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The Fensmark settlement and the almost invisible Late Palaeolithic in Danish field archaeology

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Traces of Late Palaeolithic activity in the North European landscape are practically invisible to modern field archaeology. The result is an almost complete loss of information about the presumably numerous activity sites from this period which each year are either damaged or destroyed by agriculture and development. This article addresses the root causes of this situation and outlines the possibilities for its mitigation. The difficulties involved in demonstrating the existence of Lateglacial settlements are illustrated via the investigation history of the Fensmark site on the margin of the bog, Holmegård Mose. This is a typical settlement of the Bromme culture, dated to 10,810 ± 120 radiocarbon years BP. The site's considerable unexploited research potential has been secured for the future by a landscape scheduling which protects a wide range of archaeological remains hidden beneath the soil.

Keywords: archaeology; method; assessment; trial excavation; *in situ* preservation; wetland; Lateglacial; Palaeolithic; Bromme culture; Denmark

A blind spot in field archaeology

The Late Palaeolithic era in Denmark extended over about three millennia, from c. 12,500 to 9700 calendar years BC (cf. Grimm and Weber 2008, Pedersen 2009, Figure 2; Weber and Grimm 2009). Even so, Danish archaeologists have for many years consistently recorded and investigated much fewer localities from this period than from any subsequent sections of prehistory, despite the fact that most of the latter are of significantly shorter duration. Furthermore, the majority of recorded Lateglacial activity sites were located incidentally as a by-product of investigations targeting ancient monuments of later date (cf. Petersen 2000, Skaarup 2001, 2002).

Until 2001, annual accounts detailing the number of investigated archaeological localities by period were published in the journal *Arkæologiske Udgravninger i Danmark*. Table 1 summarises the data given in the final five volumes (Rigsantikvarens Arkæologiske Sekretariat 1998, 1999, 2000, 2001, Kulturarvsstyrelsen 2002). The author's own experiences from the national administration of archaeological fieldwork between 2006 and 2011 suggest that the situation since then has remained unchanged: the Late Palaeolithic and (Early) Mesolithic periods are, year on year, represented by a lower number of investigations than subsequent periods.

The limited representation of Late Palaeolithic sites and excavations is not necessarily a consequence of there being fewer sites from the Lateglacial than from subsequent periods. The population density in agrarian prehistory was certainly markedly greater than during the Lateglacial. Conversely, settlement was much more stable; whereas the houses in an Iron Age village probably had to be replaced every 20 years or so, during the Lateglacial use of a typical activity site lasted perhaps as little as a couple of weeks.

It has been suggested that a significant cause of this scant representation could be that Late Palaeolithic activity sites were generally located differently (lower) in the landscape than the settlement of later periods and, as a consequence, they are less exposed to the effects of building and development works. This suggestion is, however, inconsistent with the observation that a considerable proportion of the localities so far recorded from the Hamburg, Federmesser, Bromme and Ahrensburg cultures lie relatively high up in the landscape (Rasmussen 1972, Fischer 1991, Holm and Rieck 1992, Petersen and Johansen 1993, Holm 1996, Petersen 2006, Riede *et al.* 2011). Neither does it tally with the fact that many new records are products of investigations directed at features and structures dating from agrarian prehistory (e.g. Andersen 1998, Fischer 1990a, Dehn *et al.* 1995, 2009, Nielsen 2000, Høier and Schilling 2001, Andersen in press, cf. Eriksen 2006). A more compelling reason for the under-representation is clearly the fact that Late Palaeolithic activity sites have very limited archaeological visibility. At least seven factors can be listed which have a limiting effect on archaeology's ability to identify localities from this period:

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Table 1. Archaeological fieldwork in Denmark between 1997 and 2001, number of reported investigations by period.

	Late Palaeolithic	Mesolithic	Unspecified stone age	Neolithic	Bronze age	Iron age
1997	1	26	11	111	97	103
1998	3	34	13	125	138	363
1999	1	28	5	157	142	369
2000	1	32	38	142	164	471
2001	2	29	20	134	193	409
Total, 1997–2001	8	149	95	669	734	1840
Period begins	12,500	9700	12,500	3950	1700	500
Period ends	9700	3950	3950	1700	500	1067
No. of years	2800	5750	10,800	2250	1200	1567
No. of localities per century	0.3	2.6	0.9	29.7	61.2	117.4

- The socially simple and geographically mobile existence of the period which resulted in people only leaving behind relatively small and artefact-poor activity sites with no immediately recognisable cultural deposits, features, stone constructions, etc. As a consequence, there is a risk of 'throwing the baby out with the bathwater' if the research potential of a locality subjected to trial excavation and assessment is judged solely on the basis of whether it contains features and structures or dark-coloured cultural deposits.
- The extensive disturbance resulting from the processes of graviturbation and cryoturbation during the Lateglacial has contributed to obscuring settlement traces from the period.
- Tree roots, burrowing animals, etc. have had a relatively long time, in which to disturb and obscure activity traces from this early cultural period.
- The extensive cultivation of winter crops, together with the widespread practice of sowing fields immediately after ploughing, makes it more difficult to carry out efficient field reconnaissance today than was the case, for example, in the 1960s and 1970s when Danish archaeology experienced an almost explosive increase in the number of Late Palaeolithic sites (Fischer 1985).
- The cultural traces from the Lateglacial normally occur at low concentration and with broad vertical distribution in light-coloured sandy layers which are easily confused with the 'natural subsoil' (Andersen 1973, Fischer 1990a, Holm 1993).
- The methods presently employed in archaeological evaluations and excavations, characterised by machine removal of the soil, are generally unsuited to the observation of activity traces from the Lateglacial.
- Difficulties associated with the correct dating of small Lateglacial flint assemblages which only rarely contain characteristic projectile points or *zinken* in such an intact state as directly to facilitate a typological–morphological date.

The latter problem of dating small Lateglacial flint assemblages is probably not of equal significance throughout all parts of the period. The large tanged points of the Bromme culture presumably have a greater chance of being found during a trial excavation. Field archaeologists can also fairly readily and reliably date them as this type is relatively characteristic and frequently mentioned in the literature. The chronologically significant projectile points of the other Lateglacial cultural groups are generally smaller in size and have also enjoyed less academic attention to date. These circumstances are probably reflected to some extent in the current records of Late Palaeolithic activity traces in the Danish Agency for Culture's national database 'Sites and Monuments'. A search for all activity traces from the Hamburg, Federmesser, Bromme and Ahrensburgian cultures (17 May 2012) resulted in 12, 5, 123 and 17 localities, respectively. A more general search for Late Palaeolithic and Palaeolithic records yielded 173 and 358 localities, respectively.

The differences between the totals for the four cultural epochs are possibly also, to some extent, a reflection of a slow rate of the first human immigration as well as differences in climate and variation in the duration of the respective cultures. The suggestion that difficulties associated with typological dating also play a significant role will be substantiated below via two examples relating to, respectively, the Federmesser and Ahrensburgian cultures. The former was probably of more or less the same duration as the Bromme culture. In chronological terms, the Federmesser culture apparently belonged to the climatically mild first half of the Allerød period (GI-1c according to Björck *et al.* 1998, cf. Blockley *et al.* 2012), whereas the Bromme culture was, by all accounts, associated with the second half of the same climatic period (GI-1a and probably the initial part of GS-1, Fischer 1991, Pedersen 2009, Fischer *et al*. 2013).

The extent of the dating-related difficulties is apparent from the outcome of the first excavation season at the Slotseng site. This research project was led by one of Denmark's leading experts in the Late Palaeolithic. On the basis of several years of intensive field reconnaissance at

the site, yielding a number of artefacts from the Hamburg culture and a few tanged points of Bromme character, the excavation director was expecting to excavate a partly ploughed-up flint concentration dating from the Hamburg culture. To his surprise, however, the site turned out to be an artefact-rich, heavily ploughed-up flint accumulation from the Federmesser culture (Holm 1993). A similar experience awaited archaeologists from the museum in Vordingborg when, in 2002, they began a research excavation at a well-known locality from the Bromme culture, Eskebjerg (Rasmussen 1972) and subsequently discovered the most artefact-rich flint accumulation from the Ahrensburgian culture yet encountered in Denmark (Pedersen 2009, cf. Petersen and Johansen 1993, p. 30).

