

WE TEND TO TENT – REFLECTIONS ON A GROUP OF FEATURES AT THE MAGDALENIAN SITE OF BAD KÖSEN-LENGEFELD, SAXONY-ANHALT

Abstract

At Bad Kösen-Lengefeld, a well-preserved Magdalenian camp site with a large variety of features, such as hearths, paved areas, and pits has been excavated during the last years. Judging from the spatial distribution of finds and features, we propose a tent structure enclosing a massive hearth construction as well as an adjacent open-air activity zone as a plausible interpretation, although the possible contemporaneity in the use of both areas needs further investigation. We discuss this finding against comparable structures at other Magdalenian sites as well as the ethnographic record.

Keywords

Tent structures, postholes, hearth, paving, ethnography

INTRODUCTION: INSIDE OR OUTSIDE?

There seems to be little dissent that dwelling features were regularly constructed by Upper Palaeolithic hunter-gatherers. How these objects can be detected in the archaeological record, how they were constructed, what shape they had, and what functions they served is, however, still a topic of considerable debate. Circular features of mammoth bones usually interpreted as remains of buildings have been described early on in Palaeolithic research for Eastern and eastern Central Europe (Gladkih et al., 1984). In Western and western Central Europe, in contrast, architectural objects seem to have been less massive and have taken the more ephemeral form of tents. Leaving no tangible remains themselves, these buildings have to be inferred from features created by their constructive elements and the observable imprint they impose on the spatial patterning of objects in their environment. The first detailed analysis of this kind was performed by A. Leroi-Gourhan at Pincevent, where he analyzed border effects in the distribution of different find categories to infer activity zones and the shape and location of a potential dwelling structure (Leroi-Gourhan and Brézillon, 1966, 1972; Leroi-Gourhan, 1984). Since these works, the criteria used to infer ephemeral buildings in the archaeological record have not changed significantly and usually include spatial information on hearths, postholes, paving, lithic and organic tools, production waste, faunal remains, colourants (e. g., such as hematite), and refittings. None of these criteria alone a necessary condition for a tent, and therefore the absence of any of them is no argument against the former presence of a tent at a site. There is also no single sufficient condition for inferring a former tent dwelling. Therefore, repeated observations of the same spatial boundary pattern in different categories of observations are usually considered the best argument for postulating the former presence of a tent at a site and inferring its location and shape. There is, however, debate about the argumentative capacities of each criterion and how its spatial patterning has to be structured to be considered convincing evidence for former dwelling features. Further complicating matters are



Fig. 1 View from south to the Magdalenian sites of Bad Kösen-Lengefeld and Saaleck.

palimpsest situations, where objects have been recycled and the organization of activity zones has changed several times (Leesch and Bullinger, 2012).

As a consequence, and despite substantial agreement on the general existence of tents, it is often difficult to decide whether specific features at specific sites are the remnants of tent structures and inside-activities or open-air structures and outside activities. In the following, we present features from the Magdalenian site of Bad Kösen-Lengefeld in Saxony-Anhalt and discuss the pros and cons of their interpretation as being the leftovers of a former tent.

MATERIAL AND METHODS

The site

The open-air site of Bad Kösen-Lengefeld (**Fig. 1**) is situated immediately north of the riverbank of the Saale river, approximately 6 km downstream from the city of Naumburg (Burgenlandkreis) in the eastern part of the Federal Republic of Germany. On a regional scale, the site is part of a cluster of Magdalenian sites within the Saale-Unstrut region, which includes the well-known localities of Saaleck (Bock et al., 2013), Oelknitz (Gaudzinski-Windheuser, 2013; Bock et al., 2015), Bad Frankenhausen (Feustel, 1989), and Nebra (Mania et al., 1999), among others (Kübner, 2009, 2010; Kübner and Jäger, 2015). Topographically, the site is located on an elevated terrace 35 m above the left bank of the Saale River, which – according to the preservation of the Magdalenian site of Saaleck in the extant oxbow of the Saale – did not change its course since

the end of the Late Pleistocene. While the area of the Magdalenian occupation itself is nearly horizontal, the immediate surrounding is characterized by a pronounced relief, with a steep slope towards the riverbed and another, higher terrace in the back of the site (Fig. 1). Together with a south-facing exposure, this provides both prevention from wind chill and long exposure time to sunlight. In addition, a pronounced narrowing of the river valley accompanied by steep slopes on the northern bank and almost vertical undercut banks on the opposite shore (which starts near the site and proceeds for about two kilometers in direction to Bad Kösen) provides numerous promising topographical positions for hunting of animals moving to the water source and/or along the river valley.

After its discovery in 1954 by V. Toepfer, W. Matthias, and F. Waih, the site was systematically surveyed, also by D. Mania, and investigated with a small test trench in 1966 (Adaileh, 2020). From 2008 onwards, the find area has been investigated by the Universities of Cologne and Erlangen-Nürnberg in close cooperation with the Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt (Uthmeier and Richter, 2012; Uthmeier et al., 2017). The multi-disciplinary field work involves systematic surveying, geophysical prospection, geo-archaeological drilling, excavation, the search for micro-tephra, micro-morphological analysis, and a dating program. The geological sequence comprises at least 9 m of loess, with two archaeological horizons in the upper 0.6 m of the sequence. While the lower archaeological layer seems to be embedded within *in situ* aeolian deposits, the upper (main) archaeological layer is located about 0,3 to 0,4 m above the lower layer and shows interlacing with a series of thin solifluction horizons.

Surveys and coring indicate a total settlement area in the upper archaeological layer of about 420 m² (Fig. 2). Excavations so far uncovered 91 m² of comparatively dense remains of settlement activities. Wet sieving, 3D-measurements and photogrammetry warrant precise documentation of the numerous finds and features. To date, 3,455 lithic artefacts from the surface collections and the lithic finds, faunal remains and features of the northern part of the site have been analyzed and are published (Adaileh, 2020) or await publication (Richter et al., in press).

The archaeological remnants of the upper layer largely appear to be conserved in primary position, with hundreds of manually transported limestone slabs, representing former settlement features. However, there is also evidence that small items may be under-represented in certain areas as a result of low-energy sheet flow events. A longer exposure of the palaeo-surface is indicated by the sometimes strongly weathered faunal remains or areas where only teeth were preserved.

The lower horizon has been documented during the 2017 field season and is restricted to the central part of the site. It has been recognized by the position of the artefacts, not by any technological or typological differences. However, the lithic raw material of the lower layer is of much better quality than that of the upper layer. We think that Saalian moraines, to be found some kilometers northeast of the site, were the source of this raw material, whereas the occupants of the upper layer seem to have relied on material obtained from the Elsterian tills accessible at the nearby plateau only some hundred meters distant. Up to now, the lower layer only yielded a few hundred artefacts, and three small pits can be related to this archaeological horizon.

Cornerstones of tent identification

In the following, we briefly present general aspects usually invoked in discussions about the identification of architectural objects and evaluate their argumentative capacities. Where applicable, these aspects are included in the analysis of the different features of the site. Eventually, we compare our findings with the ethnographic record as well as with other Magdalenian sites.

Hearths

Hearths are often considered important for understanding the spatial structure of a site (e. g., Leesch and Bullinger, 2012) and therefore feature prominently in some methods of intra-site spatial analysis (Stapert, 1989). However, it can be difficult to infer the location of hearths even if the preservation of other features is good (e. g., Vencl, 1995). Moreover, there is no general rule as to whether hearths are located outside, at the center, or rather at the threshold of tents (cf. Vermeersch et al., 1984; Wenzel, 2011).

Postholes

Postholes are usually considered a convincing case for remains of dwelling features. However, there are a number of imponderables connected to them. First, it needs to be demonstrated that small pits are related to architecture and thus can be considered postholes. Second, (at least) in the case of palimpsests, postholes can be too numerous or erratically distributed to form a pattern that can be meaningfully connected to a tent (Gaudzinski-Windheuser, 2013). Third, postholes can be the remnants of scaffoldings and other structures not related to tents.

Paving and weight stones

Areas covered with larger stone slabs or cobbles are often referred to as paving and are not unusual for Upper Palaeolithic sites. However, by themselves they are not sufficient to indicate the location or shape of former tents, since they could also have been constructed in non-sheltered places or covered only a part of the dwelling. Moreover, some of these structures seem to be the result of covered hearths (Bullinger et al., 2006). Larger slabs or cobbles could have served as weight stones on tent covers and thus are sometimes used to trace their potential outlines (Jöris and Terberger, 2001). Depending on the number and distribution of larger items at the site, reconstructions of outlines can vary considerably between authors (e. g., Vermeersch et al., 1984; Wenzel, 2011). There is also the danger of circular reasoning if reconstructions of outlines try to fit certain shapes, which are deemed most likely for tents (pentagons, hexagons, circles), to a find distribution that allows for multiple readings.

