VI

THE HUNTED OF GRUBGRABEN: AN ANALYSIS OF FAUNAL REMAINS

by

BRAD LOGAN

Introduction

At the present time, 506 cranial and 505 post-cranial elements of the Grubgraben faunal assemblage have been identified (Tables VI-1-4). These include all identifiable bones and teeth from the 1985 and 1986 excavations, as well as an estimated 40% of the identifiable assemblage acquired during the more intensive investigation of 1987. The bulk of this last sample consists of remains from AL2 and AL3. Post-cranial material from AL 4, not excavated until the final two weeks of the 1987 season, has not yet been thoroughly analyzed. Mandibles and teeth from all levels, however, have been identified. Analysis of the faunal material was conducted from late June to mid-August 1987, concurrent with excavation of the site, at the Institute for Paleontology, University of Vienna and the Natural History Museum of Vienna. In this endeavor, the faunal collection at the former institution was found to be more extensive and served as the primary comparative source for identification of animal remains with regard to taxon, element, part, and side. In the identification of elements, directional nomenclature followed Driesch (1976). Measurement of elements, taken with an electronic digital caliper, followed Spiess (1979) for reindeer and Driesch (1976) for all other taxa.

The paleontological collections at the Natural History Museum, though of secondary importance for purposes of identification, were of value to this study in that they include faunal remains from the earlier Gravettian site of Willendorf. This material, housed in both the Department of Geology and Paleontology and the Department of Prehistory, was reviewed cursorily in order to confirm the faunal diversity of that site described in detail by Thenius (1956). Subsequent analysis of a portion of the Grubgraben assemblage has taken place at the Museum of Anthropology and the Museum of Natural History, University of Kansas. Still in progress, this work has focused on cranial remains, primarily teeth, on loan to that institution by the Bundesdenkmalamnt.

While animal remains at Grubgraben were abundant, their state of preservation cannot be considered ideal, especially in AL4. Beyond their initial fragmentation by the site's prehistoric inhabitants, skeletal parts had experienced considerable natural weathering, probably caused by fluctuations in the amount of moisture in their loessial matrix and its cryoturbation since the time of deposition. These processes had softened elements and too frequently reduced them to jig-saw pieces. Mandibles and their associated teeth had proved particularly vulnerable. Most careful excavation and removal, often following the application of plaster bandages, was required in order to bring these remains to the project laboratory in Gars-am-Kamp. Their conservation often demanded "microexcavation" with toothpicks, sparing use of water to clean the exposed portions, a prolonged period (at least one day) of drying, subsequent soaking with a diluted water-based glue solution, and painstaking repair of broken pieces.

Table VI-1.Identified Cranial Elements of All Taxa.

	Rangifer tarandus			*Equus caballus*			*Capra ibex*		
Element	Right	Left	Ind*1	Right	Left	Ind	Right	Left	Ind
UI1	NA	NA	NA	-	-	-	NA	NA	NA
UI2	NA	NA	NA	-	-	-	NA	NA	NA
UI3	NA	NA	NA	1	-	-	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		2	-	-	-	-	-	-	-
UDM2	-	4	-	-	-	-	-	-	-
UDM3	1	4	-	-	-	-	-	-	-
UP2	1	2	1?	-	1	-	-	-	-
UP3	4	4	1?	1	-	-	-	-	-
UP4	9	4	1?	3	-	-	-	-	-
UM1	8	6	-	1	-	1?	-	-	-
UM2	8	4	1?	2	-	-	-	-	-
UM3	5	-	-	1	1	-	-	-	-
L1	1	1	-	4	5	-	-	-	-
LI2	1	-	-	3	3	-	-	-	-
LI3	1	-	-	3	3	-	-	-	-
LC1	-	-	-	2	3	-	-	-	-
LDM1	-	2	-	-	-	-	-	-	-
LDM2	-	4	-	-	1	-	-	-	-
LDM3	1	4	-	-	1	-	-	-	-
LP2	15	10	1?	1	4	-	-	1	-
LP3	19	14	-	1	2	1?	-	-	-
LP4	13	14	-	2	3	-	-	-	-
LM1	13	15	-	1	-	-	-	-	-
LM2	15	14	-	2	2	-	-	2	-
LM3	17	14	-	4	-	-	-	4	-
Unident. Tooth	-	-	3	-	-	9	-	-	-
Skull Fragment	2	-	1	1	1	2	-	-	-
Antler / Horn Fragment	4	10	14	-	-	-	-	-	1
Maxilla Fragment	1	1	-	1	-	-	-	-	-
Mandible Fragment	38	34	2	11	11	3	-	4	-
Totals	177	166	28	46	43	25	-	11	1
Taxa Totals	371				114			12	
Percent	73.3				22.5			2.4	

Table VI-1 (cont.) **

	cf *Bos primigenius*			*Mammuthus prim.*			*Alopex lagopus*		
Element	Right	Left	Ind	Right	Left	Ind	Right	Left	Ind
UI1	-	-	-	-	-	3	-	-	-
UM1	1	-	-	-	-	-	-	-	-
UM2	1	-	-	-	-	-	-	-	-
LC1	-	-	-	-	-	-	1	-	-
LP2	1	-	-	-	-	-	-	-	-
LP3	1	-	-	-	-	-	-	-	-
LP4	-	-	-	-	-	-	-	1	-
Totals	4	-	-	-	-	3	1	1	-
Taxa Totals		4			3			2	
Per Cent		.8			.6			.4	
GRAND TOTAL					506				

* Indeterminate

** Not included are an indeterminate large bovid molar and an unidentified large bovid/equid tooth fragment

Table VI-2. Identified Apendicular Elements of Major Taxa.