Danish field archaeology's difficulties with respect to dating small flint assemblages resulting from archaeological reconnaissance and evaluations can in part be due to archaeologists not keeping up to date with research developments. It is actually often possible to arrive at an approximate date solely on the basis of the flint debitage recovered from Lateglacial localities. In some instances, this date can be further supported by characteristic bluish-white surface transformation of the flint ('skimmed milk patina'). These observations are not particularly new, but have regrettably only been published in a preliminary fashion and/or in not particularly accessible publications (e.g. Andersen 1973, Fischer *et al.* 1979, Fischer 1990a, Madsen 1992, 1996, Johansson 2003, Petersen 2006). The focus on flint debitage evident in the artefact illustrations below should be seen as a contribution to the dissemination of professional knowledge on the subject.

The problem of identifying Late Palaeolithic activity sites in the course of normal field-archaeological procedures is very closely associated with current practices for the execution of archaeological evaluations. These are predominantly carried out by the cutting of 2–4 m wide trial trenches, whereby the topsoil is rapidly removed in order to search for cultural deposits, pits and postholes in the subsoil (Kulturstyrelsen 2012). Danish archaeologists have long been aware of the fact that this approach leads to a marked under-representation of Late Palaeolithic and Early Mesolithic localities (e.g. Petersen 2000, Eriksen 2006). Only the Late Mesolithic Ertebølle culture, with its often extensive and easily discernible cultural deposits extending along the contemporary coastline, apparently has an archaeological visibility which prompts an intensity of investigation approaching that seen for the later parts of prehistory. The Neolithic also appears to have a marked blind spot: excavations of sites from the East Danish Single Grave culture are somewhat of a rarity, despite the fact that the abundance of this culture's hollow-ground thick-butted flint axes demonstrates that the Zealand archipelago must have been intensively occupied during this period (Glob 1945, Figure 90).

The fact that the Late Palaeolithic also constitutes a blind spot in the developer-funded field archaeology of other NW European countries was established at a conference in 2002 (Rensink and Peeters 2006). In order to compensate for the low archaeological visibility which characterises early parts of the Stone Age, archaeologists in the Netherlands and Belgium recommend the implementation of systematic auger survey of undisturbed sand layers with the potential to contain settlement layers from these epochs. In order to function optimally, this approach should be combined with wet sieving of soil samples. It has been applied for many years in these countries and has led to the identification of numerous significant, in research terms, Stone Age localities (e.g. Kooijmans 2001a, 2001b, Kooijmans and Jongste 2006, Van Gils and De Bie 2006, Ryssaert *et al.* 2007).

Should a Danish archaeologist, when carrying out a traditional evaluation or an actual excavation, quite exceptionally happen to direct the bucket of the excavator down into undisturbed layers containing traces of Late Palaeolithic activity, they would very probably be guilty of causing the destruction of a large part of the site. The most find-rich parts of the most artefact-rich and intact settlement deposits from the Bromme culture occupy an area of only about 6–10 m in diameter (Andersen 1973, Fischer and Nielsen 1987, Johansson 2003, Pedersen 2009). There is therefore a good chance that a mechanical excavator will cut right into the centre of such a site before the latter is even discovered. Other settlements from this period have proved to have find-rich areas, which are significantly smaller. This is true, for example, of Trollesgave: over most of its area of c. 300 m^2, the number of artefacts was so modest that the site would in practice be invisible given a standard evaluation using a mechanical excavator – unless one of the flint workshops, measuring 1–2 m in diameter, happened to be struck directly (cf. Fischer *et al.* 1979, Fischer 1993a).

Despite the fundamental loss of information that would result from the hard-handed trial trenching approach outlined above, a discovery of this type must nevertheless be welcomed. Experience shows that where there is one concentration of Late Palaeolithic finds there are often others of the same type in the immediate vicinity (cf. the example given below from the Fensmark site and other areas on the margins of Holmegård Mose). The discovery can, therefore, with appropriate recording in the national archaeological database, result in a heightened archaeological awareness with respect to future development works in the local area.

So little flint knapping took place at some activity sites from the Bromme culture that, in practice, it has proved to be almost impossible to demonstrate their existence even by manual excavation of closely spaced 1 m^2 test pits at locations where field surface collection has demonstrated

the presence of extensive Late Palaeolithic activity (Nilsson 1989). The situation in Denmark and neighbouring countries appears to be no better with respect to the other Late Palaeolithic epochs, where the quantity of worked flint usually does not exceed what is normally seen at Bromme localities (Madsen 1983, Holm 1993, Petersen and Johansen 1993, Pedersen 2009).

The Fensmark site (Figures 1 and 2) exemplifies these aspects of archaeological invisibility. At the same time, it is also a typical example of the most commonly recorded sites from the Bromme culture: small flint concentrations located on a sandy plateau in direct association with a contemporary lake where the artefact assemblages are characterised by 'domestic activities' (cf. Fischer 1991, 1993a).

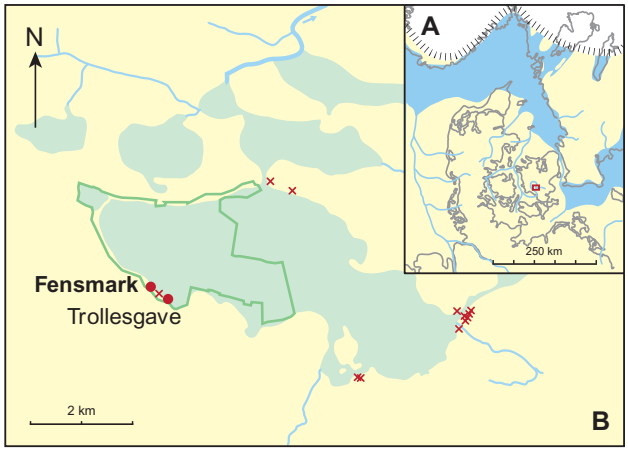

Figure 1. Location of the study area and the relations between land, water and the inland ice in mid-Allerød times, c. 13,500–13,000 calendar years BP (A), together with well-defined Lateglacial settlement sites associated with the Holmegård basin (B). The distance between the Fensmark and Trollesgave settlements is c. 250 m. The irregular polygon marks the extent of the landscape scheduling, which protects archaeological remains hidden beneath the soil. Figure modified from M. Houmark-Nielsen (2012, Figure 14–13), Fischer *et al.* (1978), Fischer (1985), and Johansson (2003).

The investigations at Fensmark

Late Palaeolithic activity sites are usually found and identified by people with a particular interest in the period and, thereby, an acquired knowledge of its material culture and of the localisation of such sites. Many of the sites discovered to date have turned up as the result of targeted and persistent reconnaissance work by amateur archaeologists and archaeology students. This was also the case with the Fensmark site. The first finds were picked up at the site in 1965 by trainee accountant, subsequently archaeologist and museum curator, Per Noe Jacobsen (Johansson 2003, p. 95). The fact that, in addition to postglacial artefacts, there were also activity traces from the Bromme culture at the site was securely established in 1970, when amateur archaeologist Axel D. Johansson found the first tanged point of Bromme type. In subsequent investigations by the author of this article in the period up until 1981, a considerable assemblage of Late Palaeolithic finds was recovered from the site. The fieldwork included both surface collection and trial excavation.

