Revisiting the Middle Palaeolithic site Volkringhauser Höhle (North Rhine-Westphalia, Germany)

Eine Neubetrachtung des mittelpaläolithischen Fundplatzes Volkringhauser Höhle (Nordrhein-Westfalen, Deutschland)

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Summary - In the current article the Palaeolithic material of the Volkringhauser Höhle is presented comprehensively for the first time. The material came to light during the course of two different archaeological activities: an excavation in 1928 and surface collection in 1940. A first question to be answered is whether the archaeological material is chronologically homogeneous. As nearly no information about the stratigraphic context is available, the chronological interpretation rests upon the typological and the technological analysis of the lithic artefacts, the analysis of the faunal remains and upon two AMS dates on bones with anthropogenic modifications. The results suggest an interpretation of the entire archaeological material as late, i.e. interpleniglacial, Middle Palaeolithic, whereby especially the age of the dated bones at around 41 000 BP supports this view. A specialty of the assemblage is the presence of blades and bladelets and the respective cores. It has been demonstrated that such artefacts are not rare in Middle Palaeolithic contexts and, furthermore, they find parallels in the Middle Palaeolithic sequence of the nearby Balver Höhle. The attempt to equate the material of the Volkringhauser Höhle with a specific Balver horizon failed due to overlaps with all of the assemblages there. In a last step functional issues of the site have been considered. Here it became clear that the Volkringhauser Höhle assemblage represents several occupational events; one "macro move", i.e. a change of the inhabited area, as well as a "micro move" could be proven.

***Zusammenfassung -** Im vorliegenden Artikel wird das steinzeitliche Fundmaterial der Volkringhauser Höhle im Hönnetal erstmals umfassend vorgelegt. Das Material kam im Zuge zweier archäologischer Aktivitäten zutage: einer Ausgrabung im Jahre 1928 und einer Aufsammlung im Jahre 1940. Dabei stand zunächst die Frage nach der chronologischen Einheitlichkeit im Zentrum des Interesses. Da nahezu kein stratigraphischer Kontext überliefert ist, basiert die chronologische Einordnung vorwiegend auf der typologischen und technologischen Analyse der Steinartefakte, der Analyse der Fauna und auf der naturwissenschaftlichen Datierung zweier Knochen mit anthropogenen Modifikationen. Die Ergebnisse dieser Analysen legen eine Einordnung des gesamten archäologischen Materials ins späte, d.h. interpleniglaziale Mittelpaläolithikum nahe, wobei insbesondere das Alter der beiden datierten Knochen von ca. 41 000 Jahren diese Annahme stützt. Eine Besonderheit des lithischen Materials ist das Vorhandensein kleiner Klingen und Lamellen und der dazugehörenden Kerne. Es konnte gezeigt werden, dass diese keine Seltenheit in mittelpaläolithischen Inventaren darstellen und darüber hinaus eine Entsprechung in den mittelpaläolithischen Horizonten der Balver Höhle finden. Eine versuchte Parallelisierung des Materials der Volkringhauser Höhle mit einem der Balver Horizonte offenbarte einerseits eine Homogenität innerhalb der Balver Sequenz hinsichtlich der angewandten Konzepte zur Grundformproduktion und andererseits technologische und typologische Überschneidungen des Volkringhauser Materials mit allen Balver Horizonten. Es konnte weiter gezeigt werden, dass das Material der Volkringhauser mehrere Begehungen repräsentiert, wobei sowohl ein "macro move", d.h. ein Wechsel des Nutzungsareals, als auch mindestens ein "micro move" innerhalb eines Nutzungsareals, belegt ist.*

Keywords - Volkringhauser Cave, North Rhine-Westphalia, late Middle Palaeolithic, AMS-dates, lithic typology & technology, faunal remains, land use model
Volkringhauser Höhle, Nordrhein-Westfalen, spätes Mittelpaläolithikum, AMS-Daten, lithische Typologie & Technologie, Faunenreste, Landnutzungsmodell

Introduction

Our interpretation of Middle Palaeolithic material is defined by traditions and conventions that have developed over many years. Thus our classification and chronological interpretation goes back to systems developed by, among others, F. Bordes (1961) and G. Bosinski (1967). For a long time these systems functioned quite well and guaranteed a basic level of comparability between different assemblages. But, as G. Freund (2001: 67) has rightly pointed out, unambiguous attribution to one of the conventional cultural units of the western and central European Mousterian and Micoquian was often difficult or even

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impossible. This may partly be down to the fact that Middle Palaeolithic material in general defies classification due to high variability within the analysed assemblages. The works of W. Weißmüller (1995), J. Richter (1997) and T. Uthmeier (2004b) have to be considered as major steps towards a revisited view of the central European Middle Palaeolithic. Here, special interest was given to functional considerations and to the reconstruction of so called land use patterns. Moreover, new methods of lithic analysis (Richter 1997; Pastoors 2000, 2001; Jöris 2001; Soressi 2002) and combining results of lithic and faunal analyses to isolate single occupational events (Bataille 2006) have contributed to draw a more complex picture of prehistoric hunter-gatherers. At the same time, the distinction between the Middle Palaeolithic on the one hand and the Upper Palaeolithic on the other hand has become more blurred.

The problems described above become more obvious in cases when archaeological material derives from old, often unsystematic excavations or from surface collections lacking any stratigraphic information. The current article presents the results of a master's thesis presented in 2006 which deals with exactly this issue using a study of the archaeological material from the Volkringhauser Höhle. This had been recovered by two different archaeological activities, an excavation and a collection, which both took place in the first half of the last century. The material recovered by excavation was classified as Middle Palaeolithic and is already published (Andree 1928c; Brandt 1964; Bosinski 1967). First of all, it was necessary to determine, whether the material recovered by both archaeological activities represents the same technocomplex. Only in a second step was attention paid to the question of how to interpret the site in a regional and functional context. In this, the nearby Balver Höhle played a key role and was considered a reference site for chronological and functional issues.

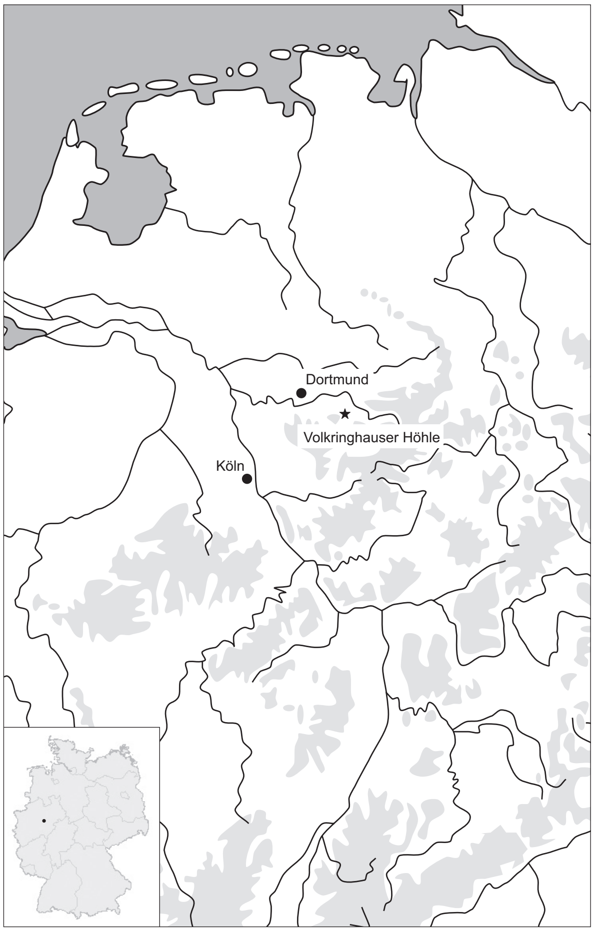

Fig. 1. Geographic location of the site Volkringhauser Höhle.

Abb. 1. *Geographische Lage der Fundstelle Volkringhauser Höhle.*

The site – geographic setting

The Volkringhauser Höhle is located in the Hönne valley, in the south of Westphalia (Germany), about 50 km southeast of Dortmund (Fig. 1). In its middle reaches between Balve and Oberrödinghausen the Hönne, a tributary of the Ruhr, crosses a Devonian reef limestone formation through a narrow karst valley. The small cave is situated within this karst valley, 16 m above today's river in the small village of Volkringhausen (Märkischer Kreis).

More than 20 caves are known from the Hönne valley, with the Volkringhauser Höhle being one of 14 that yielded archaeological remains. However, apart from the Volkringauser Höhle only four of the caves contained Palaeolithic remains: the Balver Höhle, the Burschenhöhle, the Honerthöhle and the Feldhofhöhle (Bosinski 1984).

The cave entrance is 2.50 m high and 4.80 m wide, and opens to southwest, revealing a cavity with a maximum length of five meters and a maximum width of four meters. The cave does not offer much space as the ceiling plunges quickly at an acute-angle in a south-eastern direction (Fig. 2). Today the slope in front of the cave drops away abruptly and conjectures about a possible former platform remain hypothetical.

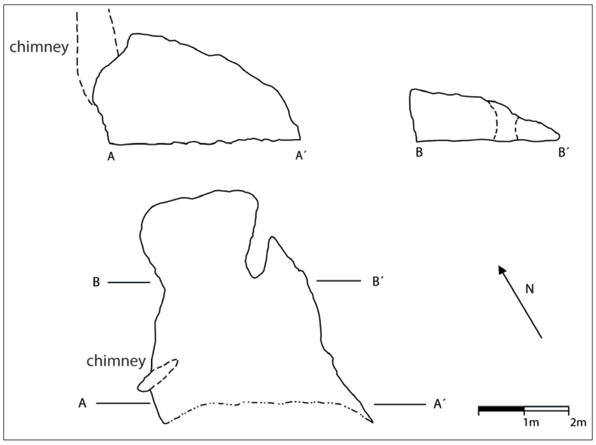

Fig. 2. Horizontal and vertical projection of the Volkringhauser Höhle (based on surveys of Stoffels 1983, cataster No. 4613/ 021).

Abb. 2. *Grundriss und Aufriss der Volkringhauser Höhle (nach Vermessungen von Stoffels 1983, Kataster Nr. 4613/ 021).*

The archaeological material – a critical analysis

The caves of the Hönne valley already attracted scientists such as R. Virchow, H. von Dechen and H. Schaaffhausen (Günther 1988) in the second half of the 19th century, following the discovery and publication of the eponymous Neanderthal fossil from the Kleine Feldhofer Grotte. The Balver Höhle was identified as archaeological site very early, but this did not prevent the cave deposits from being destroyed for agricultural purposes. By the end of the 19th century the archaeological deposits of the two largest caves of the Hönne valley, the Balver Höhle and the Feldhofhöhle, had nearly been destroyed (Günther 1988). First archaeological activities within the Volkringhauser Höhle may have taken place in the 1890s by E. Cartaus, however nothing is known about possible finds and no documentation exists (Bleicher 1991: 71). Around 1900 a drying oven was built in the western part of the cave and the removed sediments were discarded down slope without paying attention to their archaeological potential. In the first half of the 20th century J. Andree conducted several excavations in the caves of the Hönnetal, starting his work at the Volkringhauser Cave at Easter of the year 1928 together with K. Brandt. In the course of their excavation they recovered 24 lithic artefacts and numerous faunal remains. Since the lithic remains were stored together with material from other excavations and no excavation documentation exists, only 14 artefacts can now be certainly identified by reference to publications of Andree (1928c) and Brandt (1960).

In 1940 a hobby archaeologist called Schneider collected 280 lithic artefacts and a few faunal remains from in front of the cave. His collection must be interpreted as potentially reflecting all activities that had taken place previously (sampling sediments derived from Cartaus's excavation, the building of the oven and Andree's excavation). Only a short publication in a local journal reported the finds of this collection (Frese 1971). Besides the publications of the excavators themselves, the remains of the excavation by Andree have been referred to in publications of Bosinski (1967) and Günther (1988). Andree's interpretation of the archaeological remains can be neglected as they were characterised, at least at the end of his work life, by his national socialist mindset (Andree 1939). Bosinski also described Andree's work as „tendentious" (1967: 13; for a critical reconsideration of Andree's professional life see: „http://www.catalogus-professorum-halensis.de/indexb1933.html). On the basis of a typological analysis both Bosinski (1967) and Günther (1988) placed the assemblage in a Middle Palaeolithic context.

Little is known about the archaeological context of the remains discovered during the excavation. According to Brandt (1960: 84) the thickness of the archaeological layer varied between 20 cm in the area of the entrance and 50 cm at the back of the cave, where most of the remains were discovered. This could be due to the fact that the reef limestone (Massenkalk) formation strikes in this direction and the bedrock shows a slight dip towards the south. Therefore, natural processes may have favoured an accumulation of the material in this part of the cave. The sediment is said to have contained a large amount of limestone cobbles (Andree 1928c: 160; Brandt 1960: 84) and, in addition to that, parts of the sediment were sintered. Sherds of Iron Age pottery were detected above this layer (Brandt 1960: 86; Bleicher 1991). According to Andree (1928c: 160) stratification could not be identified within the layer containing the Palaeolithic remains and he concluded that the horizon has to be considered as homogeneous. This deduction may have been caused by the fact that the excavation technique is described as less than careful (Brandt 1960: 84). The excavation technique

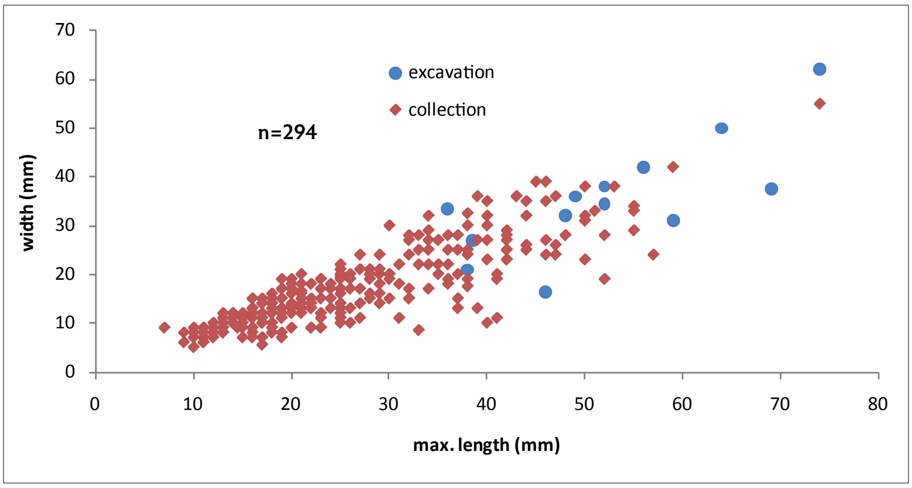

Fig. 3. Length and width of artefacts of different archaeological activities.

Abb. 3. *Längen- und Breitenmaße der Steinartefakte unterschiedlicher archäologischer Tätigkeiten.*

may also explain the high discrepancy in the number of lithic artefacts found, only 24 recovered during the excavation and 280 by subsequent collection.

A comparison of the length and width of artefacts from the different archaeological activities reveals that those discovered during the excavation are among the largest, whereas the artefacts recovered by collection display a homogeneous distribution (Fig. 3). This suggests that the standard of collecting must be considered quite good because artefacts of small dimensions as well as of larger dimensions were found. Comparison of the collected artefacts differentiated according to their raw material (Fig. 4) shows that flint artefacts smaller than 20 mm are well represented within the sample in contrast to artefacts made of siliceous schist. On the one hand this divergence might be explained by the different colour of the raw material. All flint artefacts show a thick white patina and could easily be detected against the surrounding sediment. However, the colour of siliceous schist varies from dark brown and grey to black, making it more difficult to distinguish the artefacts from the surrounding sediment. On the other hand the distribution (Fig. 4) may indeed mirror the original situation and would then need to be explained by anthropogenic factors. In summary, it can be assumed that a representative amount of archaeological remains was recovered from the site and that only small artefacts of siliceous schist may be underrepresented.

Lithic artefacts – typological and technological analysis

Archaeological remains from old excavations lacking all or most information on the archaeological context pose specific problems for the archaeologist. First of all it must be evaluated whether material left by different archaeological activities represents the remains of one and the same technocomplex. This can be verified if no typological and technological contradictions can be detected taking into account the raw material. Beyond doubt it is obvious that both typological and technological analyses bring with them specific restrictions. A chronological interpretation of an assemblage cannot solely rest upon a typological approach, as many tool or blank types are not chronologically significant. The same is true for a technological analysis; several core reduction concepts occur at different times in prehistory. A chronological assessment of the material can therefore only be based on different lines of argument. This was done when evaluating the archaeological material of the Volkringhauser Höhle.

The raw material

Following J.-M. Geneste (1988) raw material provenance was classified as local (< 5 km), regional (>5 km/< 20 km) and supraregional (> 20 km). As a local raw material siliceous schist was available in the vicinity of the site either in primary position, between three and seven kilometres from the site, or as pebbles of the small river Hönne. The colour of siliceous schist ranges from black to grey brown and sometimes even red, and is due to the amount of specific chemical elements Floss 1994: 62 ff.). The very homogeneous, black variety that has a high carbon content is often called lydite. According to Jöris (1992: 10) this variety was available in a dry valley 1 km north of the Volkringhauser Höhle. For the production of artefacts river pebbles were the most practicable material as these have been reduced by fluviatile transport to the densest and most homogeneous parts of the original matrix. The pebbles occur either as thin (2 cm) plaques or as thicker ones, up to 10 cm in thickness and 15 cm in length, and often show traces of rounding. In the

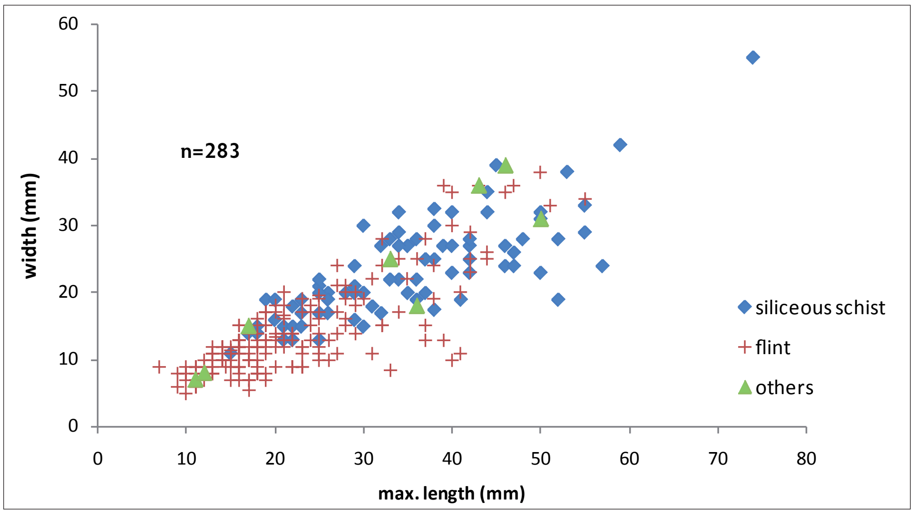

Fig. 4. Length and width of lithic artefacts of different raw material of the collection.

