Journal of Danish Archaeology vol.14, 2006, pp. 139-167

Detector sites and settlement archaeology on Bornholm. A survey of "productive sites" from the Iron Age and the Viking Age 1996-1999

by Margrethe Watt

ABSTRACT

Extensive phosphate mapping and analysis of samples from culture layers has provided an overview of the extent and state of preservation of 31 selected settlements with preserved settlement layers from the Iron Age and the Viking Age on Bornholm. Problems associated with the investigation methods and representativity of the material are discussed against the background of preliminary analyses of 30000 artefacts recovered either as surface finds or with the aid of metal detectors from more than 400 settlement sites. A small number of representative settlements is presented along with an overview of the most important finds. The article concludes with an outline of settlement development.

INTRODUCTION AND BACKGROUND FOR THE PROJECT

Bornholm is the part of Denmark in which the largest number of settlements from the Iron Age and Viking Age has been registered relative to the total area. Since the mid-1970s, when cemeteries still dominated the discussion on the island (Becker 1975), the discovery of settlement sites from the Iron Age and the Viking Age has accelerated, first and foremost due to the well-developed collaboration with amateur archaeologists (Watt 1997).

Since the mid-1980s reconnaissance of several hundred ploughed-over settlement sites, both with and without the use of metal detectors, has resulted in a dramatic increase in the number of finds of artefacts which have lain, for shorter or longer periods, in the top-soil. All in all this amounts to about 30000 stray finds of artefacts. Additionally there are about 30 hoards with coins and hack metal, primarily from the Late Viking Age.

Knowledge of the extent and character of the many ploughed-over settlements was very limited until the end of the 1990s. Compared to the situation in the rest of southern Scandinavia, only a very limited number has been subjected to traditional open excavation. None of them can be said to have been investigated in full, but several have, however, given an overview of house types from the Early and Late Iron Age as well as the Viking Age and the Early Middle Ages (e.g. Watt 1983). Of the at least 425 registered settlements, at least 60 are estimated to have preserved culture layers of unknown extent (Fig. 1)[1]. At the same time, it is presumed that these culture layers, the thickness of which in a few cases exceeds one metre, function as a kind of store, which in the course of repeated ploughing account for the many detector finds and the marked dark coloration of the top soil (Watt 1998). Due to the often complicated stratigraphy there has

[1] The term "preserved culture layer" indicates: a – actual settlement layers with large quantities of material from burnt or unburnt houses along with deposits from the immediate vicinity of these, e.g. refuse layers with abundant finds and animal bones; b – an old vegetation or cultivation layer with settlement indicators, typically in the form of small amounts of charcoal, finely-fragmented clay daub along with possible workshop debris and (dependent on the conditions of preservation) small fragments of animal bones. Traces of structures and pits which are only preserved in the subsoil are not considered as culture layers in this respect, but are naturally included in the survey.

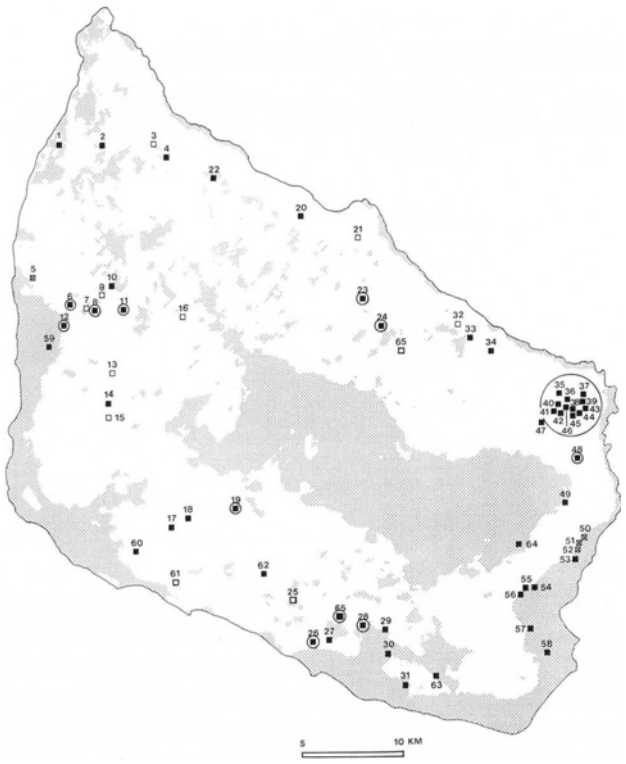

Fig. 1. Iron Age and Viking Age settlement sites with culture layers on Bornholm. Settlements included in the extensive sampling programme are marked with a circle: 6. Skovgård/Nygård, sb. 190, Klemensker parish; 8. Møllegård, sb. 202, Klemensker parish; 11. Ladegård, sb. 195, Klemensker parish; 12. Rødbjerg, sb. 201, Klemensker parish; 19. Smørengegård, sb. 144 Vestermarie parish; 23. Agerbygård, sb. 201, Østerlars parish; 24. Rytterbakken, sb. 178, Østerlars parish; 26. Sandegård, sb. 33, Åker parish; 28. St. Gadegård, sb. 160, Pedersker parish; 35-46. The Ibsker complex with, among others, Sorte Muld and Dalshøj, sb. 93 and 135, Ibsker parish; 48. Munkegård, sb. 49, Ibsker parish; 65. Runegård, sb. 202, Åker parish.

been a tendency to refrain from carrying out large-scale excavations of these settlement sites.

Of all the settlements from the Iron Age and the Viking Age which were recorded up to the middle of 1999, at least 20% were occupied during both the Early and the Late Iron Age. More than 50% are dominated by finds from the Viking Age and/or the Early Middle Ages. At the same time, preliminary analyses of the detector and surface finds have shown that the majority of these originate from less than 10% of the settlement sites.

The large sites in particular showed a marked continuity of settlement with surprisingly uniform dating profiles, dominated by artefacts from the Germanic Iron Age, but often also with a significant content of material from both the Roman Iron Age and the Viking Age.

Trial investigations

On the basis of a memorandum prepared by the author the State Antiquary initiated a project in 1996 with the aim of obtaining an overview of the state of preservation of as many as possible of the find-rich settlement sites[2]. This was to be achieved partly through the collation of information, partly through an extensive sampling programme.

In 1996 an extended trial investigation was carried out at the settlement of Agerbygård/Bakkegård, close to the round church at Østerlars. A combination of artifact distribution and phosphate analyses could here be related to the extent and stratigraphy of the culture layers as studied in a number of narrow trial trenches through the site (Watt 1998). On the basis of the experience gained here an extensive sampling programme was carried out in 1997 and 1999, involving the majority of settlements in the Ibsker complex, with Sorte Muld at the centre, as well as a number of other find-rich settlement sites. In all 31 black-earth settlement sites or settlement areas, corresponding to about half of the sites which originally were presumed to have preserved culture layer, were included in the investigation (Fig. 1).The extensive sampling programme comprised coarse phosphate mapping at top-soil level, and collecting, wet-sieving and sorting of samples from the culture layers (Watt 1998, 214ff.). In the collection of both phosphate and culture layer samples attempts were made to cover the sites with a fairly regular and uniform sampling net. The sampling programme during 1996-1999 comprised a total area of about 1 000 000 m^2. In all, 2839 phosphate samples

[2] Bornholms Museum journal number 2525; RAS P. 3239/97. Documentation for the trial investigations at the individual settlement areas is available in the form of reports with detailed descriptions of the collection principles, procedures, descriptions of the stratigraphy, analyses, artefacts, maps, along with an evaluation of the individual localities.

were collected and analysed and about 1000 representative 20 litre samples of the preserved culture layers were sieved and sorted. During the course of the whole process it was important to ensure that the work was as far as possible non-destructive. At the same time it was a condition that costs were kept to a minimum. Part of the investigation was, accordingly, aimed at finding a balance between the lowest possible cost and a professionally acceptable level of documentation as a basis for future discussion regarding the protection or investigation of ploughed-over settlements with culture layers. In the overall evaluation of the many settlement sites, results from earlier investigations and an analysis of the very extensive body of finds from the top-soil, both play a decisive role[3].

Selection criteria

The selection of settlement sites to be included in the investigation was based on a combination of criteria. In addition to the presence of culture layers, the *abundance of finds in the top -soil (including hoards)* as well as *settlement continuity at individual sites* was of major significance. Other factors such as *the geographical distribution, topographic location* and *the soil conditions* also contributed to the selection process.

Several of the find-rich settlement sites included in the investigation have been known for many years. Of the 20 settlement sites mentioned by E. Vedel in *Bornholms Oldtidsminder,* and which accordingly have been known for at least 100 years, almost half were included in the trial investigations (Vedel 1886, 339ff.).

Among the sites with a long settlement continuity is the large group of settlements around Sorte Muld in Ibsker parish. Several of these were established already by the Late Pre-Roman Iron Age (Watt in prep.). A significant chronological spread can also be seen on the larger black-earth settlements elsewhere on the island, for example Smørenge, Sandegård and Rytterbakken, while others, such as Møllegård and Agerbygård, are dominated by finds from the Late Germanic Iron Age and the Viking Age (Fig. 1 nos. 19, 26, 24, 8 and 23; cf. Fig. 5).

Within the numerous and rapidly growing group of settlements characterised by the presence of Baltic ware (*Østersøkeramik*), several of which have yielded hoards of coins and hack silver, the proportion of pre-Viking finds is usually significantly less. Even though the top-soil at the Late Viking Age sites is sometimes quite dark in colour and finds are relatively numerous, these sites, however, have a different character from the typical black-earth sites from the Iron Age. In order to gain an overview of the possible presence of a culture layer and the conditions of preservation at the late hoard sites, some localities were chosen which, in the light of their finds, are presumed to represent the chieftain's farms of the period. Among these are Ladegård in Klemensker, Munkegård in Ibsker and Store Gadegård in Pedersker (Fig. 1 nos. 11, 48 and 28).

Both the typical black-earth sites and the majority of the many late settlement sites with Baltic ware lie on heavy to moderately heavy clay soils. The greatest clay content is registered at the settlements in the Ibsker complex. The large and very find-rich settlement at Sandegård lies on moderately heavy clay soil and, furthermore, in an area where drifting sand has influenced both the formation and the preservation of the culture layers.

Relatively few of the recorded settlements lie on the areally-limited islands of glacial or late-glacial sand and gravel, of which the largest continuous areas are found in southern Bornholm in Pedersker and Poulsker parishes as well as around Grødby in Åker parish. The settlement area at Store Gadegård in Pedersker was chosen in order to obtain a representation of settlements on light soils with finds from different periods (Fig. 2). Here there was the possibility of demonstrating whether dark coloration of the sandy top soil is also associated with an underlying culture layer, and whether the clusters of houses, seen in dry summers as growth differences in crops on part of the settlement area, are due to total destruction by ploughing, or whether houses could possibly be preserved at different levels, separated by layers of blown sand and earth as at Runegård in the Grødby area (Fig. 1 no. 65) (Watt 1983).

[3] The data bases which form the foundation of this work were constructed by the author in connection with publishing the finds from Sorte Muld and the Ibsker settlement complex along with a planned presentation of the finds from the detector sites on Bornholm. The databases, comprise about 30 000 artefacts. Most of the finds are kept at Bornholms Museum. A number of the artefacts (almost exclusively metal finds) is also registered at the National Museum in Copenhagen in connection with the administration of Treasure Trove, while small portions, primarily of the non-metallic finds, are still in private ownership.

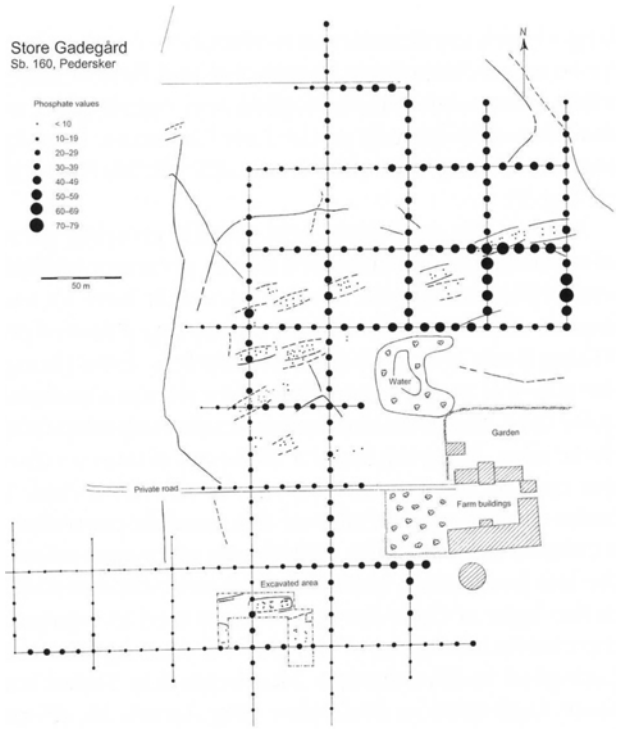

Fig. 2. Phosphate map for the settlement area at Store Gadegård, sb. 160, Åker parish. The house remains have been drawn on the basis of crop marks visible on the aerial photographs

Phosphate mapping

It is well known among archaeologists that phosphate accumulates as poorly soluble compounds in areas of prehistoric settlement. Phosphate mapping has been used since the 1930s both in connection with ordinary excavations and, since the 1980s, more routinely for locating settlements (e.g. Hartmann 1984; Östergren 1989; Hartmann 1991; Zimmermann 1992; Jørgensen et al. 1993). Various field and laboratory methods are used in phosphate mapping (Hartmann 1991; Persson 1996). For both practical reasons and for the sake of the comparability of the results, commercial laboratory analyses[4] were used in the Bornholm black-earth project.

