Flækkemagle

A Kongemosian Lakeside Habitation with a Blade Hoard

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ABSTRACT

Flækkemagle is a small lithic concentration attributed to the Blak phase of the Kongemose Culture and radiocarbon-dated to 6400-6220 cal BC. Despite plough disturbance, the site has been investigated and documented in sufficient detail to support analysis of its chronology and settlement organisation.

This study examines Flækkemagle and its archaeological context using a combination of complementary methods, including lithic refitting, AMS dating, and typological, lithic technological, and spatial analyses. On this basis, we argue that Flækkemagle represents a short-term episode of habitation, possibly by a single household or a small task group. The assemblage indicates that a range of subsistence and craft activities took place at the site, and the spatial distribution suggests that these were organised in distinct areas. Primary flint knapping and arrowhead production appear to have been concentrated near an inferred hearth, whereas activities involving the use of scrapers, borers, burins, and axes seem to have taken place further away. A hoard of twelve unusually large blades, bundled together and deposited at the former lake edge, provides evidence of highly skilled lithic production and may also reflect practices with a ritualised or symbolic dimension.

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Introduction

Flækkemagle is a small, plough-disturbed lakeside site dating to the Kongemose Culture. It is situated in Store Åmose, western Zealand, where it was first identified during survey work undertaken in connection with peat extraction in the 1940s. Initially recorded as Maglelyng K/5, it became known as Flækkemagle following excavations carried out by the late amateur archaeologist Tom Brædstrup Holm (TBH) between 1989 and 1993. The site is frequently mentioned in the literature on the Kongemose Culture, despite not having been formally published (*e.g.* Bjørnevad-Ahlquist 2020; Sørensen 2017; Stafford 1999). We address this gap by providing the first detailed presentation and analysis of the site, drawing on TBH's excavation records and analytical results, as well as new analyses of the assemblage undertaken as part of the first two authors' bachelor's projects at the University of Copenhagen.[1]

Previous interest in the site has focused largely on the discovery of an in situ hoard comprising twelve unusually large flint blades. While the hoard is highly significant, this study emphasises the research potential of the broader assemblage. Despite plough disturbance, Flækkemagle has been fully excavated and its assemblage appears to be typologically coherent and consistent with an attribution to the Blak phase of the Kongemose Culture. This apparent coherence makes Flækkemagle a useful case study for investigating lakeside activity and patterns of short-term habitation during the Kongemosian period.

Flækkemagle was primarily investigated through systematic sieving of the ploughsoil. Disturbed contexts of this kind are often regarded as having more limited interpretative potential than those preserved in situ, as ploughing may displace artefacts and obscure their spatial relationships. This is particularly apparent in Åmosen, where several exceptionally well-preserved sites, including the

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Figure 1. The geographic setting of Flækkemagle at regional and local scales. (a) Regional map showing the location of Flækkemagle in relation to other discussed sites in Denmark and Scania (b) DEM visualization of the Store Åmose basin relating the location of Flækkemagle to other sites within the mire (Content and graphics prepared in QGIS: Amalie Hellebert Puzniak Hvid).

locus classicus, Kongemose (Jørgensen 1956), have shaped expectations concerning archaeological preservation and research potential in the region. However, the conditions that enabled the preservation of these sites are becoming increasingly rare due to the cumulative effects of peat extraction, drainage, and the cultivation of former peat bogs (*e.g.* Boethius *et al.* 2020; Sørensen *et al.* 2020). Consequently, future archaeological projects will likely encounter increasingly disturbed and poorly preserved Mesolithic sites.

This article examines both the limitations and interpretative potential of plough-disturbed sites. Based on a critical assessment of the existing documentation and the composition and spatial relationships of the lithic assemblage, we argue that, despite modern disturbance, the Flækkemagle assemblage is typologically homogeneous and retains spatial patterns that may reflect the organisation of prehistoric activity.

The analysis is guided by three principal questions. First, what is the site's position within the regional relative typology and what is its absolute chronology? Second, what can its extent, assemblage, and artefact distribution reveal about its possible function and organisation? Third, what does the blade hoard indicate about technological skill and depositional behaviour?

To address these questions, we employ a combination of complementary analytical methods, including lithic typology, radiocarbon dating, and the construction of a relational artefact database, supplemented by systematic photographic recording. The spatial organisation of the site is analysed using a geographical information system (GIS) and lithic refitting to visualise spatial relationships between artefacts and to identify possible activity zones. The blade hoard is examined separately through *chaîne opératoire and* use-wear analyses to investigate its production sequence, manufacturing techniques, and potential use. Photographs and drawings illustrate artefacts and locations of particular interest.

The article is dedicated to the memory of the late Tom Brædstrup Holm and concludes with an epilogue reflecting on the considerable effort he devoted to the investigation of Flækkemagle.

Topography

Flækkemagle contributes to a corpus of well-documented Mesolithic sites in Store Åmose, alongside Kongemose (Jørgensen 1956), Ulkestrup Lyng (Andersen *et al.* 1982), Verup (Andersen 1960), Præstelyng (Noe-Nygaard 1995), and Muldbjerg (Troels-Smith 1953). Store Åmose developed within a former lake basin approximately 13 km long and up to 4 km wide. It lies in central Zealand, Denmark, and forms part of the wider Åmose wetland system, which drains westwards (Fischer 2004).

Owing to a long tradition of environmental archaeological research in Store Åmose, the natural setting of Flækkemagle is relatively well established. When the site was occupied, more than 8,000 years ago, it was situated in a wetland directly beside the contemporary lakeshore in the eastern part of the basin (Figure 1b). This extensive wetland comprised open water and areas of swamp, densely vegetated with reeds, willow and alder. Mixed deciduous woodland dominated by lime covered the surrounding landscape (Jørgensen 1963; Noe-Nygaard *et al.* 1998; Troels-Smith 1953). Together, these environments would have provided a variety of plant and animal resources for subsistence, including large game, birds, and fish. The surrounding woodland would also have provided fur, bone and antler as raw materials for tool production, clothing, and shelter, while the lake may have provided beaver and otter fur, as well as feathers suitable for arrow manufacture (Jørgensen 1956; Noe-Nygaard 1995).

The densely vegetated, swampy terrain would have made movement through the landscape difficult. Boats may therefore have enabled both local movement and perhaps also seasonal mobility between the wetland and fishing locations along the west coast of Zealand (*cf.* Fischer 1997, 2004; Fischer *et al.* 2007; Jørgensen 1961, 444; Meadows and Fischer 2024; Sørensen 2017, 129).

Fieldwork

Although Flækkemagle was initially recorded in the 1940s (Andersen 1983, 102-103), it was not excavated until 1989, by which time the site had been incorporated into cultivated land. As agricultural activity had displaced artefacts within the ploughsoil, excavation was carried out using a 1 x 1 m grid (*cf.* Fischer *et al.* 1979). Individual grid squares were excavated to the boundary between the ploughsoil and the underlying subsoil, approximately 25-30 cm below the surface. The excavated soil was sieved through a 4 x 4 mm mesh,

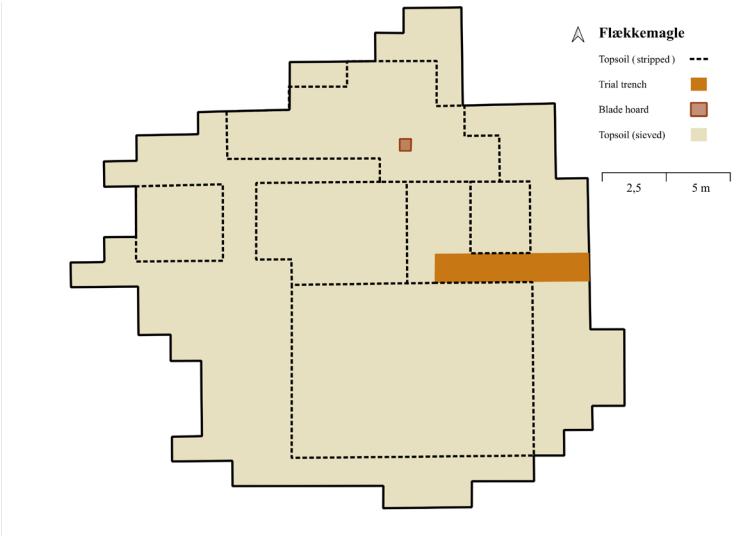


Figure 2. Map showing the areas investigated within the ploughsoil and underlying in situ mire sediments. (Content and graphic prepared in QGIS: Amalie Hellebert Puzniak Hvid from TBH's hand-drawn plans in the 1998 and 2000 reports).

which was considered sufficient to retain artefacts of chronological interest. Over a five-year period, 234 m^2 of ploughsoil was excavated this way (Figure 2). The limited number of deposits preserved in situ were investigated through test pitting and horizontal excavation of the underlying wetland sediments (SI 2).