	Rangifer tarandus			*Equus* cf. *caballus*			*Capra ibex*		
Element	Right	Left	Ind	Right	Left	Ind	Right	Left	Ind
Humerus									
Prox.	-	-	-	-	-	-	-	-	-
Dist.	2	4	-	-	-	-	-	-	-
Shaft	7	4	1	6	6	-	-	1	-
Rad/Ulna									
Prox.	3	2	-	-	-	-	-	2	-
Dist.	4	-	-	1	-	-	-	-	-
Shaft	19	22	6	3	1	-	-	1	-
Femur									
Prox.	-	-	-	-	-	-	-	-	-
Dist.	-	-	-	-	-	-	-	-	-
Shaft	6	9	-	4	3	-	-	-	-
Patella	2	1	-	-	-	-	-	-	-
Tibia									
Prox.	-	-	-	-	-	-	-	-	-
Dist.	1	3	-	1	-	-	-	-	-
Shaft	24	12	3	9	4	-	-	-	-
Metacarpal									
Prox.	5	-	-	-	1	-	1	-	-
Dist.	-	2	5	-	-	1	-	-	1
Shaft	3	5	2	-	-	2	-	-	-
Metatarsal									
Prox.	3	5	-	1	-	1	-	-	-
Dist.	5	1?	-	-	1	-	1	-	1
Shaft	24	20	23	-	1	2	-	-	-
Metapodial									
Prox.	-	-	-	-	-	-	-	-	-
Dist.	-	-	1	-	-	1	-	-	-
Shaft	-	-	6	-	-	2	-	-	-
1st Phalange	-	-	2	-	-	-	-	-	2
Prox.	-	-	5	-	-	-	-	-	-
Dist.	-	-	5	-	-	1	-	-	-
2nd Phalange	-	-	1	-	-	1	-	-	-
Prox.	-	-	2	-	-	-	-	-	1
Dist.	-	-	-	-	-	-	-	-	-
3rd Phalange	-	-	1	-	-	1	-	-	1
Prox.	-	-	-	-	-	-	-	-	-
Dist.	-	-	-	-	-	-	-	-	-

Table VI-2 (cont.)

Element	*Rangifer tarandus*			*Equus cf. caballus*			*Capra ibex*		
	Right	Left	Ind	Right	Left	Ind	Right	Left	Ind
Unident Phalange									
Prox.	-	-	2	-	-	-	-	-	-
Dist.	-	-	1	-	-	-	-	-	-
Sesamoid	-	-	4	-	-	-	-	-	3
Os Malleolare	-	4	-	-	-	-	-	-	-
Astragalus	2	2	-	-	-	-	-	-	-
Calcaneus	2	5	-	1	-	-	-	-	-
Os Carpale 3	-	1	-	-	1	-	-	1	-
Pisaform	1	-	-	-	-	-	-	-	-
Scaphoid	-	1	-	-	-	-	-	-	-
Os Centro-tarsal	2	2	-	-	-	-	-	-	-
Os Tarsi-centrale	2	-	-	-	-	-	-	-	-
Os Tarsal 3	-	-	-	-	-	-	-	-	-
Stylet	-	-	3	-	-	-	-	-	-
Dew Claw 1	-	-	1	-	-	-	-	-	-
Dew Claw 2	-	-	1	-	-	-	-	-	-
Dew Claw 3	-	-	1	-	-	-	-	-	-
Indeter. Fragment	-	-	17	-	-	2	-	-	-
Totals	117	105	93	26	18	14	2	5	9
Taxa Totals		315			58			16	
Per Cent		81.0			14.9			4.1	
Grand Total					389				

Table VI-3. Identified Axial Elements of Major Taxa

	Rangifer tarandus			*Equus* cf. *caballus*			*Capra ibex*		
Element	Right	Left	Ind	Right	Left	Ind	Right	Left	Ind
Atlas	-	-	1	-	-	-	-	-	-
Axis	-	-	-	-	-	-	-	-	-
Cervical Vert.	-	-	3	-	-	3	-	-	-
Thoracic Vert.	-	-	4	-	-	2	-	-	-
Lumbar Vert.	-	-	2	-	-	-	-	-	-
Sacrum	-	-	-	-	-	-	-	-	-
Caudal Vert.	-	-	-	-	-	1	-	-	-
Indeter. Vert.	-	-	1	-	-	1	-	-	-
Scapula	8	7	2	3	2	1	1	1	-
Glenoid	5	1	-	-	-	-	-	-	-
Innominate	1	-	-	4	-	-	-	-	-
Acetabulum	6	3	-	-	1*	-	-	-	-
Rib Fragment	-	-	28	-	2	-	-	-	-
Indeter. Fragment	-	-	1	-	-	3	-	-	-
Totals	20	11	42	7	5	11	1	1	-
Taxa Totals		73			23			2	
Per Cent		74.5			23.4			.4	
GRAND TOTAL					98				

* cf. *E. hydruntinus?*

Table VI-4. Miscellaneous Post-Cranial Elements by Taxa and Part.

Taxon	Element (Side, if known)
Cervid	1 Thoracic vert. frag., 1 Lumbar vert frag., 2 Scapulae frags., 1 Rib frag.
Large cervid	1Tibia shaft frag. (right), 1 Femur shaft frag. (right)
Cervid/small bovid	1 Metatarsal distal (left), 1 Femur shaft (right)
Larde bovid	1 Humerus shaft frag. (left), 1 Tibia shaft frag. (left)
Large bovid/ Equid	1 Tibia shaft frag. (right), 1 Lumbar vert. frag., 1 Rib frag., 1 Indeter. apend. frag.
Carnivora	1 Humerus distal (right)
Mustelidae cf. *Gulo gulo*	1 Tibia proximal
Lagomorph	1 1st Phalange
Total	18

In order to weigh the relative abundance of various animals in the Grubgraben assemblage, I rely on the minimum number of individuals (MNI) and the number of identified specimens (NISP), two of the standard indexes employed by zooarchaeologists for this purpose. I am aware of the disadvantages of these indexes but am in agreement with Klein and Cruz-Uribe (1984:24-38) that judicious use of both provides the best means of quantifying an archaeofauna (cf. Grayson 1979). One of the limitations of NISP is the fact that the number of elements in an animal varies among some species. An example from Grubgraben is the difference in the number of phalanges in artiodactyls (cervids and bovids) and perissodactyls (equids). The former possess 24 of these elements and the latter 12. When one adds the stylets and dew claws of *Rangifer,* for example, the number of potential elements compared to *Equus* increases yet again. NISP is also affected by any differences in the degree of bone fragmentation, a disadvantage Klein and Cruz-Uribe (1984:25) consider to be the most serious. However, these drawbacks to the use of NISP do not play a great role in the calculations of the Grubgraben assemblage. Phalanges are relatively rare at the site and do not adversely affect the totals of identified cervid/bovid and equid elements. It is more difficult to account for differences in the degree of fragmentation, whether cultural or post-depositional. Equid bones are more robust than those of *Rangifer* and *Capra ibex* and consequently may have suffered less breakage. It will be seen, however, that the relative percentages of taxa from Grubgraben are comparable with respect to *both* MNI and NISP. In this case, the two indexes reinforce each other.

The following discussion of the Grubgraben assemblage focuses on its value for providing information about the site's environment and its exploitation, its contrast with the faunal material from Willendorf in these regards, the season of the site's occupation, and the butchering practices of the site's inhabitants.