When interpreting the results of the analyses it is important to be aware of the fact that the content of phosphoric acid in the top-soil does not, of course, give a synchronous picture of the underlying settlement, but in principle reflects the accumulated ploughed-up material. The fact that the samples were taken in the top-soil, and were therefore a kind of mixed sample, is due in the first instance to the wish to gain an *overall* impression of the settlements. Samples taken below the top-soil (in the culture layer, old soil surface/fossil top-soil or subsoil) would give greater and, in principle, more exact fluctuations, but could at best only be interpreted through subsequent open excavation. Furthermore, physical factors such as the nature of the soil, moisture, the actual crops and repeated fallow can play a role with regard to the comparability of the individual settlement sites.

The phosphate samples in the project described here have been collected consistently every 10 metres along transects laid out strategically relative to the colour of the soil, the distribution of finds and other settlement indicators (charcoal, fragments of daub, burnt stones, etc) (e.g. Figs. 2, 7a, 9a and 19a). Each phosphate sample typically represents an area of 250-300 m^2. In comparison, Majvor Östergren, in the Gotland hoard project, operated with a sample density of one sample per c. 400 m^2, which she saw as the minimum to give a satisfactory overview of a settlement site (Östergren 1989, 55). In order to ensure a fall in phosphate values to the local background level, sample collection was typically continued 30-40 metres beyond the distribution limit of the finds and other settlement indicators. The sampling network was considered fine enough to be able to reveal any possible division of the settlements into smaller units.

In an evaluation of the results of the analyses, account has been taken of the local background level, such that the term "elevated phosphoric acid value" refers to at least a three-fold increase in phosphate values and a "greatly elevated phosphoric acid value" refers to at least a ten-fold increase.

The results of the analyses showed that at almost all the settlement sites investigated a marked relationship could be seen between the level of phosphoric acid, the dark coloration of the top soil and the many detec-

[4] All samples from 1997 and 1999 were analysed at Stein's Laboratory. The Danish Plant Directorate's "culture control method no. 3" was used in the analyses, by which the phosphate content, after extraction with dilute acetic acid is determined spectrophotometrically as phosphorous molybdenum blue. A small number of repeat analyses have shown great consistency between different batches. For this reason the results of the analyses are considered to be comparable.

tor and surface finds, especially from the Late Iron Age. At the same time a clear difference was seen in this period between central areas (areas with house remains) with high phosphate values and a steep phosphate gradient and marginal areas with moderate values and a shallower gradient. The phosphoric acid values in areas (of the same soil type) which are dominated by finds from the Roman Iron Age are, in contrast, often somewhat lower.

The two settlement sites on sandy soil (Store Gadegård and Runegård, the latter a control area) showed more modest phosphate values. This is despite the fact that long-term settlement, and in places also remains of culture layers proper, were found at both sites. The lower phosphoric acid values are presumably due to a greater flow of water through the soil and, accordingly, more rapid leaching of the phosphoric acid to a lower level.

Collection, sieving and sorting of samples from culture layers

Bulk samples were collected stratigraphically from the culture layers according to the same network as the phosphate samples, as a rule at 20 metre intervals (i.e. corresponding to every second phosphate sample). Every sample, representing about 30 cm of the layer and with a volume of about 20 litres, was wet-sieved through a 3 mm net, after which the material retrieved on the sieve was dried and sorted[5]. During sorting of these samples the content of finds and other settlement indicators was registered on forms. These were compared with observations in the field. The sieved remains were also swept with a magnet in order to collect possible magnetic iron, e.g. hammer scales[6].

During collection of the culture layer samples the character and composition of the culture layer was constantly evaluated. Here a distinction was made between central areas with proper culture layers, typically with large amounts of clay daub and abundant pottery, representing houses and their immediate surroundings, and marginal areas, where the samples contained only smaller amounts of clay daub, charcoal (old vegetation or plough layers?) and fewer finds, some of them of a different character (workshop areas). In places where the culture layer had dried out at the time of sampling, it was difficult or impossible to gain a true impression of the content of settlement indicators. This was, on the other hand, revealed during sorting of the sieved samples. A surprisingly large number of sieved samples was found to contain fish-bones, including those from sites situated a long way from the coast.

Both during the collection of the samples from culture layers and the subsequent sieving and sorting of the materials, remains of burnt houses stood out very clearly, whereas traces of unburnt houses were only rarely obsereved. This is presumably due to the fact that unburnt clay (clay daub and possible remains of clay floors) is more readily assimilated through cultivation and natural processes in the soil than the remains of burnt clay walls, which in some cases made up a large part of the sieved sample.

At many settlement sites it could be seen that the modern top-soil was darker than the culture layer lying directly beneath and in addition also often contained more immediately visible settlement indicators. This situation is presumed to reflect a concentration of non- or slowly-degradable settlement material (charcoal, burnt clay daub and possible finds) in places where ploughing has removed the original settlement layer proper and has now reached the older vegetation and cultivation horizons. The situation does, however, vary from place to place, depending on the local soils which influence the consistency of the culture layer.

A comparison of the phosphoric acid values with the thickness of the culture layers shows that high phosphate values reveal, on the one hand, that a culture layer exists, or has existed, at the settlement site but they do not, on the other hand, reflect its present thickness.

Both the sampling programme and a series of traditional excavations at Iron Age settlement sites on Bornholm have shown that the culture layers which were formed in the Early Iron Age have generally a

[5] To reduce the transportation of soil in connection with wet-sieving, the samples from the culture layers were in some cases reduced on site by dry sieving through a 3 mm net. Due to the generally high clay content it was not, however, possible to reduce the samples from the Ibsker area. No marked differences in the yield of the subsequent wet-sieving could be observed as a result of inserting this extra process at some sites.

[6] Thanks to Henriette Lyngstrøm, PhD, for advice and guidance in connection with the identification of smithing debris.

large volume of soil relative to the number of finds (corresponding to a high rate of accumulation) while the reverse appears to be the case in those from the Late Iron Age. This situation could be observed, for example, during sieving of large culture layer samples taken from the transverse profiles at Agerbygård. Here the holes dug for posts for houses, which represent various later building phases, cut deeply into the thick, but relatively find-poor layers from the Roman Iron Age (Watt 1998, Fig. 4).

Erosion and conditions for preservation

One of the project's main aims was to carry out an evaluation of the general state of preservation of the settlement sites. Efforts were made to establish the level to which ploughing had reached at the individual settlement sites, partly based on datable finds (primarily pottery) which were observed at the surface and which were recovered during sorting of the sieved samples, and partly through a comparison with the dating profiles which became apparent from the total find material. On this basis it can be stated that on the majority of settlement sites today, ploughing has penetrated deep into the Early Iron Age layers.

An attempt was made to evaluate *the erosion rate* at the few localities from which there was information about the thickness of the culture layer from earlier investigations. One of the sites from where such information exists is *Rytterbakken* near Østerlars. In 1980 several parallel trial trenches were excavated These showed that the culture layer then was up to 80 cm thick, representing the burnt remains of several partly superimposed houses, of which the latest appears to be from the Germanic Iron Age (Nielsen 1982)[7]. In 1988 a fibre-optic cable was laid across the site. In connection with this the thickness of the culture layer was registered as c. 50 cm where it was thickest[8]. During the trial investigations in 1999 nowhere did the preserved culture layer exceed a thickness of 30 cm, and is believed to date primarily from the Roman Iron Age. *That is to say that at this site about 50 cm of the culture or settlement layer, corresponding to about 2/3 of the total stratigraphy, had disappeared in the course of less than 20 years.*

More general observations in connection with the sampling programme suggest that a similar situation exists at other settlement sites. During a follow-up investigation in 1983 in the western part of the settlement area at *Smørenge* in connection with the appearance of a hoard comprising denarii and solidi, the thickness of the exposed settlement layer was registered as being at least 30 cm (Kromann & Watt 1984)[9]. Today, the culture layer, which is presumed to be the reason for the dark coloration of the plough soil over the very large settlement area, appears to be destroyed down to thin vegetation or cultivation layers.

The general impression is that the cultivation pressure has been extreme everywhere during the last 10-20 years and that only exceptionally (for example on the central part of the Sorte Muld settlement site) are find-rich culture layers preserved from the Late Iron Age and the Viking Age. Analyses of the finds (see below) suggest that the heavy ploughing activity has very probably also resulted in the great majority of metal artefacts, especially from the Late Iron Age, now present in the top-soil.

The finds

In connection with the study of the material from the large settlement complex around Sorte Muld a systematic registration was carried out of about 30 000 surface or detector finds from around 400 settlement sites from the Iron Age and the Viking Age on Bornholm. As there are very great differences in the number of finds from one settlement site to the next, it is primarily material from the find-rich settlement sites which is included in the statistical analyses. The great majority of the artefacts came to Bornholms Museum in the period between 1983 and 2000 but also privately-owned artefacts have, to a certain extent, been included. The most important reasons that the surface finds from Bornholm's settlement sites can be used at all in cultural-historical and methodological studies

[7] Bornholms Museum journal number 750. Report by Finn Ole Nielsen.

[8] Bornholms Museum journal number 750. Note from Jørgen Seit Jespersen.

[9] Sb. 144, Vestermarie parish. Report by Margrethe Watt 1983. Bornholms Museum journal number 766.

are their abundance and the fact that, originating as they do from many different settlement sites, they are able to reveal patterns of variation and repetition in the find spectra.

The follow-up investigation at Sorte Muld in 1986-87 in connection with the appearance of a large number of gold foil figures (*guldgubber*), made systematic wet-sieving of the top-soil and sorting of the sieved remains a necessity. This considerable task revealed what a find-rich active top-soil can contain in the way of archaeological material (Watt 1991; Watt 1997). In brief, it was noted that the wet-sieved material was dominated by non-metallic finds (over 75%), while the metallic finds comprised less than 25% of the total. In comparison, metallic finds from the subsequent more than 10 years of detector and surface reconnaissance made up about 70% of the material recovered (Watt 2000; Watt in prep.).

Observations at the large detector sites, including those outside Bornholm, underline the importance of being aware of the factors which influence the representativity of the material (e.g. Jørgensen & Pedersen 1996; Nielsen 1997; Jørgensen 1999; Paulsson 1999)[10].

Survival and retrieval

The chances of the finds surviving in an active top-soil are difficult to estimate precisely, partly because the most common metals, iron and bronze, are affected differently by mechanical and chemical factors.

Iron artefacts are the most vulnerable, both with respect to physical survival in the top-soil and with respect to retrieval. Since the end of the 1980s the retrieval of iron has been influenced both by legislation concerning winter green fields and an increasing incentive to cultivate winter crops. This has meant that detector reconnaissance today is often carried out on newly-sown or newly-germinated fields and is therefore subject to restrictions with regard to the digging up of iron. This, together with the temptation to exclude iron entirely when carrying out detector reconnaissance, has resulted in a clear under-representation of iron artefacts at the majority of settlement sites. A targeted retrieval of iron at a small number of sites has shown that important material is lost in this way. This is most clearly seen in the discrepancy between, for example, the relatively frequent occurrence of iron fibulae in graves on Bornholm, while these often fragile iron fibulae only rarely appear on the ploughed-over settlement sites with an otherwise good representation of contemporaneous finds.

With regard to bronze, the fragmentation of various artefacts is dependent, in part, on how compact they are in form. Observations of mechanical wear on fractured surfaces suggest that at least some artefact types are able to survive for a very long time in an active top-soil, while others quickly become fragmented. This, of course,will influence their relative representativity. Several examples of re-located hoards from the Viking Age in particular show that coins and hack silver can survive for a long time (in some cases more than 100 years) in a regularly ploughed field (Watt 1998, 213).

When material collected by surface reconnaissance or by the use of metal detectors is used in research it is also important to have an understanding of *how, and to what extent, the composition of the find material is influenced by the level of experience, systematic qualities and temperament of the individual collector.* A continuous exchange of experience within the large group of active amateur archaeologists on Bornholm has resulted in a relatively uniform collection pattern. This is reflected in the correspondingly uniform find profiles for the sites searched with metal detectors (Fig. 3, left column). In contrast, settlement sites where traditional surface reconnaissance has also been carried out show, not surprisingly, a markedly greater proportion of non-metallic finds (Fig. 3, right column).

The most attractive settlement sites, or parts of sites, are often exposed to intense reconnaissance at the cost of representative and systematic coverage. The influence on the usefulness of the distribution maps produced in this way is seen most clearly through the results of recent years' systematic detector reconnaissance on the large settlement area at Uppåkra in Skåne (Paulsson 1999, 51 and Fig. 4a-b).

The statistical treatment of the finds from the Iron Age and the Viking Age settlement sites on Bornholm in some cases has revealed apparently inexplicable anomalies. On closer examination these have proved to be due to pre-sorting by individual collectors or their wish to retain certain finds that they are not obliged to hand over by law.

Finally, the usefulness of detector finds in scientific

[10] For a more detailed discussion of the problems of representativity see also Watt (2000).

analysis is influenced by *the administrative practice* of individual museums, which undergo constant changes as the number of incoming finds increases. This applies in particular registration and conservation priorities and to educational aspects in relation to the finders (Watt 1997, 139).

Find analyses

At the majority of settlement sites with finds from both the Early and the Late Iron Age, a striking increase in the number of datable finds can be observed during the Roman Iron Age. Differences in the level of erosion between individual settlement sites appear not to change this picture significantly (Fig. 5).

The excavations at Tissø on Sjælland have shown that under optimal conditions a clear connection can be seen between detector finds in the top-soil and the underlying settlement remains (Jørgensen & Pedersen 1996). However, in cases of settlement sites with several overlying settlement phases, as at many of the black-earth sites on Bornholm, the situation rapidly becomes more complicated. Despite the methodological problems summarised above, a find distribution pattern of significance for an evaluation of the settlement's structure becomes apparent. Gold finds and hoards of denarii/solidi from the Migration Period are rarely found outside the central part of the settlements (with house remains). As a rule, most hoards appear to have been buried within, or close to, the central part of the settlement. In contrast this is not always the case with the many coin and hack metal hoards from the Viking Age and the Early Middle Ages. Investigations at sites such as Munkegård in Ibsker have shown, accordingly, that hoards from these periods may also be hidden outside the settlement area itself[11].