Find densities

Changes and discontinuities in the densities of finds can yield valuable information about the spatial organization of a site (Hietala, 1984; Kind, 1985). Different techniques of mapping are applied, such as excavation plans, mapping of quantities per area, or interpolated isolines of equal densities (Stapert, 1989; Gelhausen et al., 2004; Wenzel, 2009). An inspection of the spatial patterning identifies boundary situations occurring repeatedly at similar locations in different materials. These reoccurring boundaries are then argued to represent evidence of former dwelling features. There seems to be a consensus that a local increase in an otherwise decreasing density distribution (referred to as bimodal distribution or wall effect) is good evidence of a former spatial barrier, often interpreted as tent walls (Leroi-Gourhan, 1984; Stapert, 1989). It is,

however, debated whether a sharp drop in find density is an equally sufficient criterion to assume a barrier situation (Gelhausen et al., 2004). Often, high densities of tools are frequently considered a good indicator for the interior part of a dwelling, while the density of production waste and faunal remains should be low (Leroi-Gourhan and Brézillon, 1966; Wenzel, 2009). However, opinions differ on whether areas of high or, conversely, areas of low find densities should be considered the location of a former dwelling (Bolus, 1992; Gelhausen et al., 2004), or if both can occur simultaneously in the interior of a dwelling (Leroi-Gourhan and Brézillon, 1966; Vermeersch et al., 1987; Jöris and Terberger, 2001).

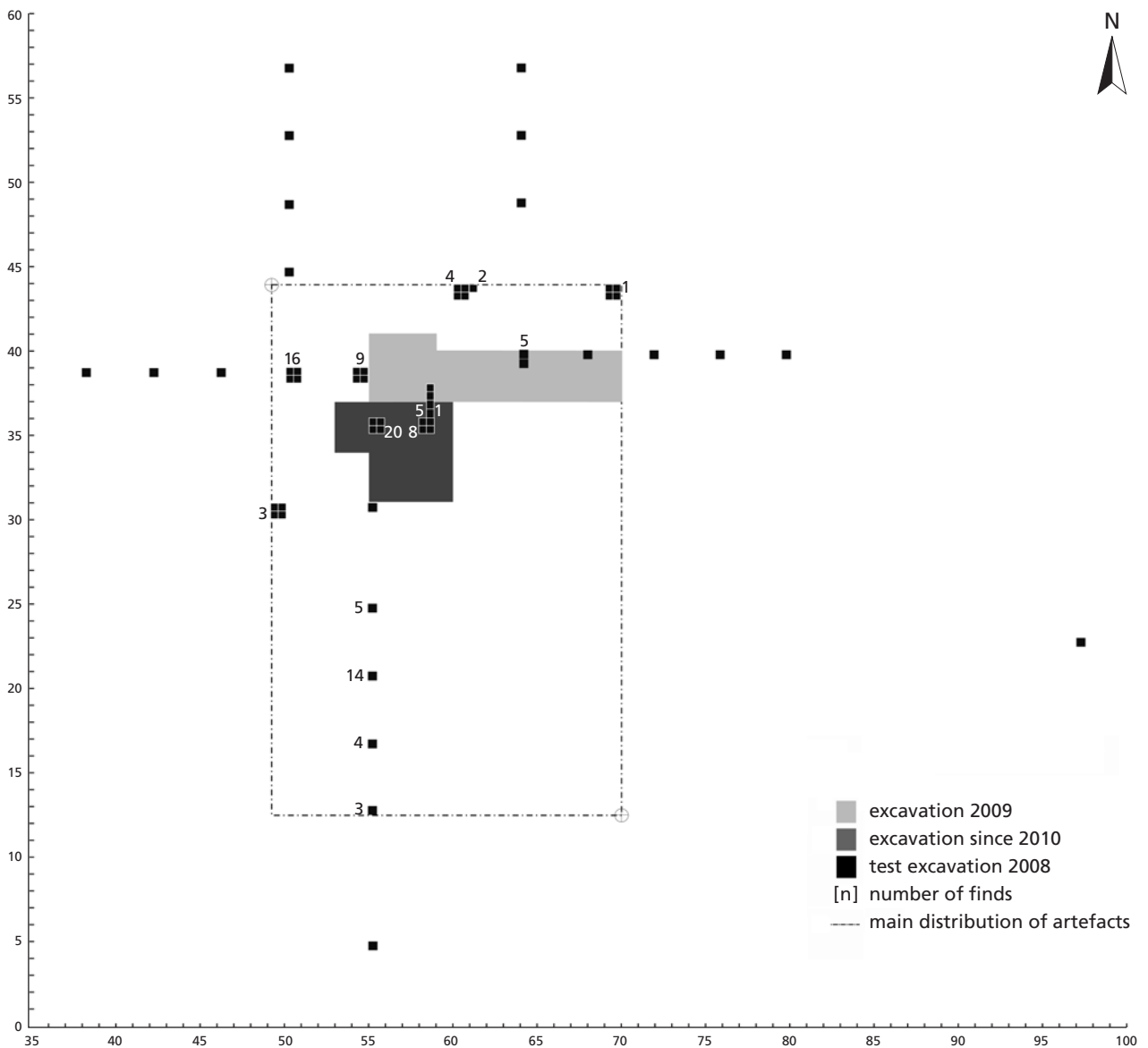


Fig. 2 Bad Kösen-Lengefeld. Overview of the excavated areas of field seasons in 2008, 2009, and since 2010.

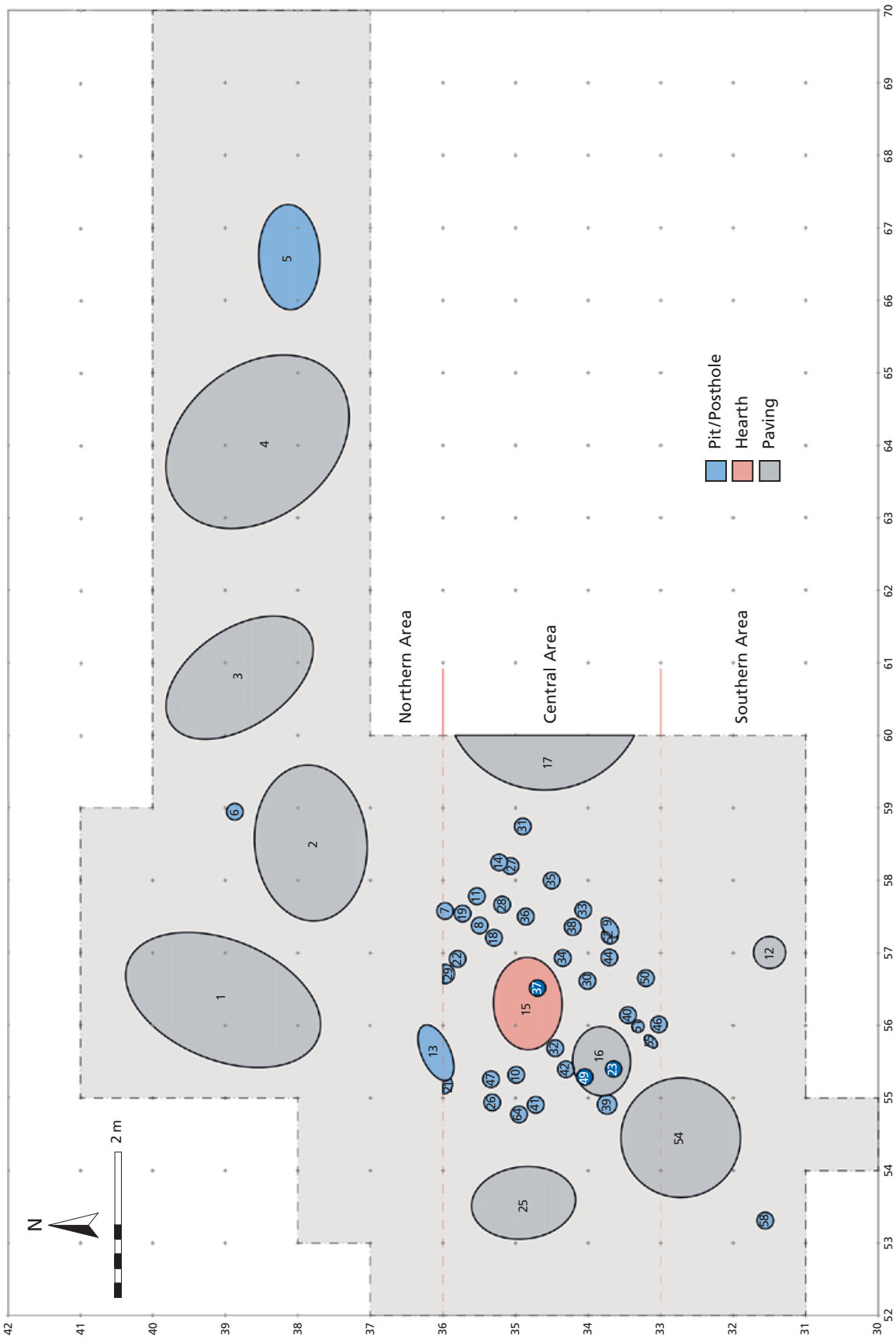


Fig. 3 The northern, central, and southern areas of Bad Kösen-Lengefeld with the main evident features. The light blue color indicates the 33 possible “postholes”, surrounding feature 15. Pits 23, 37, and 49 in dark blue are linked to the lower archaeological horizon.

