MARTIN STREET

PLAIDTER HUMMERICH

AN EARLY WEICHSELIAN MIDDLE PALAEOLITHIC SITE IN THE CENTRAL RHINELAND, GERMANY

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RÖMISCH-GERMANISCHES ZENTRALMUSEUM

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MIT EINEM BEITRAG VON

THIJS VAN KOLFSCHOTEN

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Die Ergebnisse der kleinsäugetierpaläontologischen Untersuchung, die dank der Unterstützung durch die Deutsche Forschungsgemeinschaft (Projekt: Pleistozän am Mittelrhein; KO-627/10-1/2) durchgeführt werden konnte, sind in diesem Bericht zusammenfassend dargestellt. Auf die ausführliche Beschreibung der fossilen Reste wird in dem abschließenden Bericht über die mittel- und spätpleistozänen Mollusken und Kleinsäuger aus Vulkankratermulden des Osteifel-Gebietes verwiesen (T. van Kolfschoten & G. Roth 1993). Der Beitrag von Th. van Kolfschoten wurde im Rahmen einer Stelle bei der königlichen Niederländischen Akademie der Wissenschaften hergestellt. Th. van Kolfschoten bedankt sich bei Dr. K. Kröger für seine hilfreiche Unterstützung und die ausführliche Diskussion.

Martin Street · Thijs van Kolfschoten

INTRODUCTION

The Central Rhineland is a region characterised by pronounced Quaternary volcanic activity and the landscape of the East Eifel uplands, in particular, is dominated by basanitic scoria cones formed during Middle and Late Pleistocene volcanic eruptions (H.-U. Schmincke *et al.* 1983; H.-U. Schmincke & H. Mertes 1979). While it has long been known that the youngest volcanic deposits in the East Eifel, those of the Laacher See (11,000 BP 14C), have preserved important late glacial archaeological sites such as Andernach-Martinsberg (H. Schaaffhausen 1888; S. Veil 1982) and Gönnersdorf (G. Bosinski 1979), it was only much more recently that evidence for hominid presence in the Central Rhineland was found preserved in association with older volcanic activity (G. Bosinski 1983; G. Bosinski, M. Street & M. Baales 1995).

The first of these discoveries was in the Kärlich clay pit, which had been known as a Quaternary palaeontological site since the beginning of the century, but only yielded Lower Palaeolithic archaeological remains in 1980 (G. Bosinski *et al.* 1980). In the spring of 1983 the geologist H. Strunk made a new discovery at the summit of the Plaidter Hummerich volcano, where the removal of loess cover layers within the crater prior to lava quarrying had uncovered faunal remains and quartz artefacts (G. Bosinski, J. Kulemeyer & E. Turner 1983).

During the following years it became clear that the situation at the Plaidter Hummerich was by no means unique and further Middle Palaeolithic sites were discovered at other Middle Pleistocene volcanoes, most importantly at the Schweinskopf-Karmelenberg (J. Schäfer 1987, 1990a, 1990b) and Wannen volcanoes (A. Justus 1988; A. Justus *et al.* 1987), both dating to the penultimate glaciation, and the Tönchesberg (J. Tinnes 1987; N. J. Conard 1992), where the main archaeological horizon dates to the early part of the last glaciation (Fig. 1).

The four sites have often been discussed together (G. Bosinski 1986a; G. Bosinski *et al.* 1986), with the implication that they can be classed as a special category of Middle Palaeolithic volcano site unique to the Central Rhineland, or perhaps even that they reflect a conscious preference by Middle Palaeolithic hominids to occupy extinct volcanoes in this region. This is clearly not the case and the fact that the sites are located on top of volcanic deposits is probably largely irrelevant and conceivably even unrecognised by Middle Palaeolithic hominids.

It is possible that the slight depressions of the incompletely filled craters might have offered some shelter in an open periglacial landscape, or that their often elevated location served as a »lookout« point. It has also been suggested that water may have accumulated in the craters and attracted animals and hominids to the sites. However, since the topographical location of the various localities is dissimilar, the precise reasons for occupying the sites might be quite different.

It is more probable that the two major factors leading to the survival and discovery of the sites are the fact that the crater hollows formed good sediment traps for both archaeological and palaeontological material and that the underlying volcanic deposits are now subject to intensive quarrying.

Major earth moving for purposes unrelated to archaeology is often the only activity capable of discovering older and consequently deeply buried open sites. This may be during the construction of buildings (Seclin / N. France: A. Tuffreau *et al.* 1985) or railway lines (Riencourt-lès-Bapaume / N. France: A. Tuffreau 1993; A. Tuffreau *et al.* 1991).

It may also take the form of quarrying for resources such as clay (Kärlich / Rhineland: G. Bosinski *et al.* 1980; S. Gaudzinski 1994; S. Gaudzinski & J. Vollbrecht 1995), gravel (Ariendorf / Rhineland: G. Bosinski, K. Brunnacker & E. Turner 1983; E. Turner 1986), gravel or loess (Maastricht-Belvédère / Netherlands: T. v. Kolfschoten & W. Roebroeks 1985; W. Roebroeks 1988), loess and loam (Rheindah-

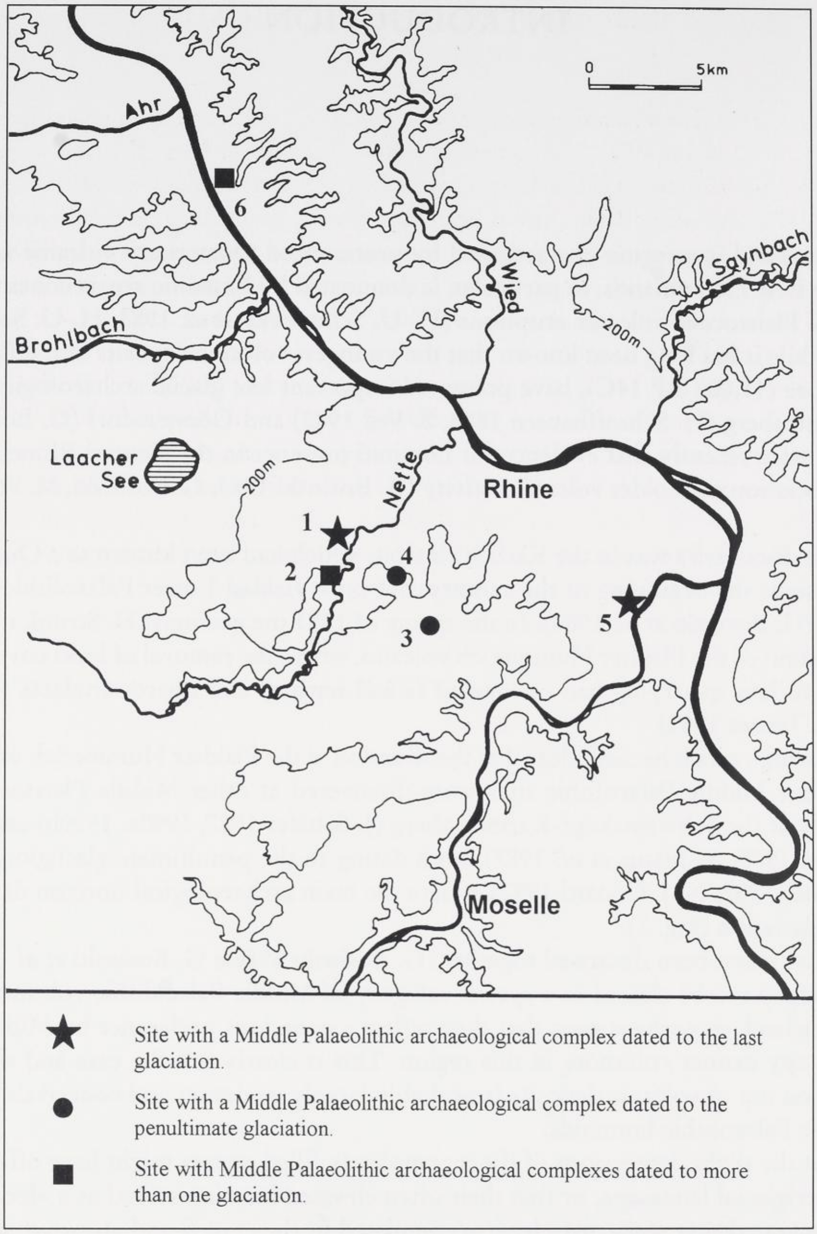

Fig. 1 Selected Middle Palaeolithic sites in the Central Rhineland. – 1 Plaidter Hummerich; 2 Tönchesberg; 3 Schweinskopf-Karmelenberg; 4 Wannen and Wannenköpfe (hominid cranial fragment); 5 Koblenz-Metternicht; 6 Ariendorf.

len / Rhineland: G. Bosinski *et al.* 1966; H. Thieme 1977, 1978, 1983; J. Thissen 1986, 1988) or lignite (Neumark-Nord: D. Mania & M. Thomae 1988; D. Mania *et al.* 1990; Schöningen: H. Thieme *et al.* 1993; H. Thieme & R. Maier 1995). In view of this background, the discovery of archaeological sites at intensively exploited lava quarries is unsurprising.

The Plaidter Hummerich is a volcanic scoria cone of Middle Pleistocene age located between the villages of Plaidt, Kruft and Kretz (Fig. 1). At a height of 274 m above sea level, the summit of the Hummerich rose some 150 m above the surrounding landscape and commanded an excellent view of the region (K. Kröger 1987, 1995; M. Street 1995). It has been suggested that this may have been one reason for the Middle Palaeolithic occupation of the crater (but see above). The volcano originally had two low peaks between which lay the crater, with a diameter of approximately 100 m, within which the main investigations took place. In spring 1983, removal of superficial layers of sediment during lava quarrying at the Hummerich uncovered quartz artefacts and bones, the significance of which was recognised by H. Strunk. After preliminary prospecting, test drilling and excavation of test pits (G. Bosinski, J. Kulemeyer & E. Turner 1983) it was decided to investigate a large area of the south-eastern crater fill. Between the discovery of the site in 1983 and the summer of 1986, when the loess cover layers dating to the last two glacial cycles were destroyed by quarrying, a total of 463 m² in the crater (Fig. 2) and a number of smaller areas outside had been excavated (K. Kröger 1987, 1995), yielding a large number of faunal remains and approximately 2,000 lithic artefacts. It is estimated that the original distribution of archaeological material must have covered at least one hectare (K. Kröger 1987).

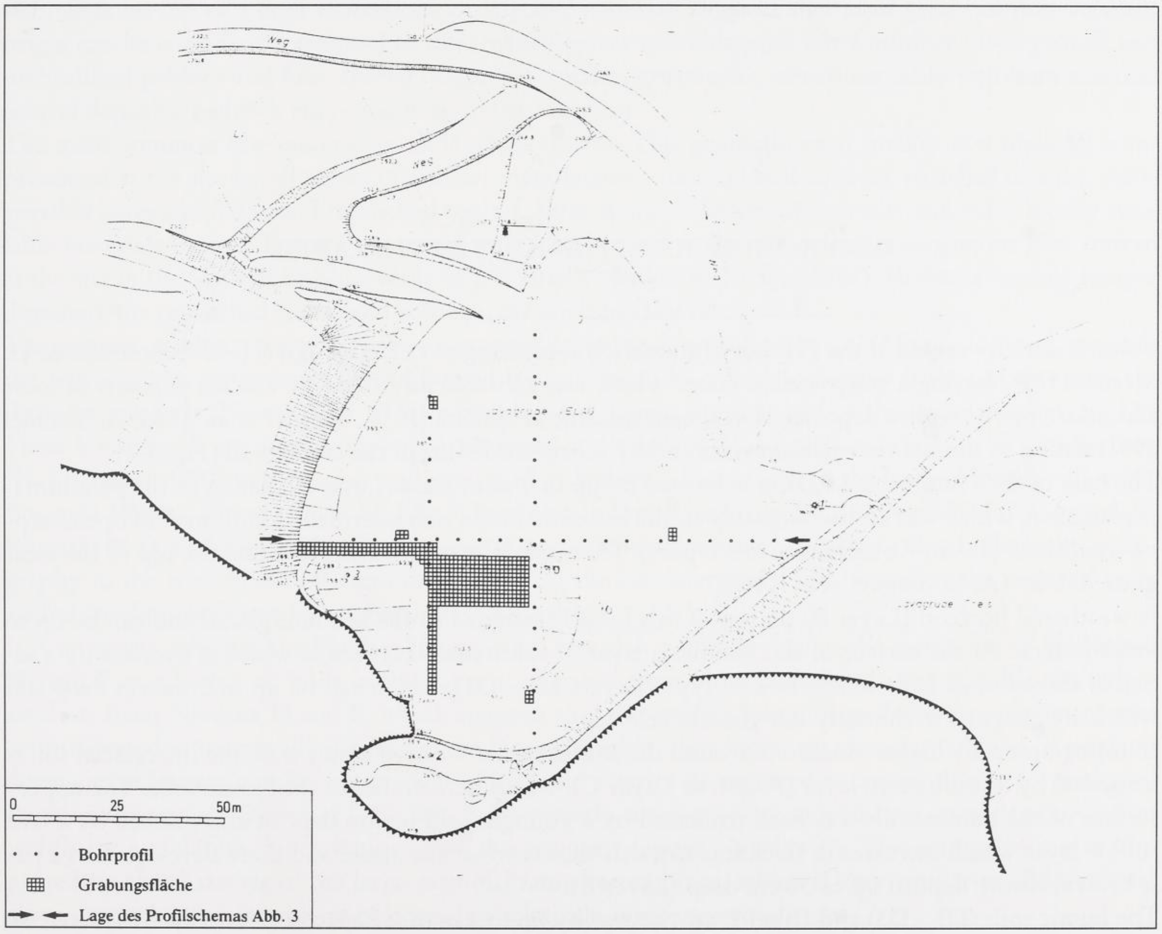

Fig. 2 Plan of the Hummerich excavation with the location of test pits and boreholes.

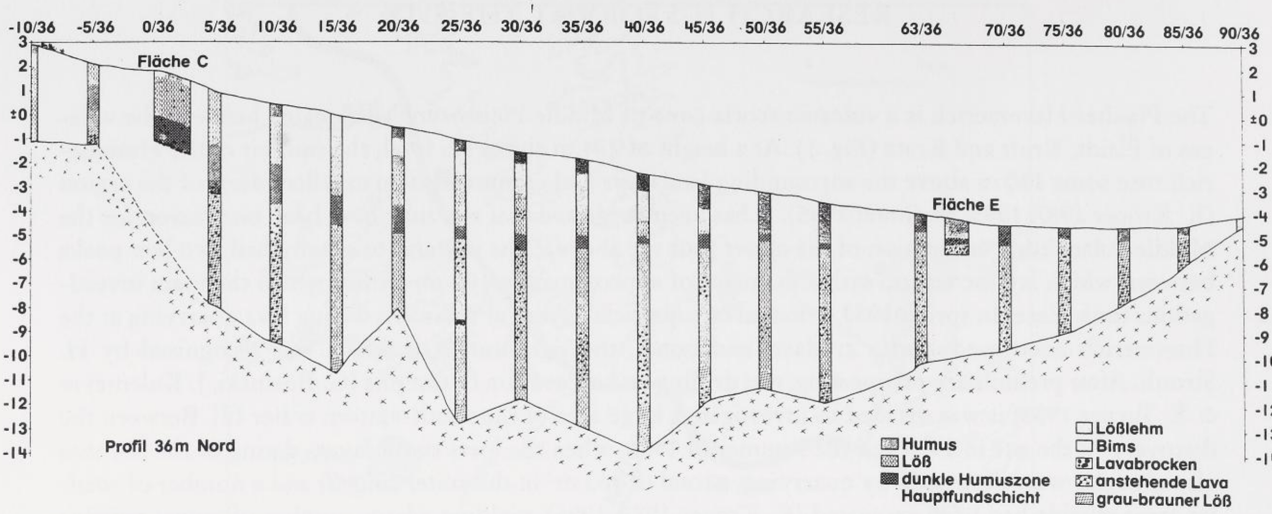

Fig. 3 Reconstruction of the stratigraphy of the Plaidter Hummerich on the basis of boreholes along axis y = 86 m (see Fig. 2).

GEOMORPHOLOGY AND STRATIGRAPHY

Volcanic activity ceased at the Plaidter Hummerich something over 200 ky ago (H.-U. Schmincke & H. Mertes 1979), leaving a steep-walled crater which was subsequently filled by aeolian deposits of loess and, more rarely, tephra deposits of younger volcanic eruptions (A. K. Singhvi *et al.* 1986; A. Semmel 1991) dating to the last two glacial cycles and by scoria eroded from the crater wall (Fig. 3-4).

The base of the Hummerich section is formed by up to 9 m of loess (Layer A) dating to the penultimate glaciation, which was archaeologically sterile but contained a rich microfauna indicative of open, steppe conditions (T. van Kolfschoten, this report). Thermoluminescence analysis dated the top of the loess to ca. 135 ky (A. K. Singhvi *et al.* 1986).

A weathered horizon (Layer B) on top of this loess is assigned to the last interglacial and can be up to 1 metre thick. At the surface of this soil lies a layer of calcareous lava rubble which is overlain by a series of three humic soils of chernozem type (Layers D1 - D3), which can be up to 2 metres deep and which are assigned to the early last glacial cycle.

In topographically higher situations around the southern and western crater wall, the interglacial soil is truncated by a solifluction layer (*Fließerde* Layer C), which here underlies the humic soils. The upper surface of the humus soils was itself truncated by a younger solifluction deposit and marked by a lava rubble layer which increases in thickness towards the centre of the crater and there develops into a pale brown, loamy deposit up to 30 cm deep (Layer E).

The humic soils (D1 - D3) and Layer E are covered by up to 3 m of last glacial loess (Layer F), dated by thermoluminescence to 23 ky (A. K. Singhvi *et al.* 1986). The stratigraphic sequence is closed by a soil development of Allerød age, pumice deposits of the Laacher See eruption and postglacial deposits.

EXCAVATION AND CONTEXT OF THE LITHIC AND FAUNAL ASSEMBLAGES

Lithic and faunal material recovered during excavation was recorded on plans and in lists and each piece given its own designation consisting of the one metre square unit in which it was found and an individual number assigned consecutively within this unit. All finds were measured in three dimensions. Material was excavated by the removal of a series of sediment spits, each of which was designated a »Plan«, and numbered consecutively from the top, beginning with Plan 1. Each find was assigned to one of these artificial units. The excavation progressed by removal of strips of sediment 2 metres in width, ensuring that details of the geology could be recorded in section drawings at two metre intervals.

Subsequent to the excavation, material was assigned to a geological layer (»Niveau«) by the excavation director, Karl Kröger, on the basis of the three-dimensional co-ordinate of the find and the information on geological boundaries recorded in section drawings. In view of the irregular nature of the geological boundaries and the visible presence of major disturbances (e.g. loess-filled crotovinas) and the possible presence of other, similar but unrecognised features, the attribution of material to a particular layer must be regarded as probable but by no means certain. This has implications for the interpretation of refitted material which apparently transcends geological boundaries.

Middle Palaeolithic lithic artefacts are present in all layers at the Plaidter Hummerich except the loess of the penultimate glaciation (Niveau A) and that of the last glacial (Niveau F). In some cases it is difficult or impossible to recognise the artificial character of lithic finds; the context of the assemblage, in aeolian sediments on top of a high scoria cone of volcanic material, suggests that most pieces of non-volcanic origin can be confidently assigned to the archaeological assemblage(s), but a number of very small and unmodified pebbles and heat-altered fragments (quartz, graywacke, schist) certainly represent material (gravel deposits, bedrock etc.) caught up in the eruption.

The most common raw material in all layers is quartz. This generally poor quality raw material is represented at the site by all stages of artefact manufacture – unmodified cobbles, smashed chunks, recognisable cores and flakes and retouched tools. Coarse-grained Devonian quartzite and other locally available materials (lydite, Tertiary quartzite) were also worked at the site, whereas exogenous flint arrived at the site in the form of finished tools or pre-struck blanks (K. Kröger 1987). Various forms of scraper dominate the retouched forms and some pieces are bifacially retouched.

The greatest numbers of artefacts were recovered from the deepest humus soil (Niveau D1) and, towards the centre of the crater, from the soliflucted layer (Niveau E), which is derived from and truncates the three humus soils (Niveaux D1 - D3) which formed during the first half of the last glaciation (Fig. 4). These humus soils are more completely preserved at the nearby Middle Palaeolithic site of Tönchesberg (N. J. Conard 1992) and are also well preserved at Koblenz-Metternich in the lower Moselle valley (G. Bosinski 1986b), where a small Middle Palaeolithic industry was recently discovered (N. J. Conard, G. Bosinski & D. S. Adler 1995). The Plaidter Hummerich assemblage is therefore clearly dated by stratigraphy to the later Middle Palaeolithic, following the last interglacial but preceding the onset of truly stadial conditions shown by renewed loess deposition.

It is uncertain whether the Plaidter Hummerich was also occupied during the formation of soliflucted Niveau E or whether all finds in this layer are derived from older contexts. It was possible to conjoin artefacts from Niveaux D and E, which suggests that the artefact assemblages from these layers cannot be interpreted as temporally distinct units. More probably, they represent the accumulation of artefacts during an unknown number of episodes of hominid activity on repeated occasions during formation of the humus horizons (Niveaux D1 - D3). Subsequently, artefacts were moved by a number of processes (solifluction, ablation, bioturbation) into the younger deposit (Niveau E). This interpretation is supported by the character of the large mammal faunal assemblage, which is very similar in all layers and always contains species typical of open, but relatively temperate conditions.

Faunal remains occur in all layers containing artefacts and, as in the case of the lithic assemblage, conjoined bone fragments show that material recovered from more than one stratigraphic layer originates

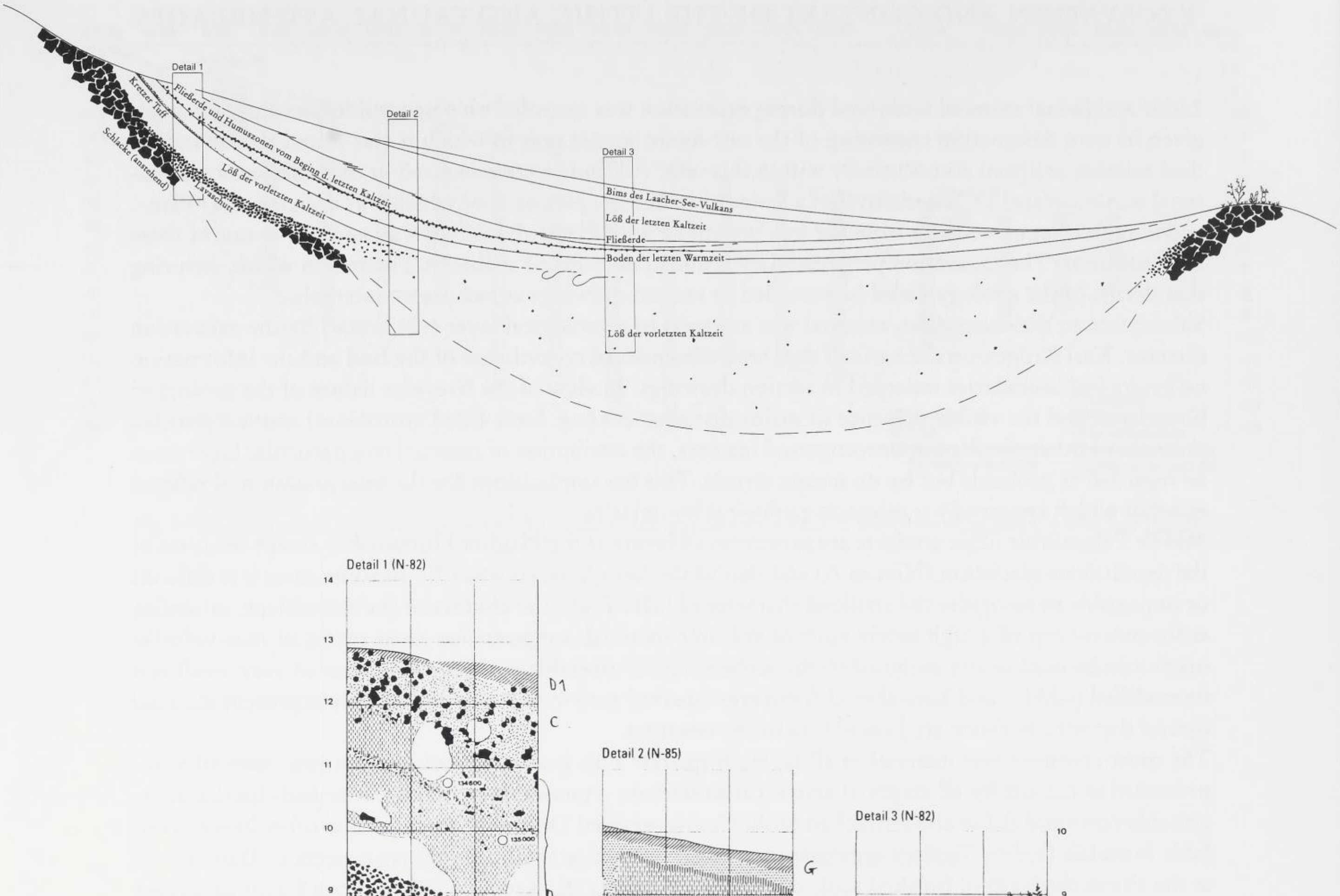

Fig. 4 Details of the stratigraphy of the Plaidter Hummerich.

from the same episode. In the case of the fauna it was demonstrated that some material derived from the *Fließerde* (C) in a topographically higher position close to the crater rim has been incorporated into the younger, lower lying humus soil layers (D1 - D3).
Since reworking can also be shown to have affected the lithic assemblage it is impossible to differentiate the Hummerich archaeological material by stratigraphic criteria. This is underlined by the faunal spectra of the different layers, which are practically identical. Species indicative of colder conditions (arctic fox, reindeer, woolly rhinoceros, mammoth) are extremely rare or totally absent in all layers, whereas species indicative of warmer / more woodland conditions (roe deer, fallow deer), are present in several horizons, showing that the fauna accumulated under open, but far from arctic, conditions.
The small mammal fauna is also similar in all layers except in the archaeologically sterile loess layer A (T. van Kolfschoten, this report). The number of specimens of value for an ecological reconstruction is small, but species with widely differing ecological preferences (e. g. lemmings, dormice) were found in the same layer (D1). This may be due to the demonstrated reworking of material from its original context, or a true reflection of short-term ecological differentiation during the total period of accumulation of the humus layers.
The commonest large mammal species, with a similar number of fragments of bone and teeth, are horse and a large bovine. A large number of specimens identified as red deer mainly comprises antler fragments; the majority of diagnostic specimens were shed antlers. Other species are less commonly represented, in some cases by only one or two fragments.
A few bone fragments of several species have impact scars due to deliberate fracture, although cut marks were not present, while a number of bones with carnivore gnawing shows that both human and animal activity have contributed to the final condition of the recovered assemblage.
Bone preservation is generally poor, with consequences for the interpretation of the faunal remains. Frequencies of body parts (e.g. the under-representation of vertebrae, ribs, other cancellous bone etc.) are probably due to differentiated destruction by weathering, and not selection by humans or even scavenging activities by carnivores. This means that interpretative models based on quantitative data from studies of recent assemblages (human or carnivore accumulated) are of no help in determining the role of man in the formation of the faunal assemblage.
In summary, it can be demonstrated by refitting that, due to post-depositional disturbances and poor definition of geological boundaries, artefacts and fauna recovered from different sedimentological units may possibly derive from the same episode of occupation. Neither spatial distribution nor refitting allow the identification of discrete concentrations of lithic material from single, clearly defined episodes of occupation. In the absence of clear indications for either spatial or temporal grouping of artefacts the lithic industry is therefore quantified in this study both separately by sedimentological unit and synthetically. Although spatial patterning shows that some faunal units have remained in articulation (despite the other evidence for transport and reworking), a certain association of the Plaidter Hummerich faunal and lithic assemblages cannot be demonstrated.

DIE KLEINSÄUGERFAUNA

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Kleinsäugerreste (Insectivora und Rodentia) konnten in fast allen Schichten nachgewiesen werden (Fig. 5). Die Erhaltung ist im allgemeinen gut, Erosionsspuren durch Transport gibt es kaum, und viele Reste (Unterkiefer, Schädel) sind mehr oder weniger komplett erhalten. Ein Teil des Materials zeigt Ätzspuren, die darauf hindeuten, daß es sich teilweise um Reste handelt, die in Form von Gewöllen von Eulen abgelagert wurden.

Eine fossile Anreicherung von Gewöllen ist in dem unteren Löß des Plaidter Hummerich (Fig. 6) nachgewiesen worden. Dieses Lößpaket lieferte eine außerordentlich reiche Konzentration von über tausend bestimmbaren Kleinsäugerresten, die aus einer Fläche von höchstens einem Quadratmeter stammen. Die übrigen Schichten lieferten im Vergleich zu dieser Konzentration relativ wenig Material. Schicht B hat z.B. nur 23 bestimmbare Kleinsäugermolaren geliefert; Schicht D1, 346.

Murmeltierreste (*Marmota* sp.) treten in der Kratermulde des Plaidter Hummerich sehr häufig auf. Hunderte gut erhaltene, z.T. artikulierte Reste konnten geborgen werden. In den damals aufgeschlossenen Profilen war manchmal sehr deutlich zu beobachten, daß die Tiere sich – ab und zu sogar sehr tief – in ältere Sedimente eingegraben haben. Die Position im Profil entspricht deshalb nicht dem stratigraphischen Alter der Fossilien.

Die Kleinsäugerfauna des Plaidter Hummerich wird von Wühlmausarten dominiert. Insektivoren-Reste kommen relativ selten vor und sind nur in dem unteren Lößpaket und im unteren Abschnitt der Humus-Schicht D1 nachgewiesen.

Fast alle Spitzmauszähne zeigen die typische dunkle, rotbraune Färbung der Spitzen. Auf Grund der morphologi-

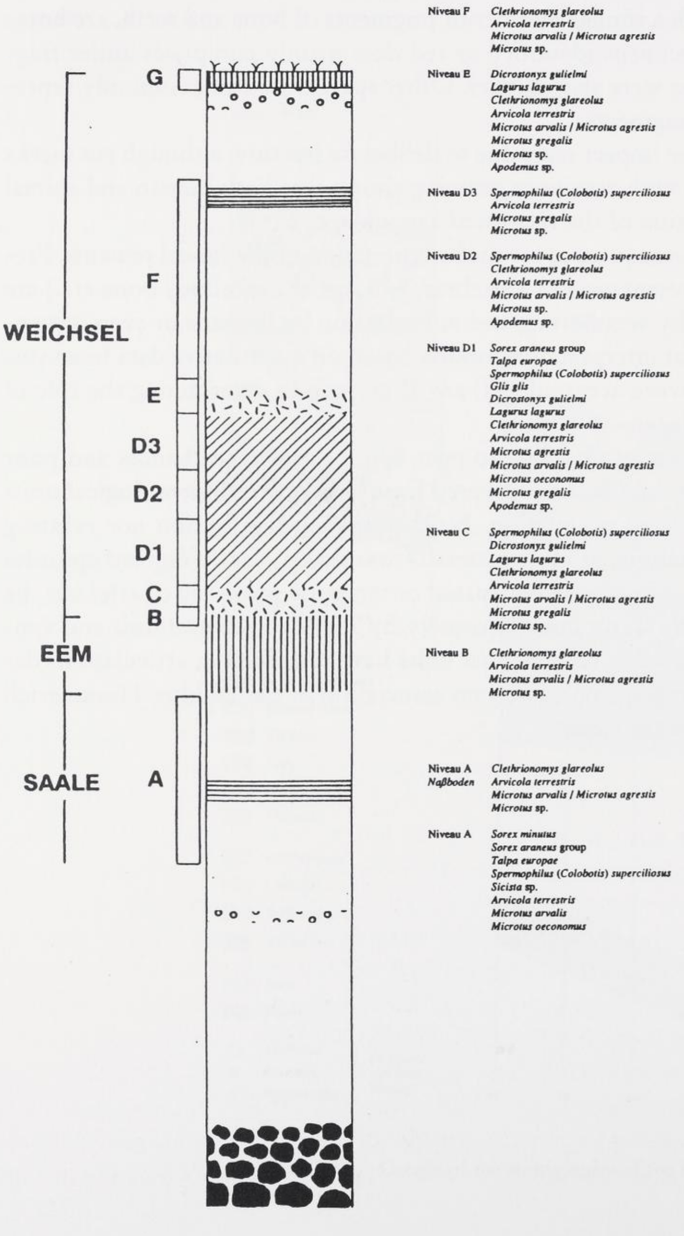


Fig. 5 Plaidter Hummerich: Schematisches Gesamtprofil mit Angabe der Kleinsäugerarten, die in verschiedenen Niveaus der Kraterfüllung nachgewiesen sind.

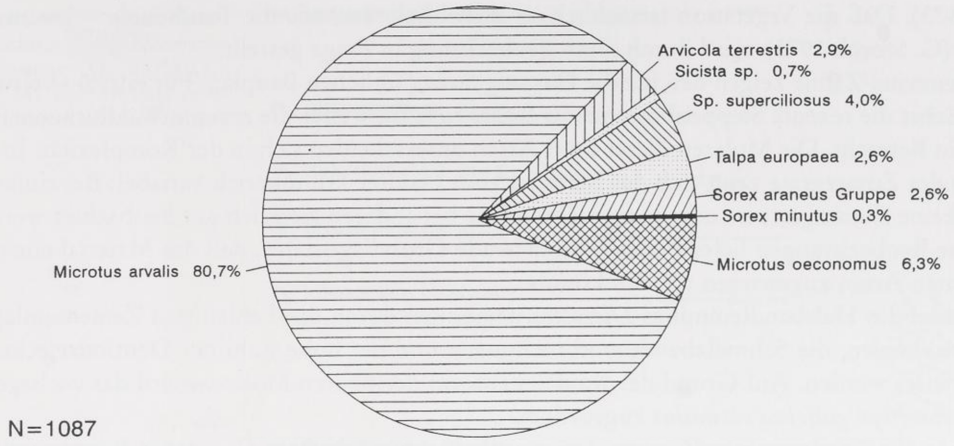


Fig. 6 Plaidter Hummerich. Saale-Löß: Prozentualer Anteil der Kleinsäugerarten der Faunengemeinschaft aus dem unteren Saale-Lößpaket.

schen Merkmale der Kiefer und der oberen und unteren Incisivi wurden die Spitzmausreste der Gattung *Sorex* zugeordnet. Die Reste vertreten mindestens zwei Arten von unterschiedlicher Größe. Dimensionen und Morphologie der kleineren Art stimmen sehr gut mit denen der rezenten Zwergspitzmaus *Sorex minutus* überein. *Sorex minutus* ist heute weit verbreitet und lebt hauptsächlich in trockeneren, offenen Landschaften von Europa bis Japan (H. G. B. Grzimek 1967). Reste der zweiten Gruppe sind eindeutig größer als die Funde, die als *Sorex minutus* beschrieben wurden. Größe und Morphologie der Zähne stimmen mit denen von der rezenten Waldspitzmaus *Sorex araneus* überein, lassen aber auch andere Arten, wie *Sorex coronatus* und *Sorex alpinus,* in Betracht kommen. Da die Systematik der *Sorex araneus*-Gruppe noch ungenügend geklärt ist (G. Storch 1974), und die Reste der Vulkane im allgemeinen dürftig sind, wird das Material als *Sorex* sp. bezeichnet.

Morphologie und Größe der Maulwurfreste erlauben eine Zuweisung zu *Talpa europaea*, eine Art, die heute weit verbreitet ist und sowohl in offenen Landschaften als auch im Laubwald lebt und für ihre unterirdische Tätigkeit lockeren, gut bewachsenen Boden bevorzugt.

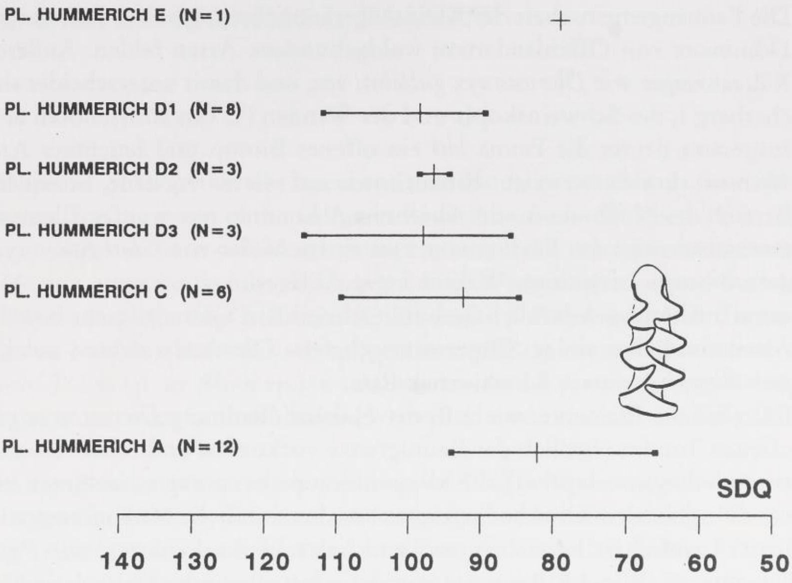
Das Artenspektrum der Nager ist in den fossilen Faunen des Plaidter Hummerich relativ groß trotz der geringen Anzahl von Resten, die in bestimmten Schichten nachgewiesen sind. Zieselreste wurden in mehreren Fundhorizonten des Plaidter Hummerichs geborgen. Es handelt sich um Reste einer größeren Zieselart. Die Maße und Morphologie des vorliegenden Materials stimmen gut mit denen der *Spermophilus* (*Colobotis*) *superciliosus*-Funde der jungpleistozänen Faunen von Eppelsheim und Rockenberg (G. A. Cubuk *et al.* 1980: 60) überein. Man vermutet, daß die Lebensweise des fossilen *Spermophilus* (*Colobotis*) *superciliosus* weitgehend mit der des rezenten, systematisch nahestehenden rötlichen Ziesels *Spermophilus* (*Colobotis*) *major* übereinstimmt und der fossile Nager ebenfalls eine Steppenlandschaft bevorzugte.

Die Murmeltierreste zeigen eindeutige Merkmale für eine Zuweisung zur Gattung *Marmota*. Eine genauere Zuordnung, etwa zum Alpen- (*Marmota marmota*) oder Steppenmurmeltier (*Marmota bobak*), wurde vom Verfasser nicht versucht (aber s. D. Kalthoff 1999a, 1999b).

Der Siebenschläfer *Glis glis* ist nur durch einen Zahn, mit seinem charakteristischen Muster, vertreten. Der bevorzugte Lebensraum der heutigen Siebenschläfer sind Laub- und Mischwälder. Die Art ist regelmäßig in den interglazialen Phasen des Pleistozäns zu finden. Das Vorkommen des Siebenschläfers scheint dabei aber weniger an die Klimabedingungen als an den Wald als Lebensraum gebunden zu sein (J. Chaline 1972: 56). *Glis glis* kommt nämlich auch in spätpleistozänen Kaltfaunen zusammen mit Tundrenelementen wie *Dicrostonyx* und *Lemmus* vor, etwa in der Fauna der Brillenhöhle, Schicht VI (G.

Storch 1973). Daß die Vegetation tatsächlich so einheitlich war, wie die Tundrenelemente anzudeuten scheinen (G. Storch 1973), wird durch diese Beobachtung in Frage gestellt.
Die Birkenmaus-Zähne zeigen den für die Gattung *Sicista* üblichen Bauplan. Für eine Zuweisung kommen zunächst die rezente Steppenbirkenmaus *Sicista subtilis*, weiter die rezente Waldbirkenmaus *Sicista betulina* in Betracht. Die Molaren dieser zwei Arten unterscheiden sich in der Komplexität. In der Entwicklung der Zusatzgrate zeigt sich das Material vom Plaidter Hummerich variabel: Bei einigen Molaren sind keine Zusatzgrate zu erkennen, während sie bei anderen ziemlich gut beobachtet werden können. Diese Beobachtungen liefern keine ausreichende Grundlage dafür, daß das Material einer der beiden rezenten Arten zugewiesen werden könnte.
Die Molaren des Halsbandlemmings *Dicrostonyx* können durch das Fehlen von Zementeinlagerungen in der Synklinalen, die Schmelzbandunterbrechungen und die hohe Zahl der Dentindreiecke beim M charakterisiert werden. Auf Grund der Kauflächenform der oberen Molaren wird das vorliegende Material *Dicrostonyx gulielmi rotundus* zugeordnet.
Fossilfunde des Graulemmings (*Lagurus lagurus*) sind in den Schichten C, D1 und E nachgewiesen. Die Reste haben wegen ihrer paläoökologischen und biostratigraphischen Aussagemöglichkeiten einen besonderen Wert. *Lagurus lagurus* bewohnt vorwiegend Steppenlandschaften, die sich durch hochkontinentale Klimaverhältnisse kennzeichnen lassen. Das heutige Areal liegt außerhalb des Dauerfrostgebietes. In saale- und weichselzeitlichen Kaltphasen wanderte die Art, unter speziellen Klimabedingungen, in Zentral- und Westeuropa ein (W. D. Heinrich 1991).
In fast allen Schichten kommen bewurzelte Wühlmausmolaren von mittlerer Größe vor. Nach ihrer Gestaltung gehören diese Molaren zum Formenkreis der rezenten Rötelmaus *Clethrionomys glareolus*, eine Art der westpaläarktischen Laub- und Mischwälder.
Schermausreste sind in den meisten Fundschichten recht oft vertreten. Dies ist sicherlich auch auf die Größe des Materials zurückzuführen; die Reste dieser Art fallen bei den archäologischen Ausgrabungen eher auf als die Reste von kleineren Arten. Die Molaren zeigen Merkmale, die auch für die rezente Schermaus *Arvicola terrestris* charakteristisch sind: Wurzellosigkeit, starke Zementeinlagerungen, drei Dentindreiecke und einen in geringem Maße variablen Vorderlobus. Schermausmolaren haben wegen ihrer biostratigraphischen Aussagemöglichkeiten einen besonderen Wert. Die zentral- und nordwesteuropäischen mittel- und spätpleistozänen *Arvicola*-Molaren zeigen eine Entwicklung in der Dicke des Schmelzbandes (W. von Koenigswald 1973). W. D. Heinrich (1978, 1987) stellte für Thüringen und Ungarn eine fortschreitende Abnahme der Dicke der hinteren Schmelzbänder am M1 im Verhältnis zu jener der vorderen fest. Ein Vergleich der Daten aus dem Thüringer Becken mit denen des Neuwieder Beckens und den Niederlanden zeigt, daß die Werte in Nordwest- und Zentraleuropa nicht geradlinig abnehmen. Die Abnahme wird im späten Saale-Komplex unterbrochen. Dieser Hiatus läßt sich mit dem Aussterben der weiterentwickelten Populationen und einer Neueinwanderung von primitiveren Formen, die heutzutage noch in Südeuropa vorkommen (T. van Kolfschoten 1990), erklären. Dieselbe Schwankung ist auch bei den vorgelegten *Arvicola*-Resten zu beobachten. Die älteren Funde vom Plaidter Hummerich (unterer Löß) haben niedrigere Schmelzdifferenzierungs-Quotientwerte als die jüngeren Molaren der oberen Schichten (Fig. 7).
Die meisten Molaren wurden der Gattung *Microtus* zugeordnet. Nur beim M1 kann man mehrere Gruppen oder Morphotypen unterscheiden, die bestimmten Arten zuzuordnen sind. Alle anderen *Microtus*-Molaren, mit Ausnahme der M2 von *Microtus agrestis*, zeigen dagegen keine artspezifischen Merkmale und können deswegen nicht zugeordnet werden. Molaren der Feldmaus *Microtus arvalis* sind schwer von denen der Erdmaus *Microtus agrestis* zu trennen. Das Material wird daher diesem Artenpaar zugewiesen. Eine Ausnahme bildet der M2, teilweise auch der M1. Allgemein läßt sich sagen, daß der M1 von *Microtus agrestis* asymmetrischer ausfällt. Die *Microtus* M1-Molaren der unteren Fauna vom Plaidter Hummerich wurden in ihrer Gesamtheit *Microtus arvalis* zugewiesen. Ausschlaggebend waren das Fehlen der Oberkiefermolaren M2 und M1 mit einer für *Microtus agrestis* charakteristischen Morphologie und die Symmetrie des M1. Ein außerordentlich hoher Anteil (37%) der Molaren stammt von sehr jungen Tieren. Die Molaren zeigen ein kompliziertes Kauflächenmuster, dünnen Schmelz und in

Fig. 7 Variationsbreite und Mittelwerte der Schmelzband Differenzierungs Quotienten-Werte (S. D. Q. - Werte) des M1 von *Arvicola terrestris* aus den verschiedenen Niveaus.



vielen Fällen konfluente Dentindreiecke. Das Auftreten von *Microtus agrestis* in Schicht D1 ist durch einen Oberkiefermolar mit einer gut entwickelten, zusätzlichen Schmelzfalte nachgewiesen.
Die Sumpfmaus, *Microtus oeconomus,* ist in der unteren Fauna vom Plaidter Hummerich relativ gut vertreten. Die Art bevorzugt Feuchtbiotope mit dichtem Pflanzenwuchs und kommt in der kalten bis gemäßigten Zone der Holarktis vor (J. Tast 1982).
Zähne der schmalschädeligen Wühlmaus *Microtus gregalis* sind in den Schichten C, D1, D3 und E nachgewiesen. *Microtus gregalis* lebt heute sowohl in der arktischen Tundra als auch in der Steppe. Ihr Auftreten in fossilen Faunen kann als Hinweis auf einen hohen Anteil von trockenen Biotopen (G. Storch 1969; W. von Koenigswald 1985) gewertet werden.
Muriden sind in der Fauna kaum vertreten, nur einige *Apodemus*-Reste konnten geborgen worden. Diese Reste stimmen morphologisch mit Molaren der rezenten Waldmaus *Apodemus sylvaticus* überein. Für eine Zuordnung kommen aber auch die Gelbhalsmaus *Apodemus flavicollis* und die Alpenwaldmaus *Apodemus alpicola* in Betracht. Durch die geringe Anzahl der Molaren und das Fehlen charakteristischer Elemente kann das Vorkommen der beiden letzten Arten nicht völlig ausgeschlossen werden.

PALÄOÖKOLOGISCHE UND STRATIGRAPHISCHE AUSSAGEN

Infolge der Durchmischung von Faunenkomponenten unterschiedlichen Alters, durch Abtragung von älteren Schichten bei der Ablagerung und die horizontale Abtragung der schräggestellten Schichten bei den archäologischen Grabungsaktivitäten, die bei der Bearbeitung der Molluskengemeinschaften nachgewiesen ist (T. van Kolfschoten & G. Roth 1993), liefern die Kleinsäugergesellschaften aus den Abschnitten C, D1-D3 und E kein völlig eindeutiges paläoökologisches Bild. Sie zeigen eine Mischung von kaltzeitlichen Elementen, wie z.B. *Dicrostonyx gulielmi,* und Arten (wie *Lagurus lagurus*), die Steppenbiotope bevorzugen, und von Waldbewohnern wie *Clethrionomys glareolus.* Trotz der Durchmischung gibt es Differenzen in der Faunenzusammensetzung, die als Unterschiede in den paläoökologischen Verhältnissen während der Ablagerung zu interpretieren sind.

Die Faunengemeinschaft der Kleinsäugeranreicherungen aus dem unteren Lößpaket (Abb. 7) zeigt eine Dominanz von Offenlandarten; waldgebundene Arten fehlen. Außerdem kommen keine eindeutigen Kälteanzeiger wie *Dicrostonyx gulielmi* vor, und damit unterscheidet sich diese Fauna von der des Tönchesberg I, des Schweinskopfs und der Wannen (T. van Kolfschoten & G. Roth 1993).
Insgesamt deutet die Fauna auf ein offenes Biotop und feuchtere Areale, wo *Arvicola terrestris* und *Microtus oeconomus* gelebt haben, sowie auf relativ trockene, kontinentale Klimabedingungen hin. Im Bereich des Naßbodens von Abschnitt A konnten nur wenige Kleinsäugerreste geborgen werden. Bemerkenswert ist das Vorkommen von einem Molar von *Clethrionomys glareolus*, einer Art, die bewaldete Biotope bevorzugt. Während des Ablagerungszeitraums von Abschnitt A waren offensichtlich, wenn auch nur gelegentlich und in beschränktem Umfang, mehr bewaldete Areale vorhanden.
Abschnitt B hat einige Säugerreste geliefert. Die Arten deuten auf teilweise bewaldete Biotope und gemäßigte bis warme Klimaverhältnisse.
Kaltzeitliche Elemente, wie z.B. der Halsbandlemming *Dicrostonyx gulielmi*, der hauptsächlich in der offenen Tundra nördlich der Baumgrenze vorkommt und relativ trockene Biotope bevorzugt, und Arten (wie *Lagurus lagurus*), die Steppenbiotope bevorzugen, kommen in den Fließerdschichten C und E vor. Die glazialen Klimabedingungen werden durch die Molluskengesellschaften bestätigt. Arten der offenen Landschaft herrschen vor, und kaltzeitliche Leitarten wie *Pupilla loessica* dominieren in den Schichten C, E und F. *P. loessica* kommt in fast allen Schichten relativ häufig vor, auch in Schicht D1. Die Art fehlt aber in Schicht D2. Das Fehlen von *P. loessica* untermauert das Bild, demzufolge die Ablagerung der Schichten D1-D3, jedenfalls teilweise, während einer wärmeren Klimaphase stattgefunden hat, und eine mögliche Mischung der Schichten nicht hundertprozentig war.

STRATIGRAPHIE

Die paläoökologischen Daten, die einen Wechsel von kälteren und wärmeren Klimaphasen andeuten, zusammen mit dem Vorkommen eines Bt-Horizonts und einer mächtigen Humus-Schicht, zeigen, daß mehrere Klimaschwankungen in der Kraterfüllung repräsentiert sind. Die Kleinsäugerfaunen sind ziemlich modern und deuten auf ein spätmittel- oder spätpleistozänes Alter hin. Die Schermausmolaren zeigen eine hochevoluierte Differenzierung des Schmelzes mit S. D. Q.-Werten von 79-98,5; Werte, die eine Einstufung in den jüngsten Abschnitt der vorletzten Kaltzeit oder der letzten Kaltzeit nahelegen (T. van Kolfschoten 1990). Die Thermolumineszenz-Daten der Lösse von 22,56-23,23 (oberer Löß) bzw. 134,6 und 135,0 ka (unterer Löß) bestätigen diese Altersangaben (A. K. Singhvi *et al.* 1986).
Die Faunenreste aus den unteren Lößablagerungen Abschnitt A werden auf Grund der Entwicklung der Schermäuse, mit dem unteren kaltzeitlichen Paket, aufgeschlossen in den Kratermulden von Tönchesberg I, Schweinskopf-Karmelenberg und Wannen und dem oberen Abschnitt der Lößdecke II von Ariendorf, altersmäßig gleichgesetzt.
Der interglaziale Bodenrest, im Hangenden der unteren Lößschicht, kann aus diesem Grund der vorletzten Warmzeit, dem Eem, zugerechnet werden. Auf dem eemzeitlichen Paläoboden liegt eine Fließerdschicht mit u.a. *Dicrostonyx gulielmi*, einem Indikator für kältere Klimabedingungen. Diese Fließerdschicht trennt den interglazialen Eem-Boden und die Humuszonen von den im Hangenden vorkommenden warmzeitlichen Klimaindikatoren, wie z.B. *Glis glis* und *Capreolus capreolus* (T. van Kolfschoten & G. Roth 1993), und den archäologischen Befunden. Es läßt sich deswegen vermuten, daß die Besiedlungsphase vom Plaidter Hummerich jünger ist als jene vom Tönchesberg II und mit einer der Interstadialen des letzten Glazials, (Amersfoort, Brørup, Odderade) gleichgestellt werden sollte.

THE LARGE MAMMAL FAUNA

Bones, teeth and antler of several species of larger vertebrates constitute the majority of finds from the Plaidter-Hummerich. They can be assigned to seven of the sedimentological horizons (Niveaux A, B, C, D1-D3 and E: Fig. 9, Fig. 10, Fig. 11) identified in sediments of the crater fill. All remains of Mammalia recovered by excavations at the site were studied for this report. Faunal remains recovered during preliminary investigations in 1983 were published by E. Turner (G. Bosinski, J. Kulemeyer & E. Turner 1983), at which time red deer (*Cervus elaphus*), horse (*Equus* sp.), extinct wild ass (*Equus hydruntinus*), a large, not further identifiable bovid (*Bos* sp. or *Bison* sp.), a smaller cervid and, possibly, a giant deer were identified. Continuation of the excavations in the following year produced remains of woolly rhinoceros and fox (K. Kröger 1987).

A number of faunal remains from the Plaidter Hummerich was described by E. Turner in a thesis presented at the University of Birmingham in 1989. By this time the faunal list had been extended to include hyaena (*Crocuta crocuta*), lion (*Panthera leo spelaea*), reindeer (*Rangifer tarandus*), fallow (*Dama dama*) and roe deer (*Capreolus capreolus*). The remains of the large bovid were identified as probably aurochs (cf. *Bos primigenius*). Finds previously described as giant deer were revised (E. Turner 1990).

The following report revises some previous identifications and includes material which was still being processed in 1988 and could therefore not be included in E. Turner's (1989) thesis. The definitive quantification of the faunal assemblage and analysis of its stratigraphical and spatial distribution and of modifications to the material by man and carnivores are presented here for the first time. Taxonomy and osteometry will be presented by E. Turner in a separate paper.

CONSERVATION AND RECORDING OF FAUNAL REMAINS

After excavation, faunal remains were transported directly to the laboratories of the *Forschungsbereich Altsteinzeit* in Schloß Monrepos, Neuwied. Post-depositional fracture of many bones and their generally poor state of preservation meant that several of the larger finds had to be removed from the site in sediment blocks supported in plaster casts. Further cleaning away of soil around the finds took place in the plaster cast, the finds only being removed immediately prior to their preservation.

All the faunal remains were conserved in a cylindrical vacuum-drying tank (Heraeus *Vakuum-Trocken-Schrank* VTR 5050K) using a 20:1 solution of *Äthylalkohol* 641 (Ethanol 96%) and PVA (Mowilith 35/73 Fest, Hoechst, Frankfurt-am-Main). Fragmented bones were glued together using 2-component epoxy resin adhesive or *Cyancrylatklebestoff* adhesive (Esterbond CA, Nürnberg) before conservation.

Registration numbers referred to in the text normally derive from the consecutive numbering of finds within excavation units of 1 m^2. Excavated specimens are listed according to the sedimentological unit to which they were subsequently attributed by the director of the excavation. Unstratified specimens, usually found in the backdirt left by quarrying operations, are labelled consecutively as *Streufund*. In addition to the finds recorded individually during excavation, a quantity of material was bagged by m^2 as *Sammelfunde*. This consists of smaller fragments and pieces considered by excavators to be indeterminable. Often a large number of very different fragments are bagged together. For this study all these fragments were re-examined and those pieces identifiable to species (including all teeth and antler) were upgraded to »single finds«.

Total records in database	**3,083**	
Total number of finds excluded from the analysis	314	
Records (e.g. tooth rows etc) not representing true finds		27
Unlocated finds/single finds subsequently downgraded by the excavator to *Sammelfunde*		178
Marmota sp.		109
Number of analysed fragments	2,769	
Analysed material identified to species		1,255
Analysed material unidentified to species		1,514

Fig. 8 Composition of the faunal database by class of material.

The faunal material was recorded by the author in a database using the site documentation (plans, lists) prepared by the excavation director (Karl Kröger) for the *Landesamt für Denkmalpflege*, Koblenz, where the excavated material will be finally stored. In some cases, several distinct finds had originally been recorded by the members of the excavation team under a single number. Sometimes these were bones of one animal, and clearly represent body parts found in articulation. In other cases, material with no clear association (e. g. bones of different species) also bears the same number. In the event of several finds bearing the same number, the original find number was still applied to all the finds, but individually identified by the addition of a letter – e. g. 1a, 1b,1c etc.
It was also found useful to assign extended numbers to finds of mandibles and maxillae with several teeth, in order to record the individual teeth for comparison with others found out of the jaw. Unlike the previous duplicate numbers, which constitute legitimate multiple finds, this system of numbering is a convenience only and it would be misleading to treat each tooth as a single find for purposes of quantification or plotting. As a result, the database in its final form contains 3,083 records which represent only 3,056 actual finds. This total of 3,056 valid finds includes those *Sammelfunde* and pieces recovered during wet screening which were identified for the first time during the present analysis and added to the database. By contrast, 178 finds registered in the original documentation (plans and lists) and still included in the faunal database could no longer be located by the present study. The vast majority are very small bone splinters recovered from test pits in the first excavation campaign. In many cases there is a record of the subsequent demotion of these unidentifiable fragments to *Sammelfunde*. Only 13 of the unlocated finds were described to species in the original lists and it seems probable that some of them might still be present but are now listed as *Streufunde*, following loss of details of their provenance. The true loss of material is therefore negligible. The »identified« missing fragments are here recorded as indeterminate, since the accuracy of the determination could no longer be controlled.
A further 109 finds in the database are remains of marmot. These were observed to be intrusive into the archaeological layer and, in some cases, were found as articulated skeletons in loess filled crotovinas. They have been examined in a separate study undertaken at the Palaeontological Institute of the University of Bonn (D. Kalthoff 1999a, 1999b).
There remain 2,769 database entries representing actual finds of bone, tooth and antler studied by this analysis. In the majority of cases the excavation co-ordinates were measured three-dimensionally and the finds are attributed to a geological layer (Niveau). 58 examined finds are *Streufunde*, i.e. material out of context, but this can be, in most cases, attributed to the early Weichselian faunal assemblage(s) due to similarities of preservation. A further 14 finds were recovered and measured during excavation, but not subsequently assigned by the director to a specific geological layer. The final breakdown of the faunal database is shown in Fig. 8.

A total of 1,255 finds (45.35%) was identified to species (Fig. 11). Almost all of this material represents large herbivore species, the exception being a small number of remains of several species of carnivore.

Of the 1,514 fragments not identified to species, the majority could at least be recognised as bones of large herbivores and these were classed by category of body part (shaft fragment, cancellous bone etc., Fig. 12). By far the most common category of unidentified bone was formed by fragments of long bone shafts (876 = 57.86%).

FAUNAL SPECTRUM AND BIOSTRATIGRAPHY

Although remains of large mammals have been attributed to a total of seven of the sedimentological units recognised at the Plaidter Hummerich, the quantity of material recovered from each unit differs greatly (Fig. 9, Fig. 10, Fig. 11). No large mammal fauna was recovered from Niveau F, and the loess of the penultimate glaciation (Niveau A) only yielded three finds of large mammals.

The largest number of finds (1,657 excluding *Marmota*) was recovered from the oldest of the three early Weichselian humus soils (Niveau D1), with appreciably less material located in the immediately underlying (Niveau C – 545 finds) and overlying (Niveau D2 – 276 finds) levels. The interglacial soil horizon and the youngest Weichselian humus soil yielded similar numbers of finds (49 finds from Niveau B, 50 from Niveau D3), while the youngest layer (Niveau E), overlying the youngest humus deposit, provided 117 finds. In a number of cases lithic material (Fig. 13) and bone fragments (Fig. 15) attributed to different geological levels can be refitted. The presence of horse teeth assigned by Elaine Turner's analysis to the same individual in as many as three sedimentological units (Fig. 14) suggests either that the attribution of material to geological layer is not always accurate, or that movement of material between geological layers was part of the site formation process. The same phenomenon is suggested by a concentration of bovid foetal bone and deciduous dentition at the Northwest of the site, which lies in both Niveau D1 and Niveau C (Fig. 16a).

Refitting lines of both fauna and artefacts follow the direction of the (in places pronounced) slope (Fig. 13, 15). In the case of faunal refits, the lines connect topographically higher, but stratigraphically older, sediment layers with lower and younger ones. This suggests that downslope movement of older material, both the sediment itself and any contained fauna and artefacts, played a role in the formation of each subsequent layer.

This is also indicated by the incorporation of scoria fragments throughout most of the stratigraphic sequences. The only source for this material, once the interior of the crater had been covered by the initial Saalian loess deposition, was subsequent erosion of material from the crater walls. It is inconceivable that such downslope movement would be limited to scoria, and not affect other material present at the site.

It therefore seems probable that re-deposition of material, and not unreliability of context, is responsible for the refitting of material between different layers. This interpretation suggests that, while it is probably useful to continue to treat the material from different geological layers separately, the incorporation of older material into younger contexts was possibly an important phenomenon, and that an unknown, but potentially major, proportion of the fauna of the oldest humus soil, Niveau D1, might have been originally deposited in Niveau C.

Having recognised and defined this problem, it was nevertheless decided to treat the fauna of the geological layers separately, in the hope that differences between them might be demonstrated empirically and themselves define the individuality of each layer. A global picture of the fauna recovered at the site can then easily be given by combining the results from the different layers.

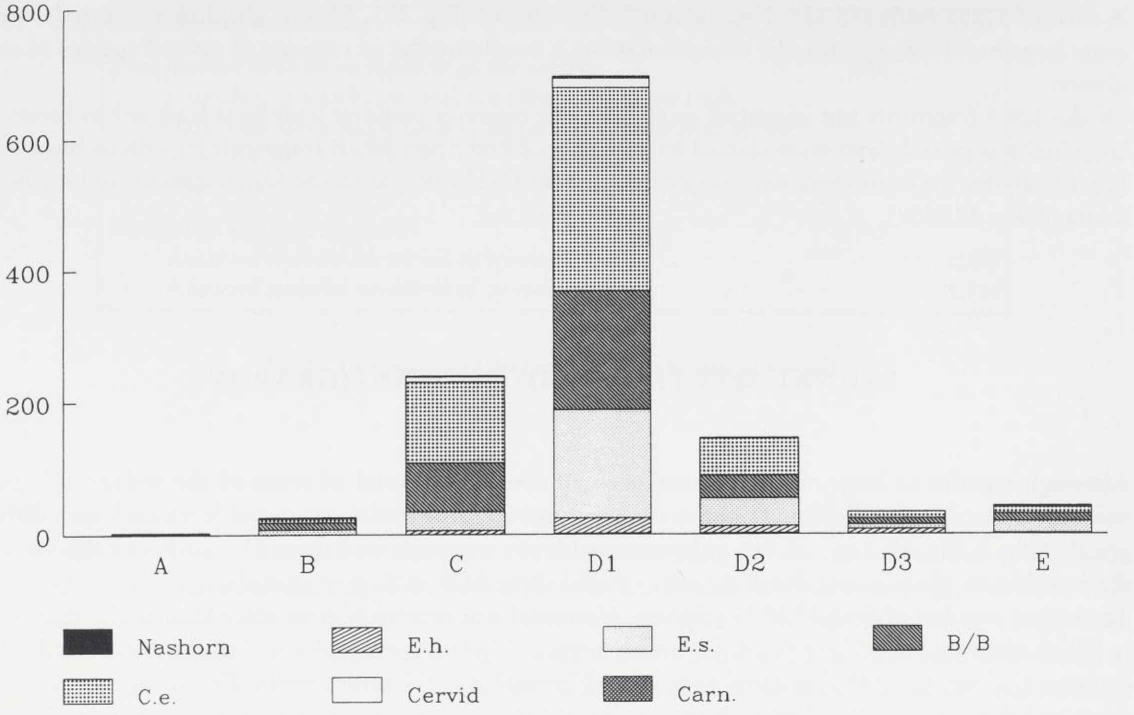


Fig. 9 Graphic representation of the contribution of each large mammal species to the fauna of the different geological layers (based on numbers of identified specimens).

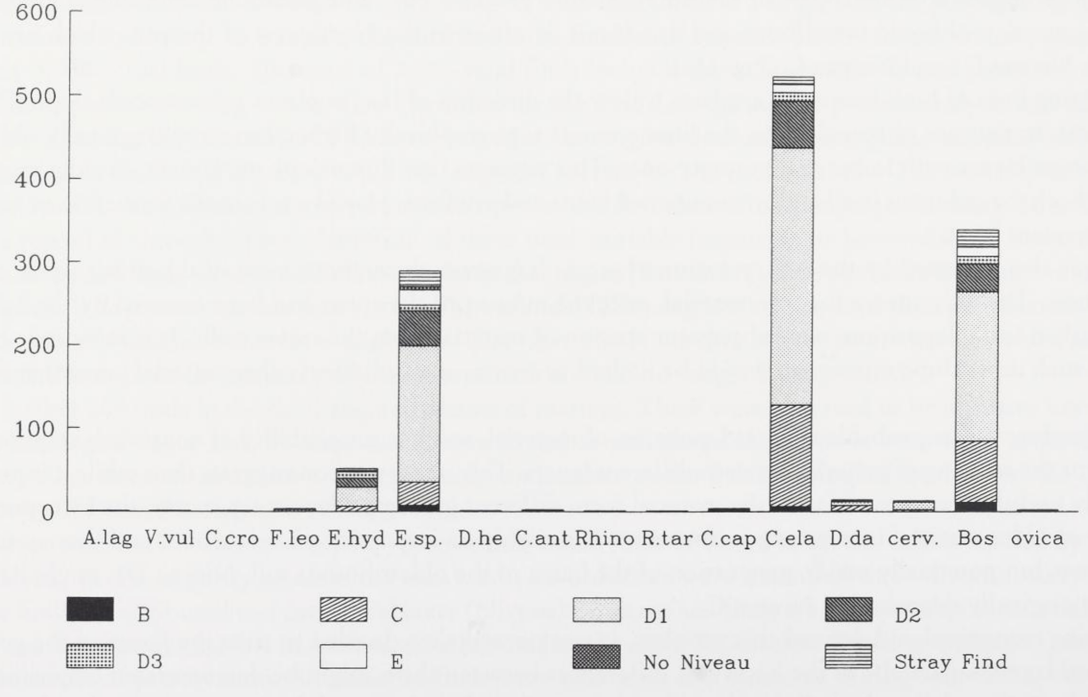


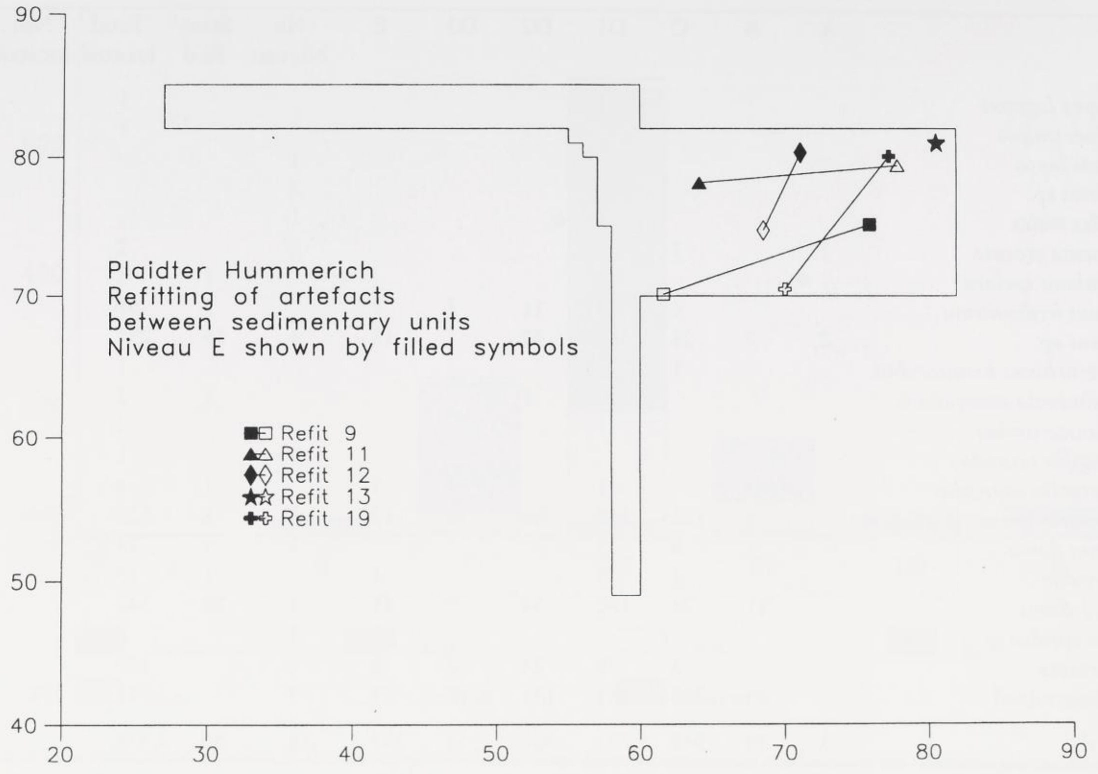
Fig. 10 Graphic representation of the proportional contribution of each geological layer to the different large mammal species (based on numbers of identified specimens).

	A	B	C	D1	D2	D3	E	No Niveau	Stray find	Total located	Not located
Alopex lagopus				1						1	
Vulpes vulpes					1					1	
Canis lupus								1	1	2	
Martes sp.								2		2	
Meles meles								1		1	
Crocuta crocuta	1		1							2	
Panthera spelaea				2					1	3	
Equus hydruntinus			6	23	11	7	1		3	51	
Equus sp.	2	7	28	164	42	7	18	4	19	291	
Dicerorhinus hemitoechus			1							1	
Coelodonta antiquitatis					1				1	2	
Rhinocerotidae				1						1	
Rangifer tarandus								1		1	
Capreolus capreolus		1		1			1		1	4	
Cervus elaphus		6	122	310	56	10	10	1	8	523	
Dama dama		1	6	5				1	1	14	
Cervidae			2	9			1		1	13	
Bos / Bison		11	74	180	34	9	11	1	20	340	
Ovicapridae							1	1		2	
Marmota			3	74	24	2	6			109	
undetermined		23	305	961	131	17	74	3		1,514	178
Total	3	49	548	1,731	300	52	123	16	56	2,878	

Fig. 11 Faunal database. Species representation by geological layer (Niveau).

Body part	**NISP**	**%**
Skull	4	0.26
Mandible	3	0.20
Tooth enamel	4	0.26
Vertebra	18	1.19
Rib	6	0.40
Flat bone	4	0.26
Cancellous bone	58	3.84
Scapula	4	0.26
Humerus	20	1.32
Radius	9	0.59
Shaft fragment	876	57.86
Pelvis	7	0.46
Femur	3	0.20
Patella	1	0.07
Tibia	8	0.53
Metapodium	2	0.13
Sesamoid	1	0.07
Indet. fragment	486	32.10
Total number	1,514	100.0

Fig. 12 Bones not identified to species.



