound	2006	DK	170501	99	Gauer-slund	541920	6168396	ETRS89	32N	burial mound (EBA with secondary cremation burials, LBA and IA). Mound surrounded by post circle. Settlement also found at the site.	1	1	Burial_Inhumation, Burial_Primary, Grave_Stone_Built	E-W	0	Male	EBA II	Grave robbed in prehistory.	x280	1	EBA II	Flint	Flint	OTH-ER	N/A	

Mobility and diet in Prehistoric Denmark: strontium isotope analysis and incremental stable isotope analysis of human remains from the Limfjord area

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ABSTRACT

The Limfjord in Denmark held a prominent position throughout Prehistory as a natural communication port between east and west. Identifying the presence of non-local individuals might shed light on socio-economic and cultural changes occurring in the Limfjord area. Existing studies attempting to do so using strontium isotope analysis on Danish prehistoric remains focus on certain archaeological time periods and/or geographic locations, resulting in an uneven distribution of analysed material. This study aimed at filling a gap in the existing literature, both from a geographical as well as a chronological point of view. Additionally, carbon and nitrogen stable isotope analysis on bone and tooth dentine from these individuals was carried out to examine dietary changes between childhood and adulthood. The strontium isotope results revealed that three, potentially four, out of 27 individuals fall outside the "local" bioavailable baseline range; two from the Neolithic, one from the Early Roman Iron Age and one from the Germanic Iron/Viking Age. We conducted incremental stable isotope analysis of tooth dentine from the three, potentially four, non-local individuals to investigate the palaeo-dietary information in their dental records at a higher resolution and potentially pinpoint their age at the time of movement. The two Neolithic individuals revealed stable isotope ratios that might be indicative of stress.

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1. Introduction

The geographical setting of the Limfjord area in the northern part of the Jutland peninsula (Figure 1) by and near the sea as well as a natural communication port between east and west, has made this area one of Denmark's important nodal points for long distance communication and trade (Kristiansen 1987; 1998; Birkedahl and Johansen 2000; Kristiansen and Larsson 2005; Nielsen 2011). This has been the case since the Ertebølle culture when people lived as hunter-gather-fishers, leaving behind the famous kitchen middens (Andersen 2008), to the Bronze Age when a concentration of mounds and grave goods show the importance of the area (Bech 2003), to the Viking Age sites of Sebbesund as ports of trade (Price et al., 2012) as well as the circular fortress-

es of Fyrkat and Aggersborg constructed during the reign of Harald Bluetooth (Roesdahl 2008). See Figure 2 for an overview of the archaeological time periods.

As a nodal communication port, Limfjord's social and economic changes through time may be related to human mobility and consequently to contact with other cultures. Recently, ancient DNA analyses have revealed several large scale migrations in Europe during the Neolithic, as well as during the Late Neolithic/Early Bronze Age transition (Haak et al., 2015; Allentoft et al., 2015). In Scandinavia, recent investigations also address aspects of palaeomobility in Prehistoric Scandinavia from the Mesolithic to the Viking Age e.g. (Sjögren et al., 2009; Frei et al., 2015a; Frei et al., 2015b; Price et al., 2011; Harvig et al., 2014; Bergerbrant et al., 2017; Eriksson et al.,

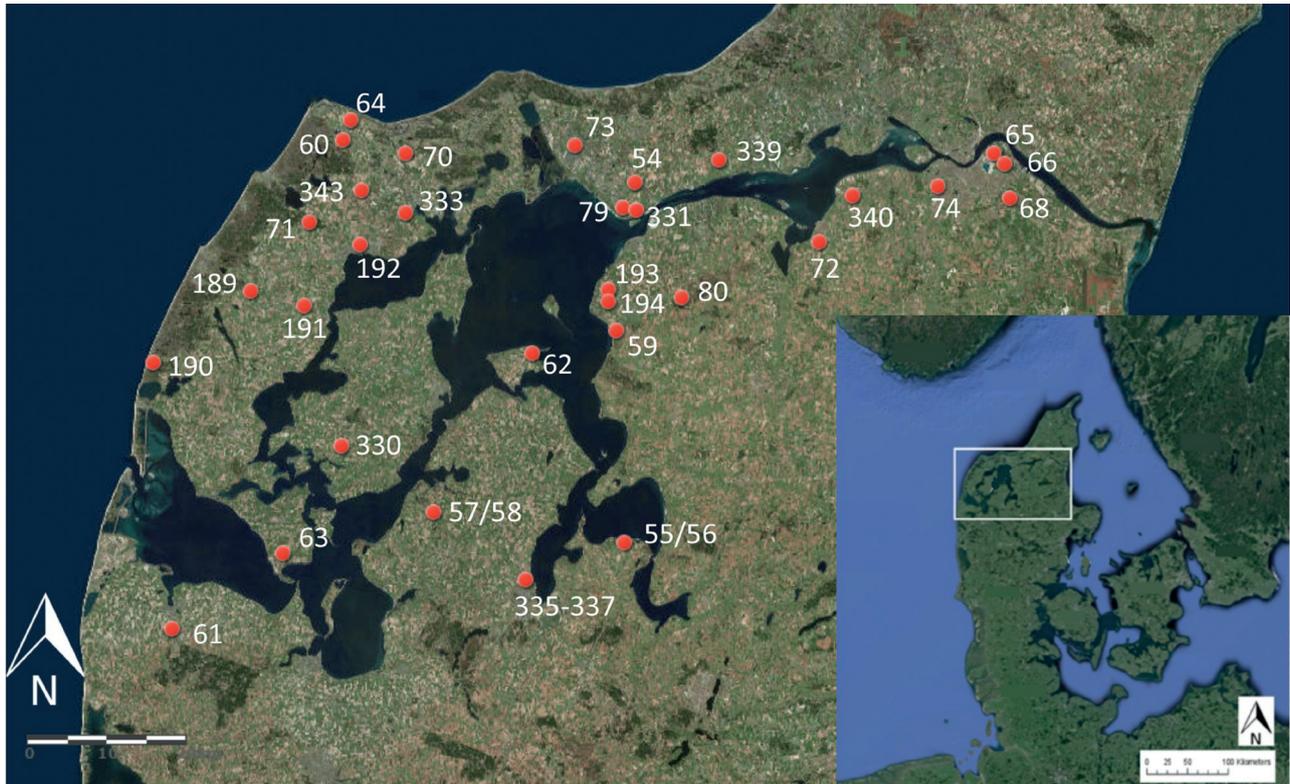


Figure 1. ArcGIS map with the sample numbers used in this study from the Limfjord area. The location of the Limfjord in Denmark is displayed in the inset. Used with permission (Copyright © 2017 Esri, ArcGIS Online, and the GIS User Community. All rights reserved).

2018; Frei et al., 2019). From within Scandinavia, Denmark has yielded the highest number of strontium isotope investigations. However, as in many other areas, the current literature does not equally represent all prehistoric periods. In Denmark, the two periods that seem to be mostly represented are the Bronze Age and the Viking Age.

In this paper we will attempt to identify migrants using strontium isotope analysis on hu-

man remains from the Limfjord area. This study aims to contribute to filling in this gap in Danish strontium isotope studies in two ways:

- 1) by providing new strontium isotope data from the Limfjord area –an area that has not yet been much investigated-, and
- 2) by providing strontium isotope data from various prehistoric periods, thus filling a chronological gap.

cal AD 800-1050	Viking Age (VK)
cal AD 400-800	Germanic Iron Age (GER)
0 cal BC/AD–cal AD 400	Roman Iron Age (RIA)
500 cal BC–0 cal BC/AD	Pre-Roman Iron Age (PRIA)
1000-500 cal BC	Late Bronze age (LBA)
1700-1000 cal BC	Early Bronze Age (EBA)
2400-1700 cal BC	Late Neolithic (LN)
2800-2400 cal BC	Middle Neolithic B (SGK)
3300-2800 cal BC	Middle Neolithic A (MN)
3900-3300 cal BC	Early Neolithic (EN)
5400-3900 cal BC	Late Neolithic – Ertebølle (ERT)

Figure 2. Timetable of Danish prehistoric periods.

Besides measuring strontium isotopes in human enamel, we measured strontium concentrations with the aim to discuss its potential value as an additional proxy. Additionally, the combination of strontium isotope analysis on the tooth enamel and carbon and nitrogen stable isotope analysis on the tooth dentine from the same tooth is also discussed. Finally, we performed incremental dentine carbon and nitrogen stable isotope analysis on a selection of teeth to investigate dietary changes during childhood and examine if a change in residency of an individual could potentially be linked to a change in diet from which the age of the movement could be deduced.

2. Movement of people in Danish prehistory

During the Neolithic small groups of people or individuals with farming skills have been assumed to have migrated into Denmark, probably spreading their knowledge to the local population (Sørensen and Karg 2014). The difference in pottery technique (Jensen 2013), the discrepancy between Scandinavia's wild aurochs and domesticated cattle (Noe-Nygaard and Hede 2006) and the relatively fast adoption of farming during the Neolithic all seem to suggest that migrants played an important role in the Mesolithic-Neolithic transition in Scandinavia. This is supported by ancient DNA studies, which reveal that Scandinavian farmers shared a closer genetic affinity with Central European farmers than with Mesolithic hunter-gatherers (Malmström et al., 2009; 2015). Additionally, numerous Bell Beaker potteries from the Late Neolithic period have been found around Limfjord, suggesting the existence of connections with Bell Beaker groups in central Europe (Arthursson 2015). These connections potentially enabled metal to be circulated to the North. Strontium isotope analyses also showed that Bell Beaker individuals from central Europe had a high degree of mobility (Price et al., 2004). However, recent investigations suggest that the distribution of Bell Beaker communities was spread out over Europe in seemingly isolated islands, although similarities in their material culture suggest that a degree of human mobility was involved (Vander Linden 2015). More recently, Frei et al. (2019) analysed strontium isotope ratios on human remains of 88 individuals from Denmark in order to investigate the degree of mobility across the Neolithic-Bronze Age transition. Four of these 88 individuals with radiocarbon ages dating to the Neolithic were excavated from the Limfjord area (2x Sejerslev, Dommergården and Sebber skole). Their strontium isotope ratios fall within the "local" baseline range for present-day Denmark.

During the Bronze Age the emergence of a supra-regional network which connected faraway regions, is evident in southern Scandinavia and northern Germany (Price et al., 2017; Bergerbrant et al., 2017; Frei et al., 2015a; Frei et al., 2017; Frei et al., 2019). During this period, mo-

bility seems to have involved warriors (Price et al., 2017), commoners (Bergerbrant et al., 2017) and even elite females (Frei et al., 2015a; Frei et al., 2017). Due to the emergence of a social elite and the development of chieftains who presumably controlled the trade, warriors might have become indispensable for the protection and regulation of such a complex network (e.g. Kristiansen and Earle 2015). The Danish Jutland peninsula, in which Limfjord is situated, obtained a prominent position in the trading network from around the beginning of the Early Bronze Age (between 1700-1600 BC) onwards, probably due to the trade of metal and amber (Kristiansen 1987; Kristiansen and Larsson 2005; Nørgaard et al., 2019). Human mobility during the Nordic Bronze Age has also been illustrated by Frei et al. (2019) who observed a change in human mobility patterns from around 1600 BC. This change, which seems to have occurred during the transition period at the beginning of the Nordic Bronze Age, a time when society flourished, expanded and experienced an unprecedented economic growth, suggests that trade and human mobility might have been closely related. Two (Jestrup, and Øster Herup) out of 14 Bronze Age individuals analysed from the Limfjord area yielded non-local Sr isotopic signatures (Frei et al., 2019).

After the collapse of the interregional trading network and the associated hierarchical society at the end of the Bronze Age, the Pre-Roman Iron Age in Scandinavia seems to become more egalitarian (Myhre 2003). This is evident from cremation burials which at this time appear to be uniform and without rich furnishings (Sellevold et al., 1984; Myhre 2003). Additionally, this period reveals an intensification of the farming system in the form of Celtic fields, which enabled more reliable crop rotation systems. Overexploitation of resources towards the end of the Bronze Age provided an opportunity for technological innovations, which were essential during the Iron Age; farming became possible on heavy soils, while iron could be extracted locally in many places in Denmark, giving the local communities more independence and reducing their need for long-distance trade (Kristiansen 2010). The focus on locally available metal raw materials and the collapse of the Bronze Age

network would suggest that people were less mobile during the Pre-Roman Iron Age compared to the previous period.

The Roman Iron Age was characterised by a re-opening up and increasing contact between Germanic tribes and Romans, resulting in trading and raiding activities. Defensive mechanisms, i.e., earthworks and fortifications, were constructed throughout the landscape in an attempt to withstand invasions (Kaul 1997, 2003; Jensen 2013). Archaeological evidence suggests several attacks against southern Scandinavia occurred, coinciding with the deposition of substantial offerings of weapons and riding gear (Ilkjær 2000). The chiefdom-oriented society that emerged during the Late Roman period continued into the Germanic Iron Age (Hall 2007). In addition to raids and attacks, market towns emerged in the 8th century and offered people the opportunity to gain personal wealth for maintaining prestige and securing alliances with other military leaders (Hall 2007).

The Viking Age is well known for its colonisations and long distance travel (Hall 2007). Market places developed into small towns with administrative, religious and legal activities in addition to trading and commerce (Hall 2007; Skre 2008; Jensen 2013; Price 2015; Ashby et al., 2015). In Denmark, several Viking Age sites have been investigated using strontium isotopic analyses of human remains, including the Limfjord site of Sebbesund, where three out of 19 analysed individuals have been identified as non-local (Price et al., 2012). However, this site has yielded more than 700 individuals, hence it is not possible at this point to estimate the percentage of non-locals vs. locals at this site.

At the Viking Age site of Galgedil on the island of Funen, tooth enamel samples from 36 humans yielded non-local Sr isotope values, which is about a third of the dataset (Price et al., 2015). Finally, Sr isotopic data from the famous fortress of King Harald Bluetooth, Trelleborg on the island of Zealand, indicated an even higher number of non-locals (Price et al., 2011; Frei et al., 2014).

3. Strontium isotope analysis

Strontium isotope analysis has proven to be a useful tool in identifying non-local individuals within the Scandinavian realm (Sjögren et al., 2009; Frei et al., 2015a; 2015b; Price et al., 2015; 2017; Bergerbrant et al., 2017; Frei et al., 2019). Geographical movements can be identified by comparing $^{87}\text{Sr}/^{86}\text{Sr}$ isotope ratios from tooth enamel with the local bioavailable $^{87}\text{Sr}/^{86}\text{Sr}$ isotopic range, which relates to the underlying geology (Ericson 1985; Price et al., 2002; Bentley 2006; Frei et al., 2020). After strontium is taken up into the human body through food and drinking water, it is incorporated into the mineral lattice of hydroxyapatite by substituting for calcium (Bentley 2006; Katzenberg 2008). However, a migrant will only become visible if the recorded $^{87}\text{Sr}/^{86}\text{Sr}$ ratio in human tissues deviates sufficiently from the local $^{87}\text{Sr}/^{86}\text{Sr}$ isotopic range. An individual travelling between two or more regions with the similar $^{87}\text{Sr}/^{86}\text{Sr}$ ranges might appear to be local. Similarly, a young individual whose tooth enamel is still forming, travelling across regions with varying $^{87}\text{Sr}/^{86}\text{Sr}$ ranges will present an average value of all of these strontium sources. Additionally, large and continuous marine food consumption during childhood can affect the tooth enamel $^{87}\text{Sr}/^{86}\text{Sr}$ values, pulling them towards the marine isotopic signal (Price and Naumann 2015). As the modern sea water $^{87}\text{Sr}/^{86}\text{Sr}$ signal falls within the Danish $^{87}\text{Sr}/^{86}\text{Sr}$ baseline, these individuals would appear local while they might not be, providing a conservative number of migrants in the dataset.

3.1 Diagenesis

Due to the high mineral content (Fitzgerald and Rose 2008), increased crystallographic organisation, crystal size and extremely low porosity, tooth enamel is less susceptible to diagenesis than dentine (Bentley 2006). Dentine is similar to bone in terms of composition and crystal size, although it is less porous than bone (Hillson 2005; Koch 2007; Burton 2008). Diagenesis should be taken into consideration when dealing with Sr isotopic data from dentine. Uptake of Sr from the burial environment including soil pore fluids by relatively porous dentine

would likely result in convergence of the dentine Sr isotopic composition towards the values in the soil, assuming that the latter acts as an infinite reservoir.

3.2 Geology and Sr isotope geochemistry of Denmark

Compared to northern Scandinavian countries, Denmark is geologically relatively young. The geological bedrock consists among others of Late Cretaceous/Early Cenozoic carbonate rocks and marine clastic sediments, while the surface is overlain by glaciogenic sediments containing weathered Precambrian material originating from Norway and Sweden (Frei and Frei 2011; Frei and Price 2012). The Danish soil surface is composed of glacially transported reworked basement material and local deposited sediments (Frei and Price 2012; Houmark-Nielsen and Kjær 2003). While the limestone ranges in $^{87}\text{Sr}/^{86}\text{Sr}$ values between 0.7078 and 0.7082, the glaciogenic tills have more radiogenic values ($^{87}\text{Sr}/^{86}\text{Sr} > 0.7095$) (Frei and Frei 2011). The Limfjord region is characterised predominantly by Upper Cretaceous to Lower Tertiary carbonates with outcrops of Eocene and Oligocene volcanic ash layers. Both types of lithologies exhibit unradiogenic strontium isotopic values which seem to have influenced the $^{87}\text{Sr}/^{86}\text{Sr}$ ratios of local surface waters (Frei and Frei 2011). The bioavailable strontium isotopic range of present-day Denmark ($^{87}\text{Sr}/^{86}\text{Sr} = 0.7081 - 0.7111$; excluding the Danish island of Bornholm, southeast of Sweden) was originally estimated from analysis of surface waters (Frei 2013; Frei and Frei 2011). These data have since been supplemented by analyses of environmental samples including soil extracts, plants, surface waters and fauna samples (e.g. Hoogewerff et al., 2019, Frei et al., 2017, Price et al., 2012, Price et al., 2011; Reiter et al., 2019; Frei et al., 2020), which have confirmed the range based on the surface waters alone.

4. Carbon and nitrogen stable isotope analysis

Carbon and nitrogen stable isotope data are commonly used in palaeodietary studies. For both car-

bon and nitrogen, uptake of the heavier isotopes increases with trophic level, $\sim 1\text{‰}$ for $\delta^{13}\text{C}$ (DeNiro and Epstein 1978) and $\sim 3\text{‰}$ for $\delta^{15}\text{N}$ (DeNiro and Epstein 1981), although higher enrichments have also been reported ($\sim 3\text{--}4\text{‰}$) (Hedges and Reynard 2007). $\delta^{13}\text{C}$ values are useful in differentiating between terrestrial C3 plants (Smith and Epstein 1971; Price et al., 1985) and marine vegetation (DeNiro and Epstein 1978) in Prehistoric Denmark. A nursing effect can raise $\delta^{15}\text{N}$ values in breastfeeding children (Fogel et al., 1989; Richards et al., 2002). Stable isotope analysis performed on adult human bone gives an indication of the consumed diet of an individual's last years in life (depending on the bone element and its related remodelling time (Cox and Sealy 1997; Jørkov et al., 2009) prior to death. Because tooth enamel and the primary dentine are formed during childhood and do not remodel after formation, these tissues record and preserve isotopic information from childhood (Piesco 2002; Garg and Garg 2013; Nanci 2013), making them exceptionally suitable for studies involving migration. While the strontium isotope analysis of the tooth mineral can reveal a potential change in residency, the corresponding tooth dentine can provide information about the diet during childhood and changes therein.

5. Material

Tooth enamel and bones samples were selected based on preservation and availability, from a larger set of human and faunal samples collected from Danish museums for a large-scale palaeodietary study (van der Sluis 2017). As such, the locations of the tooth enamel samples in this study are spread around the Limfjord area, both in a geographical as well as in a chronological sense. The current dataset is largely composed of single finds originating from the Neolithic to the Viking Age. In total 27 human (Table 1) and 9 faunal (Table 2) tooth samples from the Limfjord in Denmark were analysed. All human teeth had fully developed roots, characterised by apical closure, except for two samples, Øslev (Lim-ht-054) and Romb (Lim-ht-061). The latter had incomplete roots, which were finished to stage R $\frac{3}{4}$, indicating an age of

Tooth sample number	Tooth code	Location	Bone sample number	Bone element	Sex/age	Museum number	AS_ID and/or grave number	Archaeological period	Remarks
Lim-ht-054	7-	Øslev	Lim-hb-095	femur fragment		ÅHM 1128/59	23/60	Single Neolithic	
Lim-ht-055	7-	Torsholm	Lim-hb-049	mandible (powder)	juvenile	NM A38203	Individual A	Neolithic	
Lim-ht-056	-7	Torsholm	Lim-hb-048	mandible (powder)	juvenile 16-17 years	NM A38203	Individual B	Neolithic	
Lim-ht-057	5	Krejbjerg og Ginderup	Lim-hb-044	mandible		NM A26287-99	Individual 1	Early/Middle Neolithic	
Lim-ht-058	5+	Krejbjerg og Ginderup	Lim-hb-045	cranium (powder)		NM A26287-99	Individual 2	Neolithic	
Lim-ht-059	-6	Bjørnsholm (Vitskøl)	Lim-hb-004	long bone fragment		NM 1107/57	08/58	Middle Neolithic/SGK	
Lim-ht-062	6+	Færkerhede	Lim-hb-005	humerus	female? 18-20 years	NM 512/55	18/81	Late Neolithic	M3 was erupting
Lim-ht-190	4+	Lodbjerg klit	Lim-hb-146	cranium	female? adult	THY 6165	x1	Early Middle Neolithic	only enamel
Lim-ht-191	7	Møgelvang	Lim-hb-148	cranium		THY 2151	x300	Neolithic	
Lim-ht-192	-6	Højvang Mark	Lim-hb-153	femur		THY 1098	x19	Single Neolithic	
Lim-ht-193	7+	Næsby Østergård	Lim-hb-182	cranium fragments	20-25 years	VMÅ 2251	x8 grave A2	Late Neolithic	only enamel
Lim-ht-060	6-	Nørtorp	Lim-hb-024	humerus	male 40-50 years	NM 909/59	4/59 skeleton #1	Early Bronze Age	
Lim-ht-063	+6	Følhøj	Lim-hb-042	mandible (powder)	18-21 years	NM B10830-32		Early Bronze Age	M3 was erupting
Lim-ht-064	-8	Rærgård	x		female 30-40 years	NM 576/12 B9653-54		Early Bronze Age	Only tooth, no bone
Lim-ht-189	6	Nørhå	Lim-hb-138	fibula	female 18-35 years	THY 1550	x13 (bone) x13B1 (tooth)	Early Bronze Age	
Lim-ht-065	4	Nørre Tranders Præstegård	Lim-hb-107	femur	male adult	ÅHM 42/55	skeleton 1	Early Roman Iron Age	
Lim-ht-066	6-	Nørre Tranders grusgrav	Lim-hb-112	tibia	female 55-60 years	ÅHM 16/58	Grave 5	Early Roman Iron Age	very mature
Lim-ht-068	5+	Christianshøj (Romdrup)	Lim-hb-113	cranium fragment	male adult	ÅHM 20, 4578-81	45/55 skeleton 1	Early Roman Iron Age	underneath stone layer
Lim-ht-070	-7	Korsø	Lim-hb-019	cranium (powder)	adult male	NM 560/59	7/59 Grave III	Early Roman Iron Age	
Lim-ht-072	+6	Rygegård	Lim-hb-105	long bone fragment	male 30-50 years	ÅHM 1469x4	20/85	Early Roman Iron Age	
Lim-ht-071	-7	Vandet skole	Lim-hb-036	ulna	adult, possibly male	NM 925/59	3/60 Grave 1	Late Roman Iron Age	very rich grave
Lim-ht-073	-5	Klim	Lim-hb-017	femur	female adult	NM C27382-400, 1167/57	13/58	Late Roman Iron Age	very rich grave
Lim-ht-074	-5	Gammel Hasseris	Lim-hb-006	femur	female mature	NM 759/61	8-64 Grave 1	Late Roman Iron Age	rich grave
Lim-ht-061	+6	Romb	Lim-hb-031	cranium fragment	adult 20±2 years	NM B10706	Grave C	Germanic/Viking Age	
Lim-ht-079	4-	Aggersborg Kirke	Lim-hb-001	ulna	male 20-35 years	NM D1916/1977	13/81	Viking Age	1030 AD (¹⁴ C dated)
Lim-ht-080	-5	Brårup	Lim-hb-022	cranium fragment	male adult	NM C28826-29, 477/61-62	14/69 skeleton 1	Viking Age	
Lim-ht-081	7+	Sebbersund	Lim-hb-087	cranium fragment	female 18-35 years	ÅHM 2863	32/02 x398 F4676	Viking Age	F number (Price et al., 2012)
Lim-ht-194	7	Næsby	Lim-hb-187	rib fragments	probable female	VMÅ 867	Grave A124 box A x497 (bone) box V x1153 (tooth)	Viking Age	rich female chamber grave, only enamel

Table 1. Material obtained from human remains used in this study. The tooth code refers to the number of the tooth element counted from the first incisor (1-8), + refers to a maxillary and – to a mandibular element, while the side is indicated by whether the + or – stands on the left or right of the element number. For example, +4 refers to the left maxillary 1st premolar. Age and sex where identified was possible are as reported in the original reports. *Strontium isotope analysis was performed by Price et al. (2012) on the Sebbersund sample (Lim-ht-081). This sample was included here for measuring the $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values of the bone and dentine collagen.

Tooth sample	Animal species	Location	Museum ID number	Archaeological period
Lim-at-330	<i>Equus caballus</i>	Kammerhøj ved Redsted	Mors museum	Viking Age
Lim-at-331	<i>Microtis</i>	Aggersborg	ZMK109/1948 x49/559	Viking Age
Lim-at-333	<i>Mus sp.</i>	Hov, Flintmine	ZMK115a/1957	Neolithic
Lim-at-335	<i>Capreolus capreolus</i>	Krabbesholm II	ZMK50/2000 A6325	early Neolithic
Lim-at-336	<i>Cervus elaphus</i>	Krabbesholm II	ZMK50/2000 4478	early Neolithic
Lim-at-337	<i>Bos taurus</i>	Krabbesholm II	ZMK50/2000 2879	early Neolithic
Lim-at-339	<i>Cervus elaphus</i>	Kokkedalsmark	ZMK64/1983 x15	Bronze Age
Lim-at-340	<i>Microtis</i>	Mellemholm	ZMK31/1979 x340	Pre-Roman Iron Age
Lim-at-343	<i>Microtis</i>	Smedegård	ZMK38/1993 x501	Iron Age

Table 2. Faunal material used in this study.

7 ± 0.5 years (Moorrees et al., 1963; AlQahtani et al., 2010). The roots of the tooth from Øslev were broken off, presenting roots up to formation stage of R $\frac{1}{2}$, corresponding to an age of circa 10.5 ± 0.5 years of age (Moorrees et al., 1963; AlQahtani et al., 2010). Skeletal remains of 13 human individuals were subjected to radiocarbon dating (Appendix 2), which was performed on the bone collagen from same individual.

6. Method

Methods of strontium isotope analysis, carried out in two laboratories are described, as well as methods for bone and incremental dentine collagen extraction.

6.1 Strontium isotope analysis

Tooth enamel samples weighed between 1.35 to 31.82 mg, with the small faunal samples providing the smaller amounts of tooth enamel. Two samples were analysed in both laboratories to test for tooth enamel heterogeneity, which involved taking two different enamel pieces from the same tooth. Human tooth enamel of 12 individuals were analysed at the University of Copenhagen, Denmark. Tooth enamel samples were cleaned and cut using a diamond dental burr. Any remaining dentine was carefully removed with the dental burr. The drilling equipment was thoroughly cleaned between samples with weak HCl acid (Seastar). After placing samples in pre-cleaned and numbered 7 mL Teflon (Savillex™) beakers, 6 drops of 30 % H₂O₂ (Seastar) and 3 drops of 6N HCl (Seastar) were added. The

Teflon beakers were placed on the hotplate to dissolve the samples (few minutes), after which the lids were removed and samples left to dry at 80 °C. Subsequently, the enamel samples were taken up in a few drops of 3N HNO₃ and loaded onto disposable 100 µl pipette tip extraction columns into which we fitted a frit which retained 0.2 mL stem volume of intensively pre-cleaned mesh 50-100 Sr-Spec™ (Eichrome Inc.) chromatographic resin. The elution recipe essentially followed that by Horwitz et al. (1992), albeit scaled to our needs in so far as strontium was eluted by deionised water and then the eluate placed on the hotplate at 80 °C until dry. Thermal Ionisation mass spectrometry (TIMS) was used to determine the Sr isotope ratios. Samples were dissolved in 2.5 µl of a Ta₂O₅-H₃PO₄-HF activator solution and directly loaded onto previously outgassed 99.98 % single rhenium filaments. Samples were measured at 1250-1300 °C in 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 $^{87}\text{Sr}/^{86}\text{Sr} = 0.710241 \pm 0.000011$ ($n=5$, 2σ).

The other strontium isotope measurements were analysed at the National Centre for Isotope Geochemistry (NCIG) at UCD School of Earth Sciences, University College Dublin, Ireland. In total 30 measurements were made at UCD, three of which were on dentine, the rest on enamel. Of these 27 enamel samples, two were repeats (Lim-ht-061 and Lim-ht-066) of the samples analysed in Copenhagen to test for tooth enamel heterogeneity. One sample was analysed twice at UCD due to

its highly radiogenic isotopic value (Lim-ht-191). Three dentine samples were analysed to examine the potential effect of diagenetic alteration on the $^{87}\text{Sr}/^{86}\text{Sr}$ values.

To cut enamel and dentine samples and clean the surface, dremel tools were used, which were thoroughly cleaned with weak HCl acid and Milli-Q water between taking samples. Samples were weighed into pre-cleaned Savillex Teflon beakers, dissolved in 2.5 mL of 6M HCl (aq.) and placed on the hotplate at 100 °C for evaporation. Samples were subsequently dissolved in 1 mL of concentrated (69 %) HNO_3 to breakdown any organics and evaporated at 100 °C. Columns were prepared using pre-cleaned filter frits, which were cleaned in a sonic bath for 10 minutes and stored in 1M HNO_3 , while the Sr resin (Eichrom 100-150 μm) was measured by volume (20 mm from the bottom frit, equal to 100 mg). Columns were cleaned using several acid washes of 1M and 8M HNO_3 to remove other trace elements, finishing with 1M HNO_3 for preconditioning. Samples were dissolved in 1 mL of 1M HNO_3 , placed in centrifuge tubes and spun down at 5000 RPM for 30 minutes to remove any particulate matter that might otherwise block the resin. Samples were introduced to the columns, washed with 1M and 8M HNO_3 to remove other trace elements, after which strontium is collected in pre-cleaned Teflon beakers using 2 mL 0.05M HNO_3 . Collected samples of strontium were evaporated on the hotplate at 100 °C, dissolved in 1 mL concentrated HNO_3 to remove any organics from the resin and evaporated again. Strontium samples were dissolved in 0.05M HNO_3 and loaded onto rhenium filaments after which a tantalum-based activator (TaCl_5) was added for analysis on the Triton (TIMS). The average blank at UCD contained less than 1 ng of strontium, indicating a negligible amount of strontium contamination in the lab. During the period when the Limfjord analyses were run at UCD, the SRM987 reference material yielded $^{87}\text{Sr}/^{86}\text{Sr} = 0.7102611 \pm 0.0000144$ (2σ , $n = 19$).

Although measurements of $^{87}\text{Sr}/^{86}\text{Sr}$ in the SRM987 reference material in both Copenhagen and Dublin fall within uncertainty of the nominal value, they deviate in opposite senses (-0.000009 ± 0.000011 in Copenhagen and $+0.000011 \pm 0.000014$ in Dublin). Hence, all measurements reported in this study have been normalised to the

nominal value, i.e., 0.710250. Based on the reproducibility of analyses of SRM987 (in both Copenhagen and Dublin), a global uncertainty of ± 0.00001 (2 sigma) is used for all $^{87}\text{Sr}/^{86}\text{Sr}$ analyses reported in this study (Table 3).

Strontium aliquots were taken to determine the strontium concentrations (ppm) using the Neptune ICPMS. These aliquots were made up to ca. 3 % HNO_3 , and centrifuged to remove any particulate matter that could block the nebuliser. Sr concentrations are accurate to ca. 10 % and were calibrated using dilutions of the Ionex Multi Element ICP standard Solution 8E (Neptune Tune-up solution).

6.2 Bone and incremental dentine collagen extraction (IRMS) and radiocarbon dating (AMS)

The bone collagen extraction protocol (Brock et al., 2010) is based on the Longin method (Longin 1971) with the inclusion of an ultrafiltration step (Brown et al., 1988; Bronk Ramsey et al., 2004). A detailed description of the protocol, used standards and standard error on measurements is given elsewhere (van der Sluis et al., 2018). Collagen extraction for incremental dentine analysis followed method 2 from Beaumont et al. (2013). Samples were analysed using the Thermo Delta V IRMS with Flash Elemental Analyzer at the ^{14}C CHRONO Centre in Belfast. Collagen samples were combusted, graphitised and run in the NEC compact model 0.5MV AMS at the ^{14}C CHRONO Centre in Belfast (Appendix 2).

7. Results

Strontium isotope and strontium concentration results are presented first followed by the tooth dentine, bone collagen and incremental dentine collagen results.

7.1 Strontium isotope results

In total $^{87}\text{Sr}/^{86}\text{Sr}$ ratios were measured in 36 tooth enamel samples, of which 27 were human samples and nine were fauna samples (Table 3). The stron-

Sample	Site name	Archaeological period	$^{87}\text{Sr}/^{86}\text{Sr}^1$	Sr (ppm)
Lim-ht-054	Øslev	Late Neolithic	0.70934	
Lim-ht-056	Torsholm-individual B	Early Neolithic	0.71023	
Lim-ht-059	Bjørnsholm Vitskøl	Neolithic	0.71013	
Lim-ht-060	Nørtorp #1	Early Bronze Age	0.70913	
Lim-ht-062	Færkæde AS 18/81	Late Neolithic	0.70931	
Lim-ht-063	Følhøj	Early Bronze Age	0.71004	
Lim-ht-064	Rærgård	Early Bronze Age	0.70998	
Lim-ht-065	Nørre Tranders Præstegård	Early Roman Iron Age	0.70907	
Lim-ht-070	Korsø	Early Roman Iron Age	0.71021	
Lim-ht-071	Vandetskole grav 1	Late Roman Iron Age	0.70958	
Lim-ht-061*	Romb	Germanic/Viking Age	0.71187	
Lim-ht-066*	Nørre Tranders SOR grusgrav Grav 5	Early Roman Iron Age	0.70883	
Lim-ht-061*	Romb	Germanic/Viking Age	0.71203	130
Lim-ht-066*	Nørre Tranders SOR grusgrav Grav 5	Early Roman Iron Age	0.70884	127
Lim-ht-055	Torsholm -individual A	Early Neolithic	0.70995	63
Lim-ht-057	Krejbjerg og Ginderup	E/M Neolithic	0.71137	101
Lim-ht-057d	Krejbjerg og Ginderup dentine	E/M Neolithic	0.71441	116
Lim-ht-058	Krejbjerg og Ginderup	SGK Neolithic	0.71100	90
Lim-ht-058d	Krejbjerg og Ginderup dentine	SGK Neolithic	0.71427	104
Lim-ht-068	Christianshøj (Romdrup)	Early Roman Iron Age	0.70826	41
Lim-ht-072	Rygegård	Early Roman Iron Age	0.71111	70
Lim-ht-073	Klim	Late Roman Iron Age	0.71095	67
Lim-ht-074	Gammel Hasseris	Late Roman Iron Age	0.70996	60
Lim-ht-079	Aggersborg Kirke	Viking Age	0.71074	69
Lim-ht-080	Braarup	Viking Age	0.71029	218
Lim-ht-189	Nørhå	Early Bronze Age	0.71045	67
Lim-ht-190	Lodbjerg klit	Neolithic	0.70983	63
Lim-ht-191*	Møgelvang	SGK Neolithic	0.71387	188
Lim-ht-191*	Møgelvang	SGK Neolithic	0.71383	122
Lim-ht-191d	Møgelvang dentine	SGK Neolithic	0.71123	218
Lim-ht-192	Højvang Mark	SGK Neolithic	0.70883	91
Lim-ht-193	Næsby Østergård	Late Neolithic	0.71003	156
Lim-ht-194	Næsby	Viking Age	0.71006	177
Lim-at-330	horse Kammerhøj ved Redsted	Viking Age	0.71042	446
Lim-at-331	vole Aggersborg	Viking Age	0.70909	398
Lim-at-333	mouse Hov, Flintmine	Neolithic	0.70828	260
Lim-at-335	deer Krabbesholm II	Early Neolithic	0.71069	303
Lim-at-336	deer Krabbesholm II	Early Neolithic	0.71080	209
Lim-at-337	cattle Krabbesholm II	Early Neolithic	0.70992	326
Lim-at-339	deer Kokkedalsmark	Bronze Age	0.71077	290
Lim-at-340	vole Mellemholm	Pre-Roman Iron Age	0.70841	478
Lim-at-343	vole Smedegård	Iron Age	0.70914	326

1: All analyses have been normalised to a $^{87}\text{Sr}/^{86}\text{Sr}$ value = 0.71025 for the SRM 987 reference material (see text).

*Samples analysed in CPH and UCD to test sample heterogeneity.

Table 3. $^{87}\text{Sr}/^{86}\text{Sr}$ ratios (TIMS) and strontium concentration (ICPMS) of human tooth enamel and dentine ("d" in the sample number) and animal tooth enamel samples. The first 12 samples were analysed at Copenhagen and lack the strontium concentration data.

tium isotope ratios from our samples of human remains range from 0.70826 ± 0.00001 (Lim-ht-068 measured in tooth enamel) to 0.71441 ± 0.00001 (Lim-ht-057d measured in dentine). Two samples were analysed in both laboratories to test for tooth enamel heterogeneity. Sample Lim-ht-066 produced a $^{87}\text{Sr}/^{86}\text{Sr}$ ratio of 0.70884 ± 0.00001 in UCD and 0.70883 ± 0.00001 in Copenhagen, showing no detectable heterogeneity within analytical reproducibility. However, some samples display varying degrees of heterogeneity. For example, sample Lim-ht-191 yielded $^{87}\text{Sr}/^{86}\text{Sr}$ values of 0.71387 ± 0.00001 and 0.71383 ± 0.00001 in UCD. This small difference is potentially due to tooth enamel heterogeneity, which is supported by their different Sr concentrations. Sample Lim-ht-061 yielded a slightly larger difference ranging from $^{87}\text{Sr}/^{86}\text{Sr} = 0.71203 \pm 0.00001$ in UCD to 0.71187 ± 0.00001 in Copenhagen, suggesting a larger sample heterogeneity. This difference could stem from intra-sample variability related to different areas in the tooth from which the enamel samples was taken, which could be linked to a change in diet or perhaps a change in residency. As human tooth enamel formation takes several years to complete (AlQahtani et al., 2010), enamel from the crown can produce a different strontium isotopic signal than enamel closer to the root, in case this individual was geographically mobile during the time of formation.

While sample Lim-ht-072 (Early Roman Iron Age) is very close to the boundary of the baseline, samples with more radiogenic values (Lim-ht-057 (Neolithic), Lim-ht-061 (Germanic/Viking Age) and Lim-ht-191 (Neolithic)) indicate non-local individuals (Figure 3). The voles and mouse display similar $^{87}\text{Sr}/^{86}\text{Sr}$ ratios, while the large herbivores show more radiogenic isotopic values (Figure 3), which is probably related to the difference in feeding behaviour. Still, all animals from this study display $^{87}\text{Sr}/^{86}\text{Sr}$ ratios that fall within the Danish baseline of $^{87}\text{Sr}/^{86}\text{Sr} = 0.7081$ and 0.7111 . As such, our $^{87}\text{Sr}/^{86}\text{Sr}$ ratios of the faunal samples correspond well with the existing Danish baseline. However, a recent publication aiming at proposing a standardisation of how to create bioavailable strontium isotope baselines, recommends not to use animals, as even mice have been shown not to be local (Grimstead et al., 2017). Hence these should still be considered with care.

Our faunal tooth enamel samples have relatively high strontium concentrations (209-478 ppm, Table 3) in keeping with the general pattern that, compared with carnivores, herbivores have higher Sr concentrations in their tissues because plants are rich in strontium while meat is low in strontium (Bocherens et al., 1994; Tuross et al., 1989; Montgomery 2010). Strontium concentration values between 50-300 ppm have been reported in modern

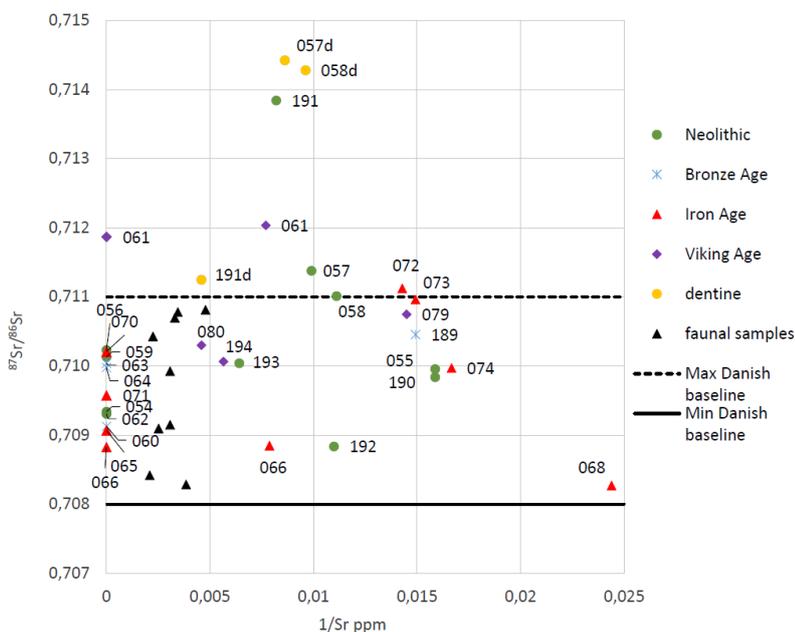


Figure 3. $^{87}\text{Sr}/^{86}\text{Sr}$ ratios and Sr concentrations of human and animal teeth from the Limfjord study. Samples displayed on the y-axis are the 12 samples lacking Sr concentration data and have been arbitrarily set to zero. $^{87}\text{Sr}/^{86}\text{Sr}$ ratios from samples Lim-ht-061 and Lim-ht-066 are plotted twice since two subsamples from each have been analysed. The area between the black lines represents the Danish baseline ($^{87}\text{Sr}/^{86}\text{Sr} = 0.7081$ to 0.7111) (Frei and Frei 2011).

human skeletal and dental tissues (Brudevold and Söremark 1967; Elliott and Grime 1993; Hancock et al., 1989; Underwood 1977; Montgomery 2010) in keeping with our human tooth enamel data from the Limfjord (41-218 ppm, Table 3).

Three dentine samples were analysed to examine the potential effect of diagenetic alteration on the $^{87}\text{Sr}/^{86}\text{Sr}$ values. This is evident in sample Lim-ht-191 (Figure 4), whose enamel is much more radiogenic ($^{87}\text{Sr}/^{86}\text{Sr} = 0.71387$) than its dentine ($^{87}\text{Sr}/^{86}\text{Sr} = 0.71123$). However, the other two samples (lim-ht-057 and Lim-ht-058) show the opposite trend, i.e., their dentine is more radiogenic (Figure 4). There are several possible explanations for this. Firstly, as dentine represents a different formation period than enamel, the difference could potentially indicate mobility between the formation of these two tissues. Alternatively, the burial environment may have masked the original strontium values as a result of diagenesis. Finally, it can also be a combination of these factors.

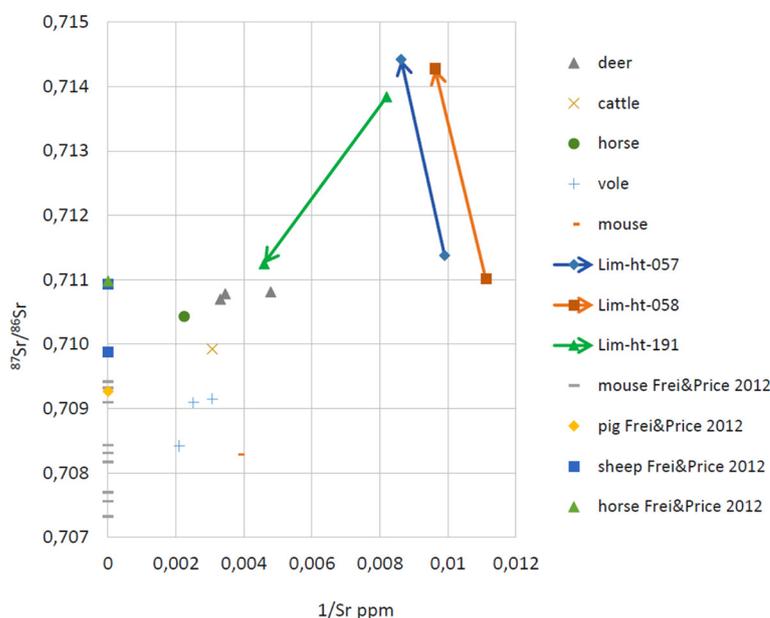
The availability of Sr concentration data for most of the samples permits possible mixtures of Sr sources to be evaluated, at least qualitatively (Figure 5). Frei and Frei (2011) observed a mixing line in their surface water samples between a possibly pre-Quaternary limestone source (low $^{87}\text{Sr}/^{86}\text{Sr}$ ratios and high Sr concentration) and a source in glaciogen-

ic soils, characterised by more radiogenic $^{87}\text{Sr}/^{86}\text{Sr}$ and low Sr concentration. Data in Figure 5 suggests a heterogeneous mixing scenario to explain the enamel and dentine data in our study. The pattern is similar to the one of Montgomery et al., (2007) for Neolithic and Bronze Age tooth enamel samples from England. In their study, Montgomery et al. (2007) suggest that this pattern is due to variable mixtures of more than two sources similar to data from the Neolithic individuals in the Yorkshire study of Montgomery et al., (2007). Two of the extreme end members in our study seem to be characterized by: 1) high Sr isotopic compositions and high Sr concentrations (low 1/Sr values); 2) intermediate Sr isotopic compositions and low Sr concentrations (higher 1/Sr values), indicated by respective trend arrows in figure 5. The third and common end member is characterized by low Sr isotopic compositions and high Sr concentrations which we equate with limestones also inferred by the study of Montgomery et al., (2007). This could indicate more than two endmembers are contributing strontium and/or that people were exploiting a variety of food sources.

7.2 Tooth dentine and bone collagen stable isotope results

One dentine increment from each tooth was analysed for its $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ ratios (Appendix 1).

Figure 4. $^{87}\text{Sr}/^{86}\text{Sr}$ ratios and Sr concentrations of the faunal tooth enamel samples and human tooth dentine and corresponding enamel samples. The arrows point from the enamel to the dentine signal. Faunal samples from around the Limfjord area from Frei and Price (2012) have been added for comparison. Strontium concentrations are not available for these samples and have been arbitrarily set to zero.



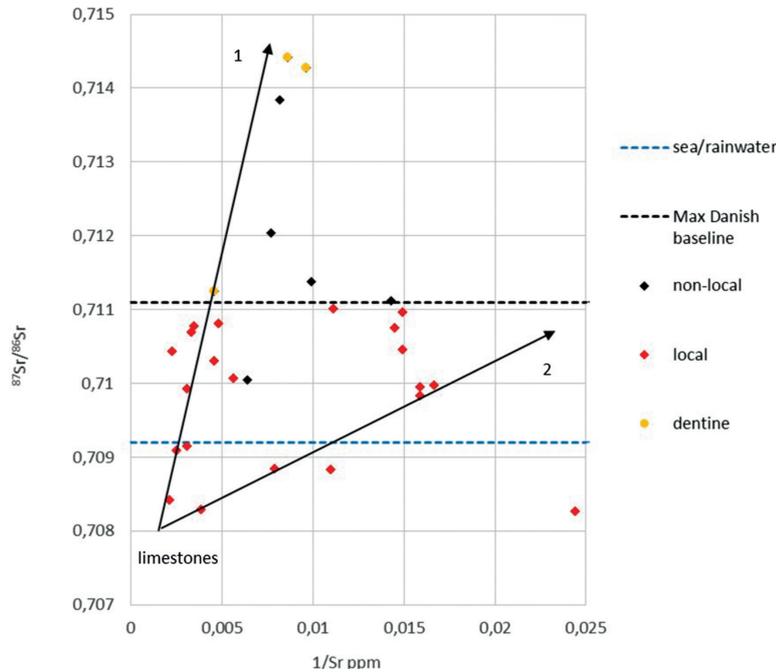


Figure 5. $^{87}\text{Sr}/^{86}\text{Sr}$ ratios and Sr concentrations of enamel and dentine samples analysed at UCD. The data array can be explained by contribution of strontium from three potential sources, each with their own strontium concentrations and strontium isotopic compositions. Trend arrows labelled 1 and 2 depict potential end-members of two of the sources, while limestones constitute the third source characterized by high strontium concentrations and low strontium isotopic signatures. Individuals interpreted as local are marked in red diamonds, while non-local individuals are plotted in black diamonds. Dentine values are plotted in yellow filled circles. Respective reference lines of the maximum Danish baseline (Frei and Frei, 2011) and modern sea water/rainwater are marked with black and blue dashed lines respectively.

Dentine increments selected for stable isotope analysis were taken from the roots rather than the crown to avoid the influence of a weaning signal. As such, the post-weaning early childhood diet can be compared with the adult dietary signal from the same individual. Increments of all 27 teeth yielded acceptable C:N ratios (DeNiro 1985), except for one sample, Øslev 5 (Lim-ht-054), which was excluded from further analyses. All dentine results have corresponding bone collagen results from the same individual, except for Rærgård (Lim-ht-064), for which no bone sample was obtained. No dentine was available from Lim-ht-193 and Lim-ht-194 and the corresponding bone samples failed to produce a signal on the IRMS. The change in diet is illustrated for each individual with an arrow from the childhood diet (represented by the dentine sample) to the adult diet (represented by the bone sample) (Figure 6). These changes in diet can be interesting when combined with strontium isotope analysis to investigate a person's geographic origin. Large shifts in diet between the childhood and adult life could indicate dietary changes related to different cultural practices or perhaps a change in residency.

Only changes in $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ ratios larger than 1‰ are discussed here. The Neolithic samples (Figure 6A) reveal four individuals with changes in at least one of their stable isotope ratios between adulthood and childhood. Sample Lim-ht-055 is

the only Neolithic sample that shows a decrease in both stable isotope ratios (1.4 ‰ in $\delta^{13}\text{C}$, 1.2 in $\delta^{15}\text{N}$) from the childhood diet to the adult diet. Three other samples reveal a change in one of their stable isotopic ratios - a drop in the $\delta^{15}\text{N}$ ratios of 1.4 ‰ (Lim-ht-056), an increase in the $\delta^{15}\text{N}$ ratio of 1.5 ‰ (Lim-ht-191) and an increase in the $\delta^{13}\text{C}$ ratio of 1.1 ‰ (Lim-ht-057). The samples from the Bronze Age show little variation between the childhood and adult diets (Figure 6B), as do the samples from the Early Roman Iron Age (Figure 6C). The Late Roman Iron Age individuals seem to have different childhood diets but cluster around similar stable isotope ratios later in life, indicating a similar diet isotopically (Figure 6D). Sample Lim-ht-073 shows an increase in the $\delta^{13}\text{C}$ ratio of 1.1 ‰ combined with a decrease in the $\delta^{15}\text{N}$ ratio of 1.2 ‰ from the childhood diet to the adult diet. Sample Lim-ht-074 similarly reveals a drop in its $\delta^{15}\text{N}$ ratio of 1.5 ‰. Two Viking Age samples show a decrease in both stable isotope ratios from the childhood to adulthood (Figure 6E), in Lim-ht-061 (1.2 ‰ in $\delta^{13}\text{C}$, 1.1 in $\delta^{15}\text{N}$) and Lim-ht-081 (1 ‰ in $\delta^{13}\text{C}$, 1 ‰ in $\delta^{15}\text{N}$).

An increase in $\delta^{15}\text{N}$ ratios is visible from the Neolithic (8-10 ‰) to the Viking Age (~11-13 ‰), which is similarly visible in a large bone collagen stable isotope dataset from these prehistoric periods and can be interpreted as the increase of marine protein consumption combined with a potential manuring effect (van der Sluis 2017).

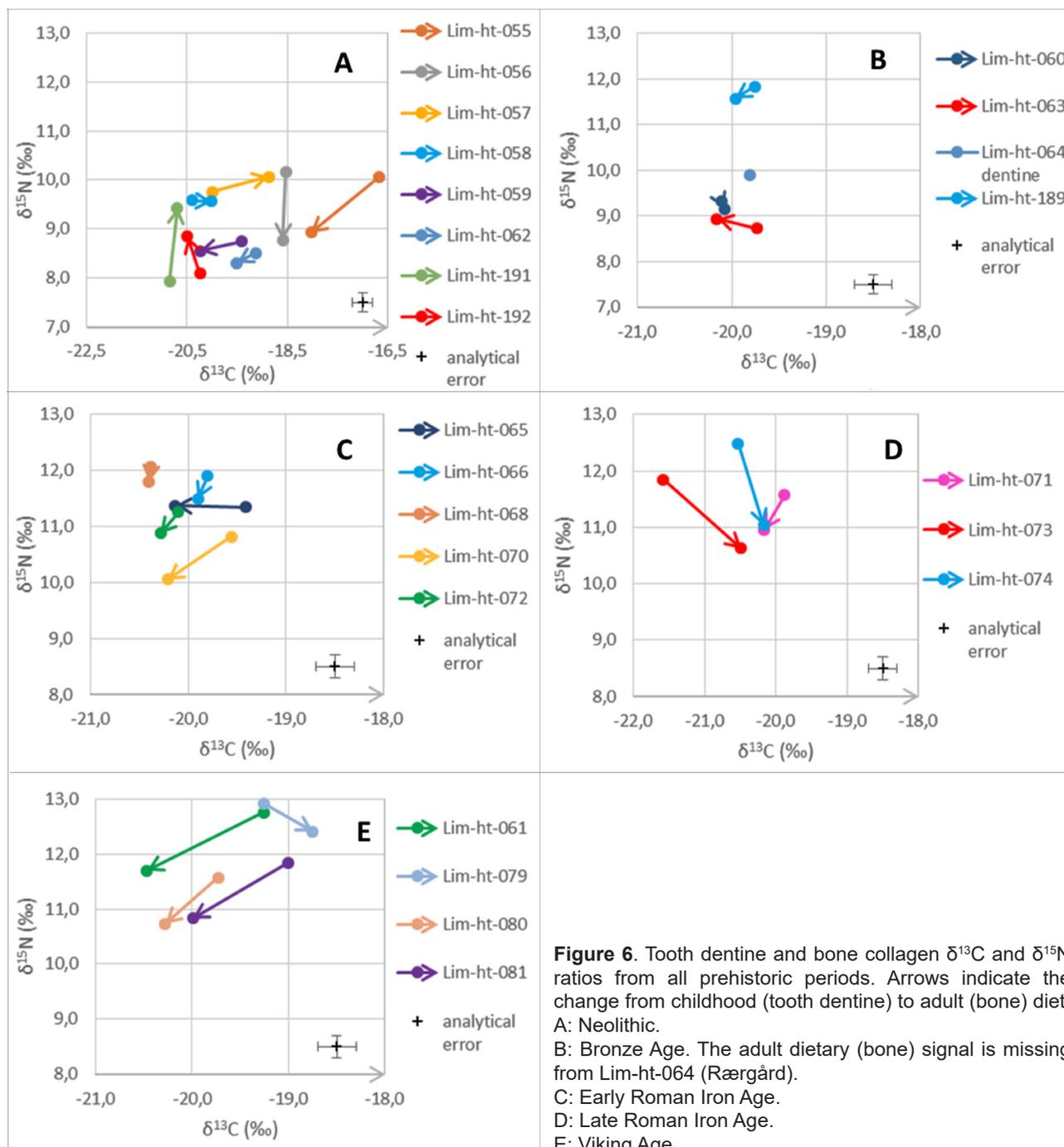


Figure 6. Tooth dentine and bone collagen $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ ratios from all prehistoric periods. Arrows indicate the change from childhood (tooth dentine) to adult (bone) diet. A: Neolithic. B: Bronze Age. The adult dietary (bone) signal is missing from Lim-ht-064 (Rærgård). C: Early Roman Iron Age. D: Late Roman Iron Age. E: Viking Age.

Wider ranging $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ ratios are visible in Neolithic and Viking Age samples, while less variation is visible in samples from the Bronze Age and Roman Iron Age. The general trend in most time periods is one of decreasing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ ratios from the dentine to the bone sample. While care was taken to avoid dentine increments likely to show a weaning effect, i.e. close to the crown, this cannot be ruled out completely as different weaning ages existed in different time periods. This decrease in $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ ratios most like-

ly indicates different diets were consumed during the childhood and adulthood, possibly connected to cultural practices regulating which food sources were available at certain ages. It is interesting to see more elevated isotopic ratios in the dentine than in the corresponding bone samples, suggesting these individuals were feeding on a higher trophic level in their early childhood (post-weaning) than in the final years of their adult life.

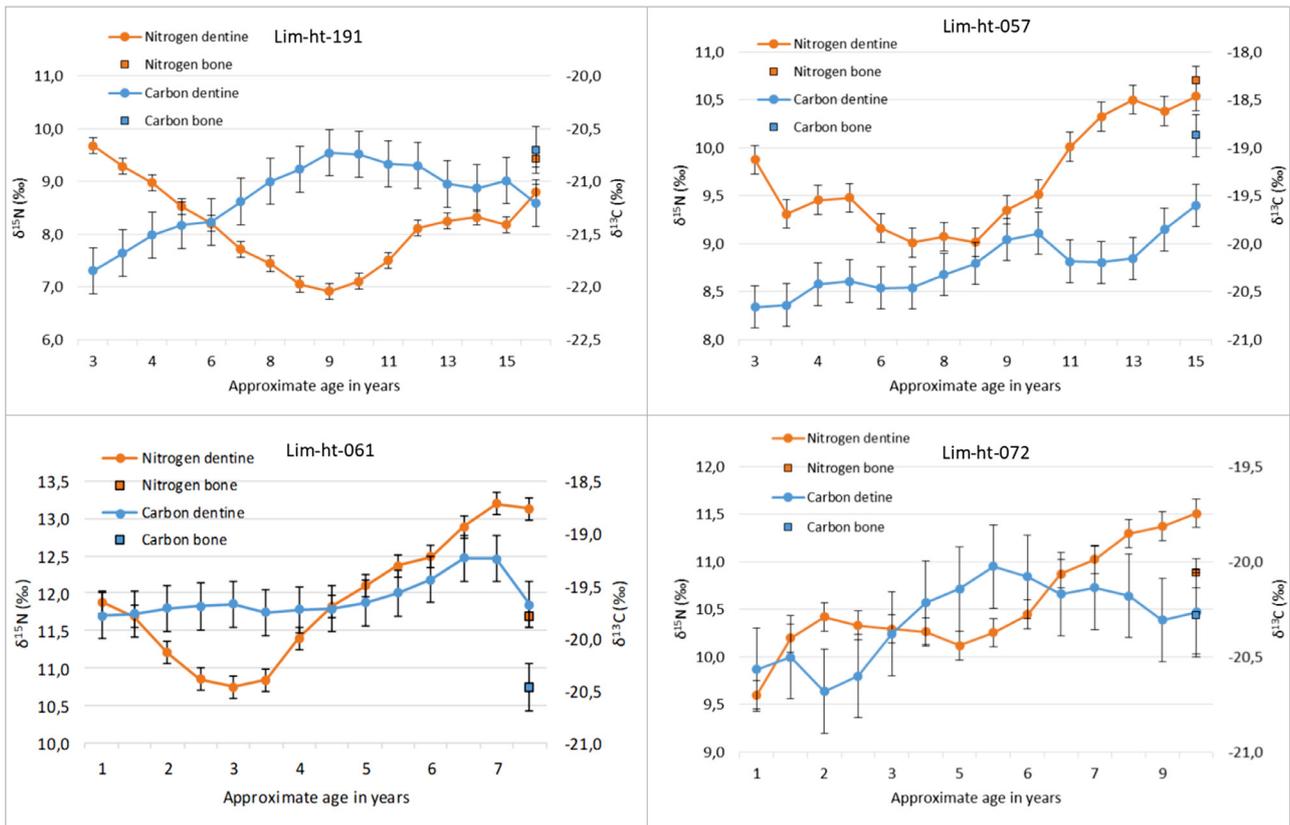


Figure 7. Incremental tooth dentine profiles of $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ ratios for the four non-local individuals. Bone collagen $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ ratios are displayed at the far right of each graph by a marker with a black outline.

