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The Changing Game: Gravettian-Epigravettian Hunting Strategies in the Middle Danube

Brad LOGAN

1. Introduction

Faunal remains from a series of Epigravettian camp sites in the Middle Danube region of Central Europe (fig. 1) document a significant change in hunting patterns from the preceding Gravettian period. Assemblages from these sites reflect a shift toward a focal reindeer hunting economy that contrasts with the more diffuse subsistence pattern represented by animal remains from Gravettian sites. This shift in hunting patterns occurred during the onset of maximum periglacial conditions during the Upper Pleniglacial after 23000 B.P. and reflects a readaptation to the consequent diminishment of game resources.

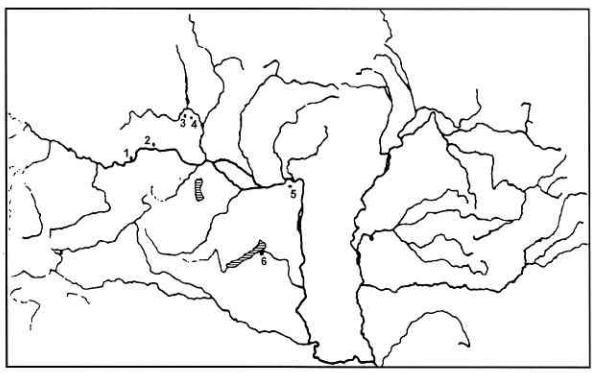

Fig. 1 — Map of the Middle Danube region showing location of sites discussed in the text: 1. Willendorf; 2. Grubgraben; 3. Dolní Věstonice; 4. Pavlov; 5. Pilismarot-Palret; 6. Sagvar. Adapted from Kozłowski 1986; Kozłowski & Otte 1987.

2. Gravettian Hunting Patterns in Lower Austria: the Willendorf Example

Ecological conditions during the end of the Interpleniglacial some 30000 B.P. and the beginning of the Upper Pleniglacial have been described as "rather mild over most of Central and Eastern Europe" (Kozłowski, 1986 : 136). A forest-steppe environment spread throughout the northern part of the middle Danube region during this time. The mosaic of habitats provided by these communities supported a broad variety of game animals south and southeast of the Carpathians. These conditions persisted until about 23,000 years ago, when the Brandenburg-Leszno glacial advance brought about climatic deterioration.

The sequence of cultural levels, their associated artefact assemblages and habitation structures at sites such as Willendorf II, Dolní Věstonice and Pavlov indicate that the Gravettian period in Lower Austria and Moravia was characterised by settlement stability (Kozłowski, 1986 : 146). Gravettian hunters exploited the varied and abundant resources available in the vicinity of these sites without apparent bias. The diversity of faunal remains at sites such as Pavlov suggests, according to Kozłowski (1986 : 185), "that Gravettian hunters did not prefer any particular animal but hunted the local almost randomly". The faunal assemblage from Willendorf II, with some deviation which reflects the unique nature of its local habitat, follows this pattern.

Willendorf II is located within Wachau, a region of rugged relief, on the Danube River about 40 river km above its confluence with the Kamp river (fig. 1 et 2). A few kilometres above this confluence, the Danube leaves the Wachau and enters a broad, relatively level plain. Thus within a short distance of the site, a wide variety of habitats were available. Radiometric dates from the Gravettian levels at Willendorf II and sedimentological data indicate levels 5 through 8 correspond to the relatively mild period at the end of the Interpleniglacial and the early Upper Pleniglacial (Kozłowski, 1986). Level 9 may date to about 21000 B.P., or the time of the Brandenburg-Leszno advance. Thenius (1956) provides a paleontological analysis of the faunal assemblages from all levels at this locality, a brief

Taxon	Level								
	1	2	3	4	5	6	7	8	9
Aquila chrysaetus	–	–	–	–	–	–	–	–	1
Lepus sp.	–	–	–	–	1	–	–	1	–
Canis lupus	–	1	–	–	1	1	1	1	2
Vulpes vulpes	–	–	–	1?	1	–	1	1	9
Alopex lagopus	–	–	–	1	–	–	–	–	25
Gulo gulo	–	–	–	–	–	–	–	–	1
Ursus cf. arctos	–	–	–	–	1	1	1	–	1
Panthera spelaea	–	–	–	–	1	1	–	1	1
Lynx lynx	–	–	1	–	–	–	–	–	–
Cervus elaphus	1	1	1	–	1	–	–	1	2
Rangifer sp.	1	–	1	2	2	1	1	1	2
Capra ibex prisca	1	1	–	2	5	1	–	3	4
Ovicaprine indet.	–	1	–	–	1	–	–	–	1
Bison priscus	–	–	–	1	–	–	1?	–	1–2
Equus sp.	–	–	–	–	–	–	2	1	–
Mammonteus (sp.) primigenius	–	–	–	–	1	–	1	1	1

Table 1 — Minimum Number of Individuals of Taxa from Willendorf II (from Thenius, 1956 : 166).

Fig. 2 — View of the Danube Valley and the Wachau downstream from Willendorf II.

review of which demonstrates the "random" hunting pattern that characterise this time.

Thenius provides minimum numbers of individuals (MNI) for taxa from each of the nine levels at Willendorf II and these reflect the diversity of species utilised and the evenness of game procurement (table 1). Fourteen taxa were recorded at the site, a diversity best represented in Levels 5, 8 and 9. Much of this variety is accounted for by carnivores, including wolf, red fox, arctic fox, wolverine, bear and cave lion. Large game animals, including reindeer, red deer, horse, bison and mammoth, appear to have been hunted without preference. The relative high number of ibex is attributable to the site's situation in the Wachau and the consequent ease with which they could have been obtained. With the exception of this bias toward a montane animal, procurement of other large game is even. There is no apparent preference for ungulates of the forest or steppe habitats. Red deer and reindeer, for instance, are present in equivalent numbers.

3. Epigravettian Hunting Patterns

Faunal assemblages from sites of the Epigravettian in Lower Austria and the Transdanube are in striking contrast to those from Gravettian sites in the same region. Two such well documented sites in Hungary are Sagvar and Pilismarot-Palret (Voros, 1982; Kozłowski & Otte, 1987; fig. 1). Pilismarot-Palret is located on a terrace in the Danube Valley about 30 air km upstream of its great southern bend and about 200 km downstream from Willendorf, site date to about 16750 ± 400 B.P. The faunal assemblage from the site is dominated by reindeer (MNI = 10), with lower frequencies of bison (MNI = 2), wolf, fox and suid. Elements notably lacking in the recovered sample are those associated with meat-rich body parts. This absence is attributed to the site's function as a satellite camp where reindeer were processed and the meat-rich parts then transported to a base camp or a cache (Kozłowski & Otte, 1987 : 143).

Sagvar is located near the northeastern edge of Lake Balaton at the northern margin of the

Outer-Somogy hillcountry and about 110 air km south of Pilismarot-Palret. Cultural materials occur in two levels separated by 100–180 cm of sterile loess. The upper level has been radiocarbon dated to 17400 ± 100 B.P. and 17760 ± 150 B.P. The lower level has been dated to ± 18600 B.P. and ± 18900 B.P. Excavations at Sagvar during 1930–1931 and 1935–1937 yielded remains of 126 reindeer (NISP = 1,488) with smaller numbers of horse (NISP = 226), otter, wolf, hare and beaver (total NISP for these animals = 7). The relative frequencies of these animals attest to the specialised economy of this period (Voros, 1982). In contrast to Pilismarot-Palret, the body parts represented at Sagvar indicate the reindeer had been processed elsewhere and only the meat-rich portions imported. Voros notes the contrast in body parts represented by identified faunal remains in terms of differences in carcass treatment within the site. For example, remains recovered from an area of 160 m^2 during excavations of the site from 1930 to 1931 include a relatively high number (NISP = 73) of axial and upper limb elements, or 31.7 % of the total length (less teeth and antlers). Conversely, remains recovered from an area of 125 m^2 during excavations from 1935 to 1937 include only 20 such fragments, or 9.4 % of the total (less teeth and antlers). Voros (1982) interprets the contrast as an indication of the consumption of meals at the campsite in the former area and the secondary butchery of animals in the latter.

Sagvar and Pilismarot-Paret provide evidence of a shift to a focal reindeer hunting pattern during the Epigravettian period and to the effect this change in strategy had on site function and settlement behaviour. Voros points out that seasonal movements of reindeer from summer feeding grounds in the Carpathians to winter feeding grounds in the Hungarian plain influenced the settlement subsistence patterns of Epigravettian hunters. Unlike their Gravettian forebears, who could select from a broad range of animal resources without ranging far from their settlements, Epigravettian groups of the Middle Danube were more closely linked to the migratory behaviour of a single species. Recent excavations at the Epigravettian site of Grubgraben in Lower Austria now provide additional evidence of this specialised hunting strategy and its attendant effect on site function.

4. Grubgraben: A Case Study of Specialised Economy During the Epigravettian

4.1. Background

Grubgraben occurs in the deep, stratified, loessic fill of a paleoravine between two promontories, the Heilingenstein and Geissburg, in the lower Kamp River valley (fig. 3). From

Fig. 3 — View of Grubgraben (arrow indicates location of 1987 excavations) southwest toward Kamptal (centre background) and Wachau (far background). Heiligenstein to right and toeslope of Geisberg to left.

this strategic location, nestled between these sheltering eminence's, hunters could view the lower valley floor and have access to the Danube plain just over 3 km distant. The Danube plain in this region is just at the eastern edge of the Wachau and undoubtedly provided herds of reindeer with winter feeding ground following their descent from summer pastures in the higher elevations of that terrain. In locating their camp near the ecotone of the Wachau and Danube plain, the hunters of Grubgraben also maximised their potential for utilising the greatest possible variety of resources. Unlike the hunters of Willendorf, however, those of Grugraben had to rely on a narrower range of animals and responded to this diminishment with a specialised hunting strategy focused on reindeer.

