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Re-evaluating the Ahrensburgian Find Concentrations from Borneck-North and -East, District of Stormarn, Schleswig-Holstein, Germany

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ABSTRACT

The re-evaluation of the find concentrations Borneck-north and -east, district of Stormarn, Schleswig-Holstein, Germany, has resulted in new insights into old excavation results. Besides revealing problematic aspects in the documentation, which unfortunately could not be solved, the re-evaluation made it possible to obtain a deeper insight into the composition of the inventories and the production sequences. Based on the results, the interpretation of the rock assemblages as tent rings is considered unlikely. The spatial distribution of the artefacts does not allow for the conclusion that the work areas are spatially delimited, although the interpretation may be impaired by the coarse-mesh grid used during the excavation. Contemporaneous occupation of the concentrations could be excluded because of an absence of refits between the inventories. At the same time, the refits indicate discrepancies regarding the chronological assignment of the inventories. Because there is no recorded stratigraphy for the sites, there is no way to ascertain whether the artefacts were all from the same layer or, instead, separated by sediment. Overall, however, the inventories were sealed and were undisturbed by later processes. The artefact production methods in both analysed inventories are in accordance with earlier studies of Ahrensburgian technology, but they show slight variations between the inventories. Despite an overarching similar approach to the material, the end result was two inventories that are distinguishable even with the naked eye. As the technical knowledge and locally available raw material can be assumed to have been similar in both inventories, the distinguishing factors here were more likely skill and intended end product. It seems, however, that both inventories had the end products removed as the occupants left the location, so no conclusions can be made about them. Although there are limits to the gain in knowledge when re-evaluating old excavations due to what seem from today's perspective to be rather poor documentation and working methods, the effort is well worth it. In addition to bringing attention to the wealth of data that until now has been relatively unused, it is possible to clear up misinterpretations resulting from, for example, the fact that results were taken over uncritically and thus became unintentionally entrenched in research. Both will ultimately lead to a better understanding of the past.

ZUSAMMENFASSUNG

Die Neuaufnahme der Fundkonzentrationen von Borneck-Nord und -Ost, Kreis Stormarn, Schleswig-Holstein, Deutschland, hat neue Einblicke in alte Grabungsergebnisse geliefert. Neben dem Herausarbeiten problematischer Aspekte in der Dokumentation, die leider nicht gelöst werden können, konnte ein tieferer Einblick in die Inventarzusammensetzung und technische Herangehensweise der Artefaktproduktion erlangt werden. Anhand der Ergebnisse wird die Interpretation der Felsgesteinansammlungen als Zeltringe für unwahrscheinlich befunden. Die räumliche Verbreitung der Artefakte lässt nicht auf räumlich begrenzte Werkbereiche schließen, wobei hier die Interpretation durch die grobe Unterteilung der Grabungfläche beeinträchtigt sein könnte. Aufgrund des Fehlens von Zusammenpassungen zwischen den Inventaren kann die zeitgleiche Belegung der Konzentrationen ausgeschlossen werden. Gleichzeitig weisen die Zusammenpassungen auf Unstimmigkeiten in der chronologischen Zuordnung der Konzentrationen oder noch nicht näher erkannte Vermischungsprozesse der Inventare hin. Da für die Grabungsflächen keine Stratigraphie vorliegt, kann nicht geklärt werden, ob die Artefakte alle aus

derselben Schicht stammen oder durch Sediment getrennt waren. Insgesamt sind die Inventare aber geschlossen und nicht durch spätere Prozesse gestört worden. Die Produktionsweise von Artefakten in den beiden analysierten Inventaren steht in Einklang mit früheren Studien zur Ahrensburger Technologie, weist aber kleinere Abweichungen zwischen den Inventaren auf. Trotz übergeordneter ähnlicher Herangehensweise an das Material sind zwei schon optisch voneinander zu unterscheidende Inventare entstanden. Da das technische Wissen und das lokal verfügbare Rohmaterial in beiden Inventaren ähnlich war, sind die unterscheidenden Faktoren hier eher Können und angestrebte Zielprodukte. In beiden Inventaren scheinen die Zielprodukte allerdings bei Verlassen des Platzes mit entfernt worden zu sein, weswegen zu diesen keine Aussage getroffen werden konnte. Obwohl dem Erkenntnisgewinn bei der Auswertung von Altgrabungen durch die aus heutiger Sicht eher mangelhafte Dokumentation und Arbeitsweise Grenzen gesetzt sind, lohnt sich der Aufwand durchaus. Neben der Fülle an Daten, die bisher noch relativ ungenutzt bestehen, lassen sich auch Fehlinterpretationen ausräumen, die beispielsweise dadurch entstanden, dass unkritisch Ergebnisse übernommen und damit ungewollt in der Forschung zementiert wurden. Beides wird letztendlich zu einem besseren Verständnis der Vergangenheit führen.

INTRODUCTION

About 70 years after the initial excavations by A. Rust at the site of Borneck, in the Ahrensburg tunnel valley, one part of its lithic inventories was re-evaluated[1]. The aim was to reconsider the original interpretation of the site, as dwelling structures, as well as the chronological positioning put forward by Rust (1958 a). For this, two adjacent Ahrensburgian inventories, Borneck-north and -east[2], were reviewed using state-of-the-art methods of lithic analysis. The questions examined were whether refits between the artefacts of these two concentrations, together with technological differences, can help to establish the chronological order of the two lithic assemblages and provide a deeper insight into Ahrensburgian lithic production. Furthermore, the research tested whether the reanalysis of material resulting from older excavations still yielded new information, which would then suggest it should be applied more often.

RESEARCH HISTORY

A. Rust's (1937; 1943) excavations at the still-famous sites of Meiendorf and Stellmoor, in the Ahrensburg tunnel valley, in the 1930s led to great advancements in knowledge about the Late Glacial of northern Germany (ca. 12 700–9600 BC; cf. Riede et al. 2010; Terberger 2004). The excavations helped researchers to understand the chronological succession of the Late Glacial cultural groups, since the stratigraphy at Stellmoor showed that the Ahrensburgian layers are younger than the Hamburgian ones (Rust 1943). Today, it is known that the Ahrensburgian groups are connected to the Younger Dryas/Dryas 3 (10700–9600 cal BC) and are quite possibly also present in the beginning of the early Holocene (Weber et al. 2011; Grimm et al. in press).

Stellmoor Hill – a distinct crest along the shoreline of the tunnel valley – had been known as a settlement site through surface finds previously (as noted by Taute 1968, 79–80). The total number of recovered artefacts is unknown. It is estimated that 100,000–200,000 pieces have been collected over time, among them approximately 2,000 tanged points (Clausen/Guldin 2017; Taute 1968, 81; Tromnau 1975 a, 17). However, a large part of this artefact collection is either lost or in private collections, where it remains unrecorded. With the settlement layers on the hill already disturbed and possibly destroyed in the 1930s, Rust hoped for undisturbed layers in the waterlogged deposits at the shore of a former Palaeolithic lake situated at the foot of the hill. Due to the success of the excavations at Stellmoor and Meiendorf, Rust continued to look for possible sites along the tunnel valley, and these were excavated in the following years. Borneck (Fig. 1) was one of them (Rust 1958 a; 1958 b; Tromnau 1975 b).

As Rust's main goal was to find sites with organic remains, most of the excavations included waterlogged deposits and had to work around difficult documentation conditions, especially at Stellmoor. Here, a construction of pipes and pumps was required to lower the groundwater level. As this was only partly effective, the excavation and documentation had to happen quickly, as the inflow of water would erode

1 The present paper is a revised version of the author's MA thesis, finished in 2019 at Kiel University (Hinrichs 2019).

2 To distinguish clearly between Borneck East as the excavation section and Borneck-east as find concentration it was chosen here to use a visible different spelling. This is not the case in the original publication by Rust (1958 a).

the profiles, leading to their rapid collapse. This was also a problem at Borneck, where it affected the bog trenches, though not to the same extent (Rust 1958 a). Here, too, pumps were required, and the documentation, along with the recovery of artefacts, had to happen hastily in some cases.

