MARKUS WILD

18 KM NORTHWARDS – ZOOARCHAEOLOGICAL AND TECHNOLOGICAL ANALYSIS OF THE AHRENSBURGIAN ASSEMBLAGE FROM NAHE LA11 AT LAKE ITZSTEDT (KR. SEGEBERG / D)

With the exception of Stellmoor (Kr. Stormarn/D), Ahrensburgian sites in the North of the Lowlands of Europe with excavated faunal remains are scarce. Especially, in this area, the faunal Ahrensburgian can thus far be equated by the term »Stellmoorian« as the eponymous site is the only that brought a suitable amount of faunal remains to light. Nevertheless, it has been demonstrated that the fauna at Stellmoor was hunted during a specific part of the year, autumn (cf. Grønnow 1987; Bratlund 1996; Pasda 2009), which represents only a fraction of the Ahrensburgian hunter-gatherers' yearly cycle. In this contribution, the faunal assemblage from the Ahrensburgian site of Nahe LA11 (Kr. Segeberg/D) will be presented.

The site is situated c. 30 km to the North of Hamburg at the edge of the local sub-district of the community of Nahe (Holstein) (**fig. 1**). Here lies the end of the River Rönne that forms a narrow valley with shallow flanks. To the east of the excavated area, the small River Rönne uses the valley of a dead lake that – together

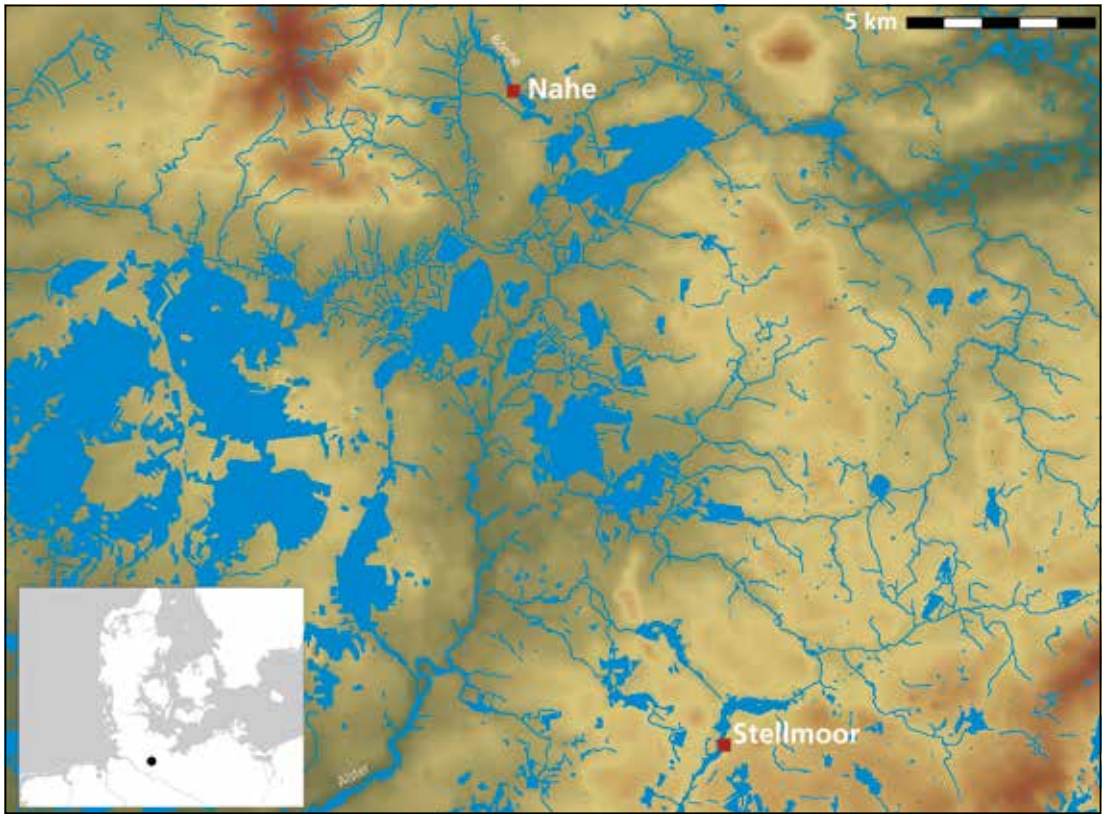

Fig. 1 The location of Nahe (Kr. Segeberg/D) in the vicinity of Stellmoor (Kr. Stormarn/D) in the Ahrensburgian tunnel valley. In between the two Ahrensburgian sites lies the Alster valley. The wetland areas were estimated on the basis of information derived from modern hydrological maps (ESRI Basemap 2006) and peat bogs remarked in Preußische Landesvermessung (PrLA, 1877/1878, Blatt-Nr. 2125-2128, 2225-2228, 2325-2328 [Landesamt für Vermessung und Geoinformation Schleswig-Holstein]) mapped on a DGM200. – (Illustration M. Wild / K. Göbel, Zentrum für Baltische und Skandinavische Archäologie).

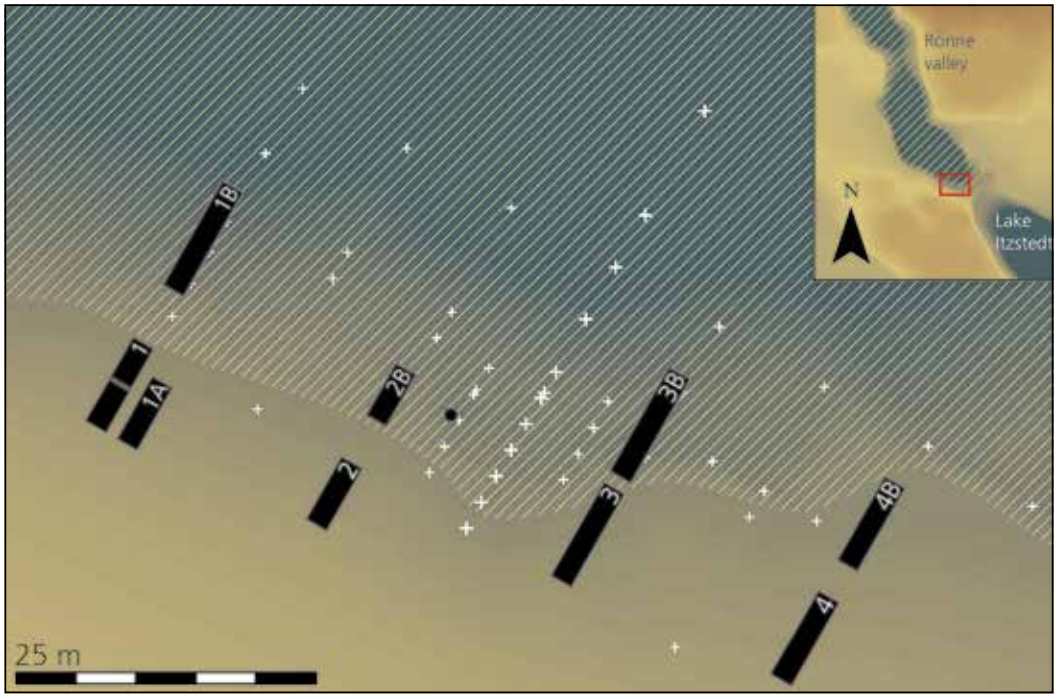

Fig. 2 The former distribution of Lateglacial limnic sediments (hatched) with excavated areas (information extracted from gyttja base heights from drillings [crosses] on a TK5 background map [yellow: 40 m a. s. l.; blue: 10 m a. s. l.]). The black spot between trenches 2B and 3 represents the location of the well shaft. – Information based on the excavation plans by I. Clausen and sediment descriptions by H. Usinger. – (Illustration M. Wild / K. Göbel, Zentrum für Baltische und Skandinavische Archäologie).

with Lake Itzstedt – formerly built a so-called groove lake[1], which was separated by a narrow ridge that still exists (**fig. 2**; Clausen 2004). To the southeastern end of the Rönne lies a hilly elevation where Lateglacial finds have been made during many years of field surveys. In 2003 and 2004, the Archäologisches Landesamt (ALM) Schleswig-Holstein, headed by I. Clausen, excavated archaeological deposits from the Late Meiendorf to the Early Holocene. These partly waterlogged layers yielded, almost exclusively in the sediments formed during the Younger Dryas, faunal remains, whilst the majority of the lithics were found on the shoreline at the bottom of the hill. This situation calls for comparison with that at Stellmoor (Rust 1943), hence the waterlogged area at Nahe has been interpreted as a refuse zone of the terrestrial site on the hill slope (Clausen 2004).