Environment and Subsistence

Animal remains from Grubgraben reflect a narrow range of faunal diversity and a corresponding focal hunting economy. Species represented include reindeer *(Rangifer tarandus)*, horse *(Equus caballus)*, ibex *(Capra ibex)*, aurochs *(Bos primigenius)*, arctic fox *(Alopex lagopus)*, mammoth *(Mammuthus primigenius)*, a mustelid (perhaps the wolverine, *Gulo gulo*), and an unspecified lagomorph. The first three of these species comprised the staples of the hunters' diet with reindeer and horse surpassing ibex in this regard. Aurochs is represented by a few teeth that could represent a single individual. The taxonomic assignment of these latter finds remains problematic and should be considered tentative. A few post-cranial fragments can only be identified as large bovid. Elements of arctic fox are limited to a single mandible fragment and a few perforated canines that suggest this animal was procured primarily for ornamental purposes and perhaps also for its fur. The mammoth is represented solely by pieces of ivory, generally in a very poor state of preservation, that may have been collected from natural-death carcasses. The lagomorph and mustelid are each represented by a single element.

All of these animals would have been at home in the pleniglacial steppe-tundra environment indicated by other environmental data from the site (see Haessarts herein). Herds of reindeer and horse were particularly abundant throughout Europe during the Upper Paleolithic (Kurtén 1968) . Dependence on the reindeer would have required a mobile settlement-subsistence pattern geared to the migratory behavior of that species. Ibex, while also gregarious, are particularly adapted to montane habitats, though they are known to descend to meadows in lower elevations during harsh winter months and during the spring (Spiess 1979; Straus 1987). These three ungulates are considered by Delpech (1983:31) to be indicative of generally cold, steppic conditions. Aurochs, a large bovid that became extinct in the 17th century, was widely distributed throughout Europe during the Pleistocene and is considered to have been an inhabitant of dense grasslands and open woodlands (Kurtén 1968:188). Delpech (1983) considers the aurochs and bison (both *B.*

priscus and *B. schoetensacki*) of the Pleistocene to be intermediate between faunal groups she defines as "cold" and "temperate". None of the animals she places in this latter group is represented in the Grubgraben assemblage (unless one accepts a single acetabulum fragment of a small equid as *E. hydruntinus*; see Table VI-3). The few smaller mammals in the assemblage, insofar as they are known, do not conflict with this interpretation of a cold, steppe-tundra environment. The ungulate species are discussed below in terms of their relative frequencies and contribution to the subsistence of the hunters of Grubgraben. First, however, the small sample of mammoth remains requires brief discussion.

Mammoth: The incorporation of mammoth bones in habitations in central and eastern Europe during the Gravettian is well documented (Kozlowski 1986). Direct evidence of hunting is more rare. In Poland, for example, one of the few kill sites containing remains of this animal is Krakow-Nowa Huta, "where mammoth remains were associated with two bone implements manufactured *in situ* and nine blades struck from two cores" (Kozlowski 1986:180). Mammoth hunting appears to have been considerably more important in the northernmost regions of central and eastern Europe where a high biomass provided more support for greater numbers of such large game (Kozlowski 1986:185). Procurement of mammoth during the Gravettian in lower Austria near Grubgraben has been documented at Willendorf I, I/N, II (Levels 5, 7-9) and, though tentatively identified, at V (Thenius 1956:162-163). Hunting of juvenile mammoth in particular may be indicated by the deciduous molars described by Thenius from the Gravettian levels of Willendorf II. Additional support for mammoth hunting in the area comes from the site of Ruppersthal, where excavation of a large concentration of skeletal remains of two mammoth also yielded two points, two blades, and a scraper (Bachmayer, *et al.* 1971). Other fauna found in association with this material included horse (*Equus* sp.), cervid, young bovid, and wolf *(Canis lupus)*. Two radiocarbon dates were obtained on bone samples from Ruppersthal, 21,566±405 B.P. and 11,640±405 B.P. Given the sedimentological context of the faunal assemblage (Wurm III), the earlier date was suggested to be accurate and the later date dismissed as the result of sample contamination.

The only mammoth remains from Grubgraben identified to date consist of a few pieces of ivory (Table VI-1, Figure VI-1). This material is insufficient to support any interpretation of mammoth hunting. Its presence at the site may reflect fortuitous scavenging of mammoth carcasses in the vicinity of the site or trade for such a commodity with neighboring populations. Though none of the fragments from Grubgraben bears traces of human modification they were probably acquired for manufacture of tools or representational art. Use of ivory as an industrial or artistic medium has been well documented throughout central and eastern Europe during the Gravettian (Kozlowski 1986:180-184).

Reindeer: This animal outweighs all others in terms of both the minimum number of individuals (MNI) and the number of identified specimens (NISP) in the total assemblage. When considered in the aggregate (i.e., all levels combined), these figures for reindeer are 19 (based on the number of lower third premolars, see Table VI - 1) or 57.6% and 759 or 75.1% respectively. Of the 122 teeth and mandible fragments presently identified by their intra-level provenience (Table VI - 5), the NISP of reindeer is dominant in each level. Though still in the majority, the proportionate NISP of reindeer vis-à-vis horse is notably lower in AL 4 than in the upper levels. Whether this reflects a shift from more equable reliance on horse (or even greater, considering the relative amount of usable meat in this animal as compared to reindeer) to greater reliance on reindeer during the later occupations of the site remains to be demonstrated with greater samples of faunal material from AL 4.

Adopting the age-groups and criteria that characterize them described by Miller (1974:16-22; 38-61) and Spiess (1979:70-84), I have examined mandibular tooth eruption