Grubgraben was the subject of limited archaeological investigation in 1870s during the first quarter of this century, and again in the early 1960s (Urbanek, 1990). The full potential of the site was not realised, however, until 1985 when Anta Montet-White (1990a), University of Kansas, cleared a seven meters long profile in the graben and when test excavations the following year revealed a deeply buried stone pavement in the adjacent vineyard. Subsequent excavations in 1987 and 1989–1990, have exposed

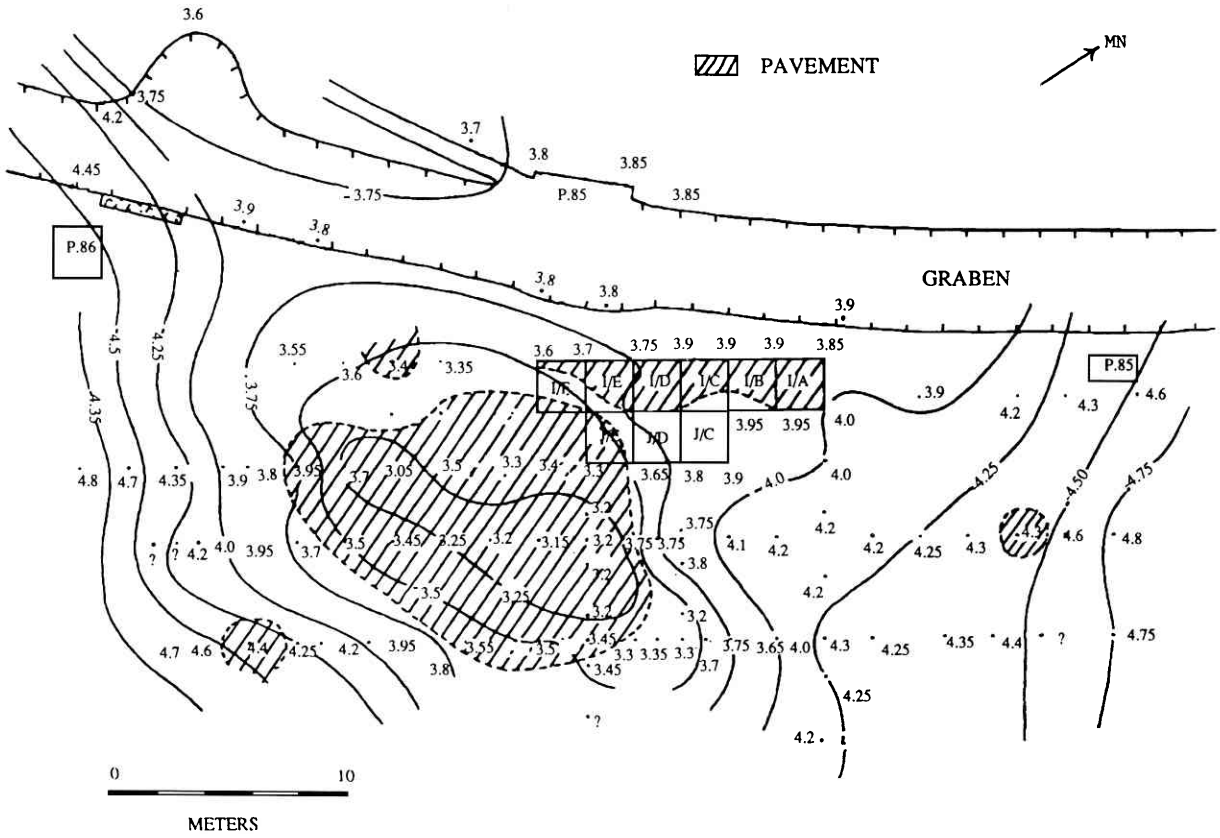

Fig. 4 — Plan view of Grubgraben showing location of 1985–1987 excavations. Numbers and contours indicate depth of cultural deposits below surface. Hashed lines indicate stone pavements. Based on Montet-White 1987: fig. 2; cf. Haessarts 1990: fig. 7.

about 100 m^2 of deposits. Figure 4, based on information obtained by Paul Haesaerts (1990; Montet-White 1987) from deposits exposed in the graben profiles and in a series of sediment cores, indicates the extent of buried cultural levels at the site with particular reference to an extensive stone pavement and the location of the excavations of 1986–1987. The analysis presented here is based on faunal material from the excavations, which exposed about 1/50th of the estimated deposits. The last two seasons of work at the site have yielded a considerable sample of faunal remains from a block excavation perpendicular to that of 1987. This material is currently undergoing analysis at the University of Kansas. Interpretations presented here are considered preliminary and provide the basis for subsequent comparison of intra-site activities related to subsistence behaviour.

4.2. Stratigraphy

There are at least five cultural levels at Grubgraben (fig. 5). Fieldwork in 1987 focused on the central three, referred to as AL 2–4, because they were associated with the stone pavement detected in 1986. Of these levels, AL 3 and AL 4 proved to be richer in faunal remains. The 30 m^2 area that included these levels is the source of most of the faunal assemblages discussed here. Within the 1987 block, AL 2 was marked by an extensive horizon of manuported stones that formed a pavement associated with lithic and faunal material (fig. 6). This pavement was underlaid by two distinct occupational levels the uppermost of which (AL 3) also contains manuports within a midden of debris (fig. 6). This levels occurs within an incipient paleosol. AL 4 is a well defined layer of artefacts and bone that occurs at the base of a well developed paleosol. The buried soil horizons reflect periods of climatic amelioration marked by increased humidity. Active springs in the vicinity of the site provided an additional inducement for settlement. These ameliorative conditions are relative, of course, to the rest of the Upper Pleniglacial. The stratigraphic sequence is estimated to span a period of 2,000–3,000 years marked by predominantly cold conditions. Three radiocarbon dates place

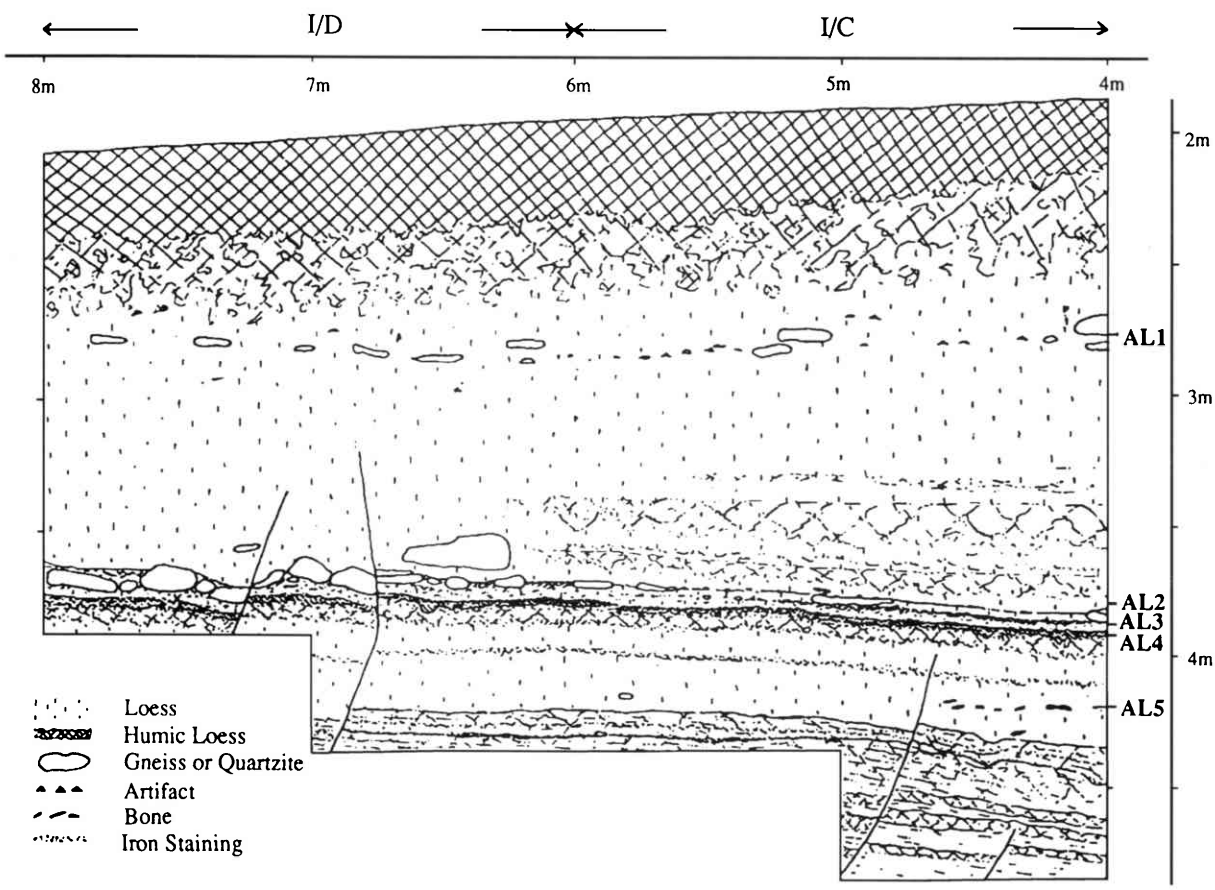

Fig. 5 — Profile of stratigraphy in 1987 excavation showing relationship of AL 1–5. Based on Montet-White 1987: fig. 3; cf. Heassarts 1990: fig. 4.

