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LIFE AT THE PALAEOPOND: A DIACHRONIC RECONSTRUCTION OF THE LOWER PALAEOLITHIC INTERGLACIAL SITE OF MIESENHEIM I (CENTRAL RHINELAND, GERMANY)

Abstract

The Lower Palaeolithic site of Miesenheim I, located at the edge of the Neuwied Basin in the Central Rhineland of Germany, was investigated in a series of campaigns at the end of the 1980s and beginning of the 1990s. The site produced an interglacial fauna in association with an assemblage of lithic artefacts. Several lines of evidence suggest find-deposition took place in the backwaters of a former Rhine Valley, close to a floodplain pond. In this paper, data are drawn together to reconstruct the diachronic development of the site during an interglacial around 500,000 years ago and how hominins reacted to changing local biotopes and exploited these situations. In total, the finds and other evidence hint at a transient use of the site by hominins. This is in strong contrast to the evidence from interglacial sites such as Schöningen and Neumark-Nord, where hominins left behind abundant traces of their presence. Despite this, sites such as Miesenheim I are important, since they provide not only information on hominin movement and land-use, but also present another, ephemeral, facet of human behavioural adaptations in interglacials.

Keywords

Lower Palaeolithic, diachronic reconstruction, interglacial, transient occupation, biotopes, hominins

Introduction

The Lower Palaeolithic locality of Miesenheim I was discovered in 1982 by Karl-Heinz Urmersbach, after extensive commercial quarrying of pumice had truncated parts of the site on a stretch of land above the village of Miesenheim. Test-trenches put down between 1982 and 1984 brought to light animal bones from a series of layers sealed by volcanic ashes (Boscheinen et al. 1984). Extensive excavations carried out in the second half of the 1980s and beginning of the 1990s revealed abundant and extremely well-preserved faunal remains in association with lithic artefacts. Several lines of evidence suggest the finds had been deposited close to an open body of water, possibly a flood-plain pond. Just over 1100 faunal remains could be identified, comprising several species of small and large mammals, birds, amphibians and fish. A rich molluscan fauna was also recovered. The faunal assemblages include species typical of warm phases, and as a whole is representative of the type of community which would have been living in and around the Rhine Valley during an interglacial phase, some 500,000 years ago. Al-

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though lithic artefacts were recovered and refitting showed that lithic production had taken place at the site, the assemblage is relatively small (n = 114). Strong evidence of human interaction with the faunal remains is lacking. A conchoidal flake scar, similar to notches produced by humans when opening bone shafts to obtain marrow was observed on a fragment of a long bone of horse or a large bovine. Fine, linear incisions on three bones, superficially resembling cut marks, are probably of natural origin. Linear incisions on a fourth bone, a fragment from a mandible of red deer, may derive from cutting by a stone tool.

In an article published in 1999 and a monograph which appeared in 2000, I attempted to define the locality in terms of type of site (Turner 1999; 2000). My efforts to fit the evidence from Miesenheim I into categories formerly applied to Lower Palaeolithic localities, such as home base or central foraging site or short stay site, were inconclusive. I willingly attributed this result to what I claimed was a fundamental problem at the site, namely superimposed sequences of deposition and faunal remains subjected to varying degrees of modification by different agents, of which hominins were only one. Finally, I concluded that the low number of artefacts, lack of structures, absence of hearths and a paucity of human modification on the bones was more characteristic of a site visited only briefly by hominins.

With hindsight, the "short visit" tag seemed to be an almost apologetic response to a need to write something explicit about the site. In effect, this term was perceived as a best fit solution and overshadowed the fact that the rather fragmentary evidence from Miesenheim I was in itself potentially important information on facets of human behaviour in interglacials. In earlier analyses, a diachronic development of the site was discussed mainly in terms of stratigraphy and sedimentology, based on geological investigations undertaken during excavation. Applying a holistic approach, this paper focuses once again on a diachronic reconstruction of the site, but integrates aspects of find-deposition more securely into this framework. Only by placing the development of the site into the foreground, can a picture emerge of how hominins reacted to changing local interglacial biotopes and exploited these situations, or were affected by these conditions.

The context of the Miesenheim I site

Location, discovery and excavation

Miesenheim I is located on the south-western edge of the Neuwied Basin, a major geomorphological feature of the Central Rhineland of Germany. Today, the site lies on the slopes of the valley of the Nette River, at about 120-130 m above sea level, some 3 km from the Rhine River and approximately 1.5 km from the village of Miesenheim (**fig. 1**). However, several lines of evidence suggest that find deposition took place close to an open body of water – a lake or floodplain pond – in a former valley of the Rhine that extended far into the area occupied nowadays by the lower reaches of the Nette.

In 1982, commercial extraction of pumice near Miesenheim cut into underlying deposits, bringing well-preserved faunal remains to the surface where they were discovered by a local hobby archaeologist and collector, Karl-Heinz Urmersbach (Boscheinen et al. 1984). After reporting the discovery to the Monrepos Archaeological Research Centre and Museum for Human Behavioural Evolution, RGZM, in Neuwied (formerly Forschungsbereich Altsteinzeit, University of Cologne), a series of test-pits were opened at the site on behalf of the Landesarchäologie / Außenstelle Koblenz (formerly Denkmalpflege Rheinland-Pfalz), revealing remains of several large mammals associated with pieces of chipped stone, interpreted as debitage from the production of stone tools. A first publication appeared in 1984, describing the preliminary results (Boscheinen et al. 1984). Larger areas were investigated in 1984-1986 (Turner 1985) and in 1990-1991. By the end of the final season, five non-contiguous areas of varying size and depth, totalling 436 m^2, had been investigated (**fig. 1c**) (Turner 1999; 2000).

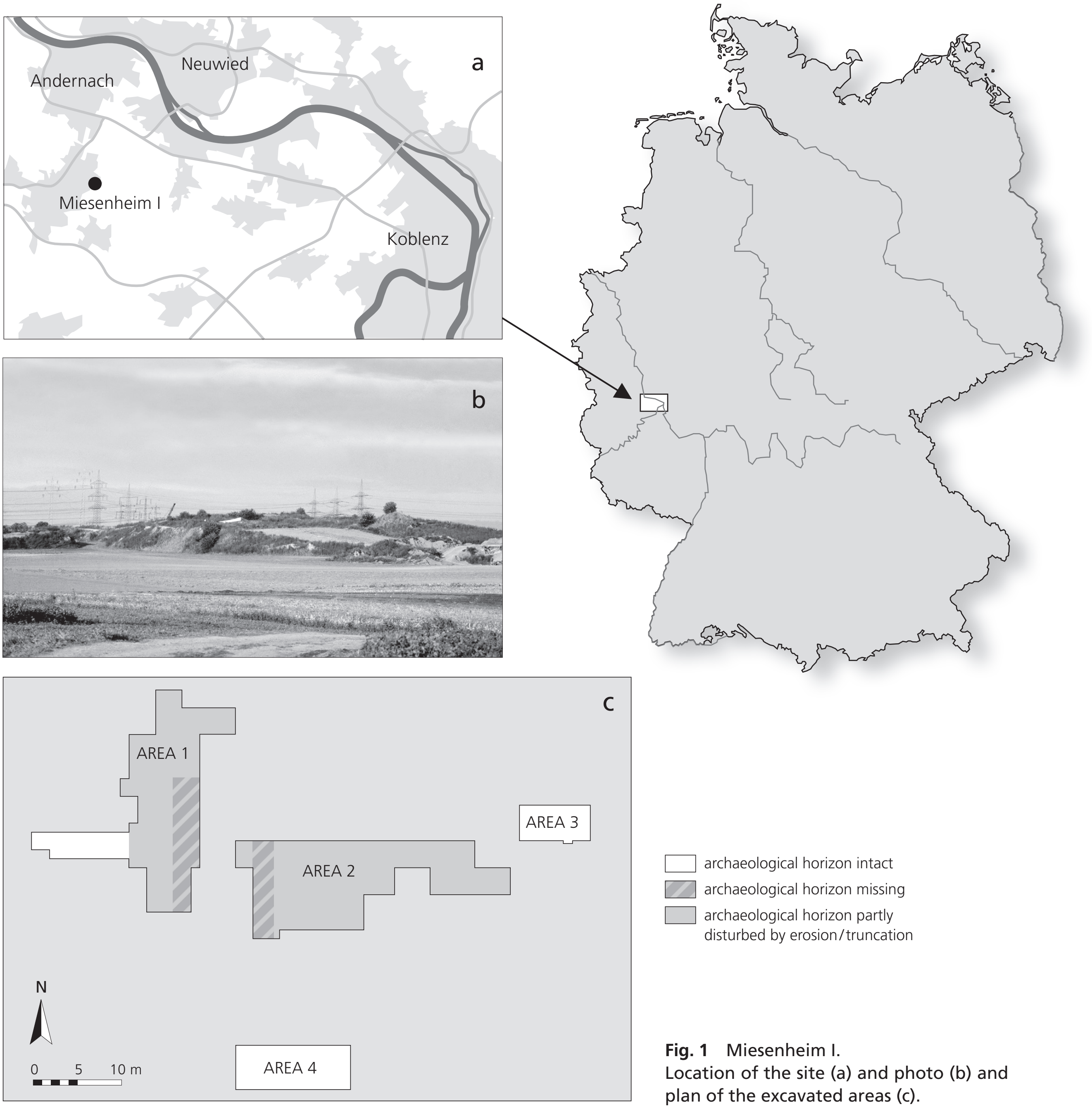


Fig. 1 Miesenheim I.
Location of the site (a) and photo (b) and plan of the excavated areas (c).

Stratigraphy, age and interpretation

During excavations at Miesenheim I, geological (Boscheinen et al. 1984; Hoselmann/Willems 1991; Müller 2000) and micromorphological (Boenigk/Frechen/Schweitzer 2000) analyses were undertaken. Since the results of these investigations have been published in detail elsewhere (Boscheinen et al. 1984; Hoselmann/Willems 1991; Turner 2000), only major phases relevant to the reconstruction of the biotope of the site during the period prior to and after find deposition are presented here, based mainly on Müller's (Müller 2000) analyses and descriptions.

