Editors' note: Mara-Julia Weber is the second recipient of the „Hugo Obermaier-Förderpreis", an award made possible by a generous endowment of the late Hertha Halter, a long term member of the Society. It is dedicated to enabling awardees to carry out independent and original fieldwork relevant to the aims and interests of the Society.

Mara-Julia Weber ist die zweite Preisträgerin des „Hugo Obermaier-Förderpreises". Der Preis konnte dank einer großzügigen Zuwendung aus dem Vermächtnis des langjährigen Mitgliedes Frau Hertha Halter ausgelobt werden. Die Förderung soll Doktorandinnen und Doktoranden ermöglichen, ein eigenes Grabungsprojekt durchzuführen.

New information on the Havelte Group site Ahrenshöft LA 58 D (Nordfriesland, Germany) - Preliminary results of the 2008 fieldwork

Neue Informationen zum Fundplatz der Havelte-Gruppe Ahrenshöft LA 58 D (Nordfriesland, Deutschland) - Vorläufige Ergebnisse der Ausgrabungen 2008

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Abstract - Late Glacial processes of human colonisation, adaptation and development represent a large field of study with a wide range of approaches. With respect to the archaeological succession from the classic Hamburgian to the Havelte Group, studies on the latter are still rare in Northern Germany. This paper aims to contribute to the chronological and archaeological characterization of the Havelte Group by presenting some new results from the Ahrenshöft LA 58 D site. Located in a micro-region rich in Late Glacial occupations, especially of the Hamburgian, the site was the subject of excavation in 1995. Questions regarding the homogeneity and chronological attribution of the site had been raised, leading to further fieldwork in 2008. This included palynological, micro-tephra and soil micromorphology analyses, which were partly supplemented by samples collected in 2009. The preliminary results presented here confirm the absence of indications of archaeological heterogeneity and, despite taphonomic difficulties, seem to confirm a recent age for the occupation, after the early Late Glacial Interstadial and within the Havelte Group.

Zusammenfassung - *Spätglaziale Prozesse menschlicher Wiederbesiedlung, Anpassung und Entwicklung stellen ein weites Arbeitsfeld dar, das mit einer Vielzahl von Forschungsansätzen untersucht werden kann. Im Zusammenhang mit der Frage nach der archäologischen Abfolge von der klassischen Hamburger Kultur zur Havelte-Gruppe lässt sich feststellen, dass letztere in Norddeutschland noch weiterer eingehender Untersuchungen bedarf. Neben den dänischen Fundplätzen der Havelte-Gruppe und dem niederländischen Fundplatz Oldeholtwolde wurden nämlich bislang nur die Fundstellen Ahrenshöft LA 73 und LA 58 D nach modernem Standard und in Verknüpfung mit naturwissenschaftlichen Analysen ergraben. Die Bedeutung der Lokalität LA 73 liegt vor allem in der bislang einzigartigen Überlagerung eines durch Hamburger Kerbspitzen charakterisierten Horizonts durch einen Horizont, der von Havelte-Spitzen dominiert wird. Mit diesem Aufsatz soll anhand neuer Ergebnisse zum Fundplatz Ahrenshöft LA 58 D ein Beitrag zur chronologischen und archäologischen Charakterisierung der Havelte-Gruppe geleistet werden. Der Fundplatz liegt in einer Mikroregion des Saale-Moränen-Gebiets Nordfrieslands, die reich an spätjungpaläolithischen und spätpaläolithischen Fundstellen ist, was möglicherweise auf die für Jagdaktivitäten günstige Geländesituation oder die Rohmaterialsituation zurückzuführen ist. Erste Ausgrabungen erfolgten 1995 und erbrachten ein typisches Steinartefaktinventar der Havelte-Gruppe, das jedoch mögliche Elemente der Federmesser-Gruppen aufwies. Ein ^{14}C-Ergebnis stellte die Hinterlassenschaften ans Ende des frühen spätglazialen Interstadialkomplexes und stand damit im Widerspruch zur pollenanalytischen Zuweisung zur älteren Phase des mittleren spätglazialen Interstadialkomplexes. Die Fragen nach der Homogenität des Fundmaterials und nach seiner Datierung führten 2008 zu einer weiteren Ausgrabung und der Gewinnung von Proben für Pollen- und Mikro-Tephraanalyse sowie mikromorphologische*

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Untersuchungen, die zum Teil von 2009 entnommenen Proben ergänzt wurden. Die hier vorgestellten vorläufigen Ergebnisse sprechen für ein homogenes Inventar der Havelte-Gruppe und scheinen trotz taphonomischer Probleme eine späte Datierung des Fundplatzes innerhalb der Havelte-Gruppe, und zwar in die ältere Phase des mittleren spätglazialen Interstadialkomplexes, zu bestätigen.

Keywords - Late Glacial, North European Plain, Havelte Group, dating, site formation processes
Spätglazial, Nordeuropäische Tiefebene, Havelte-Gruppe, Datierung, Fundplatzgenese

Introduction

Human recolonisation of the North European Plain during the early Late Glacial Interstadial (Greenland Interstadial [GI] phases GI-1e and GI-1d, nomenclature after Björck et al. 1998) is associated with the Hamburgian tradition. The only subdivision of this tradition which is still accepted is the bipartition into the classic Hamburgian and the Havelte Group. Based on the lithic artefacts, the classic Hamburgian is characterized by shouldered points, whereas the Havelte Group is defined on the basis of tanged points of the so-called Havelte type (Schwabedissen 1937; Bohmers 1947). Interpretations for the use of these different projectile points rely on functional, regional and chronological characteristics. In this respect, a key-site is Ahrenshöft LA 73, which is part of a micro-region with several known Hamburgian sites. This micro-region is suitable for investigations of the Hamburgian not only because of uniform environmental conditions and raw material availability, but also because of the possibility of testing inter-site relationships. A second locality which had partly been excavated in the 1990s is Ahrenshöft LA 58 D, belonging to the Havelte Group. Since this site seems to represent a younger phase of the Havelte Group compared to that at LA 73, and since Hamburgian sites excavated with modern standards are rare, we decided to renew excavations at the site in 2008. This was made possible by the Hugo Obermaier-Förderpreis dedicated to fieldwork projects proposed by Ph.D. students.

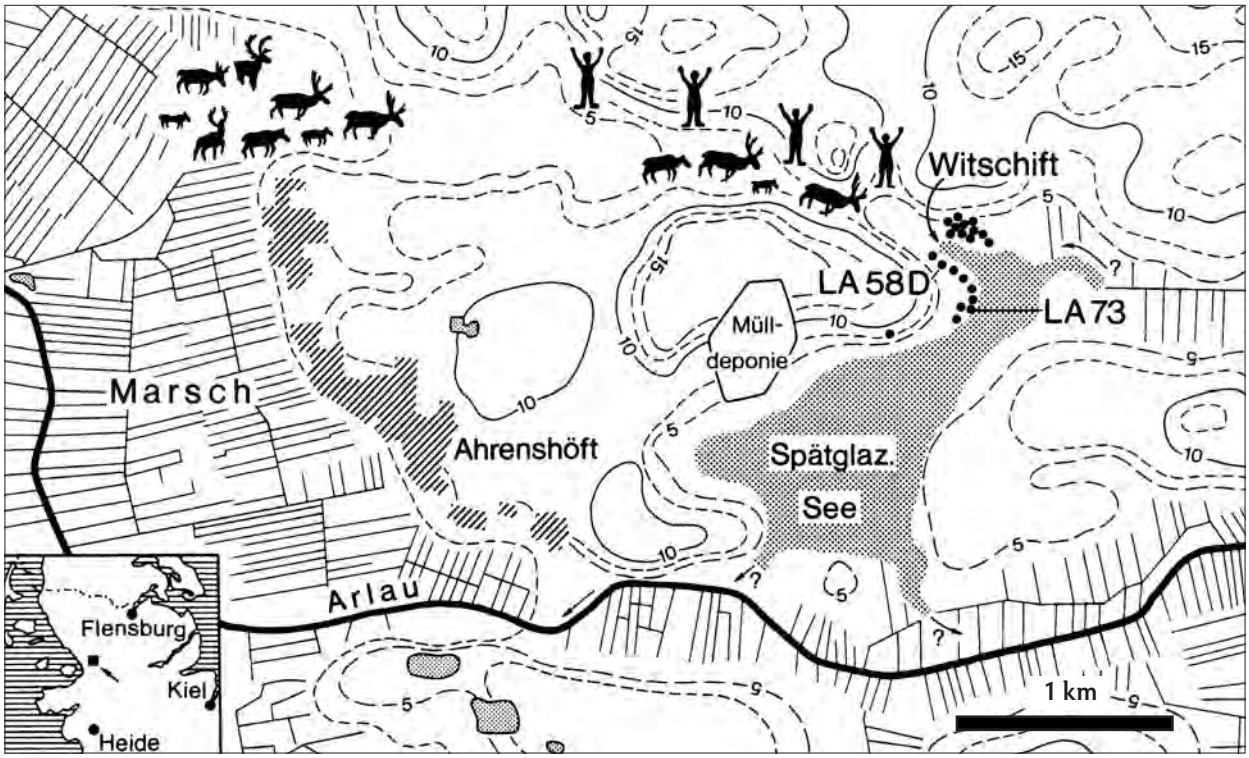

Fig. 1. Location of Hamburgian sites at Ahrenshöft, at the edge of the former peat bog Witschift and in the vicinity of a reconstructed Late Glacial lake. Schematically depicted reindeer and humans indicate one potential hunting method in this situation, inspired by ethnographic data (Grønnow et al. 1983, fig. 45). After Clausen 1998, fig. 4.

Abb. 1. *Lage von Fundplätzen der Hamburger Kultur in Ahrenshöft am Rand des ehemaligen Moors Witschift und in der Nähe eines rekonstruierten spätglazialen Sees. Schematisch abgebildete Rentiere und Menschen zeigen eine mögliche Jagdmethode in dieser Situation nach ethnographischem Vorbild (Grønnow et al. 1983, fig. 45) an. Nach Clausen 1998, Abb. 4.*

Location of the site

The different find concentrations of the Ahrenshöft site are located at the western border of the Saalian moraine area of western Schleswig-Holstein (Fig. 1). At an altitude of approximately 3 to 5 m above sea level (asl), they follow the northern and south-western shore of a peat bog called Witschift, which measures c. 350 x 150 m (Clausen 1998, 15). As the peat has been mostly removed by peat-cutting, the present topography resembles that of the Late Glacial (Clausen 1998, 17). This peat bog zone represents the north-western fringe of a depression, which itself is connected with Weichselian glacial drainage channels oriented in an east-west direction. To the north, one of the sandy dunes which lie parallel to these channels forms the boundary of the peat bog (Clausen 1998, 15).

In the mid-1990s, the existence of a Late Glacial lake was demonstrated by coring. At the western border of the Witschift and the meadow adjacent to it in the south, blackish-brown, humous silts were observed immediately beneath the modern soil. Due to their low thickness and telmatic pollen spectrum, shallow, marshy shores were reconstructed, suggesting that a northeast – to – southwest oriented lake 1.6 km long and 0.8 km wide filled the depression, with an assumed lake level of 2.5 m asl (Clausen 1998, 16).