The documentation of the old excavations in the Ahrensburg tunnel valley does not fulfil modern requirements, but these excavations still remain important research sources, and not just for archaeology, as they include results of other scientific disciplines, such as biology, zoology and geology (Clausen 2010; Weber 2013). Many of these older excavations represent the only information source about campsites in northern Germany with organic preservation, as much of the Ahrensburg tunnel valley and other possible Late Glacial sites in northern Germany are nature reserves today, so permissions for new excavations are hard to obtain (Clausen 2010; Clausen/Guldin 2016; Wild 2017). Some exceptions exist, such as Alt Duvenstedt (e. g., Clausen 1996; 1999; 2010).

Fig. 1. Location of the Borneck site (Graphic: R. Opitz).

BORNECK REVISITED

The excavations at Borneck, which was undisturbed, took place between 1946 and 1949. The site was made up of three smaller areas, referred to as Borneck West, Centre and East, as well as five trenches in the bog (Fig. 2). The latter were dug to clarify the stratigraphy and to conduct pollen analysis. The excavation of the eastern part of the site of Borneck started in autumn 1947 and revealed a stone concentration which was argued to be a tent structure, and which was attributed to the Magdalenian (Rust 1958 a). In 1948, the trench was extended, and what were argued to be Ahrensburgian stone structures were uncovered. All artefacts were recorded following a 1 × 1 metre grid. The grid lines were assigned either a letter or a number, so that each metre square is distinguishable through its unique combination of letter and number (Fig. 3 a), and these lines were maintained throughout the excavation seasons. No stratigraphy was recorded for the three excavation areas, so a correlation to the bog trenches is not possible. Further, no differentiation of artefacts by depth was made, which hampers the chronological assignment of the artefacts in areas where the inventories overlap.

From the distribution of boulders, Rust (1958 a) reconstructed tent rings. The part of the site interpreted as a Magdalenian winter tent by Rust contained what we now know to be a Federmesser Group inventory. The attribution to the Magdalenian happened due to an incorrect correlation of the Federmesser Groups and the French Magdalenian (Schwabedissen 1944; 1951; 1954). The Ahrensburgian concentrations were reconstructed as destroyed summer tents and, according to their position in relation to the Federmesser Group inventory, termed Borneck-north and -east (Fig. 2). Despite Rust's (1958 a) own doubts about whether the boulders at the site represented structures, this interpretation as tents was long accepted in the literature and only much later critically questioned (Cziesla 1990 a, 261; Kind 1985, 66–67; Kotthaus 2013, 62–63). Today it is also known that A. Rust tended to sort and move stones to 'reconstruct' the tent rings he thought he could discern (pers. com. Prof. Dr. Schietzel, 2018). Based on this knowledge, it is recommended researchers refrain from referring to the distribution of boulder structures as tents. The focus of the present paper is on the artefact concentrations.

Already during the excavation, it proved difficult to separate the inventories from the three concentrations of the Borneck East section (Rust 1958 a). Further complicating interpretation is the fact that in some cases, it seems as if the artefacts were sorted by colour and patination (Rust 1958 a, 69; 75), while in the case of row P, no assignment to an inventory was made, and the artefacts appear on both plans (Rust 1958 a, 53 fig. 16; 77 fig. 28). In 2013, J. Kotthaus reanalysed the Federmesser Group inventory from Borneck. Due to the unclear separation of the inventories (Fig. 3 b), some artefacts have now been reanalysed twice and been assigned to both the Federmesser Group and the Ahrensburgian inventories. In addition, the total number of artefacts from Borneck-north and -east (ca. 2,350) given in the text does not fit that given on the map (2,653) in the same

Fig. 2. Total excavated area at Borneck. Roman numerals indicate bog trenches. Trench V is situated about 50 m to the west, outside of the plan.

publication (Rust 1958 a). Kotthaus's (2013) reanalysis documented a difference between the artefact counts published by Rust (1958 a) and those compiled based on the actual artefacts. The same holds for the present re-analysis. The inventories were transferred to the Archäologisches Landesmuseum (ALM, archaeological state museum) Schleswig in 1968. At that time, it was noted that there were differences in the artefact count between the delivered material and the published records. This concerns missing tools as well as additional tools that were not published (ALM Archive, Ahrensburg, Stormarn no. 44). Despite this contradiction, the inventories were nevertheless termed complete on receipt. In total 2,636 artefacts were recorded in the reanalysis, 771 from Borneck-north and 1,864 from Borneck-east.

All artefacts were labelled with a letter and a number referring to the metre square from which they were recovered. Since labelling took place sometime after the excavation, some uncertainty about the exact provenance of the artefacts remains. K. Schietzel (pers. com.) provided an account of Rust's procedure in Poggenwisch, which was excavated after Borneck had been finished. Here, the artefacts were gathered in boxes by 1 × 1 metre square. Tools had already been separated from the rest of the artefacts during the excavation, but not consistently. They were labelled in post-excavation; therefore, the tools are subject to the most uncertainty in terms of their spatial position. It can be assumed that Rust worked in a similar way on each excavation, including Borneck. The lack of certainty regarding the spatial position is visible in the comparison of the distribution of tools. According to Rust (1958 a), for instance, no Zonhoven points or microliths were found in the find concentration known as Borneck-east. Contrary to this, Taute (1968, 82) explicitly refers to Zonhoven points, and during the reanalysis four were indeed recorded. It is not possible to determine if Rust simply forgot they were present or if they were wrongly labelled. As the labels constitute the only evidence for the spatial distribution of the artefacts, they were treated as true for the analysis. Thus, the new plans differ in detail from the originals produced by Rust. The fact that different categories of artefact types were used in the original analysis and the re-evaluation exacerbates this problem (see below). With this in mind, the present distribution maps can be compared with those by Rust only in a restricted way.