Figure 2 depicts the section exposed in the western wall of area 3, where a more or less intact sequence of deposits was preserved. The oldest geological unit comprises up to 10 m of homog-

UNIT	LAYER	DATING	GEOLOGY	ENVIRONMENT	CLIMATE
10			REDEPOSITED SOIL, PUMICE AND ASH		
9		464 ± 4Ka	PUMICE AND ASH		
			EROSION		
8			CV HORIZON		INTERGLACIAL
			LOESS		GLACIAL MAXIMUM
7	C		SOLIFLUCTED DEPOSITS	VEGETATION-RICH OPEN WATER	EARLY GLACIAL
6			REDEPOSITED SILTS		
5	F		ANMOORGLEY	SILTING UP WATERLOGGED OPEN, RICHLY VEGETATED WATER FLUCTUATING WATER LEVELS	INTERGLACIAL
3-4	G		REDEPOSITED SILTS	OPEN GRASSLANDS SOME WOODLAND FENLAND OPEN WATER	INTERGLACIAL
			EROSION		
2	H	≈ 600 Ka	BROWN EARTH	TERRESTRIAL	
			MIESENHEIM SANDS	FLUVIATILE	

Fig. 2 Section through the deposits at Miesenheim I showing sequence of layers, dating, geology, environment and climate. Unit descriptions for the various layers given by Müller (Müller 2000); layer definitions were given on site during excavation.

enous fine to medium grained sands, representing a phase of strong fluviatile activity at Miesenheim I. Only the top of this deposit is exposed in the section in figure 2. Named the "Miesenheim sands" by Hoselmann and Willems (1991), the sands have been correlated by Boenigk and others (2000) to the Main Terrace Complex of the Rhine. Dating to between approximately 1 Ma ago and 600 thousand years before present (Ka B.P.), this complex consists mainly of braided river sediments deposited by repeated fluvial phases in a former Rhine valley, which was up to 8 km wide in places (Litt et al. 2008).

The brunification of the top of the sands represents the commencement of pedogenic processes (fig. 2, unit 2, layer H) and a transition to terrestrial conditions at the site. However, the development of the soil forming on the sands ("Braunerde") was interrupted by erosion and the onset of waterlogging, as revealed by the accumulation of redeposited silts, which already show the effects of gleying (fig. 2, units 3-4, layer G). On top of the silts, alternating autochthonous organic and clayey and silty allochthonous sediments (fig. 2, unit 5, layer F) were deposited by near-shore sedimentation or transportation during periods of higher water. At the height of waterlogging, an open body of calm, or sluggishly-moving water, was present at the site and mud, made up of organic materials and mineral particles, accumulated in the shallows. Waterlogging at the site led to further gleying of the underlying sediments (fig. 2, unit 3, layer G). Afterwards, the lake began to silt up and during processes of gleying, the mud deposits turned into an Anmoorgley or hydromorphic soil (fig. 2, unit 5, layer F). Wet conditions still prevailed at the site, as can be seen in unit 6 (fig. 2, unit 6, layer C), whose olive-green colouration was generated under reducing conditions.

A marked change in sedimentation was recorded in the upper part of the section where soliflucted deposits (fig. 2, unit 7, layer C) indicative of early glacial conditions were laid down. Loess accumulated during the following glacial maximum. A "Parabraunerde" formed on the loess (fig. 2, unit 8, layer C). The eroded Cv horizon is the only part of this soil visible in the section. Calcium-carbonate concretions in primary position in the uppermost part of the Cv horizon indicate that the pedogenic processes had taken place under interglacial conditions. There is a further break in the deposits at this point and small fluviatile channels filled with a sequence of *in situ* and redeposited pumices and ashes (fig. 2, unit 9) are visible. The eruption that produced these materials probably took place at the end of an interglacial and was followed, more or less immediately, by a further phase of erosion and redeposition of both soil and tephra (fig. 2, unit 10).

Another feature of the deposits at Miesenheim I is the many faults which have displaced the deposits from a few centimetres to several metres in height. It is not clear whether faulting was caused by true tectonics or tectonics associated with volcanic eruptions (Müller 2000). In places, the sedimentary sequence was also severely affected by erosion and, in addition, truncated during commercial exploitation of the younger tephra at the site, the Laacher pumice, dating to 12,960 cal BP (Baales et al. 2002).

Sanidines recovered from samples taken from the tephra deposits in the section described above (fig. 2, unit 9) were dated using the single crystal $^{40}AR/^{39}AR$ method to 464 ± 4 Ka (pers. comm. Paul v. d. Bogaard in: Turner 2000). The youngest relative date for the Miesenheim sands and the absolute date from the tephra bracket units 2-9 to between approximately 600-460 Ka B.P.

The palaeoenvironmental evidence from the faunal remains

The geological and sedimentological interpretation of the site reconstruction is supported by the results of analyses undertaken on the molluscan and vertebrate faunas. Analyses of bulk samples taken from layers G-C, undertaken by G. Roth (summarised in Turner 2000) produced 73 molluscan taxa. Isolated interglacial taxa are present in unit 2 (layer H) and, in particular, in units 3-4, including the type-fossil *Cepea nemoralis*.

The samples from units 3-4 (layer G) are dominated by land snails, indicating a more or less open environment. Freshwater species and those inhabiting the banks of open waters are also present, along with species typical of fenlands and damp woodlands. Molluscs inhabiting drier, wooded areas were recovered, indicating stands of trees close by.

Freshwater molluscs (81.5 %) dominate in unit 5 (layer F), and damp woodland species predominate among the land snails from this deposit. Dry woodland species and those inhabiting open land are conspicuously absent. Towards the top of layer F, the proportion of molluscs inhabiting vegetation-rich waters decreases and counts of fenland species and species inhabiting the edges of water increase. The molluscan fauna in the upper part of layer F also indicates deteriorating climatic conditions, so the accumulation of the underlying units 3-4 (layer G) can probably be placed in the second half of a warm phase.

Freshwater molluscs also dominate in units 6-8 (layer C) and throughout this layer the number of species inhabiting richly-vegetated, standing water increases once again. Pioneer species and species indicative of unstable biotopes, such as *Gyraulus laevis* and *Radix peregra*, appear, along with many species of the genus *Pisidium*, which all prefer cold conditions. The co-occurrence of *P. lilljeborgii, P. obtusale lapponicum* and *P. stewarti* is typically found in the early or late phases of a glaciation.

The remains of 43 small and large mammals, 8 species of bird, a small assemblage of amphibian remains and a single vertebra of a fish were recovered in units 3-4 and 5 (layers G and F) and identified by E. Turner and T. van Kolfschoten (in: Turner 2000). The fauna is diverse and representative of the type of vertebrate community living in a mosaic of biotopes in and around an extensive floodplain of the Rhine. Beavers, water shrews and water voles would have inhabited the immediate vicinity of the site. The dam-building activities of the beavers may even have contributed to the formation and conservation of the lake. Other species, such as roe deer, squirrels, wood mice and dormice, would have primarily inhabited woodland. Horse and large bovines, along with microtids and hamsters indicate the presence of open conditions along the edges of the floodplain. Wild boar and dormice are indicative of interglacial conditions.

Bird remains were found in units 3-4 and 5 (layers G and F) and although definition to species was difficult due to the fragmentary nature of the material, the avifauna appears to be dominated by several species of waterfowl, notably mallards, teals, tufted duck and coot.

Sampling for pollen was undertaken on two occasions by Urban (in: Boscheinen et al. 1984) and by Bittmann (2000). Urban interpreted her results as representing an end of interglacial situation, with dominant *Pinus* and *Betula.* Based on his analyses, Bittmann came to the conclusion that pollen at Miesenheim I had been strongly degraded, leading to a biased dominance of conifers. He concluded that the botanical remains, including fragmentary charcoal pieces, offered no information on either the stratigraphical position of the deposits or a reconstruction of the environment. Only the abundant algae in Unit 5 (layer F) indicated the presence of open water surrounded by lush vegetation

Summary

The environment and climate during the development of the site can be reconstructed by combining the results of the analyses (**fig. 2**). Three main phases can be recognised:

Phase 1 – strong fluviatile activity and the accumulation of thick sand deposits at the site, followed by terrestrial conditions. Interglacial. Miesenheim sands and unit 2, layer H.

Phase 2 – the terrestrial conditions prevailing towards the end of phase 1 continue into the following phase. The local biotope is characterised mainly by open grasslands dotted with bushes and some wooded areas. An open body of water, surrounded by fenlands and damp woodlands is present. Interglacial. Units 3-4, layer G.