In combination with the position of the site between the tops of two Saalian moraines, the landscape seen by Hamburgian groups represented a bottleneck situation leading to a body of water, which would have been propitious for reindeer hunting. Comparable situations are known ethnographically, e.g. use by Inuit hunters at Aasivissuit (Grønnow et al. 1983, fig. 45), but also archaeologically, e.g. from Stellmoor (Rust 1943). Unfortunately, almost no bone material is preserved at the Ahrenshöft localities due to the sandy , hence acidic, sediment, and therefore the idea of Hamburgian hunters ambushing reindeer herds on their way east from Doggerland (Clausen 1998, 43-44) remains hypothetical. Another possible reason for the repeated visit of Hamburgian groups at this site consists in the higher amount of flint among the glacial deposits in this part of the Saalian moraines, making it a favourable location for lithic raw material procurement.

Previous investigations and remaining questions

Discovery of the find concentrations

The Ahrenshöft sites were discovered in the early 1950s by a local teacher H. Baum, who first found a Hamburgian shouldered point as well as a combination tool and an end-retouched blade, summarized as site LA 61 (Hinz 1954, 97). Together with W. Taute and K. H. Dittman, Baum discovered two more concentrations with shouldered points, "Zinken" and burins, but also one concentration which presumably belonged to the Curve-Backed Point Groups (Hingst 1957). These concentrations were not labelled and cannot be located exactly on the basis of their description, whereas Taute mentioned two localities, LA 58 b and LA 58 c, in 1957, to which LA 58 d-f were later added (Hartz 1987, 6). After Baum had given up collecting activities, H. I. Boockhoff and P. H. Andresen continued to visit the still-accessible sites sporadically. All concentrations belonging to Ahrenshöft LA 58 were identified by P. H. Andresen when the topsoil was broken up for the purpose of tree planting (Hartz 1987, 6-7). He reported that the artefacts of LA 58 a-c occurred only 5 to 10 cm below the modern surface and that they were situated in the turned sods.

In 1987, S. Hartz and K. Bokelmann carried out coring in order to record the size of the presumed Late Glacial lake. Gyttja encountered at a depth of 3 m was first considered to have belonged to this lake, but following the palynological results, it is believed to have formed during the Eemian (written comm. F. R. Averdieck).

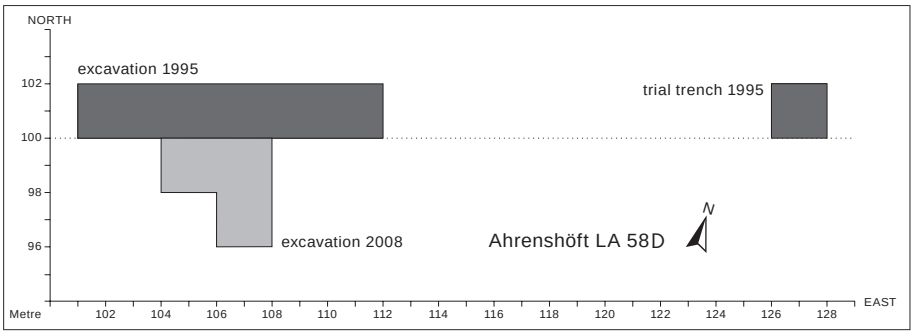

Fig. 2. Position of the excavation trenches at Ahrenshöft LA 58 D. 0.00 North/0.00 East of 1995 is changed into 100.00 North / 100.00 East in 2008 (plan: Th. Poelmann and J. Schüller).

Abb. 2. *Position der Grabungsschnitte des Fundplatzes Ahrenshöft LA 58 D. 0,00 Nord/0,00 Ost von 1995 wurde 2008 zu 100,00 Nord/100,00 Ost (Plan: Th. Poelmann und J. Schüller).*

Revisiting the documentation from the 1950s led I. Clausen in 1995 to excavate locality LA 58 D (Hartz 1987: LA 58 d), which was already known from surface finds (Clausen 1998, 14. At the occasion of landscape renaturation works, I. Clausen further discovered locality LA 73 and excavated it in 1997 and 1998 (Clausen 1998, 17, 44). This site is crucial for understanding of the early Late Glacial human recolonisation of the North European Plain because it represents the only case thus far known of a horizon characterized by Havelte tanged points stratigraphically overlying a horizon dominated by classic Hamburgian shouldered points (Clausen 1998, 44-45). Altogether 21 Late Glacial find concentrations are known along the Witschift (Clausen 1998, 14).

1995 fieldwork at Ahrenshöft LA 58 D

At LA 58 D, a trench measuring 2 x 11 m, oriented west-southwest by east-northeast and a trial trench of 2 x 2 m, situated at a distance of 14 m from the eastern trench wall, were excavated (Fig. 2). The original grid based on 0.00 North / 0.00 East in 1995 has been changed into 100.00 North / 100.00 East in 2008. In the following, position indications will refer to this new system. The finds uncovered during excavation were three-dimensionally recorded, and the remaining pieces as well as those recovered by sieving were quantified by square metre.

Stratigraphically, geological Horizon 1 was formed by the modern soil cover together with a largely anthropogenic, strongly mineralized peat (Fig. 3). In the western part of the main trench, it was followed at 5 to 10 cm depth by grey fine sand, which has been anthropogenically altered and which contained pieces of charcoal, peat and, in its lower part, lenses of leached sand and peat with a dominant fine sand fraction (Horizon 2a). At approximately 107.70 m East, this fine sand changed into black-brown, reworked peat, which was significantly affected by bioturbation and contained lenses of fine sand at its top (Horizon 2). Pollen analysis carried out by W. Dörfler and H. Usinger (pers. comm.) on a sample taken from the profile at 112.00 m East attributed it to the Holocene, most likely the Atlantic period.

In the western part, Horizon 2a overlay a reddish-brown to brown fine sand (Horizon 6), containing oxidized iron-bearing sand layers and which was inclined towards the east where it ended at about 107.00 m. Towards the base followed a 5 to 15 cm thick fine-sand layer, which contained mm-thick precipitation horizons with wavy outlines in its upper part (Horizon 7a) as well as parallel-bedded, dark-brown precipitation horizons in its lower part (Horizon 7b). 40 to 50 cm below the surface, a complex of mostly horizontally and alternately bedded silt and fine sand with a basal coarse sand layer is designated as Horizon 8. Between 102.50 and 103.60 m East, Horizons 6 to 8 were cut by a modern ditch running perpendicular to the excavation trench. Its infill consisted of yellow fine sand with parts of Horizons 7a and 7b at the base and leached fine sand together with root-bearing black peat, so that a connection with the anthropogenically moved Horizon 2a seems plausible.

In the eastern part, Horizon 2 was followed on from about 110.70 m East by a thin, grey, humus-rich, fine sand layer exhibiting vortical structure, which contained dark, humus-rich streaks (Horizon 3). Based on the presence of *Filipendula* and high amounts of *Sphagnum*, H. Usinger (pers. comm.) attributed this horizon to the *Empetrum-Betula pubescens* Pollen Assemblage Zone (PAZ), i.e. the second part of the early Allerød. In order to avoid confusion, indications of Late Glacial biozones will be accompanied in the following by their equivalent in the nomenclature of Litt & Stebich (1999) and by the latter authors' correlation with the Late Glacial event stratigraphy of Björck et al. (1998), in this case the second part of the Bølling, GI-1c$_3$. The same palynological dating applies to the subjacent dark brown, fine sand gyttja (Horizon 4), which could be observed from 111.40 m on towards the east. It should be noted that the term gyttja is not congruent with the palynological result, which does not show elements indicating a sub-aquatic formation. This sediment overlies greyish-brown silt moved by cryoturbation and alternating at its base with yellow fine sand (Horizon 5). At approximately 105.80 m East, this horizon occupied a wedge-shaped position between Horizons 7b and 8.

In general, a slight inclination of the geological horizons towards the east could be observed. Due to the presence of supposed gyttja in the eastern part, it could be proposed that the excavation trench covered the transition from mineral ground to the Late Glacial shallow water zone (see above). This hypothesis correlated with the identification by H. Usinger (pers. comm.) of a pollen assemblage characteristic of the Meiendorf, based on c. 2 % *Hippophaë* in a silt gyttja which overlay cryoturbated sands in the trial trench. Nevertheless, the changing nature of the horizons from west to east remained unexplained at this stage.

Considering the vertical distribution of the archaeological remains (Fig. 4), it could be observed that the artefacts mainly occurred between 465 and 485 cm asl, albeit with considerable dispersion. Both the aforementioned modern ditch between 102.50 and 103.60 m East and the inclination towards the east were reflected in this distribution pattern. A downward step towards the east appeared at 107.00 m East, i.e. in a position where Horizons 6 and 7a, 7b ended. In the western part of the excavation trench, the altitude of most of the artefacts corresponded to Horizon 6 and the adjacent parts of the surrounding horizons, whereas the low number of artefacts in the eastern part belonged to Horizons 2 and 3.