7.3 Incremental dentine stable isotope results

Stable isotope analysis was performed on incremental tooth dentine sections from the 3, potentially 4, non-local individuals (Figure 7) to investigate their childhood diets and potentially connect this to their moment of movement. The two Neolithic teeth (Lim-ht-191 and Lim-ht-057) show a similar pattern with decreasing $\delta^{15}\text{N}$ ratios combined with rising $\delta^{13}\text{C}$ ratios from 3 to 8.5–9 years of age, after which $\delta^{15}\text{N}$ ratios start to rise combined with a slight decrease in $\delta^{13}\text{C}$ ratios. The decrease in $\delta^{15}\text{N}$ ratios in the early years could be related to the final phase of weaning, after which the child was most likely feeding on a low trophic level diet (e.g. porridge or gruel) with perhaps the addition of some low trophic level marine protein, considering the rise in $\delta^{13}\text{C}$ ratios. However, the isotopic changes are rather large in Lim-ht-191, with a drop of 2.7 ‰ in $\delta^{15}\text{N}$ ratios and a rise of 1.1 ‰ in $\delta^{13}\text{C}$ ratios. The second half of the Neolithic profiles is characterised by increasing $\delta^{15}\text{N}$ ratios, almost

2 ‰ in Lim-ht-191 and 1.5 ‰ in Lim-ht-057. In Lim-ht-191 the increase of almost 2 ‰ in $\delta^{15}\text{N}$ is combined with a drop of 0.5 ‰ in $\delta^{13}\text{C}$. The bone collagen $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ ratios in both individuals are higher than their final dentine increments.

Interesting to note are the very low $\delta^{13}\text{C}$ ratios (–21.8 ‰) in the early childhood of Lim-ht-191. It is possible that this individual lived in a forested environment before consuming different food types.

The profile of Lim-ht-061 starts with a drop in $\delta^{15}\text{N}$ ratios until the age of 3, possibly indicating a weaning remnant, followed by a rise of 2.5 ‰ in $\delta^{15}\text{N}$ ratios and an increase of 0.4 ‰ in $\delta^{13}\text{C}$ ratios. The co-variation between the two isotopic ratios would suggest diet as a factor for this shift, most likely the consumption of high trophic level marine protein. This individual is from the Germanic/Viking Age, a time period when the consumption of marine food sources is evident on a larger scale again (van der Sluis 2017). The bone collagen $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ ratios are considerably lower than the last dentine increment. If a change in residency can be associated with a change in sta-

ble isotope ratios, it seems plausible that this occurred after the age of 7 for this individual.

In Lim-ht-072 breastfeeding possibly continued until the age of 2, after which a slight decrease of 0.3‰ in $\delta^{15}\text{N}$ ratios and increase of 0.7‰ in $\delta^{13}\text{C}$ ratios is visible, followed by an elevation in $\delta^{15}\text{N}$ ratios of 1.25‰ and a drop in $\delta^{13}\text{C}$ ratios of 0.24‰ from 5-6 years of age, similar to the patterns visible in the profiles of Lim-ht-191 and Lim-ht-057 with rising $\delta^{15}\text{N}$ ratios and dropping $\delta^{13}\text{C}$ ratios.

When $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ values co-vary, a change in diet appears to be the underlying factor, which could be the result of certain cultural practices or a period of movement during which different foods were consumed. While co-varying $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ ratios indicate induced dietary changes, a rise in $\delta^{15}\text{N}$ ratios combined with a decrease in $\delta^{13}\text{C}$ ratios may signal nutritional stress (Neuberger et al., 2013; Beaumont et al., 2015; Beaumont and Montgomery 2016; Meier-Augenstein 2017). This pattern is visible in Lim-ht-191 between ages 9 and 15.5, where an increase of almost 2‰ in $\delta^{15}\text{N}$ is combined with a drop of 0.5‰ in $\delta^{13}\text{C}$ and could be linked to a nutritionally stressful phase in this individual's life, for example during prolonged illness.

However, before $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ ratios can be connected to potential moments of movement, more dentine profiles from individuals who are deemed local based on their strontium isotopic signature should be analysed to investigate their childhood diets and changes therein for comparison with the dentine profiles of these potentially four non-local individuals.

8. Who were these non-local individuals?

While the majority of the samples within our study revealed strontium isotopic values that fall within the local range, a few have non-local values. The Møgelvang sample (Lim-ht-191) has the most radiogenic value within our dataset of $^{87}\text{Sr}/^{86}\text{Sr} = 0.71387$ and indicates an origin outside present-day Denmark (excluding the island of Bornholm). Areas with such values can be found in, e.g., Sweden, Norway, the Danish island of Bornholm or central Europe (Nehlich et al., 2009; Frei and Frei 2013; Price and Naumann 2015; Wilhelmson and Price 2017).

At Møgelvang a ploughed over burial mound contained the remains of a long dolmen with NE-SW orientation from the Funnel Beaker Culture with two chambers. Although nearly all stones had been removed, marks in the ground, occasionally with remains of the stone itself, showed their original position. A battle axe from the Single Grave Culture originated from the dolmen and may have belonged to a secondary interment in one of the chambers. The southern chamber was trapezoidal and roughly oriented East-West, with the wider end in the west and a passage in the east. Along the northern side of this chamber was a disturbance, as stray objects from the Iron Age and younger periods were found here and in the holes from the removed stones. Bone material, amber beads, a small, ornamented vessel (Middle Neolithic I style) and flint blades were found inside the chamber. The stones used in the construction of the long dolmen seem to have been mostly granite, although flat chalk stones as pavement and flat stones made of Mo-Clay were also found (pers. comm Louise Haack-Olsen). The Mo-Clay consisting of diatoms, clay and ash layers, is typical for the Limfjord area in Denmark (Heilmann-Clausen and Surlyk 2006). A recent study from Frei et al. (2019) also included strontium isotope analyses of seven individuals from the Single Grave Culture burial site of Gjerrild in eastern Jutland. One individual, a female, yielded a value that falls outside the "local" baseline range ($^{87}\text{Sr}/^{86}\text{Sr} = 0.7127$, Rise 1283) and was also interpreted as non-local. The other six individuals yielded values that fall within the "local" baseline range of present-day Denmark (Frei et al., 2019).

Samples were taken from a cranium fragment and a molar found along the western end wall of the southern chamber close to a flint blade and to the small ornamented vessel, which, however, lay in a secondary position. The cranium was dated to 2901-2586 cal BC (Appendix 2), the Middle Neolithic A/Single Grave Culture. While the childhood dietary signal shows a terrestrial-based diet ($\delta^{13}\text{C} = -20.9$ ‰) with a low $\delta^{15}\text{N}$ value (7.9‰), the adult diet shows a similar $\delta^{13}\text{C}$ value (-20.7‰) but higher $\delta^{15}\text{N}$ value (9.4‰) (Figure 7), signalling an increase of dietary protein.

The Romb tooth (Lim-ht-061) also yielded a relatively radiogenic Sr ($^{87}\text{Sr}/^{86}\text{Sr} = 0.71203$)

signal, indicating an origin outside present-day Denmark. Parts of the cranium of an adult individual of 20 ± 2 years of unknown sex were found in grave C. The burial was covered by a round mound, while other graves found in the vicinity were cremations. A bone sample from the cranium was radiocarbon dated to 675-867 cal AD (Appendix 2), i.e., the Germanic/Viking Age. While the childhood diet suggests some marine protein intake ($\delta^{13}\text{C} = -19.3$ ‰ and $\delta^{15}\text{N} = 12.8$ ‰), this is reduced in the adult diet ($\delta^{13}\text{C} = -20.5$ ‰ and $\delta^{15}\text{N} = 11.7$ ‰).

Krejbjerg og Ginderup (lim-ht-057) is derived from a Passage grave, which was constructed of eight upright stones and two cap-stones, with a passage towards the east. Artefacts found in the chamber consisted of three flint axes, blades, amber beads and parts of several skeletons. Artefacts date to the Funnel Beaker Culture and the Single Grave Culture. The site Krejbjerg og Ginderup had two boxes in the National Museum, one with a mandible and one with the cranium, which, based on the state of preservation and discolouration, appeared to belong to different individuals. Additionally, a partial maxilla is in the box with the mandible indicating a minimum of at least 2 individuals. The cranium and mandible were sampled for bone and teeth.

The non-local individual (Lim-ht-057) was radiocarbon dated to 3518-3123 cal BC (Appendix 2), Early/Middle Neolithic. This individual had a terrestrial-based diet ($\delta^{13}\text{C} = -20.0$ ‰ and $\delta^{15}\text{N} = 9.8$ ‰) during their childhood, while the adult diet shows an increase in the $\delta^{13}\text{C}$ ratio of 1 ‰, suggesting only a slight increase in marine protein intake ($\delta^{13}\text{C} = -18.9$ ‰ and $\delta^{15}\text{N} = 10.1$ ‰). The other individual (Lim-ht-058) was radiocarbon dated to 2866-2574 cal BC (Appendix 2), the Single Grave Culture, and had a $^{87}\text{Sr}/^{86}\text{Sr}$ ratio right on the boundary of the Danish baseline (0.7111) proving very difficult to assess if this individual is local or not. This person's childhood diet ($\delta^{13}\text{C} = -20.4$ ‰ and $\delta^{15}\text{N} = 9.6$ ‰) was isotopically similar to the older individual from the Passage grave, the adult diet ($\delta^{13}\text{C} = -20.0$ ‰ and $\delta^{15}\text{N} = 9.6$ ‰) does not show a shift.

Ryegård (lim-ht-072) yielded a $^{87}\text{Sr}/^{86}\text{Sr}$ ratio of 0.71111, which straddles the upper limit of the

Danish baseline range. This renders it difficult to interpret the provenance of this individual solely on this datum. Cranial fragments, including parts of the mandible and maxilla, fragments of the femurs, ribs and teeth were preserved, indicating a 30-50 year old male individual was buried in a stone coffin grave from the Early Roman Iron Age. A dark feature in the yellow soil was found during field ploughing. In this feature an east-west oriented grave was encountered with upright flat stones against the walls, one on the east and west sides, two stones on the north and south sides. Covering stones were placed on top of these upright stones. A decorated pottery piece with an ear was found inside the eastern side of the grave, while cranial fragments were encountered in the western side of the grave. Traces of bones were present on the bottom of the grave. Fragments of ornamented pottery place this grave in the Early Roman Iron Age, which is confirmed by the radiocarbon date of cranium fragments, 85-232 cal BC. Isotopically, the childhood diet ($\delta^{13}\text{C} = -20.1$ ‰ and $\delta^{15}\text{N} = 11.3$ ‰) and adult diet ($\delta^{13}\text{C} = -20.3$ ‰ and $\delta^{15}\text{N} = 10.9$ ‰) are quite similar, indicating no dietary shifts.

Finally, there is an unusual type of burial that could hint at a non-local origin. The burial consisted of a flat inhumation grave with a stone frame contained skeletal remains of 3 individuals from the Early Roman Iron Age. Skeleton 1 belonged to an adult male individual and was positioned on the bottom of the grave with 2 clay pots and covered by a stone layer. Skeleton 2 was an adult individual with severe osteoarthritis found above the stone layer. Skeleton 3 belonged to an adult individual and was found during physical anthropological examination. Romdrup (Lim-ht-068) belonged to the adult male individual found under the stone layer. While this individual's $^{87}\text{Sr}/^{86}\text{Sr}$ ratio falls within the Danish baseline range, its low Sr concentration could suggest a non-local individual. A similar 'outlier' with low $^{87}\text{Sr}/^{86}\text{Sr}$ ratio and low strontium concentration has been pointed out by Montgomery (2010). His childhood and adult diet are very similar (childhood diet $\delta^{13}\text{C} = -20.4$ ‰ and $\delta^{15}\text{N} = 12.1$ ‰ adult diet $\delta^{13}\text{C} = -20.4$ ‰ and $\delta^{15}\text{N} = 11.8$ ‰), indicating no large dietary changes.

Three, potentially four, out of 27 individuals in this dataset have strontium isotope values that fall outside the local baseline range. Two of these individuals are from the Neolithic, one from the Early Roman Iron Age and one from the Germanic/Viking Age. While some degree of mobility was to be expected in the Germanic/Viking Age individuals based on the results of previous studies (Price et al., 2011; 2012; 2015; Frei et al., 2014), the non-local individuals from the Neolithic and Early Roman Iron Age provide additional insights into the degree of human mobility during those periods. Comparing the results from the present study to that of Frei et al. (2019), an interesting observation can be made. The two Neolithic individuals (Møgelvang sample Limht-191 and Krejbjerg og Ginderup lim-ht-057) with non-local Sr signatures from this study were excavated in the vicinity of the individuals with non-local Sr signatures from Frei et al. (2019). Møgelvang is not far from Jestrup in Thy, while Krejbjerg og Ginderup is close to Øster Herup in Skive. While this may just be a simple coincidence, future strontium isotope research may shed light on potential mobility patterns in the Limfjord area and its surroundings.

9. Conclusion

Our study is the first to investigate mobility and diet of several individuals covering diachronic prehistoric periods in the Limfjord area, a key archaeological region in Denmark due to its geographical location easily accessible by waterways. Of the 27 individuals analysed in this dataset, the large majority yielded Sr isotope values that point to local origin. However, three, potentially four, individuals yielded strontium isotope ratios suggesting a geographic origin outside present-day Denmark (the island of Bornholm excluded). This study also provided strontium isotope concentration data of the Danish samples, which have not been published before and add useful information about the potential Danish strontium sources and their characteristics.

Dietary changes were investigated through stable isotope analysis of paired dentine and bone samples, as well as incremental dentine sections,

which can shed light on the childhood diet and changes therein, although nutritional stress may also leave its markers in the stable isotope ratios. As travelling in the past may have been strenuous, longer periods of nutritional stress may be apparent in the $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ profiles. However, before this can be identified in the current non-local individuals, incremental dentine profiles of local individuals are needed for comparison.

This study provides new information about human mobility and diet from this key area in Denmark. However, the restricted sample size in relation to the large time scale covered by the samples prevent us, at this point, to draw broader conclusions. Nevertheless, the present study hopes to shed light on potential issues related to mobility.

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Appendix 1. Stable isotope results

Table 1. $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ ratios from human incremental dentine samples and corresponding bone samples.

Sample number	Sample name and Increment number	$\delta^{15}\text{N}$ (‰)	$\delta^{13}\text{C}$ (‰)	C:N	Dentine yield (%)	Bone number	$\delta^{15}\text{N}$ (‰)	$\delta^{13}\text{C}$ (‰)	Period
Lim-ht-054	Øslev 5	9.0	-21.5	4.0	62.7	Lim-hb-095	8.7	-20.4	SGK
Lim-ht-055	Torsholm A 12	10.1	-16.7	3.6	59.0	Lim-hb-049	8.9	-18.0	EN
Lim-ht-056	Torsholm B 10	10.2	-18.5	3.4	46.6	Lim-hb-048	8.8	-18.6	EN
Lim-ht-057	Krejbjerg og Ginderup 11	9.8	-20.0	3.2	29.2	Lim-hb-044	10.1	-18.9	EN/MN
Lim-ht-058	Krejbjerg og Ginderup 7	9.6	-20.4	3.2	36.3	Lim-hb-045	9.6	-20.0	SGK
Lim-ht-059	Bjørnsholm Vitskøl 17	8.8	-19.4	3.3	69.7	Lim-hb-004	8.6	-20.2	Neo
Lim-ht-062	Færkærhede 12	8.5	-19.1	3.2	22.2	Lim-hb-005	8.3	-19.5	LN
Lim-ht-191	Møgelvang 12	7.9	-20.9	3.2	46.9	Lim-hb-148	9.4	-20.7	SGK
Lim-ht-192	Højvang Mark 13	8.1	-20.2	3.2	83.2	Lim-hb-153	8.9	-20.5	SGK
Lim-ht-060	Nørtørp 15	9.3	-20.1	3.3	40.8	Lim-hb-024	9.2	-20.1	EBA
Lim-ht-063	Følhøj 19	8.7	-19.7	3.3	42.3	Lim-hb-042	8.9	-20.2	EBA
Lim-ht-064	Rærgård 10	9.9	-19.8	3.2	26.9	x			EBA
Lim-ht-189	Nørhå 11	11.8	-19.8	3.3	29.4	Lim-hb-138	11.6	-20.0	BA
Lim-ht-065	NørreTranders 12	11.4	-19.4	3.3	30.8	Lim-hb-107	11.4	-20.1	ERIA
Lim-ht-066	Nørre Tranders 13	11.9	-19.8	3.2	37.4	Lim-hb-112	11.5	-19.9	ERIA
Lim-ht-068	Romdrup 7	12.1	-20.4	3.3	28.8	Lim-hb-113	11.8	-20.4	ERIA
Lim-ht-070	Korsø 13	10.8	-19.6	3.3	33.8	Lim-hb-019	10.1	-20.2	ERIA
Lim-ht-072	Rygegård 12	11.3	-20.1	3.3	25.0	Lim-hb-105	10.9	-20.3	ERIA
Lim-ht-071	Vandet skole 11	11.6	-19.9	3.3	37.1	Lim-hb-036	11.0	-20.2	LRIA
Lim-ht-073	Klim 10	11.9	-21.6	3.7	17.5	Lim-hb-017	10.6	-20.5	LRIA
Lim-ht-074	Gammel Hasseris 18	12.5	-20.5	3.4	30.2	Lim-hb-006	11.0	-20.2	LRIA
Lim-ht-061	Romb 12	12.8	-19.3	3.2	43.9	Lim-hb-031	11.7	-20.5	GER/VK
Lim-ht-079	Aggersborg kirke 12	12.9	-19.3	3.4	23.3	Lim-hb-001	12.4	-18.8	VK
Lim-ht-080	Brårup 10	11.6	-19.7	3.2	38.9	Lim-hb-022	10.7	-20.3	VK
Lim-ht-081*	Sebbersund 11	11.8	-19.0	3.2	35.1	Lim-hb-087	10.8	-20.0	VK
Lim-ht-193	Næsby Østergård	x				Lim-hb-182	failed		LN
Lim-ht-194	Næsby	x				Lim-hb-187	failed		VK

* The tooth sample Lim-ht-081 (Sebbersund) produced a $^{87}\text{Sr}/^{86}\text{Sr}$ ratio of 0.71024 (Price et al., 2012).

Table 2. Incremental dentine stable isotope analysis of the 4 non-local individuals.

Sample	$\delta^{15}\text{N}$ (‰)	$\delta^{13}\text{C}$ (‰)	C:N
Møgel1	9.7	-21.9	3.2
Møgel2	9.3	-21.7	3.2
Møgel3	9.0	-21.5	3.2
Møgel4	8.5	-21.4	3.2
Møgel5	8.2	-21.4	3.2
Møgel6	7.7	-21.2	3.2
Møgel7	7.5	-21.0	3.2
Møgel8	7.1	-20.9	3.2
Møgel9	6.9	-20.7	3.2
Møgel10	7.1	-20.7	3.2
Møgel11	7.5	-20.8	3.2
Møgel13	8.1	-20.9	3.2
Møgel15	8.3	-21.0	3.2
Møgel16	8.3	-21.1	3.2
Møgel17	8.2	-21.0	3.2
Møgel18	8.8	-21.2	3.2
Krej1	9.9	-20.7	3.2
Krej2	9.3	-20.6	3.2
Krej3	9.5	-20.4	3.2
Krej4	9.5	-20.4	3.2
Krej5	9.2	-20.5	3.2
Krej6	9.0	-20.5	3.2
Krej7	9.1	-20.3	3.2
Krej8	9.2	-20.2	3.2
Krej9	9.4	-20.0	3.2
Krej10	9.5	-19.9	3.2
Krej12	10.0	-20.2	3.2
Krej13	10.3	-20.2	3.2
Krej14	10.5	-20.2	3.2
Krej15	10.4	-19.9	3.2
Krej16	10.5	-19.6	3.3
Romb1	11.9	-19.8	3.3
Romb2	11.7	-19.8	3.3
Romb3	11.2	-19.8	3.2
Romb4	10.9	-19.7	3.3
Romb5	10.8	-19.7	3.3
Romb6	10.8	-19.8	3.3
Romb7	11.4	-19.7	3.3
Romb8	11.8	-19.7	3.3
Romb9	12.1	-19.7	3.2
Romb10	12.4	-19.6	3.3
Romb11	12.5	-19.4	3.3
Romb13	12.9	-19.2	3.2
Romb14	13.2	-19.2	3.3

Romb15	13.1	-19.7	3.3
Ryg1	9.6	-20.6	3.3
Ryg2	10.2	-20.5	3.3
Ryg3	10.4	-20.7	3.4
Ryg4	10.3	-20.6	3.4
Ryg5	10.3	-20.4	3.3
Ryg6	10.3	-20.2	3.3
Ryg7	10.1	-20.1	3.3
Ryg8	10.3	-20.0	3.3
Ryg9	10.5	-20.1	3.3
Ryg10	10.9	-20.2	3.3
Ryg11	11.0	-20.1	3.3
Ryg13	11.3	-20.2	3.3
Ryg14	11.4	-20.3	3.4
Ryg16	11.5	-20.3	3.3

Appendix 2. Radiocarbon dates.

Table 3. Conventional and calibrated ^{14}C ages of the human and faunal bone collagen samples used in this study.

Tooth sample number	Location	Bone sample number	Lab no	^{14}C age $\pm 1\sigma$ BP	^{14}C age cal BC/AD (2σ)	Archaeological period	Remarks
Lim-ht-055	Torsholm	Lim-hb-049	UBA-31955	5038 \pm 40	3799-3535 cal BC	Neolithic	This study
Lim-ht-056	Torsholm	Lim-hb-048	UBA-31302	5065 \pm 34	3920-3645 cal BC	Neolithic	This study
Lim-ht-057	Krejbjerg og Ginderup	Lim-hb-044	UBA-31298	4697 \pm 34	3518-3123 cal BC	Early/Middle Neolithic	This study
Lim-ht-058	Krejbjerg og Ginderup	Lim-hb-045	UBA-31299	4142 \pm 33	2866-2574 cal BC	Neolithic	This study
Lim-ht-059	Bjørnsholm (Vitskøl)	Lim-hb-004	UBA-31296	4303 \pm 43	3022-2760 cal BC	Middle Neolithic/SGK	This study
Lim-ht-060	Nørtorp	Lim-hb-024	UBA-31301	3150 \pm 30	1491-1296 cal BC	Early Bronze Age	This study
Lim-ht-061	Romb	Lim-hb-031	UBA-31300	1259 \pm 29	cal AD 675-867	Germanic/Viking Age	This study
Lim-ht-062	Færkerhede	Lim-hb-005	UBA-31297	3536 \pm 54	1944-1662 cal BC	Late Neolithic	This study
Lim-ht-072	Rygegård	Lim-hb-105	UBA-31303	1869 \pm 28	85-232 cal BC	Early Roman Iron Age	This study
Lim-ht-079	Aggersborg Kirke	Lim-hb-001	K-2765			Viking Age	cal AD 1030. Submitted by J. Heinemeier.
Lim-ht-189	Nørhå	Lim-hb-138	UBA-31280	2902 \pm 55	1212-909 cal BC	Early Bronze Age	This study
Lim-ht-190	Lodbjerg klit	Lim-hb-146	UBA-31285	4656 \pm 49	3628-3139 cal BC	Early/Middle Neolithic	This study
Lim-ht-191	Møgelvang	Lim-hb-148	UBA-31286	4180 \pm 59	2901-2586 cal BC	Neolithic	This study
Lim-ht-192	Højvang Mark	Lim-hb-153	UBA-31289	4001 \pm 58	2838-2301 cal BC	Single Neolithic	This study
Lim-ht-193	Næsby Østergård	Lim-hb-182	AAR-10059	3865 \pm 60	3772 \pm 60	Late Neolithic	Submitted by B. H. Nielsen.
Lim-ht-194	Næsby	Lim-hb-187				Viking Age	
	Hov, flintmine					Early Neolithic	Other material from Hov dated: Poz-7671, Poz-7675. Submitted by K.A. Soerensen
	Krabbesholm II					Early Neolithic	Other material from Krabbesholm II dated: Poz-12163, Poz-12127, Poz-26157, Lus-6138, Lus-6654, Oxa-27066 Submitted by I.B. Enghoff, K.A. Soerensen, L. Sorensen.
	Smedegård					Iron Age	Chicken from Smedegård dated (AAR-3784) 2085 \pm 45. Submitted by T. Andreasen.

Circa 2.5-3 mg of collagen was loaded with 0.09 g of copper oxide and a silver strip for contaminant removal in a small quartz tube for combustion to CO_2 . Combusted samples were graphitised using a hydrogen reduction method with iron as catalyst. Pressed targets were analysed together with oxalic acid standards and background samples in the NEC compact model 0.5MV AMS at the ^{14}C CHRONO Centre in Belfast. Radiocarbon ages were calculated from $F^{14}\text{C}$ (Reimer et al., 2004), which is corrected for

background and isotopic fractionation using $^{13}\text{C}/^{12}\text{C}$ measured by AMS that accounts for both natural and machine isotopic fractionation. An error multiplier of 1.3 was applied to the F^{14}C measurements to account for variability in sample processing. ^{14}C dates were calibrated using Calib 7.0.2 with the mixed marine and Northern Hemisphere terrestrial curves (Reimer et al., 2013) for humans. Based on 13 known age mollusc measurements (Olsson 1980; Heier-Nielsen et al., 1995) from the Limfjord area taken from the marine reservoir database (<http://calib.org/marine/>), the ΔR and uncertainty were calculated ($\Delta\text{R} = 239 \pm 164$ yrs). The percentage of marine carbon was calculated using a linear regression between a fully marine and terrestrial endmember based on $\delta^{13}\text{C}$ ratios from marine and terrestrial animals.

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Iron Age peat cutting and ritual depositions in bogs – new evidence from Fuglsøgaard Mose, Denmark

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ABSTRACT

With the discovery of peat and gyttja deposits containing archaeological remains, sealed below a colluvium, at Fuglsøgaard in eastern Jutland in 2002 came a rare opportunity to investigate a bog with abundant traces of peat cutting and subsequent ritual deposition dating to the Early Iron Age. Pollen analyses show that before, during and after the ritual deposition, the bog lay in an open cultural landscape surrounded by arable fields and pastures. Around 180 cal B.C., extensive peat extraction commenced in the bog, targeting the well-humified wood peat that had formed during the Atlantic period and could be found in the deeper layers. In this relatively tree-less area, the primary aim of the peat cutting was presumably the acquisition of fuel. It is estimated that 250-500 m² of peat was removed, leaving the bog with numerous small water-filled pits, i.e. peat cuts.

These water-filled peat cuts had a secondary role as elements in ritual activities in which depositions were made of pottery vessels, parts of domestic animals, wooden objects, bundles of flax, quantities of white/light-coloured stones etc. More than 130 pottery vessels from period II of the Pre-Roman Iron Age (250-1 cal B.C.) have been excavated at the site. ¹⁴C dates for *Linum usitatissimum* (common flax) stems in two pottery vessels assign the depositions to the period 180-1 cal B.C. All the depositions included white/light-coloured stones, and these appear to have been a general feature of many ritual depositions in wetlands at this time.

As the peat cuts in the bog became overgrown, due to renewed peat accumulation, the depositions decreased and there appears to have been a clear link between the offerings and the presence of open water into which these could be lowered. During the entire period of use (i.e. peat cutting and deposition), the bog appears to have been open and without tree cover, presumably due to persistent grazing and/or haymaking. But at the turn of the millennium, the bog had lost its ritual significance and its surface became colonised by willow scrub.

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Introduction

The bogs and wetlands of northwest Europe have provided us with a considerable and significant number of archaeological remains. Artefacts deposited in these wetland areas are often interpreted as ritual deposits representing offerings to the gods or spirits. The most frequent type of ritual deposit comprises everyday objects such as ceramic vessels, bones and wooden artefacts. In Denmark, most of these remains turned up during the extensive peat extraction that took place throughout the 19th and 20th centuries. The archaeological finds cover the entire prehistoric period, but the Early Iron Age

especially is strongly represented (Kaul 2003, 32-36). They include of course the well-preserved and internationally renowned bog bodies – Grauballe Man and Tollund Man – intact with both skin and hair due to the bog's preservative properties (Asingh and Lynnerup 2007; Fischer 1980, 2007). Similarly, the great war booty offerings in Nydam Mose, Illerup Ådal and Ejsbøl Mose (Rau 2010; Rieck 2013, 2014; Ilkjær 1994, 2008; Ørsnæs 1988; Jørgensen and Andersen 2012; Christensen et al. 2012), and magnificent objects such as the Gundestrup Cauldron and the Dejbjerg Wagon (Petersen 1888; Kaul 1991) were also discovered during peat cutting. The same is true of a huge number of

less conspicuous, but just as important, objects of more mundane character, such as ceramic vessels, wooden tools and implements and animal bones (e.g. Becker 1948, 1971; Ferdinand and Ferdinand 1961; Andersen 1993a, 1993b; Lund 2002).

Most archaeological finds discovered in bogs turned up many years ago and were largely recovered by laymen, without any actual professional archaeological excavation and scientific documentation. With very few exceptions, peat cutting is no longer undertaken in Denmark, and wetland areas are protected by the Nature Protection Act. Consequently, both discoveries of objects in bogs and archaeological excavations in wetland areas are now rare events. Despite the large quantity of finds recovered from bogs over time, we know remarkably little about the bogs with ritual deposits, and fundamental questions remain that have only been illuminated to a very modest degree: Was it, for example, specific wetland areas that were used for offerings? Were these wetlands located in the open, cultivated landscape or in more marginal areas, for example forests and woodland? Were the offerings placed on the surface of the bog or lowered into the water?

It is not possible to answer these and several other pertinent questions based on the archaeological objects alone, but only through complementary investigations of the sites in order to reconstruct their environmental history. These sites unfortunately no longer exist, as peat cutting and

subsequent drainage has removed most wetland deposits.

With the discovery in 2002 of a bog sealed below a colluvium at Fuglsøgaard near Mariager Fjord, a rare opportunity arose to investigate one of the wetland sites with extensive ritual deposits from the Early Iron Age using modern archaeological and palaeoecological methods and thereby to come a little closer to answering some of the questions above.

Site description

Fuglsøgaard Mose lies south of Mariager Fjord in eastern Jutland ($56^{\circ}40'06.66''\text{N}$ $10^{\circ}12'37.48''\text{E}$) (Figure 1). The site lies in a small hollow measuring c. 100 x 200 m and appears today as cultivated agricultural land and it is, therefore, not covered by the Nature Protection Act. During the course of drainage work in the winter of 2002, several ceramic vessels were encountered and a subsequent investigation of the drainage ditch, together with excavation in plan, revealed a peat bog containing numerous pits, sealed beneath the plough soil (Figure 2) (Fiedel 2003, 69; Christensen and Fiedel 2003, 87-91). The bog's original peat layers appeared dark on the exposed surface, while the pits contained much lighter-coloured peaty deposits. During the excavation it became clear that these pits were prehistoric peat cuts and that it was ex-

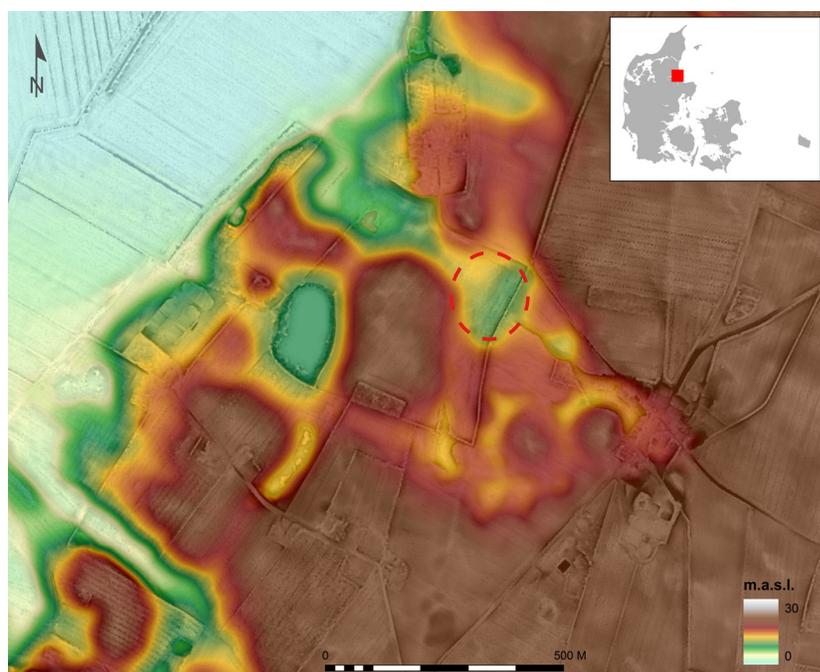


Figure 1. Fuglsøgaard Mose is located in eastern Jutland. The studied area is marked with a red broken line (Map: A. Pihl).

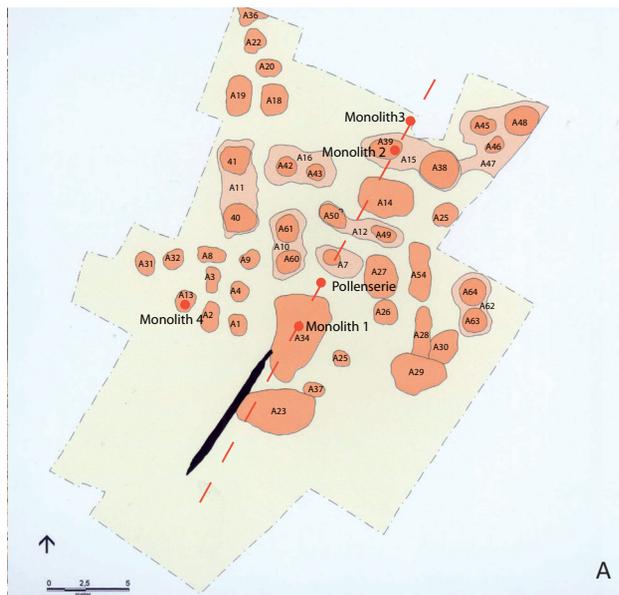


Figure 2. Overview of the bog showing the peat cuts in the central part. Red dots: Sediment sample columns (A). To the left (B) and in the bottom (C) is shown the peat cuts in plan and section, respectively. (Plan: R. Stidsing; Photos: R. Fiedel).

clusively in these features that the pots and other deposited objects lay. The extent of the bog was established by digging trial trenches and a total area of 1765 m² was uncovered, corresponding to about 25 % of the presumed area of the site, containing 81 pits, which varied between 0.5-3 m in surface diameter and had a depth of 0.5-1.7 m. A total of 52 peat cuts were excavated and more than 130 ceramic vessels were recovered, all of a type belonging to period II of the Pre-Roman Iron Age, i.e. corresponding to 250-1 cal B.C. (Jensen 2005; Johannesen 2016, 33). Several of the vessels contained birch twigs, bundles of flax stems, bones and stones, and one vessel was found to contain the remains of a puffball mushroom (cf. *Calvatia sp.*). The finds also included wooden objects such as clubs, tethering pegs, possible wagon components and other items of worked wood (Mikkelsen 2004). The relatively few bones that were found could be identified as cattle, horse and sheep/goat (Gotfredsen 2004). In the slightly acidic peat layers, the preservation conditions for bone would generally have been poor and it must be assumed that the faunal material is underrepresented. Apart from the bones, the state of preservation of organic material in the peat cuts is good as the bog, prior to 2002, had not been drained to the depth of the archaeological layers. Furthermore, the peat de-



Figure 3. Sand and soil deposits overlaying the peat deposits. The feature on the right-hand side is a modern drainage ditch (A). B shows a peat cut refilled with sandy turves. This situation indicates that parts of the bog were already covered by sandy deposits in the Iron Age; probably colluvium washed out over the bog as a consequence of prehistoric field cultivation (Photos: R. Fiedel).

posits had been sealed by a thick layer of clay-rich sand colluvium, which had been washed/ploughed down from higher terrain surrounding the bog (Figure 3).

During the excavation, samples were taken for further archaeological and scientific investigations. In addition to these, several vessels were sampled for analysis of pollen and plant macro-remains. For a detailed account of the archaeological excavation and processing of the archaeological finds, see Johannesen (2016). Several excavation photographs of the peat cuts and artefacts are presented in the supplementary data. This article focuses on the geological development of the bog, the prehistoric peat cutting and the ritual depositions. The primary aims were to investigate when the peat cuts were established, the nature of the surroundings of the bog before, during and after the active period (i.e. peat cutting and ritual deposition) and for how long it was possible to make offerings in the pits before they grew over due to renewed peat accumulation. Iron Age peat cutting and the presence of stones in bogs are also discussed.

Materials and methods

Stratigraphy

During the archaeological excavation, the bog deposits were exposed in open sections in several places (Figure 2), which permitted a detailed examination and description of the stratigraphy. The sections were surveyed and drawn, and the sediments described during the excavation. At the sampling points for the sediment columns for scientific analysis, the stratigraphy was described according to the Troels-Smith system (Troels-Smith 1955). Sediment sample columns were taken in three peat cuts which represent the growing-over phase (recurrence of peat accumulation) after the peat-cutting operations, while two sample columns were taken at places where there was natural accumulation of sediments reflecting the bog's development (Figure 2). Four of these five sample columns were subsequently subjected to pollen analysis. In this article, the results are presented from the analysis of sample column 3, which represents the undisturbed natural development of the bog, and

sample column 1, which represents the regrowth and filling in of peat cut A34, which was one of the largest peat cuts. Sample column 4 was taken in a smaller peat cut (A13) and the pollen data is included as supplementary data. The deposits proved to be disturbed and the pollen diagram is not shown.

Chronology

Series of 2 cm thick sediment samples were taken from sample columns 1 and 3, from which terrestrial macrofossils were extracted for AMS ^{14}C dating.

Samples of charcoal and non-charred plant macro-remains were pretreated for dating using the standard acid-base-acid protocol. The samples were then converted to CO_2 by combustion in sealed, evacuated quartz tubes with 200 mg pre-cleaned CuO . The CO_2 was reduced to graphite by the H_2 reduction method using an iron catalyst and MgClO_4 to remove the water. Samples were radiocarbon dated with the HVEE 1MV Tandron accelerator at the Aarhus AMS Centre (AAR-AMS), Aarhus University, Denmark (Olsen et al. 2016). The ^{14}C ages have been fractionation corrected using online AMS $\delta^{13}\text{C}$ and converted to calendar years using OxCal 4.3 with the international calibration curve, IntCal13 (Bronk Ramsey 2009; Reimer et al. 2013).

In the case of column 1, a P_sequence function was used to construct an age-depth model for the renewed peat accumulation (growing over) in the peat cut (Bronk Ramsey 2008). Several samples were taken from column 3 to date the natural accumulation of sediments, but the organic layers were heavily humified and only a few samples contained sufficient identifiable material for a ^{14}C analysis. Two ceramic vessels (x-129 and x-534) from peat cuts A23 and A40, respectively, contained stems and seeds of *Linum usitatissimum* (common flax), from which a sample was taken to AMS date their deposition (Figure 4).



Figure 4. Ceramic vessel (x-534) containing a bundle of flax, found in a peat cut (A40). The flax bundle from this vessel, dated typologically to period II of the Pre-Roman Iron Age, has been ^{14}C dated to 180 cal B.C. – cal A.D. 136. With reference to this, the date for the deposition can be narrowed down to between 180-1 cal B.C. A23 is one of the largest and most finds-rich peat cuts in the bog. The exposed top layer, with stones, pottery vessels and wooden objects, can be seen here (Photos: R. Fiedel).

Pollen analysis

A total of 35 pollen samples were analysed, of which most are presented here. The samples were prepared for analysis using standard methods, which include treatment with KOH, HCl and HF, as well as acetolysis (Fægri and Iversen 1989, 77-81). The residue from this process was then transferred to, and mounted in silicone oil, and an average of 500 pollen grains of terrestrial plants was counted per sample, as well as algae, spores and other microfossils. Entire microscope slides were analysed to account for any uneven distribution of pollen grains under the coverslip. Pollen was identified by reference to Fægri and Iversen (1989) and Moore et al. (1991), supplemented by the Danish National Museum's pollen reference collection. As the sediments were partly formed as a direct consequence of human activity, and these sedimentary changes are clearly evident in the stratigraphy, these boundaries have been used in the zonation of the pollen diagrams. As the bog covered an area of 2 ha at most, and the individual peat cuts are only a few square metres in extent, the relevant pollen catchment is limited to a maximum of a few hundred metres (Sugita 1994) and the pollen data therefore mainly reflect the very local environment in and around the bog.

Results and interpretation

Chronology

The results of the AMS ^{14}C dates are shown in table 1 and figure 5.

Sample column 3, the natural development of the bog

It was difficult to examine the chronology of the bog's natural development due to the generally poor preservation conditions in these sediments. Consequently, it was only possible to find datable terrestrial material at two levels. The lower AMS ^{14}C date (AAR-26054) from level 8.61 m a.s.l. is in the later part of the Neolithic (2737±137 cal B.C.) which concurs with the results of the pollen analysis. The upper date (AAR-26055) is from level 8.71 m a.s.l., and should therefore be younger, but actually falls at the end of the Mesolithic (4201±131 cal B.C.) and must be considered an outlier. The dated material had possibly been re-deposited. It has therefore not been possible to construct an age-depth model for the bog's natural development. The poor preservation was undoubtedly due to the early peat deposits being formed in a woodland bog, where plant macro-remains often survive badly, whereas the growth of peat in the water-filled peat cuts took place under optimal conditions for the preservation of organic material.

Lab ID AAR-	Material	¹⁴ C age ¹⁴ C years BP	Calibrated age 95.4% confidence interval(s)	Model agreement	Outlier (posterior/prior)	Calibrated age (modelled) 95.4% confidence interval(s)	Location
BASE						341 BC – 333 BC (0.5%) 318 BC – 308 BC (0.6%) 280 BC – 95 BC (92.6%) 88 BC – 67 BC (1.6%)	Cut A34, 8.35 m a.s.l.
21327	<i>Corylus</i> (Charcoal)	2168±25	357 BC – 275 BC (50.0%) 258 BC – 160 BC (44.0%) 129 BC – 117 BC (1.4%)	62.5%		329 BC – 307 BC (1.1%) 235 BC – 86 BC (92.4%) 76 BC – 56 BC (1.9%)	Cut A34, 8.38 m a.s.l.
21324	Unident.	2039 ±27	158 BC – 132 BC (5.0%) 115 BC – AD 26 (90.4%)	116.4%		90 BC – AD 17 (95.4%)	Cut A34, 8.63 m a.s.l.
21325	<i>Calluna vulgaris</i>	1880±26	AD 71 – AD 216 (95.4%)	104.0%		AD 53 – AD 135 (95.4%)	Cut A34, 8.88 m a.s.l.
21326	<i>Vaccinium uliginosum</i>	1868 ±25	AD 78 – AD 223 (95.4%)	79.4%		AD 125 – AD 238 (95.4%)	Cut A34, 9,15 m a.s.l.
TOP						AD 135 – AD 360 (95.4%) 53 BC – AD 61 (95.4%)	Cut A34, 9.20 m a.s.l. Cut A34, 8.35 m a.s.l.
21323	<i>Ranunculus flammula</i>	2007±25	53 BC – AD 61 (95.4%)	99.7%	Outlier		
8886	<i>Linum</i>	2080±55	349 BC – 308 BC (4.1%) 208 BC – AD 53 (91.3%)				Pottery vessel x-129 pit A23
8885	<i>Linum</i>	1990±65	180 BC – AD 136 (95.4%)				Pottery vessel x-534 pit A40
26054	Unident.	4138±24	2874 BC – 2619 BC (94.7%) 2605 BC – 2601 BC (0.7%)				Baulk, 8.61 m a.s.l.
26055	Unident.	5377±32	4332 BC – 4223 BC (66.9%) 4207 BC – 4159 BC (16.8%) 4131 BC – 4070 BC (11.7%)				Baulk, 8.71 m a.s.l.

Table 1. Results of ¹⁴C dates obtained for terrestrial plant material from sample column 1 (A23), the vessels and from the baulk.

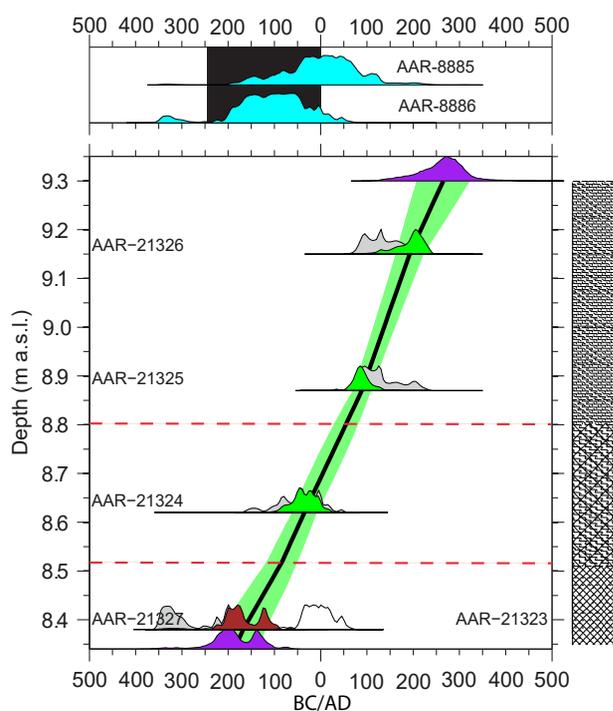


Figure 5. Below: Age-depth model for sample column 1. The boundaries are interpolated top and bottom ages for the sequence. The transition boundary indicates the shift from gyttja to peat/gyttja (offering/no offering phase). Above: ¹⁴C dates for ceramic vessels. The black area indicates the expected age range for the vessels as inferred from Johannesen (2016). Legend of sediment column see figure 7 (Model: J. Olsen).

Sample column 1, peat cut A34

The age-depth model for peat cut A34 (Figure 5) was constructed with the aid of a P_{sequence} function in OxCal 4.3. Of the five dates obtained, four were used to construct the age-depth model, while date AAR-21323 appears to be too young and must be considered an outlier. The age-depth model shows that the basal deposits were formed in 182±54 cal B.C., which must be the time immediately after peat was extracted from the peat cut. The transition between zones A34-1 and A34-2 here is dated to 83±33 cal B.C., and between zones A34-2 and A34-3 to cal A.D. 54±27.

Ceramic vessels

Vessel x-129 from peat cut A23 is dated (AAR-8886) to 2080±55 (350 cal B.C. – cal A.D. 52), while vessel x-534 from peat cut A40 is dated (AAR-8885) to 1990±65 (180 cal B.C. – cal A.D. 136). In chronological terms, the vessels belong typologically to period II of the Pre-Roman Iron Age, which extends from 250-1 cal B.C. (Jensen 2005).

Stratigraphy and pollen analysis

Sample column 3

Sample column 3 was taken in the middle of the small basin and represents the natural development of the bog (Figure 6). The sample series has a depth of 1 m and covers the upper part of the bog's stratigraphy. Deeper gyttja deposits have been demonstrated in cores from the bog, and pollen analysis of these assigns them to the early Holocene period (not shown).

FU-1

This layer consists of heavily humified wood peat containing branches and trunks. The bog was dominated at this time by relatively dense woodland of *Alnus* (alder) and *Betula* (birch), while the surrounding woodland was dominated by *Corylus* (hazel) and *Quercus* (oak), mixed with *Ulmus* (elm) and *Tilia* (lime). At one level (8.5 m a.s.l.), the value for *Alnus* pollen is 85 %. This is presumably due to the sample containing an anther of *Alnus*, which is heavily overrepresented as a result. In mitigation of this problem, the proportion of *Alnus* pollen at this level has been reduced to the mean value of the two adjacent samples. Very few pollen grains of open-landscape plants are present, and there are no indications of arable land within the pollen catchment area. It must therefore be assumed that this wood peat was formed in the Atlantic period prior to the introduction of agriculture.

FU-2

The transition between zones FU-1 and FU-2 corresponds to a change in the bog's hydrology. The Atlantic woodland peat is overlain by fen peat containing some gyttja, and the wetter conditions in the bog are similarly reflected by a marked increase in *Sphagnum* (bog moss) spores. Based on the presence of cultural indicators such as *Plantago lanceolata* (ribwort plantain) and *Hordeum* (barley), these sediments must have been formed after the introduction of agriculture around 4000 cal B.C. (Odgaard 2006, 333). This is consistent with the ¹⁴C date (AAR-26054) for level 8.61 m a.s.l., which cal dates the lower part of FU-2 to 2874-2601 B.C. It is possible that the wetter environment was a consequence of a local rise in the water table associated with woodland clearance in the vicinity, coupled with the climatic changes that took place at the beginning of the Neolithic period in Denmark (Berghlund 2003).

The pollen diagram shows that *Betula* was the dominant taxon but, unlike in zone FU-1, there are no preserved branches or trunks. This means there were no trees growing on the actual bog at this time, but there was *Betula* woodland around the margin of the bog, mixed with *Alnus*. In the upper part of the zone, values of Poaceae (grass family) begin to rise, and there is also a general increase in herbs such as *Spergula arvensis* (common spurrey) and Chenopodiaceae (goosefoot family). Together with *Plantago lanceolata* and *Hordeum*, this shows there must have been arable fields and

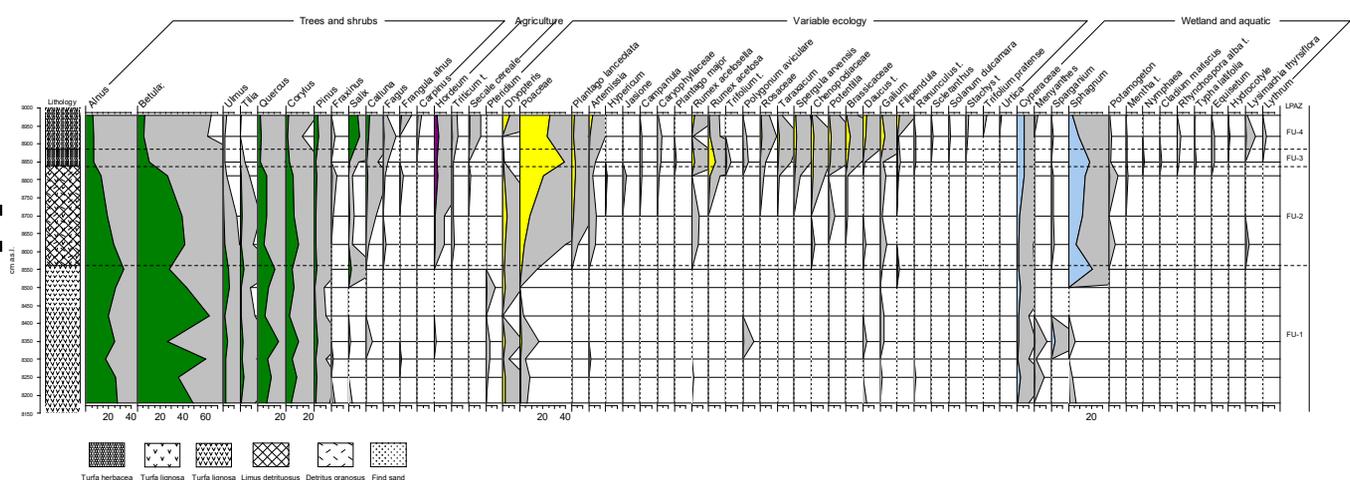


Figure 6. Percentage pollen diagram for sample column 3 showing selected taxa. The diagram shows the bog's natural development. The pollen percentages have been calculated on the basis of the terrestrial taxa. The shaded area shows a x10 exaggeration of the percentage values (Diagram: M. F. Mortensen). See also: Fig.6 large scale.

pastures on the dry land around the bog. There is nothing in the development of the vegetation to suggest that the stratigraphy is disturbed, but given the old date obtained at level 8.71 m a.s.l., this possibility cannot be discounted.

FU-3

In zone FU-3, the blackish-brown and generally highly humified peat is replaced by light-brown moderately-to-poorly fibrous peat. This sedimentary change indicates that the hydrological conditions in the bog developed further towards an even wetter environment. In the vegetation, a dramatic reduction is seen between FU-2 and FU-3 in the proportion of forest trees, while grasses and open-landscape plants, such as *Rumex acetosa* (common sorrel) and *Rumex acetosella* (sheep's sorrel) increase markedly. This development indicates that the area around the bog had become open arable land. Grazing land was dominant, and the bog itself may possibly have been grazed too, before the first peat cuts were established. The wetter conditions were probably a consequence of the shift to a wetter climate that occurred at the end of the Late Bronze Age, the so-called 2.8k event. This has been recorded at a number of localities in Denmark and across Northwestern Europe as a whole (van Geel and Renssen 1998, 24-27). In Denmark, the 2.8k event resulted in a higher water level in many lakes and bogs and many low-lying areas became waterlogged (Christensen and Mortensen 2011). It is evident in several of the peat cuts that FU-3 has been cut through by the peat cutting which, consequently, took place after this deposit was formed (Figure 2). The light-brown, fibrous fen peat of FU-3 must therefore have formed the surface of the bog when the peat cutting began, and the upper part of this layer may therefore have been disturbed.

FU-4

At the transition to this zone, peat-cutting operations came to a halt. The peat in FU-4 can be seen to consist of several separate layers, but these are addressed here as one. As can be seen from figure 2, the peat accumulated in the peat cuts and over the baulks between them. Subsequently, the activities in the bog appear to have ceased and the bog surface became colonised by willow scrub. This zone

has high values of *Salix* (willow) pollen, which can be traced over the investigated part of the bog. The surrounding landscape was open, with minimal tree cover, and subject to heavy cultural influence.

Sample column 1, peat cut A34 (Figure 7 a, b)

A34 is one of the largest peat cuts in the bog and few ceramic vessels, crushing stones, flint flakes and wooden artefacts of unknown function were deposited in it. A34 lies beside A23, which is the most finds-rich of all the peat cuts here. Parts of at least 36 vessels, 24 of which were more or less complete, were deposited in A23 in addition to a number of other artefacts such as club heads, tethering stakes, worked planks, and bones of at least three sheep/goats and four cattle, most of which were from the heads and legs. A23 and A34 are located close to the edge of the bog near a large oak trunk, which presumably functioned as a walkway alongside the peat cuts and during the subsequent depositions (Johannesen 2016, 38-39).

A34-1 (182±51 cal B.C. to 83±54 cal B.C.)

This zone represents the time just after establishment of the peat cut. During this ca. 100-year period, the peat cut was filled with water, and sandy gyttja became deposited at its base. This sandy content was probably washed in from the surrounding baulks and the dry land around the bog. In other peat cuts thrown-in fill was found, consisting of large blocks (turves) of sandy material. This backfill must originate from deposits in the marginal zone that no longer exist, because they were dug away and removed during the Iron Age peat extraction (Figure 3). The low values for algae and pollen of aquatic plants recorded here are probably due to the water being brown and discoloured as a result of its humus content from the surrounding peat, which reduced the penetration of light. Fen plants such as *Lythrum salicaria* (purple loosestrife) and *Iris pseudacorus* (yellow flag iris) gradually became established, together with members of the Cyperaceae (sedge family); presumably *Carex rostrata* (bottle sedge), which is often found in former peat cuts. *Calluna vulgaris* (common heather) and Poaceae (grass) are the dominant pollen taxa and bear witness to the open cultural landscape that existed in and around the bog. Indications of grazing and crop cultivation are evident in the form of *Plantago lanceolata* and

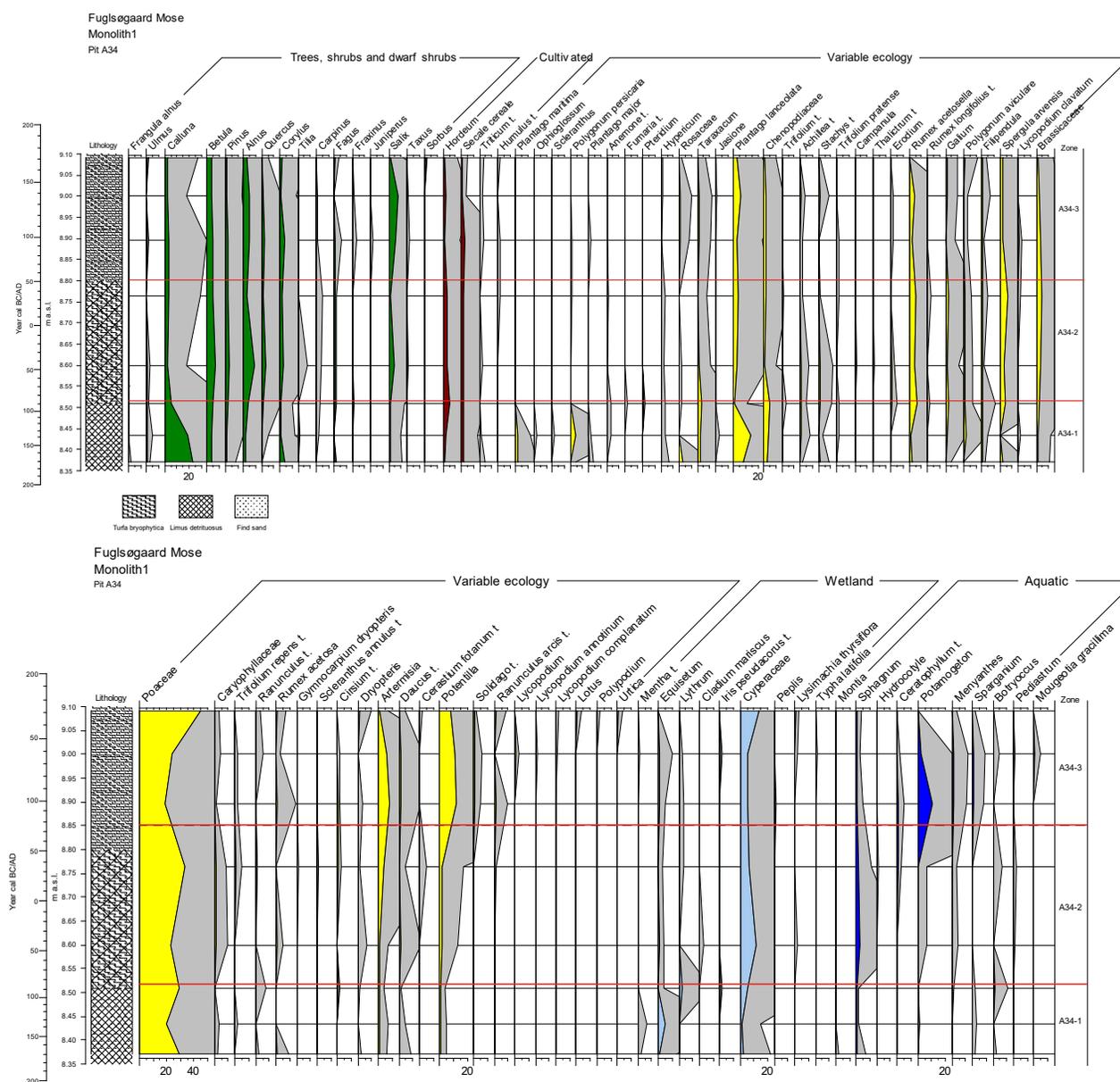


Figure 7. Percentage pollen diagram for sample column 1 showing selected taxa. The diagram shows the regrowth of peat in a peat cut. The pollen percentages were calculated on the basis of terrestrial taxa. The shaded area shows a x10 exaggeration of the percentage values (Diagram: M. F. Mortensen). See also: Fig.7 a,b large scale.

Rumex acetosella, together with cereal pollen: *Hordeum*, *Triticum* (wheat) and *Secale cereale* (rye).