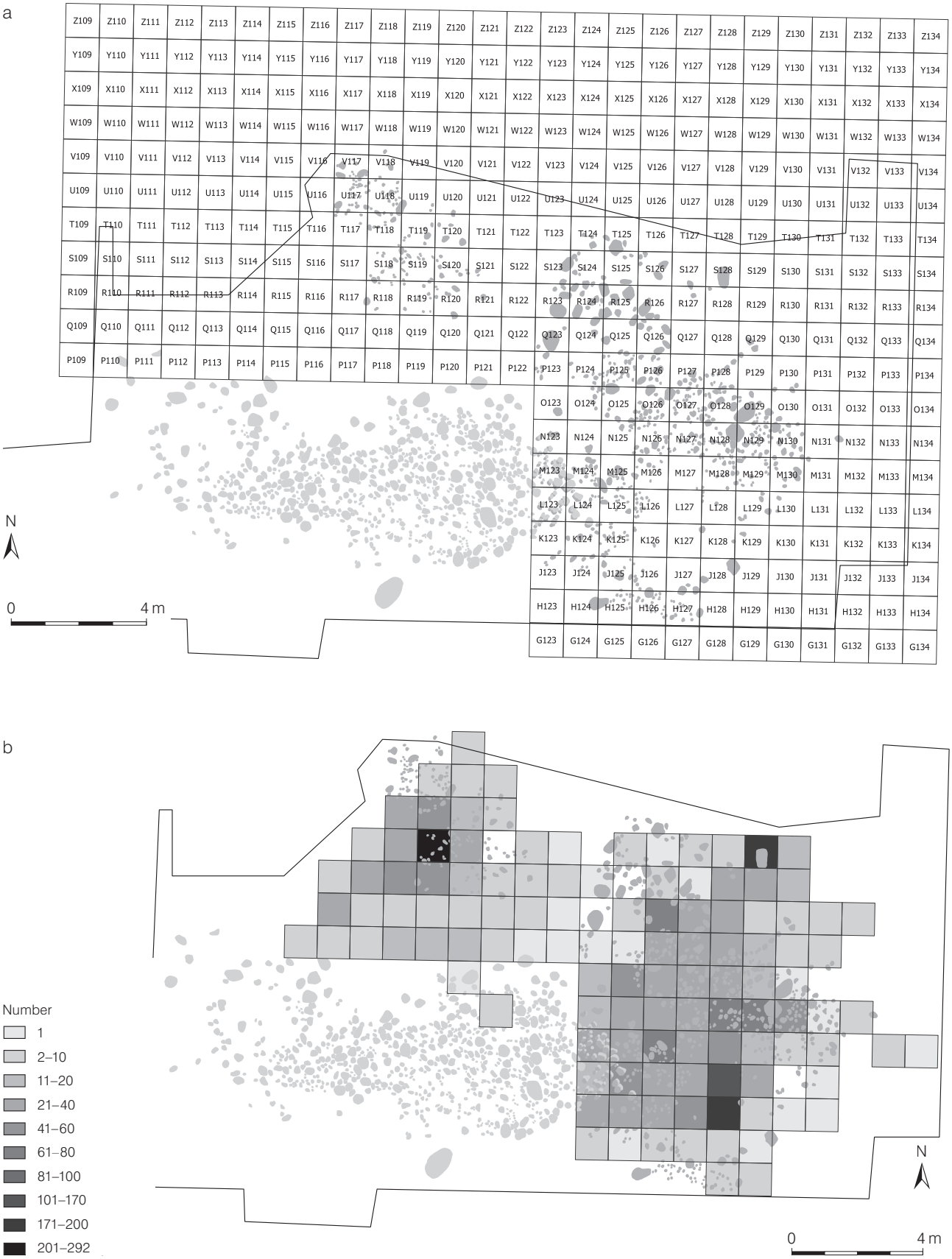

Fig. 3. **a** Lettering of metre squares used during excavation; **b** distribution of all recorded artefacts from the reanalysis. Artefacts recorded farther south than row P were included because they are part of refits.

METHODS

Since no organic remains survived at the site, except in the bog trenches, all analysis has to be based on the lithic artefacts. For this, the *chaîne opératoire* analysis was chosen. Lemonnier (1986) refined this all-encompassing and well-known approach to technology, based on Leroi-Gourhan's (1964) work and ideas. The *chaîne opératoire* analysis considers every step in the life of an artefact and does not exclude the waste products. Changes or differences in the life cycle of artefacts can thus be recognised more easily (Eriksen 2000; Pelegrin 1990; Sellet 1993). This approach has been widely used for the reconstruction of lithic technologies. Lithic artefacts are perfect containers of working processes. Manufacturing an artefact is always a dialogue between the maker and the material, and no other material records in such detail every single step in the process and lets those be visible later on as lithics do. Every mistake, whether human-made or triggered by the material, is preserved, along with the response to it. The *chaîne opératoire* analysis thus allows for the detection not only of socially prescribed approaches, but also of individual choice (Roux 1990; Schlanger 1994). By reconstructing the technologies in use, insights into the social system and its changes can be obtained. In this way, technological choices are strongly related to social groups.

Refitting is part of the *chaîne opératoire* analysis and helps to understand the reduction process. In addition, the refit complexes can give hints about the integrity of inventories. Lastly, by refitting, it is possible to determine if artefact concentrations are contemporaneous or not (Cahen 1987; Cziesla 1990 b; Eriksen 2000, 75). As the time for the re-evaluation was restricted, it was not possible to refit beyond a certain point, but nevertheless, 8.59 % of all artefacts could be refitted to at least one other artefact. Borneck-north presented a higher percentage of refitted artefacts than Borneck-east (see below). It should be kept in mind, however, that the ratio and number of refits have far from exhausted the probable total.

For the recording and classification of the artefacts, the *Flintartefaktaufnahme* (Version 1.2) was used, which has been developed by the sub-projects B 1 "Pioneers of the North: Transitions and Transformations in Northern Europe Evidenced by High-Resolution Data Sets" and B 2 "Transitions of Specialized Foragers" of the "CRC 1266 – Scales of Transformation – Human-Environmental Interaction in Prehistoric and Archaic Societies". The system provides a framework for recording artefacts and thus enables comparability of inventories even across chronological periods. The system is still in development, and a publication describing it is therefore not yet available, although it is planned for the near future. Because a fixed thesaurus based on more recent artefact definitions is included in the system, it was not necessary to refer to Rust's definitions. On the downside, it was therefore also not always possible to compare Rust's types with the new analysis.

The spatial distribution of the artefacts was analysed with the aim to observe separations in the tool concentrations. It was hoped that this could be followed by the reconstruction of separate working areas. This new visualisation of the artefact distributions was partly necessary due to the discrepancies between Rust's descriptions and maps in terms of total numbers but also because of the differing labelling on the artefacts. In some cases, Rust's maps recorded certain artefacts for a metre square which could not be re-located. On the other hand, some artefacts were labelled with metre squares that according to Rust's maps they should not belong to.

The mapping of the refits helps to identify working areas (Cziesla 1986, 262). Further, if an inventory is undisturbed, the length of connection lines can give hints about the duration of occupation at the site. Cziesla (1990 c, 31–32) concluded that short lines likely indicate short-term stays, while long lines more likely indicate with longer stays. Experimental studies suggest that this is true (Ballin 2000, 109). However, the absolute lengths of the connection lines were not calculated for either Borneck-north or -east, as no position within the metre squares was recorded.

RESULTS AND INTERPRETATION

Table 1 displays the distribution of artefact numbers in relation to the different categories in both inventories. It is obvious that the tool ratio is quite low for both Borneck-north and -east: 2.95 % and 3.43 %, respectively (domestic tools and points combined). The raw material consists of locally available flint of medium to good quality. Reduction was performed on nodules but also on big flakes or natural shatter. As preparation flakes with cortex and from early stages of core preparation are present in both inventories, there is no reason to assume that cores were regularly brought to the site in ready prepared forms. In general, the artefact preservation is quite good. Most of the artefacts are still either fully or almost completely

Tab. 1. Recorded artefacts by category. Preparation and maintenance combine crested blades, core tablets and overshots. Tool production remnants includes such pieces as microburins.

	Borneck north	% north	Borneck east	% east
Flake	412	53.4	977	52.4
Blade	255	33.1	604	32.4
Cores	11	1.4	30	1.6
Domestic tools	14	1.8	55	3.0
Points	7	0.9	9	0.5
Tool Production remnants	4	0.5	3	0.2
Preparation/maintenance	24	3.1	135	7.2
Shatter	44	5.7	51	2.7
Total	771		1864	

Tab. 2. State of preservation of flakes and blades. Not included are cores and shatter. Tools are included as incomplete forms.

	Borneck north	% north	Borneck east	% east	Total	% total
Complete	287	40.0	781	43.9	1068	42.8
Proximal	153	21.3	420	23.6	573	22.9
Medial	47	6.6	215	12.1	262	10.5
Distal	122	17.0	350	19.7	472	18.9
Incomplete	108	15.1	15	0.8	123	4.9
Total	717		1781		2498	

Tab. 3. Length of flakes, blades and cores (in cm). Only artefacts with preserved complete length are included.