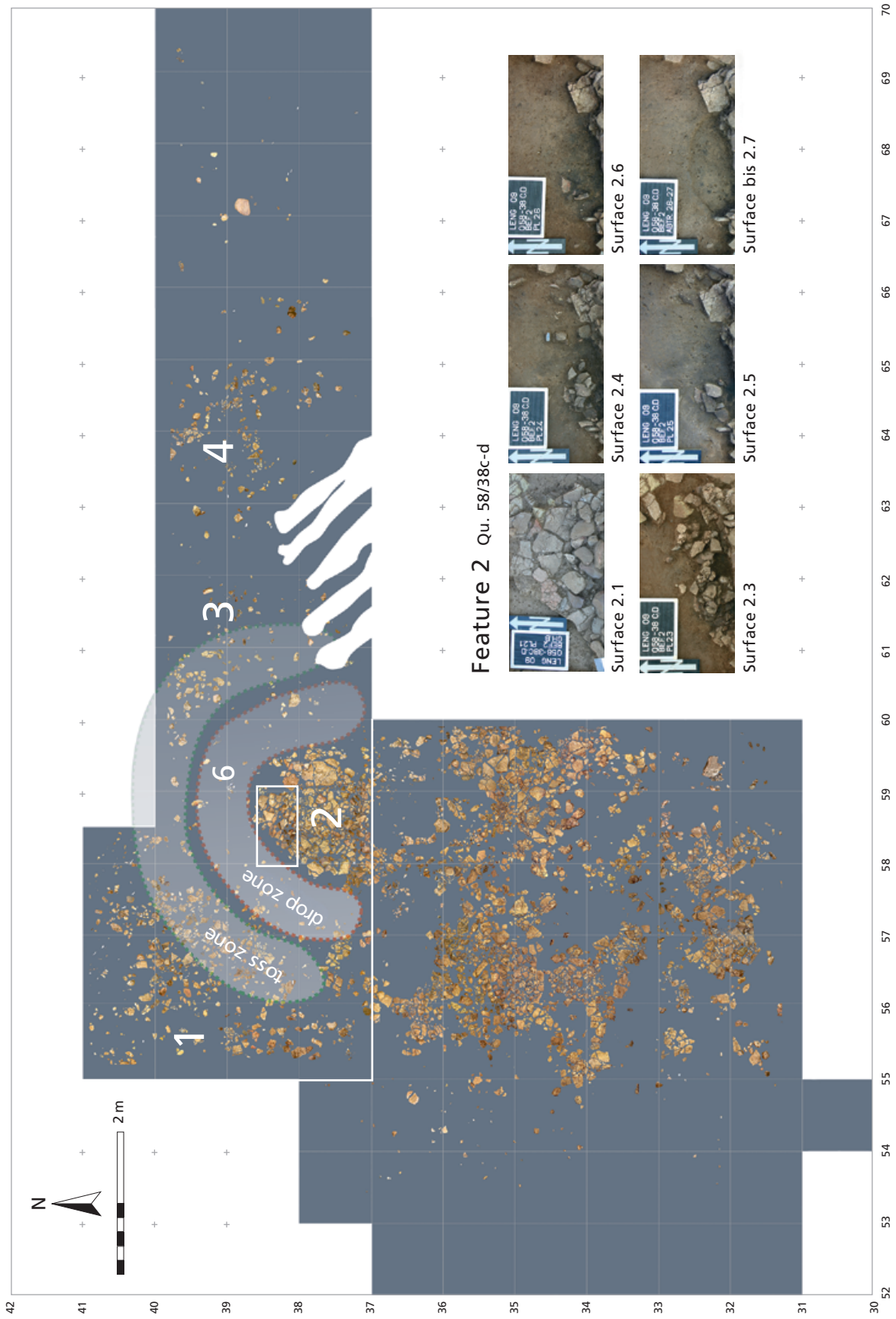


Fig. 4 Bad Kösen-Lengefeld, upper layer. Photogrammetric plan of limestone slabs with indication of the evident features of the northern area and their interpretation as remnants of open air activities (feature 1, feature 3, feature 4: concentration of limestone slabs; feature 2: combustion feature; figure 6: small pit filled with artifacts; brown: traces of ploughing; to note: feature 5 is a geological feature and therefore not depicted). The pictures in the inserted box illustrate different phases of excavation of feature 2.

Refittings

The spatial pattern of refitted objects is also used to infer former architectural objects. Connection lines not crossing certain boundaries are considered to support arguments for the existence of a former barrier (Leroi-Gourhan and Brézillon, 1966; Wenzel, 2011).

Ochre

The spatial distribution of pigments as indicators of domestic zones is also used to identify the interior parts of former dwellings (Leroi-Gourhan and Brézillon, 1966; Bosinski, 1979). It needs to be stressed that post-depositional movements of finds and periglacial phenomena such as patterned soil can arrange objects in curves and straight lines and can sort objects according to size-classes (Bertrand et al., 2010). Taphonomic processes therefore can create circular and polygonal structures and mimic boundary effects and have thus be taken into consideration for the spatial analysis of Palaeolithic sites.

RESULTS

The following discussion only concerns the upper find horizon. The excavation area can be divided into three areas, called the northern, central and southern area, which differ in both the characteristics of their evident features and the composition of the faunal remains (Fig. 3). For the question at hand, only the northern and central area will be discussed in detail.

The northern area: features related to open-air activities

The northern part of the excavation area measures 61.5 m² (Fig. 4). Among the faunal remains in this area, horse is by far the dominant species and is represented by remains from all skeletal parts, some of which in anatomical order, and indicate on-site killing and dismembering of the animals (Meindel, in press). The most prominent evident feature (labelled "feature 2") is a hexagonal structure made from more or less horizontally positioned stone slabs. It covers a surface of approximately 2 m² and has conspicuous straight and rectangular limits on three sides, two of which are oriented in a northeast-southwest direction and the other in a northwest-southeast direction. Further towards the south (i. e., towards the central area), the density of stone slabs decreases rapidly, but does not form a clear boundary line. Feature 2 consists of several layers of flat and often broken stone slabs with a maximum length of ~0.5 m and a thickness of a few centimeters. By excavating each layer separately, it became clear that the slabs lay on top of each other with almost no sediment but low numbers of lithic artefacts, burnt quartz pebbles, and faunal remains between them. Direct evidence for fire was found immediately below the basal layer of stone slabs, where sediments showed a sooty component and were sampled for the analysis of molecular proxies, and on top of the uppermost layer, where small portions of burnt sediment were located. In a first and only preliminary reconstruction of the use history of feature 2, several steps can be distinguished that indicate an area of intense domestic activity related to fire.

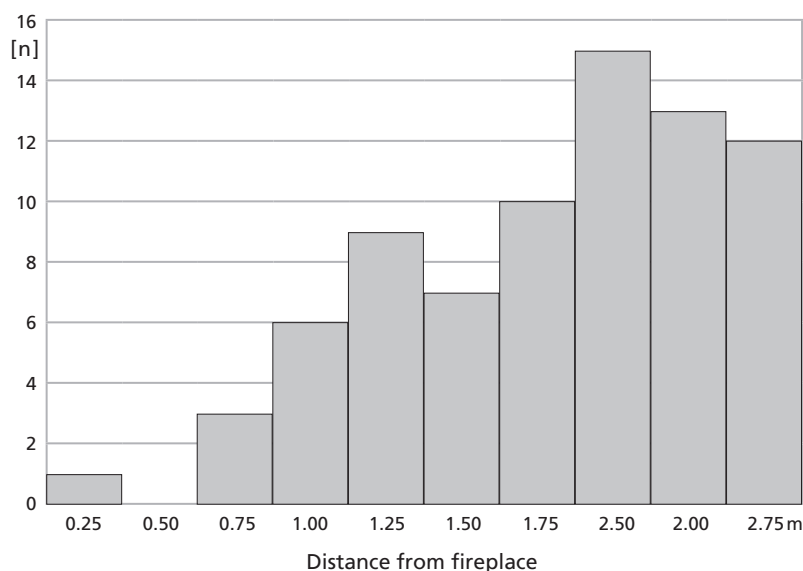


Fig. 5 Bad Kösen-Lengefeld, upper layer. Frequency (n) of lithic artefacts in concentric rings around feature 2, subdivided in steps of 0.25 m; the unimodal distribution is interpreted as indicating open air activities.

- 1.) The sooty sediment at the base may originate from an *in situ* fireplace covered with stone slabs as it has been described for Monruz (Bullinger et al., 2006). However, it is also possible that the accumulated soot has been washed down from a fire burning on top of a stone paving or even has been washed in from a nearby fireplace.
- 2.) The middle section of the feature – where faunal remains, artefacts, and heat-splintered quartz pebbles have been found between the stone slabs – may be the result of intensive and continued use of the feature as a (stone-covered) fireplace. However, it cannot be excluded that objects from previously used fireplaces were taken to construct feature 2, thereby mimicking intensive reuse of the feature.
- 3.) The last phase of use is represented by the uppermost layer of stone slabs, which seems to have been covered by a thin layer of burnt sediment, indicating that a fire had been burning on top of feature 2.

To the west of feature 2, an area of approximately 14 m² labelled “feature 1” was covered by a sparse scatter of limestone slabs (Fig. 4). Differences in the find densities of both slabs and artefacts allow a distinction to be made between a semi-circular zone almost void of finds west of feature 2 and a second, similarly oriented zone with more finds. The excavated area east of feature 2 is characterized by a generally low density of finds that decreases evenly towards the borders of the excavation. Evidence for ploughing may point to a modern destruction of possible features, but the lack of finds in the ploughing horizon in this part of the excavation and a test trench to the north without any finds more convincingly points to an actual border of the Magdalenian activities.

To answer the question of the use, context, and setting of feature 2, a ring-and-sector analysis (following Stapert, 1989, 1990; Albert, in press) was conducted. The unimodal distribution of find frequencies in the rings and sectors around feature 2 (Fig. 5) argues against the presence of a tent-like structure. An interpretation as an open-air working area around a fireplace with a close drop-zone and a more distant toss-zone (*sensu* Binford, 1978) currently seems more plausible. The activities were mainly dedicated to retooling and rehafting of backed implements, probably accompanied by hide working (due to the presence of numerous end scrapers).