Abb. 4. Längen- und Breitenmaße der Steinartefakte der Aufsammlung unterschieden nach Rohmaterial.

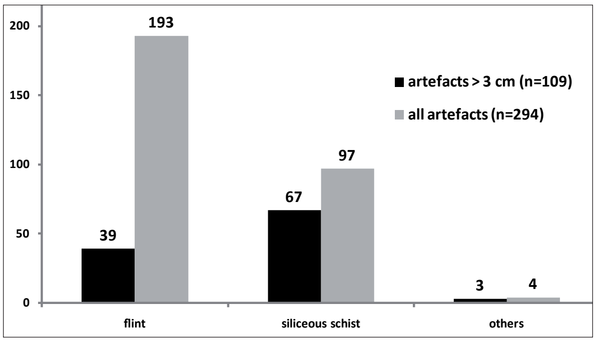

Fig. 5. Distribution of raw material used for the production of lithic artefacts (pieces > 3cm black; all pieces grey).

Abb. 5. *Zur Herstellung von Steinartefakten verwendetes Rohmaterial unter Einbeziehung aller Stücke (grau) und ausschließlich derjenigen > 3 cm (schwarz).*

case of the Volkringhauser Cave natural surfaces of the artefacts with traces of fluviatile transport show that river pebbles were preferentially chosen as raw material. For 27 pieces the shape of the raw nodule could be reconstructed; six artefacts were made on thin slabs whereas 21 artefacts were produced on rectangular pieces of more than 2 cm thickness.

In addition to siliceous schist, greywacke was available in a local radius of the site. Like schist it constitutes the main gravel component of the small river Hönne. Despite this, its use is only proven by three lithic artefacts. In total, 101 artefacts were made of local raw material (Fig. 5).

The third raw material component was flint (Fig. 5). Unfortunately, nearly all artefacts (n=191 of 193) of this raw material are patinated, which complicates secure raw material classification. The preserved cortex remains are in most cases chalky, white and highly reduced with scars of glacial transport, and thus suggest a classification as Nordic flint. This raw material was available 20 to 25 kilometres north of the cave along the southern border of the Elster and Saalian maximal glacial advances (Floss 1994). Five flint artefacts show another kind of cortex and their macroscopic features make a classification as rounded flint pebbles from Tertiary beach deposits, so called "Maaseier", probable. The eastern border of the distribution of this raw material runs along the heights of the Bergisches Land (Floss 1994: 99). If the classification as Maasei is true, transport over 50 km has to be assumed, which is not unusual within a Middle or Upper Palaeolithic context (Féblot-Augustins 1997). However, these pieces have to be considered as exceptions within the assemblage.

Of the Volkringhauser Höhle assemblage, 193 pieces (66%) are made of flint, while 101 pieces (34%) are made of the local raw materials siliceous schist and greywacke. If pieces smaller than 3 cm are excluded, a different picture arises; artefacts of local material (siliceous schist) dominate with 66% (n=67), whereas flint artefacts are represented by only 39 pieces (36%)

	flint	local raw material	total
chips	38	4	**42**
flakes			
flake, Levallois (2nd/ 3rd order)	0	2	**2**
flake, preparation flaking surface	6	0	**6**
flake, preparation striking surface	4	0	**4**
flake, simple	39	33	**72**
flake, crested	1	7	**8**
flake, natural crest	1	13	**14**
flake, surface shaping	2	3	**5**
flake, transversal	4	9	**13**
outrepassé	1	1	**2**
blades			
blade, crested	2	0	**2**
blade, natural crest	0	3	**3**
blade, simple	10	3	**13**
bladelets			
bladelet, crested	2	0	**2**
bladelet, simple	20	1	**21**
chunks	57	17	**74**
indet.	6	5	**11**
total	**193**	**101**	**294**

Fig. 6. Blank types, differentiated according to raw material.

Abb. 6. *Grundformtypen, unterschieden nach Rohmaterial.*

(Fig. 5). This is in contrast to the nearby Balver Höhle where all Middle Palaeolithic assemblages are dominated by siliceous schist with proportions higher than 90 % (Günther 1964: 100). Flint is represented by higher proportions among the collected finds, which may also be due to the higher probability of discovery because of the patinated white colour of the artefacts.

Lithic artefacts

A total of 294 artefacts was found by the two archaeological activities. The assemblages consists of 71 chunks (24%), eight cores (3%), 182 unmodified blanks (62%) and 33 formal tools (11%). Most pieces (77%) retained sharp edges, whereas 21% showed slightly rounded edges and only 2 % of the artefacts posses rounded edges. Thermal modifications could be observed on 12% of the lithic artefacts. Only 20 of the 294 artefacts showed cortical remains, which only covered from 1 to 40 % of the dorsal face, while only one artefact had a dorsal face completely covered with cortex.

Unmodified blanks

Among the unmodified blanks (Fig. 6) flakes represent the largest group (n=125), with 68 flakes of local raw material and 57 made of flint. Of the different flake types that have been distinguished, only some make a further description necessary:

Simple flakes constitute the largest group regardless of the raw material variety considered (Fig. 6). Among the simple flakes of local raw material, those with

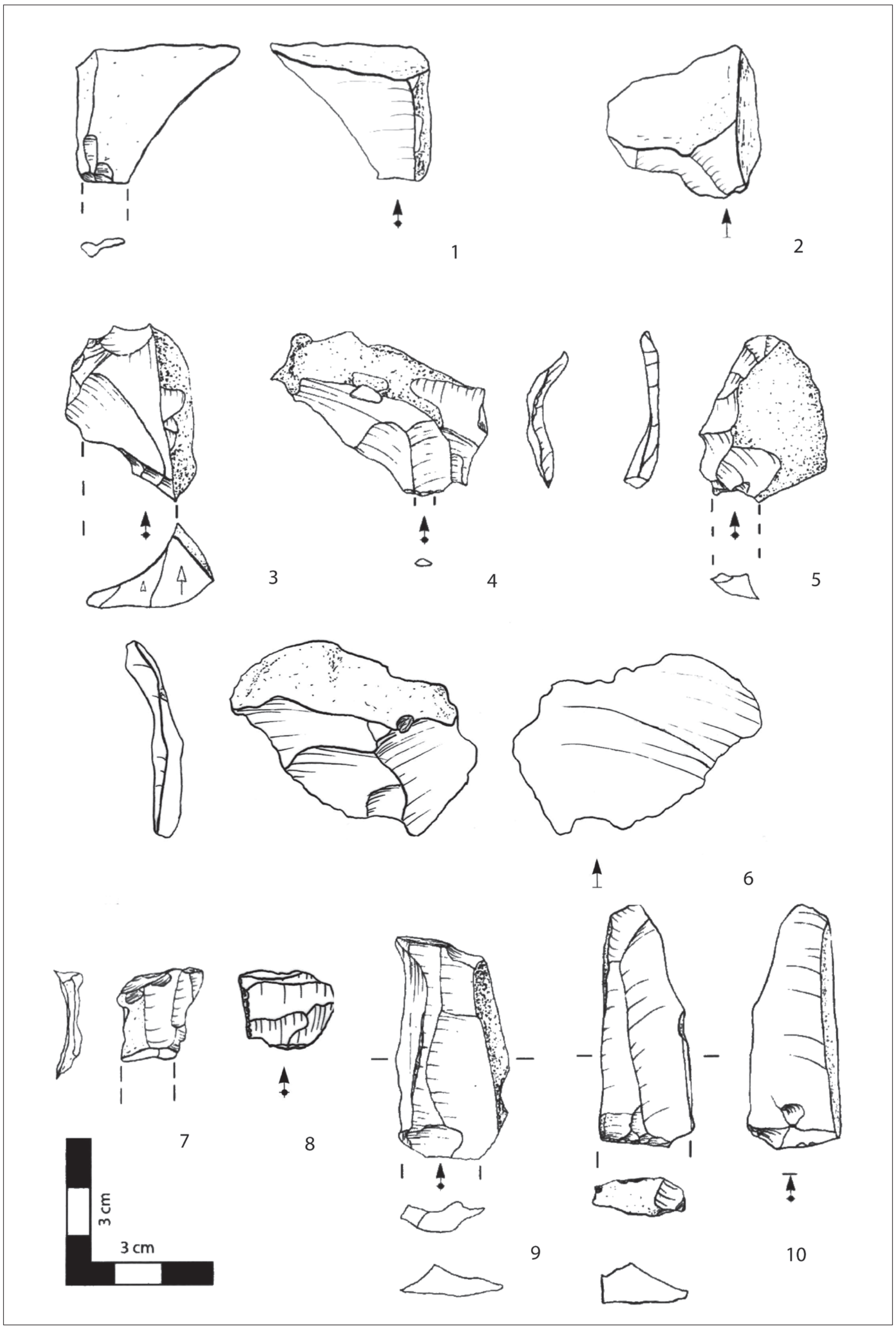

Fig. 7. Lithic artefacts of the Volkringhauser Höhle - different blanks: flakes of the initialisation of a plaquette (1-2); flake with natural crest (3), flakes of surface shaping (4-6), flaking surface preparational flake (7), striking platform preparational flake (8), blades with natural crests (9-10). 1-5 & 9-10 siliceous schist; 6-8 flint; ⅔ natural size.

Abb. 7. *Steinartefakte der Volkringhauser Höhle: verschiedene Grundformen: Platteneck (1)- und Plattenkantenabschlag (2), Abschlag mit natürlicher Kernkante (3), Abschläge der konvexen Formüberarbeitung (4-6), Abbauflächenpräparationsabschlag (7), Schlagflächenpräparationsabschlag (8), Klingen mit natürlicher Kernkante (9-10). 1-5 & 9-10 Kieselschiefer; 6-8 Feuerstein;* ⅔ natürliche Größe.

natural crests ("natürliche Kernkanten") are quite common (n=13; Fig. 7: 1-3). In addition, three out of nine transversal flakes also yielded natural crests. Among the flint flakes only two show parts of natural core crests.

Another six flakes are by-products of convex surface shaping (*"façonnage convexe"* according to Boëda 1994 & 1995). Of these, three are made of flint (Fig. 7: 6) and three of local raw material (Fig. 7: 4-5). All of them show linear butts which indicate use of soft hammer technique. Two flakes off plaque edges show the initial preparation of a rectangular nodule on-site (Fig. 7: 1-2). Among the flint flakes, those classified as results of the preparation of the flaking surface and the striking surface are well represented (n=10; Fig. 7: 7-8). According to their dorsal scar patterns they seem

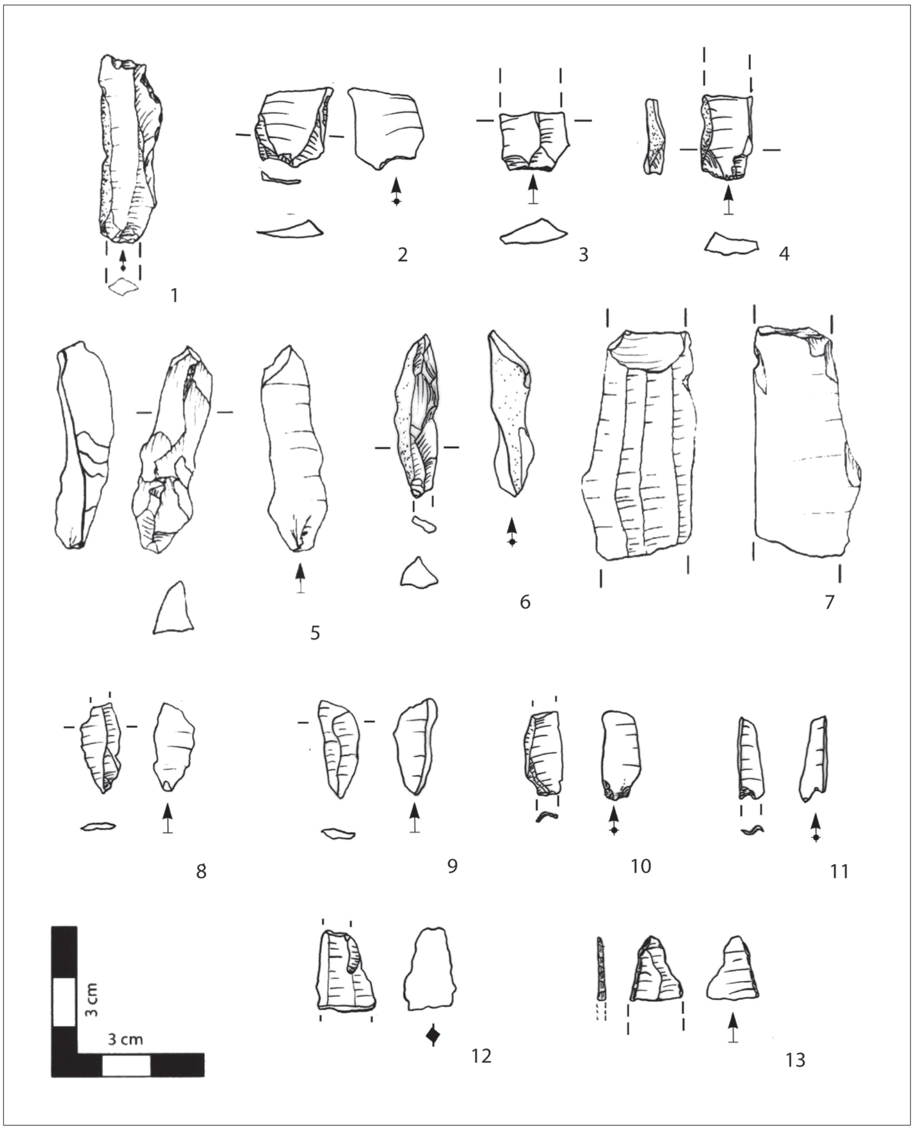

Fig. 8. Lithic artefacts of the Volkringhauser Höhle: Blade (1), blade fragments (2-4), primary crested blade (5), primary crested bladelet (6), flake with parallel dorsal scar pattern (7), bladelets (8-12), fragment of a backed bladelet (13). 1-6, 8-11 & 13- flint; 7 & 12 siliceous schist; ⅔ natural size.

Abb. 8. *Steinartefakte der Volkringhauser Höhle: Klinge (1), Klingenfragmente (2-4), primäre Kernkantenklinge (5), Abschlag mit parallelem dorsalem Gratmuster (7), Lamellen (8-12), Fragment einer rückengestumpften Lamelle (13). 1-6, 8-11 & 13- Feuerstein; 7 & 12 Kieselschiefer;* ⅔ natürliche Größe.

to be related to the unipolar production of blades and bladelets. It is difficult to form a conclusion concerning the percussion techniques applied. In the case of the flakes resulting from convex surface shaping, use of a soft hammer (either soft stone or organic hammer), which was handled in a tangential manner, has to be assumed (Uthmeier 1994; Roussel et al. 2009). For the flakes of local raw material a hard hammer technique has to be assumed because of the less carefully or fully unprepared striking surface, and the pronounced bulbs and rectilinear profiles of the blanks.

Apart from flakes, blades and bladelets are represented by 41 pieces. Blades are defined as pieces with a width larger than 12 mm. Only six blades of local raw material are opposed by 12 of flint. The blades of siliceous schist are larger than those of flint and three of them posses natural crests (Fig. 7: 9 & 10). Both the simple blades and the blades with natural backs may be part of one and the same reduction concept applied to flat, rectangular nodules. Here, blades with natural crests occur at the beginning of a reduction sequence and establish the lateral convexity for the predetermined end-products. The fact that two of the blades show hinge fractures and the striking surfaces are only slightly or not prepared indicates a hard hammer technique. Only one blade shows a dorsal and ventral retouch on the left edge and a partial retouch on the dorsal face of the right edge. The blades of flint are smaller and display more or less standardized widths between 12 and 15 mm. Two of them have been classified as primary crested blades

retouched pieces	flint	siliceous schist	total
side scrapers			
side scraper, déjeté		3	**3**
side scraper (surface shaped)	3	1	**4**
side scraper, abrupt retouch		1	**1**
side scraper, altern. retouch		1	**1**
side scraper, convergent	1	1	**2**
side scraper, double		1	**1**
side scraper, transversal	1	2	**3**
end scrapers			
end scraper		1	**1**
end scraper, short	1		**1**
Groszak		2	**2**
points			
point		1	**1**
double point *(limace)*	1		**1**
others			
backed bladelet	1		**1**
carinated piece	1		**1**
„Faustkeilblatt"		1	**1**
notched pieces		1	**1**
partially retouched piece	1	4	**5**
pièce esquilée	1		**1**
total	**11**	**20**	**31**

Fig. 9. Types of retouched pieces of different raw material (Classification acc. to: Bosinski 1967, Richter 1997, Uthmeier 2004).

Abb. 9. *Formale Gerätetypen getrennt nach Rohmaterial (Ansprache gemäß: Bosinski 1967, Richter 1997, Uthmeier 2004) .*

(Fig. 8: 5), another as secondary crested blade. None of the blades shows subsequent retouch. Only two blades are complete; the majority is represented as basal fragments (Fig. 8: 2-4). The dorsal scar patterns indicate a unipolar reduction concept (Fig. 8: 1-4).