A34-2 (83±22 cal B.C. to cal A.D. 54±27)
 The sediment here consists of peaty gyttja, and during this zone the peat cut changed from water-filled pit to level bog surface. The most important plants involved in the regrowth of peat were Cyperaceae (sedges) and *Sphagnum*, which resulted in the gradual infilling of the peat cut. Ultimately, continuous peat cover was restored, and extended over both the peat cut and the surrounding baulks. *Calluna* and *Plantago lanceolata*

values decline, while those of *Rumex acetosella*, *Spergula arvensis* and Brassicaceae (mustard family) increase.

A34-3 (cal A.D. 54±27 to cal A.D. 217±40)
 The fen peat that covered the peat cuts and the baulks left between them corresponds to zone FU-4. As can be seen from figure 2, the deposits sink some way down into the peat cuts. In the sediment in these wet depressions, macro-re-mains have been found of *Potamogeton polygonifolius* (bog pondweed), which specifically grows on muddy and peaty substrates in former, shallow

water-filled peat cuts (Schou et al. 2017, 80-81). *Potamogeton polygonifolius* was accompanied by *Menyanthes trifoliata* (bogbean) and *Sparganium-t.* (bulrush/burred). This vegetation was responsible for the formation of a dense, continuous peat deposit.

As in FU-4, there is an increased proportion of *Salix* pollen, indicating development of willow scrub on the bog following the cessation of peat cutting and ritual deposition in the peat cuts. This development is evident between 8.765 m a.s.l. (cal A.D. 39±28) and 8.895 m a.s.l. (cal A.D. 93±20), and the peak in *Salix* can be also be seen in FU-4 and peat cut A13 (supplementary data). The high values of Poaceae and open-landscape plants show that the area around the bog continued to be used generally for grazing animals and the cultivation of cereals.

Sample column 4

Sample column 4 was taken in a near-marginal peat cut (A13), from which no finds were recorded. The samples extend over a depth of 1.13 m, through a peat cut containing regrown peat and the underlying peat deposits (supplementary data).

A13-1

This zone lies below the base of the peat cut and consists of the original "primeval" peat. The pollen spectrum is dominated by *Pinus* (pine), *Corylus* and Poaceae and only few pollen grains have been recorded of *Tilia*, *Ulmus*, *Alnus* and *Quercus*. Based on this, the peat must have been formed at the transition between the Boreal and Atlantic periods, i.e. around 7000 cal B.C.

A13-2

The deposit in this zone consists of gyttja mixed with peat, which in its lower part is dominated by pollen of *Quercus*, *Betula* and *Alnus*. Values for these species decline gradually upwards, and a greater proportion of Poaceae, as well as several light-demanding herbs such as *Artemisia* (mugwort) and *Spergula arvensis* becomes evident. Cultivated species are also represented: *Hordeum*, *Triticum* and *Secale cereale*. The sediment here is interpreted as a mixed deposit: A result of older peat being intentionally thrown into the peat cut during the establishment of one of the neighbour-

ing cuts, or sediment slipping into the peat cut from the surrounding peat wall. The proportion of "primeval" peat declines up through the deposit, and the pollen spectra begin to give a more correct picture of the vegetation and can, in this part, therefore be correlated with A34-2.

A13-3

This zone represents the continuous peat deposits that cover the entire bog. The pollen spectrum is dominated by Poaceae, *Plantago lanceolata* and *Rumex acetosella* pollen, together with *Sphagnum* spores, and the zone can be correlated with A34-3.

Of the more than 80 peat cuts identified in the bog, the pollen studies cover only two, together with the natural development of the bog as evident from a section. The question remains whether the results of the investigations are representative of the overall development in the bog and the regrowth of peat in the peat cuts. In general, it can be argued that all the peat cuts were dug into the same basic sediments and therefore have the same preconditions for regrowth of peat. Similarly, the upper peat deposits, which formed after the cessation of activities, can be traced across the entire bog and must, accordingly, have the same formation history. It is therefore assumed that the analyses are generally representative of the overall development despite some variation in the peat accumulation in the individual peat cuts, dependent on various factors such as the depth of the pit, its proximity to the edge of the bog and possibly backfilling with peat turves.

Discussion

The landscape

Ice age glaciers created a gently undulating landscape in Denmark with abundant basins and depressions in which shallow lakes formed as the ice melted. Through the Late Glacial and early Holocene, thousands of such lakes dominated the terrain across large parts of the younger moraine landscape.

The extent of these past lakes is suggested by maps from the beginning of the 19th century, prior to widespread and intensive drainage, when as

much as 25 % of the land was occupied by wetlands. Many of these wetland areas have been investigated during archaeological and palaeoecological studies, and in the great majority of cases it is evident that these basins became filled with lake sediments and peat deposits during the first half of the Holocene and developed into bogs (e.g. Aaby 2008; Andersen et al. 1983; Mortensen et al. 2011, 2014).

Pollen studies show that the open cultural landscape we are familiar with today was formed on dry land as early as the Early Bronze Age (Odgaard and Nielsen 2009, 47). Consequently, the Early Iron Age therefore had an open and, in many places, largely treeless cultural landscape in which the numerous hollows and depressions featured bogs and meadowlands. Only the larger and/or deeper basins still appeared as lakes.

This description of the landscape is consistent with the present pollen diagrams from Fuglsøgaard Mose. Already before peat extraction began around 180 cal B.C, the bog appeared very open, covered with *Sphagnum* and Cyperaceae, while around it there was an open and intensively exploited cultural landscape. In the proximity of the bog were arable fields, used to cultivate *Hordeum*, *Triticum* and perhaps also *Secale cereale*, while the hillier areas hosted commons and pastures, which were exploited for animal grazing and/or haymaking. In Denmark *S. cereale* becomes a regular cultivated crop from the Late Iron Age onwards. Finds of pollen and macrofossils show that *S. cereale* was present already from the Late Bronze Age, however, it is not clear if it was cultivated on a small scale or if it was present as an arable weed (Robinson 1994, 20-39; Henriksen et al. 2009, 251; Henriksen and Harild 2020, 543; Søgaard et al. 2018). The picture remained the same after peat cutting began and over the subsequent two centuries until the bog became overgrown and developed into willow scrub in the Early Roman Iron Age. If the bog had been abandoned immediately after the peat cutting, willow scrub would probably have colonised the baulks surrounding the peat cuts in the course of a few years, as seen in many places following cessation of peat cutting in the first half of the 20th century. The fact that it took two centuries before the surface of Fuglsøgaard Mose became covered in willow scrub could be due to the bog surface

being kept open by regular haymaking or grazing of the remaining baulks.

It has previously been suggested that bogs with ritual deposits from the Iron Age were situated in inaccessible areas of woodland, meadow and bog (e.g. Ferdinand and Ferdinand 1961, 81), but this is an interpretation that can no longer be justified. Firstly, the bogs constituted a heavily exploited resource that, in addition to peat extraction, in many places took the form of wet meadows used for grazing and haymaking. Moreover, the willow vegetation growing on and around them could supply withies needed for basketry, wattle and so forth. It is clear from the pollen data that Fuglsøgaard Mose lay in an active cultural landscape in which people had their day-to-day activities before, during and in the centuries after the peat-cutting phase. A similar open cultural landscape is also evident at Rislev Valmose in western Sealand (Troels-Smith 1961, 92), Nydam Mose in southern Jutland (Kolstrup 2009, Christensen 2020, 315-317) and Aldersro I in mid Jutland (Skousen 2008, 346), that likewise contains ritual depositions. It is therefore obvious to conclude that these bogs during the Iron Age had a close association with the active arable land and habitation rather than being placed in a distant, marginal area. Perhaps this proximity to daily life was even a precondition for the selection of a bog as a ritual depositional site?

The close connection between habitation and bogs with ritual depositions is evident from the Roman Iron Age site near Skødstrup where a bog site with peat digging and ritual depositions were located close to the settlement (Mandrup et al. 2017). However, so far no settlements have been located in the vicinity of Fuglsøgaard Mose. A search in the Danish National database (Kulturarv.dk) of archaeological finds shows that the closest traces of a pre-Roman Iron Age settlement is located approximately 1400 meters west of Fuglsøgaard Mose, while finds belonging to the early Roman Iron Age is recorded from the nearby village, Klatrup, 500 meters to the west of Fuglsøgaard Mose.

Peat cutting

Evidence of prehistoric peat cutting was first demonstrated in Denmark during the excavation

of the Hjortspring Boat on Als (Rosenberg 1937, 28). It was possible here, both during the actual excavation and in the subsequent pollen studies, to establish that large quantities of peat had been extracted from the bog at the end of the Bronze Age. As a consequence, a lake was formed, in which the 19 m long Hjortspring Boat and associated weapons etc. were deposited several centuries later (350 cal B.C). The excavators recorded several small pits below the gyttja deposits, which Rosenberg referred to as "ritual wells". The development of the Hjortspring basin can now be interpreted as follows: In the course of the Bronze Age, some small peat cuts were established from which peat was extracted. Later, presumably at a time of low water table, the remaining peat that stood between the earlier peat cuts was extracted by way of a more extensive horizontal peat-cutting operation (Christensen and Fiedel 2003, 95). Consequently, only the bases of the original pit cuts are preserved. The excavation at Hjortspring therefore provided us with tangible evidence of the two fundamental peat-cutting strategies that are known to have been practised in Danish prehistory: digging of small individual peat cuts and horizontal removal of peat from peat banks extending over larger areas.

These peat banks may extend over large areas and they may be difficult to recognise in the field as the transition between the old "primeval" peat and that formed when peat growth resumed after cutting can resemble a natural succession. It is, however, often first possible to detect this form of peat extraction by pollen analysis and/or ^{14}C dating. In addition to Hjortspring, horizontal peat extraction has been demonstrated in Nydam Mose (Christensen and Fiedel 2003, 95-96; Charlie Christensen 2020), Borremose (Christensen and Mortensen 2011), Aldersro II (Skousen 2008, 246-251) and Svennum Mose (Sidsel Wählin and Morten Fischer Mortensen unpubl. data). Horizontal cutting is the most efficient method of peat extraction but requires that the water can be effectively led away. At Aldersro II (Skousen 2008, 250-251) and Svennum Mose (Sidsel Wählin and Morten Fischer Mortensen unpubl. data) there are indications that ditches were dug in advance of the peat cutting to lower the water table in the bog. Elsewhere, it is assumed that horizontal peat cutting took place at the end of the Bronze Age before

the wetter climate raised the water table in the Iron Age (Christensen and Fiedel 2003).

There is better evidence for the smaller, often circular, peat cuts that we know from Fuglsøgaard Mose. They have also been discovered at Nørre Smedeby (Becker 1948, 93) and the find site of Grauballe Man (Jørgensen 1956, 119), as well as at many other localities across Denmark (see Becker 1971). In the ritual depositions in the peat cuts, the artefacts are naturally concentrated in small, discrete heaps. It is therefore obvious to conclude that similar heaps of finds were deposited in separate, individual peat cuts. A review of previous finds suggests that finds such as the wagon wheels from Rappendam, the Gundestrup Cauldron from Rævemosen and several others must have been deposited in peat cuts (Christensen and Fiedel 2003, 92). Similar finds circumstances at localities such as Bukkerup, Turup, Risleve and Salpetermosen suggest, correspondingly, that the objects encountered here were also deposited in separate, individual peat cuts (Andersen 1993a, 72-72; Andersen 1993b, 203; Ferdinand and Ferdinand 1961, 50; Pantmann 2017).

In general, it must be assumed that all find assemblages recovered from bogs that contain preserved organic material in the form of bones, wood and other plant remains, were only preserved insofar as they came under oxygen-poor conditions quickly. If objects were placed on the surface of the bog, this would lead to swift degradation and humification of the organic parts before the peat managed to grow and cover them. All organic objects and materials found preserved in bogs must therefore either have been deposited in a naturally-formed lake, which subsequently grew over with peat, or lowered into a water-filled peat cut. Given the enormous quantities of archaeological finds that have been encountered in, and recovered from, Danish bogs over time, it must therefore be assumed that prehistoric peat cutting was much more widespread than has so far been realised.

Prehistoric peat-cutting implements, in the form of T-shaped and double spades, have been recorded from several localities (Lerche 1985, Lyngstrøm 2016). No tools have been found in Fuglsøgaard Mose that can definitely be linked to peat cutting, with the exception of small fragments of wood interpreted as the remains of peat spades

Figure 8. No peat spades have been found in the bog, but these implements have clearly left their mark in the peat. It can be seen here how the peat cutters dug into the side of the peat cut (A). Double peat cut A38 and A39 (B) (Photos: R. Fiedel).



(Johannesen 2016, 163). On the other hand, traces left by the 10-12 cm broad peat spades are clearly evident in several of the peat cuts (Figure 8 and supplementary data). The Iron Age peat cutters were obviously interested in the well-humified Atlantic wood peat. In several places, they can be seen to have dug in under large tree trunks in order to make optimal use of the peat cut (Figure 8).

Iron Age peat cutting – like that of recent times – took place in spring and early summer, so that the peat could dry prior to storage for the winter (Hove 1983; Svendsen 2009, 21-23). Some deposits are so consolidated and firm that the peat can be cut directly out of the bog in appropriate blocks, so-called “cut peat”, while others have a looser structure and the peat must be kneaded and formed prior to drying. There is an example from Nørre Smedeby of one of these “knead peats” with preserved finger impressions (Becker 1948, 98). After an initial drying phase, the peats were stacked up so the sun and not least the wind could dry them over the course of the summer. A peat stack has been found in Scotland that is dated to the Late Bronze Age. This peat stack was not taken home from the bog and subsequently became covered by peat growth and thereby preserved (Braniġan et al. 2002).

Fuglsøgaard Mose lies in a depression with no natural runoff for the water. The less-efficient method of peat cutting, i.e. peat cuts rather than a linear peat bank, was therefore the only feasible option for extracting the peat. As it was not possi-

ble to drain the bog, the peat cuts would relatively quickly fill up with water and their size may very well indicate how much peat could be extracted in the course of a working day. Because by the next day, water would have made peat cutting impossible. But the size of the peat cut may also have been governed by other factors. It is known from peat-cutting operations in the past how the base could “shoot up” if the peat cut became too large. This is a result of the surrounding peat pressing down on the underlying deposits; this excess pressure forces the basal deposits up through the peat cut (e.g. Jørgensen 1956, 122).

In some places, pairs of closely-spaced peat cuts – i.e. “double cuts” – are seen (Figure 8), where one has often been back-filled with thrown-in peat turves. It must be assumed that the pit containing the peat back-filling was dug first, after which a new peat cut was established immediately beside it. The first peat cut was then used for the disposal of peat of poor quality. As can be seen from figure 3, some of the discarded turves consist of almost pure sand, which means that, already in the Iron Age, parts of the bog must have been covered with colluvium, i.e. material eroded and washed down from the surrounding fields (cf. Figure 3).

An attempt can be made to estimate how much peat has been extracted from the bog. The peat cuts vary from around 0.5 to 3 m in diameter and 0.5 to 1.7 m in depth, and a cautious estimate shows that they had an average volume of 0.5 to 1 m³. Insofar as those peat cuts encountered are

also representative of the situation in the 70 % of the bog that has not been excavated, it can be calculated that between 250 and 500 m³ of peat was extracted.

There are no direct indications of what the peat was used for. It is known from the Middle Ages that peat mixed with the dung of domestic animals was employed for soil improvement on nutrient-poor soils (Aaby and Vegger 1995), and it is conceivable that this manuring technique was already employed in prehistoric times. But as peat turves of poor (fuel) quality were thrown back into the peat cuts, it seems unlikely that soil improvement was the primary aim of the peat cutting.

It seems reasonable to assume that the main purpose was the extraction of fuel for heating, cooking and iron production. Given the massive clearance of the woodland that took place in the second half of the Bronze Age (Odgaard and Nielsen 2009, 47), fuel was a limited resource, and in the most treeless areas peat was probably the primary fuel source. Not least because the local iron production from bog iron ore required abundant fuel resources for both the smelting and smithing processes (Lyngstrøm 2008). It is known from historical times that peat coal is well-suited to smithing (Christensen and Fiedel 2003, 97-98). Unlike charcoal, burnt peat only leaves traces in the form of ash and carbonised seeds from wetland plants in the most fortunate cases. Peat ash has, for example, been found in cremation graves (Olsen and Bech 1995, 12-14; Olsen et al. 1996, 170; Henriksen 2016, 46) and in a hearth (Henriksen 2001, 2; Henriksen et al. 2018; 407-408) in Thy, both dated to the Early Bronze Age.

Since the excavated part of the bog is penetrated by pits we must assume that all easily accessible peat was extracted and a new bog replaced Fuglsøgaards Mose as a peat source. The remaining baulks were not removed as seen in eg. Skødstrup (Mandrup et al. 2017), maybe because this removal is more time-consuming and therefore baulks were only used if there were no other peat areas in the vicinity.

Ritual activities

A central question associated with the ritual activities is: When did these take place and for how

long was the bog used for ritual depositions? From the archaeological dating of the ceramic vessels we know that the primary depositions took place in the bog during period II of the Pre-Roman Iron Age, i.e. between 250 and 1 cal B.C. In the case of both vessel x-534 in A40 and vessel x-129 in A23, this date can, via ¹⁴C dating, be narrowed down to 180-1 cal B.C. (Figure 5 and Table 1). It is not known whether all the peat cuts were established during the same short period or dug over a longer time. But as all the peat cuts are overlain by the same peat deposit, this suggests a brief period, presumably in the order of a few decades.

In most cases, the offerings were found incorporated into gyttja, but artefacts were only rarely encountered at the very base of the peat cut; they were usually found some way up in the gyttja. This demonstrates two important things:

That the peat cutting and the ritual depositions are not contemporaneous. The age-depth model for A34 indicates that several years or even decades could have elapsed between the peat cutting and the later ritual deposition. A similar situation is evident at Nørre Smedeby in southern Jutland, where several wooden bowls were deposited long after the peat cut had been established (Becker 1948, 93). Similarly, the ritual depositions at both Hjortspring and Nydam were undertaken long after the actual peat cutting, and the same applies to the bogs in which Tollund Man and Grauballe Man and other bog bodies were found (e.g. Fischer 2007, 56; Asingh and Lynnerup 2007, 17-19).

That the primary deposition took place while the peat cuts were still filled with water suggests that lowering into water constituted a central element in the ritual act. It has been proposed that the depositions were fertility offerings (Becker 1971;51) and that the surface of the water was a "gateway" or "portal" to the world of the gods (Kaul 2003, 19-22). We can only speculate as to the motives behind these depositions, but if immersion into water was significant, then these water-filled peat cuts were, in many places, the only local bodies of open water in the "lake-poor" landscape of the Iron Age.

The basal layer in the large, near-marginal peat cut A34 has been dated to 182±51 cal B.C. Being located close to the edge of the bog, it was presumably one of the first peat cuts to be established,

and a nearby oak trunk could have functioned as a walkway.

The age-depth model for peat cut A34 (Figure 5) shows that it held open water from 182±51 cal B.C to 83±33 cal B.C. The deposits that formed in it subsequently consist of peat mixed with gyttja, and it is conceivable that it was still possible to lower objects into water in the peat cut at this time too. Around cal A.D. 54±27, a layer of peat developed across the bog and it was no longer possible to deposit vessels etc. It was also during this phase that the bog was abandoned and became colonised by willow scrub, which indicates that the bog had been abandoned as a ritual area. During the Early Iron Age, Fuglsøgaard Mose served several purposes; as a grazing and/or haymaking area, a peat extraction site, and a place for ritual depositions. While the first seems to continue through the Early Pre-Roman Iron Age until the Early Roman Iron Age, the peat extraction and ritual depositions belong to a relatively short period of maybe 100 years. It is not possible to determine, if the depositions started after the conclusion of the peat extraction phase or if they were at least partly simultaneous. One could imagine that depositions were made in parts of the bog, while peat extraction was still taking place in other parts. However, there seems to be some time lag between peat extraction and deposition, when one sees the gyttja layers formed before the first depositions.

White/light-coloured stones

Stones were found in many places in Fuglsøgaard Mose and varied in size from small pebbles to large stones weighing several kilograms. As stones do not occur naturally in peat deposits, they must be seen as an anthropogenic element. Most of them occur in association with the ritual depositions and must also have been part of the ritual activities. In some cases, the stones lay beneath the artefacts, in others either together with or above them (Figure 3 and supplementary data). Stones were also evident on the low baulk between the double peat cuts and on top of the overgrown peat cut, and some peat cuts only contained stones. It is possible that the stones were deposited together with organic material which has decayed without trace, but they

may also have had a ritual value in themselves. The Secchi depth in the peat cuts, i. e. the depth at which the reflectance equals the intensity of light backscattered from the water, is unlikely to have been more than 20-30 cm, which means that some of the high-up stones could possibly have been glimpsed in the peat cuts, while others had sunk into the darkness. It has previously been suggested that the peat cuts have been used for the retting of flax and that the stones could have been used to hold down the bundles of stems (Karg 2010). This possibility can, however, be discounted as neither pollen, macro-remains or other traces of flax have been found, apart from the bundles that clearly had been deposited as a part of the ritual activities (Figure 4). Moreover, there are examples of stones that appear to have been pressed into the peaty base or the baulk from the peat cut. Several of the vessels also contained stones, and these had been placed in the vessels prior to deposition. There were, as already mentioned, also smaller stones distributed up through the stratigraphy and scattered throughout the peat. The latter must be interpreted as having been thrown out onto the overgrown peat cuts from dry land. A parallel to the continued deposition of stones can be found in the "stone-throwing" or "sacrifice-throwing" which was widespread in Scandinavia up into modern times (Henningesen and Laursen 2006), or in present-day wishing wells.

The stones are predominantly white or light-coloured, and the colour combinations do not reflect the stones that are otherwise evident naturally in the area: There appears to have been an intentional selection of white or light-coloured stones. Stones associated with ritual depositions in bogs have been noted from a number of earlier archaeological excavations. Numerous stones were found associated with the Hjortspring, Nydam and Ejsbøl war booty deposits, both above and beneath the deposited artefacts: This is interpreted as a result of "bombardment" of the objects after deposition (Kaul 2003, 215; Christensen 2003, 346-254). Becker (1971, 17) also mentions several bog sites where stones were involved, and there are numerous other similar records (e.g. Ferdinand and Ferdinand 1961, 52-55; Lund 2002, 147). Despite this, the presence of these stones is only sparsely discussed in the literature, and the colour

composition of the stones has been subject to professional discussion to an even lesser extent. One exception is Käringsjön in Scania (Arbmann 1954; Carlie 1998), where the presence of white stones is interpreted as a result of intentional selection and an integrated part of the ritual activities. Two of the present authors (M.F.M and C.C.) have, over a number of years, had the opportunity to investigate several contemporary bog sites with ritual depositions in various parts of Denmark, and the presence of white/light-coloured stones appears to be a characteristic feature at many of these. The type of stone appears to be of lesser significance, as examples were found of quartzite, quartz and patinated flint among the light-coloured stones.

Prehistoric peat cuts can often be extremely difficult to detect and identify in the field, as the deposits they contain frequently have the same appearance and structure as those of the surrounding bog. They are often not detected until late in the excavation, by which time valuable traces and deposits may have been dug away. It is therefore important to be aware at an early stage in archaeological and palaeoecological investigations of wetland areas of the significance of stones, especially white/light-coloured examples, which can reveal the presence of prehistoric peat cuts and potential ritual depositions. Due to the frequently massive occurrence of deposited stones, it has been possible in several cases to locate Iron Age peat cuts solely with the aid of a steel probe.

Conclusion

In the Late Bronze Age and Pre-Roman Iron Age, Fuglsøgaards Mose lay surrounded by an open and

intensely exploited cultural landscape. Already before the peat cuts were established, the bog was open and presumably grazed. Around 180 cal B.C., the first peat cuts were established, and it is estimated that between 250 and 500 m³ of peat was removed. After the peat had been extracted, the peat cuts were left as water-filled pits in the bog through a period of about a century. It was during this time that the primary deposition of objects in the peat cuts took place. As peat growth resumed, eventually filling the peat cuts, the open water disappeared, and the depositions decreased, i.e. there appears to have been a direct link between open water and the ritual depositions. An exception to this was, however, the white/light-coloured stones, which were found in association with the other ritually deposited objects but also continued to be deposited up until and shortly after the pit cuts had become overgrown with peat again. The bog consequently retained some form of ritual status during the centuries after the other depositions had ceased. During this period, up until the final growth of peat over the peat cuts around cal A.D. 50, the bog was kept open, either by grazing or haymaking. Traces of activities in the bog then cease, and it is evident that the surface of the bog became colonised by willow scrub.

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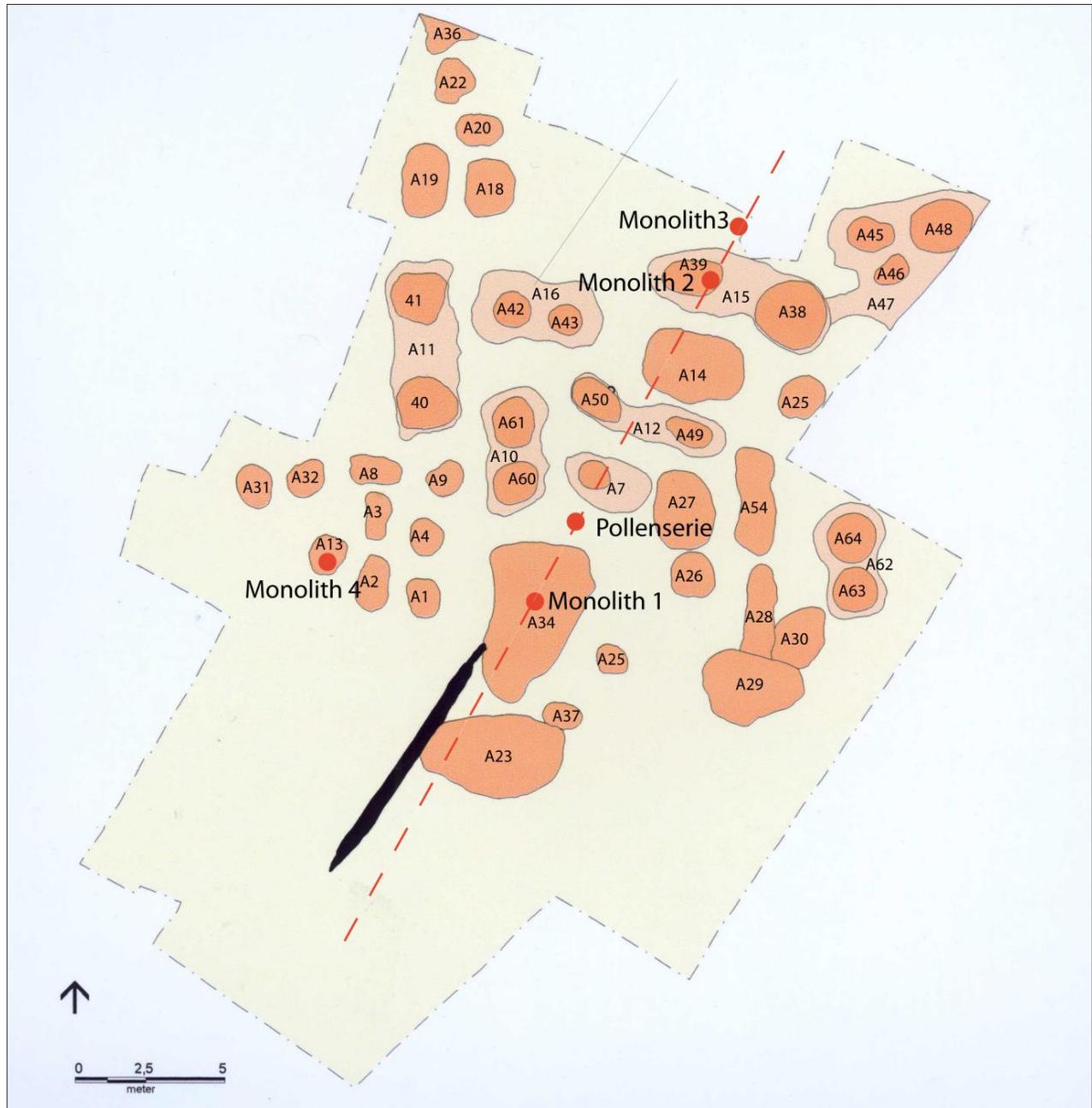
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Supplementary material

Plan: R. Stidsing, Excavation photos: R. Fiedel.

See also: Supplementary Material 3.



1. Plan of the central part of Fuglsøgård Mose.



2. The western area, where the peat cuts are evident as pale "islands" in the dark wood peat. A newly-cleaned surface can be seen to the right. The surface to the left of the ranging rods had been cleaned a day earlier and the colours are already beginning to fade.



3. Double peat cut A38 and A39, with a connection to A47 on the lower right.



4. The excavation trench in summer 2002. Peat cuts A14 and A15 are evident in the background and the layers of peat which developed over the bog can be clearly seen.



5. Section through peat cut A22.



6. Edge of peat cut A23 with obvious spade marks between the dark wood peat and the paler later peat.



7. Depositions in area A11, between peat cut A40 (back) and A41 (front). Peat cut A40 is seen most clearly, while peat cut A41 is only partially exposed. The area between the two peat cuts, stones and votive artefacts can be seen resting on the intervening peat baulk. A total of six horse skulls had been deposited in these two peat cuts and the intervening pit.



8. The skulls of six horses had been deposited in votive complex A11 consisting of the two peat cuts A40 and A41 and the intervening pit. Pottery vessels, wooden artefacts and stone had been placed around the skulls. This is interpreted as a coeval deposition. The preservation of bone in the bog is generally very poor and the skulls could only be very weakly perceived.



9. This peat cut (A40) is the southernmost of the two peat cuts below votive area A11. The pale sandy peats show that this peat cut was dug first, because they come from peat cut (A41), located directly to the north, which was dug later. Votive feature A11 is at the top of the excavation to the right, and stone and deposited artefacts have slipped down towards the base of the peat cut.



10. Pottery vessel x-534 from peat cut A40, containing a small bundle of *Linum usitatissimum* (common flax). The flax bundle has been ^{14}C dated 1990 ± 65 (180 BC – AD 136).



11. Peat cut A23, located close to the edge of the bog, was one of the richest in finds. It contained pottery vessels, wooden artefacts and many light-coloured stones. Unlike the others, this peat cut had been used for numerous depositions.



12. Deposition of white/light-coloured stones.



13. Light-coloured stones arranged in a circle on the peat baulk between peat cuts A121S and A121N, which forms part of the votive area.



14. Deposition of pottery vessel, wood and stones in peat cut A34.



15. Bundles of *Linum usitatissimum* (common flax) placed at the base of peat cut A60.

Exploring Spatial Patterns at 'Nørholm', a Metal-rich Site by the Limfjord, Northern Denmark – on Metal Detection, Settlement History and the Development of Land Exploitation

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ABSTRACT

Recreational metal detecting currently has a massive impact on North European archaeology. However, due to the poor contextual data of the finds, the unsystematic search methods and not least insufficient excavations at detected sites, the spatial understanding of the sites and the knowledge potentially to be gained from metal finds from the ploughzone is still limited. This paper presents a programme of investigations at the most productive detector site in Jutland, 'Nørholm', which offers a framework for interpretation of distribution patterns of the metal finds recovered over more than two decades by private detectorists. It is argued that overall changes in settlement patterns as well as changes in the associated field systems are major dynamics behind the spread of metal detector finds. A detailed, chronological mapping of the distribution of finds thus allow a reconstruction of the history of settlement and land use during the Late Iron Age and the Middle Ages.

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archaeology.

Introduction

Every year private detectorists hand in thousands of metal objects recently recovered from the plough soil of Danish fields, and these finds continuously invigorate the study of past societies, in particular the study of *Late Iron Age* (AD 400-1050) and *Medieval* (AD 1050-1536) societies, with new ground-breaking information (e.g. Horsnæs 2018; Høilund Nielsen 2014; Moesgaard 2018; Trier Christiansen 2019; Vang Petersen 1994; Watt 2000). Although the records have been produced in various ways over the years, the recording of find spots has been standard procedure at most sites since the beginning of private metal detecting in Denmark in the late 1970s and early 1980s. However, in most perspectives the vast research potential of this spatial data remains to be explored.

Danish research on detector finds and sites has mainly dealt with spectacular finds and find assemblages as well as with treasure trove legislation and collaboration between museums and private detectorists. Considering the impact of the detector finds on the discourse of research on societal development during the first millennium AD, methodology and spatial studies on a more detailed level

have been given surprisingly little attention. Until recently the one comprehensive study that broke this pattern was Margrethe Watts' work from the late 1990s onwards on the detector sites of the island Bornholm, mainly dealing with the erosion of the culture layers and the representativeness of ploughzone find material (Watt 1997; Watt 2000; Watt 2009). However, in recent years awareness of the subject has increased and some local studies, addressing interpretational aspects of the sites rich in ploughzone metal finds, have taken a methodical turn (Dobat 2014; Feveile 2014; Høilund Nielsen and Loveluck 2006). Concerning the spatial dimension, the new comparative study of the effects of modern cultivation on artefact displacement in the ploughzone published by Mogens Bo Henriksen is pioneering in Danish research (Henriksen 2015). But in fact, the Swedish scholar Jonas Paulsson undertook important pioneering studies in the field 15 years ago. During the initial boom of private metal detecting in Denmark in the 1980s and 1990s, while the eyes of the Danish scholars were fixed on the fantastic new find material and most effort was directed towards attempts on fitting this into the broad social, economic, political and religious developments in Iron Age

and Medieval Denmark, he carried out thorough spatial studies attempting to create a framework for the interpretation of the rapidly growing find material from the Scanian detector site Uppåkra (Paulsson 1999).

A series of investigations have indicated that spatial studies of the metal objects recovered from the ploughzone have great explanatory potential regarding the structures and development of large Late Iron Age sites, and in rare fortunate cases perhaps even regarding activities within specific buildings (Bender Jørgensen and Eriksen 1995, 84; Jensen 1987, 11; Jørgensen 2000; Vang Petersen 1994). In addition to this, the distribution patterns of detector finds seems to indicate chronological or functional divisions at a range of other productive metal detector sites across southern Scandinavia (Dobat 2010; Feveile 2014; Hilberg 2009; Sarauw and Trier Christiansen 2014; Wählin 2014). However, proper evaluation of the character and extent of the large detector sites, typically covering many ha (hectares), requires a large number of well-recorded detector finds and not least a substantial level of supporting excavations, as well as attention to the full range of dynamics, which affect the record. Hence, only a few sites have been investigated to an extent allowing intra-site analyses (Fiedel, Høilund Nielsen and Loveluck 2011; Jørgensen 2000).

One of the effects of this poor understanding of a majority of the detector sites is that there are still no general models for interpreting the spatial patterns of ploughzone metal finds. In this respect, observations from Nørholm, which is currently the most productive of a series of detector sites by the Limfjord, may offer details of interest. The area has been searched by numerous detectorists for more than 25 years, and they have so far turned in over 5.000 objects dated mainly to the Late Iron Age and the Middle Ages. In the autumn of 2014, the Historical Museum of Northern Jutland and Aarhus University carried out investigations on the hill, aiming to understand the widespread distribution of the metal objects in the ploughzone and illuminate the fundamental development of the settlement in the area during the first millennium AD. This paper discusses the results of the investigations and compares these to the overall distribution pattern of the abundant metal detector finds from Nørholm.

The Nørholm hill and the archaeological record

The narrow eastern part of the Limfjord is flanked by a series of (by Danish standards) significant hills surrounded by low-lying meadows. The Nørholm hill on the southern coast of the fjord is one of these; and today the hill, covering approximately 500 ha, mainly constitutes heavily cultivated, rich farming land. The present settlement comprises farms scattered primarily across the southern foot of the hill, the fishing village 'Klitgård' in a low-lying area by the fjord to the west, and the main settlement of Nørholm village with its Romanesque church located towards the northeast at an elevated position overlooking the fjord (Figure 1).

Apart from the metal detector finds, the archaeological record from the area is fairly sparse, and until recently only a handful of minor archaeological excavations had been conducted on the hill. However, the records do contain a series of individual finds and isolated structures dating from the Mesolithic onwards scattered across the hill, rendering it likely that settlement on the hill has been continuous for millennia. Iron Age settlement seems restricted to two areas located approximately 1.5 km apart by the southern foot of the hill. At Mellemholm to the west, minor excavations have uncovered settlement from the Late Pre-Roman Iron Age (200-0 BC), and aerial photographs have revealed settlement traces across a large area nearby (FF¹ 120508-28 & 32). In the same area, part of a burial ground with graves from the Late Roman Iron Age (AD 200-400) and the Early Germanic Iron Age (AD 400-530) has been excavated regularly during recent years (Posselt 2014).

To the east, close to the farm 'Østergård', are the remains of another Iron Age Settlement (FF 120508-69). This settlement was one of the focus areas of the investigation campaign carried out at Nørholm in 2014, during which its extent and basic character were explored through a targeted trial excavation. The trial trenches revealed intensive settlement remains across an area of approximately three ha, strictly delimited to the north by a contemporary road. Postholes, presumably from longhouses, were scattered across the entire area, and to the northeast, scattered sunken

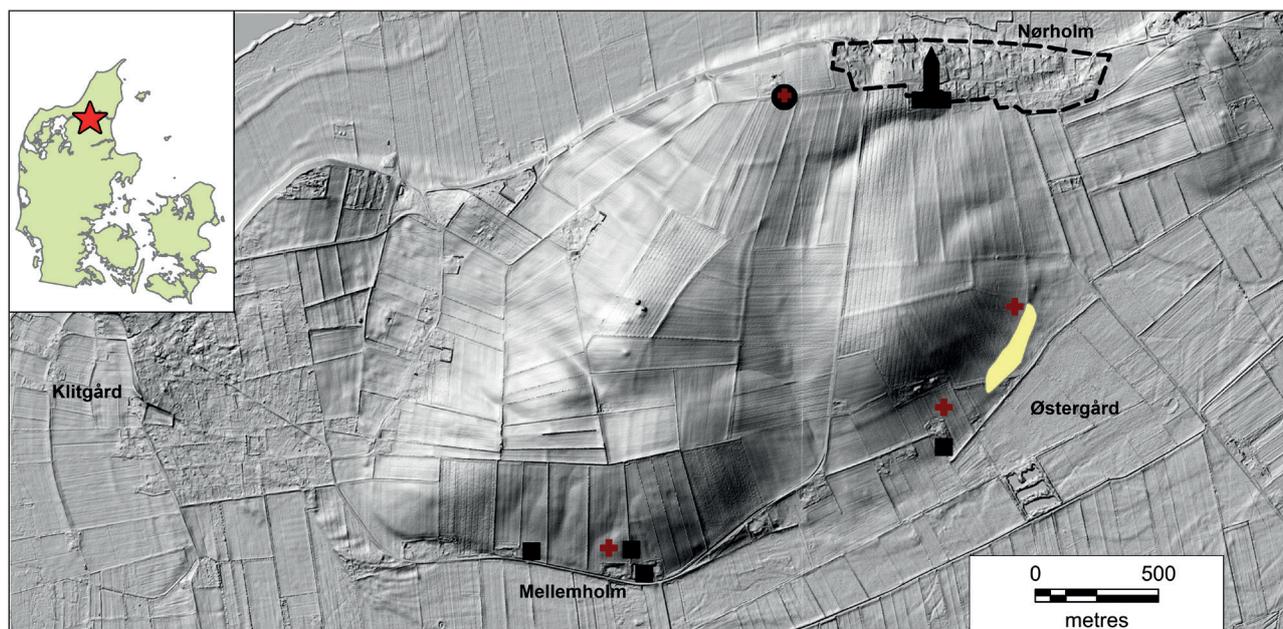


Figure 1. Investigated areas and Iron Age and Medieval settlements and graves at Nørholm. Black square = settlement 500 BC-AD 400, Red cross = grave/burial ground AD 1-500, black dot with red cross = ring ditch (Grave? AD 600-950), yellow zone = settlement AD 200-650. © Geodatastyrelsen.

featured buildings were recovered within an area of 5000 m² situated by the road. Few structures were excavated, leaving no possibility of a more detailed evaluation of the character of the settlement. However, soil samples taken from a broad range of structures across the settlement show a remarkable number of fish bones, testifying to what appears to be intensive, local coastal fishing, most likely performed on a seasonal basis. Both ¹⁴C-dating and the abundant metal detector finds recovered across the area indicate that the settlement thrived during the 3rd-7th century AD. In addition to this, longhouses spotted on aerial photographs from the neighbouring field to the west most probably represent the preceding settlement (FF 120508-60), and considering the direction of the road it seems likely that the settlement gradually shifted along the road (Posselt and Trier Christiansen 2015).

In addition to the settlement remains, a couple of Roman Iron Age (AD 1-400) graves have been investigated in connection to the late phase of the Østergård settlement, and in the 1980s a rich grave from the Early Roman Iron Age (AD 1-200) was excavated immediately to the north of the early western phase of this settlement (FF 120508-31).

Finally, several attempts to find settlement remains at the most promising locations on the top of the Nørholm hill have failed over the years.

However, during the 2014 campaign a ring ditch that may have encircled a Late Iron Age grave was uncovered on an elevated plateau overlooking the fjord 300 m west of Nørholm village on the northern part of the hilltop.

Metal detecting at Nørholm

The modest level of archaeological investigation contrasts with that of metal detecting conducted at Nørholm. The first finds from the hill were recovered in the late 1980s, and during the 1990s the area became increasingly popular among the highly active detectorists of the region. At present, the find record contains 5,640 metal detector finds, the majority of which are High- and Late Medieval (AD 1200-1536) coins. In particular, the coarse copper-alloy 'civil war coins' are abundant. Another major category is jewellery, especially brooches, which dominate the find material throughout the Iron Age and Early Medieval Period. Moreover, a large proportion of the detector finds consists of recent finds that remain to be properly determined, as well as a series of undated fragments, scrap pieces and other miscellaneous objects (Table 1).

	Coins	Jewellery/ Dress accessories	Tools	Other	Total
Bronze Age - Iron Age	13	88	7	1	109
1800-0 BC	0	9	7	0	16
AD 1-400	13	79	0	1	93
Late Iron Age	10	271	25	12	318
AD 400-530	0	67	0	0	67
AD 530-800	0	131	0	3	134
AD 800-1050	10	73	25	9	123
Roman Iron Age – Medieval Period	6	36	25	11	78
AD 1-1050	0	19	1	10	30
AD 900-1200	6	16	12	1	35
AD 1-1536	0	1	12	0	13
Medieval Period	1722	204	160	237	2323
AD 1050-1200	8	93	82	98	281
AD 1200-1400	634	1	0	0	635
AD 1400-1536	133	0	0	1	134
AD 1050-1536	947	110	78	138	1273
High Medieval Period – Renaissance	700	18	85	58	861
AD 1050-1660	700	18	85	58	861
Post-medieval Period	210	14	18	38	281
AD 1536-1660	41	13	18	38	110
AD 1660-2015	169	1	0	1	171
Undated	807	68	37	758	1670
Total	3468	699	357	1116	5640

Table 1. The composition of the detector find material recovered at Nørholm.

All the finds have been recovered by private detectorists, more than 20 of whom have handed in finds from the area over the years. Today the scatterplot covers almost the entire hill, indicating that most of the area has been intensively surveyed (Figure 2). However, there is no doubt that the well-known skewed search patterns of private detectorists, who will typically spend most hours surveying in areas where metal detecting has previously been successful, are naturally a major issue in relation to the spatial representativeness of the detector finds at Nørholm. With that in mind, the eastern and southern part of the hill, showing dense clusters of finds, are probably the most thoroughly surveyed areas. On the other hand, the widespread distribution of the numerous small Medieval coins shows that the detectorists have been very active across the majority of the fields on the hill. Apart from the constraints of the modest area covered in the existing settlement and associated gardens, metal detecting has only been limited on a couple of minor fields: in one of these a landowner prevented access, and in another access was limited because of the planting of Christmas trees.

Because the finds from Nørholm have been recovered by a broad range of detectorists during a

period of almost 30 years, the quality of the metal detector find data varies considerably. A major proportion of the finds were recovered before the introduction of GPS, initially used by some detectorists of the region in 2006-2007. Thus, most of the find locations have only been 'measured' by eye and subsequently recorded on enhanced copies of map sections of the area. Only 1.004 (18 % of the total) recent find locations have been recorded using GPS.

Ideally, only GPS-recorded finds should be used for detailed spatial analysis. However, the early finds with poor location recordings have been included to varying degrees in the following, regardless of the fact that the accuracy of the early recordings on maps is poor and difficult to properly estimate. Given the scale of the maps and their level of detail, it is hard to imagine that many of these finds have been wrongly marked by much more than 100 m, and deviations of that scale are of limited significance to the following analyses, focusing on a very rough overall level. However, the finds with the poorest spatial data, the ones with the find spot marked as a region, are only included in the initial analysis of the relationship between settlement and ploughzone metal finds, and in this case solely because they appear to enhance the impression left by the more reliable finds.

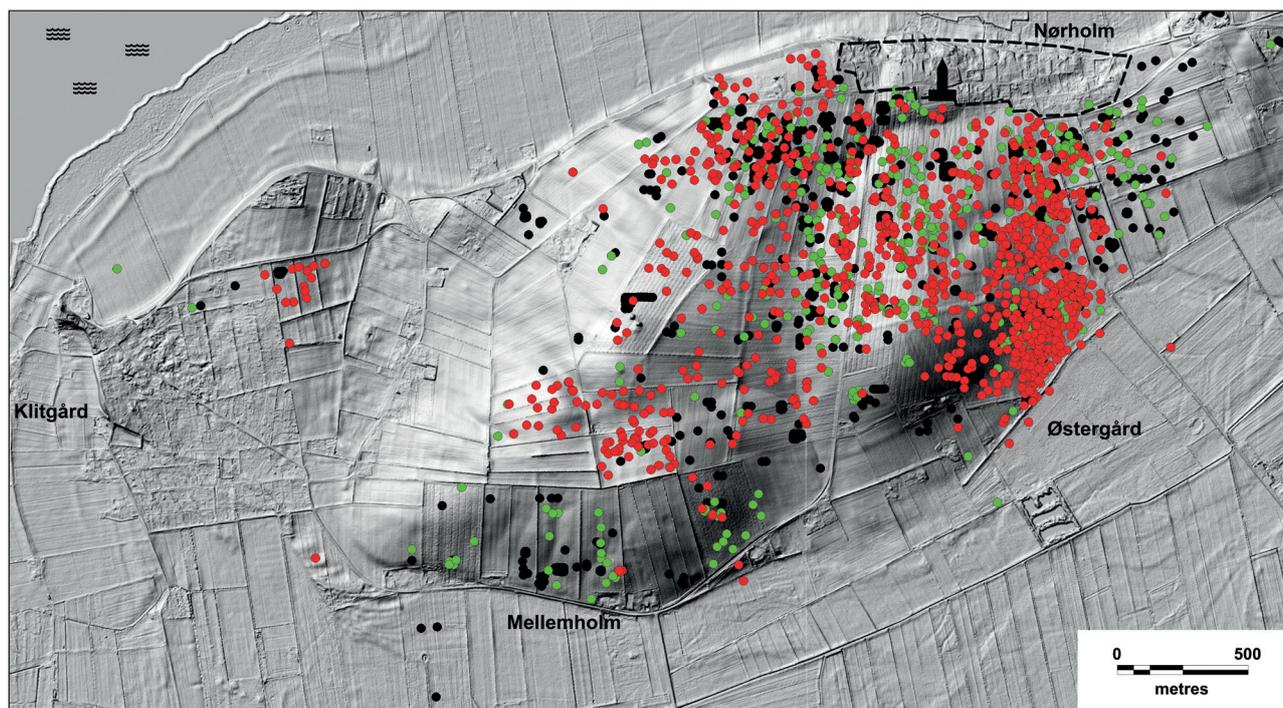


Figure 2. The distribution of all metal detector finds recovered at Nørholm (5.648 finds). Red dot = find location recorded by GPS (1.004 finds), green dot = find location recorded as point on a map (358 finds), black dot = find location recorded as a region on a map – typically part of a field (4.280 finds). © Geodatastyrelsen.

Cultivation and ploughzone detector finds

Metal detector finds from the ploughzone are a very elusive research base that has potentially been affected by a series of post-depositional processes. In terms of spatial studies on a local scale, which is the intention of the following, the effect of cultivation is of particular interest. Naturally, all detector finds have been affected by cultivation, given the fact that they are almost always found in the modern ploughzone. The finds have initially at some stage been pulled upwards, in most cases probably by the plough, thereby being removed from their original context. During the same process and typically during later processing of the soil, the objects have been further displaced horizontally (e.g. Feveile 2011; Henriksen 2015; Kromann and Watt 1984; Paulsson 1999; Sarauw 2016; Östergren 1985).

Disturbance by farming machinery is no new subject to archaeology and has been a major issue of ploughzone archaeology since the 1970s (e.g. Andersen 1973; Lewarch and O'Brien 1981; Roper 1976). In connection to metal detector finds, the phenomenon has typically been visualised by scatterplots of ploughed-out treasures or hoards (e.g.

Horsnæs 2018, fig. 2.47 and 2.48; Kromann and Watt 1984, fig. 4; Sarauw 2016, fig. 3). Henriksen has recently studied these processes through a series of case studies of such interrelated finds found scattered in the ploughzone. His studies demonstrate that the ploughing direction has a major impact on the displacement, a conclusion supported by the long oval outline of scattered pieces of ploughed-out treasures in fields, which are always ploughed in one direction. Shifting ploughing directions leaves a more circular outline indicating a shifting direction of displacement. In addition to this, a few of his examples also underline that in some cases these regular displacements have been enhanced or disturbed: either by the displacement of a larger lump of soil containing several objects, or by contrasting directions of displacement caused by differing ploughing directions at the edges of the fields. To add to the complexity, several other phenomena influence the degree of displacement, the size and the shape of the object and the terrain (sloping terrain enhances downhill displacement) being the most important (Henriksen 2015).

Furthermore, the displacement of objects in the ploughzone is, of course, a dynamic process changing over time as the soil of the fields

is repeatedly processed, most often annually, and crops and cultivation strategies are altered. Both experimental archaeology and hoards eroded by years of ploughing and further processing of the soil testify to the fact that objects can be displaced several meters a year, or even more (Henriksen 2015, 75-82; Yourston, Gaffney and Reynolds 1990; Östergren 1985); in severe cases, there are indications that a few individual objects have been moved more than 80 m (Feveile 2011, 270; Sarauw 2016, fig. 3). Fortunately, the horizontal displacement of most objects is rather limited. Even after many years in the ploughzone, the distribution of a scattered hoard typically remains rather modest, with a distinct central concentration of objects indicating the original location of the hoard (Henriksen 2015).

Finally, the investigation of a large area like the Nørholm Hill must consider that distribution patterns could be severely skewed by uneven levels of erosion. In general, the fields across the entire hill have been intensively cultivated in modern times, and erosion due to deep ploughing appeared extensive in most areas investigated by excavation. At Melleholm towards the southwest, the sad remains of several graves almost completely ploughed out have been investigated, and at the Østergård settlement to the east only a few cm were left of some of the sunken featured buildings. No doubt, the many metal finds in these areas are the result of advanced erosion. On the hilltop, only a few structures have been found and these were a few cm deep, also indicating severe erosion.

To conclude, the present state of knowledge leaves no reason not to trust the overall distribution pattern left by the metal detector finds, although locally, minor low lying areas may of course have been protected from the erosion caused by ploughing by the deposition of protective layers of soil carried by the wind or washed down by rain.

Interpretation of ploughzone finds

The interpretational perspectives of the removal from the original context and the subsequent displacement of the objects in the ploughzone are severe at a site like Nørholm, which is characterised by a large amount of varied find ma-

terial sharing the same context and found scattered across a vast area and accumulated over a long period of time. The find material at such a site is bound to be a product of a wide range of different activities, most of which are impossible to infer from the data available. The core of this issue is the insurmountable challenge of proving contemporaneity. Once removed from the original context, the only guaranteed way to prove contemporaneity is to find fragments belonging to the same object. And even in such cases, one has to consider the possibility that fragmentation took place prior to deposition. One thought-provoking example of the latter was demonstrated by two fragments of the same brooch from Randlev, eastern Jutland. These had clearly circulated after fragmentation, as one fragment was found in an undisturbed grave and the other recovered by metal detector on the neighbouring hill 400 m away (Jeppesen 2010).

Therefore, except in the case of extremely lucky incidents there is no way of proving that two or more objects from the ploughzone at large complex detector sites have been deposited as a result of the same activity. On the other hand, a considerable number of finds of the same date must be expected to reflect patterns of related activities on a more general level. In this respect, the dating of the object is a critical issue: the more general the dating, the weaker any argument for contemporaneity will normally be. This issue is the primary reason that collecting a huge number of iron objects is most often abandoned at large, complex, Late Iron Age sites (e.g. Dobat 2010, 148; Pilø 2007, 147). In this light, any argument involving the spatial relations of the many pieces with poor dating from Nørholm is invariably going to be very speculative, considering the apparent high level of continuous activity on the hill ever since the Early Iron Age.

As a consequence of issues connected to the displacement of the objects in the ploughzone, the selective recording, the varying standards of recording, the biased intensity of the metal detector surveys and the modest number and extent of supporting investigations, detailed intra-site analyses are not an option at Nørholm. Thus, the rough patterns left by the metal objects will be the focus of the following analysis.

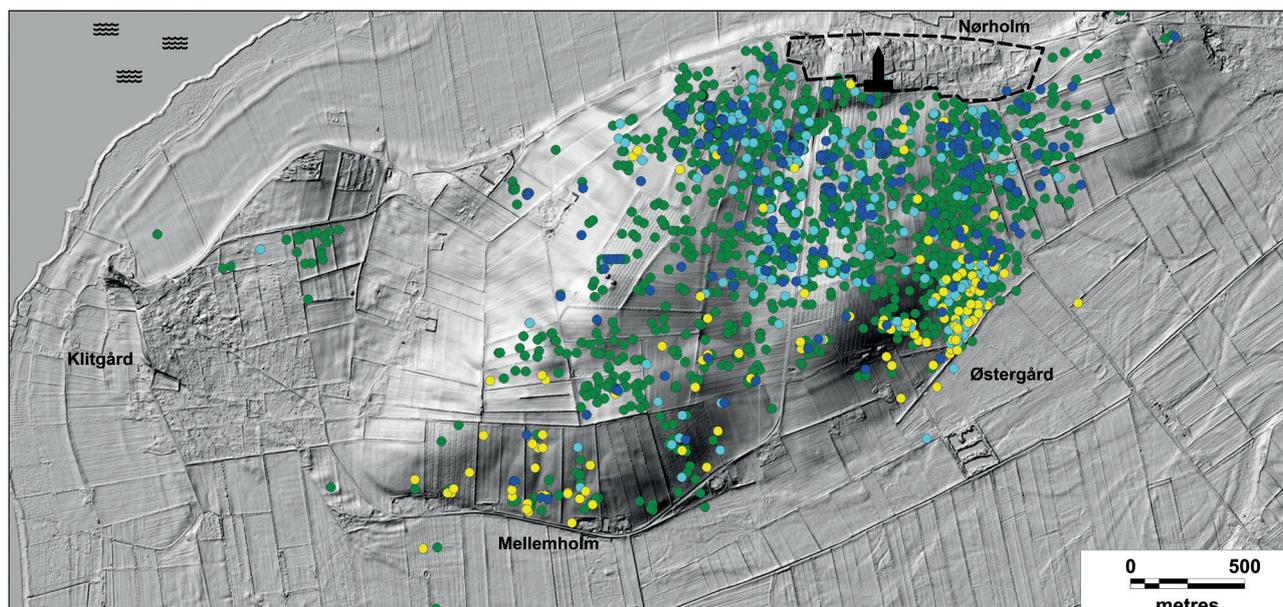


Figure 3. The distribution of Iron Age and Medieval metal detecting finds recovered at Nørholm. Yellow dot = 1st-6th century, turquoise dot = 7th-10th century, blue dot = 11th-13th century, dark green dot = undated/ other periods (finds with poorly recorded find location included). © Geodatastyrelsen.

The metal detector finds and the settlement

If the distribution of all the metal detector finds from the ploughzone is compared to the rough outline of the settlement at Nørholm from the first seven centuries AD, good correlation can be observed in many areas (Figure 3). Despite the generally dispersed picture left by the metal detector finds, the settlement areas at Melleholm and Østergård stand out as clusters of finds of similar dating. In particular, the large settlement at Østergård from the 3rd to the late 7th century is distinctively marked. Whereas the western settlement by Melleholm would only be vaguely visible if the finds whose location was poorly recorded were excluded. Generally, the proportion of these finds is high in this area due to the fact that this is where metal detecting initially began at Nørholm during the late 1980s, and most of the finds were recovered prior to the introduction of the GPS.

The dated finds from both settlement areas consist almost exclusively of brooches, and since graves as well as settlement remains were located in both areas, the ploughzone finds may originate from either type of context. It seems reasonable to assume that a considerable number of the brooches recovered at Melleholm come from eroded graves, as the graves

of the burial ground in this area are heavily eroded. At Østergård the situation appears more complex, as the graves found thus far are few and scattered, and because recent excavation results have shown that brooches are also deposited in cultural layers scattered across the settlement. In addition to this, a couple of the beak brooches found at Østergård are incomplete fragments – waste or unfinished products from a workshop rather than grave goods. Furthermore, no graves contemporary to the later part of the settlement, the 5th-7th century, have been recovered here. Hence, it seems likely that most brooches found at Østergård were dropped or otherwise deposited at the settlement or nearby. However, a few of the older brooches from the Roman Iron Age may originate from ploughed-out graves.

Due to the poor level of investigation, the boundaries of the early Iron Age settlement and burial ground towards the southwest at Melleholm are unknown, so it is not possible to discuss the correlation of the small-finds scatterplot to the distribution of the archaeological structures. However, this is, at least partly, the case at the eastern settlement at Østergård. The northern, southern and eastern boundaries of the settlement have been located. It is only a question of whether the full extent of the settlement towards the west-southwest was uncovered during the 2014 excavation.

If buffer zones with an interval of 100 m are set up around the settlement, it is clear that the density of finds is high in and immediately around the settlement and about 100 m from settlement the number of brooches drops significantly (Figure 4). Furthermore, most finds have been found in and around the northern part of the settlement, which may indicate that the majority originate in the area characterized by sunken featured buildings.

Considering the issues connected with the displacement of the objects in the ploughzone and the inaccuracy of the recorded find locations, it is never going to be possible to estimate whether the finds were actually deposited in the settlement or immediately outside. However, the widespread distribution of the brooches, which show no significant clustering, leaves the impression that the majority were dropped accidentally.

At present physical evidence of the settlement phases from the 8th-11th century has not been recovered. Hundreds of metal detector finds testify to increasing activity on the hill during this period, but the finds are generally widely distributed and appear intermixed at random. The scatterplot of finds covers most of the eastern part of the hill with

only a few clusters vaguely demarcated; and the results of the investigations conducted on the hill render it increasingly unlikely that the remains of a large settlement are to be found on the open fields on the hilltop. Towards the north, immediately south of the existing village, a concentration of Viking Age finds could indicate that the settlement relocated here during the Late Germanic Iron Age. Part of this area was actually investigated during the 2014 excavation, and no traces of Viking Age settlement were recovered here. It seems most likely that the remains of this settlement phase are to be found under the existing village.