Organic remains were poorly preserved within the ploughsoil. Nevertheless, 18 fragments of degraded, burnt bone were recovered. These remains are not considered further in the present study (SI 2).

During sieving, a hoard of unusually large flint blades was identified at the boundary between the ploughsoil and the underlying undisturbed wetland deposits. The blades were tightly packed, and an ensuing salvage excavation recovered twelve blades in total, five of which remained in situ (SI 2). In addition, 19 test pits measuring 0.25 m^2 were excavated to assess the wetland deposits surrounding the hoard.

Analysis of Flækkemagle and its Assemblage

The Lithic Assemblage

The present study is based on the complete assemblage of lithic artefacts recovered from Flækkemagle. It comprises surface finds collected by Knud Andersen and TBH, together with systematically excavated material (SI 3) (Table 1).

The lithic assemblage derives mainly from good-quality, fist-sized nodules of Maastrichtian flint of eastern Danish geological origin. The relatively small size and irregular morphology of the nodules suggest that the raw material was collected locally, potentially from locations where erosion had exposed flint in moraine deposits. Most of the material exhibits varying degrees of patination (leached), which has given their surfaces a whitish appearance. A small proportion remains unpatinated, indicating differences in the taphonomic conditions to which the artefacts were exposed. The whitish patina is often associated with exposure to a wet, oxidising environment. The absence of patination may indicate either dry conditions or deposition in an anaerobic environment, for example in the gyttja layers of the former lakebed, as documented in several excavated contexts within Store Åmose (Andersen 1983).

The assemblage represents a variety of lithic production activities and associated tasks. Blade cores and primary blades indicate the production of relatively small, mid-sequence blades using indirect percussion (SI 3). A small number of irregular cores suggest *ad hoc* flake production, while core axes and associated edge-resharpening flakes demonstrate that core axes were produced, used, and maintained at the site. The formal tool assemblage comprises a small number of burins, scrapers, borers, and blade knives. These artefacts are consistent with a range of domestic activities, potentially including bone working, hide processing, and butchery.

Table 1. Lithic Inventory from Flækkemagle. Classification and counts based on Andersen (1983) and Brædstrup-Holm (1989).

Artefact type	Andersen, K. 1983	Brædstrup-Holm, T. 1989-97
Core axe	1	7
Core axe, fragment	1	-
Core axe, edge flake	-	23
Burin	-	6
Borers	-	5
Scraper	-	4
Square blade knife	-	2
Blade with retouch	1	10
Broad trapeze microlith	-	9
Broad trapeze preform	-	1
Micro-burin	-	73
Krukowski micro-burin	-	64
Long Scalene triangle microlith	-	1
Blades	48	869
Micro-blades	-	98
Blade cores	13	5
Core rejuvenation flake	-	3
Flakes	-	551
Flint chips	-	1447
Total	**64**	**3178**

Broad trapeze points (n = 10), interpreted as arrowheads, are the most common formal tool type. These were produced from regular blades made using indirect percussion. Each trapeze was manufactured by removing the distal and proximal ends of a blade using the microburin technique. The remaining segment was then retouched to form a broad trapeze, producing characteristic Krukowski microburins as by-products (Madsen 1992).

Detailed analysis of small flint fragments recovered during sieving identified 73 microburins, of which 64 are Krukowski microburins. Together, the trapeze points and associated microburins provide strong evidence for on-site production, while the number of by-products suggests that up to 50 broad trapezes may have been produced at the site.

More broadly, the Flækkemagle assemblage suggests that the production and preparation of hunting equipment, particularly arrowheads for bow hunting, was a significant aspect of the site's use.

Typochronological Dating

Although the Flækkemagle assemblage is relatively small, the available data support its cultural attribution and a more precise placement within the established typological chronology.

In the regional research tradition, armature points are regarded as particularly important chronological indicators. Six points from Flækkemagle can be confidently classified as broad trapezes, a diagnostic armature type associated with the Blak phase, which represents the first third of the Kongemose Culture (Fischer and Malm 1997; Sørensen 1996, 2017) (Figure 3). Assemblages are classified as Kongemosian when broad trapezes constitute ≥50% of the armature assemblage, relative to narrow trapezes. Assemblages where broad trapezes account for <50% are classified as Maglemosian. Examples of the latter include the submerged coastal site of Kalø Vig I, and the inland sites of Aggemose, Mosegården IIIN, Orelund IX, and Ageröd IB and ID, dated *c.*6500–6400 cal. BC (Andersen 1985; Fischer 2001a; Fischer and

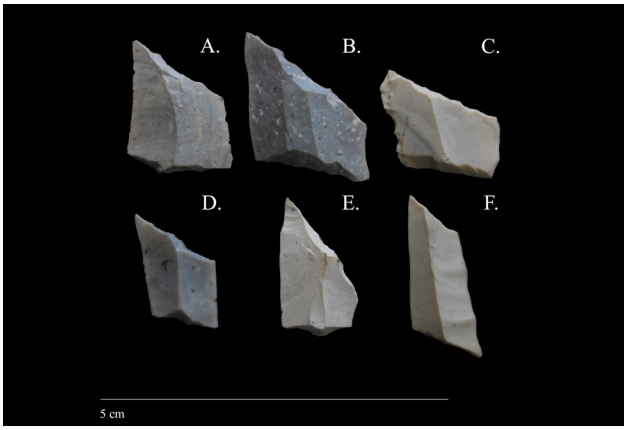


Figure 3. Broad trapeze microliths/arrowheads. Artefact C displays damage consistent with impact from use. Photograph: Mikkel Sørensen and Signe Stegmann (Graphic post-processing: Amalie Hellebert Puzniak Hvid).

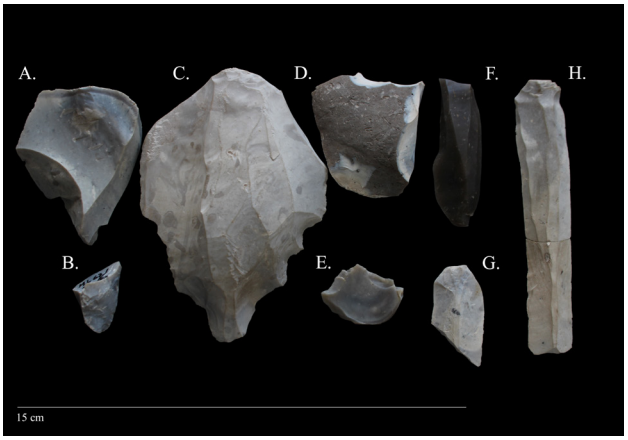


Figure 4. Lithic tool types from Flækkemagle: A and C, atypical borers; B, possible tip of a pointed flint weapon; D and F, simple burins; E, small circular scraper; G and H, blade knives (Photograph: Mikkel Sørensen and Signe Stegmann. Graphic post-processing: Amalie Hellebert Puzniak Hvid).

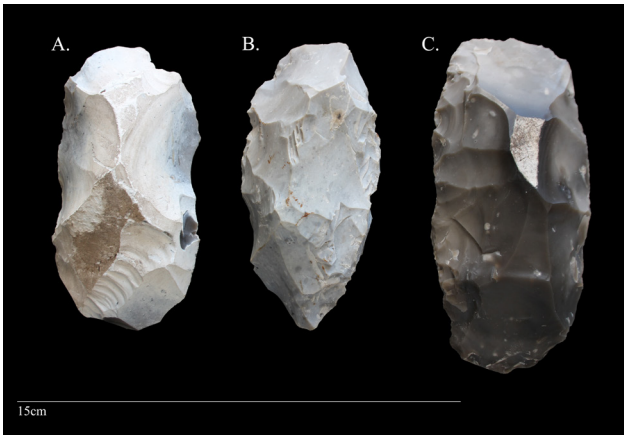


Figure 5. Resharpened core axes discarded at the site. Their relatively small size and irregular morphology is typical of Kongemose-period axes (Photograph: Mikkel Sørensen and Signe Stegmann. Graphic post-processing: Amalie Hellebert Puzniak Hvid).