		Minimum	Maximum	Mean	Standard deviation	n
Flakes	Borneck-north	0.81	13.22	3.96	2.37	177
	Borneck-east	0.76	11.35	3.75	1.80	503
Blades	Borneck-north	1.70	8.28	4.37	1.69	96
	Borneck-east	2.09	12.29	5.80	2.10	203
Cores	Borneck-north	4.36	8.53	6.22	1.45	11
	Borneck-east	2.60	8.93	6.41	1.59	30

preserved (Tab. 2) and possess quite sharp edges. But due to them having been stored loose in their storage in boxes, many pieces show at least partial chipping and crushing of the edges. A slightly elevated percentage of incomplete blades was detected in both inventories, which is not surprising, as they have been modified into tools more often than have flakes and were broken deliberately, e. g. for the production of projectile points. Only a small part of either inventory shows signs of thermal exposure after reduction. In Borneck-north, 30 such pieces (3.89 %) and in Borneck-east, 62 such pieces (3.33 %) were encountered.

One difference between the two find concentrations, Borneck-north and -east, is in the blade length (Tab. 3). While blades tend to be rather short in Borneck-north, in Borneck-east, most of the blades are longer and more regular. Despite Taute's (1968, 82) statement about the presence of a long blade in

Borneck-north, no such artefact was present in the inventory. The mentioned artefact is a crested blade (Fig. 4, right) and thus not a long blade according to Taute's own definition[3]. The longest blade was found in Borneck-north, but is not included in the table as it is a refit of three pieces (Fig. 4, left). This piece is also a crested blade, with a length of 21.23 cm, and it shows that long blade production was at least possible. The mean tendency does not indicate a difference in finished artefact length between the two inventories. This is highlighted by the fact that Borneck-east also comprises a great number of quite short blades, which lower the mean length. Together with the refitted crested blade and other refits, the mean length indicates that the subjectively observed difference in blade length between the two inventories is not an intentional choice, as is also shown by the distribution of the lengths (see below).

The intended products seem to have been carried away from both sites, with the difference that some of the longer blades remained in Borneck-east. Contrary to the blade length, the width seems to be more restricted (Fig. 5). The dimensions that the final products were meant to have cannot be reconstructed with certainty, as all artefacts in the inventories represent pieces that were either discarded after use or not deemed usable at all. It seems that narrow blades were preferred; otherwise the span of width would have been more evenly distributed. But again, the preferred pieces, which could have been of greater width, appear to have been removed from the site.

In accordance with other Ahrensburgian inventories, the majority of cores from both inventories were used for blade production and have two opposed striking platforms (Hartz 1987, 26–27 fig. 9; 2013, 395–396). For both blade and flake production, striking platforms are flat and unprepared while the reduction angle mostly ranges between 70° and 85°. Preparation of the platform edge is done more carefully in Borneck-east than in -north. This concerns abrasion in particular, which was recorded less frequently in Borneck-north (Fig. 6). Differing from the cores, most of the flakes and blades show signs of unidirectional production. The second striking platform was seemingly primarily used for maintenance and correction of mistakes than for a true bidirectional production. Varying levels of knowledge could be detected on the cores. Some of them show clear signs of having been worked by inexperienced persons, e. g. in the form of successive hinge fractures and percussion marks on the platforms (Audouze/Cattin 2011; Johansen/Stapert 2008; Shelley 1990).

Fig. 4. Two crested blades from Borneck-north.

Bulbs were frequent, mostly faint or normally shaped, on flakes as well as blades. Strongly pronounced bulbs are, however, more frequent on flakes. Lip formation was recorded on few of the artefacts, and in almost every case it was faint. While faint bulbs and lip formation are indications for soft hammer stones and/or organic mallets, distinct bulbs without lips are frequent when using hard hammer stones (Damlien 2015; Floss/Weber 2013; Hein/Lund 2017). The transitions between the techniques are fluid. Both inventories show attribute combinations which indicate a variety of techniques in use. The techniques seem to not have been bound to a specific phase in production; rather, the knappers switched between them as the reduction process and material demanded.

3 By Taute's (1968, 16) definition, a long blade has to be either > 15 cm long and min. 2.5 cm broad or > 12 cm long and > 5 cm broad. Further, the dorsal side has to show straight, parallel-running crests from earlier blade negatives. Pieces from preparation stages are thus excluded.

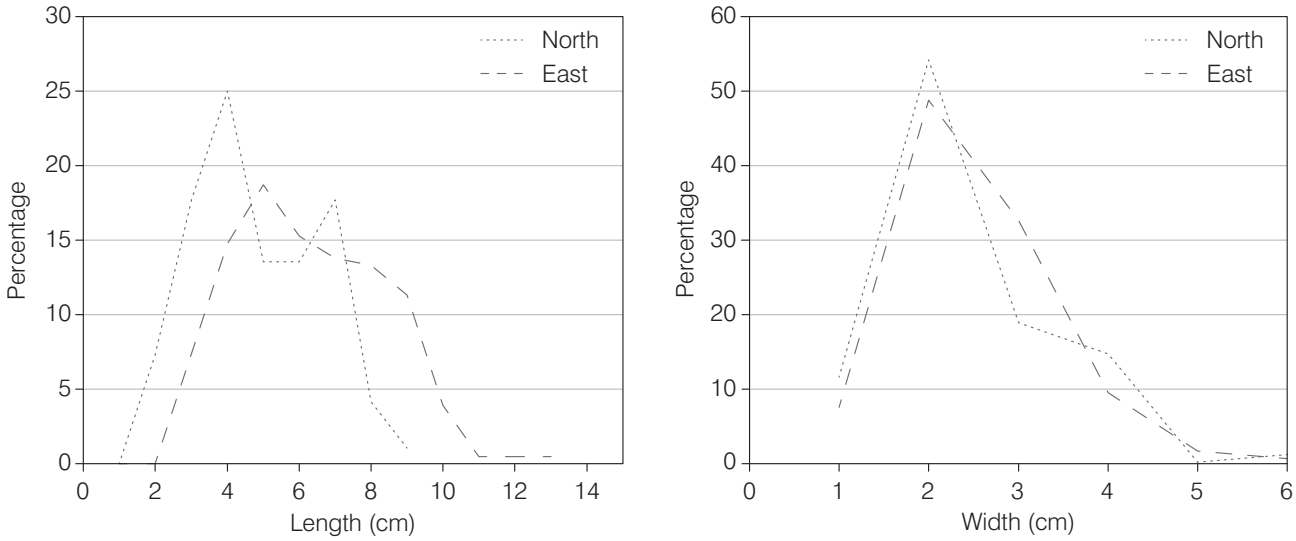

Fig. 5. Length and width for all complete blades in 1 cm-bins. Length includes laterally retouched blades; width exclude lateral retouch. Borneck-north: n = 96/95, Borneck-east: n = 203/202.