Correspondingly, a comparison of the find distribution maps with the results of the trial investigations has shown that finer metalwork (represented by ingots and casting debris of silver and bronze) was often carried out within the central part of the settlement, whereas ironworking, as a rule, was relegated to marginal areas. Among the interesting by-products of the sampling programme are the common occurrences of smithing debris in the sieved samples from the periphery of the majority of settlement sites. This suggests that there was a wish to keep the activities associated with a potential fire hazard at a distance from the living quarters. Conversely, smithing debris is only rarely seen in the sieved samples from the central parts of the settlements. As there is not always a significant number of datable finds (pottery) in the sieved samples from the marginal areas of the settlements, the smithing debris is only securely dated in exceptional cases and is therefore not necessarily contemporaneous on individual settlements. At the settlement sites where iron has been collected with some degree of systematic detector reconnaissance, finger sized iron ingots or clumps of pig iron are often found confirming that smithing was widely practised.

Type profiles

Detailed studies of the range of types at a large number of settlement sites can, through comparison with grave finds, contribute to a revelation of general problems of representativity. An example is a series of fibula spectra from the Late Germanic Iron Age. These show that early types, especially broad equal-armed fibulae, dominate in strikingly uniform quantities at the settlement sites (Fig. 4 left), while later fibulae types principally occur in graves (Fig. 4 right). Collectively, the examples are presumed to give a realistic impression of the range of fibulae present in the period. They also confirm that duck bill fibulae were the most tenacious everyday jewellery, in the same way that the equal-armed fibulae were in the Viking Age, an observation confirmed through studies of the finds from Uppåkra (Hårdh 1999; Callmer 1999).

Dating profiles

Despite individual differences in the erosion level of the settlement sites, the dating profiles from almost all the find-rich Iron Age settlement sites are strikingly uniform, with a culmination of the closely-dated finds at the beginning of the Late Iron Age (Fig. 5). This dominance of finds from the Late Iron Age often

[11] Bornholms Museum journal number 2212. Report (by Hanne Wagnkilde) on the follow-up investigation in 1995 in connection with the finding of a hoard from the Late Viking Age.

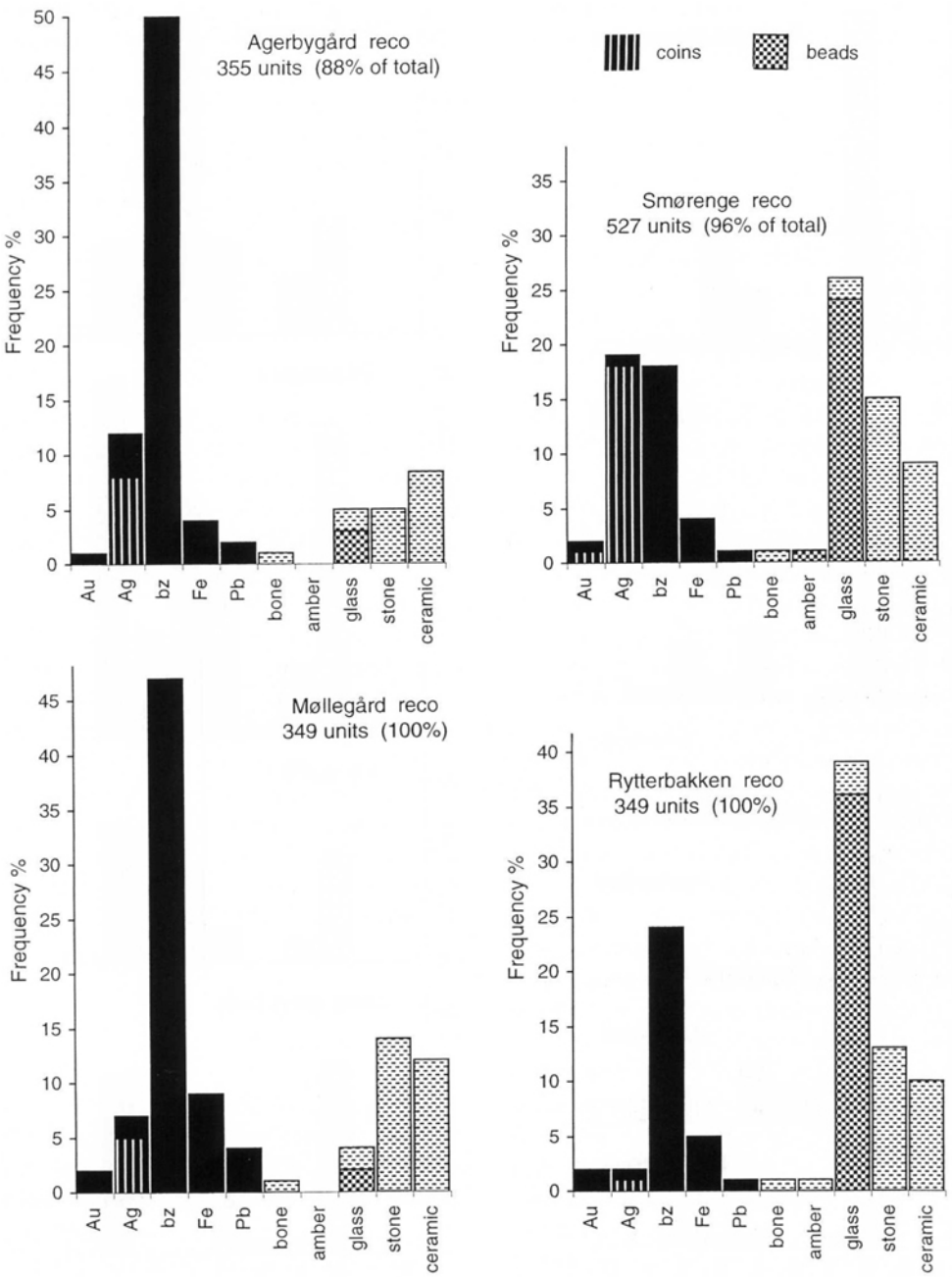

Fig. 3. Find profiles from selected settlement sites. The finds are presented as a percentage of the total detector and surface finds.

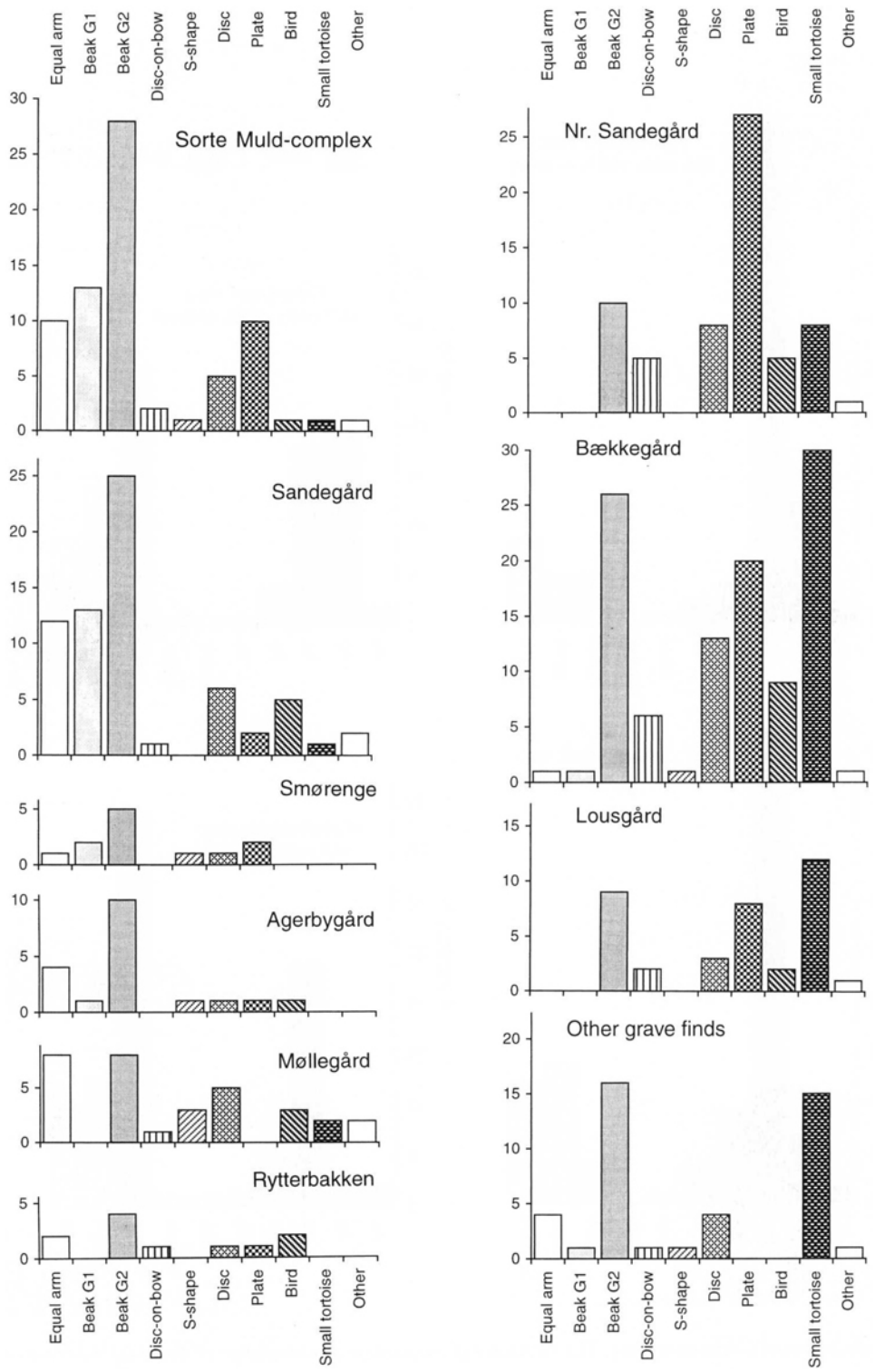

Fig. 4. Frequency spectrum for different fibulae types from settlement sites (left) and graves (right) from the Late Germanic Iron Age.

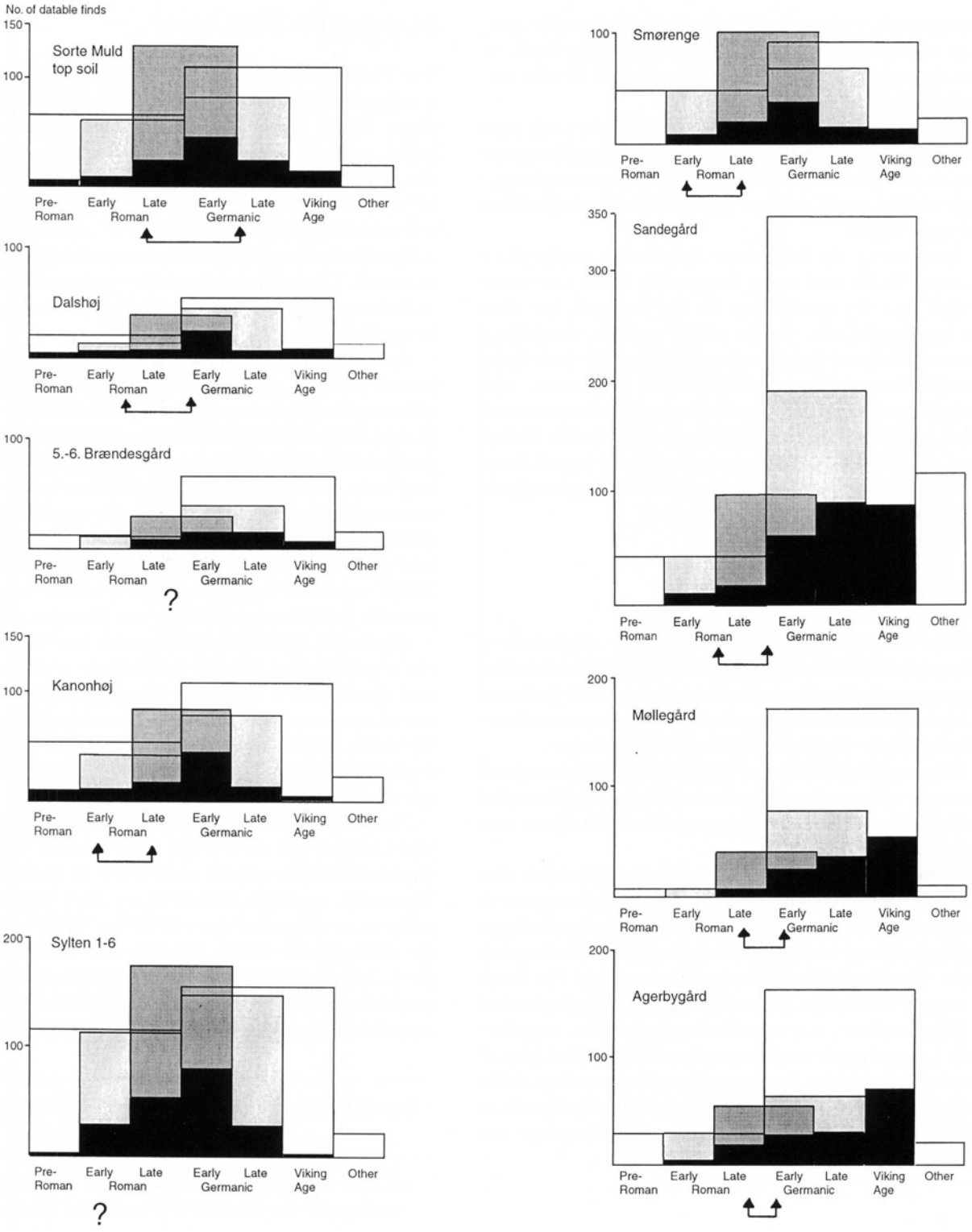

Fig. 5. Dating profiles from selected settlement sites in the Ibsker complex (left) and the rest of Bornholm (right). The arrows mark the estimated erosion level of the settlement sites.

becomes more apparent if less-precisely datable artefacts which can only be dated to either the Early or Late Iron Age (e.g. the majority of glass beads) are included in the analysis.

