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.

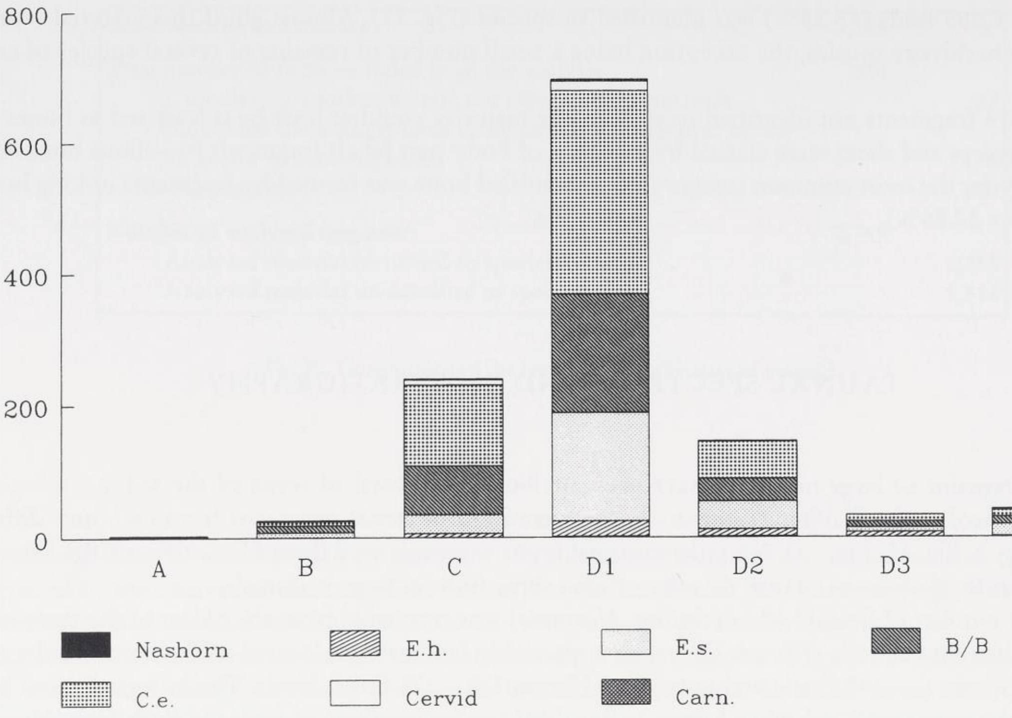


Fig. 9 Graphic representation of the contribution of each large mammal species to the fauna of the different geological layers (based on numbers of identified specimens).

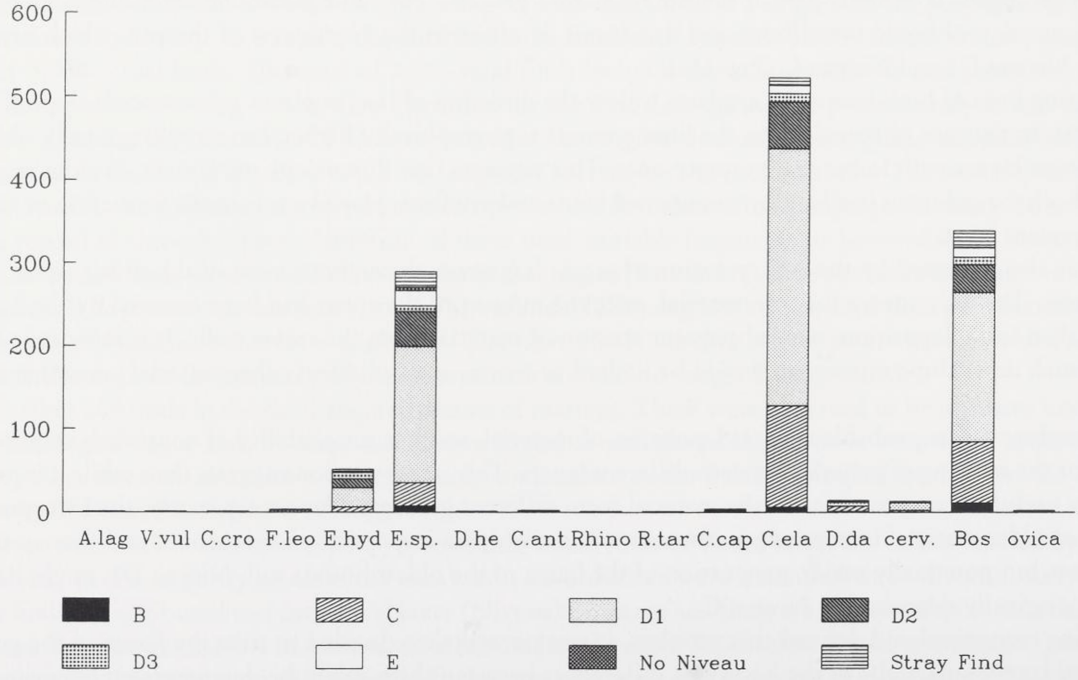


Fig. 10 Graphic representation of the proportional contribution of each geological layer to the different large mammal species (based on numbers of identified specimens).

	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.

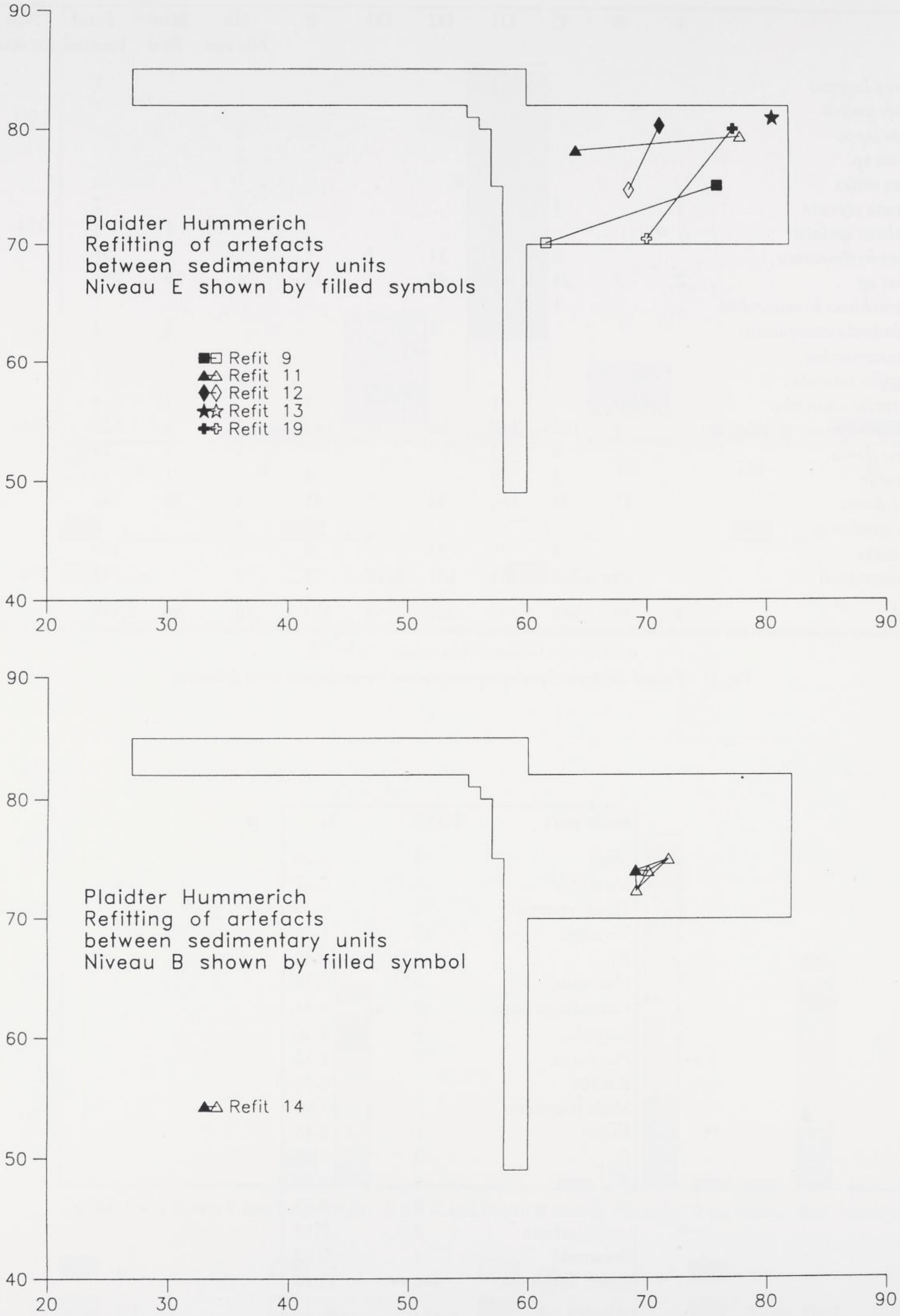
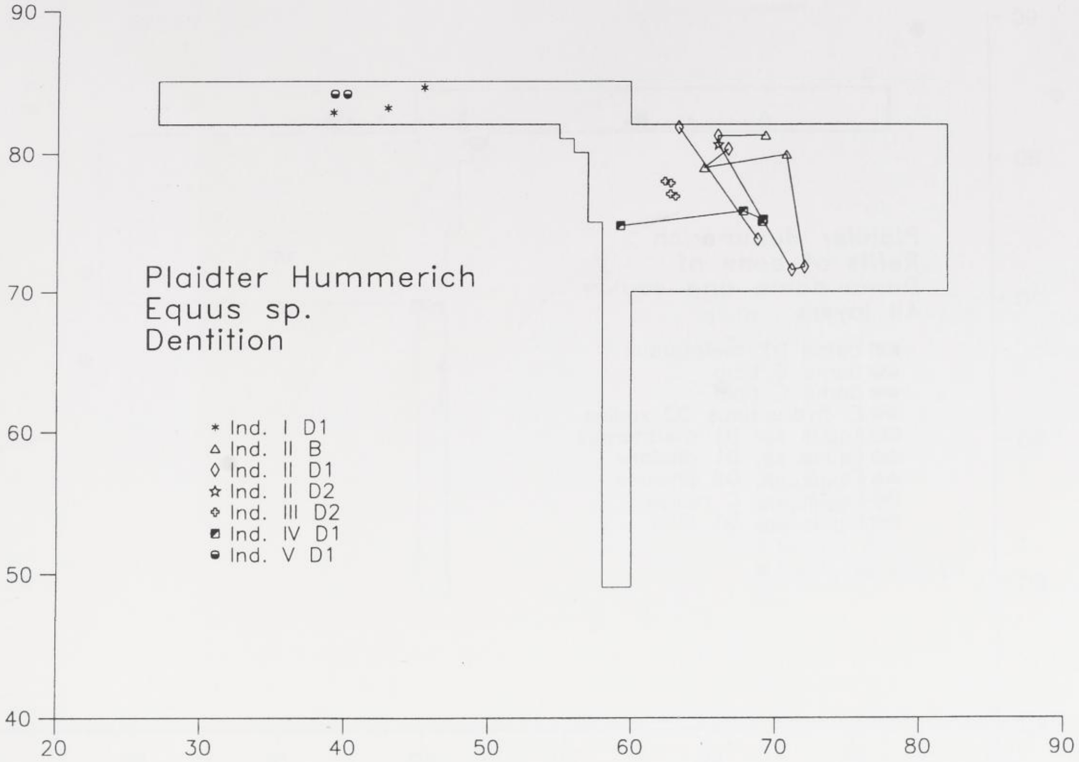


Fig. 13 Refitting of artefacts between sedimentary units. – Above: Refits between Niveaux D1 and E (Niveau E shown by filled symbols); below: Refits between Niveaux D1 and B (Niveau B shown by filled symbols).



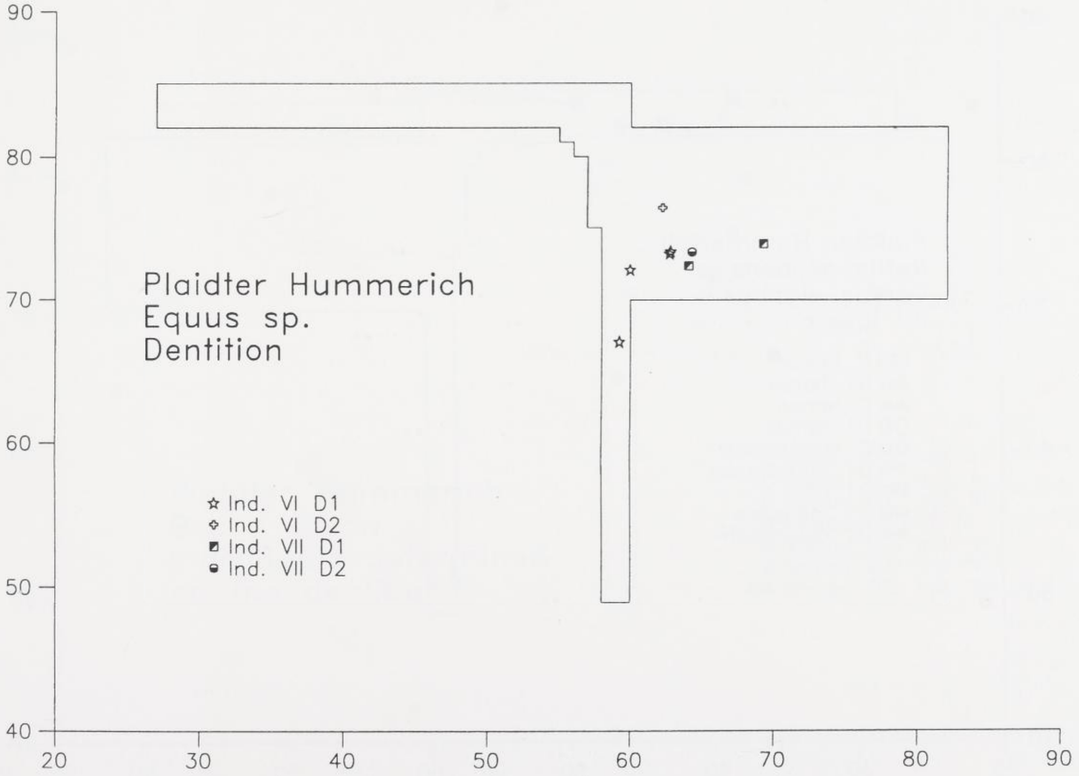


Fig. 14 Location and stratigraphic provenance of the teeth of seven identified individuals of horse (*Equus* sp.).