Fig. 6 — Left: View of 1987 excavation showing stone pavement of AL 2, looking south. Right: View of Units I–J/D–E looking west showing stone pavement of AL 2 and, in lower-right unit (north-western quadrant of J/D), clustered lithics and bone of AL 3.

Element	*Rangifer tarandus*			*Equus caballus*			*Capra ibex*			cf. *Bos primigenius*			*Mammuthus prim.*		
	Right	Left	Ind.	Right	Left	Ind.	Right	Left	Ind.	Right	Left	Ind.	Right	Left	Ind.
UI1	NA	NA	NA	1	2	–	NA	NA	NA	–	–	–	–	–	16
UI2	NA	NA	NA	1	2	–	NA	NA	NA	–	–	–	–	–	–
UI3	NA	NA	NA	1	2	–	NA	NA	NA	–	–	–	–	–	–
UDI1	NA	NA	NA	–	–	–	NA	NA	NA	–	–	–	–	–	–
UDI2	NA	NA	NA	–	–	–	NA	NA	NA	–	–	–	–	–	–
UDI3	NA	NA	NA	1	1	–	NA	NA	NA	–	–	–	–	–	–
UC1	–	–	–	–	–	–	NA	NA	NA	–	–	–	–	–	–
UDC1	–	–	–	–	–	–	NA	NA	NA	–	–	–	–	–	–
UDM1	1	6	–	–	–	–	–	–	–	–	–	–	–	–	–
UDM2	1	9	1	–	–	–	–	–	–	–	–	–	–	–	–
UDM3	2	8	1	–	–	–	–	–	–	–	–	–	–	–	–
UP2	3	4	1?	–	2	–	–	–	–	–	–	–	–	–	–
UP3	6	8	1?	1	–	–	1	–	–	–	–	–	–	–	–
UP4	13	8	1?	3	–	–	–	–	–	–	–	–	–	–	–
UM1	15	14	–	1	–	1?	–	–	–	1	–	–	–	–	–
UM2	16	8	1?	2	–	–	–	–	–	1	–	–	–	–	–
UM3	7	2	–	1	1	–	–	–	–	–	–	–	–	–	–
LI1	1	1	–	4	5	–	–	–	–	–	–	–	–	–	–
LI2	1	–	–	3	3	–	–	–	–	–	–	–	–	–	–
LI3	1	–	–	3	3	–	–	–	–	–	–	–	–	–	–
LC1	–	–	–	2	4	–	–	–	–	–	–	–	–	–	–
LDM1	–	3	–	–	1	–	–	–	–	–	–	–	–	–	–
LDM2	–	5	–	–	2	–	–	–	–	–	–	–	–	–	–
LDM3	1	8	–	–	1	–	–	–	–	–	–	–	–	–	–
LP2	23	17	1?	2	4	–	–	1	–	2	–	–	–	–	–
LP3	26	23	–	1	2	1?	–	–	–	2	–	–	–	–	–
LP4	18	26	–	2	3	–	–	–	–	1	–	–	–	–	–
LM1	18	26	–	1	–	–	–	1	–	1	–	–	–	–	–
LM2	22	23	–	2	2	–	1	3	–	–	–	–	–	–	–
LM3	25	21	–	5	–	–	1	4	–	–	–	–	–	–	–
Unident. Tooth	3	8	15	2	6	20	–	–	–	–	–	–	–	–	–
Skull Fragment	4	2	6	3	1	2	–	–	–	–	–	–	–	–	–
Antler/Horn Fragment	5	12	37	–	–	–	–	–	2	–	–	–	–	–	–
Maxilla Fragment	9	7	–	2	5	–	–	–	–	–	–	–	–	–	–
Mandible Fragment	71	69	10	16	25	20	1	5	–	1	–	–	–	–	–
Totals	*292*	*318*	*75*	*60*	*77*	*44*	*4*	*14*	*2*	*9*					*16*
Taxa Totals	*685*			*181*			*20*			*9*			*16*		
Per Cent	*74.95*			*19.8*			*2.19*			*0.98*			*1.78*		
Grand TOTAL	***911***														

Ind. = Indeterminate.

Table 2 — Identified Cranial Elements of Large Mammals at Grubgraben.

Element	*Rangifer tarandus*			*Equus* cf. *caballus*			*Capra ibex*		
	Right	Left	Ind.	Right	Left	Ind.	Right	Left	Ind.
Humerus Prox.	1	1	–	–	1	–	–	–	–
Dist.	3	5	–	–	1	–	–	–	–
Shaft	17	18	1	15	13	–	–	1	–
Rad/Ulna Prox.	10	6	–	–	4	–	1	4	–
Dist.	6	1	–	2	–	–	–	–	–
Shaft	36	39	15	15	9	–	1	1	–
Captitato–Trapezoid	1	4	–	NA	NA	NA	–	1	–
Grand Os	NA	NA	NA	–	1	–	NA	NA	NA
Os Crochu	–	1	–	–	–	–	–	–	–
Pisaform	1	1	–	1	1	–	–	–	–
Pyramidal	–	1	–	–	–	–	–	–	–
Scaphoid	2	2	–	–	1	–	–	–	–
Semi-Lunate	1	2	–	–	1	–	–	–	–
Metacarpal Prox.	12	8	–	–	1	–	1	1	–
Dist.	–	3	13	–	–	1	–	–	2
Shaft	5	16	6	–	–	8	–	–	–
Os Matacarpal	IV	NA	NA	–	–	2	NA	NA	NA
Femur Prox.	2	–	1	–	–	–	–	–	–
Dist.	–	–	–	1	–	–	–	–	–
Shaft	13	18	6	10	4	–	–	–	–
Patella	3	1	–	–	–	–	–	–	–
Tibia Prox.	1	1	–	–	–	–	–	–	–
Dist.	7	4	–	1	2	–	–	–	–
Shaft	69	36	7	24	27	4	1	1	–
Os Malleolus	3	4	–	–	–	–	–	–	–
Astragalus	5	2	–	–	–	–	–	–	–
Calcaneus	6	6	–	1	–	–	–	1	–
Grand Cuneiform	–	1	–	–	1	–	–	–	–
Scapho-Cuboid	5	3	–	NA	NA	NA	–	–	–
Metatarsal Prox.	7	10	–	3	–	1	–	1	–
Dist.	6	1 ?	4	–	1	–	1	–	1
Shaft	53	53	52	–	2	11	–	–	–
Metapodial Prox.	–	–	1	–	–	–	–	–	–
Dist.	–	–	4	–	–	6	–	–	–
Shaft	–	–	18	–	–	9	–	–	–
1st Phalange	–	–	4	–	–	1	–	–	2
Prox.	–	–	16	–	–	–	–	–	–
Dist.	–	–	12	–	–	2	–	–	–
2nd Phalange	–	–	2	–	–	2	–	–	1
Prox.	–	–	5	–	–	–	–	–	1
Dist.	–	–	–	–	–	–	–	–	–
3rd Phalange	–	–	1	–	–	1	–	–	3
Prox.	–	–	1	–	–	–	–	–	–
Dist.	–	–	–	–	–	–	–	–	–
Unident Phalange Prox.	–	–	2	–	–	–	–	–	–
Dist.	–	–	1	–	–	–	–	–	–
Sesamoid	–	–	8	–	–	–	–	–	3
Stylet	–	–	3	NA	NA	NA	–	–	–
Dew Claw 1	–	–	2	NA	NA	NA	–	–	–
Dew Claw 2	–	–	2	NA	NA	NA	–	–	–
Dew Claw 3	–	–	3	NA	NA	NA	–	–	–
Indeter. Fragment	–	–	28	–	–	17	–	–	–
Totals	*275*	*248*	*218*	*73*	*70*	*65*	*5*	*11*	*13*
Taxa Totals	*741*			*208*			*29*		
Per Cent	*75.77*			*21.27*			*2.96*		
Grand TOTAL	***978***								

Table 3 — Identified Apendicular Elements of Major Taxa.

Element	*Rangifer tarandus*			*Equus* cf. *caballus*			*Capra ibex*		
	Right	Left	Ind.	Right	Left	Ind.	Right	Left	Ind.
Atlas	–	–	4	–	–	1	–	–	–
Axis	–	–	–	–	–	–	–	–	–
Cervical Vert.	–	–	9	–	–	8	–	–	–
Thoracic Vert.	–	–	12	–	–	2	–	–	–
Lumbar Vert.	–	–	12	–	–	–	–	–	–
Sacrum	–	–	–	–	–	–	–	–	–
Caudal Vert.	–	–	–	–	–	1	–	–	–
Indeter. Vert.	–	–	1	–	–	2	–	–	–
Scapula	15	19	3	11	8	3	1	2	–
Glenoid	9	3	1	2	4	–	–	–	–
Innominate	5	6	–	10	7	–	–	1	–
Acetabulum	8	8	–	4	3	1	–	–	–
Rib Fragment	2	–	34	–	3	11	–	–	–
Indeter. Fragment	–	–	1	–	–	4	–	–	–
Totals	*39*	*36*	*77*	*27*	*25*	*33*	*1*	*3*	–
Taxa Totals	*152*			*85*			*4*		
Per Cent	*63.07*			*35.27*			*1.66*		
Grand TOTAL	***241***								

Table 4 — Identified Axial Elements of Major Taxa.

the occupation of AL 4 between 18000 and 19000 B.P., or the time of the last glacial advance (Montet-White, 1990a) and roughly contemporaneous with the lower level at Sagvar. The faunal assemblages from AL 2-AL 4 reflect the same adaptation to the periglacial conditions of this period, that is, one of intensive reindeer hunting.