Intra-site studies of the distribution of the Late Medieval finds in the actual settlement are not possible as the remains of the Medieval village are almost certainly completely covered by the existing village. The Romanesque church reveals the approximate location of the Medieval settlement; trial trenches dug close to the village boundaries to the west and south have shown no indication that earlier phases of the village stretch beyond the existing settlement, while to the north the terrain is unfit for settlement because it slopes. Only towards the east-southeast is there a slight chance of finding substantial traces of the predecessor of Nørholm

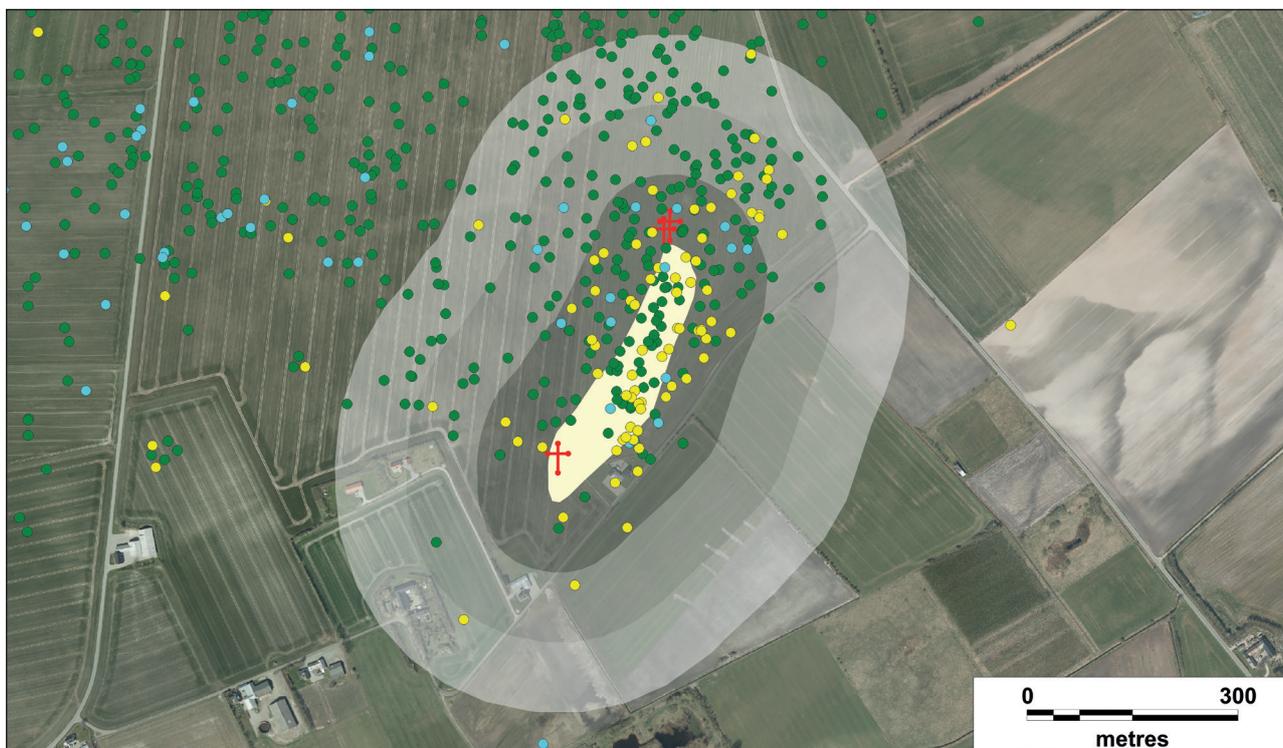


Figure 4. The density of ploughzone metal detector finds at the Iron Age settlement at Østergård and in the vicinity. Yellow region = settlement. Yellow dot = 1st-6th century, turquoise dot = 7th-10th century, green dot = all other (finds with poorly recorded find location excluded). © Geodatastyrelsen.

village in open terrain. However, one thing is very apparent at Nørholm. Large numbers of Medieval coins and other small objects have been scattered outside the village across all fields to the south and southwest of the village – many as far as 1.5–2 km from the village.

Metal detector finds in the landscape

Given the modest level of archaeological investigation, traces of minor settlements may still be hiding on the Nørholm hill. Nevertheless, it seems safe to assume that a major proportion of the 400 ha covered by the scatterplot of detector finds only contains a few scattered archaeological structures. The circular ditch found on the hilltop during the 2014 investigation may, however, indicate that some of the Late Iron Age detector finds scattered in this area and other finds scattered outside the actual settlement areas perhaps derive from eroded graves. Due to the tradition of placing the graves in grave mounds and stone settings erected on the surface, most remains of graves from the Late Germanic Iron Age and the Early Viking Age, in particular, are probably only present in the ploughzone. On the other hand, this can only account for some of these extremely scattered finds. The extensive spread of the small metal finds is a characteristic feature of several of the productive sites by the Limfjord (Trier Christiansen 2008, 102). Similar tendencies were obvious when the Bejsebakken settlement was excavated about 9 km east of here in 1998–2000. Prior to the excavation, the entire southern half of the hill was surveyed. A total of 62 ha was covered in a system of trial trenches 10 km long and spaced at 20 m intervals (Sarauw 2006, 12; Sarauw 2019, 22–23). During the 1980s and early 1990s, the hill was a treasured site for the local detectorists, and small metal finds from the Late Iron Age have been recovered from most parts of the area. On the top of the hill was a marked cluster of finds, and it transpired that these pointed to five ha of settlement remains. But no archaeological structures contemporary to the detector finds that were found scattered or in small clusters across the rest of the area were ever located.

The wide distribution of the finds is far too extensive for it to be a result of erosion and displace-

ment caused by modern ploughing and harrowing. It seems very likely that the scattering of objects was caused by large-scale distribution of settlement waste, used as fertiliser on the fields. This must definitely be true of the widespread Medieval coins at Nørholm. The distinctly wide distribution of these coins probably reflects intensively cultivated fields. Even if one imagined that the abundant coins were dropped during large-scale markets held on the hill, for instance, the distribution seems far too extensive. If isolated outliers and remote clusters are omitted, the main scatter still covers more than 300 ha.

The secondary distribution of cultural deposits containing metal objects could, of course, be fairly recent, meaning that most of the finds scatter only reflects modern agricultural strategies. However, there is no record of this practice; and the fact that the scatterplots of objects from different periods varies indicates either that the spread of the metal objects took place at different times, or that they were taken from different cultural deposits and distributed in different fields. The latter seems unlikely as the 11th–12th century finds and the finds from 13th–14th century do not display the same pattern of distribution, even though these were probably deposited originally in waste in the same place – in Nørholm village. They would most probably have been randomly mixed and scattered if the manuring had been carried out in later times.

The abundant Iron Age finds found widely distributed outside the settlements may be products of a broad range of activities. Some may have been dropped on the fields during field work or other activities, some may have been secondarily deposited in waste used as fertiliser, and others may have been deposited intentionally in graves or hoards. Although the original contexts are unknown to us, it appears plausible that the finds reflect areas of intensified activity in a broad sense. Furthermore, compared to the scenario displayed by the finds widely distributed on the surrounding fields of the settlement during the High- and Late Medieval period, it appears likely that a fair proportion of the widely distributed objects dated to the Late Iron Age and Early Medieval period have ended up on the remote fields due to similar processes. If this is the case, the distributions of the metal detector



Figure 5. The distribution of metal detector finds from the 1st-6th century (black dots) and the exploitation of the landscape at Nørholm in the 19th century. Background: land exploitation zones on the cadastral maps. (Finds with poorly recorded find location excluded). © Geodatastyrelsen.

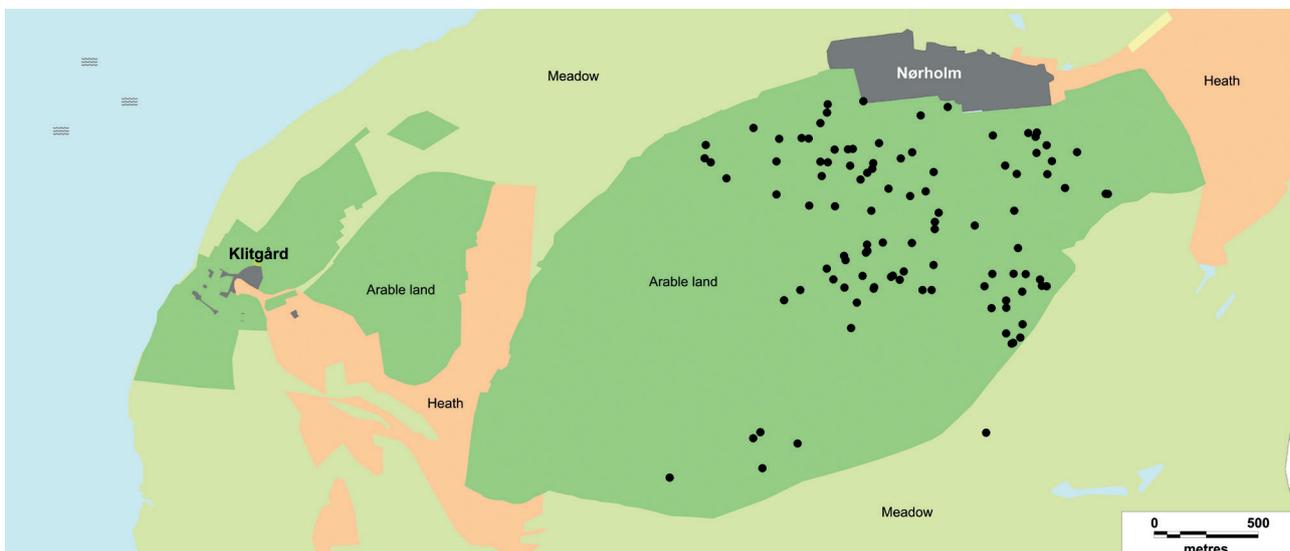


Figure 6. The distribution of metal detector finds from the 7th-10th century (black dots) and the exploitation of the landscape at Nørholm in the 19th century. Background: land exploitation zones on the cadastral maps. (Finds with poorly recorded find location excluded). © Geodatastyrelsen.

finds may depict a rough outline of the most intensively cultivated fields during this period, too.

Further support for this hypothesis may be found by comparing the distribution of the metal detector finds to the earliest detailed maps of landscape exploitation, found on the cadastral maps of the early 19th century (Figure 5-8). Interestingly, the spread of the finds is almost exclusively restricted to the zones of 19th century arable land. Only a few finds have been recovered from the meadows surrounding the hill. This is hardly a surprise, as both past activities in general and present metal

detecting have probably been modest in these areas – particularly to the north of the hill, where the forelands by the fjord are never ploughed and hence have probably never been exposed to metal detection. However, the almost total absence of finds from the heaths is striking. Only two medieval finds have been recovered in the heaths, which are found on both sides of the hill. Today both areas are cultivated fields – optimal detecting terrain. The absence of finds in these areas indicates low activity throughout the Iron Age and the Middle Ages and supports the argument that the scattering

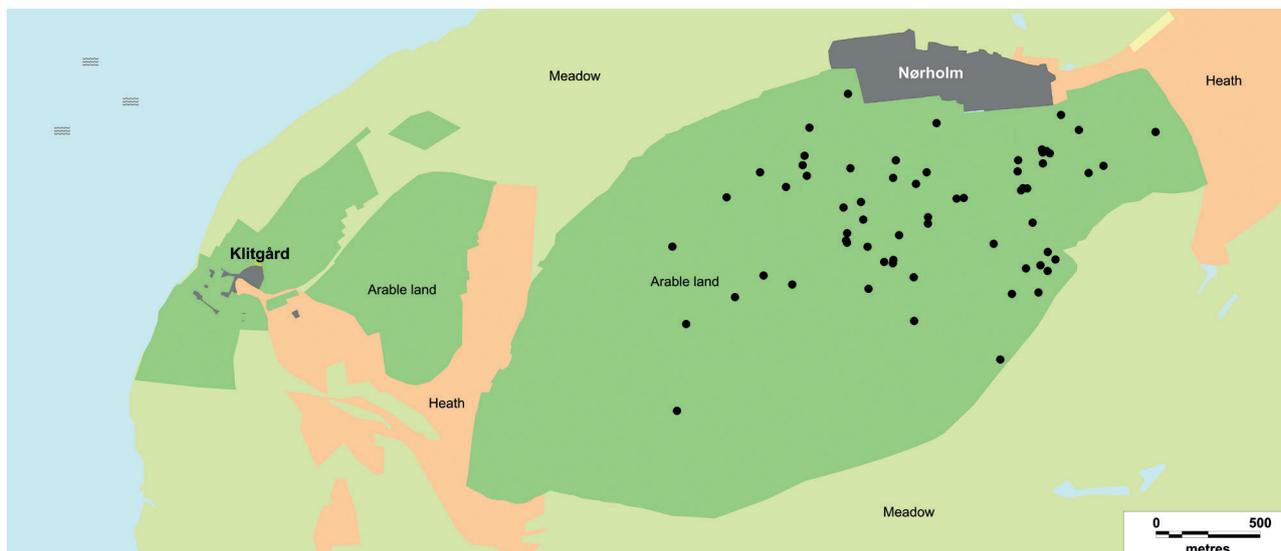


Figure 7. The distribution of metal detector finds from the 11th-12th century (black dots) and the exploitation of the landscape at Nørholm in the 19th century. Background: land exploitation zones on the cadastral maps. (Finds with poorly recorded find location excluded). © Geodatastyrelsen.



Figure 8. The distribution of metal detector finds from the 13th-14th century (black dots) and the exploitation of the landscape at Nørholm in the 19th century. Background: land exploitation zones on the cadastral maps. (Finds with poorly recorded find location excluded). © Geodatastyrelsen.

of the metal objects is not the result of recent processes. The distinct pattern could, of course, have been caused by post-medieval large-scale digging of heath turfs used for e.g. fuel, manure or building materials. But there is no record of such activities having taken place on the hill in recent times and the same pattern can with only a few exceptions be found across most of the eastern Limfjord region. It thus seems plausible to assume that these areas were already heath lands prior to the Middle Age, or that they became so during this period. Actually, it seems likely that turfs were dug in the heath and

in the surrounding low-lying meadows on varying, but probably often rather large scales from the Pre-roman Iron Age onwards. The existence of vast heath lands near the settlements on the hills by the Limfjord and the exploitation of heather and turfs during the Iron Age has been testified through a long range of investigations (e.g. Dalsgaard 2009; Henriksen, Harild and Mose Jensen 2009). Furthermore, Runge has, based on finds and archaeobotanical analyses of material recovered at the Early Iron Age settlement 'Nørre Hedegård', argued that the strategy of letting imported turfs soak the

nutrients deposited by husbandry in folded areas and stables for subsequent distribution on the fields was in fact probably a manuring strategy in practice at some of the highly specialised stationary settlements by the Limfjord since the Early Iron Age (Runge 2009, 254). Sod-manuring has been fairly common in the sandy areas of western and northern Jutland in historic times and the strategy has also been traced in Viking Age contexts (Haack Olsen 2005; Lerche and Jensen 1968; Madsen and Vegger 1992; Stoklund 1990).

Sod-manuring probably enhanced the maintenance of existing patterns of land exploitation, since this strategy normally included the import of turfs from adjacent areas in the outfield: an investment in the arable land with a marked preserving effect on field systems: once cleared and manured regularly, fields were only reluctantly given up. Furthermore, the continuous feed of new soil may explain why so many objects have survived a stay of more than a thousand years in the ploughzone. They were gradually buried in a deep layer of top soil and only deep modern ploughing have brought them into circulation again.

The heaths may even have covered a much wider area prior to the 19th century cartographic survey of the hill. In both areas, wide ones bordering the heaths are free of finds. Naturally, the scatterplot of the finds is not sharply delimited. However, if we ignore a few extremely scattered Viking Age finds, several of which are pieces of horse gear – probably dropped more randomly in the landscape than most other types of finds – the western heath covered almost half of the Nørholm hill during the 7th to the 12th century, but was reduced markedly, in particular on the central part of the hill, during the 13th century. An area of approximately 50 ha almost exclusively dominated by finds from the 13th and 14th century indicates this expansion of arable land. Furthermore, during the same period activity seems to have picked up in two other smaller areas. To the west close to the fishing village Klitgård, an area of approximately five ha has yielded a series of finds, and towards the northeast a cluster of finds points to exploitation of new lands. The extent of the latter area is hard to estimate as a number of the finds here are quite scattered. However, at least 10 ha must have been incorporated, and seven finds dating to the late 10th-12th century may

indicate that the expansion here started one or two centuries earlier than in the other areas.

If we can trust the distribution of the finds from the 13th-14th century to roughly mirror the cultivated land, it covers an area of between approximately 220 and 280 ha, as opposed to the finds from the 11th-13th century which point to only 150-180 ha. But the scatterplots are, of course, not sharply delimited and a few scattered finds dating AD 1000-1200 in the areas of expansion may indicate a gradual intensification of exploitation towards the end of this period. Estimates of the situation prior to approximately AD 1000 are challenged by the fact that a larger part of the finds may represent the scattering of eroded graves, thereby disturbing the overall picture. However, the main spread of the finds from the 7th to the 11th centuries covers an almost identical area to that of the finds dated to the following centuries. Hence, it seems that the extent of the cultivated land remained roughly the same during these centuries, except perhaps from the areas gained from disused heathen burial grounds. Since the village was most likely situated in approximately the same location during this period, one could argue that the distribution pattern might be the product of a manuring strategy initiated anytime within this broad period, and that finds of mixed dates were brought out during a few late manuring campaigns. This cannot on the basis of current evidence be conclusively rejected. However, given the scope of the spread, these would have had to be very extensive campaigns or a very structured process of many smaller ones. It appears much more likely that the widespread distribution was generated by centuries of repeated manuring.

Estimates of arable land during the first six centuries AD following the same model is not possible, as the finds outside the settlements are few and scattered. Hence, a few ploughed out graves could potentially drastically affect the calculation. However, a couple of spatial tendencies can be observed. First of all, the finds from the first five centuries AD present a much more scattered picture. Because of the bipartition of the settlement, activity and possibly the exploitation of land seem to have covered a larger area than in later periods. Actually quite a few of these older finds have been recovered in the areas of the High Medieval expansion suggested above. Secondly, the finds from ca.

AD 530-600 appear to signal a transitional phase between the old system of scattered land exploitation and the later pattern of intensified use focusing on the eastern part of the hill, although the number of finds is sparse and the picture is proportionally vague when the chronological perspective is refined. Apart from a few outliers, the finds outside the Østergaard settlement mainly seem restricted to a smaller area of 15-20 ha directly north of the settlement. This area was covered by several trial trenches during the 2014 investigation and no traces of contemporary archaeological structures were located here.

The one major area of uncertainty is towards the southwest, near Melleholm c. 2.5 km from the Nørholm village. Throughout the 7th to 14th century the finds in this area are few and scattered, probably therefore reflecting more extensive exploitation of the area. Perhaps, despite being fairly remote from the village, the area was still worth cultivating without intensive manuring due to the nutrients accumulated there by the settlers during the Iron Age (1000 m has been suggested to be the maximum rational distance for the distribution of manure (Hansen 1973, 14)); or perhaps settlement in the area was never completely abandoned, but was simply markedly reduced.

Conclusion

Like all finds removed from their original context and recovered from the turbulent topsoil layers of modern fields, metal detector finds from the ploughzone are an elusive source of evidence, in particular in relation to spatial studies. The quality of the finds from Nørholm is further limited by the varying standards of recording conducted by the private detectorists in the field. Nonetheless, the metal detector finds recovered on the Nørholm hill seem to mirror not just the overall development of the settlement but possibly also to some extent the exploitation of the surrounding landscape during the Iron Age and the Middle Ages.

When they are combined, the detector finds and the rest of the archaeological records outline the spatial development of settlement at Nørholm. Initially during the Roman Iron Age settlements seem to have thrived in two locations situated

1.5 km from one another by the foot of the southern side of the hill away from the fjord. According to the distribution of the detector finds, the western settlement at Melleholm was abandoned or reduced some time during the late 6th century. The eastern settlement at Østergård thrived for a century more and seems to have moved gradually eastwards, presumably along an existing road. Finally, the settlement was moved during the 7th century, probably 800 m to the north to its final destination, where the village of Nørholm is situated today. However, the existence of the previous Iron Age settlements was not completely forgotten. This is indicated by the names of the fields on the 19th century cadastral maps: the entire southern part of the hill carries the name '*Gammel Jord*' ('Old Ground') (Frederiksen 1960, 17).

The widespread distribution of metal finds outside the settlements is most likely a result of the fertilization of fields with waste from the settlements, whereby the areas with a high density of finds probably represent arable land to a large extent. Following this hypothesis, the cultivated fields appear to have covered roughly the same area of 150-180 ha during the 7th to the 13th century, whereas the area of cultivated land seems to have been expanded by 50-100 ha during the following centuries. Although slightly late, this development correlates well with the general impression of a rural expansion in Denmark during the period AD 1000-1250. However, due to the early intensification of agricultural production, the extent of the expansion appears modest compared to estimates of the development in other areas of Denmark where the extent of arable land may have been multiplied by 4-5 during this period (Stenak et al. 2009, 283-301, 288-289). The investigated parts of the Iron Age settlement at Nørholm are too modest to support this decisively. But in the thoroughly investigated areas on the neighboring hills in the vicinity of Aalborg to the east, settlement is remarkably dense (Nielsen 2002; Runge 2009, 165;) and the development of highly stationary settlements at many locations in the region during the Early Iron Age indicates the economic adaptation to high population density as early as 300-100 BC (Lund 1998, 163).

If the suggested interpretation of the metal finds from the ploughzone, and hence the estimates of

cultivated fields is even remotely correct, the development on Nørholm represents a contrast to the results of the most recent comprehensive studies of land exploitation in Iron Age and Medieval Denmark, the 'AGRAR 2000 project' (Odgaard and Rømer 2009). These studies present a general picture of the agricultural development in Denmark during the first millennium AD in which a large proportion of nutrients were presumably derived from animal husbandry and where arable land consisted of fairly small intensely cultivated parts of the infield close to the settlement (Fabech and Ringtved 2009, 166). Even though it is impossible to infer anything about the basic strategy of cultivation, rotation cycles and fallow periods, and even if we consider that there may have been patches of uncultivated land here and there within the vast area of the finds distribution, the extent of the area manured with waste from the settlement during the 7th to the 11th century appear strikingly large compared to the 4-6 ha suggested to be the cultivated part of the 50-100 ha infield of a standard settlement of 4-6 farms from the Viking Age. According to the oldest historical counts Nørholm was the largest village and had the richest soil in the region (Himmerland) in the 17th century. 35 farms with land and 20 units without land are listed and the total size of arable land was at that point in time 860 acres (Frederiksen 1960, 65). No doubt the village at Nørholm was somewhat larger than an ordinary agrarian settlement in the first millennium too, but the large area of cultivated land probably also reflects the practice of an agricultural strategy that relied on cereals grown in the fields to cover a decisive part of the basic diet of the population and perhaps also a strategy aimed at producing a surplus. In short, a development of an extensive open-field system that resembles the one commonly perceived to take place centuries later during the 11th-12th century.

The considerable discrepancy between the estimated extent of arable land presented by Ringtved and Fabech in connection with the Agrar 2000 project and the size of arable land at Nørholm, suggested here, is probably also due to the fact that somewhat less favorable farming areas in Sweden and Norway formed an important inspirational base for the model of agricultural development presented in the 'Agrar 2000 project'. In

relation to densely populated areas in southern Scandinavia with soil of fairly good agricultural quality like the Limfjord region, it might be more beneficial to look for inspiration in, for example England, where the development is characterized by a marked shift towards intensified cultivation of land, including the cultivation of large open fields sometime around AD 700 (e.g. Rippon, Fyfe and Brown 2006; Williamson 2003). Although perhaps visualized better at Nørholm due to unusually intensive metal detecting for almost 30 years, the widespread distribution that characterises the find record from this hill is by no means a unique phenomenon. Most other sites in the region, as well as many sites from other parts of southern Scandinavia, display similar spatial patterns (e.g. Feveile 2014, fig. 3; Henriksen 2002, fig. 6; Trier Christiansen 2008, 102; Ulriksen 1998, 99; Wählin 2014, 148). However, the wide distribution of the finds is rarely considered, and spatial studies of the metal detector finds are generally neglected. The study of the Nørholm material suggests that local spatial studies of the detector finds, even though often on a very rough scale, may be worth the effort, but also that even basic settlement locations and extents may be extremely difficult to deduce solely from the scatterplots of the metal finds from the ploughzone in less well-surveyed areas.

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Notes

- 1 FF refers to the Danish record of sites and monuments <http://www.kulturarv.dk/fundogfortidsminder/>

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Dominating the Landscape – the emblematic Setting of Borgring and the Viking Age Ring Fortresses of Denmark

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ABSTRACT

This study explores the underlying reasons behind the construction and topographical location of the Viking Age ring fortress, Borgring near Køge, and the impact it had on the society on a regional scale. A key question is whether this manifestation of power is also expressing a disruption of the existing power structure in the region. The evidence from Borgring will be compared to the other four ring fortresses as well as other fortifications and large structures of the Viking Age in Denmark. In the end we will propose a new theory explaining that the Viking Age ring fortresses along with other monumental structures dated to the reign of King Harald Bluetooth (ca. AD 958-AD 986/987) represent a symbolic manifestation of a new order of society instigated by the conversion of the King in AD 963. More than being military strongholds the shape, the size and the positioning of the structures in the landscape were premeditated to impress both locals and travellers following important roads throughout the realm and to remind them of the King's presence and his power based on a new ideology.

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Introduction

Since the discovery of the first Viking Age geometrical ring fortress in Denmark in the 1930ties, the size and design have nourished the perception that they have been military fortifications, either suppressing the local population or being strongholds and barracks for soldiers and naval forces (e. g. Andersen 1988; Holst et al. 2012, 494; Nielsen 1990, 145; Nørlund 1948, 160; Olsen and Schmidt 1977, 96; Roesdahl and Sindbæk 2014, 453-462). However, the excavations of Borgring at Køge, Denmark, between 2016 and 2018 (Christensen et al. in prep.; Jessen et al. in prep.; Ljungkvist et al. in prep.; Mortensen et al. in prep.) have prompted a reassessment of the alleged military aspect of the Danish ring fortresses.

The hypothesis of this study is that the Viking Age ring fortresses along with other monumental structures dated to the reign of Harald Bluetooth represent an emblematic manifestation of a new order of society instigated by the conversion of the King in AD 963. The shape, the size and the location of the structures in the landscape were

premeditated to impress both locals and travellers following important roads throughout the realm and to remind them of the King's presence and his reign based on a new ideology.

The study will investigate, if the construction of Borgring and the concurrent manifestation of a new ruler ideology had an impact on the regional society. We will explore the strategic use of the terrain when placing Borgring and compare the evidence with other monumental structures of the late 10th century Denmark. Consequently, we will propose a new theory of the role of the ring fortresses and related constructions (Figure 1).

The Topography of East Zealand

The topography of the region surrounding Borgring varies from relatively flat loamy moraine to a more undulating dead ice landscape with extensive woodlands. To the north of the Køge Stream the topography is characterised by an even, very fertile arable land towards Roskilde Fjord and along the Bay of Køge to the east (Figure 2). To the west and northwest of Borgring there is a pro-

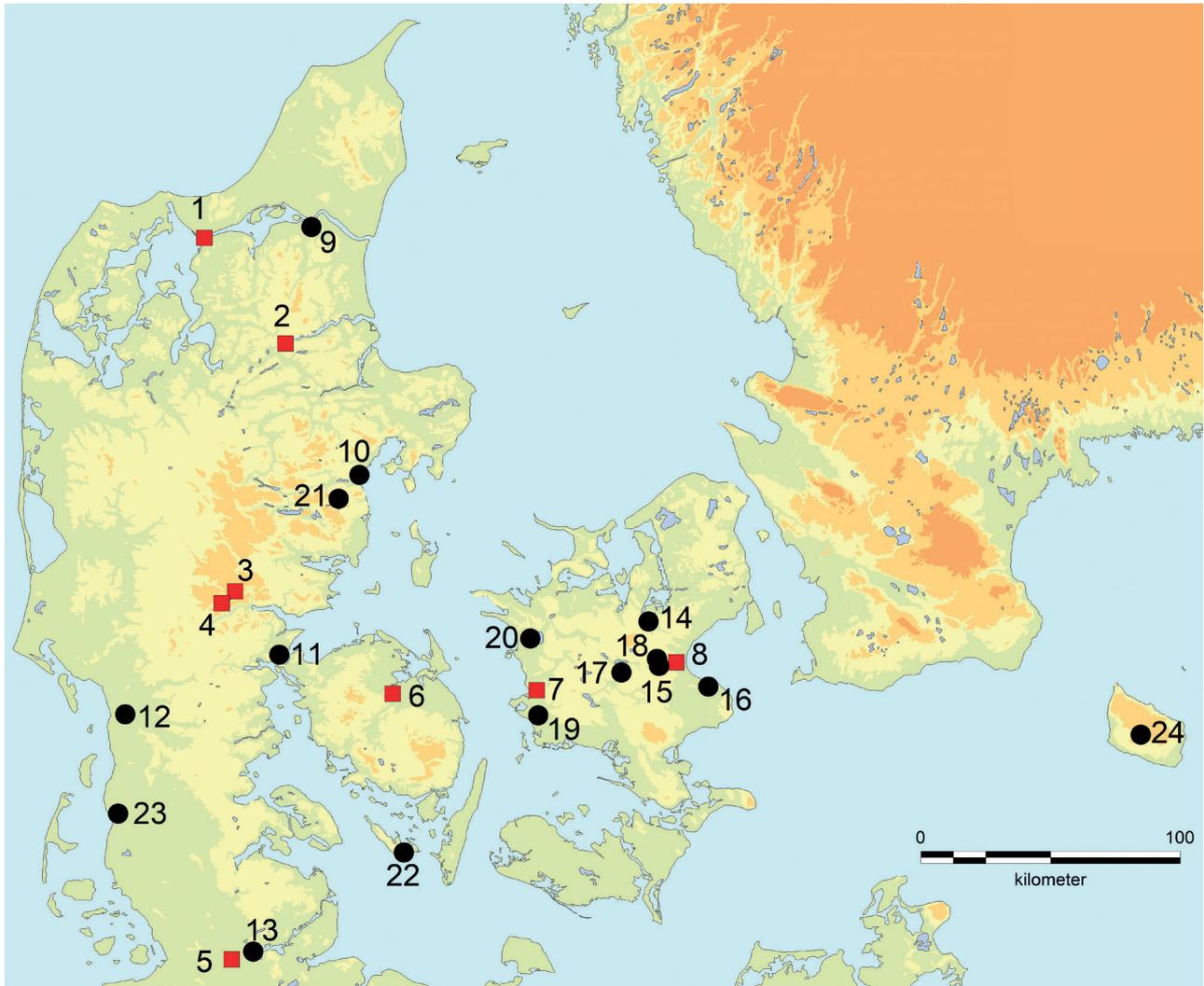


Figure 1. Harald Bluetooth's monumental constructions (red squares). 1) Aggersborg. 2) Fyrkat. 3) Jelling. 4) Ravning Enge. 5) Kovirke/Dannevirke. 6) Nonnebakken. 7) Trelleborg. 8) Borgring. Other sites mentioned in the text (black dots): 9) Aalborg. 10) Aarhus. 11) Erritsø. 12) Ribe. 13) Hedeby. 14) Lejre. 15) Ågård. 16) Strøby-Toftgård. 17) Ringsted. 18) Dalby Sø. 19) Boeslunde. 20) Tissø. 21) Trælborg. 22) Sankt Alberts. 23) Trælbanke. 24) Gamleborg.

nounced dead-ice landscape with numerous pools, ponds and drenched hollows. South of the Køge Stream the terrain is dominated by flat arable land shifting with less dramatic dead-ice profiles in the southeast.

A comparison of pollen records shows a near identical vegetation development in the region from the early Holocene until the Late Bronze Age. The developmental similarities cease in the Late Bronze Age when a massive deforestation is seen on the flat, fertile loamy moraine of eastern Zealand, while the woodlands persist on the hilly inland where it is more difficult to cultivate. Focusing on the period from the late Iron Age until the Early Medieval Period it is clear that the landscape sur-

rounding Borgring was dominated by open grassland (Mortensen et al. in prep. A) (Figure 3).

The Power Structure in Viking Age East Zealand

It seems evident that the establishing of Borgring was a demonstration of power by the King of the Danes. Even though the construction of the ring fortress apparently did not have an immediate and significant influence on the regular settlements (Schultz et al. in prep.), the mark of the Christian king inflicted on the existing structure of power in East Zealand. Both the existing power structure and the transformation of it are reflected in the

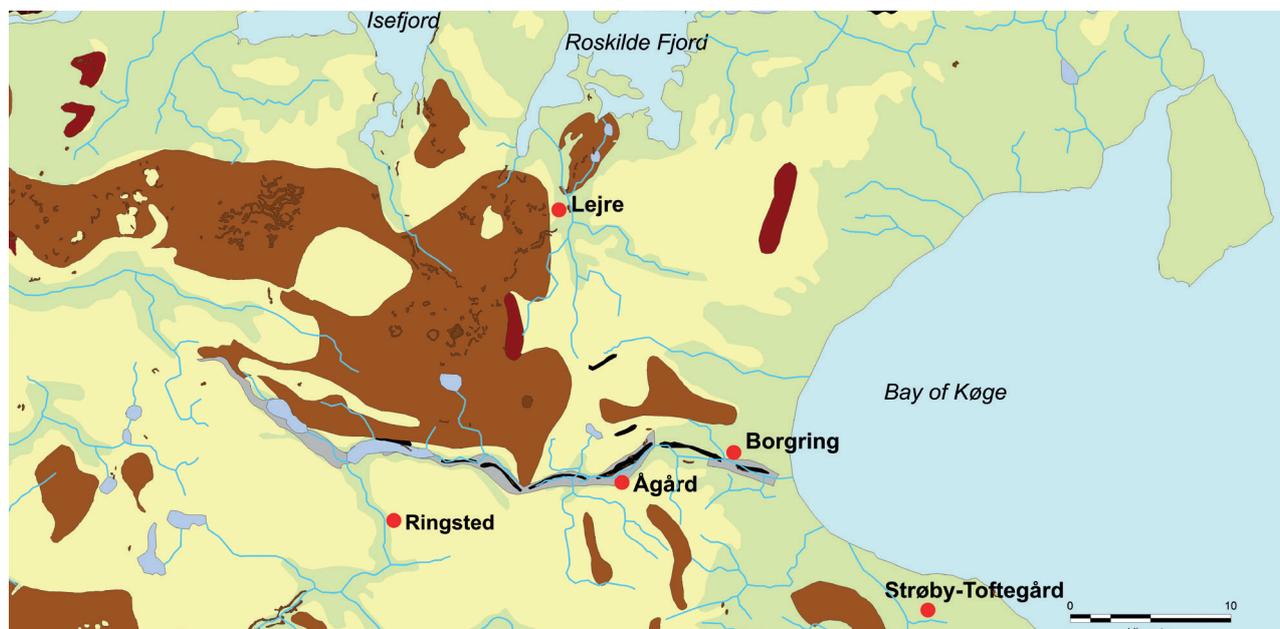


Figure 2. The principal geological surface of central East Zealand. Brown colours: dead ice and lateral moraine. Grey: tunnel valley. Black: esker. Yellow: terrain between 30 and 80 m a.s.l.

two distinctive residential sites of the region, Lejre and Strøby-Toftegård (cf. Figure 2).

Lejre is located 19 km to the north of Borgring and was *the* central place of East Zealand from the 5th or 6th century AD to the late 10th century AD (Christensen 2007 and 2015). Topographically, Lejre sits in a border zone between a fertile and even terrain with numerous settlements to the east and a relatively uninviting and uninhabited pronounced dead-ice landscape to the west (Figure 4).

Lejre is generally recognized as a central cult place materialized by two large heaps of scorched stones mixed with animal bones, which are suggested to be ‘*hörgr*’, i. e. shrines for offerings. In addition, the pronounced dead-ice topography to the west is suggested to have been a ritualized landscape, and at Lejre rich deposits have been revealed at the very edge of the dead-ice area (cf. Christensen 2015; Hedeager 2011, 148-152; Szczepanik and Wadył 2014). The forested landscape may have held cosmological connotations of the sacred grove associated with the gods, initialization and growth symbolism (Schjødt 2003, 212; Steinsland 1989, 170). Separating the contrasting topographies was a stream apparently called ‘*Giofn*’ meaning ‘the Rewarding’, one of several names attached to the goddess Freya. A tributary of the stream springs from the dead-ice landscape while another arm comes from the even and fertile terrain.

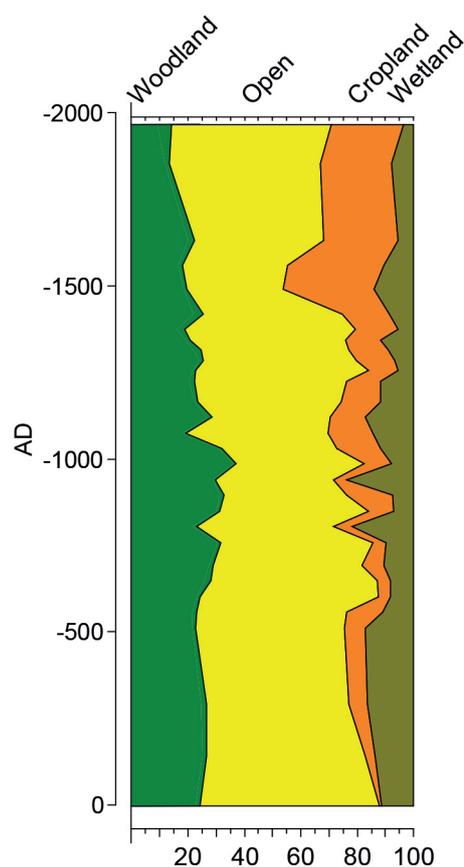


Figure 3. REVEALS modelling of pollen data from Lake Dalby shows the land use over the last 2000 years. The model compensates for differences in pollen production and dispersal between different plant taxa and translates pollen percentage data into regional vegetation composition. The diagram highlights the open grassland that dominated the landscape during the Viking period.

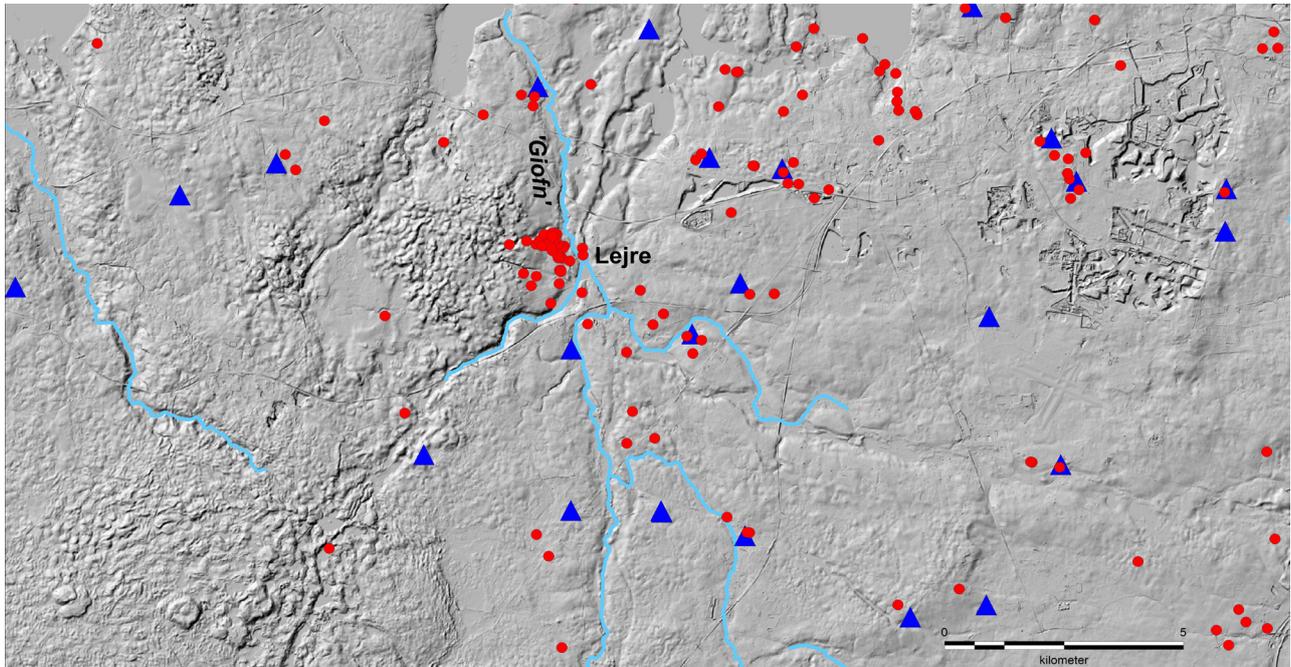


Figure 4. LIDAR map of Lejre and the surrounding area. The pronounced dead ice landscape is visible to the west while the flat, arable land is seen to the east. Dot: Viking Age find spots. Blue triangle: Place names dating from the Iron Age and Viking Age (Background map: © Danish Geodata Agency).

This may have been conceived as if two ‘Worlds’ – the sacred and the profane – were feeding a holy stream passing by Lejre on its way to the fjord. According to the archaeological evidence, the might and splendour of Lejre ended around AD 1000 when the hall and the three-aisled houses were no longer renewed, and at the same time the long tradition of cultic events at the site ceased. Within a century, the ritualized woodland became the scene of forest clearing and establishing of ordinary agrarian settlements.

Strøby-Toftegård is an extra-ordinary site too, situated c. 15 km southeast of Borgring. Even though it did not reach the status level of Lejre, excavations have revealed a magnate’s residence with a series of monumental halls, long houses and pit houses combined with a remarkable find material dating the site from the 7th century until just before AD 1000 (Beck and Schultz in prep.). The sequence of halls is not as long as at Lejre, and the halls themselves are smaller, but constructional details resemble parts of the great residential halls.

In this respect, Borgring was placed in an area situated between two extra-ordinary residential sites with central functions concerning both the sacred

and the profane. Add to this the site of Ågård only 7 km to the west of Borgring (cf. Figure 2). Although ranking at a lower level than both Lejre and Strøby-Toftegård, Ågård is standing out in its own right both in size and continuity as well as in structure and artefacts. Furthermore, constructional details in a number of houses are pointing at a close relation between the three sites.

Lejre, Strøby-Toftegård and Ågård represent three different ranks of power of which the two superior sites lost significance or disappeared in the decenniums just before AD 1000, most likely because of their central position in the pagan cult. The relatively high secular status of the Ågård settlement continued into the Medieval Period being the central village of the shire including a church and an aristocratic residence.

Thus, the introduction of a new ruler ideology in the late 10th century had a profound impact on the upper pagan strata of the society, while lower strata of local aristocracy and landowners were not affected in the same way. How the unseated pagan leaders reacted is hard to say. Neither at Lejre nor at Strøby-Toftegård is any evidence suggesting a violent end to their former status. It was their pagan prominence and meaning that disappeared. It is very likely that they continued to possess their

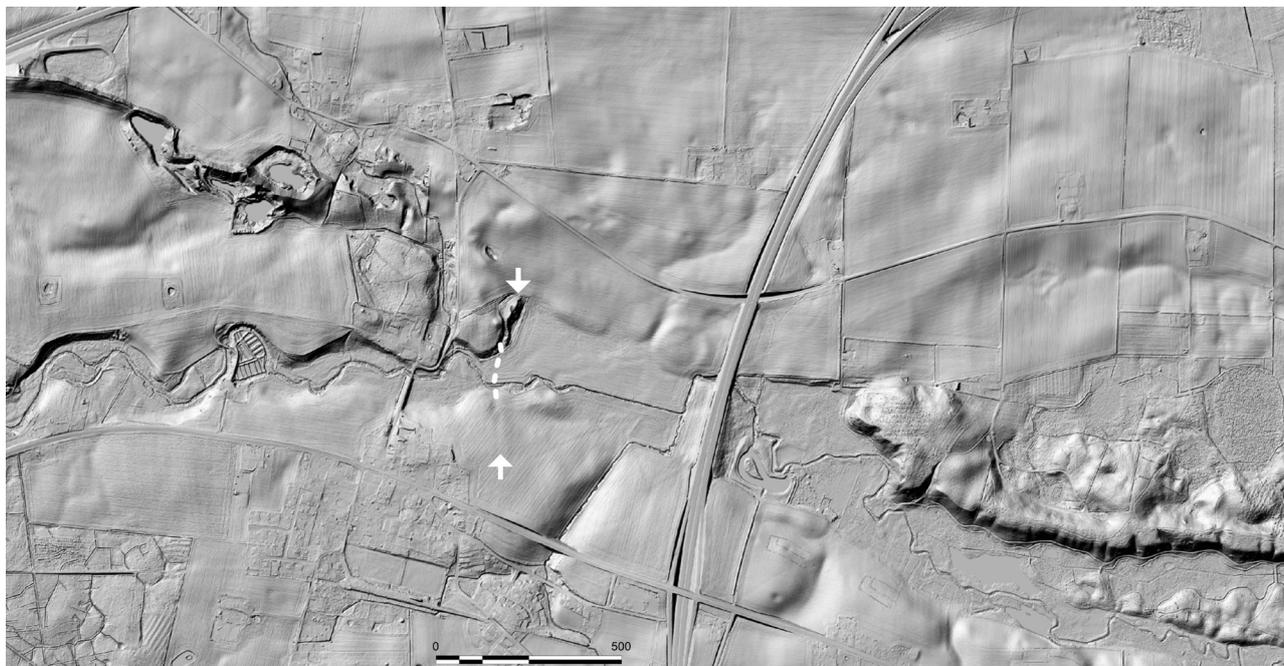


Figure 5. LIDAR map of Borgring (centre) in its topographical environment. The hollow road tracks are between the white arrows (Background map: © Danish Geodata Agency).

domain but apparently at a lower level of excellence and honour.

Locating a Ring Fortress in the Landscape

Borgring sits on the sloping bank of a tunnel valley in-between two parts of an esker running parallel to the valley (Figures 2 and 5). The ring fortress is located in the middle of the nearly 1 km wide gap of the esker presenting itself in a very visible way. The selected building ground for the ring fortress did not meet the required needs of size and a major pre-construction modification of the building ground took place, most of all as infilling to the south and west (Jessen et al. in prep.). Therefore, it is clear that the diameter of the rampart was predetermined. Although the diameter of the different ring fortresses varies, this shows that requirements for the individual fortress were non-negotiable. Apparently, neither was the selected spot for building the fortress.

The importance of this particular position is connected to the Køge Stream valley. A thorough geo-archaeological investigation of the Køge

Stream valley has convincingly shown that the stream was not navigable for vessels larger than a dinghy during the Viking Age (Jessen et al. in prep.). Thus, the position of Borgring was not related to sailing. Instead, the possibility of crossing the stream valley was the crucial point. The issue of a dominating presence at important land based transportation corridors and the perception of the landscape have been decisive factors for the location of Borgring.

Finding a Way

Attempts to recreate a land based transportation network of the past traditionally have had a point of departure in rows of Stone Age and Bronze Age burial mounds allegedly indicating the lines of important roads (Müller 1904). This perception has been combined with Early Iron Age ramparts and Viking Age rune stones (Mathiessen 1971), settlements, fords and the nature of the terrain (Becker-Christensen 1982, 24). Lately, the GIS-generated Least-Cost-Path method to find the 'cheapest' route through a terrain has been applied (Lemm 2013, 297-307). Whatever method, the exact road is often impossible to point out, and

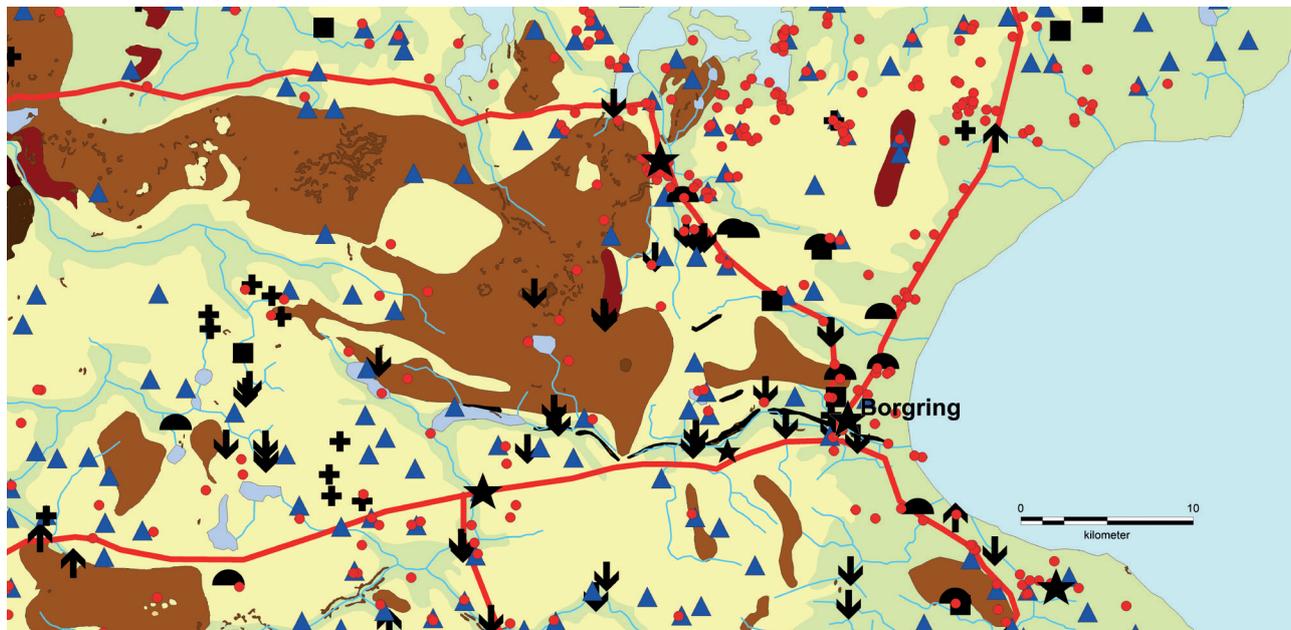


Figure 6. Map showing the principles of pointing out transport corridors (red line) in East Zealand following topography, fords, archaeological finds and place name evidence. Black cross: Place name evidence indicating a sacred place. Hemisphere: Place name including 'mound'. Square: Place name indicating centrality. Blue triangle: Place names dating from the Iron Age and Viking Age. Star: High status site. Arrow up: Documented ford. Arrow down: Ford on late 18th and early 19th century maps. Red dot: Viking Age site or stray find.

unless fords and hollow roads – often undated – specify the track it is more likely that *corridors* of transport may be indicated. In other words, it is not the specific road that is appointed but a probable passage through the terrain.

During the Viking Age, Zealand had no towns as centres and therefore it is assumed that the primary routes connected different regions and magnate's residences. In this study, the suggested lines of the transport corridors follow concrete archaeological locations from villages to stray finds as well as place names dating from the first Millennium AD and particularly place names indicating special settlements or locations related to the upper strata of the society and the religious sphere (Figure 6). Fords are nodal points for the land-based traffic and fords – either documented archaeologically or present on cadastral maps from the late 18th and early 19th century – have been mapped. We cannot be sure that they have all been in use during the 10th century but they indicate the existence of natural preconditions for fording a watercourse. Furthermore, the accessibility of the terrain has been assessed using GIS elevation maps with a 0.5 m contour line, GIS maps screening the steepness of the terrain exceeding 12 percent as well as digitized cadastral and topographical maps from the late

18th and the 19th century revealing drenched areas and wetlands of the undrained landscape.

Approximately 500 m to the west of Borgring, there has been a ford connecting two hollow roads. This crossing is situated where the stream valley changes from being narrow with rapidly flowing water to a wider profile with a very limited gradient of the watercourse. Considering the advantages of the terrain, it is most likely that this stretch of stream valley had been a primary point of crossing the Køge Stream since Prehistory serving as a junction for the main transport corridors. The importance of the ford at Borgring is stressed by the fact that it is nearest to the north-south transport corridor in East Zealand (Figure 7). Flanking this corridor are the 'sacred' place names Vivede ('the wood with the shrine'), Hellested ('the holy place' or 'the place owned by the man called Holy'), Godebjerg ('the hill of the god') and Salby ('the settlement with the magnate's hall/house of the gods'), and there is a concentration of place names comprising the word 'mound', maybe indicating important ancestral burials or sacred places.

Studying the topography in a wider perspective the assumption of a central ford at Borgring finds

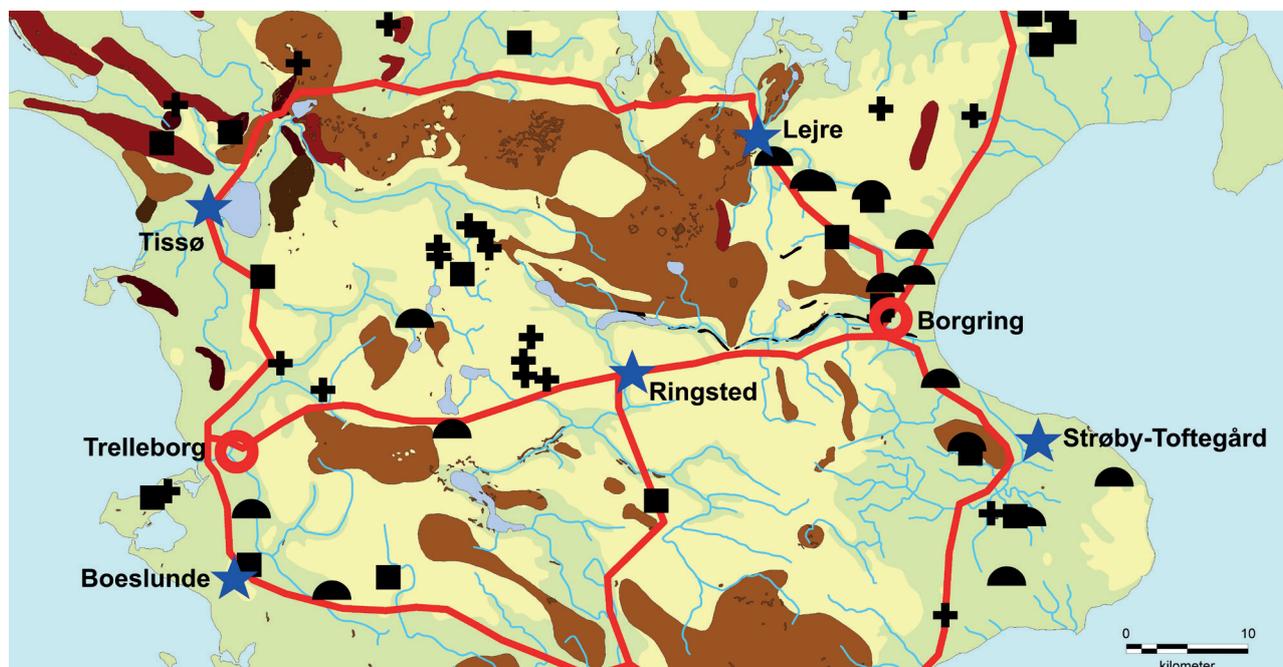


Figure 7. Suggested main transport corridors in Zealand following topography, fords, archaeological finds and place name evidence. Circle: Ring fortress. Cross: place name evidence indicating a sacred place. Hemisphere: place name including 'mound'. Square: Place name indicating centrality. Blue star: High status site including the possible *ting* at Ringsted.

further support. The pronounced dead-ice area of more than 350 square kilometres between the tunnel valley of Central Zealand and the fjord system of North Zealand has not offered the best of conditions for roads. The countless hillocks changing with streams, waterlogged hollows, swamps and lakes offer no easy passing. Neither archaeology nor the place name evidence indicate that the area was used for settlements during the Late Iron Age or the Viking Age. On the contrary, the place names demonstrate that the area was not settled until the 11th century or later.

It seems evident that this terrain formed a barrier between the northeast and the northwest of Zealand, but assumingly with a transport corridor between Lejre and the residential site of Tissø ca. 45 km to the west passing to the north of the dead-ice area.

Considering Central Zealand it is reasonable to suggest that an east-west transport corridor south of the tunnel valley and the dead ice formation existed. For this route to connect with a north-south transport corridor in East Zealand, the ford at Borgring seems to be central in order to avoid the pronounced dead-ice terrain. At the same time, the crossing has been essential for the communication between the high status sites of East Zealand, Lejre and Strøby-Tofttegård. Furthermore, the central

east-west route is passing through or by the 3rd level magnate's site, Ågård, stressing the importance of both the route and the settlement.

Taking a larger part of Zealand into consideration, it is possible to sketch a system of transportation corridors connecting specific sites of high status. In West Zealand, the two sites of Tissø and Boeslunde stand out. Tissø more or less resembles Lejre as a magnate's residence including cultic obligations through ca. 500 years (Jørgensen 2003). Approximately 30 km to the south, the Boeslunde settlement site consists of 11-12 separated archaeological localities within an area of ca. 38 hectares with many metal objects from the Iron Age, Viking Age and Early Medieval Period retrieved in the topsoil by metal detectorists (Nielsen 1997). Only limited trial excavations have so far shed light over the actual structure of the Boeslunde settlement area, but the amount and quality of the metal objects including more Viking Age silver treasures indicates its regional importance.

In East Zealand, Lejre and Strøby-Tofttegård equal the situation of Tissø and Boeslunde. Thus, in each region there is a superior residential and cultic site connected to a site of slightly minor importance. The two superior sites are mutually connected by the northern transport corridor, and the

central east-west route connects the regions of East and West Zealand. In the centre of the latter route, we find Ringsted. Here, the *ting* of Zealand was held in the early 12th century at the latest, and both the King and the bishop of Roskilde clearly had serious interests in Ringsted in the 11th century (Ulriksen et al. 2014, 174). Whether this position had its roots further back in time is not known. At Ringsted the central transport corridor crosses the Ringsted Stream on its way between the Great Belt and the Bay of Køge. This system of transport corridors connecting high status settlements may have been the situation for several hundred years. The importance of the network is stressed by the fact that the King added the ring fortresses Borgring in the east and Trelleborg in the west, both located on strategic points in the transportation network between the traditional pagan magnate's residences. The aim has not been to block the communication between the residential sites, farms and villages. Instead, this has been an effective way for the King to stress his power, presence and domination in a landscape including the traditional main junctions of transportation on Zealand. Considering East Zealand, the junction at Borgring may even have been perceived as a part of a ritualized main route serving the leaders of the community travelling to gatherings and religious feasts at Lejre. Even though it is difficult to substantiate specific perceptions of the landscape in a pagan society 1000-1500 years ago, it is possible that the transport corridor between Strøby-Toftegård and Lejre is heading ever closer to the mysterious and sacred landscape embodied in the pronounced dead-ice terrain, partially following the stream originating in the fertile settled landscape until it meets the stream of *Giofn* coming from the 'Other World' (cf. figure 4). Following this argument, the location of Borgring is far from coincidental. On the contrary, the ring fortress dominates the important ford on the main route between the two primary pagan sites of East Zealand. It is important to notice that by the end of the 10th century, the great halls of both Lejre and Strøby-Toftegård were no longer rebuilt, and the former importance of these high-profiled pagan locations evaporated. It may not have been Borgring in turf and timber that was so intimidating in itself, but it is a symptom of the change in fundamental ideological and religious

beliefs as well as power bases in the late 10th century. In fact, the same situation was unfolding in West Zealand, where the King's ring fortress of Trelleborg was located on the transport corridor between Boeslunde and Tissø. Thus, it is no coincidence that Trelleborg and Borgring dominated each end of the east-west transport corridor crossing Central Zealand.

The topographical Situation of Iron Age Strongholds and Viking Age Ring Fortresses: a Comparison

In order to fully understand the idea behind the Viking Age ring fortresses it is expedient to compare their design and location with concurrent strongholds or fortifications. Regarding the identified strongholds of Viking Age Denmark, they are only few and have rarely been subject to modern excavations. They are found in different shapes and sizes and their topographical situation varies too (la Cour 1972). Some consist of a rampart of earth and sods and perhaps a moat in front of it demarcating the landside of an area that is typically bordered naturally by a stream or gorge or both to the other sides as seen at Trælborg close to Hørning, Jutland (Heijnis 2018). Others have a coherent rampart enclosing the inner space of a stronghold with access through a single gateway. This type of fortification is mostly located on hilltops or at the rim of a promontory exploiting the natural slopes on as many sides as possible. Subsequently, the terrain has a definite consequence on the outline of the earthwork bordering the inner space of the stronghold. Examples are Hochburg at Hedeby in Schleswig (Kalmring 2018) and Gamleborg in Almindingen on Bornholm (la Cour 1972, 23) (Figure 8). Differing from this topography is the position of the moat and rampart at Sankt Albert on the island of Ærø, situated on an eroding cliff facing the sea (Heijnis 2018, 40; Skaarup 2005, 248). In the flat marshlands of South Jutland is the ring-shaped but undated rampart of Trælbanke that basically resembles the location and lay-out of fortresses from the North Frisian Isles of Sylt and Föhr dating from the Viking Age (Segschneider 2009), but neither are perfectly circular or have four symmetrically positioned gates in the cardinal points of the compass.



Figure 8. The location and topography of Gamleborg, Bornholm (LIDAR map combined with ortophoto. © Danish Geodata Agency).