Lake Itzstedt lies at the eastern part of a valley that topographically extends the flat meltwater erosion valley of the Alster (Gripp 1964, 305) northwards. The area is situated at the transition between the outer fringe area of the upper moraines and Saalian formations, while the exact genesis is not clear. It is characterised by a landscape with elevations and water-filled depressions (Woldstedt/Duphorn 1974, 90).

Archaeologically the area is well known due to finds from hobby archaeologists who collected flint from sites around the lake. Within the Mesolithic/Neolithic collection of G. Steffens, Hamburgian *Zinken* and points from an unknown cultural affiliation were identified (Rust 1962, 159; Tromnau 1974). Furthermore, Ahrensburgian finds have been reported from the Rügelsberg (Itzstedt, Kr. Segeberg/D), 500 m to the southeast of Lake Itzstedt. Unfortunately, construction works had already destroyed the site before finds were reported to archaeologists. Besides a typical Tanged Point, the small assemblage contains a so-called Bruised Blade and a Zonhoven Point (Tromnau 1970), indicating a Late Ahrensburgian occupation of the area (cf. Taute 1968, 217; Barton 1998). Other Lateglacial finds have been made to the northwest of the

lake. From the surface find collection of G. Mende, W. Taute mentions a tanged Ahrensburgian point. The site location is described as »bei der Schleuse links der Au nahe von dem Austritt aus dem Itzstedter See«[2] (Taute 1968, 86). This describes the hilly elevation to the south of the excavated area. Th. Poelmann has been surveying this small elevation at the southern side of the angle of Lake Itzstedt and the small River Rönne from 1986 until 2006. He found an inventory of more than 12,000 lithics. It contains Ahrensburgian and Zonhoven points on the upper hill slope as well as lithics that point to the Hamburgian on the northern lower slope of the hill (Th. Poelmann, pers. comm.). The exceptional amount of lithics found by him as well as the presence of waterlogged sediments at the foot of the hill led to comparisons with the Stellmoor hill slope and kettle hole (Rust 1943), and a succeeding excavation of the lower areas.

THE STRATIGRAPHICAL SETTING OF THE SITE

The large quantity of lithics discovered at the higher points of the hill demonstrates that ploughing has probably destroyed the find bearing sediments. Furthermore, Ahrensburgian sites on higher locations are well known from the lowlands (Taute 1968), while sites with faunal preservation are seldom. In 2003, the first excavations (**fig. 2**, trenches 1-4, 1A) aimed to locate the shoreline of the former lake. Although expected, the excavations did not encounter Lateglacial sediments. Nevertheless, cultural layers were found containing lithic artefacts. Unfortunately, these cannot be assigned typologically to the Ahrensburgian. Unexpected, were finds of four bones, of which three belong to reindeer (*Rangifer tarandus*) (these finds are labeled with the inventory numbers K17, K23, K62, K97 at the ALM at Schloss Gottorf, Schleswig). Their presence suggests a Lateglacial refuse zone in the area of the Rönne. Two northeast-southwest directed sections made in trench 1 (150E/92-98N) and trench 4 (210E/102-110N) yielded an Atlantic detritus layer lying on Saalian or Early Weichselian sediments, while Lateglacial sediments were absent entirely. It became clear that neither of them were contemporaneous with the reindeer bones, suggesting that the former shoreline was emptied. To finally prove the hypothesis of an Ahrensburgian refuse zone and to clarify the stratigraphical setting of the site, four more trenches were excavated northwards into the presently waterlogged limnic sediments. Trenches 1B-4B were located in the prolongation of the first trenches that missed the former Lateglacial shoreline (**fig. 2**). As the sediments in this area were overflowing with water during the excavations, it was impossible to document any sections. In contrast, a mechanical digger removed the trench and the spoil was searched for finds on site. With this excavation technique, it was possible to recover another 150 fragments of bone and antler of several species (see below), and, furthermore, prove the hypothesis of a Lateglacial refuse layer. Unfortunately, neither a documentation of precise spatial data nor wet sieving was conducted. To further evaluate the stratigraphy, a well shaft was deepened into the limnic sediments and transects of drillings were set up from the shoreline into the Rönne and along its valley northwestwards. Although Hartmut Usinger was unable to finish the geological and palynological analyses of these soil samples, preliminary results include the following. At the middle of the Rönne valley sediments deposited during the Meiendorf are succeeded by an Allerød deposition of lake sediments and a Younger Dryas sand gyttja. While Preboreal and Boreal sediments seem to be absent in the area of the trenches 1B-3B, an Atlantic detritus lies beneath the recent topsoil. Surprisingly, few reindeer bones were found in the lower part of the detritus, indicating an event that replaced the sediments of the upper parts of the riverbed (Weber/Grimm/Baales 2011, 291). This potential phenomenon will further be called »circulating pump-hypothesis«. To clarify the time of deposition of reindeer bones, four have been dated. These point to two occupations during the Younger Dryas: one in the middle and one at the end of the latest glacial stadial (Weber/Grimm/Baales 2011). Nevertheless, the provenience of the four samples is unpublished so far but

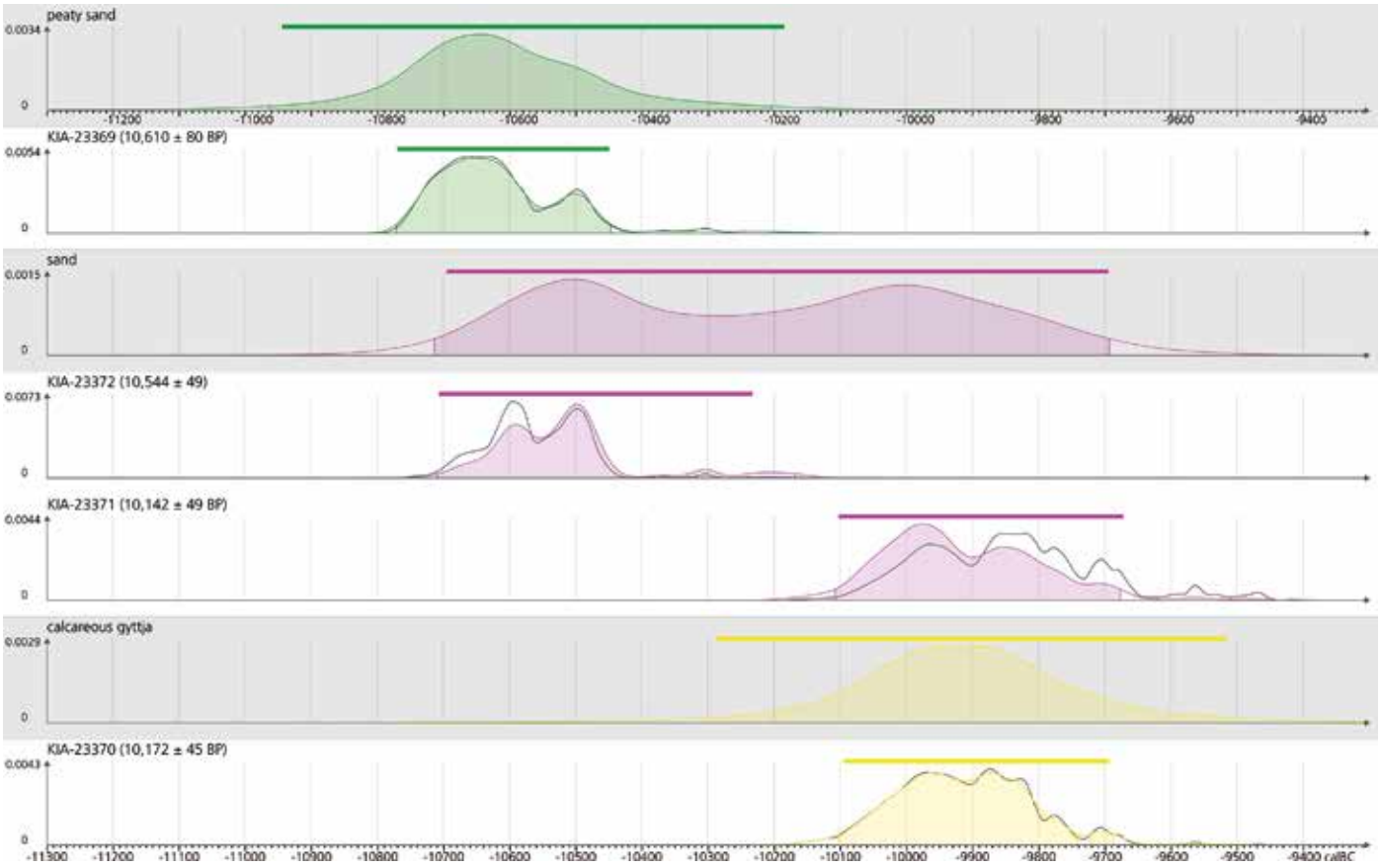

Fig. 3 ^{14}C plot of the four dates from Nahe LA11 (Kr. Segeberg/D). The horizontal division represents the layering from old (at the bottom) to younger (at the top) Younger Dryas sediments. This indicates the mixing of the sediments also within the find layer. – Calibrated with Chronomodel v1.1 and the calibration curve IntCal13 (Reimer et al. 2013), calibrated dates given in cal BC. – (Illustration M. Wild).