Collection from the field surface took place up to several times in the course of a winter, after the area had been ploughed. This work was, as far as possible, carried out at times when a long period of rainfall or strong spring winds had ensured that the artefacts lay clean and easily visible on the surface. The finds distribution was in the first instance compared visually with the terrain and soil characteristics. It became apparent that scrapers, burins and blades of Bromme character were associated with a sandy plateau, bordered on one side by a heavy clay slope and on the other by wetland deposits. The indications of Late Palaeolithic activities occurred in particular on a small weakly defined promontory – the location which on the basis of the subsequent excavations is referred to as find concentration A.

During the later years of the investigations, all finds – cores, blades (L ≥ 2B) and retouched tools from the field surface – were plotted in to the nearest metre, using a

Figure 2. The SW end of Holmegård Mose where intensive field reconnaissance along the edge of the bog has revealed several Late Palaeolithic activity areas. To the right, a white excavation tent can be seen at the Fensmark site and the spoil heaps generated by the excavation of the Trollesgave settlement are evident to the right of the small group of trees. A further site from the Bromme culture has been discovered between the two localities.

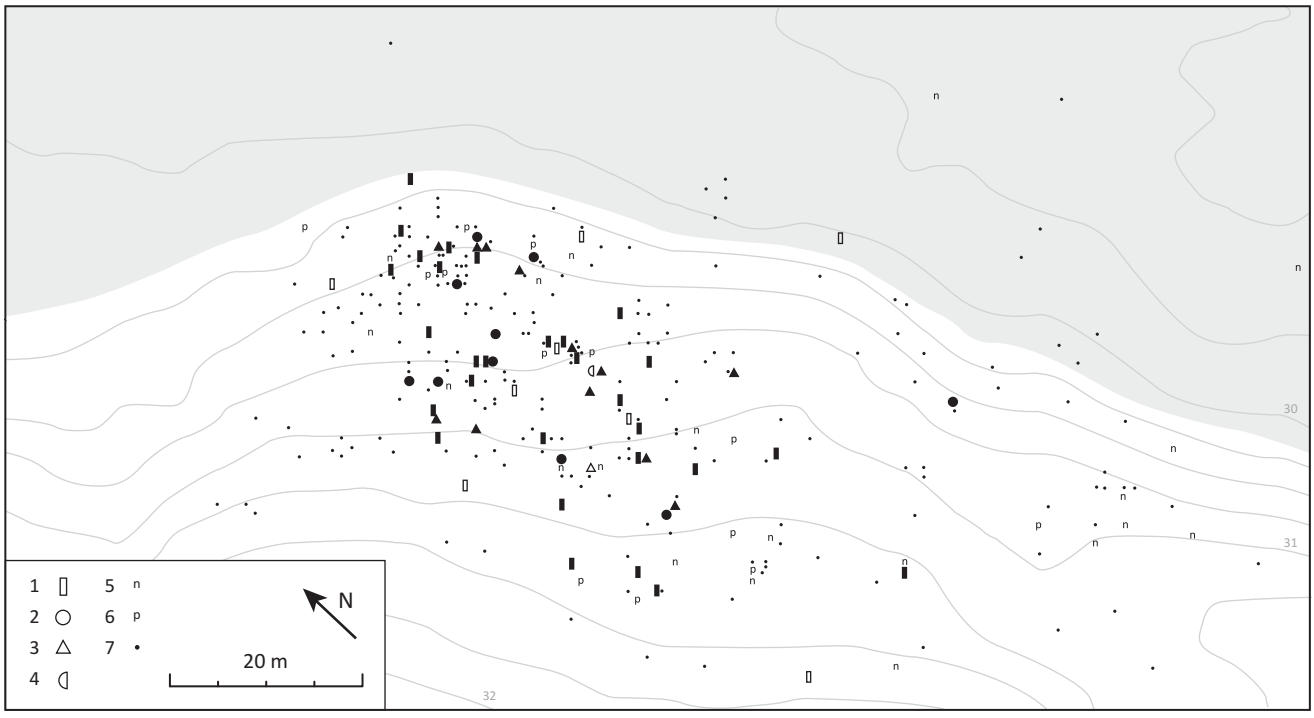

Figure 3. Fensmark: finds from the field surface plotted in relative to the height contours for the terrain (equidistance 0.25 m). Artefacts of Late Palaeolithic character are shown with a solid symbol when they result from a representative random sample, taken when the entire site area was searched in a uniform manner. 1: blade, Late Palaeolithic; 2: scraper, Late Palaeolithic; 3: burin, Late Palaeolithic; 4: Federmesser; 5: Neolithic artefact; 6: postglacial artefact (unresolved whether Mesolithic or Neolithic); and 7: artefact, unspecified Stone Age.

measuring tape and optical square. The results are given in Figure 3, which shows that flint artefacts of Late Palaeolithic character were concentrated within an area of c. 65 × 25 m. In this area, and continuing further towards the SE, there were also a few Mesolithic artefacts and numerous Neolithic finds. Artefacts of Late Palaeolithic character appeared to be mostly concentrated on the above-mentioned weakly defined 'promontory' in the NW part of the investigated area.

Trial excavations (Figures 4 and 5) took place in 1974 and 1975. Their primary aim was to find intact settlement layers and scientifically datable wetland deposits with cultural traces – corresponding to what had already been demonstrated at the neighbouring site of Trollesgave (Fischer and Mortensen 1977, Fischer 1990b).

Apart from some of the wetland deposits, all the soil was sieved using a mesh size of 4 × 4 mm. The finds were divided up according to geological layers in horizontal units of 1 × 1 m. In the examination of the layers beneath the plough soil the investigation units were often reduced to 0.25 m^2. Larger and chronologically more significant artefacts were mostly plotted in to the nearest centimetre, in three dimensions (Figure 5).

In the first instance only the plough soil was investigated. The entire area where field reconnaissance had yielded artefacts of Late Palaeolithic character was covered by a regular network of 1 m^2 test pits, situated 9 m apart (Figure 4). The astonishing result of this considerable investment of effort was that traces of Late Palaeolithic settlement were practically none existent: a total of 13 flint implements with retouch were encountered, of which only two appeared to be of Late Palaeolithic date (Figure 6).

Subsequently, in the central part of the investigation area, a series of supplementary test pits was laid out midway between those, which had already been dug. These additional efforts invested in sieving plough soil did not lead to further finds of retouched implements of Late Palaeolithic character. Consequently, the Lateglacial settlement remained virtually invisible to this systematic and intensive investigation of the plough soil. This permits the following conclusion to be drawn with respect to future investigations of totally or partially ploughed-over Late Palaeolithic activity sites: plotting in of artefacts found on the field surface, at a total cost of about 10 man-days, gave a significantly more precise picture of the presence of

