RECREATIONAL METAL DETECTING AND ARCHAEOLOGICAL RESEARCH:

Critical Issues Concerning Danish Metal-Detector Finds

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ABSTRACT: *Recreational Metal Detecting and Archaeological Research*

Thirty-five years of private metal detecting have had a profound impact on the field of archaeology in Denmark. In particular, the areas of Iron Age and Early Medieval research have benefited from the extensive new find material. Although the detector finds constitute a genuine revelation in archaeology, the handling and use of Danish detector finds for research purposes is not without obstacles. This article discusses several of the critical issues that limit the research value of the detector finds on the basis of find material recovered in the eastern Limfjord region, northern Jutland.

INTRODUCTION

"What nobody owns belongs to the King". With this statement, the ownership of stray goods was clarified in Valdemar Sejer's Jutish law of AD 1241. Initially, economic benefit for the crown was the sole intention of the law. However, in 1752 this intention changed, and the statement was added that the finder of such stray goods was to receive complete economic compensation from the state when properly handing over the finds (Glob 1980: 13-17). Today, these principles continue to form the backbone of the Danish treasure trove act, which is a major component of cultural heritage management in Denmark. Despite their age, these principles have never been more important than during the past 35 years of booming recreational metal detecting.

Although the first metal detectors were invented in the 1830s, the breakthrough for the instrument in the field of archaeology did not occur until 140 years later. During World War II, large numbers of metal detectors were produced for bomb detection, and by the war's end, recreational metal detecting had become a reality in the United States (Cornelison and Smith 2009). These years also saw the first positive contributions of metal detecting to the field of archaeology in England (Addyman 2009: 5). However, there as in many other parts of Europe it was in the hands of private users that the metal detector won the attention of archaeologists. During the 1970s and 80s, the recovery of an impressive number of rare objects followed the booming recreational use of the instrument, and the capacity of metal detecting to contribute to archaeology became unmistakable (see Thomas and Stone 2009).

Unfortunately, reckless treasure hunting, looting of protected areas, and illicit trade in antiquities swept through Europe in the wake of the increasing popularity of recreational metal detecting (Addyman 2009; Fischer 1983; Östergren 1989). The administrative reactions to this phenomenon varied remarkably from country to country (Thomas and Stone 2009; Watt 1997). As a direct consequence, the quantity and quality of material collected and recorded as a result of metal detecting and the general scientific impact of the material differ substantially, even between neighboring countries. In contrast to most of its neighbors, Denmark chose not to limit private metal detecting through legislation but stuck to the old principles. Only minor specifications were added to the existing law in 1984 (Det Arkæologiske Nævn 1985). Instead, the focus was directed toward educating the detectorists. Consequently, one is allowed to search in Denmark – only in protected areas is metal detecting banned. However, one's finds must be handed over to the local museum, and rare or valuable finds and finds of special cultural importance are considered "treasure trove", i.e., state property. Finders receive economic compensation adjusted according to the value of the find (whereby material value and rarity are decisive parameters) and not least the care demonstrated during its handling, including the recording of the location of the find (Dobat 2013a; Moesgaard, Pedersen, Vang Petersen 2010).

The positive effect of this encouraging attitude to the private use of metal detectors can hardly be overestimated. It has secured and stimulated cooperation between private detectorists and local museums, and the contribution of the metal detectorists to

the archaeological record has been groundbreaking. Series of new find types have been added to the archaeological record, and other find types, formerly sparse, have increased, which has dramatically altered current distribution patterns, particularly those of small, non-ferrous artifacts (see Gjelssø Bertelsen 1994; Grinder-Hansen 1994; Høilund Nielsen 1991; Moesgaard 2002; Pedersen 2004; Vang Petersen 1991). In addition, small metal finds have proven to be excellent surface indicators of settlements from the metal-rich periods – the Iron Age and the Middle Ages – and the finds have resulted in the discovery of a large number of previously unknown settlements, revealing an unprecedentedly broad variety of settlement types (Birkedal Christensen and Johansen 1992; Feveile 2014; Henriksen 2000; Høilund Nielsen 2014; Jørgensen and Pedersen 1996; Trier Christiansen 2008; Ulriksen 1998). Thus, the metal detector has profoundly changed our understanding of societal development during the Iron Age and Early Medieval Denmark (see Høilund Nielsen 2014; Näsman 1991).

Although the detector finds constitute a genuine revelation in the field of archaeology and have enjoyed the professional and public attention they deserve, the handling and use of Danish detector finds for research purposes is not without obstacles. The challenges are numerous. The intention of this article is to discuss a number of the critical issues that limit the research value of the detector finds. A preliminary presentation of the history of metal detecting in Danish archaeology will contextualize the discussion.

METAL DETECTING AND DANISH ARCHAEOLOGY

In the early 1980s, two well-prepared private detectorists began to survey the find spots of old gold finds in the environs of Gudme, on Funen. This strategy proved to be a rewarding one. The detectorists soon located their first gold find, and in the subsequent years, the number of spectacular finds from the area reached levels unprecedented in Danish archaeology. The abundance of remarkable finds quickly became the basis for a research project performed by the National Museum in cooperation with local museums, and during the 1980s and 90s, extensive excavation uncovered an unusually rich system of settlements centered on an elite residence that was at its peak during AD 200-600. At Gudme, the close relationship between the small metal finds from the plow layer and settlement activities was noted for the first time, a fact which elevated Danish settlement archaeology to a new level of understanding during the following years (Nielsen, Randsborg, Thrane 1994).

The Gudme Project initially relied on the surveys performed by the private detectorists and was only one of several archaeological investigations conducted during the 1980s that was the direct outcome of a response to metal detector finds recovered by private detectorists. In certain instances, these investigations involved considerable cooperation between museums and private detectorists (see Birkedal Christensen and Johansen 1992; Jensen 1991; Kromann, Anne & Watt, Margrethe 1984). These came to be the first of numerous archaeological investigations supported by the efforts of private detectorists. Since then, a series of investigations has been launched at various productive detector sites in many parts of Denmark, and frequently, through their surveys private detectorists have played a central role, a major benefit being the possibility of conducting detector surveying on a scale that would never have possible with paid labor (see Dobat 2013b; Henriksen 2000; Lauridsen 2014; Sindbæk, Brown, Goodchild 2012; Stridsing 2014; Ulriksen 1998; Wåhlin 2014). One drawback of this phenomenon is the low number of professional archaeologists who have acquired metal-detecting skills and the limited development of general, scientifically verified methods for metal detecting. On the other hand, direct interchange with museums has produced a large corps of semi-professional metal-detecting archaeologists.

Metal-detector associations represent a major component of the positive development of private metal detecting in Denmark. In several regions of the country, detectorists join associations that have become significant platforms for the basic education of newcomers and the promotion of the broader, cultural historic values of detector finds (see http://www.thy-morsdetektor.dk or http://www.harja.dk). In these forums, newcomers can learn the basic skills of recording and handling finds from veteran detectorists, and communication from the museums to the increasing number of detectorists is smoothed, which eases the workload of the heavily burdened local museums. Additionally, the associations have become treasured partners during systematic searches of larger areas.