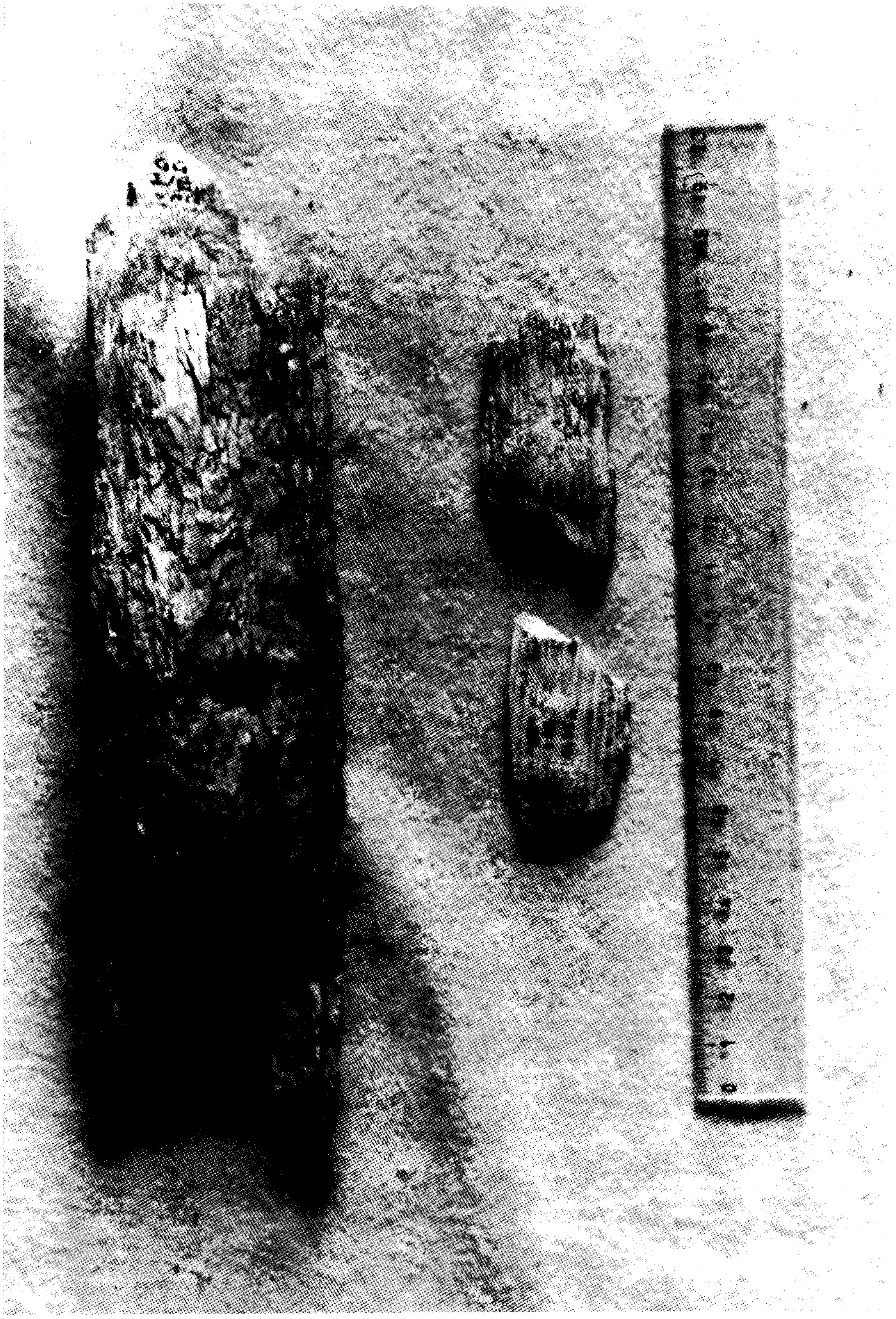

Figure VI-1. Mammoth ivory from Grubgraben. Note poor preservation of upper fragment.

Table VI-5. Distribution of Identified Mandible Fragments and Teeth.*

Taxa	AL2	AL3	AL4	Total	Per Cent
Rangifer	12	56	12	80	66.1
Equus	1	20	10	31	25.6
Capra	-	5	-	5	4.1
Other	-	2	3	5	4.1
Total	13	83	25	121	
Per Cent	10.7	68.6	20.7		

* Provenience listing is according to catalog number. As one such number may designate a mandible fragment with more than one tooth, figures presented here do not correspond to NISP presented in Tables 1-4.

Table VI-6. Age Group Composition of *Rangifer tarandus* Mandibles.

Age Group:	-2 yrs.		2 yrs.		3-5 yrs.		6-9 yrs.		10 yrs. +	
Side:	L	R	L	R	L	R	L	R	L	R
Tooth										
P2	-	-	3	-	1	2	1	4	-	-
P3	-	-	4	-	1	3	2	4	1	-
P4	-	-	3	1	2	4	2	3	1	-
DM1	-	-	-	-	-	-	-	-	-	-
DM2	2	1	-	-	-	-	-	-	-	-
DM3	2	1	1	-	-	-	-	-	-	-
M1	3	-	3	1	2	5	1	4	1	-
M2	2	-	3	1	2	7	1	3	-	-
M3	1	-	3	1	2	5	-	2	-	-
NISP (Side)	10	2	20	4	10	26	7	20	3	-
NISP (Group)	12		24		36		27		3	
Percent	11.8		23.5		35.3		26.5		2.9	
NISP (Total)	102									
MNI (Group)	3		4		7		4		1	
Percent	15.8		21.1		36.8		21.1		5.3	
MNI (Total)	19									

and wear patterns in order to determine the demographic distribution of the Grubgraben reindeer. These age-groups are also comparable to those defined by Leroi-Gourhan and Brezillon (1972:160-170) for their analysis of the reindeer assemblage from Pincevent. Only mandible fragments that contain at least two adjacent molariform teeth with well preserved occlusal surfaces were selected for this analysis. The sample consists of 31 mandible fragments with a total of 102 teeth representing at least 19 individuals. They are distributed among five age groups as follows (Table VI-6) :

Less than two years old (Figure VI-2,7): 3 (15.8%)

Two years old (Figure VI-3): 4 (21.1%)

Three-five years old (Figure VI-4): 7 (36.8%)

Six-nine years old (Figure VI-5): 4 (21.1%)

Ten+ years old: 1 (5.3%)

The distribution across the five age groups is normal, with the youngest and oldest animals composing the smallest proportion of the diet. This distribution can be adopted for comparison to future samples from the site, as well as to other Upper Paleolithic faunal assemblages from western and central Europe. For example, Spiess (1976:201) provides data from Abri Pataud, in southwestern France, for one such comparison. (Spiess distinguishes between calves and yearlings. For purposes of comparison I have lumped these categories into the less-than-two year old group.) Of 93 animals from this site, 26 (28%) fall within the less than two year old group, 11 (11.8%) in the two year-old group, 31 (33.3%) in the 3-5-year-old group, 18 (19.4%) in the six-to-nine-year-old group, and 7 (7.5%) in the ten+ year old group. The two assemblages are comparable with respect to the predominance of animals from three to five years old and the rarity of animals ten years old or greater. The most striking difference is in the reversed proportion of calves and yearlings with respect to two-year-olds in the Abri Pataud sample. Given the small sample from Grubgraben, we cannot assume with any great conviction that the hunters of that site were selecting against the youngest animals in the herd. However, such an interpretation can be adopted as a working hypothesis to be tested with an enhanced sample following future excavation of the site. It should be pointed out that the comparison here is between an open air site where faunal remains have been subject to weathering processes not experienced by the more sheltered remains of Abri Pataud. The surviving deciduous molars of calves and yearlings from Grubgraben are notably more fragile than the dental remains of older animals. It is possible that attrition has diminished what may well have been a greater example of this age group.