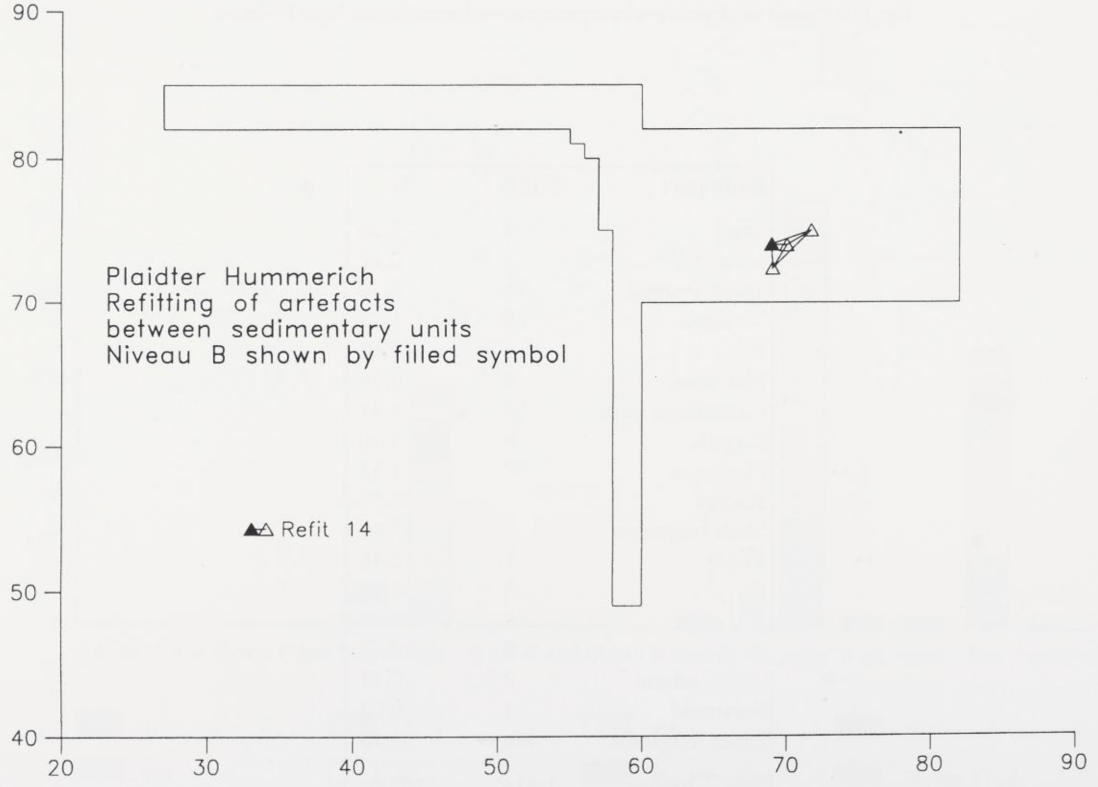
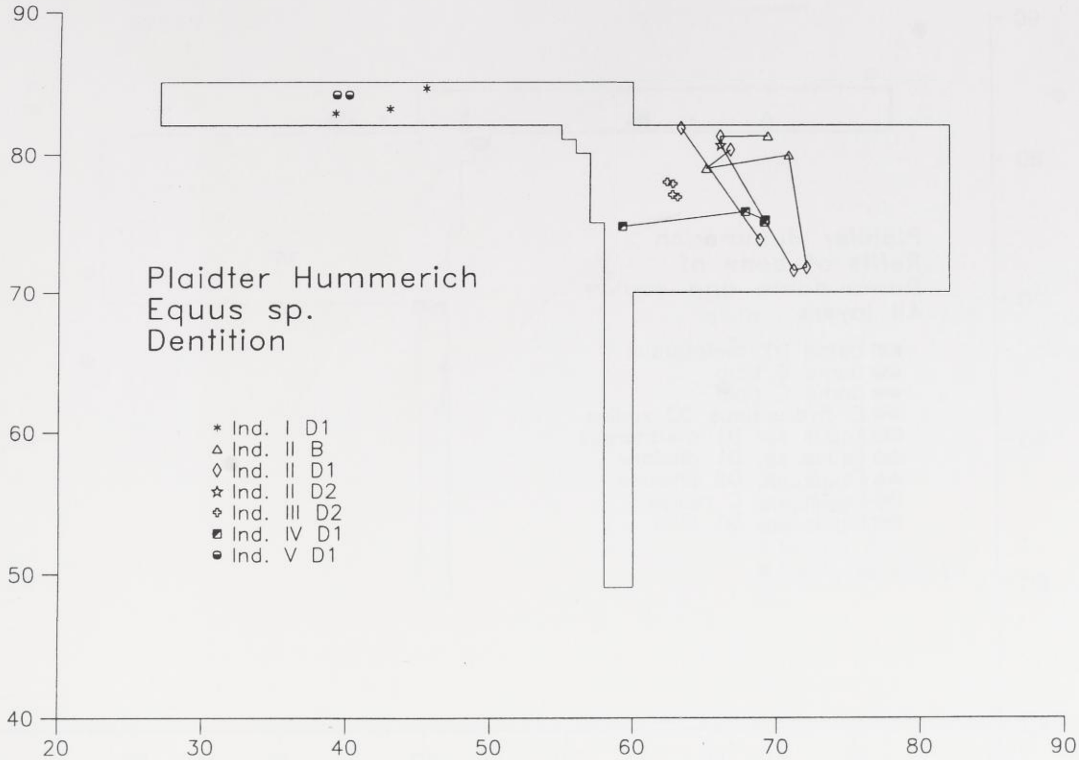


Fig. 13 Refitting of artefacts between sedimentary units. – Above: Refits between Niveaux D1 and E (Niveau E shown by filled symbols); below: Refits between Niveaux D1 and B (Niveau B shown by filled symbols).



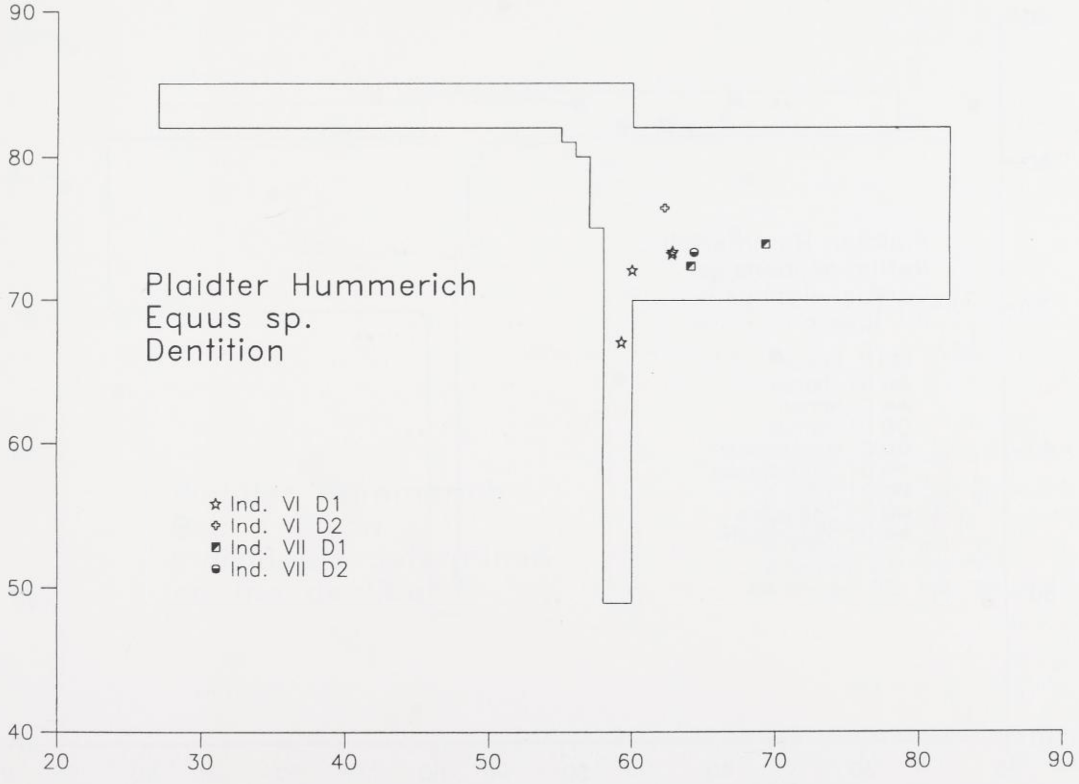


Fig. 14 Location and stratigraphic provenance of the teeth of seven identified individuals of horse (*Equus* sp.).

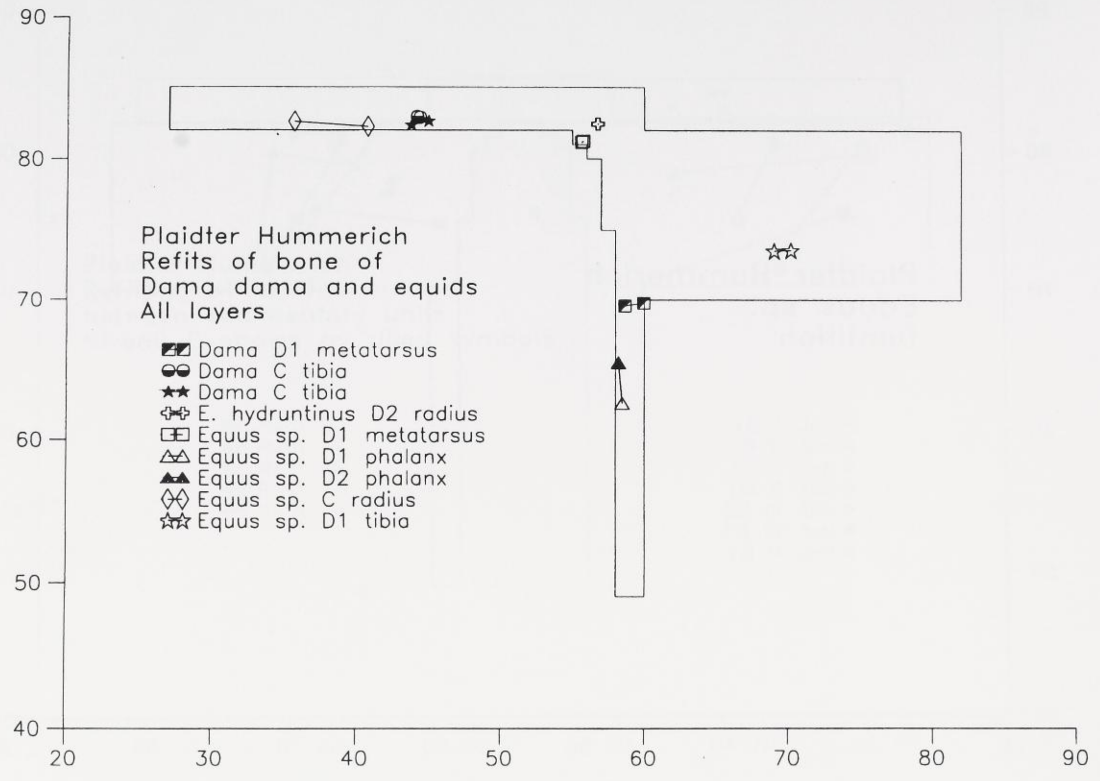
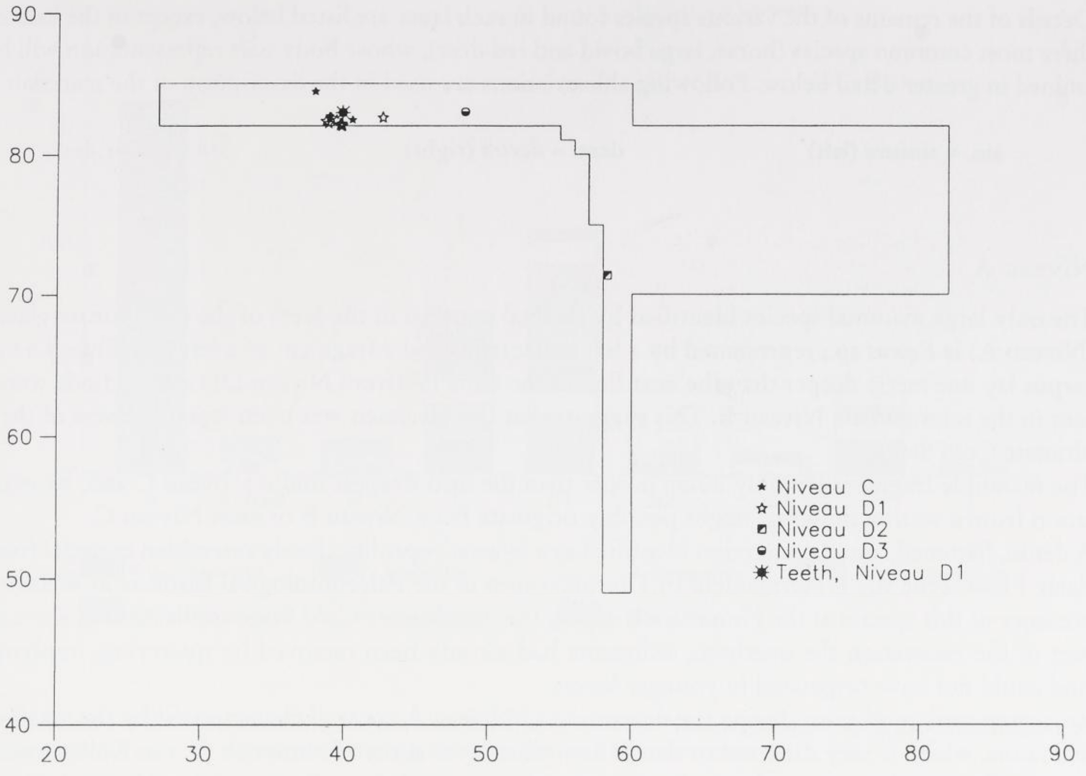


Fig. 15 Location and stratigraphic provenance of refitted bone fragments. – Above: Refits on bone of equids (*Equus* sp. and *Equus hydruntinus*) and fallow deer (*Dama dama*); below: Refits on bone of red deer (*Cervus elaphus*).



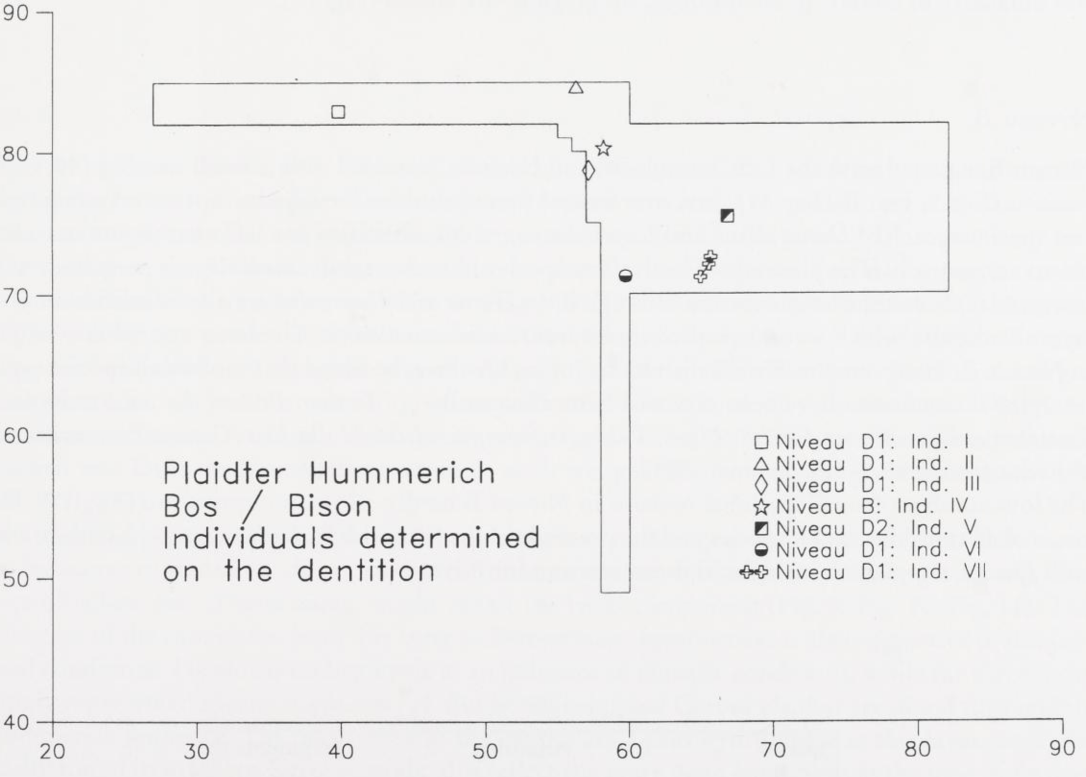


Fig. 16 Above: Location and stratigraphic provenance of foetal bone of the large bovid (cf. *Bos primigenius*); below: Location of teeth of seven individuals of bovid (cf. *Bos primigenius*). Determination after E. Turner.

Details of the remains of the various species found in each layer are listed below, except in the case of the three most common species (horse, large bovid and red deer), whose body part representation will be examined in greater detail below. Following abbreviations are used in the description of the material:

sin. = *sinistra* (left) **dext. = *dextra* (right)** **s/d = sin. or dext.**

Niveau A

The only large mammal species identified by skeletal material in the loess of the penultimate glaciation (Niveau A) is *Equus* sp., represented by a left metacarpus and a fragment of a left mandible. The metacarpus lay one metre deeper than the next find in the same m^2 (from Niveau D1) and no finds were present in the intermediate Niveau B. This suggests that the specimen was truly from the loess of the penultimate Cold Stage.

The mandible fragment lay only 30 cm deeper than the next deepest find in Niveau C and, by extrapolation from a section drawing, might possibly originate from Niveau B or even Niveau C.

A dense, flattened round concretion identified as a hyaena coprolite closely resembled material from the Early Pleistocene site Untermaßfeld in Thuringia seen in the Palaeontological Institute at Weimar. The presence of this species at the Hummerich during the penultimate Cold Stage seems assured since at this part of the excavation the overlying sediments had already been removed by quarrying, implying the find could not have originated in younger layers.

Environmental conditions during the deposition of Niveau A are well characterised by the small mammal fauna, which is very different to that of any other layer at the Hummerich (T. van Kolfschoten, this paper). The faunal spectrum shows the presence of open conditions (*Spermophilus*, *M. arvalis*) but species indicative of cold (e. g. *Dicrostonyx*, *M. gregalis*) are absent (Fig. 17).

Niveau B

Niveau B, equated with the Last Interglacial soil horizon, provided only a small number (49) of faunal remains (Fig. 9, Fig. 10, Fig. 11). Just over half of these could be identified to species. Among them are one specimen each of *Dama dama* and *Capreolus capreolus*, identified as a left metacarpus and a left humerus respectively. The presence of both these species in such a small assemblage is consistent with the interglacial character of the deposit, although both *Dama* and *Capreolus* are also identified in younger layers at the site which were deposited under interstadial conditions. The latter species is even present in Niveau E, interpreted as Weichselian loess. It can, however, be noted that molluscan species typical of interglacial conditions have been reported from Niveau B ». . . *In dem Boden, der zahlreiche* $CaCO_3$-*Pseudomycelien aufwies, fand E. Bibus, Tübingen, warmzeitliche Mollusken (Cepaea hortensis und Bradybaena fruticum. . .*« (A. Semmel 1991).

The low number of small mammal remains in Niveau B hardly allows interpretation (Fig. 17). The absence of all typically stadial species and the presence of the bank vole (*Clethrionomys glareolus*), a woodland species, support an interglacial interpretation for Niveau B.

Species	Anatomy	fragments (n)
Capreolus capreolus	Metacarpus sin.	1
Dama dama	Humerus sin.	1

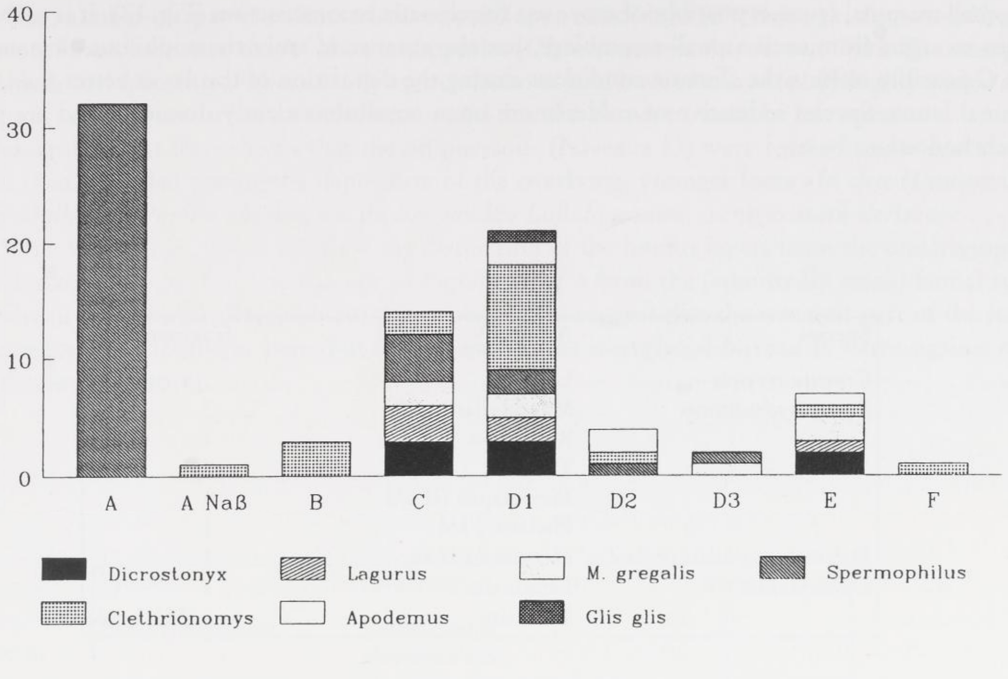


Fig. 17 Summary of the representation of diagnostic species of rodents in the different geological layers (based on numbers of identified specimens); data after Th. van Kolfschoten, this paper.

Niveau C

The layer of sediment (Fließerde = Niveau C) found above the interglacial soil is only present towards the edge of the crater. It is interpreted as a soliflucted deposit which was formed during cold conditions after the last interglacial »Der warmzeitliche Boden wurde von einem hellbraunen schluffigen Sand [Niveau C] überlagert, der 35 cm mächtig war und im basalen Teil zahlreiche solifluidal eingeregelte basaltische Schlackenbröckchen und stellenweise kräftige CaCO3 Ausscheidungen enthielt.« (A. Semmel 1991). The solifluction process will have truncated the interglacial palaeosol »... durch die im Zusammenhang mit Solifluktion häufig vorkommende Abspülung kann ein Teil des oberen Bt-Horizontes gekappt worden sein ...«, but this truncation is not believed to have been very pronounced »Die Horizontverkürzung hat aber wohl nur einen geringen Betrag erreicht, denn die vorstehend beschriebene Mächtigkeit und Differenzierung entspricht m.E. noch weitgehend dem ursprünglichen Zustand.« (A. Semmel 1991, 285).

It might therefore be expected that Niveau C would contain a heterogeneous fauna, with autochthonous species indicative of stadial conditions and allochthonous species derived from the interglacial soil. The presence of fallow deer (*Dama dama*) might reflect the latter component (Fig. 9, Fig. 10, Fig. 11). The identification of the rhinoceros from this layer as *Dicerorhinus hemitoechus* is also suggestive of not fully glacial conditions. Hyaena is undiagnostic as an indicator of climatic conditions, while the three most commonly represented species, *Equus* sp., cf. *Bos primigenius* and *Cervus elaphus* are found throughout the Hummerich sequence. The occurrence of the extinct ass *Equus hydruntinus* in this layer, a species essentially found in southern Europe, might also reflect the more open conditions at the time of formation of the solifluction layer, but the faunal spectrum is in no way suggestive of extreme stadial conditions.

The small mammal fauna is possibly of more use for climatic reconstruction (Fig. 17). It is perhaps dangerous to argue from such a small assemblage, but the absence of truly themophilous elements in Niveau C possibly reflects the climatic conditions during the deposition of this layer better than the large mammal fauna. Species indicative of colder/more open conditions clearly dominate and are probably autochthonous.

Species	Anatomy	fragments (n)
Crocuta crocuta	Ulna sin.	1
Equus hydruntinus	Mandibular tooth	3
	Radius sin.	1
	Tibia sin.	1
	Metacarpus III s/d	1
	Phalanx 2 s/d	1
Dicerorhinus hemitoechus	Metatarsus II sin.	1
Dama dama	Femur sin.	1
	Tibia sin.	5 (MNI = 3)

Niveau D1

Niveau D1 is interpreted as a humus-rich steppe soil formed during the early part of the last Cold Phase »*The humus layer is inferred to correspond to the beginning of the Würmian …*« (A. K. Singhvi *et al.* 1986) and is the oldest of three such described deposits, [*es*] »*…schloß sich über der Solifluktionslage ein schwarzbrauner Abschnitt an, der hier 120cm mächtig war. Er ließ sich in einen basalen 40cm starken Horizont (7, 5 YR 4/4) mit zahlreichen basaltischen Schlackenbröckchen* [D1], *einen mittleren 30cm starken bräunlich gefärbten und deutlich steinärmeren Horizont* [D2] *und einen hangenden 50cm starken Horizont* [D3*] mit kräftiger Braunfleckung gliedern …*« (A. Semmel 1991).
Niveau D1 contained the largest amount of faunal remains, in terms of numbers of bone and tooth fragments, recovered from the Plaidter Hummerich. Nevertheless, despite providing over three times the number of specimens as Niveau C (the layer with the next highest number of specimens), the number of large mammal species identified is almost the same in both layers (9 in Niveau D1, 7 in Niveau C). The faunal spectrum of the layers is very similar, but not identical (Fig. 9, Fig. 10, Fig. 11); the only real difference is provided by the less commonly identified species. Thus, hyaena is not present, but both lion (*Panthera leo spelaea*) and arctic fox (*Alopex lagopus*) are found in Niveau D1. Rhinoceros and roe deer (*Capreolus capreolus*) are each represented by one identified fragment. Otherwise, the dominance and relative proportions of *Equus* sp., cf. *Bos primigenius* and *Cervus elaphus* are still present, as are the much less important species *Dama dama* and *Equus hydruntinus*. The solifluction layer (Niveau C) and the oldest interstadial soil (Niveau D1) are, to all intents and purposes indistinguishable on the basis of their large mammal fauna. Additionally, refitted bone fragments and tooth series show that either there was movement of material between the layers or that their definition and distinction are not 100% accurate.
The small mammal fauna is only slightly less ambiguous. Unlike Niveau C, which produced a fauna lacking thermophilous species, the faunal spectrum of Niveau D1 reveals a heterogeneous species list

(Fig. 17). The number of species characteristic of cold/open conditions (*Dicrostonyx*, *Lagurus*, *M. gregalis*, *Spermophilus*) is close to that of the thermophiles (*Clethrionomys*, *Apodemus*, *Glis*). The interpretation of this faunal spectrum, either as fully autochthonous (and hence indicative of a highly varied ecological mosaic) or as a mixture of autochthonous and derived elements, must be left open.
The molluscan fauna at least shows that the humus-soils (Niveaux D) were formed under less stadial conditions than prevailed during the deposition of the overlying, younger loess »*In den Humuszonen ist bei den Mollusken Pupilla loessica, die im hangenden Löß dominiert, weniger stark vertreten ...*« (A. Semmel 1991). It does not, however, allow the distinction of the humus layers from the underlying solifluction horizon (Niveau C). The absence of *Pupilla loessica* from the (admittedly small) faunal spectrum of Niveau D2 (Th. van Kolfschoten, this paper) might suggest that the warmest part of the interstadial sequence is to be sought here, but its presence in the interglacial Niveau B warns against over stressing this interpretation.

Species	Anatomy	fragments (n)
Panthera spelaea	Canine tooth	1
	Humerus dext.	1
Equus hydruntinus	Mandible dext. with tooth	1
	Epistropheus	1
	Pelvis dext.	1
	Femur dext.	2
	Tibia sin.	3
	Astragalus dext.	2 (MNI = 2)
	Calcaneum dext.	2 (MNI = 2)
	Metacarpus III sin.	1
	Metatarsus III dext.	1
	Phalanx 1	4
	Phalanx 2	4
	Phalanx 3	1
Rhinocerotidae	Mandibular molar dext.	1
Capreolus capreolus	Antler burr	1
Dama dama	Astragalus dext.	1
	Calcaneum dext.	1
	Metatarsus dext.	2
	Phalanx 1	1

Niveau D2

The large mammal fauna of Niveau D2 is represented by a much smaller assemblage than the underlying Niveau D1 (Fig. 9, Fig. 10, Fig. 11). Niveau D2 is thinner than Niveau D1 (see above) and present over a smaller area, being more strongly truncated by subsequent solifluction towards the centre of the crater »*A layer of stony rubble and a pale brown loamy deposit...* [Niveau E] *separate this humus strata* [Niveaux D] *from the overlying unstratified loess (< 3 m)* [Niveau F]. » (A. K. Singhvi *et al.* 1986). Nevertheless, six species of large mammal were identified, only three less than in Niveau D1. The faunal

spectrum is similar to that from the other layers; once again, the fauna is dominated by horse, large bovid and red deer, the only real differences being among the rarer species. No large carnivore is present, but *Alopex lagopus*, present in Niveau D1, is replaced in Niveau D2 by *Vulpes vulpes*. This might be argued as a tenuous indication of climatic amelioration in Niveau D2 (cf. above arguments from the molluscan fauna).
Possibly the relatively high number of specimens assigned to *Equus hydruntinus* also reflects open, but not very cold conditions. Against an interpretation of Niveau D2 as the warmest part of the interstadial sequence speak the absence in Niveau D2 of both fallow deer (*Dama dama*) and roe deer (*Capreolus capreolus*) and, possibly, the presence of the woolly rhinoceros (*Coelodonta antiquitatis*).
The small mammal faunal spectrum also lacks clear indicators of truly cold conditions (Fig. 17), although we hesitate to argue for a combination of open (*Spermophilus*) and warmer (*Clethrionomys*, *Apodemus*) conditions on the basis of only four specimens.

Species	Anatomy	fragments (n)
Vulpes vulpes	Maxillary molar tooth	1
Equus hydruntinus	Radius dext.	2
	Femur dext.	2 (MNI = 2)
	Metacarpus III s/di	1
	Metatarsus III dext.	1
	Metapodium	1
	Phalanx 1	3
	Phalanx 2	1
Coelodonta antiquitatis	Tarsal (*naviculare*) sin.	1

Niveau D3

Niveau D3 is the youngest early Weichselian humus soil at the Plaidter Hummerich and is found over the most restricted area. It contains only 52 specimens of mammal bone, tooth and antler, 33 of which are identified to species (excluding *Marmota*) (Fig. 9, Fig. 10, Fig. 11). The high proportion of specimens of *Equus hydruntinus* is put in perspective once it is known that the seven finds are from only two groups of teeth and, probably, one articulating lower limb. The other species present, in approximately equal numbers, are once more the three large ungulates *Equus* sp., cf. *Bos primigenius* and *Cervus elaphus*.
Among the small mammals (Fig. 17), it can be noted that both of the thermophilous species identified in Niveau D2 are absent and that *M. gregalis*, indicative of more stadial conditions, is present, together with *Spermophilus*. It is perhaps speculative to argue on the basis of two specimens, but possibly the absence of thermophiles reflects the beginning of the return to colder conditions suggested by the micromammal spectrum of the overlying Niveau E.

Species	Anatomy	fragments (n)
Equus hydruntinus	Incisor tooth	3
	Mandibular milk molar	2
	Metapodium III	1
	Phalanx 3	1

Niveau E

Towards the centre of the crater of the Plaidter Hummerich, the early glacial stadial soils are truncated and overlain by a soliflucted deposit Niveau E »... *A layer of stony rubble and a pale brown loamy deposit (=30 cm)* [Niveau E] *separate this humus strata* [Niveaux D] *from the overlying unstratified loess (< 3 m).*« (A. K. Singhvi *et al.* 1986). At the most easterly (deepest) part of the site the humus soils have been removed entirely and the solifluction deposit lies directly on the interglacial soil »*Auf dem fossilen Bt-Horizont lagen in einer Mächtigkeit von 20 cm Basaltschlacken mit eingeregelten Längsachsen. Wahrscheinlich war dieses Material von den Kraterrändern her solifluidal hangabwärts transportiert worden.*« (A. Semmel 1991). Semmel's description and the section drawings are in agreement that the deposit from this younger episode of solifluction (Niveau E) is not present in higher locations closer to the crater wall. Nevertheless, section drawings show that the upper surface of the humus soils (Niveaux D) has been moved downslope by solifluction at these locations too (visible as interfingered humus and loess deposits). This suggests that, as in the case of the earlier solifluction event, which truncated the interglacial soil in positions higher on slope of the crater, this younger episode will have moved material from older deposits and incorporated them into the younger Niveau E.

Earlier papers have reported that several archaeological horizons could be recognised at the Plaidter Hummerich (G. Bosinski *et al.* 1986; A. K. Singhvi *et al.* 1986; K. Kröger 1987; A. Semmel 1991). A. K. Singhvi *et al.* report that »*The section yielded three archeological horizons (termed A1, A2, A3) ... Horizon A3 (on the surface of the humus layer)* [i. e. Niveau E] *once again provided coarser material with few bones and a developed stone-tool industry with tools made of quartz, quartzite, chert, flint, and chalcedony*« (A. K. Singhvi *et al.* 1986). Three distinct archaeological horizons – A1, A2, A3 – are here claimed to be directly correlated with the sedimentological Niveaux C, D1 - D3 and E.

However, a more recent account of the site stresses the role of erosional reworking and superposition of finds »*Durch Erosionsprozesse ist die Hauptfundschicht* [Niveaux D1 - D3] *im oberen und unteren Profilbereich, am Kraterrand und in der Kratermitte gekappt. Besonders in der Mitte des Kraters ist eine Schicht aus verlagertem Material* [Niveau E] *aufgelagert, die eine reichhaltige Steinindustrie lieferte. . . Die beschriebenen Verlagerungsprozesse erschweren eine stratigraphische Einordnung der Funde. Es ist wahrscheinlich, daß hier Artefakte aus Schichten, die weiter oben austraten, von der Erosion erfaßt wurden und jüngeren Schichten aufgelagert wurden.*« (K. Kröger 1987, 20). The author concludes that in the absence of an exact correlation of geology and archaeological material (»*genaueren Analyse des Fundzusammenhangs in der Horizontalen, wie in der Einbettung in die geologische Schichtenfolge*«) the finds should be treated as one complex »*Es erscheint von daher angemessen, die Funde aus mittelpaläolithischem Zusammenhang gemeinsam zu besprechen*« (K. Kröger 1987, 22). This conclusion is reinforced by the fact that K. Kröger subsequently refitted a number of artefacts between Niveaux D and Niveau E. This is probably a reflection of solifluction processes reworking material downslope or mixing originally discrete layers.

Unlike earlier solifluction activity, which accumulated a relatively thick deposit (Niveau C) containing faunal remains, the younger solifluction episode appears to have been more destructive of organic ma-

terial and no equivalent finds could be refitted between Niveau E and the older deposits. Much of the faunal material from Niveau E has a different appearance to that from the other layers. It is greyish in colour and often has surfaces flaked away by weathering, whereas material from Niveaux B, C and D is reddish and has surfaces ranging from (rarely) quite fresh to deeply corroded.
It is possible that only very little older fauna survived to be reworked into Niveau E and that the material from this layer does reflect a largely autochthonous assemblage accumulated during a colder phase of solifluvial activity. Nevertheless, in the light of the arguments quoted above, it seems unjustified to assume that the small Niveau E fauna is a discrete entity.
The amount of identified material in the large mammal assemblage represents six species, the same number as the assemblage from Niveau D2, which contained more than twice as many specimens. Horse, large bovid and red deer remain the most common element, no other species being represented by more than one fragment (Fig. 9, Fig. 10, Fig. 11). The presence of *Capreolus capreolus* and, possibly, *Equus hydruntinus* is surprising if the fauna were indeed contemporary with the episode of solifluction, although both species were also present in the older solifluction deposit Niveau C. The occurrence of an ovicaprid in this part of the Hummerich deposits can be more easily accepted as a contemporary element, the three species in question – *Saiga tatarica*, *Capra ibex* and *Rupicapra rupicapra* – being readily explicable in a colder, drier or more montane environmental context.
The diagnostic small mammal fauna is again represented by only a few finds (Fig. 17). Nevertheless, it is noticeable that five of the seven specimens are indicative of open or cold conditions (*Dicrostonyx*, *Lagurus* and *Spermophilus*). The possibility that one specimen each of *Apodemus* and *Clethrionomys* are reworked from older deposits must be considered. One specimen of the latter species is even recorded from the last Cold Phase stadial loess deposit Niveau F (Fig. 5), showing that its presence should not be automatically equated with more temperate conditions.

Species	Anatomy	fragments (n)
Equus hydruntinus	Phalanx 3	1
Capreolus capreolus	Humerus sin.	1
Cervidae	Tibia sin.	1
Ovicapridae	Tibia dext.	1

Summary

Little can be said about Niveaux A and E. Only horse was represented in Niveau A, by perhaps no more than one individual. The presence of hyaena is shown by a coprolite.
Fallow deer and roe deer were present in Niveau B (interpreted as an interglacial soil horizon). The presence of fallow deer is usually considered indicative of interglacial climatic conditions, so that its presence is in good agreement with the dating of the soil formation to the Last Interglacial. Nevertheless, the dominant species in this layer are already horse, large bovid and red deer, the only other species identified.
Niveau C is interpreted as a soliflucted layer deposited under cold conditions, which suggests that the presence of fallow deer in this layer is probably best explained by reworking, either due to reworking of older material from the interglacial horizon (Niveau B) or (perhaps more plausibly on the evidence of spatial association) due to bioturbation/poor definition of sedimentological boundaries between Niveau C and Niveau D1. The presence of extinct ass in Niveau C, but not in Niveau B, and the absence of roe deer in the former layer may also reflect the existence of a more open, if not colder, landscape du-

ring the formation of the soliflucted deposit. Once again, the dominant species in Niveau C are the large bovid, horse and red deer; also present are spotted hyaena and extinct rhinoceros (*D. hemitoechus*). A generally similar fauna to that of Niveau C is found in Niveaux D1 - D3, the humic soil horizons which formed following the onset of cooler conditions after the Last Interglacial. The fauna from these horizons is dominated by horse, large bovid and red deer.
Of the three humus soils Niveau D1 alone contains very small amounts of material identified as fallow deer and roe deer. Their presence here may suggest that some denser forest cover still existed. The absence of fallow deer in layers above D1 may be due to deteriorating climatic conditions and loss of forest cover, but roe deer is still present in the base of the younger loess cover (Niveau E).
The carnivore species red fox, arctic fox and lion are also present in the humus soils. Typically, at the Hummerich and at other similar Pleistocene sites in the Neuwied Basin, carnivores are generally only represented by small amounts of material representing no more than one individual (E. Turner, 1990; 1991). Arctic fox is present in Niveau D1 and red fox in D2. The former species is usually associated with more extreme cold stage faunas in central Europe, although it does extend into boreal forest in winter at the present day. The co-existence of red and arctic fox is also known from Central Rhineland Pleistocene contexts and has been recorded from the Magdalenian site Gönnersdorf (F. Poplin, 1976). The presence of arctic fox in layer D1 may reflect a variety of ecological niches which allowed »arctic« species to extend their range further than is possible today. Woolly rhinoceros is also generally associated with cold stage faunas, but is known to have occurred during interstadials and at the end of interglacial phases, which could explain its presence in Niveau D2 at the Hummerich.
Niveau E contained remains of the large bovid, horse, red deer, extinct ass, roe deer and an ovicaprid (the latter species each represented by a single bone). A bone identified as reindeer is without stratigraphic provenance, but probably originates in this layer.

BONE PRESERVATION AND BODY PART REPRESENTATION

The Hummerich bone assemblage is dominated by shaft fragments. This is clear both from the absolute counts of the material identified to species and body part, and from the large amount of material not further identified. The generally poor preservation of the assemblage suggests that it has been subject to severe attritional processes, which may have included human and carnivore activity and a range of weathering processes. Before interpreting the excavated faunal assemblage it is therefore necessary to attempt to quantify the degree of loss of material due to attrition.
It is evident that the amount of damage to, and loss of, bone will reflect the inherent stability of the bone in question. It is banal to point out that elements such as poorly ossified costal cartilage will be destroyed before robust limb bone shafts. It is less easy to quantify this destruction objectively, although a number of studies have examined this problem against the background of loss by carnivore damage (e. g. C. K. Brain 1967; C. W. Marean & L. M. Spencer 1991; C. W. Marean & L. Bertino 1994). The problem of recognition of this destructive factor will be returned to below.
R. L. Lyman (1994) summarises very useful data on the absolute density of bone of a range of species. The values for »bone mineral density« are obtained by passing a photon beam of known strength through a bone and measuring the loss of signal. Measurement is therefore absolute and reflects the mineral content, and hence strength, at chosen locations on the various body parts (Fig. 18).
Of relevance for the Hummerich are Lyman's measurements for bison and deer; no values are given for equids and it is probably unjustified to extrapolate from values for other species.
Lyman's data were measured at locations on the skeleton selected for their archaeological relevance. For this analysis the data were further modified by taking into account which elements of the skeleton are

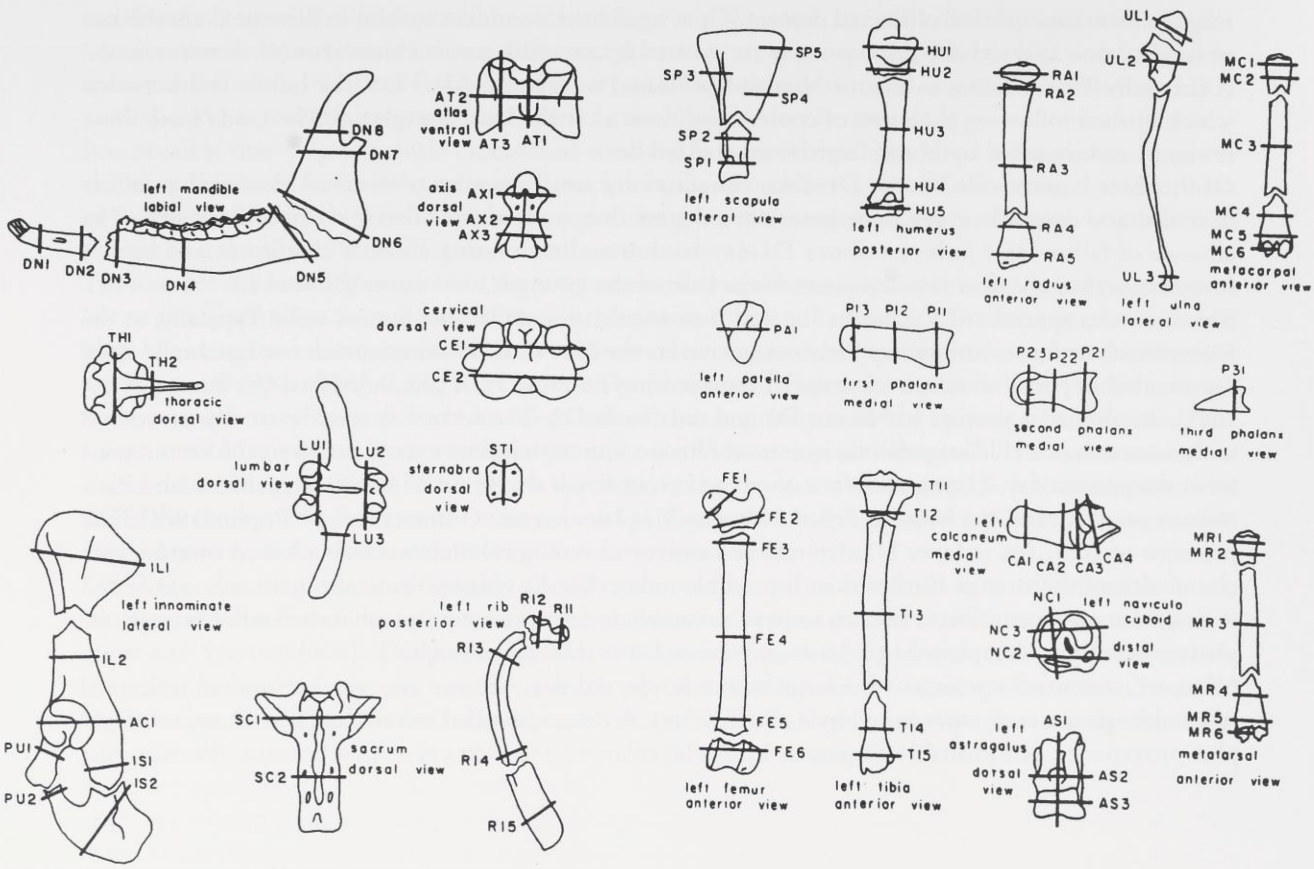


Fig. 18 Anatomical locations of scan sites where photon absorptiometry measurements have been taken on ungulate bones with an indication of the actual bone fragments recovered archaeologically (adapted from Lyman 1994, Fig. 7. 4).

actually present. Taking the pelvis as an example, the only part of this element regularly found is the acetabulum with the more massive parts of ilium, ischium and pubis, but without the cancellous parts of these bones. Rather than taking the four separate measurements shown by Lyman it was therefore decided to use the mean value of his AC1, IL2, IS1 and PU1 as the measurement of the element actually preserved. There is good agreement between the several values for bone mineral density on the skeletal units defined in this way, so that it seems justified to group measurements rather than using each one individually.

Bone density values are then plotted against the relative frequency of body parts in order to calculate the degree of correspondence between density and presence. Relative frequency is calculated using the number of specimens of a part of the skeleton actually identified, expressed as a proportion of the number of specimens to be expected from a given number of identified animals. In order to have a large enough sample for the analysis, this latter number is equated with the minimum number of individuals (MNI) of each species established for the site irrespective of layer. In the case of the large bovid, a figure of 12 individuals was established, while red deer is represented by at least 11 individuals.

The number of each element of the skeleton originally present in the body is known for both species, so that this figure can be multiplied by a factor of 12 and 11 to find out how many elements of the skeleton would have been present in the case of complete carcasses of bovid and red deer respectively. Obviously, certain elements will have been much more numerous than others; for both species, the number of first, second or third phalanges would be four times that of the upper limb bones, since each leg, front and back, has two of each phalange. Similarly, ribs and vertebrae will have been represented by a larger number of elements than scapula and pelvis.

The relative presence of the different skeletal parts is calculated irrespective of body side. For example, the proximal metatarsus of red deer (Fig. 19e, MR1) is represented by 11 specimens (the sum of duplicating fragments from both sides of the body), which is 50% of the specimens (22) which could be expected from 11 individuals.

In order to establish the relative frequencies of skeletal parts at the Hummerich it was first necessary to define the number of identified specimens (**NISP**) in a way which would allow comparison between different body parts. This proved to be less straightforward than first assumed, since, although a large number of shaft fragments can be identified to body part (giving a high NISP), this figure cannot be assumed to represent the true number of specimens of this bone element originally present. While it is probable that spatially widely separated bone fragments do indeed represent different bones, this remains an assumption only. It was therefore decided to accept only the exact duplication of a feature (e. g. *foramen* or *trochanter*) as a valid criterion for estimating the minimum number of any element. Following R. L. Lyman (1994, 510) this **MNE** can be defined as »... *the minimum number of skeletal elements necessary to account for (to have contributed) the specimens observed* ...«. In the case of the Hummerich the MNE can be appreciably lower than the NISP, especially for certain elements such as bovid and cervid metapodials. These shaft fragments are easily identified, but it is very difficult to assess duplication as the morphology of the shaft is so uniform. A similar problem is presented by the radius. Shaft fragments of other bones with more pronounced morphological features (e. g. tibia, humerus) allow the MNE to be calculated more accurately.

Plotting bone density against the MNE and not the NISP lowers the degree of contrast between the commonly found elements such as shaft fragments and more rare elements such as cancellous bone. On the other hand, using the unmodified NISP would artificially exaggerate this contrast by suggesting that each shaft fragment represents a separate bone and hence a different specimen. Despite this apparent problem, the results of the analysis are very promising. In almost all cases there is a clear correspondence between bone density and the occurrence of an element of the skeleton at the site. Similar bone types show similar patterns of attrition and survival, and these patterns are almost identical for both species studied (Fig. 19, 20).

With the exception of the axial skeletons (Fig. 19a, 20a) which are represented by one measurement, either two or three measurements of the correspondence between density and presence were calculated for all bone elements, and plotted on scatter diagrams (Fig. 19, 20). The points plotted for each element of the skeleton were joined by a line to show clearly that the measurements represent the same bone.

Selected body parts were grouped together in one diagram to illustrate similar patterns of behaviour for different bones. These patterns were established by preliminary diagrams which plotted together all bone elements for each species, but these are necessarily crowded and confusing. The groups chosen for both species were: axial skeleton (Fig. 19a, 20a); scapula and pelvis (Fig. 19b, 20b); humerus and femur (Fig. 19c, 20c); radius, ulna and tibia (Fig. 19d, 20d); metacarpus and metatarsus (Fig. 19e, 20e). The measurements are defined after the scheme of R. L. Lyman (1994, Fig. 7. 4), but the labels used in this analysis refer to the first one appropriate to the bone elements recovered archaeologically defined in Fig. 18. For example, SP1 (for the scapula) here indicates the mean of SP1 and SP2, the two measurements of the denser, distal part of the bone; HU3 (humerus) is the mean of HU3 and HU4, which are the shaft fragments recovered most commonly at the Hummerich. Ribs were designated simply by RI, since only fragments corresponding to RI3 were present.

There is a clear correspondence between low density and low presence in the case of vertebrae and ribs of *Cervus elaphus* (Fig. 19a). These bones are among the least dense of any parts of the skeleton of either species and no element is represented by more than 10% of the amount of material to be expected from 11 individuals.

The scapula and pelvis of both species reveal a similar pattern (Fig. 19b, 20b). The denser parts of both bones (AC1, SP1) are more commonly represented than the cancellous parts of the pelvis (IL1) or the

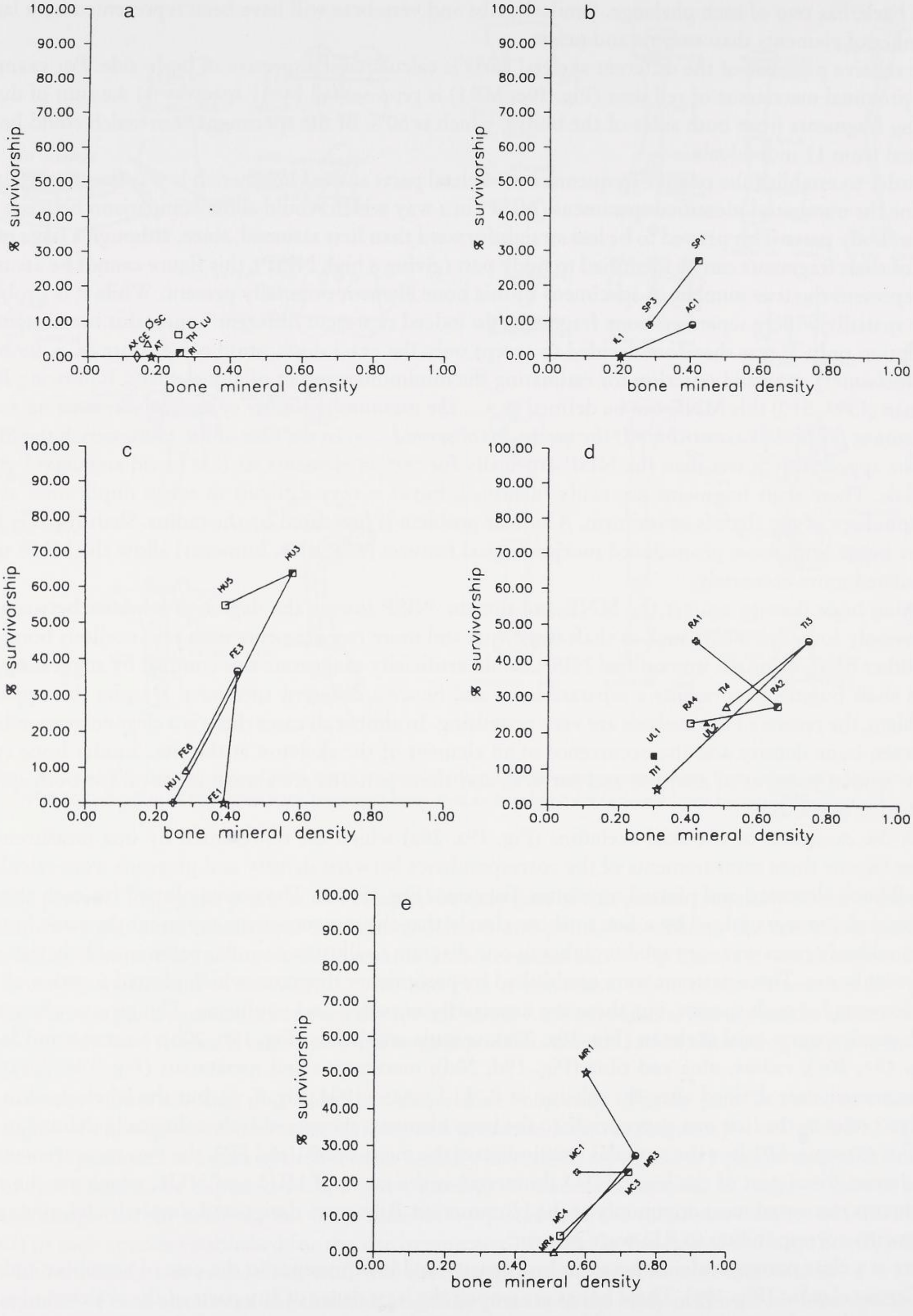


Fig. 19 Correlation of bone density and body part frequency for bones of *Cervus elaphus* from the Plaidter Hummerich (for location of measurements see fig. 18). – a: Axial skeleton; b: scapula, pelvis; c: humerus, femur; d: radius, ulna, tibia; e: metacarpus, metatarsus.

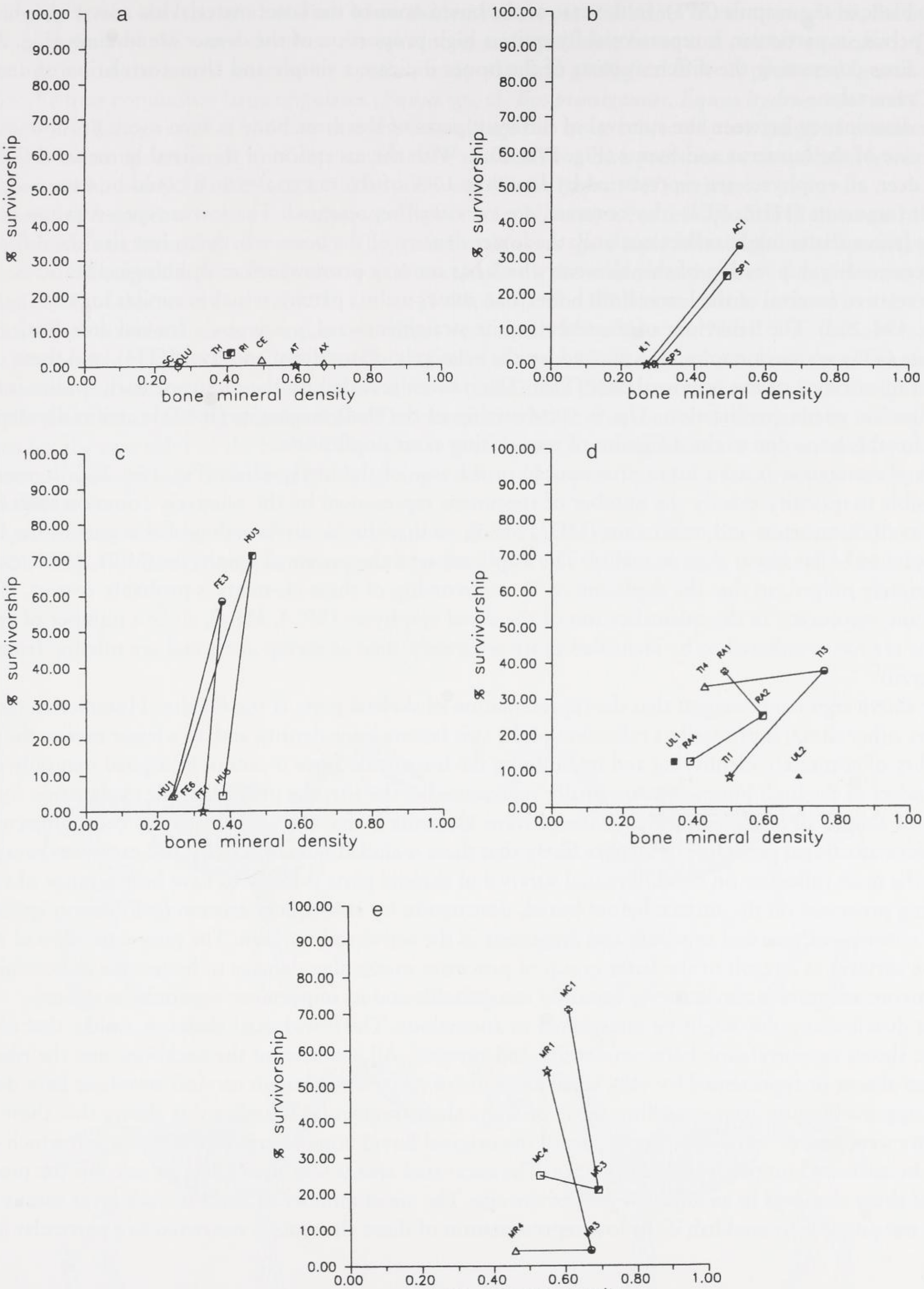


Fig. 20 Correlation of bone density and body part frequency for bones of cf. *Bos primigenius* from the Plaidter Hummerich (for location of measurements see fig. 18). – a: Axial skeleton; b: scapula, pelvis; c: humerus, femur; d: radius, ulna, tibia; e: metacarpus metatarsus.

thin blade of the scapula (SP3). In the case of the bovid none of the latter material has survived, whereas the pelvis, in particular, is represented by quite a high proportion of the denser acetabulum (Fig. 20b). The lines connecting the different parts of the bones indicate a simple and clear correlation of density and survival.

The discrepancy between the survival of different parts of the same bone is even more pronounced in the case of the humerus and femur (Fig. 19c, 20c). With the exception of the distal humerus (HU5) of red deer, all epiphyses are represented by less than 10% of the material which could be expected. The shaft fragments (HU3, FE3) , by contrast, are very well represented. The lower representation of red deer femur shafts might reflect not only the lower density of the bone substance, but also the difficulty of recognising duplication of this element which has no very pronounced morphological features.

The relative survival of the lower limb bones also shows a clear pattern which is similar for both species (Fig. 19d, 20d). The behaviour of the tibia is quite straightforward, particularly for red deer. Shaft fragments (TI3) are most common, followed by the relatively dense distal epiphysis (TI4), and there is almost no survival of the proximal part (TI1). The pattern revealed by the radius of both species is very similar but needs qualification. The % survivorship of the shaft fragments (RA2) is artificially depressed for this bone due to the difficulty of recognising exact duplication.

This phenomenon is even more pronounced in the case of the metapodials (Fig. 19e, 20e). It was impossible to quantify exactly the number of specimens represented by the relatively common shaft fragments of metacarpus and metatarsus (MC3, MR3), so that the % survivorship of this part of the bone appears to be far lower than in reality. The duplication of the proximal epiphyses (MC1, MR1) can be accurately judged, so that the depiction of % survivorship of these elements is probably correct. There is some inaccuracy in the quantification of the distal epiphyses (MC4, MR4), since a number of specimens are too weathered to be identified more accurately than as metapodials and are missing from the diagram.

The above arguments suggest that the representation of skeletal parts at the Plaidter Hummerich (and at many other sites?) is primarily a reflection of the two factors bone density and, to a lesser extent, the possibility of accurately identifying and quantifying the fragments. Since it cannot be argued that only shaft cylinders of the limb bones were originally represented at the site, the only plausible explanation for the loss of almost all of the epiphyseal bone of some elements is that the assemblage has been subjected to massive attritional processes. It is quite likely that these included human activity and carnivore ravaging, but the main influence on the differential survival of skeletal parts is likely to have been a range of weathering processes on the surface before burial, destruction by subsequent erosion (solifluction episodes) and consequent renewed exposure and diagenesis in the active soil horizon. The poor condition of most bone surfaces as a result of the latter group of processes means that damage to bones due to hominid or carnivore activities is almost never certainly recognisable and its importance cannot be evaluated.

One distribution plot might be interpreted as anomalous. The bovid axial skeleton, unlike that of red deer, shows no correlation between density and survival. All elements of the backbone and the ribs are either absent or represented by very small amounts of material, although cervical vertebrae have densities approaching or even exceeding those of some shaft fragments. Whether this shows that these elements were not, or were only rarely, part of the original bovid bone assemblage is a question which cannot be answered on the available evidence. The excavated area is too incomplete to rule out the presence of these elements in an adjacent part of the site. The small number of finds in each layer means that it is not possible to establish if the low representation of these elements is restricted to a particular level.

NISP and MNI of the larger herbivore species

It has been argued that the composition of the Hummerich faunal assemblage primarily reflects the influence of attrition by a range of factors – human and carnivore destruction, physical and chemical

weathering. It was also shown that, even when the less robust parts of bones have not survived, the more dense fragments of the same elements are present in an identifiable form and can be quantified. This quantification of the faunal material by species, body part and geological layer is presented here in detail for the four commoner large ungulates (*Equus* sp., cf. *Bos primigenius*, *Equus hydruntinus* and *Cervus elaphus*). Recognition of the fact that the assemblage has been subjected to a range of destructive processes warns against using this data uncritically as a basis for interpretations extrapolated from observations of human (L. R. Binford 1978) or carnivore (C. K. Brain 1967) activity.
All identified fragments from each sedimentological unit (Niveau) were first quantified in terms of the NISP (number of identified specimens). The basis for this was the simple identification of species, skeletal part and body side. A second value was then calculated, the minimum number of any element (for the definition of this see above and R. L. Lyman [1994, 510]). The MNE was strictly defined by the exact duplication of a skeletal element and is sometimes very much lower than the NISP. This value was also first calculated for each side of the body. The higher of the two MNE values by body side automatically allows the calculation of the minimum number of individuals (**MNI**) – e. g. three duplicated right humeri demonstrate at least three individuals. The cumulative MNE was then also calculated by adding the figures for the two sides of the body. This value is useful since some elements are represented by many specimens from one side of the body only, giving a distorted impression of the frequency of this part of the skeleton.
The quantification of the identified large ungulate skeletal material is shown by a series of drawings (Fig. 21 - Fig. 49). Each species is represented by four views of the skeleton, a, b (above), c and d (below).

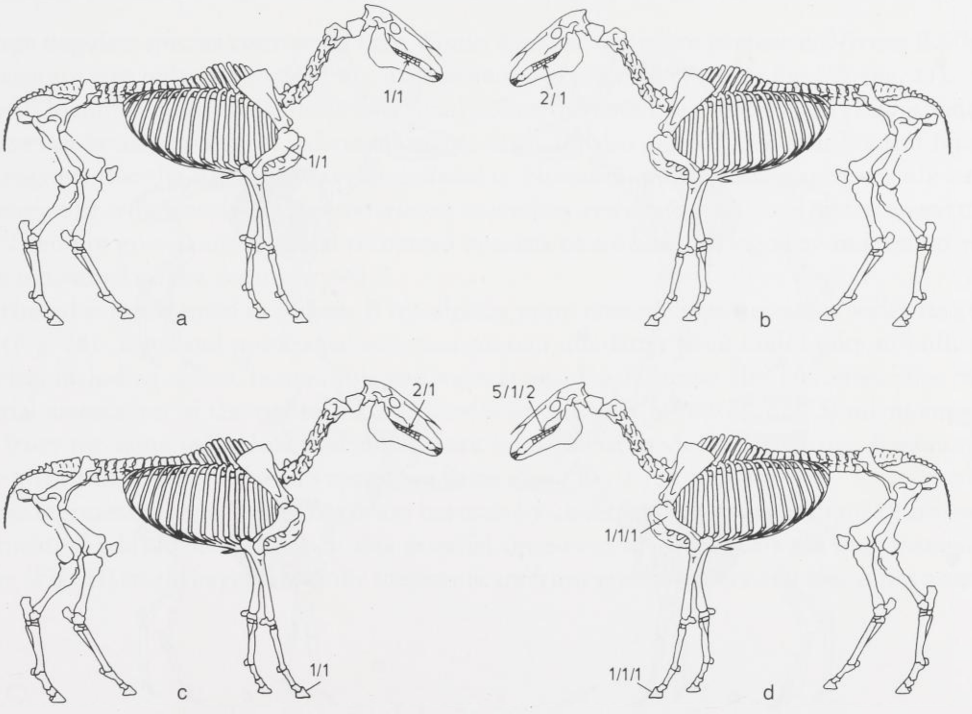


Fig. 21 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Equus* sp. in Niveau B at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

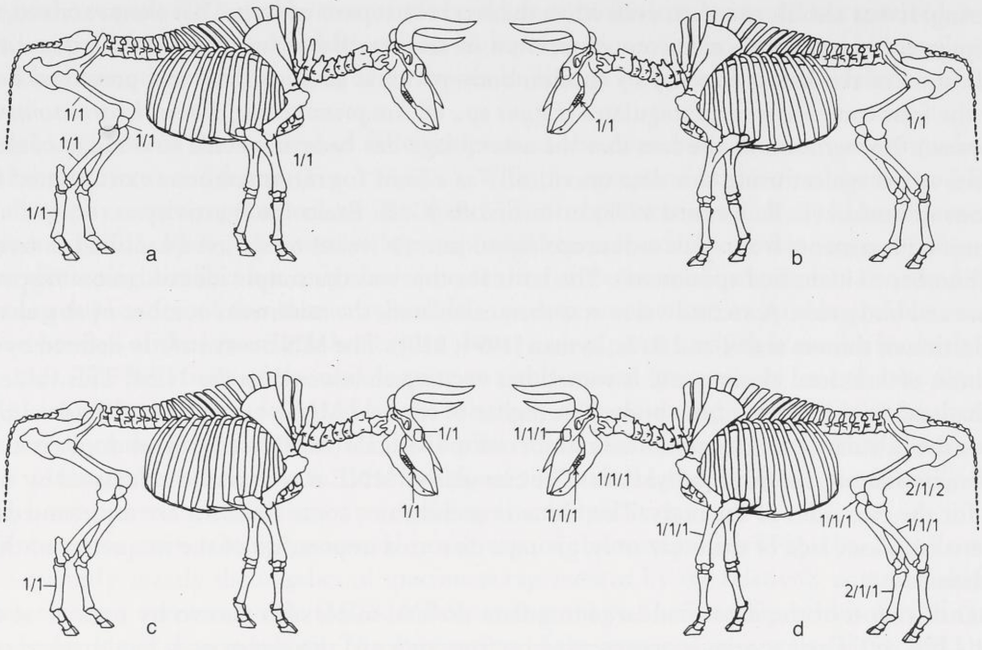


Fig. 22 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of cf. *Bos primigenius* in Niveau B at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

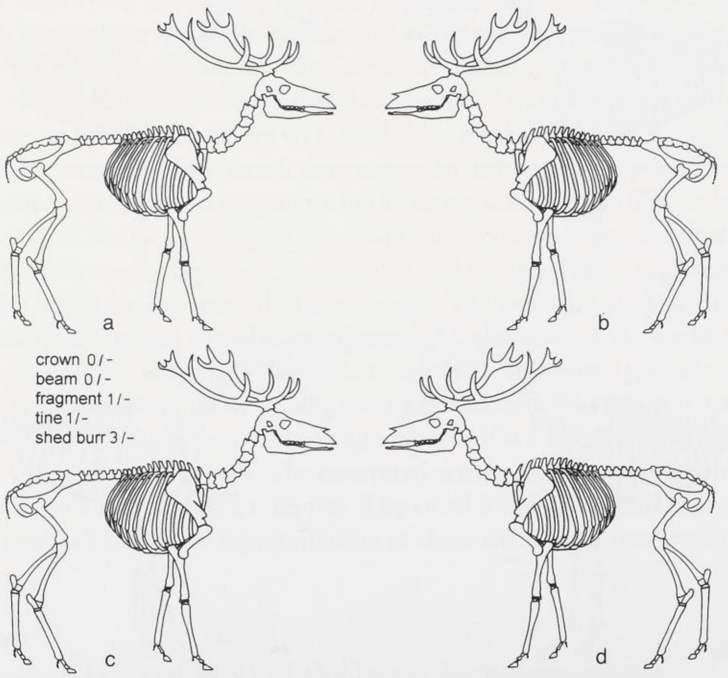


Fig. 23 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Cervus elaphus* in Niveau B at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

The first two views show the right and left sides of the body respectively. The axial skeleton and fragments undetermined to body side were plotted on the third drawing (c). The fourth view (d) gives the total NISP for both sides of the body (including specimens of indeterminate side) and for the axial skeleton and also the cumulative MNE (the sum of distinct elements from both sides of the body, but excluding pieces of indeterminate body side). Additionally, this drawing gives the MNI, which is based on the higher of the MNE values.
The phalanges are commonly indeterminate to body side and are most often found in drawing c. Phalanges and, less often, metapodials which are unidentified as fore or hind elements are drawn and counted together, rather than being distributed between the front and back of the skeleton. In the case of *Cervus elaphus*, the numerous fragmentary specimens of antler were divided into six groups for quantification (antler with skull, shed burr, beam, tine, crown and unidentified fragment) and listed at the side of the drawing.
The identified parts of the skeleton are described by two (a, b, c) or three (d) numbers respectively (e.g. 6/3 or 9/2/3). In drawings a, b and c the first (left) number gives the NISP and the second (right) number shows the MNE. In the fourth drawing (d) the first (left) number gives the total NISP for both sides of the body and specimens of indeterminate side and for the axial skeleton; the cumulative MNE (the sum of distinct elements from both sides of the body) is given by the last (right) number. The MNI (established using the higher MNE) is shown by the central number.
Although always giving a high NISP, antler of red deer was of only limited value for estimation of either the MNE or the MNI. Only the first two categories defined above can give any information at all. Massacred antlers can normally be recognised as separate specimens, but shed antlers were only counted as distinct specimens and used to estimate the MNE if more than 50% of the base was preserved. The MNE and MNI calculation for antler will therefore err on the low side.

Niveau B

Of the large ungulate species considered here, *Equus hydruntinus* is not present in Niveau B. The other three species are also only represented by small amounts of material (Fig. 21, Fig. 22, Fig. 23).
The material identified as horse is comprised mainly of teeth/tooth fragments (Fig. 21). The fact that some of these can be assigned to an individual whose teeth are also found in Niveau D1 and Niveau D2 (Fig. 14) suggests that the attribution of this material to Niveau B is problematic and possibly a result of poor definition of sedimentological boundaries or secondary reworking of faunal material into other sediments. The only postcranial material recovered consists of a humerus fragment and a third phalanx. Only one individual can be demonstrated.
The large bovid is represented in Niveau B by slightly more material representing a wider range of body parts (Fig. 22). Teeth and postcranial bone are present, the latter from limb bones of both the fore and hind leg, including radius, femur, tibia and metatarsus. A patella was also identified. The relatively close spatial association of the right tibia and patella (in adjacent m^2 62/72, 63/73) might suggest that they are from the same individual, but this cannot be demonstrated. Although two femora (left and right) are identified, the MNI for this species remains one.
Red deer is represented in the interglacial soil horizon by antler fragments only (Fig. 23). It is impossible to estimate the MNI on the basis of this material since even the shed burrs are fragmentary. Spatial patterning (Fig. 51) might suggest that the fragments are from several antlers, but this is not a certain argument.

