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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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; Wåhlin 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 (FF[1] 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

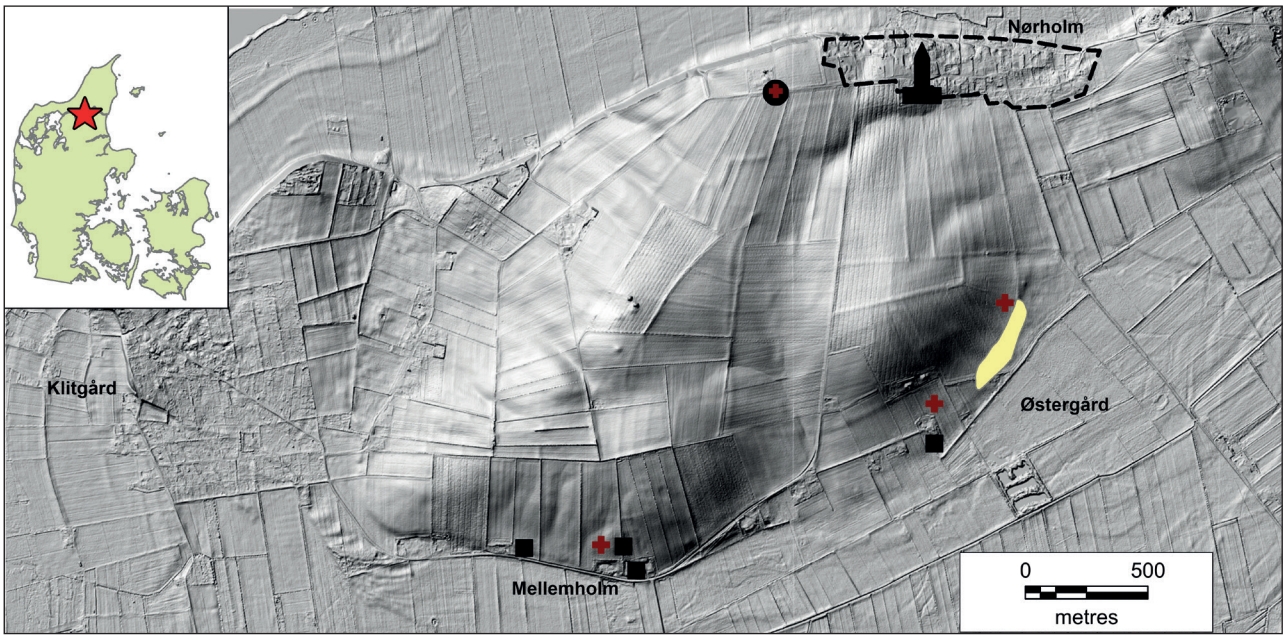

Figure 1. Investigated areas and Iron Age and Medieval settlements and graves at Nørholm. Black square = settlement 500 BC-AD 400, Red cross = grave/burial ground AD 1-500, black dot with red cross = ring ditch (Grave? AD 600-950), yellow zone = settlement AD 200-650. © Geodatastyrelsen.

featured buildings were recovered within an area of 5000 m^2 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 ^{14}C-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.