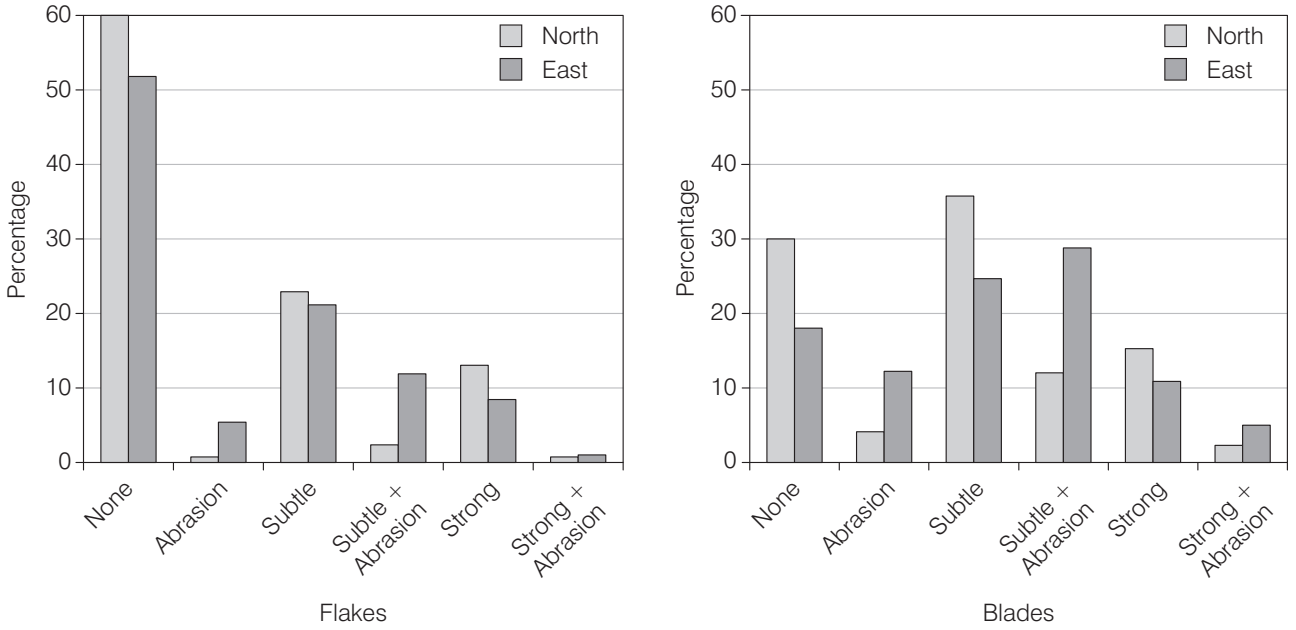

Fig. 6. Type of core edge preparation on flakes and blades. Borneck-north: n flake = 244, n blade = 215. Borneck-east: n flake = 727, n blade = 457.

Tools are mostly worked on blades, but not on the most regular ones. Likewise, no tools were made on specially produced flakes. Especially the scrapers demonstrate this, as some of the pieces are worked on preparation flakes or crested blades. As was the case for the blanks, tools are worked in similar ways in both inventories. Notably the Ahrensburgian tanged points (n_north = 1, n_east = 4) seem to have a more circumscribed working process than the other tools. This is remarkable since the Zonhoven points (n_north = 4, n_east = 4) seem to have a less restricted basic form and production process. They show a greater variation in approaches to achieve the chosen form. With such small numbers of artefacts, it is not possible, though, to draw definite conclusions about the working process.

A total of 78 refit complexes, comprising 229 artefacts, were found. Of these, 28 refits belonged to Borneck-north, comprising 102 artefacts (13.21 % of the inventory), and 50 refits belonged to Borneck-east, comprising 121 artefacts (6.49 % of the inventory). One refit complex could not be assigned to

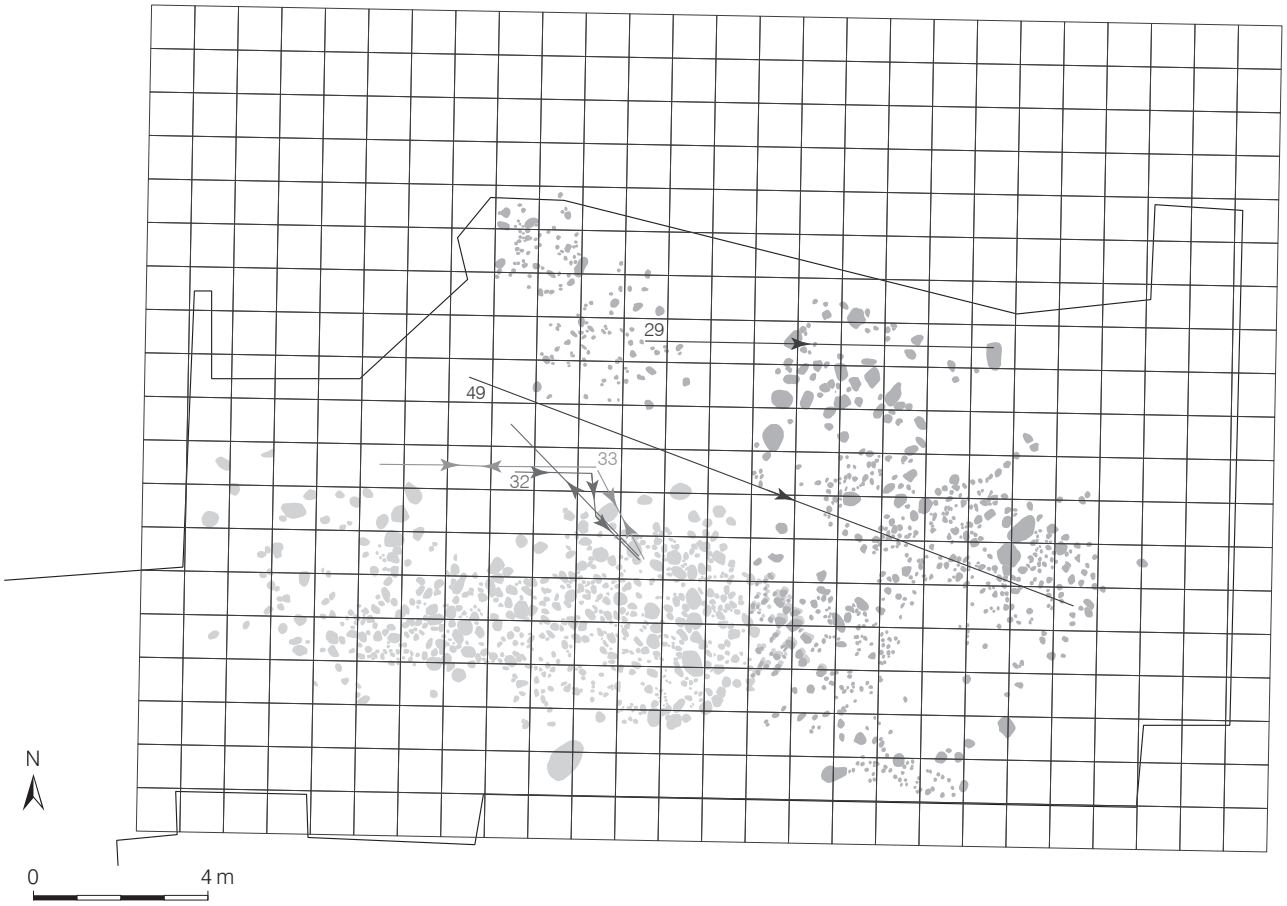

Fig. 7. Connection lines and succession of removal of the refit complexes that span across inventories.

an inventory, as the artefacts are not labelled. Refit complex 68, from Borneck-north, contains two refit complexes, 13 and 16. The artefacts refitted in these complexes have just been counted once for the total number. Four of the refits connect the inventories (Fig. 7). Two connect Borneck-north and -east, the other two, Borneck-north and the Federmesser Group inventory. Except for one broken blade end-scraper, the refit complexes comprised no tools. Most of the refits were found in directly adjacent metre squares. In 20 cases, the connection lines skipped one or more metre squares (Fig. 8). The refits indicate the same *chaîne opératoire* as the attribute analysis. They also show that Borneck-north and -east were probably not contemporaneous, as just two connecting pieces are present. Furthermore, they emphasise the problematic curatorial separation of the concentrations, notably of Borneck-north and the Federmesser Group inventory. In contrast to the technological analysis, the refits show that large blades could have been obtained from the chosen raw material volumes. Most of the recovered cores were quite small and exhausted, but refit complex 3 (Fig. 9), from Borneck-north, shows that rather large nodules were available. This is further emphasised by the already mentioned crested blade (Fig. 4, left), which demonstrates that the removal of long and more or less regular artefacts was possible. Similar refits could not be made for Borneck-east. But because, in general, longer blades are present here, it can be supposed that large nodules were used. As no long blades that match Taute's definition (cf. note 3) were found in the inventories, it is possible that those were produced and carried away from the location as finished products. Intensive preparation depended on the purpose of the removal. Intended products were prepared with much more care than preparation, maintenance or recovery pieces (Fig. 10). Distinct differences in preparation and techniques on products used for different purposes are visible here. The larger platform remnants, with little to no preparation, belong to flakes removed to clear the core surface of knapping mistakes. Some of them show further distinct points of percussion, which suggests the use of a hard, inorganic hammer. In contrast, blades, intended to be