Niveau C

Niveau C provided the second largest number of faunal remains from the Plaidter Hummerich, but arguments have already been advanced to suggest that the assemblage might be regarded as a type of open system, possibly derived in part from Niveau B and certainly closely related to Niveau D1. Nevertheless, the large ungulate material from this layer is quantified here as if it were a discrete unit (Fig. 24, Fig. 25, Fig. 26, Fig. 27). The most immediately noticeable feature in Niveau C is the absence of any teeth or skull fragments of both *Equus* sp. and cf. *Bos primigenius*. It might first be considered whether this is due to problems of correct identification of sediment boundaries, which may have led to assignment of all of the relatively small number of specimens of teeth to Niveau D1 and none to Niveau C. That this is probably not the case seems to be indicated by the spatial distribution of the teeth of horse (Fig. 14) and bovid (Fig. 16b). The sediment of Niveau C had a relatively restricted distribution around the higher part of the crater wall and was not represented towards the centre of the crater. This part of the site is, however, where most of the teeth of the two species were found, the only exceptions being two horses (Individuals I and V, Fig. 14) and one bovid (Individual I, Fig. 16b), all found to the Northwest of the excavation.

The fact that some of the bovid foetal/neonatal bones found adjacent to the very young bovid teeth are assigned to Niveau C might be interpreted as showing that at least teeth of bovid Individual I might have been recovered from Niveau C by an extended excavation area. The presence of neonatal tooth of horse in Niveau D1 at the same area of the site might even suggest that there is a connection between the remains of the two species. On grounds of their spatial context no other teeth belong to Niveau C. It is difficult to explain the absence of teeth in Niveau C as merely a function of the relatively small sample. Some teeth and tooth fragments of *Equus hydruntinus* (Fig. 26) and *Cervus elaphus* (Fig. 27) are present in this layer, despite the overall smaller quantity of material identified as these species. In the final analysis, this phenomenon might suggest selection by a process or processes other than attrition; the mechanism of this selection – possibly human or carnivore activity – cannot be reconstructed on the evidence available.

The postcranial skeleton of both the larger species is represented by a range of elements (Fig. 24, Fig. 25). Fragments of the limb bones dominate, represented almost exclusively by shaft fragments, but some bones of the axial skeleton are also present (horse vertebrae and bovid ribs). The problem of the differential destruction of elements of the skeleton was already discussed (Fig. 19, Fig. 20) and it is believed that the low representation of the axial skeleton of horse can be explained by this process. The absence or very low presence of the more robust bovid vertebral elements in this and other layers is possibly more problematic.

Both horse and bovid are represented by a MNI of three individuals in Niveau C by duplication of the metacarpus and humerus respectively (Fig. 24d, Fig. 25d). A range of other elements provides evidence for at least two individuals. Several limb bone fragments are assigned to *Equus hydruntinus*, but no more than one individual can be demonstrated (Fig. 26).

Unlike in Niveau B, red deer is represented in Niveau C by teeth and a range of postcranial bone (Fig. 27). The axial skeleton is absent, probably due to attrition (Fig. 19), but all limb bones are present. Both the radius and the metatarsus demonstrate the presence of at least four individuals. Antler fragments are relatively numerous and allow the recognition of beams and tines and one crown. All the identified antler burrs are from shed antlers; no massacred specimens were present. 15 specimens are more than 50% complete, so that a minimum of 8 individuals is necessary to account for this figure.

The interpretation of the presence of large numbers of shed antlers at the Hummerich (mainly identified as red deer, but rare specimens of roe deer are also present) is problematic. There is no evidence that they have been modified as tools in any way, and they may have been accumulated by animal, and not human, activity.

It has been observed that individual deer often seek out the same place to shed their antler every year. It can be suggested that, if the interior of the Plaidter Hummerich crater depression was sheltered and offered more vegetation cover than the surrounding open areas, then stags attracted to the summit of the volcano would automatically contribute to a natural accumulation of shed antlers at the site. Shed antlers are very often subject to rapid destruction by the gnawing activities of animals needing mineral nutrients (including deer), but this might have been counteracted by rapid burial in conditions of increased sedimentation (colluvium, solifluction episodes).

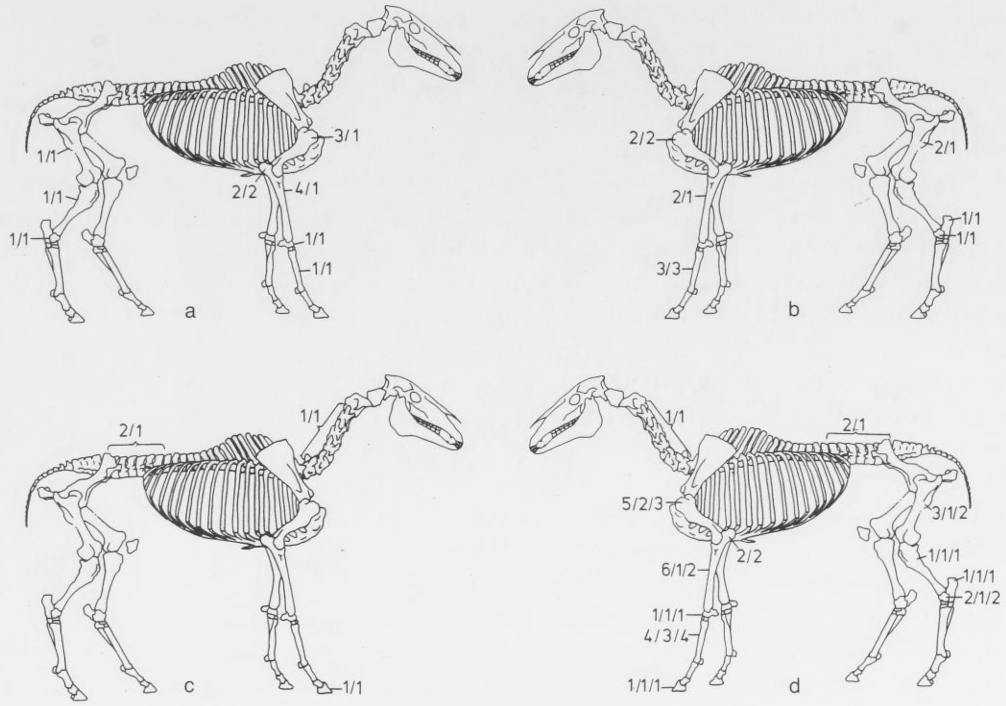


Fig. 24 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Equus* sp. in Niveau C at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

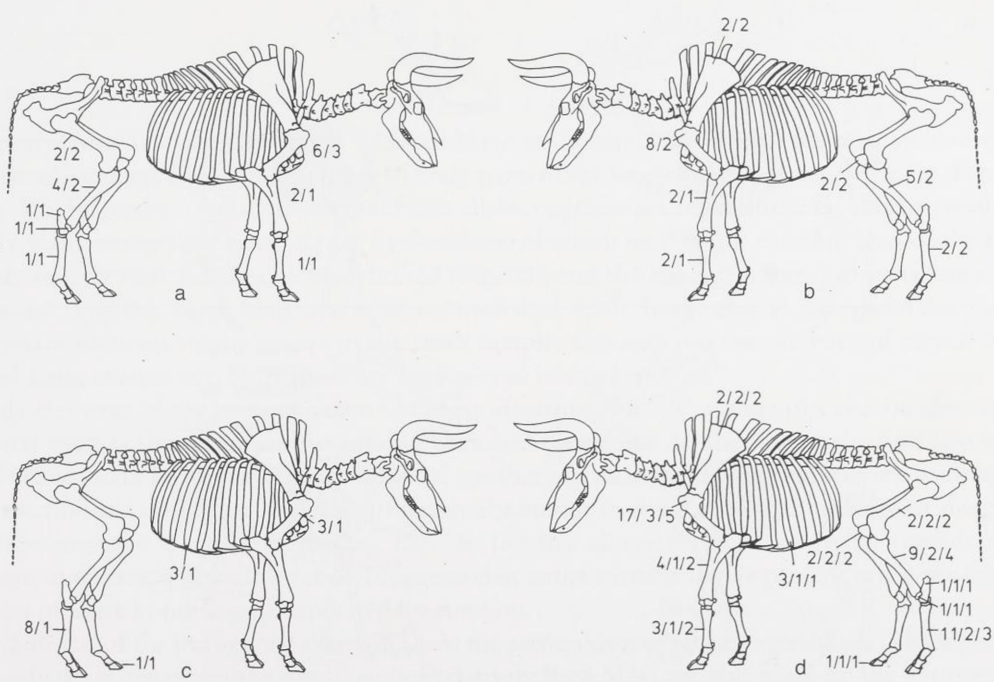


Fig. 25 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of cf. *Bos primigenius* in Niveau C at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

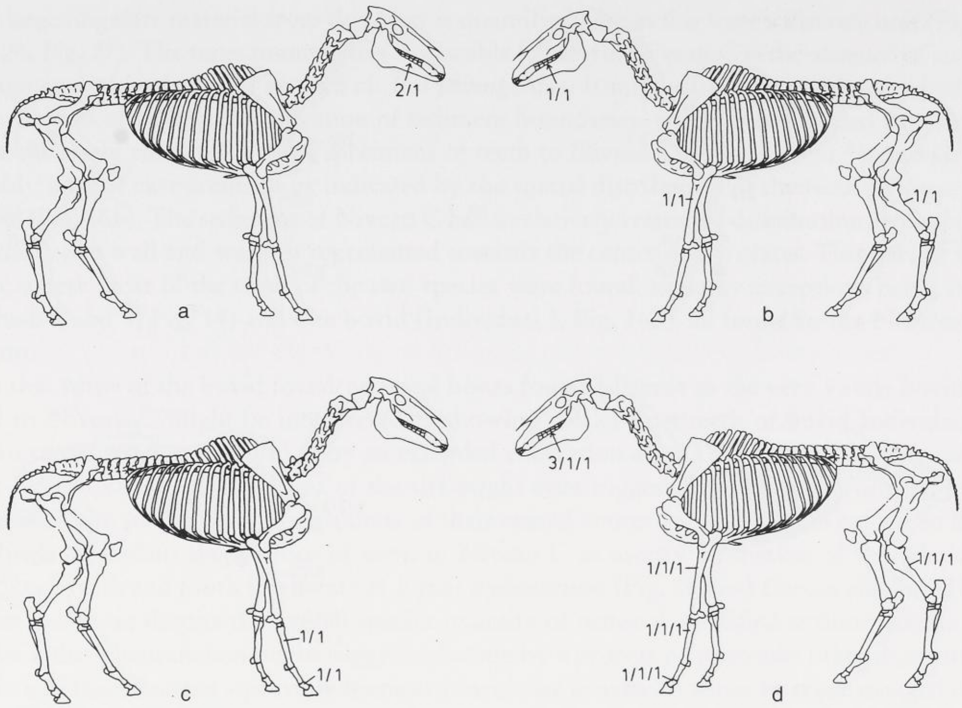


Fig. 26 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Equus hydruntinus* in Niveau C at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

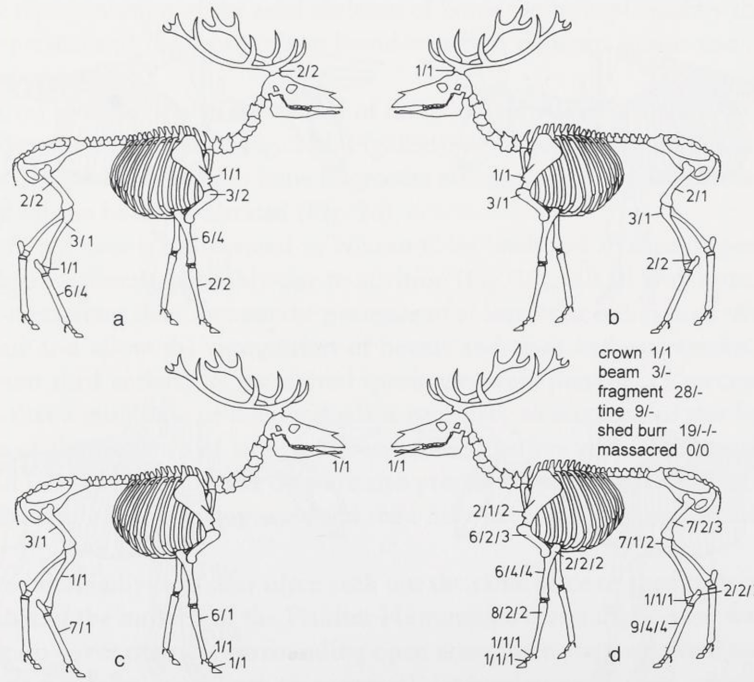


Fig. 27 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Cervus elaphus* in Niveau C at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

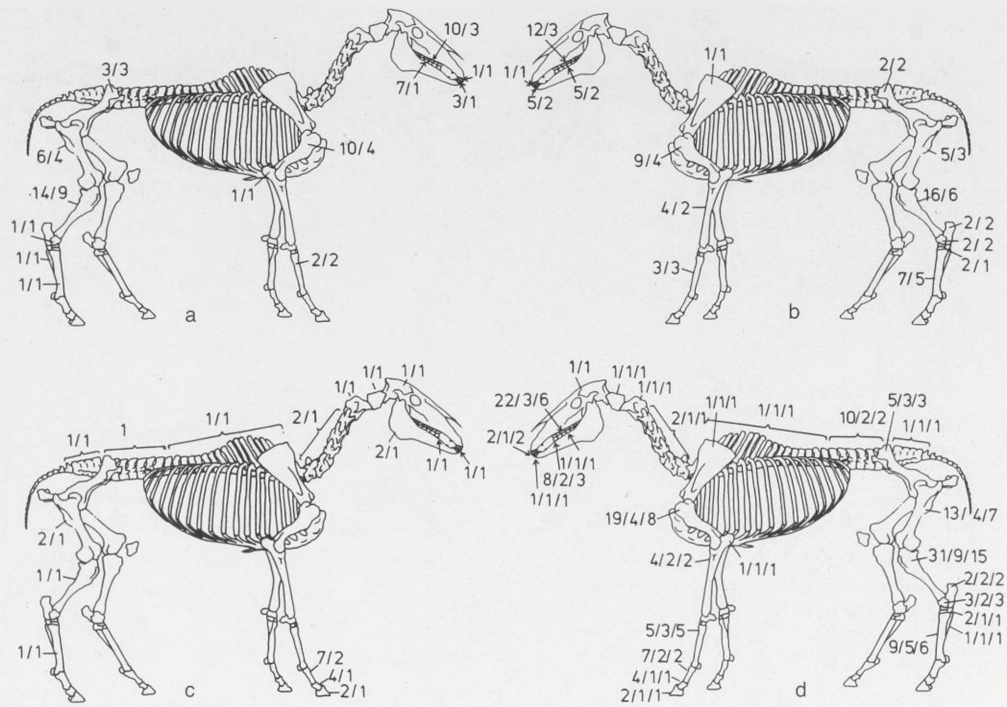


Fig. 28 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Equus* sp. in Niveau D1 at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

Niveau D1

It is unsurprising that the richest faunal assemblage at the site, Niveau D1, has also yielded the most comprehensive range and largest number of body parts of the large ungulate species (Fig. 28, Fig. 29, Fig. 30, Fig. 31). In general terms it can be said that all four species are represented by all parts of the body, the only major exceptions being *Equus hydruntinus*, of which no teeth or certain bones of the forelimb and only one cervical vertebra were identified (Fig. 30), and the absence of cervical vertebrae of cf. *Bos primigenius* (Fig. 29) which has already been commented upon. In the case of the extinct ass, the absence of certain elements might be due to the small sample, although, on the evidence of several bones of the hind limb, at least two individuals are represented in this layer.

The only elements of the horse skeleton not to be identified (Fig. 28) are the ribs and smaller or less robust parts such as the carpal and sesamoid bones and the patella. In the case of the first two elements their absence might be due to a combination of weathering, their small size and recovery techniques (rapid excavation and no sieving). Ribs are probably absent due to weathering and inability to identify weathered specimens to species level (cf. Fig. 13). The fact that all vertebrae of horse were present (with the exception of the small caudal vertebrae) suggests that entire carcasses were present, since the low representation of these bones can be explained by attrition.

Many elements of the postcranial skeleton allow the recognition of several individuals. The highest MNI (9 individuals) is given by the right tibia, but relatively high MNI are also given by the left tibia (6) and metatarsus (5) and the left and right humerus and right femur (all 4). The fact that the highest MNE (and therefore MNI) was obtained on the tibia is a function not only of the stability and survival of this bone, but also of the presence of clear diagnostic features allowing a certain recognition of duplication.

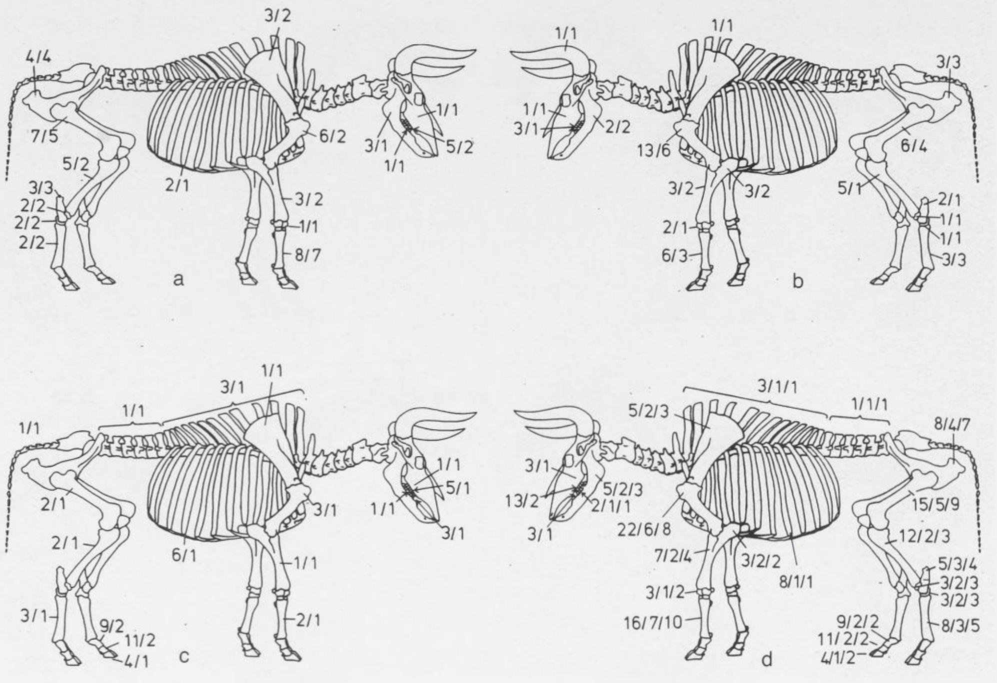


Fig. 29 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of cf. *Bos primigenius* in Niveau D1 at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

The large bovid is represented by almost all skeletal parts (Fig. 29). Ribs and carpal bone of this species were present and identified (in small numbers) since they are larger and more easily identified than the equivalent elements of horse. The absence of caudal vertebrae can certainly be explained by their small size and lack of sieving. Only the absence of all cervical vertebrae might be interpreted to mean that the large bovids were not present as entire carcasses, but reached the site (by whatever mechanism – carnivore predators, hominid hunters?) as dismembered units.

Fewer individuals of this species can be identified in Niveau D1 than was the case for horse, but relatively high figures for the MNI (Fig. 29) are given by a range of parts: right metacarpus (7), left humerus (6), right femur (5), left femur and right pelvis (4).

The material identified as *Equus hydruntinus* was commented upon above. It is noticeable that all bones giving a MNI of two are from the right hind limb (Fig. 28a).

The only skeletal parts of red deer not present in Niveau D1 (Fig. 31) are the carpals and the caudal vertebrae. The phalanges are represented by only one specimen. Both these features are probably due to a combination of weathering and low recovery rate. Although red deer has appreciably lower NISP counts than horse and the bovid, the MNE and MNI figures are relatively elevated. This is particularly apparent for the right humerus (NISP = 8, MNE/MNI = 6) and for the left metatarsus (NISP = 4, MNE/MNI = 4). The latter bone illustrates perfectly the problem of estimating the relative frequency of certain bones (cf. Fig. 19e, Fig. 20e). The readily identifiable cervid metatarsus has a total NISP of 25 but a combined MNE of only 8. This can be contrasted with the humerus (above), almost every specimen of which could be identified as a different individual.

Antler from Niveau D1 includes one right massacred specimen and two of unknown body side (Fig. 31), requiring a MNI of at least two. Of a further 48 shed antler bases from both sides of the body, 26 are over 50% complete, showing that appreciably more than 13 pairs of shed antlers were present.

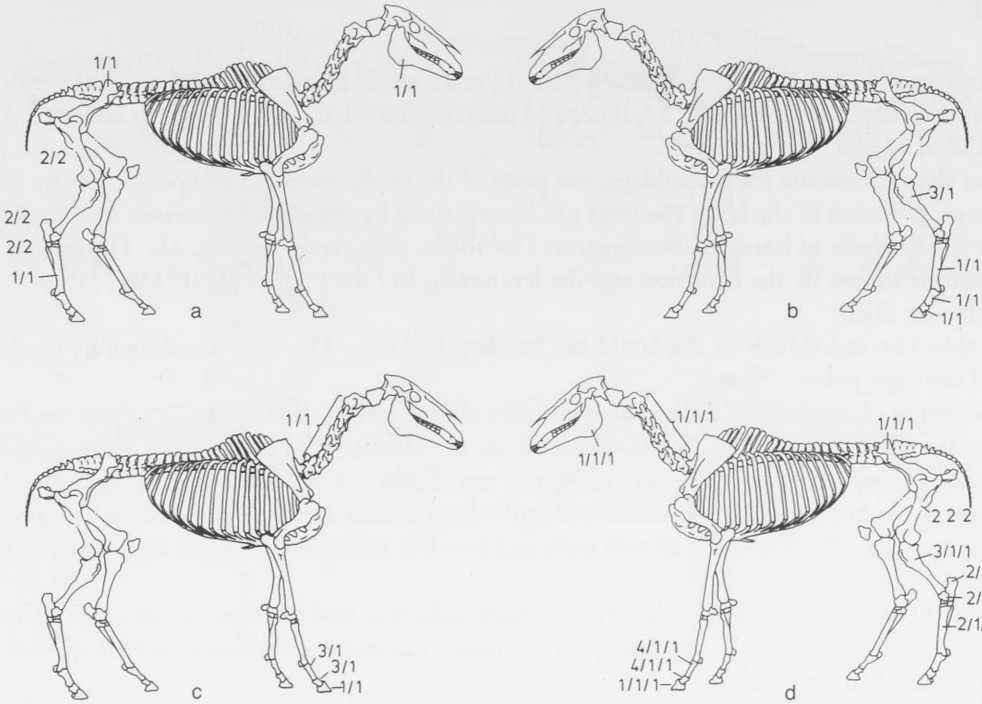


Fig. 30 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Equus hydruntinus* in Niveau D1 at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

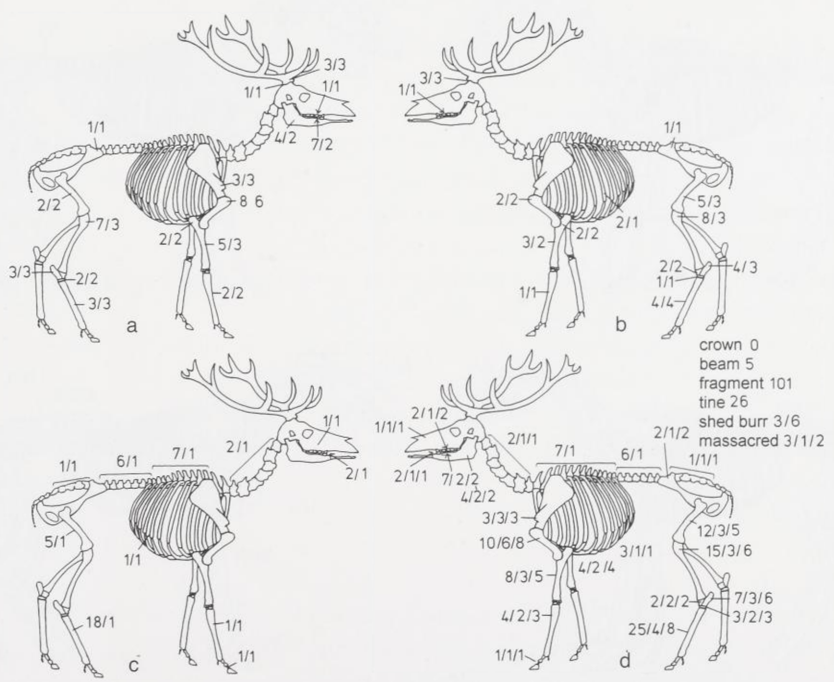


Fig. 31 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Cervus elaphus* in Niveau D1 at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

Niveau D2

The relatively small faunal complex from Niveau D2 contains all four large ungulate species which are of interest here (Fig. 32, Fig. 33, Fig. 34, Fig. 35). Horse and bovid are again the most common species, with a NISP of 41 and 34 respectively.
Limb bone shafts dominate the assemblage, but parts of the skull, vertebrae and pelvis are also present. The low representation of the latter elements can be explained by attritional processes, but, despite this, at least two individuals of horse are demonstrated by the lumbar vertebrae (Fig. 32). The same number of individuals is shown by the dentition and the left tarsals, but the highest MNE/MNI (3) for horse is given by the left tibia.
No more than two individuals of the bovid can be identified (Fig. 33). They are shown by the left humerus and the right pelvis.
Eleven specimens identified as *Equus hydruntinus* are all parts of the limbs (Fig. 34). Both the fore and hind limbs are represented and at least two individuals are identified by duplication of the right femur. The absence of other elements of the skeleton is not significant in view of the small sample size.
As in all layers, the majority of the specimens identified as red deer are identified as antler, most of these small fragments (Fig. 35). The bases of two right and two left antlers were found, as was one left antler base attached to the skull.
Five further shed antlers cannot be identified to body side, but two of these are over 50% complete, showing the presence of at least 6 shed antlers (and hence a minimum of three stags) in addition to the antler still attached to the skull.

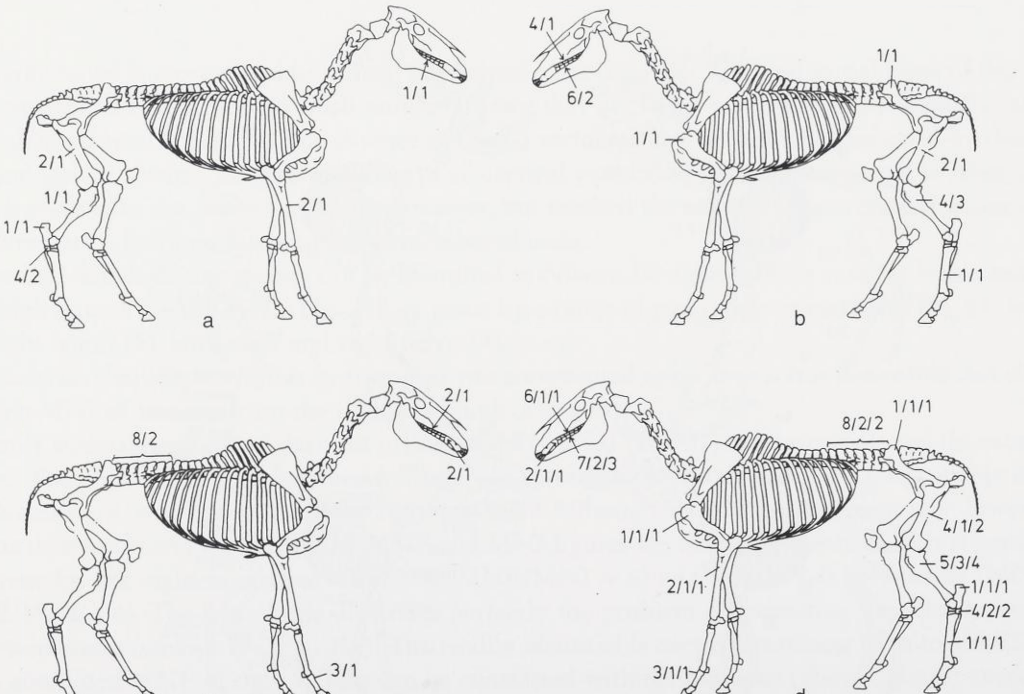


Fig. 32 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Equus* sp. in Niveau D2 at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

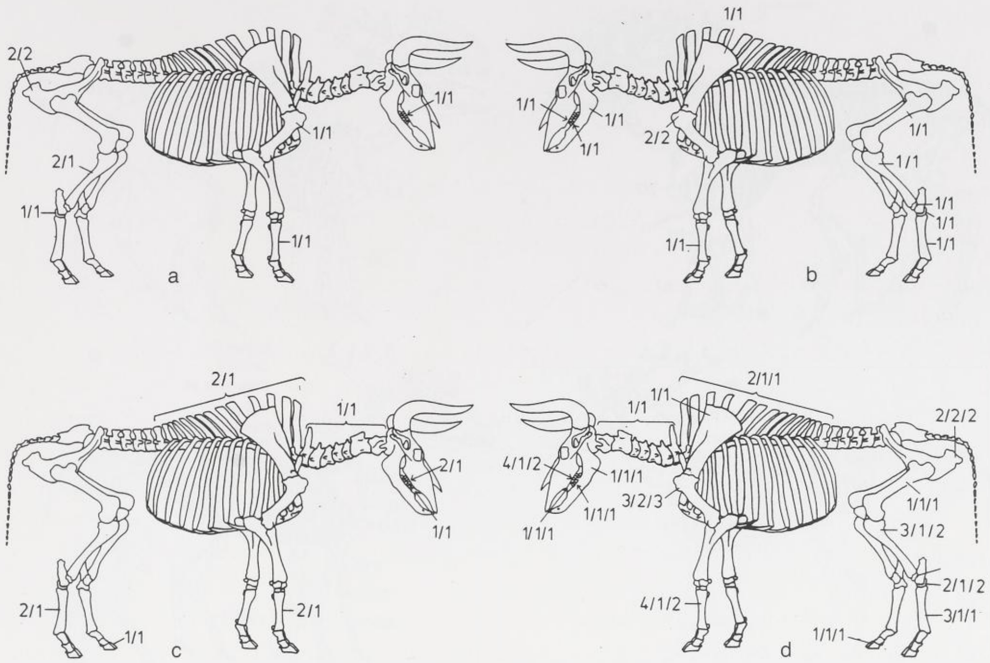


Fig. 33 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of cf. *Bos primigenius* in Niveau D2 at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

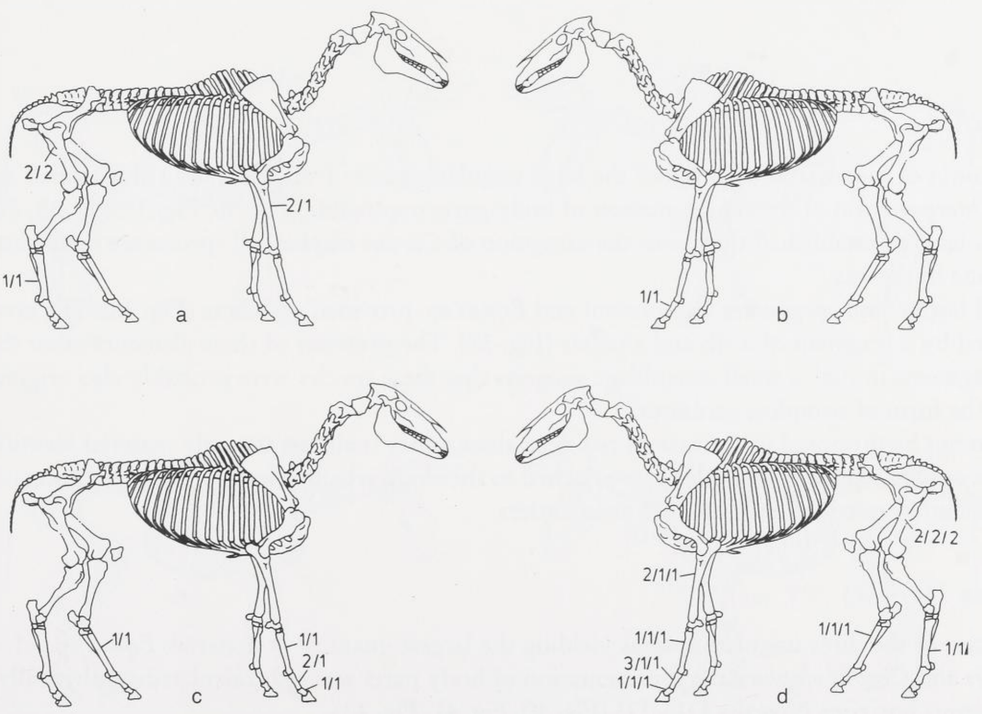


Fig. 34 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Equus hydruntinus* in Niveau D2 at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

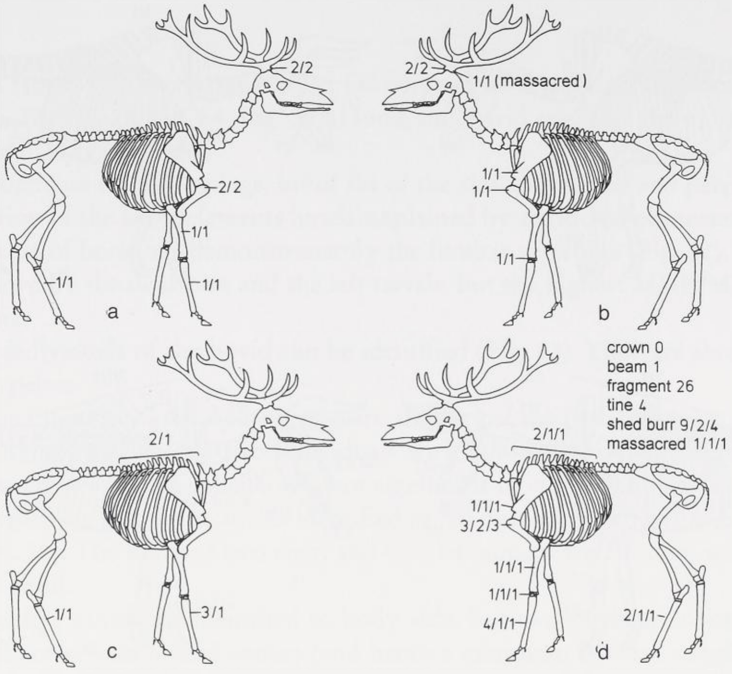


Fig. 35 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Cervus elaphus* in Niveau D2 at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

Niveau D3

The amount of identifiable material of the large ungulate species from Niveau D3 is so small as to render an interpretation of the representation of body parts impossible (Fig. 36, Fig. 37, Fig. 38, Fig. 39). It can at least be established that, with the exception of *Cervus elaphus*, all species are demonstrated by limb bone fragments.
Teeth of both equid species are also present and *Equus* sp. provided vertebrae (Fig. 36). The bovid is represented by a fragment of a rib and a pelvis (Fig. 37). The presence of these elements other than limb bone fragments in such a small assemblage suggests that these species were probably also originally present in the form of complete carcasses.
This can not be proposed in the case of red deer, since antler is almost the only material identified (Fig. 39). The only exception is an antler base attached to the skull, which at least shows that this material can not all be interpreted as deriving from shed antlers.

Niveaux D1 - D3

In the case of the three ungulate species yielding the largest quantity of material, *Equus* sp., cf. *Bos primigenius* and *Cervus elaphus*, the representation of body parts was also calculated synthetically for the three humus horizons Niveaux D1 - D3 (Fig. 40, Fig. 41, Fig. 42).
While it is unproblematic to add the figures for the NISP in order to summarise the total number of fragments in the interstadial soil context, the calculation of a synthetic MNI is potentially less straightforward in view of evidence (refittted bones, identification of individuals) that the three Niveaux D proba-

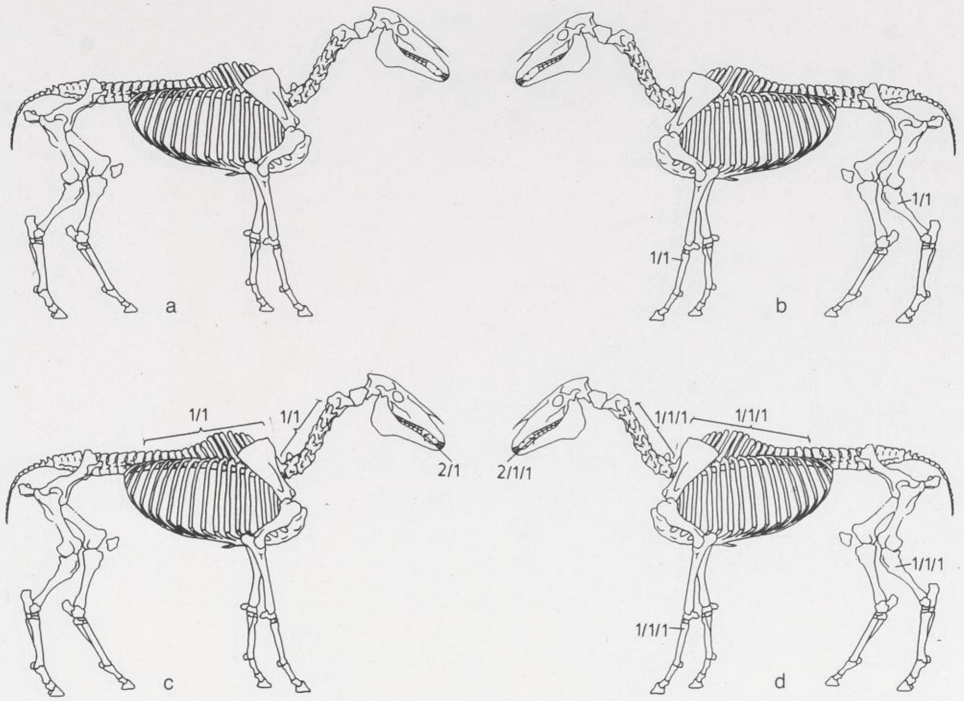


Fig. 36 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Equus* sp. in Niveau D3 at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

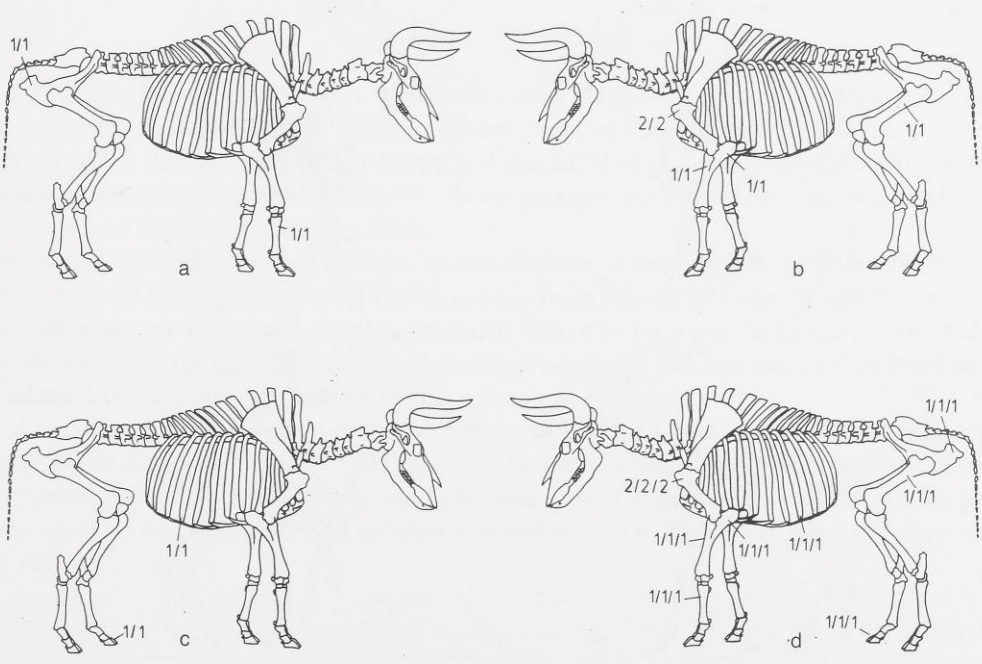


Fig. 37 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of cf. *Bos primigenius* in Niveau D3 at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

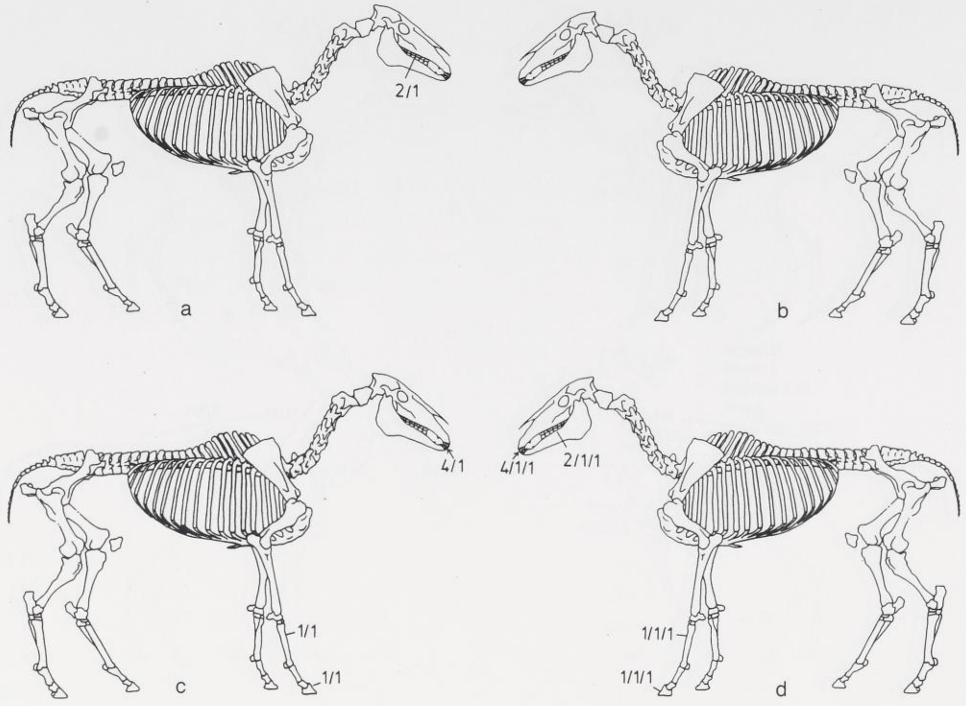


Fig. 38 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Equus hydruntinus* in Niveau D3 at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

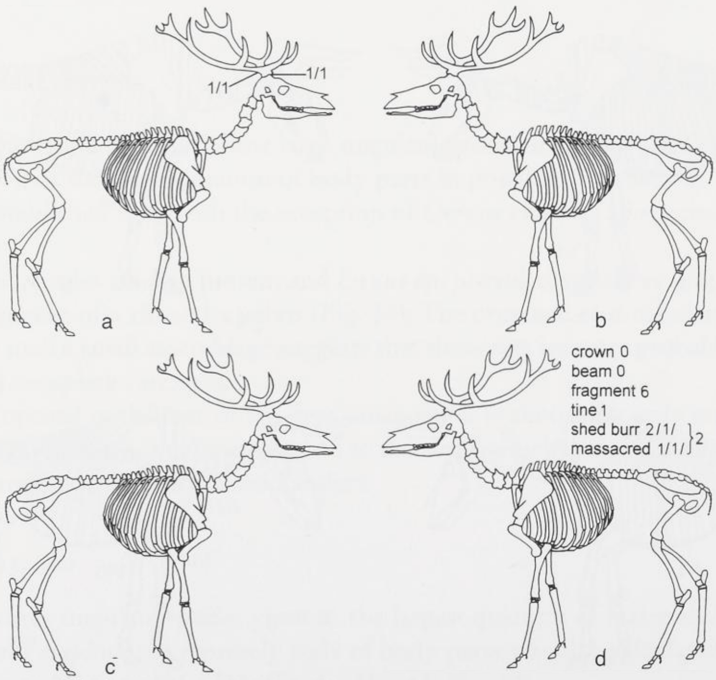


Fig. 39 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Cervus elaphus* in Niveau D3 at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

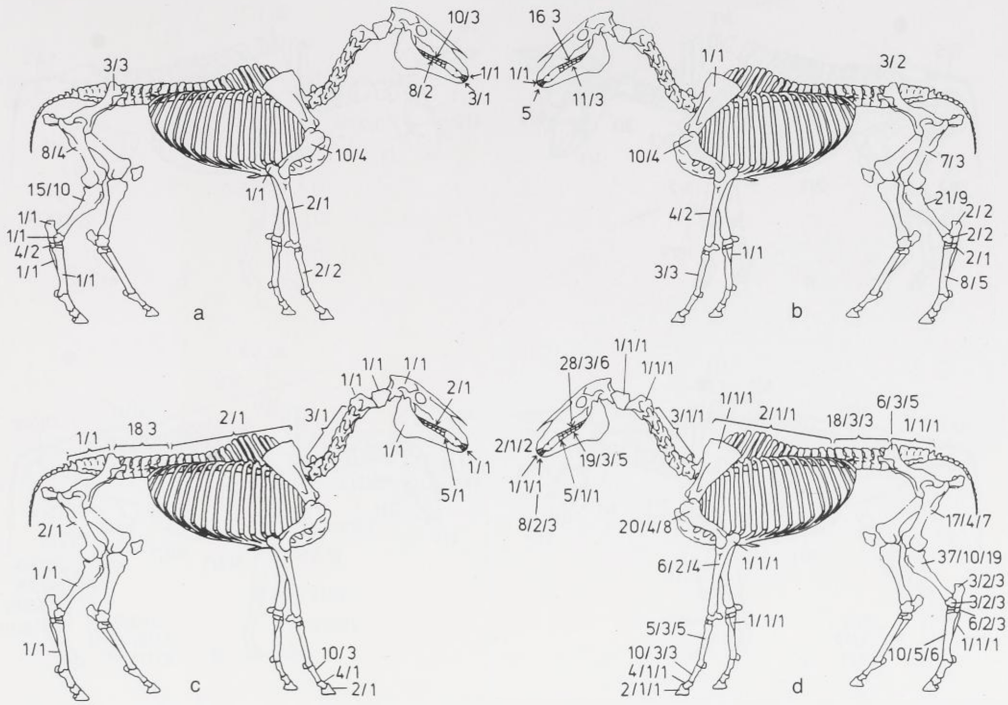


Fig. 40 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Equus* sp. in Niveaux D1 - D3 at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

bly form an inter-related complex. Since bones or teeth of the same individual might be recovered from different layers the highest MNI for different elements can not be simply added to obtain a combined figure. Fortunately, this problem does not apply if the MNI is calculated strictly on the basis of the MNE, since the criterion of exact duplication of body part guarantees that all specimens used for the calculation are indeed from different individuals.

The synthetic result for the NISP of all three humus horizons is only slightly different from that for Niveau D1 alone since the vast majority of the material is from this layer. In the case of *Equus* sp. the only missing elements are the caudal vertebrae and ribs (Fig. 40). With the exception of the caudal vertebrae and the sacrum no part of the skeleton of cf. *Bos primigenius* is now missing (Fig. 41). The phalanx 1 and phalanx 2 are the only elements of red deer not present (Fig. 42).

The MNI also changes only slightly in comparison with Niveau D1. A further specimen of right tibia raises the MNI of *Equus* sp. from 9 to 10 (Fig. 40). The addition of several specimens now gives a MNI for cf. *Bos primigenius* of 9 (left humerus and right metacarpus) instead of 7 for the latter element in Niveau D1 (Fig. 41). The highest MNI of red deer is raised from 6 to 8 on the evidence of the right humerus (Fig. 42).

Niveau E

The overall number of fragments recovered from Niveau E is appreciably larger than that from Niveau D3, but a larger proportion is unidentified or determined as marmot, so that the NISP of identified large mammal bones is quite similar to that from the upper humus horizon (Fig. 43, Fig. 44, Fig. 45).

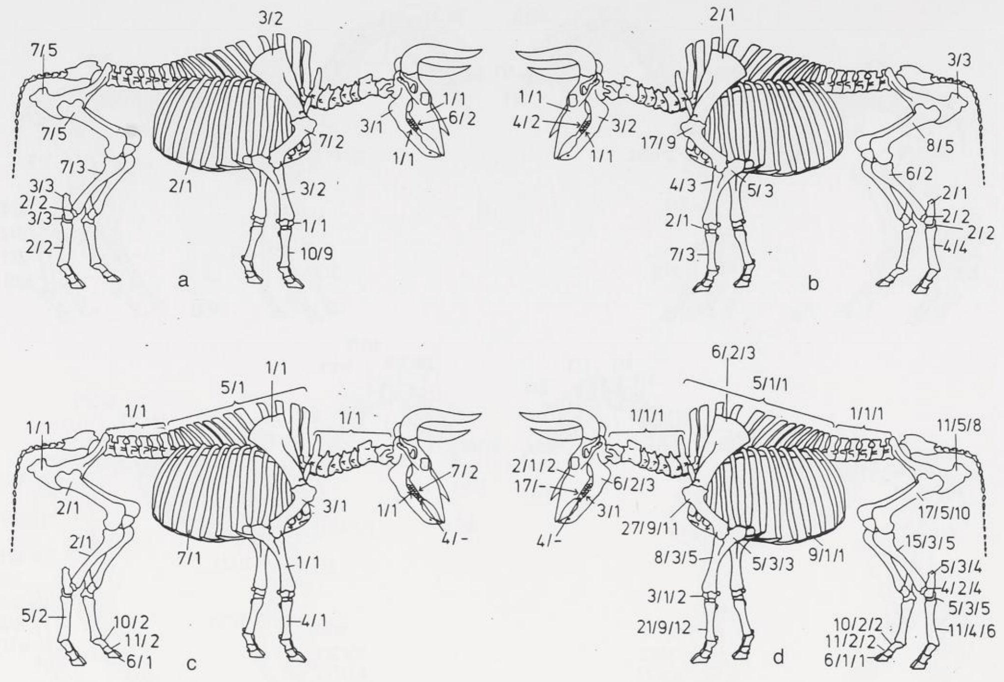


Fig. 41 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of cf. *Bos primigenius* in Niveaux D1 - D3 at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

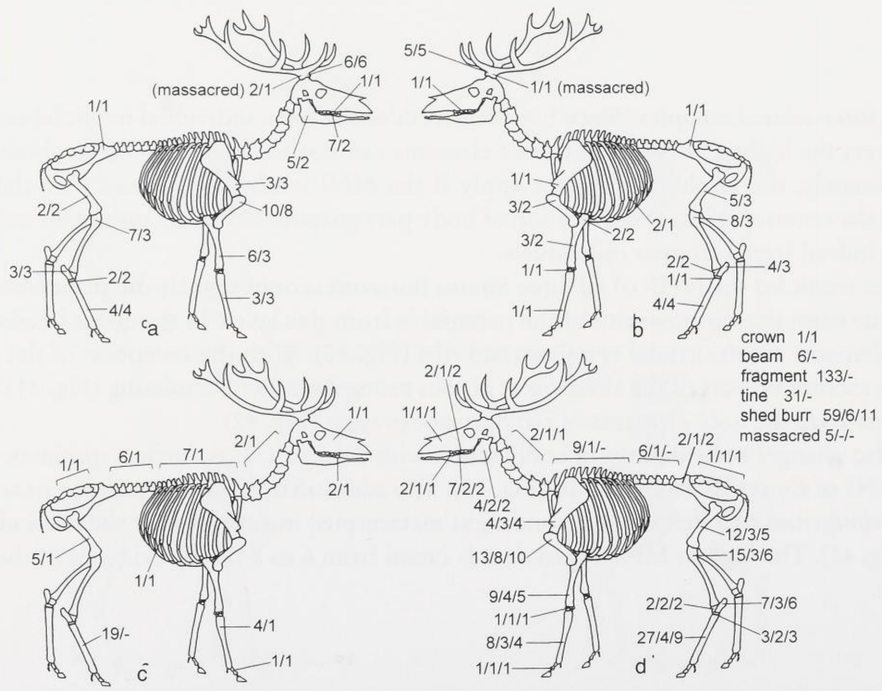


Fig. 42 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Cervus elaphus* in Niveaux D1 - D3 at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

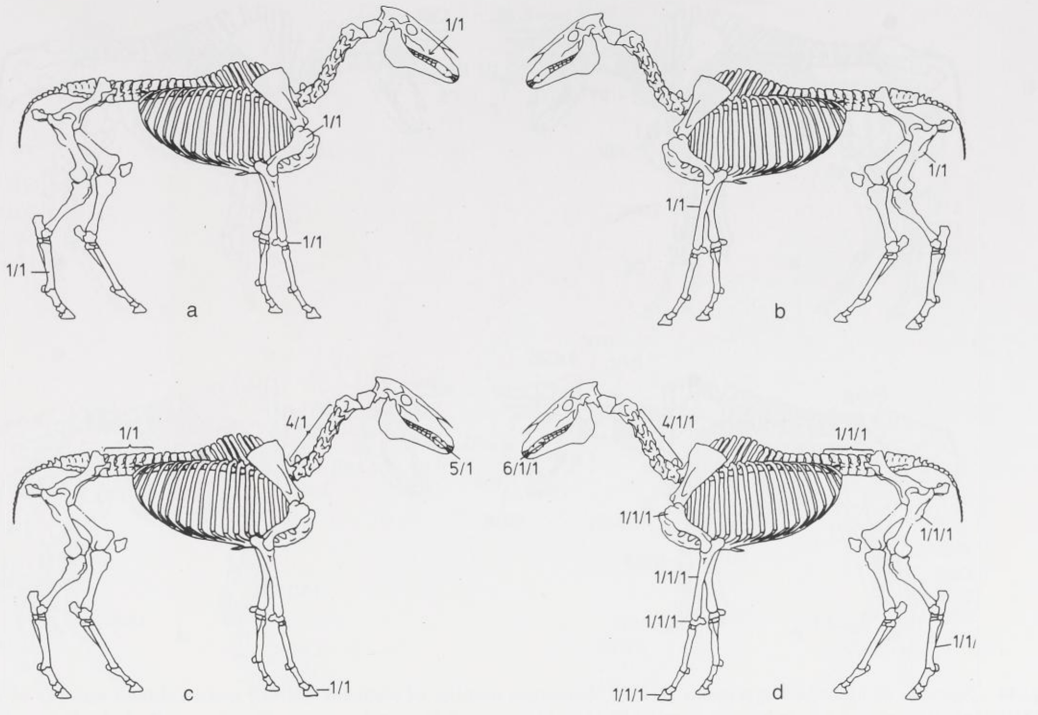


Fig. 43 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Equus* sp. in Niveau E at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

The greater number of specimens of *Equus* sp. is, to a large extent due to the presence of very small splinters of tooth enamel. Both horse and bovid are represented by elements of the skull and by bones of the fore and hind limbs (Fig. 43, Fig. 44); horse alone has evidence for vertebrae.

As was the case for the small assemblages from Niveau B and Niveau D3, red deer is present only in the form of antler and none of this is attached to the skull (Fig. 45).

No element of the skeleton of any species provides evidence for more than one individual. The low number of specimens precludes a meaningful interpretation of the material from Niveau E. The survival of a number of horse vertebrae is surprising since the layer was formed by solifluction processes.

Synthesis of all layers

The overall results for NISP, MNE and MNI of the four ungulate species irrespective of layer are presented in Fig. 46, Fig. 47, Fig. 48 and Fig. 49.

It is questionable if it is legitimate to synthesise the faunal material in this way, but the evidence that different sedimentological layers contain faunal remains with a common origin makes it clear that neither can the Niveaux be treated as wholly distinct entities.

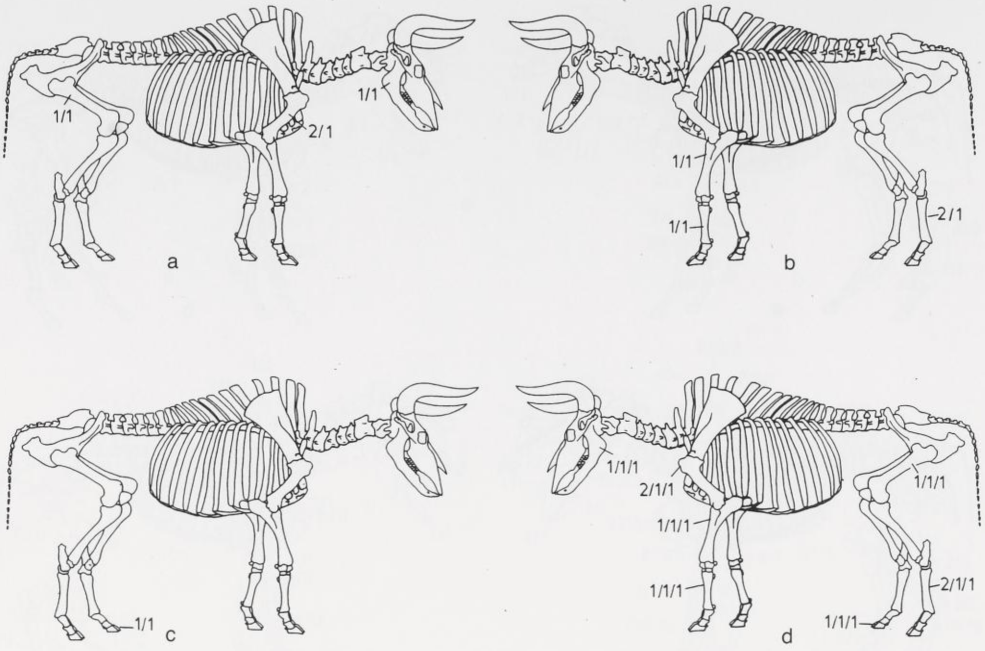


Fig. 44 Number of identified specimens (**NISP**), minimum number of elements (**MNE**) and minimum number of individuals (**MNI**) of cf. *Bos primigenius* in Niveau E at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

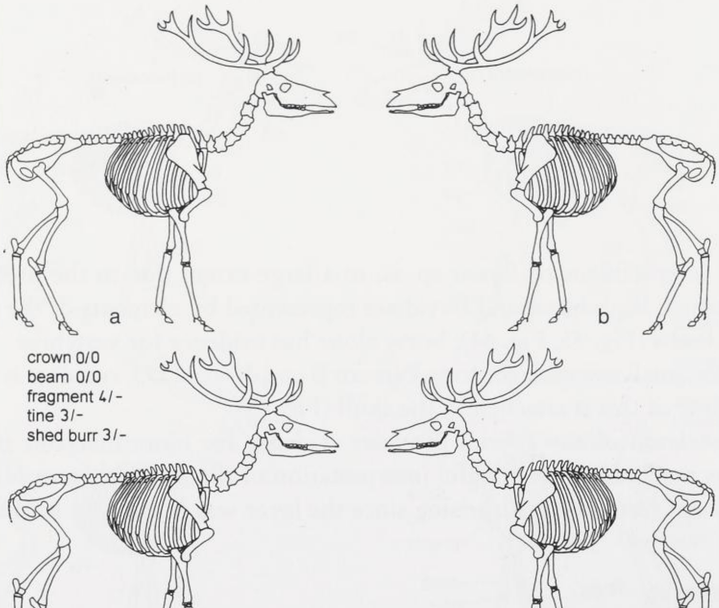


Fig. 45 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Cervus elaphus* in Niveau E at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

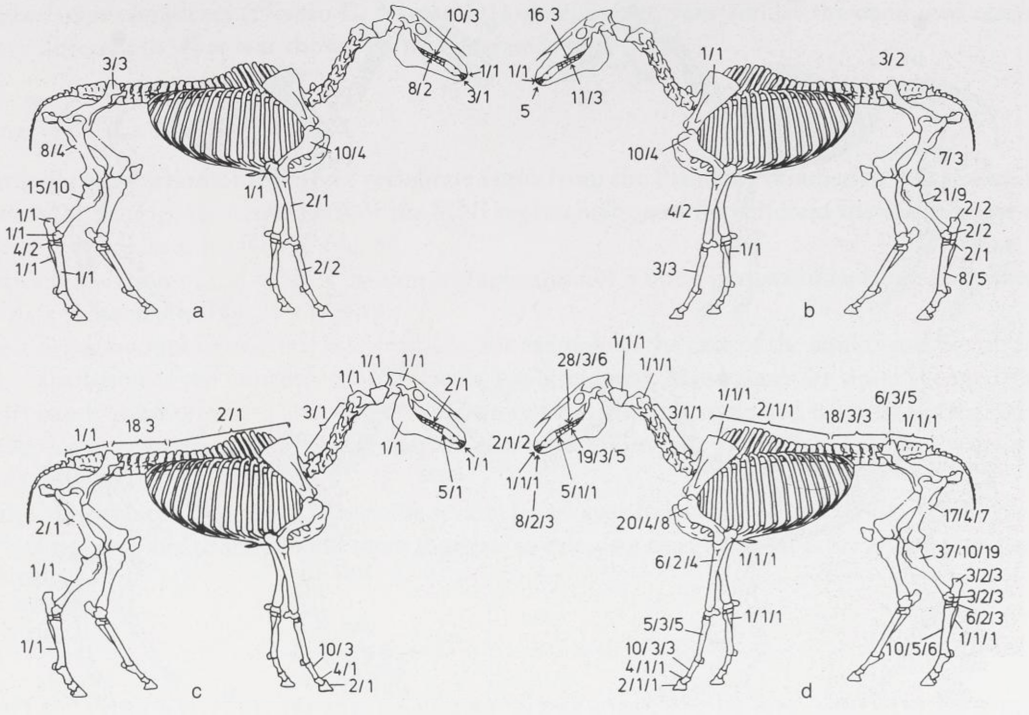


Fig. 46 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Equus* sp. in all Niveaux at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

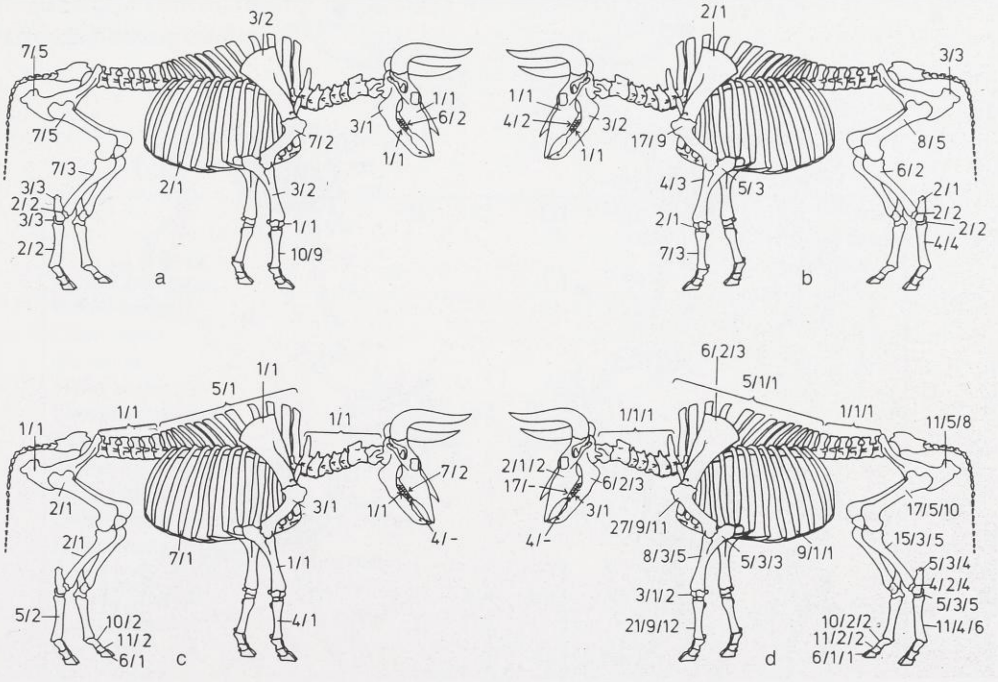


Fig. 47 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of cf. *Bos primigenius* in all Niveaux at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

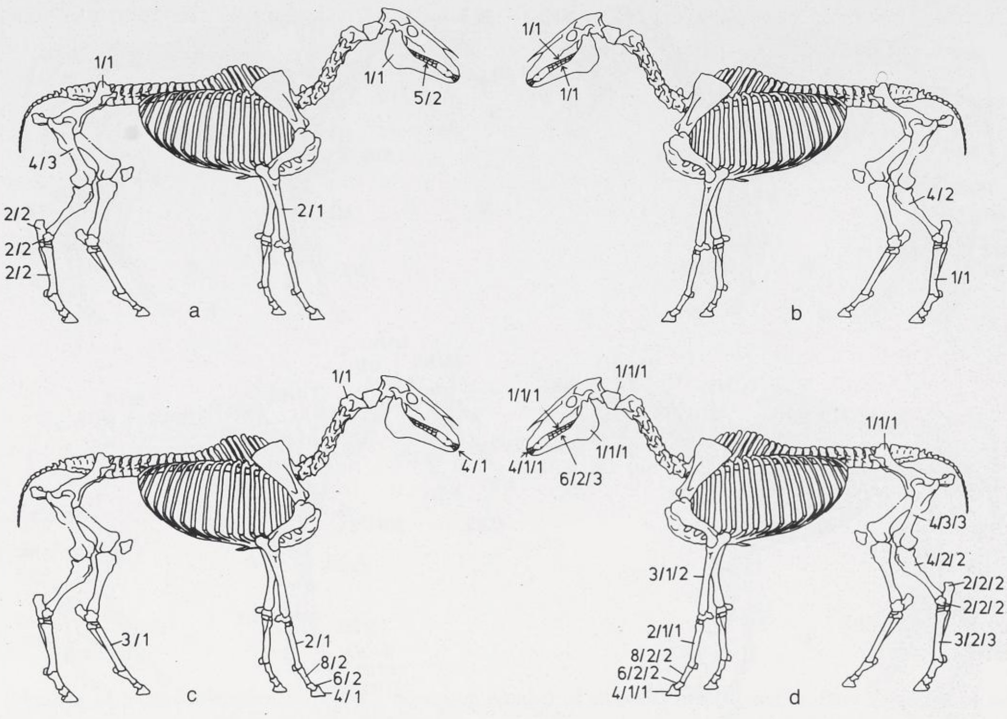


Fig. 48 Number of identified specimens (**NISP**), minimum number of elements (**MNE**) and minimum number of individuals (**MNI**) of *Equus hydruntinus* in all Niveaux at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

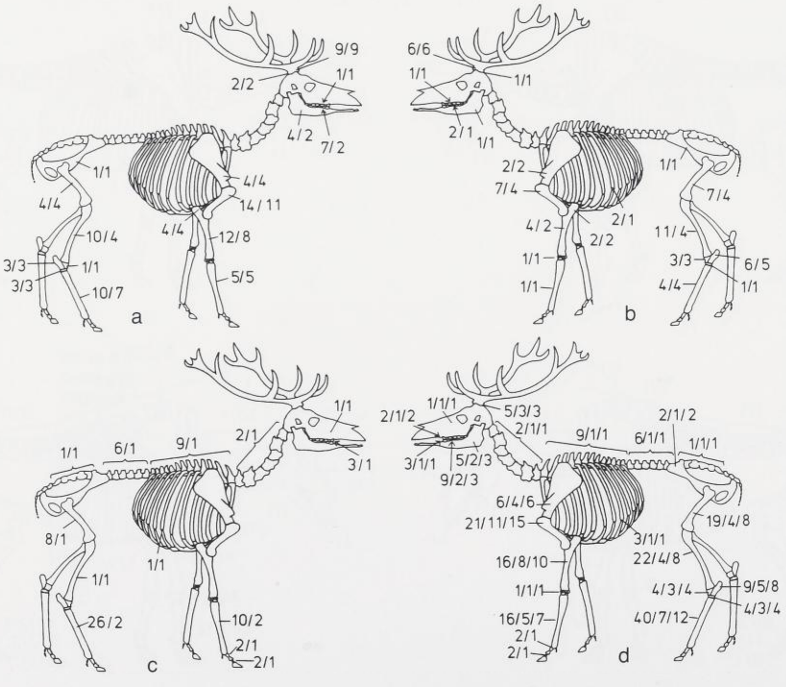


Fig. 49 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Cervus elaphus* in all Niveaux at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

Since the larger complexes (Niveau C, Niveau D1) were, in fact, very similar the combined results are not very different to what was shown by the separate layers.

Summary of the NISP and MNI

The overall composition of the larger vertebrate fauna from the Plaidter Hummerich was shown in the form of NISP by Fig. 10. A synthesis of the MNI representation of the different species of larger mammal by geological layer is given in Fig. 50.
The basic calculation of the MNI is by simple duplication of a body part within a layer and equivalent to the data presented in Fig. 21 - Fig. 49.
Where a larger amount of material was available, for example in the case of the equids and bovid, a more »exact« calculation of the numbers of individuals was attempted, based generally upon ageing data provided by tooth eruption and crown height wear. Stray finds are only indicated when this is the only evidence for a species at the site. MNI for *Cervus elaphus* is shown for antler (left number) and for bone and/or tooth (right number).
Since the MNI figures for each species in the several layers are often based on the MNE of different body parts, it is not possible to simply add them together to calculate the global MNI for the Hummerich.

SPATIAL DISTRIBUTION OF FAUNAL REMAINS IN PLAN AND IN SECTION

The spatial distribution of all faunal material was plotted by computer using the three dimensional co-ordinates measured during excavation. The north and south co-ordinates (»x« and »y«) obviously refer to the excavation grid system, that for depth (»z«) was converted by the excavator of the site into values above an arbitrary datum »0.0 m«.

	A	B	C	D1	D2	D3	E	Stray find
Alopex lagopus				1				
Vulpes vulpes					1			
Canis lupus								1
Martes sp.								1
Meles meles								1
Crocuta crocuta			1					
Panthera spelaea				1				
Equus hydruntinus			1	1	1	1	1	
Equus sp.	1	1	3	9	4	1	1	
Dicerorhinus hemitoechus			1					
Coelodonta antiquitatis					1			
Capreolus capreolus		1		1			1	
Cervus elaphus		1/1	8/4	10/6	2/2	1/0	1/0	
Dama dama		1	1	1				
Cervidae			1	1				
Bos / Bison		1	3	7	2	2	2	

Fig. 50 Minimum numbers of individuals for all species of larger mammals found at the Plaidter Hummerich in each geological layer (Niveau).

Three separate plots were combined into composite illustration (Figs. 51 - 58). The central plot shows the location of material within the excavation, the outlines of which are shown by a continuous line. This horizontal plot shows the two major prolongations of the excavation area which extend up the slope of the crater wall in the north-western and southern part of the site. It is clear that these extensions, a 3 m wide surface along the quarry face to the Northwest and a 2 m wide trench to the South, only give an incomplete picture of the distribution of material in higher positions on the slope of the crater wall. The outline of a number of test pits is not drawn, but these are the explanation for a small amount of material outside the limits of the main excavation area.

In some cases more than one find has the same co-ordinate and it is possible that two or more fragments are represented by only one symbol.

Two projections of finds against the arbitrary datum »0.0« were also drawn. They show the vertical position of material looking to the North and the West and are found above and to the right of the horizontal plot respectively. Each vertical projection automatically shows a clustering of finds at the right of the plot. These clusters are the result of foreshortening of perspective and show the material in the two steeply sloping extensions.