striking (**fig. 3**). Three layers were attributed to the Younger Dryas: a calcareous gyttja, covered by sand that is succeeded by a peaty sand layer. However, it should be reminded on the fact that a mechanical digger scooped out the sediments coarsely and different people described the location of the sediments. Thus, the sedimentological and stratigraphic information within the Younger Dryas remains vague (I. Clausen, pers. comm.). However, sample KIA-23370 – a lumbar vertebra from the calcareous gyttja – gave a very young date (10,172 ± 45 BP), while a humerus from the uppermost and latest developed Younger Dryas layer – KIA-23369 – gave the oldest date (10,610 ± 80 BP). The layer in between was dated twice, and while another lumbar vertebra – sample KIA-23371 – gave a result (10,142 ± 49 BP) possibly younger than at least one Stellmoor date (Weber/Grimm/Baales 2011), the ^{14}C date of sample KIA-23372 on a reindeer antler (10,544 ± 49 BP) would fit into the postulated older occupation. However, it must be stated that up to now it is not clear how many occupations took place at Nahe. A palimpsest cannot be excluded, and, furthermore seems to be highly likely. Especially, in the context of high amounts of lithics found on the hill that indicate repeated occupations. Nevertheless, a possible dating strategy would require at least the sampling of numerous faunal remains. Furthermore, dating samples should derive from new excavations and secured stratigraphic positions. Nevertheless, the analysis of the faunal remains of the Stellmoor kettle hole showed that, although it is a huge palimpsest (Rust 1943), seasonality and subsistence patterns can still be observed (Grønnow 1987; Bratlund 1996; Pasda 2009). It seems these sites have been visited regularly to a certain time of the year. Thus, in the following the Nahe remains will be analysed as one bulk assemblage.

Fig. 4 Construction of a well. This method was applied in order to gain more precise knowledge of the situation of finds within the interwoven sediments at Nahe LA11 (Kr. Segeberg/D). – (Photo Archäologisches Landesamt Schleswig-Holstein).

MATERIAL

The finds from the excavations at Nahe LA11 are stored at the ALM at Schloss Gottorf. A total of 146 lithic artefacts were found primarily in trenches 1-4 and 1A. Of these, 105 were simple flakes or debris, while 35 blades and only one single core were recorded. Besides these forms, one end-retouch on a flake, one flake endscraper and one scraper on a core tablet were observed. Unfortunately, a correlation between find bearing layers of the Lateglacial sediments in the trenches was not possible. Furthermore, it was not likely to assign any of these artefacts to a certain cultural epoch, except that the blade production evidenced is known from the Upper Palaeolithic onwards. Nevertheless, the lithics would not be suspicious when found within an Ahrensburgian assemblage.

However, 135 faunal remains were recovered during the field seasons 2003 on the shoreline (1-4, 1A), 2004 during the test excavation in the wet-logged sediments (1B-4B), and the excavation of a small part of the lake within a well shaft (**fig. 4**). Finally, a total of 154 pieces of bony tissue were found at the beginning of the analysis in the archives of the ALM. They are all analysed as a part of this study, but as the geological circulating pump-hypothesis (see above) suggests, the assemblage can show species related to the Lateglacial as well as the Holocene.

Due to the coarse technique of excavating the waterlogged sediments with a mechanical digger, whose spoil was then searched for archaeological finds on site, as well as a lack of wet sieving, the majority of finds is quite large in size. This leads to a rate of close to 90 % of determined fragments.

The majority of the finds were stored in separate airtight plastic zip-bags in boxboards. The preservation of the entire material ranges between excellent and poor. While some of the bones show every detail in perfect condition, others show an intensive deterioration of spongeous and compact tissue. In extreme cases, several millimetre thick layers of the compact surface did exfoliate during the post-excavation years, as finds of cohesive parts in single plastic bags indicate (cf. **fig. 5**). Due to this situation, it was possible to refit and analyse the different parts of the specimens in the majority of cases. These disintegrated objects were counted as single specimens. All the fragments were of a dark to greyish brown colour. They do show slight

Fig. 5 Nahe LA11 at Lake Itzstedt (Kr. Segeberg/D). Fragment of a right humerus diaphysis of reindeer. – (Photo C. Janke, Stiftung Schleswig-Holsteinische Landesmuseen Schloss Gottorf).

signs of weathering and porosity, while none of the finds shows any signs neither of carnivore gnawing nor of contact with fire.

The entire collection was determined to species level, skeletal element and part of the skeletal element following the system of D. Zawatka and H. Reichstein (1977), regularly applied and further refined at the Archäologisch-Zoologische Arbeitsgruppe (AZA) at Schleswig (cf. Schmölcke 2004, 20-24). Refitting was tried inter-stratigraphically on all determined elements in order to decrease the number of elements to the minimum level.

Where possible, measurements were taken according to A. von den Driesch (1976) using a measuring box, a tape measure and digital callipers. The Number of Identified Specimens (NISP), the Minimum Number of Elements (MNE) and the Minimum Number of Individuals (MNI) were determined in order to reconstruct the size of the *thanatocoenosis* (death assemblage). As 86 % of the NISP consist of Lateglacial reindeer bones, the focus of this study lies on these. Sketching of the age structure of the reindeer individuals was done primarily by comparing the fusing of epiphyses with the data collected for the Sisimut reindeer population on Greenland (Pasda 2009, 45 tab. 13). As the population represented in the Nahe assemblage would have lived in the German Lowlands, the Sisimut reindeer that live in a comparable environment were favoured to other populations living in a more mountainous area (e. g. Hufthammer 1995). This is also supported by a genetic analysis of Ø. Flagstad and K. H. Røed (2003): they suggest morphological changes in different reindeer populations due to adaptations to different environments in the Postglacial. Furthermore, it is important to note a general difference in size of skeletal elements between recent and Younger Dryas reindeer populations (Pasda 2009, 59-85 figs 57-69), as well as further differences within contemporary cervid populations that live in different areas (Wagenknecht 2000, 42-48). Accordingly, measurements taken on bones of one site should be compared with assemblages of the same provenience. In the best case, the reference is part of the same population of reindeer, or at least from a population that lives in a comparable environmental setting. This has some implications for the study of the Nahe assemblage. Potentially, the reindeer found in Nahe was part of/or highly comparable to the populations of the Younger Dryas levels in the Ahrensburgian tunnel valley (Bratlund 1991; 1996; Weinstock 2000a; 2000b; Pasda 2009). Or, if not, at least is most-likely the best fit in terms of size as they probably lived partly contemporaneously (**fig. 3**; Weber/Grimm/Baales 2011) in the German Lowlands. Following this, the measurements of bones and antler were compared with these assemblages as well as the assemblage from Hohler Stein (Kr. Soest/D) (see **tab. 3** below), a site situated at the edge of the Lowlands and dating to the Younger Dryas (Baales 1996).