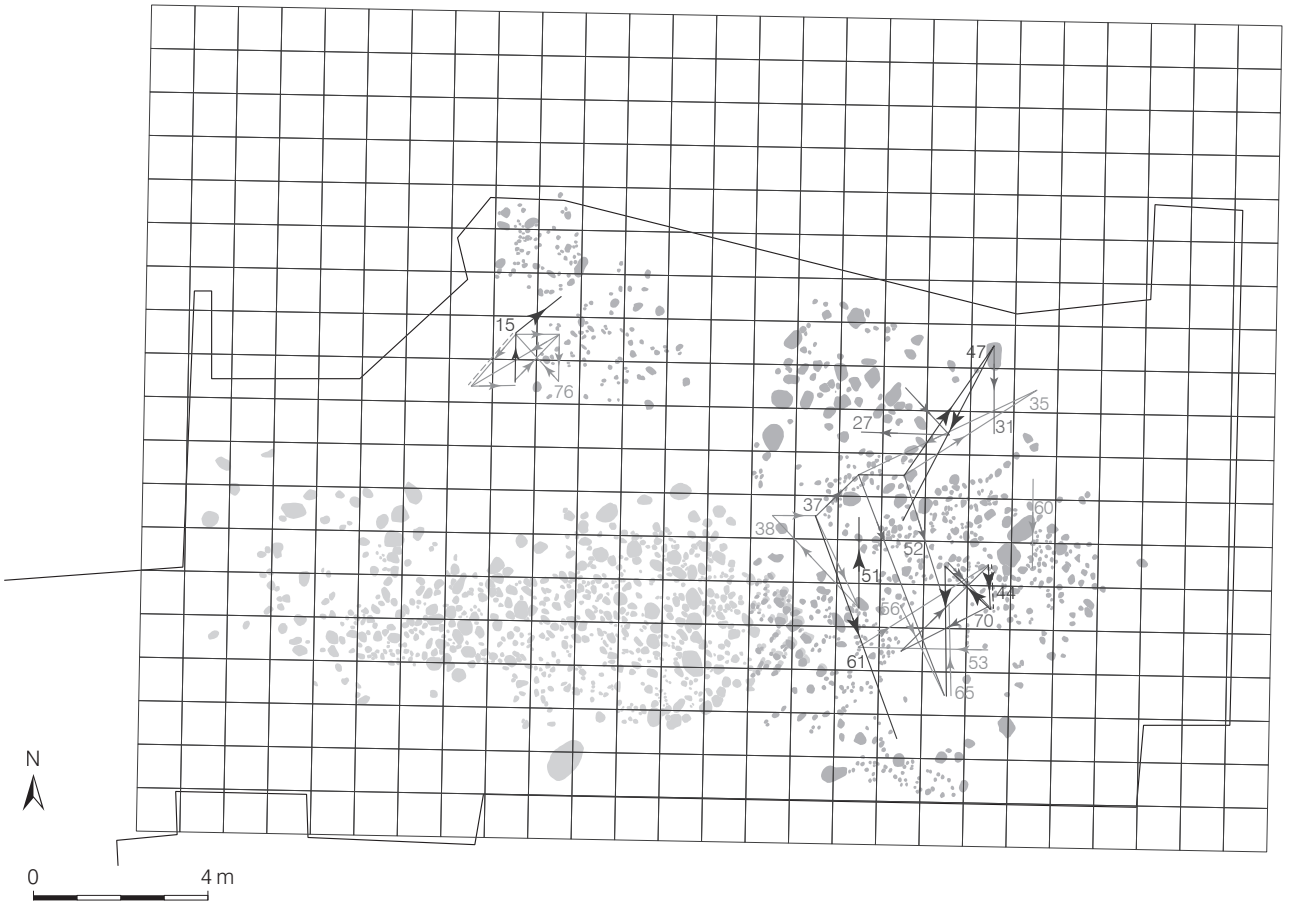

Fig. 8. Refit complexes that skip adjacent quadrants. Arrows indicate succession of removal. Differentiation by shades of grey was chosen to simplify the identification of cohesive refit complexes.

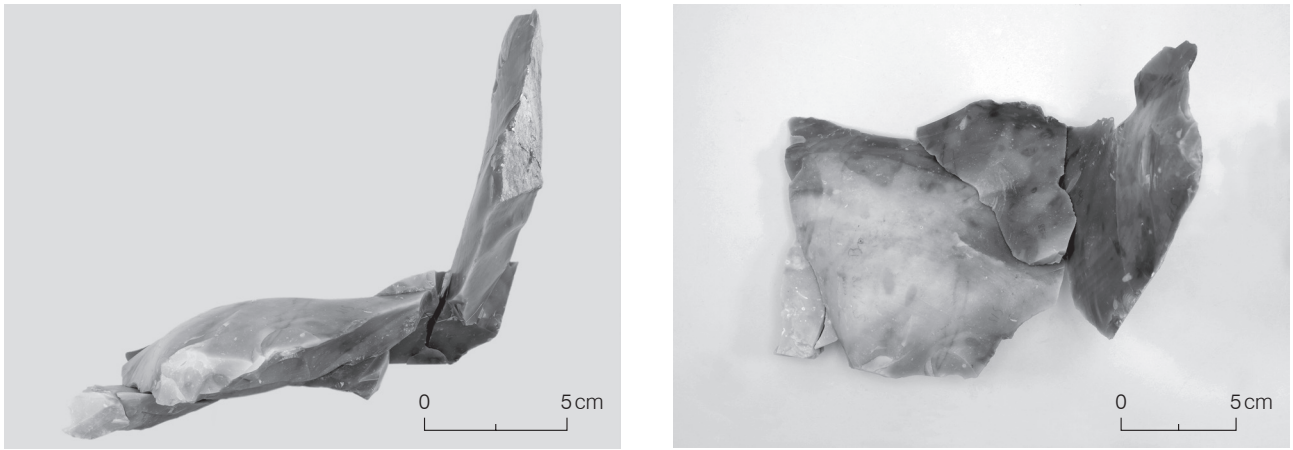

Fig. 9. Refit complex 3, Borneck-north. Core preparation flakes that show the dimension of the used nodule.

thin and regular, show quite small platforms, without clear points of percussion but with meticulous preparation and very faint bulbs. Those pieces were likely struck with a soft hammer, either antler or a soft stone. As mentioned before, this explains the variety of knapping attributes, which do not sum up to a clear pattern. In both inventories, the knapping tool was changed during production as required depending on the purpose and aim of the intended removal.

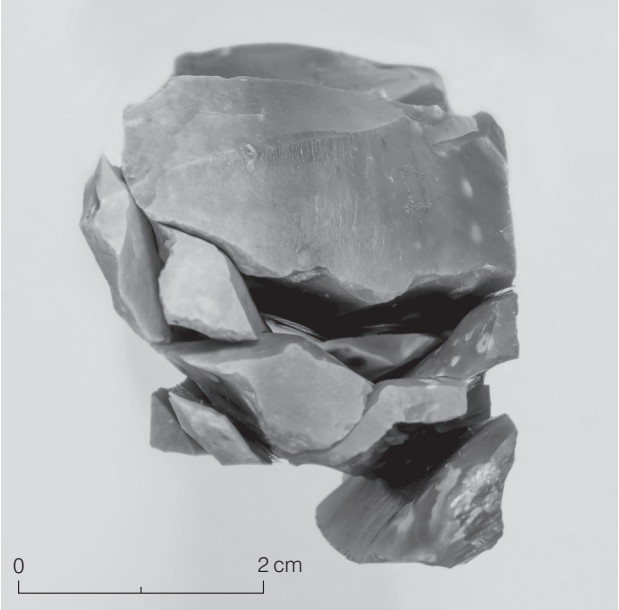

Fig. 10. Refit complex 76, Borneck-north. Top view of one striking platform.