A positive but easily overlooked side effect of private metal detecting has been the involvement of a large group of citizens, a significant number of whom would probably never have become that aware and knowledgeable about our cultural heritage, had it not been for their hobby. In addition, spectacular finds recovered by elated amateurs have repeatedly made headlines in the media, which offers the public a

thrilling and positive aspect of archaeology and thus represents a public relations success for the field.

However, not all of the experiences related to the liberal Danish legislation on metal detecting have been positive. In 2003, a local detectorist turned in a nearly intact Etruscan bronze jug, which was found in a field south of Aalborg in the 1980s. Apparently, the well-preserved jug had been located 60 cm below the surface – obviously, a situation to be addressed in the field by experts from the local museum, which should have been informed immediately (Klingenberg 2009). Today, detectorists are substantially better informed, and the chance of a similar occurrence is minimal because of an improved knowledge of proper procedure. However, individual errors will occasionally occur in a system that involves a large number of individuals from different backgrounds, and any system that relies to a large extent on trust and self-discipline is bound to occasionally fail because of the inexperience of individuals. Practices such as "night-hawking" (i.e., surveying without the permission of the landowner or surveying protected areas) of course occur in Denmark[1]. Similarly, it is naïve to believe that all metal-detector finds that would be classed in the "treasure trove" category have been handed over to museums (see Jensen 2004a; Jensen 2004b). However, the archaeological record speaks for itself. The record has increased rapidly while prospering from a well-functioning treasure trove system supported by the high degree of general trust in Danish public institutions and the intensive agricultural cultivation of most of the country (Dobat 2013a).

THE DANISH METAL-DETECTOR FINDS

Any archaeological record is the product of a range of selective processes and only represents a fragment of past material reality. This statement is indeed also true in the case of metal-detector finds. A wide range of formation processes has shaped the composition of the detected finds and the data recorded in connection with them. Certain of these processes are general to most archaeological find material, whereas others are specifically relevant to detector finds. A fundamental understanding of these processes is crucial to the handling of research material. In the following sections, several dominant factors that affect Danish metal-detector finds are discussed.

1 In the Aalborg area, incidents of trespassing metal detectorists occasionally occur, most often because of misunderstandings. Negative events that resulted from unfortunate actions of private metal detectorists have also been recorded across the country (Fischer 1983; Kjer Michaelsen 2000; Ulriksen 2013).

Fig. 1. Area covered by the find records of Nordjyllands Historiske Museum.

In 2011, it was estimated that there were at least 200 highly active metal detectorists in Denmark. One challenge posed by this large group of detectorists is the handling and recording of the constantly increasing number of detector finds (Dobat 2013a: 712). Danish detector finds probably number in the tens of thousands. However, it is impossible to provide even a rough reliable estimate of this number, and in any case, such an estimate would mean little because the varying methods and criteria of recording at local Danish museums have resulted in substantially different records. The importance of this issue will become clear in several aspects of the following discussion.

The basis of this discussion is the record of finds recovered by private detectorists at the local Nordjyllands Historiske Museum in Aalborg, by the eastern end of the Limfjord. Since the beginning of the detector boom, this area has been one of the highest yielding metal-detecting areas in Denmark. Yet, the 14,984 recorded metal finds from the eastern Limfjord region are not fully representative of all Danish detector finds. There are obvious regional differences. For example, precious objects of silver and gold seem sparse here compared with other detector hotspots in Denmark. Additionally, there are discrepancies, which are owing to variations in methods of registration and other post-depositional processes. However, the finds may serve as a firm starting point for a discussion of the scientific issues implicit in the records of the metal-detector finds.

Apart from a small number of objects, all of the metal-detector finds recorded at Nordjyllands Historiske Museum consists of non-ferrous alloys. However, a substantial number consist of iron and bronze.[2] The absence of iron objects is the result of the highly selective priorities of the detectorists, which are determined by the large number of iron objects that occur at most detector sites in the region. A significant number of these objects originate in farming tools of recent date. However, the majority cannot be dated, even within broad chronological frameworks. The enormous amount of iron in the topsoil is probably due to the marked continuity of the settlements in the region. The productive detector sites are located where activity has been high since the Iron Age, and thus, an extensive quantity of waste has accumulated in the plow layer in these areas. Therefore, detectorists adjust their metal detectors to ignore the iron objects to avoid receiving thousands of uninteresting signals. This practice is common throughout Denmark, and it is apparent that we are losing important material for this reason, material that suffers by remaining in the plow layer.[3] On the other hand, tasking private detectorists with collecting and recording all of the iron objects is clearly not an option. The required administrative resources would be too substantial, not to mention the costs of preserving and storing the numerous objects, which would impose a considerable economic burden on the local museums. Systematic sampling surveys of selected sites combined with thorough recording and a vigorous strategy of cassation may be a solution to this challenge.

Objects of copper alloys are by far the most prevalent detector find. These objects constitute approximately 95% of the find records from the eastern Limfjord region[4]. Most are simple, inconspicuous medieval coins of poor quality from the 13th and 14th centuries, but this group also includes 1,218 brooches or brooch parts of varying types. The brooches are the most frequently occurring Iron Age find group. Lead objects represent somewhat less than 4%, and lead seals account for nearly half of the group. Solid silver objects amount to only 185 objects, the majority of which are silver

Fig. 2. Typical selection of detector finds recovered at the eastern end of the Limfjord – scanned and ready for delivery to the National Museum.

coins, whereas objects of gold are represented by a modest 19 pieces of various jewelry and small scrap pieces. In addition, a considerable number of dress accessories are tinned or gilded, particularly those from the Late Germanic Iron Age and the Viking Age. Typically, the tinning or gilding is only preserved in protective depressions of the ornamentation. Finally, a large group of jewelry employs mountings of glass or stone, of which small circular enamel brooches from the Viking age are among the most common. However, in most cases, the mounted materials are not preserved.

Most detector finds from Danish fields are relatively small and weigh from a few to 30 grams. Finds smaller than one gram are rare. However, finds of tiny gold foil figures and bits of silver dirhams of less than one gram occur. However, it requires luck, skill, and patience to locate such objects, and the frequency of their presence in detector finds is not representative of their number in the plow soil at Danish detector sites. There are no such small finds among the ordinary private detector finds from the fields near the eastern Limfjord. However, in 2012, a small hacksilver treasure was found during an excavation in Sønder Tranders, eastern Aalborg, and by far the largest

2 Among the weights are several of the oblate spheroid type with an iron core covered by a bronze mantle. Many of the brooches possess partly preserved iron pins.

3 The results of the systematic collection of iron objects at Tissø and Sorte Muld indicate the potential of recording the iron finds (Jørgensen 2000; Watt 2000).

4 Because alloy types are not recorded for a considerable number of the older finds from the 1980s, this figure is an approximation. In these cases, the type of alloy has been determined by the type of object.

portion of the 314 silver pieces recovered with metal detectors consisted of small bits of coins of less than one gram. A number weighed less than 0.2 grams (Trier Christiansen 2013). Evidently, the chance of detecting such small items is significantly improved by the optimal conditions offered by a smooth, firm surface of an excavation area.[5]

The modest size of the detector finds is often due to fragmentation. Not surprisingly, the period spent in the plow layer is damaging for metal objects. The degree of damage varies according to different factors. The size, shape, and alloy of the object are important, but naturally, so are the period of time spent in the plow layer and the intensity of cultivation at that location. Not only the mechanical effects of cultivation but also chemicals, particularly from fertilizers, have a harmful effect on metal in the soil of the fields (Nord, Mattsson, Tronner 2005). In addition, at a certain point, plowing will eventually leave an object on the surface, where it is exposed to the degrading processes of the weather if it is not found and removed.