FAUNA BELONGING TO A POTENTIALLY NATURAL *THANATOCOENOSIS*

Through the examination, it was possible to determine bones of the ichtyo- and avifauna in the waterlogged sediments (**tab. 1**): northern pike (*Esox lucius*) (right dentary), great black-backed gull (*Larus marinus*) (right coracoid), undetermined gull (*Larus* sp.) (left coracoid), whooper (*Cygnus cygnus*) or mute swan (*Cygnus olor*) (right ulna) and an undetermined duck (*Anatidae* sp.) (two left humeri). These bones, almost exclusively, do represent the basic one individual (sensu Bratlund 1999), and none of the specimens shows

taxa	NISP	NISP (%)	MNI	MNI (%)
Rangifer tarandus	112	86.82	5	26.32
Alces alces	1	0.78	1	5.26
Bos primigenius	1	0.78	1	5.26
Capreolus capreolus	1	0.78	1	5.26
Cervus elaphus	3	2.33	1	5.26
Sus scrofa	1	0.78	1	5.26
Sus scrofa f. domestica	1	0.78	1	5.26
Canis cf. familaris	1	0.78	1	5.26
Lutra lutra	1	0.78	1	5.26
Esox lucius	1	0.78	1	5.26
Larus marinus	1	0.78	1	5.26
Laridae	1	0.78	1	5.26
Anatidae	2	1.55	2	10.53
Cygnus cygnus/olor	2	1.55	1	5.26
sum	129	100.00	19	100.00

Tab. 1 Accumulative and relative list of faunal taxa with the Number of Identified Specimens (NISP) and the Minimum Number of Individuals (MNI).

any signs of anthropogenic modifications. Thus, these individuals are interpreted as elements of background fauna of unknown age. Furthermore, a single left lower jaw of European otter (*Lutra lutra*) was excluded from the study, as it is not possible to identify it as anthropogenic refuse.

TERRESTRIAL FAUNA FROM THE LAKE SEDIMENTS

The majority of the bones found at Nahe belong to reindeer. Besides this, a total of seven terrestrial mammal species were discovered in the small test trenches. These are only represented by single or few bones and, again, exclusively do represent single individuals. Besides the remains of the big mammals, aurochs (*Bos primigenius*) (left first *phalanx*) and elk (*Alces alces*) (fragment of left rib), with red deer (*Cervus elaphus*) (fragment of right mandibular, right *metacarpus* and left *pelvis*, parts of a right leg with *femur* and *tibia*) and roe deer (*Capreolus capreolus*) (fragment of left pelvis) further cervids were identified. Remains of a domesticated dog (*Canis lupus familiaris*) (fragment of a rib) and a wild boar (*Sus scrofa*) (fragment of frontal bone [*Os frontale*]) as well as a domesticated pig (*Sus scrofa f. domestica*) (fragment of right *scapula*) complete the faunal list.

As the circulating pump-hypothesis indicates complicated stratigraphical conditions, and the excavation methods were coarse without the documentation of tridimensional data and drawing of sections, the secure attribution of faunal elements to the Younger Dryas levels has to be discussed in detail.

First and foremost, one small part of a frontal bone of domesticated pig can be dismissed for further investigations as this species is a clear indicator for latest- and post-hunter-gatherer societies (for further discussion see Krause-Kyora et al. 2013; Evin et al. 2014; Rowley-Conwy/Zeder 2014a; 2014b). For the rest of the Nahe mammals, this evidence of temporal provenience is harder to find. In her study of the fauna of 50 Younger Dryas zoological and archaeological sites in Central Europe and Southern Scandinavia, J. M. Fahlke (2009, 98-100) mentions only elk, aurochs, red deer, dog, and reindeer as reliable Younger Dryas species. While there is enough evidence for the occurrence of the latter species in this period (Kollau 1943; Fischer/Tauber 1986; Baales 1996; Benecke 2004; Aaris-Sørensen/Mühldorff/Petersen 2007; Sommer et al. 2014), there is only scarce evidence for its existence in the Preboreal (Kind 2003; Ukkonen et al. 2006; Aaris-Søren-

sen/Mühldorff/Petersen 2007; Drucker/Kind/Stephan 2011). Furthermore, the four ^{14}C dates made on reindeer bones (Weber/Grimm/Baales 2011) confirm their Younger Dryas origin. Thus, the presented study focuses on the analysis of the reindeer assemblage of Nahe.

Elk is known from at least four sites dating to the Younger Dryas: Stellmoor (Krause/Kollau 1943; Wild/Weber 2017), Wustermark 22 (Lkr. Havelland/D; Gramsch/Beran 2010), Veddelev Havn (Region Sjælland/DK; Aaris-Sørensen 1990) and Allerød Teglværksgrav (Region Hovedstaden/DK; Hartz/Milthers 1902). Nevertheless, its presence is rare. It seems as elk relates to warmer periods at the transition Allerød/Younger Dryas and the subsequent transition to the Preboreal (Aaris-Sørensen 2009, 27) or to more southern and forested regions (Theuerkauf/Joosten 2012). An allocation to Middle Younger Dryas events in Nahe would be precarious.

In Northern Central Europe auroch is not known before the spread of Holocene environmental niches (Schreve 2001; Bocherens et al. 2015; Wright/Viner-Daniels 2015). Therefore, a single first phalanx of this species in Nahe will not be considered any further in this paper.

A comparable situation can be observed for red deer (Sommer et al. 2008, 723). There exists Mid-Younger Dryas evidence for this species at the edge of the Lowlands with two British sites – Elder Bush Cave (Staffordshire/GB; Gowlett et al. 1986, 210) and Hyaena Den (Somerset/GB; Hedges et al. 1998, 228-229). Nevertheless, they are absent from Northern Central Europe, thus, the five remains of red deer will also be excluded from the faunal study of the Lateglacial occupation at Nahe.

The domestication from wolf (*Canis lupus*) to dog seems to be multiple events taking place from the Early Upper Palaeolithic onwards (Germonpré et al. 2009; Thalmann et al. 2013; Germonpré et al. 2015; Schünemann/Krause 2015). However, Final Palaeolithic evidence of dogs is scarce in the Lowlands and adjacent areas (Street/Napierala/Janssens 2015). From the double burial in Bonn-Oberkassel (D) remains of a dog were detected (Cziesla 2012; Nobis 1979; 1986), which date to the transition from the Final Magdalenian to the *Federmessergruppen* (Higham et al. 2015). The only Ahrensburgian evidence so far comes from the Kartstein (Kr. Euskirchen/D). Here, phalanx bones of wolf and dog were found (Baales 1992). It is noticeable that within the many faunal remains from Stellmoor neither dog nor carnivore gnawing was identified (Gripp 1943; Rust 1943). The only gnawing documented at the site comes from reindeer and rodents (Grønnow 1987, 144; pers. observation). Probably, the specimen from the Kartstein remains a unique phenomenon in the Ahrensburgian or this species is solely related to the southernmost Lowlands and the hilly parts of the mid-range mountains. Perhaps it was more difficult to find wounded and scattered animals in the more mountainous, thus more impenetrable, environment at the Kartstein than it was in the shallow and treeless environment of the Ahrensburgian tunnel valley. This might be stressed by the situation we see with the beginning of the Mesolithic. Dogs became a regular symbiotic partner of humans in the Lowlands (e. g. Clark 1954; Schuldt 1961; Street 1989a; cf. Petersen 2013), where single animals were hunted within a mosaic environment. Furthermore, like in Stellmoor none of the found reindeer fragments discovered in Nahe, shows traces of carnivore gnawing. Therefore, a Younger Dryas date for the single rib of Nahe can be seen as unlikely.

To conclude, except the bones of reindeer none of the identified specimens should be considered within this study without further direct dating, due to their uncertain relationship to the Younger Dryas layers.

THE REMAINS OF REINDEER AT NAHE

As previously mentioned, remains of reindeer are dominant on the site. Through radiocarbon measurements and the geology of the site, it can be stated that these animals lived during the Younger Dryas (**fig. 3**). A

element		NISP	NISP (%)	MNI
cranial skeleton	antler indet.	21	18.75	1
	shed antler	1	0.89	1
	unshed antler	12	10.71	5
	cranium	1	0.89	1
axial skeleton	*atlas*	1	0.89	1
	axis	4	3.57	3
	vertebrae thoracales	8	7.14	–
	vertebrae lumbales	4	3.57	–
	vertebrae cervicales	5	4.46	–
	vertebrae indet.	3	2.68	–
	sternum	1	0.89	1
	costae	15	13.39	–
anterior extremity	*scapula*	2	1.79	1
	humerus	5	4.46	2
	radius	4	3.57	2
	ulna	1	0.89	1
	metacarpus	1	0.89	1
posterior extremity	*pelvis*	2	1.79	2
	femur	3	2.68	2
	tibia	5	4.46	2
	tarsale centrale	1	0.89	1
	other tarsal/carpal bones	2	1.79	1
	calcaneus	2	1.79	1
	metatarsus	2	1.79	1
other limb bones	*phalanx* I	6	5.36	1
sum		112	100.00	

Tab. 2 Accumulative and relative list of reindeer bones and antlers with the Number of Identified Specimens (NISP) and the Minimum Number of Individuals (MNI).

total of 112 fragments of bone and antler were identified and related to reindeer (**tab. 2**). Of the determined pieces, 14 were rejoined/refitted to 6 fragments. Due to the lack of spatial data, it was not possible to analyse these further. Overall, the assemblage shows that while the caudal parts are rather equally represented, the ensemble is biased towards cranial parts, especially unshed antlers. Through rejoining/refitting and measuring of the circumferences proximal and distal of the burr (**fig. 6, tab. 3**; von den Driesch 1976, 36-37) it was possible to determine a minimum of five reindeer within the assemblage.