Alongside one specimen made of local raw material, 22 bladelets of flint are represented. Among them are one primary and one secondary crested bladelet. Three bladelets show traces of burning and one shows a backed retouch. Analysis of the percussion technique used revealed that a soft hammer technique has to be assumed for at least seven bladelets. In most cases, these bladelets posses linear butts and display a curved profile; only two show a bulb scar negative ("Bulbusnarbe"). Most dorsal scar patterns suggest a unipolar mode of reduction with only one piece revealing a bipolar scar pattern. The possible reduction concepts will be discussed later in relation to the technological analysis of the cores.

The only bladelet of local raw material represented is a medial fragment (Fig. 8: 12). The dorsal scar pattern displays unipolar negatives. The only other indication for bladelet production using local raw material is a flake that shows a parallel dorsal scar pattern (Fig. 8: 7). As discussed above, the under representation of bladelets and other small sized artefacts may be the result of the uneven mode of collection and must not necessarily mean a definite lack of bladelets.

The retouched pieces

The analysis of the retouched pieces gives first indications regarding the chronological attribution of the assemblage. As already mentioned, a chronological interpretation cannot be based on the presence of so called index fossils alone, but on a combination of analysis of the formal tools and the results of the technological and faunal analyses. Absolute dating may provide another aspect for the line of argument. In total, 33 formal tools are represented (Fig. 9) and thus make up 11% of the whole assemblage. In addition to these, one carinated piece was counted as core (cf. Le Brun Ricalens et al. 2005; Teyssandier 2007). Nearly 60 % (n=20) of the artefacts are complete. None of the retouched pieces shows traces of fire. Cortical remains on the dorsal faces are nearly absent, with 19 pieces showing no cortical remains, four artefacts of local raw material and one of flint having cortex remains up to 40% and only one flint artefact (splintered piece of *Maasei* flint) presenting a dorsal face completely covered with cortex. 14 simple flakes, one Kombewa flake, three flakes with natural crests, two flakes with partially natural crests, one blade, two Levallois flakes of 2nd/3rd order, one bladelet, three transversal flakes and one chunk served as blanks for the retouched pieces.

The retouched pieces will not be discussed in great detail, but some characteristics are pointed out. Their classification follows the nomenclature of Bosinski (1967) and, for the surface shaped pieces, that of J. Richter (1997). The largest tool class (13 pieces) is that of the side scrapers (Fig. 9). Different types of side scrapers are represented (Fig. 10), but pieces with one retouched edge are dominant (n=8). Four simple side scrapers (Fig. 10: 1 & 8) are retouched on surface shaped blanks (for definition of *surface shaping* see Richter 1997: 185; Uthmeier 2004b: 27); two are made of flint and two of siliceous schist. Among the three end scrapers represented, one short end scraper is made of flint and is the only artefact of this raw material that is not patinated. This and the typological classification suggest that this piece does not belong in a Middle Palaeolithic context as this tool type has so far not been documented within a central European Middle Palaeolithic assemblage (e.g. Bosinski 1967). It may therefore be considered as deriving from a Late Palaeolithic or Mesolithic occupation (cf. Demars & Laurent 1989).

Although not a tool in the basic sense, a carinated scraper is present (Fig. 12: 2). Artefacts of this type are traditionally interpreted as index fossils for an early Upper Palaeolithic context. However, it has to be taken into account that carinated pieces, or at least specimens resembling carinated pieces, are also reported from the nearby Balver Höhle. Günther (1964: 79) mentioned several artefacts, which occurred in nearly all the different horizons of the cave and are characterized by lamellar "retouch" along their narrow edges. Moreover, the artefact from the Volkringhauser Höhle has without question to be interpreted as a core, as no preparation of a sharp edge can be observed. In my opinion the occurrence of only one carinated piece and the total lack of other characteristic early Upper Palaeolithic remains suggest that the carinated piece belongs in a Middle Palaeolithic context.

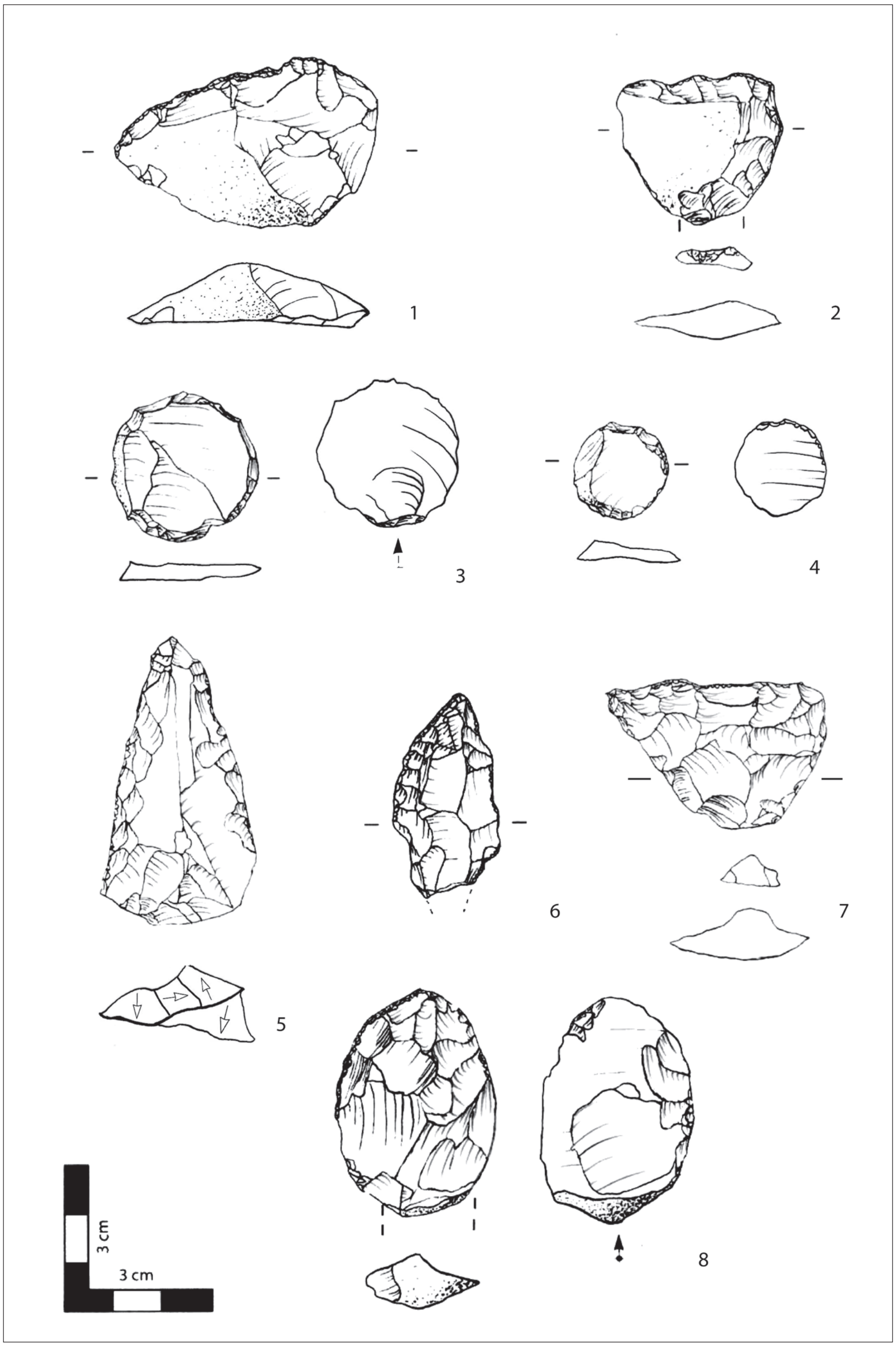

Fig. 10. Lithic artefacts of the Volkringhauser Höhle: side scraper on surface shaped blank (1 & 8), convergent side scraper (2), Groszaki (3 & 4), point (5), double point/ limace (6), transversal side scraper (7). 1, 6 & 7 flint, other siliceous schist. 2, 5 & 8 artefacts of the excavation, all others belong to the collected material; ⅔ natural size.

Abb. 10. *Steinartefakte der Volkringhauser Höhle: Schaber an formüberarbeitetem Trägerstück (1 & 8), Winkelschaber (2), Groszaki (3 & 4), Spitze (5), Doppelspitze/ Limace (6), Breitschaber (8). 1, 6 & 7 Feuerstein, alle anderen Kieselschiefer. 2, 5 & 8 Artefakte der Ausgrabung, alle anderen wurden im Zuge der Aufsammlung geborgen;* ⅔ natürliche Größe.

As an index fossil in the classical sense the so called groszaki (Krukowski 1939-1948) must be taken into account (Fig. 10: 3 & 4). In general this artefact type comprises round and intentionally retouched pieces, which are relatively frequent among late Middle Palaeolithic/Micoquian assemblages in central and eastern Europe. They are also present in the late Middle Palaeolithic deposits of the Sesselfelsgrotte, Bavaria, and Richter points out their chronological significance (Richter 1997: 184). According to him only those pieces showing a circulating but not alternating retouch should be classified as groszaki. He also emphasizes the transitions between groszaki on the one hand, which he classifies as end scrapers, and simple end scrapers and double end scrapers on the other. Pieces that show a circulating, alternating retouch are compared to artefacts of "Type Balve" defined by Bosinski (1967: 33). Use wear analysis of 202 microliths of the assemblages A 01-A 06 of the Sesselfelsgrotte suggest a usage of the microlithic pieces in connection with herbaceous remains (Richter 1997: 184).

In his publication on the newly excavated deposits of the Neanderthal type site Hillgruber (2007) reports a high number of groszaki among the retouched pieces and stresses the significance of this artefact type. However, it has to be mentioned that Hillgruber's definition deviates from Richter's. In contrast to Richter, Hillgruber neglects the kind of retouch and only focuses on the shape, i.e. contour of the artefacts. In doing so, he also includes pieces with alternating or inverse retouch. According to him, a differentiation on the basis of the different kinds of retouch would artificially divide this group (Hillgruber 2007: 344). In this case, however, it is more the position and the kind of retouch that yields conclusions about artefact function than the contour. Use wear analysis would be of great value here to permit conclusions about the usage of these pieces and to demonstrate functional differentiation within this artefact class, beyond the shape of the artefact. Only those pieces in the assemblage of the Volkringhauser Höhle were classified as groszaki that were round in shape and showed a circulating - but not alternating - intentional retouch. According to this classification two groszaki made of local raw material are present. One of them was made on a Kombewa- flake (Fig. 10: 5). Hillgruber also pointed out, that the selected blanks among the Neanderthal material are often Kombewa flakes or flakes from surface shaping (Hillgruber 2007: 342). Both artefacts of the Volkringhauser Höhle assemblage show nearly circulating retouch on the dorsal face which produced blunt angles of around 60° (Fig. 10: 4 & 5). In order to make inferences about artefact function, both pieces were subject to a use wear analysis, but no wear could be detected (pers. comm. K. Sano). However, this does not necessarily imply that they were not used and these results may be paralleled with those of G. Lais (1994; after Richter 1997: 184) for the microliths of the G-stratigraphic complex of the Sesselfelsgrotte, where use of the artefacts for processing herbaceous material only leaves traces of use after a specific amount of time. In sum, it has to be acknowledged that microlithic pieces are not a rarity within late Middle Palaeolithic assemblages. On the contrary, they are a quite frequent component and can be seen as a characteristic feature of late Middle Palaeolithic assemblages (Dibble & McPherron 2006).

Another artefact of putative chronological significance is a point, which, with reservation, has been classified as limace (Bosinski 1967: 32) (Fig. 10: 6). Bosinski considers this formal tool type together with double points of "Type Kartstein" to be index fossils of his different Mousterian assemblage types (Bosinski 1967: 66). What both have in common is the dorsal keel, the completely surface shaped upper surface and the plano-convex profile. The only difference between *limaces* and double points of "Type Kartstein" is given by the partially or completely surface shaped lower surface of the latter. However, the surface shaping of the lower surface is only necessary in cases where no plano-convex cross section is provided by the chosen blank. Therefore the separation of the two tool types seems to be negligible especially because both often occur together in Bosinski's Mousterian of "Type Kartstein", e.g. Achenheim III, Fischleitenhöhle/Mühlbach & Obere Klause II/Essing (Bosinski 1967: 64 ff.). The Volkringhauser artefact displays only a completely surface shaped dorsal face with a keel, whereas the lower face is formed by the ventral face of the selected blank. A surface shaping of the lower surface was not necessary due to the already plano-convex profile. At the proximal part the artefact is broken, the left edge runs concavely and the cross section is thinned. This may indicate a hafting of the artefact. A similar piece can be found in the Sesselfelsgrotte assemblage (Richter 1997: Taf. 62: 1). Richter (1997: 239) also considers the plano-convex profile the characteristic feature of the points of „Type Kartstein". Nearly all double points of the Sesselfelsgrotte show a plano-convex profile but frequently lack the dorsal keel. Richter stresses the fact that double points of the "Kartstein type" are also common within Micoquian assemblages (Richter 1997: 239 ff.), a fact that is considered a further proof for the connection of Mousterian and Micoquian assemblages.

In general, the presence of surface shaped artefacts can be interpreted as a chronological marker for a Middle Palaeolithic context (Fig. 11). For one thing a fragment of a bifacially surface shaped artefact of homogeneous local raw material is represented (Fig. 11: 1). Both retouched edges meet in an acute angle. One edge shows a flat, regular retouch, whereas the other has alternating retouch. Bosinski (1967: 119) has classified this artefact as "Faustkeilblatt". However, as the artefact does not provide a uniform flat profile, but a biconvex one, the classification as Faustkeilblatt seems to be inadequate. The artefact should rather be classified as a fragment of an unidentifiable bifacially surface shaped tool. In addition to that it has been reworked several times. Another piece realized on a flat plaque of local raw material bears resemblance to a Faustkeilblatt (Fig. 11: 2), and should be classified as such. Although the lower surface remained nearly unworked, which contradicts the formal classification, the natural shape of the raw nodule guaranteed the flat profile. The upper surface shows remnants of natural surfaces, but has otherwise been completely surface shaped.

What at first sight seems incongruous is the terminal fragment of a backed bladelet. The left edge shows a regular retouch, struck from ventral to dorsal (Fig. 8: 13). Backed bladelets are not completely

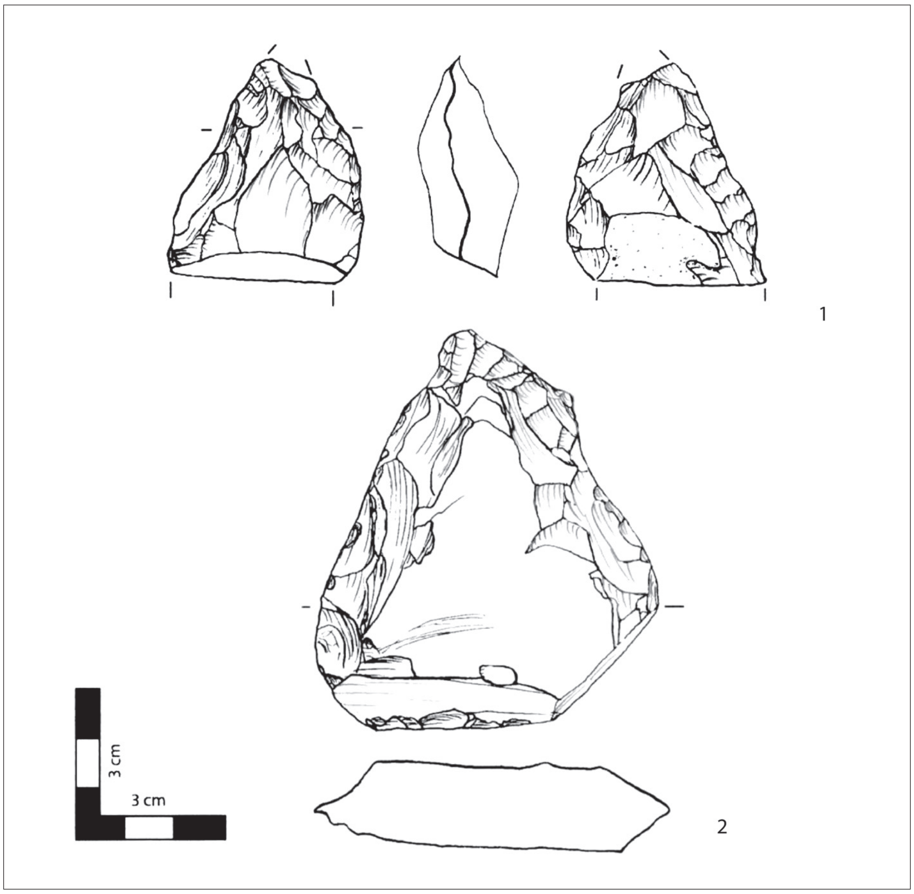

Fig. 11. Volkringhauser Höhle: lithic artefacts of the excavation: fragment of a bifacially surface shaped tool (1), Fauskeilblatt (2). Both local raw material; ⅔ natural size.

Abb. 11. *Volkringhauser Höhle: Steinartefakte der Ausgrabung Andree: Fragment eines bifaziell form-überarbeiteten Werkzeuges (1), Faustkeilblatt (2). Beide lokales Rohmaterial;* ⅔ natürliche Größe.

unknown from Middle Palaeolithic contexts, although they are more typical for Upper Palaeolithic assemblages. Middle Palaeolithic examples have been reported from the 2B layer of Tönchesberg (Conard 1992: 80 ff.) and also from the French sites of Seclin and Rocourt (Révillion 1993; Révillion 1995; Révillion et al. 1994). At Rheindahlen pieces often exceed five centimetres (Bosinski 1974).