Hansen 2005; Grøn and Sørensen 1995, 1998; Larsson 1978) (Figure 1a).

The blade hoard (covered in detail later in the article) provides further chronological evidence consistent with the Blak phase. Its blade technology is characteristic of the blade concept known from both the Kongemose Culture and the final techno-group of the Maglemose Culture (Sørensen 2006). This concept has been documented, for example, at the Argus site, dated to the middle phase of the Kongemose Culture (Fischer 1987), and at the Tågerup site in western Scania, dated to the Blak phase (Karsten and Knarrström 2003; Knarrström 2001). The technological characteristics of the hoard are therefore consistent with the chronological attribution established from the armature assemblage. In combination with its archaeological context, we infer that the hoard was most likely deposited during the site's period of habitation.

The remaining assemblage includes irregular core axes, a possible tip fragment of a pointed flint weapon and flakes typical of handle-core production (Figure 4 and 5; SI 3), all of which are consistent with the Blak phase classification (Sørensen 1996).

The spatial distribution of the lithic assemblage provides no clear evidence for multiple chronologically separate episodes of activity. The only apparent exception is an asymmetrical triangular microlith (SI 3), identified as a 'Sværdborg type' characteristic of phase 3 of the Maglemose Culture (*c.*7000-6800 cal. BC) (Sørensen 2018). Although the artefact was unearthed centrally within the horizontal scatter, we interpret it here as an isolated loss that predates the main period of site use, because it represents the only chronological deviation in the assemblage and because numerous traces of Maglemosian activity have previously been documented in the Store Åmose (Andersen 1983, 1985; Wickman 2009).

^{14}C Dating

A series of individual plant-material samples, including partly charred wood and charcoal, was

available for radiocarbon dating (SI 2). An initial selection underwent plant macrofossil and wood anatomical analysis, with the assistance of the late macro-fossil specialist Claus Malmros from the National Museum of Denmark. Subsequently, three pine, and one willow charcoal sample were AMS-dated. Although the biological age of the sampled material could not be assessed, its morphology and taxonomy indicate that it derived from trees that were several years, and possibly decades, old when burnt. Leaves and plant fibres found between the hoarded blades would, in principle, have been more suitable for dating because of their low biological age, but they were rejected because later humus and rootlets had infiltrated them.

Of the four samples selected for AMS dating, two were taken from a vertical section along the former shoreline, at the northern edge of a concentration of lithic debris. These samples, AAR-7304 and AAR-7305, were considered suitable for dating the site's period of habitation and came from a distinct horizon of highly degraded, gyttja-rich peat that measured 1–2 cm. The horizon contained a large amount of charcoal, sand, and small stones, including unworked flint fragments, many of which showed clear evidence of fire-crazing. This material is interpreted as intentionally deposited discard from a hearth originally established on a sandy substrate (*cf.* Andersen *et al.* 1982; Andersen 1983). The two dates place Flækkemagle between *c.*8400 and 8200 cal. BP (Table 2,

Lab number	Inventory number	Sample position	Material sampled	δ13C (‰)	14C age BP	Cal BP	Comments
AAR-7304	M60498	Positioned horizontally in lower part of the habitation horizon	Charcoal (Pinus sylvestris)	-25.12	7485±65	8410-8170	Excavation report item no MLK74,5/43,5:1
AAR-7305	M60499	Positioned in upper part of the habitation horizon	Charcoal (Pinus sylvestris)	-24.23	7600±65	8550-8210	Excavation report item no MLK74,0/43,5:1
Ua-2288	M51507/ M51412	Sample taken from imprint of blade in the sediment, *i.e.* directly next to and just below the hoard	Charcoal (Salix sp.)	25*	8660±90	10120-9480	
			-				
AAR-7306	M51401/ M51410	In level with uppermost part of the undisturbed blades or right above these	Charcoal (Pinus sylvestris)	-25.82	8295±65	9470-9030	Sample taken *c.*20 cm from the hoard

Table 2. AMS radiocarbon dating results from Flækkemagle (calibrated date 95% probability).

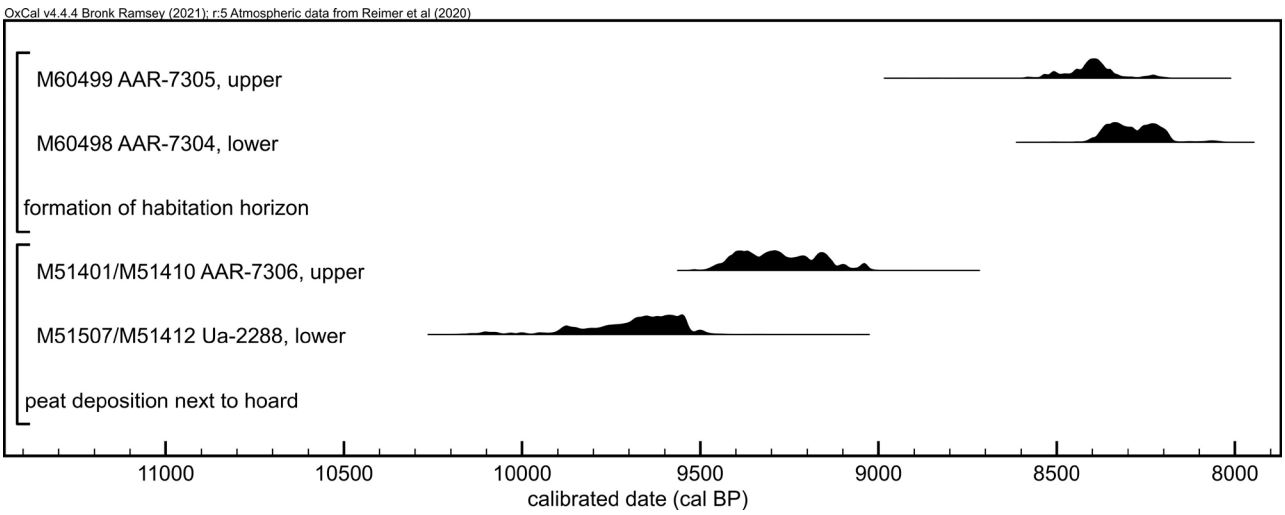


Figure 6. Probability distribution of the radiocarbon dates (Bayesian graphic: John Meadows).

Figure b), consistent with the Blak phase in both Sørensen's (2017) chronology and the typological dating proposed above.

The remaining two charcoal samples were taken from deposits a few centimetres from the blade hoard, separated vertically by 5 cm and weighing 0.028 and 0.032 g, respectively. The upper sample, AAR-7306, came from highly degraded swamp peat, whereas the lower sample, Ua-2288, came from gyttja with a slight intermixture of peat. Their AMS dates are consistent with the chronological order of sedimentation (Figure 6).

The Blade Hoard

The Hoarded Blades

The radiocarbon dates associated with the hoard suggest two possible depositional scenarios. The blades may either have been deliberately buried in pre-existing swamp deposits or placed in the littoral zone of the lake, where they sank into lacustrine sediments. In either case, they remained undisturbed for about 8,000 years in anoxic, frost-free conditions favourable to preservation.

When the hoard was discovered in 1989, several blades exhibited surface marks, and a few had more substantial fractures, possibly caused by pressure from agricultural machinery or related activities. Following refitting, the hoard comprised twelve complete blades, ranging from 15 to 21 cm in length, with a median length of 17.5 cm. All twelve are unpatinated and retain sharp lateral edges, giving them a freshly knapped appearance consistent with deposition shortly after manufacture. The presence of air-filled fissures (Figure 7) supports this interpretation, as these occur only in worked flint that has not been exposed to frost. This interpretation is further supported by microscopic use-wear analysis conducted by use-wear specialist Helle Juhl Jensen (1992), which found no evidence that the blades had been used prior to deposition.