The presence of the majority of body parts (cranial parts, axial elements and extremities) suggests that entire carcasses of reindeer were processed at the bank close to the find place of the bones in Nahe (cf. with Teichert 1987; Street 1989b; Bratlund 1996, for comparison with solely kill and secondary butchering sites). Whether the animals were hunted here or were transported from an adjacent kill site cannot be answered presently. Nevertheless, it is interesting to compare the tubular situation of the several fords within the Ahrensburgian tunnel valley with the ford between the small valley of the Rönne and Lake Itzstedt. This stresses the similar character of the site with that of Stellmoor, and others for whom a »head'em-off-at-the-pass« strategy had been postulated (Baales 1996, 1). Apart from the question of the location of the kill site, more detailed information yield the diverse anthropogenic modifications that can be found numerous on the faunal remains from Nahe (**fig. 7**). A quarter of the bones show butchery marks that indicate different steps in the process which took place at Nahe. While none of the traces observed on the bones can be clearly related to the killing of the animals, skinning could be the first documented step in the operational

element (specimens)	measurement	values (mm)	values (reference; mm)
antler (K4/K25/K26/K47/K48/K49(+K50)/K51/K78)	pcb	71/73/59/50/61/54/107/123	35.1-162.9 (S_{ant})
	dcb	72/73/61/41/51/69/111/134	30.8-164.8 (S_{ant})
atlas (K107)	bfcd	72.5	53.4-76.8 (S)
axis (K65)	bfcr	64.1	54.2-75.5 (S)
	lcde	82.8	69.4-90.5 (S)
	sbv	44.9	33.0-52.3 (S)
scapula (K97)	bg	29.8	24.5-37.5 (S)
	lg	31.0	30.8-41.8 (S)
	slc	36.6	24.0-45.0 (S)
humerus (K52/K68)	bt	36.4/41.5	38.9-49.0 (S)
radius (K18/K59)	bd	-/47.0	37.5-48.5 (S)
	sd	19.2/-	19.2-33.2 (S)
	bfd	-/43.0	–
ulna (K19)	bpc	25.2	21.5-30.5 (S)
metacarpus (K39)	gdb	42.0	39.4-47.8 (S)
pelvis (K69)	lar	35.8	–
	sb	24.1	–
	sc	75.9	–
tibia (K82)	sd	20.5	21.4-24.7 (S); 15.3-20.6 (S_{juv})
	cd	59.0	–
talus (K75)	bd	30.7	25.4-31.7 (S)
	dl	27.4	23.0-28.4 (S)
	dm	28.4	24.0-30.2 (S)
	gll	49.9	46.9-50.3 (HS); 42.0-50.0 (S)
	glm	45.9	44.1-47.9 (HS); 39.5-46.7 (S)
calcaneus (K74/K106)	gl	88.6/92.7	87.4-105.1 (S)
	gb	31.5/27.3	27.2-34.5 (S)
metatarsus (K90/K100)	gdb	-/40.2	39.0-45.0 (S)
	sbod	16.6/-	15.3-18.8 (S)

Tab. 3 Abbreviations for measurements (after von den Driesch 1976) applied to the faunal material from Nahe LA11 (Kr. Segeberg/D) and reference assemblages. – Abbreviations: bd: breadth of the distal end. – bfcd: greatest breadth of the caudal articular surface. – bfcr: greatest breadth of the cranial articular surface. – bfd: greatest breadth of the facies *articularis distalis*. – bg: greatest breadth of the glenoid angle. – bp: breadth of the proximal end. – bpc: greatest breadth of the proximal articular surface. – bt: greatest breadth of the trochlea. – btr: greatest breadth of the region of the trochanter tertius. – cd: circumference of the *diaphysis*. – dc: greatest depth of the *caput femoris*. – dcb: distal circumference of the burr. – dl: greatest depth of the lateral half. – dm: greatest depth of the medial half. – dpa: depth across the processus anconaeous to the caudal border of the *ulna*. – gb: greatest breadth. – gdb: greatest distal breadth. – gl: greatest length. – glc: greatest length from caput head. – gll: greatest length of the lateral half. – glm: greatest length of the medial half. – HS: Hohler Stein (Baales 1996). – lar: length of the *acetabulum* on the rim. – lcde: greatest length in the region of the *corpus*. – lg: length of the glenoid cavity. – pcb: proximal circumference of the burr. – S: Stellmoor (Weinstock 2000a). – S_{ant}: Stellmoor antler. – S_{juv}: Stellmoor juveniles (Pasda 2009). – sb: smallest breadth of the shaft of the *ilium*. – sbod: smallest breadth of *diaphysis*. – sbv: smallest breadth of the *vertebra*. – sc: smallest circumference of the shaft of the *ilium*. – sbod: smallest breadth of *diaphysis*. – sbv: smallest breadth of the *vertebra*. – sc: smallest circumference of the shaft of the *ilium*. – slc: smallest length of the neck of the *scapula*.

chain of animal processing at Nahe. As E. J. Reitz and E. S. Wing (2008, 127) mention, killing, dismembering and skinning of bones can leave similar traces on bone surfaces. Besides cut marks on the cranium, those on the metapodials and phalanxes are typical traces of the skinning process. At Nahe four out of six first phalanxes show single or multiple cut marks and prove the skinning of reindeer. Cut marks on the dorsal edge of an *atlas*, the medial condyle of a distal *femur epiphysis*, and the lateral and dorsal parts of two *calcanei* can be regarded as evidence of the dismembering of different elements and regions of the body to achieve smaller units. Furthermore, secondary and final butchering stages (Lyman 1987; 1992) can be

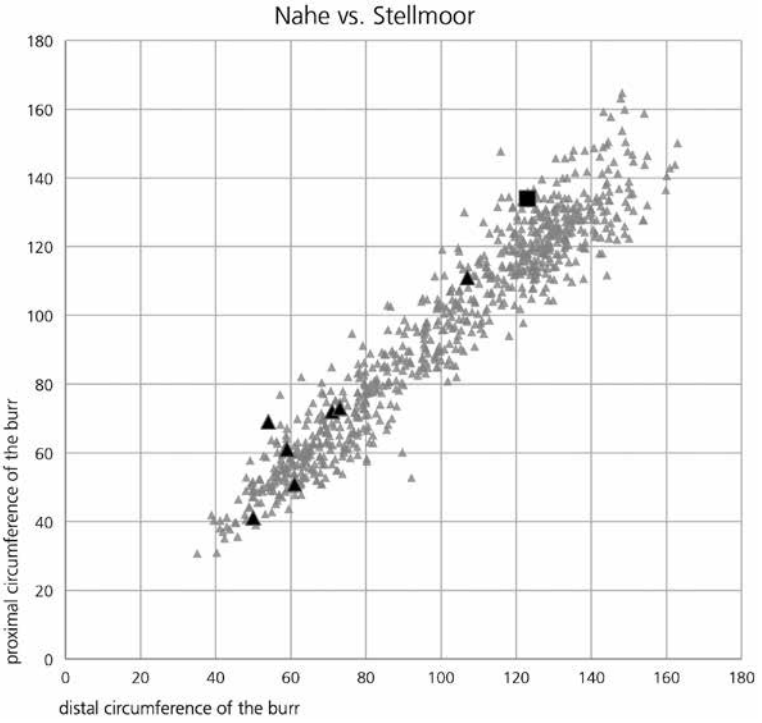

Fig. 6 Plot showing the proximal and distal circumference of the burr of unshed reindeer antlers in mm. – ▲ Nahe not worked; ■ Nahe worked; ▲ Stellmoor. Antler beneath the 80 mm-border most probably belongs to adult females and juveniles; antler above the 100 mm-border belongs most probably to adult males. – (Illustration M. Wild).

observed on several elements. Transversal to oblique cut marks beneath the epiphyses of ribs, a *humerus*, *radius*, *metacarpus* and a *metatarsus* are signs of the filetting of meat. Five longitudinal grooves on the medial side of a proximally preserved *scapula* are also indicating that meat was taken off these parts of the skeleton (cf. Berke 1987, 45 fig. 33a; Street 1989b, 27 fig. 17, 1). The final step of nutritional exploitation can be seen in the extraction of marrow. Bones that contain a lot of marrow are the long bones of both extremities. At Nahe 84 % of the bones are preserved fractured (e. g. **fig. 5**). The obliquely to the *axis* fractured bones, like seen on other sites (Noe-Nygaard 1977), together with smooth fracture planes and helical or spiral fracture outlines indicate an intentional opening of these bones (Outram 1998). For the Kartstein it was made plausible that the bones were bruised into smallest parts (the majority between 1.5 and 2.5 cm of length) for the decocting of so-called bone grease (Baales 1996, 90-94; for further discussion see Binford 1978, 157-165). In Nahe the ratio of epi- and diaphyses seems to be almost equally. Furthermore, most of the bones vary between lengths of 4 and 7 cm, and, thus, were too big for the effective extraction of fat (cf. Church/Lyman 2003). All in all this indicates that the marrow extraction was the last step of the nutritional exploitation of reindeer.