This interpretation, if accepted, has also consequences for the interpretation of feature 1. Since the scatter of artefacts attributed to activities carried out around feature 2 are superimposed on (and do not spatially



Fig. 6 Bad Kösen-Lengefeld, upper layer – excavation of feature 19. Example of a small shallow pit without stone wedges. **1** Bird's view showing both the occupation surface in the eastern half, no colouration visible in planum view and the next excavation level in the western half with lithics, bones, and red colour; **2** South-North section, view to east, of feature 19 showing the findings mostly scattered in the southern part with steep southern limit and shallow northern limit of the pit; **3** The next excavation stage with next spit removed in the eastern half and deepening of the western half continued. The feature displays a round planum shape and an asymmetric section shape with asymmetric distribution of filling.

respect) feature 1, the latter seems to be a remnant of an earlier site use. Similar explanations apply for two additional stone scatters found east of feature 2 (Fig. 4: “feature 3” and “feature 4”). The results of the ring-and-sector analysis suggest that feature 3 was part of the drop and toss zones of lithic artefacts in the vicinity of feature 2. However, at the present state of investigation, it proved difficult to decide whether the discard of waste in the area of feature 3 was restricted to artefacts deposited on an already existing feature of stone slabs, or if the tossing also included stone materials from feature 2. The distance between feature 4 on the one hand and feature 2 and feature 3 on the other makes a contemporaneous functional relation less plausible. Therefore, at least feature 4 at the northernmost periphery of the site most probably originates in an earlier occupation phase, and the stone paving was exploited by later occupants in order to set up the much better preserved feature 2. Unaware of the results of future analysis of the precise chronological and functional relation between each of the features, the different states of preservation of the stone scatters or structures clearly show that we are dealing with at least two subsequent occupation events within the upper archaeological horizon.

Central area: features related to a tent-like architectural object

To the south of the features described above and in the central area of the known find scatter, 36 small pits have been recorded (Fig. 3). These features are restricted to a comparatively small area of the excavation, and comparable features have not been documented elsewhere at the site. The pits are usually between ~ 15-20 cm in diameter and ~ 10-30 cm deep (Figs. 6-8). They are distinguishable by their infill consisting of red pigments, artefacts, bone fragments, and smaller stone slabs. Some part of the infill, such as small limestone slabs at the bottom of the pits, had presumably been installed intentionally, while others probably fell in by chance from the settlement surface. However, in most cases, it has not been possible to determine the shape of the pits exactly, because the sediment infill is mostly indistinguishable in colour and grain size from the adjacent sediment, and the pigments tend to fade out and blend into the sediment rather than highlighting clear boundary lines. The fact that sediment infill and surrounding sediments are identical except for the anthropogenic remains indicates the absence of any soil formation processes during both the occupational event itself and later, until the site had been covered by loessic material. The upper part of some pits appears eroded and covered by an overlying solifluidal sediment layer with mixed particles of loess, coarse sand, fine gravel, and humic components. The processes that led to the deposition of the solifluidal sediments in these parts of the site thus also eroded the former loess cover, but its remnants have been trapped in the respective pits. Consequently, the depths of part of the pits must be considered minimum depths. Reconstructions of the shape of the pits are not yet available. Because the outlines of the pits were often only vaguely detectible at the top-planum level, and in order to record their possible oblique and asymmetrical shape (potentially invisible in arbitrarily located profiles), the spatial recording of the artefacts and reddish colourings of the infill will be used to create 3D-reconstructions of the pits for further inspection (Fig. 6: 3).

The pits enclose the up to now most complex stone feature found at the site of Bad Kösen-Lengefeld, labelled “feature 15” (Fig. 3). It consists of a large, oval limestone slab which covered a large, shallow pit filled by some globular quartz river pebbles. The overlying oval limestone slab displays patches of blackish colouring (ash particles?). About a dozen globular quartz river pebbles (originally complete, but some now partially fragmented *in situ*) were found scattered in the center on top of the large limestone slab. Craquelée and reddish colour indicate that these quartz pebbles had been exposed to heat. The whole construction – shallow pit – round pebbles – oval slab – round pebbles – was completely preserved until



Fig. 7 Bad Kösen-Lengefeld, upper layer – excavation of feature 36. Example of a small shallow pit with layered stone wedges. **1** Bird's view of top planum (western half): limestone slabs protruding from the occupation layer, eastern half stone fragments and debris used stuffed under top limestone slabs; **2** Western half: top limestone slabs cleaned and eastern half: stuffing debris removed down to pure loess.

the moment of excavation. The entire hearth construction was probably covered by a number of additional limestone slabs uncovered on top of the upper quartz pebble layer; however, in contrast to the large oval limestone slab below, the uppermost limestone slabs are badly preserved and incomplete. At present, we interpret this construction as the central fireplace of the last occupation phase of the site. Further investigation will tackle the history of the fireplace including its architecture, raw materials, and functional components.

The outline resulting from the small pits (Figs. 6-8) described above is indicated by a circle of limestone slabs. Between these pits and the central fireplace of feature 15, a circular corridor of 0.5 to 1 m width remained partially free of small pits. We interpret at least the majority of the small pits as postholes, in the sense of positioning traces of pole bases either intentionally dug or unintentionally imprinted into the occupation surface. The postholes form a polygonal structure that encloses the central fireplace (feature 15) in a roughly constant distance of 1 to 1.5 m and are absent in other parts of the site. To date, with analytic studies of the site just beginning, we cautiously assume that the cluster of postholes surrounding feature 15 is indicative of a former architectural construction at the site, most likely a tent-like dwelling. The dwelling would have had a polygonal to sub-circular outline with a maximum diameter of the substructure (indicated by the small pits) of about 3.5 m and a circular corridor of 0.5 to 1 m around a central fireplace. Up to 36 posts could have constituted the dwelling, or, alternatively, a dwelling of 18 posts was erected twice (three settlement phases: 12 postholes each; 4 settlement phases: 9 postholes each). If the dwelling would have been rebuilt several times, the diameter of its substructure would have been smaller than the maximum diameter estimated above and well below 3.5 m. However, the total area roofed by the dwelling might have been larger, depending on the way it was constructed (see discussion below).

In the future, these findings need to be contrasted with the results from refits (not yet available), as well as more in-depth analyses of the distribution of other find categories, for example the faunal material.

DISCUSSION

Leroi-Gourhan referred to his analysis at Pincevent as “ethnological presentation of habitation 1”, highlighting the fact that from its inception, ethnographic reflections were part of the analysis of dwelling structures at Palaeolithic sites (e. g., Hahn and Rousselot, 1975). The ethnographic record, however, is quite varied with regard to tent architecture (Faegre, 1980). Interestingly, their archaeological reflections seem to follow a temporal trend. Earlier reconstructions of Magdalenian dwellings are dominated by rounded shapes (Leroi-Gourhan and Brézillon, 1966, 1972; Bosinski, 1979; Vermeersch et al., 1984; Audouze, 1987; Pigeot, 1987; Olive, 1988). During the 1990s, polygonal reconstructions emerged (Gaussien, 1992, 1994) and were discussed alongside rounded shapes (Schmider, 1992; Terberger, 1997) also in the early 2000s (Jöris and Terberger, 2001; Stapert, 2003; Pigeot, 2004). In recent years, polygonal shapes seem to have become the dominant way of reconstruction outlines (e. g., Gelhausen et al., 2004; Sensburg, 2007), partly “reshaping” some of earlier interpretations (e. g., Wenzel, 2009), although rounded shapes are still described (Bodu et al., 2006). Other studies identified the location of a tent without reconstructing its precise shape (Holzkämper, 2006). Instead of being grounded in opposing methodical and conceptual paradigms, these two views rather seem to reflect different degrees of abstraction (or attention to detail) and are thus not really in conflict with each other. If tents were built using posts and skin-cover, then a truly round shape is impossible to achieve. So, as a matter of fact, all tents are necessarily polygonal in shape, but may vary with regard to the number of exterior surfaces and thus approximation to a circle.

Given the apparent imponderables with regard to structural details, these differences seem, by and large, to be of minor importance, since the noise may outweigh the signal. However, they can become relevant for questions about the construction (e. g., Faegre, 1980) or calculations of the area covered by the tent, which, in turn, has consequences for reflections on group sizes. The shape and size of tent structures can also provide hints about their function. Not all tents are necessarily dwellings and alternative options for use have recently also been discussed for the circular structures of mammoth bones in Eastern Europe (Pryor et al., 2020).

General characteristics of conical tents

To approach the question which type of ethnographically documented dwelling would match our excavation results, we need criteria to evaluate the structural elements, including the posthole attributes and positions. As a base for discussion, we list a selection of possible criteria based on the descriptions of Torvald Faegre (1980) of hunter-gatherer tents (**Tab. 1**). The tent types selected for comparisons are those that share basic features with the dwelling structure of Bad Kösen-Lengefeld and are listed in Table 2: poles as construction elements for the tent walls which follow a sub-circular to polygonal outline. These constructions either involve long inclined poles leaning against each other (conical longitudinal section) or a scaffold of shorter poles with additional poles for the roof resting on top (vertical walls and inclined roof). To be sure, it cannot be expected that Magdalenian dwellings are in complete accordance with ethnographic examples. Instead of looking for 1:1 matches, it thus seems more instructive to search for general characteristics of tent-like dwellings from environments poor in trees. **Table 1** summarizes a list of constructional features of conical tents taken from the ethnographic literature (Faegre, 1980) and complemented by data from case studies of Magdalenian key sites, such as Gönnersdorf (Sensburg, 2007; Street et al., 2012), Nebra (Mania et al., 1999), and Oelknitz (Gaudzinski-Windheuser, 2013), and evaluates possible archaeological evidence for the listed constructional features.