To sum up, with the exception of the short end scraper, no retouched artefacts are represented that are uncommon within a Middle Palaeolithic context. In contrast, those artefacts which can be said to have a chronological significance point to a Middle Palaeolithic context. Furthermore, no differentiation could be observed for the raw materials used. Typically Middle Palaeolithic artefacts, such as surface shaped tools and side scrapers were manufactured both of siliceous schist as well as of flint.

The cores

A total of eight cores could be identified within the assemblage, all but one, recovered by the surface collection. All cores were subject to a work step analysis, which will not be reported here in detail, but which will be cited when the technological descriptions are concerned (Richter 1997; Pastoors 2000, 2001). Clear reduction concepts could be observed on four cores (Fig. 12: 1, 2 & 3), whereas all others revealed a rather flexible handling of the given configurations. One of the opportunistic cores of flint (Fig. 13: 1), shows the production of small flakes from a flat nodule. Cortical remains are still visible on both sides of the core. After the flake production the core was used as splintered piece. Another opportunistic core, made of local raw material, also shows an opportunistic production of flakes. All available surfaces were integrated in the reduction sequence.

The only core recovered by the excavation (Fig. 13: 2) is of local raw material and shows features of the Levallois concept (Boëda 1994). Possibly the reduction has been carried out on a flake (*outrepassé*), although no definite conclusion can be reached since no chronological relationship could be established between the production of the preferential flakes and the lower surface. The reduction surface shows two bipolar negatives and a centripetal configuration of the lateral convexities. The knapping axis of the produced predetermined flakes runs parallel to the horizontal cross section of the upper and the lower surface of the core, while the knapping angle of the

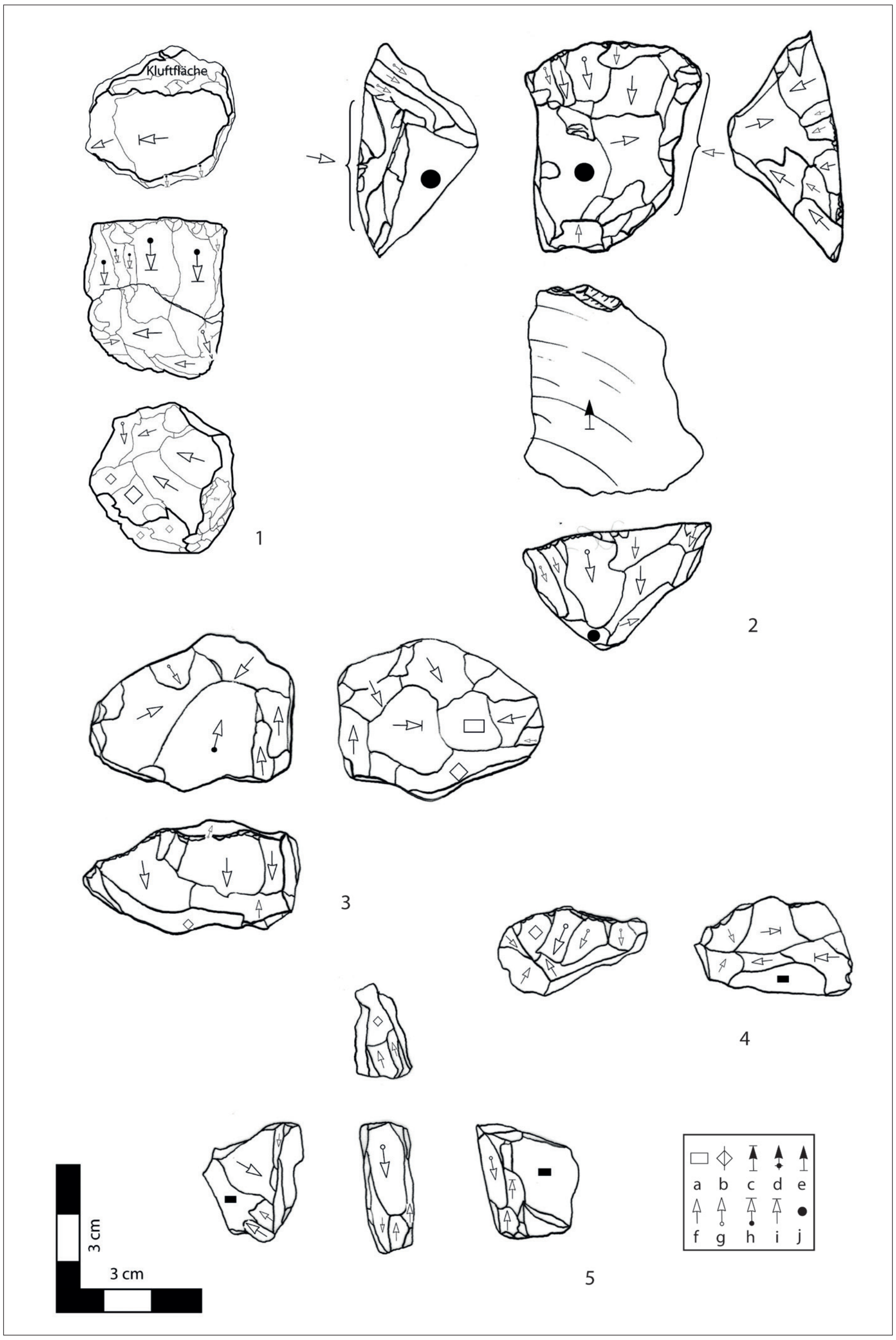

Fig. 12. Volkringhauser Höhle - Cores: unipolar blade core ("semi tournant", 1), bladelet core ("carinated piece", 2), centripetal core (Levallois recurrent centripète, 3), opportunistic bladelet cores (4 & 5). 3 siliceous schist, all others flint. Technological signatures (Richter 1997, 151): open symbols: shape of the ventral face negative; closed symbols: shape of the ventral face positive. a) natural surface b) striking axis known, c) striking direction known, butt not preserved, hinge lip d) striking direction known, butt preserved, e) striking direction known, butt not preserved, f) striking direction known, core crest not preserved, g) striking direction known, bulb negative preserved, h) striking direction known, core crest preserved, hinge fracture, i) striking direction known, core crest not preserved, hinge fracture, j) surface covered with cortex; ⅔ natural size.

Abb. 12. *Volkringhauser Höhle Kerne: unipolar, halbumlaufend abgebauter Klingenkern (1), Lamellenkern ("Kielkratzer", 2), zentripetaler Levallois Kern (3), opportunistische Lamellenkerne (4 & 5). 3 Kieselschiefer, alle anderen Feuerstein. Technologische Signaturen (nach Richter 1997, 151): offene Symbole Zustand des Ventralflächennegativs; geschlossene Symbole: Zustand des Ventralflächenpositivs. a) natürliche Fläche, b) Schlagachse erkennbar, c) Schlagrichtung erkennbar, Schlagflächenrest nicht erhalten, Angelbruch, d) Schlagrichtung erkennbar, Schlagflächenrest erhalten, e) Schlagrichtung erkennbar, Schlagflächenrest nicht erhalten, f) Schlagrichtung erkennbar, Kernkante nicht erhalten, g) Schlagrichtung erkennbar, Bulbusnegativ erhalten, h) Schlagrichtung erkennbar, Kernkante erhalten, Angelbruch, i) Schlagrichtung erkennbar, Kernkante nicht erhalten, Angelbruch, j) mit Kortex bedeckte Fläche;* ⅔ natürliche Größe.

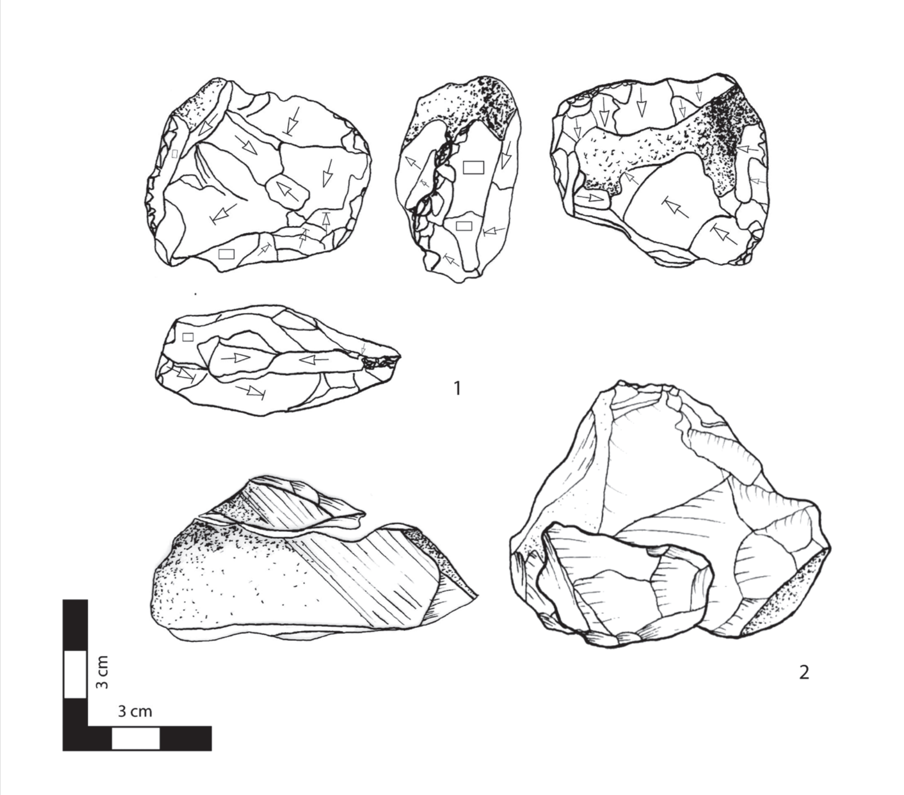

Fig. 13. Volkringhauser Höhle Cores: flake core belonging to a raw material unit with appertaining flake (1), flake core, which has subsequently been used as splintered piece or hammerstone (2); ⅔ natural size.

Abb. 13. *Volkringhauser Höhle Kerne: Abschlagkern der zu einer Rohmaterialeinheit gehört mit dazugehörendem Abschlag (1), Abschlagkern, der anschließen als ausgesplittertes Stück, bzw. Schlagstein benutzt worden ist;* ⅔ natürliche Größe.

preferential flakes is as high as 80°. The core therefore shows some characteristics of the Levallois recurrent bipolar method, although these are not sufficient to classify it definitely as a Levallois core.

Another core which has been assigned to the Levallois recurrent centripetal method (Fig. 12: 3) is made of homogeneous black siliceous schist (lydite). A clear hierarchy between the upper and the lower surface could be observed. After reduction following the Levallois concept, a new reduction surface has been established at right angles to the previous, following which another few flakes were produced. Four cores reveal different strategies to produce either blades or bladelets (Fig. 14). One of them, mentioned previously, resembles a carinated piece (Fig. 12: 2; Fig. 14) and is made from a flake, with its ventral face serving as striking platform. Cortical remains are still visible on the flaking surface. The lateral convexities have been prepared and bladelet production took place on the front side, whereas the opposite side showed smaller negatives and splintering of the edge, which might be interpreted as use wear. This does not contradict the concept of the carinated pieces as cores (cf. Le Brun Ricalens et al. 2005; Teyssandier 2007). Although researchers agree that carinated pieces are mainly cores, some nevertheless show subsequent usage as tools (Schulte im Walde 1987). Furthermore, one flint core reveals a *semi-tournant* reduction to produce small blades (Fig. 12: 1). The reduction sequence started with the preparation of a crested blade (Fig. 14). The distal convexity was realized by rough preparation with the help of intentional *outrepassés*. The striking platform has been rejuvenated by removals of core tablets. As striking instruments both soft stone and hard stone may be considered, as the profile of the produced bladelets (deduced from the negatives still visible on the core) were straight. The core was discarded because the last sequence of bladelets ended in hinge fractures, which may have been due partially to the heterogeneous matrix of the raw material, but was probably also a result of the lack of thorough distal preparation and the use of a hard hammer. With a soft hammer used in tangential manner and by the intentional production of plunged blades the knapper should have been able to cope with this problem. However, a correction of the distal part was not carried out and the core was therefore abandoned. Two other flint cores (Fig. 12: 4 & 5) displayed the flexible, i.e. opportunistic production of small bladelets. Both were struck from chunks and all natural present convexities were used to produce the bladelets (Fig. 14). Although bladelets are traditionally linked with the Upper Palaeolithic and are certainly represented there in higher quantities, they may also occur in Middle Palaeolithic assemblages.

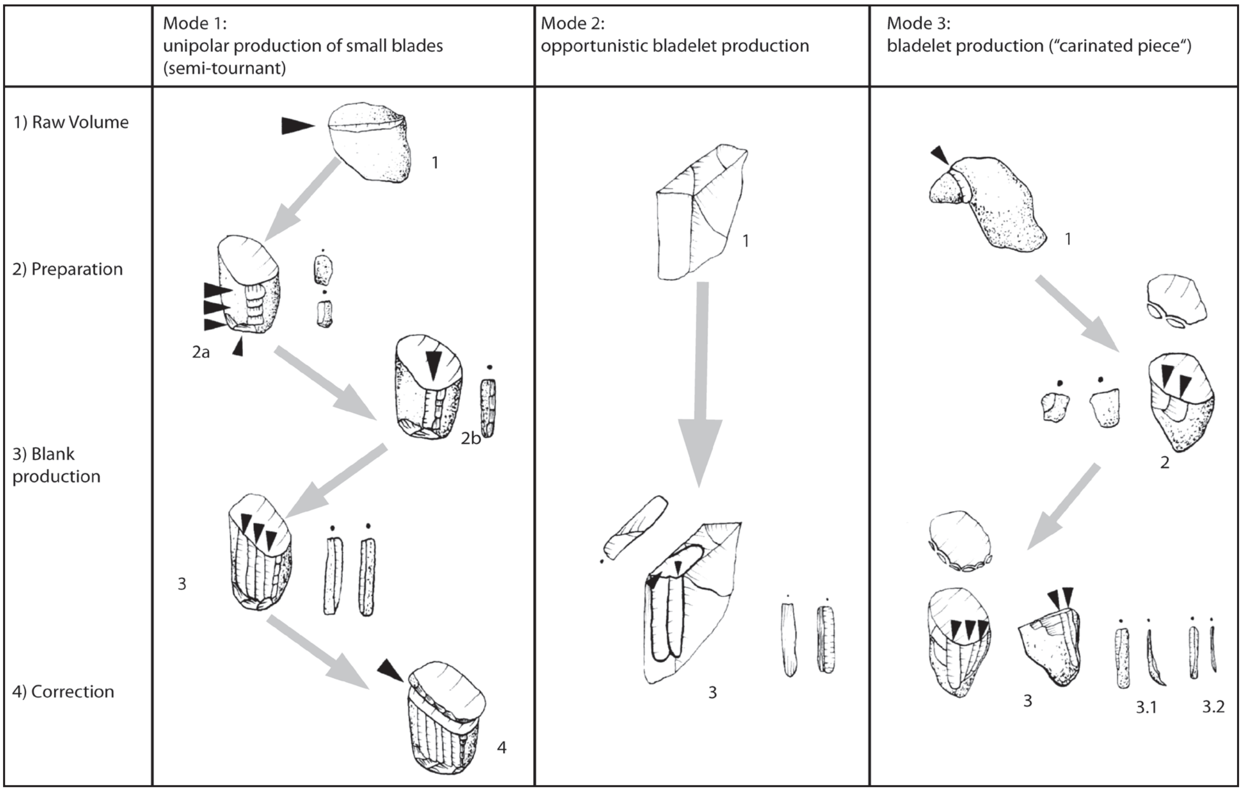

Fig. 14. This figure illustrates the 3 reconstructed modes of blade/bladelet production: Mode 1) unipolar production of small blades via semi-tournant reduction; Mode 2) opportunistic bladelet production by using given configurations of the original raw nodules; Mode 3) bladelet production via "carinated piece" by using a large flake.

Abb. 14. *Diese Graphik stellt die rekonstruierten Operationsschemata zur Herstellung kleiner Klingen, bzw. Lamellen dar. Schema 1) halbumlaufender unipolarer Klingenabbau, Schema 2) opportunistische Lamellenproduktion unter Einbeziehung natürlicher Gegebenheiten der Ausgangsstücke, 3) Lamellenproduktion mittels „Kielkratzer", wobei ein Abschlag als Ausgangsstück dient.*

One recently studied example of this is the nearby Balver Höhle, where bladelet cores are present in nearly all horizons (Pastoors & Tafelmaier 2010). Their production follows natural given configurations of the selected nodules or blanks and thus resembles the bladelet production at the Volkringhauser Höhle.

All but one of the represented cores are of small size and show an intense reduction, thereby displaying a high raw material economy. The evaluation of efficiency in working processes has a long tradition and is arrived at by the application of different methods (Brantingham & Kuhn 2001; Uthmeier 2004b; Pastoors & Tafelmaier 2010). In this case the efficiency of processing was measured by counting all negatives on the core and differentiating according to their function between predetermining (providing convexity), predetermined (exploiting convexity) and both predetermining and predetermined blanks (exploiting convexity by simultaneously providing convexity). This method differs from the one applied to the assemblages of the Balver Höhle (Pastoors & Tafelmaier 2010), in which only the negatives on the reduction surfaces were counted in order to evaluate the efficiency of the working process. Within the reduction sequences of most cores the dominant blanks prevail are both predetermining and predetermined. Only the core discovered by the excavation shows a dominance of preparation blanks. Therefore, with this one exception, a highly efficient processing of the raw material can be proposed (Fig. 15).

Concerning the question of the chronological attribution of the assemblage it has to be noted that typical Middle Palaeolithic reduction concepts are represented. Besides the putative Levallois core (Fig. 13: 2), which displays the reduction of a surface rather than the exploitation of a volume, one recurrent centripetal Levallois core was identified. The unspecific flake cores are not chronologically significant and may occur in different Palaeolithic assemblages. The presence of blade and bladelet cores warrants further consideration, as they are traditionally linked with Upper Palaeolithic contexts. However, several examples of Middle Palaeolithic sites yielding both typical Middle Palaeolithic reduction strategies and blade and bladelets cores side by side are known today. They occur over a vast geographical area and at different periods of time (cf. overview in Pastoors & Tafelmaier 2010). Several examples are known from France at the sites of Seclin, Riencourt-lès-Bapaume and Saint-Germain-des Vaux (Révillion 1993; Révillion 1995; Révillion et al. 1994) or from Spain at the Cantabrian sites of El Castillo and Cueva Morín (Maíllo Fernández 2005; Maíllo Fernández et al. 2004).