AGE AND SEX STRUCTURE OF THE REINDEER HERD AND SEASONALITY OF OCCUPATION

Several age indicators were observed within the assemblage. Most of the information derives from fused epiphyses and indicates the presence of at least one adult animal at the site. In contrast to these bone ends, which fused at a minimum age of 42 months, there are several bones with unfused ends that show the presence of at least one younger animal. Reindeer can build their first antler within their first year (Berke

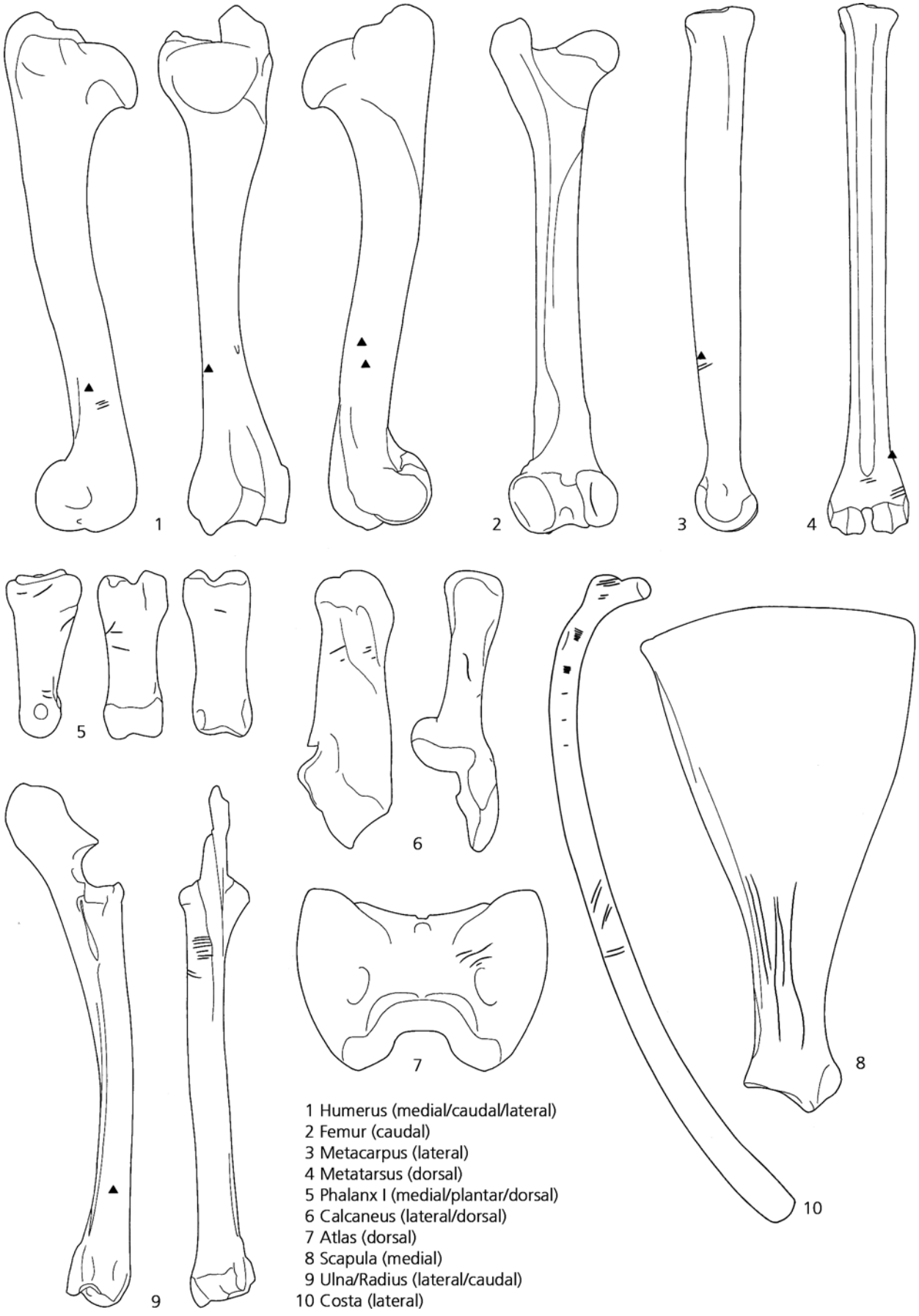

Fig. 7 Nahe LA11 at Lake Itzstedt (Kr. Segeberg/D). Overview of cutmarks (—) and impacts (▲) observed on the reindeer bones. – (Illustration M. Wild / G. Hagel-Bischof, Stiftung Schleswig-Holsteinische Landesmuseen Schloss Gottorf / J. Schüller, Zentrum für Baltische und Skandinavische Archäologie).

1989). Characteristically for these first-year antlers are the lack of any tines. The burr builds through several longitudinal gouges forming a depression around the beam. A comparable find was made at the Kartstein (Baales 1996, 60-61 fig. 42). M. Baales observed first signs of the shedding process around the zone of the burr that cannot be seen on the specimen from Nahe. Following H. Berke the age of this find lies between six and twelve months (Berke 1989, 115 figs 11. 16). However, as the shedding process has not started yet, it is likely that the yearling died within the sixth and eleventh month of age between November and April. Further information on the age of the different individuals was achieved through the measurement of the bones. Comparing the smallest diameter of a *tibia* (K82) with measurements taken by (Weinstock 2000a) shows that the measurement lies beneath the range of specimens from Stellmoor. A further look into the literature offers data for unfused bones from the same site into which upper range the Nahe measurement falls (Pasda 2009). Besides this, evidence of the existence of young reindeer within the assemblage is present. The small values for the greatest breadth of a left and a right *calcaneus* (K74, K106), and the breadth of the *trochlea* of a left and a right *humerus* (K52, K64) show the presence of at least two smaller animals that seem to be older than the yearling (see **tab. 3**). In eight cases of unshed antler, it was possible to determine the proximal and distal circumference of the burr. As no reliable data for comparison was available, the majority of antlers from the Stellmoor collection were measured (**fig. 6**). The result of the proximal circumference of the different antlers is plotted against the distal circumference following the argumentation of J. Weinstock (2000a; Pasda 2009). The values of the Stellmoor random sample lie between 35.1 and 162.9 mm for the proximal circumference of the burr, and 30.8 and 150.1 mm for the distal circumference of the burr. In contrast, the ranges for Nahe are 50.0-123.0 mm for the proximal circumference and 41.0-134.0 mm for the distal circumference. Furthermore, the highest Nahe values are 24 % smaller in the proximal circumference of the burr and 10 % smaller in the distal circumference. On the other hand, the proximal circumference of the antler of the yearling is 42 % higher than that of the smallest Stellmoor antler, while its distal circumference value exceeds it by 33 %.