In a small number of cases no vertical measurement was given for a find, so that some pieces could only be plotted in plan. Certain projections of finds gave anomalous results, showing that the vertical coordinate had been calculated wrongly (usually by exactly 10 m!). In most cases these finds were also only plotted in two dimensions.

The fauna from layers containing relatively small amounts of material was plotted together using only the distinction of species identification. In layers with larger numbers of finds the more common species were plotted on several plans distinguishing between body parts.

Only a selection of the total number of plans drawn is reproduced here, since it was rarely possible to identify meaningful patterns of distribution, the plans rather confirming the random and ubiquitous distribution of all categories of faunal material.

The distribution of the large number of unidentified fragments was also plotted separately for Niveau C (Fig. 53) and Niveau D1 (Fig. 55). Although it is impossible to recognise detail in the dense mass of the symbols, the plots are included here in order to provide a clear illustration of the horizontal and vertical limits of the respective sedimentological layers.

Niveau B

The amount of material from the interglacial soil Niveau B is small enough to allow the plotting of all species together (Fig. 51). No identified remains of any species are present in the southern trench or very far into the north-western excavation area, but remains of the bovid and red deer are scattered across the rest of the site. By contrast, six of the seven finds identified as *Equus* sp. are located within a fairly small area to the North of the site and three of these are teeth of one individual (vid. Fig. 14). One find each of fallow and roe deer is also present.

Niveau C

The richer faunal assemblage from Niveau C was first plotted on a total of nine plans. This sediment unit was only present in higher positions on the crater wall so that no finds were present in the larger and lower lying excavation area to the East. It is in consequence difficult to recognise any spatial pattern in the restricted area of the narrow excavation areas to the Northwest and South and only two plots are reproduced here (Fig. 52, Fig. 53).

The location of finds of less common species is shown in Fig. 52. Horse and fallow deer are present in both the north-western and the southern extension of the excavation, but two further species (*Crocuta crocuta* and *Dicerorhinus hemitoechus*) are only found in the former area of the excavation. Four fragments of *Dama* tibiae were refitted in the former area (Fig. 15).

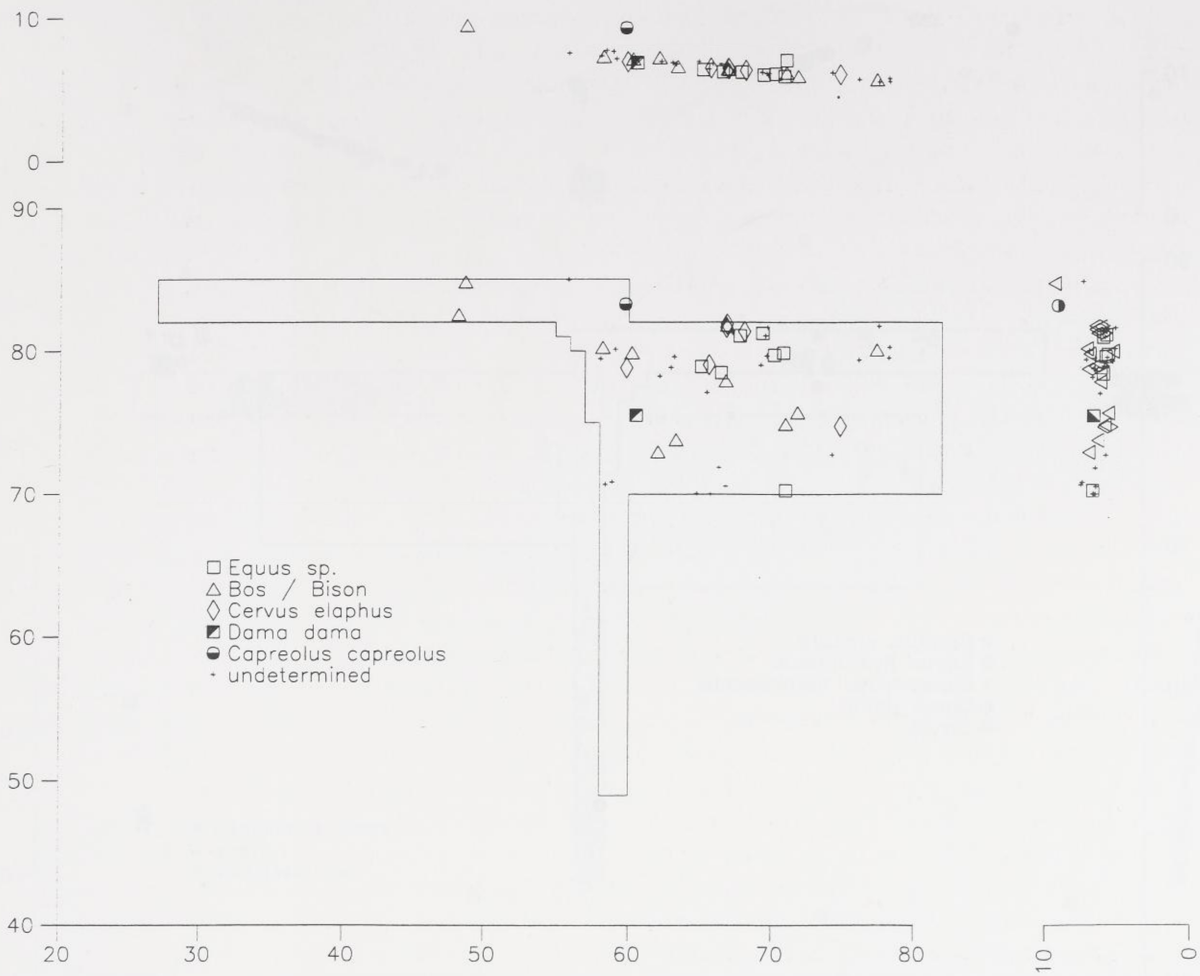


Fig. 51 Horizontal and vertical distribution of all faunal remains in Niveau B at the Plaidter Hummerich (for explanation see text).

The location of the horse teeth (identified to individuals) was already shown (Fig. 14). The richest concentration of postcranial material of this species from Niveau C is found in the north-western extension of the site. In this area two fragments of radius in m^2 35/82 and 40/82 were refitted and possibly show movement of material downslope (Fig. 15).

A small number of bones of horse, in all cases found in close proximity, can be re-articulated in several layers and show that erosion and reworking did not affect all material to the same degree. In Niveau C lumbar vertebrae 5 and 6 found more than 50cm apart in m^2 38/82 could be re-articulated. The latter piece also articulates to a fragment of sacrum, which was found quite close in m^2 39/84, but assigned to Niveau D1.

The relatively restricted distribution of foetal bone of the large bovid was already shown (Fig. 16a). The remaining material bones of this species in layer C is more evenly distributed, also in comparison with

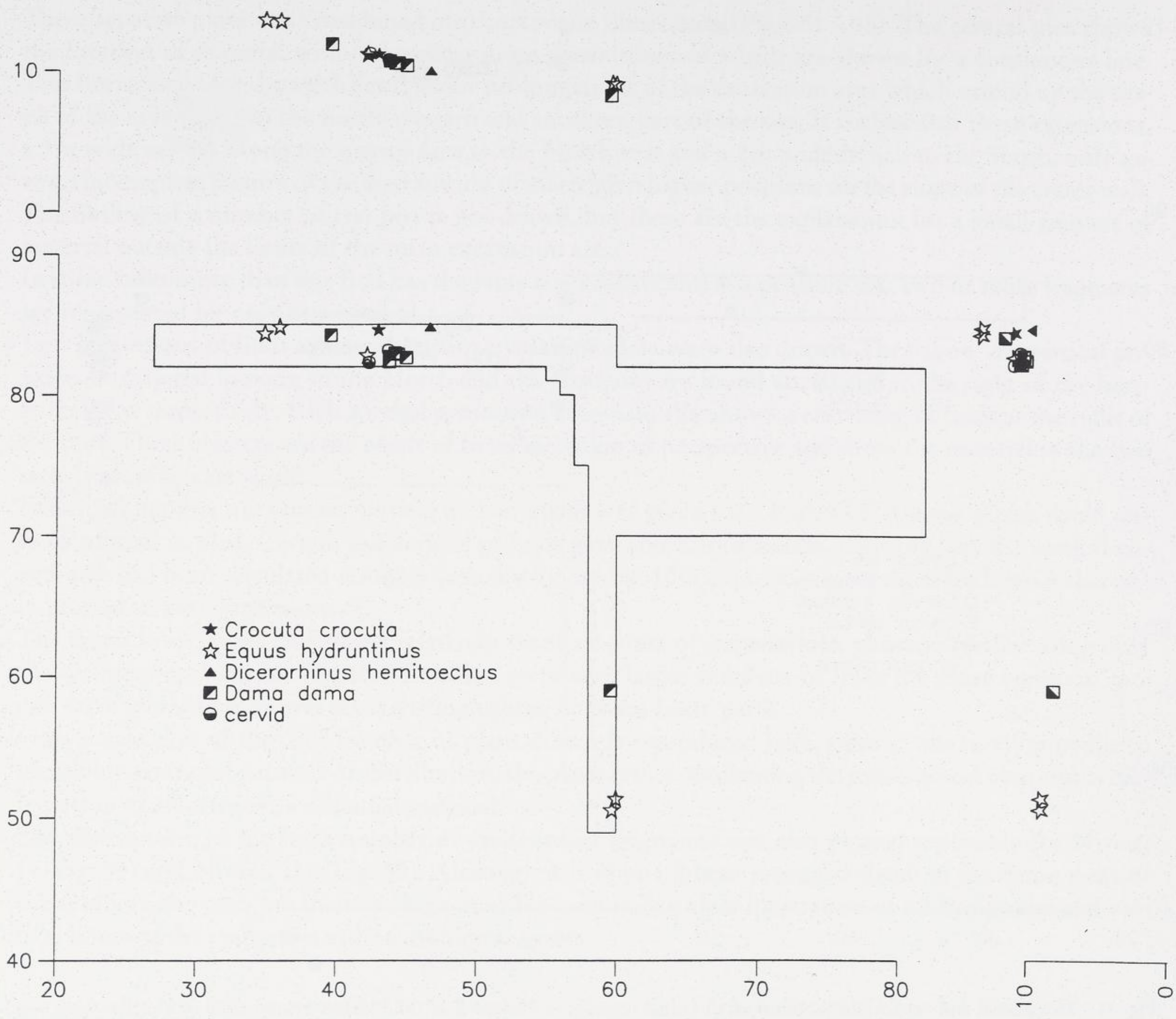


Fig. 52 Horizontal and vertical distribution of the less common species in Niveau C at the Plaidter Hummerich (for explanation see text).

that of horse and occurs in both extensions of the excavation. While the number of finds is still too low to be able to recognise any meaningful spatial patterning, a few features can be commented upon.
The scapula, tarsal and femur are only present in the north-western part of the site, whereas rib and patella are found only to the South. The radius and the tibia are also unevenly distributed, being represented by one find only at the Northwest and South of the site respectively.
It is not possible to identify either hominid or carnivore activity as the cause of features of distribution such as the lack of association of parts such as tibia and femur. It is more probable that these details are due to the low number of specimens involved and result from random attrition of an originally homogeneous spread of material. The more numerous humerus fragments are more evenly distributed in both areas and may give a better impression of the true distribution of material before destruction.
Bones of the fore limb of red deer are quite evenly distributed, although both the humerus and the metacarpus are more numerous to the Northwest. The tibia is only found at this part of the site and frag-

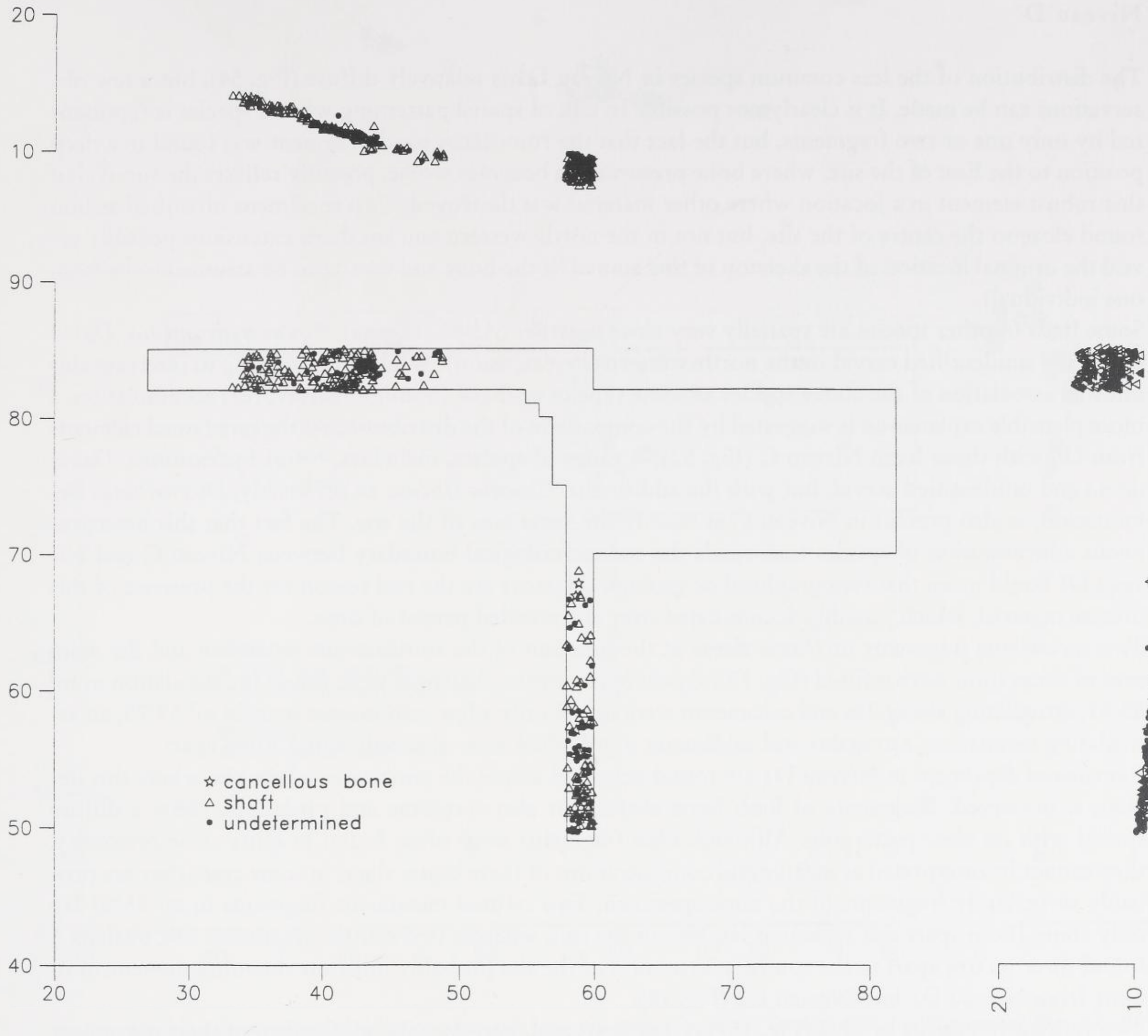


Fig. 53 Horizontal and vertical distribution of remains unidentified to species in Niveau C at the Plaidter Hummerich (for explanation see text).

ments of metatarsus and indeterminate metapodia are also more frequent here. Once again, this might simply reflect the overall higher number of fragments at the Northwest of the site.

Three groups of refitted material (femur and metatarsus) are also found in this area (Fig. 15), but are over very short distances and probably represent bone breakage in the sediment and post-burial movement due to soil activity (in the case of one femur involving both Niveau C and Niveau D). A red deer humerus and radius were found in articulation in m² 58/50 at the southernmost extension of the excavation. The existence of true spatial zonation cannot be claimed due to the low number of finds and small size of the sampled areas. Antler of red deer is, perhaps surprisingly, more abundant in the southern extension of the excavation. This also applies to shed antler bases, suggesting that not only the number of fragments, but also the number of specimens of shed antlers was higher here.

Unidentified bone fragments are abundant in both the southern and the northwestern trenches and »define« the occurrence of layer C at the site (Fig. 53).

Niveau D1

The distribution of the less common species in Niveau D1 is relatively diffuse (Fig. 54), but a few observations can be made. It is clearly not possible to talk of spatial patterning when a species is represented by only one or two fragments, but the fact that the rhinoceros tooth fragment was found in a deep position to the East of the site, where bone preservation becomes worse, possibly reflects the survival of this robust element in a location where other material was destroyed. Two specimens identified as lion found close to the centre of the site, but not in the north-western and southern extensions possibly reveal the original location of the skeleton of this animal (if the bone and tooth can be assumed to be from one individual).

Some finds of other species are spatially very close together (*Alopex lagopus*, *Equus hydruntinus*, *Dama dama* and unidentified cervid in the north-western site extension). While it is tempting to interpret this unusual association of the above species as some type of artificial (hominid/carnivore?) accumulation, a more plausible explanation is suggested by the comparison of the distribution of the rare faunal elements from D1 with those from Niveau C (Fig. 52). A range of species, including *Equus hydruntinus*, *Dama dama* and unidentified cervid, but with the addition of *Crocuta crocuta* and, possibly, *Dicerorhinus hemitoechus*, is also present in Niveau C at exactly the same area of the site. The fact that this heterogeneous concentration of species transcends the sedimentological boundary between Niveau C and Niveau D1 could mean that topographical or geological factors are the real reason for the presence of this diverse material, which possibly accumulated over an extended period of time.

Two metatarsus fragments of *Dama dama* at the junction of the southern site extension and the main area of excavation were refitted (Fig. 15). *Equus hydruntinus* phalanges were found in articulation in m^2 63/81, articulating astragalus and calcaneum were found only a few centimetres apart in m^2 59/75, an articulating metatarsus, astragalus and calcaneum in m^2 62/74 were also only some 30 cm apart.

Remains of *Equus* sp. in Niveau D1 are found scattered across the entire area of the site where this deposit is preserved. Fragments of limb bone shafts, but also vertebrae and phalanges, show a diffuse spread with no clear patterning. Although tibia fragments were often found in quite close proximity, they cannot be interpreted as meaningful concentrations of these bones since, in some cases they are probably or certainly fragments of the same specimen. Two refitted metatarsus fragments in m^2 55/81 lay only some 10 cm apart and represent fracture in the soil, whereas two refitted fragments of a phalanx 1 found three metres apart in the southern extension of the site probably illustrate downhill movement of bone from Niveau D1 into Niveau D2 (Fig. 15).

Two refitted fragments of tibia (Fig. 15) lay 1 m apart and, here too, the mechanism of their movement might have been gravity since they lay along the axis of the slope. Re-articulated material from this layer includes phalanges found in articulation in m^2 66/71, and found lying very close together in 59/63, articulated tarsals in m^2 58/75, cervical vertebrae found ca. 1 m apart in m^2 57/74 and 57/75 and lumbar vertebrae which lay adjacently in 61/72.

Material identified as the large bovid generally behaves similarly to that of horse and is found widely across the site. However, foetal bone and milk teeth of this species form a recognisable concentration in the north-western site extension, where they also are found in Niveau C (Fig. 16a). Little refitted material is present and the few recorded cases are over short to very short distances (< 1 m). Two fragments of tibia in m^2 70/73, two fragments of a phalanx 3 in m^2 65/72 and two tarsal fragments in m^2 73/80 almost certainly represent breakage in the sediment. The latter bone (a calcaneum) is normally a robustt element and the fact that it has been weathered into two fragments probably reflects the more destructive milieu at the eastern area of the site. Re-articulations are present but rare. They include phalanges found close together in m^2 39/82, phalanges articulating between 65/72 and 66/71 and between 61/77 and 62/77, tarsals 60 cm apart in 65/72 and, possibly, a tarsal and a metatarsus some 20 cm apart in m^2 58/51.

No obvious patterning can be recognised for distribution of remains of red deer in Niveau D1, except perhaps that within the southern and north-western extensions of the site there are two zones with no

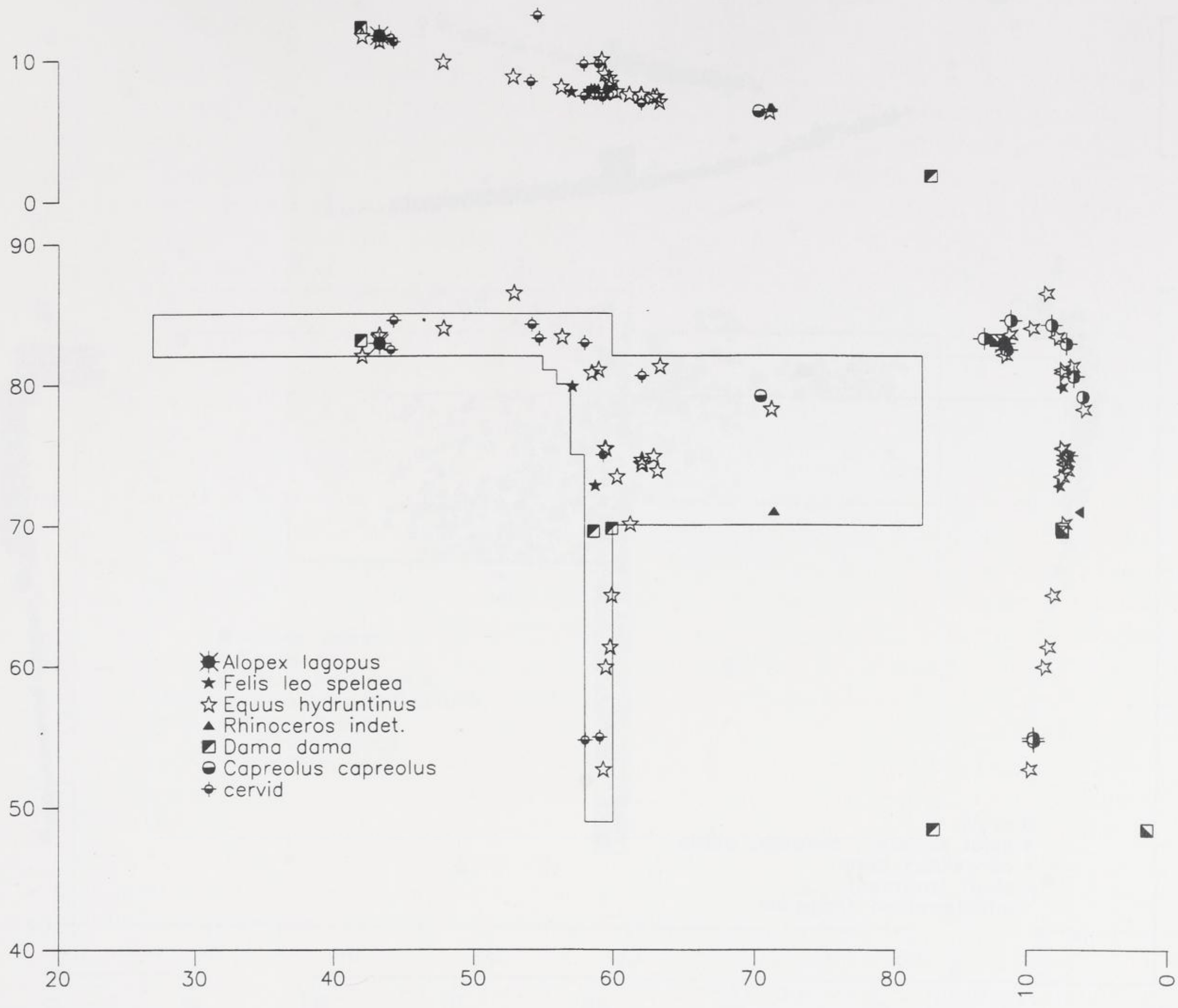


Fig. 54 Horizontal and vertical distribution of the less common species in Niveau D1 at the Plaidter Hummerich (for explanation see text).

elements of the fore limb and hind limb respectively. The first of these is over 15 m long and the second almost 10 m long. The explanation for this phenomenon is unknown; the quantity of material involved ought to be large enough for this pattern not to be random.

Refitted bone of *Cervus elaphus* in the north-western site extension of Niveau D1 includes a rib, mandible, metatarsus and femur, the latter piece refitting to Niveau C (Fig. 15). The metatarsus refits over some 4 m downslope and was possibly moved by soil activity and gravity; the other finds are all refitted over very short distances and were probably broken *in situ* after burial.

One refit each in the southern extension (femur) and the main excavation area (calcaneum) were also found in close proximity and are probably due to the same process (Fig. 15). An articulating forelimb, consisting of humerus, radius and ulna and metacarpus, found in m^2 73/72 shows that at least some material was buried quite rapidly and not afterwards disturbed.

An astragalus and calcaneum, found in m^2 48/84 and 49/82 respectively, probably articulate and would then, by contrast, demonstrate secondary re-deposition, since the first find is from Niveau C and the lat-

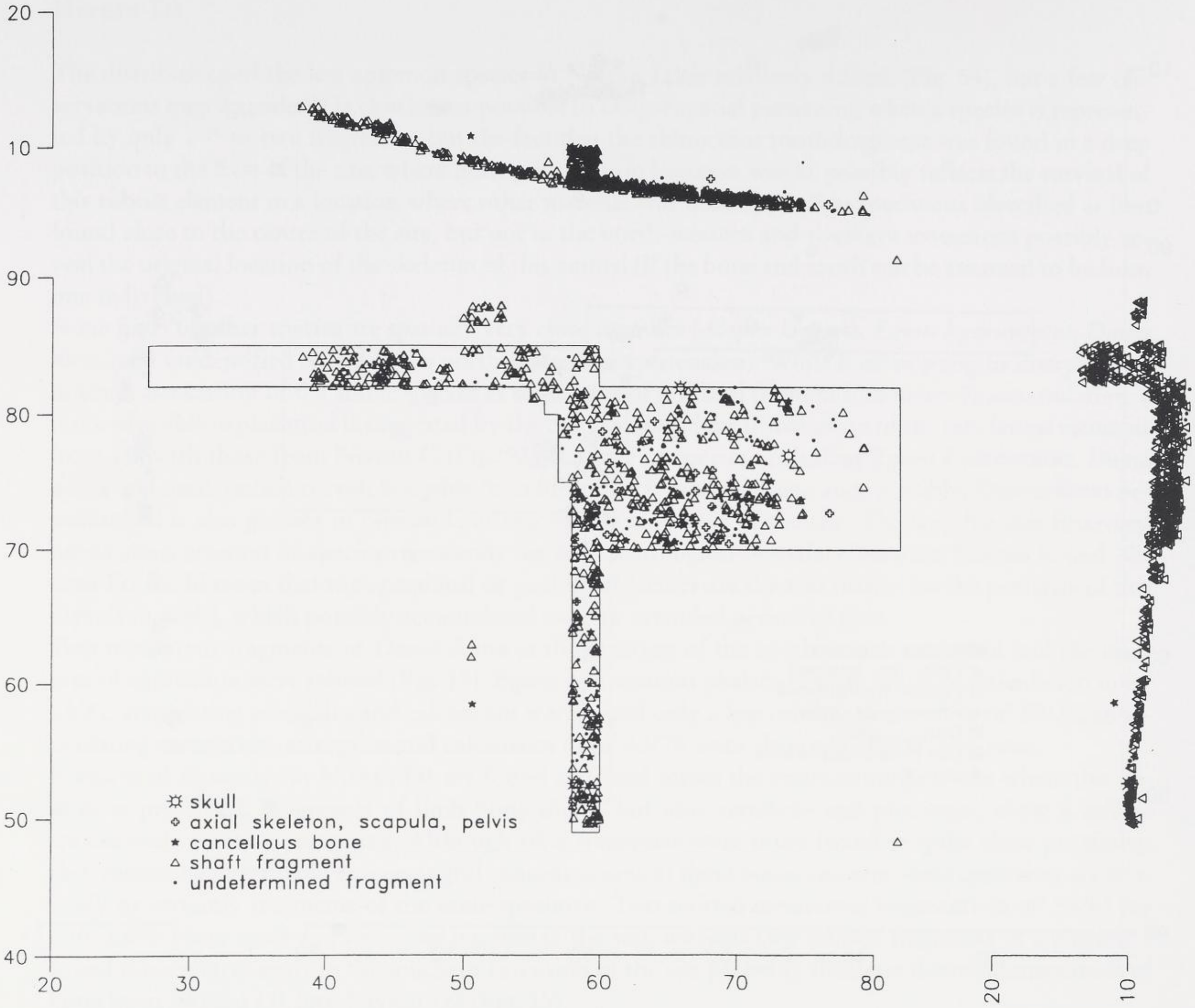


Fig. 55 Horizontal and vertical distribution of remains unidentified to species in Niveau D1 at the Plaidter Hummerich (for explanation see text).

ter from Niveau D1. A red deer metatarsus in m² 58/80 re-articulates to a centrotarsale in m² 58/79, a distance of over 1 m.
Antler is found across the entire excavated area, again with no features capable of clear interpretation. Fragments, but shed bases are found at the very end of the southern trench, but the latter are otherwise found universally. A skull fragment with antler lay to the South of the central main excavation.
The plot of the large amount of unidentified material (Fig. 55) defines the overall limits of faunal distribution (and preservation?) in Niveau D1. Areas of differing density of occurrence are not pronounced, but appear to be present. The West of the north-western extension contains more material than the central part of this area and the number of finds seems to decrease from South to North through the large excavation area. The drop in number of finds from West to East is, of course, due to the decreasing thickness and eventual disappearance of Niveau D1 in this direction.

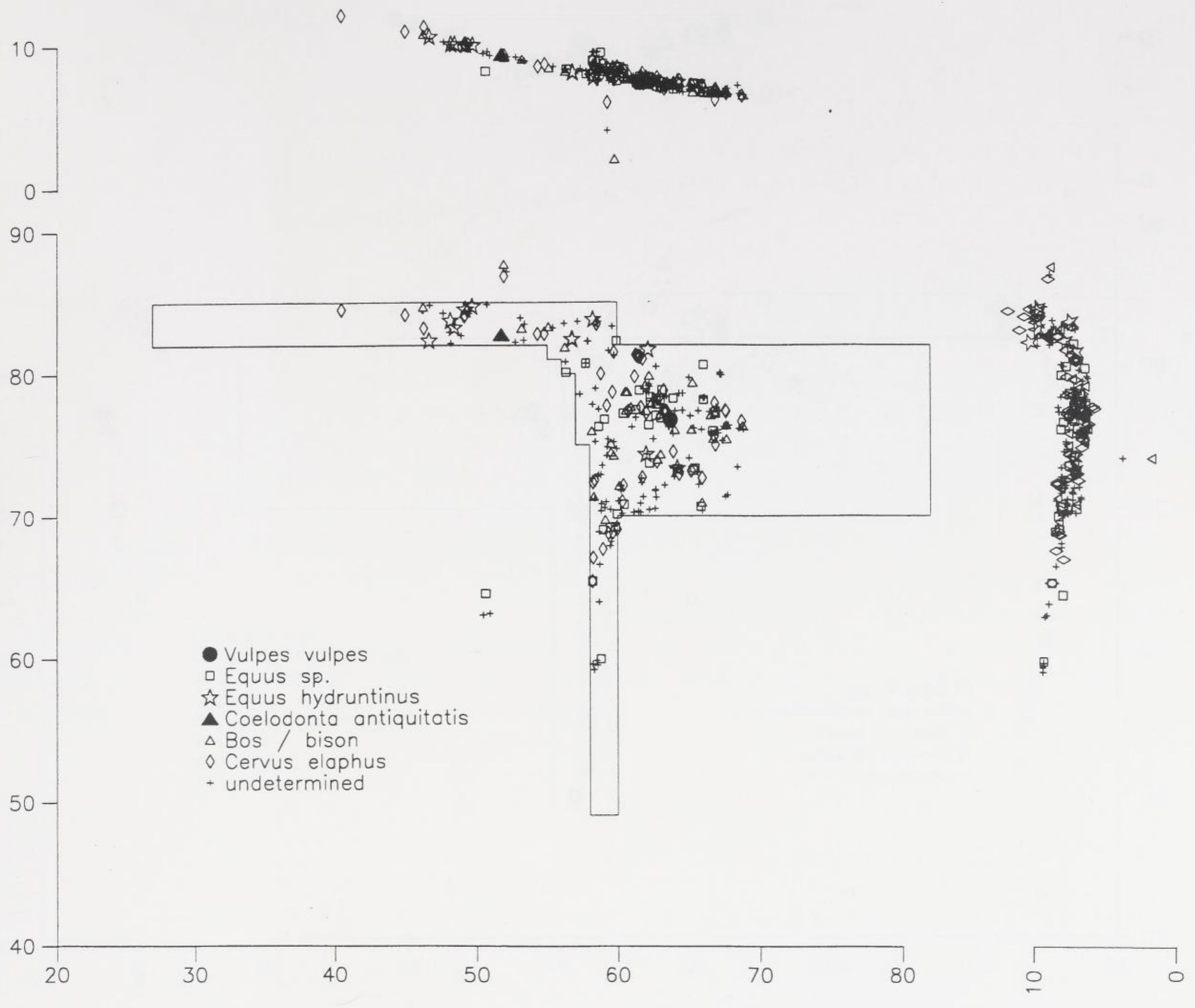


Fig. 56 Horizontal and vertical distribution of all faunal remains in Niveau D2 at the Plaidter Hummerich (for explanation see text).

Niveau D2

The relatively small amount of material from Niveau D2 can all be plotted together (Fig. 56). As in the case of the plots of material from Niveau C, the spatial distribution of the finds clearly illustrates the extent and boundaries of the sedimentological unit, and the spread of faunal material does not extend as far to the East, West and South as does that in Niveau D1.

No distribution pattern can be discerned and fragments attributed to all species are found over the entire area. Two refitted fragments of a radius of *Equus hydruntinus* lay immediately adjacent to each other and were probably fractured in the sediment, while a fragment of a horse phalanx which was refitted to a second piece from Niveau D1 is probably reworked from the latter layer (Fig. 15). Two tarsals of *Equus* sp. in m^2 63/78 were found in articulation.

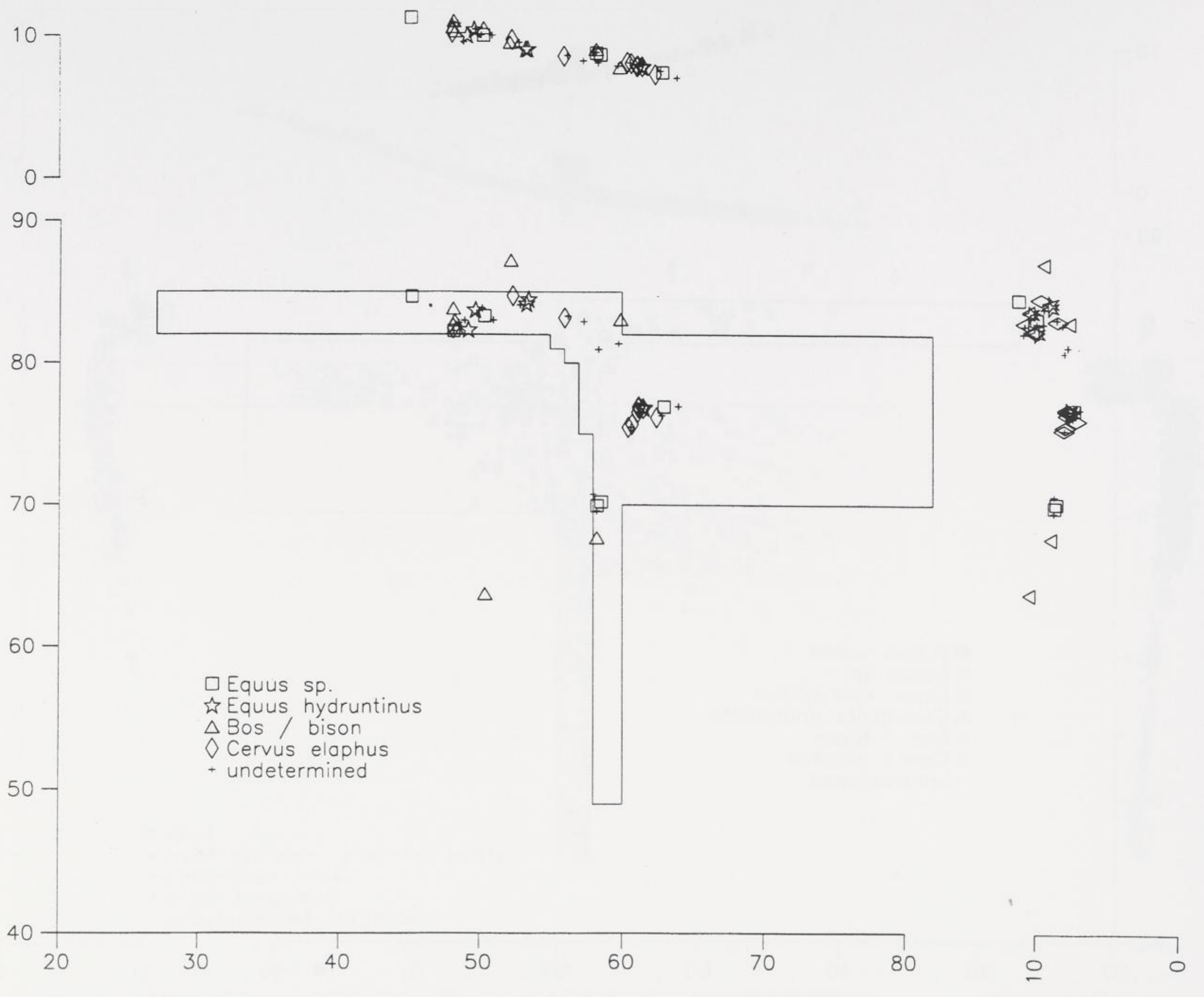


Fig. 57 Horizontal and vertical distribution of all faunal remains in Niveau D3 at the Plaidter Hummerich (for explanation see text).

Niveau D3

Only 51 fragments of faunal material were attributed to Niveau D3 (Fig. 57). The occurrence of this deposit is restricted to a band running around the crater which is truncated by solifluction to the East. The irregular distribution of material assigned to this layer probably reflects the geology of the site rather than any patterning due to hominid or carnivore activity. Three articulating bones (humerus, radius and ulna) of the large bovid were found *in situ* in m^2 48/83, showing that some material in this layer was not heavily affected by erosional processes.

Niveau E

The origin of the faunal remains in the solifluction deposit Niveau E is not wholly clear. It is uncertain if all remains attributed to this layer are of the same age (i. e. younger than the interstadial soil complex Niveaux D1 - D3), or represent a mixture of autochthonous and allochthonous reworked elements. The humus horizons are truncated by Niveau E and, at the East of the site, only a thin remnant of Niveau

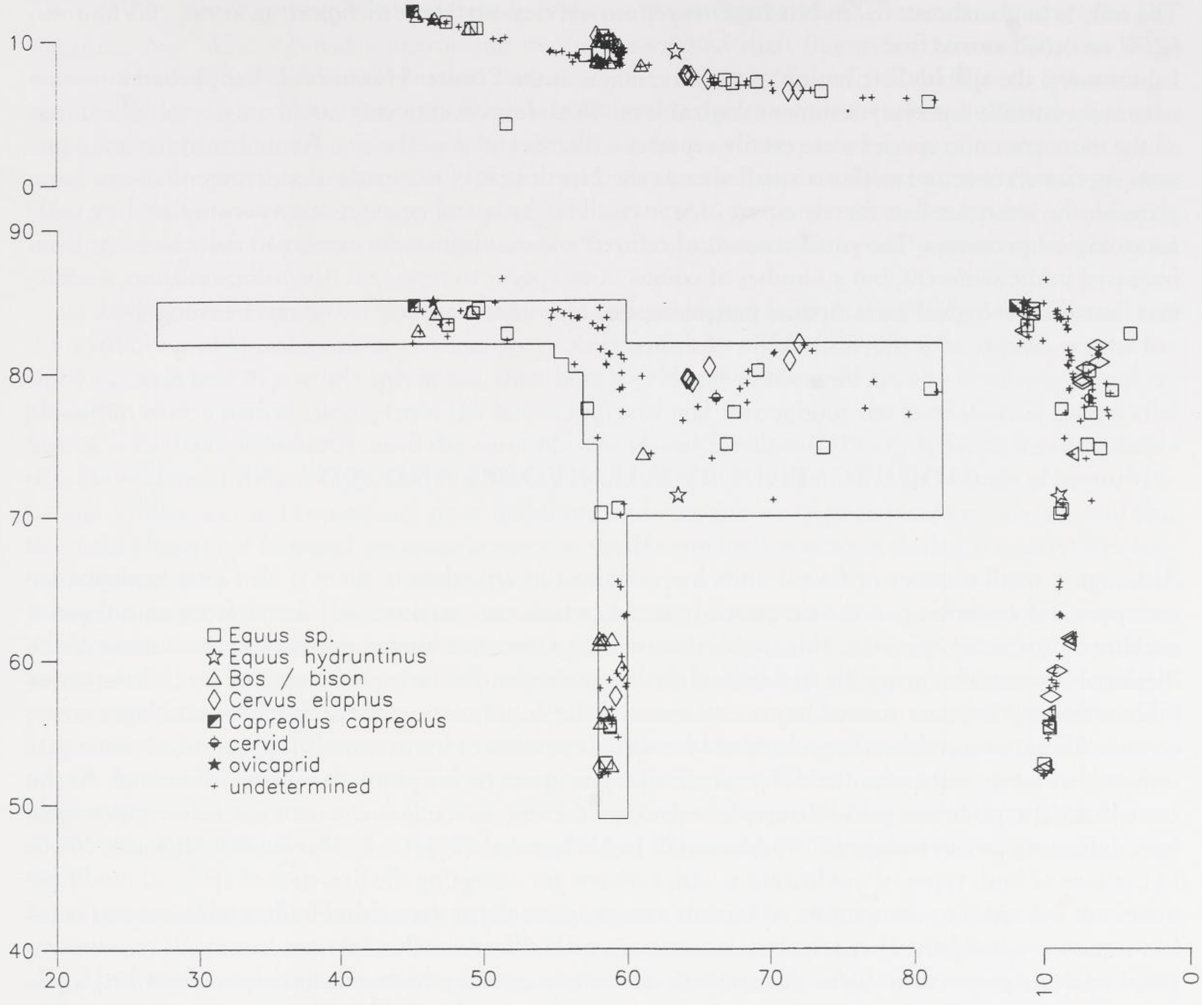


Fig. 58 Horizontal and vertical distribution of all faunal remains in Niveau E at the Plaidter Hummerich (for explanation see text).

D1 separates Niveau E from the interglacial soil Niveau B. Conjoined lithic artefacts show that material in Niveau D1 and Niveau E must be regarded as potentially one complex in its origin (Fig. 13).
It is possible that slight differences visible in the distribution of faunal elements are due to a heterogeneous origin of the assemblage. It is, for example, noticeable that no remains of the bovid are found in the eastern part of the site (Fig. 58). One explanation might be that material identified as this species in the rest of the excavation area is reworked by erosion from the underlying layers, but has not survived to the East of the site where this process was more destructive. By this argument, only the remains of horse and red deer, which are present at the East of the site, might then be contemporary with the formation of Niveau E.
A further feature of interest is the presence of two rare faunal elements (ovicaprid and roe deer) in the north-western extension of the site (Fig. 58). A higher concentration of both uncommon species and unidentified material can also be observed here in Niveau C (Fig. 52, Fig. 53) and Niveau D1 (Fig. 54, Fig. 55). This suggests that the processes behind the accumulation of faunal remains at this position (suggested above to have more likely been geological than archaeological) remained active until the formation of Niveau E.

The only articulated material in Niveau E were four cervical vertebrae of *Equus* sp. (CV3 - CV6) in m^2 67/77 recorded as one find.
In summary, the spatial distribution of faunal remains at the Plaidter Hummerich was plotted horizontally and vertically for every sedimentological layer. With few exceptions it could only be observed that all the more common species were evenly represented across most of the site. A number of the less common species were found within a small area to the Northwest of the excavation, where they can most plausibly be interpreted as merely a part of an overall larger faunal concentration accumulated by sedimentological processes. The small amount of refitted material is in some cases material which has been fractured in the sediment, but a number of connections appear to represent downslope erosion, sometimes between geological units. Spatial patterning due to hominid activity could not be recognised.

MODIFICATION BY CARNIVORES AND HUMANS

Although a small number of faunal units has remained in articulation, there is also clear evidence for transport and reworking of the excavated material, which may, in any case, derive from an unknown number of unrelated episodes. This means that, while an intensive human presence at the summit of the Plaidter Hummerich during the first half of the last glaciation is clearly demonstrated by the numerous lithic artefacts, the exact role of human activities in the accumulation of the faunal assemblages is uncertain. All bones were therefore examined for direct evidence of human modification in case some pattern might emerge either for the different stratigraphic units or for particular species of animal. At the same time, attention was paid to traces of carnivore damage to the fauna, which can be an appreciable factor affecting an assemblage (C. W. Marean & L. M. Spencer, 1991; C. W. Marean & L. Bertino, 1994).
In the case of both types of modification, strict criteria for accepting the presence of artificial modification were defined. For recognition of human manipulation these were either indiscutable cut marks (in fact none were recognised) or impact fracture scars with a clear conchoidal scar.
Detailed descriptions of features characteristic of bone fracture by hominids have been described by R. J. Blumenschine & M. M. Selvaggio (1988, 1991) and S. D. Capaldo & R. J. Blumenschine (1994), while J.-P. Brugal & A. Defleur (1989) replicate such fracture patterns on large mammal bones. Carnivore gnawing was accepted if there was definite evidence of tooth punctures, crenellation of bone edges or furrowing of bone (vid. L. R. Binford 1981). Criteria for distinguishing hyaena damage from hominid modification have been examined by R. J. Blumenschine (1988); R. J. Blumenschine & M. M. Selvaggio (1991) and S. D. Capaldo & R. J. Blumenschine (1994).
At the Hummerich it was possible in almost all cases to distinguish breaks on fresh bone from those due to post-burial crushing (cf. P. Auguste 1994), but the mere presence of green bone breakage (»spiral fracture«) was not accepted as proof of human modification, since such breaks can be produced by carnivores and, indeed, by other physical factors when the bone is in a fresh state.
The majority of fresh breaks on the Hummerich bones are probably indeed due either to hominid or carnivore activity, but it is impossible to distinguish the two in the absence of the features listed above.
In addition to the specimens with acceptable evidence for human or carnivore damage, a slightly larger number of fragments showed features which, although highly suggestive of modification by one or other agency, did not fully satisfy the defined criteria. It was not considered desirable to simply ignore this material and it was therefore also quantified as »questionable« evidence.
A very small number of bone fragments (8) allows the recognition of impact scars considered to be clearly due to deliberate fracture by hominids (Fig. 59), but definite cut marks were not present on any specimen, unsurprisingly in view of the poor surface preservation of most bone. It is noticeable that, despite the very low proportion of hominid-modified fragments, they are found throughout the stratigra-

phy and are identified for a number of species. Niveau B provided a smashed metatarsus of cf. *Bos primigenius*; Niveau C, a bovid humerus and two undetermined shaft fragments; Niveau D1, two fragments, one identified as a bovid tibia and the other indeterminate; Niveau D2 and Niveau E one undetermined shaft fragment each (Fig. 59). While it is noticeable that the three definitely modified specimens identified to species are from the bovid, this should not be over-interpreted since, of a further 26 specimens which are possibly/probably modified, several can be identified as *Equus* sp. and *Cervus elaphus* (Fig. 59). The nature of the evidence accepted here means that the bones affected are, with one exception, limb bone shaft fragments. The exception is a bovid calcaneum with a poorly preserved surface and dubious cut marks.

It has already been argued that the definition of sedimentological units at the Plaidter Hummerich and the attribution of faunal material to these are problematical. It will not therefore be argued, on the basis of 8 certain and 26 possible specimens, that there is evidence of hominid activity involving faunal exploitation over a period lasting from the last interglacial and throughout the formation of interstadial humus soils (Isotope Stage 5?) until the onset of truly glacial conditions (IS 4?). It seems more probable that the evidence for hominid activity in Niveau B and Niveau E is due to a combination of bioturbation and solifluction and consequent poor definition and recognition of geological boundaries, and that the main phase(s) of hominid presence/activity at the Hummerich was/were during the early Weichselian interstadial(s).

A larger number of bones (19) has been carnivore gnawed, showing that animal activity has also contributed to the final state of the recovered assemblage. Certain evidence for carnivore gnawing is found on bones of all three species with possible/probable traces of hominid modification and is also definitely present on bones of *Equus hydruntinus* (Fig. 59). The more even representation of this type of modification on the bones of different species might be due merely to the larger sample since, unlike scars of impact fracture by hominids, gnawing affects practically all parts of the body, from antler to the phalanges. No evidence for carnivore gnawing was recognised on the small bone assemblages from Niveau A and Niveau B, but all other layers (including Niveau D3) contained carnivore-gnawed material (Fig. 59).

Bone preservation at the Hummerich is generally poor and this has major consequences for the interpretation of the faunal remains. It has already been suggested that the frequency of body parts (for example, the under-representation of vertebrae, ribs etc.) is due to differential destruction by weathering and dissolution as a direct reflection of bone density. The same applies to the limb bones, whose presence can be demonstrated on denser shaft fragments but only exceptionally on cancellous articular ends. This means that a number of interpretative models based on quantitative data from studies of recent faunal material (whether human or carnivore accumulated) are of little use in interpreting the origin and formation of the Hummerich faunal assemblage, since they specifically focus on the relative proportions of articular ends of limb bones to show, for example, human selection for utility (L. R. Binford, 1978) or the degree of carnivore destruction (C. K. Brain 1967). While the possibility cannot be ruled out that hominid and/or carnivore modification were major factors in the initiation of bone destruction, the Hummerich faunal material has clearly suffered so much loss due to subsequent abiotic factors, that the extent of damage of this type can no longer be recognised.

The recovered assemblage no longer directly reflects either the selection of body parts by humans or scavenging activities by carnivores so much as the inherent stability of the recovered bone fragments. The very low proportion of bones with surviving evidence for modification by hominids or carnivores can do nothing to shed more light on the relative role of these agents in the accumulation and modification of the excavated bone assemblage. On the evidence of numerous lithic artefacts and of bones and teeth of several carnivore species it is clear that both hominids and carnivores were present, at least sporadically, at the summit of the Plaidter Hummerich during the period of formation of the deposits containing the ungulate fauna. It is nevertheless impossible to argue from this evidence and from the few examples of biotic bone modification whether hominids or carnivores played the major role in the accumulation and modification of the Hummerich faunal assemblage.

			Human		Carnivore	
			yes	?	yes	?
Niveau E	undetermined	vertebra			1	
		shaft	1			
Niveau D3	*Bos / Bison*	humerus			1	
		radius			1	
		ulna			1	
		pelvis				1
Niveau D2	*Bos / Bison*	femur		1		
		tibia				1
	Cervus elaphus	humerus		1		
	Equus sp.	radius		1		
		tibia		1		
	Equus hydruntinus	femur				1
		phalanx 1			1	
	undetermined	shaft	1			
Niveau D1	*Bos / Bison*	scapula			1	
		humerus			1	1
		radius				1
		metacarpus				1
		pelvis			1	
		femur		1	2	1
		tibia	1	1		
		astragalus				1
		calcaneum		1		
		metatarsus		1		
		metapodium		1		
		shaft		1		
	Cervus elaphus	antler			1	1
		humerus		1		2
		ulna				1
		metacarpus				1
		tibia		1		
	Equus sp.	radius		1		
		tibia		1		1
		metatarsus				2
	Equus hydruntinus	calcaneum			1	
		phalanx 1			1	
	undetermined	vertebra				1
		shaft	1	4		
Niveau C	*Bos / Bison*	humerus	1	2	1	1
		radius				1
		patella			1	
		tibia			1	
		metatarsus		2		
		shaft		1		
	Cervus elaphus	humerus				1
		radius		1		
		femur			1	
		metatarsus				1
	Equus sp.	radius			1	
	undetermined	shaft	2	2	1	1
Niveau B	*Bos / Bison*	metatarsus	1			
Total			8	26	19	22

Fig. 59 Traces of modification to bones from the Plaidter Hummerich by man (butchery) and carnivores (gnawing), arranged by geological layer, species and body part.

The least likely proposition would be that the ungulate fauna can be interpreted as an assemblage largely accumulated without the agency of these two factors. Nevertheless, it is likely that some species naturally sought out the summit of the volcano, and that, upon death, their remains also became part of the bone assemblage. Clearly, the marmot remains and those of smaller rodent and insectivore species are to be interpreted in this way. Bones and teeth of the carnivore species may be examples of this. Traces of carnivore gnawing on bones in the fossil assemblage and the hyaena coprolite are certainly independent of human presence.
The interpretation of the large numbers of shed antlers (mainly identified as red deer, but specimens of roe deer are also present) is problematic, since their presence may be due to animal, and not human activity. Their high frequency might be explained by the fact that individual deer often seek out the same place to shed their antler every year. Even if they were brought to the site by hominids, their seasonal information is worthless since they could possibly have been curated for a long time after they were collected.
Other, admissible evidence for the time of death of individual animals in the Hummerich faunal assemblage is however present. An antler frontlet of red deer found in layer D2 shows that the animal died during the period September to March/April; by contrast, bovine foetal bones found in layer D1 indicate death during the summer months (May-August?).
Nevertheless, in view of the taphonomical arguments advanced above, it is impossible to interpret any of this evidence in terms of human seasonality. In all probability, the Plaidter Hummerich was visited by hominids, carnivores and ungulates during all seasons of the year during the long period of time believed to have been needed for the accumulation of the faunal assemblage.

COMPARISON WITH THE FAUNAL ASSEMBLAGE FROM TÖNCHESBERG 2B

The horizons at the Plaidter Hummerich which yielded the largest quantity of faunal remains and the greater part of the lithic assemblage date to the first half of the Last Cold Stage. Faunal remains from a nearby site, the Tönchesberg (N. J. Conard, 1992), also date to this period and offer the closest regional parallel to the Plaidter Hummerich (Fig. 60). The Tönchesberg volcano probably erupted at around the same period as the Hummerich and the deposits in the craters at both sites are similar, except that the humic layers at Tönchesberg are more complete, reaching a depth of several metres.
At Tönchesberg the main archaeological horizon, Tö 2b, with rich faunal remains, is located in a dark brown humic colluvium overlying the last interglacial soil development and represents the initial cooling after the Eemian or Last Interglacial (Isotope Stage 5d/5e [N. J. Conard, 1992; U. Becker 1990]).
The faunal spectrum is comparable to that from the Hummerich. A range of species is common to both sites: red fox, hyaena, horse, extinct ass, rhinoceros (*D. hemitoechus*), red deer, fallow deer and the large bovine (cf. *Bos primigenius*). Wolf, arctic fox, a marten, badger, lion, woolly rhinoceros, reindeer, roe deer and an ovicaprid are represented only in the overall larger assemblage from the Hummerich; while the northern lynx occurs only at Tönchesberg. Only the record of the latter species at Tönchesberg is of possible chronological significance. The northern lynx first appeared rather late in Europe. Its earliest known occurrence is at the Taubach locality, in a fauna dating to the Last Interglacial (E. Turner 1990), in keeping with the suggested dating of the deposits at Tönchesberg to a very early stage of the Weichselian interstadial complex.
The presence of fallow deer at both the Plaidter Hummerich and Tönchesberg, and of roe deer at the former site, in layers post-dating the Last Interglacial, indicates that these species still survived in the region under cooler conditions.
Of the species found only at the Plaidter Hummerich, a certain number might be interpreted as indi-

	Tönchesberg 2B		Hummerich C		Hummerich D1	
	NISP	MNI	NISP	MNI	NISP	MNI
Alopex lagopus / Vulpes vulpes	21	1	-		1	1
Crocuta crocuta	1	1	1	1	-	-
Lynx lynx	5	1	-	-	-	-
Equus sp.	27	2	28	3	164	9
Equus hydruntinus	1	1	6	1	23	1
Rhinocerotidae	9	1	1	1	1	1
Cervus elaphus *	32	3	62	4	127	6
Cervus elaphus **	574	55	60	8	183	>13
Dama dama	4	2	6	1	5	1
Bos / Bison	56	4	74	3	180	7
Total	730		238		684	

Fig. 60 Number of identified specimens (NISP) and minimum numbers of individuals (MNI) for species of larger mammals from the early Weichselian complex Tö 2b at the volcano site Tönchesberg , Neuwied basin (after N. J. Conard 1992) compared with Niveaux C and D1 at the Hummerich.
* gives the NISP and MNI for *Cervus elaphus* excluding the information of the antlers.
** gives the NISP and the MNI for *Cervus elaphus* including the information of the shed antlers.

cating more stadial conditions than at the time of deposition of the Tönchesberg fauna. Of these, some are without any stratigraphic context (*Rangifer tarandus*), while others are assigned to layers younger than the interstadial humus soil horizons (the ovicaprid in Niveau E). Nevertheless, the presence of *Coelodonta antiquitatis* and *Alopex lagopus* (in Niveaux D2 and D1 respectively) has no equivalent in the Tönchesberg 2b fauna. In the Central Rhineland the latter two species are more typically associated with stadial faunal complexes from loess deposits of the Penultimate Glaciation (Wannen, Schweinskopf; E. Turner 1990).

At Tönchesberg N. J. Conard (1992) suggests that the hunting of medium-sized and large animals played an important role in the subsistence of the site's hominid inhabitants. It has been shown that, at the Plaidter Hummerich, although both hominid and carnivore activities played a role in the accumulation of the faunal assemblage, the relative importance of these two factors can no longer be accurately reconstructed.

Despite minor differences in the faunal assemblages from the two sites, the dominant large mammal species at both the Hummerich and Tönchesberg (albeit with low numbers of individuals at this site) are horse, a large bovid and red deer. Their dominance in the early Weichselian horizons suggests the existence of temperate, rather than stadial, open grassland, with the presence of some woodland cover.

Problems in recognising the mechanism(s) behind the accumulation of the faunal assemblage(s) (hominid/carnivore predation or natural death assemblage) mean that it is impossible to judge how far the proportional representation of the different species in the palaeontological assemblage is that of the living animal community, but nevertheless allow the recognition of a particular »interstadial« faunal group in the Central Rhineland at the beginning of the last glacial, which is very different from the stadial fauna known from the penultimate glaciation.

THE LITHIC ASSEMBLAGE

RECORDING THE LITHIC INDUSTRY – THE DATABASE

The excavator of the greater part of the Hummerich site, K. Kröger, had recorded many attributes of the finds (excavation co-ordinates, lithic raw material determinations etc.) during the course of a doctoral thesis (K. Kröger 1995) and these data were available to the present author in the form of lists compiled for the transfer of the material to the responsible archaeological authority, the *Landesamt für Denkmalpflege, Abt. Archäologische Denkmalpflege, Amt Koblenz.*
Nevertheless, all material of the lithic assemblage was re-examined by the author for this study, leading in a number of cases to a different determination or interpretation of lithic specimens. A small amount of material (44 specimens) recorded in the original inventory lists could no longer be located and is therefore absent from the database which forms the basis of this study. It is possible that some specimens originally regarded as »single finds« were subsequently downgraded to the category of »general find« and for this reason are not present as labelled specimens. This certainly happened in the case of a number of faunal specimens (e. g. unidentifiable small bone splinters) and small, unmodified quartz pebbles may similarly have been removed from the category »single find«.
A few of the examined specimens (82) were not present in the original lists. The majority (55) comprises stray finds with no contextual information. Another 20 finds recovered by excavation can be plotted in two dimensions but have no information on their stratigraphic context. Only in the case of seven further excavated finds is it possible to reconstruct the stratigraphic context accurately; six are from Niveau D1 and one from Niveau E. A total of 2,015 lithic specimens (including artefacts and unmodified pieces, but excluding two fragments of pottery) was thus finally examined for this study (Fig. 61).

LITHIC RAW MATERIAL

The raw materials of the Plaidter Hummerich lithic assemblage have been analysed and described in previous studies by Harald Floss (1994) and Karl Kröger (1995) and their results are taken into account by the present study (Fig. 61). All artefacts were, however, re-examined and, except where noted, the raw material determinations are those of this author.
In some cases, it is difficult or impossible to recognise the artificial character of lithic finds, particularly those of quartz and Devonian slate and graywacke. The context of the assemblage, within aeolian sediments on top of a high scoria cone of volcanic material, might suggest that most pieces of non-volcanic origin can be confidently assigned to the archaeological assemblage(s) and K. Kröger (1995) interprets all non-pyroclastic rocks as having been transported to the summit of the volcano by hominids.
The present author believes that a number of small unmodified pebbles and heat-altered fragments of quartz, graywacke and slate probably represents material caught up in the eruption (gravel deposits, bedrock, etc.) and subsequently incorporated into the covering sediments by processes such as erosion, solifluction and bioturbation.
This is clearly the case for numerous fragments of scoria present throughout the stratigraphic sequence since the steep slope of the crater interior (Fig. 3) will clearly have been conducive to continued and repeated downslope movement from the crater wall.

It was noted that many specimens of graywacke and slate from the Plaidter Hummerich show abrading and battering of their edges for which exact analogies can be found on material derived from the Devonian bedrock found in pumice deposits erupted by the late Pleistocene Laacher See volcano.
The previous analysts of the raw materials used different approaches in their studies, H. Floss being more interested in a global classification of the composition of Rhineland Palaeolithic assemblages through time (H. Floss 1994), and K. Kröger in technological and typological variations within the Hummerich assemblage and their implications for the interpretation of the site (K. Kröger 1995, 47). As a result, the quantitative data of the two authors are not identical (Fig. 61).
K. Kröger (1995, Fig. 15) gives no quantitative data for artefacts recovered as stray finds or lacking a stratigraphic position, neither does he quantify the small number of artefacts from Niveau B in his analysis. However, based on his premise that all lithic material recovered from the Plaidter Hummerich derives from human activity (K. Kröger 1995, 47), he does quantify all lithic material recovered from Niveaux C, D1-D3 and E, irrespective of whether this has been artificially modified or not (K. Kröger 1995, Fig. 15). The counts for Niveaux C, D1-D3 and E can therefore be directly compared with counts for the equivalent stratigraphic units carried out for this study.
H. Floss does not give values for different contexts (since he had no access to detailed stratigraphic data; H. Floss 1994, 146), but instead presents overall counts for all the artefacts of each raw material.
He bases his analysis on Niveaux C, D1-D3 and E, but also includes unprovenanced material (stray and unstratified finds). Since H. Floss (1994) quantifies the artefacts from all sedimentological units together, the results of his analysis can only be compared with the counts of this study for the total assemblage (Fig. 61). His counts show that he did not have access to all artefacts.
A number of the more important differences between the total of raw materials identified by the present author and the determinations of H. Floss (1994) and K. Kröger (1995) are to be explained by Floss' selection of artefacts only (*»geschlagene Steinartefakte«*), whereas the present study includes all finds. This applies particularly to Devonian graywacke and slate (Fig. 61, GRW = 197; SLT = 77), neither of which was included by H. Floss, and also to finds unidentified to raw material by the present author (Fig. 61, IND = 40), which, almost without exception, are either unmodified material of volcanic origin or the smallest category of pebbles recovered during excavation (*»Kieselsteine«*).
In K. Kröger's (1995) definition the category *»Quarzit«* includes not only dense Devonian quartzite in the form of river cobbles, material which is almost all clearly artificially modified, but extends to material defined by the present author as graywacke and slate.
Some of these materials are also in cobble form and may have been modified but the artefact status of most of the material is doubtful. Due to the different definitions of this material it is not possible to directly compare the counts for Devonian quartzite in this study with K. Kröger's data.
The present study lists over 200 pieces of quartz more than Floss. 170 of these can be accounted for by very small, mainly unmodified pebbles. Over 30 quartz fragments, whose artificial character is not certain, each weigh less than 10 grams, and it is possible that H. Floss also excluded this material from the analysis. The counts for quartz given by K. Kröger and by this study are very similar for the different Niveaux and, in the case of Niveaux C, D1 and D3, almost identical.
Single finds of fragments of unmodified scoria (which certainly originate from the eruption of the Hummerich) are listed by the present author (Fig. 61, BAS = 36), but H. Floss (1994) only lists one clearly artificial flake, which is probably made of a different type of basalt to that found naturally at the site (H. Floss 1994, 149).
A transverse scraper from Niveau E, is described by Kröger as a variety of porphyry but the present author identifies it as a fine-grained Devonian quartzite.
In summary, the present study lists the raw material of all lithic finds recovered at the Plaidter Hummerich, irrespective of their artificial character (the interpretation of the assemblage with regard to its artificial character is dealt with later in this study), but including and distinguishing between the different contexts.
The number of specimens listed by this study is therefore higher than those of either H. Floss or K. Krö-

Niveau	QZ	DQT	TQT	SS	CH/ CH	MFL	FL	TUF	TOT SIL	DEV GRW	DEV SLT	TOT DEV	BAS	SAND	IND	CONG	TOT ALL	QZT KK	OTH KK	POT
E	446 (322)	31 (27)	18 (18)	14 (12)	11 (11)	11 (11)	4 (4)	1 (1)	536 (406)	86 (3)	41 (0)	127 (3)	10 (1)	2 (0)	19 (0)	0 (0)	694 (410)	-	-	0
	454	*	*19*	*14*	*9*	*14*	#	#	@	*	*	-	#	#	#	#	*705*	*142*	*54*	
D3	30 (23)	2 (2)	1 (1)	1 (1)	1 (1)	0	0	0	35 (28)	5 (0)	0	5 (0)	2 (1)	0	1 (0)	0	43 (29)	-	-	0
	29	*	*1*	*0*	*1*	*1*	#	#	@	*	*	-	#	#	#	#	*45*	*6*	*7*	
D2	106 (80)	5 (4)	4 (1)	0	0	0	1 (1)	0	116 (86)	13 (0)	4 (0)	17 (0)	3 (0)	0	3 (0)	0	139 (86)	-	-	0
	115	*	*4*	*0*	*2*	*0*	#	#	@	*	*	-	#	#	#	#	*194*	*19*	*54*	
D1	617 (519)	30 (29)	17 (15)	11 (9)	7 (6)	10 (10)	1 (1)	0	693 (589)	51 (0)	21 (0)	72 (0)	3 (0)	0	11 (1)	0	779 (590)		--	0
	614	*	*16*	*10*	*7*	*11*	#	#	@	*	*	-	#	#	#	#	*774*	*78*	*38*	
D1-D3	753 (622)	37 (35)	22 (17)	12 (10)	8 (7)	10 (10)	2 (2)	0	844 (703)	69 (0)	25 (0)	94 (0)	8 (1)	0	15 (1)	0	961 (705)	-	-	
D1-D3	*758*	*	*21*	*10*	*10*	*12*	#	#	@	*	*	-	#	#	#	#	*1,013*	*103*	*99*	
C	72 (62)	1 (1)	3 (2)	1 (1)	0	2 (2)	1 (1)	0	80 (69)	7 (0)	2 (0)	9 (0)	1 (0)	0	0	0	90 (69)	-	-	0
	*71**	*3*	*8*	*0*	*3*	#	#		@	*	*	-	#	#	#	#	*94*	*7*	*2*	
C-E	1, 271 (1,006)	69 (63)	43 (37)	27 (23)	19 (18)	23 (23)	7 (7)	1 (1)	1, 460 (1, 178)	162 (3)	68 (0)	230 (3)	19 (2)	2 (0)	34 (1)	0	1, 745 (1, 184)	-	-	0
C-E	*1, 283*	*	*43*	*32*	*19*	*29*	#	#	@	*	*	-	#	#	#	#	*1, 813*	*252*	*155*	
B	21 (18)	0	0	0	0	0	0	0	21 (18)	6 (0)	3 (0)	9 (0)	0	0	0	0	30 (18)	-	-	0
Unstrat.	23 (9)	1 (1)	0	1 (1)	1 (1)	0	0	0	26 (12)	11 (3)	4 (0)	15 (3)	1 (0)	0	0	0	42 (15)	-	-	0
Stray	98 (65)	22 (14)	15 (9)	7 (6)	2 (2)	6 (6)	2 (2)	2 (2)	154 (106)	18 (0)	2 (0)	20 (0)	16 (1)	0	6 (0)	2 (0)	200 (107)	-	-	2
Total	1,413 (1,098)	92 (78)	58 (46)	35 (30)	22 (21)	29 (29)	9 (9)	3 (3)	1,661 (1,314)	197 (6)	77 (0)	274 (6)	36 (3)	2 (0)	40 (1)	2 (0)	2,015 (1 323)			2
Total	**1, 206**	**86**	**51**	**31**	**23**	-	**34**	**3**	-	-	-	-	**1**	-	**4**	-	**1,439**	-	-	-

Numbers of all recorded lithic finds and of artefacts only (bracketed) counted by this study.
Italic characters represent raw material determination after K. Kröger (1995, fig. 15).
Boldface characters represent raw material determination (totals only;
TUF includes a specimen identified as Limonite) after H. Floss (1994, 147).
= This raw material was quantified by K. Kröger (1995) together with other raw materials and cannot be broken down into separate units.
* = All Devonian rocks were classed together by K. Kröger (1995) under "Quarzit" (QZT KK) and cannot be quantified separately.
@ = Value cannot be calculated since, in K. Krögerr's definition. »Quarzit« (QZT KK) also includes Devonian slate and graywacke.
- = Data not available/not applicable

QZ - quartz
TQT - Tertiary quartzite
CH/CH - chert, chalcedony
FL - other flint
DEV GRW - Devonian graywacke
BAS - basalt
IND - indeterminate
POT - pottery
TOT SIL - total of fine-grained silices (see text)
TOT DEV - total of Devonian rock types (see text)
TOT ALL - total of all lithic finds

DQT - Devonian quartzite
SS - siliceous slate
MFL - Meuse flint
TUF - volcanic rocks
DEV SLT - Devonian slate
SAND - sandstone
CONG - conglomerate
QZT KK - "Quarzit" after K. Kröger (1995)
OTH KK - other raw materials (K. Kröger 1995)

Fig. 61 Plaidter Hummerich. Lithic raw materials recorded and examined during this study compared with the results of H. Floss (1994) and K. Kröger (1995).

ger (Fig. 61), providing the definitive quantification of the assemblage equivalent to the inventory list submitted to the final repository of the material, the *Landesamt für Denkmalpflege, Koblenz*.

Lithic Raw Material Sources and Availability

A major distinction can be made between locally available raw materials and those obtained from greater distances, either within the Central Rhineland or, exceptionally, from other regions.

Quartz

The most common raw material in all layers at the Hummerich is quartz (Fig. 61, QZ), which occurs in primary context as veins in the Devonian bedrock of the Central Rhineland. The material is normally white to off-white and macrocrystalline and is inhomogeneous due to the presence of numerous fracture planes.

Primary vein quartz was not an important source of raw material during the Rhineland Palaeolithic but, in a secondary context, quartz cobbles obtained from river terraces form an important element of the lithic assemblage at many Middle Palaeolithic sites in the Neuwied Basin, being the most common raw material at several of them (Fig. 70).

Quartz cobbles are the major component of Pleistocene and Pliocene terrace deposits in the region (H. Floss 1994, 73). The older terraces contain a higher proportion of quartz relative to other, softer materials and the degree of rounding of the quartz cobbles is also greater in older terraces. H. Floss believes that the size and degree of rounding of the cobbles found at the Plaidter Hummerich indicate that they originate in terrace deposits of the Rhine and were not collected from the gravels of the nearby Nette river (H. Floss 1994, 150).