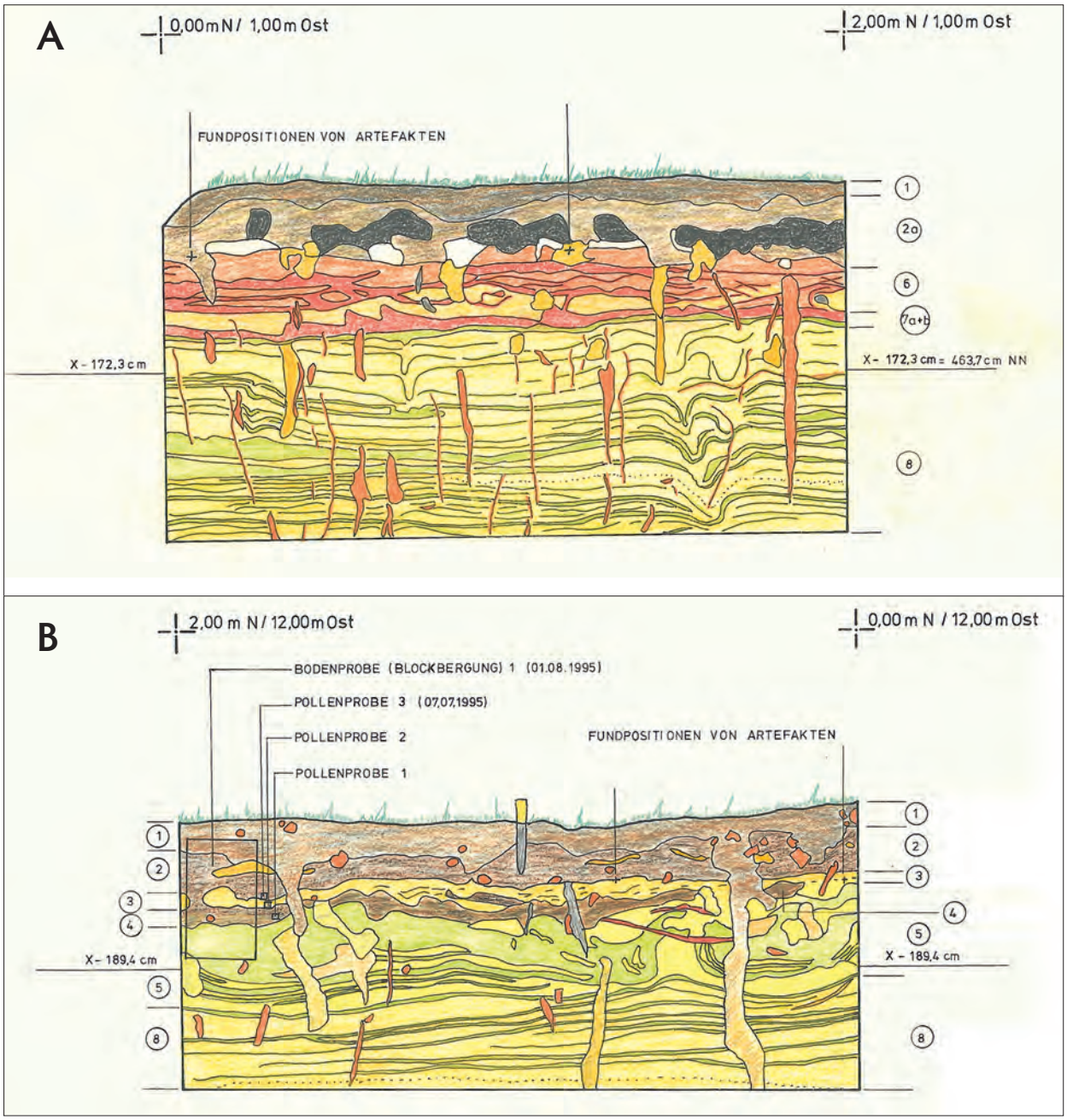

Fig. 3. Ahrenshöft LA 58 D. Profiles of the 1995 excavation at A) 100.00-102.00 m North / 101.00 m East, view from East, and at B) 100.00-102.00 m North / 112.00 m East, view from West (drawing: I. Clausen). Legend of A: 1 – modern soil, strongly mineralized and anthropogenically moved ash-grey peat; 2a – grey fine sand, anthropogenically altered, containing charcoal pieces, peat, and basal lenses of leached sand and peat with dominant fine sand fraction; 6 – reddish brown to brown fine sand with oxidized iron-bearing sand layers; 7 – fine sand containing in its upper part (7a) mm-thick precipitation horizons of wavy outline and (7b) parallel-bedded dark brown precipitation horizons; 8 – yellowish-brown alternately bedded silt and fine sand with basal coarse sand layer; white surfaces – leached sand. Legend of B: 1 – modern soil, strongly mineralized and anthropogenically moved ash-grey peat; 2 – reworked brownish black peat, strongly affected by bioturbation, containing fine sand lenses at its top; 3 – humus-rich grey fine sand of vortical structure, with dark humus-rich streaks; 4 – dark brown fine sand gyttja; 5 – greyish-brown silt moved by cryoturbation, at its base alternating with fine sand; 8 – yellowish-brown alternately bedded silt and fine sand with basal coarse sand layer. Both A and B: dark orange surfaces – modern cut tree roots; light orange surfaces – disturbed by bioturbation.

Abb. 3. *Ahrenshöft LA 58 D. Profile der Grabung 1995 bei A) 100,00-102,00 m Nord/101,00 m Ost, Ansicht von Osten, und B) 100,00-102,00 m Nord/112,00 m Ost, Ansicht von Westen (Zeichnung: I. Clausen). Legende zu A: 1 – Grasnarbe, stark mineralisierter Torf, aschgrau, anthropogen bewegt; 2a – Feinsand, grau, anthropogen bewegt mit Holzkohle- und Torfpartikeln, im Liegenden mit feinsandigen Torf- und Bleichsandlinsen; 6 – Feinsand, rotbraun bis braun, mit eingeschalteten Lagen oxidierter eisenhaltiger Sande; 7 – Feinsand mit (7a) wellenförmig eingelagerten, millimeterstarken Ausfällungshorizonten und (7b) parallel geschichteten Ausfällungshorizonten dunkelbrauner Färbung; 8 – Schluff-Feinsand in regelmäßiger Sortierung, braungelb, Basis mit Grobsandlage; weiße Flächen – Bleichsand. Legende zu B: 1 – Grasnarbe, stark mineralisierter Torf, aschgrau, anthropogen bewegt; 2 – umgelagerter Torf, schwarzbraun, stark durchwurzelt, stark vergangen, Hangendes mit Feinsandlinsen; 3 – Feinsand, grau-humos, mit verwirbelter Struktur und dunkel-humosen Schlieren; 4 – feinsandige Mudde, dunkelbraun; 5 – Schluff-Feinsand, grau-braun, im Liegenden wechselgelagert mit gelbem Feinsand, kryoturbat bewegt. Zu A und B: hellorange Flächen – rezente gekappte Baumwurzeln; dunkelorange Flächen – bioturbate Störungen.*

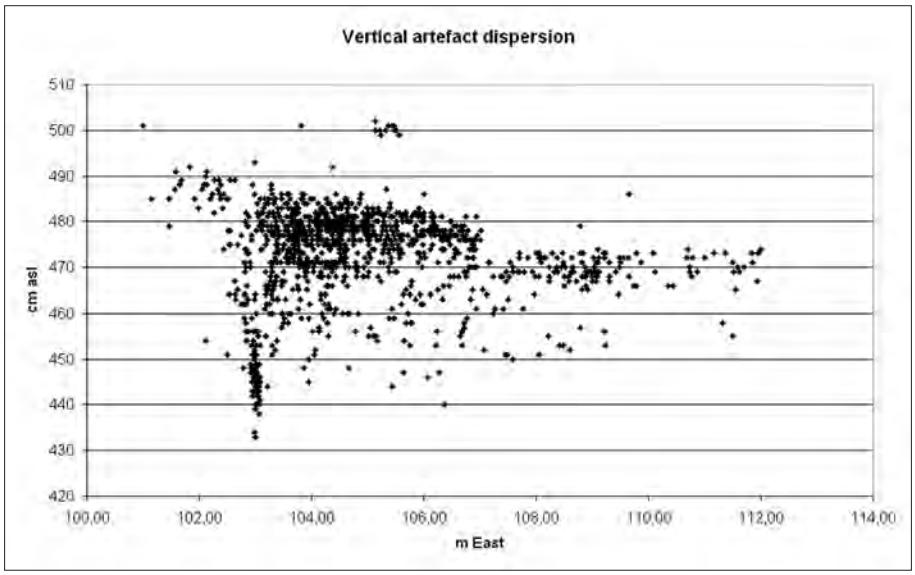

Fig. 4. Ahrenshöft LA 58 D. Vertical distribution of three-dimensionally recorded artefacts in the 1995 excavation trench, plotted along the west-east profile.

Abb. 4. *Ahrenshöft LA 58 D. Vertikale Verteilung der dreidimensional eingemessenen Artefakte im Grabungsschnitt von 1995, entlang des West-Ostprofils aufgetragen.*

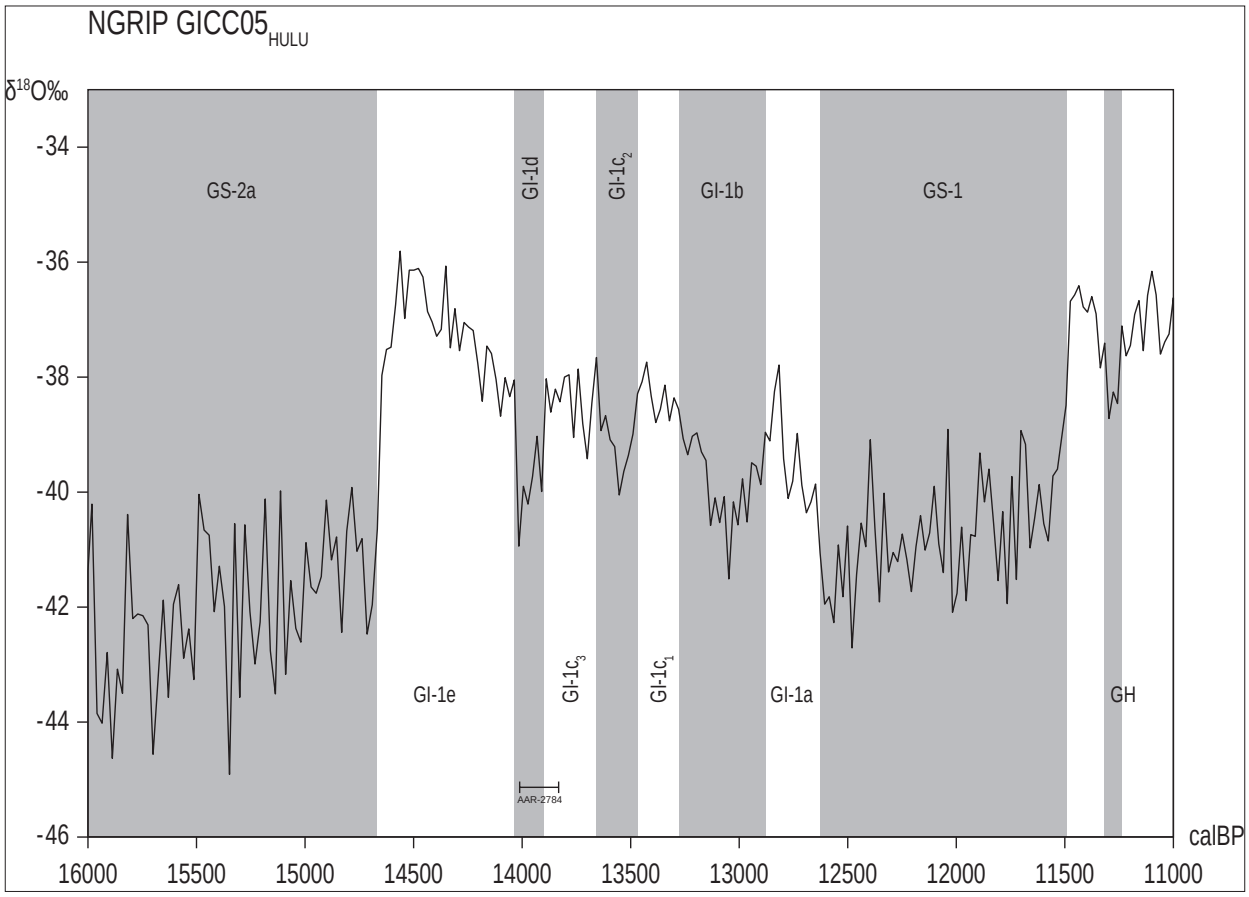

Fig. 5. Late Glacial event stratigraphy (Björck et al. 1998) based on $\delta^{18}O$ curve from NGRIP ice-cores on $GICC05_{HULU}$ timescale (Andersen et al. 2006; Rasmussen et al. 2006; Svensson et al. 2006; Vinther et al. 2006; Weninger & Jöris 2008). The single radiocarbon date for Ahrenshöft LA 58 D is indicated (graph: J. Schüller).

Abb. 5. *Spätglaziale Ereignis-Stratigraphie (Björck et al. 1998) basierend auf der $\delta^{18}O$-Kurve der NGRIP-Eiskerne auf der $GICC05_{HULU}$-Zeitskala (Andersen et al. 2006; Rasmussen et al. 2006; Svensson et al. 2006; Vinther et al. 2006; Weninger & Jöris 2008). Das einzelne ^{14}C-Ergebnis für Ahrenshöft LA 58 D ist angegeben (Grafik: J. Schüller).*

Remaining questions

These observations led to the first series of research questions dealing with:

- the dating of the Havelte Group occupation and
- site formation processes.