Dwelling features dug into the sediment or fixed with larger objects located on the occupation surface are comparatively well-documented in the Palaeolithic record and were, for example, documented in larger numbers at the Magdalenian site of Nebra (Mania et al., 1999). From a methodical point of view, inferences to interpret the excavated features as postholes are based on historical, ethnographical, and/or modern analogies. The ethnographic record includes much more elusive construction elements that do not leave traces in or on the ground. Among these is a removable supplementary wooden construction with a small number of poles, which are erected to enhance the installation of the actual skeleton frame of the tent, but removed before the dwelling is used. Such lightweight constructions are not supposed to take heavy loads, because the main weight of the outer cover of the tent is installed only after their removal. Hence, they will not leave much trace on the surface of the inner part of the dwelling or are easily wiped out by later activities. The same applies for ring beams made from ropes, which guarantee the cohesion of the poles despite the centrifugal load caused by the weight of the tarpaulins. Regarding the load management in conical tent constructions on poles, it is useful to have a more detailed look at possible measures taken to fix the poles. In the next section, we first look for evidence of features from **Table 1** in the archaeological record of Bad Kösen-Lengefeld. This will allow a better understanding of some of the basic constructional elements deduced from the outline shape and the mounting of the tent frame at its base. In a second step, we will compare these features with those from tents documented in the ethnographical record in order to reduce the number of possible matches.



Fig. 8 Bad Kösen-Lengefeld, upper layer – excavation of feature 38. Example of a steep, deep pit with massive lateral stone wedges and a supporting horizontal slab at the base. **1** Bird's view showing both the surface of the upper archaeological horizon in the SW half, with no colouration visible in planum view, and the following excavation level in the NE half, with lithics, bones, and red colouring; **2** oblique view with unchanged surface and extended section yielding a massive limestone slab at the base; **3** SE-NW section displaying the bag-shaped outline with debris filling to the SE and a massive, horizontal slab in the center of the bottom.

Construction elements inferred at Bad Kösen-Lengefeld







The analysis of evident and latent features of Bad Kösen-Lengefeld is just beginning. Therefore, only preliminary hypotheses can be developed here, which are mainly based on the documentation of the field work, e. g., drawings of surfaces and sections as well as 3D-models of features. In the future, these hypotheses need to be tested with more sophisticated spatial analysis. For example, the spatial proximity of some of the features interpreted as postholes points to a repositioning and/or replacement of individual poles during the use of the structure, or to two or more reinstallations of the entire construction. Given the density of the stone paving, it is also possible that not all poles were installed in postholes but fixed between larger slabs. This is also possible for the inner part of the structure, where no posthole features have been observed. If the very general table of features typical for ethnographically known conical tents (**Tab. 1**) is used to identify basic structural components at Bad Kösen-Lengefeld, then these would be the following:

- The basic construction was that of a frame built from poles.
- The contour line described by the corresponding postholes is sub-circular to polygonal. The diameter of the contour line of ~ 3.5 m corresponds to a covered ground area of ~ 10 m².
- The investment in the excavation of the postholes and examples of stone wedges to better fix the poles indicate that the poles themselves carried the vertical load. This is supported by the small distances between the poles. As a consequence of fixing the poles in the postholes, additional ropes to connect poles were probably not necessary.
- The fact that the central part is void of postholes, and the lack of additional postholes near those of the contour line, implies a simple frame without additional constructional elements to carry the roof.
- If the poles fixed in the postholes were the only vertical constructional elements, then the tent must have been of conical shape.
- The restricted number of construction elements point to a mobile dwelling construction.
- The ring of limestones surrounding the postholes is indicative of a mounting of cover of the tent on the ground from the outside. The covering therefore most probably consisted of tarpaulins made from animal skin.

Possible analogies in the ethnographical record

Against this background it is possible to discuss the degree of similarity between features of the dwelling of Bad Kösen-Lengefeld and ethnographically documented examples selected for a similar ground shape (**Tab. 2**). The problem of far-reaching conclusions from ethnographical comparisons, which have to rely on the analogy of a small number of features selected by preservation, has already been mentioned above. It follows that any ethnographical analogy proposed for Bad Kösen-Lengefeld is nothing more than a working hypothesis supposed to guide further analysis.

Conical tent types usually involve a central structure in order to reduce the roof load of the marginal poles. However, in the case of Bad Kösen-Lengefeld, there seems to be no convincing evidence for a massive central structure. Any central construction – if it existed – must have been made from a small number of poles only. This corresponds well to the rather large fireplace in the center (feature 15). Nevertheless, the use of a temporary sub-construction that helped to erect the outer skeleton, but was removed after completion of the tent, cannot be excluded. Furthermore, conical structures always rely on inclined poles. This is also true for a scaffold of tripods carrying a roof construction, and has consequences for the shape of the postholes and their contents. At Bad Kösen-Lengefeld, the shape of the postholes is still subject to ongoing research

| Part of the construction of mobile tent-like dwellings | Constructional purpose | Direction of load controlled by the constructional item | Constructional elements | Possible archaeological evidence |
|---|--|---|--|--|
| Removable supplementary construction | Installation of the main frame | No loads | Poles erected in the centre or near to the outer walls | Removed prior to use of the dwelling, no postholes (or intentionally refilled, therefore no sink for finds) |
| Central pole construction | Support for the roof in addition to the marginal pole structure |  | Small number of poles (potentially with larger diameter than those of the marginal structure) | Postholes in the central part; eccentric position of the fireplace |
| Connection near the floor between upright/inclined lateral elements of the marginal frame | Reduction of centrifugal forces at the base of the poles due to pressure from the roof/ the wall cover |  | Ropes connecting diametrically opposed poles; ring beam | Impossible unless preservation of organic materials (e.g., bog sites) |
| Securing poles in postholes | |  | Excavation of a posthole; if the pole is vertically inclined, the posthole has to be sufficiently larger than the radius of the pole to enable inclination | Evident feature most reliably identifiable when refill is different from surrounding sediment (e.g., mixed with ochre, charcoal or humus) and/or if indicated by finds in the refill |
| Securing poles without posthole by wedging with stones | |  | Spatially isolated larger (e.g., thicker) stones forming a triangle, circle or rectangle | Identification of isolated stones and/or slabs along the circumference of the assumed dwelling in the course of detailed spatial analysis |
| Unilateral support of the position of poles from outside of the structure | |  | Spatially isolated larger (e.g., thicker) stones at the circumference of the assumed dwelling | |
| Prevention from subsidence into soft ground | |  | Spatially isolated thin slab or spatially isolated group of several thin slabs | |

Tab. 1 A tentative list of basic constructional elements of conical tents (compiled with data from Faegre, 1980; Mania et al., 1999; Gaudzinski-Windheuser, 2013; Jöris and Terberger, 2001; Street et al., 2012).

and we cannot present a conclusive answer as to the inclination of former poles. If the preliminarily reconstructed diameter of approximately 3.5m and the presumed lack of a central construction is taken into consideration, then the best agreement would be a dwelling construction that shares numerous elements of the domes of the arctic Inuit. However, the construction of the Inuit dome largely depends on bending elastic wooden poles made from willow, which are interconnected in the center of the roof. To work against energy in an upward direction resulting from the bending of elastic organic material, it is necessary to put additional weight on the roof, which in case of the Inuit dome is snow. If the combination of the estimated

size and the presence of a central fireplace is considered, then the Northern European Kata would offer good parallels for most of the features of the dwelling at Bad Kösen-Lengefeld. This is even more so as the relatively small number of postholes in the marginal structure would be in good agreement with the hypothesis that the postholes in Bad Kösen-Lengefeld may result from two subsequent installations of the same tent (or at least the same tent type). To the contrary, the northern American Tipi as well as the Siberian Cone and Jaranga are different with regard to their marginal pole structures and/or their size. In sum, according to their dimensions and number of poles involved, at the present moment, the Inuit dome and the Kata would yield the first working models to be tested against the above indicated attributes.