Fragmentation has a marked effect on the composition of the detector finds. A significant example is the modest appearance of the fragile, oval brooches from the Viking Age. The brooches, particularly the double-shelled type, are probably among the first objects to break when they enter the plow layer. These objects are most likely generally underrepresented in the find material recovered by metal detecting (Watt 2000: 83). A few small fragments of such objects in the record indicate that they also circulated among the settlements of the eastern Limfjord. However, most are a few centimeters long, and whereas many similar pieces may have been collected by private detectorists over the years, they were interpreted as uninteresting scrap bronze and subsequently discarded.

The speed of the fragmentation of objects in the plow layer is an intriguing question. Figure 3 presents an attempt to visualize the development of fragmentation of cruciform brooches, beak brooches and Urnes-type brooches (the three most common types of brooch found near the eastern Limfjord) between 1994 and 2004 and between 2005 and 2014. The finds remain too sparse to form a statistically firm baseline. However, a comparison may provide hints regarding the general speed of the degrading processes. At first glance, it seems that the fragmentation of the brooches is increasing. However, although the number of both smaller

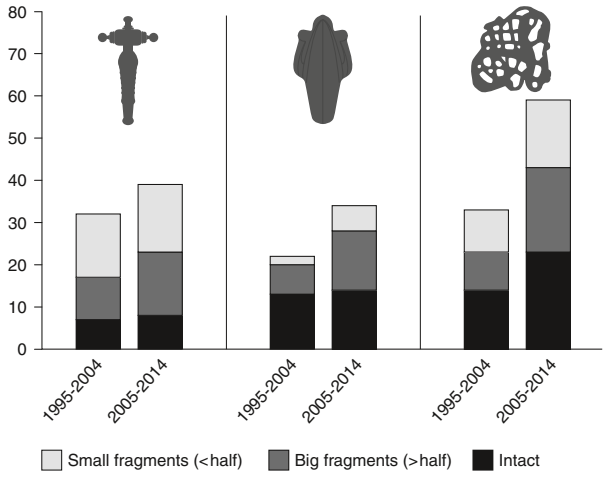

Fig. 3. The development of the fragmentation of the three most common types of brooch recovered during the past 20 years, by the eastern Limfjord.

and larger fragments has generally been increasing for all brooch types, so has the number of intact brooches. Only for beak brooches has the ratio of fragmented pieces significantly increased compared with the number of recovered intact brooches, which could indicate a tendency toward increasing fragmentation during the past 20 years. But the uncertainties are many. Most importantly in this perspective, comparability of the finds presupposes that the majority of finds have been present in plow soil during the entire investigated period and that the brooches were intact when they entered the plow horizon. However, certain finds may in fact represent recently eroded cultural deposits, and others were perhaps already broken prior to deposition during the Iron Age. Similarly, small fragments are particularly poor subjects for quantitative analysis. They are underrepresented because they are difficult to detect, occasionally hard to recognize, and several pieces may actually represent only one brooch. However, Figure 3 is a representative illustration of the prevalent fragmentation, particularly of certain brooches.

The record of detector finds from the eastern Limfjord is shaped by more than 30 years of uniform patterns of surveying and recording. These patterns were formed by the prevailing effort to detect well-dated, often beautiful non-ferrous objects. Similar tendencies are more or less apparent in most records of detector finds from the rest of Denmark. However, different priorities at local museums have resulted in extreme variation in the records from region to region.[6]

5 Similar observations were made during recent excavations at a new productive site, Vester Vandet, near the western end of the Limfjord – THY 6017 V.Vandet – No. of location: 110210-120.

6 In connection with an ongoing PhD project, the author is in the process of collecting data on detector finds from six local museums located along the Limfjord. None of the museums use the same recording method, and the variation in the records is substantial, even between neighboring museums.

This fact is particularly conspicuous in relation to the recording of undated pieces of non-ferrous alloys. In many regions, these pieces have had low priority during the recording of detector finds. However, they have been collected and removed from the sites by the detectorists during the surveys for practical reasons, e.g., to avoid disturbing signals during future metal detecting in the same areas. In this manner, many productive Danish sites have been drained of potentially important find material. The nearly complete absence of waste products from non-ferrous metalworking at the productive sites by the eastern Limfjord is an illustrative example.[7] In light of the substantial number of common local types of brooches found at these sites, it seems likely that the production of some of the brooches must have occurred in the region. A few scattered finds of brooches with casting defects indicates the former presence of non-ferrous metal craftsmen. A die for the manufacture of D-bracteates detected at Postgården (southeast Aalborg), a model for Urnes-type brooches recovered at Sebbersund, loose pins for brooches found during the excavation of the settlement on Bejsebakken, and a small number of other indications support the general impression that production waste must be substantially underrepresented in the find record of many of the sites (Birkedal Christensen and Johansen 1992: 211; Trier Christiansen 2008: 124; Vang Petersen 1991: 225).

THE CHRONOLOGICAL CONTRIBUTION OF METAL-DETECTOR FINDS

Detector finds located by private detectorists are by definition stray finds. Under ordinary circumstances, metal detectors do not detect objects below 20-25 centimeters from the field surface. Because the depth of ordinary plowing is typically 30 cm, the plow layer is the find context. This deprives the finds of a significant proportion of scientific value. When researchers address chronological issues, weak contextual support means that the dating of an object rests solely on the qualities of the object itself. Consequently, the duration of the circulation or use of an object become impossible to assess, as does the association of broadly dated objects with specific phases of sites characterized by a long duration.

Thus, some detector material must be handled with special care. In particular, the long circulation of certain coins, such as Roman silver coins, has the potential to result in seriously misleading dates. Additionally, in certain cases, well-dated brooches and other jewelry may cause chronological confusion. A number of these finds may have circulated for far longer than usual, perhaps as treasured antiquities or as part of scrap metal stocks. Arne Jouttijärvi has demonstrated that most copper alloys from the Late Iron Age consisted of recycled scrap metal. Thus, scrap metal stocks must have been common (Jouttijärvi 2002: 37).

Despite the substantial issues connected with the chronological utility of detector finds, the dating of sites is a major contribution afforded by such finds. On many sites, the mere number of relatively well-dated metal objects provides a fairly good initial dating framework and often a rough outline of the varying levels of activity during the site's lifespan. However, it must be emphasized that this outline is approximate. Detector finds reflect the number and character of finds recorded in the plow layer but do not necessarily directly reflect the full chronological span and composition of the objects that circulated at the sites. Recordings from Bornholm and Uppåkra have demonstrated that the presence of preserved cultural layers may have a significant impact on the chronological composition of the detector finds. The finds in the plow layer represent only the portions of cultural deposits that have been reached by the plow (Hårdh 1998; Watt 2000).[8] Consequently, detector finds from the plow layer provide a fragile basis for the dating of activities at a site if not supported by additional data. In such cases, as in most archaeological investigations, interpretation that is based on the absence of objects is a delicate matter.