Despite the fact that the position of the artefacts could be connected with stratigraphic units, the following aspects attracted attention: Firstly, the very low depth of the Late Glacial artefacts below the recent surface was surprising but corresponded at least partly to the situation at LA 73 (Clausen 1998, fig. 5b). The fresh character of the lithic industry, the preservation of charcoal, and the general impression of low horizontal displacement (see below) made it even less plausible to consider this depth relative to the surface as one the archaeological material had occupied for thousands of years. Taking into account the chronological position of the Havelte Group before the Younger Dryas, one would also expect considerable effects of cryoturbation in the sediment in which the artefacts were embedded, again comparably to LA 73 (Clausen 1998, 17, 20). Thus, it seemed and still seems sensible to imagine an originally thicker sediment cover, which could have consisted of the sand forming the dune north of the Witschift (see above) or of the transgressing peat. The removal of material could also explain why, according to the palynological results, early Allerød (Bølling, GI-1c$_3$; Fig. 5) sediment was found immediately under Atlantic peat. However, a second difficulty would still arise from the dating of the find-bearing Horizon 3 to the early Allerød (Bølling, GI-1c$_3$). The Havelte horizon at LA 73 could be palynologically attributed to the *Hippophaë* maximum of the Meiendorf phase (GI-1e; Usinger 1998, 68) and the single pollen samples taken in connection with worked antler and artefacts in the kettle hole at Slotseng, which is situated close to two Havelte and two CBP Groups occupations (Holm 1992, fig. 4; 1996, 45-48, 52; 2003, 56), equally indicate a deposition during the Meiendorf (GI-1e; Mortensen 2007, 20). Lithostratigraphically, occupations attributed to the Havelte Group belong either to the Meiendorf (GI-1e) or the Oldest Dryas (GI-1d; Lanting & van der Plicht 1996, 95-96). This corresponds to the radiocarbon results for the few sites analysed by this method (Grimm & Weber 2008, 26-27, 30), except for Oldeholtwolde where radiocarbon results of Allerød age (Bølling-early Allerød, GI-1c$_3$-c$_1$; Hedges et al. 1992; Lanting & van der Plicht 1996) contradict the stratigraphic attribution to the Oldest Dryas (GI-1d; Stapert 1986, 32).

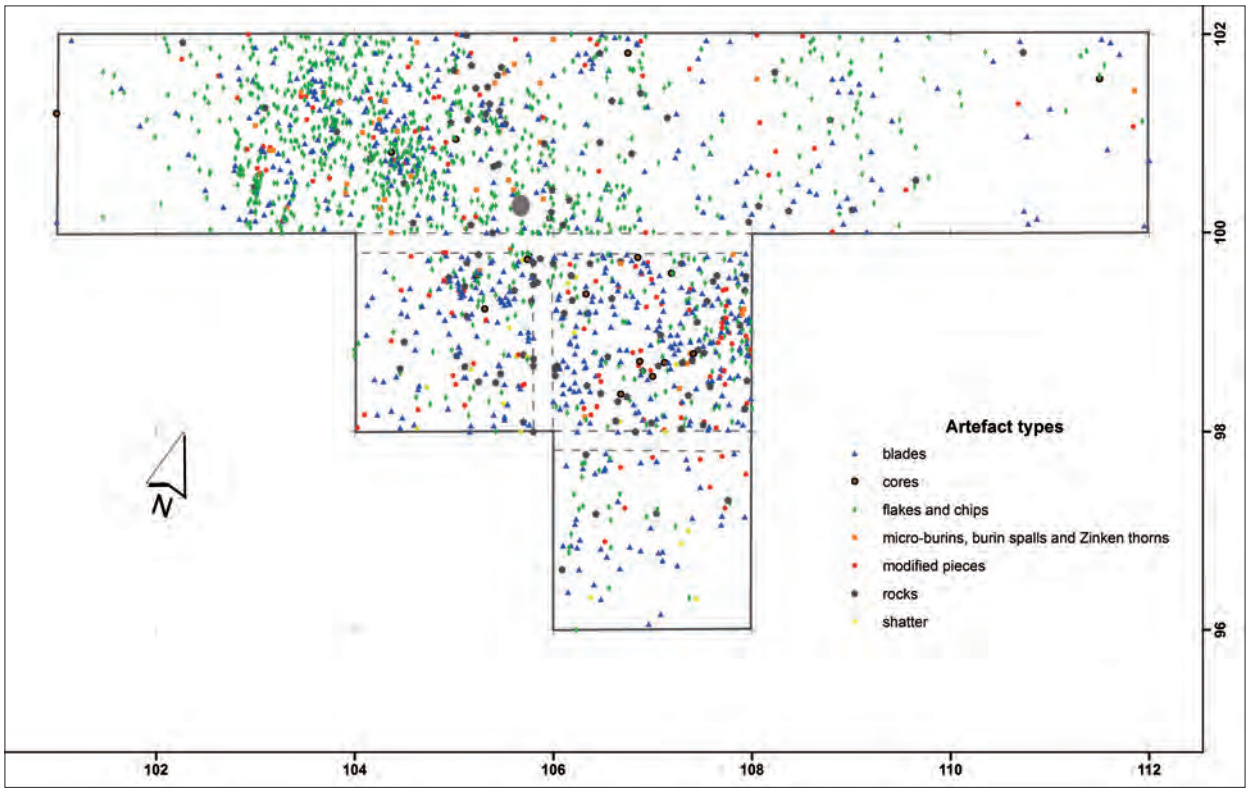

Fig. 6. Ahrenshöft LA 58 D. Horizontal distribution of three-dimensionally recorded artefacts from 1995 and 2008 (GIS application: A. Glykou and H. Erlenkeuser). Note the dominance of flakes and chips north-west of the charcoal concentration (grey surface) and of blades south-east of it.

Abb. 6. *Ahrenshöft LA 58 D. Horizontale Verteilung der dreidimensional eingemessenen Artefakte von 1995 und 2008 (GIS-Anwendung: A. Glykou und H. Erlenkeuser). Beachtenswert ist das Überwiegen von Abschlägen und Absplissen nordwestlich der Holzkohlenkonzentration (grau eingezeichnete Fläche) und von Klingen südöstlich von dieser.*

The most important radiocarbon result in this context is the one obtained on charcoal from the presumed fireplace of LA 58 D itself (see below), which indicates an age of 12 030 ± 60 BP (AAR-2784; Clausen 1998, tab. 3) or, after calibration with the CalPal-2007_{HULU} curve (Weninger & Jöris 2008; software application: CalPal download version, Weninger et al. 2007), of 12 060-11 880 cal. BC, i.e. the late Oldest Dryas (GI-1d, Fig. 5; Grimm & Weber 2008, 30). Calibration with the IntCal 09 curve (Reimer et al. 2009; software application: OxCal 4.1, Bronk Ramsey 2009) yields a broader period from 12 088 to 11 792 cal. BC and thus covers the very end of the Meiendorf (GI-1e), the entire Oldest Dryas (GI-1d), as well as reaching further into the Bølling (GI-$1c_3$).

In general, dating charcoal in sandy environments should be avoided due to the risk of an absence of contextual connection between the charcoal and human activity. In this case, however, the provenance of the sample from within a concentration of charcoal and other material with traces of heat exposure (see below) implies that it was part of a fireplace. Although it represents the most recent radiocarbon result for the Havelte Group (with the exception of those from Oldeholtwolde) and is almost identical with a date from the Curve-Backed Point Group site Klein Nordende (Bokelmann et al. 1983, for a review of the Klein Nordende dates including new ones, see Riede et al. in press), the age indication for Ahrenshöft LA 58 D is not compatible with the palynological attribution, or it may correspond only to the younger limit of the IntCal 09 calibration result. It should be noted then that the dating of this assemblage by association with the charcoal relies on only a single ^{14}C date and the number of artefacts recovered in the eastern area of the site where the palynologically dated horizons occurred is in any case low, although they include a Zinken as a typical Hamburgian element (Fig. 7: 15).

Despite the probability of post-depositional artefact displacement, the horizontal distribution of the artefacts from 1995 seemed to reflect the prehistoric situation (Fig. 6). At 105.60-105.80 m East / 100.20-100.40 m North, a concentration of charcoal occurred, which is interpreted to be part of a fireplace. Additional evidence for a fireplace could be provided by the accumulation of black sand and flint artefacts with traces of heat exposure as well as the presence of five pieces of rock 0.50 m east of the charcoal concentration. At 104.10-104.90 m East / 100.40-101.20 North, the high density of lithic artefacts might be interpreted as a knapping location. To the north and to the south, the limits of the site obviously had not been reached. Thus, one further aim of the new excavation campaign was to uncover a larger area of the site in order to gain additional insight into its spatial organization, and to obtain a larger artefact assemblage in order to evaluate its cultural homogeneity.

In general, the 3210 lithic artefacts recovered in 1995, including debris without ventral surface, characterized this occupation as one of the Havelte Group. Four Havelte tanged points (Fig. 7: 1-3, 5) occurred together with single and double Zinken (Fig. 7: 13-15) as well as scrapers on regular blades with or without retouched edges (Fig. 7: 7-9). The blades were regular, rectilinear in profile and obtained by soft percussion, using both organic and stone hammers. Among the small cores, which exhibit frost-shattered surfaces, two opposite platforms (n = 7) dominate over single platforms (n = 3), one case being indeterminable. In one further case, two opposite platforms exist and the common reduction face was also used as a platform for a dorsal reduction face. Core preparation by cresting is only visible for one dorsal crest and two dorso-lateral crests on the cores. The only elements reminiscent of Curve-Backed Point Group artefact types were a backed point with basal fracture (Fig. 7: 4) and two scrapers (Fig. 7: 10) with a resemblance to Wehlen scrapers (Schwabedissen 1954, pl. 57). The blank of the point, however, corresponds to the Havelte point blanks in its thinness and regular blade character, and the unretouched edge shows one fine negative adjacent to the fracture, which could either be due to this fracture or represent the extremity of one part of the tang retouch. Thus, this fragment could still fall within the range of variation of Havelte points. The two scrapers in question do not only possess lateral retouch but were also made on blanks which do not seem to have been obtained by regular blade production. The first one (Fig. 7: 10) is made on a blank with a shatter surface on its dorsal face and appearing to have been detached by a soft hammerstone. It shows entirely retouched, slightly converging edges. The second one is equally modified on a blank detached by a soft hammerstone and has cortex in combination with a frost-shattered surface and short negatives on its dorsal face in the direction of the blank itself. One of its slightly converging edges exhibits oblique retouch, which is fine over most of its length and long, i.e. non-invasive with retouch flake scars longer than 2 mm, at its distal part. The second of these scrapers displays long retouch at its distal part, use retouch at its medial part and fine retouch at the proximal end.