Some thoughts about the availability of wood

Tents as discussed in this article rely on wooden construction elements. In a glacial environment, this immediately raises the question of the availability of wood and the potential presence of trees in the surrounding landscape (Uthmeier, 2017: 297). Pollen analyses indicate that during the Oldest Dryas (i. e., Greenland Stadial GS 2a, ~ 16.9-14.7 ka; Björck et al., 1998; Rasmussen et al., 2006), Central Europe was divided into three larger vegetation zones (Maier, 2015). Steppe elements prevailed in the north-western part, while tundra elements were dominant in the south-western part. In both regions, trees and larger shrubs seem to have been very sparse and even absent in some areas. East of the Hercynian Forest, however, the situation appears to have been different. In the pollen spectra from Ascherslebener See (former Gaterslebener See, Müller, 1953), values of arboreal pollen are significantly higher than in pollen archives located further west. This region thus apparently marks the westernmost extent of a vegetation zone that spans over the Bohemian Forest up to the valleys of the San and Vistula rivers as well as the lowlands of Masuria in the east and is characterized by comparatively high values of arboreal pollen (cf. Kaplan et al., 2016: Fig. 1). These high values cannot be convincingly explained by wind dispersal alone, given that the dominant wind direction has been from west to east (Meyer and Kottmeier, 1989). Rather, it seems that changing precipitation patterns hampered tree-growth in the western and fostered it in the eastern part of Central Europe (Florineth and Schlüchter, 2000). Macroscopic remains are rare. A piece of pine charcoal from the site of Wilczyce in Poland was ¹⁴C-dated to 15,220 ± 200 cal BP (12,770 ± 120 ¹⁴C BP; Poz-14892; Fiedorczuk and Schild, 2002), and another from the site of Putim in Bohemia dated to 15,560 ± 130 cal BP (13,010 ± 60 ¹⁴C BP; GrA-36010; Verpoorte and Šída, 2009), indicate the presence of pine during the occupation of Bad Kösen-Lengefeld within the catchment area of the Elbe River. Although direct evidence of the presence of trees in the surrounding of Bad Kösen-Lengefeld is lacking, the potential for scattered stands of pines and birches seems not unlikely.

Relation between the northern and the central area of Bad Kösen-Lengefeld

The relation between the features of the northern and central part of the excavation area is difficult to assess as long as detailed analyses concerning the spatial distribution of lithic artefacts and faunal remains, the death season of the prey species, and the refitting of artefacts are not completed. For now, the precise temporal relation between the features found in the upper layer, although spatially immediately adjacent, remains to be investigated. While the hypothesis that at least major parts of these features belong to the same occupation and in combination represent a system of site use with a tent and an outer activity area seems a plausible reading, the difference in prey species in each of the two parts call for caution.

| | Fireplace | Central pole structure | Marginal pole structure | Diameter | Position of pole base | Positioning devices |
|--|-----------|---|---|----------------------------------|--|---|
| Tipi (N.-America) * 153 | excentric | 3-4 posts, rope fixed to ground. Backwards skewness, windward | 15 tent poles of pinewood | ~4 m | inclined towards centre (i. e., centripetal) | floor stop to reduce centrifugal tension? |
| Inuit-Dome (Arctic) * 138 | excentric | no central poles. Always snow covered to stabilize dwelling | 30 bent willow poles connected to the centre | ~3 × 2.7 m | straight | floor stop to reduce centrifugal tension? |
| Kata (N.-Europe) * 123 | central | 3 straight poles or 10 benched poles | 20-30 poles, stone weights | ~3-3.8 m | inclined, centripetal | floor stop to reduce centrifugal tension? |
| Cone (Siberia) * 117 | central | 3 frame poles and 2 cross sticks | 30-50 poles | ~4-5 m? (estimated from drawing) | inclined, centripetal | not necessary |
| Jaranga (Siberia) * 108 | central | tripod stand of ~3-5 m long poles | 7-8 tripods supporting conical roof (i. e., 21-24 pole imprints), stone weights | ~5-10 m | inclined, multiple directions | not necessary |
| Attributes of the assumed dwelling at Bad Kösen-Lengefeld, upper layer | | | | | | |
| Bad Kösen-Lengefeld | central | no traces of central postholes | 36 postholes | ~3.5 m | no information | no information |

Tab. 2 A selection of possible criteria derived from the descriptions of Torvald Faegre (1980) of hunter-gatherer tent types (* no. refers to Faegre, 1980), compared with the situation at Bad Kösen-Lengefeld (green: good agreement, orange: poor agreement).

The faunal composition and potential recycling of stone slabs from the northern part support the assumption of at least two occupations. A potential re-use of the tent area in the southern part is also in line with this observation. However, it remains difficult to state which of the features documented in the northern area are contemporaneous to the dwelling of the central area and the fireplace inside it. At the moment, the only argument for the hypothesis that the northern and the central part constitute functionally different areas of the same occupation is the northward orientation of a gap in the otherwise more or less dense line of postholes in the southern part. If this would be identified as the entrance of the dwelling, e. g., by the direction and distances of refits, then Bad Kösen-Lengefeld would combine two different, yet much-debated models of Magdalenian site use in one and the same occupation:

- the construction of a complex, recurrently used fireplace covered by stone elements in the northern area as found, for example, in Monruz-Neuchâtel and Monruz-Champrevères (Bullinger et al., 2006), and
- a tent-like dwelling with a complex fireplace in the centre, as discussed for the concentrations of Gönnersdorf (Sensburg, 2007; Terberger, 1997; Street et al., 2012; Jöris and Terberger, 2001; Mania et al., 1999).

Admittedly, contemporaneity between the features of the northern and central part is the most parsimonious hypothesis at the moment. However, it is still possible that further analyses will show a temporal gap between (some of) the activities of the northern and central part. Unaware of these uncertainties, the claim of functional differences between open-air activities in the northern area and activities in a dwelling in the central area are based on the absence of evidence for dwelling features in the northern area, notwithstanding comparable preservation.

CONCLUSION

Over the course of the excavation of the northern area during the early campaigns between 2009 and 2012, attempts to interpret the site focused on concentrations of stone slabs. Given the almost total absence of other kinds of evident structures, such as pits and postholes, the excavation team worked on the assumption that settlement activities at Bad Kösen-Lengefeld took place mostly in the open and that dwellings were less important than frequently claimed by archaeologists. Consequently – and in line with observations at other Magdalenian sites with similar findings – it was assumed that dwellings might have been of ephemeral nature and of limited use (as a mere shelter for sleeping) with no visible traces to be preserved. Unconnected to artefact scatters and activity zones, it was expected that the shelters were placed in the empty spaces of the settlement areas.

First and foremost, potential activity zones were identified by the presence of features related to the use of fire, such as feature 2 (the geometric multi-layered paving) or feature 15 (the central hearth). Both the range of different components and the stacked stone slabs appeared as complex architectural constructs rather than just simple stone scatters, and – with all caution – can be interpreted as stoves rather than conventional “fireplaces” (Bullinger et al., 2006; Leesch and Bullinger, 2012; Moseler 2012). The differences already observed in this early stage of investigation between feature 2 and feature 15 need further analysis. Possible explanations range from differences in the duration of use (including intensive re-use, rebuilding and recycling in the case of feature 2) to differences in function.

While the interpretation of these features still stands, the hypothesis about the presence of elaborated dwellings changed when in 2014 the excavation team commenced to unearth a large number of small pits (now 33 belonging to the main occupation horizon) in what is now called the central part of the site. Provisionally interpreted as “postholes”, these features turned out to clearly surround feature 15. The diameter of the resulting contour of ~3.5m does not only fit the range found in ethnographically documented dwellings. At the same time, it leaves enough interspace between the fireplace of feature 15 in the center and the assumed walls along the contour line. Finally, a gap in the line of “postholes” would be in good agreement with the presence of an entrance.

We expect that future analysis of the “postholes” will enable the addition of further arguments for testing the above developed working hypothesis concerning the construction of the dwelling. The chosen excavation technique will facilitate complete 3D reconstructions of the outlines of the pits, based on the positions of the filling elements (artefacts, bones, rocks, etc.). According to the information yielded by ethnographic records and experiences derived from other Magdalenian excavations, we will apply the following criteria to future analysis of the “postholes”:

- Planigraphic *outline*: symmetric or asymmetric (indicating an oblique or straight position of the pole)?
- *Size of outline*: similar or different (to identify the presence of initial larger poles and supplementary smaller poles)?

- *Direction of elongated outlines*: are they directed to the center or not?
- *Distribution of stone wedges* and their position within a posthole: do wedges allow a possible inclination of the pole to be identified?
- *Depths*: do postholes of different depths exist, and is it possible to identify a pattern?
- *Infill*: is it possible to identify a regular pattern concerning the infill processes, or are they different (and thus allow a temporal differentiation)?
- *Stratigraphic relation*: do postholes exhibit information about relative chronological relations, e. g., one or more postholes cutting into older postholes?
- *Refits*: do refits exist between objects from the infill of postholes?

Future analysis must compare all features uncovered at the Magdalenian site of Bad Kösen-Lengefeld in order to establish an intra-site chronology. It already seems highly probable that the northern area of the site was used in the course of two occupations within the upper archaeological horizon, with the later using parts of the existing paving of the first. The same applies to the central area, where immediately neighboring “postholes” are best explained by a repeated installation of a tent-like dwelling at a more or less identical place of the site in order to make use of the fireplace structure of feature 15. At present, there are no convincing arguments against a contemporaneity of parts of the evident and latent features observed in the northern and the central area. Therefore, Bad Kösen-Lengefeld combines two models of Magdalenian settlement features often seen as contradicting each other, i. e., open-air activities related to complex structures made from flat stones and related to the use of fire on the one hand, and the classical perception of activities inside a robust dwelling with an internal fire place on the other.

Acknowledgements

The authors would like to thank the Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt, and especially Prof. Dr. Harald Meller and his team, for more than a decade of organisational, scientific, and financial support. Corresponding financial support came from the Universität zu Köln and additional support – for two field seasons – from the Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU). For many years, Joel Orrin (excavation engineer/Cologne) has now supervised our annual fieldwork and he also developed (with Florian Sauer/Cologne) the digital (3D-)documentation. Some of the general data presented here is based on a number of bachelor and master theses at the Universities of Cologne and Erlangen (S. Szyja, Th. Albert, A. Adaileh, H. Decker, A. Puskar, P.