The closest terraces are some 2 km to the South of the Hummerich, but Floss does not rule out a source closer to the site for this raw material. The quartz used at the Hummerich is generally of poor quality and is represented by all stages of artefact manufacture – unmodified cobbles, smashed chunks, recognisable cores and flakes and retouched tools. This is probably to be interpreted as a reflection of its abundance and of the short distance of transport from the raw material source to the Plaidter Hummerich.

Devonian quartzite

Devonian quartzite occurs in the Lower Devonian strata of the Rhenish Slate Massif, but primary quartzite and material from block fields were not normally selected for artefact production. Instead, as in the case of quartz, dense river-rolled cobbles of quartzite from terrace deposits were preferred. They are a common raw material on Central Rhineland Middle Palaeolithic sites and Devonian quartzite is well represented at the Plaidter Hummerich.

Tertiary quartzite

Another raw material characteristic of the Central Rhineland is Tertiary quartzite, also called limnoquartzite, a material formed by cementation of beds of sand by movement of free silica in the groundwater and thus genetically quite distinct from metamorphic Devonian and other Palaeozoic quartzites. The material is fine- to very fine-grained and has a conchoidal fracture similar to that of flint.

A common variety in the Central Rhineland is grey-green with pronounced yellow mottling, sometimes referred to as »*Blümchenquarzit*«, and is the type of quartzite predominantly found at the Plaidter Hummerich. This quartzite occurs at primary outcrops, in block fields and in river terrace deposits as cobbles. On the evidence of cortex types material from the Hummerich is identified by H. Floss as coming from both river gravels (30%, probably from terraces of the nearby Nette river) and from block fields (15%). The nearest known block fields of Tertiary quartzite are found within a radius of 3-6 km around the Hummerich, but the presence at the site of 3 very large blocks with a total weight of 25 kg suggests to H. Floss that there was probably a raw material source even closer.

Siliceous slate

The term siliceous slate (German *Kieselschiefer*) is restricted (following H. Floss, 1994, 62) to a group of siliceous rocks of Palaeozoic origin, including lydite, *Radiolarit* (radiolarian chert) and *Tonschiefer* (which can be regarded as a less silicified variety of *Kieselschiefer*). In the region of the Rhenish Slate Massif these materials are found as Silurian, Devonian and, most commonly, Carboniferous formations in primary contexts located mainly east of the Rhine. However, almost all artefacts of siliceous slate found at archaeological sites are made from cobbles obtained from river gravels, which are locally readily available.

Flint

In accordance with H. Floss (1994, 80) the use of the term »flint« is restricted in this study to fine-grained siliceous rocks from formations of the Upper Cretaceous period. This material is almost pure cryptocrystalline silica and has optimal qualities for the manufacture of flaked stone artefacts. Various sources of flint are possible in the context of the Plaidter Hummerich.

Primary flint sources

A major source of the flint found in the Rhineland Palaeolithic are Upper Cretaceous chalk formations near Aachen and Maastricht and further to the West into Belgium. Several primary sources have been described and characterised – Rijkholt, Valkenburg and Simpelveld (Dutch South Limburg); Lousberg and Vetschau (Aachen region), all at least 100 km from the Neuwied Basin. A number of artefacts from the Hummerich is made of a material closely resembling Rijkholt flint (H. Floss 1994, 150). Another potential primary source of raw material found at the Hummerich are eluvial deposits with residual flint (cf. southern English »clay-with-flints«). Several sources of eluvial flint are known south and east of surviving primary chalk formations of the western border of Germany, South Limburg and eastern Belgium, the most easterly being some 60 km from the Neuwied Basin.

Secondary flint sources

A major source of secondary flint are gravels of the River Meuse, which cut through primary Upper Cretaceous chalk formations, the closest source to the Neuwied Basin being Meuse gravels some 90 km away in the Niederrheinische Bucht. Meuse gravel flint shows alteration of the cortex by rolling and staining due to infiltration by iron oxides. It can be difficult to identify Meuse gravel flint when cortex is not preserved and the flint is only slightly or not at all altered by staining or transport, creating a potential problem in the case of several Hummerich artefacts. In fact, the distinction between primary flint and secondary gravel flint is largely academic in the case of the Hummerich. Primary outcrops and relatively unaltered secondary flint sources will have been, at most, some few tens of kilometres apart, an unimportant factor in the estimation of the distance that lithic materials were transported by hominids to the Central Rhineland.

Flint can also be found in other Pleistocene river terraces (Rur, Kyll, Prüm, Ahr, Nette, Moselle, Rhine), where it is derived from Tertiary eluvial deposits. It differs from Meuse gravel flint in being more heavily rolled and weathered. It is usually heavily stained and brown to brown-green in colour and is opaque. Nodules are usually quite small and with many cracks and fissures, and are of only poor quality for artefact manufacture. A number of flint artefacts at the Hummerich (Fig. 61 FL) are probably made from material of this type and may therefore be regarded as »local« (Rhine/Moselle [and Nette?] terraces) in origin.

Tertiary marine sediments (sands) contain beds of flint nodules eroded from primary chalk deposits by transgressions of the Tertiary sea. Pebbles of this material (e. g. *Maasei* flint) have a typical scarred cortex and are very rounded due to prolonged pounding and rolling in the Tertiary sea, and reworking of Tertiary deposits by Pleistocene river erosion often incorporates the nodules into Quaternary gravel deposits. This material is quite commonly found at Rhineland Palaeolithic sites and one Hummerich artefact is possibly made of *Maasei* flint.

Another type of flint found in the Rhineland is derived from Pleistocene moraine deposits which are found as far south as a line running from Krefeld - Neuss - Düsseldorf - Ruhr valley. Reworking by Pleistocene river erosion subsequently incorporated flint of this type into gravel deposits, particularly those of the Rhine. Distinction of this material from Meuse gravel flint is often difficult when cortex is not preserved and an artefact from the Hummerich previously described as moraine flint and cited as an example of long range mobility to the Northeast might equally well be made of beach pebble or river terrace flint from Tertiary deposits (H. Floss 1994, 152).

Other fine-grained siliceous materials

Chalcedony

Chalcedony is here defined (following H. Floss 1994) as cryptocrystalline silica formed during the Tertiary. It is known in a range of varieties from several primary sources both in the Central Rhineland and at greater distances. Floss (1994, 151) suggests that the Hummerich chalcedony was obtained in the Central Rhineland and that 70% may be from primary outcrops and 30% from river terrace deposits, although two artefacts from Hummerich Niveaux D1 and E are macroscopically indistinguishable from artefacts from the Final Palaeolithic assemblage at Andernach-Martinsberg determined by H. Floss (1994, 280) as »*Kieseloolith*« (= siliceous oolite, A. Watznauer 1982b, 177) for which an origin in Tertiary deposits in the Mainz Basin is proposed.

Chert

The term chert is used here in translation of »*Hornstein*« and, following H. Floss (1994, 104), is restricted to siliceous rocks formed during the Triassic and Jurassic periods. Primary outcrops are found both in southern German and Swiss Jura formations and to the Southwest of the Neuwied Basin in the region of Luxembourg/Lorraine, but the only specimens recovered from the Plaidter Hummerich are three artefacts of secondary pebble chert which are stained and cannot be more accurately identified (H. Floss 1994, 150). The author of the present study did not positively identify the chert artefacts recognised by H. Floss but it is probable that they are present among the 23 specimens of heterogeneous material classed as CH/CH (Fig. 61).

Tuff

H. Floss identifies two flakes of a volcanic tuff, which he believes could be a trachyte. He suggests that they may have been transported as cobbles by the Nette river from an East Eifel source and were therefore available close to the site.

A large core made on a cobble of a volcanic rock of a different type was not seen by Floss. A large cobble of identical rock found at the nearby Final Palaeolithic site Kettig (M. Baales 1994, 1995) had been used, not for the manufacture of artefacts, but as a hearth or cooking stone. It is unlikely that a stone used for this purpose would be transported over a very great distance, suggesting that cobbles of this material were accessible in the gravels of the Neuwied Basin.

Subsequently, the author recognised a large unmodified pebble of the same material in the geological collection of the Catholic University of Louvain, Belgium. It is described as a porphyry from the Nahe region found in the Rhine gravels at Sinzig, some 30 km to the North of the Neuwied Basin. This purely geological specimen confirms that large cobbles of dense lithic materials of southern origin could certainly have been transported as far as the Neuwied Basin.

Devonian slate and graywacke

These rocks are a major component of the Devonian bedrock of the Rhenish Slate Massif and can be regarded as universally available in the region. Neither material is well suited for the manufacture of stone tools, although river cobbles of these materials were certainly transported to the summit of the Plaidter Hummerich by man and, in some cases, unequivocally modified by flaking into coarse tools. Uses other than artefact production can be envisaged for rocks of these types, but a large number of small and unworked specimens can be legitimately excluded from the archaeological assemblage, in particular those showing signs of alteration which can be better explained by their having been caught up in the volcanic eruption (see above).

Other rocks

Various other types of rocks are represented by small numbers of specimens. In some cases surface finds collected from spoil heaps left by machinery proved on closer examination to be spurious (two fragments of pottery!).
Two fragments of conglomerate are without context and possibly unrelated to the archaeological horizon. By contrast, two pieces of red sandstone recorded from Niveau E might reflect material intentionally brought to the site.
A potential source are Moselle terrace gravels which contain large amounts of sandstone derived from the central Moselle valley.

Raw material spectrum and spatial analysis

Absolute counts of all lithic finds recorded by this study are shown by raw material and layer in figure 61, where they are, as far as possible, compared with results of the previous analyses of the Hummerich assemblage. A second figure, showing the number of specimens identified by the present author as humanly modified (i. e. the true artefact count) is also given.

Niveau B

In Niveau B only 18 of 21 finds of quartz (spaced over a large area, Fig. 62) are regarded as certain or potential artefacts. This small assemblage is hardly likely to constitute an independent episode of activity, and refitting of one artefact to others from Niveaux D1 (Fig. 13) allows their interpretation as merely the deepest-lying elements of the lithic assemblage found in the oldest last glacial humus soil (Niveau D1) and they are not regarded as material deposited during the preceding interglacial. There is equally no reason to suggest that material assigned to Niveau B are artefacts deposited in sediments of the penultimate Cold Stage which were subsequently altered by interglacial weathering, as has been suggested for the assemblages from Rheindahlen »Westwand« (H. Thieme 1983) and Tönchesberg 2a (N. J. Conard 1992).

Niveau C

Niveau C is only found around the central part of the slope of the crater and is not present either higher up on the eroded crater rim or in a deeper position towards the centre of the crater to the Northeast.

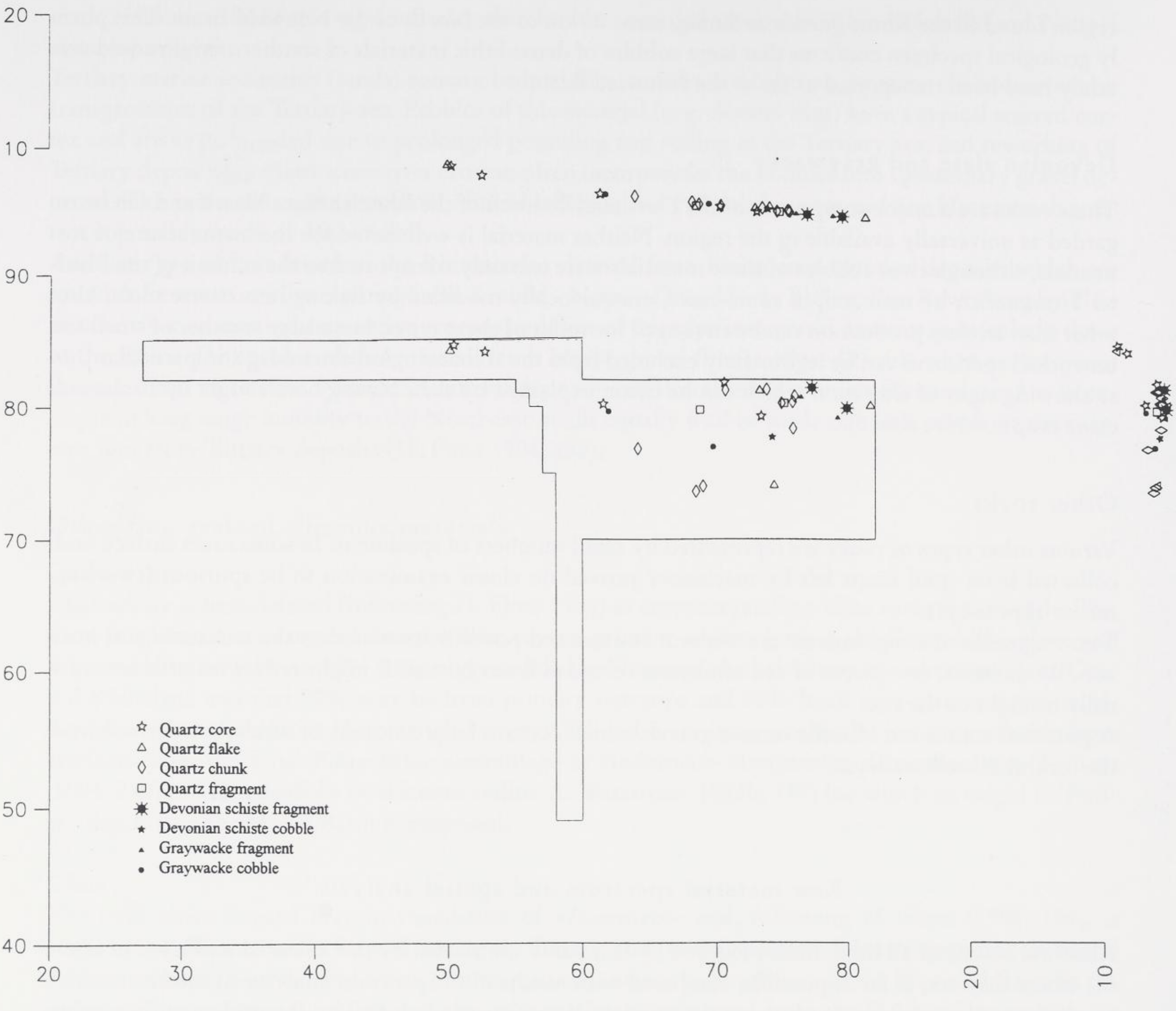


Fig. 62 Niveau B. Spatial distribution of recorded single finds of lithic materials.

There is evidence that Niveaux D1 and C may be either mixed or that material in Niveau D1 is derived from Niveau C. The relatively small lithic assemblage from Niveau C shows no clearly recognisable spatial patterning. The commonest material, quartz, is found across the entire area of occurrence of this sediment unit. The small number of artefacts of fine-grained materials precludes spatial analysis, although it can be noted that four of the seven modified fine-grained artefacts are found within a relatively small area of the north-western extension of the site. The distribution of unmodified Devonian rocks and basalt shows no patterning.

Niveau D1

Spatial patterning in Niveau D1 is not immediately apparent. The commonest raw material, quartz, is distributed across most of the investigated area of this sedimentological unit, including the north-western and southern extensions to the excavation (Fig. 63).

A decrease in the density of finds of this material to the West of the main excavation area and a complete absence of finds in several m^2 are the only anomalous features. This distribution pattern is possibly

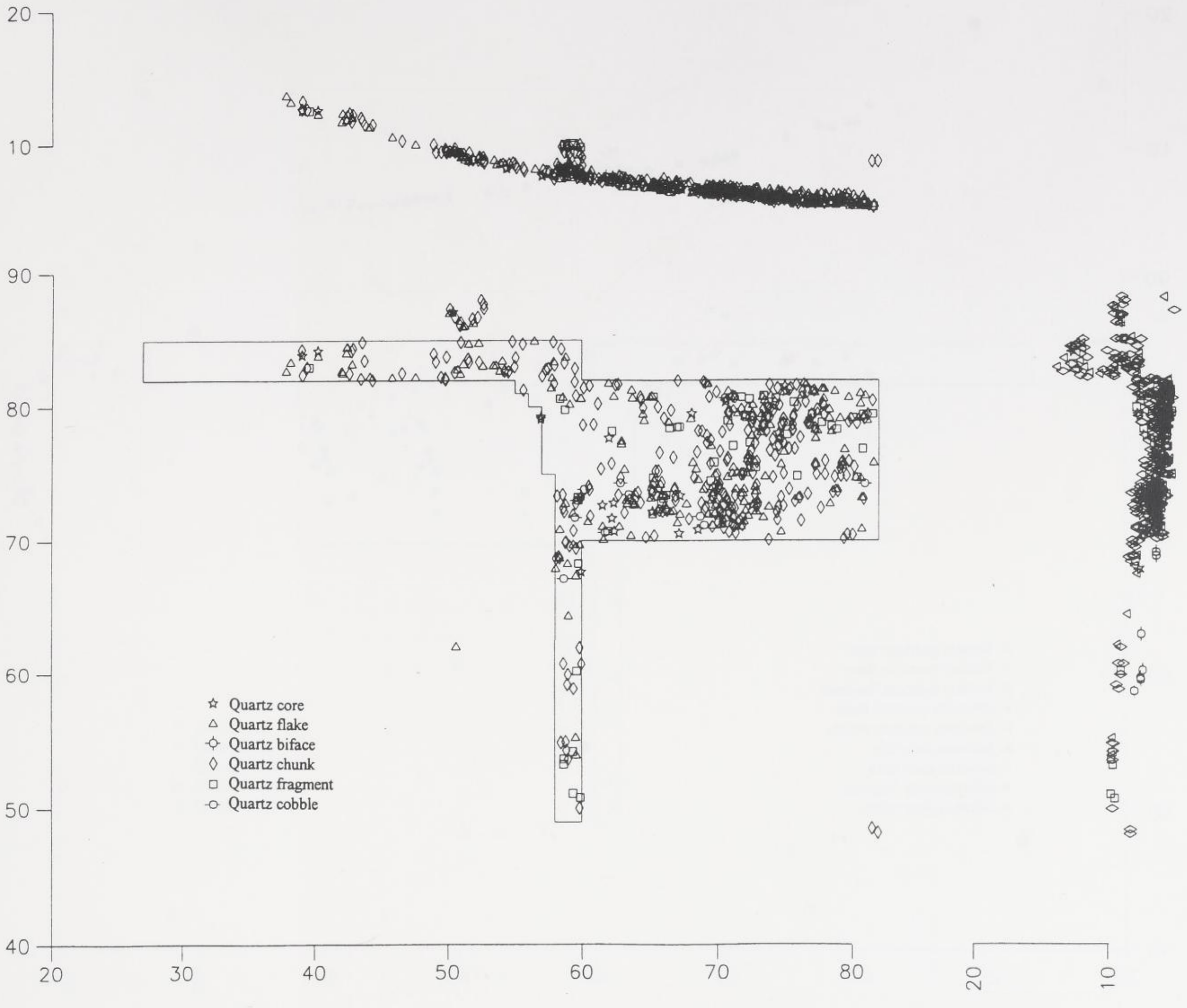


Fig. 63 Niveau D1. Spatial distribution of recorded single finds of lithic materials; quartz.

due to eastward downslope erosion of material from a restricted area of the site. Four of five refits between artefacts in Niveau D1 and others located in Niveau E are over relatively long distances and follow the line of the main slope (Fig. 13).

Lithic materials other than quartz are also widely distributed across the site. Devonian and Tertiary quartzite, in particular, mirror the distribution of quartz in the main excavation area, being less well represented to the West and more common to the East (Fig. 64). By contrast, the southern extension of the excavation contains only an unmodified Devonian quartzite cobble, a Meuse flint flake and a fragment of Tertiary quartzite, possibly suggesting that these materials were rarely worked or used in this area. The few specimens of siliceous slate in Niveau D1 do not allow the recognition of spatial patterning in their distribution (Fig. 64). Although only few specimens of flint and chalcedony/chert are present, they occur widely across the site, although there is a clear absence of specimens of these materials too in the north-western part of the main excavation area.

The spatial patterning of Devonian slate and graywacke closely reflects that of the artefacts of finer-grained materials and quartz. It is unclear whether this implies that most of the Devonian rocks can be re-

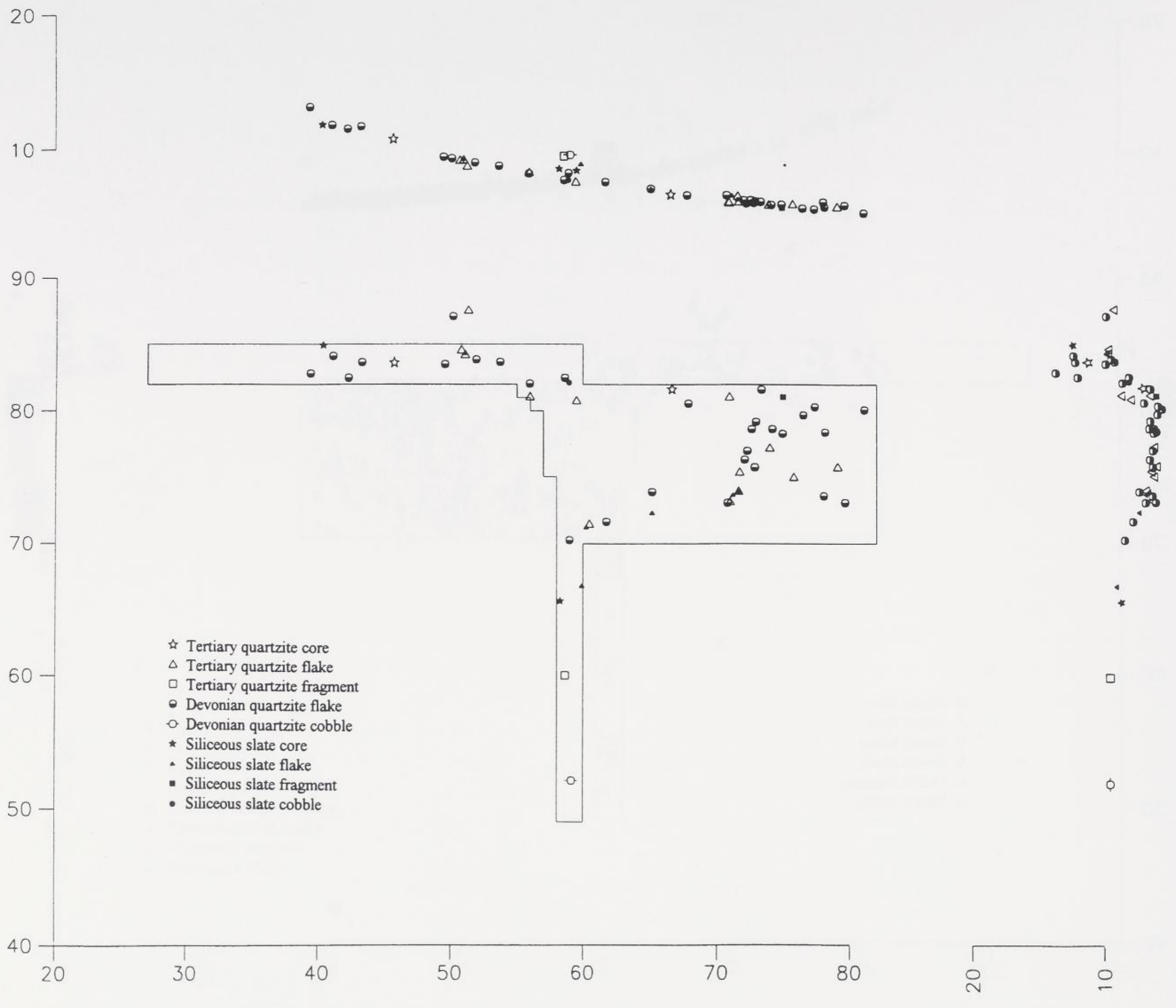


Fig. 64 Niveau D1. Spatial distribution of recorded single finds of lithic materials: Tertiary quartzite, Devonian quartzite, siliceous slate.

garded as also deposited by hominids or whether the distribution patterns of all lithic materials merely reflect differential accumulation by geological processes, notably the secondary reworking of sediments due to the steep slope.

The distribution of quartz, flint and chalcedony/chert and of the Devonian rocks is especially similar in the eastern part of the main excavation, showing a more dense concentration of finds running across the centre of this area in a line from Southwest to Northeast. At first this linear pattern suggests a shallow channel, running downslope from the Southwest, within which lithic material was concentrated. However, another explanation is more plausible. This is that the sediment of Niveau D1 to the Southeast of the site was, to a large extent, disturbed and eroded so that many artefacts were here incorporated into the solifluction layer Niveau E. By contrast, material lying originally to the West may either have been eroded downslope (eastwards) into the topographically lower-lying Niveau D1 sediments or have remained *in situ* but have become incorporated into the younger phase of humus soil development represented by Niveau D2. It is noticeable that the spatial distribution of artefacts in this layer, particularly of quartz (Fig. 65) complements that of Niveau D1. On balance, the spatial distribution of lithic finds

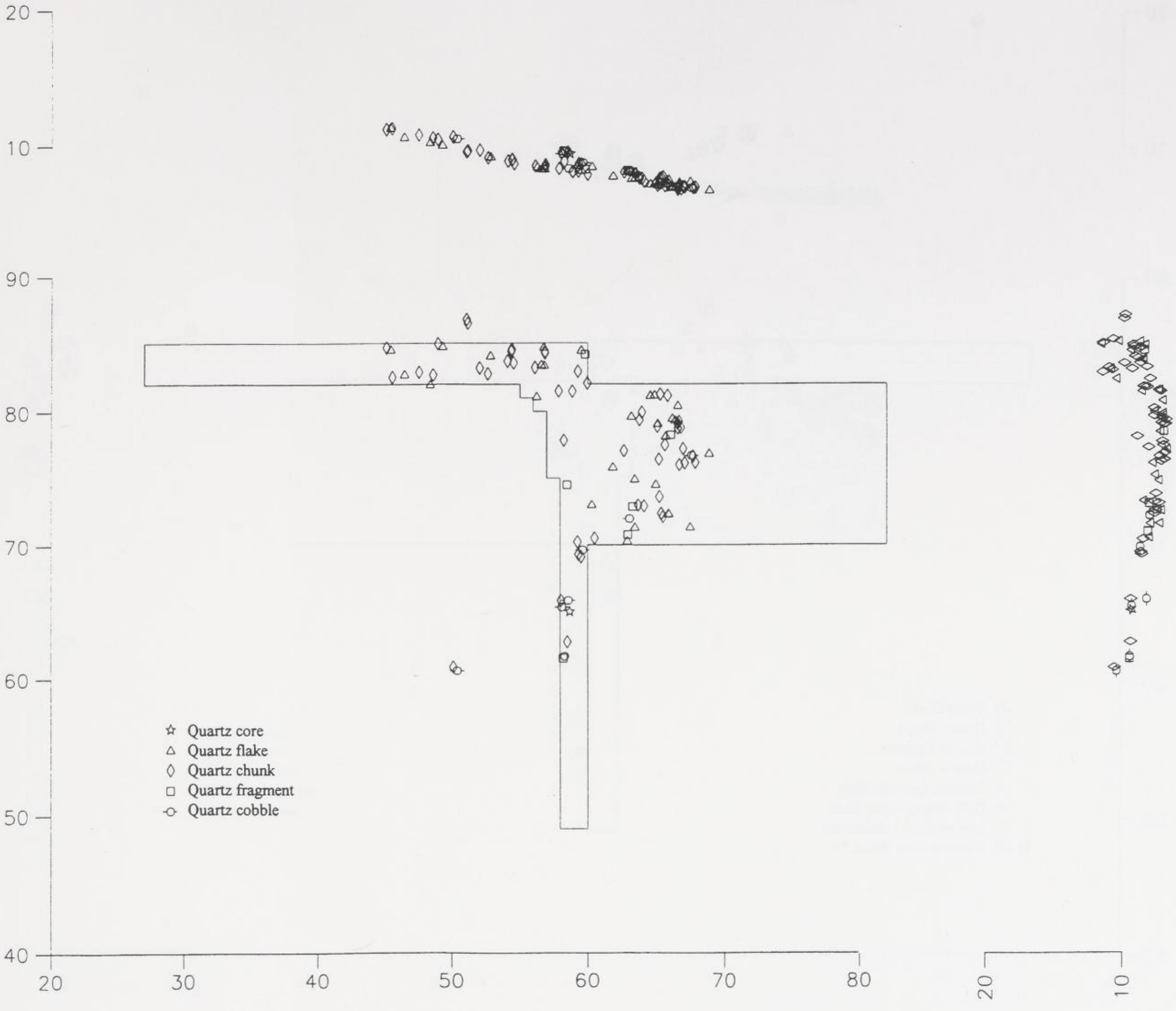


Fig. 65 Niveau D2. Spatial distribution of recorded single finds of lithic materials; quartz.

in Niveau D1 can be described as random, with no evidence for the survival of humanly determined concentrations of artefacts. Indeed, within the main area of the excavation, there are clear indications of secondary movement of material, leading to an under-representation of finds to the West and East and an accumulation of finds at the centre of this area.

Niveau D2

It was already noted that the spatial distribution of lithic material in Niveau D2 (Fig. 65) is complementary to that of finds in Niveau D1 (e. g. Fig. 63) and an explanation, in the form of erosional and soil formation processes, was offered for this phenomenon.
The sedimentological unit D2 was restricted to a mid-slope position in the crater and its limit up-slope (in the southern and north-western extensions of the excavation) and downslope (in the eastern part of the main excavated area) is clearly shown by the distribution of the quartz artefacts (Fig. 65).

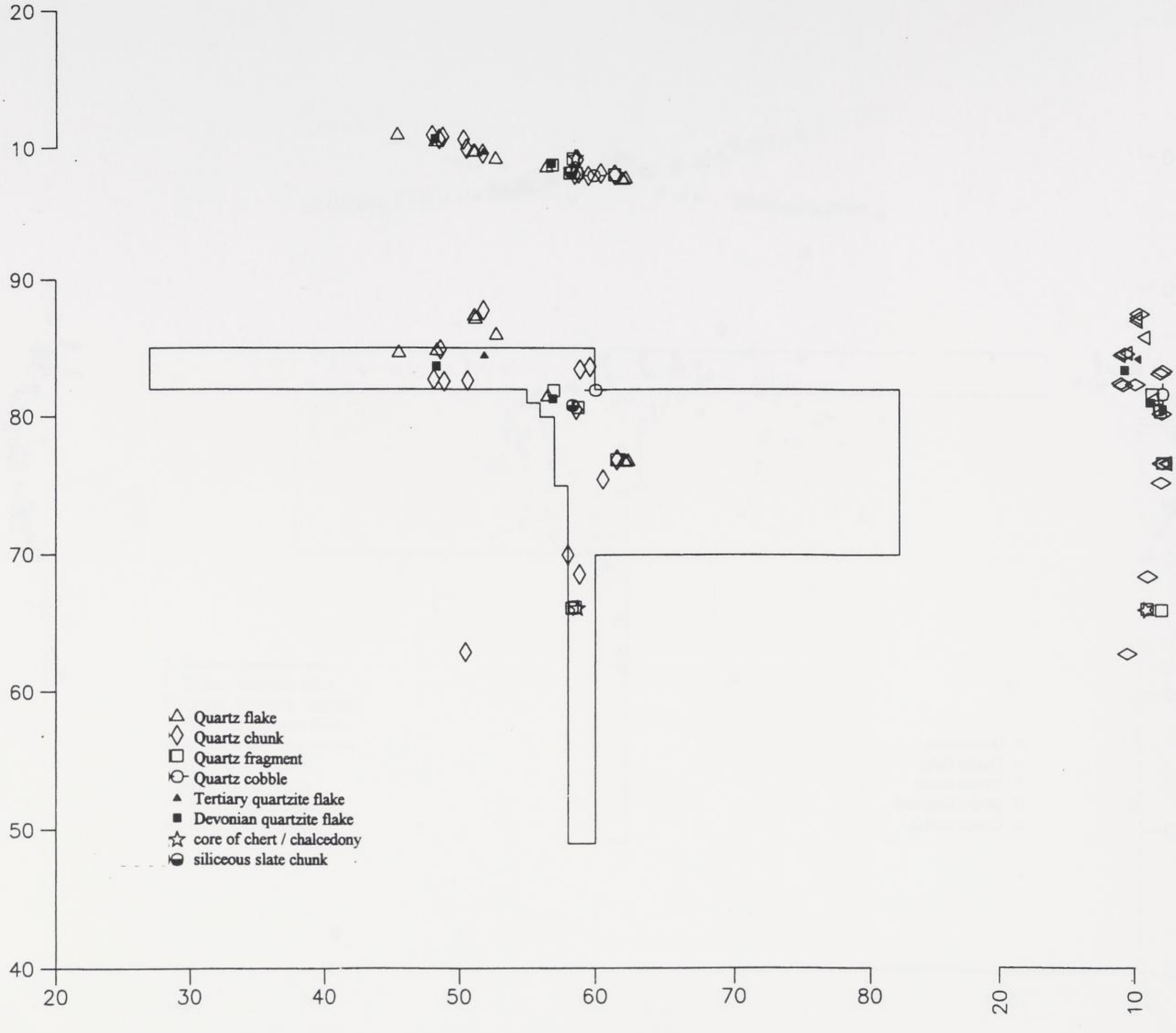


Fig. 66 Niveau D3. Spatial distribution of recorded single finds of lithic artefacts.

Niveau D3

With only 43 single finds, Niveau D3 has the second poorest lithic assemblage after Niveau B. As in the case of this material, it is difficult to interpret the finds in Niveau D3 as anything more than one of the extremes of the vertical dispersal of a continuum of finds in the early glacial humus soil complex.

Spatial distribution says little of interest about the lithic assemblage from Niveau D3. The occurrence of this sedimentological unit was even more restricted than that of Niveau D2, particularly to the East where Niveau D3 was often visibly removed completely by solifluction and the eastern boundary of Niveau D3 lies further to the West than does that of Niveau D2.

It can be assumed that artefacts originally present in Niveau D3 to the East of its recorded limit were incorporated into the sediments of Niveau E. By contrast, in an up-slope position (to the West and South), the lithic assemblage of Niveau D3 may have been »supplied« with material eroding out of older humus deposits in topographically higher positions.

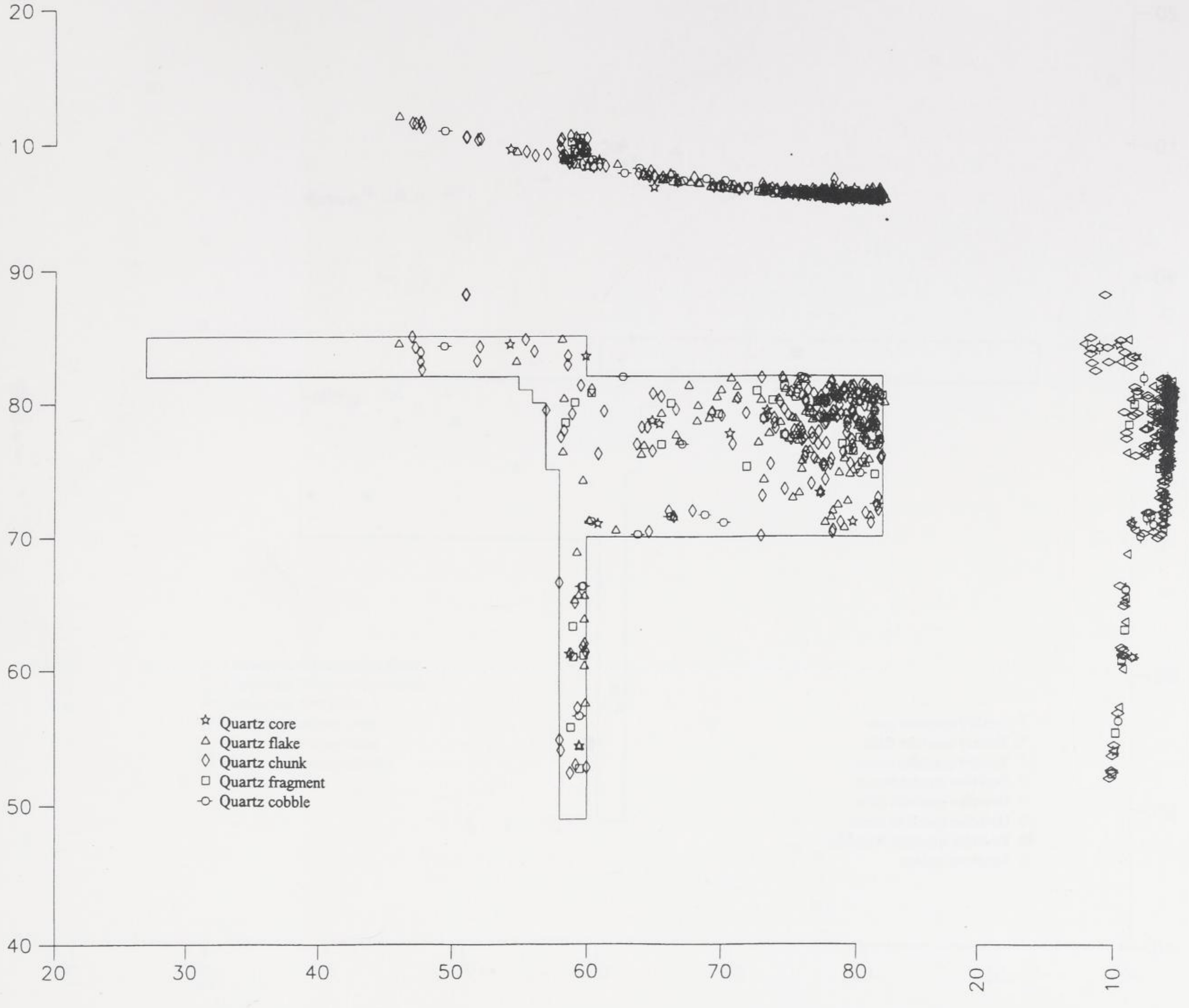


Fig. 67 Niveau E. Spatial distribution of recorded single finds of lithic materials; quartz.

Niveau E

Niveau E provided the second largest lithic assemblage (after Niveau D1) from the Plaidter Hummerich (Fig. 61) and, as in all layers, the single finds are dominated by quartz. It is nevertheless noticeable that Niveau E contains a higher proportion of non-quartz artefacts than most other layers. Ignoring modified basalt and graywacke, 84 (20.7%) of the total of 406 artefacts are made of either quartzite or finer-grained materials (flint, chalcedony/chert, lydite or tuff).

Only the very small assemblage assigned to Niveau D3 has a similar proportion of non-quartz artefacts, the other assemblages containing from between 0% (Niveau B) to 12.1% (Niveau D1) of these materials. The higher proportion of finer-grained lithics in Niveau E offers one of the better arguments for the existence of several different occupations of the Hummerich over a period of time and can possibly be interpreted as showing a more discriminating selection for »better« raw materials than was carried out in the older layers. However, this does not necessarily imply a fundamentally different (e. g. better-organised) strategy of raw material procurement since several of the materials may have been as readily available in local gravels as quartz. Truly long distance procurement only seems probable in the case of

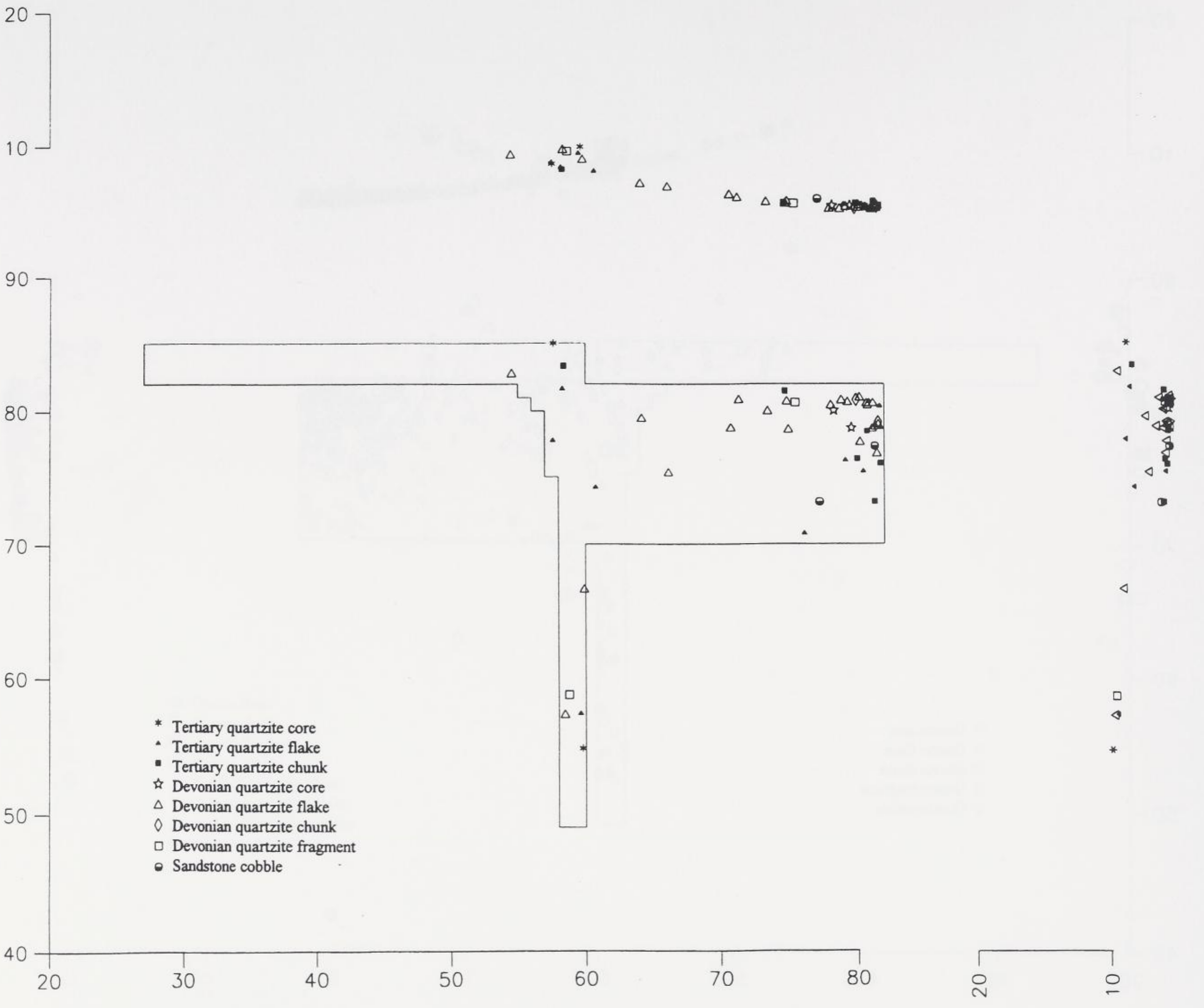


Fig. 68 Niveau E. Spatial distribution of recorded single finds of lithic materials: Tertiary quartzite, Devonian quartzite, sandstone.

artefacts of Meuse flint which, with 11 specimens, forms only 2.7% of the total of cores, flakes and chunks from Niveau E. This compares with 2.9% of the assemblage in Niveau C and 1.7% of that in Niveau D1.

The most apparent feature of spatial patterning in Niveau E is the presence of a denser concentration of material to the East of the site. This is particularly clear in the case of quartz (Fig. 67) but can also be recognised for other materials such as quartzite (Fig. 68) or Devonian rocks. This concentration of material is interpreted as a result of a combination of downslope movement of artefacts from the West of the site and the probable incorporation of older lithic material from the humus soils (Niveaux D1-D3) due to the deflation of these layers by solifluction and other geological processes.

It was already suggested that refits between artefacts in Niveau E and Niveau D1 provide evidence for these non-anthropogenic influences, and the complementary distribution of quartz artefacts in Niveau D1 (Fig. 63) and Niveau E was noted.

No clear patterning can be recognised in the case of less common materials (Fig. 69) and it is most improbable that spatial patterning due to hominid activity can be recognised.

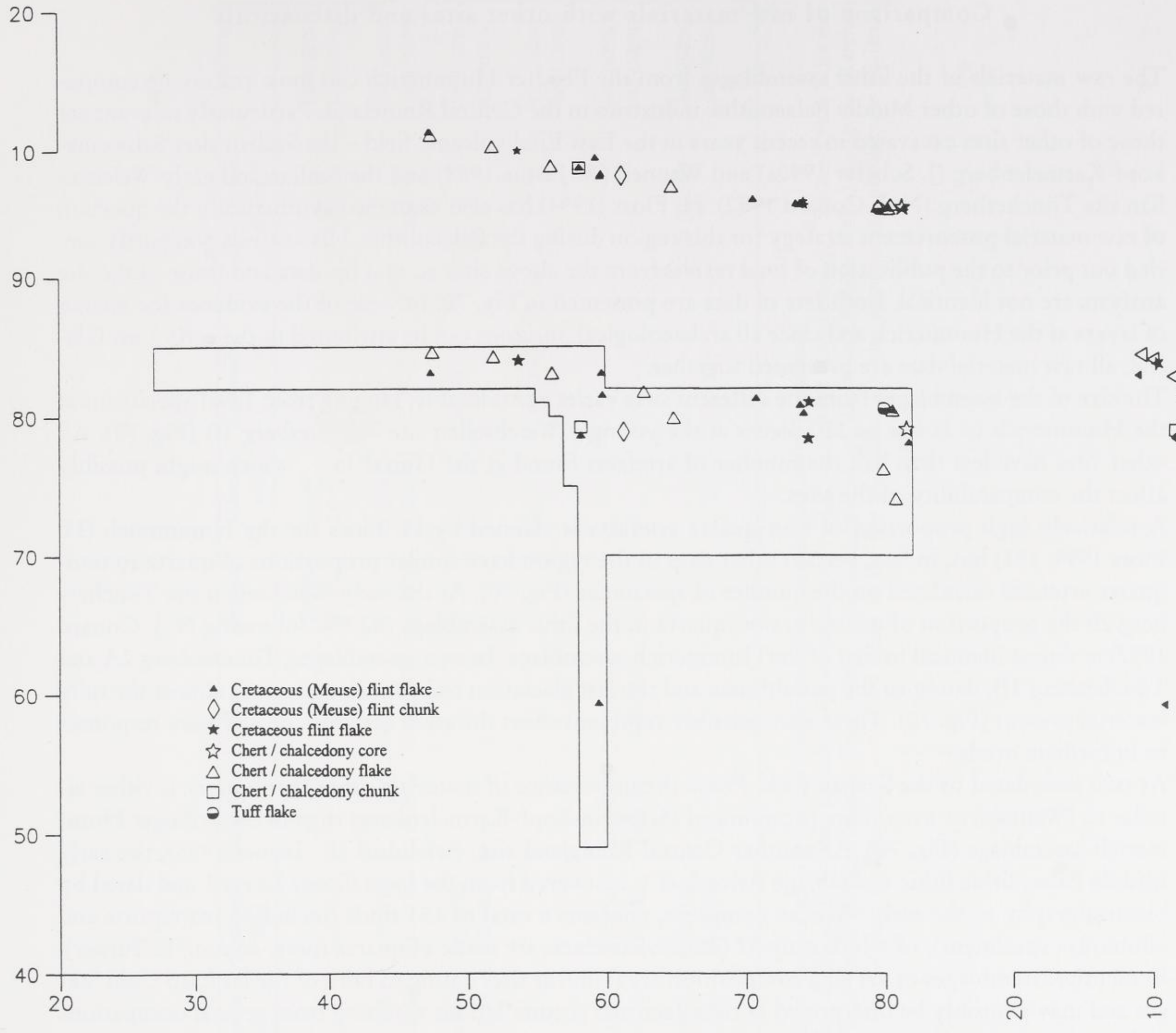


Fig. 69 Niveau E. Spatial distribution of recorded single finds of lithic materials: Flint, chert/chalcedony, tuff.

Stray and unstratified finds

The category »stray find« is here understood to mean material collected from the immediate area of the archaeological investigation but out of context and takes into account all finds which were originally assigned a single-find number (Fig. 61).

This group includes both valid finds of clearly Middle Palaeolithic tools (including some of the more carefully worked specimens of finer-grained materials), non-specific lithic artefacts and objects which clearly do not belong to the Middle Palaeolithic assemblage such as fragments of pottery.

It is perhaps self-evident that this group of finds contains a high proportion of non-quartz artefacts (cores, flakes, chunks) which will have been more easily recognised or thought »worth« collecting. A small group of finds recovered during excavation but not subsequently assigned to a sedimentological unit is classed together as unstratified finds. Only 15 specimens are artificially modified. Both stray and unstratified finds are included in this report for the sake of completeness but their information value is clearly limited.

Comparison of raw materials with other sites and discussion

The raw materials of the lithic assemblages from the Plaidter Hummerich can most readily be compared with those of other Middle Palaeolithic industries in the Central Rhineland. Particularly relevant are those of other sites excavated in recent years in the East Eifel volcanic field – the Saalian sites Schweinskopf-Karmelenberg (J. Schäfer 1990a) and Wannen (A. Justus 1988) and the Saalian and early Weichselian site Tönchesberg (N. J. Conard 1992). H. Floss (1994) has also examined synthetically the question of raw material procurement strategy for this region during the Palaeolithic. His analysis was partly carried out prior to the publication of final results from the above sites so that his data and those of the site analysts are not identical. Both sets of data are presented in Fig. 70. In view of the evidence for mixing of layers at the Hummerich and since all archaeological horizons can be attributed to the early Last Glacial, all raw material data are presented together.

The size of the assemblages from the different sites varies considerably, ranging from 1,661 specimens at the Hummerich to as few as 120 pieces at the younger Weichselian site Tönchesberg 1B (Fig. 70). All other sites have less than half the number of artefacts found at the Hummerich, which might possibly affect the comparability of the sites.

A relatively high proportion of non-quartz artefacts is claimed by H. Floss for the Hummerich (H. Floss 1994, 151) but, in fact, certain other sites in the region have similar proportions of quartz to non-quartz artefacts calculated on the number of specimens (Fig. 70). At the early Weichselian site Tönchesberg 2b the proportion of quartz to non-quartz in the lithic assemblage (82.8% following N. J. Conard 1992) is almost identical to that of the Hummerich assemblage. In two assemblages, Tönchesberg 2A and Tönchesberg 1B, dating to the penultimate and the last glaciation respectively, quartz is almost the only material present (Fig. 70). These may possibly represent short duration activities or »*ad hoc*« responses to immediate needs.

At two sites dated to the Saalian Cold Phase the importance of materials other than quartz is either similar to (Wannen) or even more pronounced (Schweinskopf-Karmelenberg) than in the younger Hummerich assemblage (Fig. 70). At another Central Rhineland site, Ariendorf (E. Turner 1986), the early Middle Palaeolithic lithic assemblage Ariendorf 1, recovered from the loess Cover Layer 1 and dated by biostratigraphy to the early »Saalian complex«, contains a total of 151 finds (including manuports and »dubious« specimens), of which only 57 (45.2%) artefacts are made of quartz (pers. comm., E. Turner). Evidently, assemblages of varying composition are found at sites dating to both of the last two Cold Stages and may plausibly be interpreted as time-factored accumulations resulting from several occupations and/or phases of activity. While it is true that no other assemblage is as heterogeneous as that from the Hummerich this may merely reflect the overall greater number of artefacts present, the large area of the excavation (which probably recovered lithic material from different and unrelated events) and the probability that the assemblage was accumulated over an appreciable depth of time.

The composition of the non-quartz component of the assemblage differs appreciably from site to site. Devonian quartzite is particularly well represented at the Schweinskopf site, whereas a large number of artefacts of Tertiary quartzite is present at Tönchesberg 2B. The Wannen assemblage is reasonably well balanced and Cretaceous flint is also relatively well represented here. In summary there is no immediately recognisable chronological pattern in the representation of raw materials at the East Eifel sites.

The presence of exogenous raw materials is interpreted as showing that the Middle Palaeolithic groups which occupied the Central Rhineland must at other times have visited different regions with these lithic resources. Nevertheless, the most commonly used raw materials remain those available in the immediate vicinity of the site. Another early Weichselian Rhineland site, Wallertheim to the South of the Mainz Basin (N. J. Conard, D. S. Adler, D. T. Forrest & P. J. Kaszas 1994, 1995), provides a further illustration of this typically Middle Palaeolithic phenomenon. The lithic assemblages of six distinct sedimentological units dated to the last interglacial and the beginning of the last Cold Phase contain a large proportion of artefacts made of volcanic rocks. These commonly occur in the local river terraces and in their

	Quartz	Devonian quartzite	Tertiary quartzite	Siliceous slate	Cretaceous flint	Chalcedony/	Chert	Limonite	Volcanic tuff	Graywacke	undetermined/ diverse	total
Tö 1B *	109 (90.8%)	1 (0.83%)	4 (3.33%)	-	4 (3.33%)	-	-	1 (0.83%)	1 (0.83%)			120 (100%)
*Tö 1B **	*110 (90.2%)*	*1 (0.8%)*	*4 (3.3%)*		*4 (3.3%)*			*1 (0.8%)*	*1 (0.8%)*		*1 (0.8%)*	*122 (100%)*
Hummerich *	1,413 (85.07%)	92 (5.54%)	58 (3.49%)	35 (2.11%)	38 (2.29%)	22 (1.32%)			3 (0.18%)			1, 661 (100%)
*Hummerich **	*1, 206 (83 8%)*	*86 (5.98%)*	*51 (3.55%)*	*31 (2.15%)*	*37 (2.57%)*	*20 (1.39%)*	*3 (0.21%)*	*1 (0.07%)*	*3 (0.21%)*		*1 (0.07%)*	*1, 439 (100%)*
Tö 2B *	461 (82.8%)	5 (0.89%)	71 (12.74%)	8 (1.43%)	4 (0.71%)					8 (1.43%)		557 (100%)
*Tö 2B **	*733 (90.4%)*	*2 (0.2%)*	*63 (7.8%)*	*8 (1.0%)*	*5 (0.6%)*							*811 (100%)*
Tö 2A #	421 (99.8%)									1 (0.2%)		422 (100%)
Tö 2A #	*447 (100.0%)*											*447 (100%)*
Schweinskopf #	431 (65.2%)	181 (27.4%)	40 (6.0%)	1 (0.15%)	5 (0.8%)	1 (0.15%)	2 (0.3%)					661 (100%)
Schweinskopf #	*360 (61.4%)*	*176 (30.0%)*	*38 (6.5%)*	*1 (0.2%)*	*6 (1.0%)*	*4 (0.7%)*	*1 (0.2%)*					*586 (100%)*
Wannen #	253 (72.4%)	30 (8.6%)	11 (3.15%)	5 (1.5%)	11 (3.15%)						39 (11.2%)	349 (100%)
Wannen #	*253 (84.3%)*	*21 (7.0%)*	*10 (3.3%)*	*4 (1.3%)*	*12 (4.0%)*							*300 (100%)*

Fig. 70 Lithic raw material representation at selected Middle Palaeolithic sites in the Central Rhineland.
Data for the Plaidter Hummerich in normal characters are based on this study. – Data for other sites are taken from N. J. Conard, 1992 (Tönchesberg), J. Schäfer, 1990a (Schweinskopf-Karmelenberg) and A. Justus, 1988 (Wannen). – Data in italic figures are taken from H. Floss (1994). – For the Schweinskopf, data from J. Schäfer (1990a) synthesize all archaeological horizons, whereas those from H. Floss (1994) are for the main horizon only. – * = site dated to the last glaciation; # = site dated to the penultimate glaciation.

suitability for artefact manufacture are the equivalent of the Devonian quartzites found at the East Eifel sites. All materials at these latter sites other than Cretaceous flint probably occurred in river terraces or block-fields within a narrow radius and can therefore be regarded as locally available.
A slightly different question is the interpretation of the true exogenous materials which were brought to the site from a long distance. H. Floss calculates the importance of Meuse flint (32 artefacts) relative to the remaining artefacts of materials other than quartz (H. Floss 1994, 147) and suggests that this material, which makes up 13.7% of the non-quartz assemblage, is unusually well represented at the Hummerich. The present study arrives at a similar figure (15.2%) for the total of 38 artefacts (all Cretaceous flint) relative to the remaining 212 artefacts of materials other than quartz. In fact this proportion of Cretaceous flint can also be matched at other sites. The very small non-quartz assemblage at the Weichselian site Tönchesberg 1B contains four flint artefacts (ca. 36% of the total calculated on the data of N. J. Conard or 33% on the data of H. Floss respectively). At the Saalian Wannen site Cretaceous flint makes up as much as 19.3% (after A. Justus 1988) or even 25.5% (after H. Floss 1994) of the non-quartz assemblage. The importance of flint here can also be calculated as 4.0% of the total assemblage, a figure appreciably higher than that (2.29%/2.57%) for the Hummerich (Fig. 70).
The artefacts of exogenous raw materials cannot be uncritically interpreted as evidence for long range/ long term logistical procurement, since it is probable that artefacts were routinely carried between sites as finished (usually retouched) tools and thus simply transported as part of the everyday equipment of the group. This interpretation can, however, possibly be qualified by evidence for specialized artefact manufacture at other localities with highly suitable raw materials (ateliers). At a number of such sites in neighbouring regions quartzite of good quality was worked intensively and the finished products are believed to have been removed for use elsewhere (Ravensberg: L. Fiedler & S. Veil, 1974; Reutersruh: A. Luttropp & G. Bosinski, 1971; Ratingen: R.-W. Schmitz 1995). While such ateliers may simply reflect opportunistic use of resources available in a territory exploited by a group, it is certainly possible that artefacts were produced at these sites with the express intention of transporting them to other regions.
It can be concluded that locally occurring and readily available lithic raw materials dominate not only at the Hummerich but at all the East Eifel Middle Palaeolithic assemblages. A first indication of a real change in the strategy of obtaining lithic raw material in the Rhineland is possibly visible at the site of Remagen-Schwalbenberg (V. App *et al.* 1995, 43). At this site a find horizon in the Weichselian Lohner soil dates to between 30 and 40 ky and is regarded as transitional from the Middle to the Upper Palaeolithic. A large proportion of the assemblage, which contains artefacts interpreted as preforms for foliate tools, consists of exogenous tabular Lousberg flint from the Aachen region, a distance of ca. 90 km from the site.
Both the dominant role of local raw materials and the consistent presence of low frequencies of exogenous materials can be observed throughout the European Middle Palaeolithic.
In a study of lithic raw materials in Belgian Middle Palaeolithic assemblages A.-G. Krupa (1990) observes similar phenomena. In tables he lists the presence of raw materials at 16 sites, giving the distance of the raw material source from the site but unfortunately without quantifying the frequency of the recovered artefacts of each material. Nevertheless, the information from each site can be summarised to give the following synthesis. The sites yielded in different cases as many as 11 and as few as 2 raw material groups. These can be subdivided into local and exogenous materials, whereby the latter were obtained from between 20 km to more than 50 km from the site. At five sites local raw materials were found exclusively, while at 10 sites materials were recovered which had been transported more than 50 km. If each occurrence of a raw material group at a site is counted separately a total of 104 raw material units is established. 69 of these material/site-units are local, while only 35 are attributed to exogenous materials. Of the latter group 14 represent material transported more than 50 km. Local materials are almost twice as well represented as exogenous siliceous rocks, whereby an appreciable proportion of the latter has been transported over quite long distances.
Syntheses of the treatment of lithic raw materials in north-western Europe have been given by M. Otte (1991a); E. Rensink, J. Kolen & A. Spieksma (1991) and W. Roebroeks, J. Kolen & E. Rensink (1988).

Otte (1991a, 162) differentiates between Belgian cave sites located at a distance from sources of good Cretaceous flint and open air sites close to such sources. During the Mousterian the relative quantity and the treatment of local and exogenous raw materials are closely linked to distance »*Les processus les plus élaborés sont réservés aux roches éloignées et de bon qualité dont ne sont ramenés que les produits finis. Les roches locales, moins favorables, montrent des techniques rudimentaires, un outillage grossier (denticulés, encoches) et tous les produits de la chaîne opératoire*«. These are, of course, two ideal extremes and there also exist more balanced assemblages containing »*. . . des matériaux régionaux d'ou l'outillage courant est tiré (racloirs abondants)*«, which may be quite relevant for the Hummerich with its scraper-dominated assemblage.

E. Rensink, J. Kolen & A. Spieksma (1991) compare data from the north-western and central-eastern European Late Middle Palaeolithic (dated to the Eemian and early Weichselian) and point out that the distance of transport of exogenous raw materials is very variable across this area.

Belgian sites routinely contain artefacts of Wommersom quartzite and »phtanite« which have been transported from 10 km-80 km and are found in the form of finished tools, a similar situation to the presence of Cretaceous flint at the Central Rhineland sites. This latter material was also imported »*. . . in large quantities. . .*« (E. Rensink, J. Kolen & A. Spieksma 1991, 144) to the Belgian sites which are only some 30 km from outcrops.

By contrast to this pattern, lithic raw materials found at central and eastern European »Taubachian«, Micoquian and Mousterian sites may have been transported from sources more than 150 km, and even as far as 300 km distant. E. Rensink, J. Kolen & A. Spieksma (1991, 142) propose that during the Middle Palaeolithic the procurement of lithic raw materials was embedded in the daily subsistence activities of the group and that long distance transport from exogenous sources can simply be interpreted as a reflection of the overall degree of mobility and territory size of the group. This implies that more easterly groups exploited larger territories than their western contemporaries. In an interesting parallel to the observations at Remagen-Schwalbenberg long distant transport of exogenous materials becomes particularly important in the final Middle Palaeolithic leaf point assemblages.

W. Roebroeks, J. Kolen & E. Rensink (1988) had already pointed out the range of ways in which lithic artefacts can be transported and argued for the existence of »planning depth« and »organisation« as elements in the transfer mechanisms of Middle Palaeolithic assemblages, in part using the evidence of exogenous materials at the Hummerich and other Central Rhineland sites. Studies of evidence for mobility provided by lithic raw materials carried out for eastern central Europe by J. Feblot-Augustins (1993) also point to the greater distances of transport found in eastern assemblages contrasted with those from south-west France. The author suggests that environmentally determined greater seasonal mobility on the eastern European plains could be the reason for the observed differences.

In an analysis of raw material exploitation in eastern German (Thuringian) Lower and Middle Palaeolithic assemblages D. Schäfer & T. Weber (1986, 137) write that »*. . . no inventories analysed here speak for any form of raw material transport over long distances*«. However, the dominant role of suitable, locally available material (Cretaceous flint) may have obscured the evidence for such transport (if imported and local materials are indistinguishable) or rendered it unnecessary. Interestingly, the authors do identify long range raw material transport (60-80 km) at the late Middle Palaeolithic leaf point site Ranis with one raw material (chert) possibly originating as much as 200 km from the site.

Seminal research on the acquisition and use of lithic raw material resources was carried out for south-west France by J.-M. Geneste (1985, 1988a, 1988b, 1989) and his work has been taken as a standard for comparison by numerous other authors. He distinguishes between raw materials available within a radius of 5 km of the site and easily obtainable during daily activities (from the »*. . . territoire qui semble avoir été le plus fréquenté. . .*«), materials obtained within the immediately surrounding region at distances up to 20 km, and materials from the »*. . zones les plus périphériques du territoire. . .*« at distances of 30-80 km from the site (J.-M. Geneste 1988a, 63).

The first raw material group forms 55%-98% (mean = 88%) of the assemblages examined by Geneste and has a low index of utilisation (5%). It can be equated with quartz at the Hummerich. Other local materials here potentially include several of the finer-grained siliceous materials derived from the Rhine gravels. Geneste's second group was generally introduced to the sites as *blocs aménagés* and forms 2%-20% of the assemblages with an index of utilisation of 10%-20%. This is the most variable group. At the Hummerich this might be the equivalent of certain specimens of chalcedony and relict flint or of Tertiary quartzite obtained from block fields/primary sources. The final group defined by Geneste is always represented by low numbers of artefacts in the form of finished tools or debitage of secondary modification (»... *les chaînes opératoires ne sont jamais représentées que par leurs phases terminales*...«) and consequently shows a very high index of utilisation (74%-100%). The clearest analogy at the Hummerich is provided by the artefacts of Cretaceous flint derived from primary or *quasi*-primary sources.

This behaviour can be observed at many Middle Palaeolithic sites. L. Meignen (1988) describes in detail the differences in the treatment of different raw materials in two layers at the Mousterian site Marillac (Charente). Here a local flint of poorer quality is represented by a large amount of primary debitage and cortical pieces, although cores are not particularly common, whereas a smaller quantity of better quality flint, the source of which is some 15-20km from the site, is present mainly in the form of retouched tools, whereas primary debitage, cortical pieces and cores are all very rare.

In an examination of the relationship between raw material and technology at 13 sites of the Quina Mousterian in the Perigord A. Turq (1992) establishes that from 90 to 98% of the raw material used is of local origin (< 5km), while the rest was brought to the sites from sources between 10 to 100km distant. A clear difference to the situation at the Hummerich is that the local element is characterised by »... *the selection of good quality material from local alluvial deposits and outcrops*...« (A. Turq 1992, 75), a description which certainly cannot be applied to the Hummerich quartz debitage.

Overall, the Quina Mousterian assemblages show an interesting mixture of similarities and differences to the Hummerich material. The French assemblages are indeed characterised by a »... *very limited degree of preparation of both the striking platforms and main flaking surfaces of the cores*...«, but also by an »... *abundance of small chips and fragments*...« interpreted as indicating »... *extensive retouching and resharpening of retouched tools on the sites*...« (A. Turq 1992, 76) which cannot be paralleled at the Hummerich. It may, however, be questioned whether the absence of such material does not merely reflect the fact that sediment was not sieved at the German site.

The size distribution of debitage at the neighbouring early Weichselian site Tönchesberg 2b (N. J. Conard 1992, Fig. 41) is very different from that at the Hummerich (Fig. 51) although the excavator of the former site estimates that wet-sieving the excavated sediment would have further »... *roughly tripled*...« the recovery rate of artefacts < 1.5cm (N. J. Conard 1992, 28). Since the sediment type and the conditions of excavation were more favourable at the Tönchesberg than at the Hummerich it seems on balance wiser to treat the absence of very small primary and secondary debitage products at the Hummerich as a probable artefact of excavation methods. Of more value for comparison is the degree to which flakes were retouched into tools, which is high (55-76%) at the Quina sites (A. Turq, 1992, 76). At the Hummerich only 190 (11.44%) of the total of 1,661 artefacts of finer siliceous materials are certainly or possibly retouched. If only the 157 definitely retouched tools are considered then 9.45% of the assemblage has been modified, in both cases the figures are appreciably lower than those for the French sites. Perhaps of more value for comparative purposes, of the 250 artefacts of materials other than quartz a total of 54 (21.6%) is retouched, double the figure reached for all artefacts including quartz but still far below that for Quina sites.

At the French Quina sites »... *morphologically »Levallois« flakes do not occur in association with other characteristic by products of the Levallois production scheme.*« (A. Turq 1992, 76). This is only partly true at the Hummerich where isolated specimens of prepared cores show that Levallois products were occasionally manufactured at the site from local raw materials, although other exogenous Levallois products were indeed more probably brought to the site as finished products.

Summarising the occurrence of raw materials in a study of south-west French Middle Palaeolithic sites P. B. Pettitt (1995, 38) suggests that local materials routinely make up ca. 90% of the assemblage at en-closed sites (caves) and as much as 100% on open sites. The East Eifel sites clearly fit this pattern although a clear difference is the high proportion of local quartz at the Rhineland sites which is not the case for the French assemblages, where flint was available locally (P. B. Pettitt 1992, 22).

TECHNOLOGY

All single finds in the lithic assemblage were assigned to one of six technological categories. The categories »core« and »flake« are self explanatory. The term »chunk« was chosen to represent angular specimens (particularly of quartz) whose dimensions (thickness) do not allow them to be regarded as flakes but which are not truly cores. Other authors have used the term »angular debitage« for such material. This category of find is also regarded as humanly modified on grounds of size, results of refitting or of context. The term »fragment« is used to describe angular specimens which cannot be certainly interpreted as artefacts. This may be due to their very small size or to the presence of features which suggest they represent »background« material from the Devonian bedrock caught up in the eruption and mixed with the scoria of the volcanic cone. »Cobble« is used for larger river-rolled specimens, normally unmodified but potentially including hammerstones or pounders. »Pebble« is used for very small unmodified water-rolled finds (*Kieselsteine*) regarded as unconnected with human activity. The six categories were assigned subjectively and not according to strict metrical criteria. In the case of »flakes« and »chunks« of quartz, in particular, they form a continuum.

Representation and spatial analysis of technological groups (»*Grundformen*«)

As done for the raw materials, the various technological classes are listed by stratigraphical unit, although refitting shows that boundaries between these are not rigidly defined. Equally, the location of all technological categories of finds was plotted, but only a few of the plots are reproduced here since spatial patterning was not normally observed.

Niveau B

The only humanly modified lithic finds from Niveau B are 18 cores, flakes and chunks of quartz (Fig. 71).

	core	flake	chunk	fragment	cobble	pebble	total
QZ	5	4	9	2		1	21
GRW				2	2	2	6
SLT				2	1		3
TOT	5	4	9	6	3	3	30

Fig. 71 Niveau B. Artefact class and raw material of recorded single lithic finds.

It was argued above that material from Niveau B does not represent an independent occupation of the site, but merely the deepest-lying material of the early Weichselian assemblage. The presence of five cores in an assemblage of only 18 artefacts would otherwise be surprising. The large proportion of quartz chunks is a function of the fracture properties of this material and will be seen to occur in other layers. The small size of the assemblage does not allow recognition of any spatial patterning (Fig. 62).

	core	flake	chunk	fragment	cobble	pebble	total
QZ	4	22	35	4	2	5	72
DQT		1					1
TQT		1	1		1		3
LYD		1					1
MFL		1	1				2
FL		1					1
BAS				1			1
GRW				3	4		7
SLT				2			2
TOT	4	27	37	10	7	5	90

Fig. 72 Niveau C. Artefact class and raw material of recorded single lithic finds.

Niveau C

Four cores, 35 chunks and 22 flakes of quartz form the largest category of the lithic assemblage of Niveau C (Fig. 72).
Devonian quartzite, lydite and a type of flint are only represented by flakes and no cores are present. Whether the absence of cores of the less common materials shows that the flakes were manufactured elsewhere or is merely a reflection of the low quantity of material recovered is unclear.
Working of these materials may also have taken place at the Hummerich but outside the excavation area or in a location from which material was subsequently eroded into a different layer. Cobbles of Tertiary quartzite and graywacke (Fig. 82) are probably manuports but show no signs of having been worked.

Niveau D1

The largest number of lithic finds was attributed to the deepest humus soil, Niveau D1 (Fig. 73). 586 of 777 single finds from this layer (75.4%) are interpreted as artefacts. Most specimens are quartz (515) but almost 25% of the flakes in this layer are of other raw materials. The large number of quartz chunks (56.7% of the modified quartz) merely reflects the fracture properties of this material.
The five non-quartz cores are nevertheless of materials (Tertiary quartzite and lydite cobbles) which were probably available in the immediate region of the site. Materials such as flint, which were obtained at greater distances from the site, are represented by flakes only. While it is tempting to interpret this as showing that flakes of exogenous materials were not produced at the Hummerich but were transported ready made to the site, this is not certain.
Devonian quartzite is also a locally available raw material and is represented by 29 flakes in Niveau D1. The absence of cores of this material should at least warn us that production of and selection for flakes of exogenous materials might also have taken place quite locally, even if evidence for this activity was not found in the excavated area of the site.