THE GEOGRAPHICAL ISSUES

If all metal-detector finds from the eastern Limfjord region are mapped (Fig. 4), they display a marked concentration of the richest find spots along the coast of the Limfjord. However, can we trust this significant distribution pattern? When confronted with this question, the map clearly exhibits a negative aspect of the unsystematic surveys of private detectorists: We lack information regarding the spatial extent of the metal-detecting surveys and the general level of surveying. In most cases, the recordings of Danish detector finds

7 During the past few years, detectorists in the area have been encouraged to record and turn in melted, non-ferrous scrap pieces, too. However, old habits die hard, and the record contains only a handful of these pieces of waste products from non-ferrous metalworking.

8 A similar tendency has been recorded at the detector site of Postgården, Aalborg SE. Few finds older than the Late Germanic Iron Age have been recovered at this site, and in 2007, a large-scale trial survey revealed preserved cultural layers from the Early Germanic Iron Age here. ÅHM 5403 Postgården – No. of location: 120113-55.

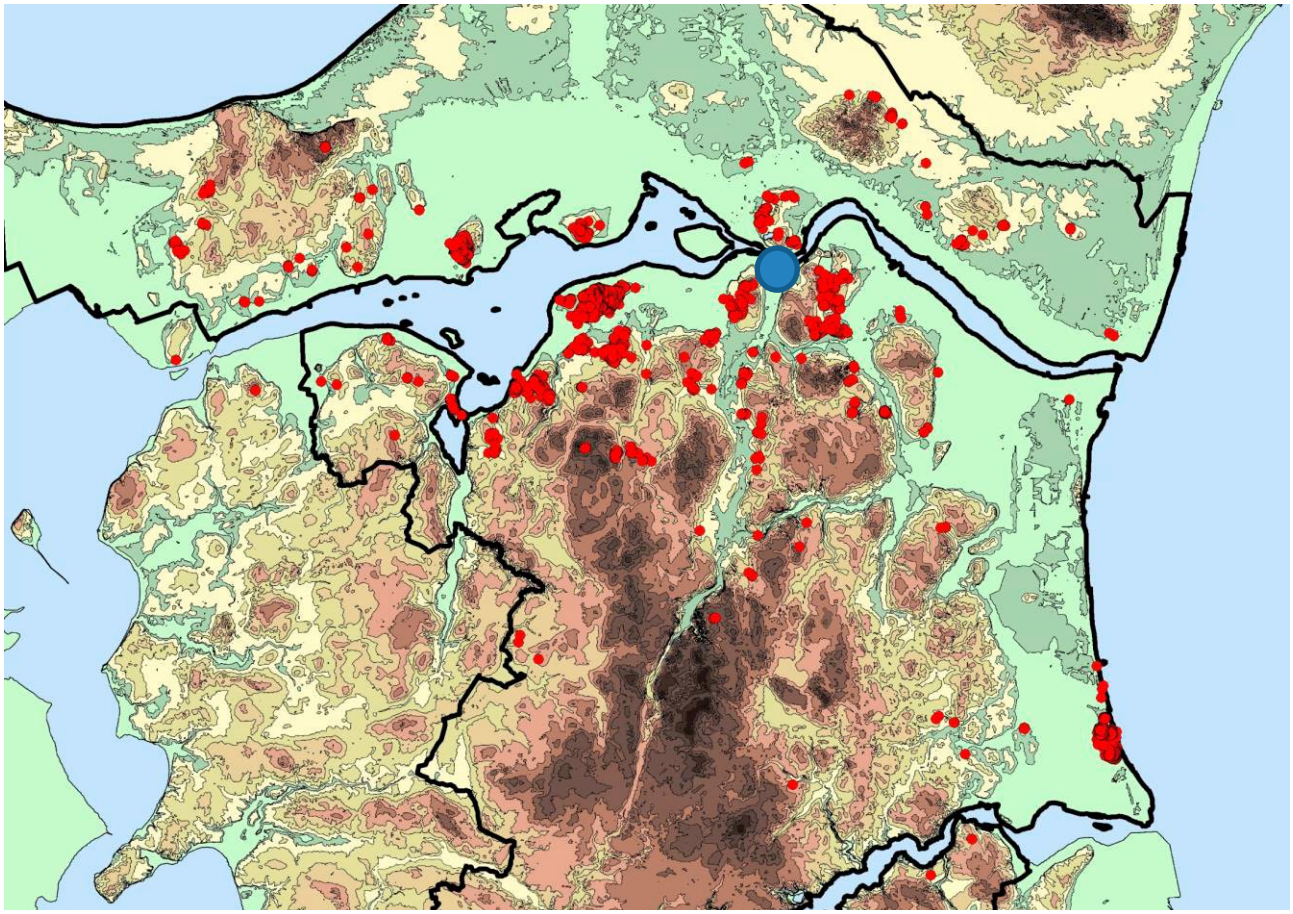

Fig. 4. The distribution of detector finds from the eastern Limfjord region (blue dot = Aalborg).

do not enable the evaluation of the level of surveying beyond the rough impression left by the number of finds, the number of detectorists who handed in finds, and the time span over which the finds have been recorded, and the only information on the geographical extent of the surveys is the distribution of the finds. Consequently, surveyed areas without finds are absent in the records. The absent recordings of survey patterns are a fundamental issue in connection with the interpretation of the spatial distribution of the detector finds, both on a local scale (in terms of understanding the find distribution at single sites) and in the study of regional and supra-regional research issues.

The map of the detector finds recovered by the eastern Limfjord provides a fairly reliable impression of the level of surveying in a considerable part of the region. The detector finds signal that most of the hills in the Aalborg vicinity have been subjected to intensive metal detecting. However, a new productive site was located in this area in 2005 after nearly 20 years of intensive metal detecting on the nearby hills. This discovery occurred despite the fact that the new site is positioned on a hilltop directly adjacent to the small village of Sønder Tranders (which dates from the Middle Ages) and the fact that the productive site of Postgården (well-known to local detectorists since the late 1980s) is located on top of the neighboring hill only 700 meters to the east. Detectorists are notoriously creatures of habit, and they exhibit a marked tendency to search where they have been previously successful, thereby reinforcing a distribution pattern that is most likely misleading. Tests comparisons of results from systematic surveys conducted by a professional archaeologist and random surveys performed by private detectorists have demonstrated this problem at Uppåkra, in Scania (Paulsson 1999: 51-52). In addition, repeated surveys of one area may continue for years. In the Aalborg area, certain sites have been surveyed for more than 20 years and continue to yield finds. The ongoing detection of new finds may be due to the continuous erosion of cultural deposits on the sites, but it is also a fact that the process of emptying a plow layer is a task that requires patience and persistence.[9]

9 Results from annual metal-detecting surveys of the site of a treasure excavated in 1983 at Smørenge, on Bornholm, indicate that emptying a plow layer may require more than 13 years (Watt 2000: 84).