4.3. The faunal Assemblage

The faunal assemblage from the 1987 excavations at Grubgraben consists of 2,355 identified fragments, of which 911 are cranial (including teeth) [table 2], 978 are apendicular [table 3], and 241 are axial (table 4) pieces of reindeer (*Rangifer tarandus*), horse (*Equus* cf. *caballus*), ibex (*Capra ibex*), large bovid (*Bos*/Bison), and mammoth (*Mammuthus primigenius*) with the balance assigned to more general taxa groupings (table 5). Only five fragments are identified as arctic fox (*Alopex lagopus*), arctic hare (*Lepus timidus*), and perhaps wolverine (*Gulo gulo*) [table 6]. Reindeer is the dominant animal in all levels and in all body part categories (NISP = 67 %). Horse (NISP = 26,8 % and ibex (NISP = 2,3 %) appear in all levels as secondary food sources with the former significantly outweighing the latter. At least two large bovids tentatively identified elsewhere (Logan, 1990) as aurochs (*Bos primigenius*), occur in the assemblage. Mammoths are represented throughout the three levels only by pieces of ivory, generally in a poor state of preservation. The presence of this material in conjunction with the absence of any other part of this animal probably reflects the fortuitous collection of ivory from carcasses encountered during forays from the site. This material was probably used as an artistic and/or industrial medium.

Two aspects of the faunal assemblage warant discussion with respect to both Gravettian and Epigravettian sites in the Middle Danube. These are its taxonomic composition and its taphonomic nature. The former provides additional evidence of the contrast between the hunting strategies prevalent during these two periods. The latter sheds light on one aspect of Epigravetien hunting patterns, that is, the function that different sites appear to have had in a settlement-subsistence round determined to a large extent by the migratory behaviour of the principal game animal.

Carnivora	1 Humerus distal (right)
Mustelidae cf. Gulo gulo	1 Tibia proximal
Alopex lagopus	1 mandible fragment (left); 1 LP4 (left); 1 LC1 (right)
Lepus timidus	1 Scapula (left); 1 1st Phalange

Table 6 — Small Mammals Represented at Grubgraben.

Element	Rangifer?			*Equus?*			Large Bovid			*Rangifer / Capra*			Equid / Large Bovid		
	Right	Left	Ind.	Right	Left	Ind.	Right	Left	Ind.	Right	Left	Ind.	Right	Left	Ind.
Skull Fragment	–	–	1	–	–	1	–	–	–	–	–	–	–	–	–
Mand. Fragment	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–
Unid. Tooth	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–
Axis	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–
Cervical Vertebra	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–
Thoracic Vertebra	–	–	2	–	–	–	–	–	–	–	–	–	–	–	1
Lumbar Vertebra	–	–	1	–	–	–	–	–	–	–	–	3	–	–	1
Indeterminate Vertebra	–	–	–	–	–	–	–	–	–	–	–	3	–	–	1
Scapula	–	–	2	–	–	–	–	–	–	–	1	4	–	–	–
Rib Fragment	–	–	4	–	–	–	–	–	–	8	4	84	–	–	3
Humerus Prox.	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–
Shaft	–	–	–	–	–	–	1	1	–	–	2	–	–	–	–
Rad / Ulna Shaft	1	–	1	–	–	–	–	–	–	1	1	1	–	–	–
Pisaform	1	–	–	–	–	–	1	–	–	–	–	–	–	–	–
Metacarpal Prox.	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Shaft	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–
Femur Prox.	–	–	–	–	–	1?	–	–	–	–	–	–	–	–	–
Dist.	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Shaft	1	–	1	–	–	–	–	–	–	1	2	2	–	–	–
Tibia Dist.	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–
Shaft	1	–	–	–	–	–	–	1	–	2	2	–	1	–	–
Astragalus	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–
Metatarsal Dist.	–	–	1	–	–	–	–	–	–	–	1	–	–	–	–
Shaft	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Metapodial Dist.	–	–	2	–	–	–	–	–	–	–	–	–	–	–	1
Shaft	–	–	–	–	–	2	–	–	–	–	–	–	–	–	1
1st Phalange Dist.	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–
Sesamoid	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–
Unid. Long Bone Shaft	–	–	5	–	–	2	–	–	–	–	–	34	–	–	5
Taxa Totals	*30*			*7*			*5*			*161*			*15*		
Grand TOTAL	***218***														

Ind. = Indeterminate.

Table 5 — Elements of Unspecified Taxa from Grubgraben.

The narrow range of animal species hunted by the occupants of Grubgraben reflects in part the disappearance, or at least the significant regression, of the temperate forest from Lower Austria. For example, there is no trace in the faunal assemblage of red deer, a temperate parkland animal once a constant in the diet of Gravettian hunters in the region. The only game on which the Epigravettian hunters could rely for subsistence were herd animals of the steppe. Ibex occur in such small numbers and had such relatively small meat-yields that they could only have served as an occasional alternative or supplement to a diet limited largely to reindeer and horse.

The taphonomic nature of the bone fragments, like that of the faunal assemblages from Pilismarot-Palret and Sagvar, provides a clue to the function Grubgraben served within the seasonal round of the Epigravettian hunters in the Middle Danube. Two characteristics of the assemblage suggest the area excavated, if not the entire site, was occupied during the winter (elsewhere [Logan, 1990], I have presented more limited data based on tooth eruption in mandible fragments of reindeer less than one year old that also support the interpretation of a winter occupation; recent efforts to detect seasonal information from cementum annuli on selected teeth in the assemblage have not been successful because of the degree of attrition at the juncture of the root and cementum [Patsy Witney, University of Kansas, personal communication]). These are the highly fragmented condition of the bones resulting from narrow extraction and the significantly high frequency of elements associated with meat-poor body parts.

Nearly all of the elements from the sample area exhibit the tell-tale fracture marks related to marrow extraction. Mandibles of reindeer and horse, in particular, are numerous and, without exception, lack the basal portion of horizontal ramus (fig. 7). Some basal fragments bear impact points from the percussion related to this process (fig. 7). Apendicular elements consist predominantly of splintered shaft fragments and reduced articular ends (fig. 8), a pattern indicative of marrow processing observed among contemporary reindeer hunters such as the Nunamuit (Binford, 1981: 162–163). Many of these fragments also exhibit impact points from percussion breakage (fig. 9–14).

The frequency of elements from various body parts in terms of their general utility for consumption provides the most telling information about site function and season occupation. Table 7 shows the number of identified specimen (NISP) and relative frequency of the fragments

Fig. 7a — Reindeer mandibles lacking basal portion, of horizontal ramus.

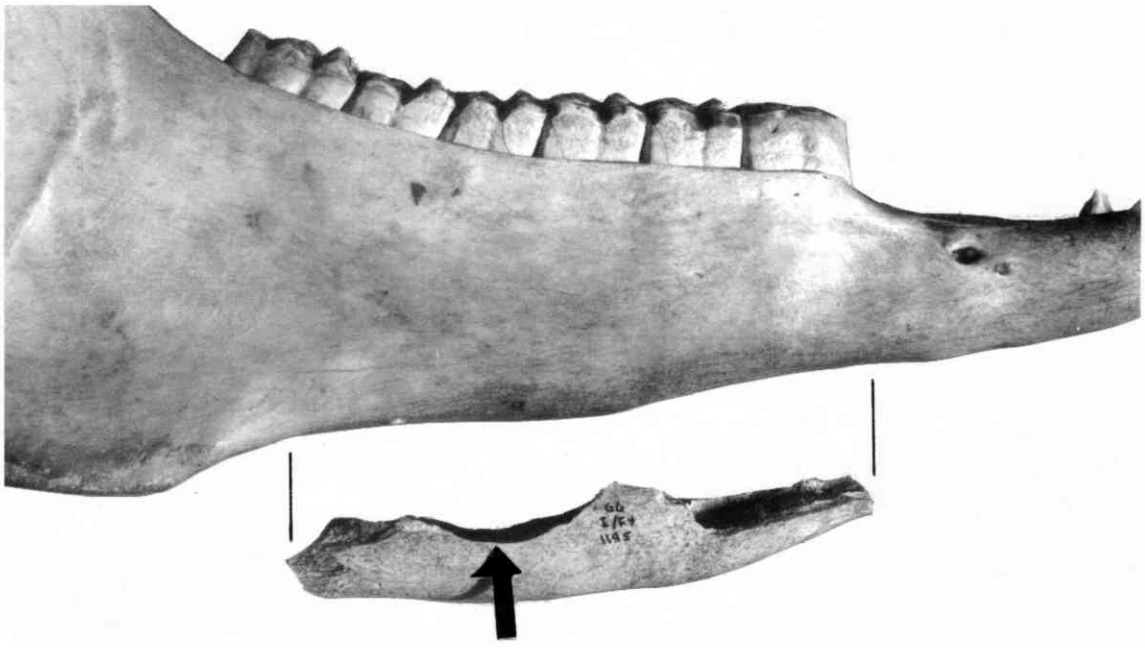

Fig. 7b — Basal fragment of equid mandible with impact point (arrow) and its approximate location on *E. caballus* element. Length of arrow is one inch (2.54 cm).