The typical situation where later features cut into Early Iron Age settlement layers may well be the reason why, at many settlement sites, artefact types representing several centuries are present in the top-soil at the same time.

Analyses of the finds have shown that newly ploughed-up finds and worn fragments from the same period can lie side-by-side in the top-soil, but that the youngest finds, on the whole are, the most fragmented. Some of these finds probably come from long ploughed-out settlement layers and structures. The complicated stratigraphy, which can be documented particularly well at the settlement sites in the Ibsker area, shows that structures and culture layers from widely differing periods may be affected by ploughing within short distances of each other.

The individual settlement sites

Of the 31 settlement sites which were subjected to extensive trial investigations, two thirds lie within the large central complex in Ibsker which will be included in the collective treatment of the finds from Sorte Muld and the Ibsker complex (Watt in prep.).

From within the Ibsker complex Dalshøj is a good example of how the extensive trial investigations play an important role in bringing earlier excavations into perspective.

From among the numerous other settlement sites routinely explored with metal detectors, two representative examples have been chosen; one from the large black-earth settlements with a long settlement continuity (Sandegård in Åker) and one from the large group of farm sites from the Viking Age (Ladegård in Klemensker). It is hoped that these sites, together with a presentation of a selection of the most important finds from the sites, can give an impression of the cultural-historical and research potential inherent in the surface and detector finds from the Iron Age and Viking Age settlements on Bornholm.

Dalshøj, sb. 135, Ibsker parish[12]

The Dalshøj settlement (Fig. 1 no. 46) today lies as a cultivated field on a north- and northeast-facing slope, 50-55 metres above sea level, with meadows below and a view over the Baltic Sea. The settlement site, which lies only 200 metres from Sorte Muld (Fig. 6), is seen after ploughing as a poorly-defined dark area covering at least 20-30 000 m^2. At several places within the settlement area ice-scoured rock surfaces lie exposed. The soil consists of clay with pockets of sand and damp areas which are partly due to the uneven bedrock below.

In the period between 1950 and 1953 Ole Klindt-Jensen carried out excavations at Dalshøj, which in all comprised an area of about 1200-1300 m^2 (Klindt-Jensen 1957, 185ff.). Nine more-or-less well preserved, partly overlapping houses were exposed, most of them had been destroyed by fire. In addition to the houses, investigations were carried out of a number of pits as well as a stretch of cobbled road which lay 'at the same level as house remains A-B' (Klindt-Jensen 1957, 16 and 203ff., as well as Figs. 7 and 10), of which remains are possibly still preserved below the ploughing level[13].

Since the 1980s reconnaissance has been carried out at intervals at the site by amateur archaeologists, and since 1989 it has been regularly scanned with a metal detector by the amateur archaeologist Klaus Thorsen. At the latest registration (1998) about 250 finds had been collected from the plough soil, primarily metal artefacts.

Sampling. In 1999 an extended sampling programme was carried out at the site which made it possible to establish its extent and state of preservation. Phosphate analyses revealed an area with elevated values covering more than 20 000 m^2 (Fig. 7a). Despite the disturbance of the plough soil over the central part of the settlement site, which the excavation at the beginning of the 1950s must have caused, there is a still surprisingly good agreement between the dramatically

[12] Bornholms Museum journal numbers 1639 and 2156.

[13] Amateur archaeologist Klaus Thorsen reports that when passing with the detector he can pick up signals from the cobbled area on the southwestern most part of the settlement site, but that it cannot be followed with certainty over a longer stretch.

elevated phosphoric acid values in the plough soil and the house remains investigated by Klindt-Jensen. The phosphoric acid values suggest that the settlement had extended up to the ridge to the south where it joins the settlement area around Baunehøj, Sønderhøj and Kanonhøj (Fig. 6). During the collection of samples it could be seen that there was striking agreement between the dark coloration of the plough soil and phosphoric acid values greater than 30.

The evaluation of the culture layer at the settlement site is based on sieved samples collected at 42 points which, with the exception of Klindt-Jensen's excavation field, were evenly distributed over the whole of the settlement site (Fig. 7b). The trial investigations showed that the actual settlement layer lay within the area of elevated phosphoric acid values (above 40), not least around and to the northeast of the earlier excavation area. This confirms that Klindt-Jensen's investigations here (in contrast to his excavation at Sorte Muld) included the central part of the settlement.

The thickness of the culture layer varied greatly, which is due partly to the fact that it is preserved in pockets in the underlying bedrock. A sharp fall in the terrain northeast of the old excavation area may have resulted in an accumulation of settlement or clearance layers here. In several places, especially in the southwestern part of the site, it was noticed that the modern plough soil was significantly darker than the thin underlying culture layer. This is probably due to the fact that the plough soil here comprises primarily ploughed-up, originally charcoal-rich, settlement material (burnt-out houses, cooking pits). This is confirmed indirectly by the »tongue« of finds which extends from the central part up towards Bavnehøj (Fig. 7c-d).

According to information from Klindt-Jensen, ploughing in the 1950s affected in particular house remains from the Roman Iron Age and the beginning of the Early Germanic Iron Age.

Older settlement layers on the whole seem to have been untouched. The pottery collected now from the top-soil, and which dominates the culture layer samples from the sampling pits, suggests that ploughing of the settlement site today largely affects culture layers from the Roman Iron Age.

The finds. With the exception of a hoard containing

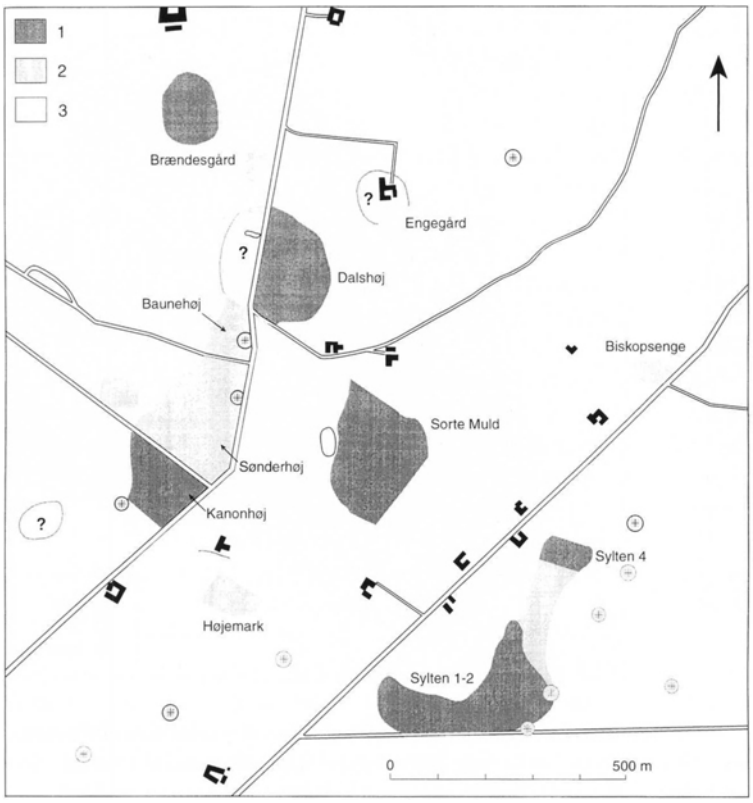

Fig. 6. The settlement sites of the Ibsker complex showing the frequency of reconnaissance: 1. regular reconnaissance (more than 10 times); 2.reconnaissance carried out 5-10 times; 3. reconnaissance carried out less than five times.

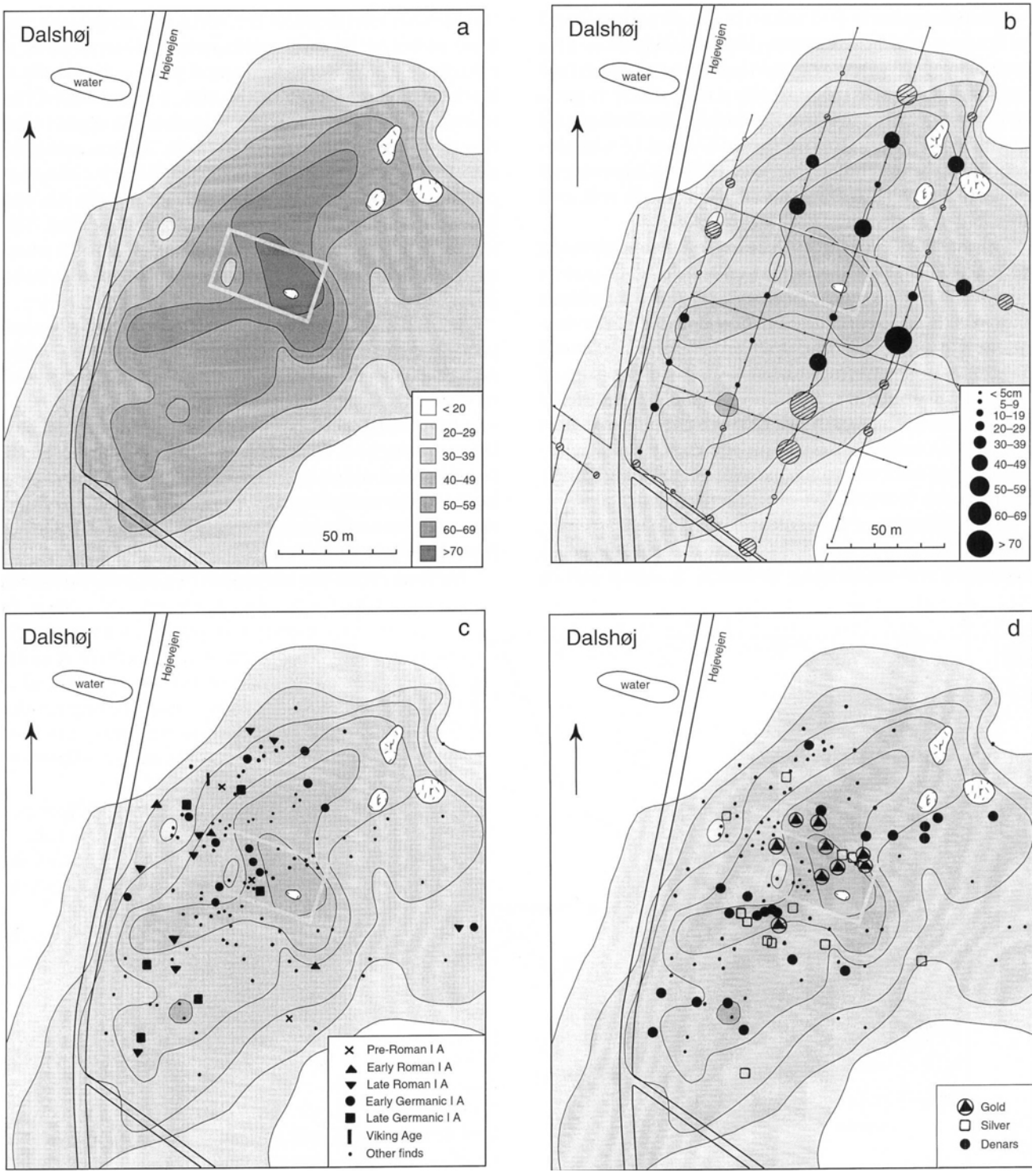

Fig. 7. The Dalshøj settlement site, sb. 135, Ibsker parish. Trial investigation 1999. (a) Phosphate map, (b) sampling lines and thickness of the culture layer (black circles mark compact culture layers, hachuring indicates peripheral areas) (c) dated finds, (d) precious metal and coins from detector reconnaissance. The rectangular area marks Klindt-Jensen's excavation (1950-53).

solidi and a relief brooch, the finds from Klindt-Jensen's 14 months of excavations are relatively modest. Of the c. 300 artefacts from later detector and surface reconnaissance, there is a single solidus (Honorius 393-423) as well as 31 denarii from the 1st and 2nd centuries AD. The solidus found with a detector, along with other finds of precious metal, was retrieved close to the area where a hoard containing a total of 17 solidi, hack gold and a relief brooch was found during Klindt-Jensen's investigations (Klindt-Jensen 1957, 186ff.). However, the even distribution of denarii over the whole settlement area suggests that they were never part of a single hoard (cf. Fig. 7d).

Among the 35 fibulae found by detector in the top-soil there are, not surprisingly, many of Early Iron Age types. Among the later finds is a stamp-decorated gold finger ring and a fragment of a buckle of gilded silver with Style 1 ornamentation (Fig. 8). Finds from the Late Germanic Iron Age are few and from the Viking Age there is only a polyhedral weight and possibly a glass fragment from a pointed beaker. The relatively large number of early finds are clearly seen by comparing the dating profile for the site with that of other settlement sites (Fig. 5).

The find distribution map (Fig. 7c) reveals that while the finds from the Early Iron Age are found spread over the whole site, the majority of finds that can be dated to the Early Germanic Iron Age, including fragments of glass beakers (especially Snartemo beakers), come from the central part of the settlement. It should, however, be mentioned that a certain amount of re-deposition of the top soil must have occurred in connection with the excavation.

Fig. 8. Clasp of gilded silver, matrix for the production of waffle-patterned gold foil and a stamp-decorated gold finger ring from detector reconnaissance of Dalshøj. Scale ca. 1:1. Photo: Nationalmuseet (clasp), others M.Watt.

Several pieces of bronze casting debris have been retrieved, especially in the western part of the settlement. Iron slag and an elongated iron ingot were found down-slope from the settlement. The fact that smithing of iron has taken place just here is confirmed by the presence of smithing debris in a sieved sample from this area. In addition a matrix for the production of waffle-patterned gold foil was found about 30 metres down-slope from the houses (Fig. 8).

Overall evaluation of the settlement site at Dalshøj. The part of the settlement which was investigated in 1950-53 is estimated, on the basis of the 1999 sampling, to only constitute around 5% of the total area of 20-25 000 m^2. However, it includes a significant portion of the central part of the settlement. The high phosphoric acid values which continue to characterise the excavation area are probably due to the fact that the soil from the excavation was put back to cover the excavated area. Even though a certain mixing of the soil must have taken place in the areas affected by Klindt-Jensen's excavation, the marked agreement between the investigated house remains, the high phosphate values and the number of finds from the top-soil cannot be a coincidence.