Later, the site is waterlogged. Damp woodlands and fenlands are still present. A lake with lush vegetation and fluctuating levels of water forms at the

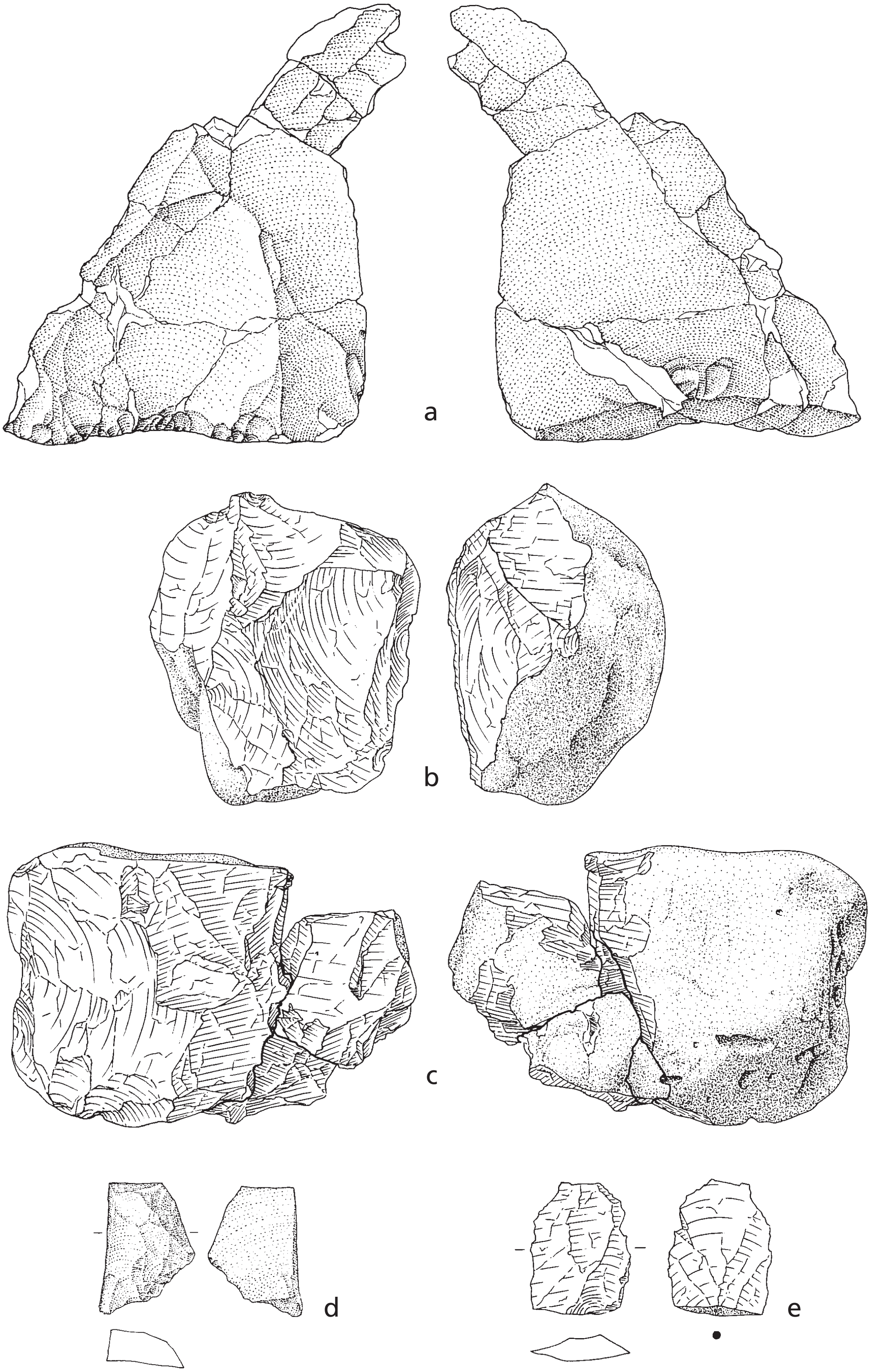


Fig. 3 Lithic artefacts from Miesenheim I. Fine-grained quartzite flake with retouch along the base (a); quartz core (b); quartz core with refitting angular debris (c); quartzite Burin de Siret (d); quartz flake (e).

Tab. 1 Counts and percentages of artefacts and raw materials at Miesenheim I.

material	core	flake	flakelet	angular debris	hammer-stone	burin	total	% total
KSC	–	1	1	–	–	–	2	1.8
QZ	4	13	21	64	–	–	103	94.5
QZT	–	1	–	1	1	1	3	2.8
RF	–	–	1	–	–	–	1	0.9
total	4	15	23	65	1	1	109	100.0
% total	3.7	13.7	21.2	59.6	0.9	0.9	100.0	

KSC = siliceous slate, QZ = quartz, QZT = quartzite, RF = river flint

Tab. 2 Counts of artefacts and raw materials in units 3-4, layer G and unit 5, layer F at Miesenheim I.

unit	material	core	flake	flakelet	angular debris	hammer-stone	burin	total
5 (layer F)	KSC	–	–	1	–	–	–	1
	QZ	–	6	6	23	1	–	36
	QZT	–	1	–	1	–	1	3
	RF	–	–	1	–	–	–	1
sub-total								41
3-4 (layer G)	KSC	–	1	–	–	–	–	1
	QZ	4	7	15	41	–	–	67
sub-total								68
totals		4	15	23	65	1	1	109

KSC = siliceous slate; QZ = quartz; QZT = quartzite; RF = river flint

site, but gradually silts up. Second half of an interglacial. Unit 5, layer F.

Phase 3 – open water with lush vegetation present again at the site. Early glacial conditions, followed by Glacial Maximum and the following warm phase. Units 6-8, layer C.

Find distribution

The lithic artefacts and faunal remains form a single horizon of finds stratified in the interglacial deposits of units 3-4 and 5 (layers G and F). In the few parts of the site where the stratigraphic sequence was intact, finds were distributed vertically up to 50-70 cms in depth. Close clusters of anatomically connected bone elements as well as short refits between bone fragments and between lithic artefacts indicates that the finds were recovered more or less *in situ*. However, the vertical distribution of the finds, evidence of deposition of some faunal remains during different seasons of the year (see below 4) and superimposed incidences of deposition suggest we are dealing here with an attritional assemblage.

Post-depositional factors, in particular phases of erosion and removal of tectonically-displaced portions of the site during the quarrying of pumice had resulted in a differential representation of finds over the site areas. Intact sediments containing finds were present in area 3 and the western part of area 1, but here find density was often less than 10 finds per square metre. In contrast, area 2 produced the densest concentration of finds even though the sedimentological sequence at this part of the site had been partially eroded (**fig. 1c**).

Lithics and larger vertebrates

The lithic assemblage

The presence of hominids at Miesenheim I is testified by an assemblage of 114 lithic artefacts (Turner 2000); and see Vollbrecht (1997). A total of 109 artefacts was recovered during excavation and 5 additional pieces were collected when the site was discovered. The excavated assemblage comprises artefacts of quartz, quartzite, siliceous slate and relict river flint, raw materials locally obtainable from the gravels of the Rhine River and its tributaries. Despite its relatively poor cleaving properties, quartz was the preferred raw material and 94.5 % of the lithic finds are made of quartz (**tab. 1**). The lithic artefacts are distributed vertically through units 3-4 (layer G) and 5 (layer F), but the majority of the finds are located in the gleyed silts of units 3-4 (n = 68) with less quantities in unit 5 (n = 41) (**tab. 2**).

The quartz artefacts comprise flakes, angular debris and several core-like pieces (**fig. 3**). An elongated quartz pebble shows damage at one end, consistent with its use as a hammerstone. Only two finds are retouched, a fine-grained quartzite flake (**fig. 3a**) and a flake of quartz. The absence of other retouched artefacts and the fairly large amount of debris, including some flakes produced during retouching (Vollbrecht 1997) suggests, on the whole, that finished artefacts were removed from the site.
An interesting accumulation of stones was revealed in area 2. Stratified at the base of units 3-4 (layer G), this feature comprised a single layer of mainly quartzite and some quartz pebbles, spread diagonally across the trench in the eastern part of area 2 (**fig. 7**).

The larger vertebrates

Out of a total of 1699 recorded faunal remains, 1146 bone, teeth and antler, representing 15 mammals, could be identified (**tab. 3**). These remains are excellently preserved, but highly fragmented due to pressure from overlying sediment after burial. Since the number of identifiable specimens (NISP) for many of the animals was not particularly high, more detailed assessments of minimum numbers of individuals (MNI) could be attempted by taking into account body-side, counting juvenile and adult bones separately, recording differently-sized bones of adult animals and defining eruption and wear stages and different patterns of morphology on teeth. The pattern that emerged after analysis was one of low numbers of identifiable fragments combined with high numbers of individuals for most animals. The discrepancy between NISP and MNI gives an impression of how much material from the individual animals either did not reach the site or, more likely, was removed after deposition. The activities of hominins, carnivores, phases of erosion and even the removal of parts of the site during the commercial extraction of pumice are all factors which contributed to the representation of bones at Miesenheim I. Finally, only four species – horse, a large bovine, red deer and roe deer – produced enough material for an in-depth analysis.

Strong visual evidence of human modification of the bones is lacking. Fine, linear incisions on three bones, superficially resembling cut marks and submitted for SEM analysis, are probably of natural origin, whereas linear incisions on a fourth bone, a fragment from a mandible of red deer, may derive from cutting by a stone tool (pers. comm. Jill Cook) (**fig. 4**). A conchoidal flake scar, similar to notches produced by humans when opening bone shafts to obtain marrow, was observed on a fragment of a long bone (humerus) of horse or large bovine (**fig. 8**).

The putative cut mark on the mandible and the impact notch on the long bone suggest hominins may have procured only red deer and horse / large bovine. In order to test this hypothesis, the skeletal part representations of these animals were compared to that of roe deer, which appears to bear no evidence of hominin modifications. Due to the relatively low counts of elements for all of these vertebrates, counts of minimum numbers of elements (MNE) were split into four carcass units (head, axial, limbs and feet) and expressed as percentages of the total number of elements (**fig. 5**). The skeletal representation of red deer is very similar to that of roe