Niveau D2

The artefacts in Niveau D2 are dominated by quartz, with chunks of this material making up almost 60% of the total worked assemblage (Fig. 74).
Only one quartz core is present in Niveau D2 and worked materials other than quartz are only present as flakes. This should not be over-interpreted in view of the small size of the assemblage.

	core	flake	chunk	fragment	cobble	pebble	total
QZ	26	197	292	51	10	39	615
DQT		29			1		30
TQT	2	13		1		1	17
LYD	3	6		1	1		11
CH/CH		6		1			7
MFL		10					10
FL		1					1
BAS				3			3
GRW				32	12	7	51
SLT				15	3	3	21
IND			1	2	1	7	11
TOT	31	262	293	106	28	57	777

Fig. 73 Niveau D1. Artefact class and raw material of recorded single lithic finds.

	core	flake	chunk	fragment	cobble	pebble	total
QZ	1	29	50	6	7	13	106
DQT		4		1			5
TQT		1		1	2		4
FL		1					1
BAS				2	1		3
GRW				8	3	2	13
SLT				4			4
IND					1	2	3
TOT	1	35	50	22	14	17	139

Fig. 74 Niveau D2. Artefact class and raw material of recorded single lithic finds.

	core	flake	chunk	fragment	cobble	pebble	total
QZ		9	14	5	1	1	30
DQT		2					2
TQT		1					1
LYD			1				1
CH/CH	1						1
BAS			1	1			2
GRW				4	1		5
IND						1	1
TOT	1	12	16	10	2	2	43

Fig. 75 Niveau D3. Artefact class and raw material of recorded single lithic finds.

Niveau D3

The small lithic assemblage attributed to Niveau D3 contains 29 artificially modified specimens, 6 of which are of materials other than quartz (Fig. 75). The only core from this layer is a discoid specimen on a flat pebble of a glassy material, probably chalcedony (Fig. 88, 3). Of the 12 flakes, two are of Devonian and one is of Tertiary quartzite, a similar proportion of non-quartz to Niveau D1.

	core	flake	chunk	fragment	cobble	pebble	total
QZ	10	123	189	32	17	75	446
DQT	2	23	2	2	2		31
TQT	2	10	6				18
LYD	3	4	5	1		1	14
CH/CH	1	9	1				11
MFL		10	1				11
FL		4					4
TUF		1					1
BAS		1		4	4	1	10
GRW			3	56	8	19	86
SLT				25	4	12	4
SAND					2		2
IND						19	19
TOT	18	185	207	120	37	127	694

Fig. 76 Niveau E. Artefact class and raw material of recorded single lithic finds.

Niveau E

The second largest lithic assemblage is assigned to Niveau E (Fig. 76). 59% of the 694 single finds are cores, flakes or chunks, which compares with a figure of 75% for the lithic material from Niveau D1. The difference in the proportion of artefacts to non-artefacts in the two layers is accounted for by materials derived from the Devonian bedrock (slate and graywacke) in Niveau E, possibly suggesting that this assemblage was more heavily influenced by non-anthropogenic formation processes. This could have taken the form of the concentration of naturally occurring, unmodified lithic elements due to deflation and solifluction of sediment and resulting conflation of the heavier rock fragments. For quartz alone, the proportion of artefacts to non-artefacts is 72% in Niveau E (compared with a proportion of 83. 7% in Niveau D1).

Quartz cores are appreciably less common in Niveau E (10 specimens) than in Niveau D1 (26). By contrast, cores of other materials are more common (although no flint cores are present) and provide 44% of the total. The same tendency can be observed for the flakes, 33.5% of which are of materials other than quartz (ca. 25% in Niveau D1). The proportion of chunks in the quartz assemblage (58.7%) is very similar to that of Niveau D1 (56.7%), suggesting that purely mechanical factors of quartz fracture are responsible for the technological composition of quartz industries.

The spatial distribution of the material in Niveau E is heavily influenced by geological processes, most clearly seen in the plan of quartz (Fig. 67), the accumulation of which at the deepest, north-eastern part of the site is certainly due to solifluction processes.

It is uncertain whether any humanly influenced patterning can be expected under these circumstances, but it is noticeable that both cores of Devonian quartzite are located at the eastern edge of the site whereas the two cores of Tertiary quartzite are at the North and South of the excavation area (Fig. 68). Flakes of Devonian quartzite appear to occur predominantly in the northern half of the main excavation area (Fig. 68), a pattern also visible for Meuse flint and chert/chalcedony (Fig. 69), but since lithic material is generally more common here, this may again only reflect the overall pattern of distribution due to geological factors. A large proportion of the lydite is found in the southern extension of the excavation, but Tertiary and Devonian quartzite, Meuse flint and quartz are also present here so that it is not possible to isolate an exclusively lydite »zone« or »phase« at this part of the site. The distribution of the assemblage seems rather to be random with a better representation of artefact classes at those parts of the site with the densest concentration of artefacts.

	core	flake	chunk	fragment	cobble	pebble	total
QZ	2	43	29	7	4	36	121
DQT		14	1	1	7		23
TQT	2	5	2	3	2	1	15
LYD		3	4	1			8
CH/CH		4					4
MFL		6					6
FL		2					2
TUF	1	1					2
BAS			1	13	3		17
GRW			3	11	10	5	29
SLT				4	2		6
IND				6		1	7
TOT	5	78	40	46	28	43	240

Fig. 77 Stray and unstratified finds. Artefact class and raw material of recorded single lithic finds.

Stray and unstratified finds

Just over half of the total of 240 stray and unstratified finds are artefacts. 117 fragments, cobbles and pebbles make up the balance (Fig. 77), only seven of which are certainly or possibly artificially modified. Of the finds of quartz only, 61% are artefacts. Unlike in the case of excavated and stratified material, flakes of quartz (58%) dominate over chunks (39%), which is certainly simply due to preferential collection of »better« quartz artefacts. 45% of the flakes are of materials other than quartz, again certainly due to selection of »better« or more less ambiguous material.

Synthesis of technological aspects for all single finds

A number of general features can be established if the technological groups from all layers (including stray and unstratified finds) at the Hummerich are considered together (Fig. 78). The first of these is that almost no formal artefacts are manufactured from basalt and from Devonian slate and graywacke. The

	core	flake	chunk	fragment	cobble	pebble	total
QZ	48	427	618	107	41	170	1,411
DQT	2	73	3	4	10		92
TQT	6	31	9	5	5	2	58
LYD	6	14	10	3	1	1	35
CH/CH	2	19	1	1			23
MFL		27	2				29
FL		9					9
TUF	1	2					3
BAS		1	2	24	8	1	36
GRW			6	116	40	35	197
SLT				52	10	15	77
SAND					2		2
IND			1	8	2	30	41
TOT	65	603	652	320	119	254	2,013

Fig. 78 All finds. Artefact class and raw material of recorded single lithic finds.

rare exceptions are one flake and two chunks of basalt and six chunks of graywacke. No other specimens are regarded as unequivocally worked by flaking, although some cobbles were certainly used as hammers and pounders. 22.5% of the quartz assemblage (318 of 1,411 specimens) cannot be regarded as worked (with the exception of hammers etc.). The presence of unworked quartz cobbles as a raw material reserve must also be considered.

Of the worked quartz, 56.5% is in the form of chunks, a figure close to that established individually for Niveaux D1 and E. It has already been suggested that this is purely a function of the fracture mechanics of quartz. 39.1% of the quartz is in the form of flakes and 4.4% is present as cores.

The cores at the Hummerich are dominated by quartz specimens which form the largest single group of this artefact class (73.8% of the total of 65 specimens). Cores of other raw materials are much less common or totally absent, only locally available siliceous slate and Tertiary quartzite being represented by more than two specimens (each with 6 = 9.2% of the total).

Fine-grained raw materials are relatively well represented at the site by flakes (Fig. 78) where they account for 29% of the assemblage. Nevertheless, this has to be seen in relation to the figure for the cores of these materials which amount to 26% of the total. Seen in this light, cores of fine grained rocks are just as frequent relative to flakes as are those of quartz, which might be interpreted as showing that the primary debitage of all raw materials took place at the Hummerich to the same degree. The only exception to this is provided by Cretaceous flint which is not represented by any cores at all.

Morphological and metrical analysis of technological groups

Cores

Morphology of the cores

Cores were classified following the terminology given by M. Brézillon (1977) who draws upon a number of authors for detailed descriptions of technological attributes of cores (Fig. 79). The majority of the Hummerich cores are very simple and fall into one of two groups which, paraphrasing Brézillon, are designated as polyhedral (»*polyédrique*«) or formless (»*informe*«).

The first group of polyhedral or globular cores (»*nucleus polyédrique*« after A. Leroi-Gourhan, 1964 or »*nucleus globuleux*« after A. Cheynier, 1949 and D. de Sonneville-Bordes, 1960) is described by M. Brézillon (1977, 90) as follows. »*Le débitage peut être conduit en exploitant tour à tour toutes les faces du bloc, les surfaces d'enlèvement devenant ensuite plans de frappe*« A total of 30 specimens was found at the Hummerich.

The group of formless (»*nucleus informe*«) cores can be regarded as a variant of the first group and only differs from this in lacking any regularity of form (»*. . . nucleus à éclats ne présentant aucune forme déterminée, d'où les éclats ont été obtenus. . . sans que les enlèvements soient faits régulièrement*« following D. de Sonneville-Bordes, 1960). 24 finds were designated formless cores.

These two connected groups make up 83% of the total of 65 cores. The 11 cores which do not belong to these two groups are represented by a range of types. Five of these contain two specimens (3%) each. Two specimens meet the definition of J. de Heinzelin (1962; quoted in M. Brézillon, 1977, 89) of a »*nucleus à enlèvements isolés*« in which the debitage is limited to the »*enlèvement de quelques éclats isolés sur la périphérie d'un bloc ou plus généralement d'un galet*«. This type of core could grade into the class of formless cores and differs from this mainly by the small amount of modification to a relatively large piece of raw material. Two unifacially worked specimens are designated circular unilateral cores »*nucleus circulaire unilatéral*« with »*éclats enlevés d'un seul coté, l'autre restant la surface originale du bloc ou du galet*« (J. de Heinzelin 1962, quoted in M. Brézillon, 1977, 90).

Another type of core is represented by two specimens worked bifacially into a circular form and desig-

	B	C	D1			D2	D3	E					Stray			Total
	Qz	Qz	Qz	SS	TQ	Qz	Ch	Qz	DQ	TQ	SS	Ch?	Qz	TQ	Po	
Formless	4	2	5	1	1	1		6	1	1		1		1		24
Isolate								2								2
Polyhedral	1	2	19	1	1			1		1	2		2			30
Circular			1						1							2
Disc							1							1		2
Bipolar				1												1
Prepared								1							1	2
Chopping tool			1								1					2
Subtotal	5	4	26	3	2	1	1	10	2	2	3	1	2	2	1	
Total	5	4		31		1	1			18				5		65

Fig. 79 Morphology of the cores from the Plaidter Hummerich.

nated as disc cores. Two artefacts can only be described as chopping tools, being bifacially retouched along one edge. Whether this was the intention and the specimens indeed functioned as tools is unknown. Two further finds are carefully worked following a formal pattern and can be classed as prepared (Levallois) cores. Finally, one unifacial core has been worked from opposing platforms and is classed as a bipolar core.

All five cores assigned to Niveau B are of quartz, four of them formless. These use whole or fragmentary cobbles or angular chunks and in some cases show the negative scars of only one or two flakes removed opportunistically.

The four quartz cores from Niveau C include two specimens each designated as polyhedral and as formless. The polyhedral specimen 34/84-8 also shows battering of the cortex suggestive of use as a hammerstone.

26 (86.9%) of the cores in Niveau D1 are of quartz, most of them of polyhedral (19 = 73%) or formless (5 = 19%) type. One other specimen is described as a circular core and the final piece can be designated typologically as a chopping tool. The formless cores are made on fragments of larger or smaller cobbles and carry one, two or several flake scars. The polyhedral cores form a very heterogeneous group with specimens made recognisably from cobbles and others with no remaining cortex. Certain cores are worked very methodically from several striking platforms whereas others show a preference for one striking platform. One specimen has bifacial removal of flakes from several striking platforms so that the piece can almost be described as a disc core. A number of finds are irregular in shape and grade into the category of formless cores. The size of the cores varies greatly from very small (12grams) to very large (846grams) and the homogeneity of the material is also very variable.

The quartz core 61/72-9 could equally be classed as a chopping tool, although the spatial patterning of the core and two further refitted fragments is difficult to understand if the core itself was indeed the desired final product.

Three cores from Niveau D1 (9.7%) are of siliceous slate and include one specimen each of polyhedral, bipolar and formless type. The unifacial bipolar core 59/117-1 (Fig. 87, 6) is worked using natural cortex surfaces and cleavage planes as the striking platform. Flakes were removed from opposing sides of the same face but the last of these broke off short due to a cleavage plane. 58/65-10 is a small polyhedral core of black lydite with remnant cortex (Fig. 87, 4). It is bifacially worked and one edge is slightly retouched. The two remaining cores from Niveau D1 are formless and polyhedral specimens made on rolled Tertiary quartzite cobbles. The single core from Niveau D2 (58/65-1) is a formless core on a fragment of a flattened quartz cobble with flake negative scars.

One of the most interesting cores is assigned to the small assemblage from Niveau D3. 58/66-1 (Fig. 89, 3) is a bifacially worked flat pebble of fine grained material with a dense cortex which could be a form of chalcedony. Technologically a disc core, the piece might be described typologically as a bifacially retouched scraper.

Of the 18 cores attributed to Niveau E, 10 (55%) are of quartz, a much lower proportion than that found in Niveau D1. The majority (6) of the quartz cores is classed as formless and they occur both as recognisable cobbles and as specimens without cortex. They are in general very carelessly worked and it is sometimes uncertain if all fractures are due to intentional working. There is a degree of overlap between the formless cores and two specimens classed as »*nucleus à enlèvements isolés*« on the definition of J. de Heinzelin (quoted in M. Brézillon, 1977, 89) in which the debitage is limited to the »*enlèvement de quelques éclats isolés sur la périphérie d'un bloc ou plus généralement d'un galet*«. Clearly, the distinction between formless cores and these specimens is fairly arbitrary since all specimens represent cobbles which were worked only cursorily before being discarded.

The two other quartz cores from Niveau E are a small polyhedral core and a prepared core. In contrast to the majority of carelessly worked quartz cores this specimen has been worked bifacially around its circumference and flakes were then removed from the less convex of the two prepared faces. One flake found near the core was refitted. The piece clearly resembles prepared (Levallois) cores of finer-grained materials and it can be assumed that, in this case too, the intention was to obtain flakes of a predetermined shape. This suggests that, despite the normally poor standard of lithic technology shown by most quartz cores, something like a template existed in the mind of the knapper and a more demanding technology could be employed if wished.

Both cores of Devonian quartzite found at the Hummerich are from Niveau E and comprise one formless and one unifacially worked circular specimen. The cortical face of the former shows heavy impact scars and the piece is certainly the broken end of a hammerstone from which at least one small flake was subsequently removed. This may simply represent the opportunistic use of the piece while engaged in a different activity. Three cores of siliceous slate from Niveau E include two of polyhedral type and one specimen which can be regarded as a chopping tool, which is an angular cobble of olive-green siliceous slate worked bifacially to form an irregular edge (Fig. 94, 9). 59/57-5 (Fig. 94, 11) and 59/56-2 (Fig. 94, 10) are small polyhedral cores of olive green siliceous slate. The second find has been flaked from all sides and might almost be termed a disc core. The two cores of Tertiary quartzite in Niveau E are a formless core on an angular chunk and a polyhedral specimen which has been worked from all angles. Finally, a small pebble of fine-grained material (chert or residual flint?) from which at least two flakes have been removed can also be regarded as a formless core.

The five stray finds of cores comprise two polyhedral quartz finds, two cores of Tertiary quartzite and one of porphyry. The Tertiary quartzite is of poor quality with unrolled/poorly rolled cortex (blockfield material?). The first core has mainly natural cleavage planes and only one flake scar is present, but the second is a disc core with several flake scars and has been bifacially worked along one edge, perhaps as a tool.

The very large (1,383 grams) prepared (Levallois) core of porphyry has been worked to give a deep keel and a flatter convex surface from which at least one large flake has been removed. It is interesting that the only two prepared cores at the site should be of a rare material (porphyry) and quartz. The presence of only two prepared cores for a total of 65 specimens shows that even though the technique was clearly known it was rarely used at the site.

Metrical analysis of the cores

The length, breadth and width of cores were measured following their greatest dimensions and irrespective of the orientation of their striking platform(s). The cores vary greatly in size, the three largest quartz cores measuring between 125-129 mm in length and between 96-120 mm in breadth, a size also reached by a single prepared core of porphyry. In the case of both groups of raw material these large cores fall outside the mean range of the maximum length of the cores, which falls between 40-70 mm in the case of quartz and slightly lower for the other materials. The same tendency is present for the breadth of the cores. The highest frequency of both quartz and non-quartz cores falls between 40-49mm but, with the exception of the porphyry specimen, appreciably larger cores (60mm) are only represented by quartz. This difference is almost certainly merely a reflection of the presence of a larger number of bigger quartz cobbles in the available material.

Flakes and chunks of Quartz

In view of the differences in their flaking properties the flakes and chunks of quartz and those of other, fine-grained siliceous raw materials will be treated separately.
The mechanical properties of quartz create a number of special problems for the analysis of the morphology of artefacts of this material. The fracture pattern of quartz mean that it is often impossible to recognise bulbs of percussion. More commonly, an angular cone may be visible on the ventral face of a flake or chunk; however, this feature may equally occur on the residual »core« from which the desired piece was struck. It is often easier to recognise the mechanism of flaking an artefact by the morphology of the striking platform, where crushing and indentation at the point of impact are commonly present on both cores and on flakes/chunks.
Faults in the raw material very often lead to irregular fracture, influencing the length, breadth and thickness of the required artefact. The most obvious result of this is the high ratio of thicker chunks to thinner flakes in the assemblage. In addition, many of the thinner specimens defined as flakes nevertheless differ from flakes of more homogeneous raw materials in their proportion of length to breadth, since numerous flakes have broken prematurely from the core in what would be a hinge fracture in the case of the latter materials.
For all these reasons it was not considered desirable or necessary to closely characterise and describe the morphology of quartz flakes and chunks in the same way as can be done for the smaller assemblage of fine-grained artefacts.
A quantitative analysis of the striking platforms of the quartz artefacts is similarly problematical. A large number of striking platforms consist of cortex but, in the case of numerous other specimens, crushing and/or removal of the striking platform during the knapping process (or by subsequent breakage) leave few diagnostic features which can be examined. It is practically impossible to distinguish intentional facetting or core edge preparation of quartz flakes and chunks from spontaneous fracture and this is not attempted here.

Metrical analysis of flakes and chunks of quartz

Problems in the metrical analysis of the quartz assemblage are caused by the difficulty of distinguishing primary and secondary breakage of artefacts. Secondary fracture of a flake of fine-grained material can usually be recognised, but it is often impossible to differentiate between quartz flakes which have broken during their manufacture and those which may have been broken subsequently (whether deliberately or accidentally). In view of the impossibility of distinguishing primary and secondary breakage the metrical analysis of the Hummerich quartz included all specimens.
Measurements of flakes and chunks were taken relative to the axis of flaking. As described above, quartz chunks were defined subjectively as the thicker of those specimens believed to have been artificially flaked; because of problems of distinguishing dorsal and ventral flake surfaces, a slight overlap with the group of cores cannot be ruled out.
Comparison of the absolute measurements of flakes and chunks showed that the length/breadth ratios of both groups are very similar, the majority of specimens falling between values of 1:1 and 2:1. As might be anticipated, the ratio of breadth to thickness of the two groups is more clearly distinguishable and the group of flakes determined on morphological grounds comprises appreciably more thinner pieces than do the chunks. This is probably to be interpreted as a reflection of the different homogeneity of the raw material. Better fissile quartz cobbles would probably fracture in a more »orthodox« manner to allow

the production of thinner flakes, which would in turn more commonly bear those morphological features (bulbs of percussion, flaking scars etc.) typically associated with fine-grained siliceous materials.

Flakes of fine-grained siliceous materials

The artefacts of fine-grained siliceous materials are more susceptible to a conventional analysis of their morphological and metrical characteristics than were those of quartz. Intact and proximally or terminally preserved specimens can be clearly distinguished. A very small number of longitudinally fractured flakes can be regarded as spontaneous »Siret« fractures and in the case of one Meuse flint flake only the medial part was preserved.
Other technological details can also be recognized. The terminal part of a struck artefact (normally a flake) may either leave the core as a »hinge« fracture, it may remove the foot of the core as a »plunging« flake or do neither of these and is then simply designated »normal«. Irrespective of the state of preservation the artefact may or may not have cortex. The striking platforms of fine-grained materials can also be well characterised and preparation of cores (e. g. »Levallois technique«) can be recognised, unlike in the case of quartz. Details of the striking platform, or butt, which were noted include the type (»cortex«, »smooth«, »facet«), the presence of incipient cones of percussion from previous blows to the core striking platform and the presence/absence of core edge trimming (»dorsal reduction«).
Technological details are summed up for each layer in table form, except for the assemblage of Niveau B which contains only quartz artefacts (Fig. 71). Particularly interesting material is commented upon in more detail.

Niveau C

42/83-15 is an irregular chunk of Cretaceous flint of Rijkholt type with a small remnant of cortex (Fig. 82, 4). The specimen is not retouched but has a battered edge showing the removal of previous flakes from the core edge. This specimen does not necessarily conform to the idea that only finished artefacts and tools were brought to the Hummerich and might easily have been worked from a core at the site.
58/58-15 is an intact flake with hinge fracture of a translucent variety of Cretaceous flint, which resembles Baltic rather than Meuse flint. The striking platform is faceted, but this is because the blow which removed the specimen was struck to a retouched tool edge. The dorsal surface is absolutely flat and the flake was probably struck from the ventral face of a scraper or point (cf. 70/81-7, Fig. 94, 3) and thus demonstrates tool modification at the site.

Niveau D1

– Devonian quartzite
22 of the total of 26 diagnostic flakes (84.6%) of Devonian quartzite from Niveau D1 are intact, while two specimens each (7.7%) are terminal and proximal fragments. 18 of the 24 terminal ends (75%) are detached »normally« from the core, two (8.3%) are hinge fractures and four (16.7%) are plunging (»*outrepassé*«) flakes (= »*Kernfüße*«). 10 of the 24 striking platforms (41.7%) are cortex and the same number is unfaceted. Three of the remaining specimens are certainly faceted and one questionably so. Only one striking platform (4,2%) has an incipient cone of percussion from a previous attempt at flake removal (»*Schlagauge*«). One proximal dorsal face has possible traces of core-edge trimming (dorsal reduction). Of the 26 flakes, 20 (77%) have remaining cortex on the dorsal face (e. g. Fig. 87: 9, 11, 14), although others have been intensively worked, removing all cortex (Fig. 87: 12, 13).

– Tertiary quartzite
6 of the 9 diagnostic flakes of Tertiary quartzite in Niveau D1 are intact (66,7%) and three are terminal

fragments. One of these (11%) is a hinge fracture, 3 (33.3%) are plunging flakes and the remaining specimens are »normal«. 4 of the 6 striking platforms are unfaceted while one specimen each (16,7%) is faceted or on cortex. No specimen shows proximal preparation of the dorsal face or incipient cones of percussion. 4 of the 9 specimens (44.4%) have cortex remaining on the dorsal face.
51/84-7 is a flat and thin hinge flake with a prepared (faceted) striking platform (Fig. 87, 8). The dorsal face has negatives of previous flakes, one of which was struck from the same striking platform as this one and the specimen is clearly a flake from a prepared (Levallois) core. By contrast, 75/75-4 is a simple broad flake struck without any preparation from the edge of a cobble (Fig. 87, 10).

– Siliceous slate
All four diagnostic flakes of siliceous slate are intact specimens and all of them are »normal« flakes (i. e. not plunging or hinge fractures). Two of the striking platforms are cortical, while one each are faceted and unfaceted. There are no incipient cones of percussion and the proximal dorsal faces have not been prepared. Two flakes have dorsal cortex; 58/82-4 is part of a cobble (Fig. 87, 5) and is probably artificially struck although clear features of flaking are not present. Secondary modification of the piece removes the evidence for primary debitage of a large flake of black siliceous slate (*Tonschiefer*) (71/73-1, Fig. 87, 7), but the ventral face is very uneven, perhaps suggesting that the flake was struck with a great deal of force.

– Chert/chalcedony
Three of the six flakes of chert/chalcedony in Niveau D1 are intact, two are terminal fragments and one is a proximal specimen. All of the five diagnostic flakes are »normal« removals and all four striking platforms are unfaceted, without incipient cones of percussion or dorsal reduction. Three of the six specimens have dorsal cortex.

– Cretaceous (Meuse) flint
Only three of the ten flakes of Cretaceous flint from Niveau D1 are intact; six are proximal fragments and one is a terminal end. Three of the four diagnostic flakes are hinge fractures, the fourth is a »normal« flake removal. Two of the nine striking platforms (22.2%) are faceted and the remaining seven are unfaceted; there are no cortical striking platforms. One striking platform (11.1%) has an incipient cone of percussion, the dorsal face of one striking platform has been prepared and this might be true of two further specimens. Only one of the ten flakes has cortex.
A flat flake of Cretaceous flint of Rijkholt type 58/117-1 terminates in a hinge fracture (Fig. 87, 2). The striking platform is faceted and at a very acute angle to the flake ventral surface, and the piece was certainly struck either from a bifacial tool or a prepared disc-like core. The dorsal face of a distally broken flake of Cretaceous flint of Rijkholt type 64/73-12 is covered by very shallow scars of previous flake removals. The butt is faceted with very similar scars and the piece can certainly also be regarded as deriving from the modification (resharpening/thinning ?) of a bifacial tool.
67/78-4 is an elongated flake (Fig. 87, 1) with sub-parallel dorsal negatives of previous flakes struck in bipolar fashion from opposing ends of the core. Another dorsal negative at a right angle to the axis of the flake might suggest that the parallel orientation of the other negative scars is merely opportunistic and not evidence for deliberate blade production. The butt has two clear cones of percussion, showing that more than one blow was required to detach the flake. The bulb of percussion is very flat and may indicate use of a soft hammer.

– Baltic (?) flint
72/73-15 is a proximal fragment of a flake of pale grey, translucent flint which removes part of the ventral surface of a convex scraper, using the retouch as the striking platform (Fig. 87, 3).

Niveau D2

– Devonian quartzite
All three flakes of Devonian quartzite in Niveau D2 are normal removals and have cortical butts and dorsal cortex. No specimen bears incipient cones of percussion although one flake shows possible preparation of the proximal dorsal face.

– Tertiary quartzite
51/87-18 is a short squat flake (Fig. 89, 5) with one clear dorsal scar of a flake struck from the same direction. The large striking platform has a small flake scar but this cannot be described as facetting.

Niveau D3

– Devonian quartzite
Both diagnostic finds of Devonian quartzite from Niveau D3 are the terminal ends of small flakes detached »normally« from the core. One has cortex whereas the other is without.

– Tertiary quartzite
51/84-2 is an elongated flake of non-homogeneous Tertiary quartzite. The dorsal face shows that at least one previous long flake was struck from the same striking platform (Fig. 89, 4). The striking platform is unfaceted and the flake is without cortex.

Niveau E

– Devonian quartzite
Of the 19 diagnostic Devonian quartzite flakes from Niveau E, 8 (42,1%) are intact. There are 6 proximal fragments (31,6%), 2 (10,5%) terminal specimens and 1 medial fragment (5,3%). The remaining two flakes (10,5%) are longitudinally fractured Siret breaks. 8 of the 12 diagnostic flakes (66,7%) are detached normally from the core, 3 (25%) are plunging flakes and 1 (8,3%) terminates in a hinge fracture. Of the 16 preserved striking platforms, 8 (50%) are cortex and 6 (37,5%) are unfaceted. Of the remaining two specimens one is certainly and one possibly faceted. No specimen has incipient cones of percussion or trimming of the dorsal face. 17 of the 19 flakes (89,5%) have remaining cortex, e. g. the large cortex flake 80/81-1 (Fig. 95, 4).
Steep dorsal retouch removes the terminal end of flake 62/70-3 (Fig. 95, 7) which still retains cortex. Ventral retouch of the artefact partly removes the proximal end of the piece but the remaining part of the butt suggests that it may have been faceted. 80/80-2 and 80/80-3 refit to form a large flake (Fig. 95, 8), the terminal end of which removes the opposite side of the cobble core. The dorsal face has negatives of flake removals from several directions. 74/78-3 is a flake split longitudinally by a Siret fracture (Fig. 95, 5). The large flake 73/80-1 (Fig. 95, 9) was clearly struck from an intensively worked core and has no cortex. The dorsal face shows negatives from flakes struck from several directions and the terminal end of the flake removes a core edge of a striking platform at 90° to the axis of this flake showing that the core was polyhedral. 81/80-12 is a flake struck from a prepared core (Fig. 95, 6). The dorsal face shows negatives of flakes removed by blows from around the core which can perhaps be regarded as preparation flakes. Two of these have left clear impact scars and this flake broke along the axis of one of these when it was struck. The very thick butt has been intensively faceted but a small area of cortex remains adjacent to this.

– Tertiary quartzite
Of the 8 diagnostic flakes of Tertiary quartzite in Niveau E, 4 specimens are intact and 4 are proximal fragments. 3 of the 4 intact specimens are detached »normally« from the core, the fourth is a plunging

flake. 4 of the 8 striking platforms are faceted and 4 are unfaceted. Two specimens have incipient cones of percussion and two show trimming of the dorsal face.
57/77-2 is the proximal part of a classic flake from a prepared core (Fig. 95, 1). Flat dorsal negatives show that the core was prepared by the removal of flakes by blows from different sides and the striking platform of the flake shows careful facetting. 80/75-2 is an irregular broad flake (Fig. 95, 3). Dorsal retouch of the proximal edge may be from core preparation and not secondary modification. The butt of a small flake 81/80-18 (Fig. 93, 11) has two facets which may be due to preparing the striking platform. Similarly, small flakes removed from the proximal dorsal face may represent another aspect of core preparation.
59/57-4 is a flake retouched to a convergent side scraper (Fig. 95, 2). This obscures technological details but the find has a major thermal fracture (refitted to the specimen), probably due to cold rather than heat.
60/74-1 (Fig. 93, 13), 80/80-14 (Fig. 93, 12) and Streu 301 form part of a refitted sequence of elongated flakes which allowed the »reconstruction« of a further, unrecovered element by making a plaster cast of the hollow left between the flakes. The knapper used an angle at one edge of the core formed by the junction of a dorsal flake scar and a natural cortex surface to guide the removal of the flakes. The first of the flakes to be produced in the sequence was 60/74-1 (Fig. 93, 13), but before this was struck, at least two unsuccessful attempts to remove flakes using the same striking platform had resulted in hinge fractures. Perhaps because of this, the knapper at this point re-prepared the core by carefully facetting the striking platform. The second flake removed was the one not recovered during excavation. This again took advantage of the ridge between the negative left by the removal of 60/74-1 and the natural cortex. The third flake removed was 80/80-14 (Fig. 93, 12), which was struck from the opposite edge of the core and retains the faceted butt from core preparation. The last flake of the sequence is Streu 301, the butt of which is not faceted.

– Siliceous oolite and siliceous slate
Of five considered flakes of siliceous slate and oolite in Niveau E, 3 are intact and 2 are proximal fragments. 2 of the 3 intact specimens are detached »normally«, the third is a plunging flake. One striking platform is faceted, the other 4 are unfaceted. No striking platform has incipient cones of percussion, but two proximal ends show possible trimming of the dorsal face. 4 of the five specimens have remains of cortex.
81/80-1 is a broad and thick flake of a fine-grained siliceous material (Fig. 94, 7) which is macroscopically identical with siliceous oolite from the late Palaeolithic site of Andernach. A small area of cortex remains. The striking platform has a small facet and the adjacent dorsal face has been finely flaked, possibly also as core preparation. 58/58-1 is a flake of olive-green/grey siliceous slate struck from an angular cobble (Fig. 94, 8). Dorsal scars, one of them from a hinge fracture, remove much of the cortex. The flake itself is *»outrepassé«*. 74/80-3 is part of a flat flake of black siliceous slate (Fig. 94, 12). The terminal end is partly broken off along a natural fault in the material. The dorsal face close to the butt has small negatives, possibly due to preparing the core. The specimen is reddened and possibly burnt. 78/79-1 is a chunk struck from an angular cobble of dark-grey/black siliceous slate (Fig. 94, 13). Minor flakes and battering of the dorsal cortex surface may represent earlier attempts to detach flakes from the cobble.

– Cretaceous (Meuse) flint
Of the 10 flakes of Cretaceous flint in Niveau E, 5 are intact, 2 are proximal fragments and 3 are medial specimens. 2 of the 5 diagnostic specimens terminate in hinge fractures and 3 are »normally« detached flakes. Of 7 preserved striking platforms, 6 (85, 7%) are unfaceted and one is possibly intentionally faceted. One specimen has an incipient cone of percussion and 2 (28,6%) have possible preparation of the dorsal face. One flake has cortex and a second has an area of possible cortex, but 8 specimens (80%) have no cortex.
70/81-7 is a flake of dark grey Cretaceous flint of Rijkholt type (Fig. 94,3). All details of the primary

debitage are removed by retouch. 74/80-1 is a very thick flake of white, heavily patinated flint struck from the edge of an angular block (Fig. 94,1). There is a small area of preserved cortex on the dorsal face and some recent damage to the artefact. The dorsal face close to the striking platform is battered and has stepped flake scars. These are probably due to an unsuccessful attempt to detach a flake rather than to deliberate core edge preparation. 80/80-6 is a thick flake of pale grey Cretaceous flint of Rijkholt type which has been frost-shattered (Fig. 94,4). All details of the primary debitage are removed by this and by retouch. 81/78-5 is a flake of medium grey Cretaceous flint of Rijkholt type (Fig. 94,2). It is broken off terminally and the proximal end is removed by two flake removals from the ventral face.

– Cretaceous flint and chert or »local« residual flint
A total of 11 diagnostic specimens of flint and/or chert are present in Niveau E, of which 3 (27,3%) are intact. One (9,1%) is a proximal fragment and 2 (18, 2%) are terminal fragments, while 5 (45, 4%) are medial sections of flakes. Two flakes each (40%) terminate either »normally« or as hinge fractures, while the remaining specimen is a plunging flake. Three of the 4 preserved butts are unmodified and one is faceted; there is possible preparation of one dorsal face of a striking platform. In a clear difference to the Meuse flint artefacts, 10 of the 11 present specimens (90, 1%) have remains of cortex (at most 20% for Meuse flint), probably suggesting a very different origin or *chaîne opératoire* for the two classes of raw material.
74/78-4 is a cortex flake of either gravel or eluvial flint (Fig. 94, 6), which might be of local origin. 74/80-8 is a retouched flake of orange-brown translucent flint (Fig. 94, 5) which resembles Grand-Pressigny flint but has a different cortex than the latter, the small area of cortex on the Hummerich specimen being thin, white and porcellaneous. The primary debitage of the specimen is unclear both because the flake seems to have detached from the core in a quite irregular way and because it has been intensively secondarily retouched.

Stray and unstratified finds

– Devonian quartzite
Eight (57,1%) of the total of 14 stray and unstratified diagnostic flakes of Devonian quartzite are intact, and 2 each (14,3%) are proximal, medial or Siret fragments. 8 of 10 specimens are detached normally (»feathered«) and 2 are plunging flakes. 9 of 12 preserved butts are cortex and only 3 (25%) are smooth. No butts have impact scars from previous attempts at flake removals and only one has possibly been dorsally prepared. 10 specimens (71.4%) have remains of cortex, e. g. Streu 300, a flake of homogeneous quartzite struck from a natural corner of an angular cobble (Fig. 97, 9). The butt is also cortical and the terminal end of the flake removes the cortex of the opposite side of the cobble.

– Cretaceous (Meuse) flint
Two flakes (33.3%) of Meuse flint are intact, while one is a proximal and three are medial specimens. One of the two intact specimens appears to be a thermal (frost) fracture, rather than an artificial flake, the other is detached »normally« from the core. One butt each is faceted and unfaceted; neither have impact scars, but the dorsal face of one has been reduced. 3 of the 6 specimens have remains of cortex. Streu 46 is an irregular flake of pale grey patinated flint, possibly of Rijkholt type (Fig. 97, 7). The dorsal face has negative scars of flakes struck from around the circumference of the piece and remains of similar scars on the ventral face suggest that the piece was originally a flat disc core or a bifacial tool. Features of the ventral face suggest that the flake is frost-fractured and not intentionally struck. Streu 150, a flake of medium-grey of Rijkholt type (Fig. 97, 4) was clearly struck from a prepared core and has a dorsal negative of a previous flake removal from the same striking platform. Minor flake scars are probably to be interpreted as core edge preparation of the dorsal face but the butt itself is not faceted.

– Chert (?)

The raw material of Streu 57, a thick, naturally pointed flake (Fig. 97, 6), is not certain but could be chert or local relict flint. It is not homogeneous and consists of a coarse, almost quartzitic and a fine-grained, flint-like part.

Metrical analysis of the fine-grained silices

Metrical analysis of the flakes of fine-grained materials only took into account the intact specimens, grouping these together by raw material irrespective of layer.

The mean length of the non-quartz flakes is appreciably above that of the quartz specimens although since measurements of all quartz flakes were taken into account (for reasons described above) the inclusion of a number of broken specimens will lower the overall values for this material. The breadth of flakes of quartz and non-quartz does not show any appreciable differences.

The ratio of length: breadth of the majority of the 79 intact flakes of non-quartz siliceous materials falls between 1:1 and 2:1, with a smaller number of finds lying below this (i. e. they are broader than they are long) and only three specimens (of different materials) exceeding a ratio of 2:1. The small number of intact specimens makes it difficult to recognise any patterning due to the properties of the different raw materials, but the siliceous slate flakes are normally smaller and less elongate than the majority of specimens, whereas four of the thirteen flakes of Tertiary quartzite are more elongate than average, with a length/breadth ratio of 2:1. A number of flakes of Devonian quartzite behave in a similar fashion, although only one specimen exceeds a ratio of 2:1. Flakes of Meuse flint are generally of small dimensions and often squat in form (a number of flakes terminate in hinge fractures). This possibly reflects that they could be resharpening flakes from tools brought to the site rather than primary debitage. Plotting breadth against thickness reveals a clear bipartite division into one group containing both types of quartzite and Meuse flint, in which the ratio breadth to thickness falls around 3:1, and the group of other materials in which the ratio of breadth to thickness falls around 1:1 or only slightly higher. Within the first group, the flakes of Tertiary quartzite and the Meuse flint are normally both relatively and absolutely thinner than those of Devonian quartzite. Within the second group, flakes of chert/chalcedony are proportionally thinner than those of siliceous slate. This pattern apparently identifies the fracture properties of the different raw materials quite well.

A few features beyond those pointed out in the comparison of the flakes alone can be recognised. The dimensions of the cores almost always exceed those of the flakes of the same raw material. This might be interpreted as showing that cores were not normally exhaustively »worked out« and that they could still have been exploited for their material. There are some exceptions to this phenomenon. In the case of Devonian quartzite, in particular, the dimensions of the two cores fall within (and indeed at the lower extreme) of the range of values for the flakes.

Cores of Tertiary quartzite are on average larger than those of siliceous slate, which is probably simply a reflection of the size of the raw materials available. The dimensions of unworked cobbles of these materials and also of Devonian quartzite lie at the upper end of or above those of the respective worked material, possibly suggesting that they represent a potential raw material reserve or at least reflect the original size of material brought to the site. The relative proportions of the cores of different raw materials fall within a broadly similar range, whereby two cores of Tertiary quartzite are more nearly spheroid/polyhedral and two cores of chert/chalcedony are clearly more flattened compared to the other cores. The latter feature probably simply reflects the shape of the raw material (flattened cobbles) since although one specimen is intensively worked and can be described as a disc core, the other has only two flake removals. Pebbles of this type of raw material may be derived from originally tabular beds of siliceous material (chert/chalcedony), whereas other cores use more symmetrical material such as sub-spherical cobbles (Devonian/Tertiary quartzite), angular cobbles (siliceous slate) or angular blocks (Tertiary quartzite).

Comparison of technology with other sites

A problem in the evaluation of the Hummerich lithic assemblage is caused by the dominance of quartz as a raw material and the rarity of published studies of comparable industries or of studies of quartz technology in a Palaeolithic context. From the point of view of technological attributes, F. P. Dickson (1977) describes the use of quartz and the flaking properties of this material in a different context, but this analysis is of only limited relevance for the Hummerich.

Industries characterised by quartz are known from the Central Rhineland but have, with exceptions (e. g. E. Lipinski 1986), tended to be ignored. At Rockeskyll in the central Eifel a surface collection of more than 10,000 finds (including a small number of potsherds and postglacial artefacts) was dominated by quartz artefacts and a very few specimens of Cretaceous flint. Some 5% of the quartz artefacts were retouched, whereas most of the flint is in the form of finished tools, and the quartz tool spectrum is dominated by scrapers (E. Lipinski 1986, 230-231). There are very clear similarities with the Hummerich here, and while the integrity of the Rockeskyll surface collection is uncertain, the depth of time represented by the stratified Hummerich assemblage is also vague.

The quartz assemblage of a mainly Saalian site at La Cotte de Saint Brelade on the Channel Island Jersey (P. Callow 1986a; P. Callow & J. M. Cornford 1986) is to some extent chronologically (and more generally »culturally«) of relevance to the Hummerich assemblage. Here a succession of assemblages contained from as little as 0.3% (Weichselian layer 11) to 45.3% (Eemian? layer 6) and 40.7% (Saalian layer 5) quartz (P. Callow 1986b, 203). Differences in the relative importance of quartz within the industry are attributed to fluctuating sea-levels and corresponding accessibility of lithic raw material sources. At La Cotte the nine Saalian layers contained an assemblage of 11,929 pieces of quartz, the majority of which (in the different layers from 83.5%-92.2%, mean = 89.8%) was classed as waste, a category which included splinters, chunks and unmodified flakes. These are treated rather cursorily »... *In view of the problems the material presents these were not included in the further analysis. Such technological and typological observations as can be made are therefore based on the cores and the tools.*« (F. Hivernel 1986, 315).

The French site of La Borde (Lot) has a lithic assemblage with a particularly high proportion of quartz artefacts (J. Jaubert *et al.* 1990; J. Jaubert 1993). This is interpreted as a chronologically determined phenomenenon and, with reservations, it is believed that it is possible to identify a »... *premier groupe de séries, d'âge anté-würmienne, où le quartz ne serait relayé que par une infime proportion de silex (< 5%)... cet ensemble pourrait être rattaché à un Paléolithique moyen ancien...*«. (J. Jaubert *et al.* 1990, 120). While this chronological argument cannot be applied to the Hummerich, which is clearly a younger site, La Borde nevertheless offers an interesting possibility for comparison with a site where quartz is proportionally even more important (96.23%, J. Jaubert *et al.* 1990, Tabl. I) than at the Hummerich (84.9% of the 1, 661 finds of fine-grained lithic materials). The 170 smaller »pebbles« at the Hummerich will be ignored in the following comparison since they probably have no equivalent in the La Borde assemblage (J. Jaubert *et al.* 1990, Tabl. II). At the French site 220 (8.12%) specimens are classed as cores or pebble tools (Hummerich = 3.9%). 1, 042 specimens of the La Borde quartz assemblage are described as »*enlèvements*« and 178 finds are »*outils sur éclat*«. If these are classed together as being the equivalent of »flakes« at the Hummerich they form 45.05% (Hummerich = 34.4%). Similarly, 201 specimens of »*débris, cassons, esquilles < 2cm*« and 1,043 »*fragments de galets > 2cm*« can be equated with the classes »chunks« and »fragments« at the Hummerich and their frequencies compared. At La Borde this material form 45.95% of the total, while at the Hummerich the non-«flake« debitage and possible debitage forms 58.4% of the total recovered quartz. Finally, the unmodified categories (»*galets entiers*«, »*non taillés, naturels*«) form 0.88% of the La Borde quartz assemblage and the 41 quartz »cobbles« at the Hummerich account for 3.3% of the total.

The differences between the proportions of the artefact classes »flakes«, »chunks« and »fragments«are possibly influenced by the definitions of the different analysts at La Borde and the Hummerich. Alternatively, the mode of fracture of the type of quartz used at the two sites might be different; if the Hummerich material is less homogeneous fewer specimens will be recognisable as flakes. Nevertheless, despite these problems of comparability, there are clearly more cores at the French site while more unmodified cobbles were recorded at the German site.

At a general level it can be established that there is a broad correspondence at all three sites between the proportion of cores and retouched specimens on the one hand and the unmodified waste (flakes and chunks) on the other. For La Borde and the Hummerich, the relative proportion was calculated on the basis of fractured material only (i. e. excluding the unmodified cobbles), the value for La Cotte is that given as »waste«. In the case of the Hummerich the proportion was calculated twice; the second figure also takes into account those artefacts which are only possibly retouched.

At La Cotte the 296 quartz cores form 2.5% of the quartz assemblage, while at the Hummerich 3.4% (48 specimens) of the quartz industry is represented by cores. 54.8% of the La Cotte cores are described as »shapeless«, a figure which can be compared with 41.6% (20 of the total of 48) quartz cores at the Hummerich (classed here as »formless« or »isolate«) and 50.9% at La Borde (»*informes, ébauches*«). At La Cotte 21.4% of the cores are described as »discoidal« and 16.7% as »globular«. Their combined value of 38.1% is perhaps most closely equivalent to the 52.1% (25) »polyhedral« cores at the Hummerich (56.25% if one specimen each of a »circular« and a »prepared« core are also included in this group). At La Borde 14.37% of the cores are »*discoïdes*« and 33.53% »*globuleux*« or »*polyédriques*«. Their combined total of 47.9% falls between that of the British site and the Hummerich. The balance of the cores at La Cotte comprises »prismatic« (1.7%), »pyramidal« (1.75%) and »miscellaneous« (4.8%) types; the latter of which might be equated at the Hummerich with one specimen which can equally be designated a chopping tool. Two specimens (1.19%) at La Borde are also »*prismatique*«.

Evidence of the technology for the chronological position of the assemblage

The dating of the Hummerich assemblage to the first part of the Weichselian is not in question. In recent years it has been recognised that a number of north-western European sites dated to the early last glaciation are characterised by assemblages containing laminar debitage and a true blade technology of »Upper Palaeolithic« type. Such sites are known from northern France (Seclin: A. Tuffreau *et al.* 1985; Riencourt-lès-Bapaume: A. Tuffreau, N. Ameloot-van der Heijden & T. Ducroq 1991; N. Ameloot-van der Heijden 1993; Saint-Germain-des-Vaux: D. Cliquet 1992) and also from Belgium (Rocourt: M. Otte, E. Boëda & P. Haesaerts 1990), but are also found closer to the Hummerich in Germany and in the Rhineland itself. The unexpected existence of laminar debitage in an unquestionably Middle Palaeolithic context was indeed first described in the B1 (»*Westwand-Komplex*«) at Rheindahlen, close to Mönchengladbach (G. Bosinski *et al.* 1966; H. Thieme 1978, 1983, 1990; J. Thissen 1986, 1988). A second German site with a similar industry was uncovered by lava quarrying in the Neuwied Basin at the site Tönchesberg 2b (N. J. Conard 1990, 1991; 1992). There has been much discussion of these Middle Palaeolithic assemblages with laminar debitage (N. J. Conard 1990, 1991; M. Otte 1991b; A. Ronen 1992; S. Révillion 1993) and of their relationship to the development of Upper Palaeolithic technology but their main relevance in the present context is the fact that, at all sites, they are stratigraphically dated to the early glaciation. Nothing similar to these blade assemblages is recognisable at the Hummerich and their absence here, when they are found at the neighbouring Tönchesberg, where the industry is dated by stratigraphy and palaeomagnetism to the base of the early Weichselian interstadial complex, is a possible indication that the occupation of the Hummerich should be dated to later in the glaciation than at the former site. Good confirmation of this interpretation is found at Riencourt where blade industries are found stratified between a Saalian industry of Ferrassie Mousterian type and an horizon containing artefacts with Micoquian affinities (A. Tuffreau 1992). This will be returned to below.

RETOUCHED TOOLS

Spectrum of tool types and spatial distribution

The retouched pieces are discussed arranged by layer and by raw material. Scrapers form the commonest class of definable retouched artefacts at the Hummerich and the largest group is formed by those of quartz. Other typologically defined groups are rare and the quantification of the secondarily modified lithic assemblage is complicated by the presence of numerous »unorthodox« retouched specimens, particularly of quartz. The categories of tools recognised were »scraper«, »point«, »biface«, »retouch«, and »possible retouch«. A number of the retouched forms is discussed in detail and illustrated.

Retouched artefacts in Niveau B

Only two of the total of 18 quartz artefacts in Niveau B show secondary modification (Fig. 80). 75/78-12 is a chunk which has been retouched for some 15 mm along one edge to form a scraper. 70/81-12 is also a retouched chunk but in this case the secondary modification is limited to the removal of two or three marginal flakes (Fig. 82, 1). Both the scraper and the second retouched flake were found in the main, eastern part of the excavation.

	scraper	retouch	total
QZ	1	1	2
TOT	1	1	2

Fig. 80 Niveau B. Tool type and raw material of single lithic finds of retouched artefacts.

Retouched artefacts in Niveau C

Perhaps surprisingly, only 50% of the retouched specimens from Niveau C are quartz (Fig. 81), the balance being made up by one specimen each of three fine-grained siliceous rocks. Half of the tools are scrapers, one of quartz and the other two of siliceous slate and Meuse flint.

A quartz flake 40/82-7 (Fig. 82, 2) is bifacially retouched (albeit irregularly) and might be seen to fit the definition of a *»Keilmesser«* (*Bocksteinmesser*) – *»annähernd gerade, beidflächig retuschierte Schneide und einen geraden oder geknickten Rücken«* (G. Bosinski 1967, 29). An overall morphological resemblance is certainly present but the lack of clear flake scars makes it impossible to demonstrate a deliberate intention to produce an artefact of this form.

42/82-16 is a large quartz chunk with removed flakes (Fig. 82, 3), one side of which is almost entirely natural (cortex and natural cleavage plane). A cortex flake of siliceous slate 38/84-6 was retouched laterally and terminally to form an angle and an oblique edge and can be described as a scraper (Fig. 82, 6). Finally, a medial fragment of a flake of patinated Cretaceous (Meuse) flint 43/82-13 has been finely retouched laterally to form a scraper (Fig. 82, 5).

	scraper	point	biface	retouch	total
QZ	1		1	1	3
TQT				1	1
LYD	1				1
MFL	1				1
TOT	3		1	2	6

Fig. 81 Niveau C. Tool type and raw material of single lithic finds of retouched artefacts.

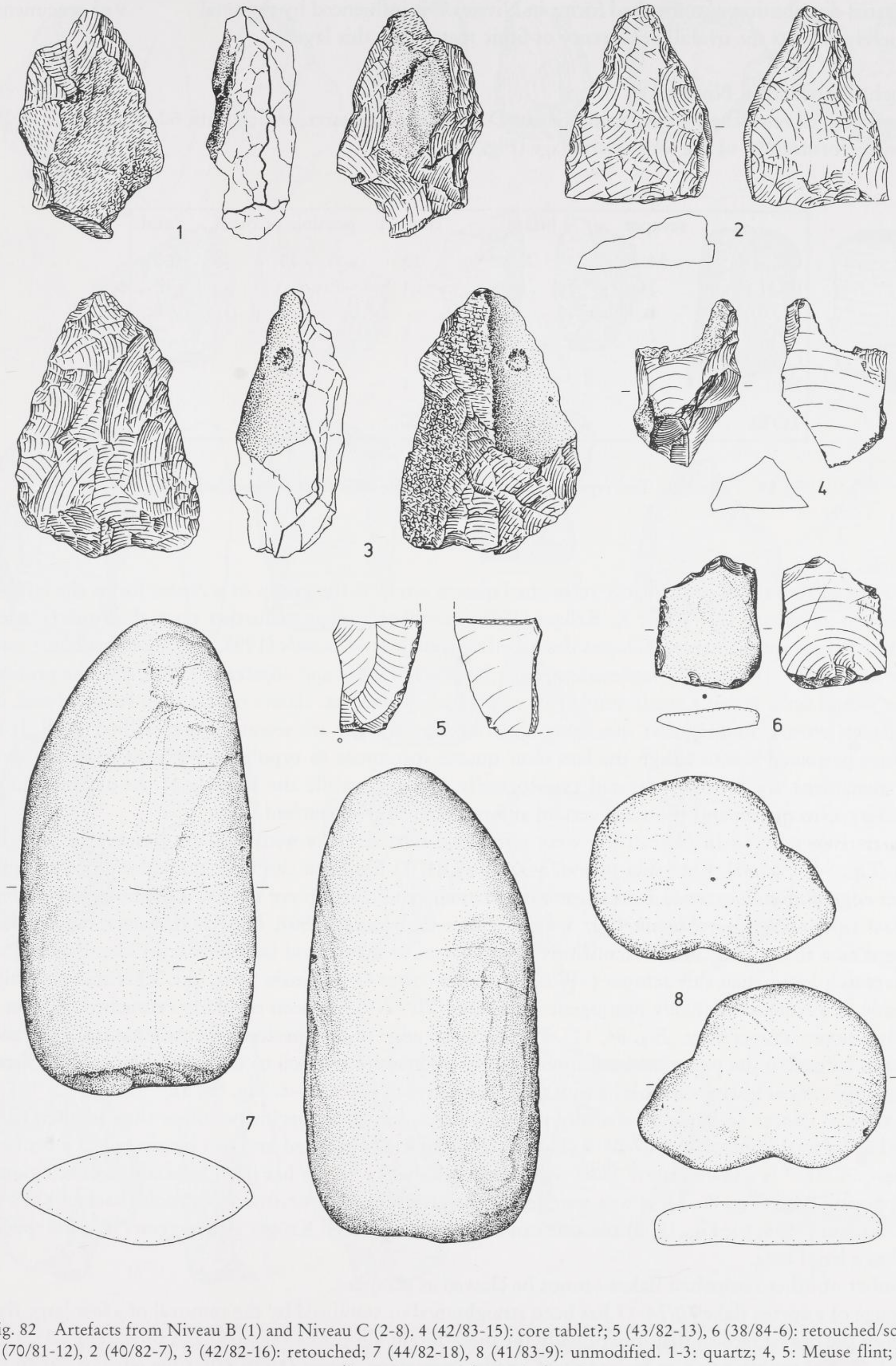


Fig. 82 Artefacts from Niveau B (1) and Niveau C (2-8). 4 (42/83-15): core tablet?; 5 (43/82-13), 6 (38/84-6): retouched/scraper; 1 (70/81-12), 2 (40/82-7), 3 (42/82-16): retouched; 7 (44/82-18), 8 (41/83-9): unmodified. 1-3: quartz; 4, 5: Meuse flint; 6: lydite; 7, 8: graywacke. – Scale 2:3.

The spatial distribution of retouched forms in Niveau C is influenced by the small number of specimens and merely reflects the overall occurrence of lithic material in this layer.

Retouched artefacts in Niveau D1

The majority of retouched artefacts in Niveau D1 is made of quartz, which with 60 of the total of 75 specimens forms 80% of the tool assemblage (Fig. 83).

	scraper	biface	retouch	possible retouch	total
QZ	34	2	13	11	60
DQT	3		4		7
TQT	1				1
LYD	2		1		3
CH/CH			1		1
MFL	1		1		2
TOT	41	2	20	11	74

Fig. 83 Niveau D1. Tool type and raw material of single lithic finds of retouched artefacts.

– Quartz

With 34 of 60 retouched or probably retouched quartz artefacts the group of scrapers forms the largest component in Niveau D1. While K. Kröger (1995) describes a range of further retouched quartz artefacts and assigns them to several classes described variously as »*Fäustel*« (1995, 59), »*faustkeilblatt- und blattartige*« forms (1995, 60), »*keilmesserartige*« forms (1995, 60) and »*Spitzen*« (1995, 63), the present author would only assign a small number of retouched artefacts to classes others than scrapers and, in some cases, would disagree that specimens described by Kröger are secondarily modified at all. It is therefore preferred not to assign the less clear quartz specimens to typological groups and only two other specimens are formally defined typologically (bifaces), while the balance of the assemblage is formed by a heterogeneous group of certain and possible edge-retouched finds.

29 quartz flakes found in Niveau D1 were retouched into scrapers with convex, concave or straight edges (Fig. 84; Fig. 85). One side of 69/73-17 (Fig. 84, 7) has been carefully retouched to a straight scraper edge. Retouch extends around onto the terminal end of the piece so that it might be designated an offset side scraper *(»rechtwinkeliger Schaber«* after G. Bosinski 1967, Taf. X). However, the opposite lateral face shows less careful retouch from the dorsal to the ventral face so that an identification as an alternately retouched side scraper (»*Wechselschaber*« after G. Bosinski 1967, Taf. X) is also possible. One side of a flake of relatively homogeneous quartz (70/71-9) has been regularly retouched to form a slightly convex scraper edge (Fig. 84, 11). The opposite edge of the specimen forms a natural back and the terminal end of the piece has been intentionally thinned by retouch to the ventral face. In all these features, the piece clearly resembles a flint tool from Niveau E (74/80-8: Fig. 94, 5).

A number of quartz artefacts is bifacially retouched but only two specimens (other than scrapers) are classed as bifacial implements. 67/81-9 (Fig. 86, 2) is bifacially worked and can be classed as a broken »biface«. 72/75-7 is a thick quartz flake with a natural »back« which has been bifacially worked along the opposing edge (Fig. 86, 5). It was assigned to the group of »*keilmesserartige*« tools (backed knives) by K. Kröger (1995, 61; Fig. 18, 2) and this can be upheld, although Kröger also suggests that the specimen has a basal tang.

A number of other retouched flakes cannot be classed as scrapers.

One edge of a cortex flake 70/74-11 has been straightened or stabilised by the removal of a few large flakes from the dorsal face so that functionally the piece might almost be regarded as a biface (Fig. 85, 11). Indeed, K. Kröger assigns it to his group of »*keilmesserartige*« forms (1995, 60). One edge of 72/72-12

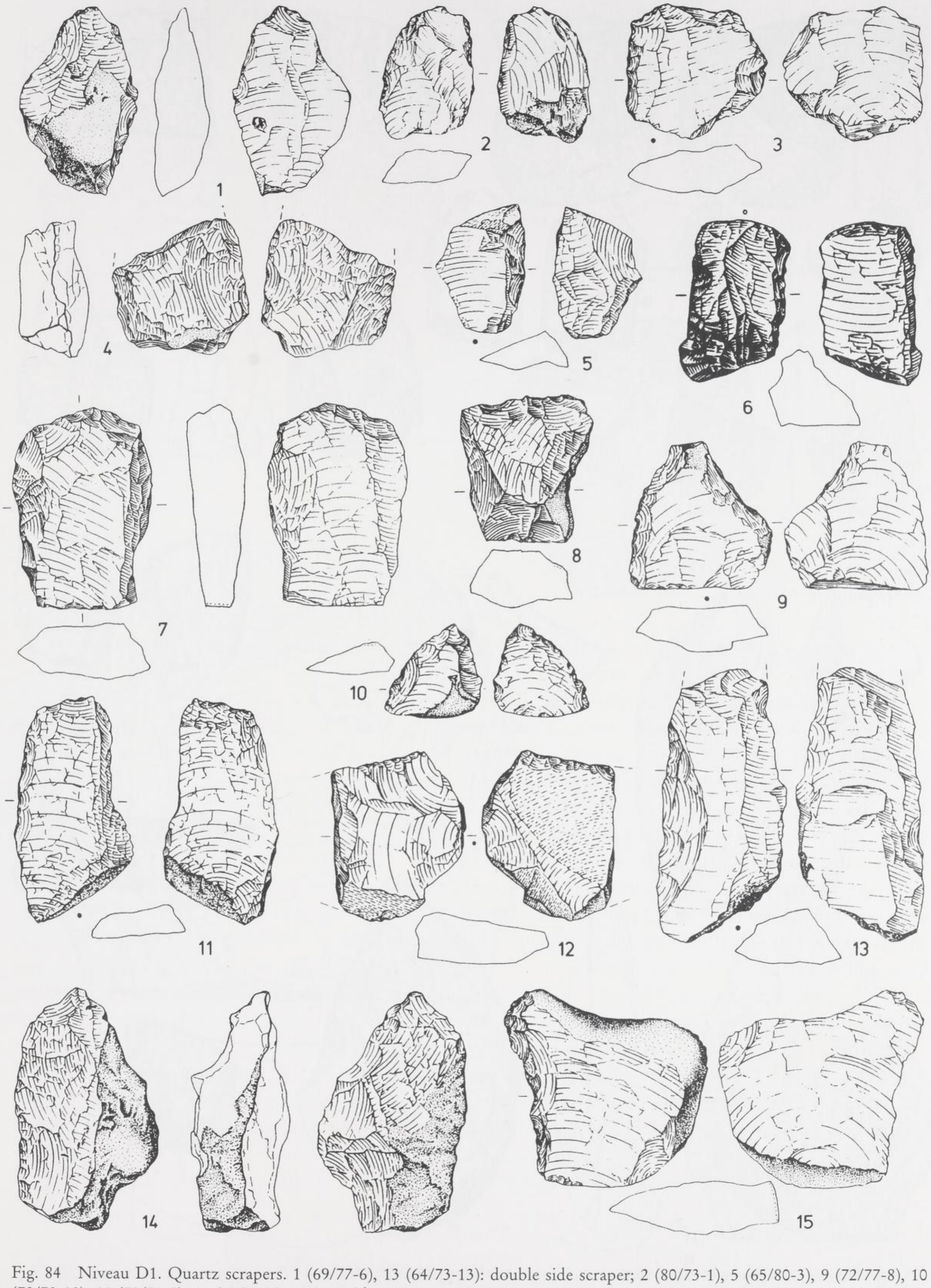


Fig. 84 Niveau D1. Quartz scrapers. 1 (69/77-6), 13 (64/73-13): double side scraper; 2 (80/73-1), 5 (65/80-3), 9 (72/77-8), 10 (72/72-12), 11 (70/71-9), 14 (62/80-6): convex side scraper; 3 (77/75-7), 6(70/72-10), 7 (69/73-17), 8 (69/71-11), 12 (72/73-16): straight side scraper; 4 (59/80-14), 15 (63/75-4): concave side scraper. – Scale 2:3.

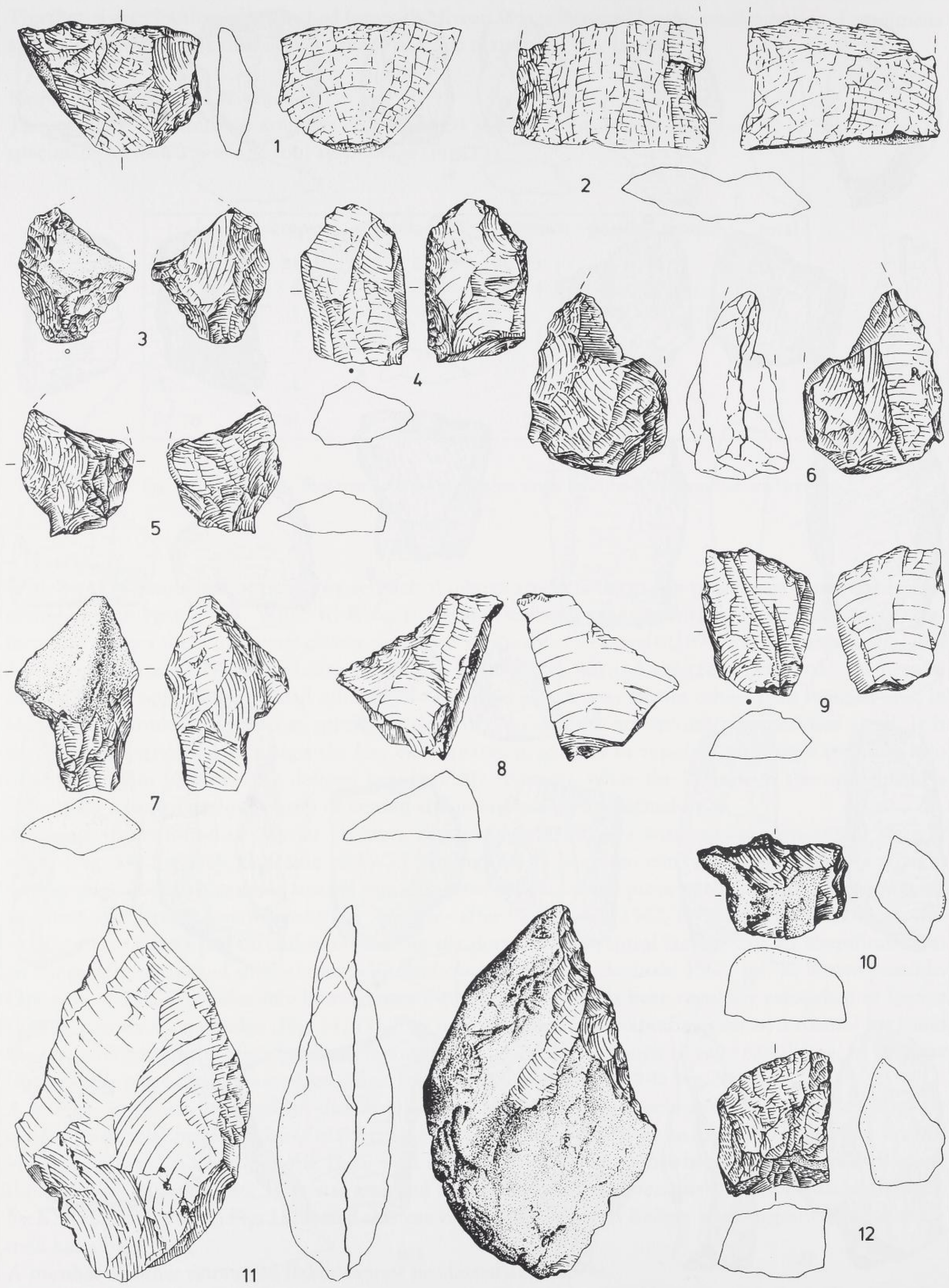


Fig. 85. Niveau D1. Quartz artefacts with retouch or probable retouch. 1 (70/71-16), 9 (71/73-7): transverse scraper; 4 (71/72-1): double side scraper; 2 (78/78-9), 7 (50/82-4), 8 (75/73-2), 10 (71/70-5): retouched; 3 (60/81-3), 5 (40/83-9), 6 (58/84-6), 11 (70/74-11), 12 (70/70-4): possibly retouched. – Scale 2:3.

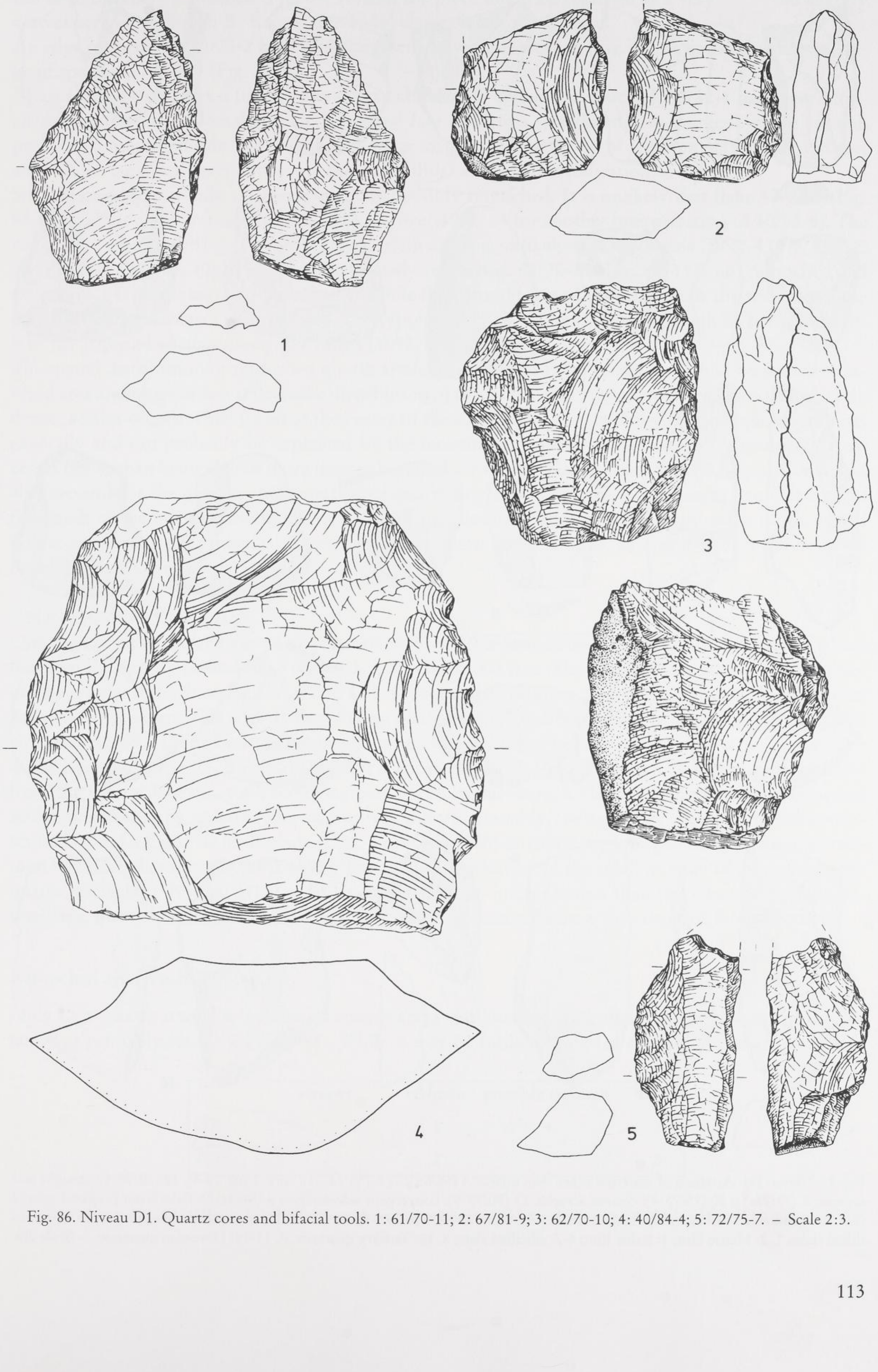


Fig. 86. Niveau D1. Quartz cores and bifacial tools. 1: 61/70-11; 2: 67/81-9; 3: 62/70-10; 4: 40/84-4; 5: 72/75-7. – Scale 2:3.