Core type	predetermined blanks		predetermining blanks		predetermined and predetermining blanks		natural/old surfaces		unknown		total number of worksteps	
	n	%	n	%	n	%	n	%	n	%	n	%
flake core (levalloid)	2	8	12	48	0	0	4	16	7	28	25	100
Levallois recurrent centripetal	1	4	5	18	12	44	5	19	4	15	28	100
opportunistic core & splintered piece	0	0	8	50	6	38	1	6	1	6	16	100
opportunistic core	0	0	5	25	9	45	4	20	2	10	20	100
carinated piece	0	0	5	21	14	58	4	17	1	4	24	100
opportunistic bladelet core	0	0	0	0	11	65	2	12	4	23	17	100
opportunistic bladelet core	0	0	3	13	12	50	1	4	8	33	24	100
blade core semi tournant	0	0	10	42	9	37	1	4	4	17	24	100

Fig. 15. Efficiency analysis of cores: all negatives on the cores are classified either as predetermining, predetermined and predetermining/predetermined. Afterwards they are counted and a ratio is calculated.

Abb. 15. *Effizienzanalyse der Kerne der Volkringhauser Höhle. Dabei werden alle Negative der Kerne unterschieden in vorherbestimmende, vorherbestimmte und vorherbestimmende/vorherbestimmte Abschläge. Diese werden gezählt und anschließend zueinander in Beziehung gesetzt.*

In Germany such sites are Balver Höhle (Pastoors & Tafelmaier 2010), Salzgitter-Lebenstedt (Pastoors 2009), Tönchesberg (Conard 1992), Rheindahlen (Bosinski 1974) or the Oberneder Höhle/Bavaria (Uthmeier 2004b) (Fig. 16) and the bladelet cores do not therefore contradict a classification of the assemblage as Late Middle Palaeolithic.

Faunal analysis

The faunal assemblage, consisting of 219 bones and antler fragments, was recovered in the course of the excavation by J. Andree and K. Brandt. The remains have been classified in cooperation with Dr. H. Berke (University of Cologne) and recorded in a database. Due to their fragmentary preservation, the finds were first roughly sorted into different size classes (Albrecht et al. 1983), within which are included animals that show similar heights at the withers. If possible, the remains were further classified taxonomically and anatomically. In some cases it was also possible to determine the sex and the age of the individuals. Anthropogenic modifications were documented as well as biotic (e.g. carnivore activity) or post depositional ones.

As with the lithic material, the faunal remains lack clear stratigraphic information, even though they came to light during the excavation. Priority was therefore first given to the question of which species were present and whether the assemblage could be described as homogeneous with respect to the palaeoecology of the represented species or whether species were represented whose habitats are mutually exclusive. In general, it has to be noted that caves were attractive places not only for humans but also for animals (Hahn 1995: 34) and therefore it has to be carefully examined who, human or non human predators, were responsible for the accumulation of the bones. Moreover, even if anthropogenic modifications can be detected on the bones this does not necessarily mean that the animals have been hunted (Binford 1978b, 1978a; see also Gaudzinski 1995). Especially the hunting of large bovids has to be critically evaluated, because chasing large bovids, or indeed species such as mammoth or woolly rhino, would seem to pose a great risk to the life and health of prehistoric hunters (Uthmeier 2006). Without question, both Neanderthals and anatomically modern humans were capable of hunting very large herbivores, but it is doubtful that this type of food procurement was a regular subsistence practice. Hunting very large herbivores may have occurred in some cases, for instance in times of food shortage, but only as an exception to the rule. By contrast, the hunting of middle sized herbivores seems to be the preferred acquisition strategy (Gaudzinski 1995, 1999; Patou-Mathis 2000).

Apart from a number of teeth, none of the bones is complete. In his publication, Andree (1928c, 1939) does not give any number for the recovered bones and only lists the represented species, although his list differs from the one in the current study. It seems as if Andree only considered teeth and clearly identifiable bones and neglected all other finds. However, he attaches special importance to four putative bone artefacts, which will be discussed later.

According to Brandt (1960) the distribution of the faunal remains within the cave seems to be congruent with the distribution of the lithics. As mentioned above, the material is highly fragmented, which is in part due to the less than careful excavation techniques (Brandt 1960: 84) indicated by fresh fracture traces. Many pieces, however, show old fracture patterns. This observation will be discussed in the context of

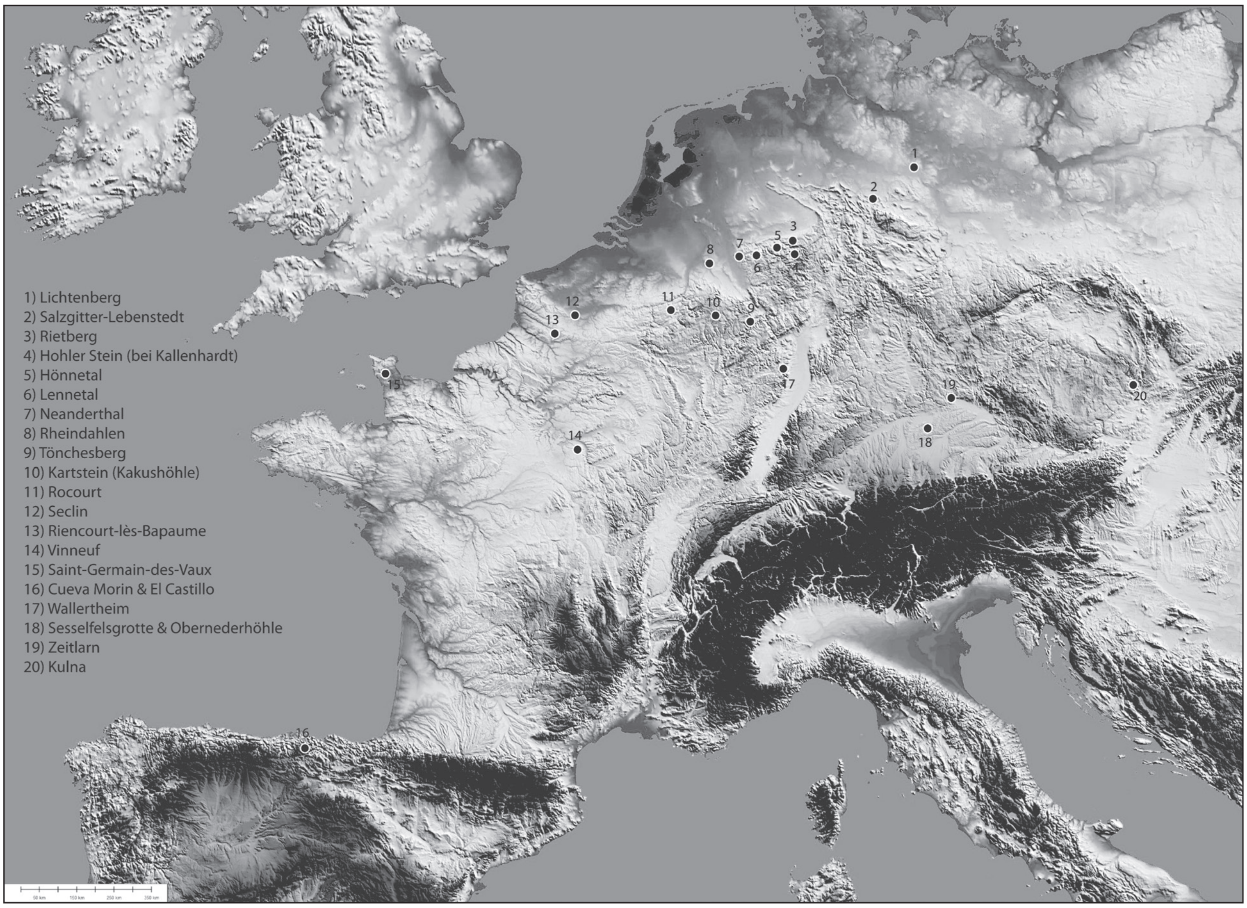

Fig. 16. Location of sites mentioned in the text.
Abb. 16. *Lage paläolithischer Fundplätze, die im Text erwähnt werden.*

anthropogenic modifications. The bone surfaces are in most cases scarcely weathered and relatively well preserved. Rounded, sometimes polished edges may be due to chemical weathering processes (Jöris 2001: 73). Besides, the bones are in some cases slightly fossilized. In comparison to the bones the antler fragments are more fragile and partly slightly decalcified; however, they can also be described as relatively well preserved. The state of both the bones and of the antlers suggests a rapid embedding of the archaeological material without considerable post depositional disturbances.

123 fragments of the faunal remains (56%) could be identified to their genus. An attribution to species was, in most cases, difficult. Nevertheless, all of these pieces were exactly identified anatomically. The remaining 96 pieces (44%) could be sorted to different size classes, whereby 73 pieces (33%) were attributed to size class 5 and 23 pieces (11%) to size class 7. The anatomical position could be determined for only two fragments of the remains of size class 7, whereas 10 pieces could at least be attributed to a skeletal element group. Within size class 7, 18 fragments were classified as splinters of long bones and five pieces were correctly identified anatomically.

Within the faunal assemblage the following species are represented (Fig. 17): *Mammuthus primigenius* (mammoth), *Coelodonta antiquitatis* (woolly rhino), *Panthera leo spelaea* (cave lion), *Ursus spelaeus* (cave bear), *Cervus elaphus* (red deer), *Canis lupus* (wolf), *Gulo gulo* (glutton), *Rangifer tarandus* (reindeer), *Bos* vel *Bison* (aurochs or bison), *Equus sp.* (horse/ass), *Lepus* sp. (hare). A definite taxonomic classification of the bovid remains was not possible due to the lack of characteristic elements to differentiate between aurochs and bison (Gaudzinski 1995: 305; von Koenigswald 2002). Conclusions about relative frequencies of specific taxa are mainly based on estimations of minimum numbers of individuals (MNI), though this method has been criticized and said to be insufficient (Gaudzinski 1995: 356). As a corrective the numbers of identified specimens (NISP) may be added, whereby the exact number of represented individuals is estimated to lie somewhere in between (Gaudzinski 1995: 356). The remains of the Volkringhauser Höhle represent a small faunal assemblage with low MNI and NISP numbers.

Except for one representative of *Rangifer tarandus* and one of *Coelodonta antiquitatis,* which were identified as juvenile, all other individuals were classified as adults. Besides the bone remains 68 shed antlers form part of the faunal assemblage. In addition to these, a small piece of mammoth ivory was identified, which did not show any traces of processing. With the mammoth, the woolly rhino and the reindeer, species of cold, steppe environments are represented. Together with red deer, horse, cave bear and the carnivores cave lion, glutton and wolf they represent the typical combination of the so called mammoth steppe (Guthrie 1990, 1995; von Koenigswald 2002; Bocherens 2003), which characterized the palaeo-environment of Pleistocene hunter gatherers at least since the beginning of the last glacial period. However, the combination of the represented taxa does not allow for a further, more accurate characterization of the palaeoenvironment. This is also hampered by the fact that mammals were capable of adapting to different kinds of environmental conditions. Moreover, microfaunal remains that would allow for a more detailed analysis (van Kolfschoten 1995) are missing. In contrast to the predators and red deer, which is said to show only limited movement within a specific territory, long-range migrations and seasonal displacements are assumed for mammoth, woolly rhino and reindeer (Sturdy 1975; Gordon 1988; von Koenigswald 2002).

Besides the abiotic modifications mentioned above, biotic changes of both anthropogenic and animal origin are visible on the organic remains. Hyena is documented within the faunal assemblage of the Volkringhauser Höhle by gnawing marks and by eight completely digested and excreted bones. The percentage of bones with traces of carnivore activity accounts for 5 % of the whole faunal assemblage (Fig. 18), whereby gnawing marks of hyena could be identified on two mammoth bones, eight bones of size class 7, one bovid bone and two antler fragments.

According to Andree (1927) the assemblage is said to contain four organic artefacts. In his opinion especially the rounded surfaces of the objects suggest such an interpretation (Andree 1928c: 164). Nevertheless, as shown above, the polished surfaces may be due to chemical or depositional processes and do not necessarily imply anthropogenic modification. Unfortunately a review of Andree's assumptions was hampered by the fact that only one of the four putative artefacts could be identified among the organic remains. This "artefact" has been classified by Andree as an awl. However, the putative artefact is a tibia fragment belonging to size class 7, that tapers off distally. Because no unambiguous modifications could be identified, the interpretation as a tool was rejected. It might be that the natural shape of the piece invited prehistoric man to use it as an "*outil de fortune*" (de Sonneville-Bordes & Delpech 1977), but use wear traces could not be identified either.

In contrast, 36 bones showed impact marks and thus the amount of anthropogenic modifications within the faunal assemblage accounts for 12% (Fig. 18). Impact marks are visible on the remains of woolly rhinoceros, red deer, bovids, reindeer and the fragments of size classes 5 and 7 (Fig. 18). The question arises whether those impact marks result from the process of dismembering or from the fragmentation of the bones for marrow extraction and the position of the impact marks is therefore of interest. The positioning on the lateral, distal and proximal parts of the bones implies a fragmentation for marrow extraction, because the bones could not have been in anatomical position when the fragmentation took place. In addition to that, the high degree of fragmentation in general may be interpreted as the result of food processing (Gaudzinski 1995: 371) as no post depositional disturbances are assumed. No cut marks could be identified.

In order to draw further conclusions about the accumulation of the faunal assemblage the remains of mammoth, woolly rhino, red deer, reindeer, bovids and the size classes 5 & 7 with biotic modifications were subjected to an analysis of the represented skeletal elements (Fig. 19). In general, the patterns of body part representation may allow assumptions about the agents of bone accumulation (i.e. animal predators or humans) and carcass exploitation. The question of differentiating between hunting and scavenging activities is a highly debated issue and no consensus exists (cf. Gaudzinski 1995, 1999; Kuhn 1995; Patou-Mathis 2000). If anthropogenic transport can be assumed, the representation of skeletal elements allows conclusions about import and export activities, provided that a critical, taphonomic analysis of the concerned material has previously been conducted. In the current study the anatomical apparatus was

Taxa	MNI (minimal number of individuals)	NISP (number of identified specimen)
Mammuthus primigenius	1	10
Panthera leo spelaea	1	1
Coelodonta antiquitatis	2	12
Ursus spelaeus	1	5
Cervus elaphus	2	4
Bos vel Bison	1	9
Canis lupus	1	4
Rangifer tarandus	1 (+10)	72
Gulo gulo	1	3
Equus sp.	2	2
Lepus sp.	1	1
GK5	-	73
GK7	-	23
Total	**14 (+10)**	**219**

Fig. 17. Represented taxa within the faunal assemblage of the Volkringhauser Höhle. Numbers are given as minimum number of individuals (MNI) and as number of identified specimen (NISP).

Abb. 17. *Repräsentierte Tax im Faunenensemble der Volkringhauser Höhle. Es sind sowohl die Mindestindividuenzahlen (MNI) als auch die Anzahl der einer Spezies zugeordneten Knochen (NISP) angegeben.*

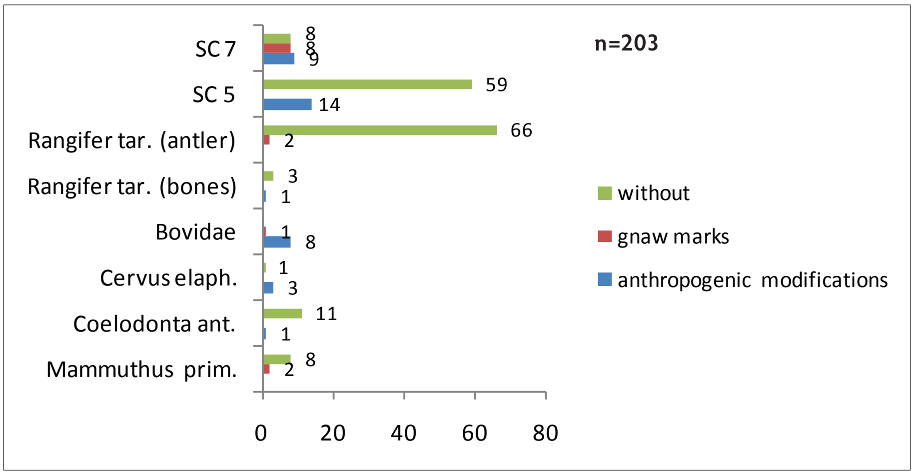

Fig. 18. This diagram shows the different modifications identified on the bones. Modifications are either documented as gnawing marks or as anthropogenic modifications (impact marks).

Abb. 18. *Dieses Diagramm stellt die Knochen mit Modifikationen dar. Veränderungen an den Knochen sind entweder als Verbissspuren von Karnivoren oder als Schlagspuren dokumentiert.*

divided into six groups of specific skeletal elements: SE 1: cranial parts including mandibular and maxillary bones; SE 2: vertebrae; SE 3: ribs, SE 4: scapula and pelvis; SE 5: long bones of the stylo- and zeugopodium including metacarpal and metatarsal bones; SE 6: small bones of the autopodium. In the case of the material from the Volkringhauser Höhle the remains of *Mammuthus primigenius* did not show any anthropogenic influence, but gnaw marks of hyena are present on two ribs. Therefore anthropogenic influence is doubtful and nonhuman predators are seen as major agents in the accumulation of the mammoth remains. With the woolly rhino the picture is different: four parts belong to the SE3 and seven to the SE5 group. Only one fragment of *carpale* 3 belongs to the SE6 group. Anthropogenic influence is indicated by impact marks on the left humerus of an adult individual. Although human agency is proven this does not consequently attest human hunting of this very large herbivore.