Somewhat different from these fortifications are the semi-circular ramparts with moats in front of them enclosing the Viking Age trading places Hedeby (Andersen 1998, 133), Ribe (Croix et al. 2019) and Aarhus (Jantzen 2013, 63). To begin with, these sites related to trading and seafaring did not have a fortification. It is a feature added at a point in time when needed. Thus, the location was dictated by other objectives than the fortificatory ideals.

Considering the topographical position of Borgring, the ring fortress sits on the somewhat uneven terrain of a minor promontory projecting

into the stream valley at 4-10 m a.s.l. surrounded by higher grounds of 14 m to 23 m a.s.l. In other words, Borgring was located with a high degree of visibility in an open space at the same level or lower in the terrain than the immediate neighbourhood. As stated above the building ground was not large enough to meet the demand of the desired diameter of the rampart, so a modification of the terrain was required. Looking for an alternative place to construct a fortification would have been to build a rampart along the rim of the hilltop 500 m to the west overlooking the ford across the Køge Stream (cf. figure 5). The de-

fensive values would have been at least equivalent to those of Borgring, and there could even have been more space inside the rampart. Instead, the open low-lying location was preferred.

Comparing the features of Borgring to the topographies of the other ring fortresses, there are some similarities.

Trelleborg was built with a fairly high visibility on a low-lying promontory 5.5 m a.s.l. between two streams, previously the scene for a Viking Age cultic site (Jørgensen 2009, 329-330; Nørlund 1948, 38-44). The surrounding terrain elevates between 8 m and 12.5 m a.s.l. As at Borgring, it has been necessary to extend the existing terrain in order to get enough space for the diameter of the rampart. Alternative defensive measures could have been a rampart across the promontory in the same way as chosen at Trælborg, near Hørning. There was an important ford at Pinemølle 1.6 km to the west of Trelleborg crossing the Tude Stream in a north-south direction most likely being part of the transport corridor connecting Tissø and Boeslunde (Christiansen et al. 1989; Nørlund 1948).

Nonnebakken holds most of the same characteristics as Trelleborg considering the terrain and visibility, even though the promontory is less evident. Here, it was also necessary to add soil before building the rampart in order to gain the necessary space (Runge 2018, 47). The ring fortress is situated 11 m a.s.l. on the lowest part of a hillside sloping from 19 m a.s.l. towards the Odense Stream, just opposite the budding urban site of Odense. The name 'Odense' means 'the sanctuary devoted to Odin' (Jørgensen 2008), but it is uncertain exactly where the sanctuary was located. On the northern side of the stream a settlement developed during the Viking Age and in 988, Odense became the first bishopric in Denmark outside Jutland (Runge and Henriksen 2018). The main road crossing the island of Funen from east to west is passing through Odense. One of the roads connected to it comes from the south and follows the rim of the stream valley into Odense opposite Nonnebakken and another road from the southeast enters the town crossing the stream ca. 700 m east of the ring fortress.

None of the ring fortresses presents itself more prominently than Aggersborg. The importance of the location is witnessed by the initial demolishing

of an existing large and wealthy settlement before construction of the ring fortress on the site. From the top of the hill 600 m behind and 10 m above the ring fortress, the ground is sloping towards the Limfjord. The diameter of the rampart is twice the size of Fyrkat and the gradient of 5-6 percent inside the rampart presents the ring fortress to the spectator looking from the south. Aggersborg was a dominating feature at the important crossing of the Limfjord, and at the same time overlooking the equally important fairway shortcutting the hazardous sailing route around the Cape of Skagen.

The location of Fyrkat stands out on the narrow promontory projecting into the stream valley (Figure 9). Despite this, the promontory is actually situated lower than the surrounding sides of the stream valley (cf. Olsen and Schmidt 1977, 35, Figure 21). As at Borgring, Nonnebakken and Trelleborg, it was necessary to supply the building ground with additional levelling before constructing the rampart. Alternatively, it would have been possible to build a 'hillfort-like' rampart following the edge of the promontory secluding an area larger than the ring fortress. Previously, it has been suggested that the position of Fyrkat was chosen for its defensive/fortificatory qualifications (Olsen and Schmidt 1977, 37). Reassessing the information on Fyrkat on the background of the topographical setting of the other ring fortresses, the north-south crossing of the stream valley may have been a *raison d'être*. A crossing would have been possible by the reinforced but undated ford at Gammel Onsild Bro ca. 2 km to the west, from where the rampart of Fyrkat is visible (Figure 10). Most likely, crossing may also have been possible by means of a ford immediately east of the ring fortress. Here, a road and ford dated to the Viking Age has been excavated in the stream valley (Haue and Dobat 2013, 93). Additionally, in the outskirts of the modern town of Hobro, there are indications of hollow roads in the sloping sides of the stream valley, where it narrows in to less than 200 m just before it flows into the Vesterfjord. From here, Fyrkat is clearly visible. During the Medieval Period, the stream could be crossed using a bridge nearby, but it is unknown, if it existed in the 10th century. However, the bridge emphasizes the importance of the north-south bound transport corridor going southwards to the Randers area by the River Gudenå with rich Vi-

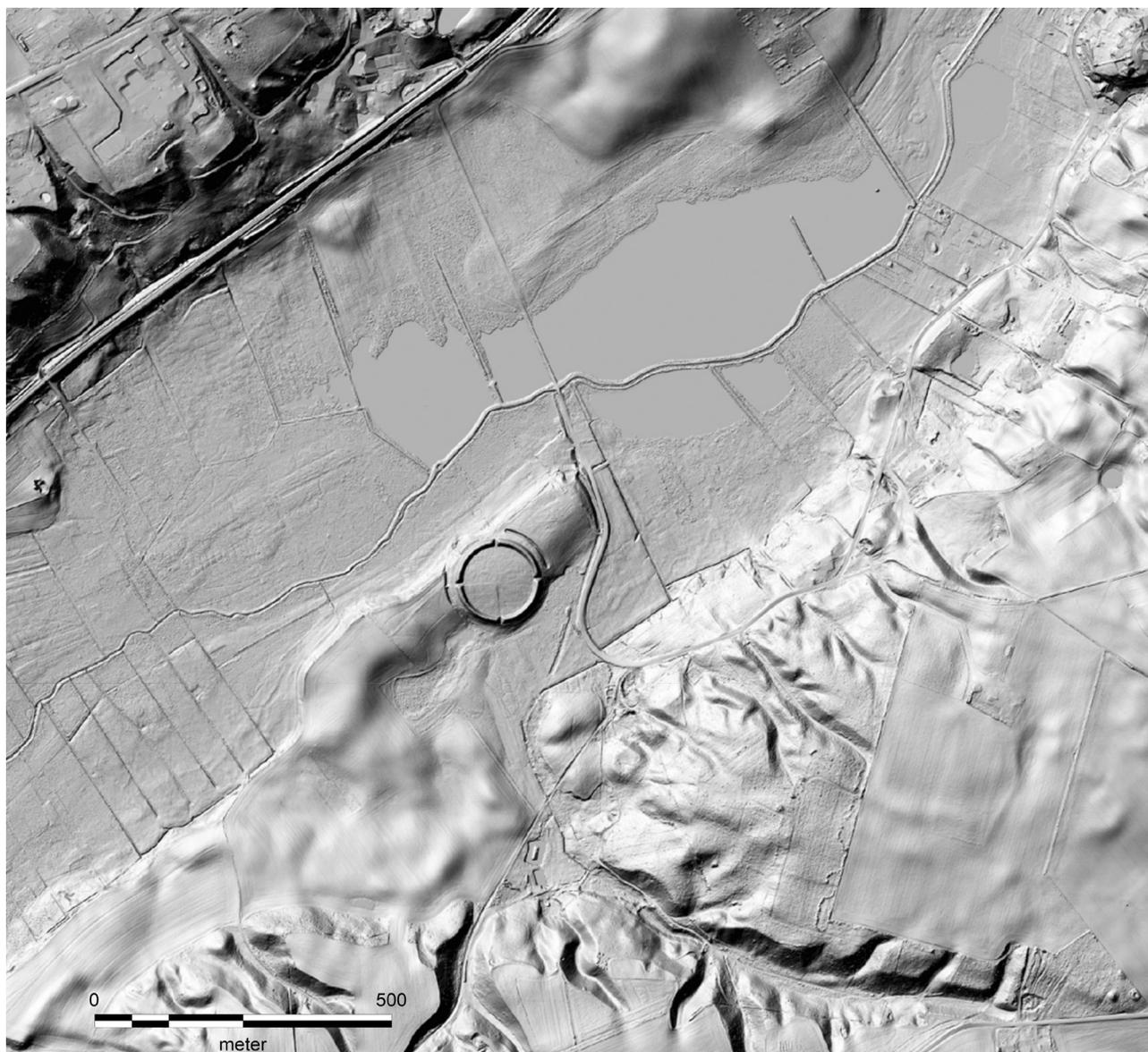


Figure 9. LIDAR map of Fyrkat (centre) (© Danish Geodata Agency).

king Age burials (Nielsen et al. 1985, 1986; Pedersen 2014, Kat. 205, 210, 229, 247, 248 and 249; Stidsing 2016). To the north is Aalborg at the Limfjord, already a landing site in the Viking Age and a significant crossing point in the eastern part of the Limfjord. The important crossing point in the central part of the Limfjord could be reached in the northwest at Aggersborg. On the north side of the stream valley, a Viking Age burial place was excavated at Hørby Skoleby. Among the graves was a woman interred in a wagon body indicating a high status person. The place name of the nearby village Hørby means either 'the settlement with/by the stone heap' i.e. a *hörgr* or 'the settlement where flax is cultivated' (Jørgensen 2008). A few kilome-

tres south of Fyrkat, the transport corridor is passing a settlement originally called Onsild meaning 'Odin's shelf/rack', presumably referring to a construction connected to the worshipping of Odin (Jørgensen 2008). In the present day village of Sønder Onsild, eight Viking Age burials have been excavated, one of which also contained a female interred in a wagon body (Roesdahl 1978). Just outside the village to the northwest is a mound called Odinhøj ('the mound of Odin'). No Viking Age burial has been found in the particular mound, but due to the oldest written form of the name, it is believed that it belongs to the Viking Age (Olsen and Schmidt 1977, 35-36.). From here, the transport corridor enters the more than

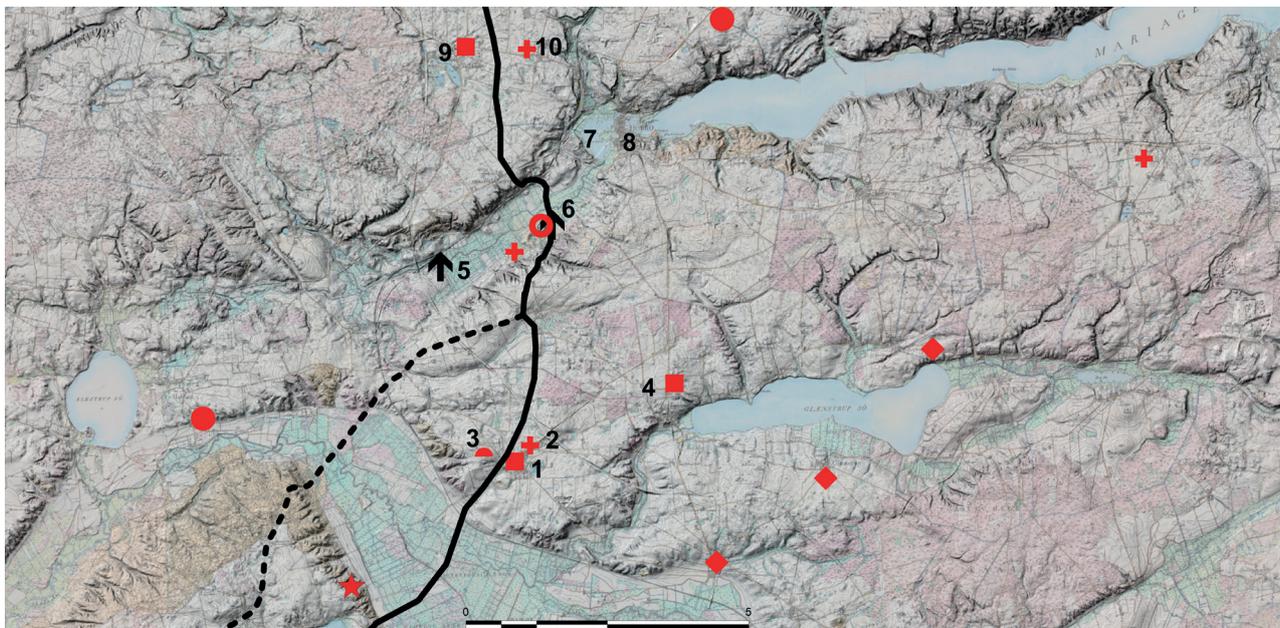


Figure 10. The topography, transport corridors and Viking Age finds around Fyrkat. 1) Sønder Onsild. 2) Burial place Sønder Onsild. 3) Odinshøj. 4) Karlby. 5) Gammel Onsild Bro. 6) Ford by Fyrkat. 7) Vesterfjord. 8) Town of Hobro. 9) Hørby. 10) Burial place Hørby Skoleby. Star: Deposited tool box. Lozenge: Rune stone. Cross: Burial. Dot: Stray find. Black line: Suggested transport corridor. Dotted black line: Suggested route by Olsen and Schmidt (1977, 38-42) (Background maps: © Danish Geodata Agency).

1.5 km wide stream valley of Skals Stream through a gentle slope. Not far from the hollow road up the valley slope on the other side, a tool box was deposited in the second half of the 10th century (Lund 2006, 325). Furthermore, rune stones have been found some kilometres to the east around the lake, Glenstrup Sø, while the place name Karlby on the north side of the lake means ‘the settlement of the men’ (Jørgensen 2008). Some scholars have interpreted these ‘men’ as members of the King’s retinue (Brink 1999, 425; Dobat 2011). All these elements indicate a high status area in the centre of which the ring fortress of Fyrkat was located right on the transport corridor.

To be or not to be geometric

In the account of Borgring and its sister fortresses above, there has been an emphasis on the fact that the shape and specific diameter was chosen before the selection of the building ground and that neither was negotiable. Even though the surrounding area may have offered other topographically obvious possibilities for a fortification, the selected location was imperative. Additionally, the con-

struction of the ring fortresses was well-planned, well-organized and well-executed.

Basically, there is no contradiction between this approach and a sheer fortificatory point of view. On the other hand, the preference of high visibility and a low topographical situation compared to the immediate surroundings does not increase the defensive capacity. Neither does the installation of four gates instead of just one. The extreme focus on the geometry and topography of the ring fortresses carries the mark of more than a defensive martial objective.

In Denmark, there are other large-scale structures with a geometric design ascribed to the rule of King Harald Bluetooth. In Jelling, Jutland, is the legendary burial monument of Harald’s parents, King Gorm and Queen Thyra, accompanied by the rune stone of King Gorm commemorating his wife, and Harald’s rune stone commemorating his parents and the deeds of Harald himself. Recently, excavations have revealed a massive palisade of oak with four ca. 360 m long sides forming a rhombus encapsulating a ca. 360 m long ship shaped stone setting and two large mounds (Holst et al. 2012). Dendrochronology indicates that the rhombus was built between AD 958 and

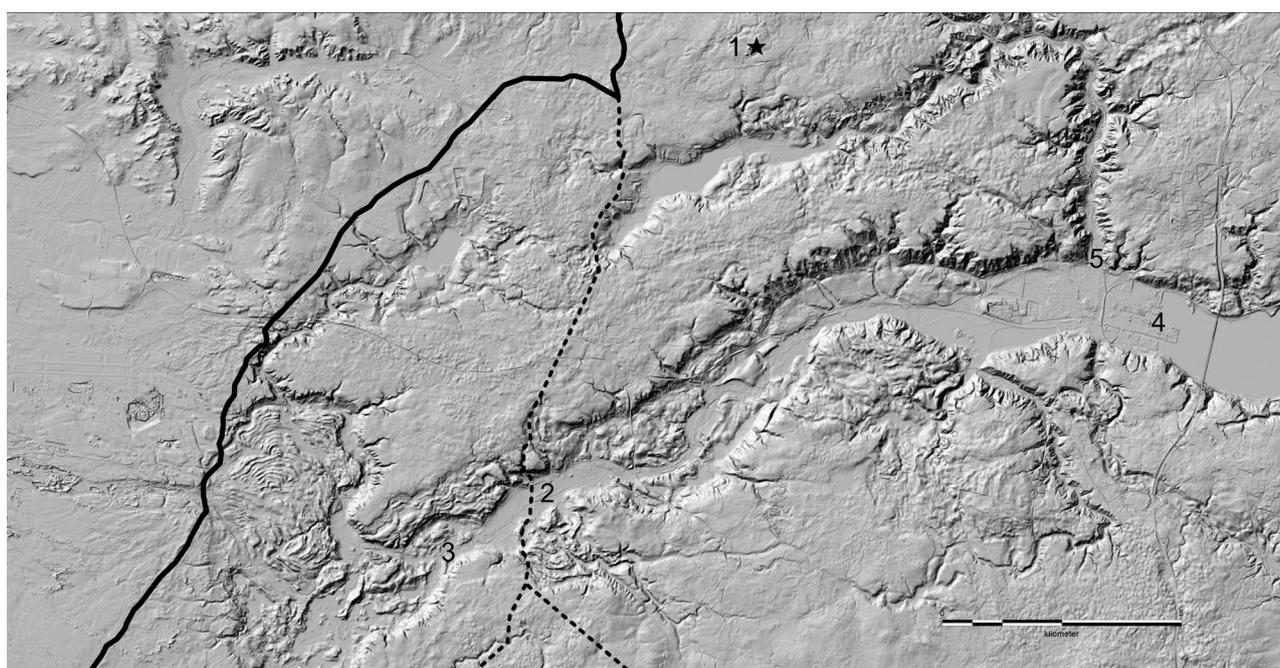
985, most likely around the year AD 968 (Jessen et al. 2014, 14).

At Raving Enge, some 10 km to the southwest of Jelling, a ca. 760 m long oak bridge is another impressive structure from the era of Harald Bluetooth (Jørgensen 1997). The bridge was ca. 5 m wide and formed a straight line across the Vejle Stream valley. Timbers are dated to AD 979 or 980 by dendrochronology. At both ends of the bridge, heavily worn hollow roads are making their way up the steep slopes of the valley. Excavations have not revealed traces of an earlier ford, even though the Roman Iron Age fortification of Troldborg Ring at the top of the northern rim of the stream valley holds a strategic position for controlling a crossing at this point. Instead, it has been suggested that the primary ford in the area was located at Kolborg some 2 km to the west of the Raving Enge bridge (Jørgensen 1997, 83). From time to time, the Kolborg ford was reinforced with stones, branches and timbers and dendrochronology indicates more building phases during the 3rd-6th centuries AD, the 9th-10th centuries AD and in the 14th century AD (Deichmann and Lindblom 2011). The hollow roads leading to the Kolborg ford are not as worn as at the Raving Enge bridge, but this can be due to differences in preservation.

Speaking of roads, it is conspicuous that the primary ancient transport corridor of Jutland, Hærvejen (in Medieval terms 'the public road'), is passing by Jelling ca. 2.5 km to the west and from there makes a noticeable turn to a westerly route in order to avoid the Vejle Stream valley (Mathiessen 1971, 49) (Figure 11). Hærvejen as a subject is traceable in the written records from the Medieval Period but it is assumed that it has its roots in Prehistory. Burial mounds tend to indicate the line of Hærvejen in some areas of Jutland including the Jelling area, but it is also clear that the direction of the road could change through time from the Bronze Age to the Viking Age (Becker-Christensen 1982, 20 and Figure 72). If Hærvejen had its course across the Vejle Stream valley during the Viking Age it may have been at the Kolborg ford or at Raving Enge.

It has been suggested that the Raving Enge bridge was constructed in order to secure the supply line to the border at Danevirke, where tensions were building up between the Danish king and the East-Frankish King Otto II in the 970ties (Jørgensen 1997, 86). If supply lines from Central East Jutland were of the essence in relation to the situation at Danevirke a hundred kilometres away it is difficult not to consider Hærvejen as fit for the task. Even though crossing the Vejle Stream valley

Figure 11. The topography around the Raving Enge bridge. 1) Jelling. 2) Raving Enge bridge. 3) The Kolborg ford. 4) Vejle Fjord. 5) Grejs Stream valley. Black line: Hærvejen. Dotted line: the probable route using the Raving Enge bridge (Background map: © Danish Geodata Agency).



is a short cut it is no more than 5-10 km gained and in that case, the ford at Kolborg offered the necessary facilities.

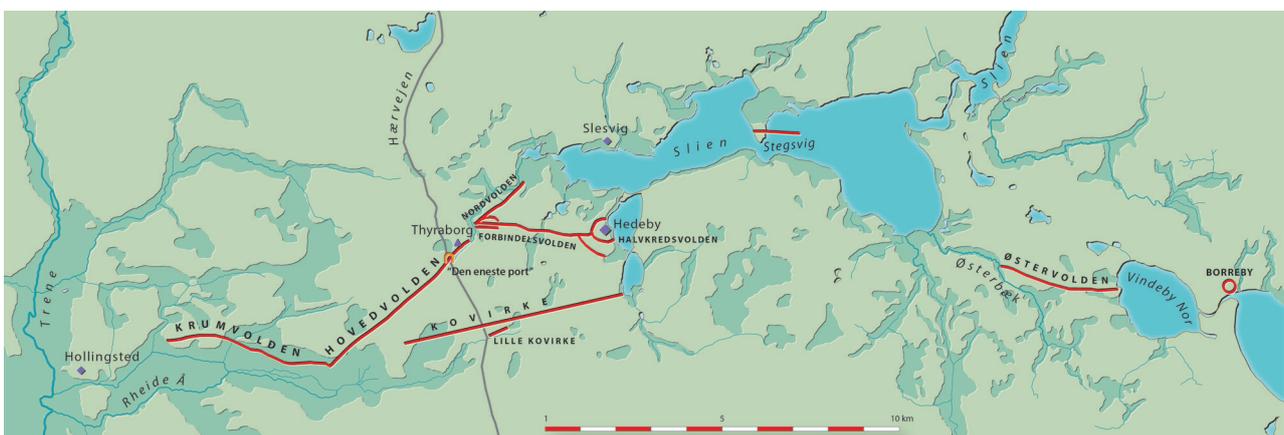
Instead, the Raving Enge bridge may have invited the transport between the trading site of Aarhus and the south-eastern part of Jutland, and travellers crossing from Funen to Jutland going north may have followed a transport corridor passing Erritsø (cf. below) to Raving Enge and circumventing the extremely steep sided valley of Grejs Stream between the Vejle Stream valley and Jelling (cf. Figure 11). The time of building of the Raving Enge bridge coincides with the existence of the geometrical ring fortresses and so does the meticulous precision and skill in the robust construction. Likely, the purpose was to impress people travelling between locations of importance in East Jutland and the link to the rhombus palisading the royal graves of King Harald's parents is evident.

Also at the Dannevirke fortification, Harald Bluetooth has put his mark. The fortification line dates back to the Migration Period at the least, and has been expanded several times (Tummscheit and Witte 2018). In the 10th century it consisted of a sequence of ramparts 17 km long – most of them interconnected – that practically functioned as the border line across the root of the Jutland peninsula (Andersen et al. 1976; Andersen 1998). The ramparts of Dannevirke take advantage of the fortificatory lines of the terrain in order to secure the passageways between wetlands, lakes and streams.

Thus, the lines of the ramparts are organic and modelled by the terrain in which they are implemented. In contrast to this, is Kovirke, a ca. 6.5 km long rampart and moat forming a completely straight line between the wetlands along the Rheide Stream and the innermost part of the fjord Schlei, Selk Nor (Figure 12). The ca. 7 m wide rampart was built of soil dug up from the moat with a V-shaped cross section in front of it and the front of the rampart was clad with a timber palisade. A 4 m wide gateway with two rows of posts as walls has been excavated. The dating of Kovirke to the 10th century rests on ¹⁴C-dated charcoal found in the postholes from the palisade, but it has been suggested that the rampart was built in the last quarter of the 10th century because of constructional similarities with the ring fortresses (Andersen 1998, 167; Erlenkeuser 1998, 193-194; Dobat 2008, 42). In accordance with the other structures ascribed to Harald Bluetooth is in particular the strict geometric design and the V-shaped moat. Also the construction of the palisade and gateway resembles that of the ring fortresses. Furthermore, the selected locality for the geometric figure of Kovirke is in front of the main system of ramparts of the border zone built through centuries. Indeed, it follows the intention of exclusiveness and visibility, where people travel – and where the forces of the East-Frankish King may have mustered before an attack.

Denmark holds other monumental constructions from the Viking Age, which are definitely spectacular but do not have an explicit focus on

Figure 12. The complete fortification line of Dannevirke. Kovirke is the straight long line to the south. Map by Jørgen Andersen, Museum Sønderjylland (after Tummscheit and Witte 2018, Figure 1)



geometry and symmetry. Examples of Viking Age fortifications not belonging to the geometrical ring fortresses have been mentioned above and in short they take different shapes and are situated in varying topographies. Aristocratic sites with substantial palisades are known from both Zealand and Jutland, but it is debated, whether they are to be understood as defensive measures or if they are 'just' exclusive to the surroundings.

At Lejre, a nearly 1 m deep trench for a palisade is framing an area of ca. 2.6 hectares including the hall and other buildings dating from the 8th century (Christensen 2015, 76 and 85). The shape of the palisade was four-sided but far from geometrical.

At Tissø the residential area of 1 hectare in the 6th century to 2.5 hectares in the 10th-11th century was fenced from the beginning to the end, but there was neither a fortificatory motive nor was there any desire for geometry (Jørgensen 2009, 338).

The same pattern of late Viking Age magnate's residences enclosed by fences but without a geometrical design are known from Lisbjerg (Jeppesen and Madsen 1990), Vorbasse (Hvass 1980) and Gammel Hviding (Feveile 2014, 76), all in Jutland.

In contrast to this, is the recently excavated magnate's residence at Erritsø on the east coast of Jutland. Excavation has revealed a square of 110 by 110 m defined by a palisade with a 1.6 m deep V-shaped moat in front of it (Ravn et al. 2019). There are no preserved traces of a rampart, but it is assumed that at least the dug-up fill from the moat has been placed behind the palisade. Inside the square is a large 34 m by 12 m main building connected to a fenced-in special area including a smaller house resembling the situation at Lejre and Tissø. ¹⁴C-datings tend to place Erritsø in the 8th-9th century. Obviously this is older than the reign of Harald Bluetooth, and it makes it even more striking that Erritsø holds at least two characteristic features of late 10th century royal construction work: the palisade forms a geometric square and the moat has a V-shaped cross section just like Kovirke and the ring fortresses. Add to this the prominent and visible location in the terrain overlooking both an important fairway of the Little Belt and an equally important crossing of the same fairway between Funen and Jutland. Separated in

time, though, Erritsø stands alone and premature in the Early Viking Age.

Summarizing the large-scale constructions of the 10th century AD and comparing them to corresponding structures from the First Millennium AD, it is clear that a group characterized by a geometrical design dated between AD 968 and 981 stands out. Each structure in this group exudes premeditation, organization and skilful execution and they are all situated at strategically critical spots in the communication system of roads, fairways and crossings. Together they indicate a comprehensive plan covering the Kingdom of Denmark aiming at executing the sensation of royal presence in a prominent and dominating way. On Zealand, Trelleborg and Borgring were located on main routes. On Funen, Nonnebakken both dominated the communication across the island, the pagan cultic site and the budding town of Odense. In Jutland, Aggersborg was overlooking the crossing and the fairway of the Limfjord, while Fyrkat sat on the main road in a high-status loaded area between important locations like Aarhus and Aalborg.

The monuments in question are constructed within a relatively short span of time – 10 to 15 years – and they all lost their significance shortly after they were built. Among the ring fortresses Aggersborg, Fyrkat and Borgring seem to have only been partly finished (Ljungkvist et al. in prep., Olsen and Schmidt 1977, 76; Ulriksen 1990), and Fyrkat, Trelleborg and Borgring all bear witness to partial damage by fire (Ljungkvist et al. in prep.; Nørlund 1948; Olsen and Schmidt 1977), and at least parts of the palisade at Jelling were burned too (Jessen et al. 2004, 19). None of the fortresses were ever rebuilt, Kovirke was never repaired (Andersen 1998, 168) and there are indications that the Raving Enge bridge may have lasted less than 5 years (Jørgensen 1997, 82). On the basis of the existing evidence, it is not possible to verify whether the simultaneous collapses coincided with the violent death of Harald Bluetooth in AD 986 or 987. However, if the observation concerning the duration of the Raving Enge bridge is accurate the fall of king and bridge is overlapping. It is therefore feasible that there was a direct link between the death of Harald Bluetooth and the collapse of the symbols of the newly established power structure.

The only signs of repair and secondary building activity are found at Trelleborg, an incident dated to AD 981 (Nielsen 1990). After AD 986/987 it seems like no one had much interest in maintaining the structures. The vision behind them obviously lost its meaning. Inside the rampart and in the gateways of Trelleborg and to some extent at Borgring, there is evidence of a short-lived 'after-life' in the 11th century that clearly differs from the original design and idea (Christensen et al. in prep.; Ljungkvist et al. in prep.; Nørlund 1948).

A Conclusion and a Theory

The hypothesis of this study is that Borgring was built, not merely as a military defensive controlpost/fortress, but specifically as a symbol of royal power with the purpose of applying a significant impact on the society in the region. The analysis of the aristocratic sites around Borgring shows that Lejre, the residential manor of a king and a central pagan cult site for ca. 500 years, ceased to exist around AD 1000. Within the same narrow time frame the magnate's residence of Strøby-Tofttegård met the same destiny. Even though we cannot produce exact archaeological or dendrochronological dating of the downfall of the two important pagan locations, the evidence strongly indicates a connection between their fate and the introduction of Borgring and a stronger and Christian royal power.

Borgring itself could not have been constructed at a more central location in late 10th century Eastern Zealand. Here, the extra-ordinary design was at display on a scene, which had been prepared carefully beforehand by moving more than 1900 cubic metres of soil to the site.

The visibility, the excellence and the dominance of main transportation corridors tie the idea of the ring fortresses together. Other Viking Age fortifications like Gamleborg, Trælborg and also the Iron Age rampart Troldborg Ring seem to have been constructed at important roads too, but their way of using the topography differs from the ring fortresses by holding hilltops. The fortified trading places are focused on navigability and their defence works are secondary and therefore conditioned by the terrain in a different way than the 'hillforts'. The linear structures of Kovirke and the Raving

Enge bridge and the rhombus of Jelling share the constructional stringency and topographical significance with the ring fortresses and they all belong to the same decades of the reign of Harald Bluetooth. Kovirke and the Raving Enge bridge also share the fact that their functional capacities were already taken care of or could have been achieved in an easier and even better way in the close vicinity. It is equally important to note that after the death of Harald Bluetooth these specific monuments were abandoned.

These observations witness a building programme instituted by an unprecedented geometrical design mirroring a vision of the King in order to put his explicit mark on his realm. The constructions clearly differ from the traditional structures and magnate's residences with roots in the Iron Age society and point towards a new era. For King Harald Bluetooth the initiation must have been his baptizing in AD 963 (Gelting 2010, 106).

Why Harald turned away from the Pantheon of Norse mythology and received baptism at this point in time is still debated. Faith is a possibility, of course, but there is no reason to doubt that he has observed ideological, political and maybe even economic advantages in the Christian order of society (cf. Gelting 2010, 123; Randsborg 1980, 21-22; Sawyer 1982, 139; Steinsland 2000, 95, 147). It is also probable that during the two decades between Harald's baptism and his death he attempted to implement the different elements of the new order by means of a firm power base throughout his realm. His progress and rate of success is difficult to estimate. The sentence on the rune stone of Jelling '... won the whole Denmark for himself...' (translation from Holst et al. 2012, 479) may imply that Harald's conversion had support from chieftains and magnates all over his kingdom. There are no written accounts nor archaeological evidence suggesting turmoil, uproar or skirmishes because of the conversion and the deconstruction of the central pagan site of Lejre took place around AD 1000 in a way that has left no traces of violence. On the other hand, the subjection could have been forced upon reluctant parties without burning down the settlements.

In an atmosphere that may have been more delicate, than we can detect today, King Harald Bluetooth instigated his ambitious building pro-

gramme. The motive may have been to stress that the conversion combined with the ideological and political alterations included his subjects.

Around AD 968, Harald apparently refurbished the burial monument of his parents by building the rhombus and the associated houses. The rune stone promoting Harald's deeds may have been part of this initiative. In reality, Harald made use of an important trick to inspire confidence in his vision of his future reign. The pagan mound, where it is assumed that King Gorm was interred, was a symbol of power, a sign of tradition, of trust and the continuation of life (Steinsland 2000, 157). By showing respect for the mound, Harald secured a basis in the pagan tradition but at the same time he was adding a symbolic construction around them pointing in the direction of a new order – his new Christian order. Within a few years, the construction of the ring fortresses began. Fyrkat holds the oldest dating indicating the mid-970ties, but there is no convincing evidence revealing, which fortress was the first one, or if they were built more or less at the same time. Trelleborg has a secondary building phase in AD 981, but we do not know, when it was initially constructed and that also concerns Aggersborg, Nonnebakken and Borgring. We consider that all of the ring fortresses were built between 968 and 986, as were the rhombus of Jelling, the Ravning Enge bridge and Kovirke. All of the structures were monumental, and even though most of them have the expression of fortifications, they did not take the most advantageous fortificatory positions in the topography. Instead, they held prominent locations where they were visible to travellers on important routes. Furthermore, their geometric shapes stood out and were difficult to ignore. They would have signalled the presence of the King and his new order even though he was not there in person.

Final remarks

Did it work? 'Yes' is the short answer considering the assumed situation on Zealand, but it was probably not until the time of King Harald Bluetooth's grandson, King Knud the Great, that all aspects of 'the new order' were implemented and accepted by the subjects. To Harald, the building programme

may even have caused the rebellion that he met in the mid-980ties. Most likely, the King had asked his chieftains to provide the necessary turfs, soil, timbers and men for the construction work, and maybe he went too far in his demands. From written accounts of a later date there are indications that King Harald enforced too heavy burdens on the commoners resulting in the rebellion led by the King's son, Sven Forkbeard. The type of burden is obscure, but the building programme may have been part of it.

After Harald was killed, there is no evidence of use or maintenance of the structures, probably because they had no indispensable function, and because they signalled all that was wrong with King Harald Bluetooth's reign in the mid 980ties. In this light, we may perceive the burning of at least parts of the palisade in Jelling and the partial fires in the gateways of Fyrkat, Trelleborg and Borgring as symbolic or ritualized destructive measures in the wake of Harald's death.

One may object that the ring fortresses had a military purpose. The constructions fulfil such a task and their topographical setting do have defensive benefits, but putting the evidence together another explanation materializes and stresses the fact that the emblematic values of the structures of King Harald Bluetooth are not to be underestimated.

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Rune Stones as Material Relations in Late Pagan and Early Christian South Scandinavia

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ABSTRACT

In this article, the material qualities and the use of space on rune stone and its links to the landscape during the Viking Age and in the Early Medieval Period in South Scandinavia are explored and related to acts of commemoration and changing spatial perceptions. The 11th century rune stones from Denmark and Scania without iconography have previously received less scholarly attention by the archaeologists, but here they form the main focus. Whereas the commemorative aspects of the rune stones have been noticed by a number of scholars, less emphasis has been on their material qualities and the spatial aspects of the inscription on the stones; the spatial references in the rune stones to the surrounding landscape; and the bodily effect they had for the readers of the runes. The rune stones are studied as expressions of social relations between living, deceased and places in late pagan and early Christian Scandinavia. Three phenomena are explored: the rune stones at bridges and the role of the bridge in paganism and Christianity; the use of the surface and shape of the stones to separate diverging beings; and the shape of the inscription and its relation to the new concepts of afterworld in terms of heaven above, while simultaneously creating links to near and distant pasts. Further, the process of creating relations to distant pasts in the Early Christian period is explored.

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Introduction

In this article, the use of space on the rune stone from the late Viking Age and Early Medieval Denmark and its links to the landscape will be explored. Raising the stones were acts of commemoration. The way in which the inscriptions cover the surface of the stones may provide us with insights into the principles of categorisation, as will be structured in the following. As the inscription typically include the name of a deceased and the raiser of the rune stone, the manners in which living and deceased were categorised and located spatially may be studied through the inscription. Thus, various traditions in the way the rune stones were inscribed may be identified in pre- and post-conversion times. The physical engagement with the rune stones and their spatial setting in relation to the process of conversion in Scandinavia will be examined, focusing on the acts of commemoration and changing spatial perceptions during the conversion, as expressed in the use of the body of

the stones and human bodies. Furthermore, as the Viking Age was a period in Scandinavian history in which the past was actively used and reworked in material terms (Andrén 2013; Artelius 2004; Arwill-Nordbladh 2008; Hällans Stenholm 2006; Lund and Arwill-Nordbladh 2016; Pedersen 2006), the raising of rune stones was one of the central means to express a close relationship to the deceased, whilst at the same time creating links to recent as well as distant pasts.

More than 3000 rune stones have been documented as raised in Scandinavia in this period. The majority were raised in the 10th and 11th century with the lion's share in Uppland, Sweden (Sawyer 2000, 7-12). In the rune stone tradition in present day Denmark and Scania, Sweden peaks slightly earlier (for a discussion of the chronology of the Danish rune stones, see Imer 2014, Stoklund 1991, 2006). The rune stones from this area are predominantly dated to the 9th-11th century, and more than 100 of these rune stones were raised in the time shortly

after the conversion (Imer 2014, 171). This article will focus on the rune stones dated from ca. 900-1020/1025 AD; the Pre- and Post-conversion group in Lisbeth Imer's chronological study (Imer 2014). It will also include examples from the Bornholm group, which is slightly later, dating from ca. 1025-1125 AD, but which paralleled to the Post-conversion group of present-day Denmark and Scania. They represent the earliest Christian rune stones in the area in which they were raised; the island of Bornholm (Imer 2014). The aim of this focus is to single out some of the principles of categorisation of beings, including living and deceased, and their spatial positions around the time of Conversion.

The Danish and Scanian rune stones have been used in studies of religion, focusing for example on the use of masks in the iconography or the concept of the þulr (presumably a skald or a reciter) (Imer 2016, 242). Other areas of interest concern political history, focusing on e.g. the control of land, or the social organisation e.g. military titles such as *drengr* (Enoksen 1999; Fuglesang 1981, 2005; Krogh 1982; Randsborg 1980; Sawyer 2008; Sawyer, Sawyer et al. 1987; Stoklund 1991; Sundqvist 2008). Possibly due to their elaborate iconography, the 11th and 12th century Christian rune stones of Södermanland and Uppland have been studied intensively (see for instance Andrén 2000; Back Danielsson 2015a, 2015b; Gräslund 2002, 2003; Gräslund and Lager 2008; Klos 2009; Lager 2003; Ljung 2016 with references). Similarly, a small group of decorated 11th century rune stones from Hadeland in Norway, most significantly the rune stone from Dynna, has been utilised in analyses of early Christianity in Scandinavia (Fuglesang 1980; Jesch 1991; Staecker 2004; Steinsland 2014; Strömbäck 1970). In comparison, the early Christian 11th century rune stones from present day Denmark and Scania in Sweden are among the least studied rune stones. A feasible reason is the lack of iconography on this group of stones, as consequently they can neither be used in analyses of the Viking Age society per se, nor as examples of early Christian art. This body of material has the potential to shed light on central aspects of the way humans interacted physically with the stones and used the materiality of the stones to find new

ways of understanding and expressing the social relations between the living and the deceased in the time of the conversion to Christianity. In a qualitative analysis, it is the qualities and characteristics of a phenomenon which are being explored, not its quantitative expression. Such an approach is compulsory due to the more or less accidental selection of rune stones; namely the ones preserved or rediscovered and available in the present day. Furthermore, the total number of rune stones from Denmark and Scania is insufficient for statistically significant quantitative analysis. As the true size of the population of rune stone is unknown, this body of preserved material cannot be assumed to be a statistically representative sample. This does not render the material invalid for research, more that it requires a nuanced, qualitative approach that respects the social changes the material potentially represents within the discreet categories. Thus, this is not an exhaustive analysis of all South Scandinavian rune stones, but the identification of a number of phenomena within the group of Pre- and Post-conversion rune stones which may have wider implications for the comprehension of how these rune stones worked as acts of commemoration.

Stones for Commemoration

That objects and structures may have greater endurance than human beings provide them with the potential to work as parts of commemorative processes. Roberta Gilchrist states that heirlooms are repositories for collective memory (Gilchrist 2013, 170). Portable artefacts are not alone in this capacity; monuments and other objects which did not circulate physically have this ability. Rune stones are created as places of commemoration, most often to the deceased, but they have also had additional social functions. They are examples of the strong focus in the Viking Age on relating to and revitalising the past (Ljung 2016, 49-53). Whereas Birgit Sawyer has interpreted the rune stones as avowals of property and inheritance (Sawyer 1988), Torun Zachrisson has seen them as memorial inscriptions which were additionally, albeit more indirectly, used as protectors of the property, as the raiser demonstrated their relations whilst si-

multaneously placing the deceased in their social network (Zachrisson 1994, 233). These perspectives are rewarding, as they point to the relational aspects of the inscription. Thus, the rune stones may essentially be understood as expressions of *social relations* between the living, the deceased, and places in late pagan and early Christian Scandinavia (see also Imer 2016, 68).

The process of remembering, which takes place through the memory of former action, is always something on its own terms; a transformation of the tradition (Gadamer 2001 [1960], 131). Essentially, in the process of remembering, there is always a link to a new memory (Olick 1999, 340). Material culture, and in particular monuments, may function as mnemonic agents for the collective memory of social groups (Assmann 1995; Bradley 1993; Halbwachs 1992; Thomas 1996; van Dyke and Alcock 2003; Williams 1998). The human experience with the landscape is a bodily experience. Moreover, material culture embodies particular elements in the landscape. In these processes, it is material culture which brings memory into a place (Harris 2010; Ingold 1993, 152-154; Jones 1998, 302, 2007; Lund 2009, 103-110; Lund and Arwill-Nordbladh 2016). In recent years, a focus on materiality has caused an increased awareness on the interplay between objects and humans, on the qualities of material objects, and on the effects and affects of materiality on humans, and in particular the human body (Gosden 2005; Harris 2010; 2016, Malafouris 2013; Pétursdóttir 2012, Tarlow 2012). In essence, humans encounter the world through our bodily experience with the world, and the sensorial is not separated from the perceptual in this meeting (Merleau-Ponty 1994, 11-12). As Yannis Hamilakis points out, memory is activated through the sensorial interaction with matter (Hamilakis 2013, 118-124). On a universal level, memory is fundamentally linked to place. Neuro-scientific research demonstrates that all memories are bound to places, as memory and reference of place is stored as a unit in the human brain (Moser and Moser 1998, Moser 2005). This means that in order to learn where places are located in space, one has to associate the places with specific events. Thus, the material dimensions of memory also include aspects of spatiality. Stefan Brink

has pointed out that particularly in societies where writing was not yet well established, the landscape could function as the container and conserver of cultural memory (Brink 2008, 119). It may, however, be rewarding to take this a step further by acknowledging that the landscape was not merely a container, but acted back on the human agents living in and of the landscape. Raising rune stones were part of changing the places in a process of place-making. The commemorative aspects of the rune stones have been noticed by a number of scholars (Gräslund 2002; Ljung 2016; Sawyer 2000). Ing-Marie Back Danielsson has reflected on spatial aspects and the physical engagement with rune stones through an analysis of a number of Christian rune stones from the Mälars valley with elaborate iconography (Back Danielsson 2015b). Even the South Scandinavian rune stones, which lack this type of highly detailed iconography, hold the potential for analysing the spatial aspects of the inscription on the stones and the spatial references in the rune stones to the surrounding landscape. In the following, these spatial aspects and the bodily effect they had for the readers of the runes will be examined.

The inscriptions as well as the locations of the rune stones indicate that there was a profound, deep felt need to *create* memory in Viking Age Scandinavia (Lund and Arwill-Nordbladh 2016; Williams 2016). The stones are often located in relation to cemeteries (Back Danielsson 2015a, 162-164; Larsson 1990, 162). Several inscriptions state that they were raised with the purpose of commemorating the deceased and remember the raiser of the stone. The acts of raising the rune stones were commemorations of social relations; in particular social relations between the living bereaved and the deceased. In this expression, it is central to underline their *physicality*. Interpretations of prehistoric standing stones point towards the importance of the materiality of the stones (see for instance Kohring 2014; Robb 2009). This is even relevant for the rune stones and includes placing emphasis on the material qualities of the raised stones (see Back Danielsson 2015a, 158 with references). These important notions remind us that the rune stones did not simply *represent* relations. They materialised them. Where the physical body

of the deceased was decaying in the soil, the body of the rune stone was present in the landscape as a real and substantial entity. Thus, rune stones may have been raised to create memory, but their outcome was far wider, as they were not merely mental ideas, but material objects which affected the humans that engaged with them. The effect of the rune stone must have varied depending on whether or not the observer or reader of the rune stone was literate or illiterate, as the process of reading the runes also included a bodily movement of the reader, depending on where on the stone the inscription was. This physical engagement with the rune stone further related to the location of the rune stone in the landscape, as will be demonstrated in the following.

The Use of Space in the Composition of the Runic Inscriptions

The Scandinavian rune stones have mainly been analysed by philologists, art historians, and archaeologists, focusing respectively on the texts, the images on the stones, and their location in the landscape. In a methodologically innovative article from 2000, Anders Andrén points out the shortcomings of this labour division, as a large number of the rune stones were clearly produced with the ambition of a combined reading of the stones (2000). Several of the stones contain references to *kjenninger*, pre-set metaphors used in the Skaldic poetry. A striking example is the Tumbo stone (Sö 82¹) from Södermanland, Sweden, which contains an inscription stating that the stone is raised by ‘Visten (...) after Frøsten, his brother, death/dead in Greece (...)’. The image on the stone shows a beast biting around the word ‘death’, which Andrén relates to the *kjenning* ‘to become the wolf’s food’, known from the Skaldic poetry (Andrén 2000). Andrén’s reinterpretation of this stone demonstrates that different social groups would have had divergent access to understanding and thus using the rune stone for commemoration, depending on not only whether or not the observer/reader of the rune stone was illiterate or not, but also depending on the reader was familiar with Skaldic poetry used among the social elite (for a discussion on literacy and rune stones in relation to the Swedish early medieval stones, see also Bianchi 2010).

Andrén’s approach to interpreting the rune stones appears to be particularly applicable to the Swedish Late Viking Age stones, as they very often include ornamentation and visual images. Yet, the approach is also relevant for analysing rune stones which do not contain visual images, as even the location and configuration of the inscription on the surface of the stone relate directly to concepts and metaphors used in Viking Age Scandinavia (Lund 2005, 2009, 134-148). As will be demonstrated in the following, the outline of the runic inscriptions on stones are formed and shaped in accordance with fundamental principles that relate directly to the world-views and mentalities of the Viking Age. These principles, which have been overlooked in previous research, include distinct means of separating living and deceased and between humans and other beings. The properties of the inscriptions shape the ways in which the stones, including its material qualities and characteristics in terms of shape and form, have been used.

Dividing the Living and the Deceased

A noticeable feature on the Pre- and Post-conversion rune stones is the composition of the inscription. The scheme ‘X raised this stone after Y’ dominates the material (Imer 2016, 135). A large proportion of the rune stones separate the name of the living and the name of the deceased on two separate bands. This pattern can be identified on 92 rune stones (89.3 %) of the Pre- and Post-conversion rune stones from present day Denmark and Gottorp County² in Schleswig. The high percentage of occurrences of this pattern indicates that this inscription design was not accidental, although as pointed out in the introduction, the total number of raised stones is unknown. Simultaneously, this was clearly not an unalloyed pattern, but one of several in a repertoire of schemes. The same pattern can be identified in the group of Pre- and Post-conversion rune stones from Scania, Sweden, but appears to be less dominating, occurring on 47 (65.3 %) of rune stones in these groups. This lower occurrence is not surprising considering that the dates of the Scanian rune stones are, in general, some years younger than the Danish rune stones from eastern Jutland (Imer

2014, 170-171). Moreover, as will be demonstrated later in this article, a new scheme emerges for the explicit Christian Post-Conversion rune stones, for which the traditional separation of being through bands gives way to new forms. The remaining 11 (10.6 %) of Pre- and Post-conversion rune stones from present-day Denmark also separate the name of the living and the deceased, not through two separated bands, but by letting the band of the inscription run in a spiral or portal in which the name of the living and the deceased are located the furthest away from each other. Similarly, most of the remaining 20 (42.6 %) Scanian rune stones of the Pre- and Post-conversion group do not separate the living and the deceased in two bands, but locate their names on either sides of a portal or a spiral. In addition, there are three of the Pre- and Post-conversion rune stones that fall completely outside of this pattern, as they are raised in memory of the raiser himself and thus naturally do not contain the same segregation of the deceased and the bereaved. A typical feature in the South Scandinavian rune stones of the Pre- and in particular Post-conversion group dating to c. 900-1020/1025 (Imer 2014, 170-174; Stoklund 1991, 191), is that Y's name is followed by some of the qualities or the title of Y, such as 'Y, a very noble þegn' (Old Norse most presumably meaning *magnate* (Imer 2016, 25, for a discussion on the difficulties in separating the Pre- and Post-conversion rune stones, see Imer 2014:168-171). These stones were raised in the period of transition from paganism to Christianity. Typically, the inscription also describes the relationship between the raiser and the deceased.

One noticeable conceptual way of separating living and deceased is *the bridge*. Viking Age South Scandinavian settlement and cemeteries were in many cases³ divided by a stream and connected by a bridge or a ford (Adamsen 2004; Lund 2005). This division arguably finds equivalence in a number of Old Norse written sources, pointing towards the conceptual idea of the realm of the living and the dead as being divided by a river or stream and connected by a bridge (Adamsen 2004; Hedeaer 2002; Lund 2005, 2009, 127-147). During the Viking Age, artefacts – mainly weapons and tools – were laid down in the water in close proximity to bridges and fords as part of ritual or structured acts of deposition (Lund 2005, 2009, 127-139). Similarly, a number of silver hoards have been deposited in wetlands in liminal places including at bridges (Hedeaer 2003; Zachrisson 1998, 114-117). In the same period and in the same regions, bridges and fords were being marked by the raising of rune stones (Enoksen 1999; Larsson 1990; Lund 2005; Thörn 2004; Øeby-Nielsen 2005).

The rune stones with the word bridge in the inscriptions from present-day Denmark are few, but most of them are early Christian stones (Imer 2016, 292). The inscriptions mentioning a bridge follow the scheme 'X raised this stone and built this bridge after Y' (Lund 2005; Sawyer 2000). Thus, the spatial concept of the bridge as a threshold connecting the living and the dead, who were located on each side or bank is expressed in the composition of the inscriptions. This metaphorical thinking is also conveyed in other manners. The Källstorp stone (DR 269) (Figure 1) has a Christian inscription, which follows the same principle

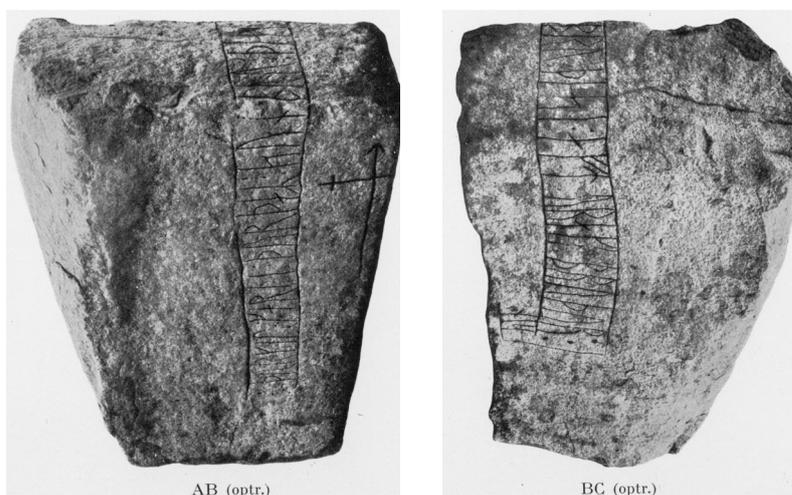


Figure 1. The Källstorp stone, Scania, Sweden (after Jacobsen and Moltke 1941, plate 645-646).

as the rune stones at bridges, yet with the inscription in one belt, with the word *bridge* written on the top of the ridge of the stone (Lund 2005). The stone is part of the Post-conversion group, dating it to c. 970-1020/1025 (Imer 2014, 170-173).

In other instances the inscription is divided in two opposite and parallel bands, one with the name of the raiser, and the other with the name of the deceased. The living and the dead were thereby separated, but also reflected on each side of the bands (Lund 2009, 137-142). A very direct expression of this is found on the Hjermind stone 2 (DR 78), where the first letter, Ty (↑), of the name of the raiser, Tove, is directly mirrored in the first letter, Ty (↑), of her son, Toste (Jacobsen and Moltke 1941, 76, 1942; Lund 2009, 139-140) (Figure 2). In our modern optic, the Tys even appear as arrows pointing towards each other, but as the arrow as a typographical symbol was developed in post-medieval times it was presumably not perceived similarly in the late Viking Age. Yet, optically the arrow shape of the Ty rune leads the eye towards the other Ty rune and mirrors it.

This spatial divisional principle is identifiable in rune stones with explicit pagan inscriptions as well as on unequivocal Christian examples. The ideas of the afterlife in Viking Age paganism appear to have been diverse and not mutually exclusive (Price 2008a, 2008b, 2014). Old Norse Scaldic poetry indicates that the grave itself could be considered a rest place for the deceased, at the same time as iconographic material of the period supports the identification of various otherworlds in the Old Norse written sources, including the idea of *Valhall* and *Hel* (see for instance Brink 2007; Lund 2013, with references for a discussion on the diverging ideas of afterlife in Viking Age Scandinavia; Steinsland 2005). The conversion to Christianity included an alteration in the role of the bridge in the cognitive landscape. In Early Medieval Christian Scandinavia of the 11th century, it was no longer the *body* of the deceased that was thought to cross the bridge, but the *soul*. Bridge building was considered a good Christian deed equal to gifts to the church, not only for its practical function, but also for its role in the Christian perspective on the afterlife (Smestad 1988, 172; Thörn 2004, 245).

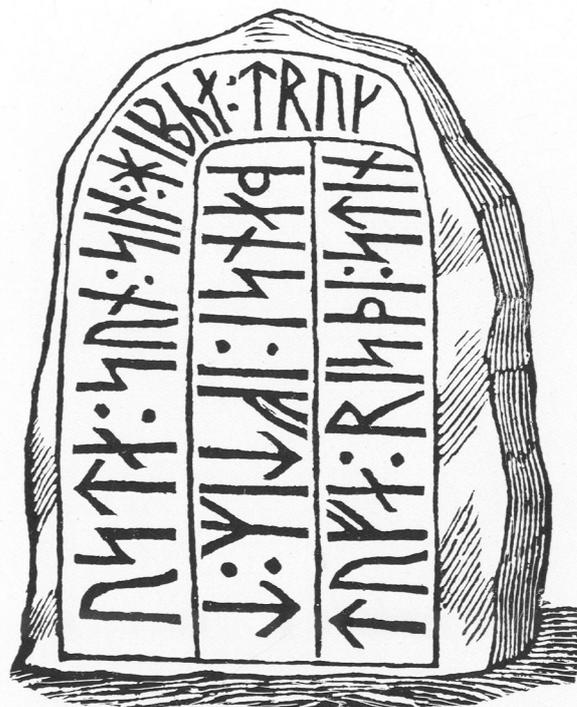


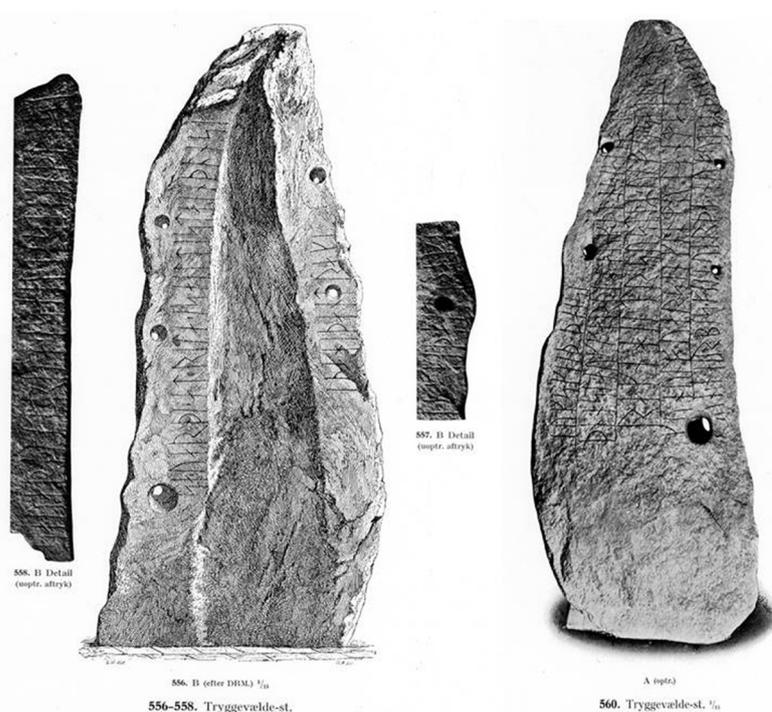
Figure 2. The Hjermind stone 2, Jutland, Denmark (after woodcut by Worm reproduced in Jacobsen and Moltke 1941, plate 214).

The oldest Christian rune stones were raised by believers, who asked God to help the souls of their deceased relatives (Herschend 1994, 101). Torun Zachrisson equals this to the requiem mass, where the souls of the dead should find the right way to the light and paradise by means of prayers of the bereaved and the help of God and God's mother (Zachrisson 1998, 148). A central source for this interpretation is found in an English collection of sermon texts by Wulfstan of York (d. 1023 AD), where the building of bridges is described as a good Christian deed that will help the soul on its difficult journey (Roesdahl 1990, 26).

Separating Categories of Beings

Whereas the bridge as a phenomenon has been studied by numerous scholars, little attention has been given to the fact that during the Viking Age, the *shape* of the stone and the different sides of the stone are also used to underline the junction between different categories of being, such as living and dead, and to classify the social role of the de-

Figure 3. The Tryggevælde stone, Zealand, Denmark (after Jacobsen and Moltke 1941, plate 556-558, 560).



ceased. In these instances, the name of the raiser is on one side of the stone, the name of the deceased on the following side, and on the third side the inscription may include a statement; in other examples this division is made through the carving in separate bands. For instance, the different sides of the stone are used for separating the living raiser and the deceased relative on rune stones such as the Vordingborg stone (DR 221), Zealand. This stone may be of the Pre-conversion group, dating it to c. 900-970 AD, but due to the fact that the interpretation of the inscription is uncertain, the dating of the Vordingborg stone is expanded to include the 9th century in the Danish rune database (Imer 2014, 168-171, 173; Jacobsen and Moltke 1941, 208-209, 1942, 271-274). Thus, it is the materiality of the stone that is actively used to underscore this distinction. The immanent qualities of the stone, including its shape, were enhanced through the moderation and manufacturing of it in order to match the principles of categorisation conveyed in the inscription. The rune stone from Tryggevælde (DR 230) is another example of these two dispositions.

The stone has two broad sides with inscriptions and two narrow sides without. The inscription on one of the broader sides includes four bands: One mentions the raiser and her kin, one describes the deeds; raising the stone and building a mound,

one mentions the deceased (her husband), and the final describes his kin and qualities. On the upside, broad side is a warning that 'he, who *ailti*⁴ or remove this stone will become a '*rita*'⁵. At some point after the stone was inscribed, five holes have been drilled through the stone (Figure 3). These perforations appear to partly respect the inscription, as they only destroy small parts of six runes. The stone is of the Pre-conversion group, dating it to the period between 900 and c. 970 AD (Imer 2014; Jacobsen and Moltke 1941, 217-219, 1942, 281-286, 1022-1023). The stone demonstrates that the inscriber used the bands as a means of expressing fundamental categories in the cognitive schemes by separating persons, their affiliations, and qualities. Furthermore, the shape of the stone and the different sides of the stone were employed to underline these divisions. Like a number of Viking Age and Early Medieval rune stones, the Tryggevælde stone has been worked prior to the inscription. This means that not only was the original shape of the stone used consciously, but it was even altered in order to make it express these divides.