Wild Horse: With the exception of a relatively small acetabular fragment that may be comparable to *E. hydruntinus*, all identifiable equid elements are assignable to the larger species *E. caballus*. Chase (1986), following analysis of 11 identifiable equid elements from the 1985 test excavation, suggested that "on the basis of size and tooth morphology, most of the *Equus* are probably *E. hydruntinus*." However, this identification was based on cursory examination of the remains without access to a comparative collection. My identification is based on a review of these elements plus the complete collection from the 1986 test excavations and a large sample of the 1987 assemblage, a total of 114 cranial and 81 post-cranial equid elements, with the aid of the comparative collections in Vienna. Measurements on all equid teeth invariably compared favorably with those on the single

Figure VI-2. Buccal and occlusal views of mandibles of reindeer less than two years old. The high relief wear patterns of the teeth in these examples indicate death sometime during the first to seventh month (i.e., mid-June to mid-December).

Figure VI-3. Buccal view of mandibles of reindeer ca. two years old. Note variation in the presence of DM3 and eruption of premolars and M3. According to Miller's (1974 : 39-42) illustrated examples, the upper mandible shown here may be from an individual 17-27 months old.

Figure VI-4. Buccal view of mandibles of reinder from three to five years old.

Figure VI-5. Buccal view iof mandibles of reinder from six to nine years old.

specimen of *E. caballus* at the University of Vienna and also with those provided by Spiess (1979) on *E. caballus* from Abri Pataud (Table VI-7,8). Speiss (1979:272) also provides comparative measurements for the dentition of modern horse (*E. equus*), which he considers to have been of comparable size, and the equid teeth from Grubgraben fall comfortably within the range of those measurements as well. In lieu of any remains of *E. hydruntinus*, which were lacking at both the University of Vienna and the Natural History Museum of Vienna, a single specimen of *E. asinus*, a female from Tuareg Esel, western Sahara, in the former collection (UWIP 1272) was used for comparison during the identification of equid dentition. None of the teeth approach the small size of that specimen nor do any of them compare to similar data on the same species provided by Spiess (1979:273).

The wild ass is rare at Upper Paleolithic sites in southwestern France and is considered to have been more common in temperate environments (Delpech 1983). Spiess (1979:258) suggests that "during the driest (and coldest?) stadials of the last glaciation, the winter range [of *E. hydruntinus*] may have been more localized and restricted than that of the larger *E. caballus*." The wild horse on the other hand was "particularly well adapted to steppic conditions" throughout the Paleolithic (Delpech, 1983:31) . Given the cold steppe-tundra environment that prevailed during the Epi-gravettian at Grubgraben, it is not surprising that the equids represented are wild horse.

While not as numerous as reindeer in the recovered sample from the site (MNI=5, based on right lower first incisors, TableVI-1; NISP=195), the wild horse provided a significant amount of usable meat. Spiess (1979:273-274) grants an adult male of the species a weight of 350 kg of which 55% could be considered edible meat and 5% fat (during the winter). Comparable figures for an adult male reindeer are 110 kg of which 55% is edible meat and 10% is fat. Of course, the proportion of fat varies considerably throughout the seasonal cycle and is higher during the winter in females. Depending on the season, an adult male horse could provide at least three times as much edible meat as an adult male reindeer. Thus, though the MNI of horse vis-à-vis reindeer at Grubgraben is markedly lower, the relative contributions of edible meat of both animals are more equable. We can thus consider the wild horse to have been a major food source rather than a secondary supplement.

Ibex. The ibex is represented in the assemblage by 30 elements (Tables - VI-1-3) of which the number of right lower third molars provides the MNI of four (Table VI-1). A particularly tricky game animal in its montane habitat (Straus, 1987), the ibex of Grubgraben may have been more easily obtained in the vicinity of the site when they descended from the hilly terrain of the nearby Wachau to lower elevations during bad winter months or for spring foraging. Spiess (1979:281) adopts a mean weight of 40 kg for an adult male ibex of which 55% could be considered edible meat and a figure of 5% for winter fat content. Again, these figures varied considerably between the sexes and throughout the seasons. Given these measures and the number of individuals represented at Grubgraben, we can assume that ibex served a supplementary role in the Epigravettian hunting economy. That horse and ibex played important roles in the subsistence pattern probably reflects the fact that the reindeer, for a variety of behavioral reasons, does not provide a reliable single resource for hunters (Burch, 1972) .

Aurochs: As noted above, the identification of this animal at Grubgraben remains problematic. It is based on the presence of a maxillary fragment that contains a complete first molar and anterior portion of the second molar. This fragment and a second, a mandibular fragment containing the first premolar and anterior portion of the second premolar, compare favorably to material identified as *Bos primigenius* from the site of

Table VI-7. Measurements of Equid Teeth from Grubgraben.*

Catalog Number/Tooth or Tooth Row (Side)	Occlusal Length (cm)	Occlusal Breadth
IA2-428/ UP2 (L)	3.72	2.73
JC-1511/ UP3 (R)	3.01	2.79
IIP2-?/ UP4 (R)	3.13	-
IF3-1080/ UP4 (R)	2.68	2.71
IC4-1812/ UP4 (R)	2.86	2.88
IF3-1080/UM1-M3 (R)	7.70	-
IIP2-87/ UM1 or UM2 (L)	2.48	-
IF3-1080/ UM1 (R)	2.35	2.61
IF3-1080/ UM2 (R)	2.42	2.63
JC-1404/ UM2 (R)	2.63	2.60
IF3-1080/ UM3 (R)	2.95	2.28
IE2-1227/ UM3 (L)	2.81	2.40
IIP2-533/ LI1-2 (R&L)	-	6.66
IIP2-523/ LI1 (R)	1.13	1.40
IIP-369/ LI1 (L)	-	1.72
IP2-245/ LP2-P4 (L)	8.68	-
JD3-1139/ LP2-P4 (L)	9.36	-
IA2-2261/ LP2 (R)	3.20	1.50
JD3-1139/ LP2 (L)	3.28	1.48
IC3-1976/ LP2 (L)	3.18	1.48
IC1-1394/ LP3 or P4 (R)	2.73	1.76
IC3-1696/ LP3 (R)	2.91	1.76
JD3-1139/ LP3 (L)	3.11	1.69
ID4-217/ LP4 (R)	2.97	-
JD3-1139/ LP4 (L)	3.05	1.59
IC3-1947/ LP4 (L)	3.08	1.86
JE-1090/ LM2 (R)	3.25	1.25
JC-1211/ LM2 (R)	3.30	1.17
JD3-1150/ LM2 (L)	2.81	1.44
JC1-1618/ LM2 (L)	2.61	1.62
IA4-5/ LM3 (R)	2.72	1.38
JC-1029/ LM3 (R)	3.52	-
JD3-1199/ LM3 (R)	3.16	1.48
JD4-1566/ LM3 (R)	3.31	1.54