Overall, the spatial distribution of the artefacts does not contradict Rust's plans. Quite the opposite: the differences are rather small. In most cases, there is a minor difference in artefact number contained in individual metre squares, and occasionally some metre squares which had been empty before show artefacts (Fig. 11). Greater discrepancies are observed in the spatial distribution of tools. Especially the end scrapers are problematic (Fig. 12). Rust (1958 a) did not differentiate between different scraper types in his maps, which further complicated the comparison. Additionally, he describes 34 scrapers for Borneck-east, but indicates 60 on the map.

No clear working areas could be recognised, which could be due to the large-meshed excavation grid (Fig. 13). A tendency towards only preparation and blank production can be seen in the northern concentration of Borneck-east. Except for a great portion of flakes and blades with remaining exterior surface, just a few cores and preparation or rejuvenation products were found here. Likewise, only three tools – a flake and a blade, both with retouch, and a Zonhoven point – were recorded.

During a stay in Schleswig, Dr. Jérémie Jacquier, Post-Doc Université de Rennes, UMR 6566 – CReAAH, chose a small sample of blades from Borneck-east for use-wear analysis. No sample was taken from Borneck-north, because the preservation of use-wear was not assured, as result of the loose storage in boxes. One blade showed traces from the working of hide or fresh bone, while another seems to have been used as a butchering knife. Further use-wear analysis is desirable, but the results could fall short of expectations due to the state of preservation of the artefacts.

DISCUSSION

It seems that the inventories from Borneck-north and -east are undisturbed by later processes. As the refits show either no great displacement of the artefacts or, alternatively, connecting lines in every direction, all mixing between the inventories seems to have happened while people dwelled at the site (cf. Fig. 8). Kotthaus (2013) came to the same conclusion as the present paper, both emphasise the difficulties of the cultural attribution of the artefacts. The technology does not differ from that of other known Ahrensburgian inventories (cf. Hartz 1987), and despite minor differences in the working process, basically the same artefacts were produced, in the same way. Only the blades show a difference in regularity and length. Both inventories exhibit signs of a variety of knapping tools having been involved in the reduction process or, possibly, a variation of different ways of using just one tool, like the soft hammer stone. No clear-cut separation in the use of knapping tools was detected. A tendency to prepare the strike for intended blanks with more care than that for maintenance pieces was visible. Due to the smaller striking surfaces on the former, those were more likely knapped with an organic hammer or soft stone.

Tools were made from all kinds of flakes and blades and show no sign of specifically produced blanks – unlike Ahrensburgian points, which show a preference for narrow and straight blades. As no complete or nearly complete knapping sequence could be refitted, the shape of the intended products could not be determined. Long blades *(Riesenklingen)* or *Großklingen* were not recorded, but production of those seems to have been possible. It can further be assumed that part of the produced artefacts was removed from the site, as the people moved on. Since the inventories are quite small and the tool ratio is low, an argument for short-duration camps can be made. With respect to the results of the use-wear analysis, at least for Borneck-east, a successful hunting event can be assumed, where the game was at least partly processed in the camp.

Some of the cores in both inventories show indications of having been knapped by an inexperienced person; in some cases, the knapper seems to have been an absolute beginner. An obvious example can be found on a core from Borneck-north that displays successive hinge fractures from failing to remove a flake from the same spot, again and again.

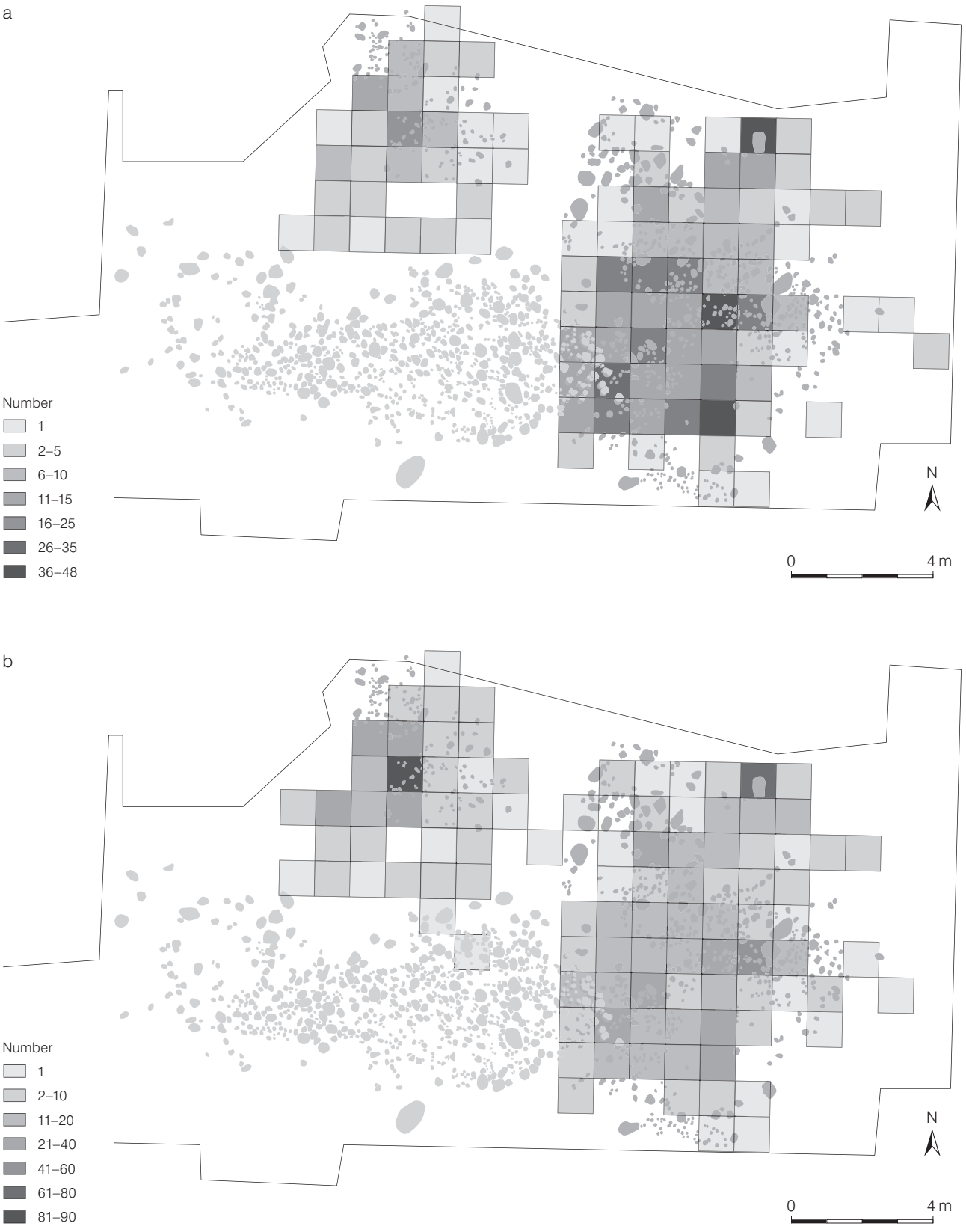

Fig. 11. Spatial distribution of recorded blades: **a** Rust (1958 a, 71 fig. 25; 77 fig. 28); **b** reanalysis.