All skeletal elements of the bovids belong to the SE 5 group and all bones except one bear traces of anthropogenic modifications. Only one tibia fragment of an adult individual showed gnawing marks of hyena. The pattern of body part representation implies a selective transport of specific body parts to the site. Perhaps the butchering of the animal took place elsewhere. Two metatarsal fragments of *Cervus elaphus* were sorted to the SE 5 group and a lower third molar to the SE 1 group. A fragment of a left calcaneus belongs to the SE 6 group. Except for the molar all remains show anthropogenic modifications placed near the joints; therefore human agency can be postulated. Of the reindeer bones two were sorted to the SE 4 and two to the SE 5 group. Anthropogenic modifications are visible on only one right radius of an adult individual. Reindeer is known to have been a preferred prey species of Middle Palaeolithic hunters in the region (Günther 1964), but whether the remains from the Volkringhauser Höhle can be interpreted as quarry is questionable. Ten out of twelve anatomically identified fragments of size class 5 belong to the SE 5 group, whereas two others were sorted to the SE 4 group. Impact marks could not be identified, due to the fact that pieces are highly fragmented. , Impact marks were visible on five bones which could not be classified anatomically. In contrast, 19 fragments of size class 7 belong to the SE 5 group and four to SE 3 group. Eight fragments had been completely digested and excreted by hyenas; eight others demonstrate anthropogenic influence by impact marks.

To summarize, it must be noted that in all represented taxa the bones of the SE 5 group, i.e. those of the stylo- and zeugopodium, dominate. In addition, ribs from mammoth and rhinoceros are represented. They belong to the body parts of high nutritional value. If all bones showing anthropogenic influence are put together, a similar picture arises: parts of the SE 5 group dominate, while ribs are also well represented. Of the cranial remains only teeth are represented and bones of the autopodium and scapula and pelvis are nearly lacking. Vertebrae are not present. Any further interpretation of the faunal assemblage must be understood as a hypothesis: on the one hand the faunal remains are not numerous, and on the other hand the lack of specific body parts must not necessarily be due to anthropogenic influence (e.g. import and export activities), but to taphonomic processes.

If one nevertheless assumes that prehistoric hunter and gatherers contributed to the accumulation of the faunal remains different scenarios are possible (the following according to Kuhn 1995: 74 ff. and Uthmeier 2004a: 446 ff.).

1) If hunting was the acquisition strategy (and the prey too large to be transported as a whole) one

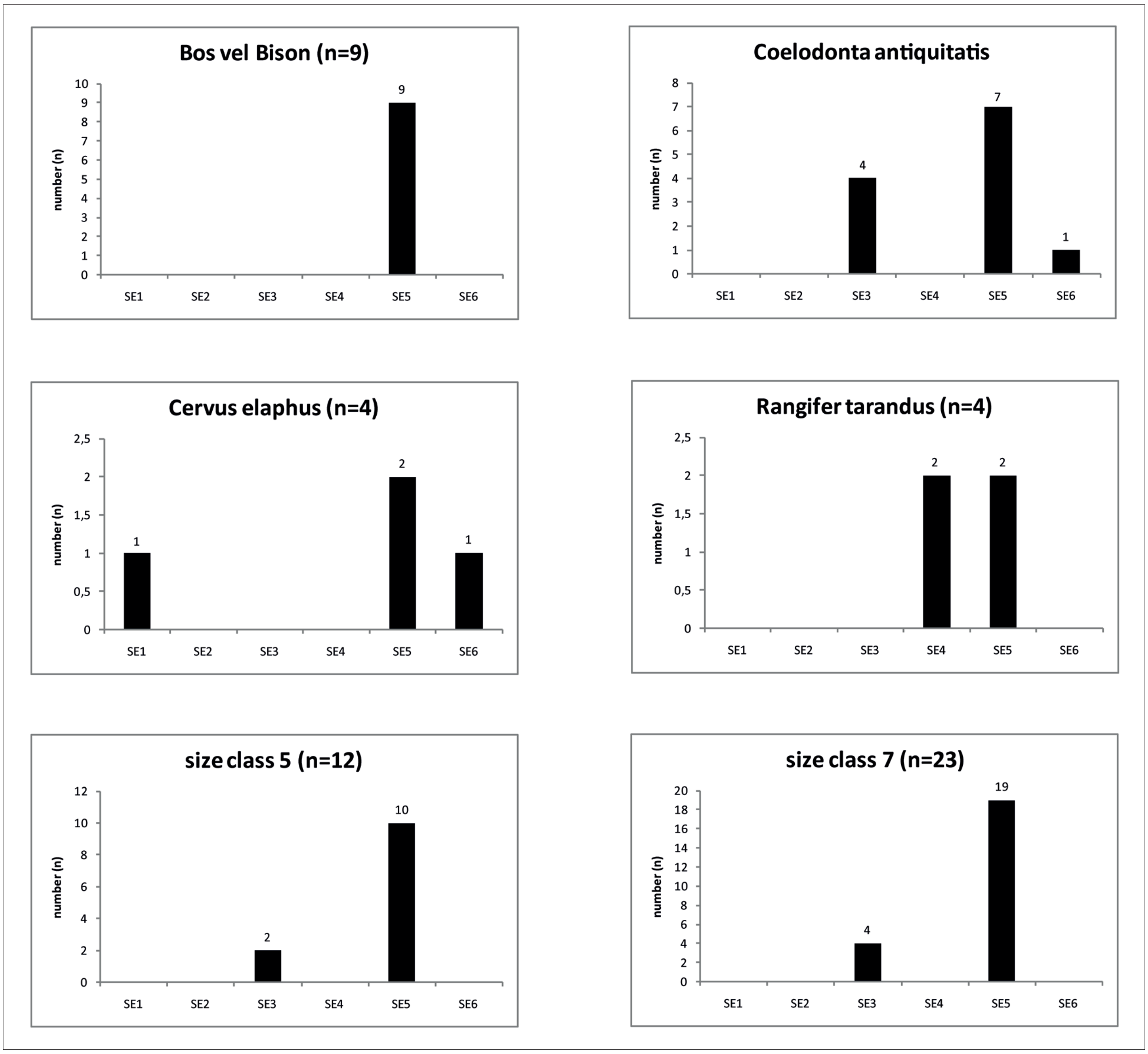

Fig. 19. Analysis of the represented skeletal elements. SE 1 group: cranial parts including mandibular and maxillar bones; SE 2 group: vertebrae; SE 3 group: ribs; SE 4 group: scapula and pelvis; SE 5 group: long bones of the stylo- and zeugopodium including metacarpal and metatarsal bones; SE 6 group: small bones of the autopodium.

Abb. 19. *Analyse der repräsentierten Skelettelemente.SE 1 Gruppe: Craniale Teile inkl. Ober- und Unterkiefer; SE 2 Gruppe: Wirbel; SE 3 Gruppe: Rippen; SE 4 Gruppe: Scapula und Pelvis; SE 5 Gruppe: Langknochen des Stylo- und Zeugopodiums einschl. Metacarpi und Metatarsi; 6) kleine Knochen des Autopodiums.*

supposes that easily perishable parts like the tongue, brain and offal were consumed at or near the place of butchery. Which body parts remain at different sites is due to several factors:

a) In the case of a site where the prey is butchered and afterwards processed and consumed, complete carcasses should be represented.

b) In the case that the prey is only butchered on site and afterwards transported elsewhere, only parts of low nutritional value should be represented on site.

c) If prey is imported, only specific body parts of high nutritional value should be represented and a selective assemblage should be present.

If there was no exclusive access to animal carcasses scavenging has to be assumed and a different picture should arise.

2) In cases of scavenging, body parts of low nutritional value such as cranial elements, parts of the vertebral column and legs should be represented (Stiner 1991: 466 ff.; Kuhn 1995: 74 ff.; Patou-Mathis 2004: 361 ff.;). Such an assemblage, however, may be difficult to distinguish from a killing/butchering site, from which parts of higher nutritional value have been exported. If there are, for instance, no cut marks on the bones and there are no hints that whole carcasses had previously been present on-site an interpretation of the place as a killing butchering site has to be questioned and scavenging has to be taken into account as an alternative. Since anthropogenic modifications are represented on a large set of bones and body parts are represented selectively, human agency may be postulated for the Volkringhauser

	indet.	male	female	male adult	female adult	juvenile	total
right	0	0	0	4	5	1	10
left	0	0	0	1	6	0	7
indet.	32	7	12			0	51
total	32	7	12	5	11	1	68

Fig. 20. Determination of age and gender of shed antler of *Rangifer tarandus*.

Abb. 20. *Alters-und Geschlechtsbestimmung von Abwurfstangen von* Rangifer tarandus.

Cave. The absence of complete carcasses argues against an interpretation as a place where butchering and further processing and a related long-term occupation took place. The remains of *Cervus elaphus*, of which only one tooth and parts of the legs are delivered, may indicate butchering of the prey on site. Furthermore, the lack of ribs and vertebrae, which yield only low amounts of meat relative to their high weight, may hint at the export of most parts of the individual to a nearby place for further processing. The remains of bovids, rhinoceros and reindeer show a selective transport of specific body parts and their consumption on-site. This is also supported by the fact that parts of high nutritional value are represented among the skeletal elements present. Scavenging cannot be proven, but may not be otherwise ruled out. Hunting of very large herbivores has been commented upon critically above.

Moreover, the rather small size of the faunal assemblage may point to single short term occupations by prehistoric hunter gatherers. The diversity of the represented taxa revealed by the low counts for MNI and NISP also favours such an interpretation, if is accepted that the remains of one, and not of different species, were brought to the site during the course of an occupation. The quantity of meat per individual was not calculated because the selective representation of body parts would not have produced accurate data (Klein & Cruz-Uribe 1984: 34).

Apart from the bones, 68 fragments of shed antler of *Rangifer tarandus* are represented (Fig. 20). The question arises how these pieces accumulated at the site. Natural transport mechanisms are excluded due to the geographic setting of the cave and humans or animals are assumed to be the principal agents. Numbers of specimens and deductions about sex and age can be taken from Figure 20. For the major part basal antler fragments are represented and 25 pieces show remains of the burrs. Neither antler tines nor parts of the shovels are represented and there are only a few fragments of the beams. No anthropogenic modifications are visible on any antler fragments. However, the fact that no gnawing marks are present and the antler fragments seem to be selected, mean that anthropogenic transport has to be taken into account. Accumulations of cervid antler are known from different Palaeolithic periods (see an overview in Baales 1996: 97 ff.). At the Middle Palaeolithic site Tönchesberg, 574 fragments of *Cervus elaphus* were recovered within layer 2B, 110 specimens of which are basal fragments with parts of the burrs (Conard 1992). Furthermore, numerous fragments of reindeer antler, mostly from juvenile individuals, were found in the eponymous so called "Rentierschicht" at the nearby Balver Höhle (Günther 1964: 56). At the Aurignacian site Lommersum (Hahn 1989) and the Magdalenian site Petersfels accumulations of antler are assumed to be of anthropogenic origin (Berke 1987: 100 ff.). M. Baales assumes similar human agency for the accumulation of shed antler within the late Palaeolithic layers at the Kartstein site (Ahrensburgian layer) and Hohle Stein/ Kallenhardt (Baales 1996: 99 ff.). Accumulations of antler are also reported from sites without archaeological remains as it is the case in the Oeger Höhle (Westphalia) where 360 fragments of shed antler of female, subadult reindeer individuals were recovered (Hülsken 1991).

Interpretations seeking to explain the accumulations of antler are as numerous as the sites themselves. J. Tinnes (1987) considers the possibility of using antler as fuel, because some pieces of the Tönchesberg 2B layer are burnt. This explanation does not seem to apply to the material from the Volkringhauser Höhle since no burnt fragments are present. M. Baales cites ethnographic data and takes into consideration that ritual purposes may lead to the accumulation of antler (Baales 1996: 100). He further proposes that such accumulations may be caches to store raw material for future processing. However, since the material at the Volkringhauser Höhle is dominated by fragments of female and young individuals and since these fragments are small and thin and not very suitable for the production of tools, this interpretation has to be rejected. Another interpretation is that antler, and especially the compact basal parts with the burrs, may be used as percussors (Hahn 1993). As no traces of this kind can be recognized on the pieces of the analysed assemblage such an explanation has to remain hypothetical. It is possible that antler fragments have been used as striking instruments for only a short period of time and therefore no use wear is visible. It seems that even if humans contributed to the accumulation of the antler fragments in the Volkringhauser Höhle, a satisfactory explanation for this activity cannot be given. Since to a large extent basal fragments are represented, usage as striking instruments seems possible; however extensive use of soft hammer is not mirrored in the lithic assemblage. Indications for seasonal aspects cannot be drawn from the represented antler assemblage. While it is indeed known that male individuals cast their antlers after the rut in late fall, whereas female animals keep their antlers until spring, one cannot assume that the shed antlers were collected immediately after their discard.

Two bones discovered in the course of the excavation with anthropogenic modifications (Fig. 21) were dated by AMS at the Leibniz Laboratory for Radiometric Dating and Isotope Research at Kiel. Both bones, a humerus fragment of an adult bovid (*Bos vel Bison*) and a left humerus fragment of *Coelodonta antiquitatis*, revealed distinct impact marks. Both samples yielded enough carbon for dating (Fig. 22). The δ^{13} value of -20.84 ± 0.18 ‰ for the rhinoceros bone fell within the standard range, whereas the one for the bovid with -25.54 ± 0.28 ‰ was more strongly negative than usual. The samples gave an age of 37 040 + 440/- 410 BP for the rhinoceros bone and 39 870 + 780/- 710 BP for the bovid bone. According to P. Grootes (written communication) a reliable calibration is not possible; he proposes a calendric age near the geomagnetic Laschamp event 41 000 years ago, but also considers an even higher age for both bones possible. Calibration using CalPal07 (online calibration with Weninger, Jöris & Danzeglocke 2010) gave ages of 41 874 ± 370 calBP for the *Coelodonta antiquitatis* and 43 700 ± 738 calBP for the bovid bone. These calibrated ages are not considered as exact results but do support Grootes' assumption.

Discussion

A question that needs to be answered before any further interpretations can be made is whether the entire assemblage of the Volkringhauser Höhle represents the remnants of a Middle Palaeolithic occupation. In the case of the lithic remains it could be demonstrated that those retouched pieces traditionally said to have chronological significance point to a Middle Palaeolithic context. Furthermore, it has been stated that the different inventory types of the Central European Middle Palaeolithic defined by G. Bosinski (Bosinski 1967), which are based on the occurrence of specific index fossils, cannot be regarded as cultural units in space and time, but represent components of the technological knowledge of Middle Palaeolithic hunter-gatherers. The technological analysis gave similar results. The represented reduction concepts reflect common strategies of raw material exploitation during the Middle Palaeolithic and blade and bladelet cores often form part of Middle Palaeolithic lithic assemblages. The presence of a raw material unit (Weißmüller 1995) containing four collected artefacts and a core recovered by excavation, indicates the homogeneity of the two assemblage components. The butt of one flake shows a marked correspondence to the striking platform of the core. Although the pieces could not be refitted directly, the matrix of the raw material and the reconstructed striking angle suggest a position on the core as demonstrated in Figure 13: 2.

The results of the faunal analysis also suggest the homogeneity of the assemblage. The represented taxa mirror the typical co-occurrence of species of the so-called mammoth steppe environment. This admittedly spans a long period of time; however, a more precise chronological attribution was hampered by the lack of micro faunal remains. AMS dating of two cut-marked bones gave similar ages and therefore suggest proximity of time. In the following the whole assemblage will therefore be treated as the remains of a late Middle Palaeolithic occupation of the region, represented by several distinct activities in the Volkringhauser Höhle.

The assemblage of the Volkringhauser Höhle will now be compared with other late Middle Palaeolithic sites to investigate similarities and differences and to evaluate whether the Volkringhauser Höhle falls within the ranges of variability of those sites. Without question the nearby Balver Höhle is of special importance as this site provides a long sequence of different Middle Palaeolithic occupations. Here several excavations have taken place, producing different assemblages and different chronological interpretations. The different layers and their assemblages have been subsumed to five horizons (Balve I, Balve II, Balve II/III, Balve III und Balve IV; see Fig. 23). The oldest horizon Balve I comprises the archaeological remains of layer 1959/6 (upper part), layer 1959/5, A/II and layer B/II. The following horizon Balve II contains the assemblages of layer B/III/1939, B/III fine/1939 and layer 4/1959. Horizon Balve II/III has only been discovered at the entrance and includes the archaeological remains of the so-called "Stoßzahnschicht"/"tusk level" (A/III/1939). From a stratigraphical point of view, this layer can only be placed between horizon Balve I and Balve IV. Layers B/IIIa/1939, 2/1959 and 1/1959/ lower part belong to horizon Balve III. Horizons Balve I to Balve III have all been interpreted as Micoquian because of the presence of bifacial surface shaping (Günther 1964).

The uppermost horizon Balve IV contains the assemblages of layers A/V lower part/1939 and A/Ia/1939. Due to the *quasi* absence of bifacially surface-shaped artefacts this horizon has been classified as Mousterian (Günther 1964). 15 bifacial artefacts discovered within this horizon have been interpreted as foreign elements, following the idea that Mousterian and Micoquian assemblages are, in general, mutually exclusive. Therefore those artefacts have been sorted to another assemblage named Balve IVa (Günther 1964; for opposing view: Richter 1997). Based on the archaeological material of horizon Balve IV, Bosinski defined the Mousterian of type Balve IV (Bosinski 1967).