Figure 6 shows a representative overview of values for a reindeer herd »near the end of October« (Pasda 2009, 103)[3]. At this time, the herds consist of adults of both sex and younger animals. After the rut, huge reindeer herds start to migrate into more favourable conditions of the calving grounds. At the beginning of the migration, adult males lose their antler, thus, they do not stay in competition with juveniles and females in the search for food. G. R. Parker (1972) reports that male reindeer separate themselves from the herd starting from their fourth winter, while they are definitely not staying anymore in their fifth. In terms of the yearly cycle, the process of segregation of bulls starts in November and is finished by January. Interestingly, the described period falls at the same time that is indicated by the antler of the yearling. Nevertheless, some of the postcranial measurements taken at Nahe (K59, K75, cf. with **tab. 3**) are situated within the upper limits of the ranges given for Hohler Stein and Stellmoor, indicating the presence of at least one adult male within the assemblage. Only two of the antlers found within the off-bank refuse zone at Nahe are comparable to the huge sizes of some Stellmoor antlers, thus, they belong to larger males while the rest belongs to cows and juveniles. One of them seems to derive from an artefact possibly produced somewhere else (see below). Furthermore, large reindeer antler beams seem to play a major role in Ahrensburgian bone industries, making it highly likely that such beams were imported from somewhere else (cf. Rust 1943; Sturdy 1975; Bratlund 1996). However, the seasonality of human presence on site can nevertheless range between different time horizons. The first scenario comprises the months between the end of the rut, around November while adult males lose their antler (Berke 1989, 115 figs 11. 16), and the final segregation from the main body of the herd in January. The other enfolds the timespan directly succeeding when the herd consists of cows and juveniles. It ends in April with the *terminus ante quem* given by the antler of the yearling. The large antler, however, might indicate another event in late summer or autumn when male bulls wear their

antlers (Berke 1989, 115 figs 11. 16) or it probably derives from a dead animal and was brought into the site. Nevertheless, in this case, the presence of postcranial bones of an adult male must be explained. During the segregation of bulls from the main corpus of the herd in winter, bulls live in scattered or smaller bands, batting around the landscape (Parker 1972). Perhaps Ahrensburgian hunters were able to find and hunt such animals in the vicinity of Lake Itzstedt.
Nevertheless, it should be stated, that due to the small window excavated in Nahe, changes in the observed patterns are possible. For instance, the low number of rear adult male limbs in the refuse area of the Stellmoor kettle hole (Grønnow 1987; Pasda 2009) indicates a selection of long bones with higher nutritional values (cf. Pasda 2009, 104 fig. 195 after Binford 1978, tab. 1.7; Outram/Rowley-Conwy 1998, 846) by the Ahrensburgian people. Besides this, the problems with the stratigraphy and varying absolute dates have to be taken into account, resulting in the possible palimpsest situation.

ANTLER TECHNOLOGY

All the worked faunal material consists of antler. A basal beam with the attached skull showing two artificial depressions on the anterior aspect (K51) is the only finished object (**fig. 8**). It shows a distal fracture plane caused by an undetermined action. The brow tine is not preserved and possibly removed intentionally. Overall, the artefact has a length of 15.9 cm and a width of 4.7 cm. The proximal circumference of the burr measures 10.7 cm, the distal circumference of the burr 11.1 cm (cf. **fig. 8**). The lower depression is 2.7 cm long, 1.1 cm wide and up to 6 mm deep. The second depression is broken and preserved on 3.5 cm length, 1.4 cm width and has a depth of at least 4 mm. Furthermore, it shows signs of another hole that was deepened into the spongeous tissue at the deepest point of the depression. The depressions have been made into the fresh or soaked antler with direct percussion. This action left little cutting planes and stepped ends can be observed where the tool stopped to penetrate the bony tissue. These marks are regularly orientated obliquely to the axis of the beam (**fig. 8**). It is not clear what caused the perforation of the spongeous tissue.
Comparable pieces are only published from Stellmoor. A. Rust (1943, 174-175 pls 52-54) reported 27 artefacts with similar depressions and holes. Of these, nine were broken within the modification indicating the use of high force. The size of the modifications ranges between a length of 2.5-5.0 cm, a width of 1.5-3.0 cm, and a depth of 1.0-2.0 cm. The additional holes inside the depressions deepened these a further 1.0-2.0 cm. Interestingly, the location of the modifications is always situated posterior at the middle part of a full beam and in all cases, only a single depression was observed. In contrast to Stellmoor, antlers of fully-grown reindeer bulls are scarce at Nahe. This scarcity might be the reason why multiple depressions can be observed on one beam. After the breakage of a depression, another depression was deepened into the beam. The Nahe object may thus be the last shape of this tool type before it was discarded. These artefacts are usually interpreted as parts of composite constructions. While A. Rust understood these beams as parts of pedestals (Rust 1943, 175), G. Tromnau postulated their use in hide boats (Tromnau 1981). If we assume that the beams with such depressions found at Stellmoor and Nahe are the same type of tool, the presence of K51 at Nahe with two depressions on the anterior aspect of the basal part contradicts both hypotheses as the tools would not be feasible for the suggested actions.
Two more objects possibly show anthropogenic modifications but lack the respective stigmata: a basal part of a bez tine shows a fracture plane at the conjunction to the beam (K79). The object becomes narrower on the two opposing flat sides of the tine. This indicates the intentional predetermination of the point of breakages. The other object is a 5.2 cm long, 1.7 cm wide, and 0.5 cm thick blank (K30). One lateral side does not

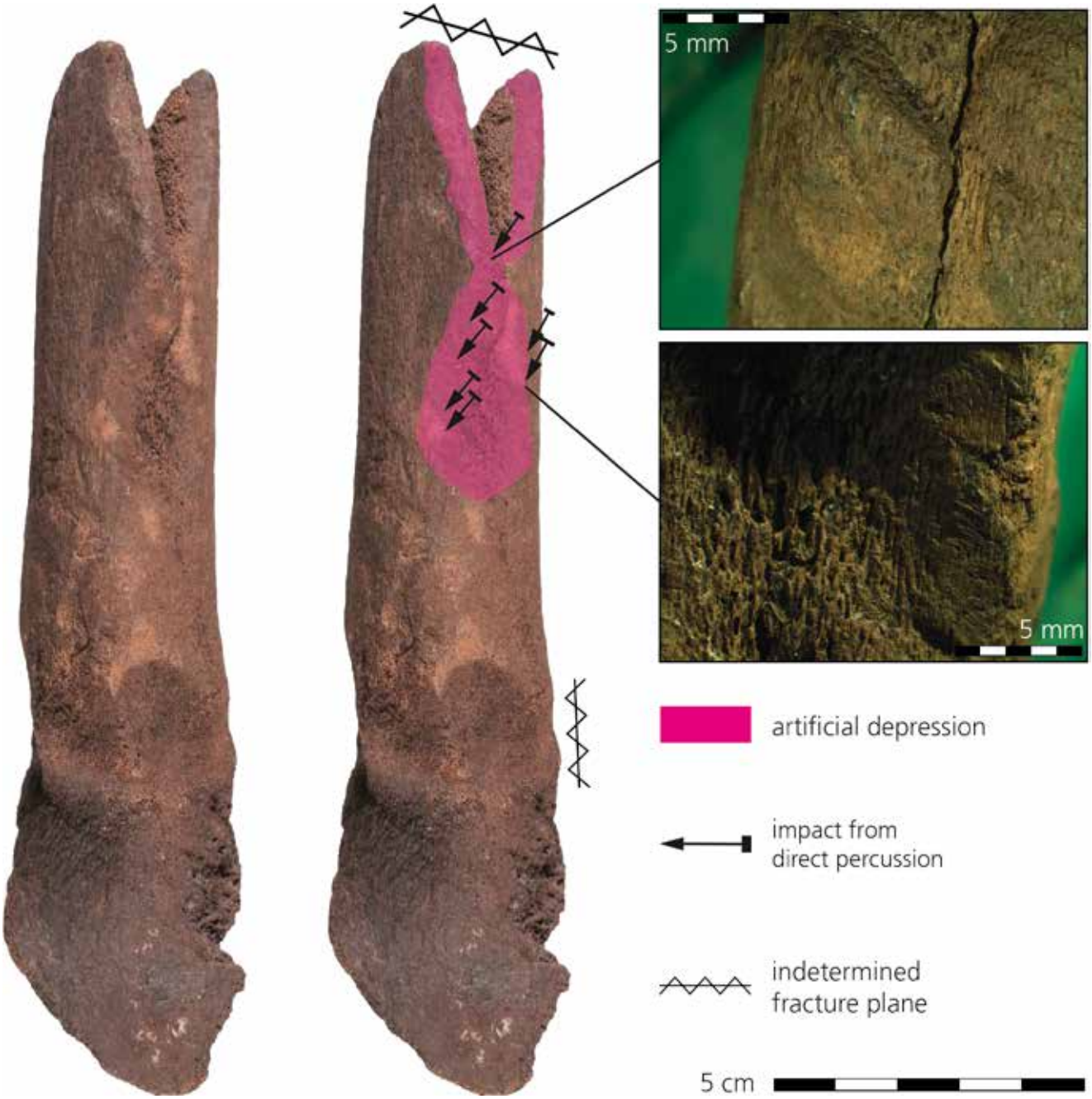

Fig. 8 Nahe LA11 at Lake Itzstedt (Kr. Segeberg/D). Proximal antler beam with attached cranium and two artificial depressions (anterior aspect). – (Illustration M. Wild / C. Janke, Stiftung Schleswig-Holsteinische Landesmuseen Schloss Gottorf).

show any signs of a groove or scraping but is perfectly even. Such a blank could rather derive from splitting the antler (cf. Liolios 1999) than from coarsely fracturing it (Rust 1943, 168-173).