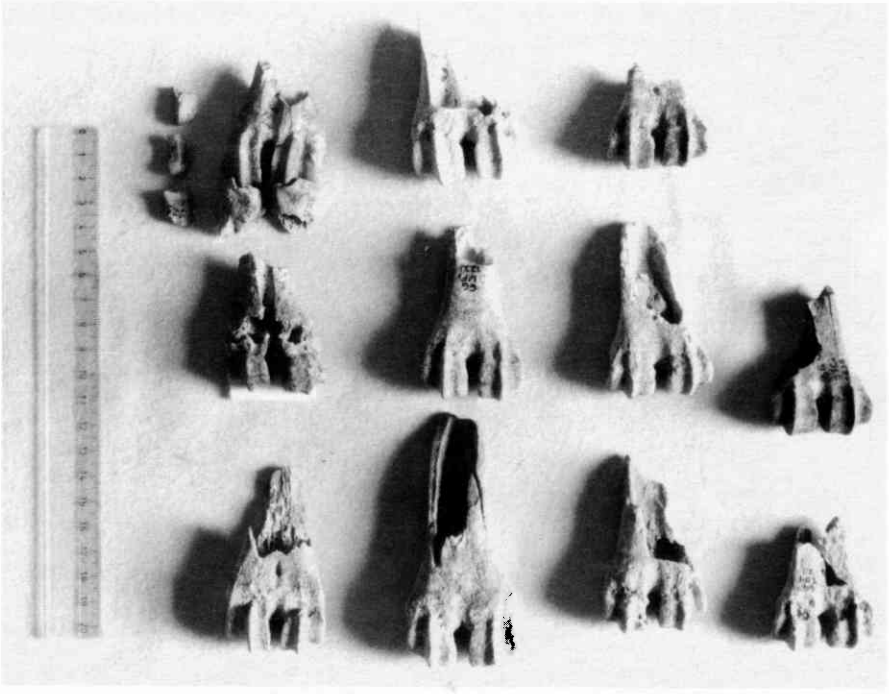

Fig. 8 — Reduced articulator ends of reindeer and ibex metapodials showing characteristic marrow-extraction breakage pattern.

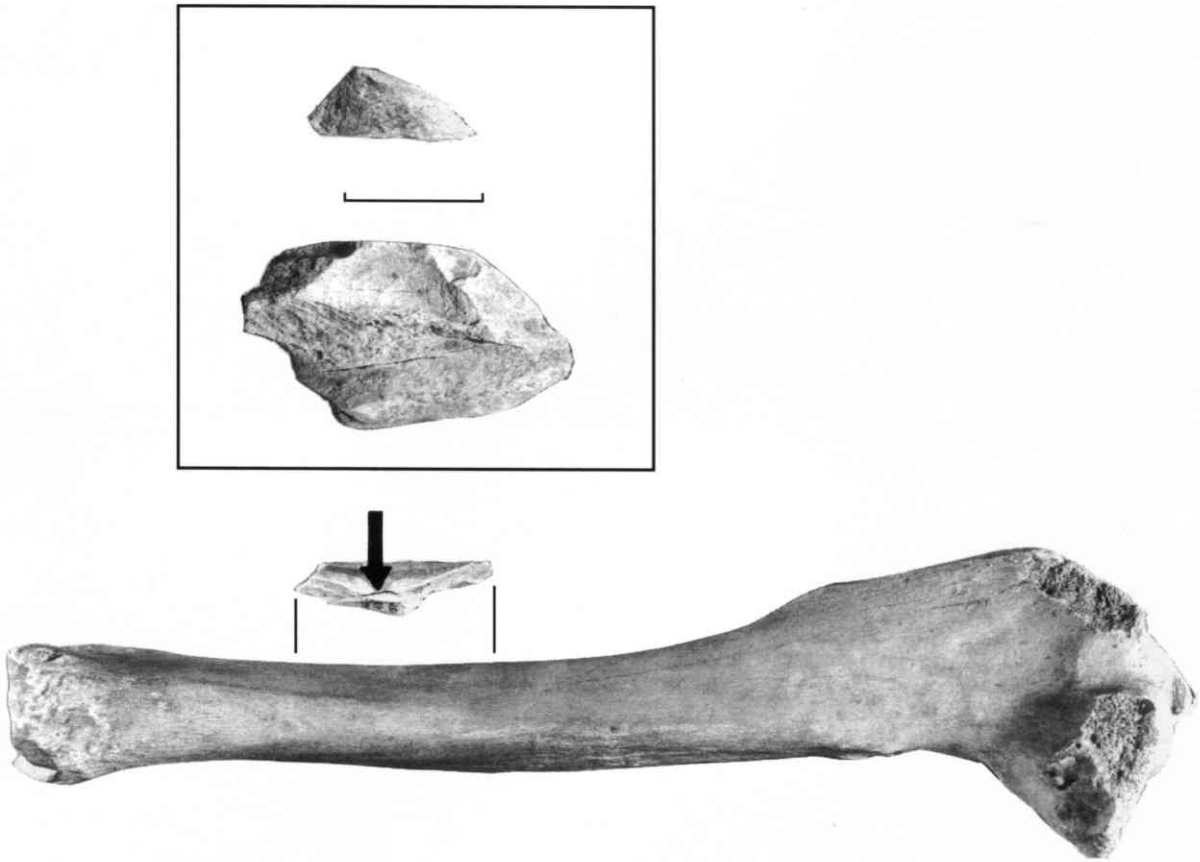

Fig. 9 — Equid tibia shaft fragment with impact flake showing point of impact (arrow) and approximate location on comparative specimen. Inset shows interior surface of fragment with detached flake. Length of arrow and inset scale is one inch (2.54 cm).

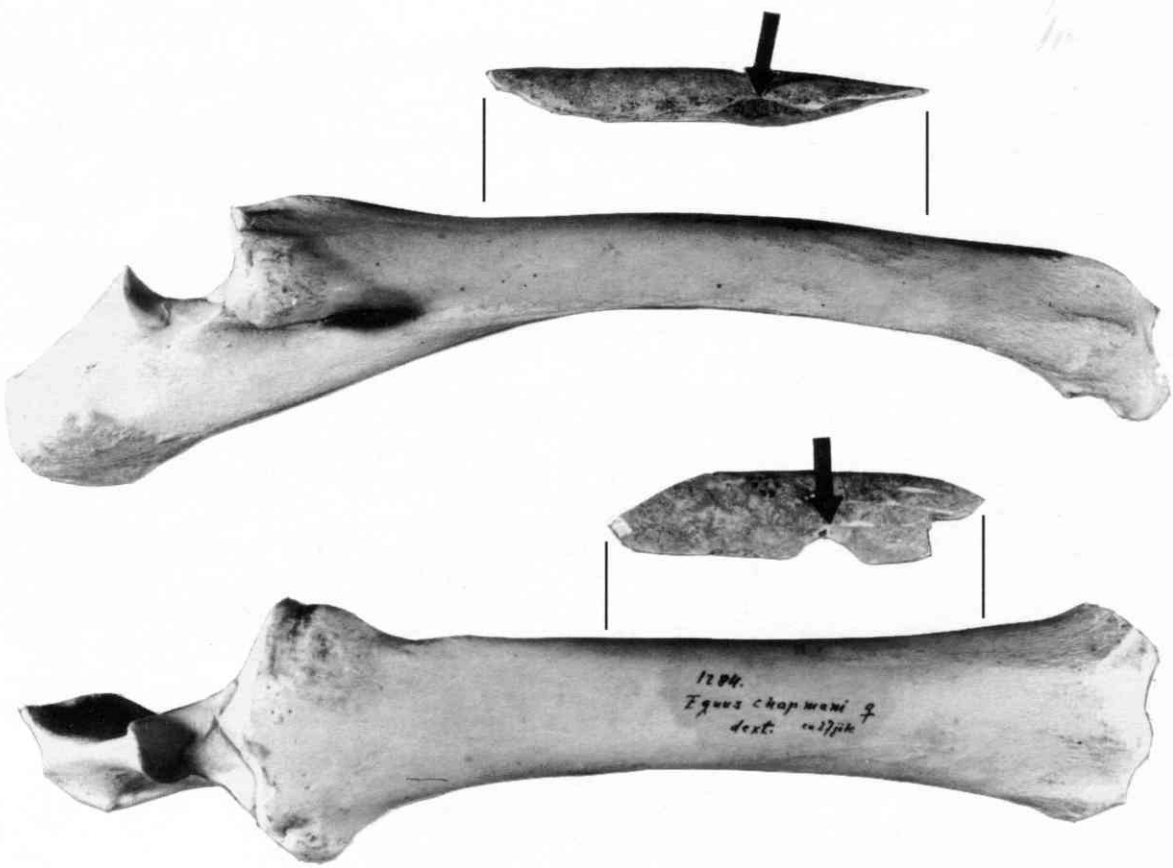

Fig. 10 — Equid radius-ulna shaft fragments with impact points (arrow) and approximate locations on comparative specimen. Length of arrow is one inch (2.54 cm).