On a local scale, the movement of the objects during their period in the plow layer is a significant issue. It is evident that plowing has a particularly considerable effect on the distribution patterns of objects that enter the topsoil. In 1935, part of a silver hoard was recovered at Garde, on Gotland. Nearly 50 years later, the same area was systematically surveyed by metal-detecting archaeologists. No fewer than 600 new coins were recovered, which the continuous cultivation of the field for half a century had scattered over an area of more than 40 by 40 meters. However, most of the silver objects had traveled only a few meters, and the majority remained less than 10 meters from their original positions (Östergren 1985: 19, Fig. 3). A similar distribution pattern of silver objects from a scattered hoard has also been revealed at Smørenge, on Bornholm, and experimental data simulations of artifact movement in the plow layer have predicted patterns that closely resemble the evidence left by the detected hoards (Kromann, Anne & Watt, Margrethe 1984; Yorston, Gaffney, Reynolds 1990). However, the scale of the displacement of objects in the plow layer varies. The different methods and strategies of cultivation have had a varying impact on the extent of displacement, as have the sizes and shapes of the objects. Generally, large and irregularly shaped objects tend to move more than small, smoothly shaped ones (Paulsson 1999: 47). In 2014, a Bronze Age hoard was recovered by a private detectorist close to Gl. Skørping, approximately 20 km south of Aalborg. Most of the more than 300 fragments of bronze were found within a few meters of their original positions, e.g., a pottery vessel, the bottom of which was found in situ, that still contained bronzes and an arm ring of gold. However, one object was recovered 87 m from the vessel. A combination of plowing and sloping terrain probably caused the significant movement of certain objects.[10]

Despite the object displacement, spatial studies may provide important information regarding a site's general or specific structures. One of the best examples of this phenomenon is the recovery of lead casting evidence in a trelleborg house excavated at Gl. Hviding, near Ribe, in the 1980s. A concentration of lead waste was found within a small area during the initial metal-detecting surveys of the plow layer. During the subsequent excavation, the lead was linked to a section of the long house recovered at the spot (Jensen 1987). At several other sites, such as Tissø and Gudme, several metal finds from the plow layer could be related to remains of specific activity areas or structures revealed in the subsoil (Jørgensen 1999; Jørgensen 2000; Jørgensen and Pedersen 1996).

In sum, the lack of information regarding the level of metal detecting and the spatial extent of the surveys is a general problem when the spatial distribution of detector finds is analyzed, that is, when local, regional, and supra-regional patterns are studied. Ideally, to obtain an adequate estimate of metal-detecting surveys, an entire range of quantitative and qualitative variables should be recorded in connection with them. Repeated systematic surveys in a pre-planned grid, which is a strategy followed in certain research projects, could produce the data necessary for a better understanding of detector finds (see Bill 2013; Dobat 2010). However, in the case of the detector finds recovered by private detectorists, this level of documentation is not achievable. GPS technology may represent a relatively simple and inexpensive solution to this problem via tracking during future surveys. Since the 1990s, GPS has revolutionized the detectorists' recording of the find spots, and tracking has been used in many large-scale surveys coordinated by local museums.[11] However, even if such a relatively high level of spatial information were available, researchers would continue to face challenges related to the interpretation of areas with few or no finds. As expected, various factors, such as the skill and equipment of the individual detectorist and the condition of the field during a survey, will often affect an investigation's outcome.

THE INTERPRETATION OF METAL-RICH SITES

Essentially, the major contributions made by the rapidly increasing number of detector finds fall into two categories. First, the finds have proven to be valuable research material for researchers who study supra-regional distribution patterns of types and stylistic or production-related traits. Second, the detector finds have proven to be excellent indicators of settlements, particularly settlements from the Late Iron Age and the Middle Ages, which prior to the introduction of the metal detector were significantly underrepresented. In this regard, the detector finds have provided a large boost to the study of settlement and societal

10 ÅHM 6451 Bækkedal, Gl. Skørping – No. of location: 120310-334.

11 Finally, the precision of registering find spots varies considerably from region to region because of the different standards enforced by local museums. In connection with the finds turned in to the Aalborg Museum, until recently, accuracy often differed from finder to finder because of different registration methods.

development during these periods.[12] Whereas the first contribution is a logical development following the substantial increase in new find material recovered from widely distributed sites and thus will not be additionally addressed, the latter contribution deserves a few remarks because this aspect of the detector finds raises several intriguing questions.

By far, most of the detector finds seem to originate in eroded settlement layers that have been revealed through excavations across the entire country (see Feveile 2014; Henriksen 2000; Trier Christiansen 2008; Wåhlin 2014). The productive detector sites represent a broad variety of different settlements, and the categorizing and interpretation of these sites has been a key problem in the field since the beginning of the detector era. The focus has centered on the clarification of the many diverse functions of the settlements and the scope of these functions (see Høilund Nielsen 2014; Skre 2011; Ulriksen 2004). Often testifying to the former presence of a sociopolitical and economic elite or activities such as specialized crafts and trades at the settlements, the detector finds have played an important role during the interpretational work. Until now, most research on the detector finds and sites was more or less explicitly based on the fundamental idea that the majority of the detector finds were accidently dropped during use. This assumption might well be the case. However, it can hardly account for all of the finds, and even where it applies one may ask, "Why dropped here?" We will never reach a detailed understanding of every find. On the other hand, the large number of detector finds is bound to display many patterns generated by the consumption modes of past societies. The detection of these patterns demands extensive, well-recorded research material. A sufficient quantity of material exists in Denmark, but the quality and variations of the records at local museums make the comparison of material across regions complex and time-consuming.

When searching for meaningful depositional patterns, Iron Age brooches represent an obvious starting point. The brooches appear in conspicuous numbers at many sites. On Bornholm, M. Watt noted that the composition of the brooches differs between the graves and the settlements during the Late Germanic Iron Age. Evidently, here, the selection of brooches recovered at the settlements is not a direct reflection of the brooches worn by the population in the area. Certain later brooch types are scarcely present at the settlements but well represented in the graves in the nearby burial grounds (Watt 2000: 90, Fig. 7). At the most productive detector site by the eastern Limfjord, at Nørholm, the early types of brooch from the Late Germanic Iron Age, the beak brooches, and the small, equal-armed brooches also display a significantly divergent distribution pattern compared with other mostly later types of Late Germanic Iron Age brooch (Fig. 5). Nørholm is a hill "island" located on the southern coast of the Limfjord, and the detector finds from the hill have been found scattered over an area of more than 300 hectares. However, the majority of the early Late Germanic Iron Age brooches are markedly concentrated in a limited area to the southeast. Ongoing investigations have shown that this is the location of a large settlement of the Late Iron Age. No settlement remains have been located in the large areas at the top of the hill to the north although large numbers of detector finds have been recovered there. For some reason, the beak brooches and to a certain extent the substantially fewer, equal-armed brooches were dropped in large numbers in the settlement but not frequently in the adjacent areas compared with all other, slightly later types of brooches. One explanation might be that the brooches in the settlement area represent scrap metal stock for metalworking, as has often been suggested in connection with the many fragmented brooches from Late Iron Age settlements (Høilund Nielsen 2014: 30; Jørgensen 1994: 57). But if this was the case, one would expect the brooches to be concentrated in certain areas of the settlement. This does not seem to be the case at Nørholm.