Refitting identified three blade-removal sequences, each comprising three blades (1, 3 and 5; 8, 6 and 9; and 7, 10 and 11). The remaining three blades (2, 4 and 12) could not be refitted with confidence (Figure 8 and 9a–c; SI 5). Similarities in colour and texture nevertheless suggest that all twelve blades were produced from the same core (SI 6).

The site assemblage contained no blades comparable in size and quality to those present in the hoard. Moreover, TBH's refitting analysis found no flint flakes that could be refitted to the hoarded blades. Together, these observations suggest that the blades represented in the hoard were not produced at the site but were instead brought there as finished products.

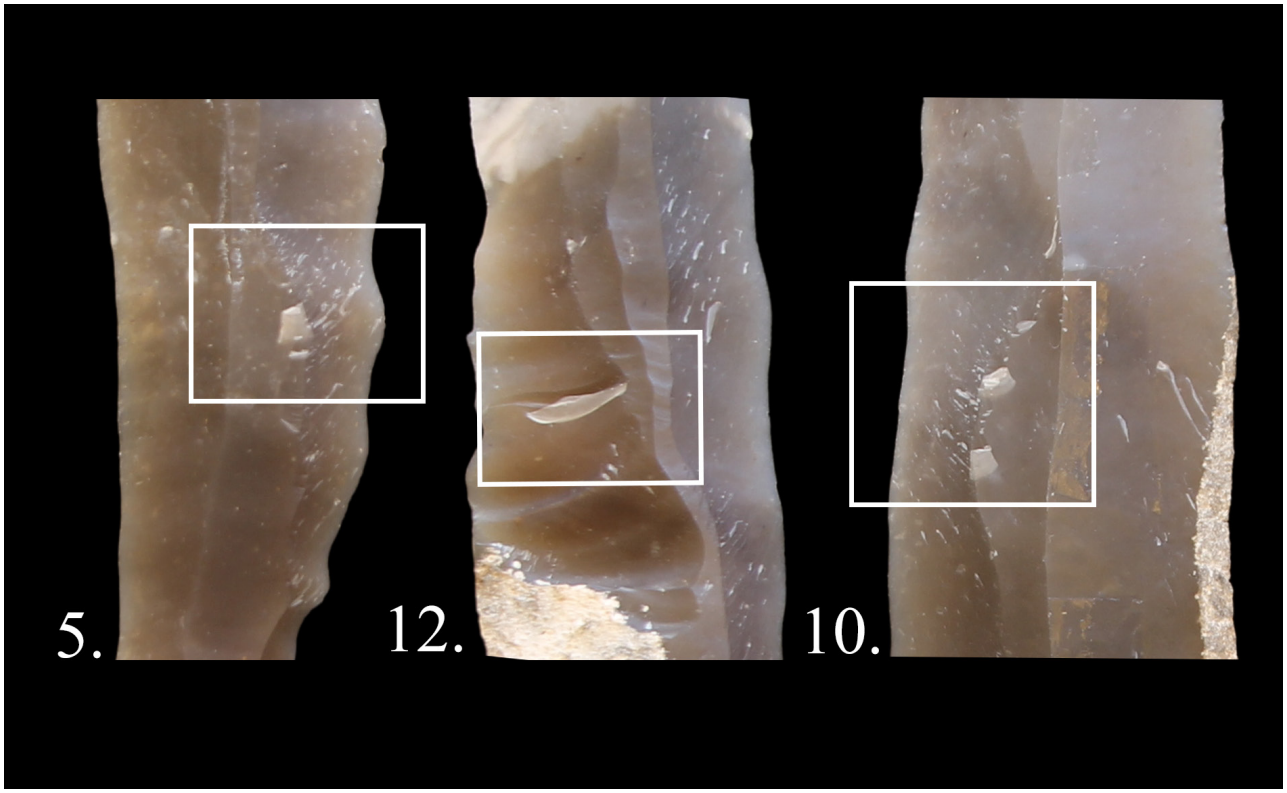


Figure 7. Air-filled fissures visible on the surface of blades 5, 10 and 12 (Photographs: Signe Stegmann. Graphic post-processing: Amalie Hellebert Puzniak Hvid).

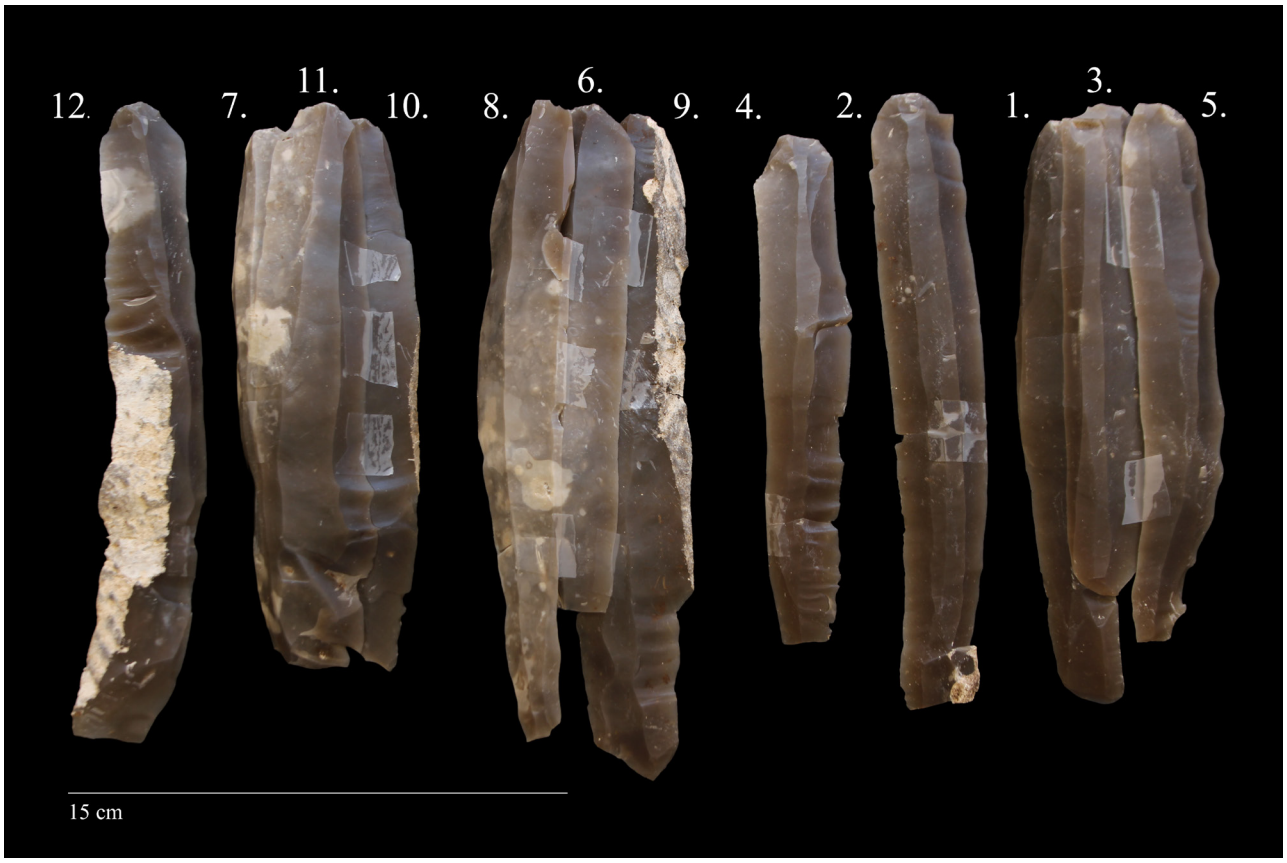


Figure 8. The refitted blades from the hoard (Photograph: Mikkel Sørensen and Signe Stegmann. Graphic post-processing: Amalie Hellebert Puzniak Hvid).



Figure 9a. Detailed photographs of the hoarded blades, shown from the dorsal side (Photographs: Mikkel Sørensen and Signe Stegmann. Graphic post-processing: Amalie Hellebert Puzniak Hvid).



Figure 9b. Detailed photographs of the hoarded blades, shown from the ventral side (Photographs by Mikkel Sørensen and Signe Stegmann. Graphic post-processing by Amalie Hellebert Puzniak Hvid).