*After Driesch 1976 : 52-53

Table VI-8. Dental Measurements on *Equus caballus* from Abri Pataud and the University of Vienna

Tooth/Tooth Row	Occlusal Length (cm)[1]	Occlusal Length & Breadth[2]	
UP2	3.34		
	3.55		
	3.90		
	3.74		
	4.26		
UP3	-		
UP4	-	2.79	2.60
UM1 or M2	3.10		
	2.60		
	2.73		
	2.83		
	2.76		
	2.61		
	2.77		
	2.76		
	3.13		
UM3	3.10	2.64	2.21
LP2	-		
LP3	2.98		
LP3 or P4	2.97		
	3.02		
LM1	2.68		
LM1 or M2	2.97		
	2.70		
	2.90		
	2.75		
LM2	2.92	2.71	1.65
LM3	3.56		
	3.60		
	3.40		
	3.20		
	3.22		
	3.45		
	3.54		
	3.78		

---

1 From Spiess 1979 : 272
2 On specimen UWIP 2242

Kaiserstein Bruch in the collections of the Department of Geology and Paleontology at the Natural History Museum of Vienna. As the first molar is more complete and offers the best characteristics for comparison, the identification hinges on that specimen (Figure VI-6).

Delpech (1983:186) suggests the following criteria for distinguishing M1 of *Bos* and *Bison*:

1) Greater mesio-distal (anterior-posterior) length in *Bos*;

2) A rectangular shape defined by the anterior and posterior lobes on the lingual side at the "collar," or enamel line, in *Bos* and more trapezoidal shape at this location in *Bison* (more noticeable on the M3 than M1 and M2);

3) The presence of an "islet" of enamel between the two lobes of the molar that is common in *Bos* and rare in *Bison* and

4) The short and, near the enamel line, "pinched" aspect of the entostyle in *Bison* as compared to the ocassionally "extremely elongated" nature of this landmark in *Bos*.

Unfortunately, the large bovid M1 from Grubgraben cannot be assigned to *Bos* on the basis of all four of these criteria. In terms of its mesio-distal length (3.30 cm) and the rectangular shape defined by the lingual lobes when the tooth is viewed radically (Figure VI-6b) this tooth can be identified as *Bos*. However, it neither bears an islet, nor is the entostyle as elongated as the *Bos* specimen pictured by Delpech (1983:Plate 2, 5b). Indeed, in regard to this last criterion the molar from Grubgraben compares more favorably to Delpech's (1983:Plate 2, 2b) *Bison* specimen (cf. FigureVI-6a). Spiess (1979:277) also adopts the criterion of the islet as a hallmark of *Bos* but points out that it is to be found on molars with well worn occlusal surfaces. The molar from Grubgraben is from a young individual and exhibits little wear. As for the length of the entostyle, further research may yet demonstrate that this feature displays more variation among both bovids than is presently recognized. I base my identification on what I consider to be the most telling characteristic, the length of the tooth as measured according to Delpech (1983: 441; i.e., at a point one cm above the enamel line on the mesostyle). In this respect, the molar from Grubgraben compares favorably to that from Kaiserstein Bruch (3.16 cm) and to the single specimen from La Ferrassie (2.85) ascribed to *Bos* by Delpech (1983:441). Four UMI from La Ferrassie identified by Delpech (1983) as *Bison* measure 2.40, 2.45, 2.60, and 2.75 cm long, attesting to the relatively smaller size of the tooth in this bovid.

The tentative nature of this identification is further enhanced when we note that large bovid elements from Willendorf and Kamegg (see following section), two sites that bracket Grubgraben in time and that are located in its vicinity, have been identified as *Bison priscus* (Thenius, 1956; Brandtner, 1954). Thenius (1956:157) states bluntly that *Bos primigenius* "ist aus Willendorf nicht belegt." As in the case of Grubgraben, identification of the large bovid remains from these sites is based on small samples of material. Elements from Willendorf (including localities I, I/N, II and V) include a mandible fragment with P3 - M1, a fragmented P4, an isolated M3, distal humerus, distal tibia, astragalus, calcaneus, and second phalanx. Elements from Kamegg consist of an unspecified vertebra and phalange. Postcranial elements of *Bos* and *Bison* are difficult to distinguish and confident assignment ideally requires "a partial skeleton" from a single individual (Olsen, 1960:5; cf. Delpech, 1983:185-187). Given the few large bovid post-cranial remains from these sites, we cannot be certain of their identification as *Bos* or *Bison*. The teeth from Willendorf provide little additional support. On the basis of the morphological similarity on the P4 in the P3-M1 series to *Bison*, Thenius assigns the mandible fragment to that genus.