All horizons of the Balver Höhle are characterized by a coexistence of different reduction concepts (Pastoors & Tafelmaier 2010), among them bifacial surface shaped artefacts such as hand axes, backed knives of different types (Type "Bockstein", Type "Klausennische", Type "Ciemna/ Pradnik knives") and unifacial or bifacial surface shaped scrapers (Günther 1964; Jöris 1992, 1993). Jöris (1992: 5) points out the marked presence of so called Pradnik technology in assemblages Balve IIIa/Günther and IIIb/ Günther. This is further interpreted as a "technological-typological remarkable assemblage type" (Jöris 1992: 10), which chronologically

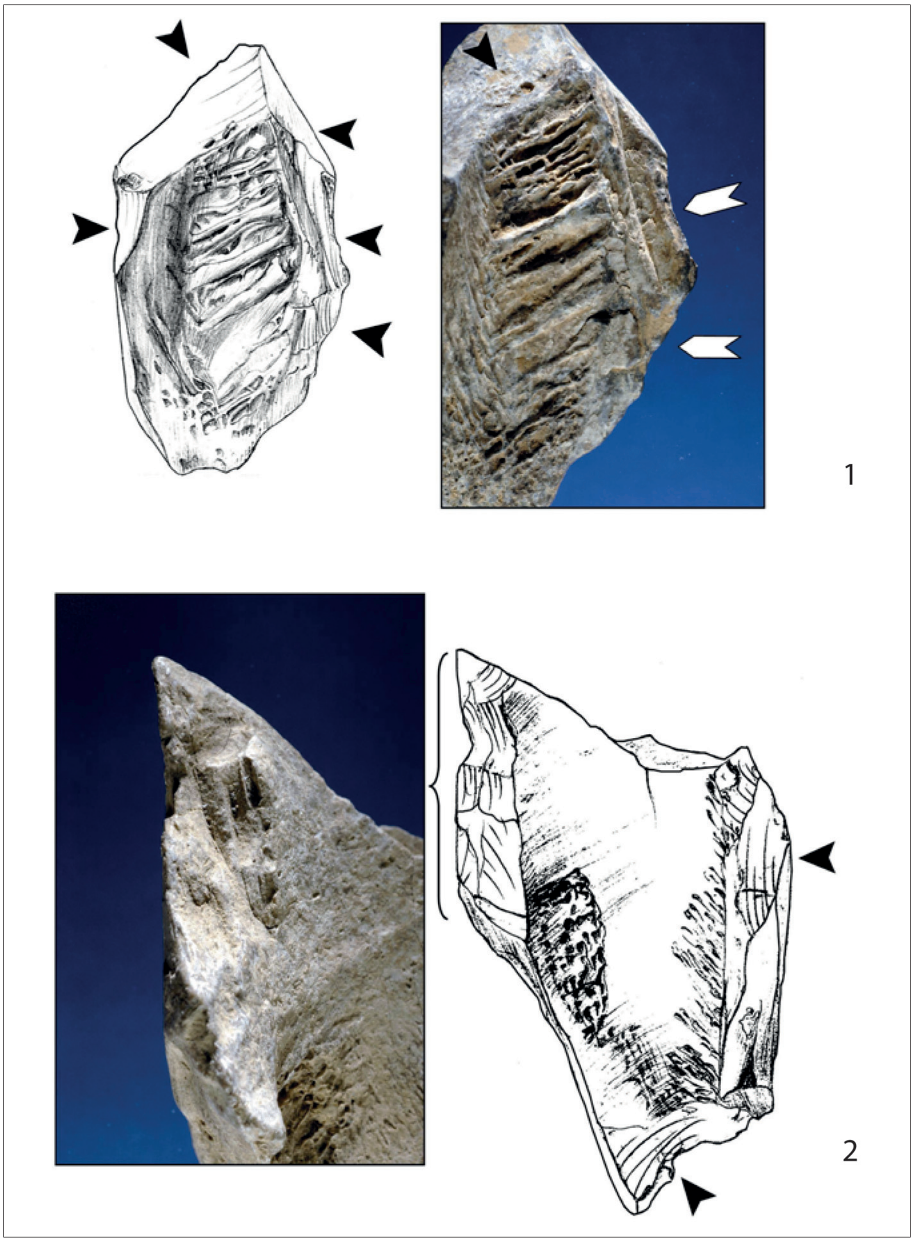

Fig. 21. AMS-dated bones with anthropogenic modifications: 1) fragment of a humerus of Bos vel Bison with impact marks, 2) fragment of a humerus of Coelodonta with impact marks. Drawings: G. Bataille and A. Pastoors; Scale 2:1.

Abb. 21. *AMS-datierte Knochen mit Schlagspuren: 1) Humerusfragment von Bos vel Bison mit Schlagspuren, 2) Humerus von Coelodonta mit Schlagspuren. Zeichnungen: G. Bataille and A. Pastoors; Maßstab 2:1.*

has to be assigned to the early phase of the last Glacial. However, it has to be noted that this rejuvenation technique is also present within all other horizons and that it is not exclusively applied to backed knives of the Ciemna type, as Jöris himself notes (Jöris 1992: 5; Richter 1997: 234). Further to this, J. Richter's (1997)

	Fraction	PMC corrected	radio carbon ages	δ^{13} ‰	calibrated with calPal07 (Weninger, Danzeglocke, Jöris 2008)
Coelodonta ant., Humerus	bone, collagen, 4.1 mg C	0.99 ± 0.05	37 040 + 440/- 410 BP	- 20.84 ± 0.18	41 874 ± 370 calBP
Bos vel Bison, Humerus	bone, collagen, 3.8 mg C	0.70 ± 0.06	39 870 + 780/- 710 BP	- 25.54 ± 0.28	43 700 ± 738 calBP

Fig. 22. AMS 14C dates of two bones with anthropogenic modifications, dated at the Leibniz Laboratory for Radiometric Dating and Isotope Research Kiel.

Abb. 22. *AMS 14C Daten von zwei Knochen mit anthropogenen Modifikationen, datiert im Leibniz Labor für radiometrische Datierung und Isotopenforschung Kiel*

layer	horizon	assemblage	Sequence acc. to Günther (1964)	Sequence acc. to Bosinski (1967)
A/Ia; A/V bottom	horizon IV	Balve IV	Balve IV	Balve IV
B/IIIa 1959/2-1 bottom	horizon III	Balve IIIa (Balve III)	Balve IIIb	Balve III
A/III	horizon II/III	Balve IIIb (Balve-Stoßzahnschicht)	Balve IIIa	Balve-Stoßzahnschicht
B/III fein B/III 1959/4	horizon II	Balve II	Balve II	Balve II
A/II B/II 1959/6-5	horizon I	Balve I	Balve I	Balve I
C/1939 B 1939/Sohle D/1939	unstratified	Balve IIIc (Balve IIIa)	Balve IIIc	Balve IIIa

Fig. 23. Overview of the different layers of the Balver Höhle and their attribution to different horizons and assemblages. The subsumption to different assemblages goes back to Günther (1964). Bosinski partially used different labels which are added in brackets. Concerning the sequence both do not agree. The different sequences can be seen in the two right columns (changed acc. to Jöris 1992: 10).

Abb. 23. *Übersichtstabelle, die aufzeigt, welche Schichten der Balver Stratigraphie zu welchen Horizonten und welchen Inventaren zusammengefasst wurden. Die Zusammenfassung zu unterschiedlichen Inventaren geht auf K. Günther (1964) zurück. G. Bosinski verwendete zum Teil andere Bezeichnungen, diese sind in Klammern angefügt. Auch was die Abfolge betrifft, sind sich beide uneins. Diese unterschiedlichen Abfolgen der Inventare sind den beiden rechten Spalten zu entnehmen (verändert nach Jöris 1992: 10).*

interpretation of the increasing importance of the Levallois concept and a preference for the recurrent unidirectional method within Balve IV has to be modified. A current study of the reduction concepts at the Balver Höhle (Pastoors & Tafelmaier 2010) reveals the consistent presence of the Levallois concept within all Middle Palaeolithic horizons. The recurrent unidirectional Levallois method is especially represented in Balve II, whereas in Balve IV opportunistic cores prevail. Furthermore, among the different Levallois methods the recurrent centripetal mode of reduction is well represented (Pastoors & Tafelmaier 2010: 28). With regard to the Volkringhauser Höhle, the presence of bladelet and blade cores in all horizons of the Balver Höhle is of special interest. The kind of core configuration, i.e. the integration of natural given convexities and an opportunistic approach, mirrors the bladelet production at the Volkringhauser Höhle.

What can be said in general is that the Balver sequence presents a quite homogeneous distribution with continuity of the different reduction concepts and the represented formal tools. Only Balve IV differs in its low number of bifacially surface shaped artefacts, although their occurrence by itself proves that this concept of blank production formed part of the „conceptual reservoir" (see Weißmüller 1995: 15 ff.) of the Balver Middle Palaeolithic. An interpretation of the Balver sequence as representing different chrono-cultural units must therefore be questioned. Richter (1997) classifies all horizons of the Balver Höhle as what he named "Mousterian with a Micoquian option" (M.M.O.). Based on his work on the layer G stratigraphic complex (G-Komplex) at the Sesselfelsgrotte, he discusses a model which redefines conventional Mousterian and Micoquian assemblages as functional occurrences of the same technocomplex. Differences in the occurrence of specific reduction concepts are interpreted as different functional cycles. For the Balver sequence he proposed a succession of M.M.O. A 1 for horizon Balve II/III, M.M.O. B1 for Balve III and M.M.O. B3 for Balve IV (Richter 1997: 244). Whereas a classification as M.M.O. is undoubtledly justified, a further categorization of Balve II/III as an "old" Micoquian seems to be problematic. Within this period non-Levallois reduction concepts such as the Quina concept are said to be predominant (although Levallois recurrent cores are present in all layers of the G-complex), however, this could be falsified for Balve II/III (Pastoors & Tafelmaier 2010: 36).

Two opposing views exist concerning the chronological interpretation of the Balver sequence. One group (Günther 1964: 39; Bosinski 1967; Jöris 1992, 1993) favours a long chronology, with the Balver sequence beginning within the last Interglacial. According to Günther (1964: 50), layer 1959/6 can be related to a phase of temperate climate, which Jöris proposes to correlate with the Eemian Interglacial (Jöris 1992: 8). Further to that, both Günther and Jöris parallel the sterile layer A/IV/1939yer A/IV/1939, containing a large amount of frost debris, with the first glacial maximum of the last glacial complex. It separates the two horizons Balve II and Balve III from Balve IV (Günther 1964: 52; Jöris 1992: 8). Richter proposes a different interpretation.

According to him, first human activities at the Balver Höhle should be dated after the first glacial maximum of the last glacial complex, at least concerning horizon Balve II/III (Richter 1997: 245). Weißmüller also postulated a younger age for the Balver stratigraphy (Weißmüller 1995: 245 ff). He criticised Jöris's correlation of "the clay accumulation horizon, in which the oldest Micoquian (Balve I and Balve II) occurs, with the Eemian" and concludes that this point of view can only be based "on the assumed age for the major layer of the Bockstein", which Weißmüller also calls into question (Weißmüller 1995: 245 ff). In his opinion, the lowest clay accumulation should be related to the Eemian (layer 11/1959; series II, samples 2 und 3 see Günther 1964; Jöris 1992). By analogy with the situation at the Sesselfelsgrotte, horizon Balve III would then be attributed to an interstadial at the beginning of Stadium 3 (Weißmüller 1995: 197) similar to the Sesselfelsgrotte archaeological G-Komplex. The fact that the archaeological horizons do not show any qualitative, but only quantitative differences, in the application of specific reduction concepts might argue in favour of the short chronology.

As demonstrated above, the assemblage of the Volkringhauser Höhle displayed parallels to all different horizons of the Balver Höhle. First of all, the coexistence of Middle Palaeolithic reduction techniques and concepts and of bladelet and blade cores is proven. The bladelet cores of the Volkringhauser Höhle therefore cannot be interpreted as an indicator of an Upper Palaeolithic occupation, but are a common strategy of blank production in the Middle Palaeolithic of the Hönne valley. Additionally, the absence of backed knives, which are represented in all Balver horizons, might be explained by functional differences between the two sites.

Apart from the Balver Höhle only a few other stratified Middle Palaeolithic sites allow a comparison with the Volkringhauser material. All of them were excavated in the first half of the last century mostly by J. Andree (1928a, 1928b, 1939). His work at the Feldhof Höhle in 1929, the largest of the Hönne valley caves some 10 km north of the Volkringhauser Höhle, produced only two small Middle Palaeolithic assemblages (layer 3: 24 artefacts, 3 of them flint & layer 4: 163 artefacts, 56 of flint) in which different scraper types prevail. A backed knife was among the surface finds, but could not be attributed to a layer. Bosinski interpreted the assemblages as Micoquian (Bosinski 1967: 115). Other surface finds included "Federmesser" and one antler point was said to belong to a Magdalenian occupation (Bosinski 1984: 386). Some other finds, five lithic artefacts from the now destroyed Honerthöhle (Grübecker Tal) and two from the Burschenhöhle, document other Palaeolithic occupations. The finds of the Honerthöhle (4 blades, 3 out of flint 1 of local raw material and 1 end scraper out of flint) are not significant chronologically but may well be seen within a Middle Palaeolithic context. The two scrapers of local raw material from the Burschenhöhle may also be evidence of a Middle Palaeolithic occupation.

In the Lenne valley, west of the Hönne valley, the opposite picture seems to apply. An alleged backed knife without stratigraphic context from the Östertalhöhle and a few finds from the Martinshöhle and Grürmannshöhle provide rare evidence for Middle Palaeolithic visits. In contrast, evidence for late Upper Palaeolithic occupations is common, for instance at the important sites of Reingsen (open air site) and Hohler Stein/Kallenhardt (Günther 1988: 133).

Within the larger region of North Rhine-Westphalia the number of sites reliably dated to the time after the first glacial maximum of the last glacial increases. Richter (2006: 103) states that 90 % of all Middle Palaeolithic finds of North Rhine-Westphalia date to the interpleniglacial. Apart from the Balver Höhle the stratified site of Kartstein in the North Eifel (Baales 2006: 176 ff.; Bosinski 1967) is of special importance (Fig. 16). At this site a late Middle Palaeolithic assemblage is represented by level Kartstein III, which was eponymous for Bosinski's (1967) Mousterian assemblage type. Among the reduction concepts the unipolar and the centripetal recurrent Levallois methods prevail. Unifacial artefacts are dominant, but bifacially surface-shaped artefacts are also represented. These are a Faustkeilblatt, scrapers on bifacially surface-shaped blanks and the double points which define the "Type Kartstein", three of which were discovered. Richter (1997) proposes to classify one of the latter as an atypical backed knife (of "Bockstein type") and another as a leaf shaped scraper.

To the west of the Volkringhauser Höhle the eponymous find of the Neanderthal must be taken into account. In the course of two excavations in 1997 and 2000 numerous artefacts have been found in rediscovered sediments originally dug from the Kleine Feldhofer Grotte (Schmitz et al. 2002; Schmitz 2003; Weniger 2006). As already mentioned in the context of the retouched forms, the assemblage reveals similarities with that of the Volkringhauser Höhle. Besides the numerous groszaki (67 pieces), unifacial tools prevail (162 pieces) whereas bifacial artefacts are rare (Hillgruber 2007: 338). Blank production varies and is influenced by the natural shape of the raw material pieces. The Levallois and the discoid concepts are represented alongside a flexible reduction pattern for so called Maasei flint. In its technological organization a bidirectional core (Hillgruber 2007: 336) resembles the core for the production of small blades from the Volkringhauser Höhle.

Further late Middle Palaeolithic sites with a coexistence of bifacial surface-shaping and production of blanks using the Levallois concept may be cited outside the borders of North Rhine-Westphalia (Fig. 16). In Lower Saxony the late Middle Palaeolithic site of Salzgitter-Lebenstedt again demonstrates the coexistence of different blank production concepts (Pastoors 2001, 2009). Besides different Levallois methods, occur strategies to produce small blades and bladelets quite similar to those of the Volkringhauser Höhle (Pastoors 2009). The predominance of bifacially surface shaped tools and the coexistence of "Faustkeilblätter", backed knives and leaf shaped scrapers contradicts the proposed artefact spectrum of the so called Lebenstedter group (Bosinski 1967) and instead displays similarities with the late Middle Palaeolithic sites of Lichtenberg/Lower Saxony (Veil et al. 1994) and the Sesselfelsgrotte (Richter 1997). This chronological attribution was further confirmed by absolute dates (Pastoors 2001: 56, 2009).

In Bavaria, the late Middle Palaeolithic site assemblages of Zeitlarn 1 (Schönweiss & Werner 1986) and the Oberneder Höhle (Freund 1987) are of special importance. In his work on the Middle - Upper Palaeolithic transition in Bavaria Uthmeier (2004b: 353) could show that experimentation with guiding ridges to produce blades was present in the analytical unit Ob2 of the Obernederhöhle and at Zeitlarn 1. The Palaeolithic knappers seem to have been inspired by the natural shapes of the raw material nodules (Uthmeier 2004b: 354), whereby the blades often ended in hinge-fractures due to the lack of distal preparation and low impact energy.

Compared to the Sesselfelsgrotte and the different assemblage types of the M.M.O. of Richter (1997: 206 ff.) one has to note that the small assemblage of the Volkringhauser Höhle cannot be attributed to a specific proposed type without problems. However, the assemblage is closer to a younger Micoquian (M.M.O. B) because of the high percentage of "Upper Palaeolithic tools", the lack of backed knives and the dominance of scrapers with more than one retouched edge. The difficulty of integrating the small assemblage into Richter's system mirrors the general difficulties of classifying human agency and comparing assemblages between different regions, at least in the Middle Palaeolithic. As a consequence one has to be satisfied with the observation that the assemblage of the Volkringhauser Höhle falls in the range of other late Middle Palaeolithic sites with regard to the represented reduction strategies and formal tools as well as on the evidence of the absolute dates.

Functional interpretation of the site

Beyond a descriptive presentation of archaeological assemblages and their techno-typological comparison with other contemporary sites, functional aspects of assemblages need to be considered. The statement by C. Gamble that "life was still very local and usually immediate" (Gamble 1999: 242) seems to be inadequate in the light of recent studies (Richter 1997; Uthmeier 2004a, 2004b; Bataille 2006, 2010; Chabai & Uthmeier 2006). On the contrary, the annual cycles of prehistoric hunter-gatherers were determined by seasonally available and/or fixed resources such as water. An archaeological site therefore represents occupation(s) by prehistoric people for specific tasks, whereby these tasks may be various and thus further determine the duration of occupation and group size. The length of the operational sequences, the represented faunal remains and the source of the lithic raw material may allow conclusions to be made about the function of a site.