The presence of potentially Curve-Backed Point Group elements is not unusual on Danish Havelte Group sites, as lithic inventories containing these elements are known from Jels 1 (Holm & Rieck 1992, 77-78) and Jels 2 – the latter only counting three backed points without any Wehlen type scrapers (Holm & Rieck 1992, 81), from Slotseng a and c (Holm 1996) as well as Sølbjerg 2 A and B and 3 (Petersen & Johansen 1994, 89; 1996, 81-82). Since it is difficult to separate Slotseng a from the Curve-Backed Point Group concentration Slotseng e (Holm 1996, 48), and since Slotseng c is adjacent to concentration b, which is equally characterized by backed points (Holm 1996, 45),

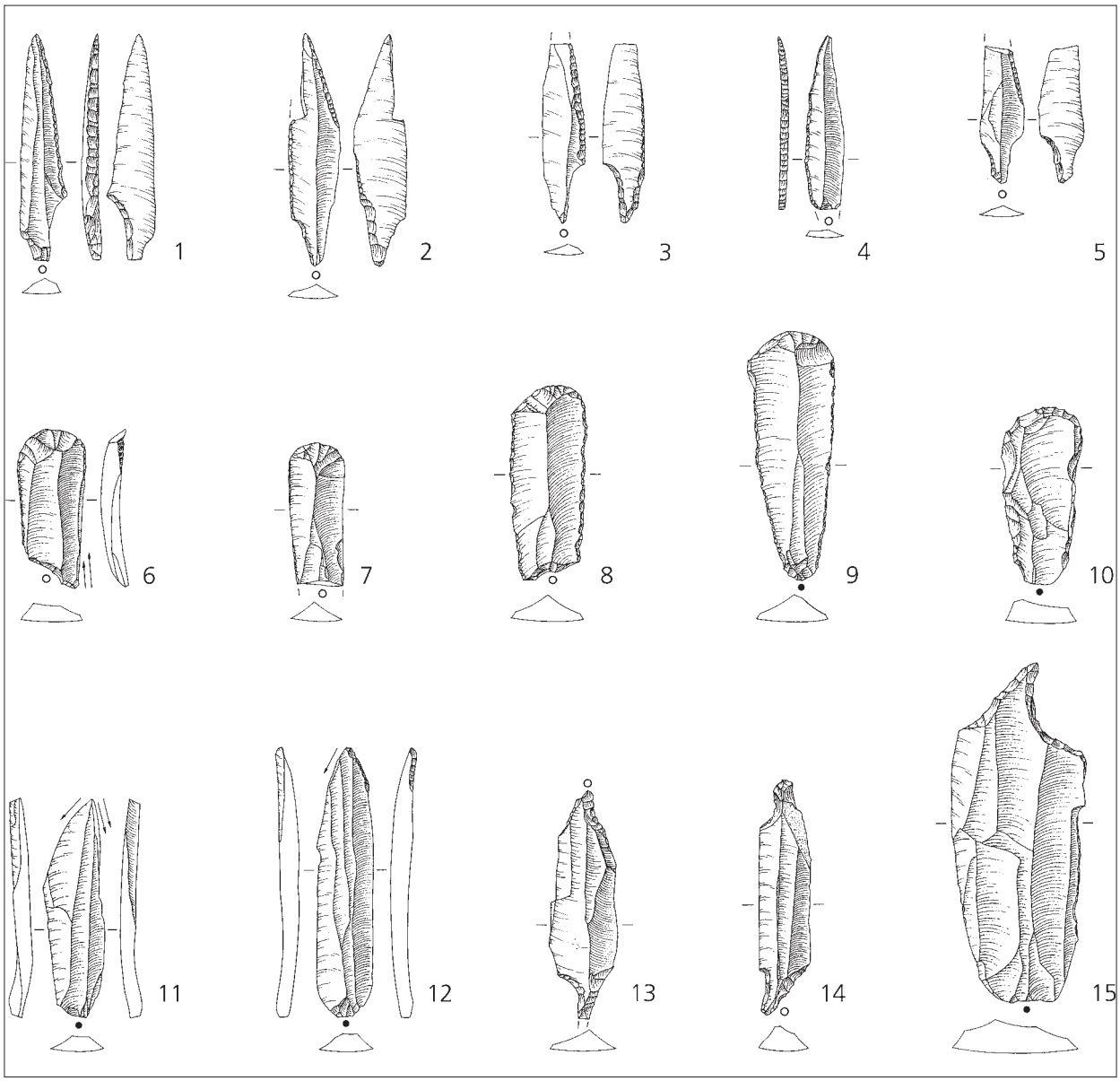

Fig. 7. Ahrenshöft LA 58 D. Modified pieces from the 1995 excavation. 1-3 and 5 Havelte tanged points, 4 backed point, 6 combination tool, 7-10 scrapers, 11-12 burins, 13-15 Zinken (drawing: A. Hebel and G. Hagel-Bischof). Modified after Clausen 1998, fig. 19.

Abb. 7. *Ahrenshöft LA 58 D. Modifizierte Stücke der 1995er Grabung. 1-3 und 5 Havelte-Spitzen, 4 rückenretuschierte Spitze, 6 Kombinationsgerät, 7-10 Klingenkratzer, 11-12 Stichel, 13-15 Zinken (Zeichnung: A. Hebel und G. Hagel-Bischof). Verändert nach Clausen 1998, Abb. 19.*

an admixture of the conspicuous elements from neighbouring concentrations cannot be excluded in this case. A comparable situation can be observed at Sølbjerg, which also yielded Curve-Backed Point Group concentrations (Petersen & Johansen 1996, 79). Therefore, an enlarged excavated surface at Ahrenshöft LA 58 D could potentially reveal the presence or absence of an adjacent Curve-Backed Point Group concentration.

2008 fieldwork

Thanks to the Förderpreis grant awarded by the Hugo Obermaier Society, a new excavation campaign directed by M.-J. Weber was undertaken at Ahrenshöft LA 58 D from June 16th to July 30th 2008. To the south of the former excavation trench, an angled trench was excavated between 104.00 and 108.00 m East and 96.00 and 100.00 m North, with 0.00 / 0.00 m East / North of 1995 being changed to 100.00 / 100.00 East / North (Fig. 2). This position was chosen in order to cover the area adjacent to the remains of the fireplace and the zone of high artefact density, but also to reach the southern limit of the concentration. Towards the 1995 trench and at 2 m distances within the new surface, baulks of 0.20 m width were left, creating three internal surfaces. Due to the known presence of artefacts in the topsoil, the sods were cut and the embedded artefacts collected by square metres. During excavation we removed the

Artefact type	Number
modified pieces, including	**78**
Havelte points	3
blade end-scrapers	12
burins	11
Zinken	9
borers	3
combination tools	5
truncated blades	2
notched pieces and denticulates	4
laterally retouched blades	17
use damaged blades	12
blades	335
flakes and chips	186
micro-burins, Zinken thorns and burin spalls	9
cores	11
shatter	20
rock	71
decomposed rock	2
charcoal	54
modern material	7
undeterminable	1
total	**774**

Fig. 8. Ahrenshöft LA 58 D. List of single finds excavated in 2008.
Fig. 8. *Ahrenshöft LA 58 D. Liste der 2008 ergrabenen Einzelfunde.*

sediment within the three internal surfaces in c. 2 cm spits, although we proceeded in thicker spits once no more artefacts were expected, since our primary aim then was to expose the profiles. As far as possible, the finds were three-dimensionally recorded and their exact orientation drawn on plans. The remaining finds were collected per quarter square metre, as were those recovered by sieving. In order to obtain new information as to the dating of the Havelte occupation, five sediment samples were taken for palynological analysis by H. Usinger from the northern profile at 99.80 m North in one case and from the eastern profile at 108.00 m East in the other four. For the purpose of identifying potential volcanic ash layers, which serve as time-synchronous signatures and thus build a chronological framework, two sediment columns (consisting of three tins) were taken from the eastern profiles at 105.80 m East and 108.00 m East by R. A. Housley and F. Riede for micro-tephra analysis as part of the RESET (Response of Humans to Abrupt Environmental Transitions) research consortium. In the same positions, four intact blocks of sediment were collected for micromorphological analysis by C. E. Miller in order to reconstruct the site formation history of LA 58 D.

Results: Archaeological homogeneity

The 2008 campaign yielded 774 excavated single finds and 12 surface finds in addition to 374 excavated

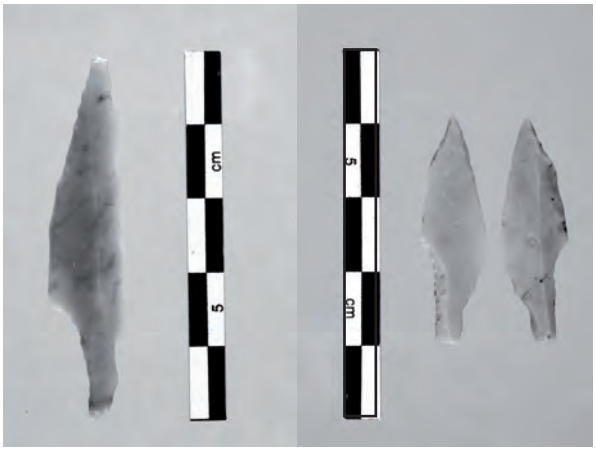

Fig. 9. Ahrenshöft LA 58 D. Havelte tanged points excavated in 2008. © Archaeological State Museum Schleswig.
Abb. 9. *Ahrenshöft LA 58 D. 2008 ausgegrabene Havelte-Spitzen. © Archäologisches Landesmuseum Schleswig.*

collected finds, 30 collected finds from profile cleaning, straightening and collapse, and 5 collected finds from surface cleaning. Since the collected finds still remain to be sorted into the different artefact categories, precise numbers cannot be provided yet. Among the excavated single finds, lithic artefacts dominate (Fig. 8) and within this category blades and their fragments represent the highest percentage. Concerning the question of homogeneity, it can be stated that no further indications of a Curve-Backed Point Groups component were found. The only projectile points are two (almost) complete Havelte points (Fig. 9) in addition to one medial (among the single surface finds) and one basal fragment. One of the complete specimens (Fig. 9: 2) is atypical and at first sight is reminiscent of Ahrensburgian tanged points because its apical part occupies only slightly more than half of its length and the apical retouch has an angled delineation, which together with inverse apical retouch on the opposite edge places the apex on the central axis of the point. Due to these features we interpret this piece as remodelled, perhaps following an impact fracture. The presence of such a fracture cannot be shown on the almost complete point (Fig. 9: 1), as it bears a transverse fracture with *languette* < 2 mm and hinge termination, but can be observed on the medial fragment, which possesses a transverse fracture with *languette* < 2 mm and step termination below the shoulder part of its tang retouch (nomenclature: Fischer et al. 1984; De Bie & Caspar 2000). Finally, the type of fracture on the basal fragment is not indicative of impact, but its position below the shoulder of the tang could be the result of a solid ligature, as observed for fractures just above the shoulder of Solutrean shouldered point replicas (Plisson & Geneste 1989, 93).

The tools are almost exclusively produced on regular blades showing features corresponding to the technological characteristics of Hamburgian blades

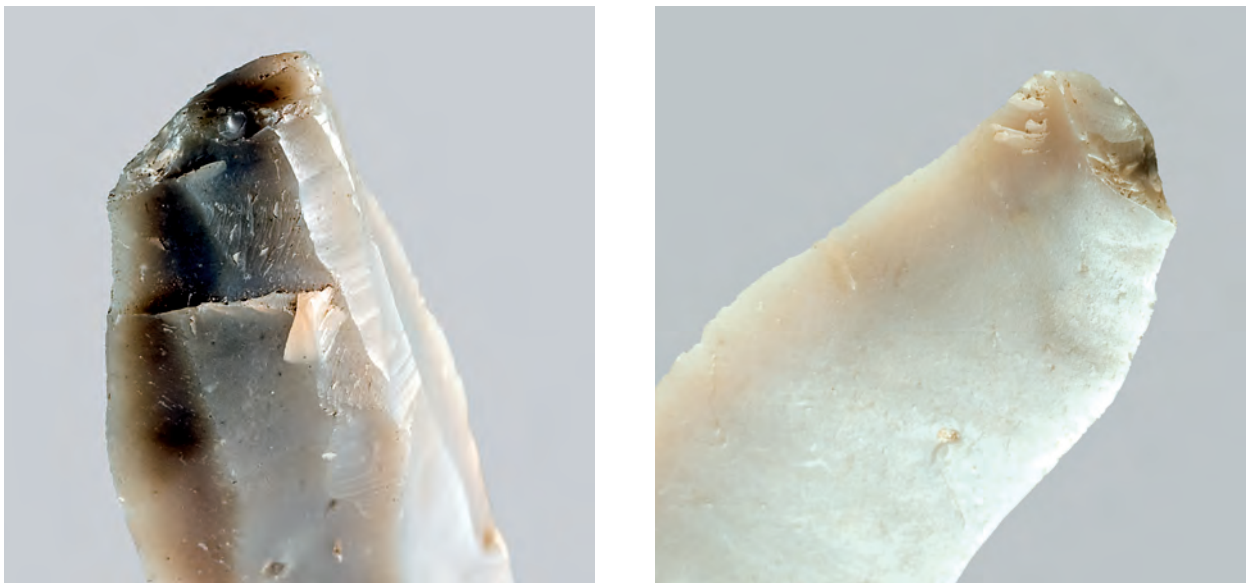

Fig. 10. Ahrenshöft LA 58 D. Blade end-scraper with *en éperon* preparation. © Archaeological State Museum Schleswig.
Abb. 10. *Ahrenshöft LA 58 D. Klingenkratzer mit* en éperon*-Präparation. © Archäologisches Landesmuseum Schleswig.*