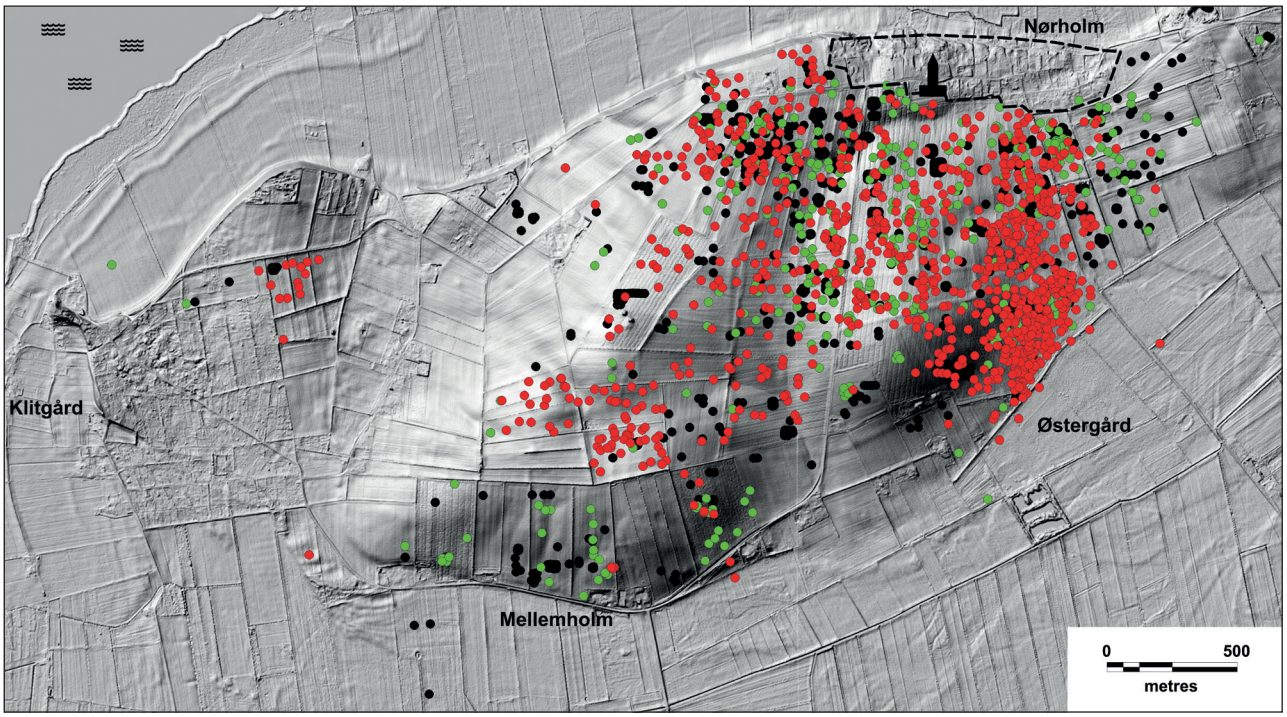

Figure 2. The distribution of all metal detector finds recovered at Nørholm (5.648 finds). Red dot = find location recorded by GPS (1.004 finds), green dot = find location recorded as point on a map (358 finds), black dot = find location recorded as a region on a map – typically part of a field (4.280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