First of all the location of the Volkringhauser Höhle and adjacent sites will be summarized. The Hönne valley is located south of the Ruhr, which serves as the natural border between the Westphalian Bay in the North and a low mountain range in the South. The caves of the Hönne valley are therefore situated at the transition from the foothills to the low mountain range, whereby most of them can be found in the middle part of a narrow karst valley. To the west the Balver forest borders the valley, reaching heights of up to 300 m, while in the east are the Sorpener and the Hacher Bergland with heights up to 200 m. The plateaus east and west of the river are marked by several hollows cut by tributaries of the Hönne. The Feldhofhöhle is the northernmost one and, located 36 m above the course of the present day river, is the highest of all the caves. The Burschen- and the Honerthöhle were situated further south, to the east of the river. The Volkringhauser Höhle is located at a point where the narrow karst valley gets wider again and it is likely that the cave could be reached from either the valley or the plateaus nearby. It has been postulated that animal herds arriving from the north transited the narrow valley from the adjacent plateaus (Günther 1964: 14). All the caves are therefore situated in strategic favourable positions. This is even more true for the Balver Höhle which is in an isolated limestone hill at the confluence of the rivers Borke and Hönne and which blocks the valley upstream. The cave has to be passed in order to reach the low mountain range and Günther already suggested that the importance of the Balver Höhle may be due to this situation.

It may be assumed that the caves containing Palaeolithic remains belonged to a common settlement system. However, an indispensable prerequisite for the establishment of so called land use patterns is the contemporaneity of the considered sites. This is not easy to establish, as in most cases absolute dates are lacking and a chronological assessment is solely based on techno-typological aspects of the assemblages. In the current study the results of the techno-typological analysis need to be taken into account. In my opinion, the similarities of the Volkringhauser Höhle and the Balver Höhle prove proximity of time. The assemblages of the Feldhofhöhle (layers 3 & 4) may be placed within the same context and it therefore seems justified to subsume the assemblages into a "technological collective" in the sense of Uthmeier (2004a: 50 ff.). Nevertheless, the following remarks must be understood as a preliminary hypothesis.

On the basis of the division of the lithic raw material into local (mostly siliceous schist) and supraregional (flint) a spatial dynamic can be recorded. The mobility radius may thus be described as including the steppe

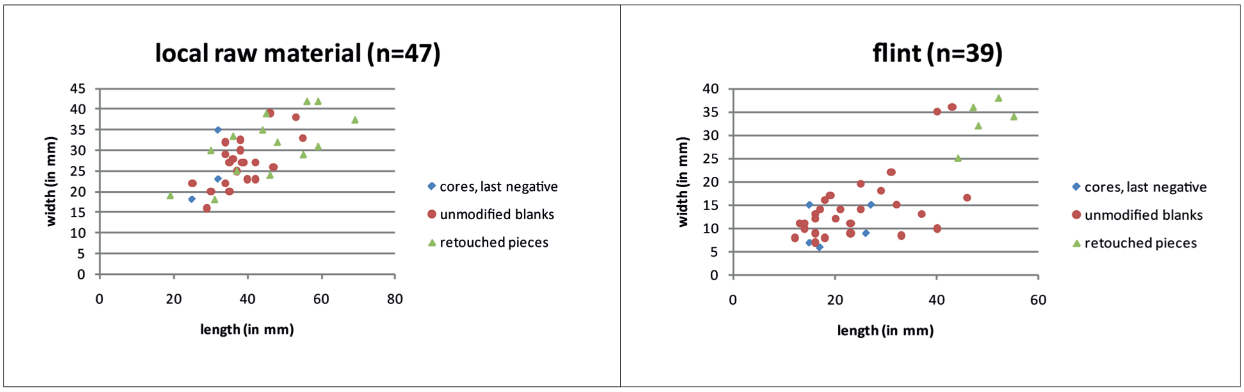

Fig. 24. Comparison of the length/width ratio of unmodified blanks, retouched pieces and the last complete blank negatives on the cores.

Abb. 24. *Vergleich der Längen und Breitenwerte von unmodifizierten Grundformen, retuschierten Stücken und den letzten vollständigen Grundformnegativen auf den Kernen.*

zone north of the low mountain range, due to the presence of flint, and the Hönne valley, because of the siliceous schist. The Maasei flint possibly points to the use of more western areas. The three raw material variants are representative of three extraction events and, possibly, three import events. It is not suggested that prehistoric people brought with them artefacts of only one raw material variant, but that the last source visited provides proportionally the most numerous raw material. It is therefore postulated that the assemblage of the Volkringhauser Höhle represents at least two occupational events, whereby Occupation 1 is represented by flint and Occupation 2 by local raw material.

Occupation 1 may be represented by the waste of a group arriving from the north. In the course of the occupation imported raw material was reduced, blanks were produced and exhausted tools were discarded. The fact that the raw material is of supra-regional origin may indicate a "macro move" and thus suggest a change of the region inhabited ("Nutzungsareal"; cf. Weniger 1991: 84). No conclusions can be made about the duration of the occupation. Apparently only flint artefacts show traces of fire, indicating the establishment of a fire during the occupation, which might speak against a short-stopover. The represented phases of the operational sequence may also be interpreted in this way, as illustrated in Figure 25 (Uthmeier 2004b: 387), which represents the different stages of the operational sequence: Stage 0 mirrors the import of unreduced raw nodules, Stages 1-3 (blank production) are indicated by unretouched blanks, Stage 4 (the discard of cores) is indicated by exhausted cores and Stage 5 (use and discard of tools) is indicated by exhausted tools. The fact that all stages of the operational sequence are represented normally indicates a longer stay, in contrast to ephemeral occupations during which specific tasks were conducted. The high number of chunks indicates blank production and especially the initialization and/or preparation of imported raw material. The distribution is further characterized by a peak in the production of blanks. According to Uthmeier (2004b: 386 ff.) this pattern suggests a short occupation; in the terminology of Weißmüller (1995: 169) one would speak of a temporary ("vorübergehend") occupation. The produced blanks might have been exported, since only the debris of the blank production is represented (i.e. unspecific small flakes without cutting edges and exhausted cores). This is also indicated by

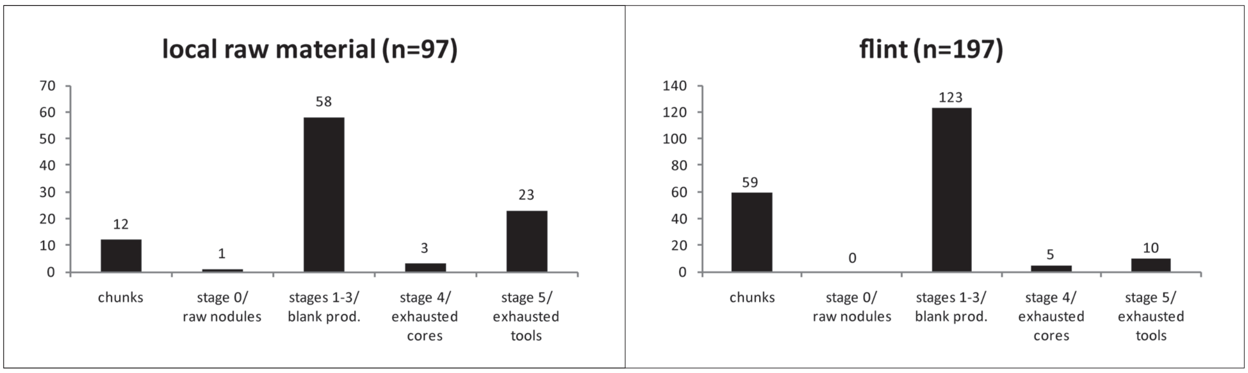

Fig. 25. Represented stages of the operational sequence according to different raw materials: chunks; stage 0: import of raw nodules; stages 1-3 blank production, stage 4: discard of cores; stage 5 usage and discard of retouched tools (according to Uthmeier 2004b: 387).

Abb. 25. *Repräsentierte Phasen der Operationskette unterschieden nach Rohmaterial: Trümmer; Phase 0: Eintrag von Rohstücken; Phasen 1-3: Grundformproduktion; Phase 4: Verwerfen von Kernen; Phase 4: Gebrauch und anschließendes Verwerfen der Werkzeuge (nach Uthmeier 2004b: 387).*

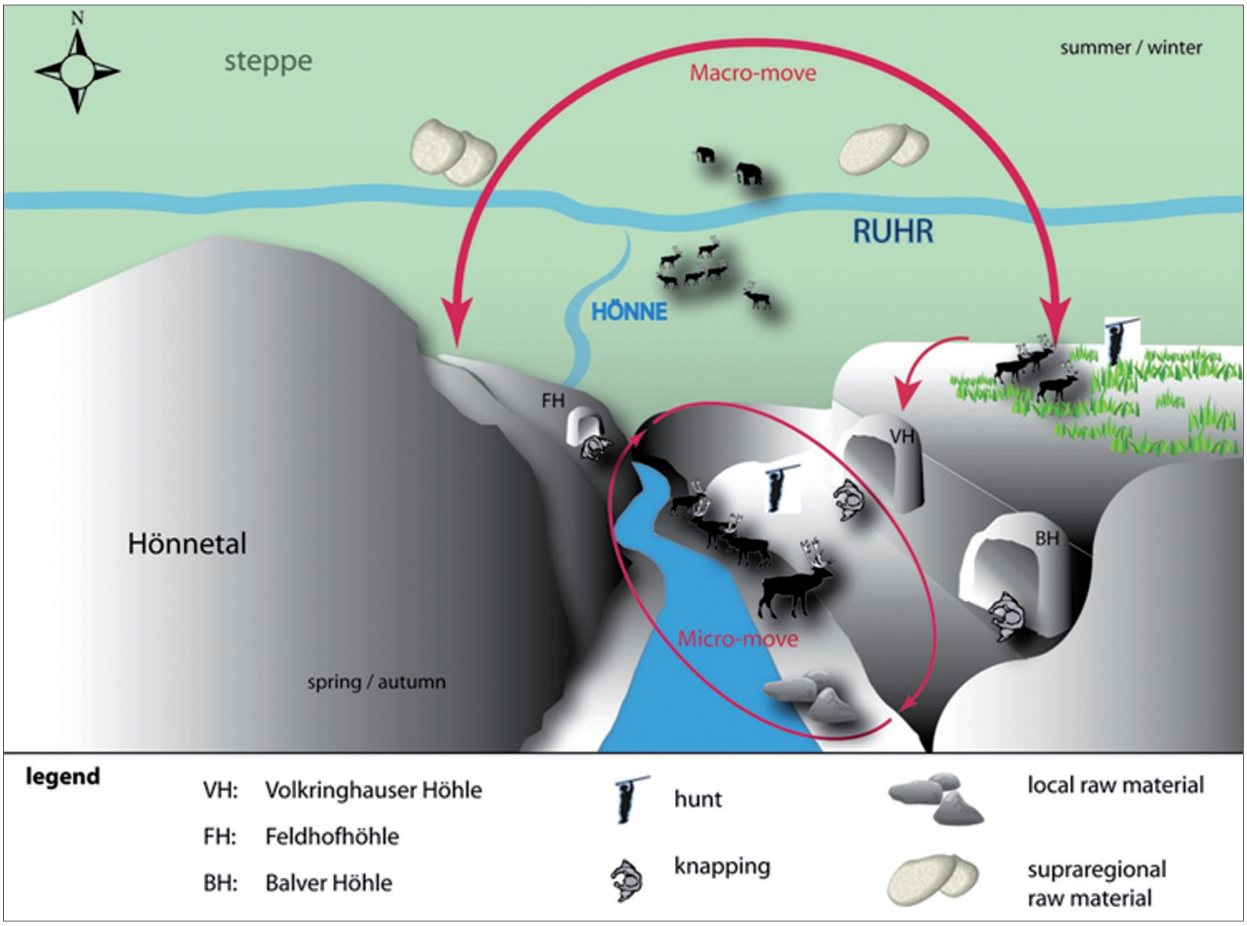

Fig. 26. Land use model: Two regions are part of the reconstructed settlement system. The lowlands beyond the Ruhr and the Hönne valley, which is located at the edge of the uplands. The superregional raw material represents a change of the inhabited area (macro move; occupation 1). In contrast to that the local raw material indicates the use of the Hönne valley. In the course of so called micro moves (occupation 2a) the Volkringhauser Höhle, the Balver Höhle and the Feldhof Höhle may have been occupied. It is likely that the short term camps at the Volkringhauser Höhle or the Feldhof Höhle were used to provision resources for a nearby camp site. Due to their strategic advantaged position at the transition from the plains to the river valley the caves were of special importance concerning hunting activities.

Abb. 26. *Modell zur Landnutzung: Zwei Regionen sind Teil des rekonstruierten Siedlungssystems: die Tiefebene jenseits der Ruhr und das Hönnetal, welches sich am Rand der Mittelgebirgszone befindet. Das überregionale Rohmaterial repräsentiert einen Wechsel des Nutzungsareals („macro move"; Begehung 1). Das lokale Rohmaterial hingegen belegt die Nutzung des Hönnetals als engeren Kernraum. Im Zuge so genannter „micro moves" (Begehung 2a) scheinen die nahe beieinander liegenden Fundstellen Volkringhauser Höhle, Balver Höhle und vielleicht auch die Feldhofhöhle aufgesucht worden zu sein. Möglicherweise dienten die kurzzeitig aufgeschlagenen Lager in der Volkringhauser und der Feldhofhöhle der Versorgung eines nahe gelegenen Hauptlagers (Balver Höhle ?). Vor allem aufgrund ihrer strategisch günstigen Lage, am Übergang zwischen Hochebene und Flusslauf, kam den genannten Höhlen wahrscheinlich eine besondere Bedeutung zu.*

Fig. 24 which compares the length/width ratio of blanks, the last complete negatives on the cores and the retouched pieces. The distribution of the flint artefacts shows an irregularity in the distribution of the unretouched blanks. Whereas large blanks were preferred for tool modification, unmodified blanks of large size are lacking, possibly due to their export. Concepts of bladelet and blade production could only be observed in connection with the flint raw material. They reflect a highly efficient raw material economy as the remaining raw material volumes were completely exploited. This may be due to the fact that not enough local raw materials were yet available.

Occupation 2 is represented by the local raw material. In this case, prehistoric hunter-gatherers have been dwelling in the Hönne valley for a longer time and provisioning with local raw material was good. The represented stages of the operational sequence differ only in the higher amount of discarded exhausted tools. Apart from that, the distribution is similar to that of the flint raw material. Blank production is represented, as well as the production of surface shaped tools. Large sized raw material nodules are not represented and may have been exported, while highly reduced cores and tools were discarded. A short, temporary occupation seems probable in this case as well. However, it must be acknowledged that the flint artefacts and those of local raw material represent more than one occupation. The use of fire is not indicated. Two interpretations may be provided for Occupation 2:

Possibility 2a) The Volkringhauser Höhle may be interpreted as a site for specific tasks, where a task group conducts provisioning activities for a nearby field camp ("Hauptlager"; Binford 1980: 10). According to Weniger the occupation of the Volkringhauser Höhle may be part of a so called "micro move" (Weniger 1991: 84). In the terms of Binford (1980: 10) the Volkringhauser Höhle would be classified as a station. What initially seems likely but is insusceptible of proof is an interpretation of the Balver Höhle as the nearby field camp.

Possibility 2b): A group leaves the Hönne valley and makes a short stop at the Volkringhauser Höhle. Imported raw material is reduced and imported retouched pieces are used and afterwards discarded (Fig. 25). In this case the Volkringhauser Höhle would be part of a so called macro move where a group changes its inhabited region.

The analysis of the fauna also suggests several occupations during which imported meat is consumed. In addition to this, local game is hunted and the meat bearing parts are exported. This scenario may most likely be related to an occupation of type 2a, which assumes a nearby field camp. Further connections cannot be drawn between the faunal remains and occupational events.

The low numbers of bifacially surface shaped tools as well as the lack of notched pieces indicate short term occupations, as these pieces only become numerous in cases of long term occupations (Richter 1997: 179 & 191). This may only be the case at the Balver Höhle where stone artefacts in general are most numerous and the amount of bifacially surface shaped pieces is also high, at least in horizons II and III. The low quantity of surface shaped pieces within Balve IV may indicate another function of the site within a settlement system. As discussed above the blank production concepts are identical to those of the earlier horizons. Richter interprets Balve IV as a M.M.O. B3, the most recent facies of the Micoquian. Whether this reflects a cultural break as Richter suggests or only a different site function will need to be proven by future analysis.

The faunal remains of the Volkringhauser Höhle do not permit further conjecture about seasonal aspects. What, however, can be said is that mobile species such as reindeer or horse left the lower areas to move to the uplands in order to avoid plagues of biting insects and to give birth to their young (Gordon 1988). In autumn they returned to spend the winter in more protected areas. With their strategically advantageous location the Balver Höhle and other caves provided good conditions for hunting these animals. The numerous archaeological remains of the Balver Höhle suggest the particular importance of that site and no other cavein the Hönne valley resembles it in its numbers of artefacts and faunal remains.

In summary (Fig. 26), the assemblage of the Volkringhauser Höhle represents several occupations, whereby the flint raw material has been interpreted as representing a change of the inhabited region ("macro move"). In contrast, local lithic raw material indicates the use of the Hönne valley as a core region and its use at the Volkringhauser Höhle may indicate a micro move in the course of which the site functioned as task site, at which specific provisioning activities were conducted for a nearby field camp. Alternatively, the local raw material may represent a macro move during which a group leaves its inhabited area to the north. The overall low number of archaeological remains at the Volkringhauser Höhle suggests a less intensive use of the site than the Balver Höhle. What must be taken into account is that these assumptions are only valid if one accepts the premise that the whole assemblage of the Volkringhauser Höhle represents Middle Palaeolithic occupations.

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