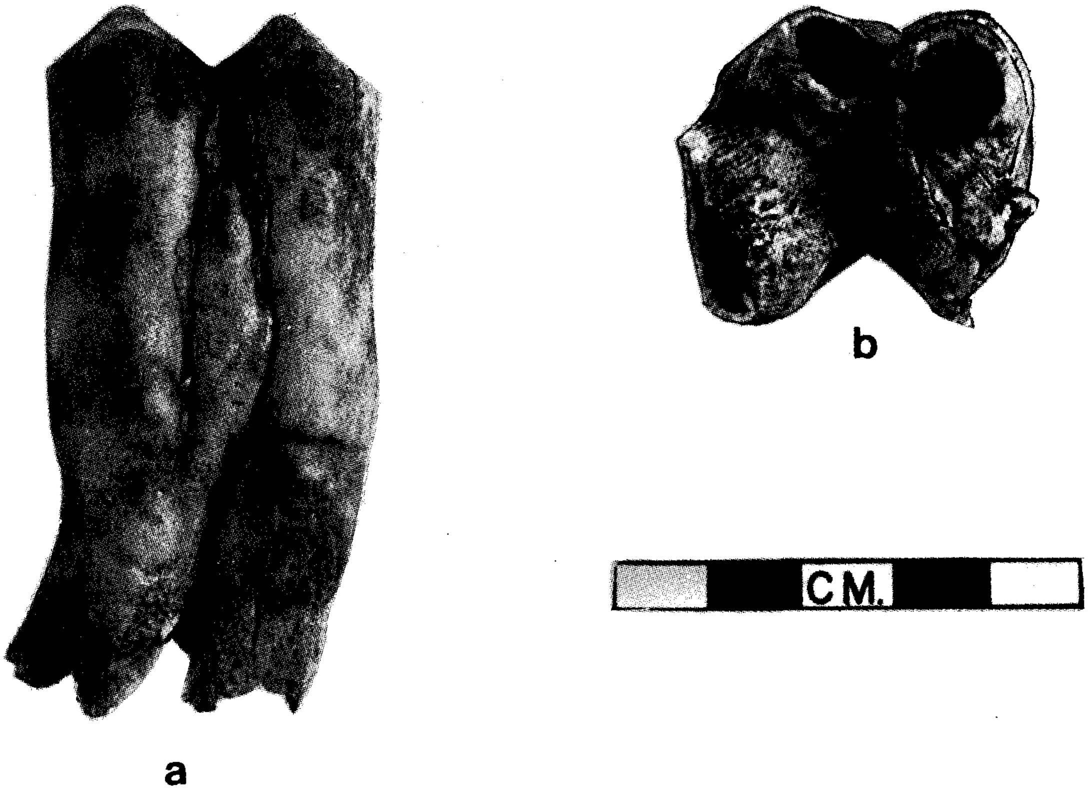

Figure VI-6. a) Buccal view of M^1 of large bovid (*Bos primigenius?*) from Grubgraben. b) Radicle view of same molar.

Figure VI-7. Buccal and occlusal views of left mandible of reindeer that died during its first year (September-June), probably during the winter months.

Delpech (1983: 185-187), following a thorough analysis of criteria that can be used to differentiate the two bovids, does not rely on premolars to distinguish *Bos* and *Bison.* She focuses instead on upper and lower molars. Given this, the identification of *Bison* at Willendorf hinges on an isolated M3 that Thenius (1956:158) assigns to that genus on the basis of the structure of its talonid. As illustrated (Thenius 1956: Fig.115), this element does lack one of the criteria noted by Delpech (1983:186) as indicative of *Bos*, the presence of an "epine" between the distal two lobes of the tooth that, while not as elongated as the ectostylid, is as well developed. An equally telling criterion, however, is the mesio-distal length of the M3, which is greater in Bos. Thenius (1956:158) provides comparative lengths of this tooth (4.60 cm) to those of *Bison bonasus* (4.00 cm), *Bison bison* (4.45 cm), and *Bos primigenius* (4.60). In this respect, the molar from Willendorf compares more favorably to aurochs than bison. Obviously, the identification of the large bovid remains from Willendorf remains as problematic as that of Grubgraben .

The habitat preferences of the two large bovids of the Upper Paleolithic in Europe differ somewhat. The aurochs prefered "mast-producing parkland scattered among grassy pastures," whereas the bison "is a grazer and optional browser who does not need as much winter shelter and is independent of fall mast production" (Spiess, 1979:261). This suggests that the bison would have fared better in the relatively barren steppe-tundra of Grubgraben during the Pleniglacial. However, Delpech (1983:31) considers both of these bovids to have been wide-spread throughout Europe regardless of climate. In her faunal-climate associations, she assigns both an intermediate place between cold and temperate animals .

Spiess (1979:278-279) suggests a large bovid (either *Bos* or *Bison*) could range in weight from 500 to 1400 kg, of which 55% would be edible meat and 5% fat (during the winter months). He notes that a kill of an adult aurochs "was equivalent to about 15 caribou or 4 horses in terms of food quantity." Given this comparison, we could conclude that the lone bovid of Grubgraben, though a young animal, would have rivaled the meat and fat contribution of most of the reindeer and horses represented in the faunal assemblage. However, I do not think we can suggest on the basis of a single animal that *Bos* served as a reliable food source. Although it would have contributed a substantial amount of edible meat, the single kill should be regarded as fortuitous when compared to the number of other ungulates represented at the site. No doubt the hunters of Grubgraben were loath to pass up a large bovid when the opportunity for taking one arose.

Grubgraben and Willendorf: A Comparison

Thenius' (1956) analysis of the faunal assemblage from Willendorf II provides the basis for comparison to the earlier Gravettian occupation of that site. Thenius' analysis focuses on selected diagnostic elements and counts of these should not be adopted as a comparable index of relative abundance to the NISP from Grubgraben. However, he does provide MNl counts for all taxa from each of the nine levels at the site. Comparison of that information with the same index of Grubgraben fauna reveals a distinct contrast in the variety of animals obtained by the occupants of the two sites. Fourteen taxa were recorded at Willendorf II, a diversity best represented in Levels 8 and 9, the latest occupations (TableVI-9). Willendorf II is located on the Donau River about 30 air km from Grubgraben and 38 river km above its confluence with the Kamp. Unlike Grubgraben, which is strategically nestled between two small hills within view of the broad plain of the lower Kamptal, Willendorf is situated in the Wachau, a region of greater relief, and is separated from the Donau by a narrow strip of floodplain. This contrast may have contributed to the differences in faunal diversity that characterize the assemblages from the two sites. It may explain the greater frequency of ibex remains at Willendorf since those animals would have been found in greater numbers in the rugged terrain of the Wachau.

Table VI-9. Minimum Number of Individuals of Taxa from Willendorf II.*

	Level								
Taxon	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 (sic) *primigenius*	-	-	-	-	1	-	1	1	1

*From Thenius 1956 : 166.

Much of the variety at Willendorf is accounted for by carnivores, including wolf *(Canis lupus)*, red fox *(Vulpes vulpes)*, arctic fox *(Alopex lagopus)*, wolverine *(Gulo gulo)*, bear (*Ursus* cf. *arctos*), cave lion *(Panthera spelaea)*, and lynx *(Lynx lynx)*. Only one of these animals, arctic fox, is definitely present at Grubgraben (the presence of wolverine must await recovery of more diagnostic remains). The contrast between the sites in this respect may stem from either or both of two factors: 1) more wide-ranging procurement of these animals for their pelage by the inhabitants of Willendorf than those of Grubgraben, 2) a greater degree of post-depositional disturbance of midden debris by carnivores with attendant natural inclusion of some through non-cultural causes. Given the regularity with which these forms are present throughout the levels at Willendorf and the notably high frequency of both species of fox in the last level, the first of these factors must account for the bulk of the carnivore remains. Though admittedly speculative, we may attribute the difference in what can be considered the pursuit of luxury items (i.e., a large quantity and variety of pelts) to the fact that the inhabitants of the harsh climate of the Epigravettian had to invest more time in economic practices that guaranteed survival as compared to those that enhanced status. Alternatively, if harder to demonstrate given the broad tolerances of all of these steppic carnivores, the contrast might reflect the effect of climatic changes on the relative abundance of these animals and the consequent ease with which they could have been obtained.