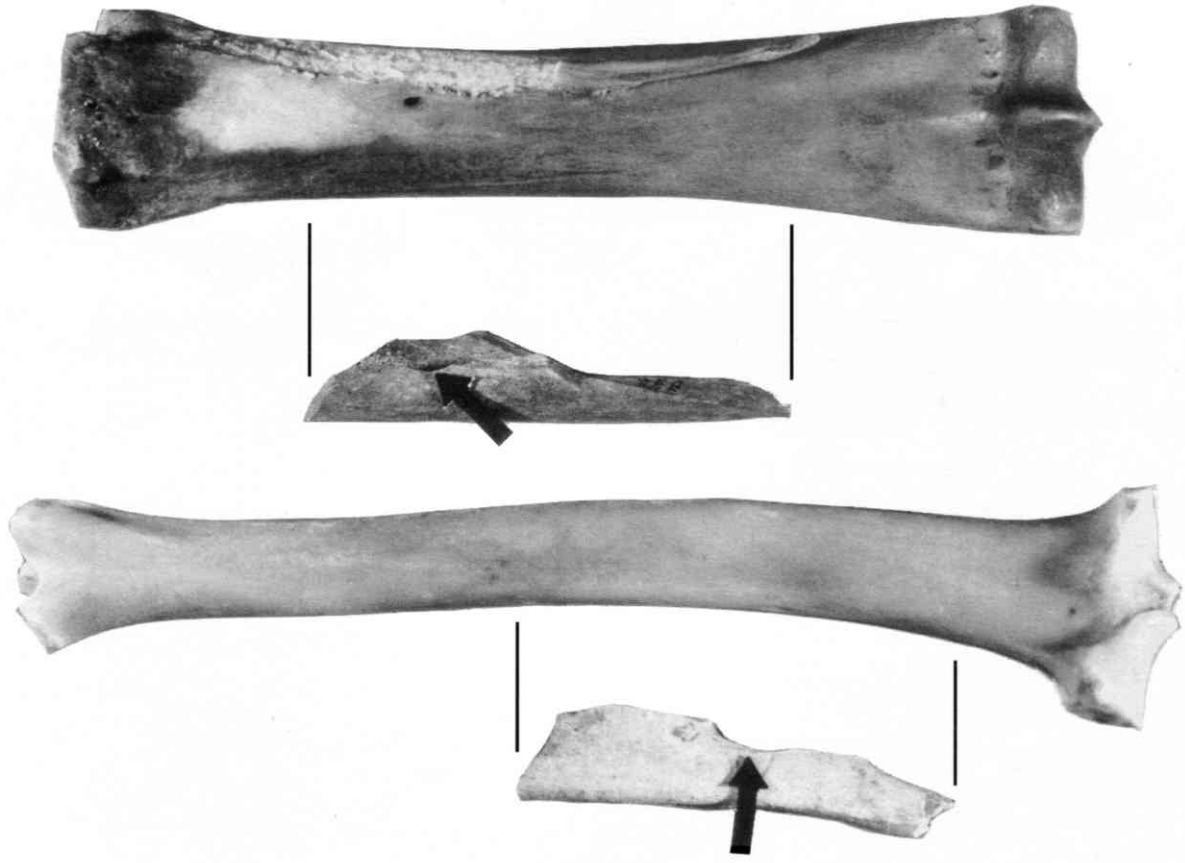

Fig. 11 — Equid metapodial shaft fragment (above) and reindeer tibia shaft fragment (below) with impact points (arrows) and approximate locations on comparative specimens. Length of arrow is one inch (2.54 cm).

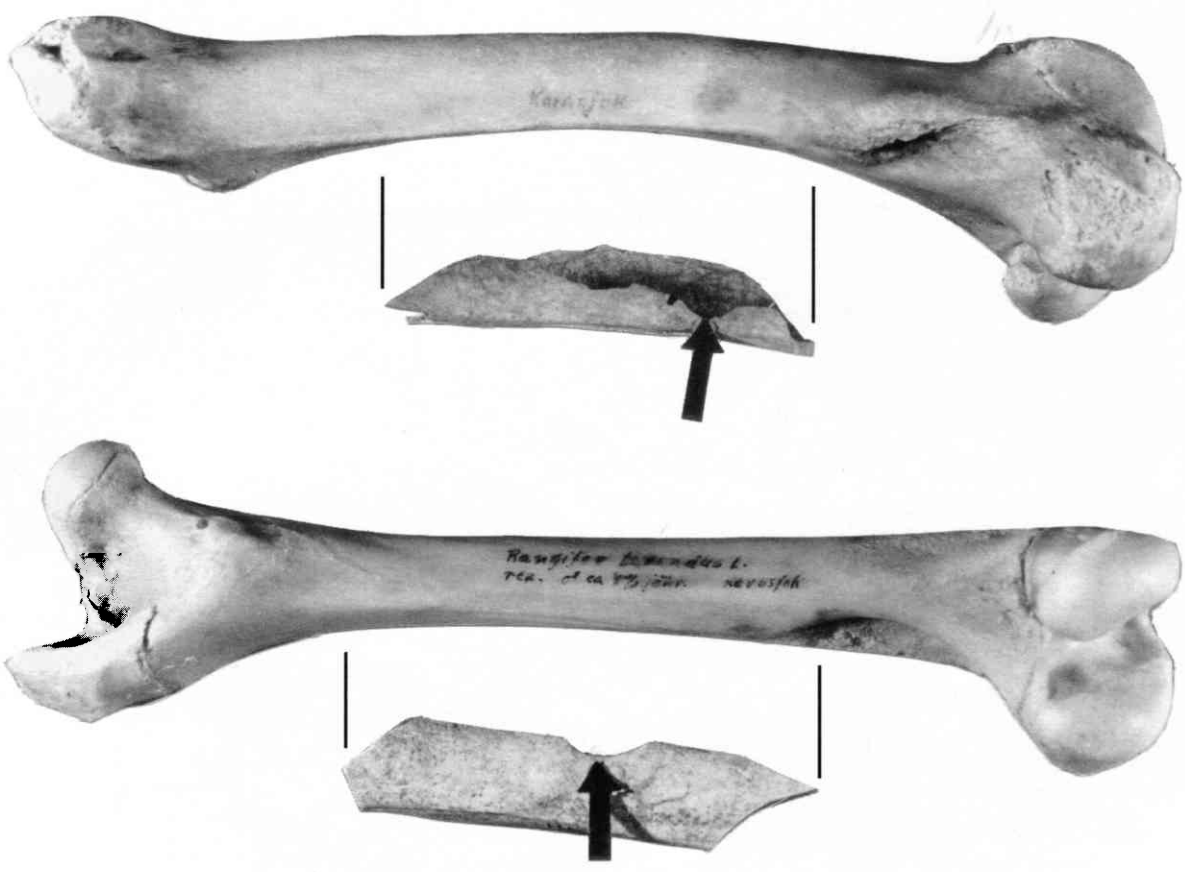

Fig. 12 — Reindeer femoral shaft fragments with impact points (arrows) and approximate locations on comparative specimen. Length or arrow is one inch (2.54 cm).

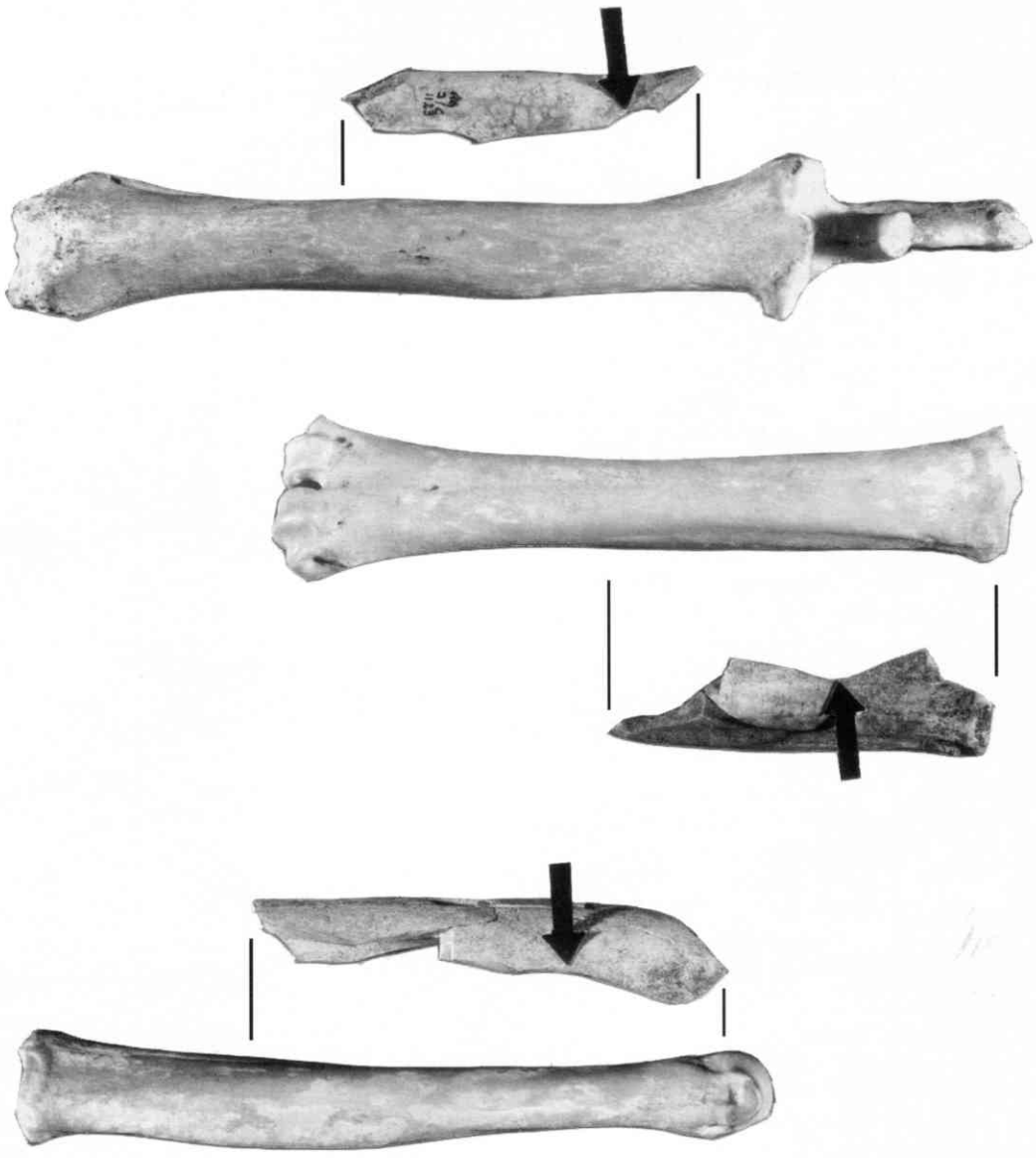

Fig. 13 — Ibex radius-ulna shaft fragment (above) and reindeer metacarpal fragments (centre, below) with impact points (arrows) and approximate locations on comparative specimens. Length of arrow is one inch (2.54 cm).