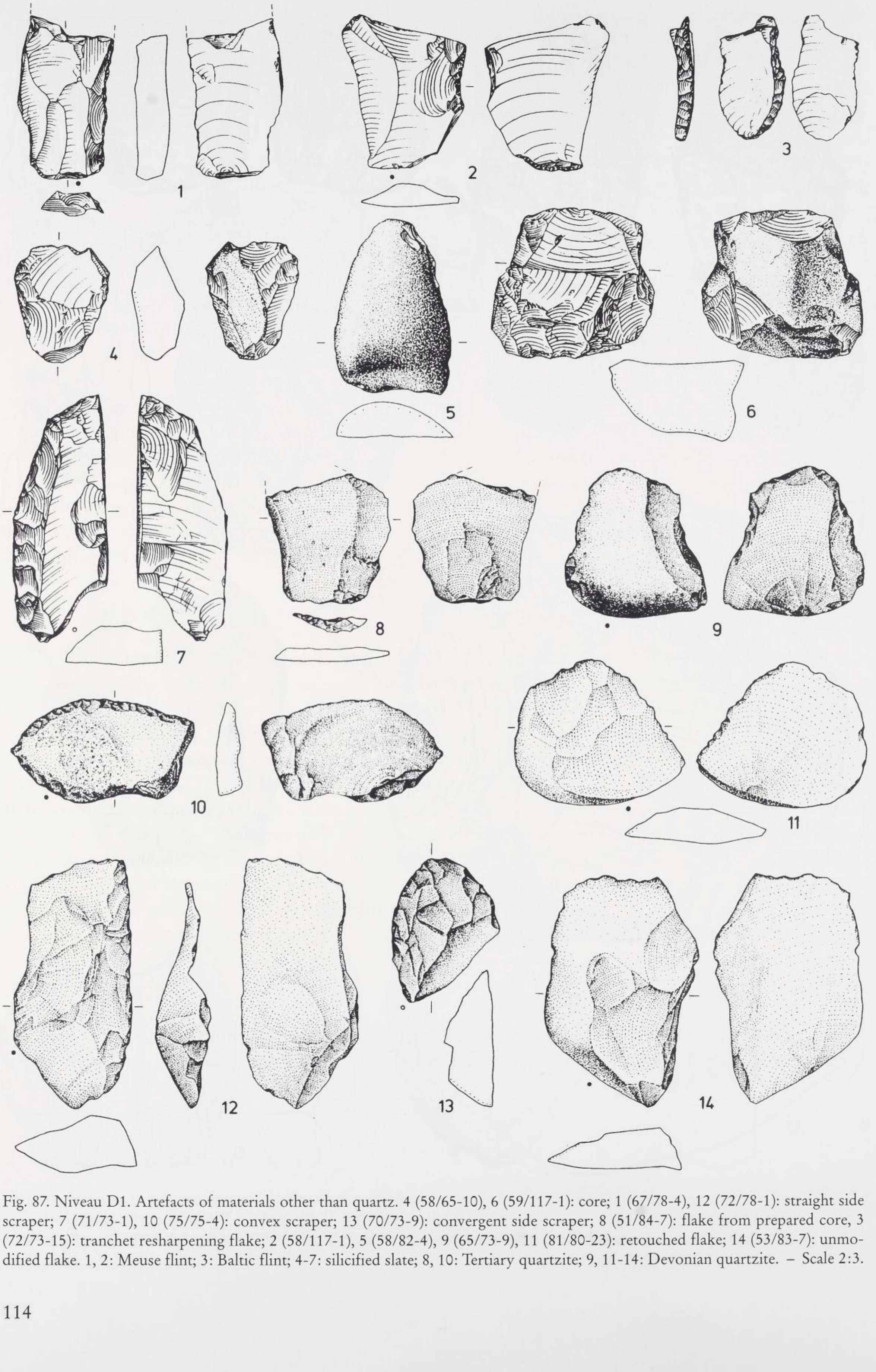


Fig. 87. Niveau D1. Artefacts of materials other than quartz. 4 (58/65-10), 6 (59/117-1): core; 1 (67/78-4), 12 (72/78-1): straight side scraper; 7 (71/73-1), 10 (75/75-4): convex scraper; 13 (70/73-9): convergent side scraper; 8 (51/84-7): flake from prepared core, 3 (72/73-15): tranchet resharpening flake; 2 (58/117-1), 5 (58/82-4), 9 (65/73-9), 11 (81/80-23): retouched flake; 14 (53/83-7): unmodified flake. 1, 2: Meuse flint; 3: Baltic flint; 4-7: silicified slate; 8, 10: Tertiary quartzite; 9, 11-14: Devonian quartzite. – Scale 2:3.

has been bifacially retouched (Fig. 84, 10) and the piece might be regarded as a very small and slightly convex scraper, although K. Kröger (1995, 64) classes it as a small point.

An edge of specimen 75/73-2 has been straightened by slight retouch (Fig. 85, 8), as has the shortest edge of specimen 78/78-9 (Fig. 85, 2).

Apart from the scrapers a further five quartz chunks are certainly retouched. 50/82-4 has been retouched from the cortex dorsal face to the ventral face to form a straight edge convergent with a second, probably unmodified side (Fig. 85, 7). K. Kröger assigns it to his group of »*Spitzen*« (1995, 63) and sees an artificial tang (not accepted by the present author) as a possible indication of hafting.

Six flakes and five chunks of quartz are only possibly retouched. It is unlikely that flake 40/83-9 (Fig. 85, 5) is intentionally retouched (but see K. Kröger 1995, 64 for another interpretation of 40/83-9). The retouch on chunk 60/81-3 (Fig. 85, 3) is uncertain and it is unlikely that specimens 70/70-4 (Fig. 85, 12) and 71/70-5 (Fig. 85, 10) have been intentionally retouched. 61/70-11 (Fig. 86, 1) is not retouched and represents a typical quartz »pseudo tool«. While the natural form of the flake lends the specimen a superficial resemblance to a biface it cannot be typologically classified as such (although K. Kröger assigns it to his group of »*keilmesserartige*« forms [1995, 60]).

The spatial distribution of retouched quartz artefacts in Niveau D1 is relatively diffuse across the excavated area and more or less reflects the distribution of the quartz industry as a whole (Fig. 63). A slightly denser scatter of retouched forms at the centre of the main excavation is also visible for quartz artefacts generally and can probably be explained by the movement of material downslope by geological processes rather than being due to more intense hominid activity at this part of the site. Redeposition might also account for the densest concentration of quartz artefacts found close to a quartz hammerstone at the South of the main excavation. One possibly significant difference in the distribution of retouched quartz artefacts is their practical absence in the southern site extension, an area in which unretouched material is not uncommon (Fig. 63).

– Materials other than quartz

One edge of an irregular flake of siliceous slate 65/72-19 is formed by a natural »back« of cortex which has been thinned by several flake removals from the dorsal face. The opposite edge has been straightened by regular retouch of the dorsal face and subsequently a number of small flakes were removed from the ventral face using this edge as the striking platform so that the specimen is at least partly bifacially worked (Fig. 89, 1). The find can be simply regarded as a scraper, but the resemblance to a »*Keilmesser*« of the Bockstein type (G. Bosinski 1967, 29) is apparent. 72/73-15 is a flake of Cretaceous flint detached from the ventral face of a tool, removing part of the lateral retouch, (Fig. 87, 3) and can be interpreted as demonstrating the resharpening of a tool at the site, possibly analogous to »sharpening flakes« described from La Cotte de St. Brelade (J. M. Cornford 1986) or to the pradnik/prondnik technique common to Micoquian sites (O. Jöris 1992). The spatial distribution of the small number of retouched non-quartz artefacts in Niveau D1 is even less susceptible to interpretation than the retouched quartz assemblage, but resembles the latter with a thin spread of material across the centre of the excavation.

Retouched artefacts in Niveau D2

Only eight quartz artefacts, including a convex and a rectilinear scraper, attributed to Niveau D2 are certainly or probably retouched (Fig. 88). While it may be futile to look for spatial patterning in the case

	scraper	retouch	possible retouch	total
QZ	2	2	4	8
TOT	2	2	4	8

Fig. 88 Niveau D2. Tool type and raw material of single lithic finds of retouched artefacts.

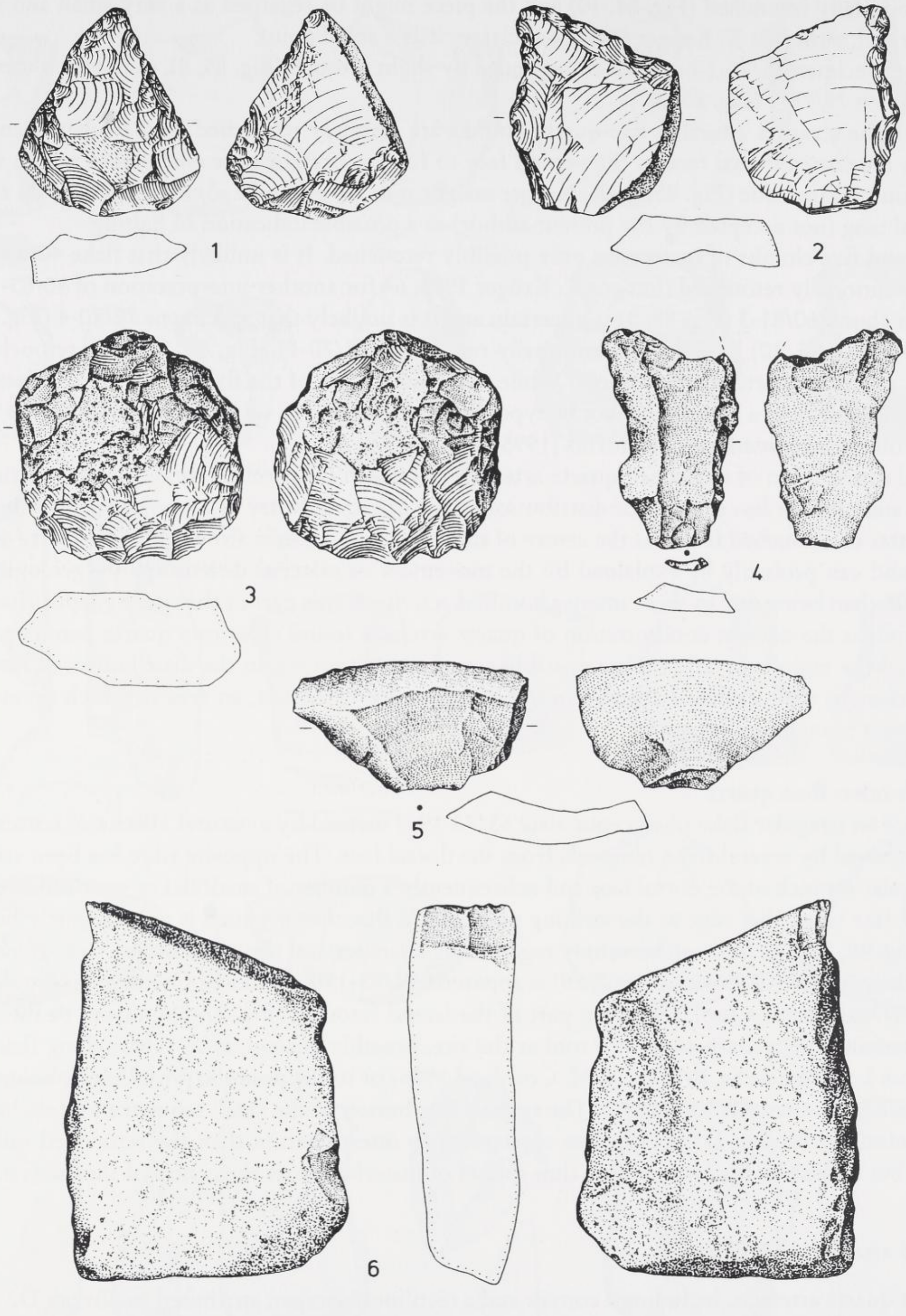


Fig. 89 Niveaux D1, D2 and D3. Artefacts. 1: 65/72-19; 2: 51/87-47; 3: 58/66-1; 4: 51/84-2; 5: 51/87-18; 6: 62/75-2. 1: siliceous slate; 2: quartz; 3: chert/chalcedony; 4-6: Tertiary quartzite. – Scale 2:3.

of only eight retouched or possibly retouched quartz specimens, it is noticeable that they do not extend into the northwestern and southern (upslope) extensions of the site, unlike the unretouched quartz industry (Fig. 66)

Retouched artefacts in Niveau D3

Three of the total of four certain or possible tools from Niveau D3 are made of quartz (Fig. 90), and two of these are doubtful or typologically indefinable.

	scraper	possible retouch	total
QZ	1	2	3
CH/CH	1		1
TOT	2	2	4

Fig. 90 Niveau D3. Tool type and raw material of single lithic finds of retouched artefacts. – Scale 2:3.

51/87-47 is a typologically good convergent scraper on a quartz flake (Fig. 89, 2). Besides retouch to the dorsal face, there is also slight ventral retouch to one edge. 58/66-1 (Fig. 89, 3) is a bifacially worked flat pebble (of chalcedony?) which was already described technologically as a core. It can however equally be regarded as a bifacially retouched »discoid« scraper or be a rough out for a flattened bifacial tool.
Of the retouched and possibly retouched artefacts in Niveau D3, the three quartz specimens are found to the North and West of the site whereas the core/scraper of chert/chalcedony was located alone to the South. It is doubtful if this has any significance.

Retouched artefacts in Niveau E

– Quartz
Eleven flakes and two chunks of quartz from Niveau E were retouched into scrapers (Fig. 91). Three quartz flakes were bifacially thinned and can, in two cases certainly and in one case probably, be interpreted as foliate pieces, possibly intended as points (Fig. 93: 6, 7, 10) Retouch was also observed on a further 13 flakes and 8 chunks which cannot be referred to clear morphological types. In almost all cases the retouch is intentional modification and not due to accidental or use-damage. 9 more finds have possible retouch.
One edge of flake 80/78-2 has been carefully bifacially retouched to form a rectilinear scraper (Fig. 93, 1). First one face was retouched, then the piece was turned and retouched from the other face in the so-called »*wechselseitig-gleichgerichtete*« flaking technique described for Micoquian industries (G. Bosinski 1967). The opposing edge is a natural cortex »back«.
59/52-6 is a »pseudo tool« of quartz (Fig. 93, 2). It resembles a biface in appearance but is basically a section of tabular (vein?) quartz which has broken into this form during primary debitage. Edge modifica-

	scraper	point / foliate	retouch	poss. retouch	total
QZ	13	3	21	9	46
DQT	1		6	1	8
TQT	2		1		3
LYD			1		1
CH/CH	1		2		3
MFL	2	2			4
FL	2				2
TUF	1				1
TOT	22	5	31	10	68

Fig. 91 Niveau E. Tool type and raw material of single lithic finds of retouched artefacts.

tion is very superficial and possibly served merely to remove irregularities or is conceivably not intentional but merely use-damage.

The spatial distribution of retouched quartz artefacts in Niveau E (Fig. 92) is very similar to that of quartz artefacts as a whole (Fig. 67) and is probably mainly a reflection of the geological processes of solifluction and ablation leading to the concentration of lithic material in the northeastern, topographically deepest part of the site. It might be questioned whether the total absence of certainly retouched quartz artefacts to the South and Northwest can be entirely explained by these processes. It is perhaps a feasible proposition that activities involving secondarily modified artefacts (»tools«) would preferentially be carried out in the deeper (more sheltered or less sloping?) parts of the crater, and that this is still reflected, albeit in a distorted fashion, by the distribution of retouched forms. It is even conceivable that the spatial distribution of the retouched quartz material might, in a few cases, still reflect the original location of hominid activities. The close proximity of three quartz scrapers in Niveau E (and a fourth specimen in Niveau D1) in m^2 77/75 (Fig. 92) is suggestive of this, although it cannot finally be proven that artefacts have indeed remained *in situ* at this part of the site.

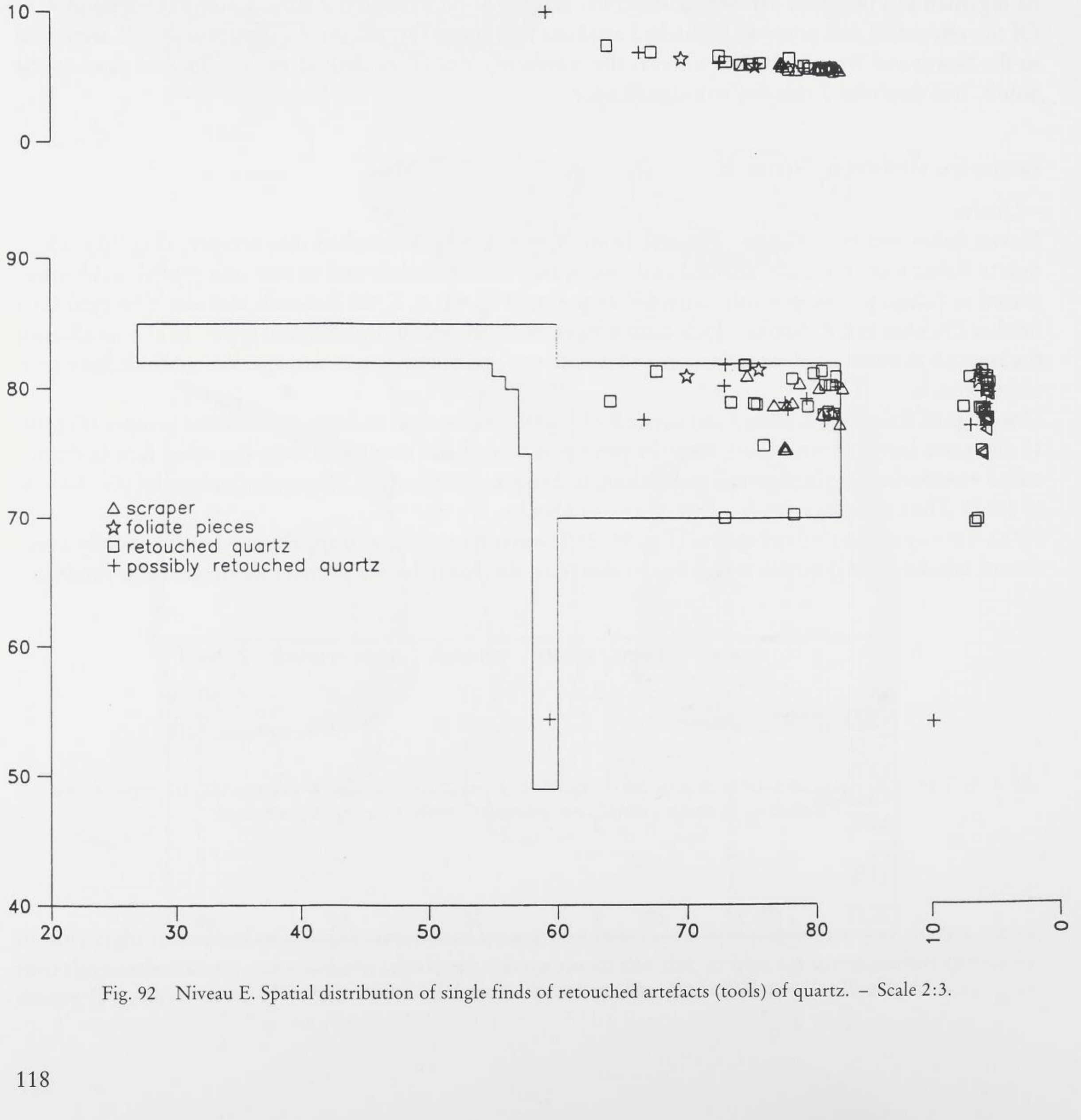


Fig. 92 Niveau E. Spatial distribution of single finds of retouched artefacts (tools) of quartz. – Scale 2:3.

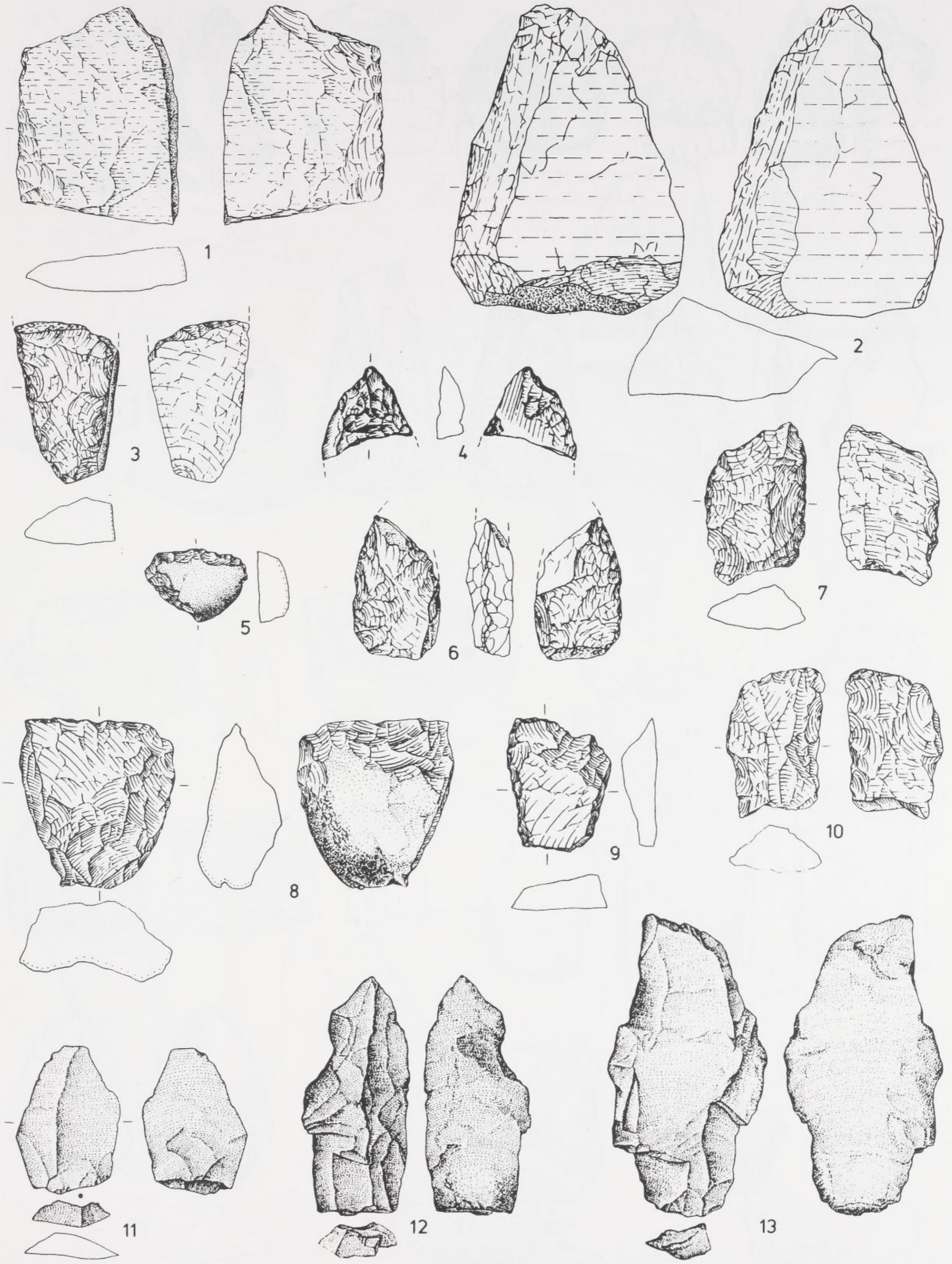


Fig. 93 Niveau E. Artefacts of quartz and Tertiary quartzite. 1 (80/78-2), 9 (77/75-1): straight side scraper; 3 (77/78-6): convex scraper; 5 (76/78-5): convergent scraper; 6 (70/81-3), 7 (75/81-1), 10 (81/78-6): bifacial foliate tool; 4 (64/79-12): retouched flake; 8 (78/70-1): retouched chunk; 2 (59/52-6): pseudo-biface; 11 (81/80-18), 12 (80/80-14), 13 (60/74-1): unmodified flakes (80/80-14 & 60/74-1 conjoin). 1-10: quartz; 11-13: Tertiary quartzite. – Scale 2:3.

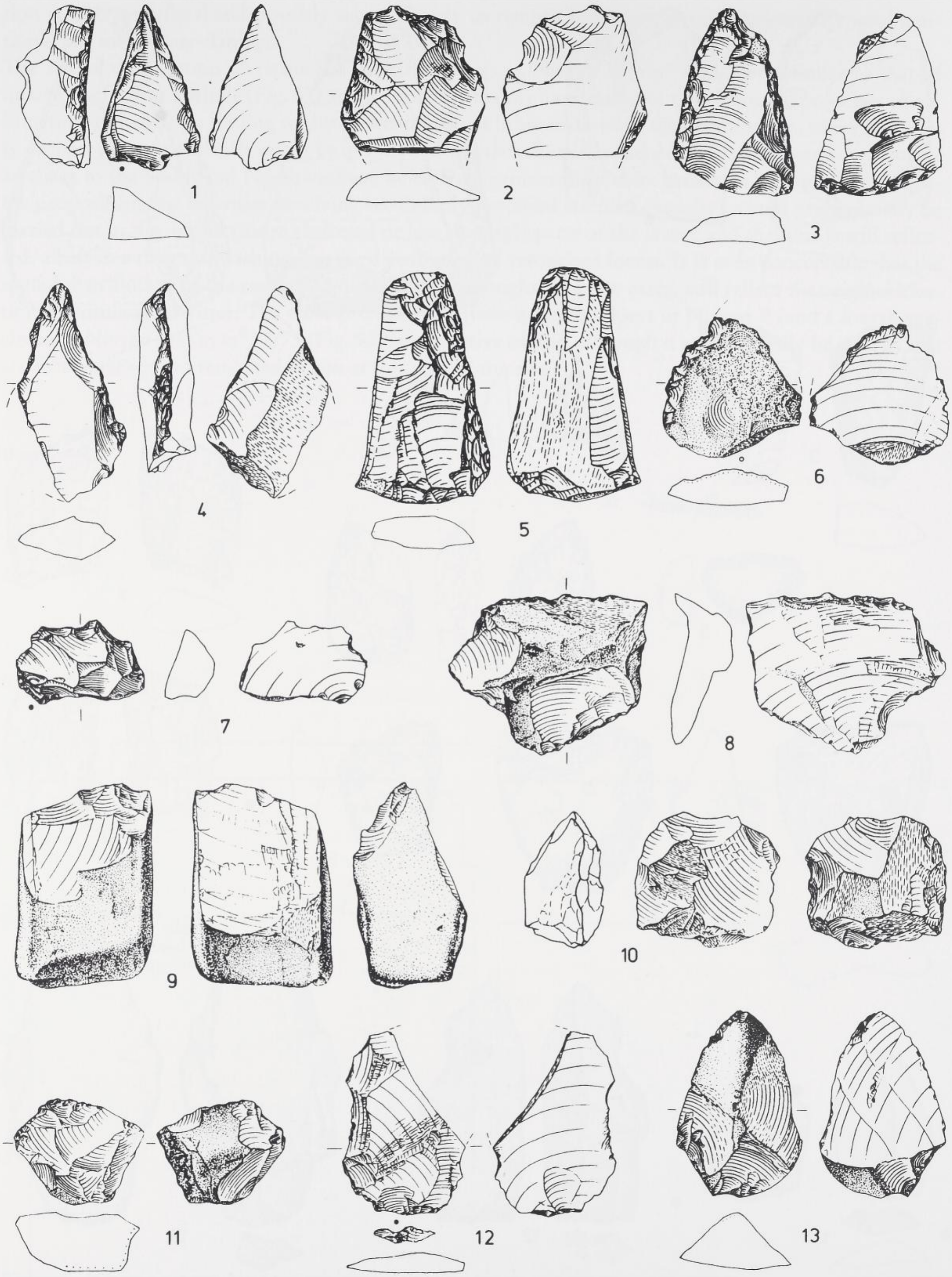


Fig. 94 Niveau E. Artefacts of flint, siliceous slate and siliceous oolite. 1 (74/80-1), 2 (81/78-5): straight side scraper; 3 (70/81-7), 4 (80/80-6): point/convergent scraper; 5 (74/80-8): straight/foliate scraper; 6 (74/78-4): convex scraper; 7 (81/80-1): denticulate flake; 8 (58/58-19): denticulate/scraper; 9 (59/52-2): core/chopping tool; 10 (59/56-2), 11 (59/57-5): core; 12 (74/80-3): unmodified flake (from a prepared core?); 13 (78/79-1): unmodified chunk. 1-4: Meuse flint; 5, 6: other flint; 7: siliceous oolite; 8-13: siliceous slate. – Scale 2:3.

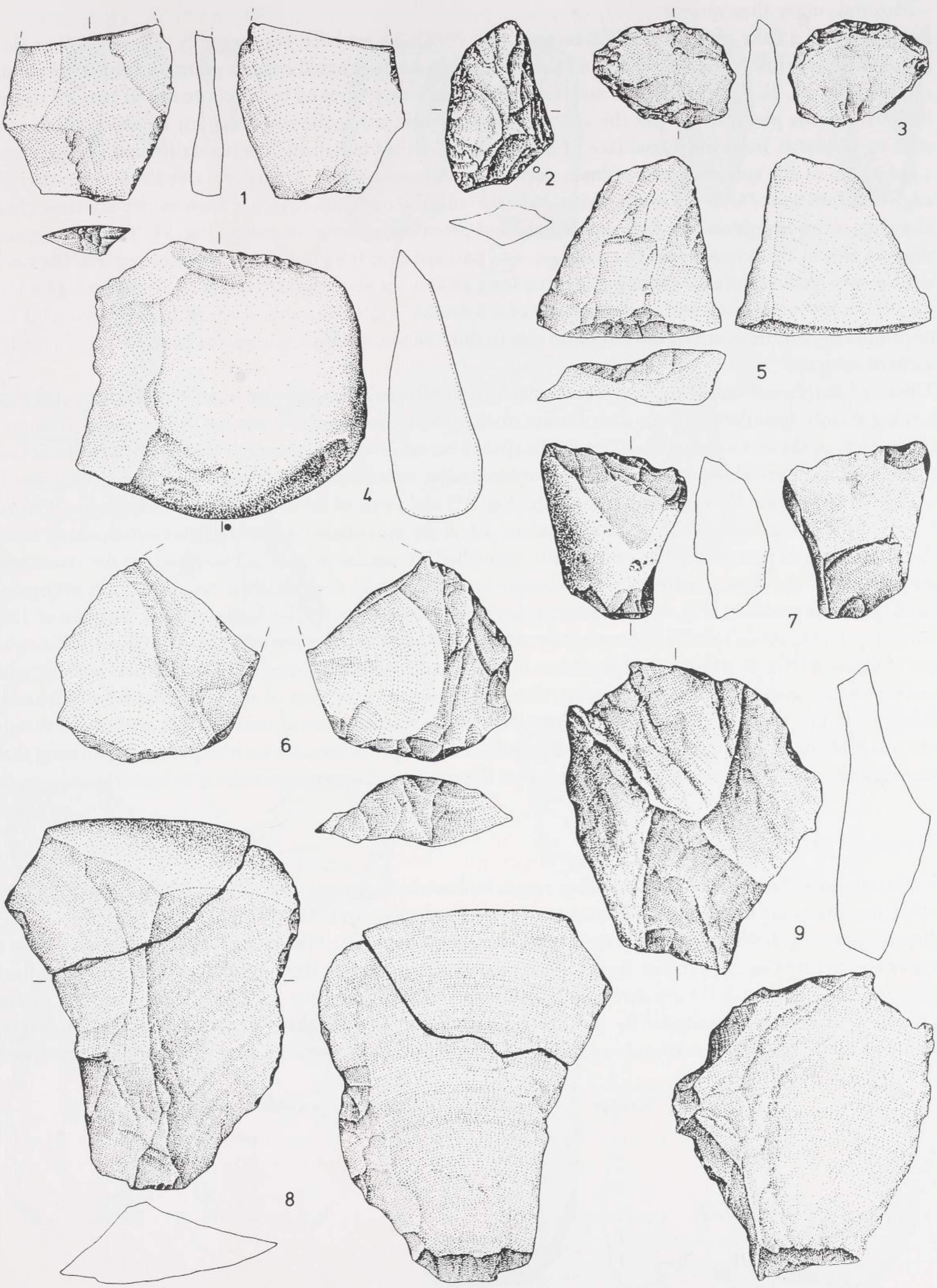


Fig. 95 Niveau E. Artefacts of Tertiary and Devonian quartzite. 1 (57/77-2), 4 (80/81-1), 5 (74/78-3), 8 (80/80-2, 3): retouched flakes; 2 (59/57-4): convergent scraper; 3 (80/75-2): convex scraper; 6 (81/80-12), 7 (62/70-3): transverse scraper; 9 (73/80-1): unmodified flake. 1-3 Tertiary quartzite; 4-9 Devonian quartzite. – Scale 2:3.

– Materials other than quartz

Both edges of a flake of dark grey Cretaceous flint 70/81-7 have been convergently retouched (one side rather more carefully than the other) and the piece might be designated either a point or a convergent side scraper (Fig. 94, 3). The base of the artefact was subsequently thinned by flakes removed parallel to the long axis of the piece, first from the ventral face and then, using the negatives left by these flakes as a striking platform, from the dorsal face. If interpreted as an aid to hafting, the basal thinning suggests that a definition of the specimen as a point is perhaps more appropriate. A narrow facet along one »lateral« edge of a flint tool 74/80-8 forms a natural »back« and the opposite edge has been invasively retouched along its entire length on one face and distally and proximally along the other (Fig. 94, 5). This suggests that the aim of the retouch was to straighten and perhaps thin the piece. This phase of retouch has been cut by very shallow bifacial flaking along the long axis of the specimen from the proximal and, to a lesser extent, from the distal end in the manner of a Kostenki knife (*Kostenki-Ende/Kostenki-Messer*). This reinforces the impression that the intention was to thin the piece, which can almost be regarded as a foliate form of scraper.

The small number of retouched non-quartz artefacts in Niveau E renders any interpretation of spatial patterning mainly speculative. Their distribution once again seems largely to mirror the overall distribution of artefacts of these raw materials. Certain details are however visible, although their interpretation is unclear. As was observed for retouched quartz artefacts, the retouched flint tools have an easterly distribution within that of the flint artefacts as a whole (Fig. 69) and none of the Cretaceous flint from the West or South of the site is secondarily modified. Indeed, of all the specimens of flint and chert/chalcedony from the northwestern part of the site only one is retouched. A similar picture is presented by the retouched quartzite artefacts. Again, their main distribution is to the East of the site in the area of densest occurrence of quartzite artefacts (Fig. 68), although two retouched artefacts of Tertiary quartzite and one of Devonian quartzite do lie outside the main concentration. A denticulate tool (of siliceous oolite?) and a scraper made on a flake of volcanic tuff represent materials otherwise not found in Niveau E and both lie within the eastern concentration. By contrast, the only retouched specimen of siliceous slate from Niveau E is located in the southern site extension, central to a small concentration of unretouched artefacts of the same material, including two cores found adjacently. This might cautiously be interpreted as showing that the siliceous slate at this part of the site represents the remains of a single episode or, at least, related events.

Retouched stray and unstratified finds

There are only 9 retouched and possibly retouched artefacts among the stray finds of quartz but the other raw materials bring the total number of retouched stray finds to 22 (Fig. 96).

Among the stray finds are some of the better made tools from the Hummerich (Fig. 97). Streu 149 is a symmetrical point or convergent scraper made on a broken flake of dark grey Cretaceous (Meuse) flint (Fig. 97, 5). The retouch is very carefully carried out and in places quite invasive. Along one edge of the piece the retouch is interrupted by the break facet so that is clear that the tool was originally larger. Retouch of the other edge extends around onto the break facet showing that the piece was modified

	scraper	point	retouch	possible retouch	total
QZ			6	3	9
DQT	2		2		4
LYD	3			1	4
CH/CH	1				1
MFL	1	1		1	3
TUF	1				1
TOT	8	1	8	5	22

Fig. 96 Stray and unstratified finds. Tool type and raw material of single lithic finds of retouched artefacts. – Scale 2:3.

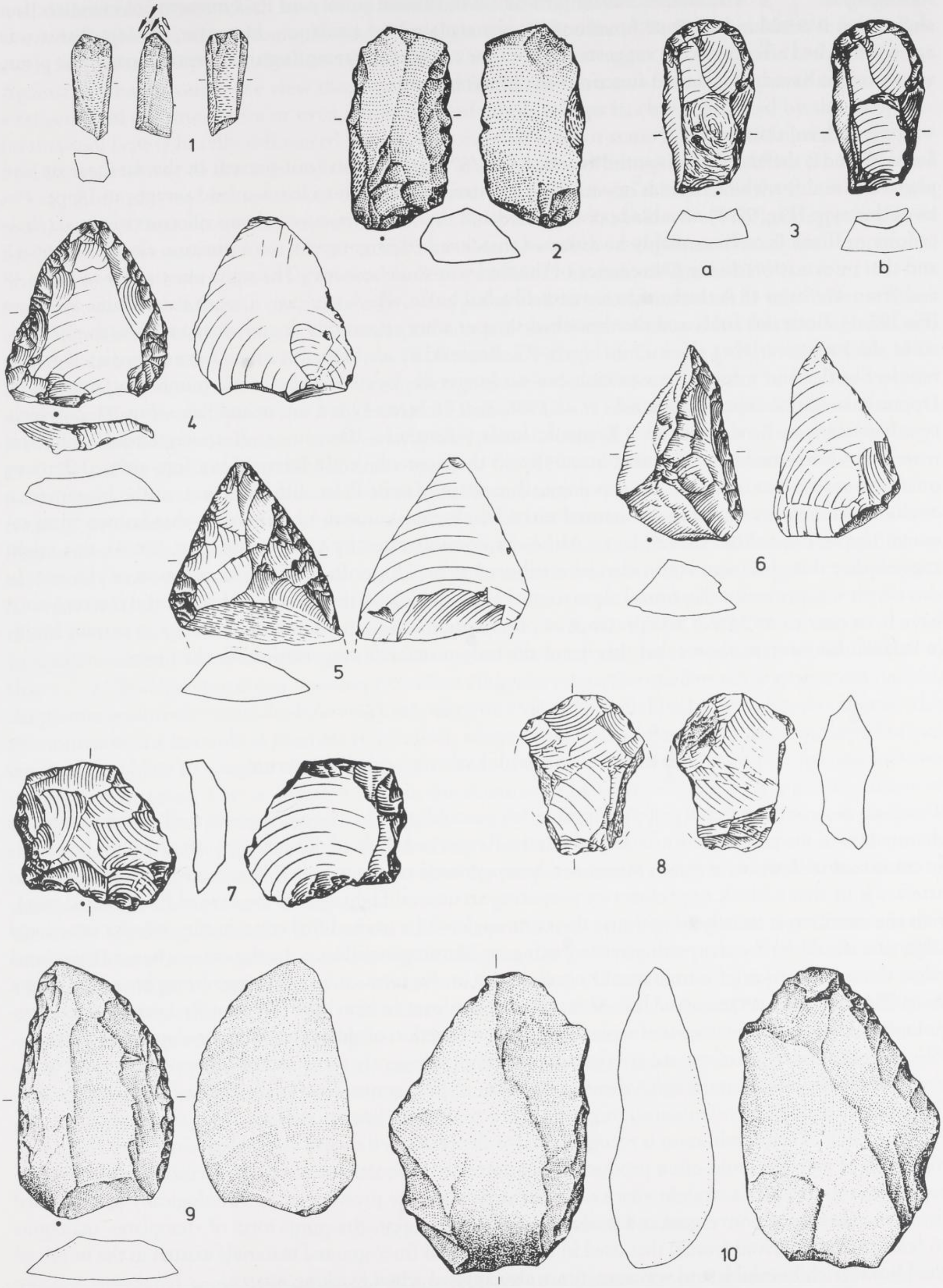


Fig. 97 Stray finds. 1 (Streu 48): tip of a dihedral burin; 2 (Streu 49): Kostenki knife (?); 3 (56/67-9 + Streu 79): end scraper on a blade; 4 (Streu 150), 9 (Streu 300): convergent scraper; 5 (Streu 149): point/convergent scraper; 6 (Streu 57): straight side scraper with stepped retouch; 10 (Streu 16): atypical side scraper; 7 (Streu 46): flake (frost fracture?); 8 (Streu 33): chunk (core?). 1, 2 Tertiary quartzite; 3: flint/chalcedony; 4, 5, 7: Meuse flint; 6: chert/chalcedony; 8: siliceous slate; 9, 10: Devonian quartzite. – Scale 2:3.

following breakage. The find could be termed a Mousterian point and its symmetry of cross section shows that it could indeed have functioned as the armature of a weapon. However, the fact that it was again retouched after breakage suggests the need for caution in attempting an interpretation of the piece, which might have had different functions at different times.

– Upper Palaeolithic forms

Streu 79 and a thermal flake (»potlid fracture«) 56/67-9 (which was not present in the database or find plans/lists and for which there is no stratigraphic attribution) refit to form an end scraper of Upper Palaeolithic type (Fig. 97, 3) on a blade of reddened and thermally fractured glassy siliceous material (chalcedony or flint). It can reasonably be assumed that Streu 79 originated from a position close to m² 56/67 and that information on the provenance of the find was somehow lost. The same must apply to Streu 48 and Streu 49. Streu 48 is the broken tip of a dihedral burin which is clearly Upper Palaeolithic in origin (Fig. 97, 1). Both this finds and the described scraper were apparently found close to a hearth uncovered in the loess overlying the humus layers (G. Bosinski *et al.* 1986, 106) which was associated with a reindeer antler and a few bones (which can no longer be located) and a small number of artefacts of Upper Palaeolithic type (G. Bosinski *et al.* 1986, Fig. 9). Streu 49 is a retouched flake (Fig. 97, 2) which, typologically can be designated a Kostenki knife (*»Kostenki-Messer«* or *»Kostenki-Ende«*). The raw material of both the burin fragment Streu 48 and the Kostenki knife Streu 49 is a fine-grained Tertiary quartzite unlike that of any of the typologically certain Middle Palaeolithic artefacts at the Hummerich or that of finds recovered from an assured early Weichselian context, but similar to that known from regional Upper Palaeolithic assemblages. Although not illustrated by G. Bosinski *et al.* (1986), this might suggest that this specimen could also be attributed to an Upper Palaeolithic occupation of the site. In this case it was probably also found close to the hearth, which on the evidence of the potlid fracture must have been near to m² 56/67. The presence of other specimens with »Kostenki retouch« in certain Middle Palaeolithic context shows that this is not the only possible interpretation for the piece.

Typological considerations and discussion

The discussion of the typology of the Hummerich assemblage has to be seen against the background of the domination of the industry by artefacts of quartz. Retouched tools of this material can often not be directly compared with those of finer-grained and homogeneous raw materials. The intention of retouching an artefact is to alter a blank or preform by preparing an unmodified edge. In the case of fine-grained materials the intention is usually to optimise the acute angle of the unmodified edge, in the case of a functional edge this would be by sharpening/resharpening or blunting/stabilising. In the case of a non-functional edge, the modification of a tool would normally be in the form of blunting/stabilising by retouching a back. This normally creates standardised morphological forms which have traditionally been assigned a typological definition, often equated with the supposed function of the piece (»scraper«/»point«/»knife«).
The angles of the edges of quartz artefacts are often not inherently acute and therefore do not need blunting/stabilising in the same way as those of artefacts of fine-grained materials. Other forms of edge modification (notching, denticulation) might be more similar for both materials.
A certain lack of standardisation is recognisable for the retouched quartz assemblage since very slight modification of an edge could often produce a tool perfectly adequate for scraping or cutting, or remove irregularities to produce a straight »back«. At the same time, the presence of morphologically standardised forms in quartz (e. g. convergent and transverse scrapers) suggests that some form of »template« analogous to (and possibly derived from?) that used in the working of finer-grained materials existed in the minds of the Hummerich hominids and was sometimes also applied when working quartz.
The non-quartz assemblage can be more readily examined within the framework of »traditional« typological studies (F. Bordes 1954, 1961, 1968; F. Bordes & M. Bourgon 1951). This approach recognises

well defined tool forms which have often been considered diagnostic of »cultures« and technologies or of chronologically and/or geographically defined groups (F. Bordes 1977; G. Bosinski 1967; D. A. Roe 1981; N. Rolland 1988; P. A. Mellars 1988, 1992).
Against this background, the view that typological forms (in German »*Formengruppen*«) are primarily a reflection of stylistic choice or even, potentially, of ethnic groups has been modified by the recognition that tool type is heavily influenced by function and that it is not static but subject to progressive modification according to the needs of the tool user. Early studies of functional variability (L. R. Binford & S. R. Binford 1966) led to discussions of the nature of artefact variability and »the functional argument« too well known to need repeating here (L. R. Binford 1973; F. Bordes 1973) and, partly due to the parallel development of microwear studies, have ended with the acceptance of analyses of tool function as a legitimate part of artefact studies (S. Beyries 1987; P. Anderson-Gerfaud 1990).
Similarly, the great influence on technology and typology of various factors such as inherent raw material properties, distance between archaeological site and raw material source has been recognised and summed up by the term »*chaîne opératoire*« (R. Cresswell 1983; J.-M. Geneste 1985, 1988a, 1988b, 1989; H. L. Dibble 1991). A commonly observed phenomenon is the different treatment of local and exogenous materials, for example in the Belgian Middle Palaeolithic »*. . . des sites éloignés de gîtes de matières premières de qualité. . . contiennent des artefacts en phtanite sous la forme d'objets finis*« (A.-G. Krupa 1990, 249). This phenomenon does not only apply to the preferential import of retouched tools of exogenous materials to a site but also to technological forms such as Levallois flakes »*. . . les grands éclats levallois, probablement réalisés sur le lieu de récolte, sont très souvent réalisés dans des matières premières excellentes*« (A. -G. Krupa 1990, 250). The opposite behaviour, namely the *ad hoc* production of casual tools from readily available materials can also be regarded as normal, in the Belgian example ». . . *les éclats bruts en quartzite aient été utilisés tels quels et auraient pu éventuellement consister en des outils de fortune en cas de besoin immédiat pour le groupe. . .* » (A.-G. Krupa 1990, 249).
In south-western French assemblages the treatment of the local and the exogenous materials differs so that »*. . . L'outillage associé aux matières premières éloignées est préférentiellement le groupe des racloirs, des pointes moustériennes et des bifaces*« (J.-M. Geneste 1989, 83). Individual site studies can identify this phenomenon, for example at Marillac (Charente), where retouched artefacts of a better quality flint material were subject to a higher degree of curation and modification than those of a first group of poorer quality raw material. This is reflected both in the dominance of »*racloirs*« and by a high proportion of transverse forms and of steep retouch of »Quina« type (L. Meignen 1988, 73). This situation cannot be compared uncritically with that at the Hummerich, where the largest number of scrapers is in fact made of locally available quartz, but it is apparent that the proportion of scrapers and retouch waste among the Cretaceous flint artefacts is very high.
Generally speaking, detailed studies of the different processes in the production of stone tools can certainly lead to a better evaluation of decision making at the level of lithic technology (E. Boëda 1988, 1994) and perhaps, by extrapolation to a better understanding of hominid thought processes in a wider sense (e. g. the question of the existence of language in the Middle Palaeolithic [H. L. Dibble 1989]). A specific example would be the typology of Middle Palaeolithic scrapers, which has been examined in several papers by H. Dibble who suggests that variation can be regarded as a function of the intensity of utilisation of raw materials and curation and consequent progressive alteration of scraper morphology (H. L. Dibble 1984, 1987a, 1987b, 1988a, 1988b).

Quantification of the retouched forms

Having presented some of the considerations relevant to a discussion of the retouched Hummerich lithic assemblage the numbers and frequencies of the retouched forms at the site can now be examined (Fig. 98). This is shown for all retouched and possibly retouched artefacts irrespective of layer but

sorted by raw material. Unsurprisingly, the largest number of retouched artefacts is made of quartz, irrespective of whether the »possibly retouched« specimens are included or not, followed by Devonian quartzite with 18 certainly retouched forms and then by lower and relatively similar numbers of other raw materials (Fig. 98a).
The proportion of retouched quartz is a different matter and it can be seen that appreciably less of the quartz assemblage (8.6%) shows secondary modification than do the other raw materials (Fig. 98b). Of these, only Tertiary quartzite shows a similar low (11.7%) degree of modification to quartz whereas no other raw material has a value lower than 20%. For reasons of comparability with other assemblages (Fig. 99), proportions were calculated as a percentage of the total of all fractured specimens of a raw material (i. e. including »fragments«) but excluding the unmodified categories »cobbles« and »pebbles«.
At the neighbouring site Tönchesberg, only 0.9% of the early Weichselian quartz artefacts from site Tö 2B are modified to tools (N. J. Conard 1992, table 11). Excluding Conard's artefact category »small

a	scraper	point	biface	retouch	poss. retouch	total
QZ	56		3	44	31	134
DQT	6		1	11	1	19
TQT	4			2		6
LYD	7			2		9
CH/CH	3			5		8
MFL	5	3		1		9
FL	2					2
TUF	2			1		3
TOT	85	3	4	66	32	190

b	scraper	point	biface	retouch	total retouched	total*
QZ	56 (4.7%)		3 (0.25%)	44 (3.65%)	103 (8.6%)	1,200
DQT	6 (7.4%)		1 (1.2%)	11 (13.4%)	18 (22.0%)	82
TQT	4 (7.8%)			2 (3.9%)	6 (11.7%)	51
LYD	7 (21.1%)			2 (6.1%)	9 (27.3%)	33
CH/CH	3 (13.1%)			5 (21.7%)	8 (34.8%)	23
MFL	5 (17.3%)	3 (10.3%)		1 (3.4%)	9 (31.0%)	29
FL	2 (22.2%)				2 (22.2%)	9
TUF	2 (66.7%)			1 (33.3%)	3 (100.0%)	3
TOT	85 (5.9%)	3 (0.2%)	4 (0.3%)	66 (4.61%)	158 (11.0%)	1,430

c	scraper	point	biface	retouch	total retouched*
QZ	56 (54.4%)		3 (2.9%)	44 (42.7%)	103
DQT	6 (33.3%)		1 (5.6%)	11 (61.1%)	18
TQT	4 (66.7%)			2 (33.3%)	6
LYD	7 (77.8%)			2 (22.2%)	9
CH/CH	3 (37.5%)			5 (62.5%)	8
MFL	5 (55.6%)	3 (33.3%)		1 (11.1%)	9
FL	2 (100.0%)				2
TUF	2 (66.7%)			1 (33.3%)	3
TOT	85 (53.8%)	3 (1.9%)	4 (2.5%)	66 (41.8%)	158

Fig. 98 a: All Niveaux: Tool type and raw material of single finds of retouched artefacts. – b: All Niveaux: Frequency of different tool types as a percentage of the total of all fractured specimens (* = excluding unmodified »cobbles« and »pebbles«). – c: All Niveaux: Frequency of different tool types as a percentage of the total of certainly retouched artefacts only (* = excluding »possible retouch«).

debris (<1.5 cm)« raises this proportion to 3% (4 of 134 specimens), but this is still appreciably less than at the Hummerich. Tertiary quartzite from the same horizon at the Tönchesberg was more intensively modified by retouch and 9% of the total assemblage consist of tools (N. J. Conard 1992, table 13). Again, by discounting the category »small debris (<1.5 cm)« the proportion of retouched specimens can be raised to 11.5%, which, interestingly, is almost identical to the percentage established for Tertiary quartzite at the Hummerich (Fig. 98b). The percentages of retouched specimens of other raw materials at Tönchesberg 2B can be calculated (after N. J. Conard 1992, table 10) but comparison with the Hummerich assemblage must be viewed critically due to the low numbers of artefacts at the former site. Nevertheless, one of the five Devonian quartzite artefacts (20%) and two of the eight siliceous slate artefacts (25%) at Tö 2b are classed as tools, compared to 22% and 27% for these materials at the Hummerich. A different picture is presented by four flint specimens at Tö 2B, none of which is retouched.
A Saalian site in the Neuwied Basin, the Schweinskopf, also yielded a relatively large assemblage of quartz artefacts (J. Schäfer 1990a, b). 423 of these are assigned to the main archaeological horizon *»Fundschicht 4«*, whereby a number of specimens are stray finds assigned to this horizon and were not recovered *in situ*. No excavated quartz artefacts are retouched, but four stray finds are (J. Schäfer 1990a, 78), which gives a percentage of 0.9% based on the total of all artefacts. This total includes a large quantity (ca. 50%) of very small debitage < 1.5 cm (J. Schäfer 1990a, Fig. 13), as does the assemblage at the Tönchesberg, and it is notable that the proportion of retouched specimens is practically identical at the two sites. Nevertheless, even if the Schweinskopf value were to be recalculated for material longer than 20 mm only, it would still be appreciably lower than that at the Hummerich.
Devonian quartzite is represented at the Schweinskopf by 180 artefacts (J. Schäfer 1990a, 81), of which 14 (7.8%) are retouched. This is appreciably less than the proportion of 22% established at the Hummerich, where 18 of »only« 82 Devonian quartzite specimens were retouched, and resembles instead the proportion of retouched quartz at the Weichselian site. The low numbers of artefacts of other materials at the Schweinskopf make comparison difficult, but larger proportions of the less common materials are retouched. Three retouched specimens of Tertiary quartzite (25%) and two (40%) of Cretaceous flint are described by Schäfer (1990), and the only artefact of siliceous slate is a scraper. A single retouch flake of chalcedony shows the presence of a tool of this material at the site.
The site of La Borde (J. Jaubert *et al.* 1990) was already described as a locality where quartz played an even more important role in the lithic assemblage than at the Hummerich. The retouched quartz artefacts here form 6.6% of the total if calculated as a proportion of all 2,684 modified specimens (J. Jaubert *et al.* 1990, 99). If the specimens < 2 cm are discounted from the total, the proportion rises to 7.2% (whereby it is unclear if the smaller category itself contains retouched specimens). This degree of secondary modification on a large quartz assemblage resembles that at the Hummerich (8.6%) quite closely (Fig. 98b). A similar result can be demonstrated for the Saalian site La Cotte de St. Brelade, where 7.6% of a very large quartz assemblage (11,929 artefacts) was retouched (F. Hivernel 1986, table 27. 1).
The proportions of retouched material in the non-quartz assemblages of the French and the English site can also be compared with those at the Hummerich (Fig. 99). The La Borde »silex« assemblage contains

	Hummerich	Tö 2B	Schweinskopf	La Borde	La Cotte de St. Brelade
QZ	8.6%	0.9 / 3%	0.9% / ca. 2%	6.6% / 7.2%	7.6%
DQT	22.0%	20.0%	7.8%	-	-
TQT	11.7%	9% / 11.5%	25.0%	-	-
SS	27.3%	25.0%	100.0%	-	-
CH/CH	34.8%	-	100.0%	-	-
FL / »silex«	31.0% / 22.2%	0%	40.0%	42.6%	13.2% - 44.6% (23.8%)

Fig. 99 Comparison of proportions of retouched artefacts at selected Middle Palaeolithic sites.

a total of 101 specimens (J. Jaubert *et al.* 1990, 101), of which 43 (42.6%) show secondary modification (J. Jaubert *et al.* 1990, 102). At La Cotte the proportion of retouched artefacts within the flint assemblages varies from as little as 13.2% in layer A (with a total of 27,437 artefacts > 20mm) to 44.6% in layer 5 (with a total of 1,348 artefacts). The majority of the layers show a proportion of retouched specimens from 20% - 30% and the mean proportion calculated for the total of all layers is 23.8% (66, 639 specimens). These values are calculated using the absolute values given by P. Callow (1986b, 219), regarding his categories »tools«, »handaxes« and »retouched« as the equivalent of all retouched forms and discounting »hammerstones« and »manuports« from the totals. There is a general inverse correlation between the frequency of retouch and the relative importance of flint as a raw material within the assemblage. In the layers with the highest incidence of retouch (layer 5 = 44.6%, layer 6 = 30.5%) flint plays a subordinate role in the raw material spectrum (39.9% and 37.9% respectively) and quartz dominates. In layers B - H, where the relative proportion of flint lies approximately between 80% - 95%, the frequency of retouch varies from ca. 20%-25%.

Comparison of the frequency of secondary modification of artefacts at the Hummerich and at a number of other sites with a major quartz component allows the recognition of both similarities and clear differences. The proportion of retouched quartz at the Hummerich is very similar to that at the sites of La Borde and la Cotte, each of which has a much larger industry than the Hummerich. By contrast, the smaller quartz assemblages from the Neuwied Basin sites Tönchesberg 2B (early Weichselian) and Schweinskopf (Saalian) have almost identical frequencies of retouched artefacts, which are very much lower than at the other sites. The Tönchesberg assemblage closely resembles the Hummerich in the frequency of retouch for Devonian and Tertiary quartzite and siliceous slate, but differs in that no flint was retouched. At the Schweinskopf the frequency of retouch on non-quartz artefacts is quite different to that at the Hummerich, but this possibly reflects the inflated importance of Devonian quartzite at the former site. The frequency of retouched flint at the Hummerich falls comfortably within the range of La Cotte, whereas the values at the Schweinskopf and at La Borde, sites where the raw material flint/«silex« is relatively less well represented, are somewhat higher.

Evidence of the typology for the chronology of the site

The stratigraphy and biostratigraphy of the site already make it clear that the Hummerich lithic assemblage can be dated to a phase of interstadial conditions at the beginning of the last glaciation and the technology of the lithic assemblage has been discussed as providing some indication for dating the occupation of the site to a younger phase of the Middle Palaeolithic than that represented by a lamellar component of debitage at Tönchesberg 2B, which is situated at the base of the early Weichselian interstadial soil sequence.

Typological considerations may also provide information of relevance to the chronological position of the site. Certain aspects of the Hummerich industry were referred to soon after its discovery as showing affinities with the Micoquian (K. Kröger 1987) and certain retouched pieces from the Hummerich are indeed bifacially worked. It is worth reconsidering these specimens in some detail. A first feature to be noted is that such bifacially retouched tools occur in all horizons and are manufactured indiscriminately from all raw materials. A bifacially retouched, naturally backed quartz specimen from Niveau C (40/82-7, Fig. 82, 2) resembles a *Keilmesser* in its overall form and finds a parallel in a bifacial tool of siliceous slate from Niveau D1 (65/72-19, Fig. 89, 1). The morphology of two specimens from Niveau D1 (70/71-9, Fig. 84, 11) and Niveau E (74/80-8, Fig. 94, 5), of quartz and flint respectively, is recognizably very similar. Both specimens might be described as elongated side scrapers with partially bifacial retouch and the presence of terminal ventral thinning (cf. Kostenki knives), in particular, is common to both specimens. A number of other artefacts have similar ventral thinning, including a flint point/convergent scraper from Niveau E (70/81-7, Fig. 94, 3) and a scraper of siliceous slate from Niveau D1

(71/73-1, Fig. 87, 7), and this seems to be a feature common to all layers. Several further quartz artefacts are bifacially retouched and suggest foliate types even if the properties of the raw material do not allow them to be classed as true leaf points. Here again, they are found in different levels, in particular Niveau D1 (65/73-13, Fig. 84, 13; 67/81-9, Fig. 86, 2; 69/73-17, Fig. 84, 7; 72/72-12, Fig. 84, 10; 72/75-7, Fig. 86, 5) and Niveau E (70/81-3, Fig. 93, 6; 75/81-1, Fig. 93, 7; 81/78-6, Fig. 93, 10). A specimen of chalcedony/chert from Niveau D3 (58/66-1, Fig. 89, 3) can possibly also be assigned to the group of bifacially worked tools, although it can also be regarded as a core.

G. Bosinski defined the Central European Micoquian *Formengruppe* on a range of criteria (1967, 42ff.) and divided it into four sub-groups (»*Inventartypen*«) – *Bockstein, Klausennische, Schambach, Rörshain* – on the basis of the presence/absence or different relative components of typical bifacially retouched tool forms such as »*Micoquekeile*«, »*Halbkeile*«, »*Fäustel*«, »*Faustkeilblätter*«, »*Keilmesser*« (e. g. »*Bocksteinmesser*« and »*Pradnikmesser*«), foliate »*Blattspitzen*« and bifacial scrapers. A relatively large number of German Middle Palaeolithic sites can be assigned to the Micoquian technocomplex, among the more important of which are the eponymous sites Bockstein III (R. Wetzel & G. Bosinski 1969), Klausennische (G. Bosinski 1967, 159), Schambach (G. Bosinski 1967, 154) and Rörshain (A. Luttropp & G. Bosinski 1967), the Balver Höhle cave site (K. Günther 1964) and material described since the appearance of Bosinski's (1967) work such as the Sesselfelsgrotte cave (J. Richter 1994) and the open sites Königsaue (D. Mania & V. Toepfer 1973), Buhlen (G. Bosinski & J. Kulick 1973, L. Fiedler & K. Hilbert 1987; O. Jöris 1994) and Lichtenberg (K. Breest & S. Veil 1989; S. Veil *et al.* 1994; S. Veil 1995). Common to all the Micoquian groups is the presence of a specific technique of debitage described as »*wechselseitig-gleichgerichtetes*« flaking. In this method of biface production the sides of the tool are retouched successively, first from one face and then from the other, so that the flake scars of one face are all cut by those of flakes subsequently detached after turning the piece, thus giving the biface very straight edges. This method of retouch is not a typical feature of the Hummerich bifacial pieces, although a bifacial scraper from Niveau E was retouched in this way (80/78-2, Fig. 93, 1). The two Hummerich bifaces which in their form most closely resemble Micoquian *Keilmesser* (40/82-7, Fig. 82, 2 and 65/72-19, Fig. 89, 1) cannot alone be regarded as sufficient evidence for assigning the assemblage to this technocomplex. A further feature of Micoquian industries is the use of the »*pradnik/prondnik*« resharpening blow, with its resulting characteristic flake (L. Fiedler & K. Hilbert 1987, Fig. 8, 11) which it has been suggested can be taken as a type artefact defining a Middle Palaeolithic »*pradnik* horizon« across central Europe (O. Jöris 1992, but see J. Richter 1994, 262). A flake removed from the edge of a retouched tool found in Niveau D1 (72/73-15, Fig. 87, 3) can be perhaps regarded as analogous to a »*pradnik/prondnik*« flake, but the presence of very similar »*coup de tranchet*« resharpening flakes in Saalian levels at La Cotte de St. Brelade (J. M. Cornford 1986, 337) and of a tool resharpened in this way from a third Cold Phase (Layer 20) assemblage at Achenheim (J. Junkmanns 1991, 1995) shows that this type of modification is not necessarily diagnostic for a Weichselian Micoquian. It is clear from the above that the Hummerich assemblage undeniably possesses a bifacial component, however this cannot be interpreted as *a priori* grounds for assigning the Hummerich industry to the Micoquian and other possible interpretations must be considered.

Apart from defining and subdividing the Micoquian component of German Middle Palaeolithic assemblages, G. Bosinski (1967) also identified a (presumed older) »Upper Acheulian« (»*Jungacheuléen*«) complex, most clearly represented at the site of Salzgitter-Lebenstedt (A. Tode *et al.* 1953; K. Grote 1978; A. Tode 1982), a »Moustérien«, which he divides into three *Inventartypen* – »*Rheindahlen*«, »*Kartstein*« and »*Balve IV*« (G. Bosinski 1967, 64) and a late Middle Palaeolithic facies (»*Altmühlgruppe*«) characterized by foliate points best known from the Bavarian assemblage Mauern II (G. Bosinski 1967 165). Two further Mousterian groups were subsequently defined, the *Inventartyp Ehringsdorf* (G. Bosinski 1974, 437) and the *Inventartyp Rheindahlen-Westwand* (G. Bosinski 1986c).

Although the interpretation of Bosinski's »*Formengruppen*« may need revising in the light of more recent analyses (e. g. J. Richter 1994; S. Veil *et al.* 1994; S. Veil 1995), the 1967 publication can still serve as a basis for discussion in the present context. At the time of Bosinski's publication (1967), it was possi-

				Obere Klause III (*Altmühlgruppe*)	Mauern II (*Altmühlgruppe*)
Balver Höhle IV (Mousterian *Typ Balve IV*)			Achenheim V (Mousterian *Typ Balve IV*)		
		Vogelherd III (Mousterian)	Achenheim IV (*Moustérien de tradition acheuléenne*)		Mauern I (Mousterian)
	Kartstein III (Mousterian *Typ Kartstein*)		Achenheim III (Mousterian *Typ Kartstein*)	Obere Klause II (Mousterian)	
Balver Höhle IIIa? (Micoquian *Typ Schambach*)					
Balver Höhle III, »Stoßzahnschicht« (Micoquian *Typ Klausennische*)					
Balver Höhle II (Micoquian *Typ Bockstein*)	Kartstein I ? (Micoquian *Typ Bockstein*)	Vogelherd II (Micoquien *Typ Bockstein?*)			
Balver Höhle I (*Jungacheuléen*)					

Fig. 100 Comparison of the relative stratigraphy of selected German Middle Palaeolithic sites and attribution to *Inventartypen* (after G. Bosinski 1967).

ble to determine the stratigraphic position of his proposed Middle Palaeolithic *Formengruppen/Inventartypen* at only a small number of sites.

The most complete German sequence was at the Balver Höhle (Fig. 100), where the base of the sequence was formed by a (poorly defined) *Jungacheuléen* (Level I) overlain by three Micoquian levels (in Layer II the *Inventartyp Bockstein*, in Layer III and the *»Stoßzahnschicht«* the *Inventartyp Klausennische* and in Layer IIIa the *Inventartyp Schambach*), although it was not absolutely certain that the »typologically younger« *Inventartyp Schambach* was indeed stratified above the *Inventartyp Klausennische*. The *Inventartyp Schambach* Micoquian (Layer IIIa) is overlain at the Balver Höhle by a late Mousterian assemblage, the eponymous *Inventartyp Balve IV*, showing that this recent facies of the Mousterian can, here at least, be interpreted as younger than a recent Micoquian. The Micoquian *Inventartyp Rörshain* was not encountered in any stratified context but was believed to be a recent phase of this *Formengruppe* due to the presence of foliate points in assemblages of this type. It was interpreted as probably younger than the *Inventartyp Klausennische*, but possibly represents a parallel development to the *Inventartyp Schambach*. J. Hahn (1990) has since questioned whether the leaf points at Rörshain can be regarded as representing a phase of the Micoquian transitional to the *Altmühlgruppe* (see below) and suggests that the interpretation of the site might need revision.

Mousterian assemblages are found stratified above Micoquian industries at two further sites (Fig. 100). At the Kartstein cave in the northern Eifel a Mousterian assemblage (Kartstein III) *Inventartyp Kartstein* was found above a Micoquian biface (Kartstein I) *Inventartyp Bockstein*, while at the Vogelherd in the Swabian Lone Valley an undefined Mousterian (Vogelherd III) was stratified above a Micoquian industry (Vogelherd II), probably of *Inventartyp Bockstein*. Furthermore, at Achenheim in Alsace an assemblage (Achenheim IV) assigned to the *Moustérien de tradition acheuléenne*, which is otherwise not represented among the material studied by Bosinski, was stratified between industries identified by him as *Inventartyp Kartstein* (Achenheim III) and *Inventartyp Balve IV* (Achenheim V), which is interpreted as a more recent phase of the Mousterian than *Inventartyp Kartstein*. By contrast with the other assemblages, *Inventartyp Rheindahlen* had not been identified in a stratified context although it was believed on comparative typological grounds to be older than the other *Inventartypen*.

Finally, the *Altmühlgruppe*, characterized by foliate points, was interpreted as the youngest phase of the Middle Palaeolithic. Although it was found stratified above undiagnostic Mousterian assemblages (Mauern II/I and Obere Klause III/II, Fig. 100) it was unclear whether the *Altmühlgruppe* was also older than the youngest Mousterian *Inventartyp Balve IV* or possibly contemporary with this.

With the few exceptions noted above Bosinski's (1967) classification of the Central European Palaeolithic had depended upon typological and comparative arguments and the study area lacked suitable stratigraphic sections necessary for the evaluation of the relative and absolute chronology of his suggested *Formengruppen* and their *Inventartypen*.

Beginning in the 1960's, excavations in the Rheindahlen brick pit near Mönchengladbach provided a first major sequence of Middle Palaeolithic assemblages in stratified context (Fig. 101) and led to a major increase in the appreciation of the complexity and duration of the Middle Palaeolithic in the Rhineland (G. Bosinski 1967; G. Bosinski *et al.* 1966; H. Thieme 1977, 1978, 1983, 1990; J. Thissen 1986, 1988; J. Klostermann & J. Thissen 1995).

Artefacts with a Middle Paleolithic technology occur throughout the last two loess cover layers and the Mousterian *Inventaryp Rheindahlen*, already suggested by Bosinski to be an older complex and which can be equated with a *Moustérien de type Ferrassie*, was shown to be dated at Rheindahlen into the penultimate (Saalian) glaciation. Bifaces typical for the *Moustérien de tradition acheuléenne* (Rheindahlen A3) and for the Micoquian *Inventartyp Bockstein* (Rheindahlen B2) were recovered and a new type of assemblage (B1) characterised by blade production (»*Rheindahlien*«) was described from the base of the Weichselian loess (summary in H. Thieme 1978). J. Thissen (1987, 40) has argued that assemblage B1 can be dated to the Eemian. Whereas H. Thieme (1978, 62) argued on stratigraphical grounds for an attribution of the B2 biface to the Upper Acheulean the specimen is clearly a typical Micoquian biface; more recently J. Klostermann & J. Thissen (1995) have claimed on the basis of raw material studies that the biface in fact forms part of the early Weichselian laminar B1 (Westwand) assemblage.

Another site of major importance discovered and first excavated in the 1960's is Buhlen in Hessen (G. Bosinski & J. Kulick 1973), a locality which comprises two adjacent (Lower and Upper) sites separated by reworked slope deposits. Here, sequences of cultural layers dating to the last glaciation are stratified within clastic deposits of weathered dolomite. The main part of the Lower Site was excavated and first results presented in the 1980's (L. Fiedler & K. Hilbert 1987) while the material from the Upper Site (1960's excavation) has also not yet been fully published (G. Bosinski & J. Kulick 1973; O. Jöris 1994). At the Upper Site a Mousterian industry (Buhlen II) described as resembling *Inventartyp Balve IV* was stratigraphically higher than assemblages (main horizon = Buhlen IIIb2) of Micoquian type, described as most closely resembling *Inventartyp Klausennische* (G. Bosinski & J. Kulick 1973, 9). The lower assemblages at the Upper Site (Buhlen IIIb3, IIIc, V, VI) were non-diagnostic Middle Palaeolithic with no Micoquian attributes and it was considered possible that the deepest layers might be assigned to the *Jungacheuléen* (G. Bosinski & J. Kulick 1973, 9-10). The 1960's investigation of the Lower Site consisted of a 1 m wide test trench with correspondingly provisional results. Nevertheless, here too, the interpretation was of a Micoquian with bifacial tools resembling that of Upper Site Layer IIIb2 overlain by an assemblage with only flake tools comparable to Mousterian of *Inventartyp Balve IV* (G. Bosinski & J. Kulick 1973, 12).