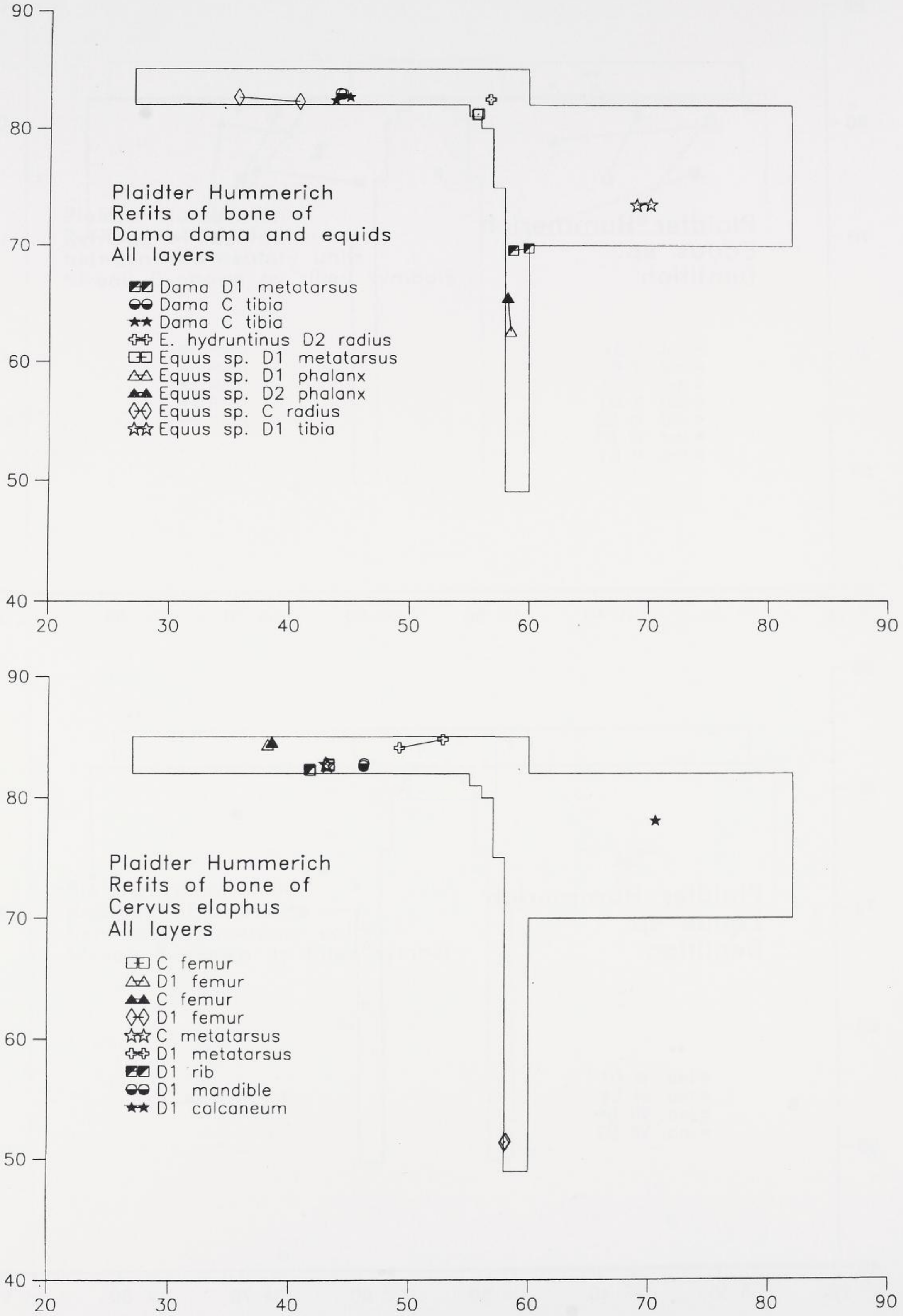


Fig. 15 Location and stratigraphic provenance of refitted bone fragments. – Above: Refits on bone of equids (*Equus* sp. and *Equus hydruntinus*) and fallow deer (*Dama dama*); below: Refits on bone of red deer (*Cervus elaphus*).

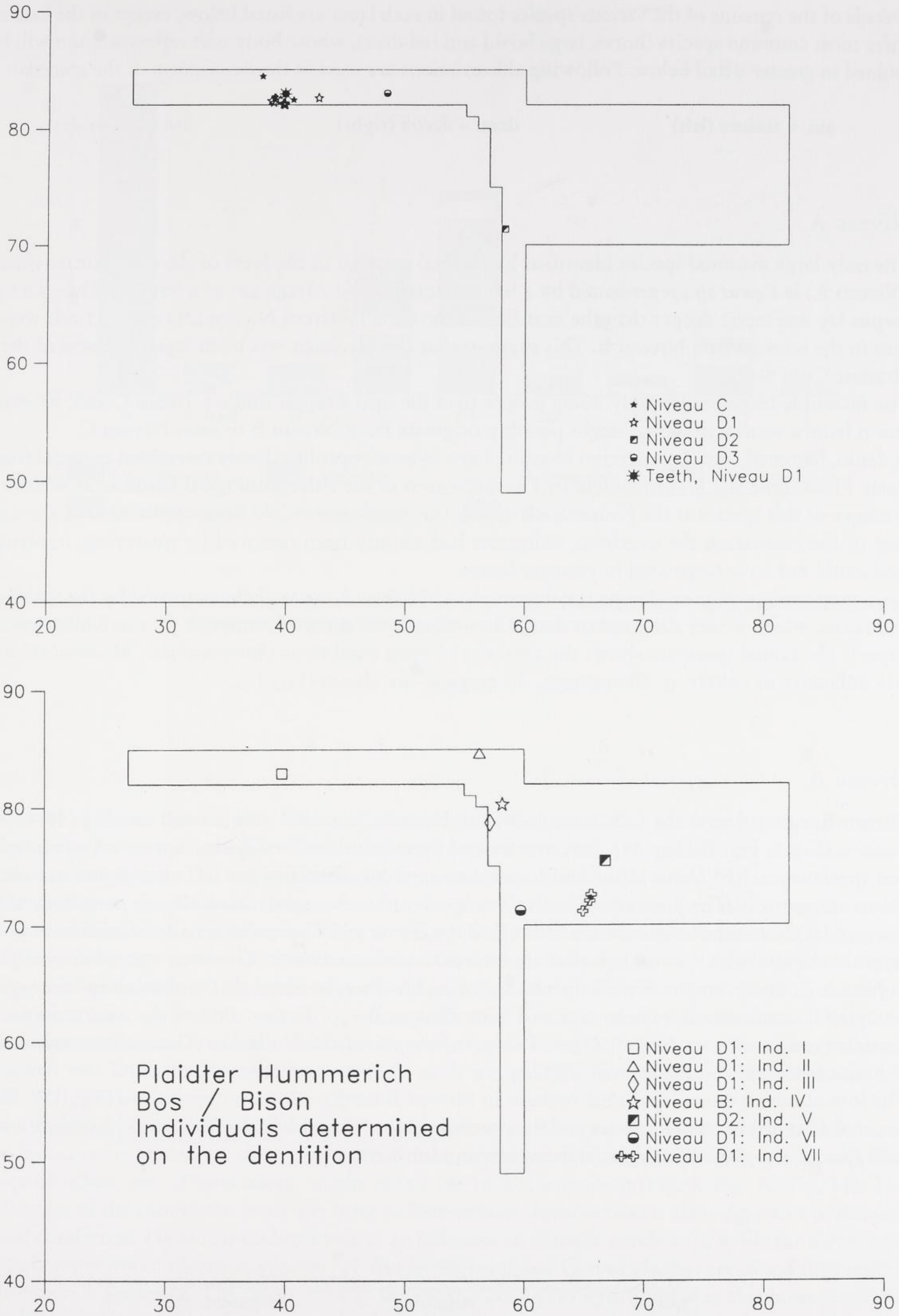


Fig. 16 Above: Location and stratigraphic provenance of foetal bone of the large bovid (cf. *Bos primigenius*); below: Location of teeth of seven individuals of bovid (cf. *Bos primigenius*). Determination after E. Turner.

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

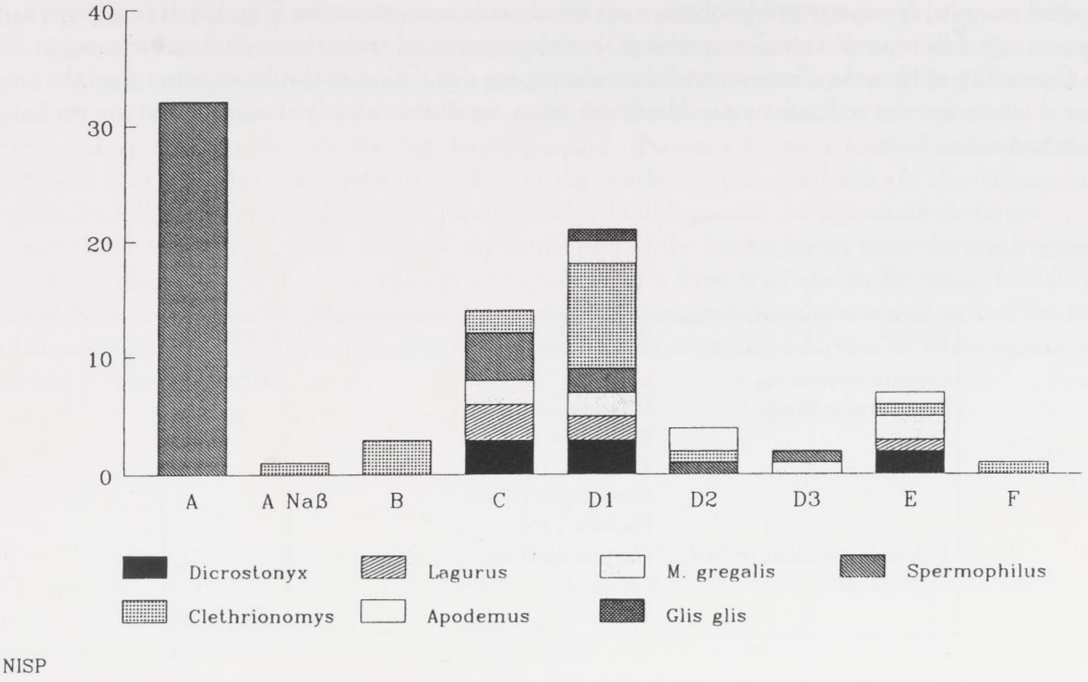


Fig. 17 Summary of the representation of diagnostic species of rodents in the different geological layers (based on numbers of identified specimens); data after Th. van Kolfschoten, this paper.

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 35cm 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 (< 3m)* [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 material 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 solifluced 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 during 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

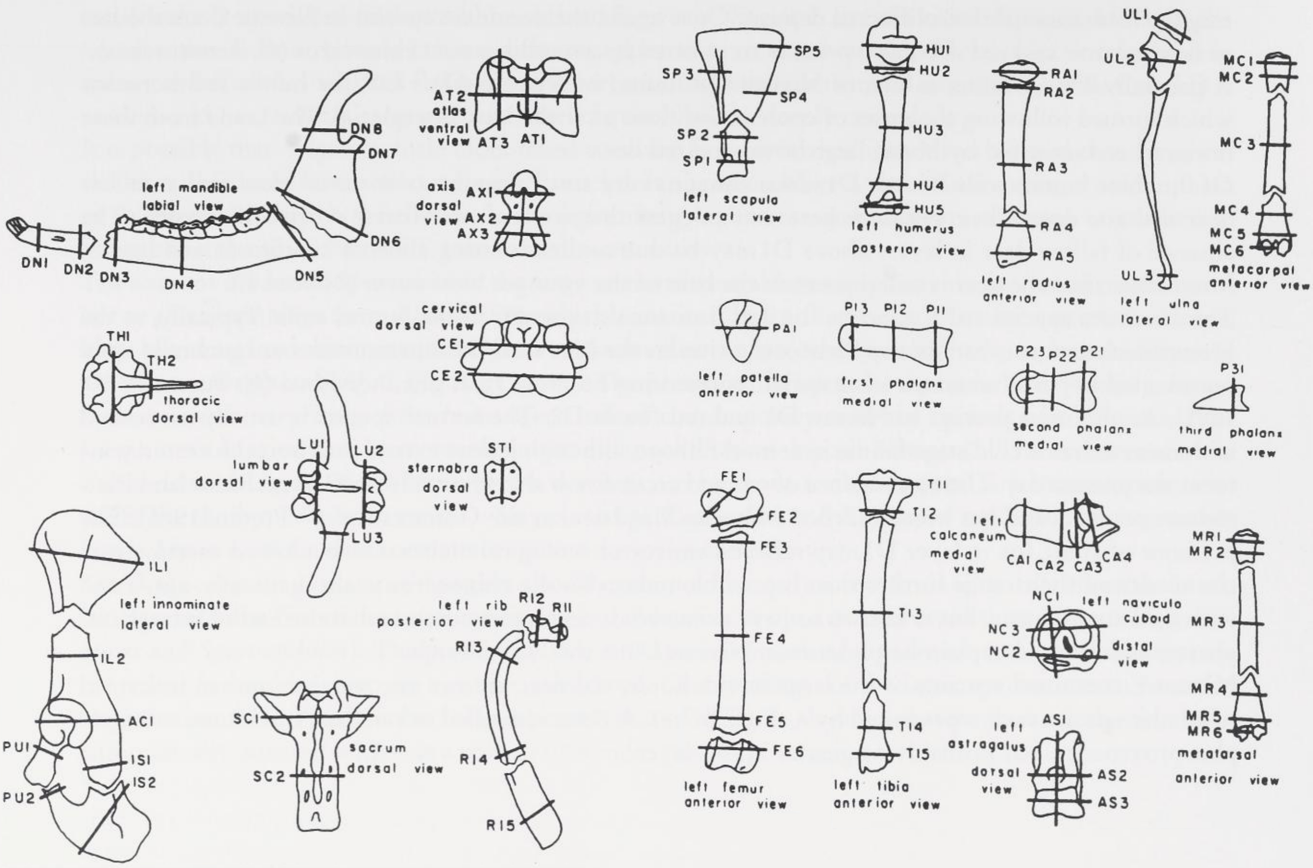


Fig. 18 Anatomical locations of scan sites where photon absorptiometry measurements have been taken on ungulate bones with an indication of the actual bone fragments recovered archaeologically (adapted from Lyman 1994, Fig. 7. 4).

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

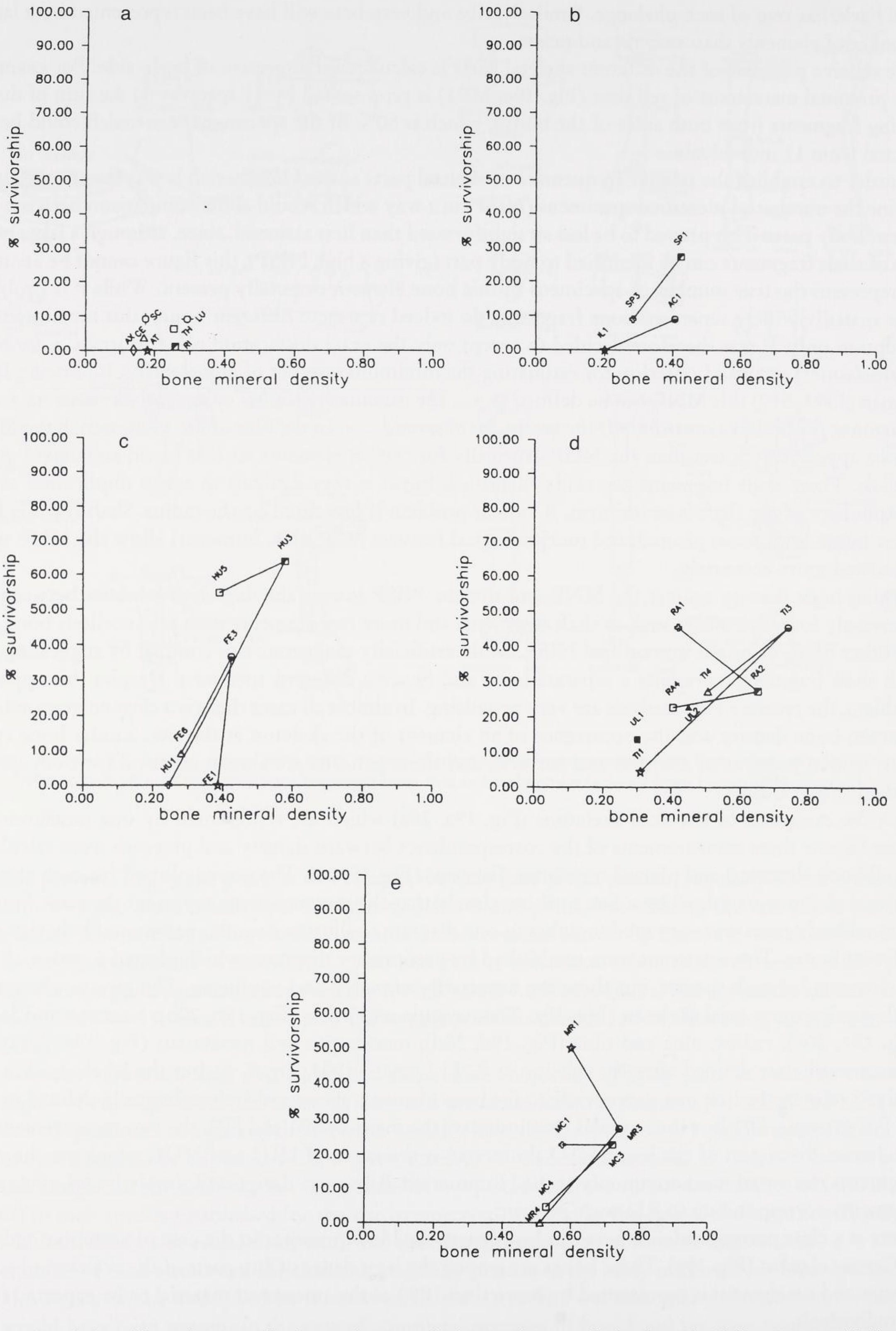


Fig. 19 Correlation of bone density and body part frequency for bones of *Cervus elaphus* from the Plaidter Hummerich (for location of measurements see fig. 18). – a: Axial skeleton; b: scapula, pelvis; c: humerus, femur; d: radius, ulna, tibia; e: metacarpus, metatarsus.