Figure 9c. Detailed photographs of the hoarded blades, shown in side profile (Photographs by Mikkel Sørensen and Signe Stegmann. Graphic post-processing by Amalie Hellebert Puzniak Hvid).

Packing

Field and laboratory observations (SI 2) indicate that the hoarded blades were systematically packed, further supporting the interpretation that they were not produced at the site. The blades recovered in situ were placed with their ventral surfaces facing upwards, whereas the uppermost blades had their dorsal surfaces facing upwards (Figure 10). The latter had been disturbed by agricultural activity, however, making their original positions and orientations uncertain (Figure 2). In all cases, the proximal ends of the blades were arranged in alternating directions.

Distinct concentrations of plant-stem fibres and herbaceous leaf-remains were found between the blades, with the fibres predominantly aligned with the blades' long axes (Figure 11). We interpret these remains as packing material, possibly intended to protect the sharp edges during handling and transport (SI 2).

Craftsmanship

The morphology and size of the refitted blade series indicate that the knapper worked on a subconical core with a single platform, that measured at least 25 cm in height and 20 cm in width. The blades may have been produced using a punch made from a curved red deer antler tine, as experimental archaeological studies have demonstrated that Kongemose-type blades can be produced in this manner (David and Sørensen 2016; Pelegrin 2006; Hartz and Zhilin 2017; Sørensen 2006). This possibility is further supported by the frequent discovery of comparable antler tools at Kongemosian sites with large, well-preserved faunal assemblages (Fischer *et al.* 1987; Jørgensen 1956; Sørensen 2017, 71).

The core was only minimally prepared by percussion from the platform before blade production began. Before the detachment of each blade, small flakes were trimmed from the front edge of the core to eliminate the negative bulb left by the previous blade. In some cases, this preparation was followed by light abrasion, probably using a soft hammerstone. The platform appears to have partially collapsed on at least two occasions, creating significant technical difficulties for continued blade production. On both occasions, however, the knapper successfully restored a workable core



Figure 10. The blade hoard. The five uppermost blades were displaced by ploughing (Photograph: Anders Fischer, 1990. Scale in cm).



Figure 11. Remains of packing material still visible between the lithic blades during excavation. preserved as dark-brown bands of degraded plant material, running parallel with long axes of the blades. These are distinguishable from recent, pale-coloured plant roots (Photograph: Anders Fischer, 1990).

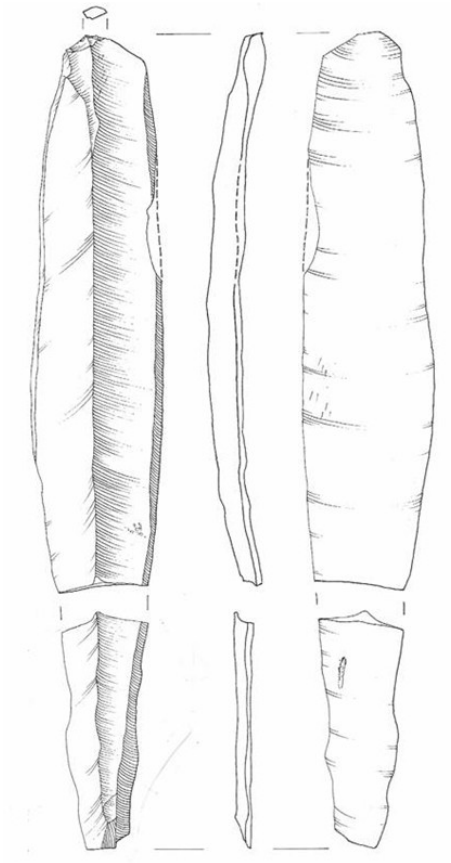


Figure 12. Example of a hoarded blade (Blade 8, Figure 8). The blade is regular, with straight ridges and a longitudinally curved profile. It displays a bulb and lip, as well as a small ellipsoidal butt with slight abrasion from the platform edge. Recent damage and breakage are indicated by dots. Length: 20.4 cm; width: 3.39 cm (Drawing: Kurt Petersen).

by detaching platform flakes to establish a new platform, allowing production to continue.

The negative scars preserved on the dorsal surfaces of the blades indicate that at least 25 blades were successfully removed from the core, twelve of which are represented in the hoard. A considerable proportion of the reduction sequence was therefore not deposited with the hoard. Some of the unrepresented blades appear to have been particularly regular and may have matched or exceeded the symmetry and technical quality of the deposited blades. A comparable absence of so-called 'superblades', has previously been identified in a refitted Kongemosian hoard from Rønneholm 8 in Scania (Larsson and Sjøstrøm 2010).

Together, the preparation and maintenance of the core, the regularity of blade removal and the successful re-establishment of the platform indicate that the reduction sequence was carried out by a highly skilled knapper, corresponding to what has been described as an 'expert knapper' (Pelegrin 1990; Sternke and Sørensen 2009). The Flækkemagle blade hoard therefore represents an exceptionally accomplished example of Mesolithic blade production in southern Scandinavia and provides evidence for a particularly high level of skill in lithic production.

Lithic Raw Material

The hoarded blades were produced from a flint nodule estimated to have originally weighed approximately 10 kg. The interior of the nodule is heterogeneous, ranging from glassy, translucent brownish-grey flint to opaque grey flint with white inclusions. These variations are consistent with Scandinavian Senonian/Maastrichtian flint. The nearest well-documented outcrops of this type are at Valsømagle and Stevns Klint, located in central and eastern Zealand, respectively (Fischer *et al.* 1979; Högberg and Olausson 2007) (Figure 1a).

Cortex preserved on the dorsal surfaces of four blades shows no clear evidence of water-rolling or abrasion, suggesting that, while the nodule may have derived from a coastal area, it is unlikely to have been collected from a beach or similar setting where it would have been exposed to prolonged wave action or marine transport. The washed appearance of the cortex, characterised by the absence of fresh chalk or limestone, further suggests that the nodule was not extracted directly from an outcrop. Instead, it was probably a glacially transported erratic that had eroded from moraine deposits before being collected.

Flint nodules of the size and quality required to produce the Flækkemagle blade hoard are rarely found in the moraine deposits of western Zealand and local collection from exposed deposits around lakes, rivers, or streams in Store Åmose therefore seems unlikely. A more plausible source is the contemporary marine shoreline, where rising sea levels brought waves into contact with moraine deposits. This contributed to the erosion and retreat of coastal slopes, exposing flint in the slope faces or

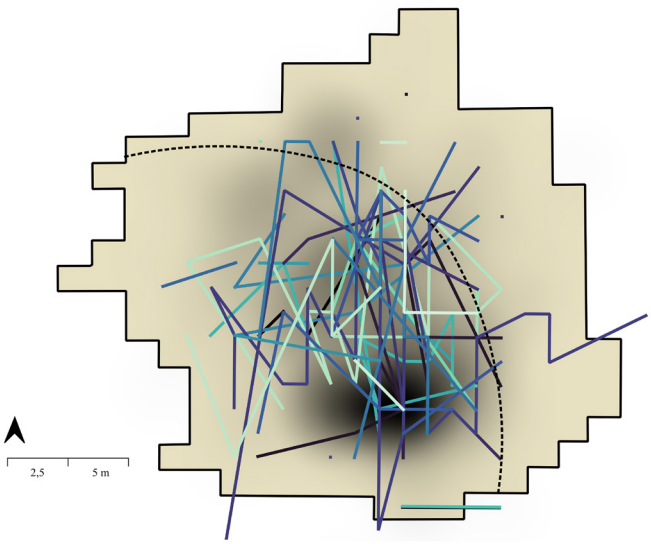


Figure 13. Visualisation of all refitted lithics, represented by a single contact surface, overlaid on a heatmap showing the distribution of fire crazed flint and burnt unworked stone (Content and graphic prepared in QGIS: Amalie Hellebert Puzniak Hvid).

releasing it through localised collapse (Christensen *et al.* 1997). One possible source is the present-day Asnæs Peninsula, located approximately 40 km west of Store Åmose and known for its large, high-quality flint erratics (Pedersen 2007, 16–17; Schülke 2009, fig. 1 and 3) (Figure 1a).