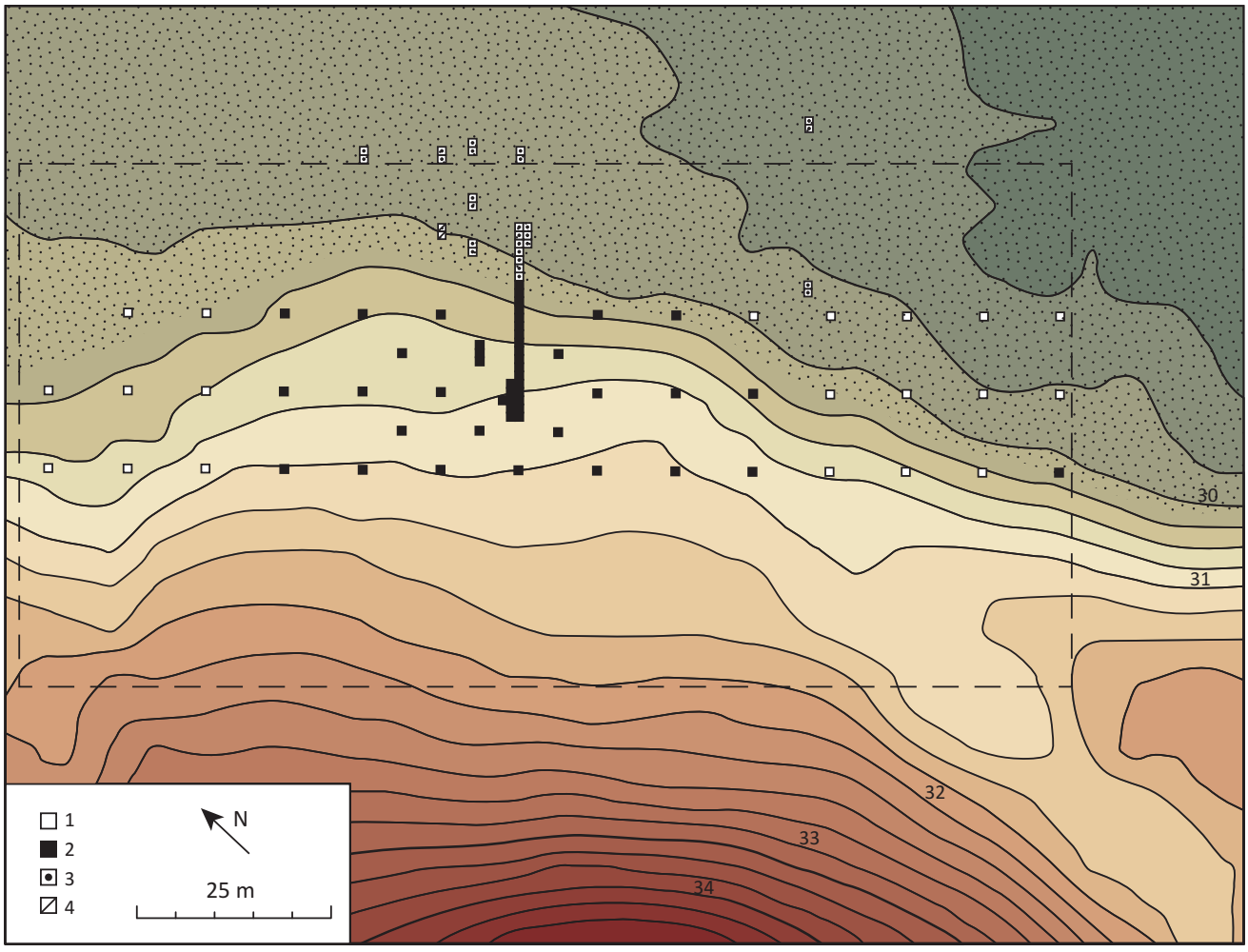

Figure 4. Excavation trenches and geomorphology. The extent of gyttja and peat deposits is marked by dot shading. The broken line denotes the extent of the area shown in Figure 3. 1: plough soil sieved, not excavated deeper; 2: both plough soil and sand layers sieved; 3: the layers beneath the plough soil excavated with shovel and trowel; 4: plough soil sieved and layers beneath the plough soil excavated with shovel and trowel.

Lateglacial habitation at the locality than the c. 25 man-days invested in sieving of random samples from the plough soil.

It was first when the excavation of test pits was continued down into the pale-coloured sandy layers beneath the plough layer (Figures 5 and 18) that secure contact was made with Lateglacial settlement traces. These sediments showed no similarity to the dark-coloured cultural layers, which often characterise settlements from later prehistory. On the contrary, they have much more in common with the kinds of deposits, which in excavations in plan of, for example, Iron Age settlements are often termed 'the subsoil' or 'the natural' – expressions which in themselves can contribute to diverting attention away from possible traces of Late Palaeolithic activity.

It turned out that beneath the centre of the concentration of finds in the plough soil to the NW there were significant quantities of flint artefacts of Bromme culture character (cf. Figures 6 and 7). Even greater quantities of Late Palaeolithic flint artefacts were encountered beneath the southern extension of the same flint accumulation in the plough soil. In the following, these two flint concentrations are referred to as, respectively, Fensmark A and B. Due to the relatively limited number of test pits, the possibility cannot be excluded that there are further Late Palaeolithic artefact accumulations in the sand beneath the plough soil at the site. Finds concentrations A and B are located in the centre of a plateau, which slopes slightly down towards the area of the Lateglacial lake. The soils of the activity areas are characterised by well-drained sandy sediments.

Figure 5. Investigation of the central part of Lateglacial Fensmark B, incorporated within a solidly cemented pale-coloured sand layer. At this point it contained flint artefacts and a hammerstone, but was otherwise hardly distinguishable from the 'natural subsoil'.

Finds from the plough soil

A significant proportion of the finds from the plough layer can, with certainty or great probability, be assigned to the Neolithic, more precisely the Early Funnel Beaker culture. Intensive field reconnaissance around the entire Holmegård basin (cf. Fischer *et al.* 1978) has demonstrated that this period is represented by settlement traces on a number of sandy plateaux at the edge of the bog – in several instances directly on top of activity sites from the Bromme culture. Settlement during the Early Funnel Beaker culture has thereby played a systematic part in reducing the possibility of identifying sites of Late Palaeolithic activity around the former lake basin. The same problem is true of the settlement from the Maglemose culture, which was located on 'dry land' around the Holmegård basin (Fischer 1993b, Schilling 2003, Kulturarvsstyrelsen 2004, p. 9). There are presumably similar barely recognisable Lateglacial elements at numerous other artefact-rich Mesolithic and Early Neolithic settlements located on the edges of bogs in Northwestern Europe (cf. Fischer and Nielsen 1987).

The intensive surface collection of flint artefacts over a period of 16 years at Fensmark resulted in the recovery of a total of four Late Palaeolithic tanged points (Figure 8a–d) and a significant number of cores, flakes, scrapers and burins which, on the basis of their production technique, size and morphology, can with great probability be assigned to the Bromme culture. The same date is possibly also appropriate for a flint point, which was found on the field surface immediately above the west end of Fensmark B (Figure 8e). Its dimensions and form, including its steep in parts bilateral side retouch as well as its lack of micro-burin facet, speak more in favour of a Late Palaeolithic 'Federmesser' or 'Rückenspitze' than a Mesolithic lancet microlith (cf. Johansson 2003, p. 95).

Finds beneath the plough soil on the plateau

On the basis of the artefacts recovered from the undisturbed sand deposits at Fensmark A, it is only possible to establish that this was an activity site, with some flint knapping, dating from the Bromme culture. The frequent finds of Late Palaeolithic artefacts resulting from field collection on this part of the site suggest that flint concentration A has been damaged by ploughing, to a considerable extent. Fensmark B is significantly better preserved. In the latter, the artefacts mostly lay some way down into the sand – generally more than 10 cm below the base of the plough soil – within a diffuse horizon of up to about 20 cm in thickness. A small number of postglacial types were encountered in the upper centimetres of the sand, and in a pit, which cut down through the Late Palaeolithic horizon. In order to exclude such later elements from consideration, mention will only be made below of the artefacts recovered from the sand deposits in the southernmost 9 m^2 of the excavation trench (see Figure 16); these yielded a total of 2385 pieces of worked flint (>4 × 4 mm).

Cores and flakes

The 19 cores (Figure 9 and 10) recovered from the undisturbed sand deposits at Fensmark B were produced by working nodules of moraine-worn flint. The raw material was a relatively brittle and homogenous flint of Danien type (Thomsen 2000), which would have been well-suited to the controlled detachment of regular flakes. The material would originally have been dark grey to greyish-black in colour. The majority of the flint artefacts from the site have undergone a bleaching process resulting in a light grey colour. This phenomenon is seen most markedly in flint originating from the interior of the nodules (Figure 19 and 20) and is a characteristic feature of many Late Palaeolithic assemblages from Denmark. Occasional pieces also show a bluish-white surface transformation ('skimmed milk patina'; Figure 15a), which characterises many Late Palaeolithic flint assemblages (Petersen 2006). More frequently the Fensmark B flints display a faint yellowish patina (e.g. Figures 9 and 11).