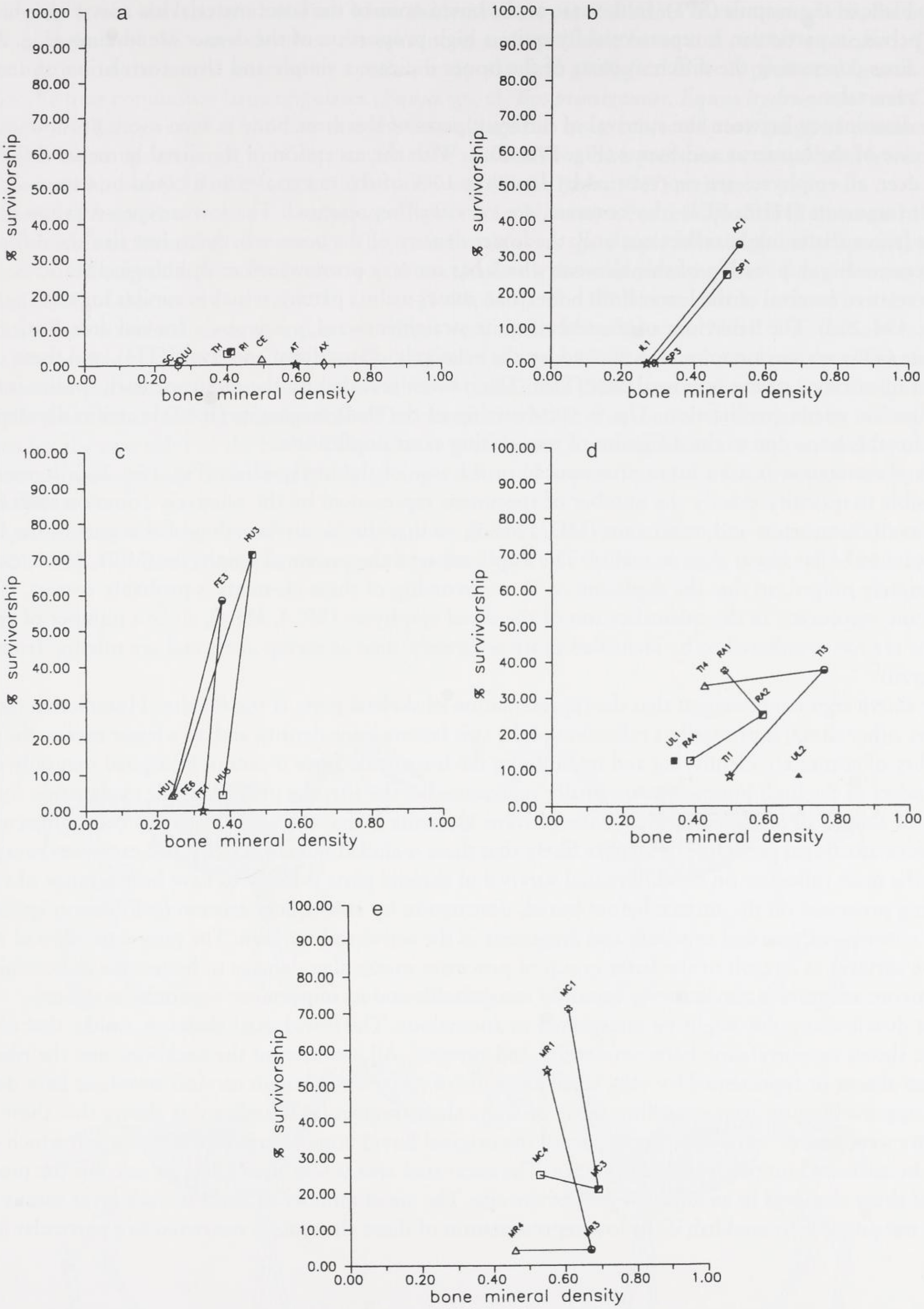


Fig. 20 Correlation of bone density and body part frequency for bones of cf. *Bos primigenius* from the Plaidter Hummerich (for location of measurements see fig. 18). – a: Axial skeleton; b: scapula, pelvis; c: humerus, femur; d: radius, ulna, tibia; e: metacarpus metatarsus.

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).

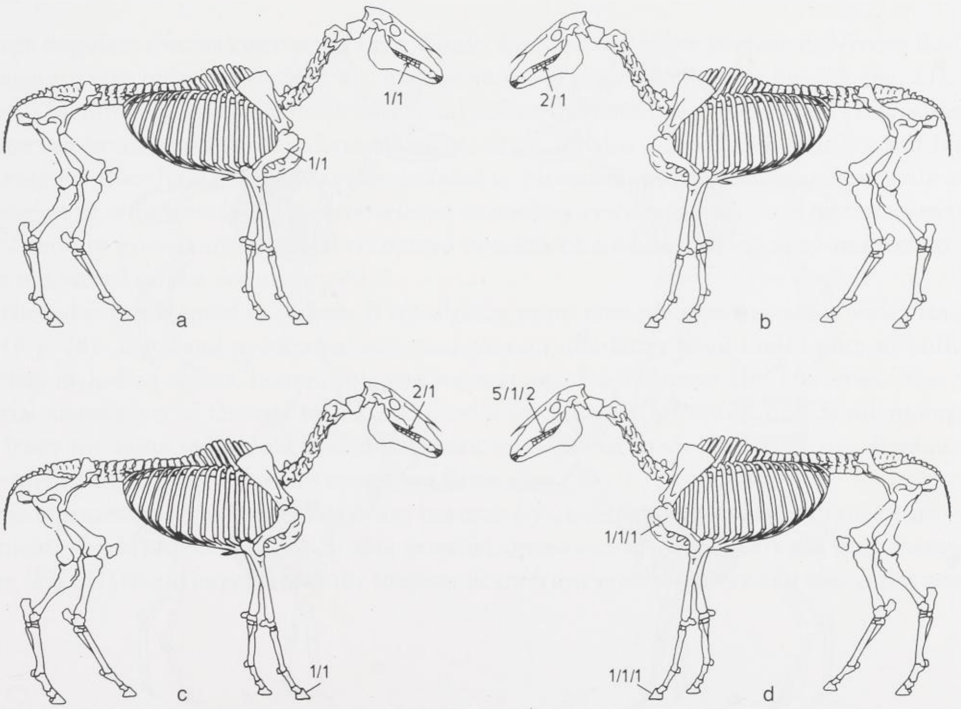


Fig. 21 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Equus* sp. in Niveau B at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

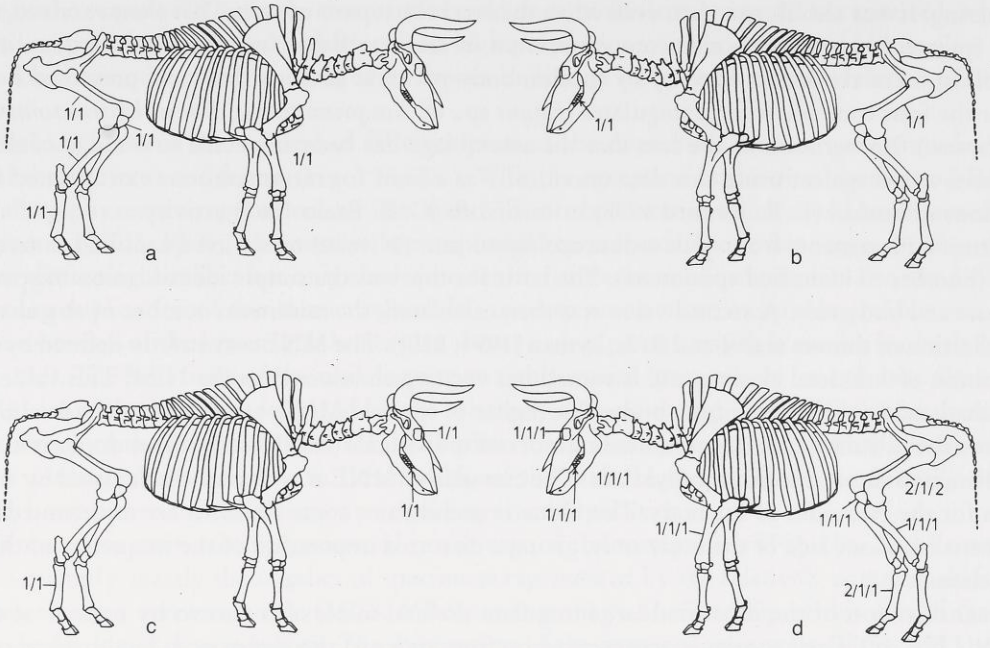


Fig. 22 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of cf. *Bos primigenius* in Niveau B at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

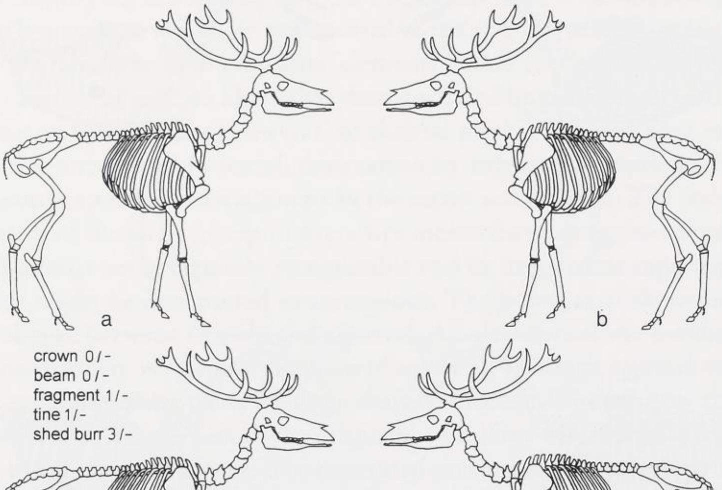


Fig. 23 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Cervus elaphus* in Niveau B at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

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).

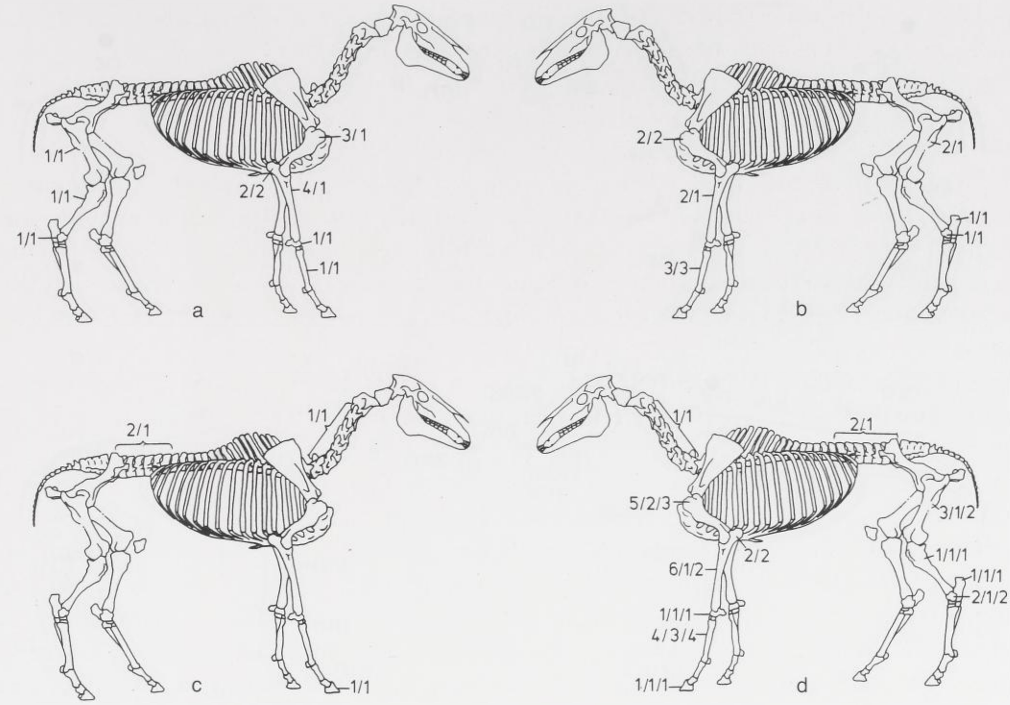


Fig. 24 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Equus* sp. in Niveau C at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

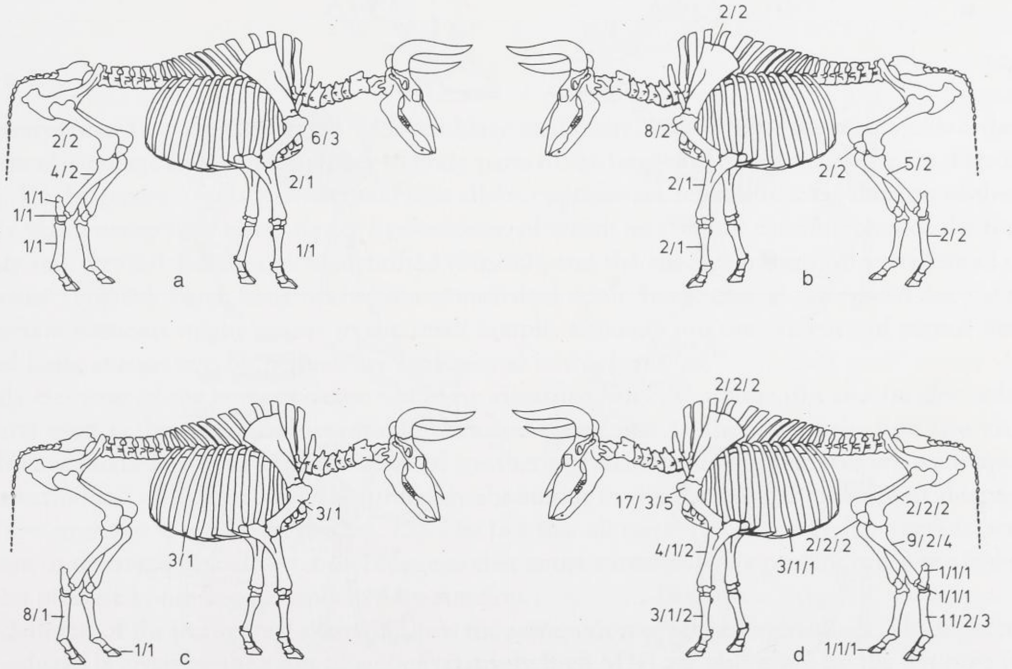


Fig. 25 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of cf. *Bos primigenius* in Niveau C at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

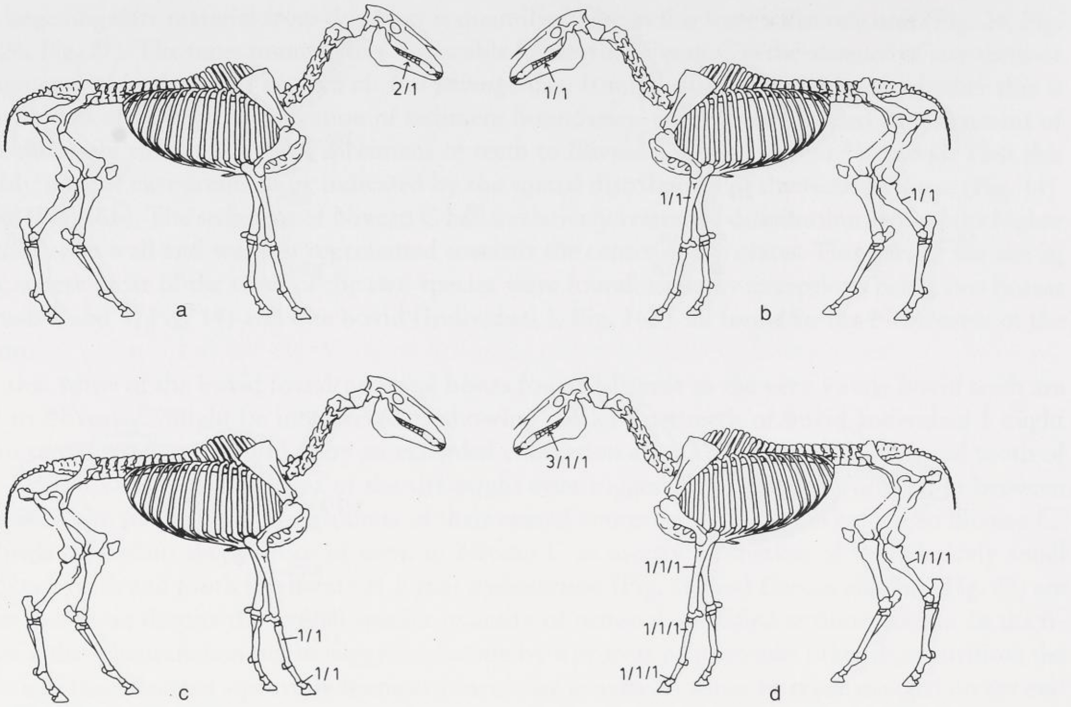


Fig. 26 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Equus hydruntinus* in Niveau C at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