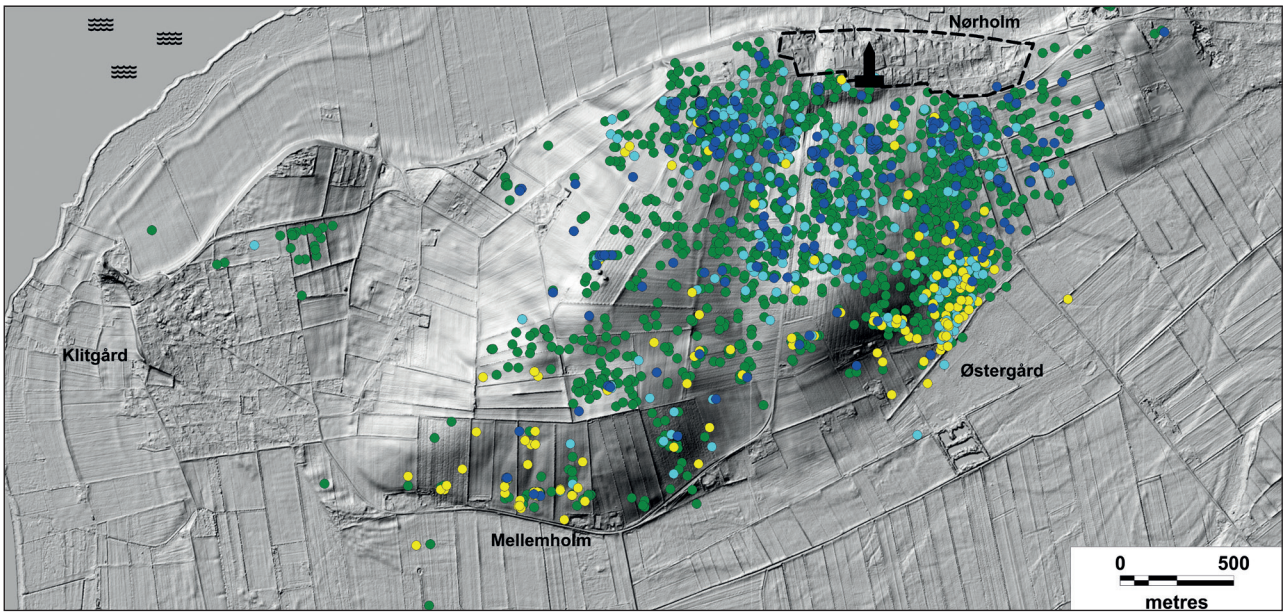

Figure 3. The distribution of Iron Age and Medieval metal detecting finds recovered at Nørholm. Yellow dot = 1st-6th century, turquoise dot = 7th-10th century, blue dot = 11th-13th century, dark green dot =undated/ other periods (finds with poorly recorded find location included). © Geodatastyrelsen.

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 Mellemholm 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 Mellemholm 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 Mellemholm 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 Mellemholm 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 accidently.

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

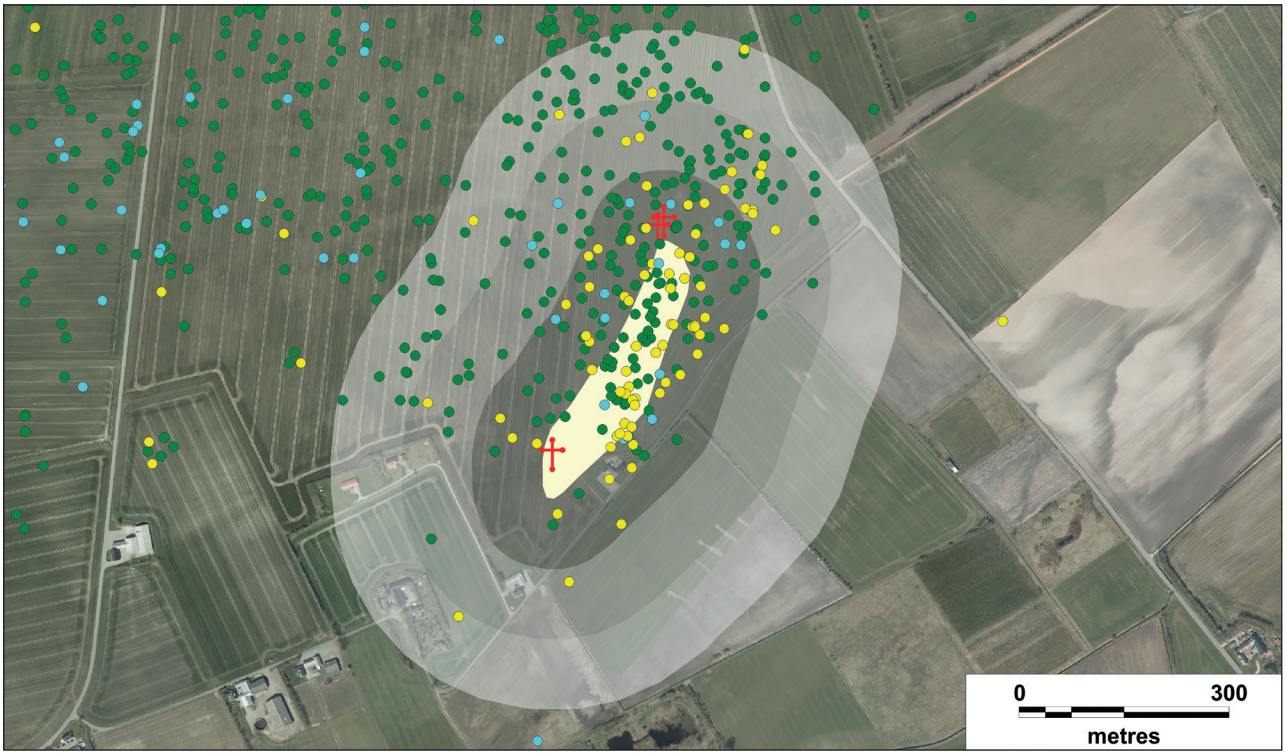

Figure 4. The density of ploughzone metal detector finds at the Iron Age settlement at Østergård and in the vicinity. Yellow region = settlement. Yellow dot = 1st-6th century, turquoise dot = 7th-10th century, green dot = all other (finds with poorly recorded find location excluded). © Geodatastyrelsen.