Internal Organisation of the Site

Artefact Distribution

The original drawings were manually aligned in QGIS using their recorded spatial reference points. All artefacts were then plotted in their corresponding 1 x 1 m recording squares, which form the grid used for all spatial visualisations. For larger find groups, heat maps generated using kernel density estimation were used to identify and visualise interpolated patterns of spatial clustering. The worked flint assemblage provides the primary body of evidence for analysing the site's internal organisation. The analysis also draws, to some extent, on the large number of unworked stones (SI 7), which were systematically retained alongside the worked flint during the field campaigns.

Although peat extraction and agricultural activity had disturbed the deposits, the horizontal distribution of artefacts and debris exhibits clear spatial patterens. Densities decline consistently from the centre of the excavated area towards its margins. Similarly, spatial links between refitted items form a largely unipolar pattern, extending from a central zone towards more peripheral areas, especially to the north and north-west (Figure 13). Fine debitage occurs in distinct concentrations despite plough disturbance and the relatively coarse 1 x 1 m sampling grid, both of which might otherwise be expected to obscure fine-scale spatial patterning. These distributional patterns suggest that the spatial integrity of Flækkemagle is sufficiently well preserved to support analyses of both functional and social dimensions of its internal organisation (*e.g.* Blankholm 1990; Grøn 2009; Stapert 1989).

Hearth

A substantial quantity of burnt material, including charcoal, bone, natural stone, and fire-crazed flint (*cf.* Fischer *et al.* 1979), was recorded in the south-central part of the site (Figure 13). Combined with field observations of dense accumulations of sand and charcoal in desiccation cracks beneath the ploughsoil (SI 2), this concentration provides evidence for the presence of a latent hearth. Comparable features have been identified at other Mesolithic sites in Store Åmose (Andersen *et al.* 1982, 12 and 19; 1983, 176). The distribution of burnt material suggests an approximate hearth diameter of 1.5–2 m. Its apparent extent should, however, be treated with caution, as it may partly reflect the redistribution of material during occupation, later plough disturbance or excavation procedures. (Figures 6 and 7; *cf.* Fischer *et al.* 1979).

Smaller concentrations of heat-affected material, generally consisting of relatively large items, occur in the northern part of the site. These may represent material discarded from the latent hearth area.

Primary Production Waste

The highest concentration of worked flint was recorded within a confined area in the southern part of the excavation (Figure 14). This cluster includes the most of the smallest flint fragments (Figure 14a), which experimental and ethnoarchaeological studies have identified as indicators of a flint-knapping locus (Fischer *et al.* 1979, 17; Moholy-Nagy 1990, 271). Larger flakes and formal blades (*i.e.* L ≥ 2B, irrespective of edge shape, etc.)[2] are similarly concentrated in this area, immediately adjacent to or just east of the latent hearth. The limited extent and largely unipolar distribution of the material may suggest that flint working was concentrated in a single area of the site and may have been carried out by one individual.

Most of the Krukowski microburins recorded at the site were also found among the lithic waste concentrated in and around the latent hearth (Figure 14b), suggesting that flint armatures were primarily produced here. This interpretation is supported by a small number of apparently unused trapeze points found close to the hearth (Figure 14c). The proximity of these finds to the hearth may relate to the hafting of finished points using adhesives such as birch bark tar (Koch *et al.* 2024; Larsson *et al.* 2017), which can be applied more easily when gently heated (Kozowyk *et al.* 2023, 3).

The artefacts clustered near the latent hearth consist largely of by-products of tool production or maintenance, supporting the interpretation of this area as an activity zone. Comparisons with better-preserved bog-shore settlements raise the possibility that this activity zone was associated with a simple shelter (Andersen *et al.* 1982; Larsson and Sjöström 2011, 467).

Formal blades, by contrast, are more widely dispersed spatial pattern. This indicates that many were moved from the primary production locus and used in secondary contexts. The distribution shows a slight clustering in the nearshore area along the north-eastern periphery of the site, which may indicate deliberate deposition in a dedicated area away from the primary living floor. The more diffuse scatter in the southern and western parts could by contrast reflect deposition near where the blades were used (Figure 15).

Areas for Tool-Use

Despite the modest assemblage, the distribution of retouched tools suggests some functional differentiation across the site. Borers and burins are concentrated around and north of the latent hearth, whereas scrapers occur more sporadically across a larger area stretching from this concentration to the north and north-western periphery of the excavated area (Figure 16). Borers and burins are commonly associated with antler and bone working, while scrapers are more often linked to hide processing (Donahue and Fischer 2015; Keeley 1980). The concentration immediately north of the latent hearth may therefore represent an activity zone for tasks requiring more space than those undertaken at the primary knapping locus.

Some axe resharpening flakes have a comparable distribution, but some extend further towards the north-western periphery, while others cluster in the same area as the borers and burins are concentrated. This clustering may reflect separate episodes of axe maintenance in different parts of the site.

Refuse Deposit

The northern part of the site, which is intersected by the inferred shoreline, contains a concentration of large flakes and blades from primary lithic production, together with exhausted blade cores and core axes (Figure 17; SI 7). This distribution may indicate that larger items were deliberately removed from the living floor and discarded at the periphery of the site. Comparable cleaning practices have been associated with prolonged or repeated occupation (Binford 1983).

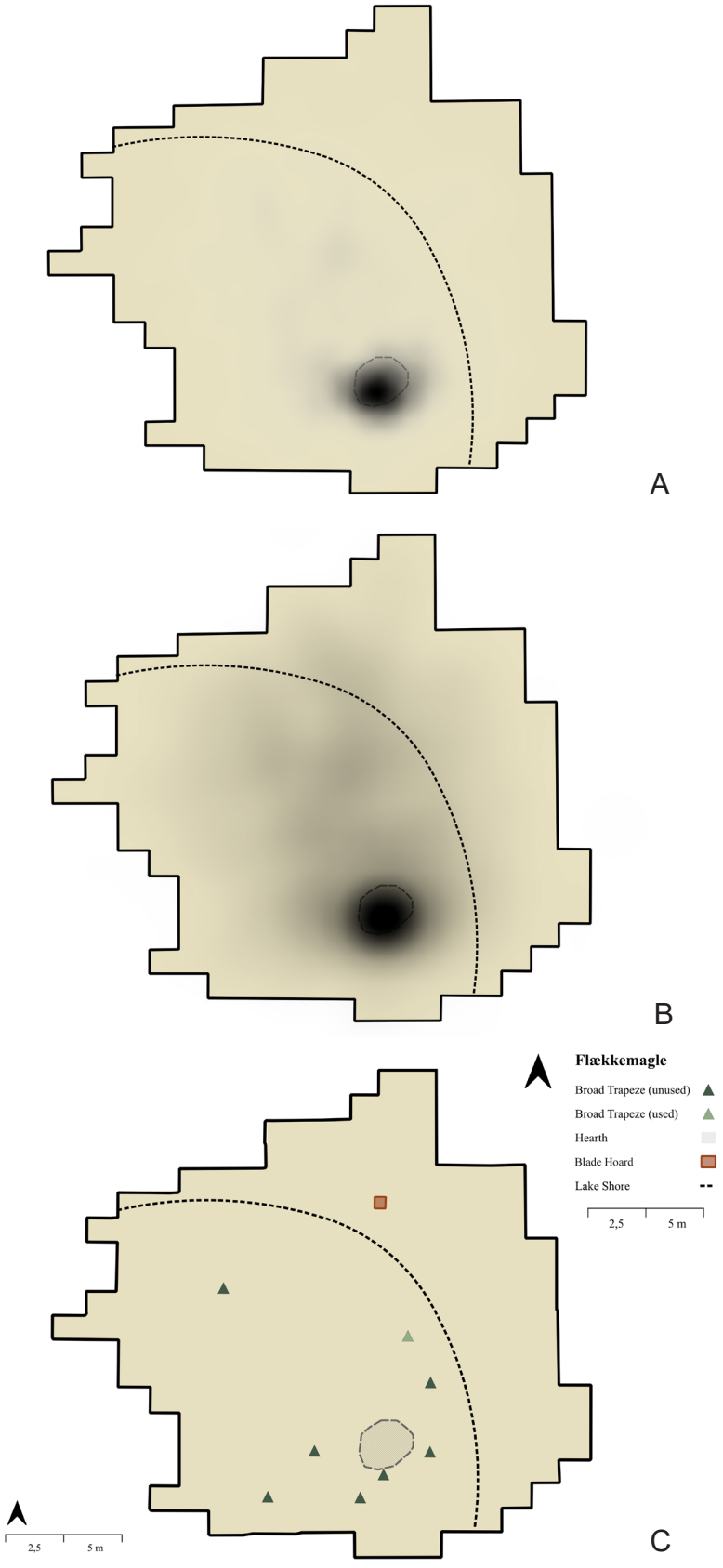


Figure 14a-c. Spatial visualisations.
(A) Distribution of small-sized lithic debitage (n = 1147).
(B) Krukowski microburins (n = 65).
(C) Broad trapezes (dark green, complete points; pale green, point displaying impact damage) (Content and graphics prepared in QGIS: Amalie Hellebert Puzniak Hvid).