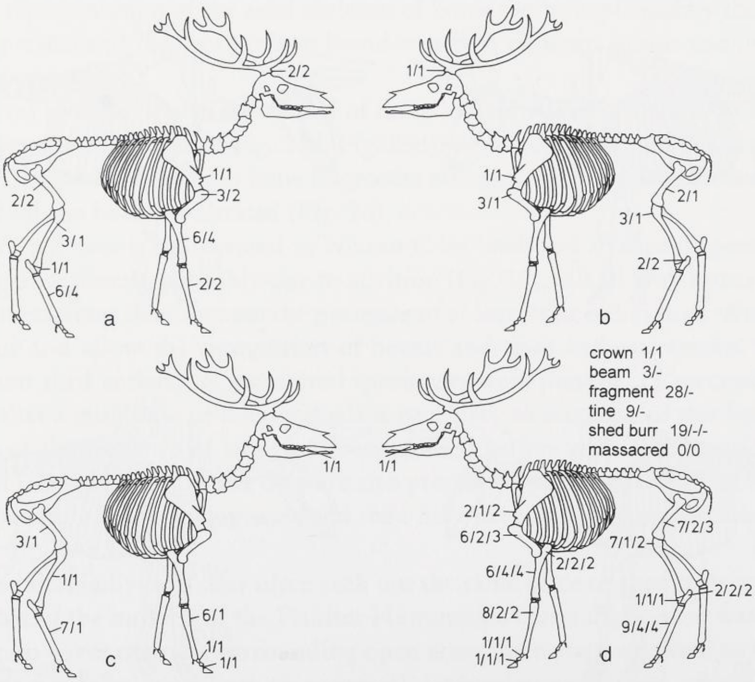


Fig. 27 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Cervus elaphus* in Niveau C at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

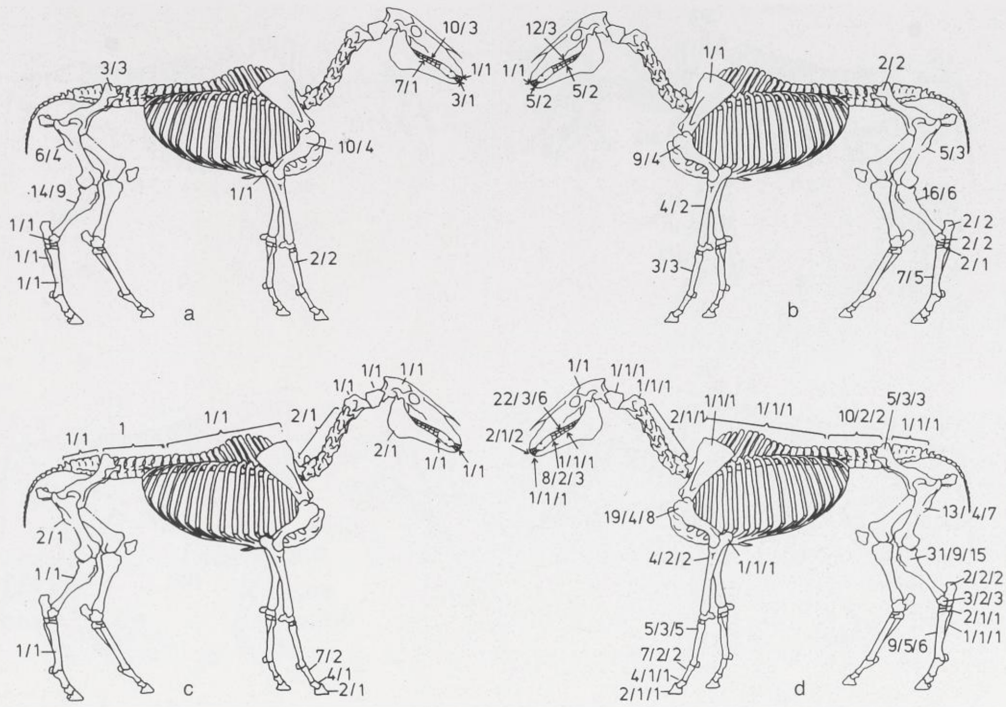


Fig. 28 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Equus* sp. in Niveau D1 at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

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.

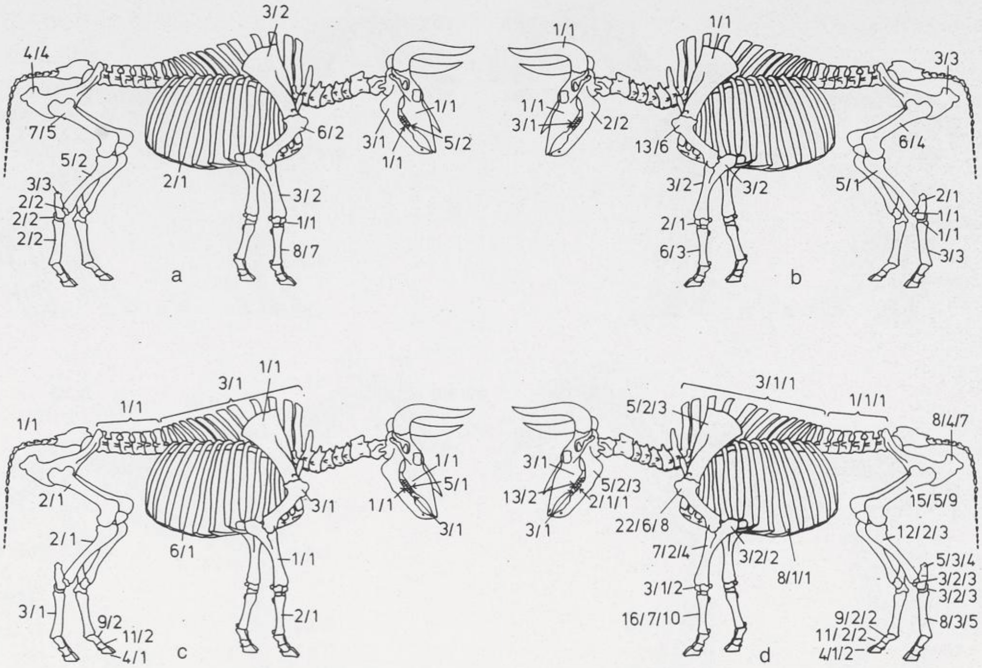


Fig. 29 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of cf. *Bos primigenius* in Niveau D1 at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

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.

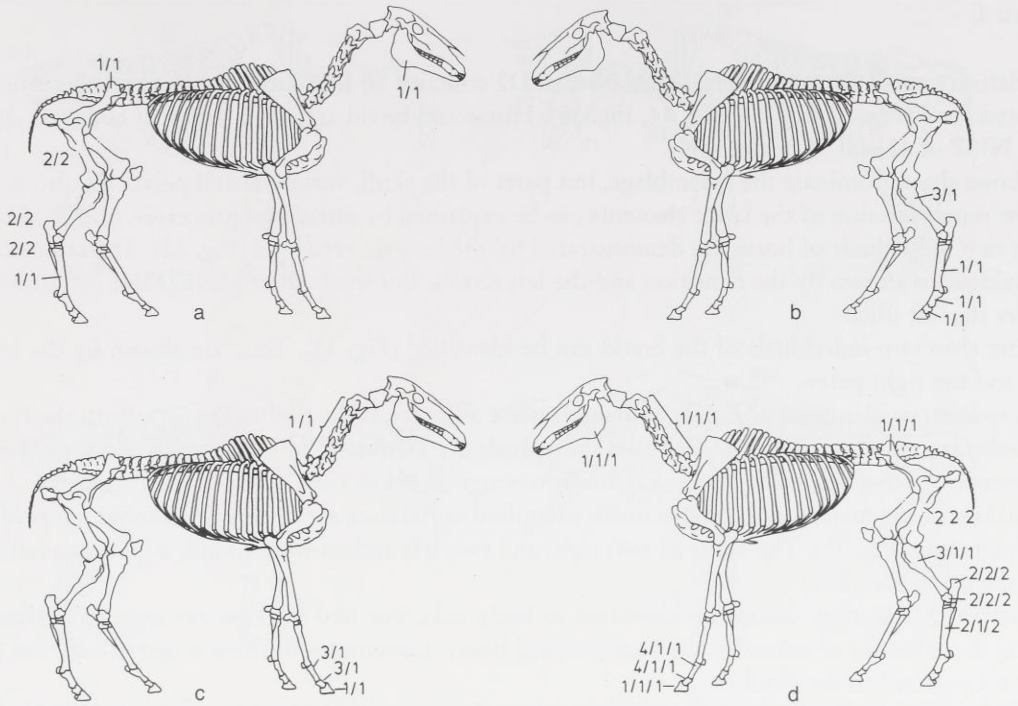


Fig. 30 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Equus hydruntinus* in Niveau D1 at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

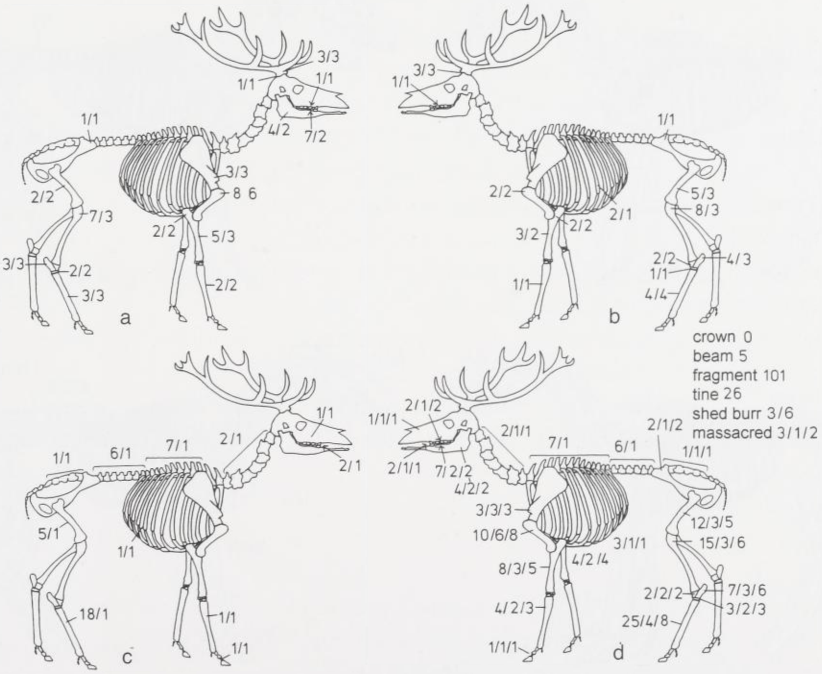


Fig. 31 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Cervus elaphus* in Niveau D1 at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

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.

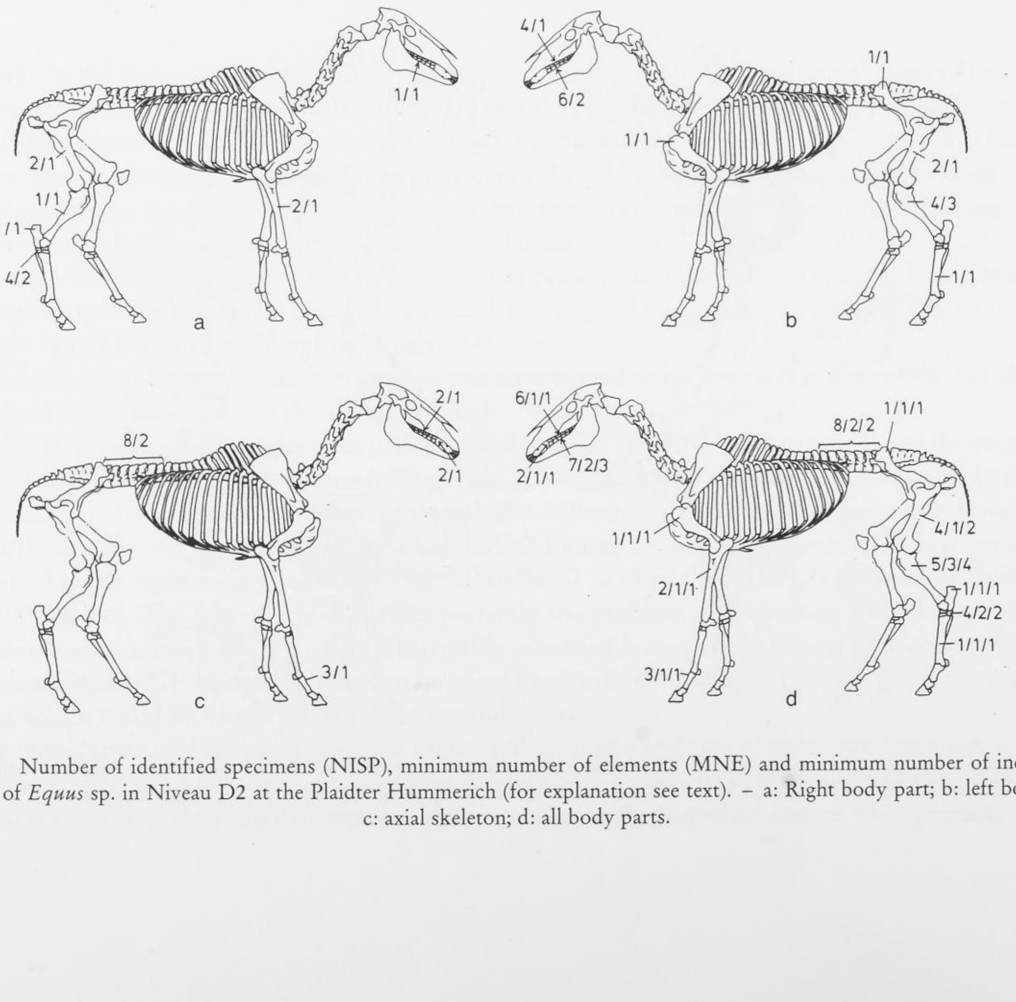


Fig. 32 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Equus* sp. in Niveau D2 at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

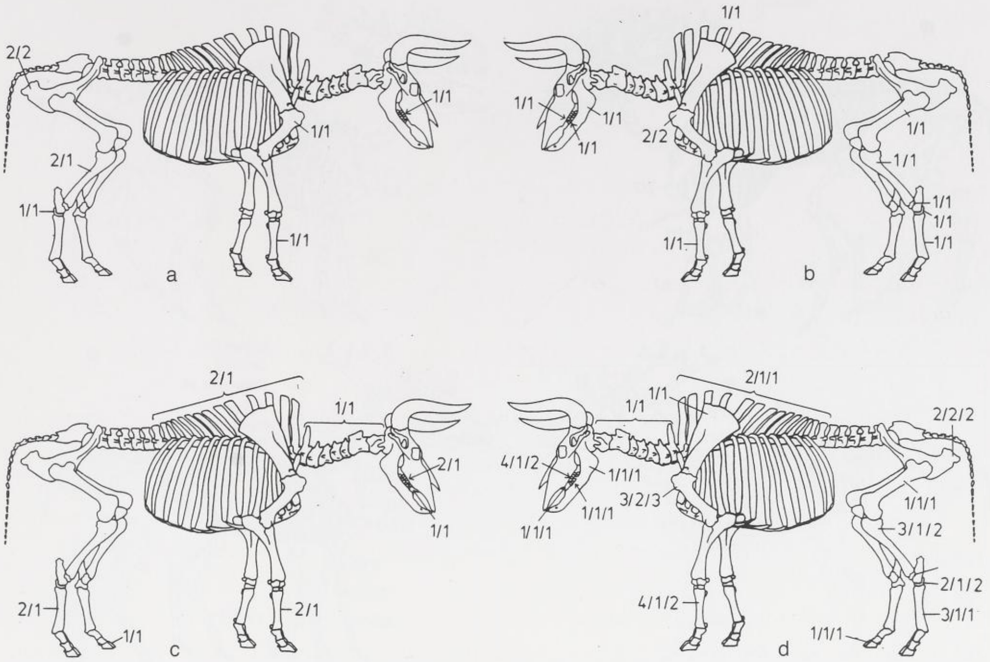


Fig. 33 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of cf. *Bos primigenius* in Niveau D2 at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