The utilisation of the shape of the stone and the sides of the stone for structuring the diverging categories appears on rune stones with explicit pagan inscription as well as on the early explicitly Christian rune stones, as the examples from Tryggevælde



Figure 4. The Østermarie stone II, Bornholm, Denmark (photos: Roberto Fortuna, The National Museum of Denmark).

and Källstorp demonstrate. This custom continues in the Bornholm group of stones dating to 1025-1125 AD (Imer 2014, 172-173), as seen on the Østermarie stone II (DR 391), Bornholm, where side A states the name of the raisers, side B mentions the deceased, their father and in addition ‘Christ help his soul’, thus locating the living on one side, and the deceased and Christ on the other (Figure 4).

Similarly, on Østerlarsker II (DR 398), Bornholm, which is inscribed on three sides of the stone, side A mentions the raisers and the stone, side B follows with the deceased and the relation to the raisers (their father), and finally side C pray that ‘Christ and St Mikkel and St Maria help his soul’ (Jacobsen and Moltke 1941, 372, 384-385, 1942, 449-451, 456-457). Thus, the disparity between different beings and qualities was expressed through spatial segregation on the rune stones. This separation in space of living, deceased, types of relation, curses (on the pagan stones) or Christ and saints (on the Christian ones) was produced with the construction and shape of the bands for the inscription, but also through the use of the materiality of the stone and alterations to the structure of the stone. Further, traces of paint, mainly red and black, on a few Swedish rune stones indicate that when rune stones were painted, the inscriptions were coloured in accordance to syntax, so that a description of the relation between the deceased and the raisers of the stone *pair brøðr* (these brothers) were painted in one colour and the following part *letu reisa* (let

raise) in another (Jansson 1984, 168). If we understand rune stones as repositories for collective memory, these effects caused by the divisions of being in separate bands and perhaps divided with separate colours were passed on to future generations that met, read, and engaged with the rune stone.

From the Earth to the Sky

Memory works through bodily practices like movements and gestures. Thus, specific bodily actions can recall past memories (Connerton 1989; Mauss 1973). This calls for a focus on the sensorial aspects of engaging with material culture (Hamilakis 2013). New ways of structuring the inscription on the rune stones also included new ways of reading it; a process which included an alteration in the bodily practices of reading. A small group of Post-conversion rune stones were inscribed in a manner which differed significantly from the older stones. These stones did not have any division of lines between the deceased and the bereaved, but were instead carved in the stone in one vertical band. Most of these inscriptions run from the bottom and upwards. The 196 cm high rune stone Århus 4 (DR67) from Jutland, Denmark, is of the Post-conversion group, dating it to the period c. 970-1025 (Imer 2014, Stoklund 1991). It is written in one band from the bottom up, stating that ‘*Kæld raised stone this after Inge, father his*’ (Jacobsen and Moltke 1942, 104)(Figure 5).

The inscription begins approximately 50 cm above ground, and the first letter in the name *'Inge'* is located in the height of 165 cm above ground followed by the addition *'father his'* running from 175 to 196 cm height. The average height of Viking Age women and men have been measured based on the skeleton remains from inhumation graves, thus most probably implicating an overrepresentation of the elite of both sexes (see Price 2008b, for a further discussion on the social groups represented in Viking Age burials). These individuals may potentially also be part of the social group which was most likely to be literate. Based on 320 individuals, the average height of women has been estimated to approximately 158 cm, and of men, to 172 cm in Viking Age Denmark (Sellevoold et al. 1984, 175-181). The sight would be turned upwards for any inscription above respectively around 155 and 168 cm (as the eyes are placed some centimetres below the top of the head). Consequently, in order to read the inscription, the reader would have had to lift the sight towards the sky and turn the head slightly backwards. Similarly, Østermarie rune stone IV (DR 393) from Bornholm from the pre-Middle Ages group was inscribed with one line in a band, *'Bove let carve stone after Thykil'* (Jacobsen and Moltke 1941, 379, 1942, 452-453) (Figure 6). The stone is 225 cm high, and the name *Thykil* starts at approximately 168 cm above ground and ends at 225 cm above ground, thus forcing the reader to raise the head towards the sky to read the name of Thykil and thereby actively commemorating him.

On the Fjenneslev stone (DR 238) from Zealand the inscription states that *'Sasser raised the stone and made the bridge'*. This stone is of the post-Conversion group, dating it to ca. 970-1020/1025 AD (Imer 2014; Stoklund 2006). It is interpreted as a Christian inscription, as a cross is placed in front of the first word, the name *'Sasser'*. In contrast to the earlier inscriptions, this text is read from the top down, and not bottom up. This means that the highest word is *'Sasser'*. The tradition of raising stones over oneself as opposed to raising a stone to commemorate another is rare, but does occur in a few other incidents – all Christian stones. The Fjenneslev stone is 220 cm high, which places the name of Sasser higher than the person reading the inscription. Again, the reader is forced to raise the

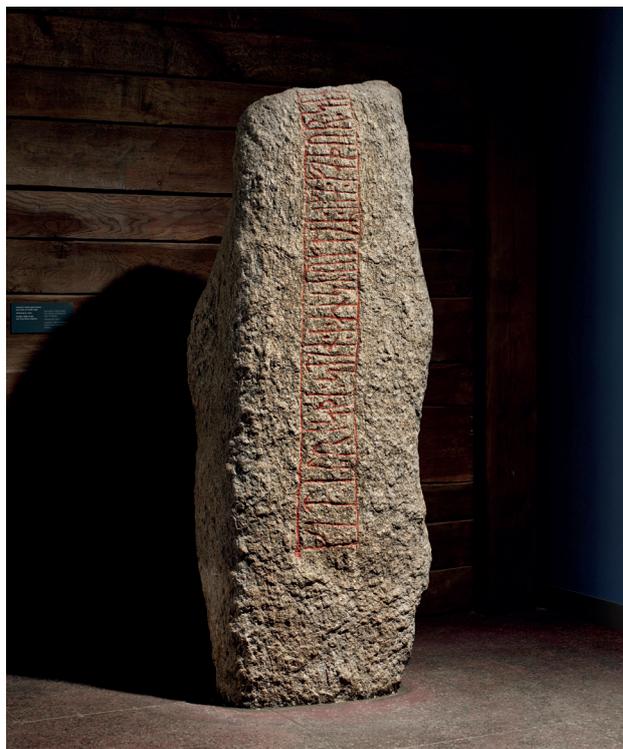


Figure 5. The Århus stone IV, Jutland, Denmark (photo: Roberto Fortuna, The National Museum of Denmark).



Figure 6. The Østermarie rune stone IV, Bornholm, Denmark located at a crossing point of the stream Gyldenså. By a curiosa, the author of this article is of the average height of a Viking Age woman. Thus, the photo is taken from the sight height of an average Viking woman (photo: Julie Lund).

sight upwards (Jacobsen and Moltke 1941, 224-225, 1942, 291-292). The Dynna stone (N 68⁶) from Hadeland may be seen as another variation of this phenomenon. The stone is dated to first half of the 11th century due to the elaborate pictures on the stone being in Ringerike style (Fuglesang 1980). The inscription states that '*Gunnvor made the bridge, Trydrik's daughter, after Astrid, her daughter. She was the most dexterous maiden in Hadeland*' (Olsen 1941, 198, see also Spurkland and Van der Hoek 2005). The inscription is engraved on the narrow side of the stone. On the broad side of the stone is the image of a figure with a glory, and figures interpreted as scenes from the epiphany, including three riders under each other. Below the lowest rider is an ornament of six so-called Irish slurs, divided in two lines. The scene has been interpreted as the three wise men (Staecker 2004, 49). The image on the broad side of the stone and the text on the narrow side have generally not been linked in the interpretations. Nevertheless, it is striking that the Irish slurs figuratively form a bridge, which the lowest of the horses is crossing. The word bridge in the inscription on the narrow side is engraved exactly against the Irish slurs. In that way the Irish slurs could be seen as a bridge where the three wise men can cross, underlining the Christian meaning of the bridge (Lund 2005, 125). The stone is 282 cm high. The last part of the inscription from the name *Astrid* and the following text is so high up that any person would have to lift the sight towards the sky to read it.

This shift emerged on stones of South Scandinavian rune stones from the Post-conversion group (c. 970-1020/1025 AD) and the Bornholm group (c. 1025-1125 AD) (Imer 2014) and on the explicitly Christian early 11th century for the rune stone from Hadeland (Fuglesang 2005; Staecker 2004). The examples of this type of inscriptions, one line in one band, are few and are unparalleled in the rune stones from previous periods. In other words, this alteration appeared concurrently with the conversion to Christianity in the area in which they were raised. Statistically, these examples do not make out a large proportion of the South Scandinavian rune stones, as only 6 stones⁷ with this pattern have been identified (thus, only 2.9 % of all Pre- and Post-conversion group rune

stones and 2.3 % of the Bornholm Group). Yet, they all appear as part of the earliest Christian inscriptions in the area in which they were raised, and thus they appear as a new scheme for the spatial structuration of the inscription. As Imer has pointed out, a number of rune stones which have hitherto been identified as Post-Jelling and thus Post-conversion cannot be differentiated from the older Jelling and Pre-Jelling stones with certainty, and must therefore be categorised more generally as part of this Pre- and Post-conversion group (Imer 2014). The number of explicitly Christian Post-conversion stones is however also very small, with only 13 stones from present-day Denmark and Scania. The group of rune stones with the band running from the earth to the sky is all but one part of this group of explicitly Christian rune stones. They also form a large proportion of the explicit Christian stones (30.8 %). Thereby, they also make out a large part of the stones that with certainty were raised Post-conversion. In addition there is the Århus stone 4 which does not have an explicit Christian inscription, but which has hitherto been interpreted as a Post-Jelling and thus potentially Post-conversion stone. The emergence of this new phenomenon of rune stones with the inscription running from the earth to the sky in one band marks an alteration of the rune stones, where the textual inscription, the size of the stone and the spatial pattern of the inscription on the surface of the stone were utilised in a new way, which compelled the reader to look towards the sky when reading the name of the deceased. They indicate a dawning perception of the otherworld as located on a vertical axis, above ground, in the sky. The concept of heaven above may thus have been expressed materially in the action of raising these stones, and incorporated bodily through the act of reading the inscription. In this sense the concept of the sky was directly linked to the bodily experience of reading and relating to the rune stone.

In spite of the introduction of this new theme, these stones are simultaneously linked to older traditions in their use of the landscape. For instance, the Dynna stone is placed in relation to burial mounds from the early and late Iron Age. Others, like the Fuglie stone 2, had a surface covered with cup marks from the Bronze Age (Imer 2016, 267-

Figure 7. Pre-Roman Menhirs at Louise-lund, Bornholm, Denmark located 1 km East of the Østermarie rune stone IV (Figure 6) at a crossing point of the stream Gyldenså (photo: Julie Lund).



268). Furthermore, rune stones were not the first stones to be raised in the Scandinavian landscape. In the 1st millennium BC in the late Bronze Age and Pre-Roman Iron Age, menhirs or *bautas* were raised, either in relation to cairns or cremation graves, or standing alone in the landscape. They were often located at places where they were visible from afar; at the coast, at fords, along a stream, or on a ridge (Jensen 2003). In this sense the rune stones relate to a much older commemorative tradition (Bianchi 2010, 224). In a few instances they have later been incorporated into ship settings. The location of the Late Viking Age rune stones show similar tendencies, as they tend to have been raised at burial sites, along roads, at fords and bridges, and in a few instances they were built into older ship settings (Enoksen 1999; Larsson 1990; Vestergaard 2007). They carried references to – and citations of – older monuments (see Lund and Arwill-Nordbladh 2016, with references for a further discussion of the rune stones as material citations). In many cases, menhirs are visible from the loca-

tion were Viking Age rune stones were raised (Back Danielsson 2015b, 72-73; Knutzen 2005, 2007). Since Bornholm is one of the places in Scandinavia with the highest density of menhirs, the relations between menhirs and rune stones are also present in this body of material. The rune stone Østermarie IV is placed at a bridge at the stream Gyldenså. One kilometre further down this very stream, East of Østermarie stone IV, at the next crossing point lays Louise-lund, which is arguably the largest Danish collection of menhirs from the Late Bronze Age and Pre-Roman Iron Age (Figure 7).

Thus, when people met and read the early Christian rune stones, this physical engagement with the stone through walking up to it, meeting it, reading it, passing it, and seeing and knowing of other raised stones in the surrounding landscape may have created links to a distant past (for a study of the physical engagement with a group of rune stones, see also Back Danielsson 2015b). Though there was no longer a collective memory

of the people or events which had caused the raising of the menhirs a thousand years earlier, they were integrated into the early Christian landscape of commemoration. Thereby, this group of stones with the inscription running in a vertical band are part of an alteration in the way the landscape was used, conceptualised and bodily incorporated, but they are by no means examples of a complete break with the former rune stone traditions.

Rune Stones as Social Relations

The reading of the rune stones included understanding the runes in terms of literacy, but also of linking this interaction with the inscription and the stone itself with the understanding of the landscape, including concepts of where deceased beings were located in the afterlife. The reading of the stone was consequently a sensorial interaction with matter, as Hamilakis describes it, which activated memory (Hamilakis 2013, 118-124). Thus, as the rune stones commemorated a deceased, with whom the raiser of the stone was closely related through kinship or other social bonds, new Christian ideas of the landscape and the spatially aspects of the afterlife was physically inscribed into the readers of the rune stone inscriptions.

Above, three phenomena have been explored. Firstly, the rune stones at bridges use the surface and shape of the stone to refer to the use of the landscape. Secondly, the surface and shape of the stones are used to separate diverging states of being and qualities. Lastly, the inscriptions running from the surface and upward are active components in incorporating new concepts of otherworlds, as heaven is now placed in the sky. The last phenomenon is not a dominant feature in the body of material examined here, but it is noticeable that it emerges on some of the earliest explicitly Christian rune stones in South Scandinavia. If we approach these inscriptions on the rune stones as materialisations of social relations, this interplay with the shape of the stones and its relations to the landscape in which it was situated in (and sometimes moved into) demonstrates that these were not mere texts, nor simply manifestations of power or claims of land. Back Danielsson com-

pares the size and stature of the rune stone to that of a person. She argues that the stones from the Mälars region may have been perceived as possessing agency and personhood based on inscription using the word 'me' and the use of the verb *fyrþi*, meaning brought, referring to the rune stone, as this verb is otherwise only used for actions done by human beings (Back Danielsson 2015a, 166). There is no such clear indication that the rune stones of the Pre- and Post-conversion group and the Bornholm group presented in this paper were also perceived as possessing personhood (see Lund 2017, for a discussion of personhood in Viking ontology); but if we cannot determine whether they were stone-persons or not, we can conclude that they were stone-bodies in the sense that their scale and size forced people to relate to and engage with them due to their placement in the landscape. The South Scandinavian rune stones of the Pre- and Post-conversion group and the Bornholm group were, in general, *larger than human*. They were located in an open agricultural landscape without mountains and with few visible rocks. The massive Fjenneslev stone, to take one example, is 220 cm high and 126 cm wide, heavier and larger than any human person, carved with runes. It had effect and affect on any person, literate or illiterate, that passed the stone (Figure 8).

Thus, the size and weight of these stones also caused and causes effects on the human body that meet and read the stone, be it by recalling the use of the bridge, by raising the sight towards the sky or by walking around the stone in order to identify the different beings separated by the surface of the stone and divided in different carved bands of inscription. The stone not only commemorated the deceased, but it materialised the social relation between the commemorated and the raiser of the stone, leaving a lasting impact on the landscape. Long after the body of the deceased has decayed the memory of the relationship between the deceased and the raiser of the stone is still preserved today as an enduring, material stone body.



Figure 8. The Fjenneslev stone, Zealand, Denmark (Photo: Roberto Fortuna, The National Museum of Denmark).

Changing Efficacies of Commemoration

Torun Zachrisson points out that the Eddic poem *Rigsþula* draws a connection between owning odal land and runic knowledge (Zachrisson 1994, 221). The dating of the poem *Rigsþula* has been debated intensively, placing it in the 8th-14th century. The archaeological material described in the poem does, however, indicate that it may have existed in an oral form in the 9th century (Lund 2009, 18-20). No doubt the acts of raising rune stones were related to rights to land, ownership, and heritage. The purpose of commemoration appears to have changed from late pagan to the early Christian period. The inscriptions from the Viking Age indicate that they were raised in order to honour the deceased and to underline the link between the deceased and the raiser of the stone. This link, and thus the stone itself, may have been operational in claims of lineage and thus rights to ownership of land. In the early Christian period, emphasise

is now also put on the relationship between the raiser and the deceased, including the deceased's presence in heaven above. The alteration expresses the change of religion from paganism to Christianity. The purpose of creating a place for commemoration also changed from the Viking Age to the early Christian stones, from glorifying a deceased and thereby also the family and kin to using the inscriptions to request prayers for the soul of the deceased.

The act of raising rune stones was a means of creating or transforming the place, providing it with references to specific families, genealogies and norms. In particularly the Post-conversion group of rune inscriptions from c.970-1020/1025 AD (Imer 2014) referred to defined groups of titles, such as *dreng* or *fellow*, thereby accentuating a particular set of relations. The production of the rune stone included a significant alteration of the place, making it into a distinct type of place for commemoration, the biography of the deceased *and* the relation between the commemorated and the stone raiser were inscribed into the landscape, and more pertinently, into the place. Raising it was part of place-making. Material culture (including human bodies and bodies of stone) played an active part in the conversion (Shaw 2013). The process of conversion included a significant alteration of ideas of the body, from extremely diverting burial practices in Viking Age Scandinavia, including fragmentation and sometimes cremation of bodies and grave goods, towards the standardised Christian inhumation grave without grave goods of the 12th century (Lund 2013). In between is the 11th century, a period where whole bodies were followed in the grave by lesser amounts of grave goods, but in all cases of *whole objects*, pointing towards a parallelism between the handling of bodies and objects (Lund 2013, 53-57). This transformation during the 11th century should not be reduced to a hybrid state, with combinations of the old and the new. Rather than understanding this as an example of syncretism, and as symbols of something else, it should be seen as practices. As the conversion in Scandinavia was incorporated through new rites, including burials, it gave rise to new conceptions of the integrity of the whole body and of whole objects (Lund 2013, 56-57). At the same time, a

group of rune stones were inscribed in a new manner, with a single line from the bottom up, forcing the sight towards the sky as part of reading and remembering the inscription, thus compelling the body of the reader or observer of the stone to react to it in a new way. In the Christian understanding of the landscape, the physical location of the deceased was thus compelled onto the body of the reader of the inscription. This process was further underlined by using large stones, larger than human, as rune stone bodies.

Notes

- 1 The Sö numbers refer to the registration of the rune stones from Södermanland, Sweden in E. Brate and E. Wessén 1924-1936 *Södermanlands runinskrifter. Sveriges runinskrifter*, volume 3. Stockholm: Wahlström & Widstrand.
- 2 The rune stones in Gottorp County in Schleswig, Germany are included in the volumes and registers of Danish rune stones and have therefore also been included in this article.
- 3 For instance in Hesselbjerg at Odder, Gammelby at Esbjerg, Volstrup in Vendsyssel and Gl. Lejre at Roskilde in Denmark fall within this pattern (Adamsen 2004).
- 4 There is no certain translation of 'ailti', but the context indicates that it is some kind of destruction.
- 5 The translation of the word is uncertain, but the context indicates that it is not something positive.
- 6 The N number refers to the registration of the rune stones in the Rune Archive in Museum of Cultural History, University of Oslo and in M. Olsen Norges innskrifter med de yngre runer. Norsk historisk kjeldeskrift-institutt, Oslo. Olsen, Magnus (1941). *Norges innskrifter med de yngre runer / utgitt for Kjeldeskriftfondet*, Oslo, Norsk historisk kjeldeskrift-institutt.
- 7 The Århus stone 4 (DR67), the Fjenneslev stone (DR 238), the Fuglie-stenen 2, the Norra Nöbbelöv stone (DR316), and the two inscriptions on the Lund stone 1 (DR 214) are all from the Post-conversion group and are explicitly Christian rune stones, as is the Østermarie stone IV from the Bornholm group.

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Workshop production of brooches with religious symbolism around the year 1100 in Denmark

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ABSTRACT

Small brooches with Christian motifs from the period of c. AD 1050–1150 occur frequently amongst metal-detector finds in Denmark. Those known as Urnes brooches, bird-shaped brooches and circular animal brooches are especially common finds over most of the country. In order to understand what lies behind the distribution and significance of these brooches, the issues of where they were made and who was responsible for production are key questions. The large number of finds must reflect a serial form of production, but up to a few years ago secure evidence of any workshop has been almost effectively absent. Presented in this paper are two recent finds of workshops in which the manufacture of these types of brooches took place, in Ribe and Aalborg respectively. On the basis of the archaeological contexts of the workshops and the finds, it is proposed that this production is to be seen as primarily an urban phenomenon, with the Church as initiator and key agent, directed at a broad circle of customers. This may have been part of an evangelizing thrust with wider popular appeal in which these small but highly meaningful artefacts played an important symbolic role.

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Introduction

The earliest centuries following the introduction of Christianity to Denmark are not rich in evidence in respect of costume and the use of dress-accessories. Metal-detector finds are a growing and primary source in this respect. The many finds show that brooches were part of the costume, and that in the period of c. AD 1050–1150 three types in particular stand out as widespread. These are those known as *Urnes brooches* (Bertelsen 1994; Westergren 1986), *bird-shaped brooches* (Pedersen 2001) and circular brooches with an animal motif of the *Aalborg-group Type* and *Agnus Dei brooches* (Bertelsen 1992; 1993).

The terminology which has been in use up to now in respect of the brooches can be imprecise and not very idiomatic.⁴ The name *bird-shaped brooch* is the least problematic in this regard, as the name is short and precisely reflects the design of the brooches rather than any specific stylistic features.

In the following, 'animal loop brooches' of the Urnes type will still be referred to as *Urnes brooches*,

a term which continues regularly to be used in the literature (Christiansen 2017, 86; Gilså in press), and 'animal loop brooches' of the Aalborg[-group] type and the Agnus Dei type will generally be referred to as *circular animal brooches*.

Although the three brooch types are common finds on many metal-rich sites all over Denmark, almost none were until recently found in archaeological contexts. As a result of this, there are a number of unanswered questions regarding the production, use and meaning of these obviously common and widespread artefacts in the period c. 1050–1150.

A few years ago, two new finds of workshops that were operative in the decades around 1100 were made in the course of archaeological investigations in Aalborg and in Ribe. At both sites, several of the brooch-types referred to above were produced. With the archaeological contextualization, a new insight can be gained into the production methods, the relation between the brooch-types and the meaning of their symbolism. The finds constitute an important breakthrough in respect of the background for the popularity and widespread

distribution of the brooches. Questions, that cannot be answered on the basis of the detector finds alone.

Starting from the evidence of the workshop finds from Ribe and Aalborg and making use of a series of parallels amongst detector finds, the focus of this article is upon the following questions:

- Where did production take place?
- What group of customers was it directed at?
- Who was responsible for it?
- What was the basis of the distribution and popularity of the brooches?

The brooches – current knowledge

The Urnes brooches appear, despite their name, in the Ringerike and Urnes Styles or with Romanesque features, but the majority are in the Urnes Style (Bertelsen 1994; Gilså in press; Røstad 2012, 193). The bird-shaped brooches may contain elements of either the Ringerike or Urnes Styles but are mostly quite separate from the Scandinavian stylistic tradition (Pedersen 2001, 39). The circular animal brooches are found in both Urnes and Romanesque Styles (Bertelsen 1992). Altogether, the stylistic features of the brooches show that their centre of gravity lay in the period of the Urnes Style, c. 1050-1150.

The brooches are generally of modest size, typically with a maximum dimension of 2-3 cm. They are provided with pin-fittings on the back, and often too with a loop or a hole for suspension of a chain or whatever. Their principal area of distribution is in present Denmark and to a lesser extent in Skåne in present Sweden (Hårdh 2010; Røstad 2012, 181). The intensive use of metal-detectors in Denmark consequent on the Danefæ legislation may be part of the reason for this. Before more intensive metal-detector activity began taking place in Denmark from around 1990, the number of finds from Sweden, Norway and Denmark were almost even (Gilså in press). It should be taken into consideration, when looking at the geographical distribution that intensive use of metal detector can change the picture drastically over short time (Feveile 2018).

The large number of detector finds which have been declared as Danefæ are curated by the Na-

tional Museum, while the majority of the associated data are recorded at the local museums in accordance with the delivery of the finds. At the moment it is consequently impossible to produce any major data-pull which could provide an overview of the whole body of finds in respect of specific brooch-types and more precise find spots, and thus to use the Danish detector finds for regional or trans-regional studies. In a recent study of the Danish finds of Urnes brooches based on data from the National Museums collection some figures for the overall count has become available (Gilså in press). This study includes 850 finds of Urnes brooches (ibid), and mentions furthermore 348 bird brooches, and around 264 circular animal brooches of the Aalborg group (214) and the Agnus Dei type (around 50) (ibid). The number grows continuously. In DIME (the new, user-driven recording platform for detector finds) (Dobat et al. 2019) around 60 finds of circular animal brooches are registered from 2/1 2018-23/10 2019.⁵

The recent study of Urnes brooches (Gilså in press) has been very useful as reference material in this paper, but many other examples are discovered via net-based detector fora, with the find places subsequently verified via the relevant local museums. Several museums have made more comprehensive information about finds from their areas available, while data from DIME have also been used.

When looking at the numbers of brooch finds from the period, they are remarkably high compared with other medieval artefact-types in the category of jewellery and dress-accessories. As an example, there are around 300 finds of pilgrim badges from the whole of Denmark, an artefact-type that is datable across several centuries from the 13th century to the 16th.⁶

The numbers and distribution of the brooches leaves us with questions about the background for their popularity, who the users were, and what the motives meant to the people at the time. The use of small amuletic brooches with animal designs rooted in religious ideas has its roots back in the Late Iron Age and Viking Period (e.g. Gråslund 2006; Pedersen 2014; Petersen 2005). In the course of the 11th century new motifs and symbols came to influence the decoration of the brooches, but their structure with pin-fittings and a loop for attach-

ments remained the same (Baastrup and Petersen 2008; Pedersen 2014). When it comes to interpreting the brooch motives, some of them are a bit harder to decode for us today than others. It has previously been suggested that the animal and snakes on the Urnes brooches depicts two animals in battle or a snake subjecting itself to the large animal (Lindahl 1983, 40), furthermore, Urnes brooches has been interpreted as emblematic royal tokens (Bertelsen 1994, 351, 358; Gotfredsen 2002, 41; Lindahl 1983, 40; Westergren 1986, 10-12), or media for social communication which expressed political and ethnic affiliation: the latter especially because of their significant geographical distribution within the territory of Denmark (Røstad 2012). A more recent explication of the design of the Urnes brooches, an animal encoiled by a snake, is that this is to be seen as an image of God the Father and the Holy Spirit in intimate symbiosis and not as two beasts fighting one another (Wood 2014). The designs can therefore be regarded as purely Christian rather than political propaganda. According to this interpretation, the Urnes brooches were presumably more than anything else attributed with intrinsic powers and were not purely symbols intended to signal something externally. They thus embody continuity in use and significance: an old and well-known amulet brooch-type in a new dress (Andersen 2015, 52-3; Baastrup and Petersen 2008; Pedersen 2001, 52-3; 2004, 72; Pedersen 2014, 221; Petersen 2005).

Amongst detector finds from the Early Viking Period, locally manufactured cross-shaped brooches, known as Råhede brooches, occur; these are have been suggested to be tokens of baptism, distributed in connection with the Christian mission (Feveile 2011). In the late Viking Age and early Christian period in Denmark the imported Carolingian-Ottonian enamel brooches could have had the same function (Baastrup 2014, 105-10; Beck, Christiansen and Henriksen in press, 32-3, 57; Roslund 2010). With the marked ingress of brooches with Christian symbolism from the decades around the year 1100 the situation appears for the first time to have involved an extensive local production of amulets of Christian significance.

In the pre-Christian period, brooches were most often female jewellery, while from the early Christian period we have no grave finds, nor

written or pictorial sources, showing by whom the brooches were used or how, or anything concerning their role and importance at the time.⁷ In this respect, the surviving objects are themselves a primary source. The questions are, whether the continuity that can be seen in the construction of the brooches, pin-fittings combined with a loop, is an expression of continuity in use, and whether the brooches are still female jewellery or were worn by both sexes (Bertelsen 1994, 350-1; Røstad 2012, 200, 203). In the Christian context there seems to be a tradition for other small brooches with religious symbolism – such as, for instance, the previously-mentioned enamel brooches – to have been worn by both men and women (Baastrup 2007, 6), just as several other types of medieval jewellery, such as finger rings and later ring brooches too, were common to both sexes.

Background: Workshop finds and models of organization

Medieval jewellers' workshops, not least from the early Christian period, have hitherto been rare in the extreme in Denmark. During excavations in Viborg, a workshop of the first decades of the 11th century has been found, at which operation appears to have been seasonal and to have involved the bronzecaster and the silversmith on varying occasions (Jouttijärvi et al. 2005; Thomsen 2005). The only certain evidence from medieval Denmark of the production of the brooches listed above until just a few years ago was a workshop found in Lund, the so-called 'Urnes workshop'. Urnes brooches were certainly manufactured here in the period of c. 1100-1150 while models for circular animal brooches and bird-shaped brooches also occur amongst the finds from the town (e.g. Bergman and Billberg 1976; Bertelsen 2002b cat. nos. 44-45; Blomqvist 1947; Carelli 2012, 86-877; Cinthio 1999; Salminen and Hervén 2001; Stenholm 1976). Outside medieval Denmark, a mould for casting of Urnes brooches occur among the findmaterial from Sigtuna.⁸

The brooches were cast in clay moulds (Bergman and Billberg 1976, 207) which had been built up either over a solid model (Lønborg 1998, 71) or using a wax model (Söderberg 2018). Both meth-

ods had their roots back in the Late Iron Age and Viking Period and are well attested archaeologically in several of the Viking-period emporia, including Ribe and Kaupang (e.g. Feveile and Jensen 2006, 60; Madsen 1984, 91-5; Pedersen 2016). The understanding has been that the use of solid models was better suited to serial production than wax models were (Lønborg 1994; Madsen 1984, 91) as the latter could be used only once while a solid model could be re-used many times over. Experimental studies, however, indicates that the opposite can in fact be the case (Hedegaard 1992; Söderberg 2018, 7). The theory, that the slim loops of the Urnes brooches would not be suitable for melted wax to pass through, has never been experimentally tested yet (Lønborg 1994, 372). Another possibility is, that both methods have been used simultaneously. As shown in Gilsås study on the Urnes brooches, the majority of the brooches are made of copper-alloy (Gilsås in press). Judging from previous publications (Bertelsen 1992, 1994; Pedersen 2001) and data from DIME and detector fora, this seem to be the case for the bird brooches and the circular animal brooches as well.

For the specialist crafts, including the casting of copper-alloy jewellery, both mobility and close associations with a powerful elite, trading centres and urban contexts are considered to have been fundamental prerequisites (Calmer 2003, 359; Salminen and Hervén 2001). With regard to bronzecasting in the Iron Age and the Viking Period a series of models to represent the organization of the craft have been elaborated: *administered urban economy casting*; *merchant and raw material casting*; *professional super-regional casting*; *court casting*; *socially governed casting*; and *domestic casting* (Hedegaard 1992; Pedersen 2016, 35; Söderberg 2004). Several of these modes of craft-organization existed side-by-side for a long time, but in the course of the Middle Ages, with the growth of multiple urban environments, the specialist artisans acquired a more permanent customer and work base and came to constitute a core of the development and economy of the towns (Callmer 2003). In Lund, those who practised metalworking are consequently viewed from around the year 1100 as an organized workforce. They were nevertheless always subject to the power-wielding elite that owned the land on which the workshop activity took place.

Over time the craftsfolk appear to achieve a greater degree of economic independence, reflected, amongst other ways, in more direct contact with the customers (Carelli 2012, 76, 86; Salminen and Hervén 2001, 268).

The geographical distribution of specific varieties and finds of lead models and miscast objects is often regarded as evidence of the individual stamp of workshops and their presence, locally or regionally (Bertelsen 1992, 1994; Christiansen 2017, 87; Lønborg 1994; Pedersen 2001, 2010). Brooches manufactured in urban contexts (*administered urban economy casting*), with the discovery in Lund in mind, may have been the source and inspiration for local production (*domestic casting*) and/or itinerant craftsmen who copied items of jewellery on demand (*professional super-regional casting*). The inconsistent artistic quality of the brooches has been interpreted as a reflex of more or less professional artisans' skills, the work of various local workshops, or degeneration in the direction of the more stylized and imprecise over time (Christiansen 2017, 86-7, 91-2; Lønborg 1994, 371; Pedersen 2010; Ramskou 1957, 199-200; Westergren 1986). If the method of production included the use of a solid model it would mean that a brooch could be copied quite readily. Together with the fact that artefacts can be transported to another location in order to be sold, and may be lost at many locations other than where they were manufactured, more certain evidence of workshop production would be production waste such as moulds, metal drops and/or miscast artefacts.

The workshop in Ribe

The workshop building and its archaeological context

In the course of excavations south of Ribe Cathedral in 2011-12, the remains of a bronzecaster's workshop were excavated (Figure 1). The settlement phase to which the workshop activity pertains is dated c. AD 1050-1150. The area was previously part of the churchyard, and subsequently a House of Canons was built on the site. During the excavation of the settlement the remains of several



Figure 1. (a) Aerial photograph with the area of excavation marked. Photo/illustration: Danish Geodata Agency/Morten Søvsø.

timber buildings were found which had, however, been extensively disturbed by later activities (Excavation report: ASR 13).

Alongside the street line to the south (present Sønderportsgade: ‘South Gate Street’), the remains of a stave-built structure with curved walls raised in 1077 were found. To the north this plot was bounded by a wooden fence in a foundation trench. In the north-eastern quadrant the remains of a small wooden building were excavated. This building is inferred to have been rectangular, and about 4.5 m wide. In its north-eastern corner was found a deep sequence composed of a large number of thin clay and dirt layers with a high level of admixed ash, and a round hearth some 0.6 m in diameter consisting of both clay and ash layers (Figure 2). Both the floor and the fireplace contained large quantities of production waste in the form of green staining, lumps of copper alloy, and clay crucible- and mould-fragments. Amongst the finds were numerous fragments of clay moulds for casting of different brooch types. Finds of crucible sherds and mould-fragments in the floor layer of the bow-sided building indicate that it was contemporary with the workshop. The workshop layers were cut by a number of pits at the

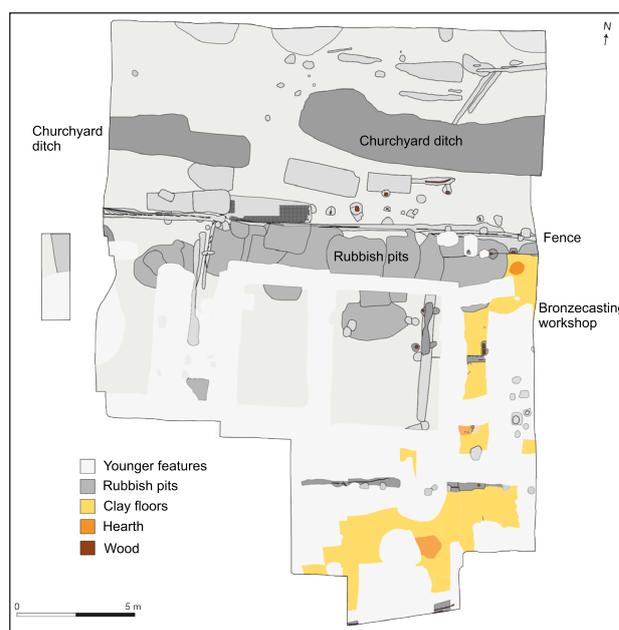


Figure 1. (b) The settlement phase with the remains of a workshop. Photo/illustration: Danish Geodata Agency/Morten Søvsø.

northern end of the plot that had been dug before the canonical cloister was built around 1150. On this basis, the functional period of the workshop can be narrowed to post-AD 1077, and on into the first decades of the 12th century.



Figure 2. Section through the hearth in the workshop. Photo: SJM.

	Totals
Mould-fragments	3628
Crucibles and crucible sherds	2570
Molten copper-ally drops	462
Brooches	23
Honestones (from primary contexts)	21
Touchstones	2

Table 1. The finds quantified.

The finds

Water-sieving increased the quantity of finds collected, especially in respect of production waste from the workshop (Table 1). Some of the finds are from the floor layer and the hearth in the workshop building but the distribution otherwise shows that the waste must have largely been gathered up and cast out over the plot around the workshop building, or buried in waste pits. Clay mould-fragments, crucible sherds and brooches also occur in later waste pits, building layers and other features subsequently cut into the area. The highest proportion of finds were from the fill of the churchyard ditch immediately to the north of the plot, including several large mould-fragments and eight complete crucibles (Figure 3a). The quantity of finds and the good quality of preservation indicate that these were deposited directly from the workshop.

Technical details of the finds

The clay moulds occur as fragments of half-form part-moulds with the impression of either the face

or the reverse of the object to be cast. Amongst the fragments there are a number of larger pieces, but no complete part-moulds (Figure 4). The degree of fragmentation could indicate that the moulds were broken after casting in order to remove the finished object, but it cannot be determined for certain that the moulds could have been or indeed ever were re-used.

Two-part moulds

By far the majority of the moulds had been two-part moulds with an upper and a lower half. Preforms for pin-fitting in the form of two prongs were cast in with the brooch itself (e.g. Figure 4a, 16a, 19b). The prongs were subsequently drilled through and filed to shape so that the pin could be attached. The correct position of the two mould halves in relation to each other was secured in the process of casting by keys- and keyholes which were located at the edge of the mould (Figure 5, 17f) (Feveile and Jensen 2006, 159; Madsen 1984, 93). The gate could have been formed with the aid of a wooden model (Lønborg 1998, 71). The inlet gate was an integral part of the mould. The molten metal was poured in through this into the cavity of the mould (Figure 6a).



Figure 3. Equipment and tools. (a) Crucibles ASR 13x1065, x1143, x1314. Without scale. (b) Possible touchstone ASR 13x479. 1:1. (c) A selection of honestones ASR 13x406, x491, x742, x1244, x1329, x1356, x3552, x3535, x3563. 1:2 (d) the inside of a crucible sherd with small golden drops. ASR 13x1420. Without scale. Photo: SJM/Henrik B. Christiansen (HBC).



Figure 4. Examples of larger mould-fragments. (a) The central piece has a channel (sprue) leading to the reverse of a brooch with a pin-fitting ASR 13x3162 (3 parts). (b) The reverse of a larger fragment ASR 13x3564. 1:1. Photo: SJM/HBC.



Figure 5. Mould-fragments with keys and keyholes. ASR 13x3530, x3482, x3552. 1:1. Photo: SJM/HBC.



Figure 6. (a) Fragment with a sprue channel and gate. ASR 13x3469. (b) Fragment with three sprues for three brooches. ASR 13x3126. 1:1. Photo: SJM/HBC.



Figure 7. Lead-model for a circular brooch with animal design. ASR 13x4255. 2:1 Photo: SJM/HBC.

Double- and triple moulds

In a number of cases, the bronzecaster was working with moulds for two objects at a time, presumably to save time and resources. What were cast in a single mould could be examples of the same brooch-type or different types (e.g. Figure 13m, p, r, s, 15a, 17e). There is a single case of a mould with a sprue that branches into cavities for three separate objects (Figure 6b).

The models

Among the workshop findmaterial is a lead-model for a circular animal brooch (Figure 7). This, and the use of two part moulds, used in order to remove the model after the mould had dried, and the presence of keys- and keyholes in order to hold the two half-moulds together in the right position during casting (Figure 5, 16a), are proof of the use of solid models in the workshop. However, it is a possibility, that both solid models and waxmodels could have been in use in the workshop. Anders Söderberg has shown how one can advantageously make use of wax models in the serial production of Urnes brooches in clay moulds (Söderberg 2018). One feature which is visible on some of the large quantity of detector-found brooches is evidence of the trimming of the openwork areas on the reverse of the brooch. This modification is assumed to have been carried out in a soft wax model and not on a finished cast metal brooch (Söderberg 2018, 6, figure 16, 20). Such marks can also be seen on some of the brooches that have been found in the Ribe area (Figure 12b, reverse). Future microscopic analyses of the surfaces of the moulds, however, together with casting experiments, may be able to shed light upon this (Söderberg 2018, 5).

Miscasts and discarded brooches

The small quantity of metal that was required for casting cooled down at lightning speed and it was thus easy for the casting to fail (Lønborg 1994, 373). One mould had collapsed during casting, perhaps because the clay had not been sufficiently fired; another mould's sprue is full of metal (ASR 13x3537, x3564). For the casting of bird-shaped brooches, the sprue always led to the vertical end of the fan-shaped tail, and in several cases discarded or lost specimens show that there is still some casting flash from the sprue in situ as an extension of the tail (e.g. Figure 13a-c). In other cases the entire bird's body has gone awry during casting (Figure 13f, g). From the layers in and around the workshop a quantity of honestones have been found which could have been used for finishing work on the cast brooches, removing casting flash and excess metal (Figure 3c).

Open moulds

Eleven mould-fragments stand apart through consisting of just a one-part oval mould (Figure 8a). The fragments have a substantial rectangular notch across the curvature of the oval, probably for a spike to hold the mould firmly during casting. The liquid metal must have been poured directly into the cavity, which is cross-shaped in all cases.

The metals

The metal alloys which were used for casting in this workshop have left green staining on the workshop floor and the fireplace layers, on crucibles and mould-fragments, and in the form of droplets. The discarded or lost brooches from the excavations are also copper-alloy. The conditions for the preservation of metals in the culture layers of Ribe are poor on the whole, and metal remains and objects in the finds from the bronzecasting workshop are generally highly corroded, with surface degradation. As yet, no systematic analysis of the metals from the workshop has been carried out, but XRF-analyses of the surface of four mould-fragments have revealed traces of copper, zinc and lead. Two crucibles contained traces of copper while the contents of two brooches were, respectively, copper/tin and copper.⁹ Some of the brooches were therefore apparently of a brass-like alloy and were originally a shiny gold colour. An Urnes brooch that was found during the excavation of a well in a settlement south of Ribe was probably manufactured in this workshop (see below). This brooch is in good condition and it gives an impression of the gold-coloured surface the now corroded brooches may have had (Figure 10a). This may have rendered the use of coatings unnecessary, but the discovery of just one crucible sherd with a couple of drops of gold (Figure 3d) and a touchstone (Figure 3b), nevertheless shows that the workshop must have worked with this precious metal to some extent, possibly for gilding.

The products of the workshop

Amongst the whole collection of mould-fragments there are a number with no impressions, or with



Figure 8. (a) Fragments of open one-part moulds for casting cross-shaped objects ASR 13x3495, x3467, x3534, x3474. (b) Fragment of a two-part mould for the casting of the same type of object ASR 13x3492. 1:1. Photo: SJM/HBC.

such limited impression evidence that they cannot be identified to brooch-type. From the 1,774 fragments with impressions, 497 can be identified to type. It is important to bear in mind that whole or larger impressions of, for instance, the small and compact bird-shaped brooches (Figure 13) will have stood a better chance of surviving because of their size than impressions on moulds for large Urnes brooches that would have been likely to suffer a higher degree of fragmentation (Figure 10) and so be represented in a larger number of fragments. The majority of the fragments do indeed have the impression of looped ribbon work of the Urnes Style without the exact appearance of the brooch being determinable. The repertoire of products that is presented below therefore probably constitutes only part of the total range of brooches, with possibly other artefact-types to be included as well. In order to reconstruct the repertoire, mould-impressions and miscast or discarded brooches from the workshop context have been compared, along with other archaeological finds from Ribe and from other metal-rich sites in the hinterland of the town (Table 2; Figure 9).

	Urnes-	Bird-	Circular frame with animal design	Circular frame, inidenti- fiable	Palmette brooch	Double cross	Double moulds included	Uniden- tifiable impress- ions	No im- pression	Total
Mould-im- pressions	347	127	9	47	2	12	40	1230	1854	3628
Miscast/ discarded brooches	4	7	4		1	2				18

Table 2. The workshop repertoires.

Urnes brooches

The design of Urnes brooches is a quadruped animal surrounded by looped ribbons. The loops may extrude from the beast itself or be separate animals (Bertelsen 1994, 347). In many cases the design is so stylized that it can be difficult to distinguish the distinct components of the design. Larger loop-holes at the bottom of the brooch motive, or next to the animals feet presumably provided a loop for the suspension of other ornaments, or for a chain or lace to be attached.

There are 347 mould-impressions with segments of zoomorphic loops from Urnes brooches amongst the workshop finds. On the basis of this assemblage and finds of brooches, the following four types may be distinguished as one range of the repertoire of the workshop.

Type 1

This type depicts an elegant, slim animal surrounded by looped ribbons or snakes. The animal has a pointed oval eye, a small ear, a curled snout and curl decoration at the shoulder. One of the loops below the animal were probably used for fastening of an eye (as on figure 26e). It is the workshop's largest and most elegant brooch design. Type 1 is represented in the workshop material by one miscast fragment (Figure 10e) and one mould-impression (Figure 10g). Complete examples on this type has been found during excavations of settlements in the Ribe area. One was found at the base of a well that is dendro-dated to c. AD 1100 (Figure 10a) and the second from the wall trench of a building (Figure 10b) (Jensen 1991, 38; Pedersen 2010, 209). Three other finds, two found by metaldetecting and one found during an excavation in Ribe, are respectively of the beast's head (Figure 10c), the lower part of the beast's neck/back with looped decoration (Figure 10d), and most of a brooch apart from the head (Figure 10f) (Kristensen 1999, 143). On the first of these the surface is covered in minute pits, possibly a casting error. The brooch nonetheless has a pin-fitting and therefore was used despite its blemish.

Type 2

This type has three conspicuous claws on the forelegs and a small crest or ear on the head. Between

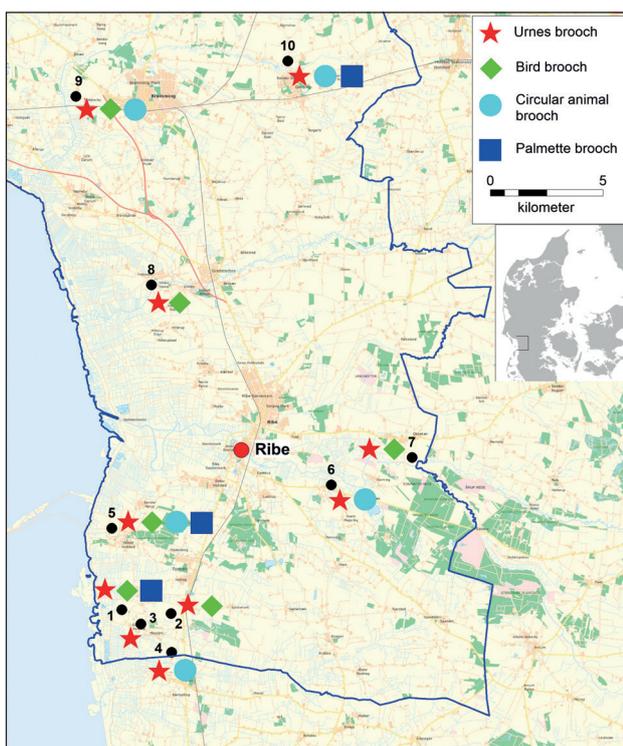


Figure 9. Finds of the workshop products from detector sites recorded at Museums of Southwest Jutland. (1) Gl. Hviding ASR 440, 1265, 1375, 1689. (2) Råhede ASR 872, (3) Høgsbrogård ASR 2321, (4) Vivegrøft ASR 2344, (5) Okholm SJM 154. (6) Seem kirke ASR 1021, (7) Obbekær SJM 740. (8) Vilslev Spang ASR 491. (9) Toftegård/Tømmerby ASR 1995, SJM 257. (10) Gørding kirke SJM 679. For specific finds from each location, see figs. 10-17, 19. Map: Claus Feveile.

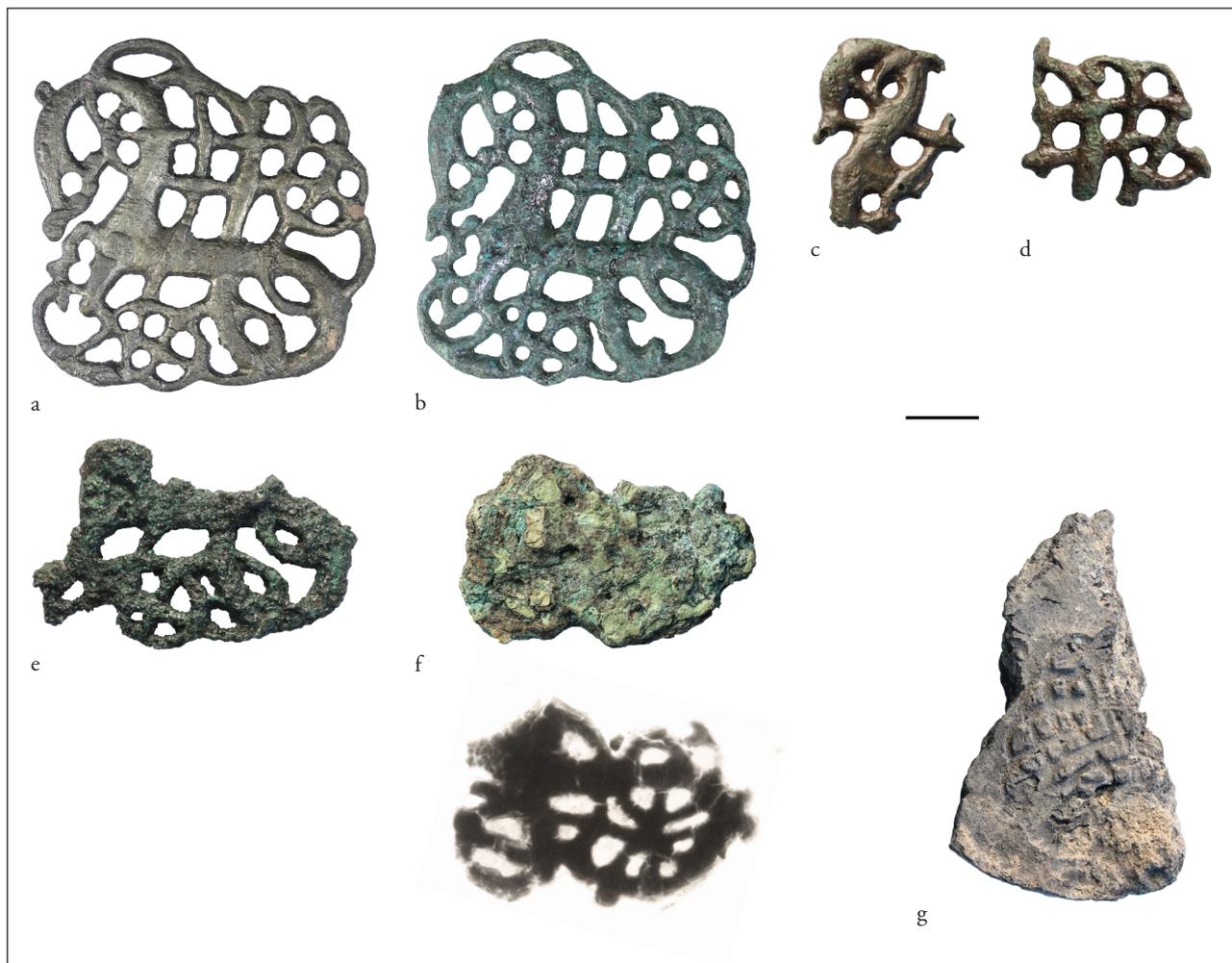


Figure 10. Urnes brooches, Type 1. (a) ASR 440x528. (b) ASR 491x21. (c) ASR 872x148. (d) ASR 872x52. (e) ASR 13x289. (f) ASR 565x279 (photo+X-ray). (g) ASR 13x3129. 1:1. Photo: SJM/HBC.

the claws a small hole is found which probably served as the loop. On well-preserved specimens there is marking in the form of transverse lines at the transition from the chest to the foreleg of the beast (Figure 11a, b). A miscast brooch from the workshop and six mould fragments are evidence for casting of brooches of this type (Figure 11h-l). The type is also known from a number of metal-rich sites (Figure 11a-f) and as an archaeological find from an excavation in the western part of Ribe (Figure 11g). They are all made of copper-alloy.

Type 3

The design on this type is an animal body with a beak-like mouth surrounded by looped decoration. The eye is a pointed oval. There is a single specimen from the workshop layer (Figure 12a) and the type is also known from metal-rich sites of the hinterland (Figure 12b-d).

Type 4

This brooch type depicts a winged, dragonlike animal looking over its back, surrounded by snake-loops. The animal has a small ear and an open mouth with a curled snout. On parallels a pointed eye and curl decoration at the shoulder can be seen.¹⁰ The snake and the animal's heads are joined (in a kiss?) over the animal's back. The design has stylistic elements from the Urnes- as well as Romanesque style. This type is only represented by a single miscast example from the workshop layers (Figure 12e).

Bird-shaped brooches

The workshop assemblage included 127 mould-fragments from the casting of bird-shaped brooches. Three distinct sub-types can be distinguished amongst these. All of the bird-shaped brooches have a hole formed between the claws

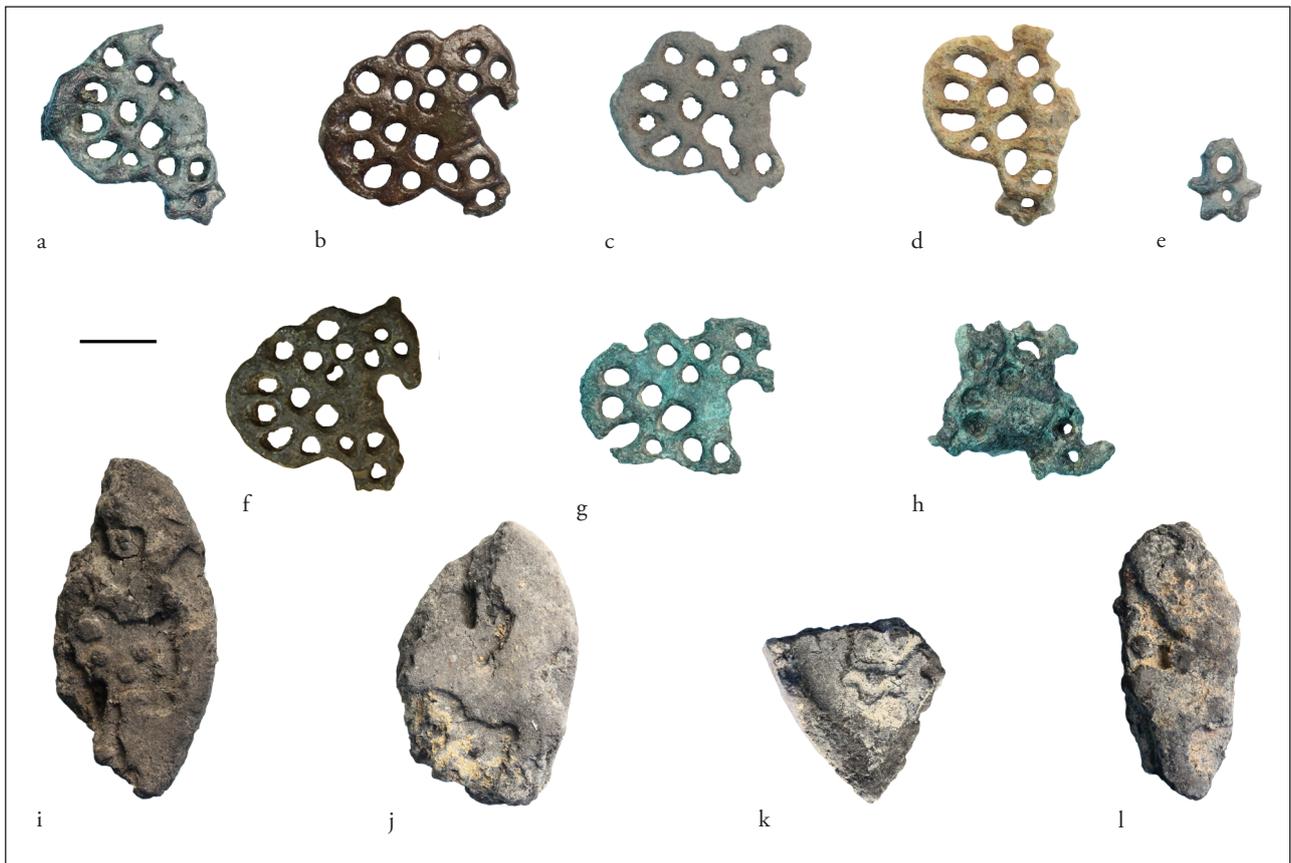


Figure 11. Urnes brooches, Type 2. (a) ASR 491x502. (b) ASR 1021x23. (c) ASR 1375x140, (d) SJM 740x23. (e) ASR 1689x22. (f) SJM 257x1. (g) ASR 11x3072. (h) ASR 13x3170. (i) ASR 13x3534. (j–l) ASR 13x3129. 1:2. Photo: SJM/HBC.



Figure 12. Urnes brooches, Type 3 (a–d) Type 4 (e). (a) ASR 13x3130 front and back. (b) ASR 1265x25 front and back. (c) ASR 872x70. (d) ASR 2321x239. (e) ASR 13x260 (photo+X-ray). 1:1. Photo: SJM/HBC.

which presumably provided a loop for the suspension of other ornaments, or for a chain or lace to be attached.

Type 1

The birds of this type have a small crest and stand on two legs with strong claws, between which there is a loop hole. They have a fan-shaped tail with

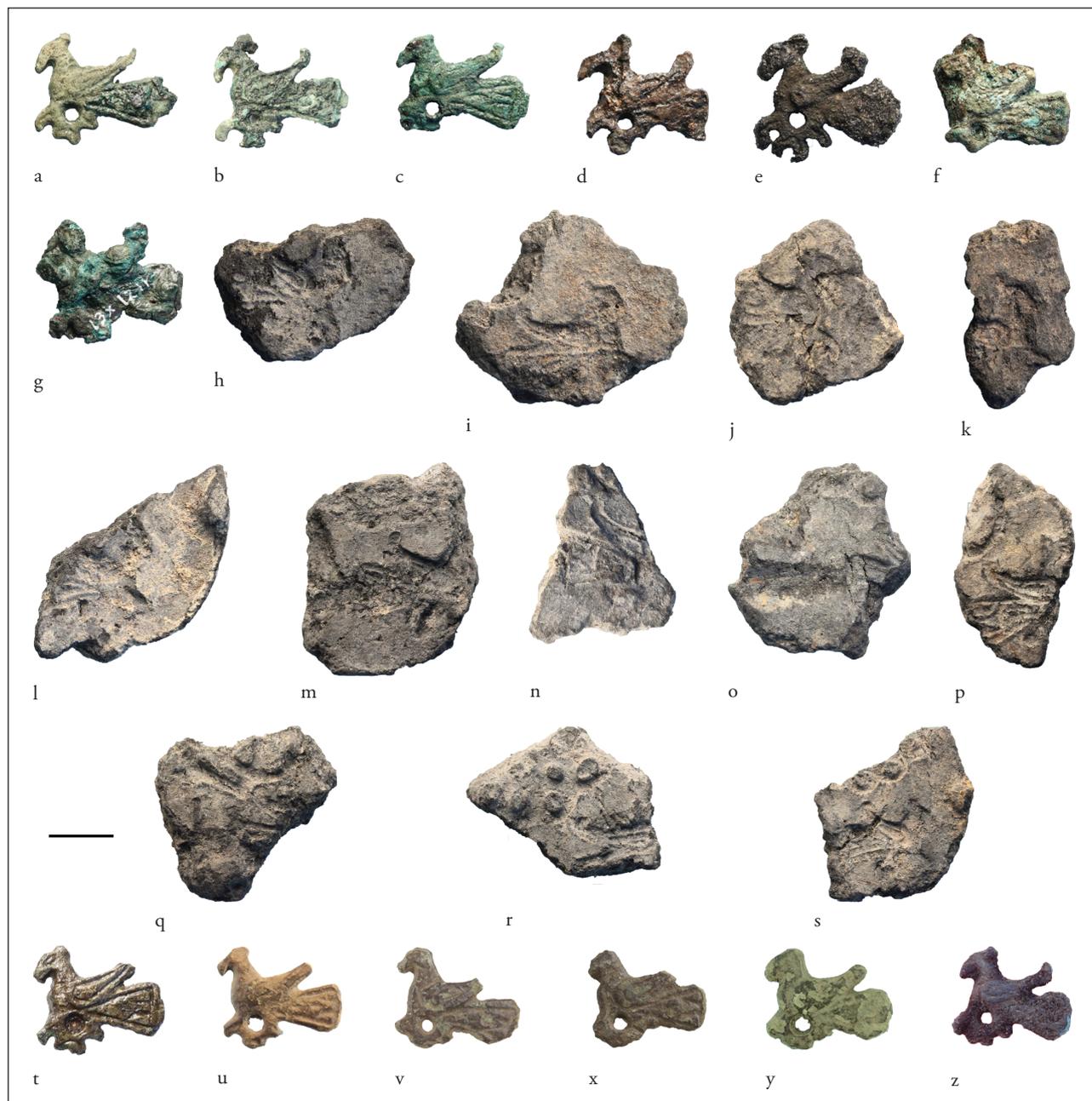


Figure 13. Bird-shaped brooches, Type 1. (a) ASR 13x479. (b) x3132. (c) x3036. (d) x1130. (e) x1273. (f) x512. (g) x1211. Mould-impressions: (h) x3492. (i) x3537. (j) x3552. (k) x3552. (l) x3129. (m) x3492. (n) x3492. (o) x3129. (p) x3495. (q) x3492. (r) x3492. (s) x3492. 1:1. Detector finds: (t) ASR 1689x83. (u) SJM 740x22 (v) SJM 257x107 (x) 115 (y) ASR 872x351 (z). HAM 5613x53. Photo, a-y: SJM/HBC. z: Poul Nørgaard Pedersen.

clearly marked feathers and a raised, slightly up-turned wing with a small curl at the end. Where the demarcation of the eye survives it is pointed oval. There are 50 definite mould-impressions and seven brooches from the workshop layers. Amongst the mould-impressions, five are from double moulds in which bird-shaped brooches of Type 1 were cast along with an Urnes brooch (Figure 13q-s), and three were cast along with an open-work circular brooch (Figure 13p). This type is also

known amongst detector finds from the hinterland of Ribe (Figure 13t-z).