The biased distribution pattern of the early Late Germanic brooches compared with other brooches also poses a challenge to understanding the later, substantially more widely distributed objects. A major portion of the detector finds on the Nørholm hill is distributed over areas far larger than the actual settlement structures. This phenomenon is characteristic of many sites by the eastern Limfjord (Trier Christiansen 2008). The spread of the detector finds is highly marked, and it is tempting to assume that a considerable number of the small metal objects may have been scattered around the settlements after being buried in settlement waste that was subsequently used as fertilizer on the surrounding fields during the Iron Age and Middle Ages. However, if this were the case, why did certain brooches deposited in the settlements only rarely end up in the fields? Numerous answers are possible. The phenomenon may be due to chronological differences, or it might indicate that a considerable number of the finds in the adjacent areas of the settlements represent actual activity areas, for

12 Prior to the mid-1980s, the settlements of the Late Iron Age, particularly those dating to the Late Germanic Iron Age, were notoriously difficult to locate (Hvass 1985).

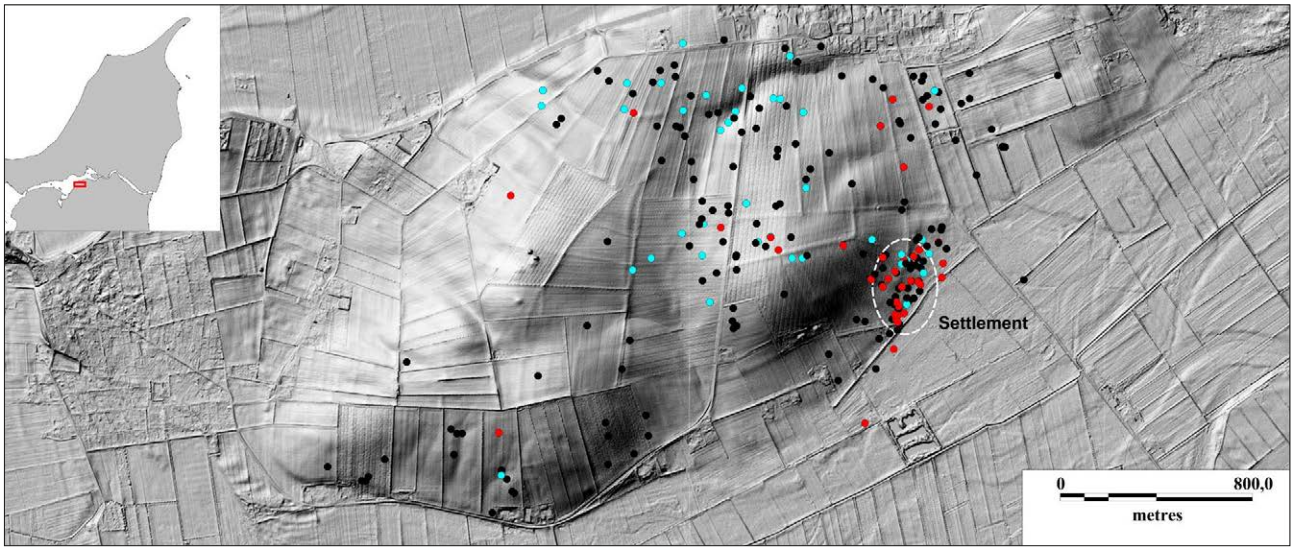

Fig. 5. The distribution of Iron Age brooches found on Nørholm (red dots = beak brooches and small, equal-armed brooches; turquoise dots = other brooches dating to the Late Germanic Iron Age).

example, burial grounds, as is well illustrated by the Viking Age burial ground recovered at Kr. Hyllinge Kirkebakke, on Seeland (Ulriksen 2013: 43).[13]

Future studies of the detector finds and sites may enable us to extract more detailed information on the activities in the settlements and their surroundings, separately from the evidence of the detector finds. For now, there seem to be too many uncertainties. The relevant variables are abundant, and they have the potential to affect the research material to such a degree that the comparison of datasets to evaluate the character of the settlements cannot be confidently conducted prior to a fundamental analysis of the find locations, including supportive explanatory fieldwork.

CONCLUSION

Thirty-five years of private metal detecting have had a profound impact on the field of archaeology in Denmark. In particular, Iron Age and Early Medieval research has benefited from the extensive new find material. The detector finds and in particular the large number of new find spots, which have uncovered an entire range of previously unknown settlement types, have supplied crucial new information to studies on social and economic development during the Late Iron Age and the Medieval period. The widespread social and economic differentiation in society has been emphasized, as has the increasing importance of communication, the circulation of goods, and specialized crafts.

Despite the significant impact of the detector finds, the small metal finds detected in the topsoil of cultivated fields are from many perspectives weak research material. The records of the metal-detector finds are affected by a series of complexly intertwined post-depositional processes, which seriously limits the research value of the finds. A major aspect of this problem is closely linked to the removal of the object from its original context by the plow and to the processes that affect the objects during their stay in the plow layer. However, it is equally evident that a considerable number of the critical issues relevant to the detector finds is due to fundamental problems that occur *after* the detection of the object. No doubt the liberal legislation concerning metal detecting has been a major contributing factor to the positive effect of metal detecting on Danish archaeology. In addition, the decentralized organization of the museums has been a decisive component of the system and facilitated close, positive contact with the detectorists. On the negative side, the multi-faceted landscape of museums and an absence of national record-keeping standards have resulted in an archaeological record characterized by large qualitative variations. Consequently, in most instances, a comparison of material across regions is at best a complex process. At present, overviews of the larger portions of the detector finds are simply impossible, and the constant increase in the find record makes the problem appear nearly unmanageable. Denmark urgently requires a web-based metal-detector find database shared by all local museums.

13 A circular ditch, which may represent the last trace of an eroded grave monument, was uncovered during a trial excavation on the top of the Nørholm hill in the autumn of 2014 (ÅHM 6368).

Finally, the considerable concerns linked to fieldwork and recording by private detectorists may raise the obvious question regarding the soundness of legal, recreational metal detecting. But in my opinion, the very fact that a major part of the potential find material from Danish settlements is located in the hostile environment of the plow layer is reason enough to support the general idea that 'the more cultivated fields surveyed the more objects saved'. However, because the speed of the degrading processes remains poorly understood, it might have been preferable had the legalization of private metal detecting followed the spread of GPS technology rather than that of the metal detector.

In addition, constantly improving metal detectors could be a cause for future concern as a challenge to the soundness of legal private metal detecting because the survey depth of the instruments is increasing. This development increases the risk of additional in-situ finds below the plow horizon being detected and removed by untrained, private detectorists without the proper recording of contextual observations. However, in several recent cases, this circumstance has actually proved to be the opposite of a disaster. Finds located only a few centimeters below plowing depth were saved from imminent destruction[14]. In this regard, proper instruction of detectorists and rewarding the correct handling of finds are important educational tools.

Aside from the critical issues related to the find material recovered by private detectorists, the metal finds hold substantial research value. Their sheer number makes the small metal finds an ideal starting point for the study of structural patterns left by the activities of past societies. A few basic modifications to recording methods and the administrative system are all that is required to significantly improve the future possibilities of harvesting the information embedded in the records of Danish metal-detector finds.

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14 This summer, Nordjyllands Historiske Museum managed to save the remains of a Bronze Age hoard still in situ based on a tip from a private detectorist - ÅHM 6451 Bækkedal, Gl.Skørping – No. of location: 120310-334. See also (Haack Olsen 2012).

REFERENCES

Addyman, Peter V. 2009. "The Development and Future of the Treasure Act and Portable Antiquities Scheme." Suzie Thomas and Peter G. Stone (eds.). *Metal Detecting and Archaeology*: 51-62. Woodbridge, Rochester, NY: Boydell Press.