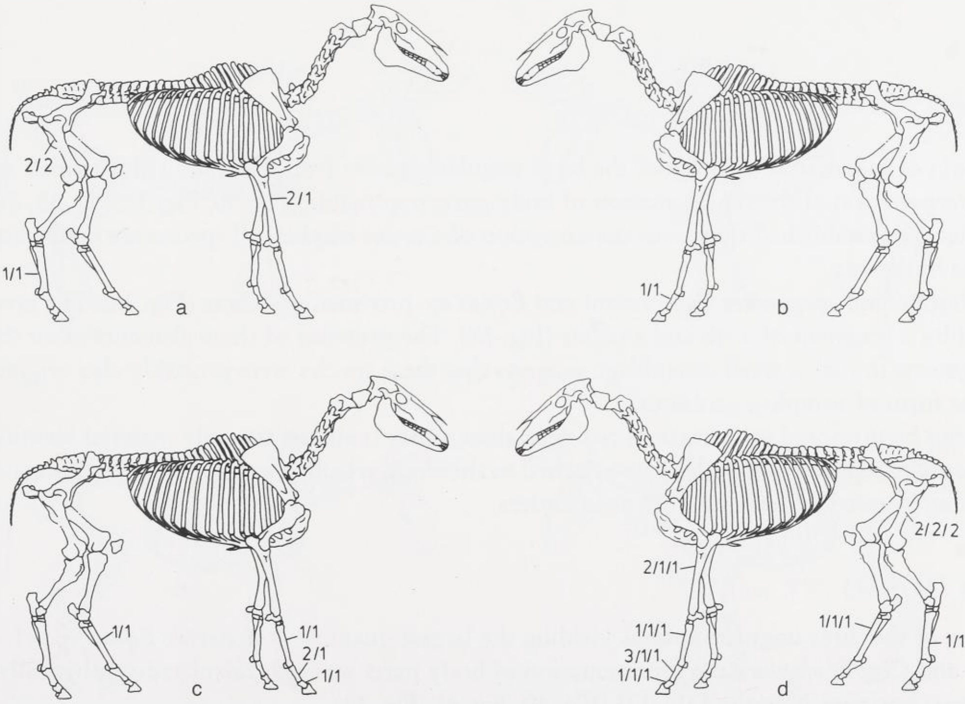


Fig. 34 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Equus hydruntinus* in Niveau D2 at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

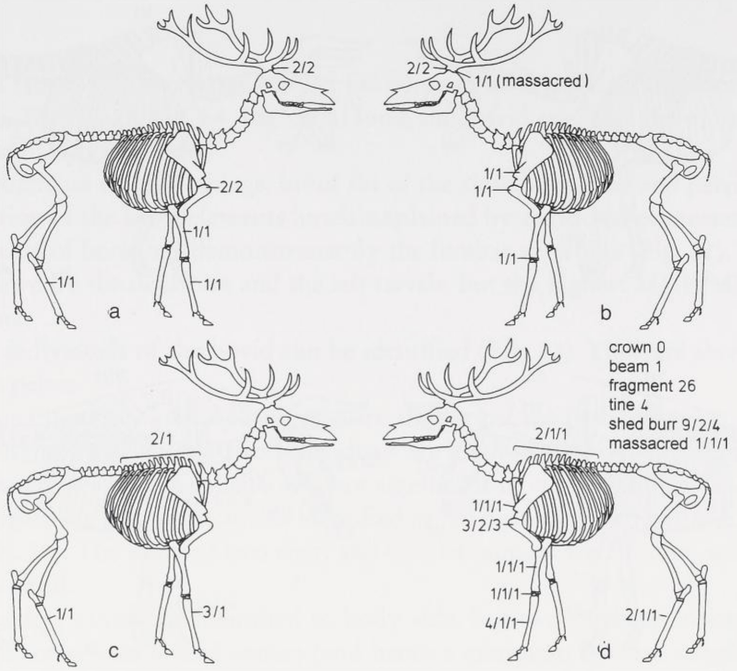


Fig. 35 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Cervus elaphus* in Niveau D2 at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

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-

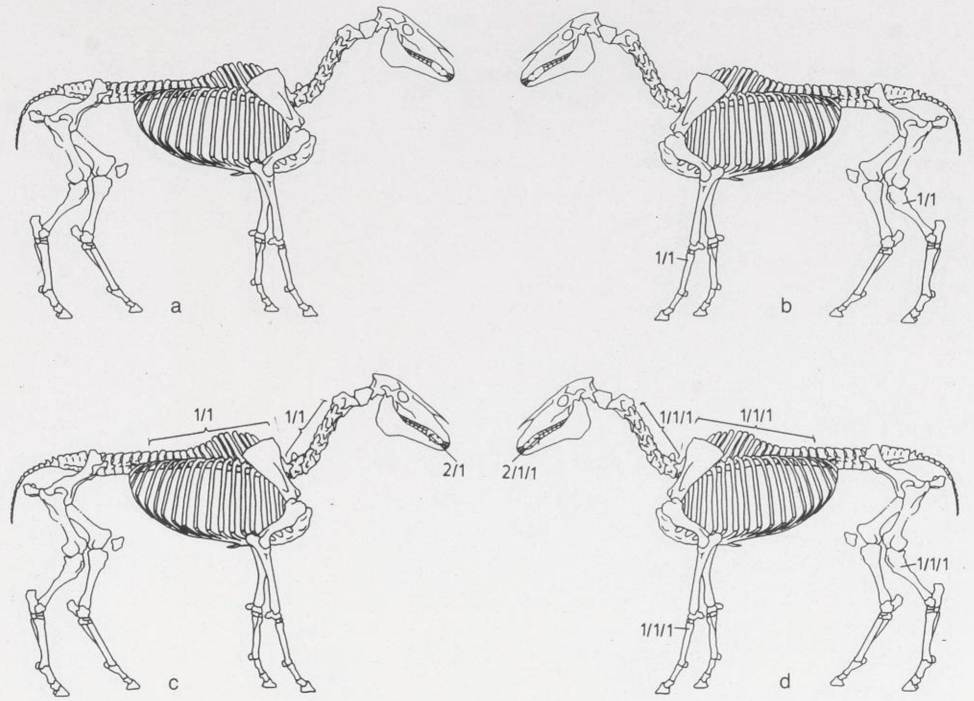


Fig. 36 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Equus* sp. in Niveau D3 at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

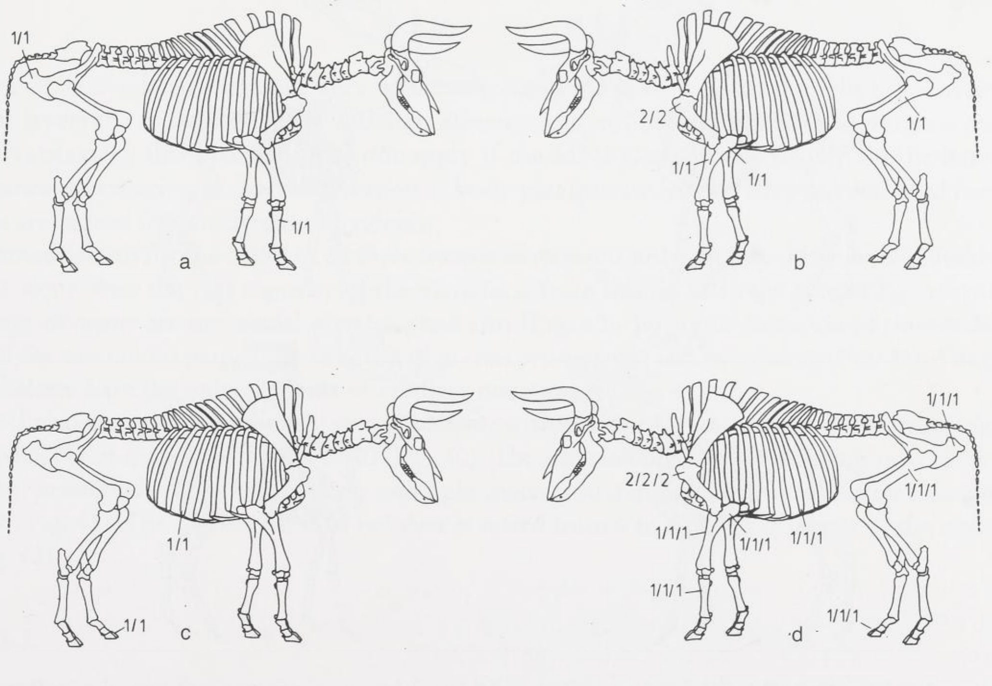


Fig. 37 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of cf. *Bos primigenius* in Niveau D3 at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

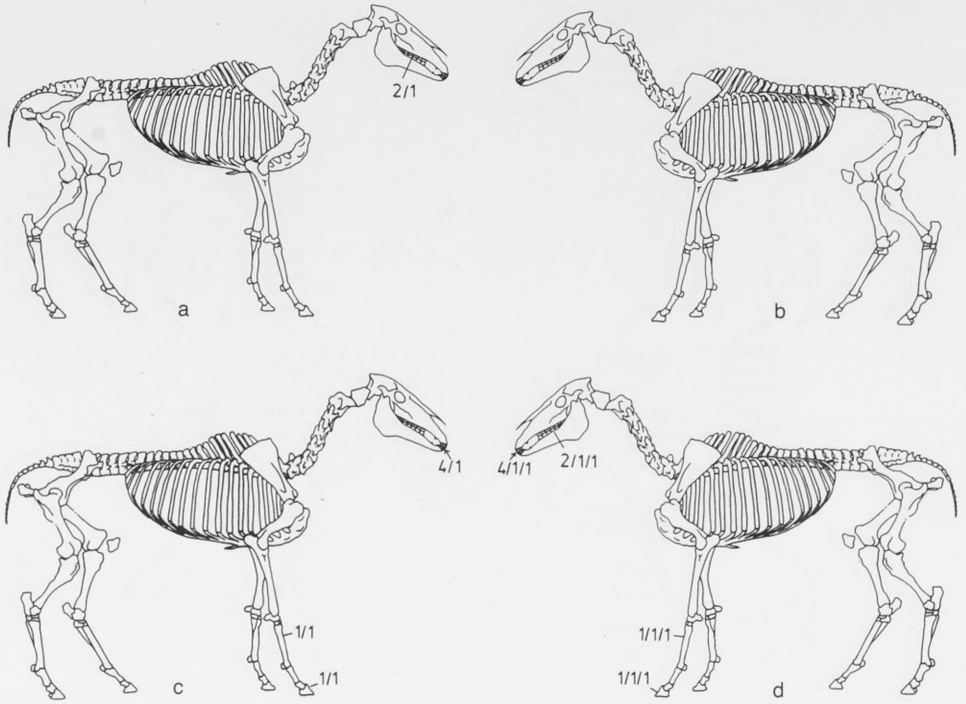


Fig. 38 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Equus hydruntinus* in Niveau D3 at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

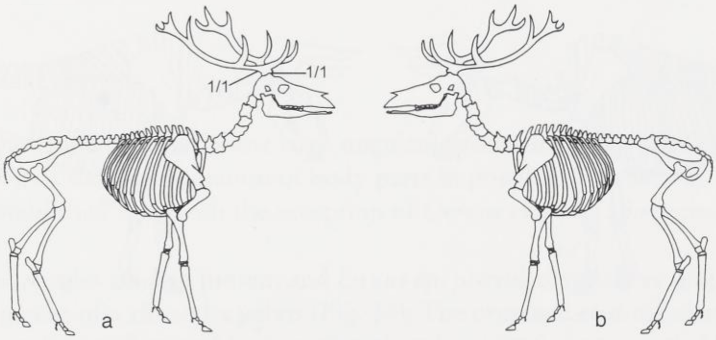


Fig. 39 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Cervus elaphus* in Niveau D3 at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

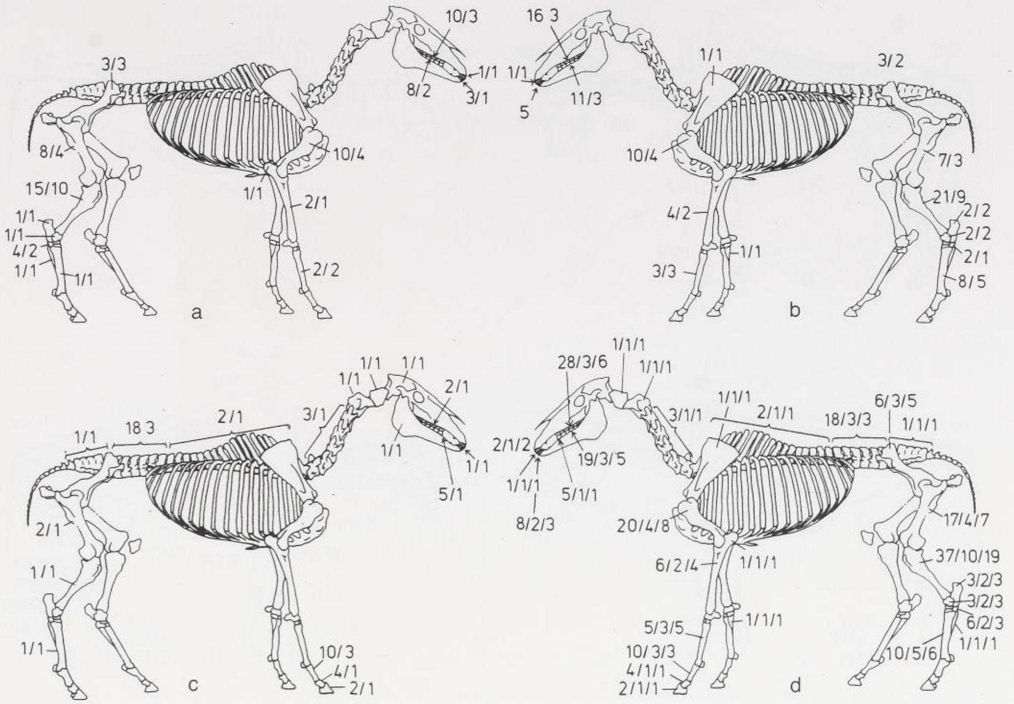


Fig. 40 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Equus* sp. in Niveaux D1 - D3 at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

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).