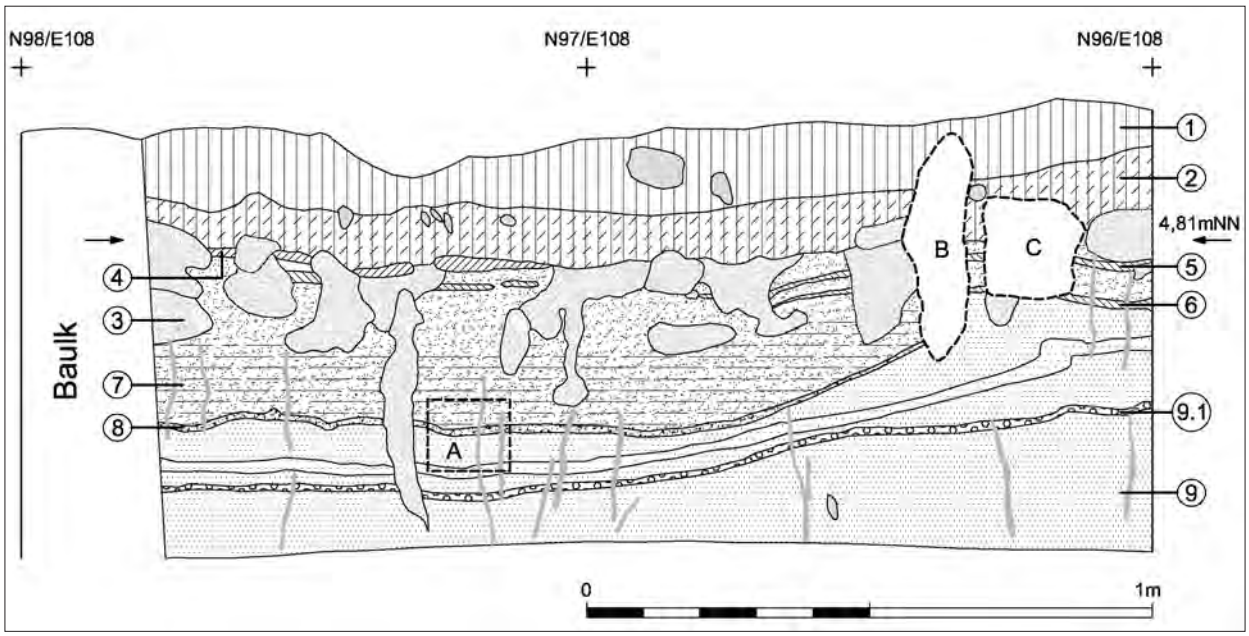

Fig. 11. Ahrenshöft LA 58 D. Profile of the 2008 excavation at 96.00-98.00 m North / 108.00 m East (drawing: I. Clausen, digitisation: J. Freigang). Legend: 1 – grey fine sand, strong root penetration, containing light sand streaks, anthropogenically reworked; 2 – black-humus fine sand, strong root penetration, partly containing light brown and mostly arch-shaped sand streaks due to bioturbation as well as charcoal particles; 3 – bioturbated parts; 4 – dark brown-humus silt, strongly decomposed peat; 5 and 6 – dark brown silt-sand and humified organic material, 5 – subdivided into upper dark brown and lower light brown layer, 6 – subdivided into upper light brown and lower dark brown layer; 7 – reddish brown iron oxide-bearing fine and medium sand, root penetration; 8 – dark brown coarse silt; 9 – yellowish-brown coarse silt, fine and medium sand, exhibiting graded bedding, root penetration, clearly moved by cryoturbation; 9.1 – coarse sand and gravel, moved by cryoturbation. A – sample 3176 for micromorphological analysis; B – sample 2866 for micro-tephra analysis; C – sample 2846 for micromorphological analysis.

Abb. 11. *Ahrenshöft LA 58 D. Profil der Ausgrabung 2008 bei 96,00-98,00 m Nord / 108,00 m Ost (Zeichnung: I Clausen, Digitalisierung: J. Freigang). Legende: 1 – Feinsand, grau, stark durchwurzelt, z.T. mit hellen Sandfahnen; 2 – Feinsand, schwarz-humos, stark durchwurzelt, z.T. mit hellbraunen, meist bogenförmigen Sandschlieren infolge von Bioturbation, z.T. mit Holzkohlepartikeln; 3 – Bioturbationsbereiche; 4 – Schluff, dunkelbraun-humos, stark zersetzter Torf; 5 und 6 – Schluff-Sand, dunkelbraun-humos, 5 differenziert in obere dunkelbraune und untere hellbraune Lage, 6 differenziert in obere hellbraune und untere dunkelbraune Lage; 7 – rotbrauner, eisenoxidhaltiger Fein- bis Mittelsand, durchwurzelt; 8 – Grobschluff, dunkelbraun; 9 – wechselgelagerte Schluffe, Fein- und Mittelsande, gelbbraun, deutlich geschichtet, durchwurzelt, deutlich kryogen bewegt; 9.1 – Grobsand-Feinkieslage, kryogen verstellt; A – Probe 3176 für mikromorphologische Analyse; B – Probe 2866 für Mikro-Tephrenanalyse; C – Probe 2846 für mikromorphologische Analyse.*

and do not comprise pieces with atypical retouch, such as scrapers of the Wehlen type. 33 specimens among the tools carry cortical, (frost-)shattered and / or old surfaces on their dorsal face, and 10 of them show the use of crests as a means of core preparation and rejuvenation. The same method is also attested on 9 % of the unmodified blades as well as on two cores in the form of dorsal crests and three others in the form of dorso-lateral crests. Four cores possess only a single platform, six specimens show two opposite platforms, and in one case, two opposite platforms are associated with two reduction faces. In this stage of the *chaîne opératoire* of blade production, one of the two opposite platforms dominates only once, whereas the platforms are equal four times. On the dorsal surfaces of the blades and blanks, both uni- and bidirectional reduction is attested, and the blades were obtained by soft percussion. One interesting feature is the *en éperon* preparation observed on the butt of a blade end-scraper (Fig. 10). This platform preparation method is characteristic of the Magdalenian (e.g. Pigeot 1987; Vermeersch et al. 1987; Valentin 1995; Floss & Terberger 2002) and was used in low percentages for obtaining blades in the classic Hamburgian. This technique has not been previously described for the Havelte Group (Madsen 1992; 1996).

Results: Dating of the Havelte Group occupation

Lithostratigraphy

During the 2008 excavation the geological horizons were defined independently from the ones identified previously, but can mostly be correlated with these. As in 1995, the artefacts occurred in the anthropogenically reworked, grey fine sand of Horizon 1 (Fig. 11) and in the underlying black-humus fine sand of Horizon 2, which seems to correspond to Horizon 2a from 1995. However, the lowermost part of Horizon 2a has been separated and grouped into Horizon 4, whereas Horizon 3 designates the bioturbated parts, mainly by burrows. According to the micromorphological observations, the dark Horizon 4 consists of humified and fragmented plant material found in association with loose sand evenly interspersed by fine organic particles (Fig. 12: B). Due to its macroscopic aspect reminiscent of the Allerød (Bølling-Allerød, GI-1c$_3$-a) soil of Horizon 2 at Ahrenshöft LA 73 (Clausen 1998, fig. 5), this horizon, which only occurred in some positions, was interpreted during the excavation as a potential formation of the same biozone.

Underneath Horizon 2, a reddish-brown fine and medium sand could be observed in all profiles and contained artefacts in its upper part (Horizon 7). During excavation, graded bedding has been observed in its lower part, but according to the micromorphological observation the graded bedding becomes more obvious and closely spaced from its lower border upwards (Fig. 12: D). The lower border of the artefact distribution seemed to correspond to a 1-2 cm thick dark brown horizon (5) within the sands of Horizon 7. Horizon 5 formed a double band with a comparable unit (Horizon 6) in most parts of the profiles not affected by bioturbation, except for the northern profile between 106.00 and 108.00 m East and the northern part of the eastern profile at 108.00 m East. Micromorphologically (Fig. 12: C), these horizons can be described as consisting of finely laminated, humified, fibrous organic material together with silt and some sand. The organic material is located at the top of individual graded beds and oriented parallel to the bedding plane. On the basis of this bedding, a deposition by water, probably associated with a lake edge position, is suggested, although water plant pollen is missing in the organic component. As these horizons showed similarities with the find-bearing silt layers at LA 73 dated palynologically to different stages of the Meiendorf (GI-1e) (Clausen 1998, 22-23, 45, fig. 9; Usinger 1998, 68), a similar age was assumed for these features. The combination of Horizons 5-7 seems to be comparable with Horizons 6 and 7 as defined in 1995, if the oxidized iron-bearing sand layers and precipitation horizons correspond to the new Horizons 5 and 6. The latter could also represent the same formation as the dark-humus streaks in the former Horizon 3 in the eastern part of the 1995 trench. Interestingly, micromorphological analysis shows that the wood fragments identified in Horizon 7 appear burned in the zone close to the presumed fireplace in the 1995 trench (Fig. 12: E).

At the lower border of Horizon 7, a thin, dark brown coarse silt layer occurred (Horizon 8, Fig. 12: F), which has a relatively well-defined upper contact with Horizon 7. The lowermost, yellowish-brown unit (Horizon 9) consists of rounded quartz grains from coarse silt to medium sand, although sand is the dominant grain size. Feldspars and some heavy minerals are present, though in quantities < 5 %, and mica is found mostly in association with the silt-size class. This sediment exhibits weak graded bedding and is affected by cryoturbation, indicating the presence of water. It further contains a layer consisting of coarse sand and gravel, which is mainly horizontal in its bedding but, parallel to Horizon 8, dips towards the north-east at 107.70 m East in the profiles at 96.00, 97.80 and 98.00 m North and between 99.10 and 99.70 m North in the profile at 106.00 m East. Thus, it seems as if Horizons 8 and 9 indicated a depression filled by the overlying horizons. Moreover, the basal sand of Horizon 9 ought to correlate with the basal sediment in the 1995 trench designated as Horizon 8.