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 archeaological 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 displacement 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

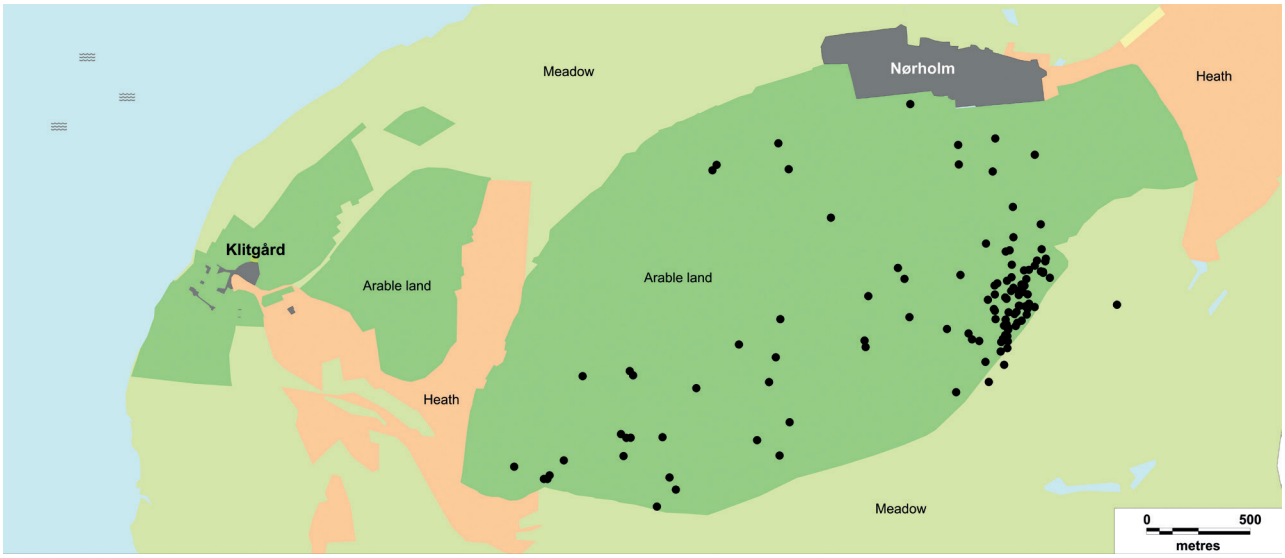

Figure 5. The distribution of metal detector finds from the 1st-6th century (black dots) and the exploitation of the landscape at Nørholm in the19th century. Background: land exploitation zones on the cadastral maps. (Finds with poorly recorded find location excluded). © Geodatastyrelsen.