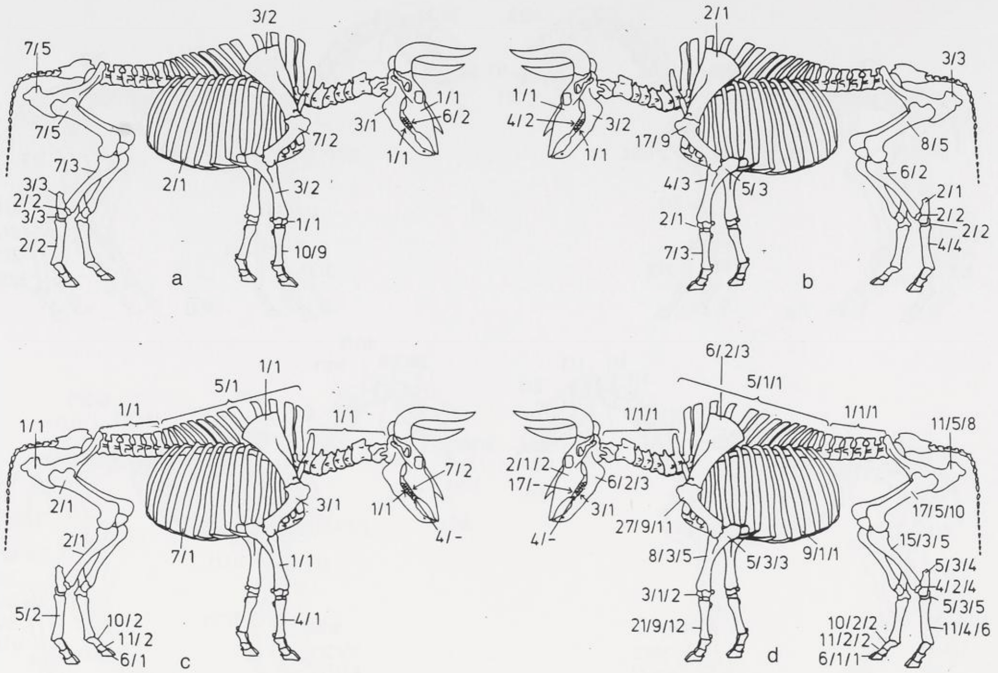


Fig. 41 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of cf. *Bos primigenius* in Niveaux D1 - D3 at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

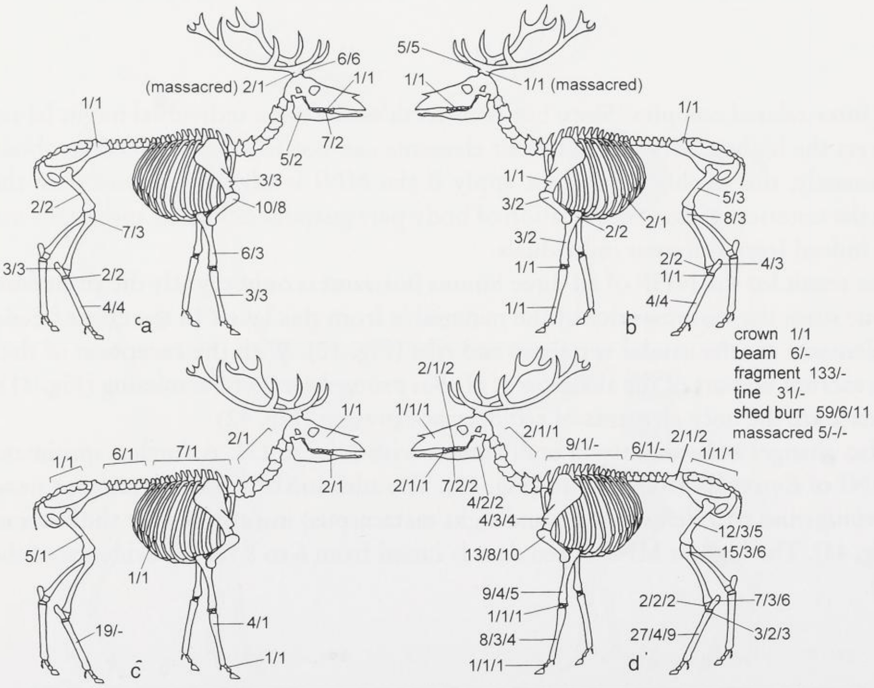


Fig. 42 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Cervus elaphus* in Niveaux D1 - D3 at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

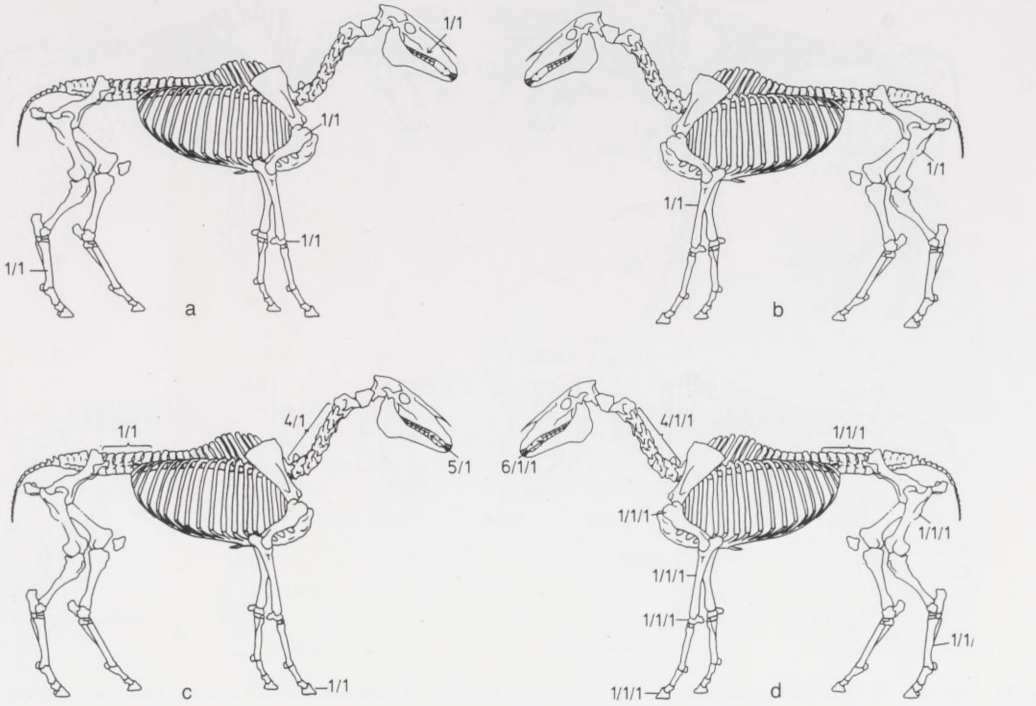


Fig. 43 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Equus* sp. in Niveau E at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

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.

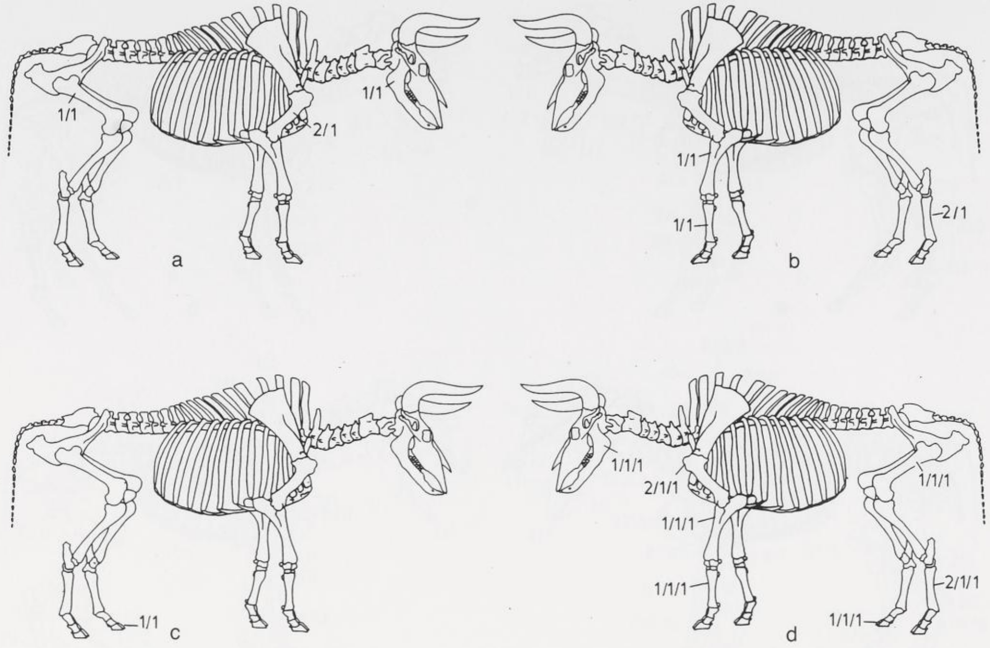


Fig. 44 Number of identified specimens (**NISP**), minimum number of elements (**MNE**) and minimum number of individuals (**MNI**) of cf. *Bos primigenius* in Niveau E at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

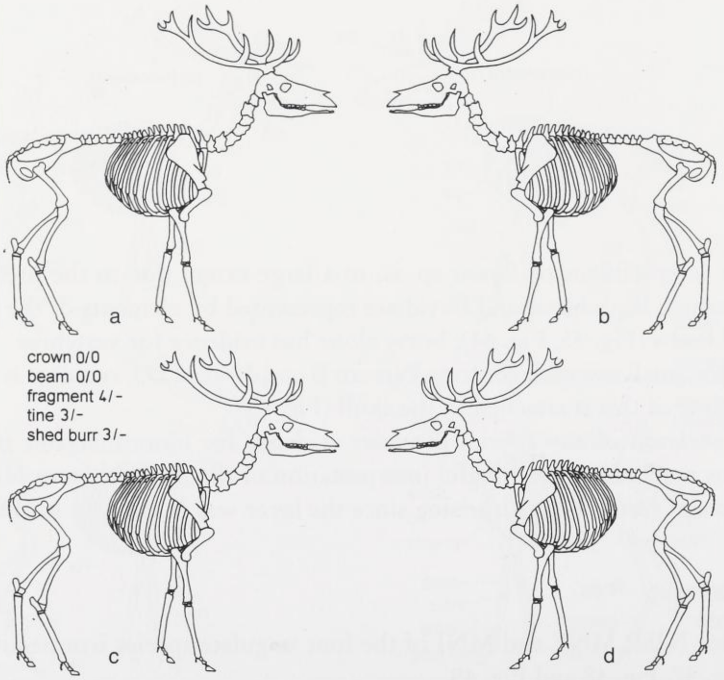


Fig. 45 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Cervus elaphus* in Niveau E at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

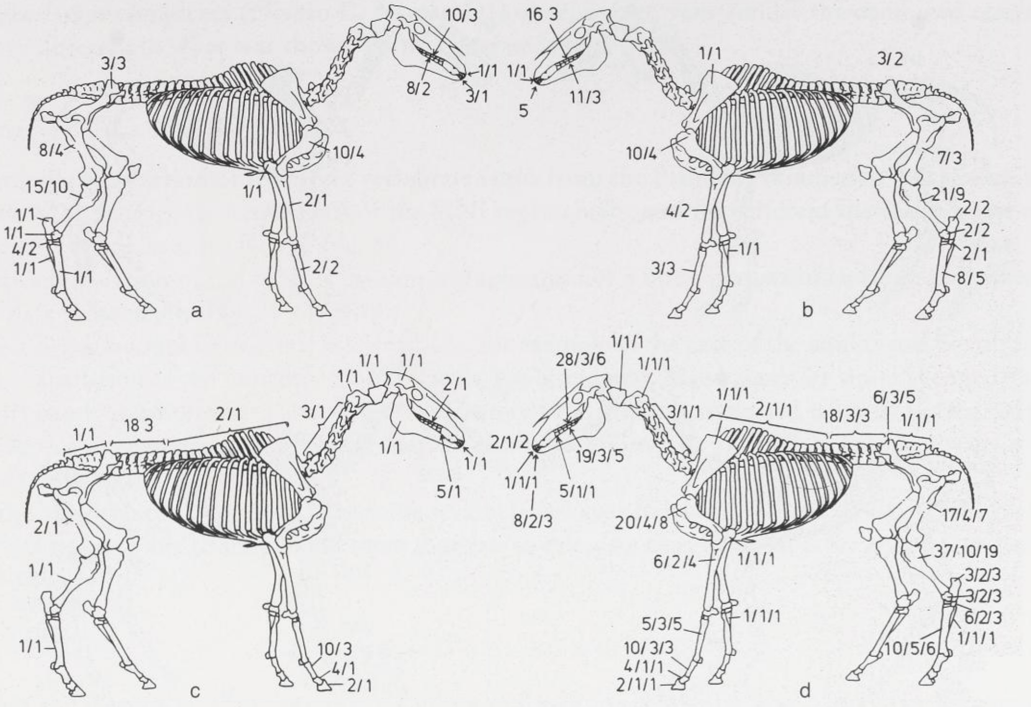


Fig. 46 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Equus* sp. in all Niveaux at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

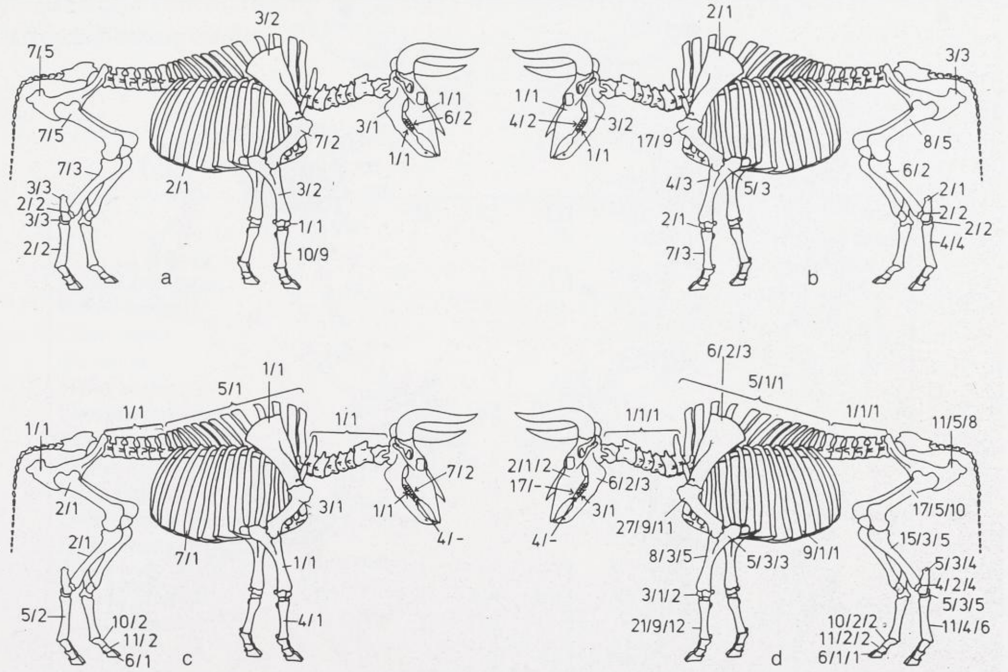


Fig. 47 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of cf. *Bos primigenius* in all Niveaux at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

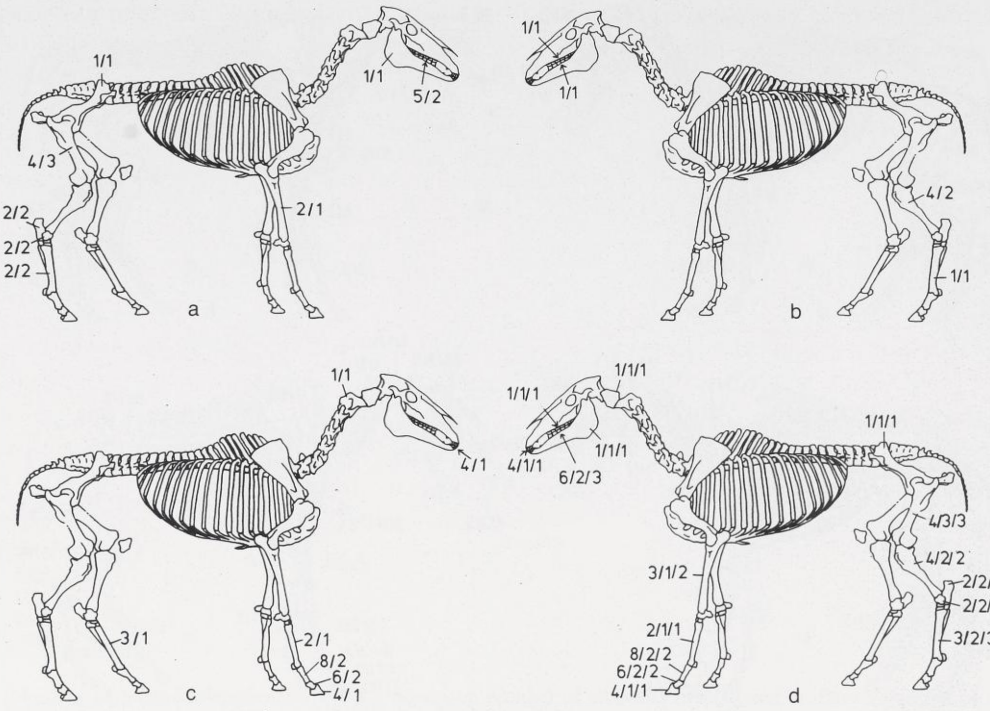


Fig. 48 Number of identified specimens (**NISP**), minimum number of elements (**MNE**) and minimum number of individuals (**MNI**) of *Equus hydruntinus* in all Niveaux at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

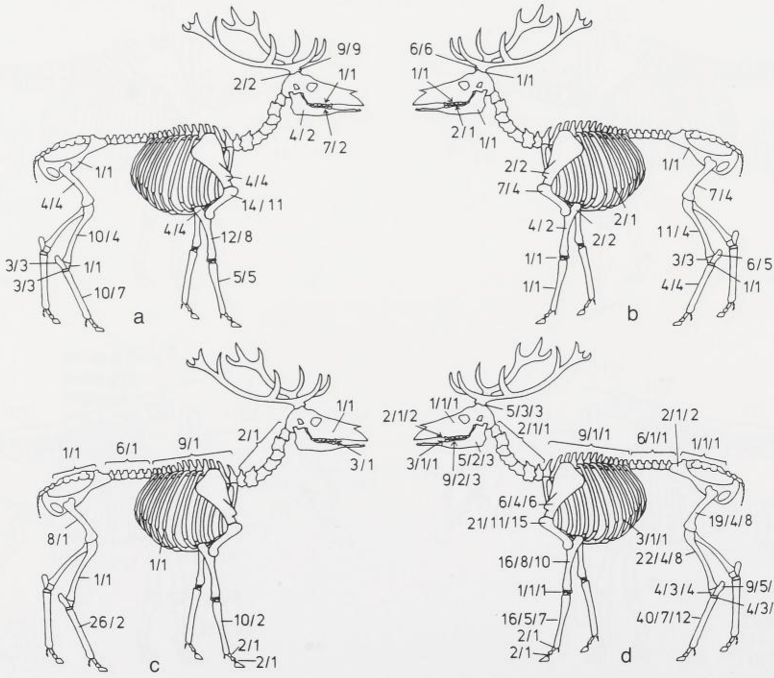


Fig. 49 Number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) of *Cervus elaphus* in all Niveaux at the Plaidter Hummerich (for explanation see text). – a: Right body part; b: left body part; c: axial skeleton; d: all body parts.