Palynology and micro-tephra analysis

Due to their resemblance to Meiendorf (GI-1e) and Allerød (Bølling- Allerød, GI-1c$_3$-a) horizons,

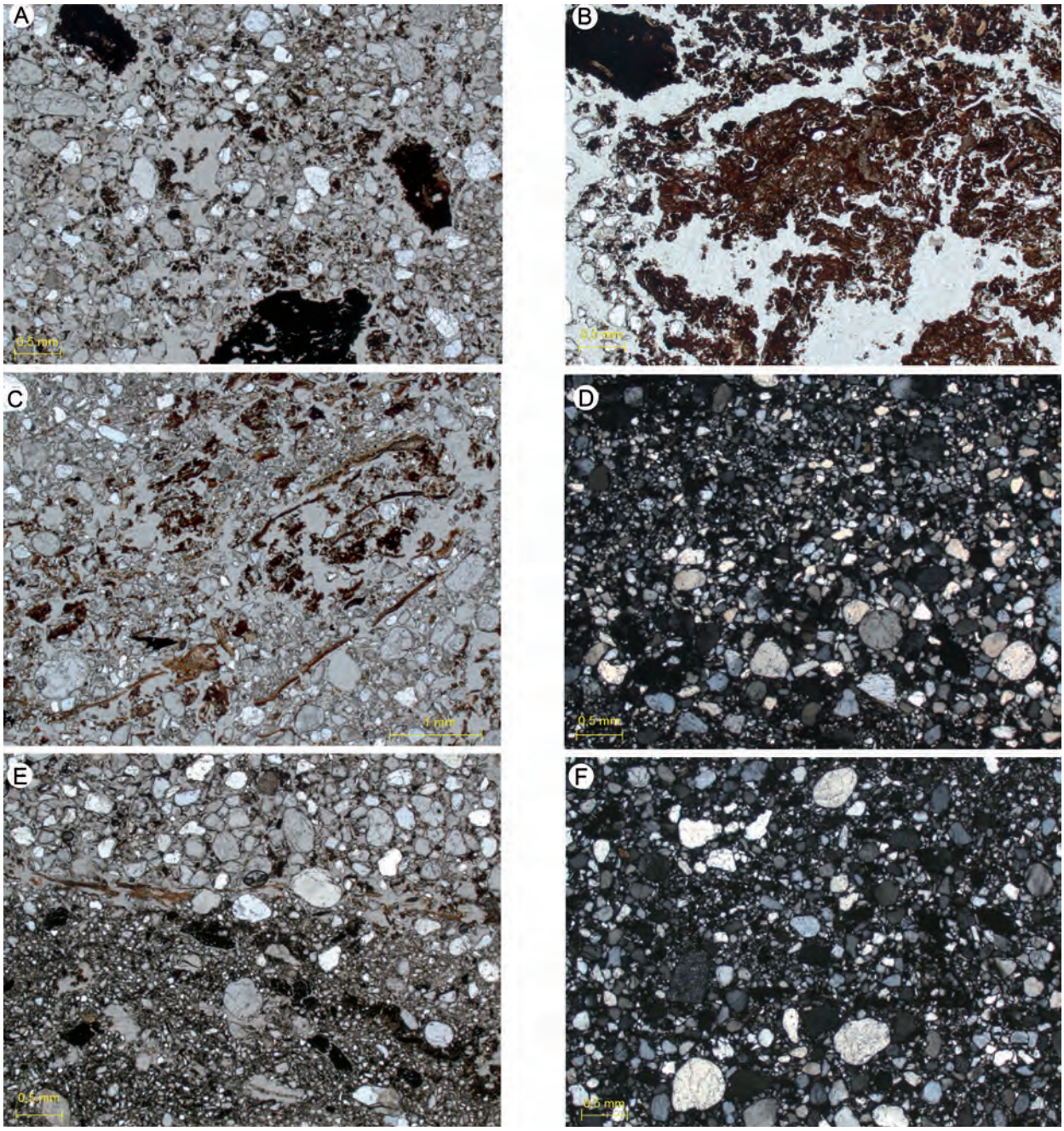

Fig. 12. Microscopic view of the geological horizons containing artefacts and/or palynologically analysed (photos: C. E. Miller). Ahrenshöft LA 58 D. A: Sample 2846a, plane polarised light (PPL). Note the small fragments of peat mixed with the sand, the structure of which is loose and exhibits no bedding. This structure is typical of the dark sand found near the top of the profile. This mixture of sand and peat was formed by bioturbation, probably after the area was significantly mined for peat. B: Sample 2846a, PPL. Large fragment of peat. This layer (Horizon 4) formed after the lake transitioned into a bog. C: Sample 2744b, PPL. Dark bands of laminated, humified fibrous organic material, typical of Horizons 5 and 6. These dark bands are associated with the tops of graded beds and were deposited within a lake margin which was becoming increasingly populated by plants. However, water plant species do not occur among the pollen. D: Sample 2742b, cross polarised light (XPL). Note the graded bedding, typical of Horizon 7. The numerous layers of graded bedding within Horizon 7 suggest that this horizon was deposited by water, most likely in a lakeshore environment. E: Sample 2742a, PPL. The finer-grained top of a graded bed overlain by the coarser base of another graded bed of Horizon 7. Note the inclusion of organic material within the beds. The dark fragments in the lower silt are woody, demonstrating that trees were present in the vicinity at the time. The woody fragments are possibly burned and may relate to the supposed fireplace identified in the field near the position of this sample. F: Sample 2743a, XPL. Here one can see the dominance of coarse silt within Horizon 8. This silt was probably originally deposited as loess, but the inclusion of rounded sand grains within the silt suggests that it has been redeposited by water, probably in the same depositional environment as Horizon 9.

Abb. 12. *Mikroskopische Ansicht der geologischen Horizonte, die Artefakte enthalten und/oder pollenanalytisch untersucht sind (Fotos: C. E. Miller). Ahrenshöft LA 58 D. A: Probe 2846a, linear polarisiertes Licht (LPL). Zu beachten sind die kleinen Torffragmente, die mit Sand vermischt sind, dessen Struktur locker ist und keine Schichtung aufweist. Diese Struktur ist typisch für den dunklen Sand nahe der Profiloberkante. Diese Mischung aus Sand und Torf entstand durch Bioturbation, wahrscheinlich nachdem im Gebiet viel Torf abgetragen worden war. B: Probe 2846a, LPL. Großes Torffragment. Diese Schicht (Horizont 4) entstand, nachdem der Flachwasserbereich vermoort worden war. C: Probe 2744b, LPL. Dunkle Bänder geschichteten, faserigen organischen Materials, das in Humus umgewandelt wurde und typisch für die*

Horizonte 5 und 6 ist. Diese dunklen Bänder sind verbunden mit den Obergrenzen nach Korngröße sortierter Schichtungen und wurden in einem Uferbereich abgelagert, der zunehmend von Pflanzen besiedelt wurde. Wasserpflanzen sind jedoch nicht durch Pollen vertreten. D: Probe 2742b, gekreuzte Polarisatoren. Beachtenswert ist die für Horizont 7 typische Schichtung nach Korngröße. Die vielen Lagen dieser Schichtung innerhalb von Horizont 7 deuten darauf hin, dass dieser Horizont durch Wasser abgelagert wurde, am wahrscheinlichsten in einem Seeuferbereich. E: Probe 2742a, LPL. Der feinkörnigere obere Bereich einer Schichtung nach Korngröße wird überlagert von der grobkörnigeren Basis einer anderen Schichtung nach Korngröße in Horizont 7. Zu beachten ist der Einschluss organischen Materials innerhalb der Schichten. Die dunklen Fragmente im unteren Schluff sind holzig und zeigen damit, dass Bäume zu dieser Zeit in der Nähe anwesend waren. Die Holzfragmente sind möglicherweise verbrannt und könnten in Verbindung mit der im Feld als Teil einer Feuerstelle interpretierten Holzkohlenkonzentration in der Nähe dieser Probe stehen. F: Probe 2743a, gekreuzte Polarisatoren. Hier ist die Dominanz von grobem Schluff in Horizont 8 sichtbar. Dieser Schluff war wahrscheinlich ursprünglich als Löss abgelagert, aber der Einschluss abgerundeter Sandkörner im Schluff deutet darauf hin, dass er durch Wasser umgelagert wurde, wahrscheinlich in derselben Ablagerungsumgebung wie Horizont 9.

respectively, at LA 73, and to their connection with the archaeological remains, samples for pollen analysis were collected from Horizons 4-6. In order to test the hypothesis of an early Meiendorf (GI-1e) origin, a sample was also taken from Horizon 8. As expected, these samples yielded birch-dominated pollen spectra with high amounts of non-arboreal pollen (the palynological data presented in the following is provided by H. Usinger). To our surprise, they also contained numerous pollen from thermophilous tree species, such as alder, hazel, oak and elm, as well as pollen from modern cultigens such as ribwort, rye and buckwheat. At the same time, *Hippophaë* as an indicator of the Meiendorf Interstadial (GI-1e) was completely lacking. While a contamination of Horizon 4 by pollen from Horizon 2 seemed possible, this was considered unlikely for the lower horizons, in particular not for the sampled positions, which had been chosen precisely because they seemed to be without obvious bioturbation or other sediment alteration. Furthermore, the homogeneity of the five spectra was particularly striking and irreconcilable with the hypothesis of contamination as the expectation would be that this should lead to a rather more heterogeneous picture. A general movement of Holocene pollen through the sediment seemed to be unlikely due to the small distance between quartz grains of the silt-size class. A postglacial age of the analysed horizons would contradict the results obtained at LA 73. Finally, in terms of a hypothesis, the different preservation of Late Glacial pollen between the profile at 112.00 m East, sampled in 1995, and the one at 108.00 m East together with the absence of contamination in the former profile, could probably be due to the presence of the peat cover formed by Horizon 2 in the eastern part, which represents the edge of the former bog area.

Micro-tephra analysis also yielded a problematic result: in the sample collected from the profile at 108.00 m East, scanning for tephra in 5 cm slices showed a large number of shards at the transition from Horizon 2 to Horizon 7, whereas the more precise scanning in 1 cm thicknesses of this part of the sediment column could not reproduce the same result. Potential explanations for this divergence could include micro-processes of sedimentation and mixing of sediment following the volcanic ash fall.

With the aim of connecting the sampled horizons at 108.00 m East with those at 112.00 m East and of taking new samples for both palynology and micro-tephra analysis, the eastern parts of both excavation surfaces were re-opened in June 2009. Unfortunately, the first goal could not be attained, though the new pollen samples provided additional information. The first sample collected from Horizon 5 in the vicinity of the 2008 position turned out to be uncontaminated and indicates an origin in the *Empetrum-Betula pubescens* PAZ of the early Allerød (Bølling, GI-1c$_3$). In contrast a second sample adjacent to the first one is heavily contaminated, as is the single sample from Horizon 6. The sand of Horizon 7, which overlies the position of the first sample from Horizon 5, contains too little pollen for successful analysis. This is also the result of a first sample from Horizon 8, but two further samples indicate a pre-Late Glacial age on the basis of a very low pollen count in combination with high percentages of hystrix (dinoflagellate cysts) and redeposited Tertiary pollen. This result correlates well with the micromorphological hypothesis of a period of loess deposition producing Horizon 8 and with the cryoturbated character of Horizon 9.