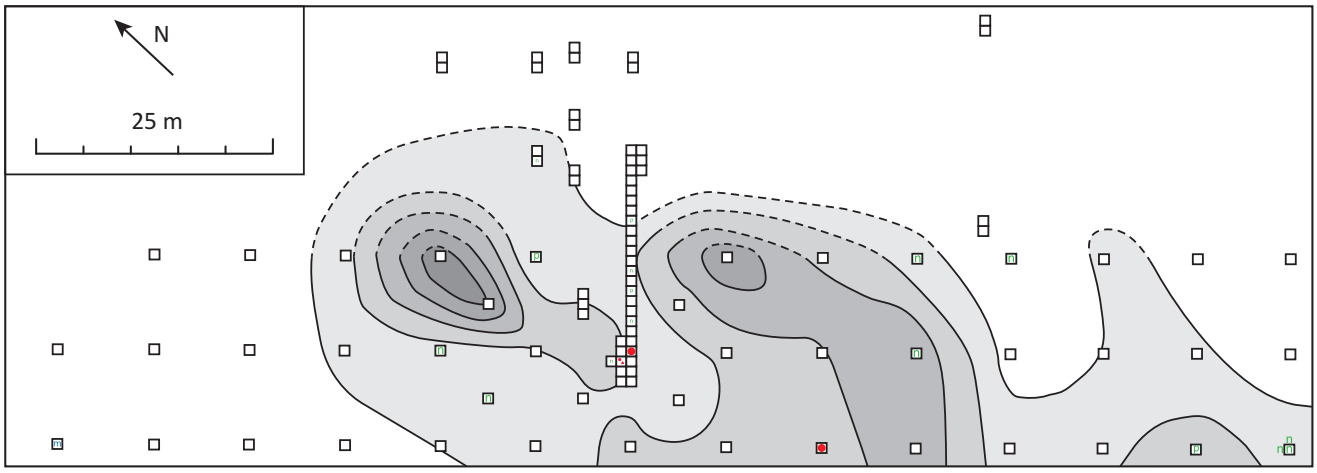

Figure 6. Distribution of finds in the excavated parts of the plough soil. The contours denote 20, 40, 60, 80 and 100 pieces of worked flint per m^2, respectively. The key is the same as on Figure 3. Large symbols mark finds from test pits arranged in a regular array, small symbols mark artefacts resulting from later extensions of the test pitting. Solid symbols mark artefacts with retouch (two scrapers) of Late Palaeolithic character. It is clear that a significant proportion of the finds were of Neolithic date and that the labour-intensive sieving of the plough soil did not provide a basis for pointing out the location of Late Palaeolithic activity areas.

The flint knapping at Fensmark B was clearly directed towards the production of large longish flakes with regular sharp edges. Some characteristic successful examples are shown in Figure 11a–d. Judging from the form and size of the bulbs of percussion and, not least, the crushing and the percussion scars on the platform remnants, knapping was carried out exclusively with hammerstones. The finds recovered from the 9 m^2 dealt with here also included a heavy hammerstone (weighing 140 g) of granite (Figures 5 and 12).

The cores and blades from Fensmark B are characteristic of the flintworking of the Bromme culture. They reflect a relatively simple craft tradition, involving heavy consumption of raw material, which stands in stark contrast to the situation in both the preceding Hamburg culture and the subsequent Ahrensburgian culture (Fischer 1990a, Madsen 1992, Weber 2012). In terms of flint technology – and probably also in its broadest sense – the Bromme culture can be perceived as the first complete adaptation to the environment in the flint-rich moraine areas of Southern Scandinavia (Fischer 1993a).

Flakes with use-wear traces

Most of the more than 2000 flakes can be considered to be debitage. However, use-wear traces visible to the naked eye demonstrate that some of the largest flakes were actually used in various ways. The commonest of these

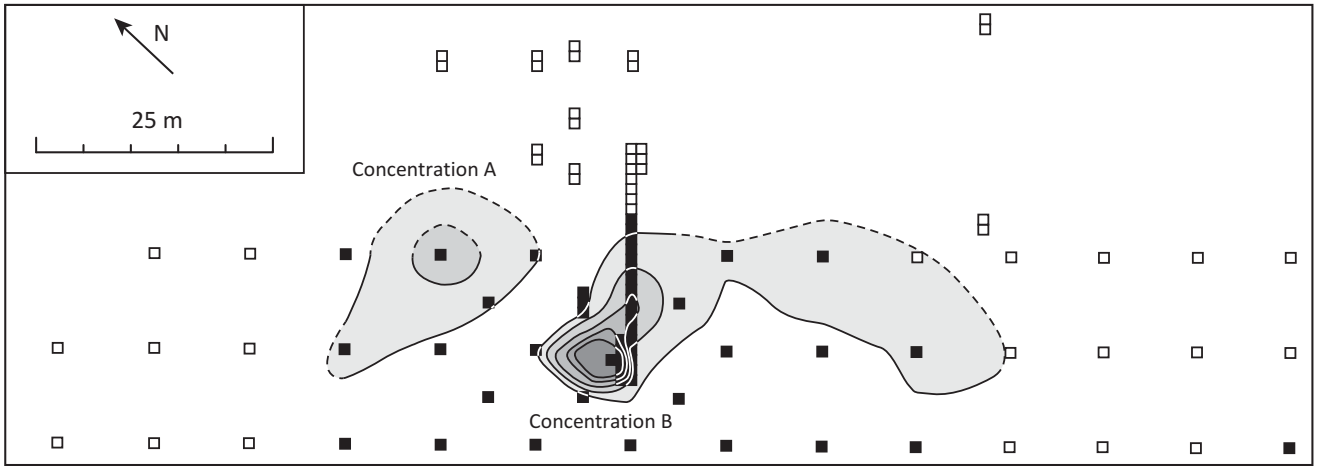

Figure 7. Number of pieces of worked flint per m^2 from all the artefact-containing layers. The contours represent the values 100, 200, 300, 400 and 500. The parts of the excavation where all excavated layers were sieved are highlighted in black.