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).

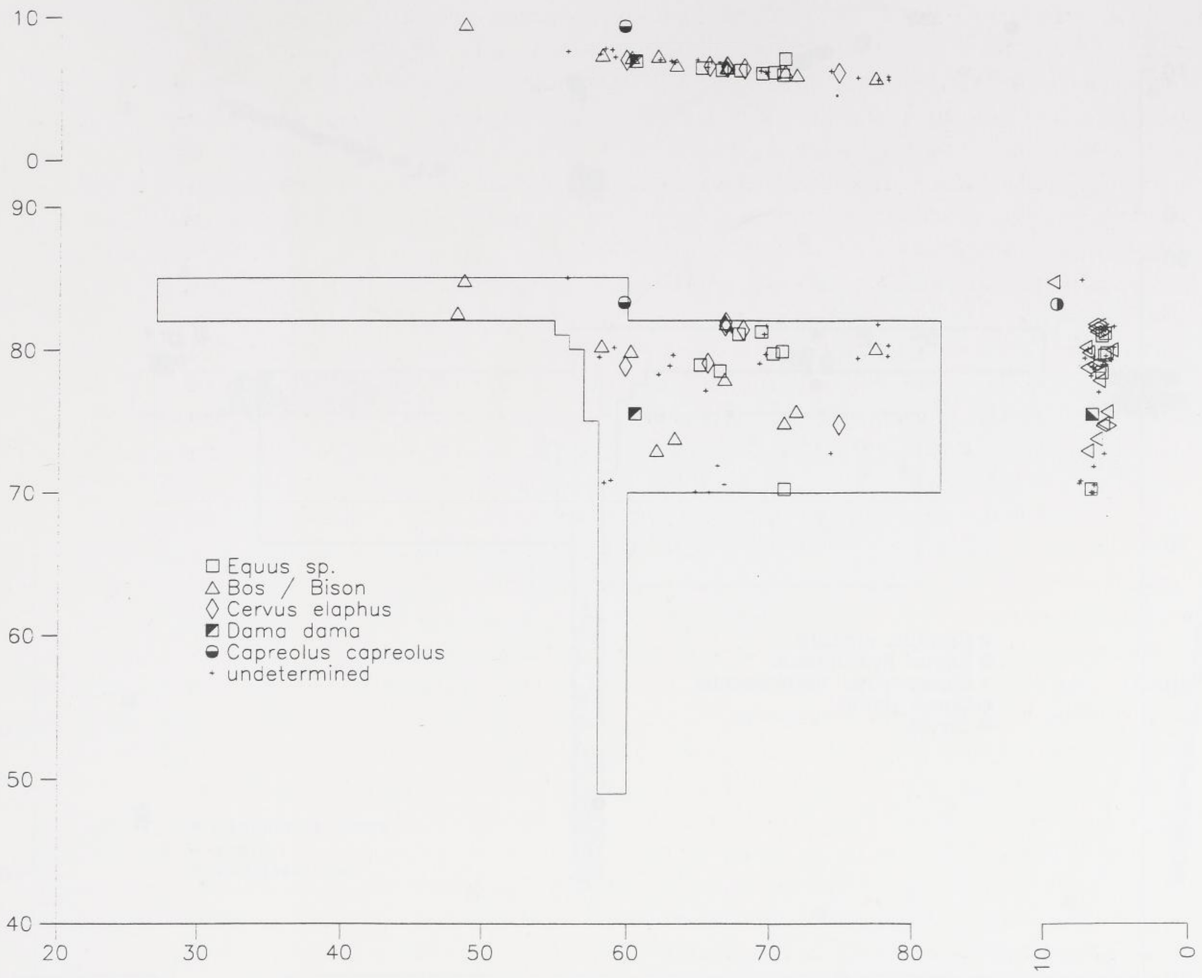


Fig. 51 Horizontal and vertical distribution of all faunal remains in Niveau B at the Plaidter Hummerich (for explanation see text).

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

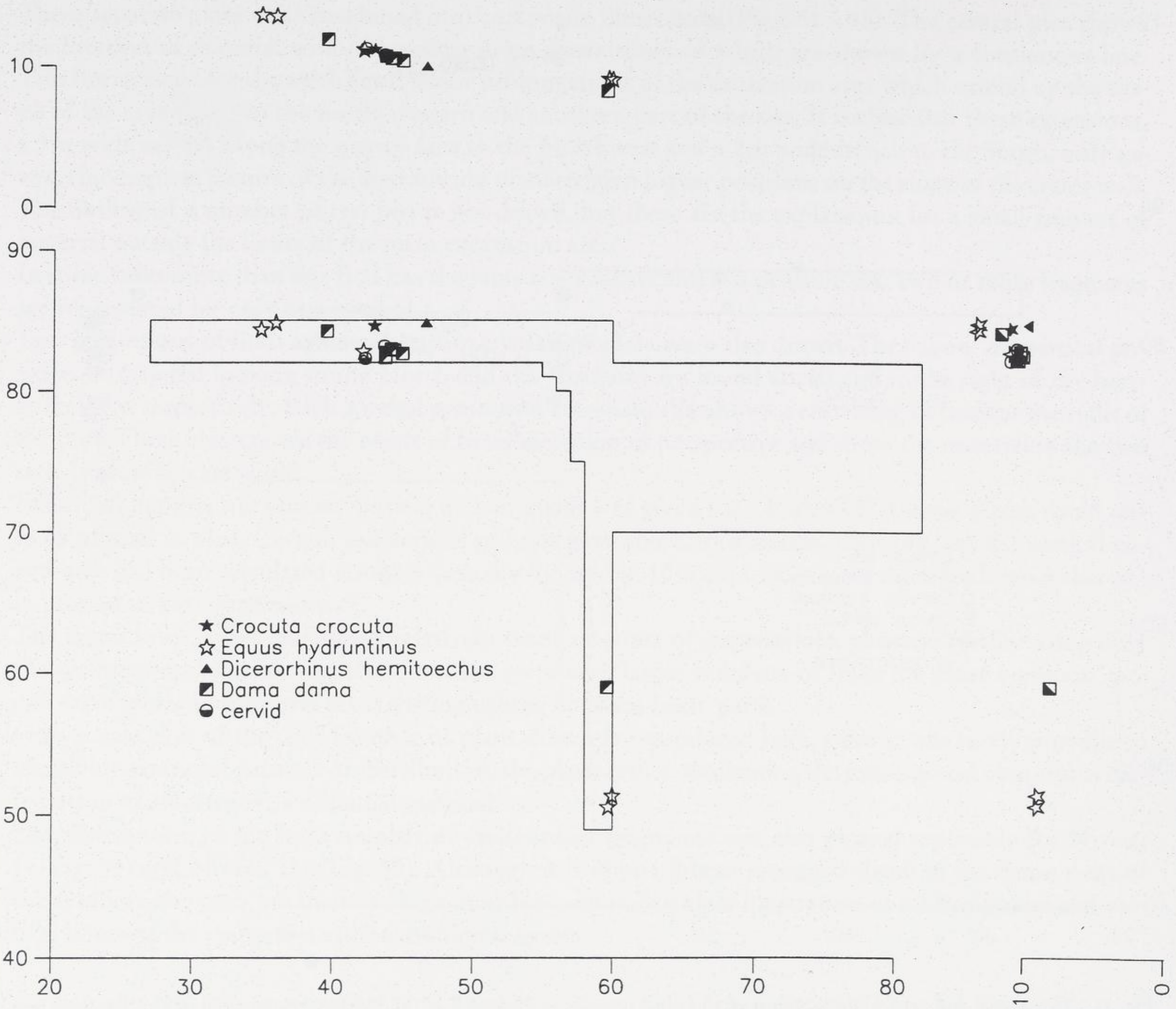


Fig. 52 Horizontal and vertical distribution of the less common species in Niveau C at the Plaidter Hummerich (for explanation see text).

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-

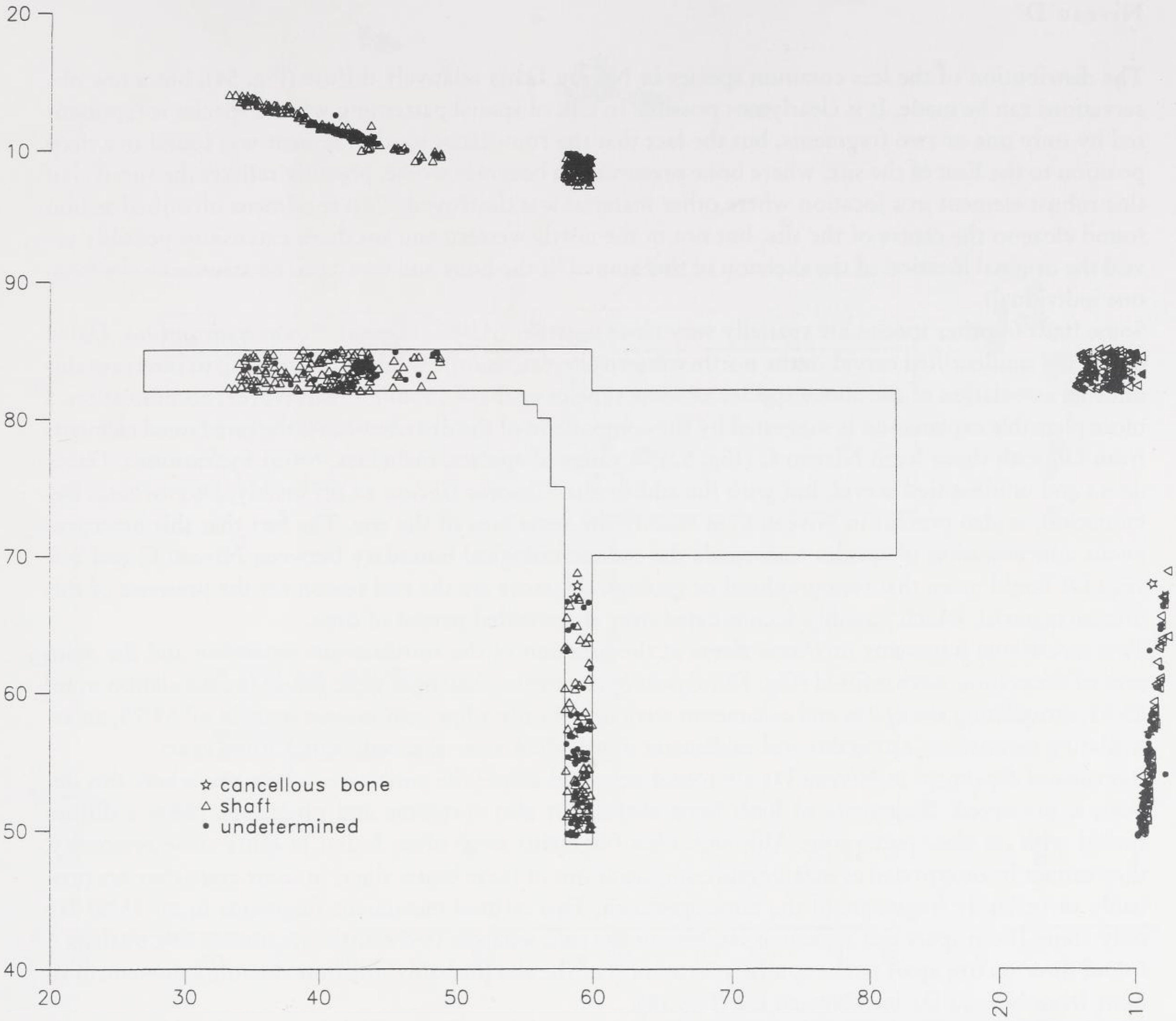


Fig. 53 Horizontal and vertical distribution of remains unidentified to species in Niveau C at the Plaidter Hummerich (for explanation see text).

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 m^2 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

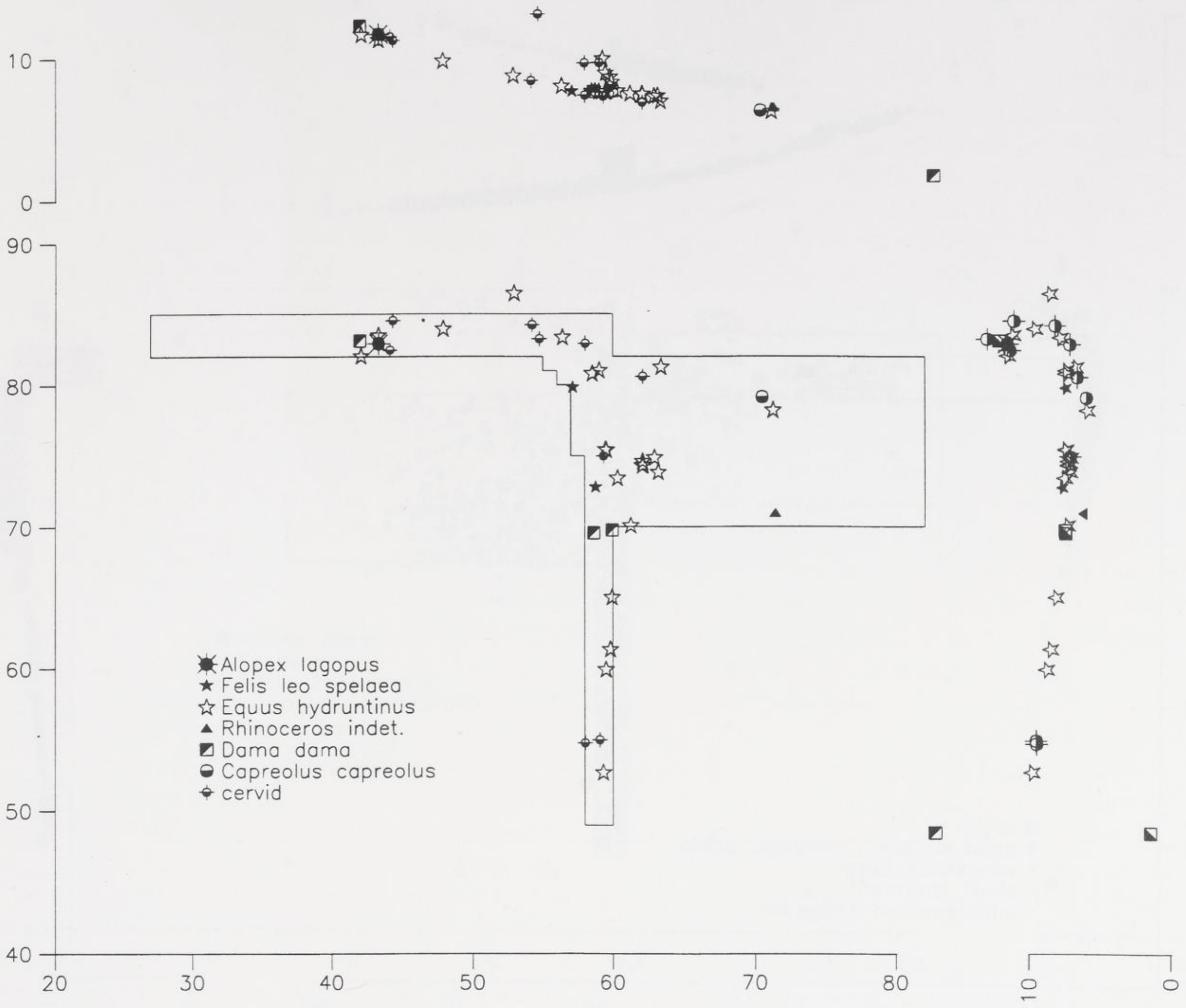


Fig. 54 Horizontal and vertical distribution of the less common species in Niveau D1 at the Plaidter Hummerich (for explanation see text).