Bill, Jan "Arabic Silver and Weights in Abundance – Metal Detector Survey at Heimdal." (17.10. 2014). *UIO: Museum of Cultural History - Research*. http://www.khm.uio.no/english/research/projects/gokstad/news/arabic-silver.html.

Birkedal Christensen, Peter and Erik Johansen 1992. "En handelsplads fra yngre jernalder og vikingetid ved Sebbersund." *Aarbøger for Nordisk Oldkyndighed og Historie* (1991): 199-229.

Cornelison, John E. and George S. Smith 2009. "Archaeology, Metal Detecting, and the Development of Battlefield Archaeology in the United States." Suzie Thomas and Peter G. Stone (eds.). *Metal Detecting and Archaeology*: 4-49. Woodbridge, Rochester, NY: Boydell Press.

Det Arkæologiske Nævn 1985. *Arkæologiske Udgravninger i Danmark*. København: Det Arkæologiske Nævn.

Dobat, Andres S. 2010. „Füsing - Ein Frühmittelalterlicher Zentralplatz im Umfeld von Haithabu/Schleswig. Bericht über die Ergebnisse der Prospektionen 2003-2005." Claus von Carnap-Bornheim (ed.). *Studien zu Haithabu und Füsing:* 131-256. Neumünster: Wachholtz Verlag.

Dobat, Andres S. 2013a. „Between Rescue and Research: And Evaluation After 30 Years of Liberal Metal Detecting in Archaeological Research and Heritage Practice in Denmark." *European Journal of Archaeology* 16: 704-725.

Dobat, Andres S. 2013b. *Kongens borge : Rapport over undersøgelserne 2007-2010*. Jysk Arkæologisk Selskabs Skrifter; 76. Højbjerg: Jysk Arkæologisk Selskab.

Feveile, Claus 2014. "At the Geestland Edge Southwest of Ribe: On the Track of a Centre of Wealth during the 1st Millenium AD." Ernst Stridsing, Karen Høilund Nielsen and Reno Fiedel (eds.). *Wealth and Complexity. Economically Specialised Sites in Late Iron Age Denmark*: 73-90. Aarhus: Museum Østjylland and Aarhus University Press.

Fischer, Christian 1983. "Den har fanden skabt." *Skalk* (1): 8-14.

Gjelssø Bertelsen, Lise 1994. «Urnesfibler i Danmark.» *Aarbøger for Nordisk Oldkyndighed Og Historie* 1992: 345-370.

Glob, Peter V. 1980. *Danefæ: Til hendes Majestæt Dronning Margrethe II, 16. april 1980*. Kbh.:

Nationalmuseet; Det Kongelige Nordiske Oldskriftselskab - Jysk Arkæologisk Selskab.

Grinder-Hansen, Keld 1994. "Mønter som kilde til middelalderens økonomiske historie - Præsentation af et materiale." *Fortid Og Nutid*: 101-133.

Henriksen, Mogens Bo 2000. "Lundsgård, Seden Syd og Hjulby. Tre fynske bopladsområder med detektorfund." Mogens Bo Henriksen (ed.). *Detektorfund - hvad skal vi med dem?Dokumentation og registrering af bopladser med detektorfund fra jernalder og middelalder: Rapport fra et bebyggelseshistorisk seminar på Hollufgård den 26. oktober 1998*: 17-60. Odense: Odense Bys Museer.

Hvass, Steen 1985. "Jernalderbopladser." *Arkæologiske udgravninger i Danmark 1984*: 18-24.

Høilund Nielsen, Karen 1991. "Centrum og periferi i 6.-8- århunderede. Territoriale studier af dyrestil og kvindesmykker i germansk jernalder i Syd- og Østscandinavien." Peder Mortensen and Birgit M. Rasmussen (eds.). *Fra Stamme til Stat i Danmark 2: Høvdingesamfund og Kongemag:* 127-154. Højbjerg, Århus: Aarhus Universitetsforlag.

Høilund Nielsen, Karen 2014. "Key Issues Concerning 'Central Places'." *Wealth and Complexity - Economically Specialised Sites in Late Iron Age Denmark*. Ernst Stridsing, Karen Høilund-Nielsen and Reno Fiedel (eds.): 11-50. Aarhus: Museum Østjylland and Aarhus University Press.

Haack Olsen, Anne Louise 2012. "En krigergrav fra Øster Vandet." *Historisk årbog for Thy og Vester Hanherred* 2012: 157-165.

Hårdh, Birgitta 1998. "Preliminäre notiser kring detektorfynden från Uppåkra.". Lars Larsson and Birgitta Hårdh (eds.). *Centrala platser - centrale frågor. Samhallsstrukturen under järnåldern. Acta Lundensia. 8:28:* 119-127. Stockholm: Almqvist & Wiksell International.

Jensen, Jørgen Steen 2004a. "Det store sjællandske møntskattefund fra Svend Estridsens tid." *Nordisk Numismatisk Unions Medlemsblad*: 148-149.

Jensen, Jørgen Steen 2004b. "Stort møntfund fra Sjælland." *Nyt fra Nationalmuseet*: 34-34.

Jensen, Stig 1987. "Pløjelagsarkæologi." *Arkæologiske udgravninger i Danmark* 1986: 9-15.

Jensen, Stig 1991. "Metalfund fra Vikingegårdene ved Gl.Hviding og Vilslev." *By, Marsk og Geest* 3: 27-40.

Jouttijärvi, Arne 2002. "Kobberlegeringer i jernalder og vikingetid." Mogens Bo Henriksen (ed.). *Metalhåndværk og håndværkspladser fra yngre germansk jernalder, vikingetid og tidlig middelalder:* 27-40. Odense: Odense Bys Museer.

Jørgensen, Lars 1994. "The Find Material from the Settlement of Gudme II - Composition and Interpretation." Poul Otto Nielsen, Klavs Randsborg and Henrik Thrane (eds.). *The Archaeology of Gudme and Lundeborg. Paper Presented at a Conference at Svendborg, October 1991*: 53-63. Copenhagen: Akademisk Forlag.

Jørgensen, Lars 1999. "Fra nutidens pløjelag til jernalderens samfund - stormænd og håndværkere i Gudme." *Årbog 1998 for Svendborg og omegns museum*.

Jørgensen, Lars 2000. "Storgården ved Tissø. Tolkning af aktivitetsområder og anlæg på grundlag af detektorfundene fra pløjelaget." Mogens Bo Henriksen (ed.). *Detektorfund - hvad skal vi med dem?Dokumentation og registrering af bopladser med detektorfund fra jernalder og middelalder: Rapport fra et bebyggelseshistorisk seminar på Hollufgård den 26. oktober 1998*: 61-67. Odense: Odense Bys Musseer.

Jørgensen, Lars and Lisbeth Pedersen 1996. «Vikinger Ved Tissø. Gamle Og Nye Fund Fra Et Handels- Og Håndværkscenter." *Nationalmuseets Arbejdsmark* 1996.

Kjer Michaelsen, Karsten 2000. "Detektorfund - Hvad Skal Vi Med Dem?" Mogens Bo Henriksen (ed.). *Detektorfund - hvad skal vi med dem?Dokumentation og registrering af bopladser med detektorfund fra jernalder og middelalder: Rapport fra et bebyggelseshistorisk seminar på Hollufgård den 26. oktober 1998*: 7-10. Odense: Odense Bys Musseer.