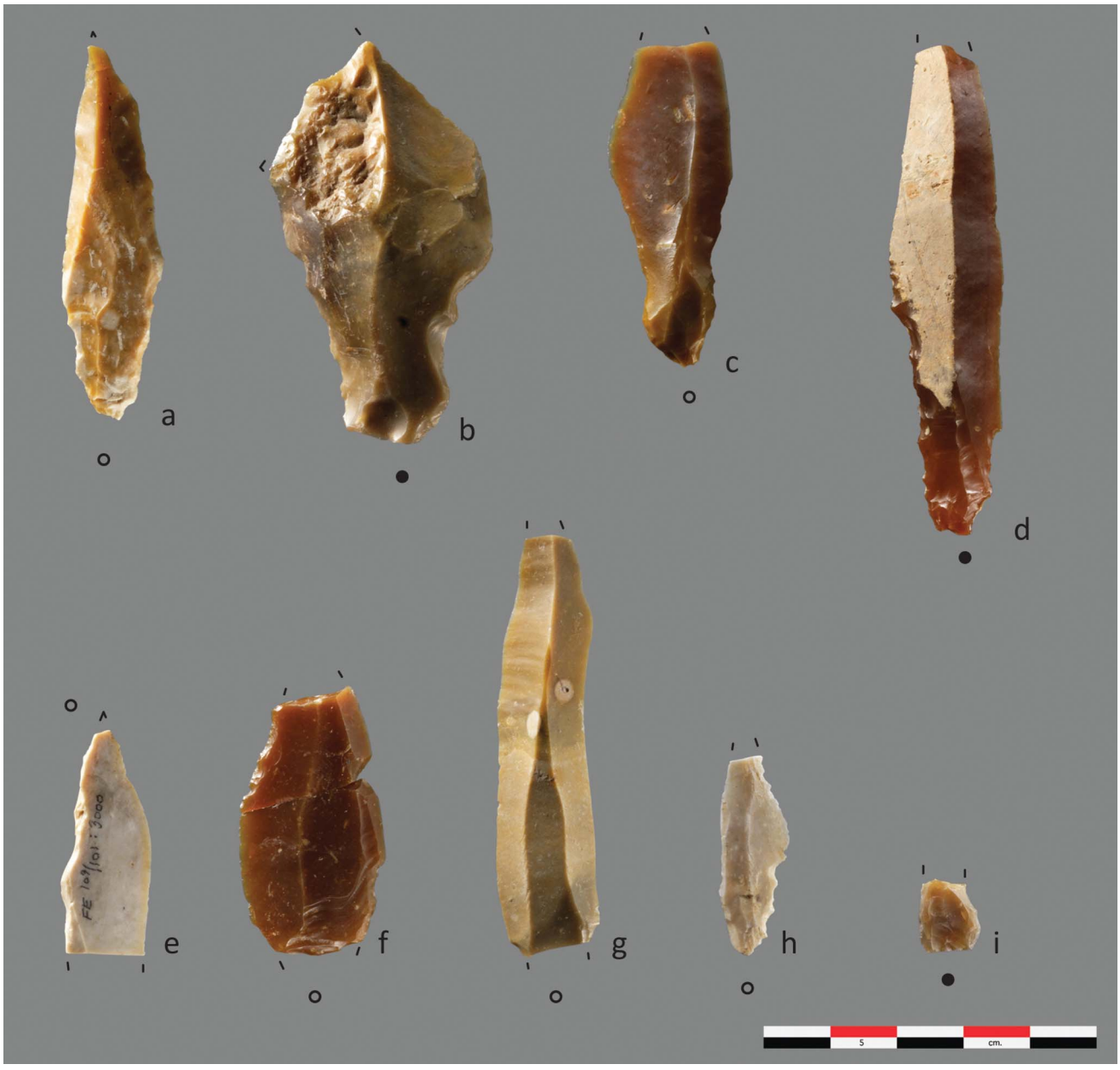

Figure 8. Flint points from surface collection (a–e) and evaluation trenches in find concentration B (f–i). Tanged points (a–d and f–i), possible 'Federmesser' (e). The following symbols are employed: ● platform remnant preserved; ○ percussion bulb end, platform remnant lacking. Scale in centimetres.

traces comprises use-wear retouch on longish, sharp-edged pieces, which were probably used as knives.

One unusually large flake (Figure 13) shows heavy crushing with step-like terminations and 'soft' percussion bulb negatives. These use-wear traces suggest that this artefact was used to chop a relatively hard material (such as reindeer or elk antler) – i.e. as a kind of axe. Blades and large flakes with related use-wear traces are known from a number of NW European flint assemblages from the Lateglacial and from Early Pre-Boreal times (Rust 1943, Tafel 47, Taute 1968, Tafel 81, Andersen 1973, Figure 76, Fagnart 1988, Barton 1991, Johansson 2003, fig. 29).

Tools with retouch

The most important typological-chronological guide type in the flint assemblage, the tanged point, is represented by four examples. They are of fairly unattractive appearance (Figure 8) as they show heavy use damage (Figure 8g and probably h and i) and evidence

Figure 9. Characteristic unipolar core from Fensmark B. Like the typical blade cores from other sites of the Bromme culture, it is of roughly conical form with less than half of the perimeter consisting of the original surface of the flint nodule. Scale in centimetres.

Figure 10. Irregular bi-polar core with one dominant platform. Scale in centimetres.

of exposure to fire (Figure 8i). In each case, the tang has been formed at the proximal end of the flake with the retouch extending from the percussion bulb side. Part of the platform remnant is preserved on the fire-damaged example. A small and somewhat clumsily retouched example (Figure 8h) was made from a blade, which lost its platform remnant at the moment of detachment.

All the 15 scrapers from Fensmark B were made from flakes with relatively straight and roughly parallel longitudinal edges (Figure 14). One has a scraper edge at one end and a burin edge at the other (Figure 14d).

The assemblage includes 45 burins (Figure 15), including the above-mentioned combined scraper plus burin. In their manufacture, use was most often made of regular oblong flakes. Many of them have deliberately produced edge retouch. The burin edges are generally robust and distinctly shaped.

On the burin edges use-wear retouch is frequently visible. Similarly, several of the scrapers show wear polish along the convex scraper edge and use retouch along their longitudinal edges. This shows that the assemblage does not only represent a flint-knapping workshop based on the local abundantly occurring flint. Other manufacturing processes also took place, such as the production of tools of bone or antler and the scraping of skins/hides, to an extent which suggests an occupation of longer duration (cf. Donahue and Fischer in prep.).

Settlement organisation

Although only a limited part of Fensmark B has been excavated, it is still possible to identify specific patterns in the artefact distribution: most of the debitage from the flint knapping is concentrated within the northernmost part (Figure 16), whereas the tools are concentrated a little further to the south (Figure 17). The distance from the most find-rich 0.25 m^2 square out to the edge of the heavy flint concentration is about 3 m.

No archaeological traces, in the form of soil features or stone structures of Late Palaeolithic date, were observed at the site. Sporadic occurrences of both fire-crazed and white-burnt flakes suggest that somewhere (beyond the limits of the excavation trench) there was a hearth (cf. Fischer *et al.* 1979, Fischer and Nielsen 1987).

Finds from the lake deposits and scientific dates

Four cores and 15 large flakes were encountered in a peat-covered solifluction layer (Figure 18) located c. 20 m from the centre of Fensmark B. In their size, mode of production and overall character these show great similarity to those found in Fensmark B. All of them were detached using a hammerstone and the cores are distinctive in being unipolar and by having platforms consisting of a single man-made detachment surface. Several of them can be refitted (e.g. Figure 19), suggesting that they originate from one and the same relatively small part of the activity area above the lakeshore at that time.

In the solifluction deposits to the north of Fensmark B a piece of unworked amber was found along with three pieces of red ochre (report from 1982 by mag.scient.

Figure 11. Examples of flakes characteristic of the Bromme culture. Entire successful blades (a–d), unsuccessful attempt at blade detachment (detachment surface turned outwards before it reached the tip of the core) (e). These are characterised by, among other things, carefully trimmed platform edges and large flat platform remnants showing crushing and curved percussion scars. Scale in centimetres.

Figure 12. Hammerstone with crushed corners and scars from detached chips. Scale in centimetres.

Søren Floris, Geological Museum, Copenhagen). Similar finds of intentionally produced ochre pigment are known from the neighbouring and approximately coeval locality of Trollesgave. This suggests that the site's Lateglacial inhabitants were not occupied exclusively in practical craft activities but were also engaged in more esoteric pursuits, such as painting their bodies or clothes.

The flint artefacts, the pieces of ochre and the amber originated from sediments, which also contained a quantity of small charcoal fragments and charcoal dust. Cand.

Figure 13. Flake with heavy use-wear traces suggesting an axe-like function. Scale in centimetres.

Figure 14. A selection of scrapers illustrating the significant variation in form, size and method of production of this type. Scale in centimetres.