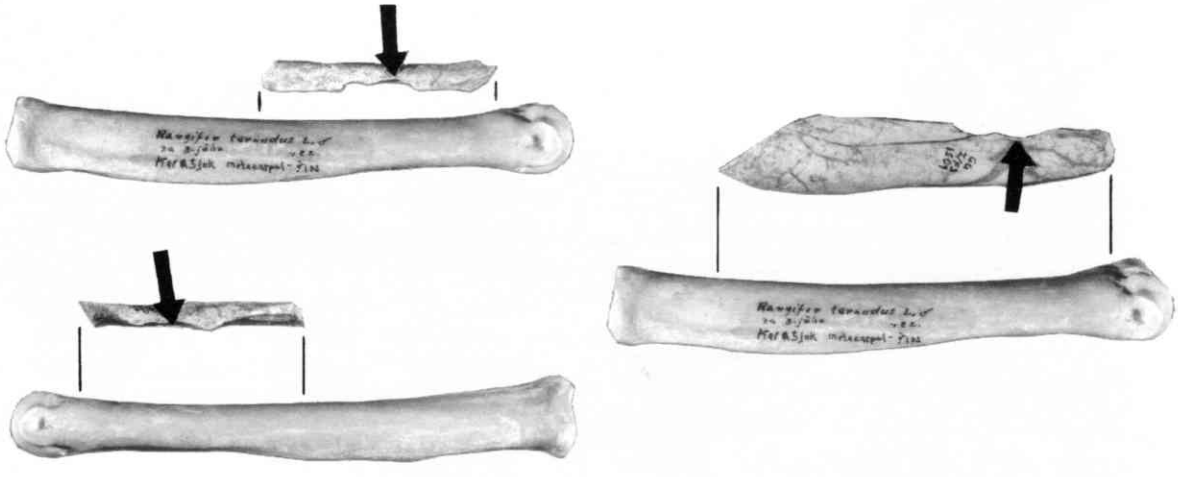

Fig. 14 — Reindeer metapodial shaft fragments (on the left lateral and medial views of same fragment) with impact points (arrows) and approximate locations on comparative specimens. Length of arrows is one inch (2.54 cm).

Anatomical Part	GUI	NISP	Per Cent
Skull (inc. maxilla)	17.49	82	7.7
Mandible	13.89	150	14.08
Atlas	23.56	4	0.38
Axis	29.64	–	–
Cervical vertebrae	35.71	9	0.85
Thoracic vertebrae	45.53	12	1.13
Lumbar vertebrae	32.05	12	1.13
Pelvis	47.89	27	2.54
Ribs	49.77	36	3.38
Scapula	43.47	50	4.69
Proximal humerus	30.23	2	0.18
Distal humerus	29.58	8	0.75
Humerus shaft fragments		36	3.38
Proximal Radius/Ulna	16.77	16	1.50
Distal Radius/Ulna	17.82	7	0.66
Radius/Ulna shaft fragments		90	8.45
Carpals	5.51	16	1.50
Proximal metacarpal	8.24	20	1.88
Distal metacarpal	8.83	16	1.50
Metacarpal shaft fragments		27	2.54
Proximal femur	98.32	3	0.28
Distal femur	100.00	–	–
Femur shaft fragments		37	3.47
Proximal tibia	27.57	2	0.19
Distal tibia	29.46	11	1.03
Tibia shaft fragments		112	10.52
Tarsals (less Astr. & Calc.)	11.20	9	0.85
Astragalus	11.23	7	0.66
Calcaneus	12.40	12	1.13
Proximal metatarsal	15.05	17	1.60
Distal metatarsal	16.24	10	0.94
Metatarsal shaft fragments		158	14.84
unident. metapodial		23	2.16
First phalange	3.32	32	3.00
Second phalange	3.03	7	0.66
Third phalange	1.85	2	0.19
Unident. phalange		3	0.28
Totals		***1,065***	***100.03***
< 20 GUI (Cranial; Lower Limbs, less Tibia)		704	66.10
> 20 GUI (Axial; Tibia & Upper Limbs)		361	33.90

Table 7 — General Utility Indexes of Reindeer Bone with Number and Frequency of Corresponding Parts from Grubgraben (From Binford 1978 : 73).

from assemblages as a whole in conjunction with the General Utility Index (GUI; Binford, 1978) of these elements. Note that two thirds of the assemblages are composed of fragments from elements with a GUI of less than 20. These elements are associated with the cranial and lower limb parts of the reindeer, those body parts poorest in meat-yield. Fragments from meat-rich (i.e., GUI higher than 20) body parts, the axial and upper limb portions, comprise only one third of the sample (= 1,065). We can appreciate the discrepancy in body part representation better in figure 15, a graphic illustration of the NISP distribution for each element. Note in particular the relative proportion of fragments from the upper (i.e., femora and humeri = 86) and lower limb elements (e.g., radia/ulna and tibae = 238). Cranial and lower limb (including the tibia, which has a GUI greater than 20) fragments account for 78 % of the fragments in the assemblage while meat-rich axial and upper limb portions are represented by only 22 % (fig. 16).

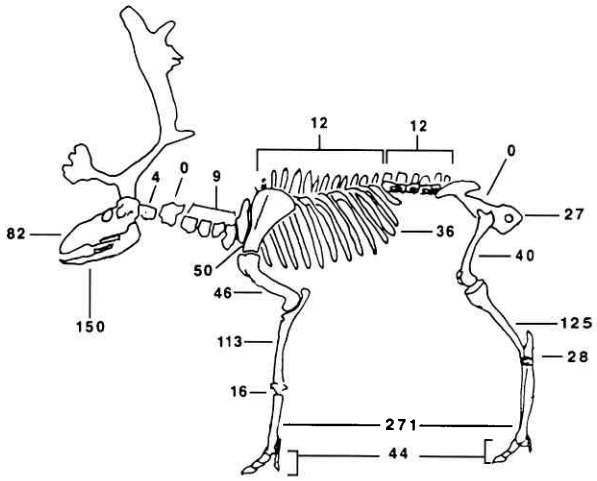

Fig. 15 — Number of identified specimens (NISP) of reindeer elements (less antlers and teeth) from Grubgraben (1987 excavation). Adapted from schematic skeleton in Spiess (1979:22).

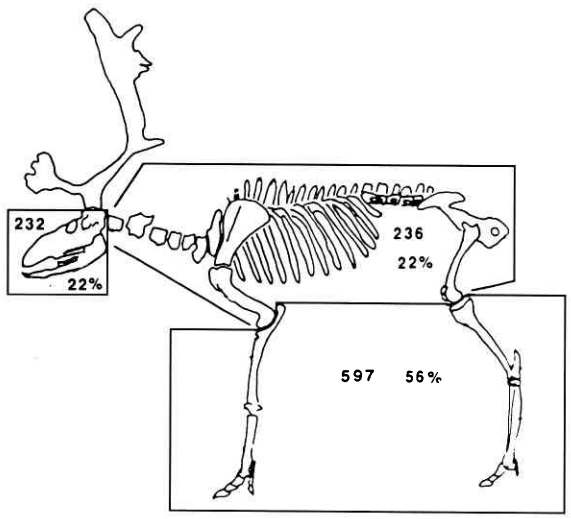

Fig. 16 — NISP and relative frequency of cranial, axial/upper limb, and lower limb elements from Grubgraben (1987 excavation).

While post-depositional attrition of more fragile axial elements, such as ribs and vertebrae, may account for some of this difference I do not believe such loss was sufficient to account for this discrepancy. Some rather fragile elements, such as scapulae, survived without much attrition (e.g., fig. 17). We could expect more robust elements, such as the centrum of some vertebrae, the sacrum acetabulae and other pelvic parts, and certainly femora and humuri to survive had they been processed like those of the lower limbs and cranium. Figures 18 and 19 show relative frequencies of body part fragments (NISP) of reindeer and horse from AL 3 (N = 274; *Rangifer* = 205; *Equus* = 69) and AL 4 (N = 576; *Rangifer* = 392; *Equus* = 184). Cranial and apendicular pieces significantly exceed the number of axial fragments from both animals in both levels. Fragments from meat-rich body parts represent a notably low percentage of apendicular elements (fig. 19). The combined totals of reindeer and horse fragments from low GUI body parts is 79.6 % in AL 3 and 71.5 % in AL 4. How are we to account for this consistent pattern?

I suggest the pattern indicates Grubgraben was a winter camp and that the high frequency of low-GUI fragments and their broken condition (fig. 17) reflects the nutritional stress of the occupants during that season. The following scenario, which accounts for several aspects of the site and its faunal assemblage, is hypothetical and can be tested with the animal remains from the 1989–1990 seasons of excavation.

The presence of elements from all body parts indicates entire reindeer carcasses were transported to the site. There is no evidence of the preliminary processing recorded at Pilismarot-Palret or the schlepp effect documented at Sagvar. This aspect of the assemblage can be attributed to the site's strategic location a short distance from the lower Kamp valley and the Danube plain. Herds of reindeer migrating in the fall from the higher elevations of the Wachau and the Bohemian/Moravian uplands to their winter pastures near the site were easily hunted and transported to Grubgraben. Sturdy (1975) has al presented ample evidence of comparable summer-highland to winter-lowland migration of reindeer and corresponding hunting strategies during the late glacial period in Central Europe. In particular, he has suggested the Danube River valley provided an avenue for migrating reindeer from the German highlands to the Hungarian plain (Sturdy, 1975). My interpretation of the strategic location of Grubgraben is consistent with his suggestion.