Among the material recovered from the northern area was also a trapeze point exhibiting diagnostic macro-fractures consistent with projectile impact (Figure 14c; *cf.* Fischer *et al.* 1984). Its presence further supports the interpretation of the area as a peripheral discard zone and may also reflect post-hunting activities at the site, potentially including butchering.

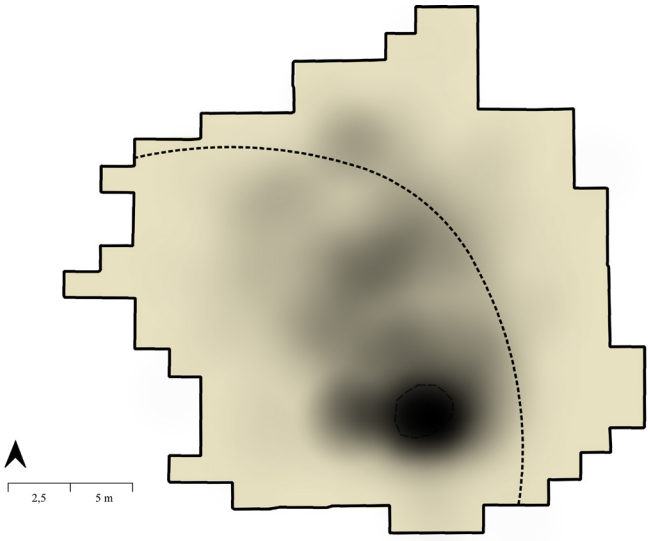


Figure 15. Spatial Distribution of formal blades (n = 869) (Content and graphic prepared in QGIS: Amalie Hellebert Puzniak Hvid).

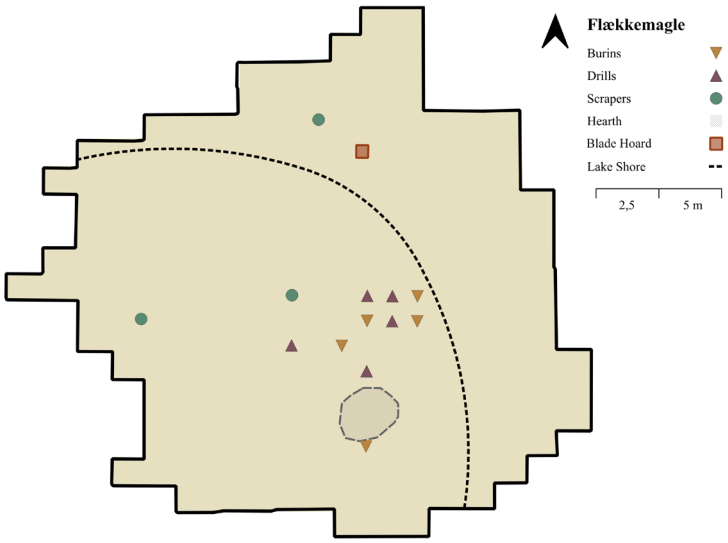


Figure 16. Spatial Distribution of retouched tools (n =13). Their distribution suggests some spatial differentiation of activities within the site (Content and graphic prepared in QGIS: Amalie Hellebert Puzniak Hvid).

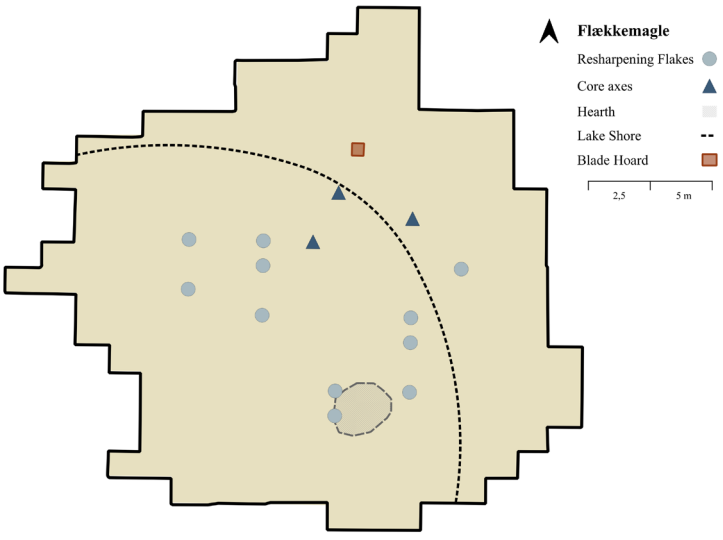


Figure 17. Spatial Distribution of axe resharpening flakes (n = 11; pale blue) and core axes (n = 3; dark blue). Their distribution suggests spatial separation between activity zones and discard area (Content and graphic prepared in QGIS: Amalie Hellebert Puzniak Hvid).

Discussion

The depositional context and contents of the Flækkemagle hoard closely resemble those from the hoards from Rønneholm 8 and Gøngehusvej 7, which were also deposited at the shoreline (Bjørnevad-Ahlquist 2020). Their blades are of comparable quality to those from Flækkemagle and likewise show no evidence of use-wear but differ in both size and arrangement. The blades from Rønneholm 8 and Gøngehusvej 7 are considerably shorter, and all but the uppermost blade were arranged with their ventral surfaces upwards. The Flækkemagle hoard is therefore distinctive, as artefacts of comparable size are generally rare in the Mesolithic record, although a small number of oversized Kongemosian objects are known, including pointed flint weapons (Sjøstrøm and Dehman 2015, 17).

Mesolithic hoards have been interpreted as expressions of ritualised practices rooted in animistic and totemistic cosmologies (Björnevad-Ahlquist 2025; Damm 2025; Fuglstevedt 2018). This approach does not treat artefacts as belonging exclusively to either a profane or sacred and symbolic sphere. Rather, they form part of a network of interconnected human and non-human agents, where the meaning and significance of artefacts were produced through their material histories of their manufacture, use, handling, and deposition. In this way, ritual action could therefore be embedded into everyday activities, connecting people, places, materials, and non-human agents. We interpret the Flækkemagle hoard within this framework, while acknowledging that its deposition cannot be linked unambiguously to a formal ritual event.

We recognise that spatial analyses of artefacts recovered from disturbed contexts must be approached with caution. Agricultural disturbance may cause post-depositional displacement of artefacts, which can obscure spatial patterns and weaken subsequent interpretations (Martens and Ravn 2016). Previous studies, however, have shown that small artefacts may experience only limited displacement, allowing elements of their spatial patterning to remain sufficiently preserved for analysis (Steinberg 1996). Interpretative potential, however, remains largely dependent on the intensity and frequency of ploughing, as well as the degree of surface slope.

It appears that Flækkemagle was only subjected to ploughing during the 1980s. We infer this from its location within a wetland that became accessible to mechanised agriculture only after the bog was drained in the second half of the twentieth century (Matthiesen and Jensen 2005; Pedersen 2009). The inferred short duration of agricultural disturbance provides some grounds for confidence in the recorded spatial patterns. Nevertheless, it does not exclude post-depositional displacement, which must be considered when interpreting the spatial relationships at the site.