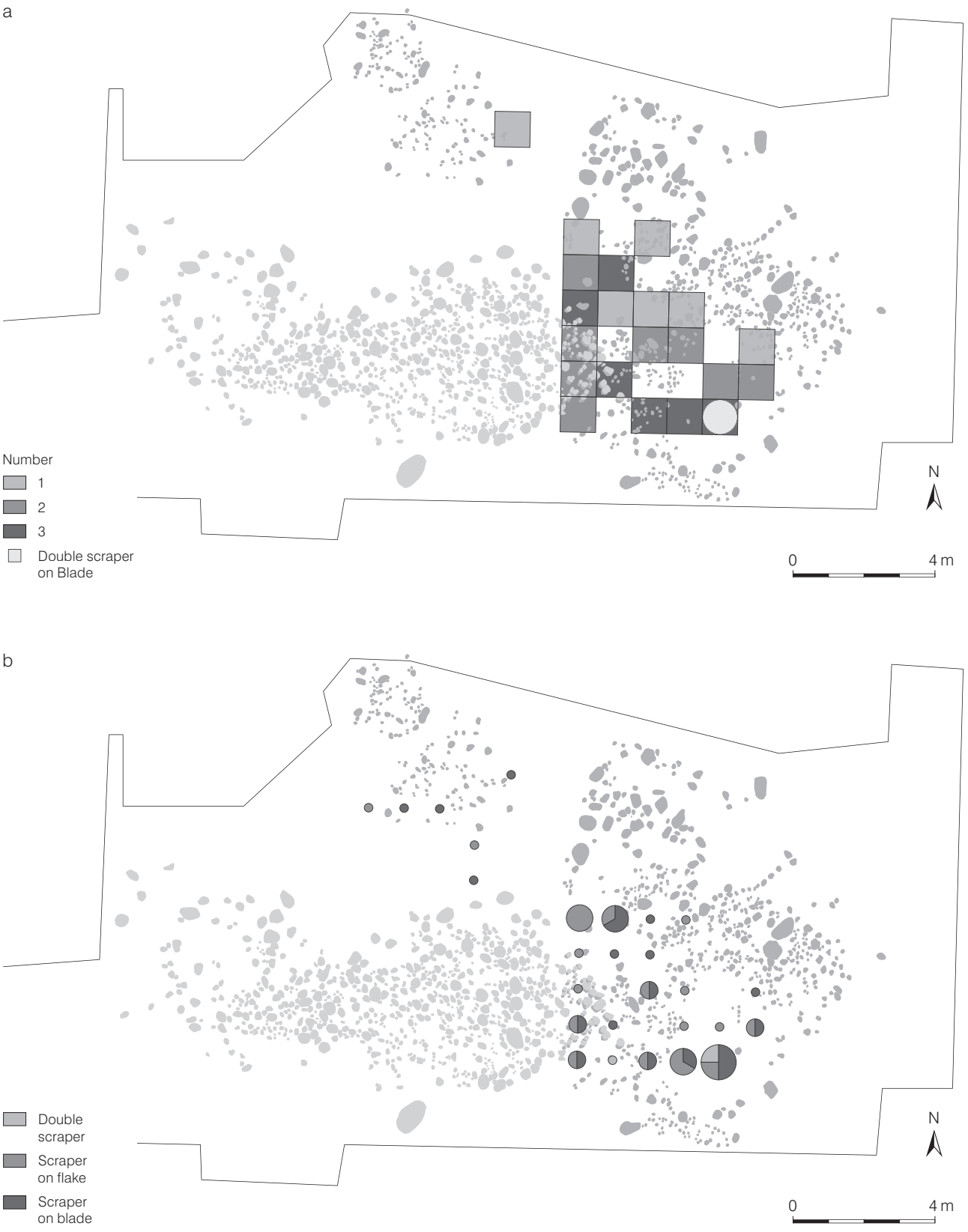

Fig. 12. Spatial distribution of recorded scrapers: **a** Rust (1958 a, 71 fig. 25; 77 fig. 28); **b** reanalysis (largest circle: 4 artefacts).

Fig. 13. Spatial distribution of artefacts potentially diagnostic for working areas: **a** Cores and preparation and maintenance products (largest circle: 9 artefacts); **b** all recorded tools (domestic and projectile points).

In the end, the core was abandoned, with the platform edge situated nearly 1.5 cm behind the core face. Successive hinge or step fractures, as well as frequent marks on core platforms, have been identified as hints of inexperienced flint knappers and children, who were still learning the craft (Audouze/Cattin 2011; Johansen/Stapert 2008; Shelley 1990). It can be concluded that more than one, and probably more than two persons, were present at Borneck-north and -east.

No separation of workspaces could be detected. The overall distribution of artefacts shows no further signs that could support Rust's proposed reconstruction as tent rings. Although absence of evidence does not imply absence in general, the hints collected in the analysis do not support the tent ring interpretation of the stone distributions, and, particularly given to the above-mentioned uncertainty, researchers should henceforth refrain from labelling them as such.

A clearer timeframe for the inventories could not be determined. On the contrary, the timeframe is now less clear. The long blade had to be excluded, and with it, the only remotely typochronological indication. Therefore the chronological siting of these two sub-assemblages remains an open question. The lack of refits between Borneck-north and -east suggest that the locations were not inhabited simultaneously. Based on refits between the blades, Kotthaus (2013, 56–57) argued for the assignment of row P to the Federmesser Group inventory. Further additions to her refit group with artefacts from the Ahrensburgian concentration from Borneck-north indicate that the separation of the inventories is not straightforward. Whether a similar situation exists between the Federmesser Group inventory and Borneck-east could not be determined. Because Rust (1958 a) assigned all the artefacts from column 123 onwards to the Ahrensburgian Borneck-east, no overlap was apparent in the re-evaluation (cf. Fig. 3 a). The only way to determine to what extent the inventories are mixed and whether Borneck-north really represents a separate Ahrensburgian occupation is to try refitting between all three inventories. Another possibility is that the Federmesser Group inventory has been assigned incorrectly and that the concentration belongs to an occupation connected with Borneck-north, or vice versa, since the attribution to the cultural groups is based on the recovered point types, which, in the case of the Federmesser Group inventory, relies on one debatable Federmesser (cf. Kotthaus 2013, 50–51). Moreover, the inventory of Borneck-north also contained only one Ahrensburgian tanged point, in addition to four Zonhoven points and a piece which can best be described as Hamburgian shouldered point. It is not possible to clearly differentiate between artefacts belonging to either the Federmesser Group or the Ahrensburgian inventory, as no major technological differences were observed on the artefacts. No stratigraphy was recorded for the sites, nor any position of depth for the recovered artefacts, so a vertical separation by layers is not possible either.

The results from this analysis could indicate that Borneck-north was inhabited first, sometime after the Federmesser Group site was abandoned, but before sediment covered the concentration. Borneck-east was then inhabited later, after both the Federmesser Group inventory and Borneck-north had become covered by sediment. This serves as one possible explanation why the artefacts from Borneck-north are mixed with the Federmesser Group inventory but not with those from Borneck-east.

CONCLUSION

The re-evaluation of the material from Borneck-north and -east, excavated between 1946 and 1949, unveiled certain problematic aspects in the documentation of the excavation that could not be solved. Further, the interpretation of the stone structures as tent rings did not stand up to scrutiny and was therefore discarded. Still, a deeper insight into the composition of the Ahrensburgian inventories and the production sequences could be obtained. Although the inventories seem undisturbed by later processes, discrepancies remain regarding the chronological separation viz. contemporaneity of the inventories or amalgamation between them. Ideally, an analysis of all inventories from the Borneck excavations would be desirable. Still, the reanalysis of this older excavation has already helped to reject some problematic interpretations.

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