Type 2

The wings of the bird of this type are raised and curve gently down towards the tail. Between the wings, the tail and the nape there is looped decoration with two perforations. The space between the legs of the bird forms a loop. The claws are strong, and the hindmost of these stretches quite a long

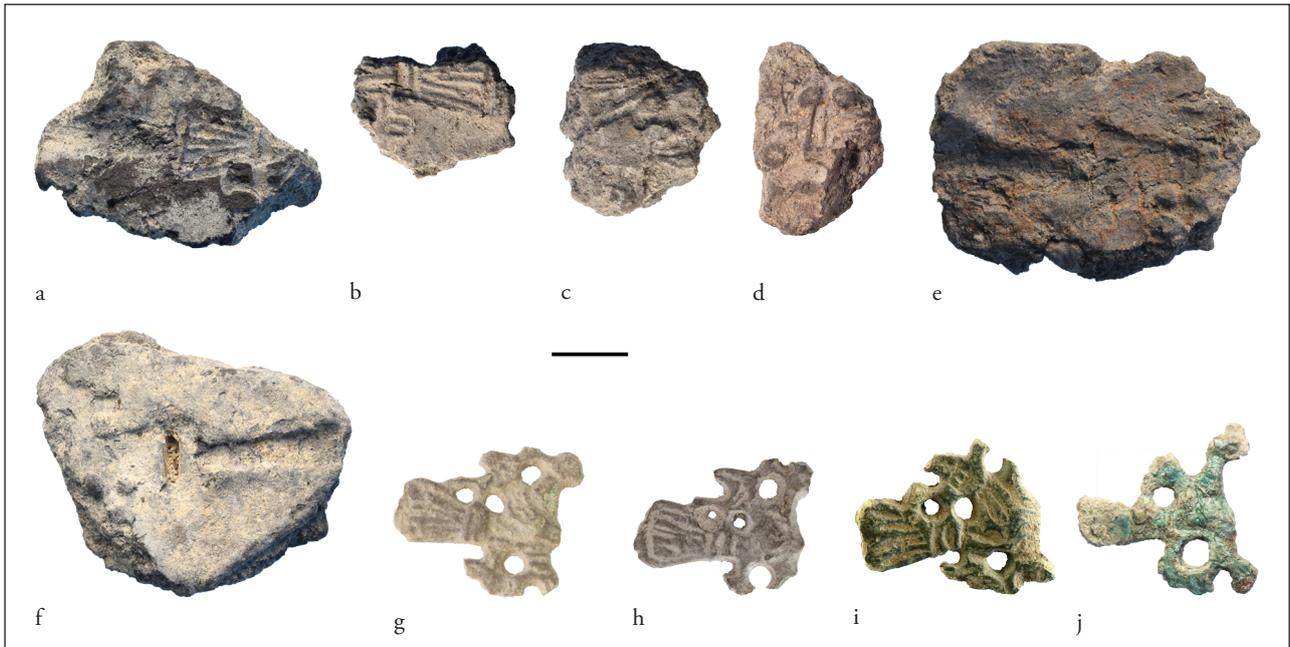


Figure 14. Bird-shaped brooches, Type 2. (a) ASR 13x3129. (b) x3492. (c) x3534. (d) x3474. (e) x3534. (f) x3129. (g) ASR 1375x130. (h) ASR 1689x281. (i) SJM 154x6. (j) ASR 11x4711. 1:1. Photo: SJM/HBC.

way back beneath the tail. On well-preserved specimens, vertical parallel lines mark the transition between the body and the tail. There is a total of 16 mould-impressions which can be assigned to this type in the workshop find (Figure 14a-f) while a number of counterparts have correspondingly been found locally on metal-rich sites (Figure 14g-i), and one example is an archaeological find from Ribe (Figure 14j).

Type 3

This type depicts a bird whose wings are resting upon the fan-shaped tail and the beak is slightly hooked. On one well-preserved double mould an impression can be seen along with that of a circular brooch (Figure 15a). The impression is flat, with

demarcation of the wing against the body as its only detail. The head is small in proportion to the body.¹¹ A brooch of this type found by metal-detecting has a number of blisters on the body and may be a miscast (Figure 15b). Despite its irregular surface the pin-fittings were completed and the brooch will therefore have been used.

Circular animal brooches

The workshop assemblage from Ribe included at least 56 mould-fragments for the casting of open-work circular brooches (Table 2). Most of these had an outer diameter of around 2 cm but there are also circular frames down to only 1.5 cm diameter (Figure 15a). On many of the fragments it



Figure 15. Bird-shaped brooches, Type 3. (a) ASR 13x3564. (b) ASR 1689x60. 1:1. Photo: SJM/HBC.

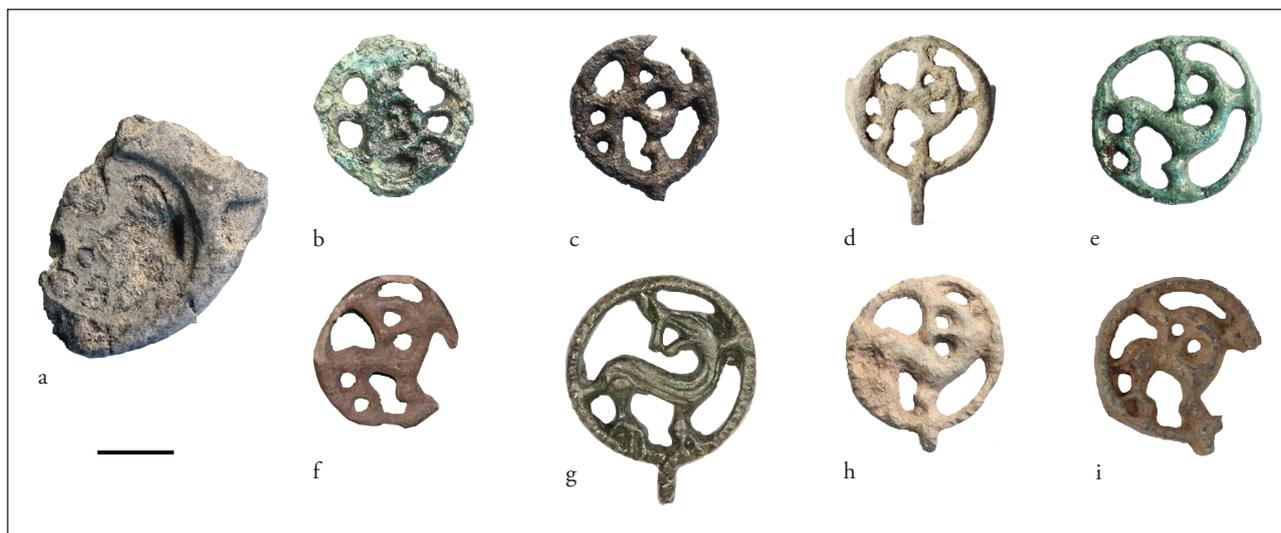


Figure 16. Circular animal brooches, Type 1. (a) ASR 13x3129. (b) ASR 13x3090. (c) x1093. (d) ASR 13x4255. (e) ASR 11x3260. (f) ASR 1995x1. (g) ASR 1021x2 (h) ASR 2344x268. (i) SJM 679x8. 1:1. Photo: SJM/HBC.

is not possible to identify the central design. The frame itself may be relatively broad and flat; in two ridges or decorated with a beaded rim.

Type 1

Circular animal brooches of the type that is also known as the Aalborg Group (Bertelsen 1992; 1993). The design is a backward-facing animal with an open mouth and a stylized pointed snout. The animal is set slightly turned within the frame and is often provided with a loop at the bottom of the frame (Bertelsen 1992). In the workshop assemblage from Ribe the type is represented by a lead model (Figure 7, 16d) and a mould-impresion from the manufacture of this type. The fragment is rather battered, and some of the impresion of the forepart and neck of the beast has been knocked off (Figure 16a). In addition to this piece two discarded brooches were found in the excavation, one of them clearly miscast (Fig. 16b) and the other lacking the final finishing work in the form of perforations for the pin-catch and pin-anchor. On the latter it would appear that the attempt to cast something to form a loop failed (Figure 16c) but the filing out of holes for the pin-fittings had started all the same. As a rule, brooches of this type would have had a cast-on loop but there are also examples without that (Figure 16e, f). It is possible that the openwork in the design could be used to fasten appendages, as in the case of the bird-shaped

and Urnes brooches. This type is highly uniform in appearance, with differences residing in where details of the design have been put, or whether the frame is decorated. In the latter respect there are some very simple examples (Figure 16f) while others have a frame with a beaded rim (Figure 16g-h); one has a well demarcated face and a curl on the snout (Figure 16g) (Bertelsen 1993).

Type 2

This type depicts circular animal brooches with the Agnus Dei motive. Inside the frame there is a stylized beast whose back forms a horizontal, undulating line just above the centre of the frame. Fore- and hindlimbs are joined to this. Above the back of the beast is a conspicuous cross. On examples that have been produced in a more detailed style an eye, tail and a spiral-demarcated shoulder are visible (Figure 28a). The outer diameter is around 2 cm. Nine mould-fragments from the Ribe workshop can be matched to this design (Figure 17a-f). These include three double moulds in which the circular brooch was cast along with an Urnes brooch (Figure 17e-f). There is also a highly abraded specimen with a pin soldered on to the reverse in the workshop assemblage (Figure 17g) and a detector-found specimen from the hinterland of Ribe (Figure 17h). This type has no soldered-on loop, but once again the holes between the legs of the animal could have served as loop holes for suspension.

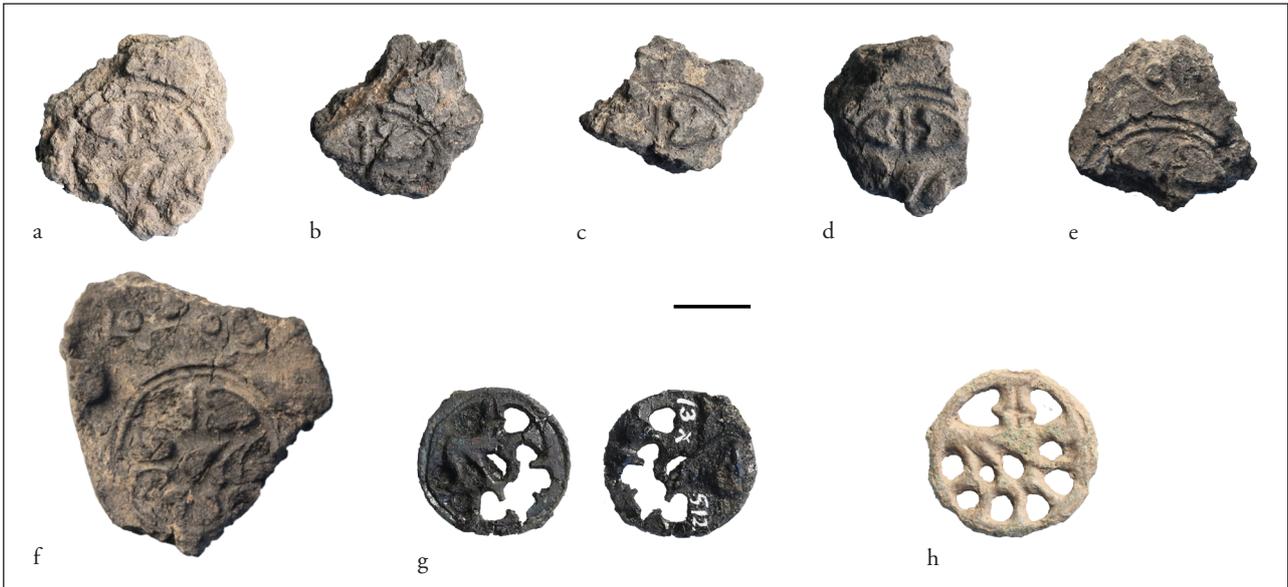


Figure 17. Circular animal brooches, Type 2. (a–c) ASR 13x3492. (d) x3520. (e) x3492. (f) x3522. (g) ASR 13x512 (front and back). (h) SJM 154x176. 1:1. Photo: SJM/HBC.

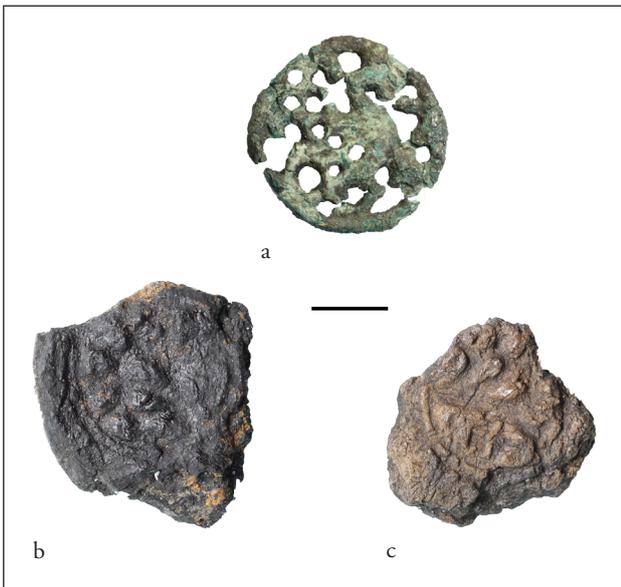


Figure 18. Circular brooch with animal design, Type 3. (a) ASR 13x3121. (b) x3492. 1:1. Photo: SJM/HBC.

Type 3

This brooch type has a circular frame which is a little larger than with Types 1 and 2. Inside the frame can be seen the body of an S-shaped animal or bird with a neck and bent head surrounded by Urnes-style looped decoration. The brooch looks like a hybrid of the Urnes-brooch and circular animal-brooch forms. There are two mould-impressions for such brooches, with profiled circular frames filled with Urnes-style decoration (Figure 18b) and one discarded or miscast brooch from the workshop layers (Figure 18a)

The palmette brooch

The products of the workshop included a type of brooch which up until a few years ago was a rarity in Denmark (Henriksen 2017, 26) (Figure 19). In this paper it is referred to as the *palmette brooch*, a name which refers to a core component of the design and its symbolism.

The palmette brooch is similar in size and construction to the other brooch-types presented above. A typical width is around 2,5 cm, and in addition to a pin-catch and pin-anchor there is sometimes evidence of a loop. On one specimen from Ladby on Fyn the loop ring is preserved (Figure 20a). Although already one can see a range of varieties and stylistic variance amongst the examples found by metal-detecting, it is pretty much the same features which recur in the symmetrical design. At the bottom there is often an oval raised area which is occasionally modelled as a bearded human face (Figure 20a-b, f); in other cases as a ribbon-bow or palmette (Figure 20c-d, g-i). Vertically above this a more or less stylized palmette or ribbon-bow spreads out, and at either side two curving animal necks with heads project which meet above the palmette and enclose the central motifs in a heart-shaped frame. In Christian iconography the palmette is synonymous with the Tree of Life and the Cross (Karlsson 1981, 117). It occurs in Mammen, Ringerike, Urnes and Romanesque art on runestones, in ecclesiastical art,

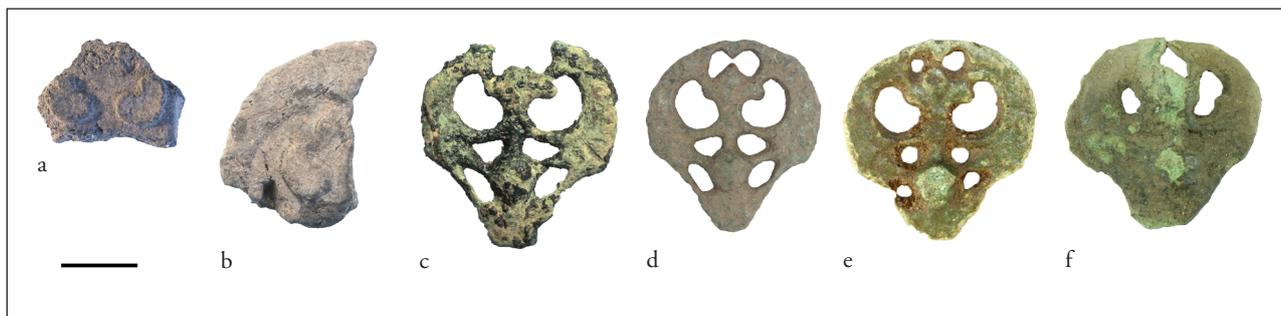


Figure 19. Palmette brooches. (a) ASR 13x3126. (b) x3474. (c) ASR 13x1139. (d) ASR 1689x256. (e) SJM 154x1. (f) SJM 679x5. 1:1. Photo: SJM/HBC.

and on minor objects including coins and items of jewellery (Jensen 1995, 54; Karlsson 1981; Vellev 1981, 59f). Trefoil palmettes appear on cruciform pendants of the 11th century (Vellev 1981; Jensen et al. 1992, Cat. No. 19; Staecker 1999, e.g. Cat. Nos. 22, 23, 25, 39). On a circular animal brooch four symmetrically arranged palmettes mark the terminals of the arms of the cross in the composition's modified cross shape (Bertelsen 1992, 245, 2002a, 30, Pedersen 2014, 210).

The palmette design often appears in connection with or in between snake-like beasts, on occasion as a linking component (Karlsson 1981, figure 1-2). The linkage can be seen as expressing a connectedness and association rather than the pacification of some negative force (Karlsson 1981, 117; cf. Wood 2014).

The design, in which the palmette almost invariably constitutes the central component, is probably just such a Tree of Life surrounded by snake-like beasts or with the latter growing from it – possibly godly rather than diabolic symbols. In several cases a human mask, sometimes bearded, terminates the frame of the brooch at the bottom. Human figures or masks, palmette motifs, the Tree of Life, Cross and beasts are compositional elements often seen together in Late Viking-period or Romanesque art (Pedersen 1981, e.g. 69, 87). In some cases the human replaces the bow/palmette which connects the animal heads (Pedersen 1981, 70, figure 3), while the palmette is contrastingly placed where the mask occurs on some of the brooches. Several of the elements appear, therefore, to be synonymous, which is, as it were, the palmette or the Cross.

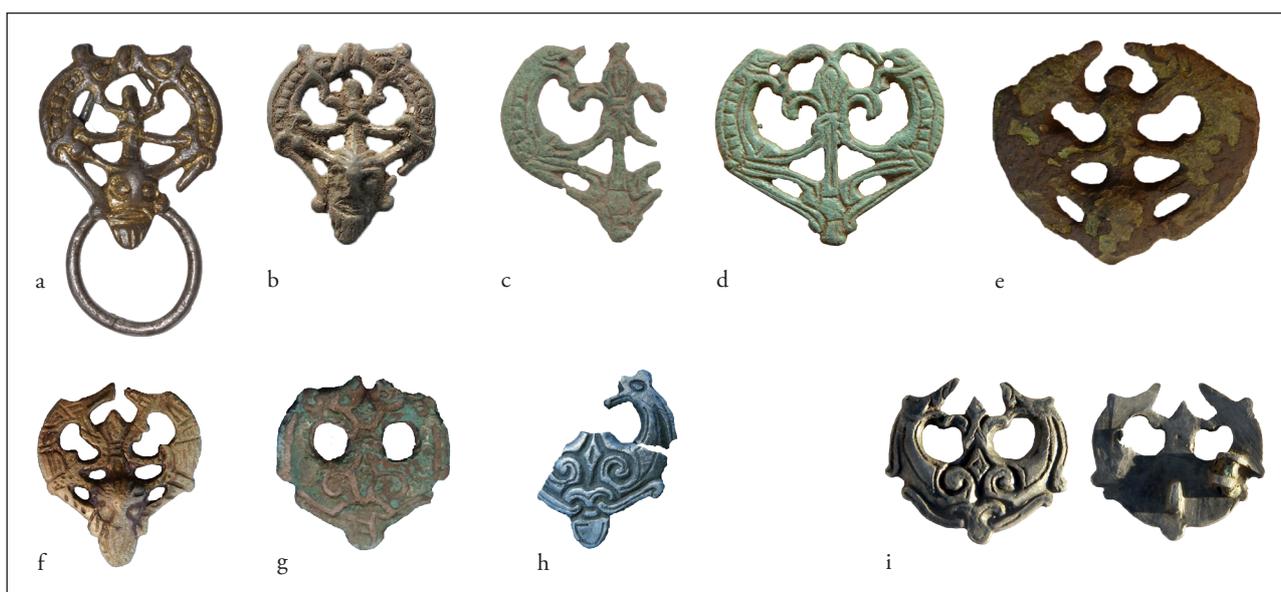


Figure 20. Examples of palmette brooches from elsewhere in Denmark. Without scale. (a) ØFM 445x1. Photo: Claus Feveile. (b) VHM 100x3061. Photo: Louise Stalschmidt. (c) OBM 9867x341. Photo: OBM. (d) ØFM 620x74. Photo: Claus Feveile. (e) HAM 4971x12. Photo Anders Hartvig. (f) MLF1905x54, copper-alloy. (g–h) MLF1930x?, x5, copper-alloy/silver. Photo: Torben Christjansen. (i) ØFM 620x670, silver. Photo: ØFM.

Since the other components have counterparts in Christian symbolism, could the mask perhaps portray Christ?

Cross-shaped objects and buckles

Another product was the small double cross with no sign of any loop, holes or anything else which could show how it was used (Figure 8, 21a-b). The double cross, known as the *crux gemina* or *patriarchal cross*, is a rare occurrence amongst the assemblage of detector finds or in archaeological contexts (Staecker 1999, 153-4). On the other hand a number of fine pendant crosses shaped as Greek or Latin crosses do appear amongst the detector finds of this period, both in de luxe editions of precious metal and cast in lead or bronze (Bertelsen 1993, 4; Jensen et al. 1992; Staecker 1999; Søvsø and Knudsen 2019, 134-6). One possibility is that the double crosses were intended to be used as pendants with a drilled hole for suspension or a loop soldered on. Alternatively they could have served as ornaments attached to other types of object. In addition, one example of three connected buckles shows that the output of the workshop also included other types of dress-accessory (Figure 21c) (Bergmann and Billberg 1976, 206).

Some observations regarding the workshop repertoire

Taking into account the many fragments with unidentifiable imprints, it seems likely that additional types might have been produced in the workshop. The finds from metal-rich sites in the hinterland of Ribe might give an impression of some of these workshop products. They cannot be associated with the workshop with any certainty but can be noted as possible suggestions as to what the repertoire also may have included (Figure 22). A few types of bird-shaped brooches stand out in particular (Figure 22a-e, f-g, h-i).

The comprehensive find material from the Ribe workshop gives new insights when it comes to several aspects. It stresses the connection, contextually and symbolic, between the brooch types represented in the material. It has earlier been cautiously suggested that the animal on the Aal-

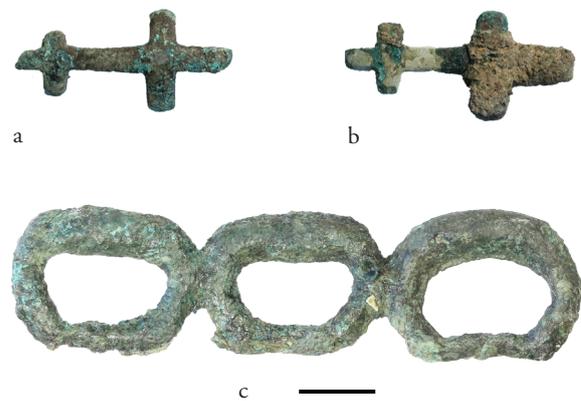


Figure 21. Double crosses. (a) ASR 13x3129. (b) x3535. (c) Three buckle loops still connected as cast ASR 13x3152. 1:1. Photo: SJM/HBC.

borg group type are perhaps another, possibly a bit earlier, version of the Agnus dei motive (Bertelsen 1992, 245, 2002a, 30, Pedersen 2014, 210). The workshop production of both types, stresses the close relationship between these two motive variants. The decorative elements used on the brooches all seem to be based in Christian symbolism but expressed through Scandinavian stylistic tradition (Bertelsen 2002a, 28-29; Gotfredsen 2002, 42). In other words, the workshop repertoire seem to be saturated with Christian symbolism.

Another important observation is the range of quality of different brooch types among the Ribe workshop products. There is a large difference in artistic quality between for instance the Urnes brooch type 1 and type 2-3. Slightly miscast products were finished, sold and used, probably at a lower price. Altogether this reflects a production targeting a broad customer base rather than the works of a number of different craftsmen, some more professional or talented than others. This evidence is a breakthrough in order to understand the background for the range of quality seen among the detector finds of these brooches all over Denmark.



Figure 22. Other brooch finds from the hinterland of Ribe. (a) ASR 491x150. (b) ASR 872x140. (c) ASR 1425x63. (d) ASR 1990x1. (e) SJM 154x144. (f) ASR 440x801. (g) ASR 1689x135. (h) ASR 440x603. (i) ASR 440x789. (j) ASR 491x148. (k) ASR 2321x1. (l) ASR 1990x2. (m) ASR 2344x57. (n) SJM 748x1. (o) ASR 872x69. (p) ASR 872x76. 1:1. Photo/drawings: SJM/HBC.

The workshop in Aalborg

In the course of excavations in the area around Budolfi Church in Aalborg, in 1981, 2015 and again in 2017, remains of one or more bronze-casting workshops which used the same techniques and had a repertoire of production that was similar to that at Ribe was found (Figure 23-27) (Jensen 2018). Crucibles were found as early as 1981, while an excavation of 2015 produced fragments of a couple of lead models, one of them (Figure 24b) possibly the lower part of a model for a variant of Urnes brooch which is known, *inter alia*, from Nørholm west of Aalborg, from Als in Himmerland (Figure 24c), and from Mollerup between Randers and Viborg (Pedersen 2010, 209).

In 2017, in connection with the construction of a sewer trench in Algade immediately south-east of Budolfi Church, further traces of workshop activities were found: this time in the form of several well-preserved waste products from bronzecasting in the layers affected. The trench lay not only within the actual medieval street itself but also cuts partly into the medieval plots that lined the street. Excavated there were, amongst other things, floor layers and a furnace pit which may be from a workshop itself. It is quite conceivable that outside of the line of the trench there are still intact and well-preserved remains of the workshop. Amongst the finds there are 60 crucible-fragments or complete crucibles, ingots, melting waste, 15 clay moulds, and both finished and miscast pieces of jewellery (Figure 25-26). The casting waste, ingots

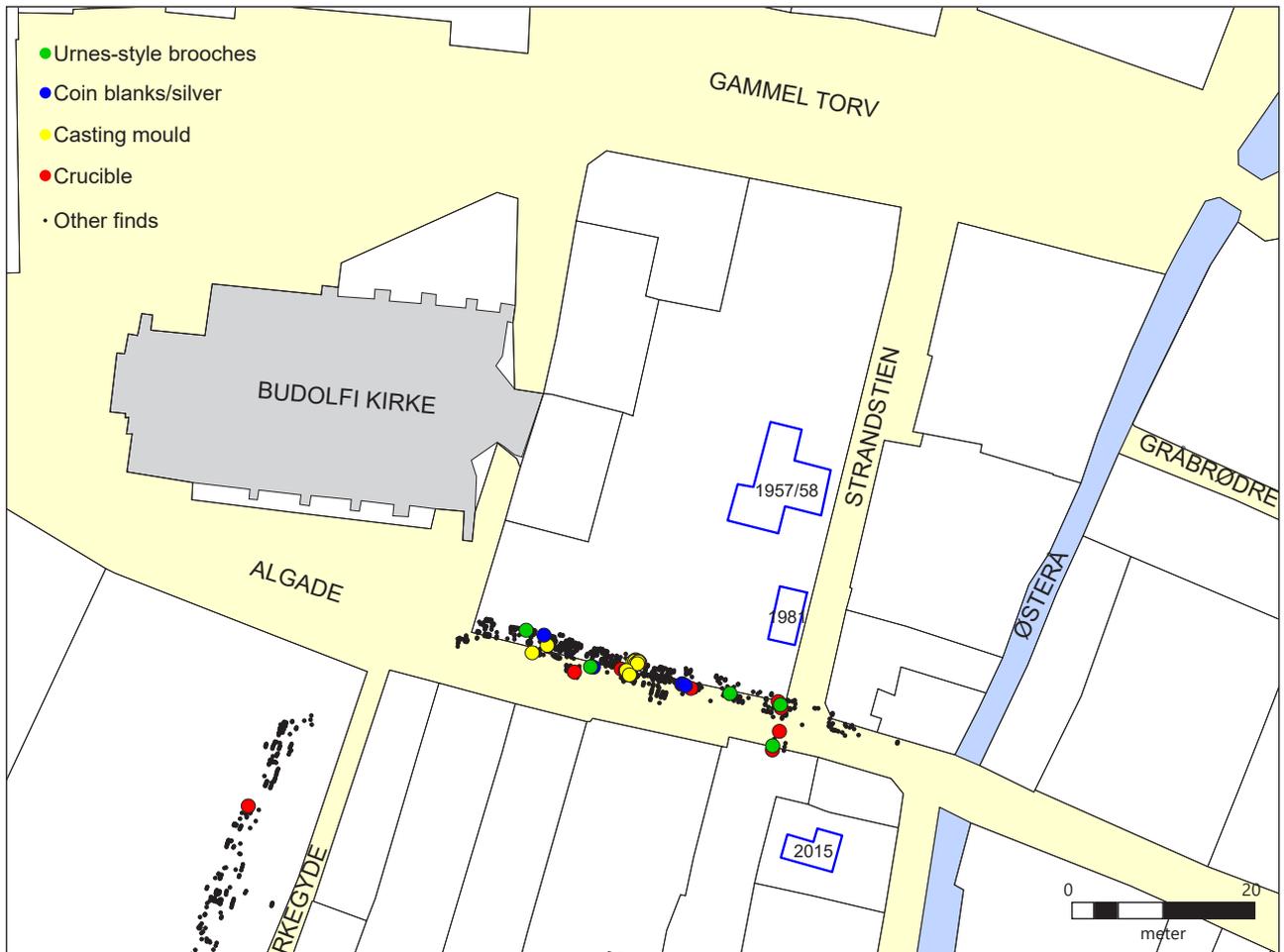


Figure 23. Plan showing the excavations referred to and the 2017 finds around Budolfi Church/Algade in Aalborg. Illustration: Christian Vrængmose Jensen.

and items of jewellery are of a brass-like copper alloy. The finds include both moulds for and ready-cast Urnes brooches. Two brooches were discarded or lost before they had a pin attached (Figure 26c-d) while a third has both its pin-catch and an attached loop (Figure 26e).

The metal finds also include two miscast circular animal brooches (Figure 26f-g). There is additionally a mould for a small pendant cruci-

fix (Figure 26h) and a nearly matching complete pendant of a lead-tin alloy (Figure 27a). This type of crucifix is dated from comparable finds to the 11th century (Jensen et al. 1992, Cat. No. 15; Staecker 1999, 473-4, 483). A small, bright brassy bird-shaped brooch that was also found in the area could be suggested to be another workshop product (Figure 27b). The finds assemblage from the sieved strata also shows that objects of

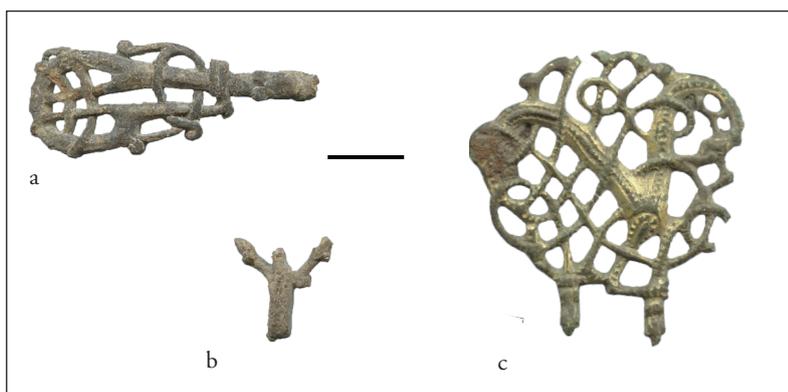


Figure 24. (a–b) Finds of lead models from Algade, Aalborg AHM 6488x42, x41. (c) Urnes brooch from Als, Himmerland. 1:1. Photo: AHM.



Figure 25. Production waste from Algade and Strandstien. Crucibles: (a) ÅHM 6713x1682, x1840. (b) ÅHM 1239x9. Melting waste: (c) ÅHM 6713x2139. Ingot: (d) ÅHM 6713x1847. Metal strips and cuts: (e) ÅHM 6713x1681, x1739, x1696, x1003. 1:1. Photo: ÅHM.

sheet metal were manufactured here, including tweezers and sheath mounts, probably produced in the same period as that in which the brooch workshop was operative (Bergmann and Billberg 1976, figure 149; Feveile 2017, 78).

Moreover, in the layers of the brooch workshop silver strips and cut blanks were found which probably derive from the minting of coins that is known to have taken place in Aalborg in the last quarter of the 11th century (Figure 25e). Most important in dating terms is a coin of The Holy King Canute which was indeed struck in Aalborg's own mint. A dendrochronological dating to AD 1082 from the excavation of 1981 should also be highlighted. It has to be considered probable that some of the archaeologically identified bronzecasting activity also dates back to the late 11th century. The finds from the pipe-trench excavation of 2017 show, furthermore, that the metalworking activities carried on into the 13th-14th centuries. Amongst other things belt buckles and ring brooches were manufactured

in this period. In Strandstien immediately east of Budolfi Church what is known as the 'pinmaker's workshop' of the second half of the 13th century was excavated as long ago as 1957. Inter alia, the activities here included the production of artefacts of sheet metal and the casting of objects in stone moulds (Kock 1992, 340-2; Riismøller 1960). This area was, in other words, intimately associated with the practice of metalworking and the production of small artefacts of copper alloy and lead-tin over several centuries.

The range of wares of the workshops and their customer base

The workshop finds in Ribe and Aalborg have a number of common features. Not just in respect of the technology and the repertoire of products. In Ribe, the comprehensive finds evidence allows for a more detailed insight into the range of the product repertoire and the extent of the production of the

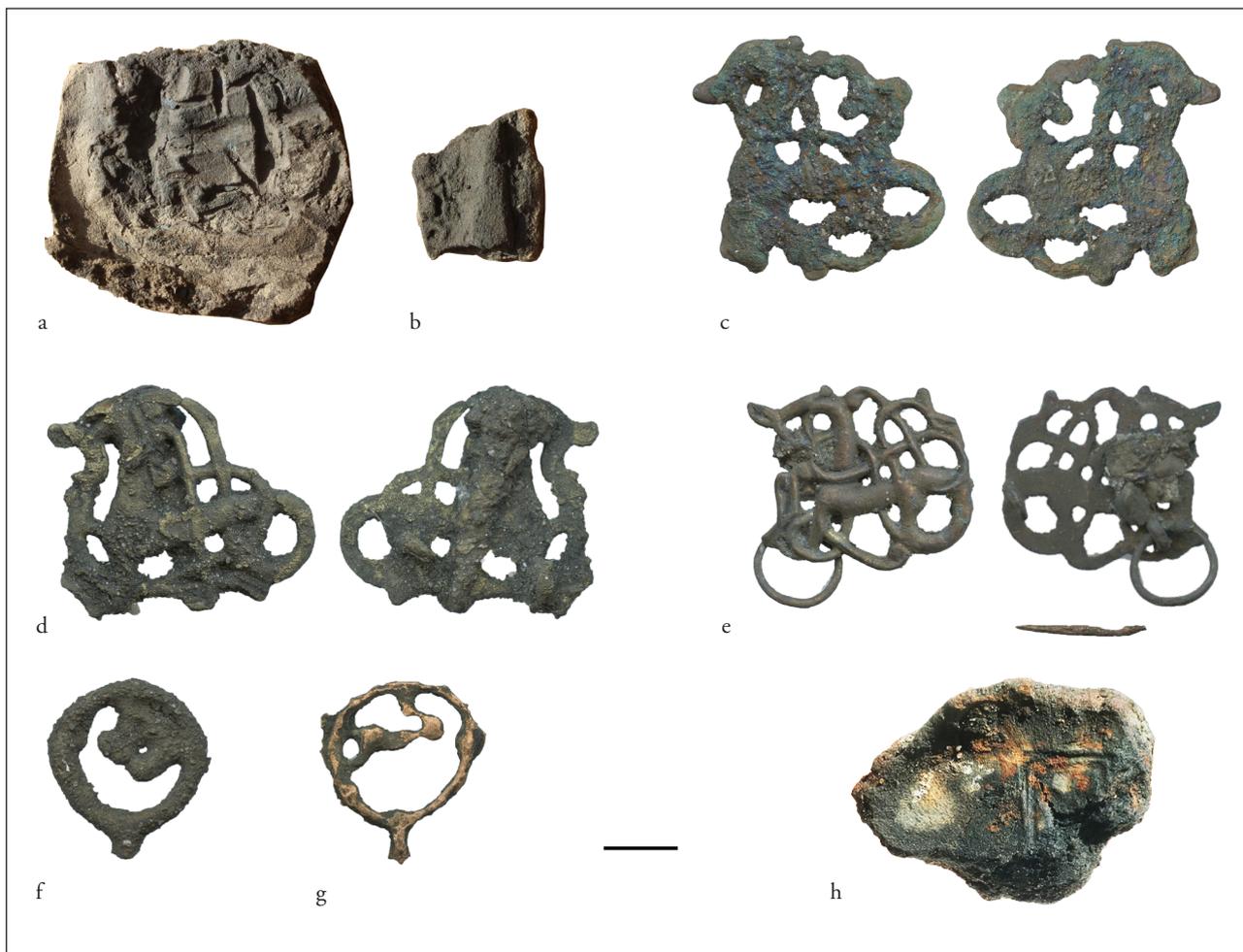


Figure 26. Moulds and brooches from the excavation in Algade, Aalborg. (a–b) ÅHM 6713x2082, x2083. (c–d) (fronts and backs), ÅHM 6713x1738, x1649. (e) 6713x1645 (front and back). (f–g) ÅHM 6713x1935, x2089. (h) ÅHM6713x2550. 1:1. Photo: ÅHM.



Figure 27. Other finds of jewellery of the 11th and 12th centuries, Algade, Aalborg. (a) ÅHM 6713x1669. (b) ÅHM 6488x14. 1:1. Photo: ÅHM.

different brooch types (Tab. 2). Most mould-impressions are from Urnes brooches, followed by impressions from bird-shaped brooches and circular animal brooches of Type 2. The numerical preponderance of Urnes brooches in relation to the other

types is corroborated by the analysis of detector finds (Christiansen 2017, tab. 4.4; Gilså in press) and by counts from a number of local museums.¹² Circular animal brooches of Type 1, small crosses and palmette brooches appear from the number of surviving mould-impressions from the Ribe workshop to have been manufactured in lesser volume here. The composition of the repertoire underlines the religious symbolism and the inter-association of the various brooch-types which otherwise are known only as stray finds in Denmark.

One important observation is the fact that brooches of varying artistic quality came from the workshop in Ribe. A similar range of quality, in terms both of the materials selected and execution, is well known from many metal-rich sites (e.g. Andersen 2015, 55). The range of variation is also convincingly reflected in the finds assemblages from the same sites (e.g. Figure 10b, 11a). This has readily been interpreted as reflecting the abilities

of more or less professional artisans, or degeneration over time (Christiansen 2017, 93; Lønborg 1994, 371; Pedersen 2010; Ramskou 1957, 199-200; Westergren 1986). The workshop find from Ribe, however, reveals that the differences in quality here reflect the range of goods offered from a single operative workshop, which must have been targeted at a group of customers of varying economic means. The brass-like alloy that was used both in Aalborg and in Ribe was probably intended to make the brooches look like precious metal and thus more valuable than they really were.

Local production and regional types?

There is generally a lack of recent analyses of detector-found brooches on a national scale; but recently a study of the Danish finds of Urnes brooches, their typology and distribution, has been made (Gilså in press). Regional studies of objects found by metal-detecting in the Limfjord area and north-eastern Fyn show the potential for mapping the overall tendencies represented by large numbers of finds in an area (Back, Christiansen and Henriksen 2019; Christiansen 2017; Henriksen 2017). In the case of the Urnes, bird-shaped and circular animal brooches in northern Jutland it could be concluded that there was more copious production compared with brooches of the preceding period, and a greater degree of standardization (Christiansen 2017, 84, tab. 4.3). It has been proposed that the most finely finished brooches could be from urban workshops and may have been the models for local copies of brooches, with similar designs but of lesser artistic quality. It has been suggested by Torben Trier Christiansen that the trend-setting urban workshops of the region are to be sought in Viborg and Aalborg (Christiansen 2017, 93). The workshop find in Aalborg came to light shortly after the publication of Christiansen's study, and has confirmed that aspect of the theory concerned with urban production. The volume of finds from Aalborg does not allow for any greater insight into the repertoire of the workshop, but based on the considerable variation attested in Ribe it is reasonable to suppose that the range of quality at the metal-rich sites in the hinterland of the town may indicate its repertoire.

On the basis of Christiansen's study (Christiansen 2017, 84-104), and from the trends of the detector evidence more generally, the image appears to be characterized by parallels that appear over large areas and by standardized types rather than local or regional varieties. Starting from the workshop finds, the small bird-shaped brooches of Type 1 from the Ribe workshop (Figure 13) and the Urnes brooches from the Aalborg workshop (Figure 26c-e) can be suggested as 'local workshop designs' which achieved a degree of regional distribution. This, however, is a view that could change very rapidly with new finds. Most of the other products from the Ribe workshop and detector-found brooches from the hinterland of the town thus have counterparts in other parts of Denmark, e.g. Figure 11,¹³ 12,¹⁴ 14,¹⁵ (Pedersen 2001, 28-9), 22g,¹⁶ 22o,¹⁷ (see e.g. Andersen 2015, 54), and 22p¹⁸ (Ramskou 1957, 199-200). The circular animal brooches, which were manufactured both in Aalborg and in Ribe (Type 1) (Figure 16, 26f-g), are common finds in the Limfjord area – hence the term Aalborg Group (Christiansen 2017, 87) – but are found in exactly the same form at many other Danish sites (e.g. Andersen 2015, 55).¹⁹ The circular animal brooch with a cross over the back, Ribe workshop Type 2, similarly occurs at many sites (Pedersen 2004, 71) (Figure 28).²⁰ In summary, a great deal of caution is required, and only with care should certain varieties be regarded as regional.

Lead models and miscast brooches are often automatically understood to be markers of local manufacture but the evidence is often less certain or based upon misunderstandings. The patrix die from Sebbesund, for instance, is not specifically for the production of circular animal brooches of the Aalborg-group type and does therefore not count as a proof of production of this specific brooch



Figure 28. Examples of circular animal brooches from north-eastern Fyn. (a) ØFM 425x150. (b) ØFM 564x40. Photo: Claus Feveille.

type (e.g. Bertelsen 1992, 251). The presumed remains of a clay mould stuck together with a miscast brooch seem instead to be the rusty remains of an iron pin stuck on a finished brooch (Christiansen 2017, 91-2).²¹ Furthermore, many miscast or worn out brooches were nonetheless used as items of jewellery (Figure 10c, 15b). If they lacked pins, they could be sewn on to the costume instead (Bertelsen 1994, 348-9, 358).²² Consequently, a miscast brooch would not necessarily have been discarded at the production site but could have had a longer functioning life. In a similar way, it is uncertain when an object was definitely used as a model where it was found and when it has ended up in some different context (e.g. Bertelsen 1994, 353). One could question whether models were perhaps sometimes secondarily used as jewellery or amulets. And were the models inevitably of lead, or could copper-alloy models, or indeed finished items, be used (Figure 29)?

The brooch finds from the hinterland of Ribe have been inferred probably to be products of the workshop in the town above (Figure 9). This is not a blanket rejection of the possibility that local production may have taken place. But with the Ribe area as a case study, the most convincing interpretation is that it was the workshop in the town which provided the hinterland with brooches of various qualities rather than that copying or alternative brooch-production took place locally, or in the hands of itinerant craftsmen. Such production in the immediate area could hardly have competed with the mass-produced and varied range that was manufactured in the town. In other parts of Denmark, distant from the towns that were in existence at that time, the situation may have been different. Before the workshop site was excavated in Ribe, it was first and foremost finds from metal-detecting in the hinterland of Ribe which provided evidence of the distribution and use of Urnes, bird-shaped and circular animal brooches in the area. Only a handful of brooches had been found in excavations in the stratigraphy of the town before 2011-12, when the workshop south of the Cathedral was discovered. There was thus nothing to indicate that it was in the town that production was located, and where there must also have been a considerable quantity of brooches in circulation. In addition to the fact that it is good fortune that the workshop

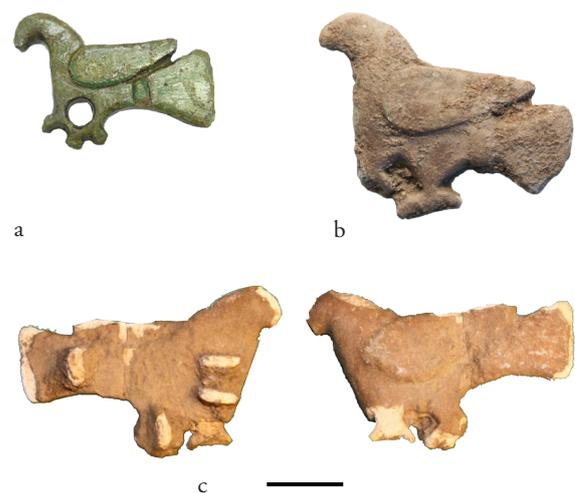


Figure 29. Possible models for bird-shaped brooches? (a–b) Copper-alloy birds with smooth reverse sides ASR 872x65, ASR 872x200. (c) Lead bird with remains of pin-fittings and a loop ASR 872x150 (front and back). Photo: SJM/HBC.

was found and that, relatively, so much of it was preserved, it was crucially important in relation to the retrieval of a major collection of finds that the layers were systematically water-sieved.

With the regularly occurrence of several of the brooch-types at the same sites in mind (Beck, Christiansen and Henriksen 2019; Feveile 2017, 59) along with the inter-association demonstrated above between the types, one should presumably put the Urnes, bird-shaped and circular animal brooches together under the microscope and look at their composition and variance in order to try to define the operative area and output of a workshop. Other contemporary metal artefacts (Feveile 2017) which can indicate workshop milieux involving various forms of metalworking (cf. the workshop finds from Aalborg and Lund) could also profitably be brought into an analysis of that kind.

Social and religious context

Alongside the presence of the king and the Church, and together with minting, church-building and social organization, craft and trade were important factors in the development of urban communities in 11th- and 12th-century Denmark. These evolved into centres of royal and ecclesiastical administration and of trade and specialized craftwork-

ing. The Church's changed role, from that of an exclusive and elite-oriented missionary Church to a social power with great ideological, political and economic influence, came to the fore in the same period, amongst other ways through the formation of parishes and the construction of timber churches (Carelli 2001, 99 and 235-6; Kristensen and Poulsen 2016, 91-2; Roesdahl 2004). The urban environments provided suitable locations for the permanent workshops and the serial production of brooches, and as shown above there clearly seem to be a link between the activities of the Church in this period and the large quantities of detector-found brooches with religious symbolism (Pedersen 2014, 223).

In Ribe, the workshop was located on the plot south of the Cathedral which was probably in the possession of the Church throughout the period. The change in use of the area after the middle of the 11th century provided space and the opportunity for the founding of the workshop and the serial production of brooches of the following decades. Could this be a piece of evidence that the Church was the principal agent in the production and distribution of the brooches? The use of small tokens of baptism/amulets with Christian symbolism was no new phenomenon at that date, and it must have been a familiar tack of the Church to expand what it offered in this way, concurrently making a profit out of it.

From the 1070s through to 1180, one can see a close relationship between minting and other metalworking in Lund. Coins were struck in the same workshop context in which a bronzecaster was producing jewellery in the 1070s, and coin brooches were also manufactured here (Carelli 2012, 86; Cinthio 1999, 45; Kristensen and Poulsen 2016, 102). Several areas with workshop activity have been excavated, and as early as the mid-11th century a large number of churches had been raised. In the present context, particularly to be noted is the linkage between the so-called Urnes workshop and a workshop area with extended continuity both back and forwards in time, and its location immediately adjacent to a plot that was in the hands of the Church (Wahlöo 1976, 20).

Some of the same features can be seen in Aalborg, where the brooch workshop and the mint were located side-by-side and immediately along-

side Budolfi Church, the timber predecessors of which can be dated to the 11th century (Kristensen and Poulsen 2016, 85). The close physical connection of the brooch workshops with minting in both Lund and Aalborg also implies a connection between this production and the presence of the royal authority.

Conclusion

The three brooch-types that are discussed above were introduced within a relatively short period of time in large quantities compared with other medieval artefact-types. Two workshops found, in Ribe and Aalborg respectively, represent key breakthroughs in terms of allowing us to place the large number of detector finds in a wider context and to understand the background to their distribution. The common features observable in respect of the location of the workshops and their range of products together suggest that this manufacturing was organized and targeted rather than haphazard or scattered, and that it was based primarily in urban contexts. The detector finds reinforce the image of the artefact-types as homogeneous and standardized, and a more detailed study of the finds of all three brooch-types from Denmark would be able to paint an even clearer picture, possibly also defining areas with other operative workshops in the decades around the year 1100. A close association with minting in Lund and Aalborg indicates that the royal authority played a role in some cases, but in Ribe most of the evidence implies that the Church was the most important agent. When it comes to the theories about a specific connection between the Urnes brooches and the Danish kingdom and Danish identity, the find of the Urnes brooch mould from Sigtuna seem to disprove this.

The differences in quality in both workshop and detector finds, both in respect of artistic quality and the raw materials used, show that this production must at the point of origin have been aimed at a relatively broad market. This may be an aspect of a strategic initiative that, at the same date as the workshops in Lund, Ribe and Aalborg, was underway or imminent in several other towns. At present, a combination of town, church and mint in the period AD 1050–1150 together with the

brooch finds from the hinterland can reasonably be used as indicators of where workshops were located. On the basis of workshop finds in the diocesan towns Ribe and Lund, Viborg,²³ Aarhus, Schleswig, Odense,²⁴ and Roskilde are obvious candidates. But as the workshop discovered in Aalborg shows, there are other towns which emerged in the middle of the 12th century (cf. Kristensen and Poulsen 2016, 66) that may have had operative brooch workshops.²⁵

These activities could have been one strand in the more demotic diffusion and adoption of Christianity. The brooches may have been baptismal tokens, like both locally produced and imported small brooches of the Viking Period, but in this case in the form of more organized and extensive, local manufacture. With a view to the later, dispersed production and trade in religious souvenirs associated with pilgrimage, it is also possible that the production of the brooches in the ecclesiastical centres which the towns also served as at this juncture was an additional element in their appeal, providing them with holy, inherent powers. The brooches could have had a symbolic significance but also an economic one for the Church. At the same time they were attributed with a protective value for the wearer, so that there were multiple beneficiaries.

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Notes

4. In the new detector-find recording platform DIME the terms animal loop brooch of the Aalborg type or animal loop brooch of Urnes and Agnus Dei type are employed.
5. <https://www.metaldetektorfund.dk/>. Search: Genstandstype: Guds lam fibel-Agnus Dei fibel.
6. Collection of data made by Mette Højmark Søvsø in 2019. Article in prep.
7. An example on a fragmented Urnes brooch found in a burial in Viborg is interpreted as a secondary deposition (Seeberg 1961, 13-14, 19; Vellev 1980, 51-52).
8. <https://emp-web-94.zetcom.ch/eMP/eMuseumPlus>. Föremål nr. 2070, Inv.nr.: 47542.
9. The XRF-analyses were undertaken by Anne Lauritsen, SDU. See ASR 13: K315.
10. DIME id: 58051.
11. E.g. ØFM 142x69, 522x263, 620x19.
12. See notes 23-25.
13. E.g. ØFM 473x89, 522x225, 620x19.
14. E.g. ØFM 356x4, 442x5, 569x27.
15. DKM 20.949 (DIME id: 10021), HOL 20.482x34, ÅHM 5918 (DIME id: 7257), ÅHM (not yet accessioned in the museum; DIME id: 3516, 10895), VMÅ (DIME id: 10106), FHM 5691 (DIME id: 2051).
16. E.g. VSM 10528x189, ØFM 572x40, 564x41, Dime id: 59495.
17. E.g. VSM 10528, x189, ØFM 142x46, x68, 383x16.
18. ÅHM 2863x38, x1724, HEM 5566x1 (DIME id: 4812), VSM 9000x153, ORM 1614x23.
19. E.g. VSM 10528x187, x190, ROM 2367x1, ØFM 142x2, 404x7, 441x3. DIME: search: Genstandstype: Guds lam fibel-Agnus Dei fibel.
20. E.g. ØFM 142x8, 419x24, 564x40, 573x10, HEM 5083x8, KAM 2007-27 (MVE), (DIME id: 3819).
21. SMS 1161x44/NM D112/2014.
22. VSM 10528x189 (brooch with no pin but with in situ preserved woolen yarn).
23. An enquiry to Viborg Museum in December 2018, for example, elicited information on the finding of 78 Urnes brooches, 52 Agnus Dei brooches and 37 bird-shaped brooches.
24. From north-eastern Fyn there are 77 Urnes brooches, 44 bird-shaped brooches and 57 circular animal brooches (Beck, Christiansen and Henriksen, in press).
25. In 2017, from the Limfjord area 194 Urnes brooches, 110 circular animal brooches including 88 of the Aalborg-group Type and of the 28 Agnus Dei type, plus and 86 bird-shaped brooches, were counted (Trier 2017, 85, tab. 4.4).

Abbreviations

ASR: Den antikvariske Samling (now SJM)	NM: Nationalmuseet
DIME: Digitale metaldetektorfund	OBM: Odense Bys Museer
https://www.metaldetektorfund.dk	ORM: Kroppedal Museum
DKM: De Kulturhistoriske Museer i Holstebro Kommune	ROM: Roskilde Museum
HAM: Museum Sønderjylland	SDU: Syddansk Universitet
HEM: Museum Midtjylland	SJM: Sydvestjyske Museer
HOL: Holstebro Museum	SMS: Skive Museum
KAM: Kalundborg Museum	VHM: Vendsyssel Historiske Museum
LFS: Museum Lolland Falster	VMÅ: Vesthimmerlands Museum
MLF: Museum Lolland Falster	VSM: Viborg Museum
MVE: Museum Vestsjælland	ØFM: Østfyns Museer
	ÅHM: Aalborg Historiske Museum

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Resilient Land Use in the Medieval and Early-modern Village

Crop and animal husbandry in Fjellie, southern Sweden, AD 1000-1800

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ABSTRACT

Agrarian land-use in the village Fjellie, southern Sweden, AD 1000-1800, was studied through analysis of plant macrofossils, pollen, animal bones and strontium isotopes. Three different farmsteads in the village were studied and compared with other villages in the Öresund region. The composition of crop and animal husbandry was relatively constant through time, apart from a distinct increase in rye cultivation and a slight increase in cattle keeping. Similarities in crop composition between the farmsteads indicate that infield arable farming was practised in collaboration, since the 13th century probably in a three-course rotation system. Also, herding of livestock in grazing commons and fallow infields were collective efforts, whereas vegetable gardening, fishing, beer brewing and the species-composition of livestock showed differences between the individual farmsteads. The agricultural system of the village was characterised by diversity, which was reflected in several different spheres: crops and animals, biotopes, labour intensity and organisation. Further, fishing contributed to resilience by reducing dependency on agriculture. The high diversity within the framework of village agriculture probably contributed to sustainable management of the resources and to agricultural and social resilience.

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Introduction

For a long time, the agrarian village was the dominating settlement structure in much of southern Scandinavia. The dating of the earliest villages differs and depends on definition (Riddersporre 1999; Rindel 1999), but at least from the 11th century sedentary villages were common and widespread (Schmidt Sabo and Söderberg 2019). Typically, a village consisted of a village core with several farms situated together, surrounded by arable fields and meadows and with access to grazing commons. The village was not only a settlement structure, but also a social organisation with developed systems of collaboration between the farms (Myrdal 2011; Schmidt Sabo 2005).

In Sweden and Denmark the village organisation lasted until the land reforms of the 18th and 19th centuries, when the land belonging to individual farms were consolidated and farm buildings were moved from the village core out to individual blocks of land (Dombernowsky 1988; Gadd 2011, 152). These reforms were completed by the end of the 19th century and meant the end of an almost

one-thousand-year long tradition of village agriculture, social structure and collaboration.

In contrast to much of the earlier settlement in southern Scandinavia, which was characterised by a degree of mobility (Hedeager and Kristiansen 1988), the villages of the 2nd millennium AD represent a more permanent structure, regarding both the location of individual farm buildings and the spatial arrangement of fields and boundaries (Porsmose 1988). One would expect this long place-continuity to put high pressure on soils and other natural resources, but the longevity itself of the village organisation indicates that it was a resilient social-ecological system based on sustainable land use (Lennartsson et al. 1998). Furthermore, the system survived crises like the Black Death (Lagerås 2016a) and reoccurring wars and violent conflicts including the devastating Dano-Swedish wars of the 16th-17th centuries. It also survived climate change, most notably the transition from the Medieval Warm Period to the Little Ice Age (cf. Lamb 1995; Moberg et al. 2005).

Despite the obvious success of the village system, and the fact that it was heavily based on agri-



Figure 1. Map of western Scania and eastern Zealand with Fjelic and other sites discussed in the text. For references see Table 1.

culture, villages from the last millennium in southern Sweden have gained limited palaeoecological attention. Research on village agriculture is based mainly on written records (Myrdal 1985, 2012; Porsmose 1988), and for most villages records on agrarian production are from the 16th century or later. Most archaeobotanical analysis are published in grey literature and relatively little is known about the agrarian production of villages. Zooarchaeological studies of animal husbandry of rural sites in Scandinavia have mainly been published in site reports, but also in a few syntheses (Cardell 2005; Vretemark 1997). With a few exceptions (e.g. Bergman et al. 2017), archaeobotanical and zooarchaeological analyses have been presented separately, leading to separate interpretations of crop growing and animal husbandry with few discussions of the land-use system.