Klingenberg, Susanne 2009. «Gravlagt i en etruskisk vinkande.» Karen M. Boe (ed.). *Tollundmandens verden : kontinentale kontakter i tidlig jernalder*: 107-116. Højbjerg: Wormianum - Silkeborg Kulturhistoriske Museum (Silkeborg Bogtryk).

Kromann, Anne & Watt, Margrethe 1984. «Skattefundet fra Smørenge. En nedgravet skat fra folkevandringstid på Bornholm.» *Nationalmuseets Arbejdsmark* 1984: 29-41.

Lauridsen, Jens G. 2014. «The Metal Detector Site of Sig Syd.» Ernst Stridsing, Karen Høilund Nielsen and Reno Fiedel (eds.). *Wealth and Complexity. Economically Specialised Sites in Late Iron Age Denmark:* 91-98. Århus: Østjyllands Museum and Aarhus University Press.

Moesgaard, Jens Christian 2002. "Single Finds as Evidence for Coin Cirkulation in the Middle Ages: Status and Perspectives." H. W. Horsnæs and J. C. Moesgaard (eds.). *Single Finds, the Nordic Perspective. Nordisk Numismatisk Årsskrift 2000-2002*: 228-275. Stockholm: Nordisk Numismatisk Union.

Moesgaard, Jens Christian, Anne Pedersen, and Peter Vang Petersen 2010. "Nuværende danefæpraksis." Michael Andersen and Poul Otto Nielsen (eds.). *Danefæ - skatte fra den danske muld*: 21-24. København: Nationalmuseet/ Gyldendal.

Nielsen, Poul Otto, Klavs Randsborg, and Henrik

Thrane (eds.) 1994. *The Archaeology of Gudme and Lundeborg : Papers Presented at a Conference at Svendborg, October 1991*. Arkæologiske Studier; Volume 10. København: Akademisk Forlag.

Nord, Anders, E. Mattsson, and Kate Tronner 2005. "Factors Influencing the Long-Term Corrosion of Bronze Artefacts in Soil." *Protection of Metals* 41 (4): 309-316.

Näsman, Ulf 1991. "Det syvende århundrede - et mørkt tidsrum i ny belysning." Peder Mortensen and Birgit M. Rasmussen (eds.). *Fra Stamme til Stat i Danmark 2: Høvdingesamfund og Kongemag:* 165-177. Højbjerg, Århus: Aarhus Universitetsforlag.

Paulsson, Jonas 1999. "Metalldetektering och uppåkra. Att förhålla sig till ett detektormaterial." Birgittaa Hårdh (ed.). *Fynden i centrum: keramik, glas och metall från Uppåkra*.Acta archaeologica Lundensia. Series in 8 ; 30) (Uppåkrastudier ; 2): 41-65. Stockholm: Almqvist & Wiksell.

Pedersen, Anne 2004. "Anglo-Danish Contact Accross the North Sea in the Eleventh Century: A Survey on the Danish Archaeological Evidence." J. Adams and K. Holman (eds.). *Scandinavia and Europe 800–1350 – Contact, Conflict and Coexistence*: 43-67. Turnhout: Brepols.

Sindbæk, Søren, Hannah Brown, and Helen Goodchild 2012. "Aggersborg under overfladen. Geofysisk opmåling af en vikingetidsborg." *Årborg 2012. Vesthimmerlands Museum*: 15-30.

Skre, Dagfinn 2011. "Centrality, Landholding, and Trade in Scandinavia C. AD 700-900." Bjørn Poulsen and Søren Michael Sindbæk (eds.). *Settlement and Lordship in Viking and Early Medieval Scandinavia*: 197-212. Turnhout: Brepols.

Stridsing, Ernst 2014. "Haslund Øst - a Newly Discovered Metal-Detector Site." Ernst Stridsing, Karen Høilund Nielsen and Reno Fiedel (eds.). *Wealth and Complexity. Economically Specialised Sites in Late Iron Age Denmark*: 119-126. Århus: Østjyllands Museum and Aarhus University Press.

Thomas, Suzie and Peter G. Stone 2009. *Metal Detecting and Archaeology*. Heritage Matters Series; V. 2. Woodbridge: Boydell Press.

Trier Christiansen, Torben 2008. "Detektorfund og bebyggelse - det østlige limfjordsområde i yngre jernalder og vikingetid." *KUML 2008*: 101-144.

Trier Christiansen, Torben 2013. "På skattejagt. Vikingesølv fundet ved Sdr.Tranders Kirke." *Årbog 2012. Nordjylland Historiske Museum:* 95-98.

Ulriksen, Jens 1998. *Anløbspladser: besejling og bebyggelse i Danmark mellem 200 og 1100 e.Kr.: en studie af søfartens pladser på baggrund af undersøgelser i Roskilde fjord*. Roskilde: Vikingeskibshallen i Roskilde.

Ulriksen, Jens 2013. "Detektorarkæologi - en succeshistorie med begyndende brudflader." *ROMU 2012. Årsskrift Fra Roskilde Museum*: 27-49.

Vang Petersen, Peter 1991. "Nye fund af metalsaget fra yngre germansk jernalder." Peder Mortensen and Birgit M. Rasmussen (eds.). *Fra Stamme til Stat i Danmark 2: Høvdingesamfund og Kongemagt*: 49-66. Højbjerg, Århus: Aarhus Universitetsforlag.

Watt, Margrethe 1997. "Overfladerekognoscering af jernalderbopladser. Nogle kildekritiske betragtninger over samarbejdet mellem arkæologer og detektoramatører." Johan Callmer and Erik Rosengren (eds.). *" - Gick Grendel att söka det höga huset - " : Arkeologiska källor till aristokratiska miljöer i Skandinavien under yngre järnålder : Rapport från ett seminarium i Falkenberg 16-17 November 1995*: 131-143. Halmstad: Halland länsmuseer.

Watt, Margrethe 2000. "Detektorfund fra bornholmske bopladser med kulturlag. Repræsentativitet og metode." Mogens Bo Henriksen (ed.). *Detektorfund - hvad skal vi med dem?Dokumentation og registrering af bopladser med detektorfund fra jernalder og middelalder: Rapport fra et bebyggelseshistorisk seminar på Hollufgård den 26. oktober 1998*: 79-98. Odense: Odense Bys Museer

Wåhlin, Sidsel 2014." Metal-rich sites in Vendsyssel." edited by Ernst Stridsing, Karen Høilund Nielsen and Reno Fiedel (eds.). *Wealth and Complexity. Economically Specialised Sites in Late Iron Age Denmark*: 143-156. Århus: Museum Østjylland and Aarhus University Press.

Yorston, R. M., V. L. Gaffney, and P. J. Reynolds 1990. "Simultation of Artefact Movement due to Cultivation." *Journal of Archaeological Science* 17 (1): 67-83.

Östergren, Majvor 1985. "Metalldetektorn i Praktiskt Bruk." *Gotländskt Arkiv*: 11-28.

Östergren, Majvor 1989. *Mellan Stengrund Och Stenhus: Gotlands Vikingatida Silverskatter Som Boplatsindikation*. Theses and Papers in Archaeology ; 2. Stockholm: Arkeologiska Institutionen.