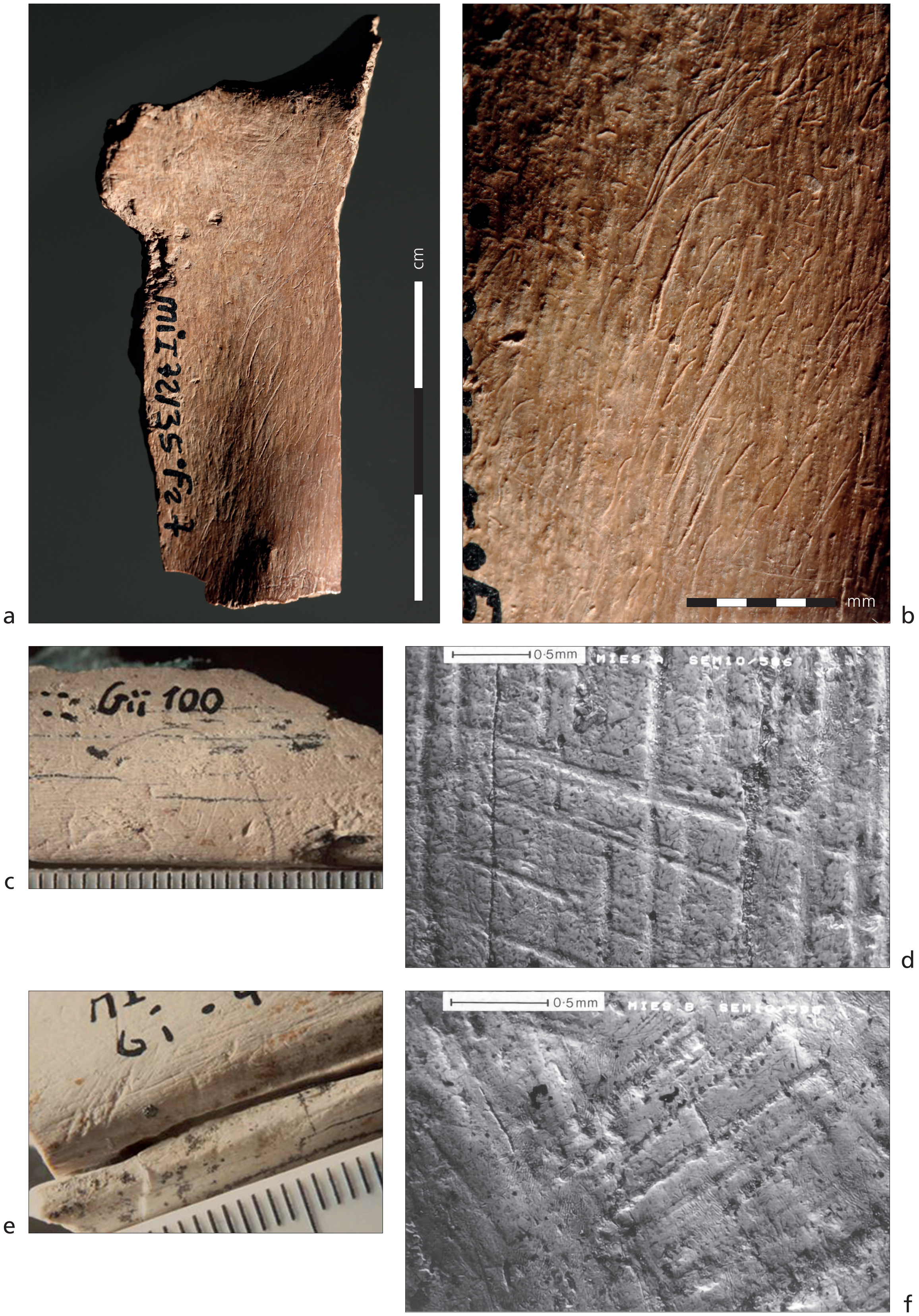


Fig. 4 Surface modifications on faunal remains from Miesenheim I. Putative cut marks on a mandible of red deer (*Cervus elaphus*) from Unit 5, layer F (a-b). (Photo Wolfgang Heuschen, RGZM). Surface scrapes on bone fragments from unit 3-4, layer G (c and e) (Photo Elaine Turner, RGZM) and details of marks taken by Scanning Electron Microscope (e and f). (Scans Jill Cook, British Museum).

deer. Horse has a more foot-dominated skeletal profile than the other animals, and the remains of the large bovine are characterised by larger quantities of axial elements than in the other species. With the exception of the large bovine (see below for description of bovine remains), there were no significant differences in the patterns of skeletal representation of horse, red deer or roe deer indicative of a specific targeting of a certain species by hominins.

Traces of carnivore gnawing were also observed on the bones, including those of the carnivores and 20.9 % of the total minimum number of elements of horse, large bovine, red and roe deer showed traces of carnivore gnawing.

Tab. 3 Numbers of identifiable specimens (NISP) and minimum numbers of individuals (MNI) of vertebrates present at Miesenheim I.

Common Name	Latin Name	NISP	MNI
Western polecat	*Mustela* (*P*) *putorius*	1	1
Steppe polecat	*Mustela cf. eversmanni*	1	1
Wild cat	*Felis sylvestris*	1	1
Elk	*Alces* sp.	2	1
Elephant	Elephantidae gen. et sp. indet.	2	2
Wild boar	*Sus scrofa*	4	1
Badger	*Meles* sp.	8	1
Mosbach wolf	*Canis lupus mosbachensis*	11	2
Deningers bear	*Ursus cf. deningeri*	12	2
Rhinoceros	*Stephanorhinus* sp.	33	3
Stehlins bear	*Ursus* (*Plionarctos*) *stehlini*	34	2
Horse	*Equus* sp.	110	4
Large bovine	*Bos*/*Bison* sp.	304	3
Roe deer	*Capreolus capreolus*	306	9-14
Red deer	*Cervus elaphus*	317	7
Sub-total		1146	
UL		396	
UM		110	
US		22	
Indet.		25	
Total		1699	

UL = Unidentified large vertebrates (cf. horse, large bovine); UM = unidentified medium vertebrates (cf. red deer, wild boar, bear) and US = unidentified small vertebrates (cf. roe deer, badger); Indet. = indeterminate fragments. MNI counts for roe deer based on teeth (MNI 9) and shed antler (MNI 14).

Seasonality and behaviour of the animals

Cervid antlers are useful seasonal indicators due to their annual cycle of regeneration. The base of an unshed antler of red deer was recovered from unit 3-4 (layer G). The pedicle is slender, more typical of a young male. Red deer stags carry their antler from September through to spring (mid-February to March), when they are shed (Schmid 1972). Young males may carry them longer, shedding in April or even May, so the individual from Miesenheim may have died any time between September and May. Tooth eruption and wear patterns observed on a mandible of a juvenile red deer from Miesenheim were compared with those established by Legge and Rowley-Conwy (1988) for a sample of modern deer and indicate death of the individual from Miesenheim I during its second winter, thus providing supportive evidence for the presence of red deer at the site during the colder months of the year (fig. 6).

Roe deer undergo a different cycle of antler regeneration than red deer, carrying their antler from April and shedding in October/November. Shed antler of 14 individual roe deer were recovered at Miesenheim I. Based on the development of the antler, four of these animals were yearlings and the remaining ten animals were adults over two years of age. Time of death could also be established for three of the juvenile roe deer using comparative data from tooth eruption and wear patterns of teeth of a modern sample (Legge/Rowley-Conwy 1988). The three juvenile individuals from Miesenheim died between summer and winter.

Additional seasonal evidence was gleaned from the avian fauna. The crake, corncrake and song thrush are summer visitors to this region today. If their seasonal migration patterns were the same

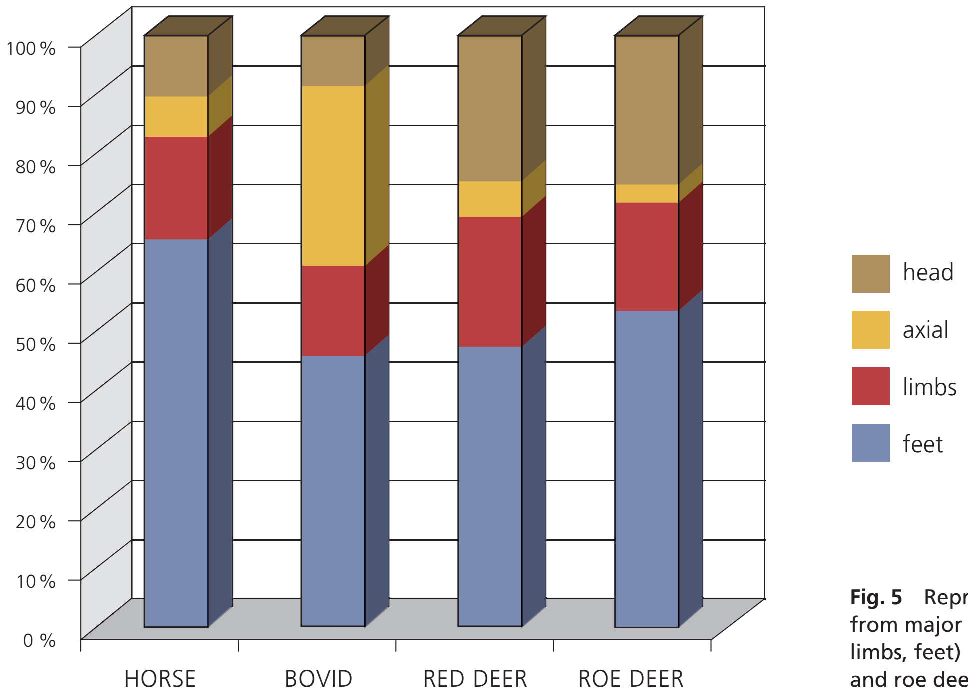


Fig. 5 Representation of elements from major body units (head, axial, limbs, feet) of horse, bovid, red deer and roe deer from Miesenheim I.

during the Pleistocene, this could be evidence for the deposition of some bird remains during the summer months. In summary, there seems to be evidence at Miesenheim I of the remains of animals and birds being deposited at the site practically all year round. This scenario gives additional support to the attritional character of the assemblage.

Roe deer are often recorded in marshy areas where they feed avidly on sedge-clover and seek refuge in thickets along riverbanks (Görner/Hackenthal 1988). Red deer are frequently found in floodplains. They seek out ponds and lakes as watering places; mud baths play an important role in their grooming. Thus, ideal conditions for both roe and red deer would have existed at Miesenheim I practically all the year round. However, there is evidence (cervid antler regeneration and cervid tooth eruption and wear) that deer were present at Miesenheim particularly during the cooler parts of the year, from autumn through winter (**fig. 6**).

The core unit of modern red deer comprises a hind and her young (calf and yearlings) (Ahlen 1965); stags form separate, temporary "bachelor" groups of varying sizes (Legge/Rowley-Conwy 1988). During the rut in September and October, red deer behaviour changes drastically as dominant males emerge from the bachelor groups and become territorial. Core unit size is temporarily increased as stags attempt to maintain a harem of females. After the rut, the larger groups disband and the smaller, sexually segregated, social groups re-form. In contrast, roe deer lead more solitary lives. They are usually encountered in small family groups, comprising a doe and her young, or as single animals (Strandgaard 1972). The bucks are usually solitary. Larger bands can form over winter (Prior 1968), when groups of mixed sexes congregate.