This study focuses on the village of Fjelic situated outside Lund in the province of Scania. Today, Scania is the southernmost province of Sweden, but it belonged to Denmark prior to 1658. We present analyses of archaeobotanical and faunal remains, strontium isotopes and pollen from the archaeological contexts of three abandoned farmsteads in the village core. The agrarian production over time and comparisons between the investigated farmsteads are presented and interpreted. The discussion focuses on the balance between individual (farm) and communal (village) production as well as between rigidity and flexibility. The results from Fjelic is set in a wider context by comparison

with archaeobotanical and zooarchaeological analysis of other villages from the Öresund region (Figure 1; Table 1). The aim is to better understand the resilient agricultural system of the village in southern Scandinavia.

Site description and archaeological contexts

Fjelic is situated in a gently undulating agricultural landscape, 4 km NW of Lund and 4.5 km E of the coast by the Öresund sound (Figure 1). Quaternary deposits are dominated by calcareous clay till (Ringberg 1987). Soils are fertile and today the area, like much of south-western Scania, is heavily cultivated with very little woodland.

According to an old map from 1769, the village at that time consisted of 22 farms, some cottages and a church (Figure 2). All farmsteads were situated close together on two sides along a village common and a brook. The farms were run by tenants and main landowners were the church and the nobility. Most of the farms were later moved from the village core in connection to land reforms. The Romanesque church, dated to the early 12th century, is the only visible reminder of its Medieval origin. The earliest mentioning of Fjelic in written documents is from 1269 (Skansjö 2019, 203).

In 2016 an area in the western part of the village core was subject to archaeological excavation

Site name	Archaeobotany	Zooarchaeology
Bunkeflo		Cardell 2009
Gårdstånga		Sten 1992
Häljarp		Cardell 1999a
Hjärup		Magnell 2016
Kyrkheddinge	Regnell 1998	Cardell 1998; Johansson 1998
Lockarp		Heimer et al. 2006
Önnerup		Ericson 1996; Gustavsson et al. 2001
Örja	Lagerås 2013	Cardell 2013
Östra Grevie		Lagerås & Magnell 2017
Östra Skrävlinge	Ingwald et al. 2009	
Övre Glumslöv		Cardell 1999c
Säby		Cardell 1999b
Södra Sallerup		Härde et al. 1997
Tärnby	Robinson and Harild 2005	Enghoff 2005; Gotfredsen 2005
Vasatorp		Magnell 2015

Table 1. Site references

(Lindberg and Schmidt Sabo 2019). It covered three abandoned farmsteads, labelled 18, 19, and 22 on the 1769 map (Figure 2). By the time of the excavation the area was used as arable land, but the three farmsteads on the old map were readily distinguishable in archaeological structures beneath the plough layer (Figure 2). Traces of different generations of buildings could be followed back at

least to the 13th century. There were also remains of earlier settlement on the site, particularly a large Viking Age farm, which may have later developed into the village (Lindberg and Schmidt Sabo 2019, 235-238). It was situated at the plot of the later farm 18 but may not have been a direct predecessor of that farm. From ca. 1250 all three farmsteads were settled. Apart from temporary abandonment

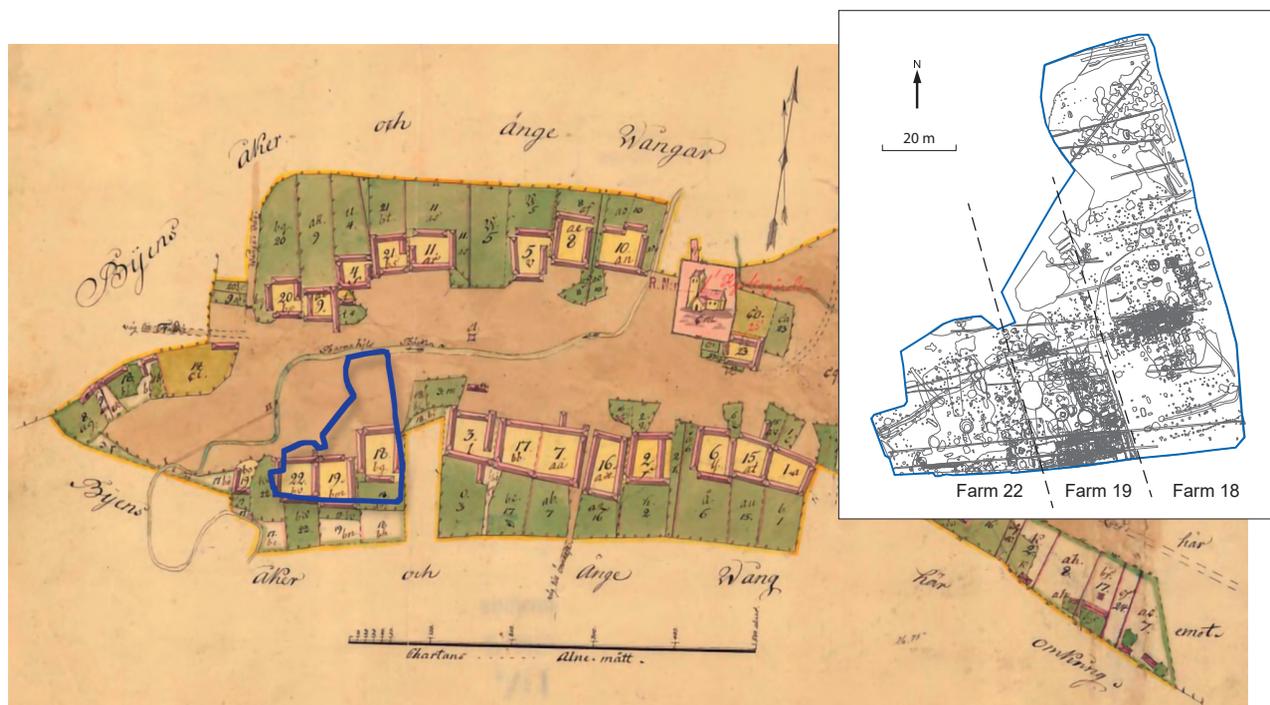


Figure 2. Map of Fjelle village from 1769/1770 together with a plan of documented archaeological structures on farmsteads 18, 19 and 22.

of farm 22 in connection to the late-medieval crisis, all three farmsteads were settled until ca. 1800.

Preserved archaeological structures were dominated by floor and destruction layers, post holes and sills. There were also remains of ovens/fireplaces and other domestic features. Outside the buildings there were several wells and cultivation layers. The find material reflected everyday life and was mostly of local or regional origin. Some finds were connected to agriculture, like iron shod spades, sickles, a scythe and millstones (Lindberg and Schmidt Sabo 2019, 125). The archaeological finds and material culture with rather few prestigious objects and imports indicate that all farmsteads could be described as ordinary peasants and villagers, but differences in building techniques and number of houses may indicate some socio-economic differences between the farmsteads. During the 13th century, farmstead 18 consisted of only one house, while farm 19 and 22 consisted of two and four buildings, respectively (Lindberg and Schmidt Sabo 2019). The investigation had an interdisciplinary approach and samples for different types of analyses were taken throughout the excavation.

Based on the archaeological chronology of the site (Lindberg and Schmidt Sabo 2019, 237), the analytical results presented in this paper are grouped into four periods, dated to AD 1025-1225, 1225-1425, 1425-1600 and 1600-1800. These periods are based on a more detailed distinction of building phases of the individual farmsteads (Supplemental information; Lindberg and Schmidt Sabo 2019).

Material and methods

Pollen analysis

Samples from seven wells and two cultivation layers were analysed for pollen. Samples were prepared using standard methods (Berglund and Ralska-Jasiewiczowa 1986) and analysed using x400-1000 light microscopes. Pollen sums varied depending on pollen preservation and ranged 77-621 (mean value: 301). The pollen diagram was constructed using Tilia software. All pollen taxa except Asteraceae Liguliflorae (regarded as over-rep-

resented) were included in the pollen sum when calculating percentages.

Plant-macrofossil analysis

115 samples (144 litre) from different contexts (e.g. floor layers, pits, fireplaces, cultivation layers, wells) were analysed for plant macrofossils. Most samples only contained charred remains, but four samples (1.2 litres) from wells also contained uncharred plant remains. Samples were floated and sieved and all material >0.4 mm was analysed using a x6.3-63 stereo microscope.

Zooarchaeological analysis

90 kg of animal bones was collected from archaeological contexts belonging to the three farmsteads, of which 55 kg was selected for analysis. Quantification was based on the number of individual bone specimens (NISP). This type of quantification may be affected by different degrees of fragmentation between species, but it is the most used method and enables comparison of species composition between sites (Grayson 1984; Vretemark 1997, 32-35). To avoid bias due to concentrations of bone from complete or big parts of animals, such as carcasses, such concentrations were excluded from quantification.

The amount of age and sex diagnostic bone enabled tentative interpretations of the general kill-off pattern of cattle on village level but was too limited for comparison between farmsteads or periods. The age estimations were based on mandibular teeth (Grant 1982; Jones and Stadler 2010), whereas sexing was based on morphology of the pelvis and osteometric analysis of metapodials (Lemppenau 1964; Vretemark 1997, 43-48; Telledahl et al. 2012).

Strontium isotope analysis

To reveal possible mobility in livestock (cf. Evans et al. 2007; Gron et al. 2016; Gan et al. 2018), enamel of nine molariform teeth of cattle from Fjelie were analysed for strontium isotopes ($^{87}\text{Sr}/^{86}\text{Sr}$)

(Supplemental material; Evans 2019). The analysis was performed by the Isotope Geosciences Laboratory at the British Geological Survey (BGS). The results were compared with a local strontium-isotope baseline based on rodent teeth from Fjellie and other nearby sites (Lund, Uppåkra) (Arcini 2018).

Results

Pollen

Pollen assemblages were strongly dominated by herb-pollen taxa, whereas tree and shrub taxa were sparsely represented (Figure 3; Supplemental material). Even though there may have been some over-representation of open-land taxa due to activities close to the wells, the result strongly indicates a very open and almost treeless landscape. This open landscape, shaped by agricultural land use, was established already by the time when the earliest wells were in use (1225-1425).

Herb-pollen included cultivated taxa, particularly cereals, but also single pollen grains of hemp/hop (*Cannabis* type). *Sinapis* type reached unusually high values in one sample (PM28210; Figure 3) from a cultivation layer close to house remains. *Sinapis* type includes several different weed and ruderal taxa, but also the genus *Brassi-*

ca, which includes cultivated species like cabbage (*Brassica oleracea*), turnip (*B. rapa*) and black mustard (*B. nigra*). Probably, the high percentages of *Sinapis* type reflect the growing of one or several of these plants in vegetable gardening.

Macrofossils

More than ten thousand plant macrofossils were identified (Table 2; Supplemental material). They were dominated by cereal grain, followed by weeds and ruderals, plants of pastures and meadows and plants of lakes, fens and wet grassland. In smaller numbers there were also macrofossils representing cultivated vegetables, plants of sea, spices and medicinal plants and collected berries, nuts and fruits.

Cereals

Cereal grain was strongly dominated by barley, followed by rye, oats and bread wheat (Table 3). Of barley grain, 95 % was identified as hulled barley, 0 % as naked, and 5 % as unspecified. Therefore, it is likely that all barley was hulled. Of oats only five grains could be identified to species and they all belonged to the cultivated species *Avena sativa*. There were also eleven pedicels from the same species. No wild oats (*Avena fatua*) were identified,

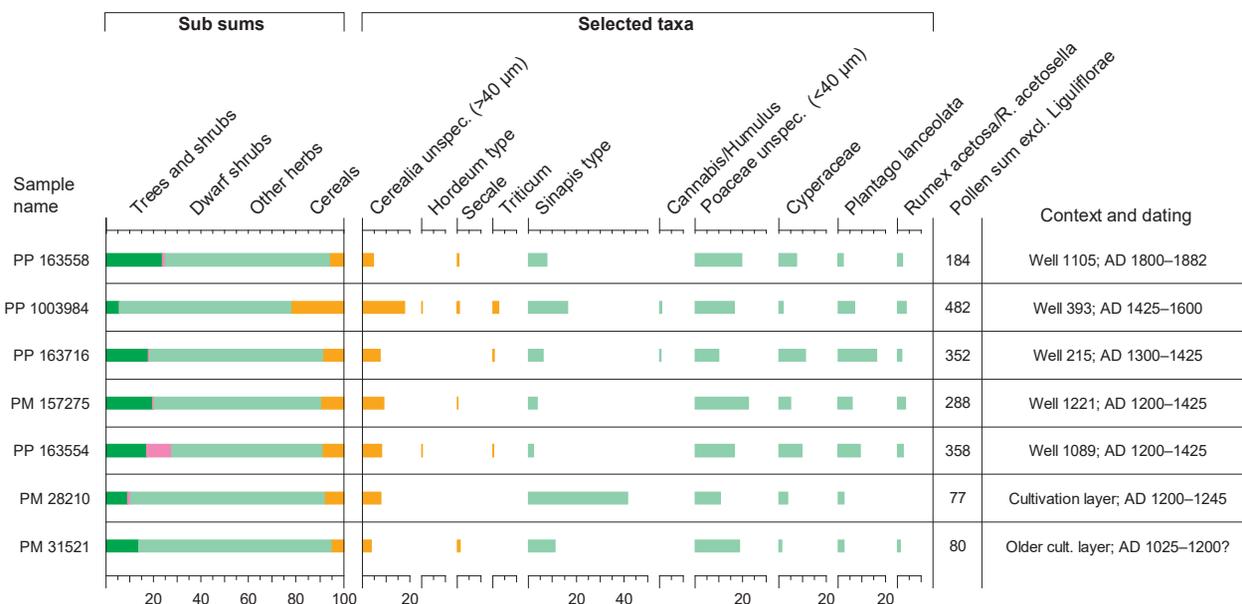


Figure 3. Simplified pollen diagram of samples from wells and cultivation layers in Fjellie showing sub sums and selected taxa. Bars show % of pollen sum excl. Asteraceae Liguliflorae. For raw pollen counts see Supplemental material.

Group	No.	%
Cereals (grain)	5 300	52,3
Cereals (chaff)	223	2,2
Cultivated vegetables	182	1,8
Spices and medicinal plants	84	0,8
Collected berries, nuts, tubers, etc.	46	0,5
Weeds and ruderals	2 678	26,4
Plants of pastures and meadows	871	8,6
Plants of lakes, fens and wet grassland	659	6,5
Plants of sea and seashore	13	0,1
Other	74	0,7
Sum	10 130	100,0

Table 2. The number of plant macrofossils from Fjellie, AD 1025–1800, grouped according to ecology and possible use and cultivation. Taxa included in the different groups are presented in Supplemental material.

and therefore it is likely that all (or at least most) of the unspecified oats (*Avena sp.*) on the site represent cultivated oats.

Cereal composition changed through time, showing a gradual (or stepwise) increase in rye at the expense of barley (Table 3). The first increase in rye (1225–1425) coincided with the first appearance of corncockle and rye broom – two weeds that thrive among autumn sown crops (Supplemental material). When comparing phases from the same time at the different farmsteads, cereal composition was very similar.

Vegetable gardening

The plant macrofossils included several taxa that indicate vegetable gardening (Table 3). These include cultivated vegetables, like pea, faba bean and turnip, and spices and medicinal plants, like black mustard, motherwort, dill and caraway. They also include wild marjoram, chicory and henbane, although these species may also have been part of the weed flora. Flax and hemp probably also reflect garden cultivation, as do the single finds of hop and buckwheat.

Macrofossils indicative of vegetable gardening were most common from periods 1225–1425 and

1425–1600, and less common from before and after. However, this is probably due to preservation. The identification of many taxa indicative of vegetable gardening, particularly spices and medicinal plants, depends on the preservation of uncharred macrofossils (in this case from water-logged sediment from wells). Such conditions were limited to periods 1225–1425 and 1425–1600.

Beer brewing

Beer brewing was indicated by 18 sprouted grains of barely, 20 fruits of bog-myrtle and one fruit of hop. Sprouted barley indicates malting, whereas bog-myrtle and hop were common beer additives (Behre 1999; Heimdahl 2014). Chronologically, macrofossils indicating brewing were well distributed, from 1225–1425 to 1600–1800. Except for one single fruit of bog myrtle, all of them came from one of the three farmsteads, farm 19.

Seaweed and collected wild plants

One sample from an indoor fireplace contained numerous charred fragments of seaweed. Two species were identified, bladderwrack (*Fucus vesiculosus*) and sea oak (*Halidrys siliquosa*), which today grow in the Öresund sound, 5 km from Fjellie. The seaweed may have been used for different purposes, like fertiliser, fodder or fuel, to produce salt or in textile bleaching (Mooney 2018).

In addition to seaweed, also bog myrtle for beer brewing (see above) had to be collected far from the village or been purchased. Bog myrtle thrives in peatbogs or poor heathland, environments that could not be found in the vicinity of Fjellie. Berries of elder, dewberry and raspberry may have been collected in the village, whereas nuts of hazel and berries of juniper probably were collected in pasture commons.

Zooarchaeology

The analysis resulted in 2310 NISP of mammals, 199 NISP of birds and 2808 NISP of fish (Supplemental material). The faunal remains were well-preserved and included also fragile bones of new-born animals, amphibians, and small fish.

Period (years AD)	1025–1225	1225–1425	1425–1600	1600–1800
Cereal grain (%)				
Oats (<i>Avena sp.</i>)	11	5	10	12
Barley (<i>Hordeum vulgare/distichon</i>)	87	78	74	12
Rye (<i>Secale cereale</i>)	2	16	15	75
Bread wheat (<i>Triticum aestivum</i>)		1	1	1
Cultivated vegetables, etc.				
Pea (<i>Pisum sativum</i>)	*	*	*	*
Faba bean (<i>Vicia faba</i>)		*	*	
Flax (<i>Linum usitatissimum</i>)	*	*	*	*
Gold-of-pleasure (<i>Camelina sativa</i>)		*		*
Turnip (<i>Brassica rapa</i>)			*	*
Cabbage unspec. (<i>Brassica sp.</i>)		*	*	*
Hemp (<i>Cannabis sativa</i>)		*		
Hop (<i>Humulus lupulus</i>)			*	
Buckwheat (<i>Fagopyrum esculentum</i>)				*
Spices and medicinal plants				
Black mustard (<i>Brassica nigra</i>)		*	*	*
Motherwort (<i>Leonurus cardiaca</i>)			*	
Wild marjoram (<i>Origanum vulgare</i>)		*	*	
Chickory (<i>Cichorium intybus</i>)	*			
Dill (<i>Anethum graveolens</i>)		*	*	
Caraway (<i>Carum carvi</i>)			*	
Henbane (<i>Hyoscyamus niger</i>)		*	*	
Collected berries, nuts, etc.				
Elder (<i>Sambucus nigra</i>)		*	*	
Hazel (<i>Corylus avellana</i>)		*	*	
Juniper (<i>Juniperus communis</i>)			*	*
Bilberry, cowberry, etc. (<i>Vaccinium sp.</i>)		*		
Bog myrtle (<i>Myrica gale</i>)		*	*	*
Dewberry (<i>Rubus caesius</i>)			*	*
Raspberry (<i>Rubus idaeus</i>)		*		

Table 3. Chronological distribution of cultivated and other useful plants identified in plant macro-remains from Fjellie. For cereal grains, numbers show % of identified cereal grains. For other species, * indicates presence.

Livestock

Almost all identified mammalian bones from Fjellie were from livestock (Table 4), which is characteristic for rural sites in southern Scandinavia. Among the livestock bones, cattle and pig were the most common with rather equal abundance (39 % and 32 %, respectively), whereas sheep and goat made up 23 % and horse 6 %. Of sheep and goat, almost all bones came from sheep (93 %) and only few (7 %) from goat. The relatively equal proportions of cattle, pig and sheep seems to be typical for other sites in the Öresund region.

The composition of livestock in Fjellie was rather stable through time, but some minor chronological changes could be noticed. Cattle showed a slight increase from 31 % in 1225-1425 to 42 % in 1600-1800 (due to small sample size, the frequency of livestock from the period 1025-1225 is uncertain). The frequency of pig and sheep was rather constant through time. The frequency of horse bones was slightly higher 1025-1425 than during later periods.

There were some differences between farmsteads 18 and 19 (the material from farmstead 22

was too small for comparison). At farmstead 19 the frequency of cattle and horse was higher, whereas farmstead 18 showed higher frequency of small livestock, like pig and particularly sheep.

Only few bones could be identified to sex, but out of ten sex-diagnostic bones of cattle, eight were from cows, one from a bull and one from an ox. Age distribution of cattle for the period 1225-1425 showed a large proportion of calves (35 %) and subadult animals, aged 18-30 months (39 %), and low frequency of adults, older than 48 months (19 %). Age distribution for the period 1425-1600 was more even, with a lower proportion of calves (13 %) and a higher proportion of adults (40 %).

Pathological changes in bones from joints of cattle, such as eburnation in acetabulum of the hip joint and phalanges with exostosis and lipping, indicate that oxen were used as draught animals, most likely for ploughing the fields.

Poultry

Poultry was represented by bones of goose, duck, and chicken. All identified bones of goose and duck were from greylag goose/domestic goose and mallard/domestic duck, respectively. It was not possible to determine if these bones represented domestic or wild birds, but since no other wild species of goose or duck could be identified it was assumed that they originated from poultry.

Despite the fragility and smallness of bird bones, which probably make them underrepresented, 9 % of all bones from domestic animals were from poultry. In addition, eggshells from goose were recovered in a layer dating to the period 1225-1425.

The proportion of bones of goose and domestic chicken in relation to livestock increased from 12 % 1025-1225 to 55 % 1600-1800. Like livestock, poultry showed differences between the farmsteads, with higher proportion of goose at farm 19 and of chicken at farm 18. However, the sample sizes of poultry were rather small when separated on different farms.

Wild game and wild fowl

Evidence of hunting was two bones of roe deer. In addition, there were bones of small birds, doves and various taxa of passerines. They were interpreted

to represent birds caught for consumption since all came from kitchen refuse.

Fish

Fish bones were abundant in layers interpreted as kitchen refuse (Table 4), which indicates the importance of fish in the diet of the villagers in Fjellie. Marine fish, mainly herring and codfishes, dominated. On village level, herring was most abundant in the period 1225-1425, whereas the frequency of codfishes and flounder increased in 1425-1600. Similar trends have been noticed for other villages in the Öresund region (Cardell 2013, 198; Enghoff 2005, 472). A comparison between the farms seems to reveal different consumption patterns in 1225-1425. From this period, herring clearly dominated (68 %) the fish bones from farmstead 18, whereas fish bones from farmstead 19 were dominated by codfishes (62 %) together with an unusual high frequency of perch (24 %).

Strontium isotopes of cattle teeth

Strontium analysis ($^{87}\text{Sr}/^{86}\text{Sr}$) of nine cattle teeth showed that six of them had slightly higher strontium values than the local baseline and two had distinctly higher (Figure 4). The slightly higher values indicate that cattle were not raised only on the local Tertiary limestone, but also grazed in nearby areas with older sedimentary bedrock (Jurassic and Triassic shale) about 1 km east of the village. The two cattle with distinctly higher values seem to originate from areas with much older Fennoscandian bedrock, mainly granitoids and gneisses, found on the ridge of Linderödsåsen and in northern Scania, about 40-60 km from Fjellie (Bergström et al. 1988; Arcini 2018; Kjällquist & Price 2019, 191).

Discussion

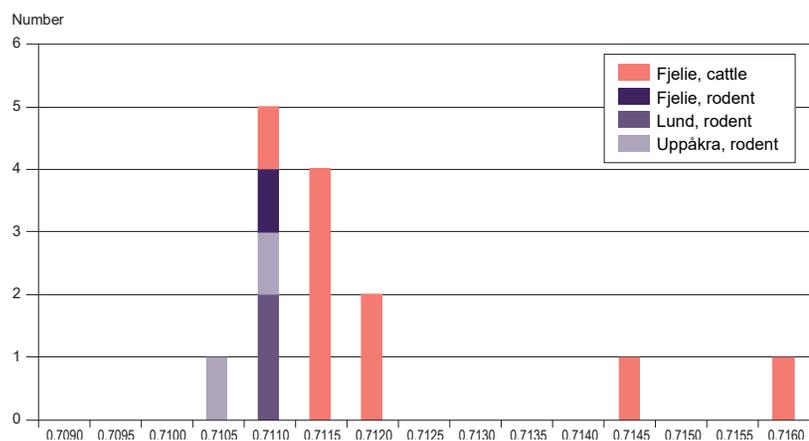
Crop and animal husbandry through time

Agriculture in the pre-industrial village of southern Scandinavia, like in most of Europe, was characterised by mixed farming, i.e. the combination of crop and livestock farming. Besides providing

Period (years AD)	1025– 1225	1225– 1425	1425– 1600	1600– 1800	total
Domesticated animals					
Cattle (<i>Bos taurus</i>)	22	497	247	166	957
Pig (<i>Sus domesticus</i>)	27	370	273	111	795
Sheep/goat (<i>Ovis/Capra</i>)	15	206	85	79	392
Sheep (<i>Ovis aries</i>)	2	17	7	14	45
Goat (<i>Capra hircus</i>)	6	1		2	3
Horse (<i>Equus caballus</i>)		98	37	20	174
Dog (<i>Canis familiaris</i>)		7	8	2	17
Cat (<i>Felis catus</i>)				5	2
Domestic/greylag goose (<i>Anser domesticus/anser</i>)	3	44	45	37	129
Domestic chicken (<i>Gallus domesticus</i>)		29	17	9	56
Domestic duck/mallard (<i>Anas domesticus/platyrhynchos</i>)	1	5		1	6
Wild animals					
Roe deer (<i>Capreolus capreolus</i>)		1		1	2
Common wood pidgeon (<i>Columba palumbus</i>)	1				1
Passerines (Passeriformes)		4	3		7
Fishes					
Herring (<i>Clupea harengus</i>)		1454	160	14	1628
Codfish (Gadidae)	2	722	210	9	943
Flounder (Pleuronectidae)	3	55	30	1	89
Perch (<i>Perca fluviatilis</i>)	1	94	3	1	99
Cyprinids (Cyprinidae)		14	8	4	26
Garfish (<i>Belone belone</i>)		1	1	1	3
Gurnard (Triglidae)			2		2
Sculpin (Cottidae)		1			1
Eel (<i>Anguilla anguilla</i>)		4	9		13
Whitefish (Coregonus)		1			1
Pike (<i>Esox lucius</i>)					3

Table 4. NISP of animal bones from Fjelle, AD 1025-1800, amphibians, rodents and insectivores excluded (see Supplemental material)

Figure 4. Strontium isotopes ($^{87}\text{Sr}/^{86}\text{Sr}$) of cattle teeth from Fjelle in relation to rodents from Fjelle and nearby Lund and Uppåkra (Arcini 2018), used as baseline for local values. See Supplementary Information.



a good mixture of nutrients, mixed farming was an efficient way of resource utilization. Waste from arable farming could be used for fodder, whereas animals were needed to pull ploughs and for transport and to provide manure for the arable fields. The system also created an energy flow from extensive outland pastures (via dung) to infield cultivation (Emanuelsson 1988; Frandsen 1988, 14). Within this basic system, there was room for local adaptation and development.

In Fjellie the most obvious development was in crop composition. Barley was the principle crop in the initial phase of the village. From around AD 1200 both barley and rye were cultivated, and after a further expansion 1600-1800 rye eventually replaced barley as the dominating crop (Figure 5). The onset of rye cultivation in Fjellie coincided with the first appearance of corncockle and rye broom, which indicates that rye already from the beginning was a winter crop (sown in the autumn).

According to written documents, Fjellie and most other villages in the region practised a three-course rotation system, at least from the 17th century onwards (Dahl 1942). In this system, the infields were divided into three parts, each part used for growing (summer) barley, (winter) rye and for fallow, in three-year's cycles (Dahl 1942, 111). In Fjellie written documents indicate that a three-course rotation system was practised during the 16th century (Skansjö 2019), but a plausible interpretation based on the above mentioned first significant appearance of macro-fossil rye and winter-crop weeds is that some kind of rotation system was practised already during the 13th century, at least on parts of the infields.

There may have been non-agrarian reasons for the introduction of rye, like the want for leavened bread (Franzén 2004, 152-158), but it is important to note that the change also laid the foundation for a more sustainable agriculture: rye had less need for manure than barley (Leino 2017, 36); the introduction of a winter crop moved some of the work with sowing and tilling to the autumn, reducing the work load in the busy springtime (Pedersen and Widgren 2011); and systematic fallow mitigated soil degradation and favoured grazing (Leino 2017). Furthermore, rye's modest environmental and climatic demands may have been an advantage. Rye is tolerant to both summer

drought and harsh winters. The latter is particularly true for winter rye (Cappers and Neef 2012; Leino 2017; Myrdal 2011). Therefore, rye may have been climatically favoured both during the Medieval Warm Period and during the Little Ice Age, but in different ways.

Parallel to the cultivation of barley and rye, also oats were grown. The relative amount of oats in the archaeobotanical record was small but rather constant and did not decrease when rye cultivation was introduced and further expanded. It indicates that oats were grown in separate fields from rye and barley. The interpretation is supported by a map of Fjellie from 1775. It shows that oat fields at least at that time were separate from the barley-and-rye fields and had a more peripheral position (Skansjö 2019), probably because of oats' less need for manure (Leino 2017).

A comparison with other villages in south-western Scania and eastern Denmark reveals some common features (Figure 5): (1) barley was the major crop at least until 1600, (2) rye increased (generally after 1200) at the expense of barley, (3) oats show low and relatively constant values, and (3) bread wheat was generally rare. Kyrkheddinge is an exception, being the only village in the comparison with strong evidence of bread wheat cultivation. The similarities indicate that the major traits in Fjellie – with an introduction of a rotation system with rye and barley, and with oats grown in separate fields – may be valid for other villages as well. It should be noted that rye was introduced on some sites in southern Scandinavia already during the Late Iron Age, approximately from the 6th century onwards, and the weed flora indicates that it was grown as a winter crop from the 9th century onwards (Henriksen 2003; Grabowski 2011). However, this study shows that several villages started rye cultivation considerably later.

When it comes to livestock, Fjellie and other villages in the region showed only minor changes through time, which indicates a rather stable system of animal practice (Figure 6). In Fjellie a slight and steady increase of cattle was noticed from the 11th to the 17th century, whereas the general trend in the region was stable values during the 11-16th centuries (median 30 %), followed by an increase in the 17th-18th centuries (median 40 %) (Figure 6). For other parts of Sweden an increase

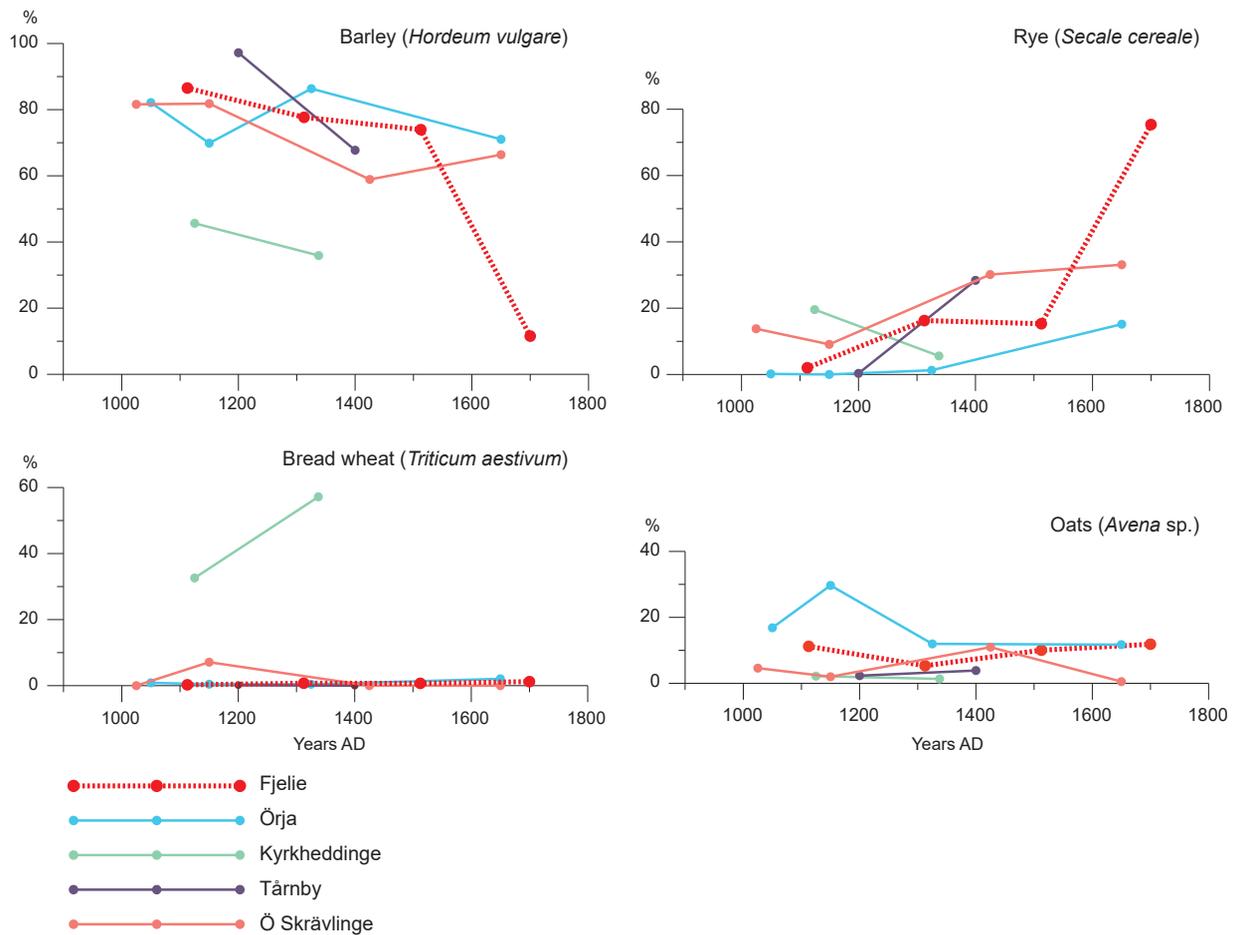


Figure 5. Frequency of main crops/cereals from Fjelie and four other villages in the Öresund region in relation to chronology. Mid-points of periods were used for the plot.

in cattle during the 17-18th centuries are also evident from historical sources (Dahlström 2006, 116-123). Since cattle produce more manure than other livestock (Börlling et al. 2017, 18-19), the relative increase of cattle may reflect an increased focus on crop farming, which led to increased need for draught animals and manure.

Sex and age distribution of cattle in Fjelie showed a large proportion of cows and calves during the 13th-14th centuries. A similar distribution is found in other Medieval faunal assemblages in southern Scandinavia and indicates that cattle keeping was focused on dairy production (Vretemark 1997, 82-84, 175). The low frequency of adult animals may also indicate a surplus production of meat, where older, less productive cows were sent to Lund for slaughter. A more even age distribution during the 15th-16th centuries indicates a changed focus, now with kill-off aiming primarily to support local domestic consumption of meat within the village.

The frequency of pig and sheep in Fjelie and other villages in the region was rather constant through time, except for some minor fluctuations (Figure 6). The relatively great importance of pig breeding (pork production) in the region probably reflects a strong emphasis on crop farming, which produced waste usable to feed pigs. The steady occurrence of sheep may reflect a constant need for wool for clothing, besides providing milk and meat.

Horse showed rather stable and similar frequencies of 5-10 % in most villages, but with a slight decrease in the 16-18th centuries (Figure 6). Horse was used for transport and as draught animal in agriculture. Scania was known for its extensive horse breeding and in the 18th century one fifth of all horse in Sweden originated from this region (Bohman 2010, 38).

Since domestic fowl and goose could be raised on cereal and household waste and on small plots of grassland, the relative increase of poultry in

relation to livestock from the 11-12th to the 16-18th centuries could possibly reflect a decrease of available pastures for sheep and cattle. Written records from the 18-19th century show that goose keeping was common and widespread in Scania at that time (Bohman 2010, 40-41). In Fjellie and other villages, the zooarchaeological record shows higher frequency of goose in relation to domestic chicken during the 15th-18th centuries (median 80 %) than during earlier periods (median 42 %), which indicates that the major expansion of goose keeping started not until the Early-modern period, possibly driven by new culinary preferences.

Finds of eggshells of goose from the 13-14th centuries in Fjellie indicate that egg production was an important reason for keeping poultry. Eggshells are generally rare in the archaeological record due to their fragility and liability to dissolution in the soil (Serjeantson 2009, 169-170). The finds from Fjellie probably reflect good preservation conditions rather than unusually high consumption of

eggs. Besides meat and egg, geese also provided feather down and pens (Serjeantson 2009, 184).

In addition to the above-mentioned trends and changes in crops and animals, there was one period in Fjellie when animal husbandry may have gained in importance in relation to crop farming. The archaeological documentation revealed that one of the farmsteads (22) was uninhabited ca. 1400-1600, which indicates temporary abandonment of this farm in the wake of the Black Death and throughout the Late-medieval crisis. There are no archaeobotanical or zooarchaeological data from the abandoned farm, but on the other two farms (18 and 19), which both survived the crisis, archaeobotanical samples showed an unusually high proportion of grassland species during the same period. It may reflect increased handling of hay, and, hypothetically, that the abandoned farmstead was used for pasture or as hay meadow by neighbouring farms. Such a use of abandoned farms during the Late-medieval crisis are known from other parts of present-day Sweden (Lagerås 2016b).

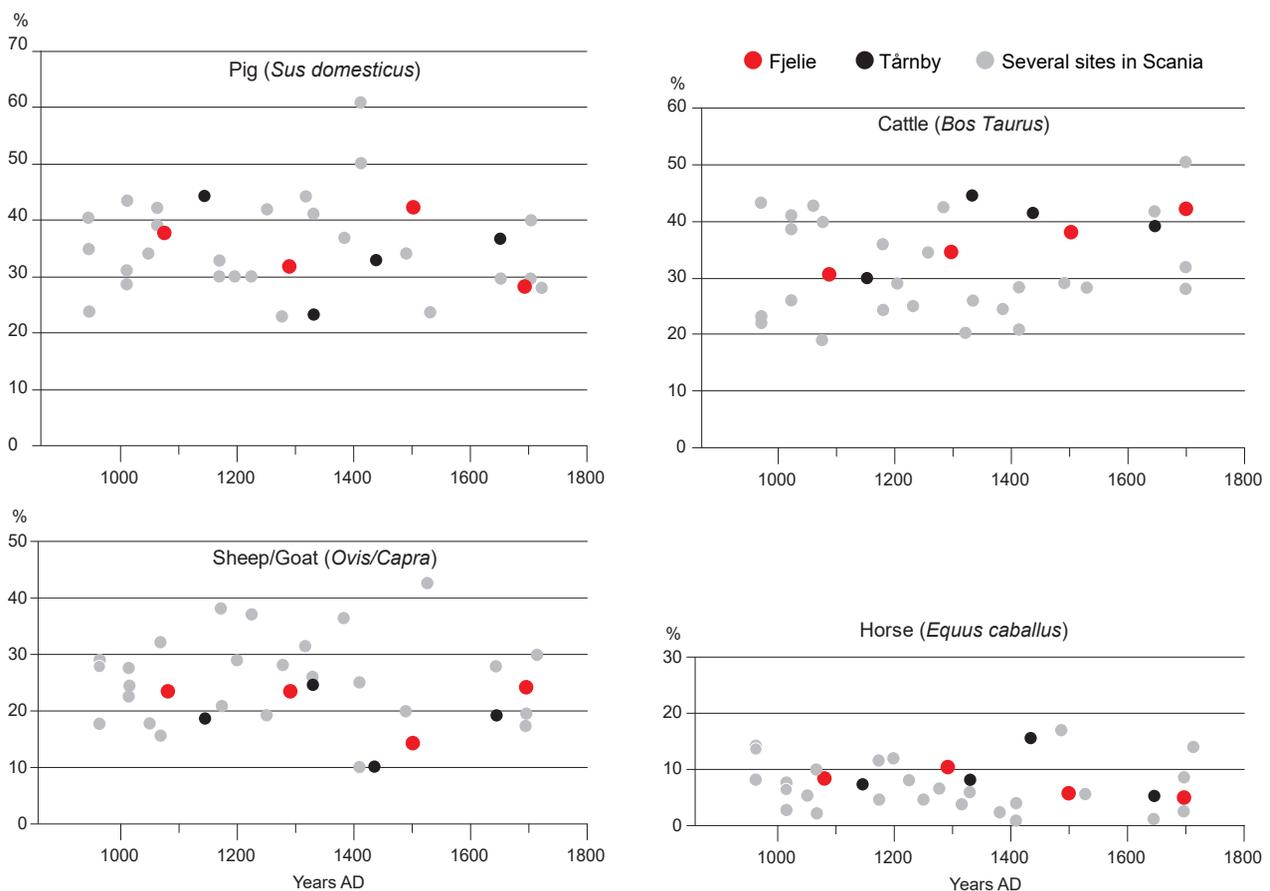


Figure 6. Frequency of animal bones (NISP) of livestock from Fjellie and 14 other villages in the Öresund region in relation to chronology.

Collaboration in the infields

By comparing archaeobotanical results from the different farmsteads in Fjellie, we can reveal similarities and differences within the village (Figure 7). For cereal grain, the material allows for comparison between farms 18 and 19 for the periods 1225-1425 and 1425-1600, and between farms 19 and 22 for 1600-1800. A striking result from this comparison is that the cereal grain composition from any period is similar between the farms. It indicates that the different farms within the village grew crops in the same proportions. When rye was introduced around 1200 it was introduced on more than one farm, and when it further increased around 1600 it did so on more than one farm. The two changes in crop composition obviously affected several farms – and hypothetically most farms – in the village.

According to numerous written records from Scania from the 17th century onwards the three-course rotation system was coordinated on village level (Dahl 1942). Even though each of the three fields were divided into numerous individually owned strips of land, all strips within one field were grown with the same crop (or went fallow) during any particular year. This coordinated open-field system saved the farmers from laborious fencing (no fences were needed within the fields) and also facilitated the organisation of post-harvest grazing in the fields (Gadd 2005, 64). It depended on collective decisions by the villagers, not only on cropping system, but also on the timing of sowing and harvest. In Fjellie and many other villages in densely settled areas, the three-course rotation was coordinated not only within the village, but also with neighbouring villages to reduce the need for fencing even further (Dahl 1968).

The coordinated arable farming in the infields was at the heart of the village system and in a way defined the pre-modern village. The archaeobotanical results from Fjellie indicate coordinated arable farming at least from around 1200, probably in a three-course rotation system that included rye and barley.

Arable land use and collaboration in the infields may also be interpreted from Medieval laws, in this case the Scanian Law. The earliest preserved copies of this law were written down around AD 1300,

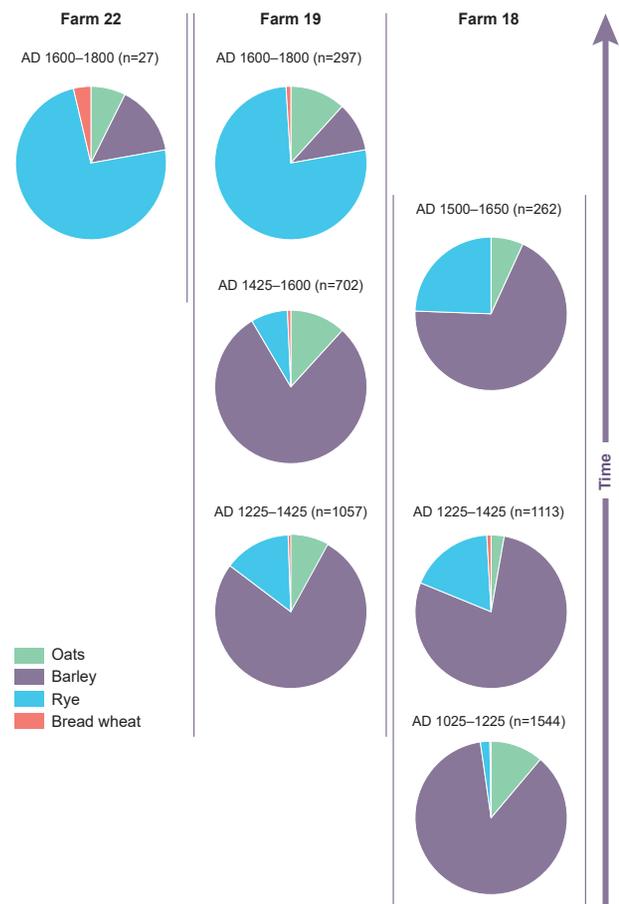


Figure 7. Frequency of main crops (cereals) at different farmsteads in Fjellie in relation to chronology.

but include passages that reflect older conditions, probably from the early 13th century (Hoff 1997, 19; Holmbäck and Wessén 1979). According to the law, rye and barley were the most important crops and they were cultivated after each other in the same fields, usually interpreted as a three-course rotation system (Holmbäck and Wessén 1979, 118). The law mentions the villager's obligations to contribute to common fencing, but also regulations on individually fenced strips of arable land (Hoff 1997, 188). It seems to reflect a transition period from individually fenced strips (but with coordinated crops and post-harvest grazing) to a fully developed open field system with no fences within the fields.

Pastures – a Common Pool Resource

Except for the rich occurrence of bones, animal husbandry is rather invisible in the archaeologi-

cal material. Evidence of byres is rare and usually ambiguous on Swedish investigation sites and very few tools are connected to animal husbandry. Still, Medieval laws and other written records show that animal husbandry was an important and integrated part of the village system. These sources also offer insights into how it was managed and organized.

In Scania livestock was kept outside during most of the year and indoors during the coldest parts of winter (Bohman 2010, 38-40). Outland pastures and infield fallow were grazed throughout the grazing season, and, in addition, mowed meadows and harvested fields were grazed in the autumn. Outland pastures were grazed by cattle, sheep, goats and horses, and the same animals also grazed fallow infields, together with smaller animals like geese and pigs. Pigs were probably kept close to the settlement and fed on household waste (including waste from threshing, malting, etc.), except during mast years, when pigs may have been brought to woodlands to feed on acorns (in Scania particularly from beech) (Bohman 2010, 40; Ericsson 2014, 239-241).

At Fjellie cattle were the most important animals closely followed by pig and then by sheep. A similar distribution between the species was common also in most other villages in the region, indicating a broad livestock base rather than specialization. The diversity of livestock on each farm guaranteed an efficient use of fodder and grazing resources.

In contrast to winter stalling, when animals were kept and cared for on the individual farmsteads, grazing during most parts of the year was a collective effort. Livestock grazed together in mixed herds on common pastures and fallow infields. The animals were individually owned and marked for identification (Hoff 1997, 215), but watched over by a common herder. In southern Scandinavia the herder was usually a professional herdsman hired by all the villagers together (Hoff 1997, 220; Myrdal 2011, 87).

Grazing commons in the pre-modern village may be defined as a Common Pool Resource (CPR) (Ostrom 1990). As such, it was characterised by collective-choice arrangements and the possibility for all appropriators (the villagers) to participate in the decision-making process. The system was labour saving, particularly by reducing the need for

fencing. But like in all CPRs, strict regulations, for instance on the number of animals (Hoff 1997, 213), were necessary to prevent over grazing and to guarantee a sustainable management. Indeed, the scarcity of pastures in the heavily cultivated regions of southern Scandinavia, put high demands on an effective system of regulations, monitoring and sanctions (Ostrom 1990, 90). A map from AD 1775, shows that the common pastures of Fjellie bordered those of seven neighbouring villages, with no fences in-between (Dahl 1968). It means that regulations were necessary, not only within the village but also between the villages, to guarantee a sustainable management of the grazing resources.

The grazing commons in Fjellie were situated approx. 1 km east of the village core, on older bedrock than both the infields and the village core. The slightly increased strontium values in several cattle teeth in comparison to local rodents reflects the use of these grazing commons for cattle grazing, as expected. However, two cattle teeth (dated to 1425-1600 and 1600-1750, respectively) showed distinctly higher strontium values, indicating an origin in more remote areas with much older bedrock. Such bedrock is found in the uplands of central and northern Scania and further north. Possibly, Fjellie was engaged in a system of transhumance or long-distance herding. An alternative interpretation may be that the high strontium values represent livestock trading and animals bought at livestock markets to avoid inbreeding and to improve the local cattle stock.

Farm-specific production and consumption

In addition to collective and coordinated practices, like infield cultivation, livestock herding and fencing, there seem to have been certain spheres of the village economy that allowed for diversity and specialization by the individual farms. One of these spheres was vegetable gardening and similar small-scale cultivation. Studies of old maps from southern Sweden have shown that vegetable gardening was widespread in the countryside at least from the 18th century onwards, and usually practised on small plots close to the individual farmsteads (Hallgren 2016). For older periods the picture is

less clear, but archaeobotanical records from Fjelle and some other villages prove vegetable gardening already during the Middle Ages (cf. Lagerås 2013). In Fjelle the identification of legumes and root crops, like pea, faba bean and turnip, and spices and medicinal plants, like black mustard, motherwort, dill, caraway, etc., reflects garden cultivation, at least from the 13th century onwards (Table 3). In addition, there were cultivation layers close to the house remains that were interpreted as plots for vegetable gardening. This small-scale cultivation may have been an important complement to cereal cropping, and since it was individually managed by the different farmsteads, it was more flexible and enabled diversity and variation according to different preferences, taste and needs. Also, gathering of berries and nuts and catching of small birds were probably carried out by the individual farmsteads.

Fishing by the villagers may have been a collective effort, but there are reasons to assume that it was rather organized on farm level. Fisherman as a profession is not known from Medieval laws in Scandinavia and the fishing in Öresund was during the Middle Ages pursued by farmers and townsmen (Cardell 2005, 291; Eriksson 1980, 26). The fish-bone species composition at two farms in Fjelle indicated different consumption patterns – one farm (18) showed a high proportion of herring whereas the other (19) had more cod and perch (Figure 8). Since there was an established large-scale market for salted herring in southern Scandinavia during the Middle Ages (Cardell 2005, 290-291; Ersgård 1988), most of the herring consumed on farm 18 may have been bought, for instance in nearby Lund or at the fish-market in Skanör-Falsterbo, whereas the cod and perch on farm 19 possibly reflect household fishing. Similarly, in village Örja, the fish-bone material indicated farm-specific specialization (Cardell 2013, 199-200).

When it comes to animal husbandry, herding was centralized and the number of animals that grazed the common pastures was regulated. Still, between-farm variation in the faunal remains from Fjelle indicated that there may have been room for differences in what type of animals each farm focused on. One farm (19) showed a relatively high frequency of cattle, horse, and goose, whereas another (18) seemed to have depended more on sheep, pig, and chicken (Figure 9). It may re-

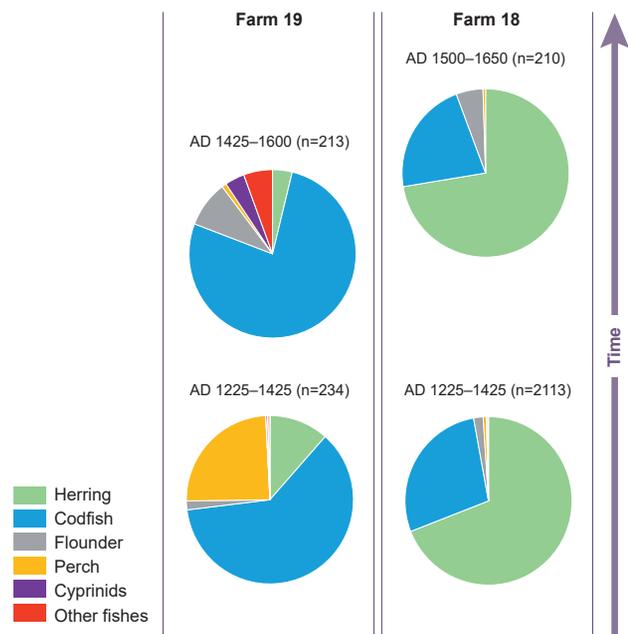


Figure 8. Frequency of different taxa of fish based on NISP at two farmsteads in Fjelle in relation to chronology.

fect socio-economic differences, varying facilities for winter stalling or different demands. During 1225-1425, farmstead 18 consisted of only one building, whereas farmstead 19 consisted of at least two buildings – a dwelling house and probably a separate stable for horse and cattle. In later periods farmstead 19 consisted of more buildings than farmstead 18. Between-farm variation in the proportion of livestock has been noted before in villages where several contemporary farms have been excavated, such as Örja and Bunkeflo (Cardell 2009, 551; 2013, 196).

We may also expect specialisation in the processing of food products. In village Örja, one of the documented farms had specialised in fish processing, probably smoking (Schmidt Sabo 2013, 118-122), while in Fjelle, finds of sprouted barley grain, bog-myrtle and hop indicated that one of the farms (19) specialised in beer brewing. This farm also had oven structures that tentatively may have been connected to the malting process. Even though all households in the village probably consumed beer, brewing may have been confined to specific farms. Most studies on beer brewing in Scandinavia are from towns, and very little is known about brewing in rural households (Heimdahl 2014).

Production and specialisation at individual farms may also have been influenced by demands

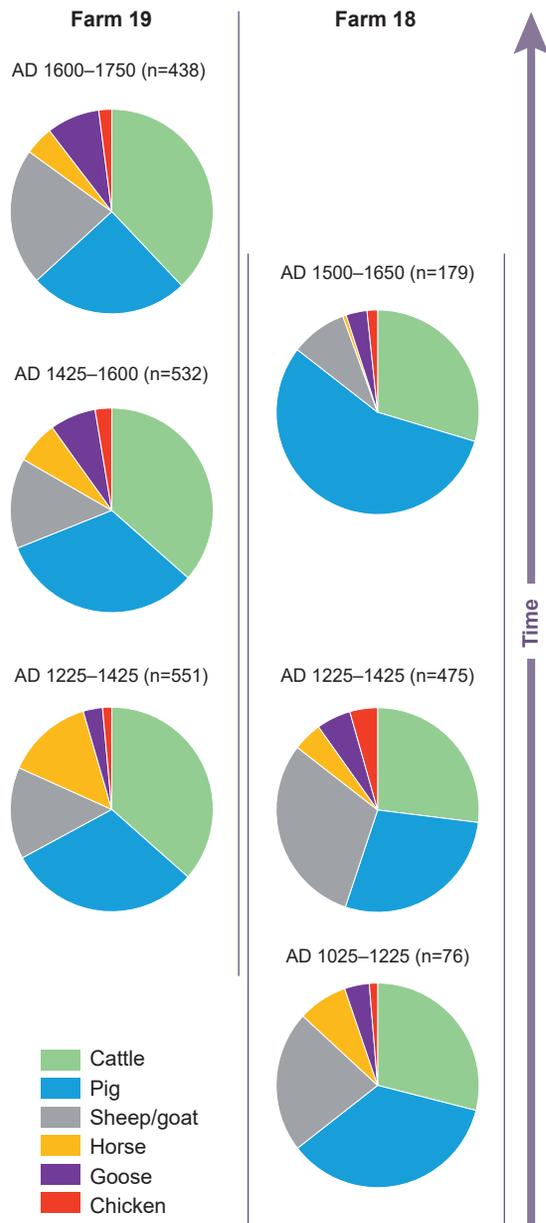


Figure 9. Frequency of livestock and poultry based on NISP at two farmsteads in Fjellie in relation to chronology.

by the landowners. In Fjellie the landowners during the Middle Ages were the nobility and the church, but the ownership of separate farms is unknown. According to written sources, farms that belonged to the cathedral chapter of Lund had to pay a yearly tax called *teja*, specified to include barley, lamb, chicken, and goose (Skansjö 2019, 211). Although not possible to prove at present, such demands by landowners may have influenced the farm-specific production.

Agrarian resilience

In the study of Fjellie we have identified several different types of diversity that characterised land-use and organisation and which may have contributed to agrarian resilience. Fjellie was in many respects a typical village for the fertile plains of southern Scandinavia and the conclusions below may be valid to villages in general in this region, even though details may differ.

Firstly, agriculture was based on a combination of many different species of cultivated plants and animals. Among plants, the most important ones were barley and rye, followed by oats. Because of its small climatic demands the latter was an important emergency crop when other cereals failed and as fodder for animals (Bakels 2012; Bohman 2010, 37–38). In addition, several non-cereal plants were grown, like legumes and root crops, spices and medicinal plants. Among livestock, most important were cattle, closely followed by pig and a slightly lower occurrence of sheep, as well as horse and poultry, particularly goose and chicken. The combination of different plants and animals, with different demands for soil, climate and fodder, meant an efficient way of utilising the resources. The diversity was also a way to reduce vulnerability to bad weather and to mitigate the effects of crop blights and infectious diseases among plants and animals. The combination of summer crops (barley and oats) and winter crops (rye) also fits well with such a risk minimising strategy. In addition, non-agricultural activities, particularly fishing, reduced vulnerability and weather dependency even further.

Secondly, agriculture was based on (and shaped) a diversity of environments and biotopes, which together may be referred to as the village's ecosystem territory (Lennartsson et al. 1998). Even though the entire landscape was affected by land use, i.e. a domesticated landscape (Eriksson et al. 2018), it typically ranged from intensively managed land close by the settlement to more extensively managed land in the periphery. In Fjellie, from centre to periphery, there was a range from garden cultivation, manured barley and rye fields, via oat fields (probably less manured due to their peripheral setting) and mowed meadows, to outland grazing commons. If also fishing by the coast (5 km away)

and long-distance grazing in remote uplands or cattle trading (as indicated by strontium analysis of cattle) are considered, the ecosystem territory of the village extended far beyond the village borders. From an ecological point of view, it was a range from completely manmade biotopes with cultivated introduced plants on manured, weeded and tilled soils, via semi-natural grasslands to natural fishing grounds. The semi-natural grasslands were shaped by grazing but still dominated by native plant species and natural soils. Hence, there was a gradient from much to less human impact on the environment from centre to periphery.

In terms of production, this range also represents a scale from the highly productive (in terms of production per acre) and labour-intensive land use of gardens and arable fields to the less productive and less labour demanding herding of livestock and land use of grazing commons. This broad spectrum of labour intensity offered flexibility, which may have been particularly valuable in periods of population fluctuation or just local changes in household size. Other studies have shown that the importance of animal husbandry in relation to crop farming increased in the wake of the Black Death of the 14th century, probably due to shortage of labour (Lagerås 2016b; Myrdal 2006). Similarly, the balance between crop farming and animal husbandry within village agriculture may have shifted due to war, plague outbreaks and other crises. In Fjellie, one farm (22) was abandoned c. 1400-1600, and from this period grassland species were common in the archaeobotanical record of the surviving farms (18 and 19), indicating increased importance of animal husbandry during the Late-medieval crisis.

Village agriculture showed diversity also when it came to the social organisation of land use, characterised by a range from collective (organised on village level) to individual (organised on farm level). Collective land use may be exemplified by the utilisation of grazing commons and the grazing on infield fallow. Arable farming was by large a collective effort, since choice of crops and time for sowing and harvest had to be coordinated on village level, even though strips of land were individually owned and managed. The same is true for infield meadows. Also fencing was probably organised on village level. Spheres for individual

decisions on farm level were garden cultivation, processing (like beer brewing) and non-agrarian contributions to the economy, particularly fishing. Differences in animal husbandry noticed between farms probably reflect variations in availability of stables and fodder for animals during winter, depending on different socio-economic conditions and sizes of the households. Like the range from labour-intensive to extensive land use, the range from collective to individual probably created flexibility in times of fluctuating population and household sizes.

To sum up, even though the long-lived settlement structure of the Medieval and Early-modern village seems to indicate rigidity, the study of Fjellie showed that village agriculture was characterised by diversity in several different ways. We identified diversity in crops and animals, biotopes, labour intensity and social organisation. The combination of different crops and animals and the dependency on several different biotopes reduced vulnerability to bad weather, crop blights and animal diseases, and the range from highly productive and labour-intensive land use to extensive land use, and probably also the combination of individual and collective, made the system resilient to fluctuations in population. This multiple diversity within the agricultural system (and complemented by fishing) seems to have been a strategy to minimize risks, both from low-order crises like temporary harvest failures and from major crises like the Black Death and war. Diversity, therefore, may have been a key factor behind the resilience of the Medieval and Early-modern village, both as an agricultural system and as a social organisation.

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Supplemental material

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