The finds of smithing debris in the sieved samples suggest that the workshop areas, which were probably part of the settlement, lay at the margins of the site, where the prevailing wind carried sparks away from the settlement itself.

The results of Klindt-Jensen's excavations, combined with the dating profile from the detector finds, give important information about settlement continuity at the site. It appears to have been established at the latest in the Late Pre-Roman Iron Age, from whence the earliest detector finds also originate. The majority of datable finds from later reconnaissance must, however, relate to a large settlement from the Late Roman and Early Germanic Iron Age which was destroyed many years ago by ploughing. In the Late Germanic Iron Age and Viking Age the number of finds declines further, suggesting that the settlement site at Dalshøj must have been abandoned already in the Early Viking Age.

Sandegård, sb. 33, Åker parish[14]

The settlement site at Sandegård in Åker parish (Fig. 1, no. 26) lies in the southern part of Bornholm between Boderne and Raghammer Odde, about one kilometre from the coast with a unobstructed view of the Baltic Sea. After ploughing, the settlement area stands out as a dark-coloured slightly elevated area covering almost 40 000 m^2. The southern part of the settlement area in particular, has been affected by blown soil and sand. The sand content decreases gradually towards the north, where in places ploughing has reached the clay-rich subsoil. Depressions due to compaction within an area of about 200 m^2 at the southern and eastern end of a pond on the northeastern margin of the site mark recent infilling. The possibility cannot be excluded that some of the finds which have been retrieved here come from addition of soil from the adjacent parts of the settlement site.

The settlement area at Sandegård is mentioned for the first time in connection with the laying of drains in 1869, when Emil Vedel described the finding of "3 Byzantine gold coins and several gold objects" (Vedel 1886, 398 and 400ff.; Klindt-Jensen 1957 Fig. 130). During a small investigation at the site in the same year, Vedel observed "that the top-soil was to a great extent dark in colour to a depth of about 1 "Alen"[ca. 63 cm], beneath this yellow clay, which, to a depth of ¾ "Alen" contained occasional flecks of charcoal and red-burnt clay. In many places cobbled areas consisting of fist-sized stoned were noted and among these a floor was found measuring at least 10 "Alen" across and consisting of massive sandstone flags" (Vedel 1886, 400f.).

In 1952 O. Klindt-Jensen carried out a small excavation at the site were he demonstrated "an almost totally ploughed-out farm site which had burned down" (Klindt-Jensen 1957, 236). In 1990 the site was inspected in connection with the ploughing up of about 10 sandstone flags each up to 60 cm across which appear to correspond to those described by Vedel[15].

During recent drainage work culture layers and pits have been observed in the eastern part of the settlement site. According to information received from a previous owner these in places reached a depth of a couple of metres below the present surface.

Since the middle of the 1980s the settlement site has been subjected to reconnaissance with and without the use of a metal detector. This has produced about 1000 artefacts[16]. Amateur archaeologist Jack Simonsen, who has regularly carried out reconnaissance at the site has, however, observed that the yield during recent detector scanning has fallen dramatically. At the same time it can be seen in the material that the relative proportion of small fragments is on the increase. It seems therefore a fair assessment that the top soil, after 12-15 years of detector reconnaissance, is virtually empty of metal artefacts.

Sampling. During the investigations in 1999 about 219 phosphate samples were collected on a 30×40 metre network covering an area of c. 50 000 m^2. The results of the analyses showed elevated phosphoric acid values within an area of 150×200 metres, corresponding to about 30 000 m^2 (Fig. 9a). The values are greatly elevated in two areas; one area of about 3000 m^2 centered about 100 metres north of present day Sandegård (Sandegård Vest), the other of at least 10 000 m^2 centred about 100 metres northeast of the farm buildings (Sandegård Øst).

105 samples of culture layer were collected at 59 points. The investigations showed that settlement layers proper, up to one metre in thickness, were preserved, especially in the samples within the areas with strongly elevated phosphoric acid values (Fig. 9b). Occasionally the sampling cut through easily recognisable cooking pits with charcoal and fire-shattered stones. A large content of well-preserved bones (including fishbones) is suggestive of refuse pits. Blown earth and sand has contributed to the formation of the culture layers both in the central part of the settlement site and on the southern and eastern periphery. This is apparent from the culture layer's sporadic sandy or mealy consistency. Potsherds, burnt clay daub, charcoal, animal bones and smithing debris, which were also found spread throughout the drift sand layers, show that the drifting of sand and earth took place already during the time when the settlement was in use. Thin sandy vegetation layers were observed in several places below the settlement layers.

[14] Bornholms Museum journal number 1371.

[15] Report by Dorte Dam 1990.

[16] The settlement was first subjected to detector reconnaissance by Ingvard Pedersen, later by Jack Simonsen. The area has also been searched for surface finds by Solveig Andersen.

As at other settlement sites which were included in the sampling programme, there was a marked distribution of the smithing debris in the sieved samples from the marginal areas of the settlement at Sandegård. In occasional samples from the northwestern periphery of the settlement the sieved remains contained more than 75% smithing debris. Smithing debris was, on the contrary, extremely rare in samples from the central areas of the settlement. The sieved samples are dominated by bones and potsherds, the great majority of

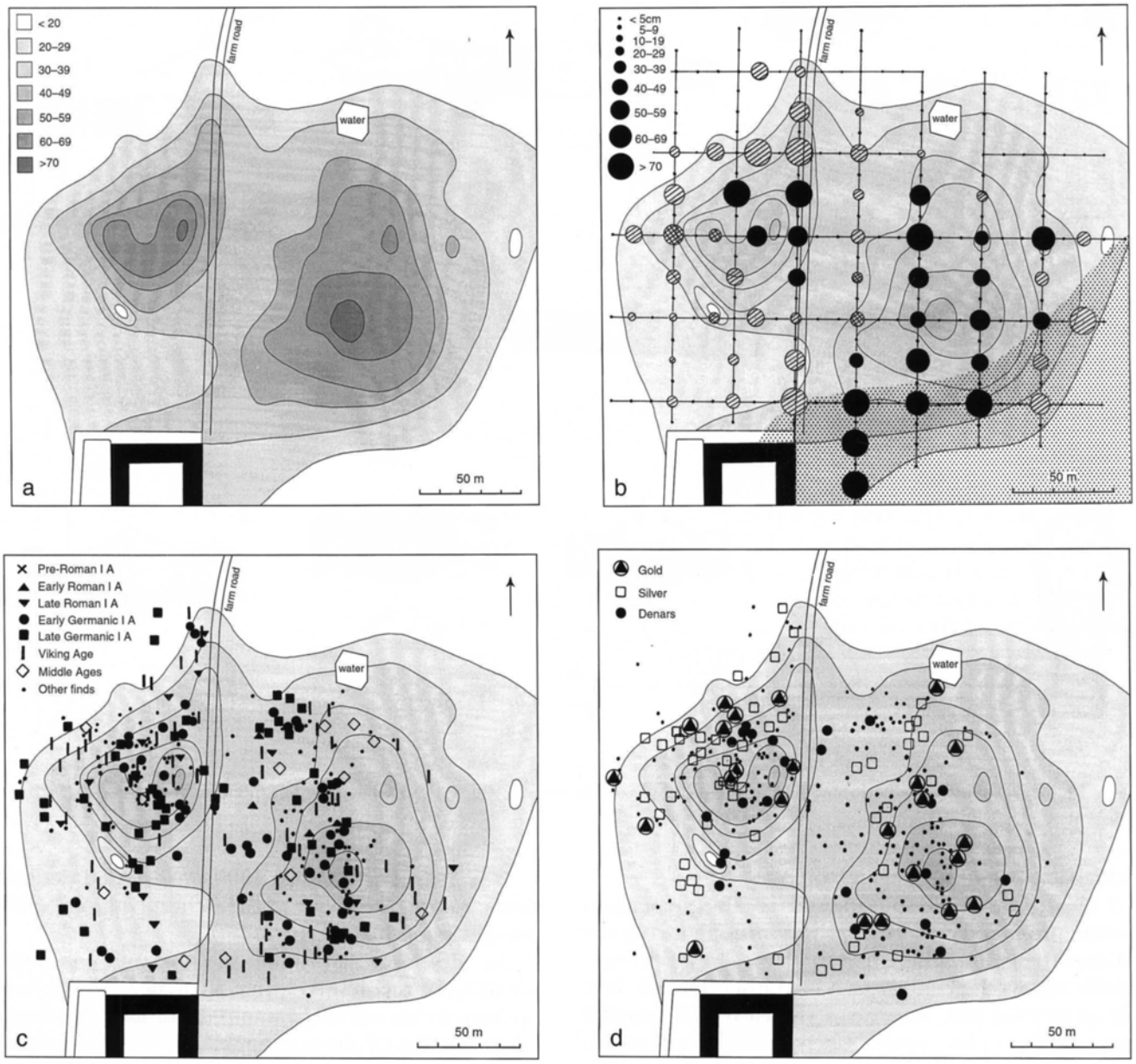

Fig. 9. The settlement area at Sandegård, sb. 33, Åker parish. Sampling programme 1999. (a) Phosphate map, (b) thickness of the culture layer (black circles mark compact culture layers, hachuring indicates peripheral areas), (c) dated finds, (d) precious metal and coins from detector reconnaissance. The stippled area marks the part of the settlement site influenced by wind-blown sand and earth.

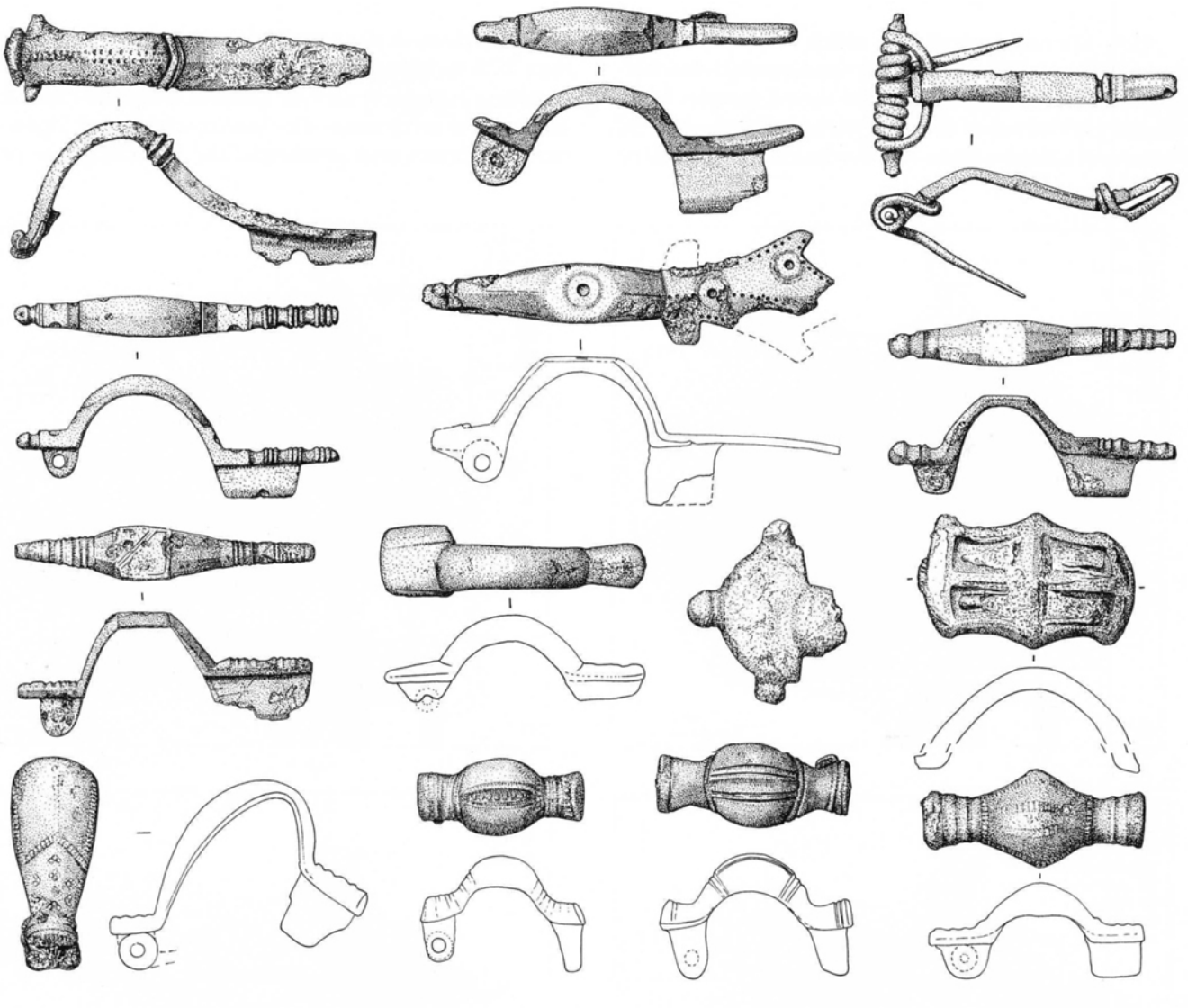

Fig. 10. Representative selection of fibulae found detector surveys on the settlement area at Sandegård. Scale 1:1. Drawings: M. Watt.

which are from the Roman Iron Age.

The trial investigations showed that the greater part of the preserved culture layer was formed during the Roman Iron Age. There may in places, however, especially within the central part of the settlement, still be preserved pits, structures (houses) and possibly also pockets with culture layers from later periods, but no large continuous areas of culture layer. The many finds from the Late Iron Age and the Viking Age, including pottery, therefore probably originate from ploughed-out settlement layers and structures (postholes and pits).

The finds. With almost 1000 surface and detector finds, Sandegård is one of the richest Iron Age settlement sites on Bornholm[17].