Both horse and large bovines would have used the floodplain to access water for drinking. Horses in particular are water-dependent and close proximity to watering places is an important requisite in their ranges. The main river courses of the Rhine would have been an optimal place for herds of both animals to access water on a regular basis throughout the year, especially in winter when other watering places may have been frozen over.

Thus, with herds of horses and large bovines and groups of cervids visiting the floodplain regularly as part of their natural ranges, Miesenheim I was an attractive place for foraging hominins. This situation

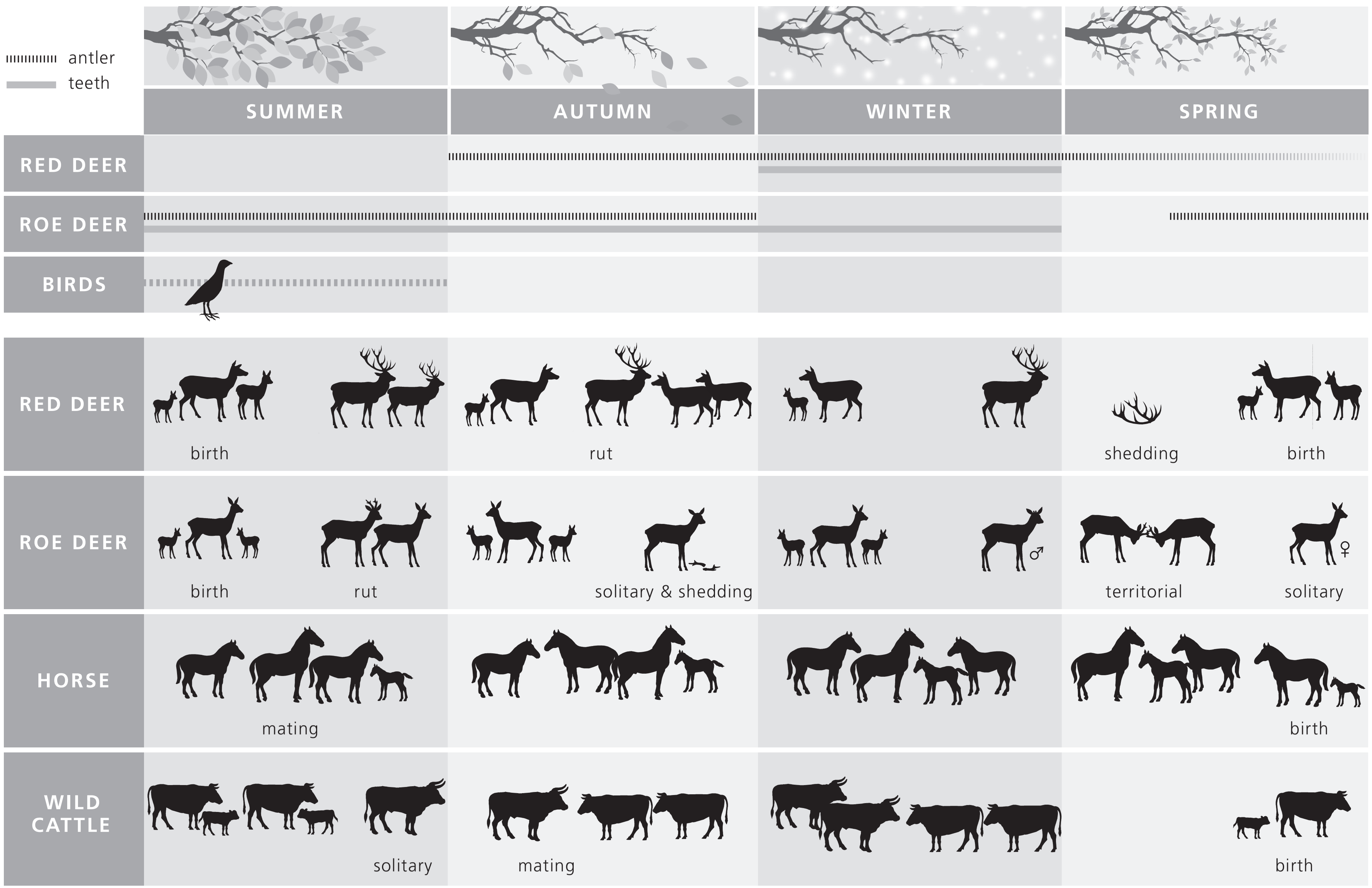


Fig. 6 Evidence of seasonality from Miesenheim I based on antler regeneration and age at death of red deer and roe deer and migration patterns of birds at the site (above), and comparative seasonal cycles of modern red deer, roe deer, horse and large bovine (below). Seasons given following the northern meteorological seasons. Spring = March – May; Summer = June – August; Autumn = September – November; Winter = December – February.

was probably optimised during the cooler months of the year, when increased numbers of cervids were present and horses and large bovines may have been using the site as a winter watering hole on a regular basis (**fig. 6**).

The diachronic development of the site of Miesenheim I and hominin activities

Phase 1

It is not surprising that there is no evidence of the presence of hominins at the site during this period of strong fluviatile activity. The locality itself and most parts of the surrounding landscape formed part of an extensive Middle Pleistocene Rhine Valley and were probably under water for an unknown period of time, but long enough to deposit several metres of sand. The transition to more terrestrial conditions, observable at the top of the sands, probably occurred as a result of downcutting of the main channel(s) of the river. As the river receded, the site and the immediate vicinity of the site became drier.

Phase 2

Erosion, redeposition of sediments, waterlogging, occasional higher water activity and the formation of an open body of sluggish water, which later silted up, all suggest a period of strongly fluctuating conditions at the site, corresponding to the location of Miesenheim I in the floodplain of the river during phase 2. Despite these, to my way of thinking, unstable conditions, hominins appear to have discovered and utilised the site only during this phase.

The oldest "feature" at Miesenheim I is the layer of pebbles discovered at the base of units 3-4, layer G (**fig. 2**). Located at the eastern end of area 2, this accumulation of stones was approximately 5m long and distributed diagonally through the trench (**fig. 7**). Some isolated pebbles were recovered above this layer and probably represent stones derived from the feature. The pebble layer had been disturbed by a fissure-like fault running through the centre and truncated by a second, deeper fault at its eastern end. The two halves of the pebble layer had moved apart by between 10 and 40cms and were displaced to approximately 15cm in depth. The feature comprised pebbles of quartzite and quartz, typical raw materials of the region. There were no indisputable signs of a particular orientation of the stones, as would be expected, for example, in the natural bed of a stream. However, the movement and re-deposition of sediments in units 3-4 (layer G) may have led to a post-depositional re-alignment of water-borne stones. Significantly, none of the pebbles showed evidence of utilisation by hominins, indicating a non-anthropic accumulation of these finds. Thus, the preservation of the pebble layer as

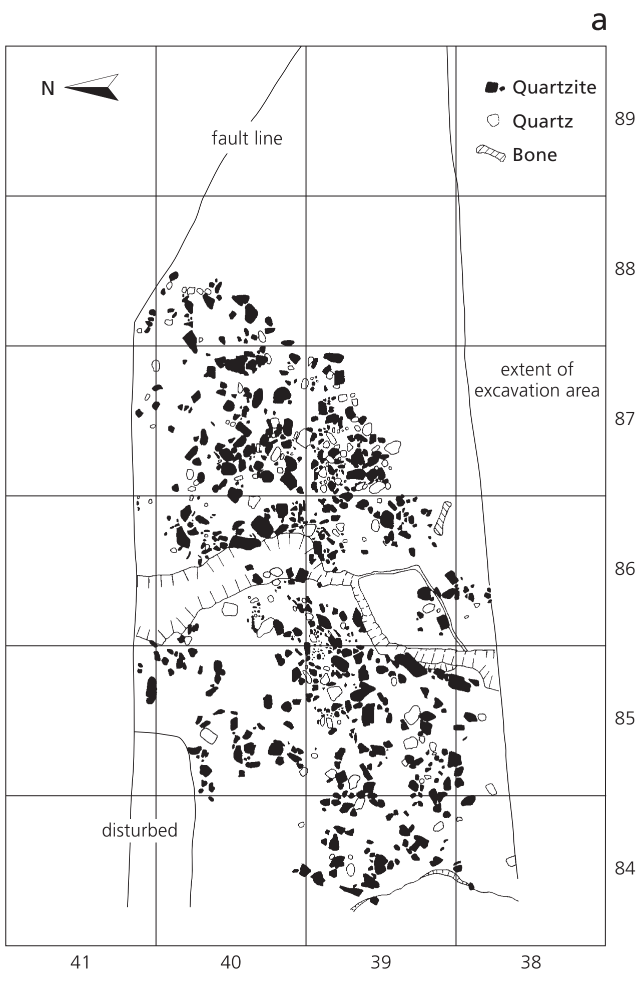
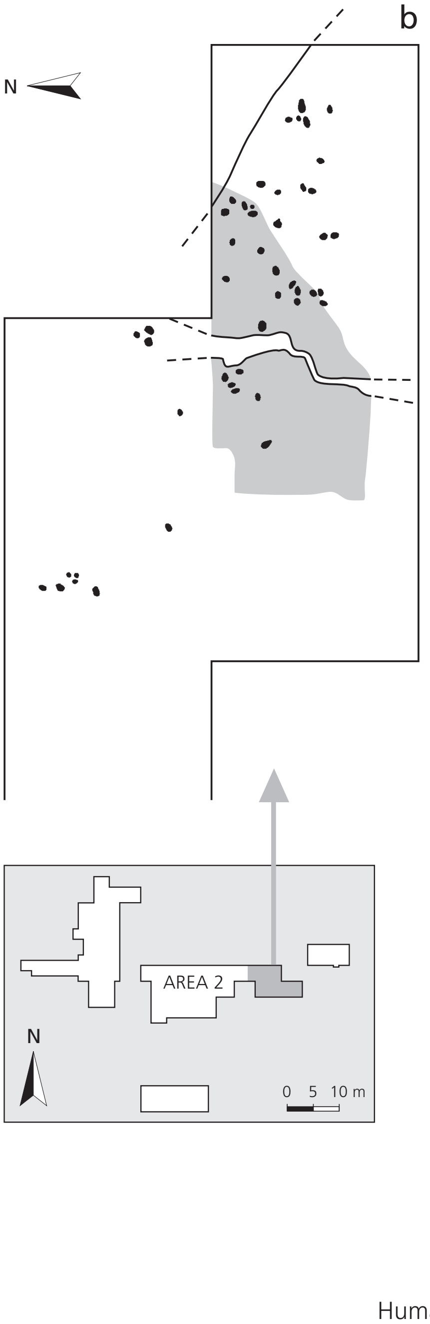