Meindl), with special thanks to Th. Albert, whose results concerned the northern excavation areas, particularly reported in this paper. Fieldwork would not have been possible without local support (U. Zeidler and many other helping hands from Bad Kösen/Naumburg and Bad Sulza) and without the many students, most of them from the two mentioned universities. Finally, the authors would like to thank Sabine Gaudzinski-Windheuser and Olaf Jöris for inviting us to contribute to the *Festschrift* for Elaine Turner and Martin Street, as well as for their corrections and helpful comments on a first draft of this article. We hope that Elaine and Martin will luckily proceed in adding meat to the naked bones and scattered lithics uncovered from the deserted camp sites of remote times.

REFERENCES

- Adaileh, A., 2020. Die Oberflächenfunde der Magdalénien-Freilandstation Bad Kösen-Lengefeld aus dem Landesmuseum für Vorgeschichte in Halle. *Jahresschrift für Mitteldeutsche Vorgeschichte* 97, 15-78.
- Albert, Th., in press. Die Steinartefakte aus dem nördlichen, durch Pferdereste geprägten Bereich. In: Richter, J., Uthmeier, T., Maier, A. (Eds.), in press. *Der Magdalénien-Fundplatz Bad Kösen-Lengefeld an der Saale, Band 1. Die Funde aus dem nördlichen und südlichen Siedlungsbereich*. Veröffentlichungen des Landesamtes für Denkmalpflege und Archäologie Sachsen-Anhalt – Landesmuseum für Vorgeschichte, Halle/Saale.
- Audouze, F., 1987. Des modèles et des faits: les modèles de A. Leroi-Gourhan et de L. Binford confrontés aux résultats récents. *Bulletin de la Société préhistorique française* 84, 343-352.
- Bertrand, P., Klaric, L., Lenoble, A., Masson, B., Vallin, L., 2010. The impact of periglacial processes on Palaeolithic sites: The case of sorted patterned grounds. *Quaternary International* 214, 17-29.
- Binford, L.R., 1978. Dimensional Analysis of Behavior and Site Structure: Learning from an Eskimo Hunting Stand. *American Antiquity* 43, 330-361.
- Björck, S., Walker, M.J., Cwynar, L.C., Johnsen, S., Knudsen, K.L., Lowe, J.J., Wohlfahrt, B., 1998. An event stratigraphy for the last termination in the North Atlantic region based on the Greenland ice-core record: A proposal by the INTIMATE group. *Journal of Quaternary Science* 13, 283-292.
- Bock, C., Genschow, M., Hellmich, M., Köhler, S., Mewes, M., Otto, G., Pasda, C., Pollock, M., Romero, R.R., Rüdell, C., Weiß, J., Zeiß, D., 2013. Steinartefakte aus Saaleck und ihre Stellung im späten Jungpaläolithikum zwischen Weißer Elster, Saale und Unstrut. *Archäologisches Korrespondenzblatt* 43, 141-158.
- Bock, C., Friedow, S., Haburau, F., Neubeck, V., Pasda, C., Romero, R.R., Völker, D., Weiß, J., 2015. Der Magdalénien-Fundplatz Ölknitz (Saale-Holzland-Kreis) – Die Ausgrabung von 1932. *Archäologisches Korrespondenzblatt* 45, 141-159.
- Bodu, P., Julien, M., Valentin, B., Debout, G., 2006. Un dernier hiver à Pincevent. Les magdaléniens du niveau IV0 (Pincevent, La Grande-Paroisse, Seine-et-Marne). *Gallia Préhistoire* 48, 1-180.
- Bolus, M., 1992. *Die Siedlungsbefunde des späteiszeitlichen Fundplatzes Niederbieber (Stadt Neuwied): Ausgrabungen 1981-1988*. Monographien des Römisch-Germanischen Zentralmuseums 22. Verlag des Römisch-Germanischen Zentralmuseums, Mainz.
- Bosinski, G. (Ed.), 1979. *Die Ausgrabungen in Gönnersdorf 1968-1976 und die Siedlungsbefunde der Grabung 1968*. Der Magdalénien-Fundplatz Gönnersdorf 3. Franz Steiner Verlag, Wiesbaden.
- Bullinger, J., Leesch, D., Plumettaz, N., 2006. *Le site magdalénien de Monruz. 1: Premiers éléments pour l'analyse d'un habitat de plein air*. Archéologie Neuchâteloise 33. Service et Musée Cantonal d'Archéologie de Neuchâtel, Hauterive.
- Faegre, T., 1980. *Zelte. Die Architektur der Nomaden*. Papyrus, Hamburg.
- Feustel, R., 1989. Bad Frankenhausen, Kr. Atern (Bez. Halle). In: Hermann, J. (Ed.), *Archäologie in der Deutschen Demokratischen Republik. Denkmale und Funde. Fundorte und Funde*. Theiss Verlag, Stuttgart, p. 370.
- Fiedorczuk, J., Schild, R., 2002. Wilczyce – a new late Magdalenian site in Poland. In: Eriksen, V., Bratlund, B. (Eds.), *Recent studies in the Final Palaeolithic of the European plain*. Proceedings of a U.I.S.P.P. Symposium, Stockholm, 14-17 Oktober 1999. Aarhus University Press, Århus, pp. 91-100.
- Florineth, D., Schlüchter, C., 2000. Alpine evidence for atmospheric circulation patterns in Europe during the last glacial maximum. *Quaternary Research* 54, 295-308.
- Gaudzinski-Windheuser, S., 2013. *Raumnutzungsmuster des späten Jungpaläolithikums in Oelknitz (Thüringen)*. Monographien des Römisch-Germanischen Zentralmuseums 105. Verlag des Römisch-Germanischen Zentralmuseums, Mainz.
- Gausson, J., 1992. Les gisements élémentaires dans le Magdalénien de la vallée de l'Isle. In: Rigaud, J.-P., Lavielle, H., Vandermeersch, B. (Eds.), *Le peuplement magdalénien. Paléogéographie physique et milieu humain*. Colloque de Chancelade, 10-15 octobre 1988. Documents préhistoriques 2. Éditions du Comité des Travaux Historiques et Scientifiques, Paris, pp. 357-364.
- Gausson, J., 1994. Le Plateau Parrain: l'organisation. *L'Anthropologie* 98, 418-426.
- Gelhausen, F., Kegler, J.F., Wenzel, S., 2004. Hütten oder Himmel? Latente Behausungsstrukturen im Spätpaläolithikum Mitteleuropas. *Jahrbuch des Römisch-Germanischen Zentralmuseums* 51, 1-22.
- Gladkih, M.I., Kornietz, N.L., Soffer, O., 1984. Mammoth-Bone Dwellings on the Russian Plain. *Scientific American* 251, 164-175.
- Hahn, J., Rousselot, J.L., 1975. Eskimo-Sommerwohnplätze in Tuktoyaktuk, N.W.T., Kanada, aus archäologischer und ethnologischer Sicht. *Tribus* 24, 157-178.
- Hietala, H.J. (Ed.), 1984. *Intrasite spatial analysis in archaeology*. Cambridge University Press, Cambridge.
- Holzschläger, J., 2006. *Die Konzentration IV des Magdalénien von Andernach-Martinsberg, Grabung 1994-1996*. Dissertation, Universität zu Köln.
- Jöris, O., Terberger, T., 2001. Zur Rekonstruktion eines Zeltes mit trapezförmigem Grundriß am Magdalénien-Fundplatz Gönnersdorf/Mittelrhein – eine ‚Quadratur des Kreises‘? *Archäologisches Korrespondenzblatt* 31, 163-172.
- Kaplan, O.J., Pfeiffer, M., Kolen, J.C.A., Davis, B.A.S., 2016. Large Scale Anthropogenic Reduction of Forest Cover in Last Glacial Maximum Europe. *PLOS ONE* 11, e0166726 <https://doi.org/10.1371/journal.pone.0166726>.
- Kind, C.J., 1985. *Die Verteilung von Steinartefakten in Grabungsflächen. Ein Modell zur Organisation alt- und mittelsteinzeitlicher Siedlungsplätze*. Urgeschichtliche Materialhefte 7. Archaeologica Venatoria, Tübingen.
- Küßner, M., 2009. *Untersuchungen zum Magdalénien im Einzugsgebiet der Saale. Untersuchungen an ausgewählten Fundstellen*. Weimarer Monographien zur Ur- und Frühgeschichte 42. Beier & Beran, Langenweißbach.
- Küßner, M., 2010. The late Upper Palaeolithic in the catchment of the river Saale – facts and considerations. *Quartär* 57, 125-137.
- Küßner, M., Jäger, K.D., 2015. Die Besiedlungsgeschichte Thüringens im späten Jungpaläolithikum in ihrem natürlichen Umfeld. *Anthropologie* 53, 295-314.