In addition to a number of coins and gold items which were recovered earlier, a further 23 gold finds (primarily hack gold), a stamp-decorated gold finger ring as well as 13 pieces of hack silver have been found during metal detector reconnaissance (Fig. 11). The coins found with a detector include four solidi, 30

[17] Find status at the end of 2000.

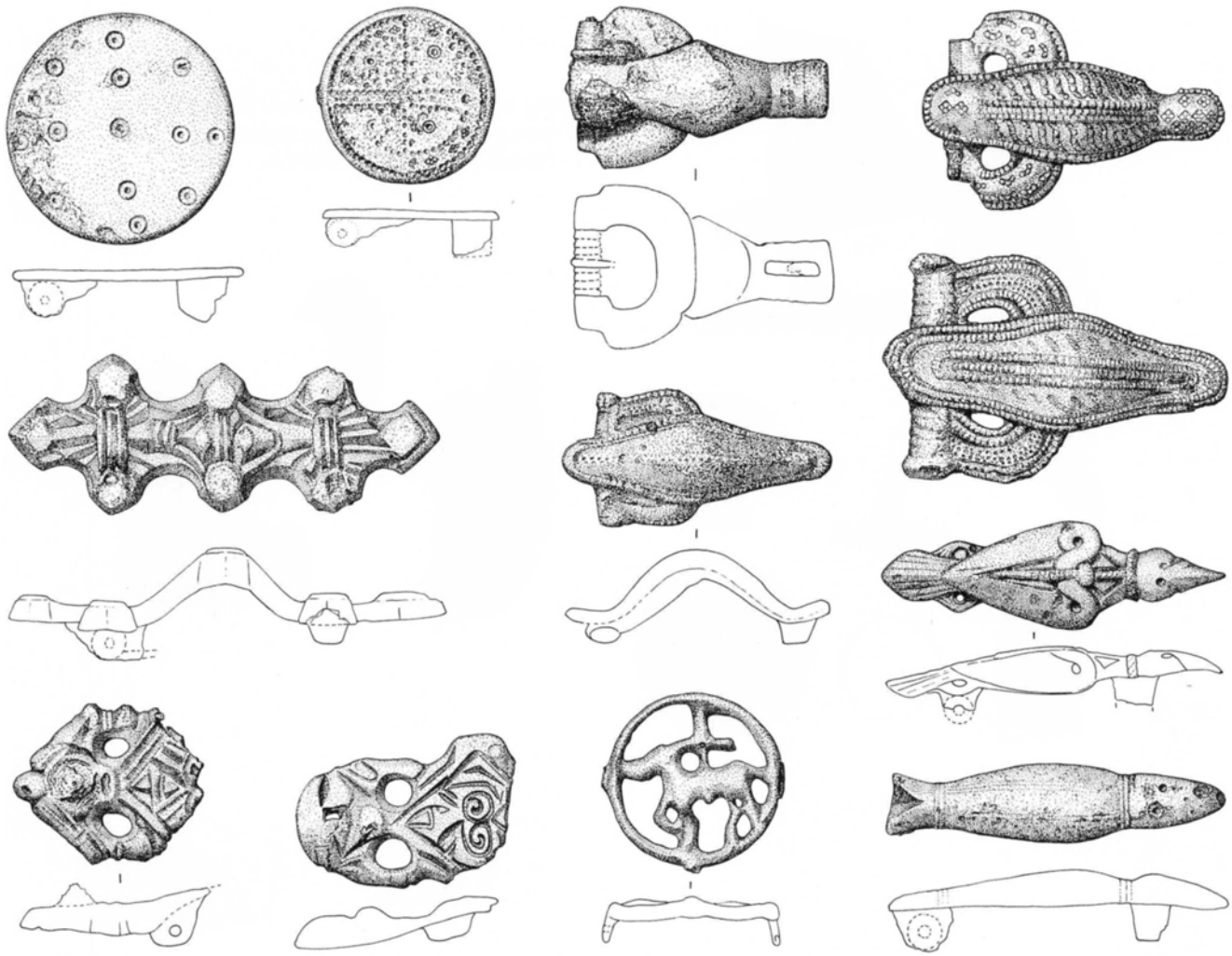

Fig. 10. Representative selection of fibulae found by detector surveys on the settlement area at Sandegård. Size 1:1. Drawings: M. Watt.

denarii, 18 dirhems, four coins of Viking Age type as well as 30 coins from the Middle Ages and the Renaissance.

With more than 150 specimens, fibulae are numerically the most dominant single artifact group (Fig. 10). Only a few can be dated to the Early Roman Iron Age, primarily from the transition from the Early to the Late Roman Iron Age. The more abundant fibulae from the Late Roman Iron Age also include some unfinished pieces, including types with turned foot (Fig. 17).

There is great variation of form in the fibulae from the Early Germanic Iron Age. In addition to various types of cross-bow fibulae there are also fragments of relief brooches (Fig. 10). As at other settlement sites the Late Germanic Iron Age is dominated by broad equal-armed and duck bill fibulae. Among the rarer types is a horse-shaped fibula of gilded bronze with inlaid garnets as well as fragments of disc-on-bow fibulae (Fig. 11).

Pendants of Late Germanic Iron Age and Viking Age types, including purse-shaped and open-worked pendants, as well as chain fasteners have been found at various places on the settlement site (Fig. 12).

Among the silver finds is a fragment of a kolben armring of solid silver, which is consistent with a date in the 5th century (Hansen 1995, 203). The majority of the other silver finds dates to the Viking Age. Included

Fig. 11. Selection of finds from the settlement area at Sandegård. Photo: Nationalmuseet (horse fibula). Others: M.Watt.

Fig. 12. Selection of pendants from the settlement area at Sandegård. Size 1:1. Drawings: M. Watt

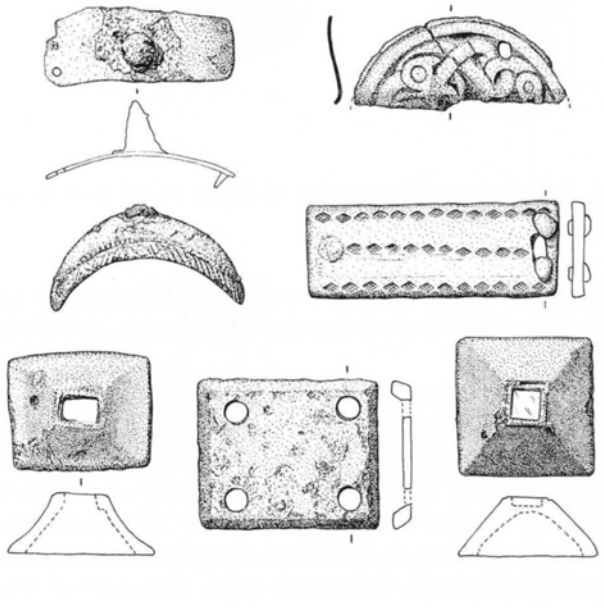

Fig. 13. Selection of belt and weapon fittings and a spur from the settlement area at Sandegård. Size 1:1. Drawings: M. Watt.

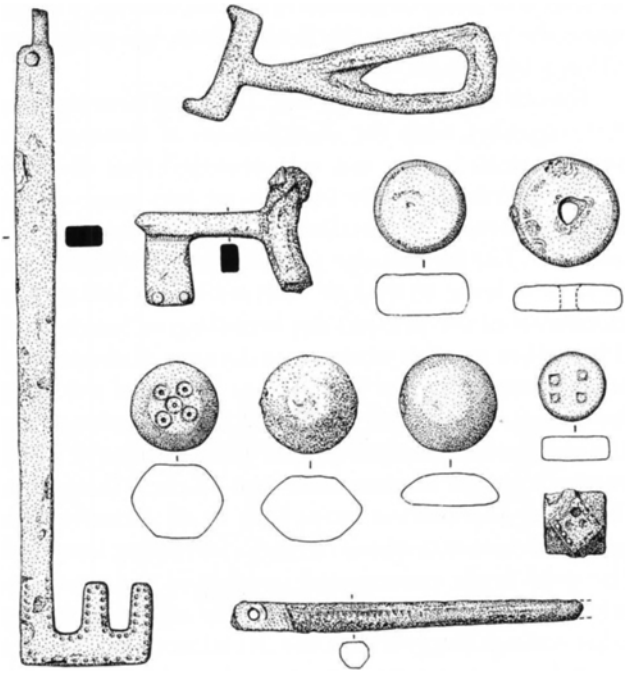

Fig. 14. Selection of keys and weights from the settlement area at Sandegård. Size 1:1. Drawings: M. Watt.

Fig. 15. Iron meat fork from the settlement area at Sandegård. Photo: Bornholms Museum

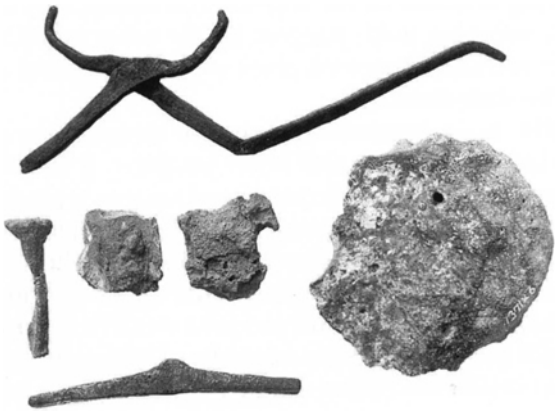

Fig. 16. Finds associated with craftsmanship from the settlement area at Sandegård. Hammer head, pair of crucible tongs, fragment of smelting crucible with melted bronze, dead head, casting residue (bronze) along with clay slags with adhering gold drops. Photo: M. Watt.

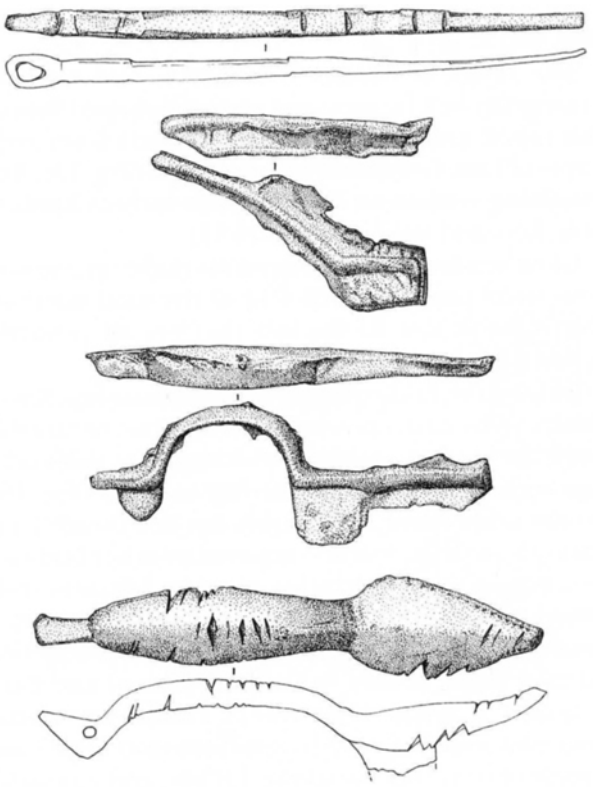

Fig. 17. Unfinished and miscast fibulae and a hacked-up bronze fibula (scrap metal) from the settlement area at Sandegård. Size 1:1 Drawings: M. Watt.

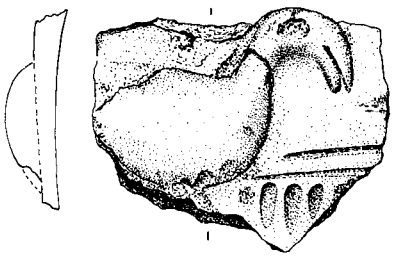

Fig. 18. Fragment of black-polished vessel with applied plastic figure of a bird. Size 1:1. Drawing:.M. Watt.

in these are a Thor's hammer, a spiral-shaped finger ring and a fragment of a trefoil stamp-decorated fitting, which has parallels in several hoards recovered recently from Bornholm (Fig. 11) (Watt 1996, 71ff., Figs. 25 and 27). Among the small finds, mention should be made of a fragment of a duck's foot pendant (Fig. 11), a type which is seen as being of eastern origin, and dated to the 11th-13th centuries (Müller-Wille 1989, 768ff and Fig. 15; Iversen & Näsman 1991, 49ff.).

The range of fittings is extensive and includes rectangular belt fittings, and pyramid-shaped fittings with inlaid garnets and decorative rivets from large lances of Late Germanic Iron Age type (Fig. 13). The remaining settlement finds include various kinds of tools, keys and weights (Figs. 14-15).

Glass beads and glass fragments make up a remarkably small proportion (3-4%) of the total material. This is partly due to the fact that not all privately-owned finds have been recorded.

Among the finds relating to craftsmanship, few of which can be dated precisely, is a small set of crucible tongs, the head of a goldsmith's hammer as well as clay slags with drops of gold adhering to them (Fig. 16). On the other hand, remarkably few deadheads from casting have been found compared to other find-rich sites, despite careful detector searches. Miscasts, unfinished and damaged fibulae as well as a fragment of a melting crucible suggest that jewellery production did take place, at least in the Late Roman and Early Germanic Iron Age (Figs. 16-17). Furthermore, slags from iron smelting as well as various iron ingots and clumps of iron (one weighing 1.2 kg), and a possible fragment of an iron-smelting furnace, have been found on the site.

The pottery from the site, which includes fragments of vessels of a high standard of craftsmanship (Fig. 18) spans the period from the Roman Iron Age to the Late Viking Age (Baltic ware).