Micromorphology

On the whole, it is precisely the varying proportions of thermophilous elements in the pollen samples obtained in 2009 which confirm that they are the result of contamination. By chance, their representation appeared uniform in the 2008 samples, and this component might therefore potentially have been in situ, since disturbances were not visible macroscopically. At this point micromorphological analysis becomes relevant, as it analyses the in situ components and structures of sediments and soils, which is ideal not only for identifying depositional processes, but also identifying post-depositional alterations which would be impossible to identify with traditional, standard laboratory measurements. Evidence for the contamination indicated by the pollen samples can indeed be provided by this method, in the form of several identified features related to post-depositional alteration. Firstly, modern roots appear even in the lowermost sample comprising Horizons 7-9 and become more obvious in stratigraphically higher samples. Secondly, empty bio-channels, potentially caused by earthworms, were also found in all samples. Thirdly, bioturbation is even

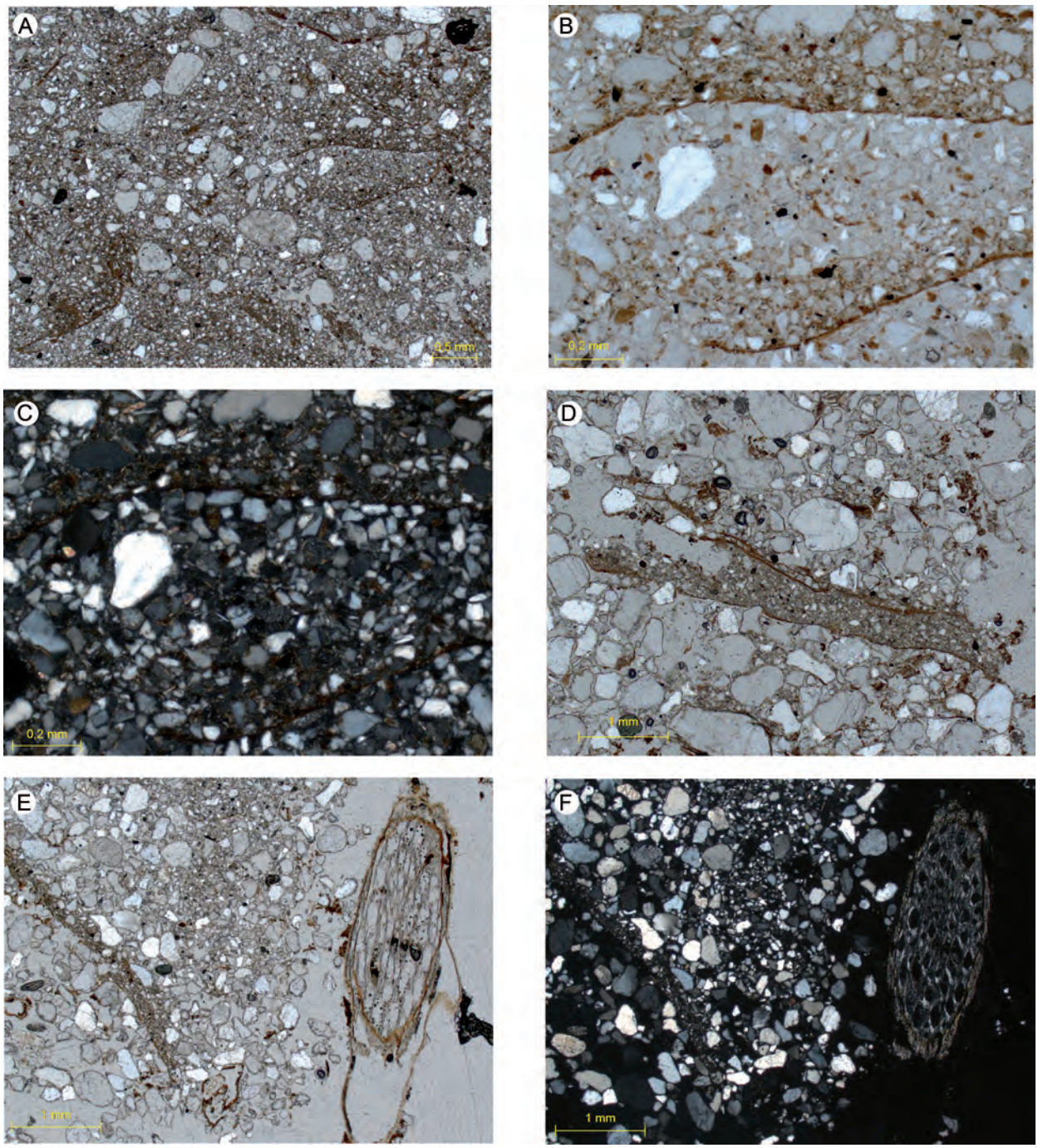

Fig. 13. Micromorphological evidence of post-depositional alteration (photos: C. E. Miller). Ahrenshöft LA 58 D. A: Sample 2744b, PPL. Note here the numerous wetting-front lenses consisting mainly of silt and caused by illuviation of water through the profile. B: Sample 2744b, PPL. A close-up view of the silt lenses. Notice the diffuse upper boundary and the sharp lower boundary which is defined by a thin layer of organic material. Also notice the weak iron staining of the silt. C: Sample 2744b, XPL. Same view as B, but in XPL. Note the higher clay content within the lenses and the weak clay coatings around some of the silt grains. D: Sample 2744b, PPL. Some of the silt lenses have been reworked by bioturbation, as seen here. E: Sample 2743b, PPL. Some of the silt lenses form in association with modern root voids, demonstrating that the features are probably related to the reworking and revegetation of the surface after peat removal. F: Sample 2743b, XPL. Same view as E, but in XPL.

Abb. 13. *Mikromorphologischer Nachweis post-depositionaler Prozesse (Fotos: C. E. Miller). Ahrenshöft LA 58 D. A: Probe 2744b, LPL. Hier sind die zahlreichen an der Befeuchtungsfront entstandenen Linsen zu sehen, die hauptsächlich aus Schluff bestehen und illuvial von Wasser, das durch das Profil vordrang, erzeugt wurden. B: Probe 2744b, LPL. Nahaufnahme der Schlufflinsen. Beachtenswert sind die diffuse Obergrenze und die scharfe Untergrenze, die durch eine dünne Lage organischen Materials gekennzeichnet ist. Leichte Eisenfärbung des Schluffs ist ebenfalls zu erkennen. C: Probe 2744b, gekreuzte Polarisatoren. Gleiche Ansicht wie B, aber mit gekreuzten Polarisatoren. In den Linsen ist ein höherer Tongehalt zu sehen, und manche Schluffkörner tragen einen leichten Tonmantel. D: Probe 2744b, LPL. Manche der Schlufflinsen wurden, wie hier zu sehen, durch Bioturbation aufgearbeitet. E: Probe 2743b, LPL. Manche der Schlufflinsen bilden sich im Zusammenhang mit rezenten Wurzelhohlräumen, was zeigt, dass diese Erscheinungen wahrscheinlich mit der Aufarbeitung und dem erneuten Bewuchs der Oberfläche nach der Entfernung des Torfs verbunden sind. F: Probe 2743b, gekreuzte Polarisatoren. Gleiche Ansicht wie E, aber mit gekreuzten Polarisatoren.*

more obvious towards the top of the profiles in the form of large (> 1 cm) channels filled with loose mixtures of surrounding sediments, corresponding to the zones partly recognized macroscopically and marked in the profile drawings. In fact, the open structure of the dark sand (Horizon 2), and the inclusion of finely comminuted organic material suggest that this horizon has been significantly reworked by bioturbation. Fourthly, lenses containing silt, clay, mica and fine organic matter occur (Fig. 13). They are only several millimetres wide and less than a millimetre in height, and have a diffuse upper boundary but a sharp lower boundary, which is marked by very fine organic material. In some instances these lenses exhibit iron staining, demonstrating that water played a role in their formation. These features are clearly not depositional because they overprint depositional features and other lenses. Furthermore, almost all of these lenses are parallel to the modern surface, whereas many of the depositional beds and layers are non-aligned with the modern surface. Those lenses not parallel to the modern surface formed along modern root channels, supporting the argument that these features were created by relatively recent movement of water through the profile, sometimes focused along bio-channels. Therefore, these lenses can be thought of as representing wetting-fronts of water moving through the profile. As soil water moved downwards, it collected the smallest grains available, the packing voids of the sand being large enough to let silt grains (< 62 µm) pass through. When the water dried out, it left the material as a lens. These lenses are found throughout the profile but are more numerous near the surface. In fact, between Horizons 5 and 6 in one of the samples, there are so many lenses that they overprint one another. Thus, since silt and smaller grains have been significantly translocated throughout the profile, especially in the described part, it is likely that pollen, including modern pollen, and micro-tephra have been significantly moved through the profile. The formation of the wetting-front lenses seems to be a consequence of the reworking of the original peat and its incorporation with sand, forming the dark sand at the top of the sequence. The removal of the peat cover and the subsequent regrowth of vegetation on the new land surface not only promoted extensive bioturbation of the upper portion of the profile, but also caused significant eluviation and illuviation through the profile.

Summary of chronological data

Concerning the dating of the Havelte occupation, the only indication in the 2008 trench is provided by the uncontaminated sample from Horizon 5. The low amount of *Juniperus* and the high value of *Sphagnum* in its pollen composition correspond to the picture of the Allerød (Bølling-Allerød, GI-1c_3-a) from the *Empetrum-Betula pubescens* PAZ onwards. Furthermore, the distribution of the birch pollen according to their size also corresponds to a *Betula pubescens* distribution with little *Betula nana.* On the occasion of the re-opening of the eastern part of the 1995 trench in 2009, three pollen samples were collected in the same stratigraphic position as the samples taken in 1995. The first sample from Horizon 4 (1995 nomenclature) shows a composition comparable to H. Usinger's result for the same position in 1997, thus confirming its dating to the *Empetrum-Betula pubescens* PAZ. In addition, the distribution of the birch pollen size indicates a *Betula pubescens* distribution with no *Betula nana.* The second sample collected from Horizon 3 (1995 nomenclature) does not contain enough pollen to analyse, and the pollen composition of the third sample, taken from Horizon 2 (1995 nomenclature), is comparable to that obtained in 1995, which attributed this peat to the Holocene, most probably from the Atlantic period. However, one metre away from this position, a new sample from the base of the same horizon in the profile at 112.00 m East shows a pollen composition corresponding to the *Empetrum-Betula pubescens* PAZ. An attribution to the Allerød (Bølling-Allerød, GI-1c_3-a) is also suggested in the case of a humus layer which crosses a cryogenic dome-like feature within the silt of Horizon 5 (nomenclature 1995) and is more recent than this silt. The latter turned out to be contaminated by pollen dating from the Allerød (Bølling-Allerød, GI-1c_3-a) in one sample and shows the expected picture in a second sample, containing very little pollen and numerous hystrix.

In conclusion, it can be observed that the horizons which were lithostratigraphically assumed to represent the Meiendorf (GI-1e) were in fact formed during the second part of the early Allerød (Bølling, GI-1c_3) and that in both parts of the excavation the archaeological remains are associated with horizons dated to this early Allerød (Bølling, GI-1c_3). However, despite the presence of heavier finds such as rock fragments and slabs in these positions, it cannot be proved that this position represents the original one. If the correlation is correct though, the recent work at Ahrenshöft LA 58 D represents the most recent dating of a Havelte Group occupation so far, excluding the radiocarbon results for Oldeholtwolde (see above).

Perspectives

The 2008 excavation campaign and the additional fieldwork of 2009 at Ahrenshöft LA 58 D produced various kinds of new data, which render the presence of an adjacent Curve-Backed Point Group occupation less likely, illustrate depositional as well as post-depositional processes, such as the high level of bioturbation at this site, and seem to confirm the former dating of the archaeological remains to the early Allerød (Bølling, GI-1c_3). Thus, the discrepancy between radiocarbon and pollen dating still exists

and remains a matter of investigation, especially as this result also has consequences for the dating of the Havelte Group in general.

Although more information is available now for Ahrenshöft LA 58 D, the analysis of the site is far from complete. A detailed analysis of the lithic industry recovered in 2008 as well as of spatial issues remains to be completed. Intra-site spatial analysis is proceeding by digitising the distribution plans, and the samples taken in 2009 for micro-tephra analysis are being analysed, as are two fragments of black material, which could represent tar and are therefore being chemically analysed at the University of Bradford by C. Heron and his team. In order to approach the dating question from another angle, a series of samples for radiocarbon dating should be submitted. Finally, it must be decided in what way the remaining parts of this important site should be uncovered.

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