Fig. 7 The pebble layer in area 2 at Miesenheim I. Plan of the pebbles as revealed during excavation (a), plan of isolated pebbles removed prior to discovery of the layer = shaded area (b) and photo of the pebble layer (c).

revealed during excavation, gives few clues as to its genesis. Only two finds, a poorly preserved shaft of a radius of a juvenile horse and a small fragment of bone were laid close to, and almost on top of, this feature. They represent the oldest faunal remains from unit 3-4 (layer G); the rest of the animal bones and lithic artefacts were stratified above the pebble layer.

Important, however, is that the distribution of lithic artefacts at Miesenheim I show a very close spatial association with this feature. Lithic artefacts and lithic debris from units 3-4 and 5 (layers G and F) were recovered overlying the pebble layer, and spreading to the west (area 2) and east (area 3) of this feature (**fig. 8**). It is possible that the pebble layer was still visible or partly visible when hominins first visited the site. This feature may have provided them with an attractive, on-site, source of raw materials for their stone artefacts, or provided a more stable, drier surface, amidst waterlogged deposits, on which hominins could stay, or both. In the western part of area 1, areas 3 and 4, the number of artefacts is low (particularly in area 4). These areas are interpreted as peripheral to the main distribution of artefacts in area 2. Several refits between quartz core-like pieces, quartz flakes and angular debris are a major feature of lithic distribution in units 3-4 (layer G) in area 2 and clearly indicate that this raw material was worked here. In addition, a quartz hammerstone was recovered in area 2 and

b



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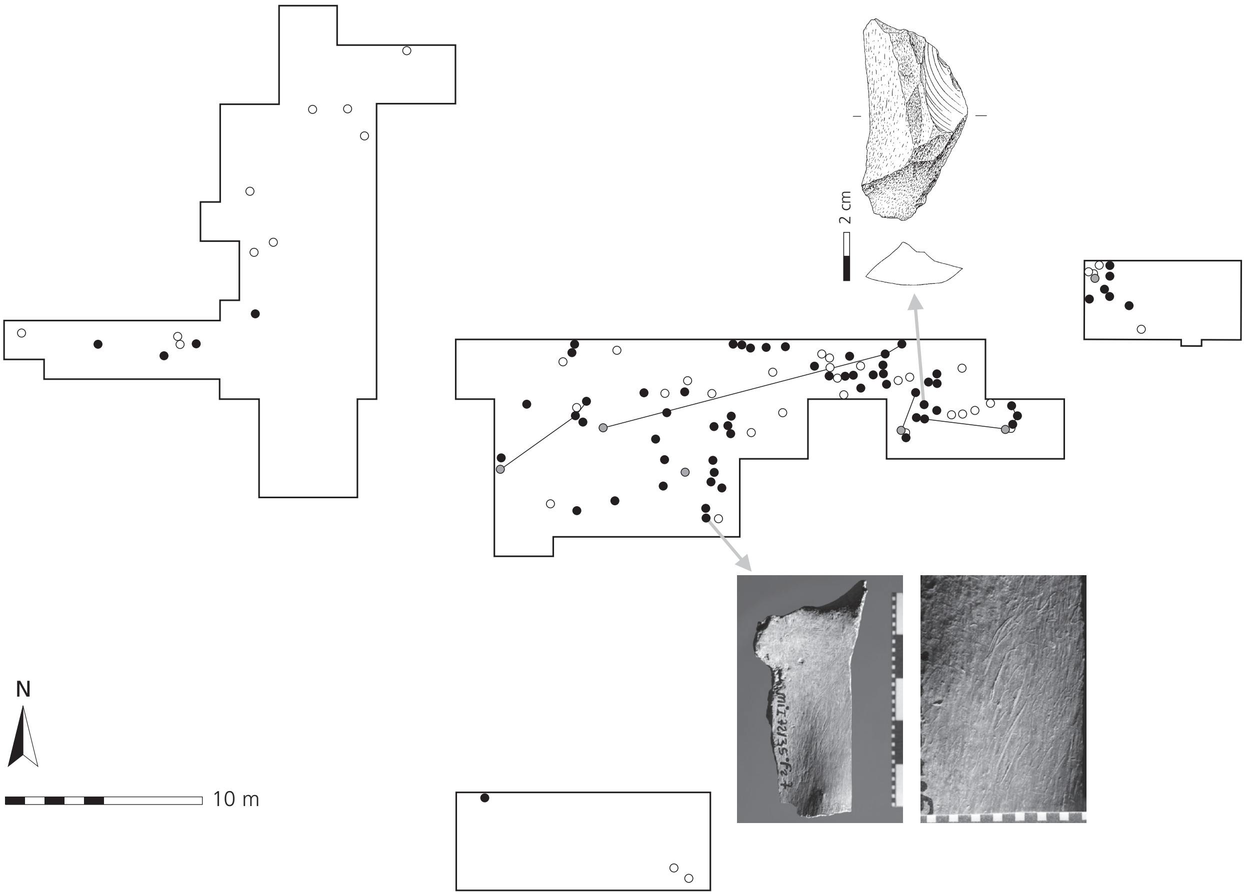

Fig. 8 Distribution of lithic artefacts in areas 1, 2, 3, and 4 and the positions of the bone with an impact notch (above) and the potentially cut-marked red deer mandible (below). Closed symbols – artefacts in units 3-4, layer G; open symbols – artefacts in unit 5, layer F. Shaded symbols – cores. Lines indicate refits between artefacts.

the fragment of a shaft of a humerus of horse/large bovine bearing the remains of a conchoidal, flake scar. A red deer antler frontlet from a young male, deposited sometime between September and April or May, was also found in this unit.

Of the four species of mammal that produced larger quantities of remains, only one, the horse, shows a clear association with units 3-4 (layer G), in which the bulk of the artefacts were also found. The open conditions in these units, indicated by the molluscan fauna, would have provided optimal habitat for the horse and may have led to the dominance of this species in layer G. Roughly 79 % of the remains of horse were recovered in this layer, in contrast to 19.2 % in the upper part of the deposits, in unit 5 (layer F). Fragmentary horse teeth and a few postcranial bones of this species are present in area 2, but on the whole, horse remains are peripheral to the main area of lithic distribution. One of the interesting aspects of the faunal assemblage from Miesenheim I is the presence of portions of animal carcasses preserved more or less in anatomical connection, and one of these examples – bones from the fore and rear legs of horse – was recovered in area 3 (**fig. 9**). This concentration of refitting fragments of bones and articulating elements is from an individual, juvenile, horse and comprises elements of the right and left fore and rear limbs and feet, a fragment of a rib and two lumbar vertebrae. These remains were spread over an area of some 16 m², with elements of the right side of the body located towards the south-east corner of area 3 and left elements more to the north-west. Several of the limb and foot bones showed traces of heavy gnawing by a carnivore and tooth scores on these elements were comparable in size to those