Overall evaluation of the site. The trial investigation has, together with the distribution of detector and surface finds in the top soil, revealed that the Sandegård settlement site consists of two more-or-less contemporaneous settlements lying close to one another. The largest one (the eastern) has had a core area of at least 10 000 m^2 centred about 100 metres northeast of the present-day buildings of Sandegård. The rather smaller western settlement of about 3000 m^2 is centred about 120 metres north of the farm buildings. They each probably represent large stationary farm complexes, both with settlement continuity from the Roman Iron Age to the Viking Age. The find distribution maps (Fig. 9c,d) show that the greatest concentrations of finds, including nearly all the gold finds, correspond roughly to the two areas with markedly elevated phosphoric acid values. The trial corings suggest that the associated marginal or workshop areas with, among other things, various kinds of pits, covered large areas around the settlement core. The sieved samples in particular have demonstrated extensive smithing activity in the marginal areas which appear primarily to be associated with the settlement from the Roman Iron Age. The distribution of, for example, ingots of precious metals and bronze, a pair of crucible tongs as well as casting remains in the top-soil (including clay slags with adhering gold) suggest, on the other hand, that finer metalworking took place within the central area of the settlement site.

The main impression from the metal finds, particularly the fibulae and other jewellery, is that they represent a mixture of eastern and western types in all periods. Even though most of the finds are not significantly different from those which can be collected at other settlement sites on Bornholm, the proportion of high quality artefacts and precious metal from Sandegård is greater than at the majority of other settlement sites outside the Ibsker complex.

Ladegård, sb. 195, Klemensker parish[18]

The settlement site at Ladegård lies on a broad ridge close to the western edge of the town of Klemensker. From the site which is situated about 100 metres above sea level, the terrain falls sharply and opens up to give

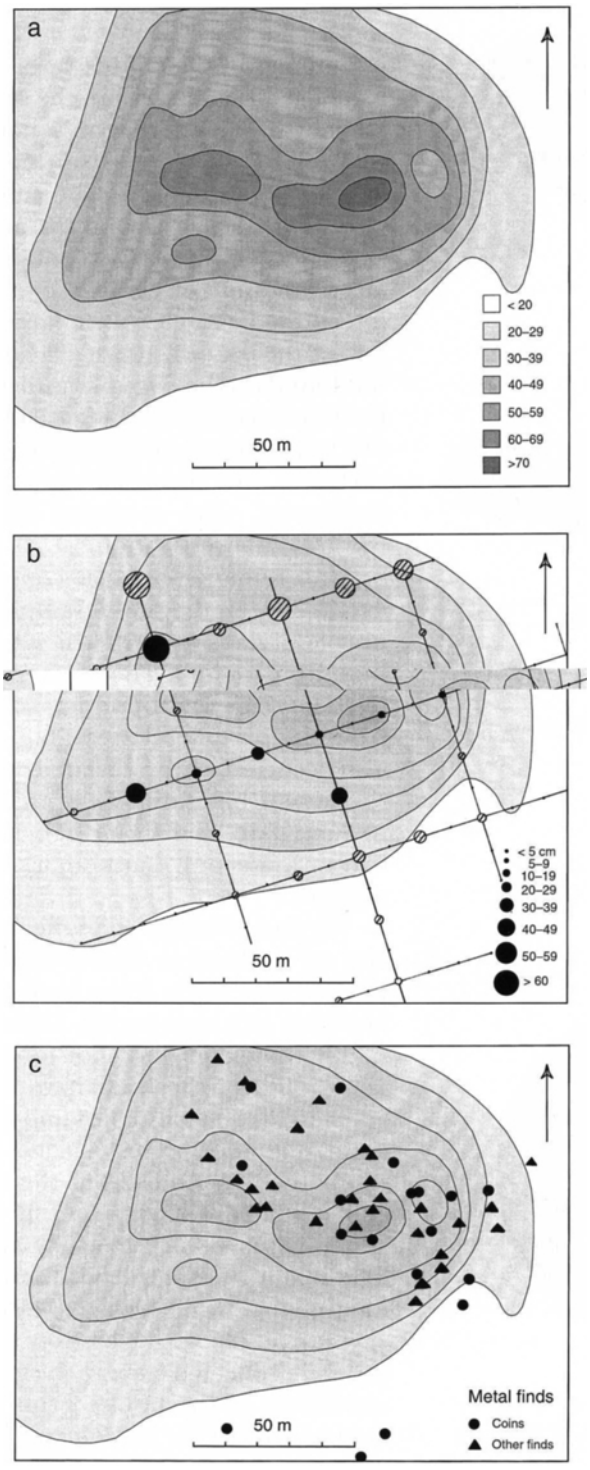

Fig. 19. The settlement area at Ladegård, sb. 195, Klemensker parish. Sampling programme 1999. (a) Phosphate map, (b) thickness of the culture layer, (c) coins and other finds from detector reconnaissance.

Fig. 20. Silver beads, hack silver and fragments of bronze jewellery from detector reconnaissance on the Viking Age settlement site at Ladegård. Photo: National Museum (disc), others M. Watt.

a broad view to the west over the Baltic Sea. The soil in the area consists of sandy clay in which the contours of a single large long house with curved walls can, in dry summers, be seen as growth differences in the crops.

The settlement site was first recorded in 1981 during registration of Klemensker parish[19]. Later the area was subjected to detector reconnaissance at regular intervals by amateur archaeologist Kaj Pedersen.

Sampling. During the extensive investigation in 1999, 100 phosphate samples were collected on a 40×40 metre network, covering an area of c. 25 000 m^2. The results of the analyses show that the phosphate content of the top-soil is elevated over an area of about 10 000 m^2 with a c. 100 metre long east-west orientated core area around the long house where the phosphate values are greatly elevated (Fig. 19a). Within the core area there is a marked agreement between the high phosphate values and finds in the top-soil. In contrast, there are no high phosphate values corresponding to a small group of finds collected 50-60 metres further

[18] Bornholms Museum journal number 891.

[19] The parish registration was carried out by Finn Ole Nielsen and Lisbeth Pedersen in collaboration with, among others, amateur archaeologist Gert Møller Larsen.

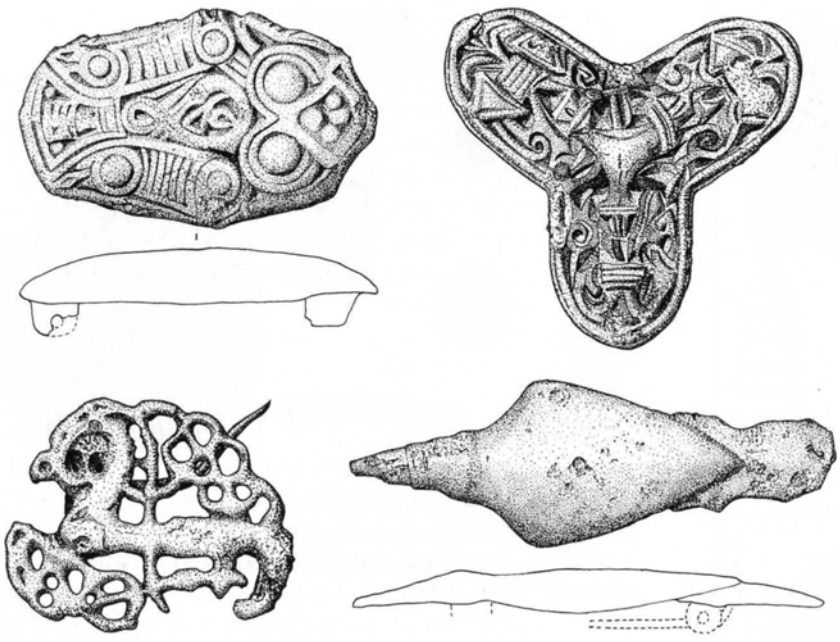

Fig. 21. Selected fibulae from Ladegård, found by detector reconnaissance. Size 1:1. Drawings: M.Watt.

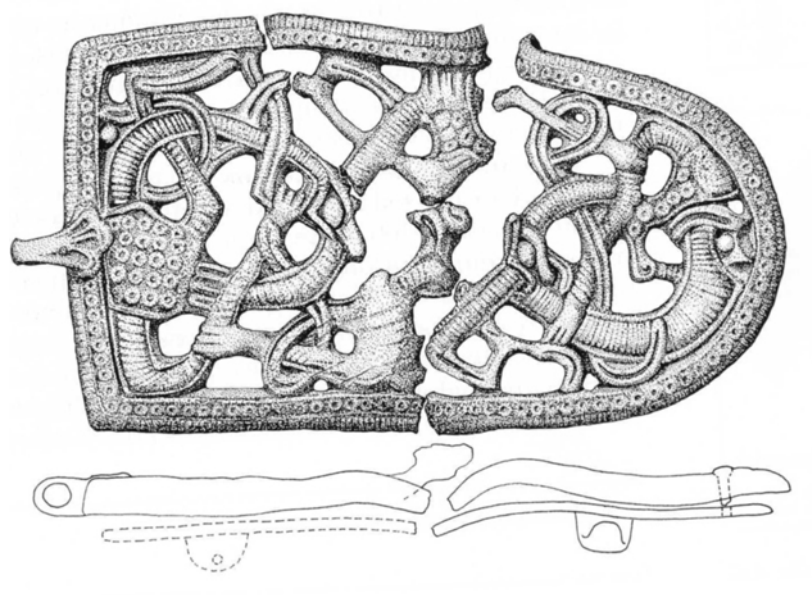

Fig. 22. Fragments of an open-work tongue-shaped brooch from Ladegård. Size 1:1. Drawing: M. Watt.

south.

Samples of the culture layer, collected at 30 points within the settlement area, showed that only modest remains of the actual settlement layers are preserved in the central part (Fig. 19b). In contrast, a (redeposited?) culture layer containing large amounts of burnt clay daub, interpreted as a clearance layer following the burning down of a house, was found on the edge of a gulley on the northern side of the settlement. Old vegetation layers and cultivation surfaces, with scattered settlement indicators, were recorded within the area of investigation.

Most remarkable is the common occurrence in the sieved samples of burnt out slags, a few of which had a high iron content. The greater part of these slags was found in samples from the peripheral areas, but they also occurred within the area where the actual habitation is presumed to have lain. Smithing debris, in contrast, was only found in a single sample.

The finds. Compared to the majority of settlement sites from this period, the finds from Ladegård are both rich and varied. Unfortunately the exact find spot for only about 30% of the finds have been recorded (primarily coins and hack silver) (Fig. 19c).

Of the 175 finds from the topsoil, five are dirhems and 15 are silver coins of 11th century type. The majority comes from the area around the long-house, whereas several pieces of hack silver (Fig. 20) were collected close to the gulley northwest of the house. From the central part of the settlement there are a number of fibulae, fragments of jewellery and fittings, of which a few date to the end of the Late Germanic Iron Age, and the remainder are from the Viking Age and the Early

Fig.23. Box-shaped brooch and an animal-head brooch of Gotlandic type, found by detector reconnaissance at Ladegård (right) and Hjulmagergård (note 20). Both brooches are filled with lead and could have had a secondary function as smelting cruibles. Photo: Bornholm Museum.

Middle Ages (Figs. 20-24). Among the Viking Age finds, mention can be made of fragments of a large tongue-shaped, openwork brooch ornamented in profile animal style (Jelling style)(Fig. 22), dating from the first half of the 10th century (Jan Petersen 1928, no. 137; Skibsted-Klæsøe 1999, 120). A Gotlandic box-shaped brooch which, like the animal-head brooch from a contemporaneous settlement at Hjulmagergård,

Fig. 24. Bronze arm ring, ornamented bronze foil and knife fitting from Ladegård. Size: 1:1. Drawing: M. Watt.

Åker parish, is filled with lead and may have been reused as a crucible (Fig. 23)[20].

Several tools and fragments of weapons and horse harness, weights of iron-core type and lead, a bolt lock, keys, spindle-whorls (or mane beads) of lead, fragments of bronze vessels as well as rotary hand querns of mica schist have also been found within the settlement area. According to information from amateur archaeologist Gert Møller Larsen (1989) a large number of iron artefacts (not mapped), including many lumps of pig iron and small ingots, have been retrieved particularly from the eastern part of the site.

The pottery collected on the surface is of Late Slavic, primarily Menkendorf type, while occasional sherds belong to vessels thrown on a rapidly rotating potter's wheel.

Overall evaluation of the settlement site. Apart from the sporadic finds of Roman Iron Age pottery in occasional sieved samples from the western margin of the area, there is nothing to suggest that there was habitation of significance at the site prior to the Late Germanic Iron Age. Several finds, including the thrown pottery, show that the site was in use at least until some time in the 13th century, when the settlement is presumed to have been moved to the site of the present day Ladegård.

As there are only very few finds from the settlement area from the High Middle Ages and the Renaissance, it is probable that most of the many iron artefacts retrieved from the top-soil, which are difficult to date, belong to the time when the site was in use (about 700-1200).

In the light of the unusual abundance and variation of finds (including weapons) and the evidence for ironworking, concentrated around a large long-house, it is tempting to identify the Viking Age Ladegård settlement with one of Bornholm's early royal manors. According to the Knytlinge Saga, among others, these are said to have existed already by the end of the 11th century, when Bornholm finally became part of the Danish kingdom.

[20] Detector find from Hjulmagergård, sb. 242. Bornholms Museum journal number 2146x1.

Conclusions

Through an extensive sampling programme at 31 find-rich Iron Age and Viking Age sites with preserved culture layers, it has been demonstrated, with the aid of selected examples, that for relatively modest expenditure it is possible to gain an overview of the size, primary structure and state of preservation of the settlements.

Together with analyses of detector and surface finds, the trial investigations have shown that at the great majority of settlement sites today ploughing has penetrated into layers from the Roman Iron Age, but pockets of preserved culture layer and structures with associated finds (postholes, pits) from later periods can be found in many places. Core samples have revealed that marginal areas still contain important information that can elucidate the economic foundations of the settlements.

The degree to which the settlements have been ploughed out, compared with the dating profiles, strengthens the suspicion that tremendous cultivation pressure has resulted in the destruction of primary settlement layers. Thus the majority of finds from the Late Iron Age and the Viking Age have today been ploughed up. It is therefore important that efforts are made to ensure that the finds are retrieved and that the registration of information in connection with surface and detector reconnaissance is of an acceptable quality.