With these limitations in mind, the Flækkemagle assemblage provides evidence for a range of sub-

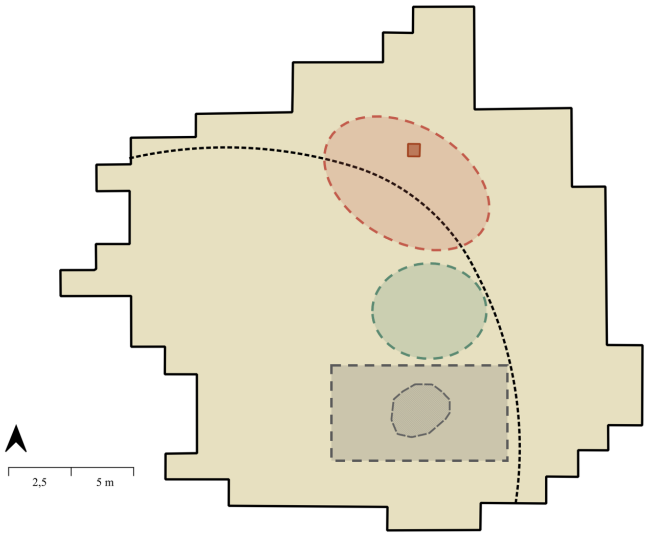


Figure 18. Final interpretation of the internal site organisation at Flækkemagle: hearth (grey polygon), primary flintworking area and possible habitation structure (black square), activity area for space demanding work (green circle), and dump zone (red circle) (Content and graphic prepared in QGIS: Amalie Hellebert Puzniak Hvid).

sistence, craft and hunting-related activities. Broad trapezes and production by-products such as Krukowski microburins, indicate that arrowheads were produced at the site. The functional interpretation of knives, scrapers, burins, and borers (Figure 18) further suggests that butchery and the processing of faunal material took place at the site. Worn-out axes are consistent with woodworking, possibly related to the production and maintenance of hunting equipment or structural elements of simple dwellings. Given their limited presence, however, it is unlikely that a larger construction or a substantial wooden object, such as a dugout canoe, was manufactured at the site.

The concentration of select manufacturing activities around the latent hearth may indicate the former presence of a habitation structure in the south-central part of the site. It is also possible that a bark floor was laid over the wet peat surface, as documented at other wetland sites (*e.g.* Andersen *et al.* 1982; Becker 1945; Bokelmann 1971; Fischer and Gotfredsen 2006). No structural remains were identified, however, so the proposed structure must therefore remain hypothetical.

The absence of fish bones cannot be taken as evidence that fishing was not practised locally, as it may reflect poor preservation or limitations in excavation and recovery. Fishing remains a possibility, particularly considering the site's lakeshore location. Recovered hazelnut shells demonstrate the processing or consumption of plant foods which may be compatible with activity during late summer or autumn. Similarly, higher winter water levels in the wetland may have prevented habitation during this period.

The apparent flint-working area and latent hearth may represent the activities of a single household or a small task group. The evidence is also compatible with repeated short visits during the Blak phase, however, the available data do not allow these alternatives to be distinguished further.

The worked flint assemblage appears to represent a range of unspecialised subsistence and craft activities, suggesting that Flækkemagle functioned as a strategically located settlement or activity site where resting, eating, hunting, gathering, and flint production took place. Variation in the spatial distribution of activity indicators, together with the apparent clearing of central areas, is consistent with a relatively short period of occupation when considered alongside the site's extent and material accumulation. Where the occupants spent the remainder of the year is unknown. The coast, however, is a plausible area, given the high density of contemporary shoreline habitation sites (Fischer 1997; Sørensen 2017).

Stable-isotope evidence from human remains recovered at coastal sites demonstrates that seafood was an important component of Kongemosian diets (Fischer *et al.* 2007; Meadows and Fischer 2024). Isotopic signatures in the bone collagen of Kongemosian dogs from Store Åmose have also been interpreted as evidence for mobility between coastal and inland areas (Noe-Nygaard 1995, 250–263). These findings make a connection between Flækkemagle and coastal areas plausible, although they cannot be tied directly to the site's occupants. The possible coastal procurement of the flint nodule used for the blade hoard offer further, albeit indirect, support for such a connection.

Conclusions

Fully excavated Kongemosian sites are rare, and particularity those with chronological coherence and well-defined spatial limits. This study establishes the importance of Flækkemagle, which can be attributed to the Blak phase of the Kongemose Culture on the basis of typology and AMS dating. In doing so, it further demonstrates the potential of small, contextually disturbed sites to contribute to our understanding of prehistory.

The assemblage provides insights into the spatial organisation of activities and its possible social aspects. It suggests that the site was occupied by a small group for a relatively short period, possibly in late summer or early autumn. The assemblage also provides evidence for an unspecialised subsistence economy involving bow hunting,

gathering, flint knapping, and other domestic activities. The hoard of unusually large blades offers further insight into advanced Kongemosian flint working and possible ritual practices and may point to a connection between the lakeside site and the coast.

Finally, this article demonstrates the potential for student-based projects to contribute to archaeological research through collaboration between universities, museums, and amateur archaeologists.

Epilogue

Drawing on his many years of field reconnaissance in Store Åmose, TBH proposed that Flækkemagle might represent a phase of the Kongemose Culture earlier than either of the two chronological units identified in previous research (Petersen 1984). This interpretation is supported by our attribution of the assemblage to the Blak phase, which had not yet been recognised when TBH made his proposal (*cf.* Sørensen 2017).

The site's limited but well-defined extent further led TBH to suggest that it might represent a brief, single-component occupation. On this basis, he considered Flækkemagle well suited to a typochronological study, which he sought permission to pursue as a hobby alongside his work as a dentist. With the support of the National Museum of Denmark, permission to excavate was granted on the condition that the fieldwork, reporting, and cataloguing of finds were carried out under the supervision of a professional archaeologist with relevant experience (SI 2).

While the work at Flækkemagle yielded insightful results, the site had not been TBH's first choice. He had initially intended to investigate a locality approximately 1 km further west, labelled Sandlyng 25 (Andersen 1983, 91). TBH's surface collection from this site included substantial quantities of flint and faunal remains (pers. comm. TBH), but the landowner did not grant permission to excavate. Sandlyng 25 is now protected from ploughing and deep drainage as part of



Figure 19. Tom Brædstrup-Holm proudly presenting the hoard of flint blades (Photograph: Anders Fischer, 1990).

Denmark's largest archaeological reserve to date (Fischer 1999, 2001b). Attempts to incorporate Flækkemagle into the reserve have so far been unsuccessful. In this regard, TBH's commitment to investigating the site was therefore particularly important, as continued disturbance would probably have substantially reduced its archaeological potential.

Acknowledgements

The paper is dedicated to the memory of Tom Brædstrup-Holm (1944-2023), who initiated and led the Flækkemagle research project. Regrettably, following a prolonged illness, he passed away before he could see the project to completion. We gratefully acknowledge the work he carried out in collaboration with his wife, Jytte Højbjerg

Brædstrup-Holm, and the dedicated volunteers who supported the project throughout.

We also thank the landowner and tenant for their hospitality and for facilitating fieldwork on the property. Our thanks are likewise due to Lisbeth Pedersen (Kalundborg og Omegns Museum) for her practical assistance during the fieldwork, as well as the late Claus Malmros (National Museum of Denmark), Helle Juel Jensen (University of Aarhus) and John Meadows (Leibniz-Zentrum für Archäologie, Schleswig) for their analytical contributions to the project.

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Archival information

The site is registered as no. 04.01.12-282 in the national inventory of sites and monuments, 'FundogFortidsminder', maintained by the Danish Agency for Culture and Palaces. The associated written records are held by the National Museum of Denmark reference numbers NM1 j. no. 4250, NM DO/OMA j. no. 7226/91 and NNU j. no. A7133. The artefact assemblage is also held by the National Museum of Denmark under inventory no. A47828, særnummereringshovednumer M III.

Notes

1 The Flækkemagle assemblage was analysed in spring 2025 by the first two authors, Amalie Hellebert Puzniak Hvid and Signe Stegmann, under the supervision of the third author, Associate Professor Mikkel Sørensen. Their work provided the catalyst and foundation for this paper. The analyses and results presented here build on that work (*i.e.* Supporting Information).
2 Here, L denotes length and B width.

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