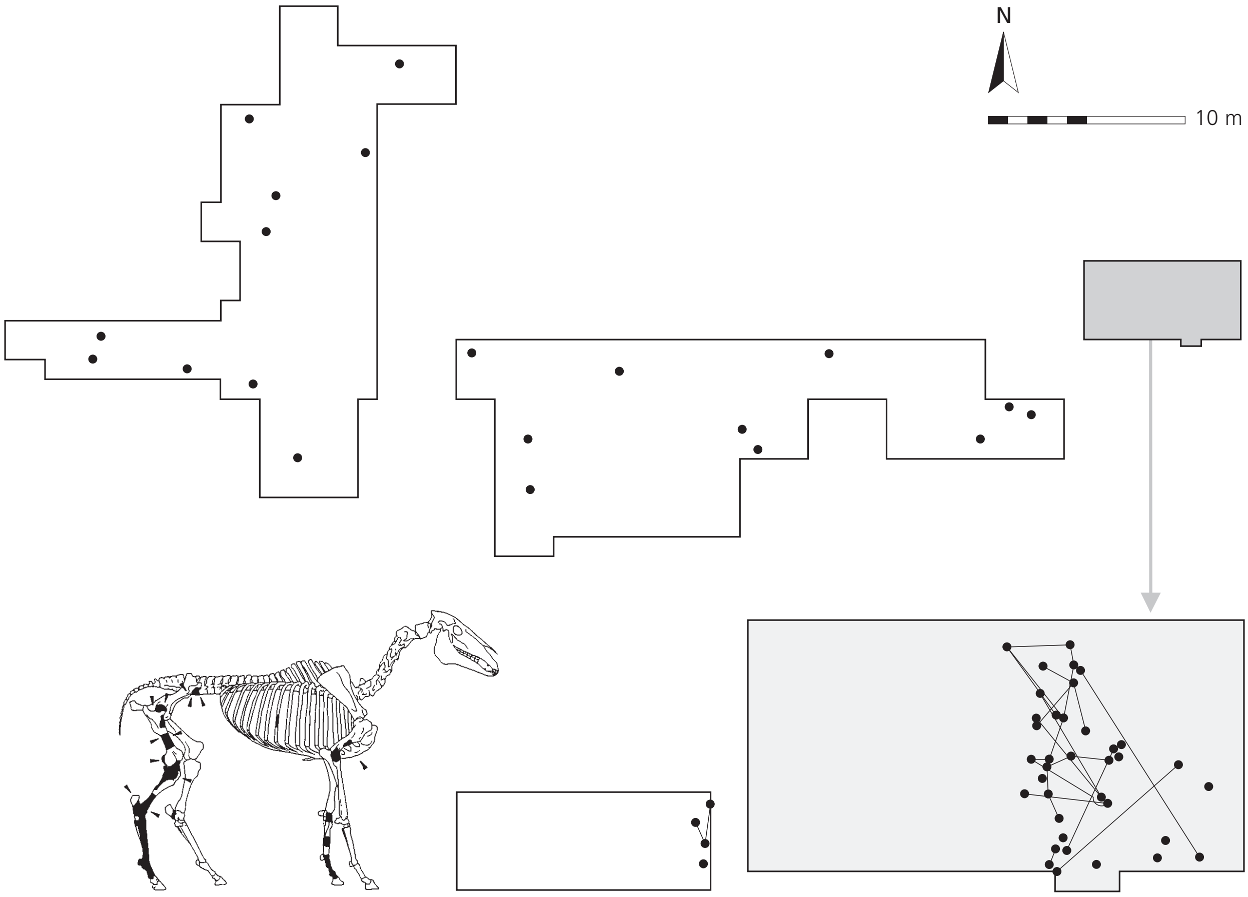

Fig. 9 Distribution of isolated horse remains in areas 1, 2, and 4 and the partial carcass of a horse in area 3. Lines indicate refits between bones.

produced by the wolf (Haynes 1983). The absence of any visible forms of hominin modification of the bones makes it difficult to interpret this assemblage of horse bones as a hominin kill which was later scavenged by carnivores, a carnivore kill which took place at the site when hominins were not present or a natural death of a young animal which was scavenged.

In contrast to horse, remains of red deer were vertically distributed more or less equally through units 3-4 and 5 (layers G and F) (52 % and 47.6 % respectively) and distributed throughout the site (**fig. 10**). Although fragments of red deer bones could be refitted, and elements re-articulated or attributed to an individual animal, articulating red deer carcasses comparable in preservation to that of horse in area 3 were not recovered. In fact, the red deer remains from Miesenheim I give the impression of a highly fragmented and widely scattered assemblage of bone. The mandible of red deer from unit 5 (layer F) with putative cut marks (**fig. 4**), was located in area 2, on the edge of the main area of lithic artefact distribution (**fig. 8**).

Teeth, fragmentary bones and antler of roe deer are widely scattered over the site, showing a state of preservation and distribution similar to that of red deer. Vertically, however, the remains of this cervid were associated with the upper part of the deposits, being predominantly found in unit 5 (layer F; 71.6 %), with fewer remains in units 3-4 (layer G; 28.4 %). A partially preserved carcass of an adult roe deer was recovered from the western edge of area 1 (**fig. 11**). This isolated assemblage of bones comprises elements from the left and right fore and rear legs of the animal, scattered over approximately ten m². Conjoins between the finds indicate displace-

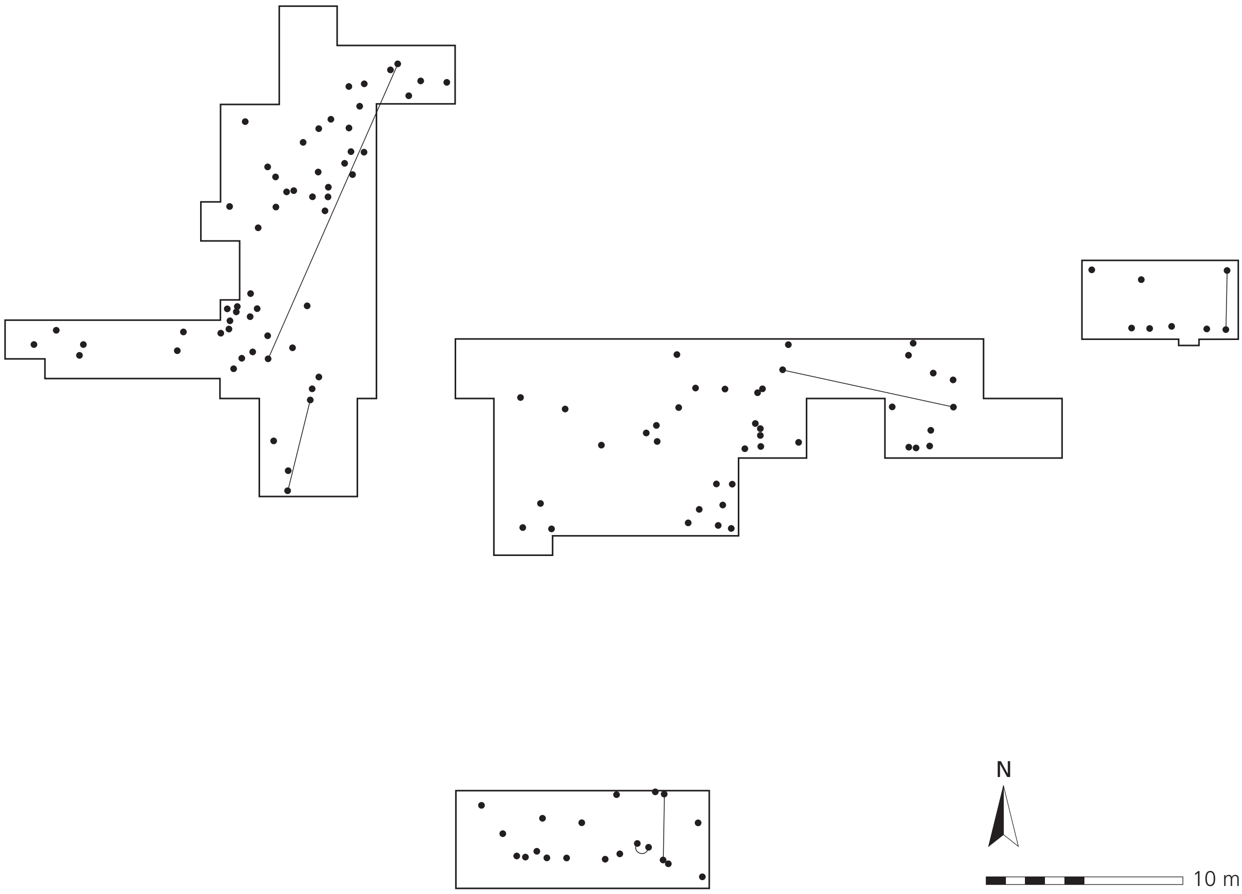

Fig. 10 Distribution of isolated red deer remains in areas 1, 2, 3 and 4. Lines indicate refits between bones.

ment of remains up to 4 m. Carnivore gnawing was observed on only one element from this assemblage and the horizontal and vertical distribution of the remains of this individual was more likely due to displacement due to faulting rather than other factors. Several closely-spaced fault lines transected the area in which the carcass had been embedded. Since this assemblage is located close to an area where pumice had been intensively worked, portions of this carcass may have been recently removed.

The remains of large bovines are almost exclusively associated with the upper part of the deposits and 96.1% of the bones of these animals were stratified in unit 5 (layer F) and only 3.9 % in units 3-4 (layer G). In contrast to the distribution of both red deer and roe deer, remains of large bovines at Miesenheim I are concentrated in the eastern parts of areas 2 and 3, with only a few isolated finds in areas 1 and 4 (**fig. 12**). The partial carcass of one mature individual is very well-preserved in area 2 and comprised pieces of the cranium, vertebrae, ribs, limbs and feet of the animal. The scapulae, caudal vertebrae, right radiocubitus and pelvis, and the left humerus were not recovered, but these elements or fragments of them may be contained in deposits to the south-east, which have not been excavated. Typical for this assemblage are numerous, and occasionally long, conjoins in the horizontal plane between bone fragments which had fractured in a dry state, reflecting the strong post-depositional effects of, presumably, pressure of overlying sediment. The position of the elements from the different sides of the body suggests the carcass was laid on its right side with its fore quarters to the north-west, rear quarters to the south-east and the articulated spine in between. Since the carcass