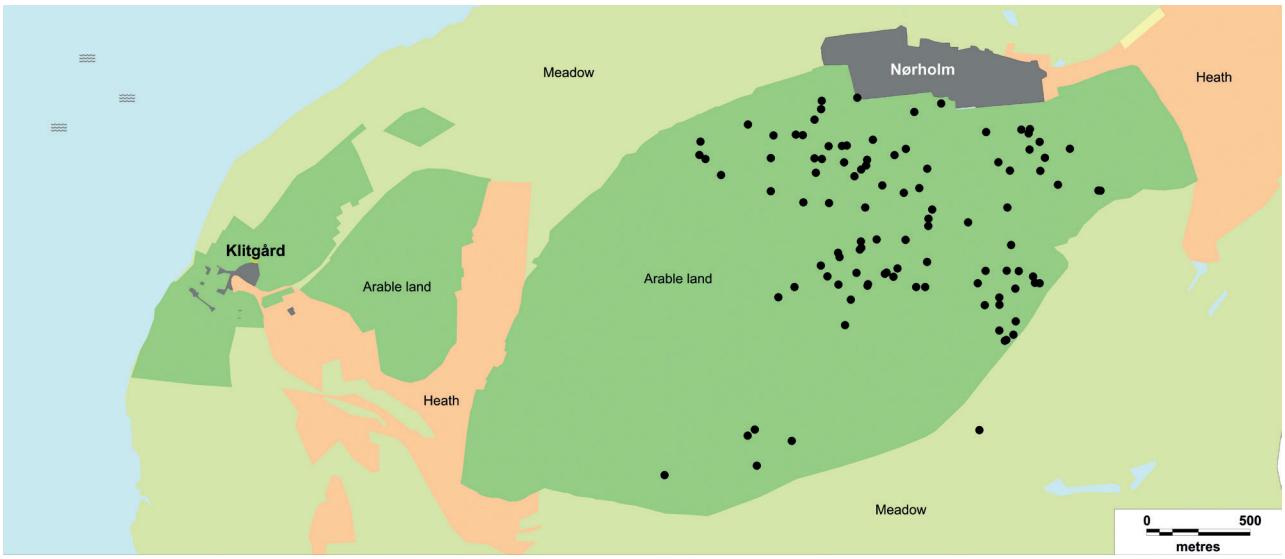

Figure 6. The distribution of metal detector finds from the 7th-10th century (black dots) and the exploitation of the landscape at Nørholm in the19th century. Background: land exploitation zones on the cadastral maps. (Finds with poorly recorded find location excluded). © Geodatastyrelsen.

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

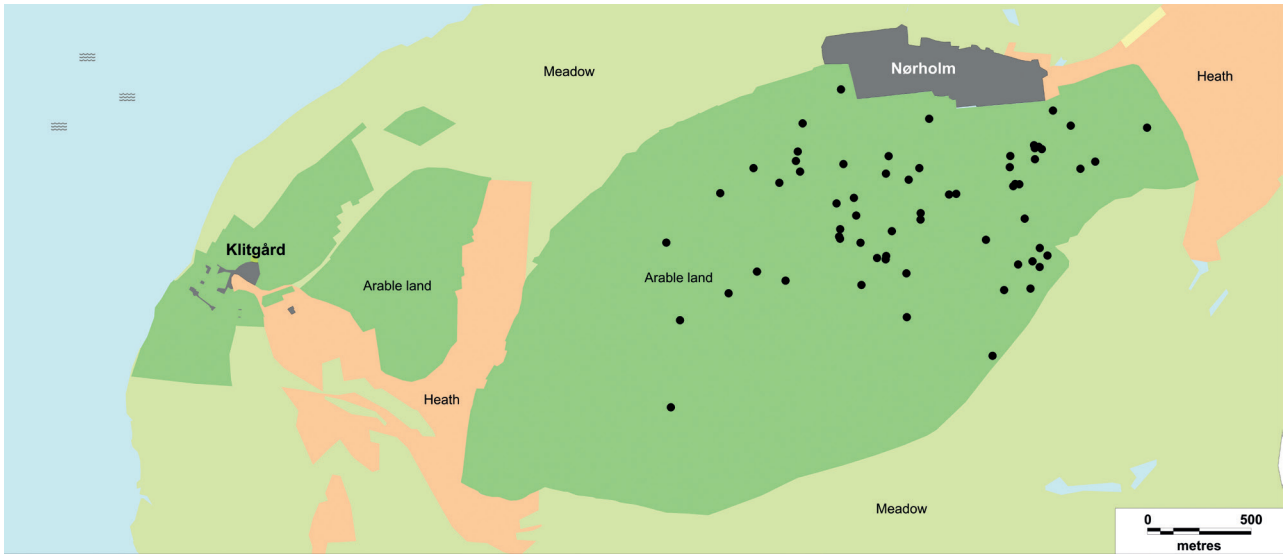

Figure 7. The distribution of metal detector finds from the 11th-12th century (black dots) and the exploitation of the landscape at Nørholm in the19th century. Background: land exploitation zones on the cadastral maps. (Finds with poorly recorded find location excluded). © Geodatastyrelsen.

Figure 8. The distribution of metal detector finds from the 13th-14th century (black dots) and the exploitation of the landscape at Nørholm in the19th 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 Mellemholm 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 Mellemholm 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 adaption 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; Wåhlin 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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