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-

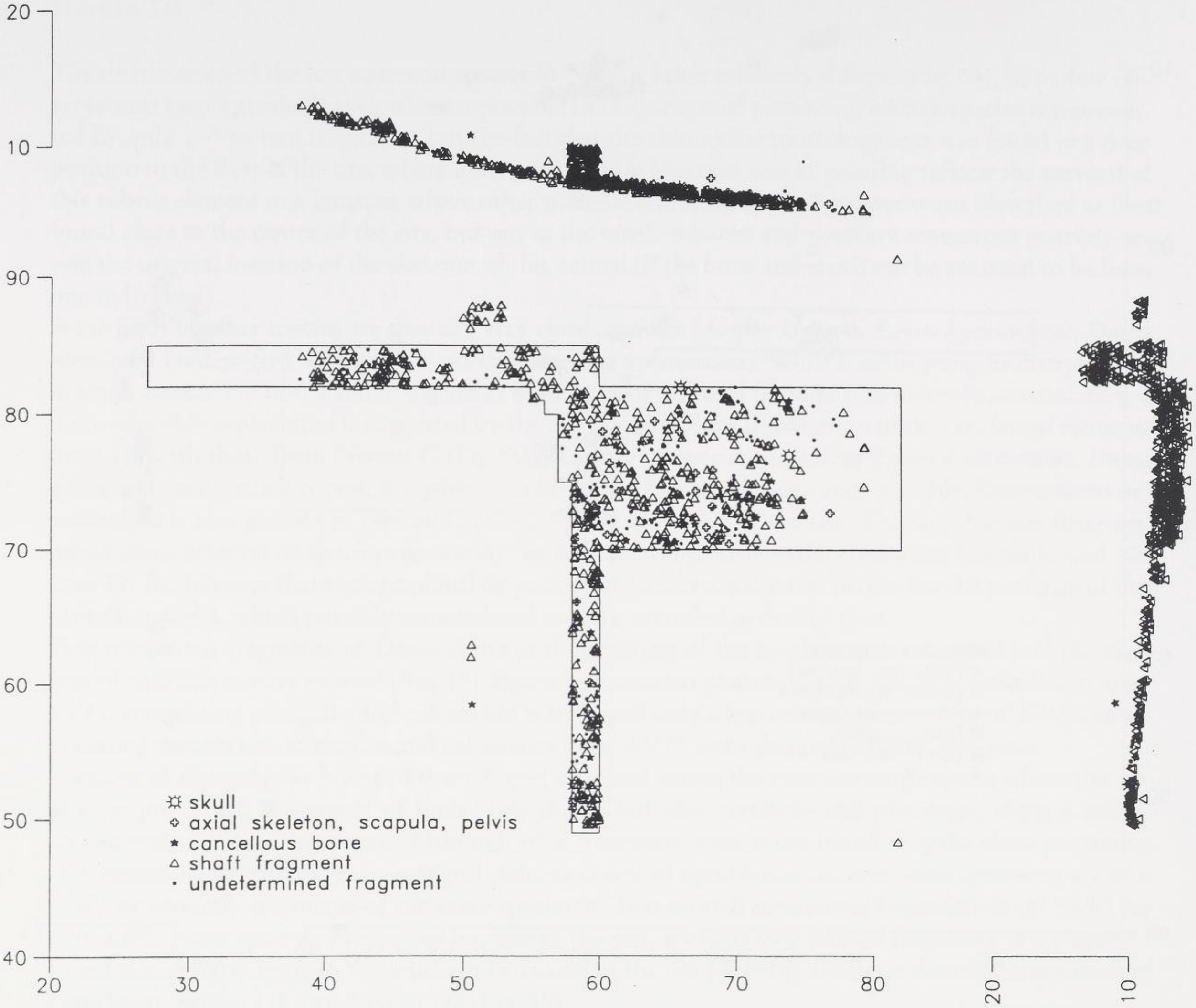


Fig. 55 Horizontal and vertical distribution of remains unidentified to species in Niveau D1 at the Plaidter Hummerich (for explanation see text).

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.

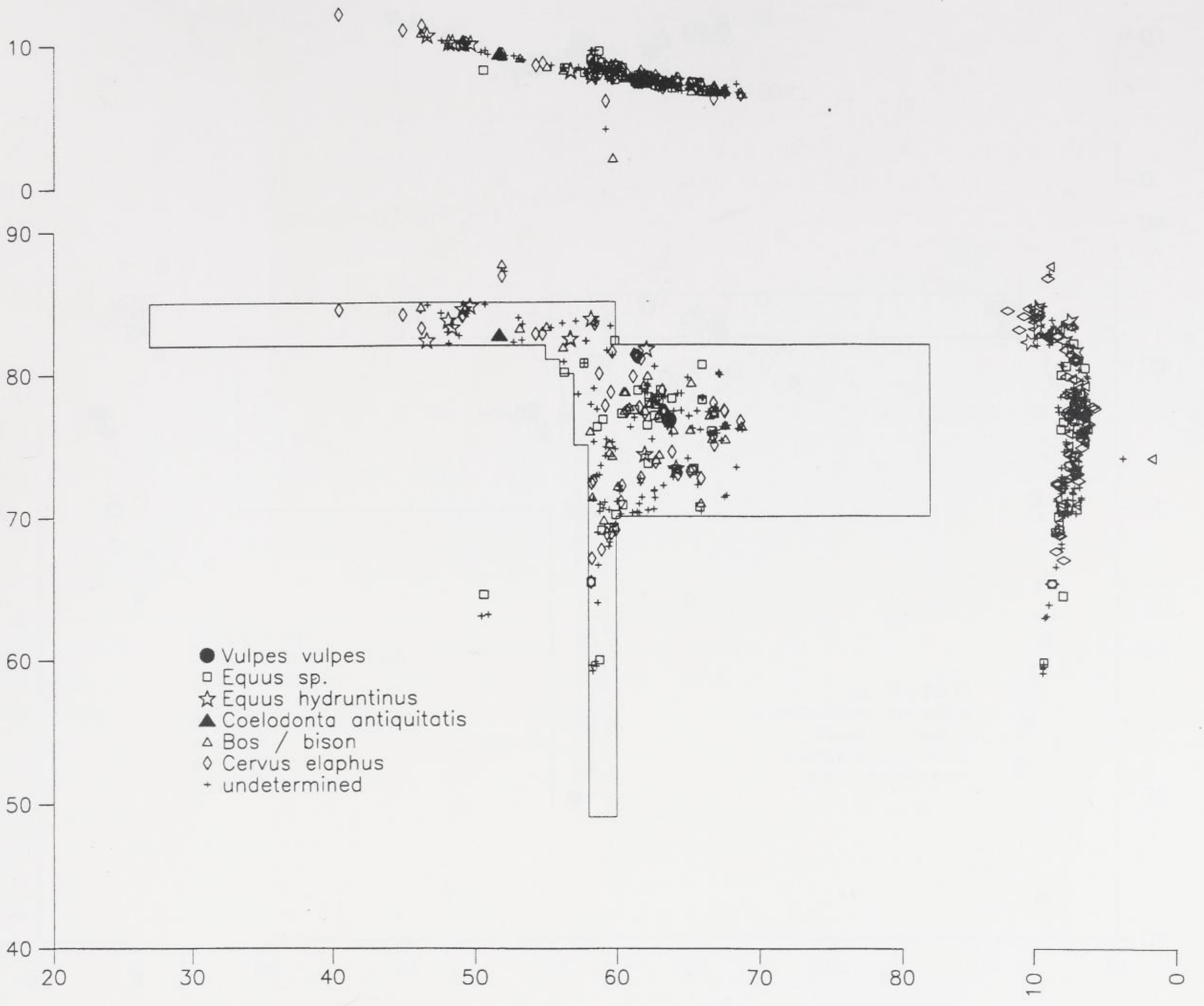


Fig. 56 Horizontal and vertical distribution of all faunal remains in Niveau D2 at the Plaidter Hummerich (for explanation see text).

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.

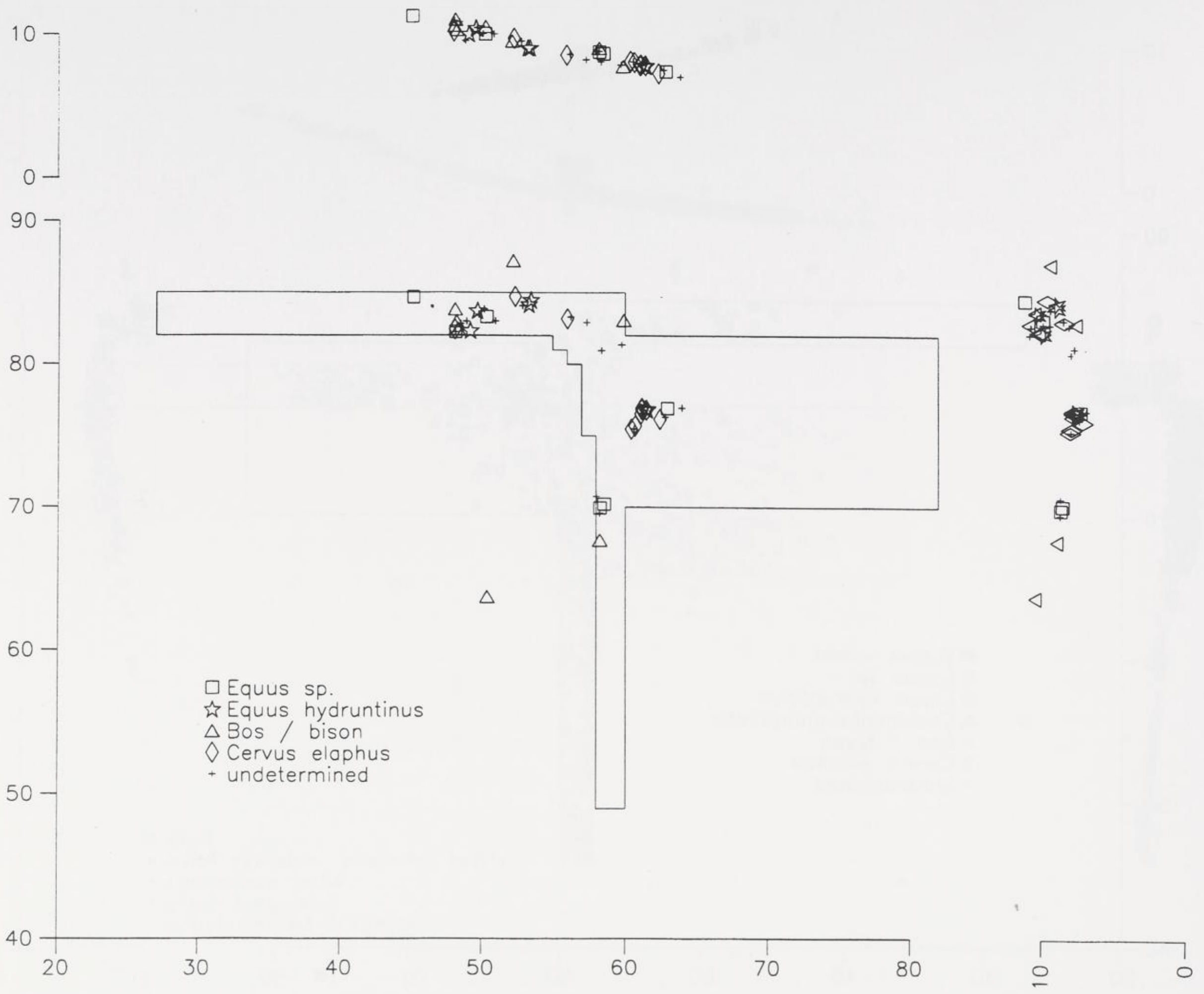


Fig. 57 Horizontal and vertical distribution of all faunal remains in Niveau D3 at the Plaidter Hummerich (for explanation see text).

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

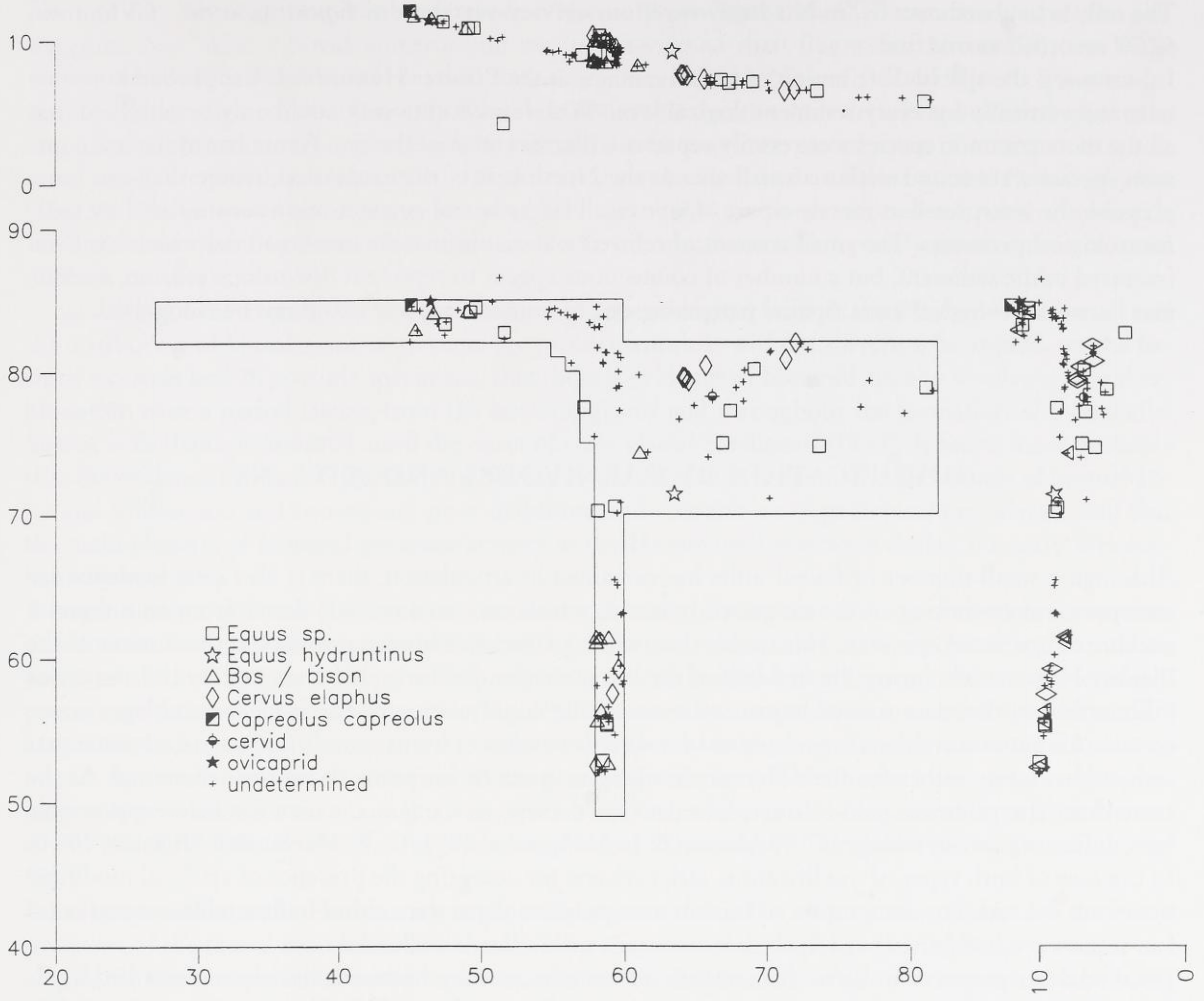


Fig. 58 Horizontal and vertical distribution of all faunal remains in Niveau E at the Plaidter Hummerich (for explanation see text).

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 stratigraphy 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.