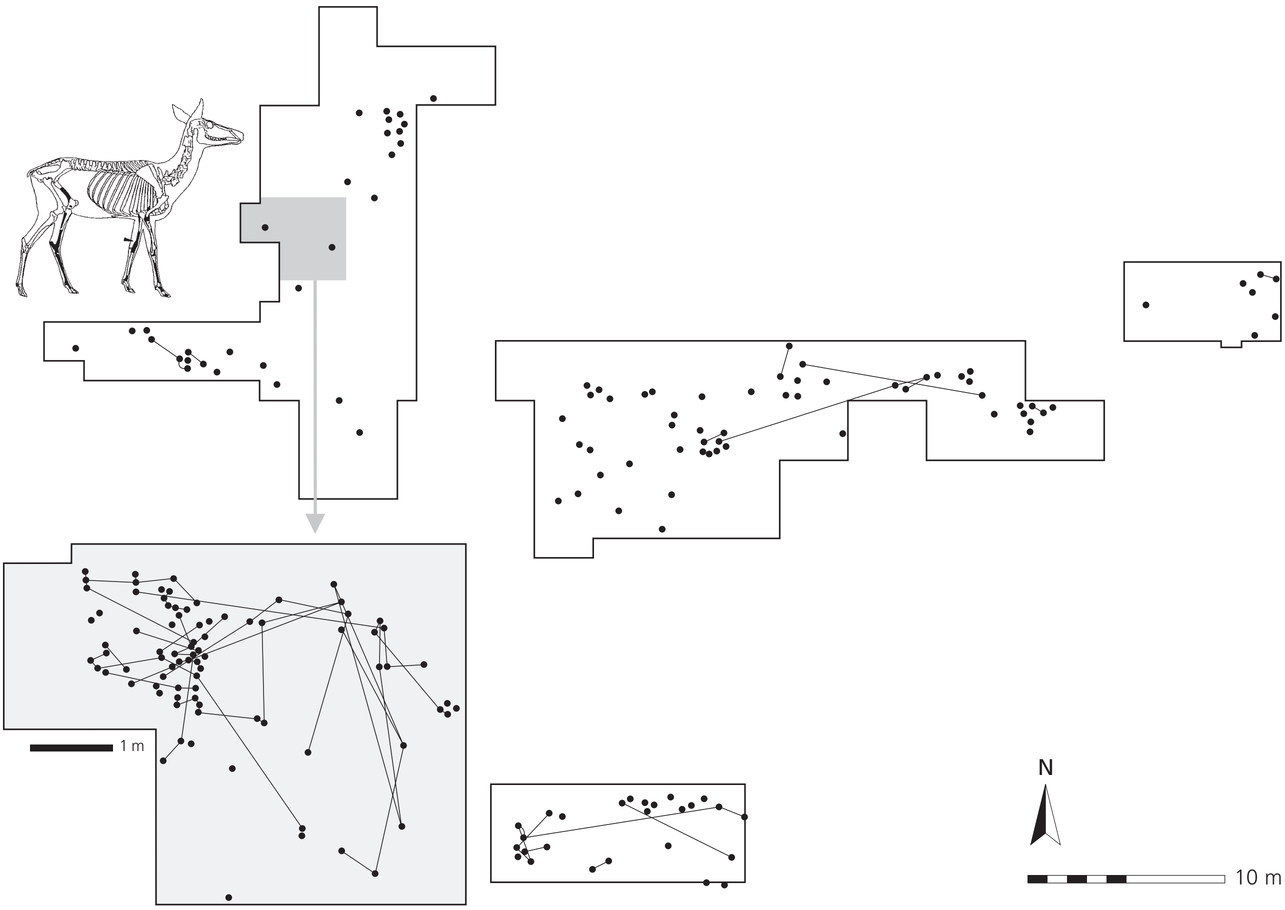

Fig. 11 Distribution of isolated roe deer remains in areas 1, 2, 3 and 4 and partial carcass of a roe deer in area 1. Lines indicate refits between bones.

of this individual was probably deposited at a time when very wet and muddy conditions prevailed at the site, the right side of the body may have sunk into the soft substrate. This would probably account for the fewer elements from the left side of the body being present, since these were more exposed to post-depositional factors, resulting in bone dispersal or destruction. Hominin modifications of the carcass were not observed and carnivore gnawing was found on only five bones.

Phase 3

As the interglacial ended and early glacial conditions took over, find deposition at Miesenheim I ceased and the site was abandoned. Even the reappearance of a body of water at Miesenheim I (fig. 2, unit 7, layer C) no longer seemed an attractive prospect under these colder conditions for a further occupation of the site by hominins.

Conclusion

Detailed analyses undertaken at Miesenheim I have revealed the genesis of a Lower Palaeolithic interglacial site from the time when the locality was part of the fluviatile system of the Middle Pleistocene Rhine River (Phase 1), its assimilation into the backwaters of the flood plain (Phase 2), burial below soliflucted deposits and loess during the oncoming glaciation (Phase 3), integration into the volcanic area of the East Eifel region and burial by younger cold stage sediments towards the end of the Glacial cycle.

In addition, the results of the geological, micromorphological and molluscan analyses of the find-

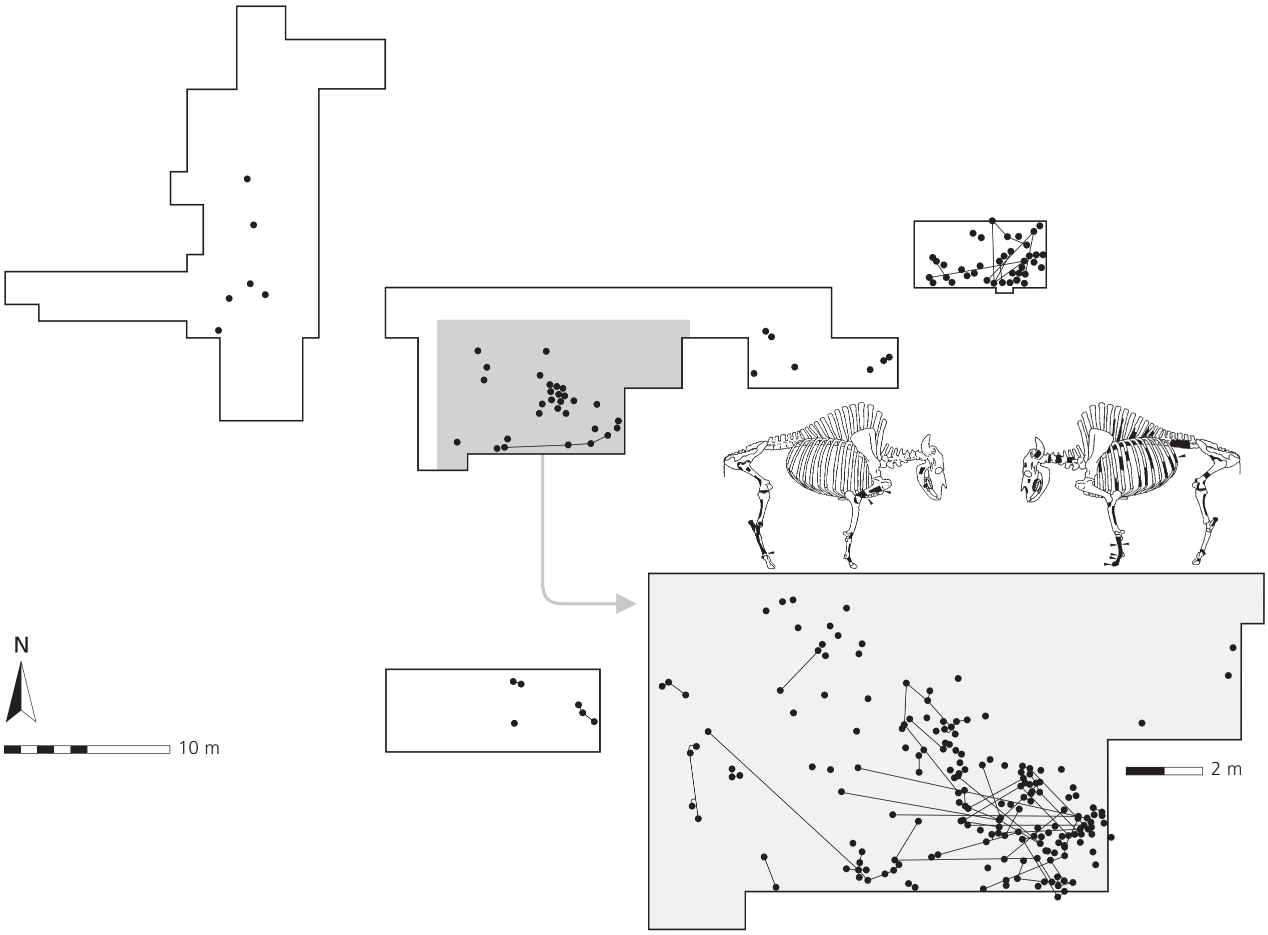

Fig. 12 Distribution of isolated bovid remains in areas 1, 2, 3 and 4 and carcass of a bovid in area 2. Lines indicate refits between bones.

bearing deposits provide the background to the hominin use of the site. During the second half of the interglacial phase, and at a time when the locality was situated in the floodplain of the Rhine, hominins utilised the site. During interglacials, valleys with wide floodplains probably teemed with wildlife, representing a high biomass with strong seasonal fluctuations. At Miesenheim I, the close proximity of an open body of water would have been an added attraction to hominins, not only as a source of water for themselves, but also as a watering hole for animals they regarded as prey.

What is lacking at Miesenheim is stronger evidence of hominin interaction with the faunal remains. The conchoidal flake scar on the long bone of horse or large bovine and the putative cut marks on the red deer mandible offer a tantalising indication of which animals hominins were interested in, but no more than that. In contrast, the lithic assemblage gives us some information about hominin activities here. Miesenheim I was a place where hominins produced stone tools made of local raw materials, which they may even have acquired at the site itself. The distribution of the debris they left behind indicates that at this time at least, areas 2 and 3 must have been relatively dry, representing a land surface which hominins could move over and where they could produce lithic tools.

Hominins were well aware of the potential of localities such as Miesenheim I, and this site may have been just one of a number of areas that were visited either once or even on a regular basis as part of hominin movement and land-use in this area of the Central Rhineland. The use of these sites may also have seasonally fluctuated. Although there is evidence at Miesenheim I for deposition of faunal remains throughout the year, seasonal indicators suggest deposition of many remains during the colder periods of the year when numbers of some species increases, during the rut, for example. These situations could have been observed and specifically exploited by hominins. Recent analysis of tracks of *Homo erectus* footprints at Ileret in north-western Kenya indicates repeated use of lakeshore habitats by hominins (Roach et al. 2016). The orientation of the tracks suggests hominins generally moved along the lakeshore, following the land-water ecotone. This is not only an effective way of foraging for both plants and animals, but also mirrors patterns of land-use by modern-day carnivores, which follow fixed waterways where densities of prey are high and where washed ashore carcasses offer scavenging opportunities, a strategy that reduces both search and stalking efforts (Roach et al. ibidem). A similar scenario can be extrapolated to the Rhine Valley during a Middle Pleistocene interglacial. Here hominins would have moved over the landscape following the banks of a changing system of braided river channels, ox-bow lakes and flood-plain ponds, where they would have encountered high densities of prey and stranded carcasses of animals. Close to one of the ponds, hominins stayed on a relatively dry area of land and produced artefacts of quartz, quartzite, siliceous slate and river flint. They smashed open a long bone to procure marrow and may have disarticulated the carcass of a red deer, before moving on again. This ephemeral use of the site appears to have been limited to the interglacial phase; since the same pond or lake-side site was no longer attractive during the following glaciation.

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