In anticipation of the encroaching winter months, the hunters of Grubgraben were loath to process only meat-rich parts for "schlepping". It was to their benefit to transport the entire carcasses to the site, subsist during the milder months of the fall on the meat-rich body parts and store the low-GUI but marrow rich parts for later use. During the cold season, with meat-rich parts running low or game more scarce in the vicinity of the site, the hunters increased their use of low-GUI body parts for marrow to off-set the reduction of meat and fat in their diet.

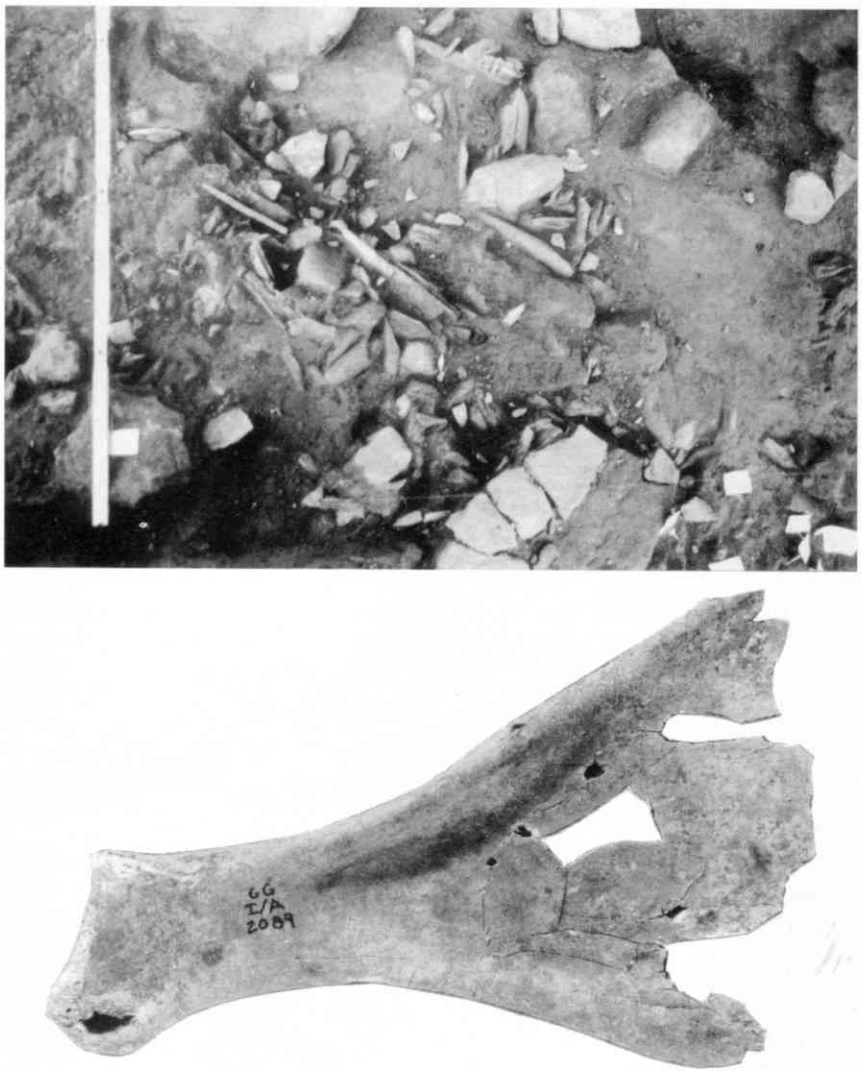

Fig. 17 — Above: Plan view of fractured bone and associated manuports in AL 3, Unit I/F at Grubgraben (1987 excavation). Below: Reindeer scapula from AL 4 showing good preservation of fragile axial elements.

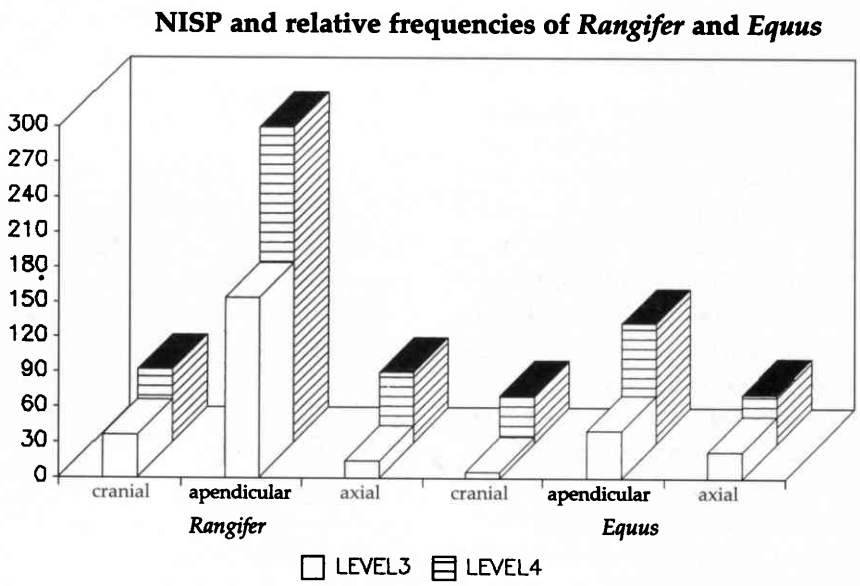

Fig. 18 — Bar histogram of the NISP of reindeer and equid bone fragments by body part from AL 3 and AL 4 at Grubgraben (1987 excavation).

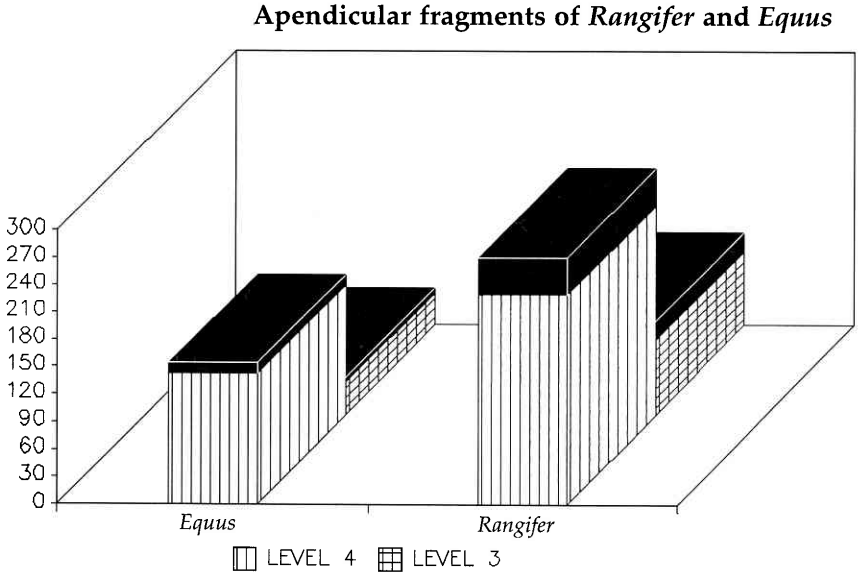

Fig. 19 — Bar histogram of the NISP of reindeer and equid apendicular fragments from AL 3 and AL 4 at Grubgraben (1987 excavation). Note relatively low frequencies of meat-rich upper limb elements.

This scenario can still account, should such prove to be the case, for discrepancies in the spatial distribution of body part elements at the site such as those observed at Sagvar (Voros, 1982). For example, it might be that the sample considered here reflects a localised activity area and that other parts of the site are conversely rich in axial and upper limb elements. If such proves to be the case, it might indicate that different parts of the site either were occupied during different seasons of the year or were the scene of different game processing tasks.

5. Conclusion

In summary, the data from the 1987 excavation at Grubgraben support an interpretation of a winter encampment of specialised reindeer hunters. Its similarity to Sagvar and Pilismarot-Palret and contrast to the Gravettian sites of Willendorf, Pavlov and Dolní Věstonice provide additional evidence of a shift to a focal hunting economy during the Epigravettian in response to the periglacial condition of the last glacial advance in Central Europe (Kozłowski & Otte, 1987). A similar shift from diversity to non-diverse faunal procurement has been documented for Western Europe during Würm IV (Simak & Snyder, 1988). Unlike the winter camp of Sagvar in the Hungarian Plain, however, Grubgraben has yielded taphonomic testimony to the practice of an alternate strategy for cold-weather survival. Whereas body parts at Sagvar reflect the schlepping of meat-rich portions, the higher frequency of low-meat parts at Grubgraben indicates entire carcasses were transported to the site for processing and consumption. The strategic proximity of the site to the northwestern Central European Plain at the edge of the Wachau where migrant herds of reindeer first approached their winter feeding grounds facilitated both hunting and carcass transport. The movement of the site occupants during the warmer seasons on long-ranging trips (*ca.* 200 km) north of Brno, to the Upper Oder Basin and the middle section of the Vah Valley has been traced through lithic raw material sourcing (Montet-White, 1990b; Pawlikowski, 1990). The combined studies of faunal and lithic materials thus provide us with more complete understanding of the mobility and seasonally-determined subsistence-settlementpattern of the Epigravettian reindeer hunters in the Middle Danube.

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Author's address:

Brad LOGAN
University of Kansas
Department of Anthropology
Lawrence KS 66045–2110 (U.S.A.)