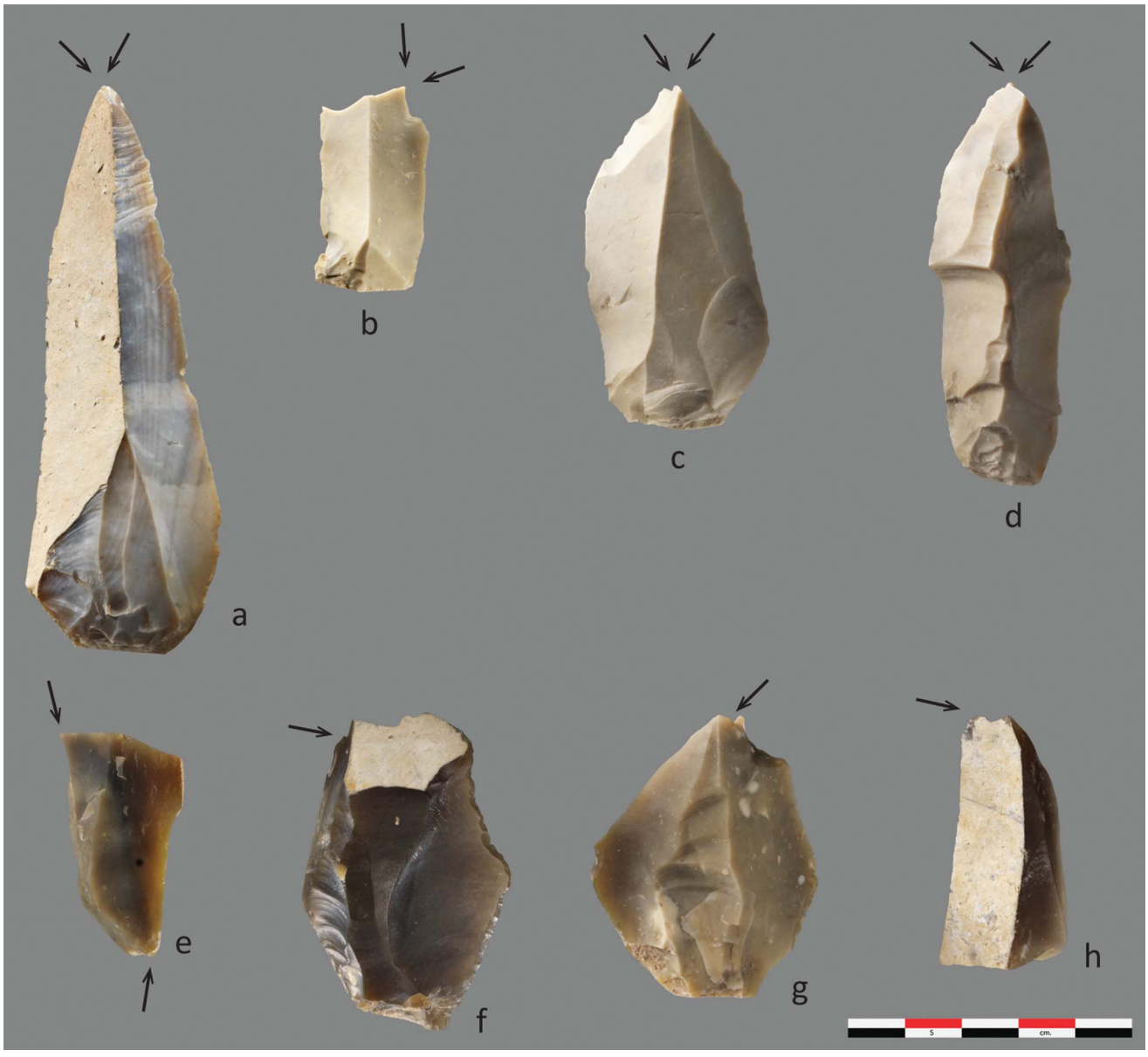

Figure 15. Burins. The burin blows of specimens e and f initiate from pre-existing flaking surfaces, while those of g and h initiate from edge retouches. Scale in centimetres.

scient. Charlie Christensen of the National Museum of Denmark has, on the basis of a pollen sample, arrived at a date of Lateglacial or Early Pre-Boreal for these deposits (report from 1976).

In the course of the trial excavations, a few pieces of charcoal were also found in the solifluction layer containing the flint artefacts. One of these has been subjected to microscopic analysis and even though it proved to be pressure-deformed it was possible to establish that it came from a diffuse porous hardwood (e.g. willow/*Salix sp.*, birch/*Betula sp*., aspen/*Populus tremuls L.* or whitebeam/*Sorbus sp*.; report from 1992 by cand. mag. Kjeld Christensen of the National Museum of Denmark). A radiocarbon analysis of the charcoal fragment gave a date of 10,810 ± 120 BP (OxA-3614; 13,065–12,543 cal BP (95.4%); OxCal 4.1), corresponding to the initial part of Grenland ice core climate period GS-1 (Fischer *et al*. 2013). This date is at present the best estimate for the age of the finds in concentration B.

The AMS date means that the Fensmark site is a member of a distinguished group. To date, it has only proved possible to obtain radiocarbon dates for three settlements from the Bromme culture. There is a single date from a peripheral part of the actual Bromme site itself of 10,720 ± 90 BP (AAR-4539; cand. mag. Ingrid Sørensen, personal communication 2012). The Trollesgave site has a larger number of

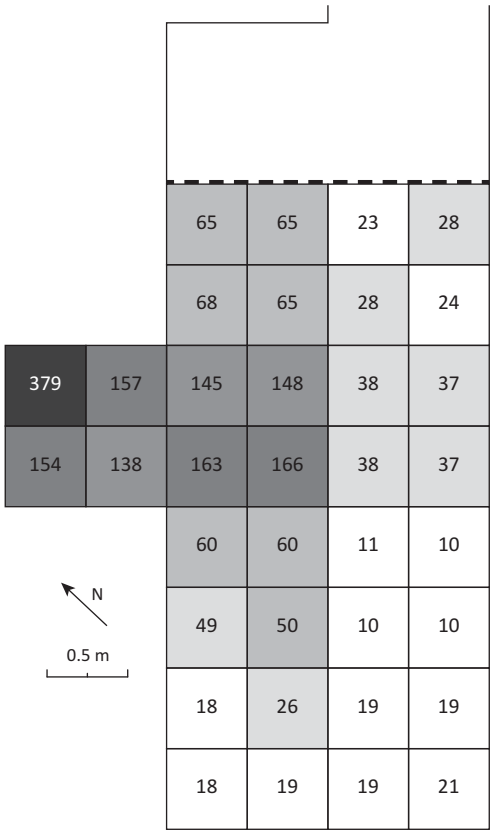

Figure 16. The intensity of worked flint per 0.25 m^2 in the layers beneath the plough soil. The area to the NE of the broken line was partially disturbed.

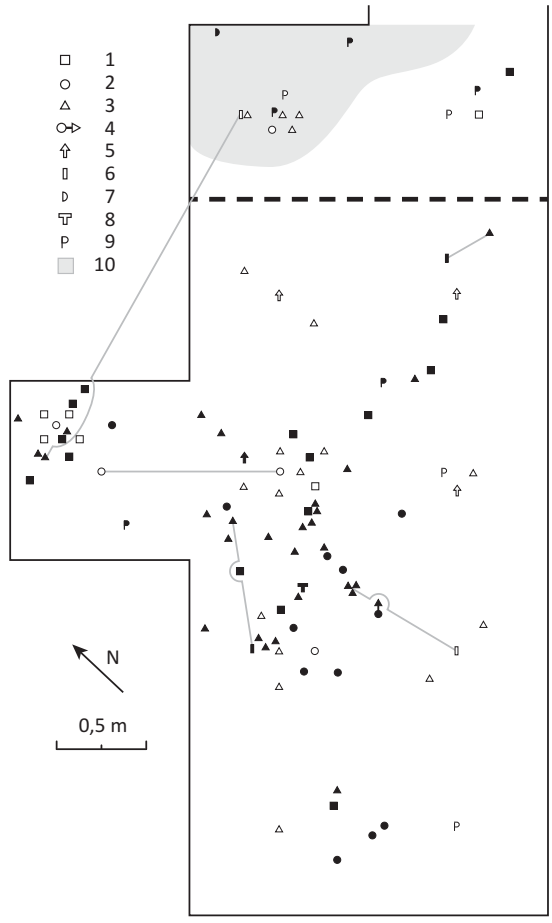

Figure 17. Distribution of cores and tools. The positions of the precisely mapped artefacts are shown with solid symbols and finds from sieving with open symbols. Flint pieces which could be refitted are joined with lines. Only finds from the area SW of the broken line are mentioned in the text. Core (1), scraper (2), burin (3), combined scraper and burin (4), tanged point (5), refitted burin spall (6), Federmesser? (7), hammerstone (8), post-glacial artefact (9), more recent disturbances (10).

radiocarbon dates as well as dates based on thermoluminescence and pollen analysis, including samples from sediments older and younger than the Late Palaeolithic habitation. These unanimously indicate a date in the Late Allerød period. An AMS analysis of a piece of charcoal from the refuse layer in the lake deposits adjacent to the settlement area resulted in a date of 10,826 ± 42 BP (AAR-16019).