The Mousterian assemblage was not recovered *in situ* but can be assigned to the archaeological Horizons ß - E (the equivalent of geological Layer 4). The Micoquian assemblage was recovered from archaeological Horizons c - e (equated with geological Layer 7 [and 6?]. It is important for the compari-

Rheindahlen A2 (cf. Mousterian *Typ Balve IV*)	Balver Höhle IV (Mousterian *Typ Balve IV*)	Buhlen II (Mousterian *Typ Balve IV*)	Mauern II (*Altmühlgruppe*)	Obere Klause III (*Altmühlgruppe*)	Remagen- Schwalbenberg ? *Blattspitzen*	J. Richter (1994) M.M.O. -B 3 Mauern Zone 4 *Balve IV*	S. Veil (1995)
Rheindahlen A3 (*Moustérien de tra- dition acheuléenne*)	Balver Höhle IIIa? (Micoquian *Typ Schambach*)	Buhlen 4a, 4b (Pradnik retouch, cf. *Moustérien à lames*) Buhlen 5 (Mousterian with denticulates)	Mauern I (Mousterian)	Vogelherd III (Mousterian)		Sesselfelsgrotte G (M.M.O. -B2) Königsaue A/B Lichtenberg Mauern Zone 5 Schambach	Lichtenberg Sesselfelsgrotte G Salzgitter-Lebenstedt
	Balver Höhle III, »Stoßzahnschicht« (Micoquian *Typ Klausennische*)	Buhlen IIIb 1 Buhlen IIIb2 (Micoquian *Typ Klausennische*) Buhlen IIIb3 Buhlen IIIc	Kartstein III (Mousterian *Typ Kartstein*)	Obere Klause II (Mousterian *Typ Kartstein*)		Sesselfelsgrotte G (M.M.O. -B1) Kartstein III Klausennische ? Rörshain ?	Buhlen
		Buhlen Va/b Buhlen VIa/b				Sesselfelsgrotte G (M.M.O. -A2)	Königsaue A
Rheindahlen B1 (blade industry) Rheindahlen B2 (Micoquian *Typ Bockstein?*)	Balver Höhle II (Micoquian *Typ Bockstein*)		Kartstein I ? (Micoquian *Typ Bockstein*)	Vogelherd II (Micoquien)		Sesselfelsgrotte G (M.M.O. -A1) Bockstein III Balve II/III Königsaue C?	Balve III
						Sesselfelsgrotte U-A01 Sesselfelsgrotte U-A02 Sesselfelsgrotte U-A03 Sesselfelsgrotte U-A04 Sesselfelsgrotte U-A05 Sesselfelsgrotte U-A06 Sesselfelsgrotte U-A07 Sesselfelsgrotte U-A08	
	Balver Höhle I (*Jungacheuléen?*)	Buhlen VIIa/b (*Jungacheuléen?*)					

Fig. 101 Expanded relative stratigraphy of German Middle Palaeolithic sites (after G. Bosinski 1967; G. Bosinski & J. Kulick 1973; J. Richter 1994; S. Veil 1978, 1995).

son of the 1960's and the 1980's excavations to know that the Upper Site Micoquian Layer IIIb was correlated with Lower Site Layers 7 and 8 of the geological stratigraphic sequence, while the Upper Site Mousterian Layer II was equated with Lower Site Layers 3 and 4 (G. Bosinski & J. Kulick 1973, 39-40). The excavation of a larger area of the Buhlen Lower Site provided a larger sample of lithic material from a more secure context (L. Fiedler & K. Hilbert 1987). Whereas the earlier investigation assigned all the younger Mousterian industry to geological Layer 4 (subdivided into archaeological Horizons ß - E) the more recent excavation recovered two assemblages from Layer 4 (4a, 4b) and also the underlying Layers 5a and 5b (L. Fiedler & K. Hilbert 1987, 135).

The two assemblages are of different character, the higher one being characterised by Levallois debitage and blade-flakes reminiscent of the *Moustérien à lames*, whereas the lower industry has only rare faceted flakes. The upper assemblage contains finely backed *couteaux à dos* and is dominated by scrapers, the lower industry is also dominated by scrapers, in this case more massive, and contains denticulate forms. A feature of the upper (Layer 4) assemblage is the presence of *»pradnik/prondnik«* resharpening flakes, previously believed to be an exclusive characteristic of the older Micoquian levels at Buhlen, but here used on scrapers, possibly cf. Hummerich specimen 72/73-15 (Fig. 87, 3). Another feature of Buhlen Layer 4 is the presence of proximal and distal Kostenki retouch (cf. *Kostenki-Messer/Kostenki-Ende*) to the ventral face of artefacts, one illustrated specimen of which (L. Fiedler & K. Hilbert 1987, Fig. 8: 7) resembles Hummerich specimens 74/80-8 (Fig. 94, 5) and 70/71-9 (Fig. 84, 11).

A site with excellent stratigraphical information and exceptional conditions of organic preservation was discovered in 1963 at Königsaue (D. Mania & V. Toepfer 1973). Here, sediments of the Pleistocene *Ascherslebener See* contained a remarkably complete record of Weichselian climatic fluctuations. The deposits preserved cycles of sedimentation interpreted as showing nine phases of interstadial warming between the Eemian and the Holocene, and within the second oldest of these, Stage Ib (equated with the Brørup interstadial, D. Mania & V. Toepfer 1973, 51), were found the assemblages Königsaue A (oldest) - C (youngest). The designation of the assemblages refers to their position in the stratigraphy and they comprise material from several concentrations found over a large area along the palaeo-shorelines of the Pleistocene lake. Although separated in the section by episodes of sedimentation, it is clear from the overall stratigraphy (all three assemblages in Sedimentary Cycle Ib) that they are located close together in geological time. Nevertheless, as is pointed out in the publication, the oldest and youngest facies could be separated by as much as 1,000 years (D. Mania & V. Toepfer 1973, 120).

The assemblages are also of greatly different size (A: 1, 481 artefacts, B: 3, 972 artefacts, C: 296 artefacts). Against this background it is interesting that Königsaue A and C are very similar and can be assigned to the Micoquian group of industries, while the intermediate assemblage Königsaue B shows practically no Micoquian characteristics and is dominated by prepared cores and their debitage. Assemblages Königsaue A and C are, however, not identical and the smaller one (Königsaue C) contains certain forms of tool (e. g. Quina scrapers) not found in the larger Königsaue A assemblage. Nevertheless, the two »Micoquian« assemblages were together described as showing the closest similarities with Bosinski's (1967) *Inventartyp Schambach*.

On the basis of the proposed early Weichselian (Brørup?) date for Königsaue A/C (cf. *Inventartyp Schambach*) and comparative typology it was argued that the older *Inventartypen Bockstein* and *Klausennische* would date to a very early phase of the Weichselian shortly after the Eemian (D. Mania & V. Toepfer 1973, 138). More recently, it has been argued that the basal organic deposit at Königsaue (Kö-Ia1) is not Eemian in date, but in fact itself represents the Brørup/Odderade interstadial, in which case the stratigraphic sequence in general must be dated younger and the archaeological horizon (Kö-Ib) be assigned to a more recent Weichselian interstadial (W. Weißmüller 1992, 32-33). It is particularly important that at Königsaue an industry of Mousterian type was found clearly stratified between two Micoquian assemblages.

The most recent discovery of a Weichselian site with bifaces was at Lichtenberg in Lower Saxony (K. Breest & S. Veil 1989; S. Veil *et al.* 1994; S. Veil 1995). Here, at this first Micoquian site located so far north of the upland zone (*Mittelgebirge*), the archaeological horizon was located within sand layers which were stratified above three humic horizons interpreted as the final Eemian interglacial and the Brørup and Odderade interstadials. Uranium-Thorium analysis dates the younger (Odderade) interstadial to ca. 60-64 ky (minimum age estimate) and thermoluminescence dates the overlying sands which contain the artefacts to ca. 57 ky and the Lichtenberg assemblage is therefore assigned to the beginning of the first Weichselian Pleniglacial (S. Veil *et al.* 1994), which can probably be equated with Oxygen Isotope Stage 4. Organic remains are not preserved at Lichtenberg and it is unclear whether the site was occupied in stadial or renewed interstadial conditions.

The Lichtenberg lithic (flint) assemblage contains two technological variants, the manufacture of bifacial tools from preselected natural frost sherds or flattened nodules and the production of unifacial tools on flakes. It is unclear to what extent the blanks for the latter category of tool are products of an independent *chaîne opératoire* or whether they represent incidental waste from the former technological variant. Only one prepared core was found and a conjoin between a flake scraper and a *Faustkeilblatt* biface shows that the second possibility is given at the site. Four main tool »concepts« were present at Lichtenberg: bifacial foliate scrapers (*blattförmige Schaber*), bifacial *Keilmesser* and *Faustkeilblätter*, and elongate symmetrical handaxes (*Faustkeile*). Results of trace wear analysis and the absence/low representation of elements such as prepared cores and scrapers suggest that all these forms may have been used in episodes of specialised butchering activities during one or more occupations of the site.

The Lichtenberg site is particularly interesting since here forms considered diagnostic of the Micoquian (*Keilmesser* and *Faustkeilblätter*) occur together with others (*blattförmige Schaber, Faustkeile*) regarded as type artefacts for the Lebenstedt *Jungacheuléen* group and a number of conclusions are drawn in consequence (S. Veil *et al.* 1994, 39-52). It is proposed that the Weichselian group of bifacial assemblages including the »*Inventartypen Bockstein, Buhlen, Königsaue*« can be expanded by a new *Inventartyp Lichtenberg* (containing *blattförmige Schaber*) and that the ambiguous term »*Micoquien*« should be replaced with the more specific classification of these industries as »*Keilmessergruppen*«. It is argued that the Lebenstedt assemblage can also be dated to the Weichselian and should therefore also be integrated into the »*Keilmessergruppen*«. Finally, it is questioned whether the term *Jungacheuléen* can still be accepted at all as valid to describe an older (Saalian) Middle Palaeolithic *Formengruppe*, possibly in the form of assemblages such as that from Herne (R.-W. Schmitz 1988).

A major stratified site excavated in the 1960's and 1970's but only recently analysed in detail is the Sesselfelsgrotte in the Altmühl valley, Bavaria (W. Weißmüller 1992; J. Richter 1994).

Here, a deep sequence of deposits contains numerous stratified archaeological horizons of crucial importance for understanding the succession of central European Middle Palaeolithic assemblages (Fig. 101). A lower sequence of eight assemblages (*Untere Schichten* = U-A01 - U-A08) is identified as a Mousterian of differing facies (W. Weißmüller 1992) and, on the information of the mammal fauna, attributed to the early glacial interstadials Stage 5c and 5a. This sequence is covered by sterile deposits with a rich small mammal fauna (containing *Lagurus lagurus* and interpreted as Isotope Stage 4) which is followed by a series of deposits (»*G-Komplex*« identified as Isotope Stage 3) containing 13 archaeological horizons of both Mousterian and Micoquian type (W. Weißmüller 1992, 53; J. Richter 1994).

An alternative biostratigraphical interpretation based on the malacofauna would place the entire stratigraphical sequence as high as Layer M3 into the Eemian (Stage 5e), Layers M2 - K would be stadial Stage 5d, with truly glacial character (*Dicrostonyx*) and Layers H and the G complex would be interstadial Stage 5c (W. Weißmüller 1992, 54). By implication, in this model it is necessary to propose a massive hiatus above the G complex and the first interpretation (G-Complex = Stage 3) is considered more likely.

J. Richter (1994) divides the Sesselfelsgrotte Complex G industries into four groups, interpreted as representing successive cycles of site occupation, during the course of which the assemblages reflect dynamically the intensity and duration of activity and specifically of tool manufacture/modification (Fig. 102). He suggests that the apparently unrelated elements of »Micoquian« and »Mousterian« character can in fact be regarded as integral components of the same technocomplex, which he designates »*Moustérien mit Micoquien-Option*« (M. M. O.), and that larger assemblages will also include bifacial forms

Layer	Sediment	Archaeology	Cycle / Group	Horizon	Bordes Mousterian	Bosinski Mousterian	Bosinski Micoquian
	partially disturbed						
A	Holocene and late	mediaeval					
	Pleistocene levels						
B		Mesolithic					
C		late Upper Pal.					
D	pleniglacial loess	sterile					
E1	cryoclastic screee						
E2	with solifluvial						
E3	erosional hiatus	latest Middle Pal	(M.M.O.-B3)			(Balve IV)	
F	cryoclastic scree	few artefacts derived from G1					
G1			**Cycle 4**	G-A01	M. typique	Kartstein	Mic. ind.
			M.M.O.-B2	G-A02	M. typique	Kartstein	Mic. ind.
				G-A03	M. typique		Mic. Kl.
G2							
	"G-Complex"	numerous "Micoquian"	**Cycle 3**	G-A04	M. typique		Mic. Kl.
G3	cryoclastic scree with	artefacts, in part	M.M.O.-B1	G-A05	M. typique	Kartstein	Mic. Kl
	several cultural levels	recovered from		G-A06	M. typique	Kartstein	Mic. Kl
	containing hearths and	distinct living floors		G-A07	M. dent.	Kartstein	non-Mic.
	burnt faunal remains						
G4	determined as a		**Cycle 2**	G-A08	M. typique	Kartstein	Mic. Kl./Pr.
	terminal interstadial		M.M.O.-A2	G-A09	M. typique	Kartstein	Mic. Kl./Pr.
G4a			**Cycle 1**	G-A10	Charent. Quina -		Mic. Bock.
			M.M.O.-A1				
G5				G-A11	Charent. Quina -		non-Mic.?
H	scree more humid	few artefacts		G-A12	Charent. Quina -		non-Mic.
	and temperate						
I	scree small mammals	few artefacts		G-A13	M. indet.		non-Mic.
K	scree cold and dry	sterile					
L	small mammals	sterile					
M1				U-A01	M. typique		
M2				U-A02	M. typique		
M3				U-A03	M. typique		
N				U-A04	Charent. Quina		
O				U-A05	Charent. Ferrassie		
P				U-A06	Charent. Ferrassie		
Q				U-A07	M. micro.		
R				U-A08	M. micro.		
S							

Fig. 102 Schematic section through the Sesselfelsgrotte stratigraphy (after J. Richter 1994, fig. 1. 4, tables 9. 1 & 9. 10, and W. Weißmüller 1992) with J. Richter's equation of the assemblages with the typological and terminological systems of F. Bordes (1981, 1984) and G. Bosinski (1967, 1974, 1976). The proposed cycle (M. M. O. -B3) with a *Balve IV* Mousterian component is not represented at the Sesselfelsgrotte.

whereas the smaller ones will lack such curated tools *»mit potentiell langer Biographie und häufiger Wiederverwertbarkeit«*. Richter analyses the Sesselfelsgrotte Complex G assemblages using both the criteria developed by F. Bordes for the Mousterian (1981, 1984) and those of G. Bosinski describing central European Middle Palaeolithic *Formengruppen* and *Inventartypen* (1967, 1974). In addition he compares and finds similarities between the Sesselfels stratigraphy (J. Richter 1994, table 9. 1) and those of Combe Grenal (J. -L Guadelli & H. Laville 1990) and the Kulna cave (K. Valoch 1988)

The two older Cycles at the Sesselfelsgrotte (M. M. O. -A = G-A13 - G-A08) are located by Richter at the end of Isotope Stage 4 and are characterised by Quina or other non-Levallois debitage and, in the case of the larger assemblages by bifacial tools typical for Micoquian *Inventartypen* (the oldest of these of *Bockstein* type). The two younger Cycles are assigned to one or possibly more interstadials in Isotope Stage 3 (contemporary with the *Moustérien typique/à denticulés* and the *Moustérien de tradition acheuléenne* at Combe Grenal) and are characterised by the exclusive use of Levallois debitage (centripetal in M. M. O. -B1 and parallel in M. M. O. -B2). The small Sesselfelsgrotte assemblages of this phase can be compared with the *Moustérien à denticulés* or the *Inventartyp Kartstein* while the larger assemblages have bifacial components similar to the *Inventartypen Klausennische/Pradnik* and *Königsaue*. Richter suggests that a hypothetical younger facies (not represented at the Sesselfelsgrotte) might be expected to associate the youngest Mousterian *Inventartyp Balve IV* with bifacial forms and possibly with foliate forms of the *Altmühlgruppe*. In Richter's interpretation the Middle Palaeolithic *Keilmessergruppen* have to be seen as a merely functional facies of the (Weichselian?) Middle Palaeolithic found in larger assemblages and they are thus fully contemporary with other industries of Mousterian type lacking bifaces.

Since it is now generally accepted that the Ehringsdorf travertine complex (and hence the *Inventartyp Ehringsdorf*) dates to an intra-Saale interglacial (E. Vlček 1993) it is possible to stress the *Charentien* features of the lithic assemblage and its similarities to other Saalian assemblages of the *Moustérien de type Ferrassie/Inventartyp Rheindahlen* found at Biache IIA (A. Tuffreau & J. Sommé 1988) and Rheindahlen B3 (H. Thieme 1978), although the Ehringsdorf industry still differs from these assemblages in its component of bifacially retouched pieces.

Equally, it is now apparent known that the lithic assemblages from Achenheim III date to the third Cold Phase (G. Bosinski 1986c) and the stratigraphical sequence here can be presented more comprehensively than was possible in 1967 (J. Junkmanns 1991, 1995). At Achenheim the Middle Palaeolithic (defined by changes in the raw material spectra, appearance of Levallois debitage and the presence of typically Middle Palaeolithic forms of tool) can first be recognised from the third loess cover layer (III = antepenultimate Cold Phase). The lower industries of this loess layer (Layers 20a, 20''', 20'', 20') contain bifacial *limaces* and can probably be equated with the *Inventartyp Kartstein* of Central Europe. Their presence in these Layers shows that forms characteristic of the *Inventartyp Kartstein* are not confined to the Weichselian. The younger industries of this part of the sequence (Layers 20, 19, 18) are assigned to a *Moustérien de type Ferrassie*, showing that this facies also appears over a wider time range. The assemblages (Achenheim IV after G. Bosinski 1967) of the second loess Cover/penultimate Cold Stage are identified as *Moustérien de tradition acheuléenne*, in the older Layer 17 possibly of *MTA Type A*, in the younger Layers (16, 15) with »Upper Palaeolithic« tool forms characteristic of *MTA Type B* (J. Junkmanns 1991, 8). The humus zones of the early Weichselian loess contain an assemblage (Layer 14) identified as a *Moustérien de type Ferrassie*, whereas the overlying industries assemblages are described as being of less certain context and morphology and only assigned to *»späteren Phasen des Mittelpaläolithikums«* (J. Junkmanns 1991, 13).

The problems of Central European Middle Palaeolithic typology and terminology have been examined in detail in the hope that this might clarify the position of the Hummerich assemblage, with its small component of bifacial tools. In fact, it can be seen that similar bifacial elements can occur in a range of central European assemblages over a long time span, and that without a clear stratigraphic framework their classification and interpretation are uncertain. At the Hummerich this means that typological considerations alone cannot date the lithic assemblage more closely than is already clear from the geological context – to the first half of the Weichselian. Nevertheless, it is relevant to also examine the typology of Middle Palaeolithic industries within the framework of the stratigraphic succession established for north-western Europe (A. Tuffreau & J. Sommé 1986; A. Tuffreau 1992).

At Biache-Saint-Vaast (A. Tuffreau & J. Sommé 1988) Saalian Middle Palaeolithic industries very similar to the *Inventartyp Rheindahlen* are assigned to a *Moustérien de type Ferrassie* »of Biache facies« (A. Tuffreau 1992). In the same region, at Seclin an assemblage characterised by blades of Upper Palaeolithic type was recovered from early Weichselian deposits dated by thermoluminescence on burnt flint to 91 ky and 95 ky (A. Tuffreau *et al.* 1985) and assigned to Isotope Stage 5a (A. Tuffreau 1992, 67) while a similar industry was subsequently recovered from the site of Riencourt-lès-Bapaume (A. Tuffreau *et al.* 1991; N. Ameloot-van der Heijden 1993) where it is assigned to Isotope Stage 5c (A. Tuffreau 1993, 108). Riencourt is a particularly important site since here a number of clearly differentiated assemblages was recovered in good stratigraphical context (Fig. 103).

The base of the sequence is formed by weathered loess layers (*limons*) interpreted as intra-Saalian (Beds 4d,4c^2,4c^1), last interglacial (Bed 4b, 4a^2) and early Weichselian (Bed 4a^1) soil developments which are followed by a succession of partially geliflucted loams and humic/gleyed soils (Beds 3, 2, 1) assigned to the Middle and Upper Weichselian. It is suggested that the upper part of the sequence represents Isotope Stages 5e (interglacial *Sol de Rocourt*) and 5c/5a (interstadial *Sol de Warneton* complex) followed by Isotope Stages 4, 3 and 2 which include both a lower and upper Pleniglacial and gley and humic horizons representing shorter periods of interstadial conditions (Fig. 103). The industries at the base of the stratigraphic sequence are an undifferentiated Middle Palaeolithic but the early Weichselian sediments provided three assemblages of special interest for the Hummerich. Assemblage CA from within the interstadial *Sol de Warneton* complex is a laminar industry similar to that from Seclin; the retouched forms include end scrapers, burins and backed pieces. Stratified above this, the biggest lithic complex, Assemblage C, contains more than 50, 000 artefacts and presents a number of interesting features. Different *chaînes opératoires* can be recognised for the debitage (A. Tuffreau 1993, 68). Production of flakes from Levallois cores is demonstrated and among the cores are also true Levallois blade cores. However, alongside these there is also production of blades of Upper Palaeolithic type such as were found in Assemblage CA. Typologically, the assemblage is described as a *Moustérien de type Ferrassie* dominated by side scrapers, but these are found alongside other tools such as burins on crested- and thick-sectioned blades and bifaces typical for *Moustérien de Tradition Acheuléenne Type A*. Assemblage C was found in the upper part of a frost-worked loam below an interstadial soil which is attributed to Isotope Stage 4 and might therefore be chronologically quite close to Assemblage CA. Somewhat higher in the sequence, Assemblage B, recovered from an interstadial humic horizon in Bed 3 (interpreted as Isotope Stage 4) is provisionally referred to as an »*industrie de tradition Charentienne à influence micoquienne*« and contains bifacially retouched forms described as »*Faustkeilblätter*« and as resembling »*prondniks*« (A. Tuffreau 1993, 110-111). Finally, Assemblage A, recovered from Bed 1, is described as a non-laminar Mousterian with Levallois debitage. This patinated and frost damaged assemblage is possibly to be equated with the »Patina Complex« in a stratigraphically similar situation at Rheindahlen.

At Riencourt the broad general picture of stratigraphy and the technology/typology which was obtained by combining the results obtained from several German assemblages can be demonstrated at one and the the same site. Nevertheless, the apparently heterogeneous character of the large Assemblage C shows that a number of typological and technological distinct features might in fact be (from an archaeological viewpoint) contemporaneous and related to phenomena (function?, raw material?) about which we can only speculate.

With this reservation, it can be observed that, on the information of the northern French evidence in general and the Riencourt section in particular, certain Weichselian bifacial industries (e. g. Riencourt B) are stratified above an horizon with laminar debitage of Upper Palaeolithic type (Riencourt CA, also elements of Riencourt C?). However, such laminar debitage may be associated with other, quite different elements (Levallois debitage, *Moustérien de Tradition Acheuléenne Type A*?). Industries classed as *Moustérien de type Ferrassie* are found in both Weichselian and Saalian contexts.

	Lithostratigraphy	Interpretation	Lithic assemblage	Horizon	
Recent surface					
Bed 1	Bedded loams	Pléniglaciaire supérieur (IS 2)	Gelifracted "patina" complex	A	patinated industry
Bed 2	Complex of loams with gleys and pseudo gleys	Pléniglaciaire Moyen (IS 3?)			
Bed 3	Cryoturbated, grey humic gelifluccted horizon, locally divided into two	Pléniglaciaire inférieur (IS 4) "amélioration"	Two lithic series, one patinated§, one unpatinated* Artefacts lie directly on surface of Bed 4	B1* B2§	*Moustérien charentien à pièces bifaciales* ("Micoquian influences")
	Gelifluccted loams below the grey humic horizon		Artefact series which can be subdivided locally into several levels	C: C1, C2 C11, C12	*Moustérien de type Ferrassie* with "*bifaces MTA*" and "*faciès laminaire*"
Bed 4a[1]	Bt horizon altered by a grey forest soil	Sol de Warneton (IS 5c / 5a)	Unpatinated series of very "fresh" artefacts At the south of the site the basal layer contains two series of artefacts, one weakly*, one heavily§ patinated	CA II RBSA* II RBSB§	*Industrie laminaire*
locally	Gelifluction horizon				
Bed 4a[2]	B(t)g horizon of a very hydromorphic brown *sol lessivé*	Sol de Rocourt (IS 5e)			
Bed 4b	Argillaceous brown loam with hydromorphic features				
Bed 4c[1]	Yellow brown loam, part of a *sol brun lessivé*	IS 7a			
Bed 4c[2]	Pale yellow brown loam, ferro-manganese nodules, colluvial horizon		Small series of worked flint	III	*Non-Levallois, non-laminaire*
Bed 4d	Reddish brown, prismatic palaeosol	IS 7c			

Fig. 103 Schematic representation of the stratigraphic sequence at Riencourt-lès-Bapaume (after A. Tuffreau 1992, 1993).

If the interpretation of the Achenheim stratigraphy is correct then both the *Moustérien de type Ferrassie* and a Middle Palaeolithic with bifacial *limaces* (resembling *Inventartyp Kartstein*?) can also be identified in the third Cold Stage (Isotope Stage 8?) and the *MTA* in the penultimate Cold Stage. Clearly, typology alone cannot provide a more exact dating of the Hummerich assemblage than that already provided by the stratigraphic position of the assemblage, but this question will be returned to below in conjunction with the evidence of biostratigraphy.

BURNT ARTEFACTS AND THE USE OF FIRE

Very little lithic material from the Hummerich shows unambiguous traces of burning and of this only the finds recovered from a secure stratigraphical context will be considered (Fig. 104).
The natural colour of the quartz found in the central Rhineland is various shades of white, ranging from milky to glassy, and it can normally be assumed that reddening is due to the action of heat. Recognition of thermal alteration of Devonian quartzite and siliceous slate is also problematic, since it is rarely very well developed on these materials. The number of questionably burnt specimens therefore remains high compared with those certainly accepted as burnt by hominids. Cretaceous flint presents few problems, since thermal alteration of this material is usually easily recognisable.
In the case of the Hummerich assemblage it cannot be automatically assumed that heating is anthropogenic since material derived from the bedrock which was caught up in the eruption of the volcano and subsequently eroded from the crater wall would probably also be thermally altered. In the case of the locally ocurring rocks (including those found in river terraces) this possibility must also be considered. Nevertheless, in the case of angular specimens which are only partially reddened it is perhaps more likely that heating occurred after fracture and that this can be interpreted as due to human modification. Exogenous material such as flint cannot, of course, have been altered during the eruption of the Hummerich.
The possibility of naturally occurring »bush fires«, which might very well have been a relatively common phenomenon given the combination of open steppe grassland and dry continental climate which obtained at the time, must also be considered. Nevertheless, it is believed that the intensity of burning necessary to cause the alterations observed on the certainly thermally altered specimens is due to longer exposure to heat in humanly created fires rather than to superficial exposure to the flames of a natural fire, which tend to move rapidly across an area and are unlikely to have had much effect on lithic material lying on or just under the soil surface. Against this background, the small amount of burnt material can do little more than establish that fire was very probably used by humans at the site; the intensity and nature of fire-related activities cannot be identified.
The only reported evident site feature at the Hummerich was apparently a »hearth« found within the upper loess cover and associated with material of Upper Palaeolithic type, including burnt specimens such as an end scraper (Fig. 97, 3). No intact features of any kind (including hearths) survived in the Middle Palaeolithic layers. The spatial distribution of burnt and all potentially burnt lithic finds offers little information. The material is found ubiquitously, with neither visible concentrations which might reveal the locations of destroyed hearths nor areas of the site in which burnt specimens were absent. This might be interpreted as showing that fire-related activities were sufficiently transient as to leave very few

	Quartz		Devonian quartzite		Tertiary quartzite		siliceous slate		chert / chalcedony		flint	
	y	?	y	?	y	?	y	?	y	?	y	?
E	2	19	1			1		2		1		1
D3		1				1						
D2		8										
D1	1	37				2	1			1		1
C		5										
B		1										
Total	3	71	1			4	1	2		2		2

Fig. 104 Presence of burnt and possibly burnt lithic material by Niveau.

traces on the lithic assemblage, but also that they occurred recurrently so that all parts of the site have some evidence for the use of fire. This would be more likely to happen if the Hummerich assemblage was the result of the accumulation of several independent episodes over a period of time. The faunal assemblage can contribute very little information to the question of the use of fire at the site since only three specimens are possibly charred (if this is not merely mineral staining.) It is nevertheless relevant that all three specimens were recovered from the north-western part of the site; two of them in adjacent m^2 (55/82-6: a horse tibia; 54/82-3: red deer antler?) and one some several metres away (47/83-7: undetermined shaft fragment with a clear impact fracture). This suggests that traces of at least one fire can be discerned here.

OTHER LITHIC ARTEFACTS – HAMMERSTONES, PEBBLE TOOLS

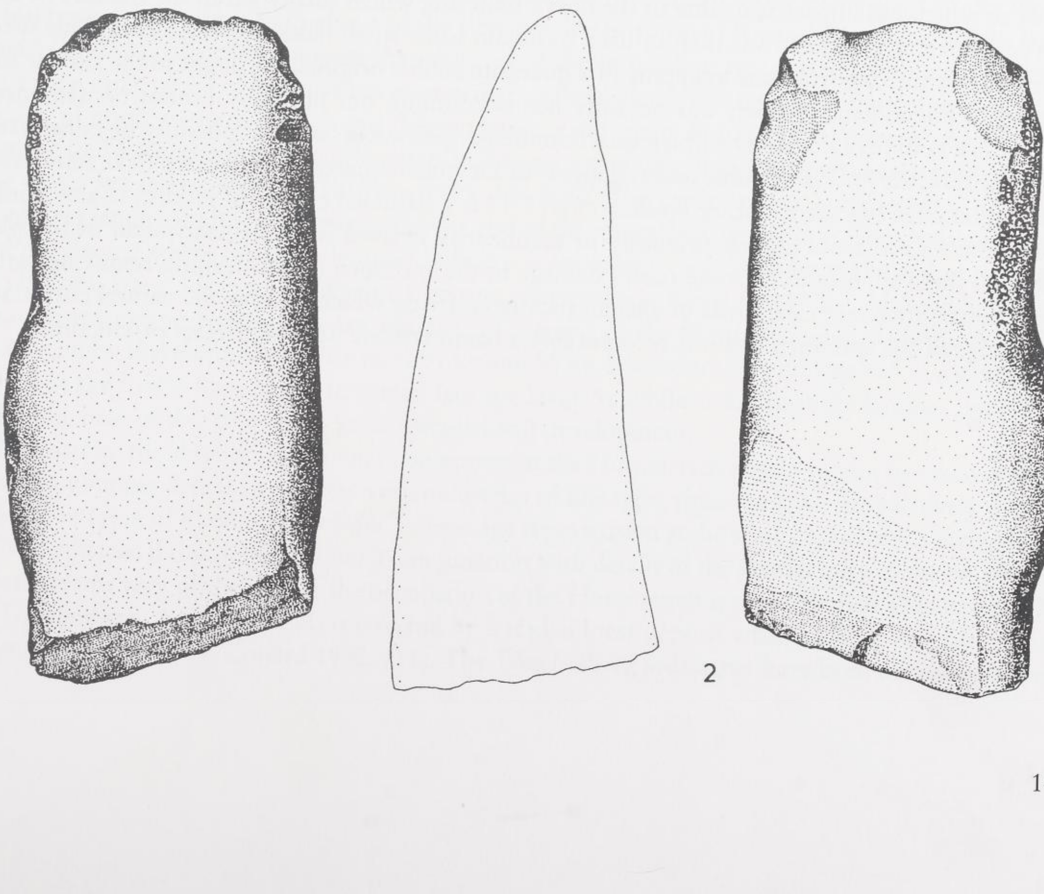
It is often difficult to recognise the artificial nature of minor modification to cobbles and fragments of lithic material, or to assign these specimens to a certain category of artefact. This particularly applies to angular fragments of the less dense rocks such as graywacke and Devonian schist which could potentially have been edge damaged during the eruption of the Hummerich, by subsequent transport in a solifluvial milieu or, finally, by hominid modification. The only possibility of distinguishing artificial from natural alteration for such materials is should the modification give the specimen a classifiable form, which here is only rarely the case. An unknown number of angular fragments of Devonian rocks might therefore conceivably have been used without leaving recognisable traces.
A different problem is encountered in the case of cobbles of denser materials (quartz, Devonian quartzite) which may served a number of functions without leaving any visible traces. While use as a hammerstone will (after a certain duration) leave flake scars classifiable by their position and by analogy with experimental results, in the case of certain other activities (breaking open limb bones for their marrow, pounding plant foods) it is highly probable that the cobbles themselves will not be modified (Fig. 82, 7, 9). This problem is not found at the Hummerich alone and on any site the majority of cobbles can only be regarded as potential tools. The special situation at the Hummerich, where it might be argued that all non-volcanic rocks can be interpreted as manuports, was discussed and it was argued that at least the smallest category of fluvially rolled specimens (»pebbles«) was probably not brought to the site by hominids. Nevertheless, the specimens with visible modification described below can only be regarded as a minimum of the number of cobbles actually used for some purpose at the site.

Niveau C

A total of three cobbles from Niveau C can be identified as hammerstones used for the production of lithic artefacts. 58/59-20 is a smashed cobble of coarse-grained Tertiary quartzite with recognisable pitting of the cortex running around its circumference. 45/83-11 is a quartz cobble with scarring of the cortex at one end due to intensive battering. A flake removal at this position is certainly due to accidental fracture during use as a hammerstone and not a deliberate attempt at debitage. Besides several flake removals, a core 34/84-8 shows battering of the cortex indicating that it was also used as a hammerstone. 44/82-18 (Fig. 82, 7) and 41/83-9 (Fig. 82, 8) are flat cobbles of graywacke which although unmodified, can nevertheless probably be regarded as manuports. Similar finds occur throughout the stratigraphy but will not be illustrated for other layers.

→
Fig. 105 Modified cobbles of Devonian schiste (229, 1) and graywacke (229, 2) from Niveau D1. 1: 70/72-17; 2: 61/70-12.

1



2

Niveau D1

Quartz cobble 69/71-8 measures approximately 7 × 6 × 4 cm and has clear scarring of the cortex showing use as a hammerstone. In the case of the graywacke cobble 39/84-4 a function as a hammerstone is possible but not certain. 77/79-21 is a fragment of a struck graywacke cobble while 51/83-5 and 57/84-6 are also graywacke cobbles, in the latter case a very flattened specimen, with possible marks due to impact fractures. 61/70-12 is a broken, naturally wedge-shaped cobble of dense Devonian graywacke or quartzite (Fig. 105, 2). The narrow end of the specimen bears traces of battering. In some cases these are clearly ancient and subsequently water-abraded but other marks appear fresher and are perhaps anthropogenic. The cortex along part of one edge has a picked appearance and this might result from active use of the stone as a hammer in lithic knapping or passive use of the narrow ridge of the specimen as an anvil. 70/72-17 is an elongate flat cobble of Devonian schist, the two ends of which are roughly flaked, probably intentionally rather than by use (Fig. 105, 1). The piece was recovered in two fragments and it is probable that it split along natural bedding planes as a result of use for hammering or chopping.

Niveau D2

62/75-2 is a flat, angular cobble of Tertiary quartzite (Fig. 89, 6) with two (clearly intentional) small flake removals from one corner and a third flake removal (which could be accidental) from one side. The piece may simply have been tested for its suitability as raw material and then not further exploited but might possibly be classed as a core. 50/86-13 is a cobble of Devonian slate which greatly resembles find 70/72-17 from Niveau D1 (Fig. 105, 1). in its raw material, shape, size and the modification of one end by rough flaking. The similarity of the two pieces reinforces the impression that these finds represent a possibly *ad hoc*, but nevertheless standardised tool type.

Niveau E

59/64-1 is a fractured flat cobble of graywacke with a »picked« surface which is suggestive of scars left by use as a hammer or retoucher. 78/80-4 is a fragment of a hammerstone of Devonian quartzite, the cortex of which has impact scars due to the heavy battering which finally led to the fracture of the piece. The recovered fragment was then re-used to obtain some small flakes leaving a core. This specimen clearly shows the opportunistic knapping of a quartzite cobble originally brought to the site for another purpose, a phenomenon which was possibly not uncommon but normally cannot be demonstrated. 80/70-1 is a cobble of coarse Devonian quartzite/dense graywacke and can possibly be considered as a chopping tool. 80/79-2 is a pebble tool (chopper) of Devonian quartzite. It has two flake removals from one angular edge but seems rather »rolled«. 81/77-13 is a flattened cobble of reddish coarse sandstone, probably obtained from gravels primarily or secondarily derived from the catchment of the Moselle. Although there appears to be some recent damage to the specimen (from cleaning/removing carbonate concretions?) there are clear areas of ancient picking/scarring which remove the natural cortex at parts of the edge of the specimen and it is recognisably a hammerstone used in artefact production.

DISCUSSION AND INTERPRETATION

Two aspects of the Hummerich site can now be examined; these are the exact chronological position of the Hummerich occupation within the European Middle Palaeolithic sequence and the function of the site.

Chronological position of the Hummerich assemblage

It has been shown by the geology (relative stratigraphy, sedimentology, absolute dating) and the palaeontology (micro- and macrofauna) that the crater of the Plaidter Hummerich was occupied during a more temperate phase (interstadial) of the early Weichselian. The lithic and faunal assemblages lie above (and in a very small number of cases within) a soil identified as that of the last interglacial which had formed upon loess of Saalian age and below loess deposits showing the renewed onset of stadial conditions.

In several of its aspects the lithic assemblage resembles those industries with a bifacial component. (»*Micoquien*«/«*Keilmessergruppen*«, »*Inventartyp Kartstein*«) described from the last glaciation. On the other hand, possibly due to the nature of the raw materials used at the Hummerich, the assemblage cannot be described as a typical example of any one of these industries. It must be borne in mind that less specific bifacial assemblages are also found in older contexts so that the presence of bifacial tools cannot alone date the Hummerich occupation more closely.

A feature not observed at the Hummerich is the presence of laminar debitage such as was present at the neighbouring Tönchesberg 2B site. Here, the assemblage, which was recovered from a colluvial humus, is assigned to a very early phase of Weichselian interstadial cooling (early Isotope Stage 5d?) and dated to ca. 115 ky/117 ky by thermoluminescence and palaeomagnetic studies (N. J. Conard 1992, 23). Other north-west European sites with similar industries have also been dated to the earlier part of the Weichselian interstadial complex. On the basis of the stratigraphic position of Rheindahlen Assemblage B1 N. J. Conard (1992, 82) plausibly suggests that charcoal of thermophilous tree species could date the industry to a very early phase of Weichselian interstadial cooling (Isotope Stage 5e-5d transition).

The dating of north-western French and Belgian laminar industries indicates two phases, one in a position similar to Tönchesberg 2B and Rheindahlen B1 and a younger phase during the first (»Brørup« or Isotope Stage 5c) interstadial (A. Tuffreau 1993, 104-106). The earlier phase is represented at Seclin, where a lower laminar industry is assigned to the end of the interglacial (transition Isotope Stages 5e-5d) and at Port-Racine where the older laminar industry is assigned to a cold phase at the end of the interglacial (Isotope Stage 5d) associated with a marine transgression dated to 117 ky. At both Seclin and Port-Racine the younger industries are assigned to the end of the first interstadial (Isotope Stage 5c), dated at Seclin by thermoluminescence to ca 91 ky and 95 ky. Riencourt Assemblage CA is also assigned to the end of the first (»Brørup«) interstadial Isotope Stage 5c while at Rocourt the laminar industry is located at the base of this first Stage 5c interstadial soil development.

Taken in isolation, the absence of a laminar component at the Hummerich clearly cannot be taken as an indication of a younger date than for sites with industries of this type, since the latter are relatively uncommon and other types of Middle Palaeolithic assemblage types existed at the same period of the early Weichselian. Nevertheless, if this detail is taken in conjunction with details of the stratigraphy of the two Rhineland sites it seems very probable that the occupation of the Hummerich is younger than Tönchesberg 2B. At the Tönchesberg, Assemblage 2B is covered by a stadial loess deposit which is itself overlain by further humic horizons (N. J. Conard 1992, 111). The Tönchesberg sediments have been comprehensively

dated by thermoluminescence (M. Frechen 1994) and it is clear that a long and complicated sequence of stadial/interstadial oscillations is far better preserved there than at the Hummerich (Fig. 106).
It is possible that the post-Eemian phase of cooling (Isotope Stage 5d?) represented at the Tönchesberg by the colluvial humus (containing Assemblage 2B) and the subsequent reworked loess horizon (*Schwemmlöß*) are represented at the Hummerich by the soliflucted Niveau C. In this case, the entire complex of *in situ* interstadial soils and humic colluvial deposits preserved at the Tönchesberg (Isotope Stages 5c - 5a, Isotope Stage 4 and possibly Isotope Stage 3) must be represented at the Hummerich by the humic Niveaux D1-D3 and the solifluction layer Niveau E. It is then impossible to determine whether the Hummerich deposits represent this entire time span condensed into a reduced sedimentary sequence or whether periods of arrested sedimentation or erosion have preserved only discontinuous parts of the Early and Middle Weichselian. If the latter is the case, it is uncertain which parts of the sequence are represented. Theoretically, Niveaux D1-D3 could represent the Stage 5c, 5b interstadials, but their interpretation as appreciably younger humic colluvial deposits such as those preserved above the *in situ* interstadial chernozems at the Tönchesberg is equally possible and, by inference from the different nature of the lithic assemblages at the two sites, perhaps more probable.

	Isotope Stage	Tönchesberg 2	TL* age (ky)	TL# age (ky)	Hummerich Level	TL age (ky)
Upper	2	Pleniglacial loess	14.1 +/- 1.5	12.0 +/- 1.2		22.56
Weichselian			17.5 +/- 1.8	15.1 +/- 1.8	F	22.85
						23.23
		Lohner Boden soil /				
		Denekamp interstadial				
Middle	3		36.5 +/- 3.8	32.3 +/- 3.8		
Weichselian		Lower *Lohner Boden*				
			64.3 +/- 7.0	68.9 +/- 7.3		
		loessic colluvium (*Fließerde*)			E	
		humic colluvium (*Fließerde*)				
			65.5 +/- 8.7	75.6 +/- 9.8		
Lower		upper marker loess			D3	
Weichselian	4	humic colluvium (*Lehmbröckelsand*)				
		lower (main) marker loess	77.8 +/- 8.9	70.3 +/- 7.4		
		humic colluvium (*Fließerde*)				
					D2	
	5a	upper chernozem soil (Odderade?)				
	5b	humic colluvium (*Fließerde*)	84.3 +/- 8.9	95.2 +/- 9.7		
					D1	
	5c	lower chernozem soil (Brorup?)	84.1 +/- 9.2	90.5 +/- 11.2		
		reworked loess (*Schwemmlöß*)	101.0 +/- 11.0	112.0 +/- 12.0		
	5d				C	
		colluvially reworked	85.7 +/- 9.8	89.0 +/- 11.5		
		soil horizon (**Blake Event**)	90.7 +/- 9.6	92.9 +/- 11.5		
Eemian	5e	*Parabraunerde* soil	100.0 +/- 9.2	106.0 +/- 13.0	B	
		loess	116.0 +/- 13.0	118 +/- 12.0		
		tephra				
		loess	104.0 +/- 12.0	108.0 +/- 12.0		
	6					
		reworked loess (*Schwemmlöß*)	106.0 +/- 11.0	122.0 +/- 13.0		
		Naßboden soil			A	134.0
						135.0

Fig. 106 Stratigraphy and absolute dating of deposits at the Tönchesberg (M. Frechen 1994) and the Hummerich (A. K. Singhvi *et al.* 1986). Tönchesberg TL dates obtained by * regeneration method or # additive dose method.

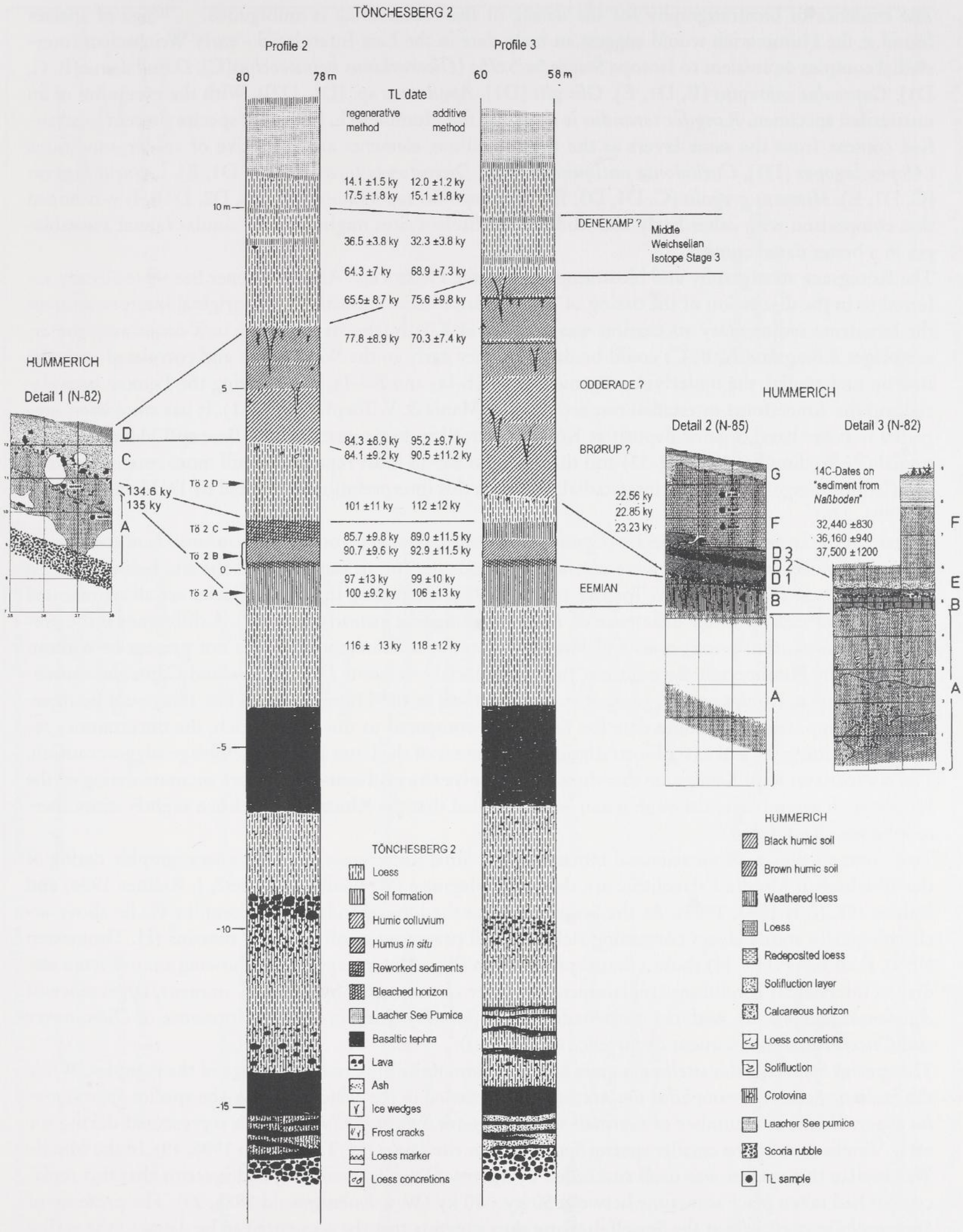


Fig. 107 Comparison of the stratigraphies of the Tönchesberg and the Plaidter Hummerich (Neuwieder Becken. After K. Kröger 1987 (fig. 4), N. J. Conard 1992 (fig. 19) and M. Frechen 1994 (fig. 7).

The evidence of biostratigraphy for the dating of the Hummerich is ambiguous. A range of species found at the Hummerich would suggest an early date in the Last Interglacial - early Weichselian Interstadial complex equivalent to Isotope Stages 5e/5c/5a (*Dicerorhinus hemitoechus*[C], *Dama dama* [B, C, D1], *Capreolus capreolus* [B, D1, E], *Glis glis* [D1], *Apodemus* sp. [D1, D2]). With the exception of an unstratifed specimen, *Rangifer tarandus* is absent at the Hummerich, but other species present in stratified context from the same layers as the thermophilous elements are indicative of colder conditions (*Alopex lagopus* [D1], *Coelodonta antiquitatis* [D2], *Dicrostonyx torquatus* [C, D1, E], *Lagurus lagurus* [C, D1, E], *Microtus gregalis* [C, D1, D3, E], *Spermophilus superciliosus* [C, D1, D2, D3]). It was hoped that comparison with other Early and Middle Weichselian sites might provide similar faunal assemblages in a better dated context.

The Königsaue stratigraphy and biostratigraphy of the Pleistocene Ascherslebener See were already referred to in the discussion of the dating of Weichselian bifacial industries. The original interpretation of the lacustrine sedimentary succession was that Layer Kö-Ib (the stratigraphic unit containing the assemblages Königsaue A, B, C) could be dated to very early in the Weichselian and correlated with the Brørup interstadial, the underlying organic layers Kö-Ia$_1$ and Kö-Ia$_2$ representing the Eemian interglacial and the Amersfoort intestadial respectively (D. Mania & V. Toepfer 1973, 51). It has since been suggested that the basal organic deposit at Königsaue itself in fact represents the Brørup/Odderade interstadial (W. Weißmüller 1992, 32-33) and that horizon Kö-Ib must represent a still more recent Weichselian (Isotope Stage 3?) »Oerel« interstadial, although this interpretation is rejected by D. Mania (J. Richter 1994, 276).

Certain of the large mammal species (*Equus hydruntinus, Crocuta crocuta, Dicerorhinus hemitoechus,* cf. *Bison*) identified at Königsaue were considered diagnostic for an early date of the site before the first main cold phase (D. Mania & V. Toepfer 1973, 85). It is interesting that these species are all represented at the Hummerich (with the difference cf. *Bison* at Königsaue instead of cf. *Bos*). A difference is the presence of *Mammuthus primigenius* and *Rangifer tarandus* at Königsaue, species not present or without context at the Hummerich. By contrast, the »interglacial« elements *Dama dama* and *Capreolus capreolus* are absent at Königsaue but present in low numbers at the Hummerich. While this could be interpreted as supporting a younger date for Königsaue compared to the Hummerich, the uncertainties regarding the integrity and exact biostratigraphical context of the latter faunal assemblage suggest caution. The comparison with Königsaue therefore cannot solve the problem of the more accurate dating of the Hummerich assemblage, although it can be established that the Rhineland site has a slightly more thermophilous character.

Two German sites with microfaunal remains of potential importance for the biostratigraphic dating of the Weichselian Middle Palaeolithic are the Sesselfelsgrotte (W. Weißmüller 1992, J. Richter 1994) and Buhlen (O. Jöris 1993, 1994). At the Sesselfelsgrotte the bifacial industries (Complex G) lie above archaeologically sterile layers containing rich and well preserved small mammal remains (H. Thomassen 1996). Four layers (L - H) show a faunal progression (Fig. 108) interpreted as showing a move from stadial to interstadial conditions (replacement of *Sorex* cf. *coronatus* by *Sorex* cf. *araneus*, appearance of *Apodemus* and *Sicista*), with the most stadial phase possibly being in Layer K (presence of *Dicrostonyx* and *Cricetulus*, most frequent occurrence of *Lagurus*).

The species *Spermophilus citelloides* gives an indication of the biostratigraphic age of the complex. While the Saalian species *Spermophilus undulatus* was succeeded in the Weichselian by the species *Spermophilus superciliosus*, at a number of German sites the genus *Spermophilus* was also represented during the early Weichselian by the smaller species *Spermophilus citelloides* (H. Thomassen 1996, 49). In the Middle Weichselian this species was itself succeeded by *Spermophilus superciliosus*, and it seems that this replacement had taken place sometime between 50 ky - 40 ky (W. v. Koenigswald 1985, 29). The presence of *Spermophilus citelloides* at the Sesselfelsgrotte thus suggests that the sequence can be dated to the earlier Weichselian before the replacement of this species by its larger relative.

The Buhlen sequence also shows a faunal progression (shown only in part by Fig. 108), in this case from temperate to open/steppe and then to cold/stadial conditions. At Buhlen, the species of suslik present is

Buhlen sequence shows cooling from IIIb4 to I		Sesselfelsgrotte sequence shows warming from L to H			
Buhlen I	*Lagurus lagurus* *Spermophilus superciliosus* *Microtus gregalis* *Sorex araneus / kennardi* *Dicrostonyx torquatus* - -	**Sesselfelsgrotte H**	*Lagurus lagurus* *Spermophilus citelloides* *Microtus gregalis* *Sorex cf. araneus* - *Apodemus sylvaticus* *Sicista* sp.	**Plaidter Hummerich**	*Lagurus lagurus* *Spermophilus superciliosus* *Microtus gregalis* *Sorex* cf. *araneus* *Dicrostonyx torquatus* *Apodemus sylvaticus*
Buhlen II	*Lagurus lagurus* *Spermophilus superciliosus* + sp. *Microtus gregalis* *Sorex araneus / kennardi* *Dicrostonyx torquatus* - -	**Sesselfelsgrotte J**	*Lagurus lagurus* *Spermophilus citelloides* *Microtus gregalis* *Sorex* cf. *araneus*, *Sorex* cf. *coronatus* - *Apodemus sylvaticus* *Sicista* sp.		
Buhlen IIIb2	*Lagurus lagurus* *Spermophilus superciliosus* + sp. *Microtus gregalis* *Dicrostonyx torquatus* *Ochotona pusilla* - - -	**Sesselfelsgrotte K**	*Lagurus lagurus* *Spermophilus citelloides* *Microtus gregalis* *Dicrostonyx torquatus* *Cricetulus migratorius* *Apodemus sylvaticus* *Sicista* sp. *Sorex* cf. *araneus*, *Sorex* cf. *coronatus*		
Buhlen IIIb4	*Lagurus lagurus* *Spermophilus superciliosus* + sp. *Microtus gregalis* *Dicrostonyx torquatus* *Lemmus lemmus*	**Sesselfelsgrotte L**	*Lagurus lagurus* *Spermophilus citelloides* *Microtus gregalis* *Sorex cf. coronatus*		
Villa Seckendorff	- *Spermophilus citelloides* *Microtus gregalis* *Dicrostonyx torquatus* *Lemus lemmus* *Allactaga major*	**Stuttgart-Untertürkheim**	*Lagurus lagurus* *Spermophilus citelloides* - *Dicrostonyx torquatus* *Ochotona pusilla* *Allactaga major fossilis* *Phodopus songorus*	**Neumark-Nord**	*Lagurus lagurus* *Spermophilus citelloides* *Microtus gregalis*
Early Weichselian *Spermophilus citelloides* (and *superciliosus*) **Middle Weichselian** (post 50 / 40 ky) *Spermophilus superciliosus*					

Fig. 108 Possible biostratigraphical position of the Hummerich relative to selected German Weichselian sites with small mammal faunas. After H. Thomassen 1996, O. Jöris 1993, W. v. Koenigswald 1985; W. -D. Heinrich 1990; W. Reiff 1994; S. Wenzel 1996.

Spermophilus superciliosus (O. Jöris 1993). If the entire Buhlen sequence dates to a period after the replacement of *Spermophilus citelloides* by *Spermophilus superciliosus* this should indicate a younger age for the sequence than for that of the Sesselfelsgrotte.
The small mammal sequences from Buhlen and the Sesselfelsgrotte could then theoretically be combined to show a cycle moving from interstadial - stadial - interstadial conditions (when the Buhlen sequence would represent the very recent Early Weichselian or Middle Weichselian).
This interpretation is supported by the »*Steppennagerschicht*« fauna from Stuttgart-Untertürkheim, assigned to the first phase of cooling (Isotope Stage 5d) after the Interglacial (S. Wenzel 1993, 1994, 1996), which includes the species *Spermophilus citelloides* (W. v. Koenigswald 1985, 9). Nevertheless, the large mammal fauna of this layer, which is stratified between two travertines formed in interglacial/interstadial conditions, contains a number of the less common species also recorded at the Hummerich (*Crocuta crocuta, Coelodonta antiquitatis, Equus hydruntinus*). The small mammal fauna contains the steppe lemming (*Lagurus lagurus*) and other small mammal species typical of open/stadial conditions (pika [*Ochotona pusilla*], the hamsters *Phodopus sungorus* and *Cricetus cricetus major*, and jerboa [*Allactaga major fossilis*]).
By contrast, an »*Allactaga* fauna« described for the Villa Seckendorff, also in Stuttgart, is described as younger than the »Brörup« interstadial (W. v. Koenigswald 1985). *Lagurus lagurus* is not found at this site although a number of other steppe and arctic elements are present (*Dicrostonyx gulielmi rotundus, Lemmus lemmus, Microtus gregalis*). The suslik species found at the Villa Seckendorff is also identified as *Spermophilus citelloides*.
The suslik found at the Hummerich is *Spermophilus superciliosus* which, by analogy with the suggested relative age of Buhlen and the Sesselfelsgrotte, might suggest a younger, rather than an older Weichselian age for the site. This comparison must however be treated with caution, since the species is, in fact, also found in the late Saalian levels at the site showing that the succession of species was a complicated phenomenon. In addition, it is unclear to what extent the different presence of the two species *Spermophilus citelloides* and *Spermophilus superciliosus* may also be influenced by geography, since the sites with the former species are found in southern Germany. The biostratigraphical value of their distinction would clearly be greatly reduced if this is an important factor.
The species *Lagurus lagurus* (found at Hummerich in Niveaux C, D1 and E) shows the existence of highly continental environmental conditions. The species is found sporadically during both the Saalian and the Weichselian in western Europe as a result of waves of immigration from the east (W.-D. Heinrich 1990). It is sometimes thought that the presence of *Lagurus* is specific to a singular early Weichselian horizon (the rodent layer known as the »*Steppennagerschicht*«) which can possibly be equated across Europe with Isotope Stage 5d (cf. Stuttgart-Untertürkheim). The absence of *Lagurus* at the Villa Seckendorf (dated to post-Brørup?) would not contradict this interpretation. The species is also found at Neumark-Nord (W.-D. Heinrich 1990).
That *Lagurus* in fact migrated into western Europe on several occasions has been pointed out by W. Reiff (1994, 46) who therefore disputes the value of this species for exact biostratigraphical dating. These doubts are clearly supported by the results from Sclayn in Belgium (located still further to the West than is the Hummerich) where *Lagurus* appears during the Weichselian on repeated occasions interpreted as Isotope Stage 5b, early Stage 4 and Stage 3 (J.-M. Cordy 1992, Fig. 12). Taken in conjunction with the older occurrences from southern Germany it seems that the presence of this species cannot give a more precise indication of the age of the Hummerich assemblage than is already known.
A final small mammal species which might give some indication of the finer biostratigraphical position of the Hummerich assemblage is *Arvicola terrestris*. The analysis of details of the tooth enamel of this species shows a different range of S. D. Q. values for the Saalian and Weichselian assemblages (Fig. 6). The Tönchesberg 2B and Hummerich Weichselian populations also show different values (T. v. Kolfschoten & G. Roth 1993, Fig. 10) and this difference might be interpreted as showing the elapse of an appreciable period of time between the deposition of the two assemblages.
In summary, the period of time represented by the upper Hummerich stratigraphy corresponds either

to a younger phase of the early Weichselian or to the early Middle Weichselian which is characterised by species showing dry and open conditions (*Equus* sp., *Equus hydruntinus, Lagurus lagurus, Spermophilus superciliosus*) with a low but continued (repeated?) presence of thermophilous/forest mammal species such as *Capreolus capreolus* and *Dama dama, Glis glis*. The absence of full periglacial conditions is suggested by the absence/low representation of truly »arctic« species. The Hummerich succession appears to be younger than the base of the Tönchesberg Weichselian succession assigned to the first Weichselian interstadial Stage 5d and containing laminar Assemblage Tö 2B.

The Hummerich lithic assemblage contains a number of features which can be linked to early/middle Weichselian industries with bifacial tools (*»Keilmessergruppen«/Mousterien Inventartyp Kartstein*) although the exact affinities of the Hummerich material cannot be more closely defined. Nevertheless, it is possible to combine these various lines of evidence to place the Hummerich in its approximate European chrono-, archaeological and biostratigraphical context (fig. 109) and to suggest that the ecological background of this recent phase of the Middle Palaeolithic can be characterised at the site in an unusually comprehensive way.

Site function

It has been pointed out that there are good reasons for believing that the Hummerich site has been heavily influenced by a number of secondary processes such as reworking of sediments and their palaeontological and archaeological content by erosion and the differential weathering and preservation of the faunal assemblage. Equally, there is no certainty that most or all of the fauna can be causally linked with the Middle Palaeolithic occupation(s) of the site attested by the lithic assemblage. That the entire site could not be excavated is a further, negative factor in the analysis.

Despite all these problems an interpretation of the possible function of the site and the reasons for its occupation by Middle Palaeolithic hominids should be attempted, in the full knowledge that this will be to a large extent speculative.

The geology of the site makes it clear that the Hummerich was not visited by hominids for purposes of provisioning with raw material. Although some artefacts (perhaps the majority) were clearly produced on the spot using materials transported to the site, a function as a specialised quarry or lithic production site (*atelier*) cf. L. Fiedler & S. Veil (1974); A. Luttropp & G. Bosinski (1971), R.-W. Schmitz (1995) can certainly be ruled out and artefact production will have been linked to the needs of the hominid group as they arose.

The presence of a large faunal assemblage and a small number of bones recognizably modified by humans suggests that these needs will have included activities linked to hunting or butchery. Exploitation of large mammals certainly played a role at the Hummerich and various categories of Middle Palaeolithic sites can be proposed as models for activities carried out within the shelter of the crater.

The first and most easily recognisable of these should be the kill/butchery site of a single animal individual. Such sites are, perhaps surprisingly, uncommon in the Middle Palaeolithic. Chronologically relevant examples of well preserved sites with single individual animal carcasses are Gröbern and Neumark-Nord in the Geiseltal (D. Mania, M. Thomae, T. Litt & T. Weber 1990; D. Mania & M. Thomae 1988) and Lehringen in Lower Saxony (H. Thieme & S. Veil 1985).

The well known arguments over the »correct« interpretation of these localities as the sites of true kills or merely as evidence for scavenging activities by early hominids need not be repeated in detail here. The evidence of the Lehringen wooden spear for the ability of Neandertals to actively hunt has been disputed (C. Gamble 1987), but the discovery at Schöningen near Brunswick in Lower Saxony of a number of spears which were clearly carefully manufactured to be used as projectiles (H. Thieme & R. Maier 1995; H. Thieme, D. Mania, B. Urban & T. v. Kolfschoten 1993) removes any reasonable doubt that early hominids were adequately armed with hunting weapons. That the lithic and faunal remains at the

France		**Lower Rhineland**	**Central Rhineland**
Site / Horizon	Technocomplex	Site / Technocomplex	
		Rheindahlen A1 (angle-backed point*)	
			Remagen-Schwalbenberg (*Blattspitzengruppen*?)
Riencourt A Corbehem Hénin-sur-Cojeul	Moustérien typique	Rheindahlen A2 Patina-Komplex cf. late "*Moustérien Typ Balve IV*"	
Riencourt B1, B2	*Moustérien charentien à pièces bifaciales* (with "Micoquian influence")		↑ ? **Plaidter Hummerich** ? ↓
Riencourt C	*Moustérien de type Ferrassie* with "*bifaces MTA*" and a "*faciès laminaire*"	Rheindahlen A3 (MTA)	Ariendorf 1
Seclin Riencourt CA	*MTA industrie laminaire* ("*Seclinien*")	Rheindahlen B1 "*Westwand*" laminar industry ("*Rheindahlien*")	Tönchesberg 2b laminar industry
		Rheindahlen B2 "*Micoquekeil*" "*Typ Bockstein*"	
	SAALE - WEICHSEL INTERGLACIAL (Isotope Stage 5e)		
Biache IIA, II base	*Moustérien Ferrassie*	Rheindahlen B3 "*Ostecke*" Mousterian "*Typ Rheindahlen*"	Schweinskopf Wannen Ariendorf 2
Salouel, Biache H	*Moustérien à denticulés*		
Bapaume-Osiers Montières	*Epi-Acheuléen*	Rheindahlen B4	
		Rheindahlen B5	
	INTERGLACIAL (Isotope Stage 7)		
Gouzeaucourt Atelier Commont Cagny l'Epinette	*Paléolithique moyen de faciès cambrésien* (Upper Acheulian) *Acheuléen*	Rheindahlen C1 (quartz) Lower Palaeolithic ?	Ariendorf 3
		INTERGLACIAL	Kärlich-Seeufer (Lower Palaeolithic)
		Rheindahlen D1 (quartz) Lower Palaeolithic ?	
		INTERGLACIAL	Miesenheim 1 (Lower Palaeolithic)

Fig. 109 Proposed correlation of the relative chronology of some Palaeolithic technocomplexes in Northern France and the Rhineland (* the point from Rheindahlen A1 is probably late Palaeolithic). After G. Bosinski 1967; S. Veil 1978; A. Tuffreau 1992, 1993.

Hummerich represent numerous individual kill sites accumulated over an unknown length of time is clearly a possibility. Conceivably, the very rare spatially restricted accumulations of single carcasses is due to the fragmentary survival of primary evidence for such events.

An alternative to individual kills of single animals would be the mass slaughter of several animals of one species as a single event. Sites with large monospecific accumulations of faunal remains are well known from the Upper Palaeolithic and in this context they are generally accepted as evidence for the ability of anatomically modern humans to exploit herds of ungulate species more effectively by the use of mass kill strategies (drives, ambushes, etc). Similar sites, in particular with accumulations of large bovid remains, are also known from earlier contexts (C. Farizy & F. David 1988, 1992; S. Gaudzinski 1996) and seem relevant in regard to the Hummerich. They are described from the French sites Champlost (C. Farizy 1988), Mauran (C. Girard & F. David 1982; C. Farizy, F. David & J. Jaubert 1994) and La Borde (J. Jaubert *et al.* 1990) and from Il'skaya I in the Caucasus (J. F. Hoffecker, G. F. Baryshnikov & O. Potapova 1991). It has been suggested that the association of a series of wooden spears with a large number of individuals of horse at the Schöningen site may also be due to a mass kill in a much older context (pers. comm. H. Thieme, Hannover, March 1998).

A chronologically and geographically close example of such a site is the early Weichselian site Wallertheim in Rheinhessen excavated in the 1920's (S. Gaudzinski 1995a, 1995b). The latter author argues that Middle Palaeolithic sites of this nature can be seen as the direct equivalents of their Upper Palaeolithic counterparts and suggests that Middle and Upper Palaeolithic patterns of prey exploitation might have been more similar than is often thought (S. Gaudzinski 1993, 1996). A site of a different nature is La Cotte de St. Brelade on Jersey (P. Callow & J. M. Cornford, J. M. 1986) where it is believed that the carcasses of several individuals of mammoth and woolly rhinoceros (in part excavated stacked and sorted by body part) might represent the result of one or more mass kills, perhaps in the form of drives over the headland cliff.

A problem in the interpretation of sites with many individuals of one species is the resolution of the depth of time involved in their accumulation. A large number of kills of individuals, or small numbers of individuals could conceivably present the same archaeological picture as a single mass kill and only arguments for selective exploitation of body parts due to the presence of a great surplus of resources might enable their distinction. A minimalistic view could be that such sites merely reflect (repeated?) exploitation of constant factors such as topography, animal ethology and seasonality patterns. Recent excavations at Wallertheim, where the fine stratigraphy is more clear than at the Hummerich, show that single bison carcasses can indeed be found in isolated contexts (N. J. Conard, D. S. Adler, D. T. Forrest & P. J. Kaszas 1994, 1995) and also distinguished a series of distinct occupations by hominids through much of the early Weichselian. The possibility that a number of separate hunting strategies are represented at this site is therefore quite high.

In the case of the Hummerich, where the fauna includes a diversity of species and which, due to the location (at the summit of a steep hill), is not likely to have lain on an animal migration route, an interpretation of the site as the locality of mass kills by ambush or drives seems highly unlikely. It is an open question whether repeated single kills of individuals might have actually taken place at the site itself. Although other Middle Palaeolithic sites in the Neuwied Basin have been interpreted as hunting localities (A. Justus 1992, 158), the topography of these sites is quite different from that of the Hummerich. It is anyway improbable that all sites can be interpreted in the same way.

The extensive area of the area occupied at the Hummerich and the relatively large lithic assemblage suggest repeated occupation over time and might speak for a diversity of functions for the site. The use of fire possibly indicates »domestic« activities or, at least, extended stays by hominids. An interpretation of the Hummerich as a »home site« can only remain speculative since any structures (dwellings, hearths) that may have originally been present have not survived. This is not in itself so unusual since features interpreted as Middle Palaeolithic dwelling structures are often ambiguous (Ariendorf Layer 2, G. Bosinski *et al.* 1983), while other claims for dwelling structures such as Rheindahlen B1 »Westwand-Komplex«, Dwelling 1 (H. Thieme 1990), Buhlen Lower Site, Layer 4 (Fiedler, L. & Hilbert, K. 1987) or Maastricht-Belvédère Site C, Southern Concentration (W. Roebroeks 1988) have been criticised (although in some cases substantiated [D. Stapert 1992]). Refitting of the lithic assemblage, which at other Middle Palaeolithic sites has provided information of varying complexity on settlement dynamics (e. g. Maastricht-Belvédère Site K: D. de Loecker 1992, 1993, 1994; Schweinskopf-Karmelenberg: J. Schäfer 1990b), is of only limited value for this question at the Hummerich and demonstrates secondary geological rather than primary archaeological phenomena.

It may be that it is illusory to search for one explanation for the Middle Palaeolithic occupation of the Hummerich. Given the unknown, but undoubtedly long, period of time represented by the accumulation of the sediment layers containing archaeological and faunal material it is very probable that the site was visited by Neandertals on several unrelated occasions. Extensive Middle Palaeolithic open sites with large lithic and/or faunal assemblages are not uncommon and several have been referred to in various contexts by the present study (Salzgitter-Lebenstedt: K. Grote 1978; A. Tode 1982; A. Tode *et al.* 1953; Riencourt-lès-Bapaume: A. Tuffreau *et al.* 1991; A. Tuffreau 1993; Biache-Saint-Vaast: A. Tuffreau & J. Sommé 1988; Seclin: A. Tuffreau *et al.* 1985; Maastricht-Belvédère: W. Roebroeks 1988; Rheindahlen B1 »Westwand«: H. Thieme 1983, J. Thissen 1986). At a number of these it is clear that quite different activities took place (intensive knapping [D. de Loecker 1992, 1993, 1994], animal butchering [P. Auguste 1988, 1991, 1992, 1993, 1994], use of fire, construction of dwelling structures [D. Stapert 1992]) so that they can quite probably be regarded as a palimpsest of several occupations or multi-functional episodes.

The Middle Palaeolithic occupation of the Plaidter Hummerich must be interpreted in this light. A number of specialised functions (quarry or *atelier*, monospecific mass-kill site) can be excluded, but otherwise it is probable that a range of activities (production of lithic artefacts, butchery of animals, use of fire) was carried out by hominids at the site. The initially surprising location of the site, at the summit of a volcano, may also indicate the deliberate and repeated incorporation by Neanderthals of this unusual topographic situation into their strategy of use of the relatively open landscape of the Neuwied Basin.

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