- Leesch, D., Bullinger, J., 2012. Identifying dwellings in Upper Palaeolithic open-air sites – The Magdalenian site at Monruz and its contribution to analysing palimpsests. In: Niekus, M.J.L.T., Barton, R.N.E., Street, M., Terberger, T. (Eds.), *A mind set on flint. Studies in honour of Dick Stapert*. Groningen Archaeological Studies 16. Groningen Univ. Library, Groningen, pp. 165-181.
- Leroi-Gourhan, A., 1984. *Pincevent. Campement magdalénien de chasseurs de rennes*. Guides archeologiques de la France 3. Paris.
- Leroi-Gourhan, A., Brézillon, M., 1966. L'habitation magdalénienne No. 1 de Pincevent près Montereau (Seine-et-Marne). *Gallia Préhistoire* 9, 263-385.
- Leroi-Gourhan, A., Brézillon, M., 1972. *Fouilles de Pincevent. Essai d'analyse ethnographique d'un habitat magdalénien (la section 36)*. Supplément à Gallia Préhistoire VII. CNRS, Paris.
- Maier, A., 2015. *The Central European Magdalenian. Regional diversity and Internal Variability*. Springer, Dordrecht.
- Mania, D., Toepfer, V., Vlek, E., 1999. *Nebra – eine jungpaläolithische Freilandstation im Saale-Unstrut-Gebiet*. Veröffentlichungen des Landesamtes für Denkmalpflege und Archäologie Sachsen-Anhalt – Landesmuseum für Vorgeschichte 54. Landesamt für Archäologie, Halle/Saale.
- Meindl, P., in press. Die Pferde aus dem Magdalénien von Lengefeld. Ein erster Einblick anhand der Funde aus dem nördlichen Siedlungsbereich und dem Befund 12. In: Richter, J., Uthmeier, T., Maier, A. (Eds.), in press. *Der Magdalénien-Fundplatz Bad Kösen-Lengefeld an der Saale, Band 1. Die Funde aus dem nördlichen und südlichen Siedlungsbereich*. Veröffentlichungen des Landesamtes für Denkmalpflege und Archäologie Sachsen-Anhalt – Landesmuseum für Vorgeschichte, Halle/Saale.
- Meyer, H.-H., Kottmeier, C., 1989. Die atmosphärische Zirkulation in Europa im Hochglazial der Weichsel-Eiszeit – abgeleitet von Paläowind-Indikatoren und Modellsimulationen. *Eiszeitalter und Gegenwart* 39, 10-18.
- Moseler, F., 2020. *Brandstrukturen im späten Magdalénien. Betrieb, Nutzung und Funktion*. Monographien des Römisch-Germanischen Zentralmuseums 151. Verlag des Römisch-Germanischen Zentralmuseums, Mainz.
- Müller, H., 1953. Zur spät- und nacheiszeitlichen Vegetationsgeschichte des mitteldeutschen Trockengebietes. *Nova Acta Leopoldina N.F.* 16, 1-67.
- Olive, M., 1988. *Une habitation magdalénienne d'Étoilles. L'unité P15*. Mémoire de la Société Préhistorique Française 20. Paris.
- Pigeot, N., 1987. *Magdaléniens d'Étoilles, Economie de débitage et organisation sociale (l'unité d'habitation U5)*. Supplément à Gallia Préhistoire XV. CNRS, Paris.
- Pigeot, N. (Ed.), 2004. *Les derniers Magdaléniens d'Étoilles: perspectives culturelles et paléohistoriques (l'unité d'habitation Q31)*. Supplément à Gallia-Préhistoire XXXVII. CNRS, Paris.
- Pryor, A., Beresford-Jones, D., Dudin, A., Ikonnikova, E., Hoffecker, J., Gamble, C., 2020. The chronology and function of a new circular mammoth-bone structure at Kostenki 11. *Antiquity* 2020, 323-341.
- Rasmussen, S.O., Andersen, K.K., Svensson, A.M., Steffensen, J.P., Vinther, B.M., Clausen, H.B., Siggaard-Andersen, M.-L., Johnsen, S.J., Larsen, L.B., Dahl-Jensen, D., Bigler, M., Röthlisberger, R., Fischer, H., Goto-Azuma, K., Hansson, M.E., Ruth, U., 2006. A new Greenland ice core chronology for the last glacial termination. *Journal of Geophysical Research* 111, 1-15.
- Richter, J., Uthmeier, T., Maier, A. (Eds.), in press. *Der Magdalénien-Fundplatz Bad Kösen-Lengefeld an der Saale, Band 1. Die Funde aus dem nördlichen und südlichen Siedlungsbereich*. Veröffentlichungen des Landesamtes für Denkmalpflege und Archäologie Sachsen-Anhalt – Landesmuseum für Vorgeschichte, Halle/Saale.
- Schmider, B. (Ed.), 1992. *Marsangy. Un campement des derniers chasseurs magdaléniens sur les bords de l'Yonne*. ERAUL 55. Université de Liège, Liège.
- Sensburg, M., 2007. *Die räumliche Organisation der Konzentration Ila von Gönnersdorf. Struktur und Dynamik eines magdalénienzeitlichen Siedlungsbefundes am Mittelrhein*. Monographien des Römisch-Germanischen Zentralmuseums 69. Verlag des Römisch-Germanischen Zentralmuseums, Mainz.
- Stapert, D., 1989. The ring and sector method: Intrasite spatial analysis of Stone Age sites, with special reference to Pincevent. *Palaeohistoria* 31, 1-57.
- Stapert, D., 1990. Middle Palaeolithic dwellings. Facts or fiction? Some applications of the ring and sector method. *Palaeohistoria* 32, 1-20.
- Stapert, D., 2003. Towards dynamic models of Stone Age settlements. In: Vasil'ev, S.A., Soffer, O., Kozłowski, J. (Eds.), *Perceived landscapes and built environments. The cultural geography of Late Paleolithic Eurasia*. Actes du XIV^e congrès de L'UISPP, Université de Liège, Belgique, 2-8 septembre 2001, colloques 6.2 & 6.5. BAR International Series 1122. Archaeopress, Oxford, pp. 5-15.
- Street, M., Jöris, O., Turner, E., 2012. Magdalenian settlement in the German Rhineland. An update. *Quaternary International* 272-273, 231-250.
- Terberger, T., 1997. *Die Siedlungsbefunde des Magdalénien-Fundplatzes Gönnersdorf. Konzentrationen III und IV*. Der Magdalénien-Fundplatz Gönnersdorf 6. Franz Steiner Verlag, Stuttgart.
- Uthmeier, T., 2017. Bestens angepasst. Jungpaläolithische Jäger und Sammler in Europa. In: Meller, H., Puttkammer, T. (Eds.), *Klimagewalten. Treibende Kraft der Evolution*. Begleitband zur Sonderausstellung im Landesmuseum für Vorgeschichte Halle/Saale. Landesamt f. Denkmalpflege u. Archäologie Sachsen-Anhalt, Halle/Saale, pp. 282-313.
- Uthmeier, T., Richter, J., 2012. Die Ausgrabungen der Universität zu Köln an der Magdalénien-Freilandfundstelle Bad Kösen-Lengefeld: Ein Vorbericht. In: Meller, H. (Ed.), *Zusammengegraben – Kooperationsprojekte in Sachsen-Anhalt*. Tagung vom 17. bis 20. Mai 2009 im Landesmuseum für Vorgeschichte Halle/Saale. Archäologie in Sachsen-Anhalt, Sonderband 16. Halle/Saale, pp. 27-39.
- Uthmeier, T., Richter, J., Maier, A., Orrin, J., Albert, T., Meindl, P., Puskar, A., 2017. Bad Kösen-Lengefeld, Burgenlandkreis – Pferde jagd im Saaletal vor 15 000 Jahren. In: Meller, H., Puttkammer, T. (Eds.), *Klimagewalten. Treibende Kraft der Evolution*. Begleitband zur Sonderausstellung im Landesmuseum für Vorgeschichte Halle/Saale. Landesamt f. Denkmalpflege u. Archäologie Sachsen-Anhalt, Halle/Saale, pp. 314-317.
- Vencl, S., 1995. *Hostim – Magdalenian in Bohemia*. Památky archeologické: Supplementum 4. Prague.
- Vermeersch, P.M., Lauwers, R., van de Heyning, H., Vynckier, P., 1994. A Magdalenian open air site at Orp, Belgium. In: Berke, H.,

- Hahn, J., Kind, C.J. (Eds.), *Structures du Paléolithique supérieur en Europe*. Colloque de Reisenburg/Günzburg, 8-14 mai 1983. Archaeologica Venatoria, Tübingen, pp. 195-208.
- Verpoorte, A., Šída, P., 2009. The Magdalenian colonisation of Bohemia (Czech Republic). *Archäologisches Korrespondenzblatt* 39, 325-332.
- Wenzel, S., 2009. *Behausungen im späten Jungpaläolithikum und im Mesolithikum in Nord-, Mittel- und Westeuropa*. Monographien des Römisch-Germanischen Zentralmuseums 81. Verlag des Römisch-Germanischen Zentralmuseums, Mainz.
- Wenzel, S., 2011. The Magdalenian dwelling of Orp East (Belgium) and its spatial organization. In: Gaudzinski-Windheuser, S., Jöris, O., Sensburg, M., Street, M., Turner, E. (Eds.), *Site-internal spatial organization of hunter-gatherer societies: Case studies from the European Palaeolithic and Mesolithic*. Papers submitted at the session (C 58) "Come in ... and find out: Opening a new door into the analysis of hunter-gatherer social organisation and behaviour", held at the 15th U.I.S.P.P. conference in Lisbon, September 2006. RGZM – Tagungen 12. Verlag des Römisch-Germanischen Zentralmuseums, Mainz, pp. 141-157.

Thorsten Uthmeier

Friedrich-Alexander-Universität Erlangen-Nürnberg
Institut für Ur- und Frühgeschichte
Kochstr. 4/18
D - 91054 Erlangen
Corresponding author: thorsten.uthmeier@fau.de

Jürgen Richter and Andreas Maier

Universität zu Köln
Institut für Ur- und Frühgeschichte
Weyertal 125
D - 50931 Köln