It therefore appears that the two geographically, topographically and typologically closely related finds concentrations, Fensmark B and Trollesgave, are also closely related chronologically. The dating of the Fensmark site should, however, be taken with some reservation, partly because it relies solely on a single AMS date and partly because the dated material originated from a solifluction deposit. As a consequence, it is not completely certain that the charcoal and the flint artefacts originated from one and the same short-term activity. Considering the proportion of the locality that remains untouched, there is a good possibility that future excavations will permit greater certainty to be attained with respect to the absolute age of this settlement from the Bromme culture.

Ways to mitigate the blind spot

The archaeology of the North European plain is presently characterised by a high level of field activity. Even so, investigations of Lateglacial and Early Holocene sites are still very much a rarity. This is, no doubt, largely due to the fact that localities from this period are very difficult to detect using the methods, which presently dominate archaeological fieldwork in this region. Despite the limited number of new records in recent years it can, therefore, safely be assumed that sites from the Late Palaeolithic and the Early Mesolithic are being damaged and destroyed by cultivation and development to approximately the same extent as localities from later parts of prehistory.

Figure 18. Wetland sediments adjacent to Fensmark B. The pale-coloured layers are from the Lateglacial and possibly the Early Pre-Boreal. The relatively granular solifluction deposit beneath and adjacent to the large stone contained worked flint of Bromme character. The bars on the rod are 20 cm in length.

Figure 19. Refit of two cores from the lake deposits. Scale in centimetres.

Investigations of the Bromme culture site at Fensmark provide an example of the approaches, which can be adopted in order to locate significant – in research terms –

Figure 20. Core recovered from the lake deposits adjacent to Fensmark B. Scale in centimetres.

activity sites from the Lateglacial and Early Holocene (i.e. reasonably undisturbed, with preserved organic remains, etc.). The results from the site testify to the advantages of employing field reconnaissance coupled with systematic plotting in of the relevant artefact finds as the first stage in an archaeological evaluation. Modern GPS equipment has made it much easier to carry out such evaluations efficiently and precisely. Conversely, present-day agricultural practices in Denmark (and almost certainly in other EU countries with a corresponding agricultural policy) mean that the search for artefacts on field surfaces must most often take place under relatively poor conditions for observation. It is now only possible under exceptional circumstances to carry out archaeological reconnaissance on ploughed fields where the soil has been allowed to lie exposed for months so as to render any potentially exposed flint artefacts readily identifiable following prolonged periods of precipitation. However, these favourable conditions for surface recording on areas of ploughed soil could be established through archaeological evaluations extending over the several months the process requires. It is therefore recommended that a combination of superficial ploughing, long-term exposure and field reconnaissance be added to developer-funded archaeology's standard repertoire of methods for use in evaluations.

Since the 1970s, ploughing has without doubt caused severe damage to numerous Late Palaeolithic sites in the North European lowlands (cf. Pedersen 2009, p. 11). Nevertheless, the excavations at Fensmark demonstrate that particularly well-preserved activity sites from the Lateglacial can lie at such a depth that they are not disturbed by agriculture, and are, in practice, impossible to locate via field reconnaissance. Corresponding observations have been made, for example, at Bromme *locus classicus* (Fischer and Nielsen 1987). It is therefore recommended that, in future archaeological evaluations, a systematic array of closely spaced test pits is dug (as at Fensmark), or an auger survey involving a dense network of sampling points is carried out in places where the

topography or previous finds in the local area suggest the possible existence of Late Palaeolithic activity traces. Regardless of whether the method adopted involves excavation or auger survey, the holes must be large enough and close enough together to ensure a real chance of detecting cultural traces in the small concentrations, which usually characterise Late Palaeolithic localities.

Should it not prove possible to invest such efforts in archaeological evaluations, finds of Lateglacial activity sites will continue to be absolute rarities in the future. As a consequence, cultivation and development will destroy significantly greater numbers of sites from this period than will be the case for agrarian prehistory. It is possible to compensate to some extent for such a loss of information through the launching of targeted searches for Late Palaeolithic activity traces. Field reconnaissance around Holmegård Mose has shown that this approach can produce valuable results. A correspondingly positive output for Stone Age archaeology has been achieved by targeted field reconnaissance in other areas of the NW European lowlands, often involving local amateur archaeologists (e.g. Nilsson 1989, Andersen 1993, Nielsen 2001, Gerken 2003).

Regardless of which methods are employed in the future to compensate for the present under-representation of Lateglacial sites in North European field archaeology, it is recommended that great care be taken of those localities with significant research potential that are already known or which turn up in the future either by chance or as the result of a targeted search. The most secure solution in this respect would be protection through scheduling, bringing to a halt any form of intervention in the soil at these particularly valuable sites. The Fensmark locality has now been secured in this way. The area was taken out of cultivation in connection with the landscape scheduling of a total of c. 6 km^2 of Holmegård Mose and its adjacent slopes (Figure 1). This scheduling has made it possible, at one and the same time, to give permanent protection to the archaeological assets in the soil and to create better conditions for the area's special flora and fauna. The prehistoric sites within the area (Kulturarvsstyrelsen 2004) can be considered as scientific reserve capital which has been lodged in an account in a state-guaranteed bank and which can be gradually withdrawn in appropriately small instalments as dictated by research requirements.

If even a moderately representative selection of scientifically significant localities from the Lateglacial are to be preserved, it will be necessary in the (near) future to establish several of these larger or smaller archaeological reservations in various landscape types and in various parts of Denmark where the presence of well-preserved activity sites from the period has been established. The Holmegård scheduling in 2009 and a campaign presently in progress under the auspices of the Danish Agency for Culture directed at obtaining permanent protection for kitchen middens dating from, in particular, Late Mesolithic times demonstrate that solutions of this type are possible. Furthermore, measures such as these, resulting in the permanent protection of Late Palaeolithic and Mesolithic settlement deposits, will often prove to be considerably less expensive than archaeological 'rescue' excavations of the implicated areas.

It can therefore be concluded that the Late Palaeolithic need not necessarily remain a virtually invisible part of Danish prehistory. It is actually possible to make developer-funded archaeology better at locating activity sites from this long and relatively poorly researched period. Furthermore, it is also possible to preserve *in situ* some of the most significant, in research terms, localities from the period such that researchers in the future will be able to draw on primary sources of high quality.

Acknowledgements

The Fensmark site is record no. 8 in Fensmark parish, Tybjerg district, Præstø county (see the Danish Agency for Culture's database Sites and Monuments, http://www.kulturarv.dk./fundogfortidsminder/). It is included in the area scheduling for Holmegård Mose (the Nature Protection Board of Appeal ruling of 29 April 2009, ref. no. 111-00019), prepared by the Danish Society for Nature Conservation with financial support from Aage V. Jensen's Foundations and with archaeological assistance initially from the Danish Forest and Nature Agency's Cultural History Department, subsequently the Cultural Heritage Agency of Denmark (2004).

The excavations at the site were carried out under the auspices of the National Museum of Denmark. The site archive is stored under ref. nos. NM 1 1042/75 and NM 8 5903, where the site name Fensmark Skydebane is employed. The finds recovered have accession no. A51811.

Fieldwork at the Fensmark site and postexcavation analysis of the finds and data from the site took place in immediate continuation of investigations of the Trollesgave settlement (Fischer and Mortensen 1977, 1978, Fischer 1990b). The direct transfer of recording systems, equipment, personnel and practical expertise, possible as a consequence, markedly improved the efficiency of the present investigation.

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