The results of the trial investigations, together with analyses of the artifacts found by detector and surface reconnaissance have revealed a clear relationship between different settlement types and characteristic find and dating profiles. An understanding of the retrieval technique, studies of deviations and repetition patterns in the representation of the types gives an impression of local types and standard inventories from different periods. This can supplement and enrich the basic knowledge of the Iron Age society which has been gained, particularly in recent years, through the study of graves (Ørsnes 1966; Nielsen 1987; Becker 1990; Jørgensen 1988; Jørgensen 1990; Jørgensen & Jørgensen 1997; Jørgensen 1999).

Seen in a broader perspective, the detector sites on Bornholm are important because they lie in immediate geographical contact with the grave finds. Whereas the grave finds reflect a conscious exhibition of the deceased's social status, the diverse detector finds represent uncensored daily life.

If the development is followed chronologically, it can be established that settlements on Bornholm, both in the Roman and the Germanic Iron Ages, comprise both large and small units. The extensive sampling programme and find analyses have shown that many of the large black-earth sites were already established by the end of the Pre-Roman Iron Age. This certainly applies to the settlements around Sorte Muld (the Ibsker complex). With at least 25 more-or-less continuous settlement sites, the Ibsker complex developed, in the course of the Late Roman and Early Germanic Iron Age, into the largest and, without doubt, the most important economic and political centre on Bornholm. It was from here that developments on the island were controlled in the 5th-8th centuries .

Iron smelting has been documented by traditional investigations as early as the Pre-Roman Iron Age (Voss 1991, 172) and the frequent occurrence of smithing debris in the sieved samples, primarily from the preserved Roman Iron Age layers, show that working of iron took place locally at the individual sites.

In the course of the Late Roman Iron Age and the beginning of the Early Germanic Iron Age the number of finds increases at almost all the large settlement sites. At the same time, the differences between the dark-coloured and find-rich central areas of the sites, which comprise one or more farm complexes, become clearer relative to the marginal areas. The underlying settlement layers with overlapping and closely-spaced remains of buildings, which characterise central areas of the black-earth sites' show that building renewal in the Late Iron Age normally took place within the same restricted area.

The connection between the dark-coloured central areas with high phosphate values and finds of precious metals (including coins), jewellery and glass is striking throughout the whole of the Late Iron Age. Miscast and unfinished fibulae and metal stamps show that the finer metal craftsmanship probably took place within the central area of most of the large settlement sites in both the Late Roman Iron Age and the Germanic Iron Age. Conversely, no certain evidence has yet been documented from the settlements on Bornholm for jewellery production which can be dated to the Viking Age.

The marked increase in the number of finds, not just within the Ibsker complex, but at most of the find-rich settlement sites, appears to occur at the same time as the large Roman Iron Age cemeteries are

abandoned at the end of the Late Roman Iron Age (Jørgensen 1990, 86). However, the degree to which these developments are due to chance or may reflect changes in circumstances relating to ownership and inheritance, as suggested by Lars Jørgensen on the basis of studies of the grave finds, requires a more detailed analysis of the settlement material.

The fact that some of the settlement sites developed in the course of the Germanic Iron Age into central sites comprising several individual contemporaneous settlements reflects without doubt the general hierarchical structure of the society with roots in the Merovingian area. This is also suggested by Lars Jørgensen and Anne Nørgård Jørgensen on the basis of the rich grave finds (Jørgensen & Jørgensen 1997, 111ff.). The distance of several kilometres between the largest settlement sites (of the Sandegård type) suggests that each could have controlled a hinterland with smaller settlements.

We can provisionally surmise on how the power structures between the Ibsker complex and the other larger settlement sites developed in the course of the Late Iron Age. The amount of prestige finds, primarily precious metals and glass, from the largest settlement sites outside Ibsker (e.g. Sandegård, Møllegård, Agerbygård) suggests that the chieftain families elsewhere on the island tried to establish themselves as competitors to the Ibsker complex in the course of the Late Iron Age. The dominance of late finds in the dating profiles from these very sites suggests that they outlived the Ibsker complex.

From the end of the Late Germanic Iron Age and in the subsequent centuries a large number of new settlements were established, which in the majority of cases can be perceived as single farms represented here by Ladegård. A preliminary analysis of the metal finds from the sites, which are dominated by the easily recognisable Baltic ware, shows that more sites than previously imagined were already established in the 9th and 10th centuries (Watt 1988). The more than 300 localities which so far represent this rapidly growing settlement category illustrate a settlement pattern which is reminiscent of that from historical times (most recently Nielsen 1994; Wagnkilde 1999, Fig. 1).

In the course of the Iron Age and the Viking Age Bornholm had links with different cultural regions. The rich find material which is the result of many years of collaboration between local detector amateurs and professional archaeologists, will without doubt be important also in the future both for understanding the political development in the Baltic region and for the testing of various social structural models (e.g. Näsman 1998).

Margrethe Watt
Dyssegårdsvej 71B
DK-2860 Søborg

Translation: David Earle Robinson & Anne Bloch Jørgensen

Manuscript submitted Feb. 2000.

References

Becker, Carl Johan 1975: Hovedlinier i Bornholms Oldtidshistorie. *Bornholmske Samlinger* 1975.

Becker, Carl Johan 1990: *Nørre Sandegård. Arkæologiske undersøgelser på Bornholm 1948-1952.* Det Kongelige Danske Videnskabernes Selskab. Historisk-Filosofiske Skrifter 13.

Callmer, Johan 1999: Vikingetidens likarmade spännen. In: Hårdh, Birgitta (ed.): *Fynden i centrum. Keramik, glass och metall från Uppåkra.* Acta Archaeologica Lundensia Series in 8°, No. 30, pp. 201-20.

Hansen, Ulla Lund *et al.* 1995: *Himlingøje - Seeland - Europa.* Nordiske Fortidsminder Ser. B, Bd. 13.

Hartmann, Niels 1984: Spottest fosfatanalyse. *Arkæologisk felthåndbog* 1984. København, Nationalmuseet.

Hartmann, Niels 1991: Fosfatanalyse og dens anvendelse som alternativ recognosceringsmetode. *Arkæologiske udgravninger i Danmark* 1990, pp. 39-46.

Hårdh, Birgitta 1999: Näbbfibulan - ett vendeltida vardagsspänna. In: Hårdh, Birgitta (ed.): *Fynden i centrum. Keramik, glass och metall från Uppåkra.* Acta Archaeologica Lundensia Series in 8°, No. 30, pp. 145-62.

Iversen, Mette & Näsman, Ulf 1991: Mammengravens indhold. In: Iversen, Mette (ed.): *Mammen. Grav, kunst og samfund i vikingetid.* Jysk Arkæologisk Selskabs Skrifter XXVIII.

Jørgensen, Anne Nørgård 1999: *Waffen und Gräber. Typologische und Chronologische Studien zu skandinavischen Waffengräbern 520/30 bis 900 n.Chr.* Nordiske Fortidsminder Serie B,Bd. 17.

Jørgensen Lars 1988: Family burial practises and inheritance systems. The development of an Iron Age society from 500 BC to AD 1000 on Bornholm. *Acta Archaeologica 58,* 1987, 17-53.

Jørgensen, Lars 1990: *Bækkegård and Glasergård.* Arkæologiske Studier Vol. 8.

Jørgensen, Lars 1994: The find material from the settlement of Gudme II - Composition and interpretation. In: The Archaeology of Gudme and Lundeborg. *Arkæologiske Studier.* Vol. 10, 1993, pp. 53-63.

Jørgensen, Lars 1999: Fra nutidens pløjelag til jernalderens samfund - stormænd og håndværkere i Gudme. *Årbog for Svendborg & Omegns Museum* 1998, pp. 8-21. Svendborg.

Jørgensen, Lars & Jørgensen, Anne Nørgård 1997: Nørre Sandegård Vest. *A cemetry from the 6th-8th centuries on Bornholm.* Nordiske Fortidsminder Serie B, Bd.14.

Jørgensen, Lars, Nielsen, Finn Ole & Sørensen, Palle Ø. 1993: Jordbundsanalyse og forhistorisk bosættelse. *Arkæologiske udgravninger i Danmark,* 1992, pp. 21-27.

Jørgensen, Lars & Pedersen, Lisbeth 1996: Vikinger ved Tissø. Gamle og nye fund fra et handels- og håndværkscenter. *Nationalmuseets Arbejdsmark* 1996.

Klindt-Jensen, Ole 1957: *Bornholm i folkevandringstiden og forudsætningerne i tidlig jernalder.* Nationalmuseets Skrifter. Større Beretninger II. København.

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

Müller-Wille, Michael 1989: Fremdgut und Import östlicher Provenienz in Schleswig-Holstein (9.-12. Jahrhundert). *Bericht der Römisch-Germanische Kommission* 69, 1988.

Näsman, Ulf 1998: Sydskandinavisk samhällsstruktur i ljuset av merovingisk och anglosaxisk analogi eller i hvad er det som centralplatserna er centrala? In: Lars Larsson & Birgitta Hårdh (eds.), *Centrala Platser - Centrala Frågor. Samhällstrukturen under järnåldern,* Uppåkrastudier 1. Acta Archaologica Lundensia Series in 8°, No. 28, pp. 1-26.

Nielsen, Finn Ole Sonne 1982: Bopladsen ved Bækkegård i Østerlars. *Fra Bornholms Museum 1981,* 37-40.

Nielsen, Finn Ole 1994: Middelaldergårde på Bornholm. *Hikuin* 21, 125-138.

Nielsen, Henning 1997: Et regionalt rigdomscenter i Sydvestsjælland. In: Callmer, J & Rosengren, E. (eds.) *"... gick Grendel at söka höga huset ...". Arkeologiska källor till aristokratiska miljöer i Skandinavien under yngre järnålder.* Hallands Länsmuseers Skriftserie No 9/GOTARC Serie C. Arkeologiska Skrifter No 17, pp. 55-70.

Nielsen, Karen Høilund 1987: Zur Chronologie der jüngeren germanischen Eisenzeit auf Bornholm. Untersuchungen zu Schmuckgarnituren. *Acta Archaeologica 57,* 1986, 47-86.

Paulsson, Jonas 1999: Metalldetektering och Uppåkra. Att förhålla sig til ett detektormaterial. In: Hårdh, Birgitta (ed.): *Fynden i centrum. Uppåkrastudier 2.* Acta Archaeologica Lundensia Series in 8°, no. 30, pp. 41-58.

Persson, Kjell 1996: Phosphate test strips. A new equipment for direct soil-phosphate field analysis. *Laborativ Arkeologi* 9, pp. 57-60.

Petersen, Jan 1928: *Vikingetidens smykker.* Bergen.

Skibsted-Klæsøe, Iben 1999: Vikingetidens kronologi - en nybearbejdning af det arkæologiske materiale. *Aarbøger for Nordisk Oldkyndighed og Historie 1997,* pp. 89-142.

Vedel, Emil 1886: *Bornholms Oldtidsminder og Oldsager.* København, C.E.C. Gad.

Voss, Olfert 1991: Jernproduktion i Danmark i perioden 0-550 e.Kr. In: Charlotte Fabech & Jytte Ringtved (eds.): *Samfundsorganisation og regional variation. Norden i romersk jernalder og folkevandringstid.* Jysk Arkæologisk Selskabs Skrifter XXVII, 171-82.

Wagnkilde, Hanne 1999: Slaviske træk i bornholmske grave fra tiden omkring kristendommens indførelse. *Meta* 2, pp. 3-19.

Watt, Margrethe 1983: A Viking Age Settlement at Runegård (Grødby), Bornholm. An Interim Report of the Investigations 1979-82. *Journal of Danish Archaeology,* Vol. 2, pp. 137-148.

Watt, Margrethe 1988: *Bornholm mellem vikingetid og middelalder.* In: Festskrift til Olaf Olsen, 105-122. København. Det Kongelige Nordiske Oldskriftselskab.

Watt, Margrethe 1991: Sorte Muld. Høvdingesæde og kultcentrum fra Bornholms yngre jernalder. In: P. Mortensen & B.M. Rasmussen (eds.): *Fra Stamme til Stat i Danmark 2.* Jysk Arkæologisk Selskabs Skrifter XXII:2, pp. 89-106.

Watt, Margrethe 1996: Det antikvariske arbejde. *Fra Bornholms Museum 1994-95,* pp. 49-80.

Watt, Margrethe 1997: Overfladerecognoscering af jernalderbopladser. Nogle kildekritiske betragtninger over samarbejdet mellem arkæologer og detektoramatører. In: Callmer, J. & Rosengren, E. *"... gick Grendel at söka höga huset ...". Arkeologiska källor till aristokratiska miljöer i Skandinavien under yngre järnålder.* Hallands Länsmuseers Skriftserie No 9/GOTARC Serie C. Arkeologiska Skrifter No 17, pp. 131-143.

Watt, Margrethe 1998: Bopladser med Kulturlag - deres betydning for studiet af bosættelsesmønstre og "centerdannelse". In: Lars Larsson & Birgitta Hårdh (eds.), *Centrala Platser - Centrala Frågor. Samhällstrukturen under järnålders.* Uppåkrastudier 1. Acta Archaologica Lundensia Series in 8°, No. 28, pp. 205-16.

Watt, Margrethe 2000: Detektorfund fra Bornholmske bopladser med kulturlag - Repræsentativitet og metode.

Skrifter fra Odense Bys Museer Vol.5, 79-97.

Watt, Margrethe (in prep.): Sorte Muld - guldgubberne og Ibskerbygden.

Zimmermann, Haio 1992: *Die Siedlungen des 1. bis 6. Jahrhunderts nach Christus von Flögeln-Eekhöltjen, Niedersachsen.* Probleme der Küstenforschung im Südlichen Nordseegebiet 19.

Ørsnes, Mogens 1966: *Form og stil i Sydskandinaviens yngre germanske jernalder.* Nationalmuseets Skrifter. Arkæologisk-Historisk række XI. København.

Östergren, Majvor 1989: *Mellan stengrund och stenhus.* Theses and Papers in Archaeology 2. Visby.