IMPLICATIONS OF NAHE FOR POSSIBLE MIGRATION ROUTES OF REINDEER DURING THE YOUNGER DRYAS

The strategic position of Stellmoor and other important reindeer hunter sites in the Lowlands has led to the postulation of different models for migration routes of reindeer and settlement systems of humans by dif-

ferent authors (Tromnau 1974; Sturdy 1975; Bokelmann 1981; Baales 1996, 255; Petersen/Johansen 1996; Grøn 2005). Furthermore, recent stable isotopic studies have revealed the Lateglacial migration routes of reindeer (Price/Bokelmann/Pike-Tay 2008; Price et al. 2017), thus, helping to understand seasonal settlement patterns of humans in the Lowlands.

As most of these models are based on the fixed point Ahrensburgian tunnel valley whose seasonality has been exhaustively studied (see above and cf. Krause/Kollau 1943; Grønnow 1987; Bratlund 1996; Weinstock 2000b; Pasda 2009), further data from sites outside this area is needed to validate these predictions. The presented data about the herd structure and the seasonality of Nahe suggests an occupation between late autumn and early spring, thus, slightly following the occupation of the sites in the tunnel valley within the yearly cycle. T. D. Price and colleagues (2017, summary and conclusion) suggest an east to west migration from summer to winter. They question if the river Elbe acted as a natural barrier for reindeer populations. If we assume that the reindeer population hunted at Stellmoor and Nahe was the same, the evidence from Nahe, located 18 km to the north of the eponymous sites of the Ahrensburgian culture and further away from the River Elbe, speaks for a migration route of reindeer that changes its direction towards the north. Probably this change was caused due to the topography of the Ahrensburgian tunnel valley, the adjacent Alster valley, and large moorlands to the west (**fig. 1**). The situation of Nahe at a comparable strategic situation as Stellmoor in front of a ford at the end of a shallow-valley makes it most likely that the reindeer population did not scatter in the area around the Ahrensburgian tunnel valley but migrated further. This possible migration route through the flat valley of the Alster – or on the elevated ice stage located to the east – leaves few fords (cf. Grube 2012, 70 fig. 71) that could easily be passed by reindeer herds. One of these lies exactly at the small gap between Rönne and Lake Itzstedt to the east of the excavated area. Further investigation of the excavated material is required to proof this hypothesis. Unfortunately, reindeer teeth are lacking within the assemblage, making it impossible so far to compare their isotope signatures with those already taken from reindeer teeth from other Ahrensburgian sites.

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Notes

1) When melting water under glaciers cannot drain off normally because of upwards slopes, the high pressure forces the melting water to find its way through the sediment. These actions result in longitudinal structures, which are later often filled with water and build groove lakes.

2) Author's translation: Close by the watergate left of the meadow near the exit from Lake Itzstedt.

3) Although the amount of antler from adult males is higher than expected (Sturdy 1975; pers. observation). This indicates that large antlers had been collected in the vicinity of Stellmoor and brought to the site.

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Zusammenfassung / Summary / Résumé

18 km nordwärts – Archäozoologische und technologische Analyse eines Inventars der Ahrensburger Kultur von Nahe LA11 am Itzstedter See (Kr. Segeberg/D)

In der Hoffnung, ein »neues Stellmoor« zu finden, wurden 2003 und 2004 Bereiche von Nahe LA11 untersucht. Da die Stratigraphie kompliziert und die Anzahl an Funden eher gering war, warteten die Funde bisher auf ihre Analyse. Insgesamt wurden nun 112 Überreste von Rentieren archäozoologisch und technologisch untersucht. Die Ergebnisse lassen auf mindestens fünf geschlachtete Tiere schließen. Fleischtragende Knochen sprechen für eine Verarbeitung der Jagdbeute vor Ort sowie für die Erlegung derselben in der Nähe. Knapp 25 % der Knochen sind anthropogen modifiziert. Durch sie können verschiedene Aktivitäten von der Häutung bis zur Markgewinnung nachvollzogen werden. Die

Herdenstruktur deutet auf die Anwesenheit im Winter hin, wodurch sich das Potenzial von Nahe bei der Untersuchung von Rentiermigrationen in der Dryas III zeigt: Es ist denkbar, dass dieselben Herden wie in Stellmoor, jedoch leicht später bejagt wurden. Nichtsdestotrotz werden Ausgrabungen nötig sein, um die beobachteten Muster der Analyse zu überprüfen, die stratigraphischen Kenntnisse zu präzisieren und eine Knochenindustrie zu finden, die existierende Studien zu Stellmoor komplementieren könnte.

18 km Northwards – Zooarchaeological and Technological Analysis
of the Ahrensburgian Assemblage from Nahe LA11 at Lake Itzstedt (Kr. Segeberg/D)

The site of Nahe was partly excavated in two seasons in the years 2003 and 2004 in the hope of finding a second Stellmoor. To date, the site has not been published nor studied in any detail. Unfortunately, the stratigraphy of the site is complicated and the number of finds is rather small. A total of 112 reindeer remains was studied zooarchaeologically and technologically. The results indicate that there are at least five individuals in the assemblage. The presence of rich meat-parts indicates that the animals were at least processed locally, and, furthermore, hunted near the site. The processing of the bones led to the high rate of c. 25 % anthropogenically modified bones. Different activity patterns can be distinguished from the skinning of animals to the extraction of marrow. The small herd identified points to a herd structure that is typical for the winter season. Taking this into consideration the analysis illustrates the potential of Nahe in the study of Younger Dryas reindeer migration routes as it may be possible that the people in Nahe hunted on the same reindeer herd paths only slightly later in the yearly cycle than the people in Stellmoor. Nevertheless, excavations will be necessary to prove the observed patterns of the zooarchaeological analysis, to further specify the stratigraphical knowledge and to unearth a bone industry to complement existing studies from Stellmoor.

18 km plus au Nord – Etude archéozoologique et technologique
de l'ensemble Ahrensbourgien du site de Nahe LA11 au Lac Itzstedt (Kr. Segeberg/D)

Le site de Nahe a été partiellement fouillé au cours de deux campagnes en 2003 et 2004, dans le but de trouver un deuxième site comme Stellmoor. A ce jour, le site n'a ni été publié ni fait l'objet d'étude détaillée. Malheureusement, la stratigraphie du site est complexe et le nombre d'artefacts est assez limité. Un total de 112 restes de renne ont fait l'objet d'une étude archéozoologique et technologique. Les résultats indiquent un minimum de cinq individus dans cet ensemble. La présence de parties riches en viande indique que les carcasses ont été traitées à proximité du lieu d'abattage. Environ 25 % des os portent des stigmates anthropiques, où différentes activités peuvent être distinguées: du dépouillement à l'extraction de moëlle. Le petit troupeau identifié présente une structure typique de la saison hivernale. Ainsi, cette étude démontre le potentiel du site de Nahe dans l'étude des voies de migration des rennes lors du Dryas récent, car il est envisageable que les groupes humains de Nahe aient exploités les mêmes populations de rennes que les groupes de Stellmoor, légèrement plus tard dans le cycle annuel. Néanmoins, de nouvelles opérations de fouilles seront nécessaires: pour valider les hypothèses proposées par l'analyse archéozoologique, pour préciser davantage le contexte stratigraphique, et pour mettre au jour une industrie osseuse pouvant compléter les données existantes sur Stellmoor.

Schlagwörter / Keywords / Mots clés

Schleswig-Holstein / Spätpaläolithikum / Jüngere Dryas / Knochentechnologie / Stellmoor
Schleswig-Holstein / Final Palaeolithic / Younger Dryas / osseous technology / Stellmoor
Schleswig-Holstein / Paléolithique final / Dryas récent / technologie osseuse / Stellmoor

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