The presence of large bovids in several levels at Willendorf indicates the inhabitants of that site were, like those of Grubgraben, eclectic hunters who took such animals when possible. However, as at the latter site, smaller ungulates served as the staples. In contrast to Grubgraben, equids did not play a major role at Willendorf and only entered the diet during the later occupations of that site. This indicates a shift in subsistence practices that was to become more prevalent during Epigravettian and Magdalenian times.

It is unlikely that a contrast in local habitat underlies the regular appearance of an animal such as red deer *(Cervus elaphus)* at Willendorf and its conspicuous absence from Grubgraben. There is no reason why red deer should not be present at the latter if the environmental contrast between the two sites had been due solely to differences in local terrain. These animals are described as browsers whose preferred habitats were woodland and forests (Kurtén 1968:163). Wapiti, the present North American form considered by many to be conspecific with *Cervus elaphus* (Kurtén and Anderson 1980:317-318) , are also known to range open meadows for grasses (Murie 1951). Given these habits, we can assume that red deer could have been hunted in the "islands of woodland" that dotted the subarctic landscape inferred for Willendorf II (Thenius 1956:165) or on the broad plain of the lower Kamptal during the Epigravettian if the climatic conditions of the earlier Gravettian period maintained during that time as well. We know from geomorphic and malacological evidence, however, that this was not the case (see Haessarts, herein). In all likelihood, absence of red deer from Grubgraben is attributable to the more severe climate that prevailed in the Donau basin following the last occupation of Willendorf some 24,000 years ago and during the occupation of Grubgraben 18,900 to 18,300 years ago. This interpretation is supported by the fact that this animal, like the present wapiti, was better adapted to temperate than cold climates (Delpech 1983:31, cf. Kurtén 1968).

The fauna from Grubgraben mark a shift to a greater reliance on reindeer and horse, in effect a narrowing of the subsistence economy to fewer species with consequent increased specialization in hunting practices during the Epigravettian phase. This trend, an adaptation to pleniglacial conditions, was to climax in the focal economy of the Magdalenian hunters represented at the site of Kamegg in the Kamptal, about 16 air km north of Grubgraben. Faunal remains from Kamegg were identified by Brandtner (1965:67-68) as horse (59 elements), reindeer (nine elements), bison (two elements), rhinoceros (one element), rabbit (22 elements), and arctic fox (two elements). The narrow range of diversity at this site is comparable to that of Grubgraben but the NISP suggests an even greater intensification of horse hunting. With regard to subsistence specialization, Grubgraben occupies an intermediate place between Willendorf and Kamegg and the cultural adaptations of the periods they represent (cf. Montet-White, 1987).

Seasonality of Site Occupation

Faunal indicators of seasonality at Grubgraben are precious few. At the present time I have identified three mandible fragments that indicate the site could have been occupied during the winter months. Unfortunately two of these fragments (FigureVI-2) lack the telltale permanent molars that might have provided such an interpretation more convincing support. These specimens, IA-196 and IA2-460a, are anterior portions of left and right mandibles respectively from an animal(s) that still retained its deciduous molars at the time of death. These molars have high relief wear patterns suggesting this event occurred sometime during the animal's (assuming a single individual is represented) first through seventh months of life. This would place the time of site occupation sometime between mid-June to mid-December. Of course, this interpretation assumes the kill was not cached elsewhere and then transported to the site for processing and consumption at a later date.

The best indicator of seasonality is specimen IF1-1243, a left mandible with deciduous second and third molars, the first permanent molar and an unerupted second permanent molar (Figure VI-7). According to Spiess (1979:77), "since LM1 can become permanent as early as 3-4 months, and LM2 can be absent as late as 13 months, the presence of LM1 and absence of LM2 (not yet piercing the bone) indicates death in this 10 month span, or September through June, *but most likely indicates death in the animal's first winter*" (emphasis mine). When this specimen is compared to the other two, the wear patterns on the third deciduous molars are comparable. The anterior cusp of the first permanent molar on IF1-1243 exhibits slight lingual-buccal wear (the posterior cusp is damaged) and that of the same tooth on IA-196 bears but very little wear on the lingual side only. The slight degree of difference between them suggests they were nearly contemporaneous kills and strengthens the case for the winter death of the latter specimen .

Additional evidence of a winter occupation of the structure(s) at Grubgraben is provided by analysis of the relative proportions of post-cranial elements associated with it (Tables IV-2-3). Those elements predominant in the assemblage are precisely those associated with the least amount of usable meat. To demonstrate this I have adopted the General Utility Index (GUI), a measure of the food utility of elements devised by Binford (1978:73) based on his observations of Nunamuit treatment of caribou *(R. tarandus)* (see Table VI-10). Axial remains, to which Binford assigns higher GUI as compared to apendicular elements, compose but 20% (98 of 487 identified bones) of the post-cranial fragments for the three major taxa. This figure for reindeer is comparable (18.8%; 73 of 388 bones) . Among the apendicular remains, elements assigned the highest GUI, such as the humerus and femur, are the most poorly represented and lower limb bones with considerably lower GUI are markedly more abundant. The ratio of upper to lower limb bones among the reindeer remains (33 to 189, or 17.5) can be taken as a measure of the contrast. This ratio would be even higher if carpals, tarsals, and phalanges were included in these figures. While it is true the phalanges, astragali and calcanei from Grubgraben were generally splintered for marrow, I consider these bones fortuitous associations of lower limb elements selected for marrow extraction. The high ratio of low GUI elements and the extreme fragmentation of these remains related to marrow extraction suggests the inhabitants of the structure were forced to rely on food sources not necessary during warmer months of the year.

Table VI-10. General Utility Indexes* of Reindeer Bone and Number of Corresponding Parts from Grubgraben.

Anatomical Part	GUI	NISP
Skull (inc. maxilla)	17.49	5
Mandible	13.89	83
Atlas	23.56	1
Axis	29.64	-
Cervical vertebrae	35.71	3
Thoracic vertebrae	45.53	4
Lumbar vertebrae	32.05	2
Pelvis	47.89	10
Ribs	49.77	28
Scapula	43.47	23
Proximal humerus	30.23	-
Distal humerus	29.58	6
Humerus shaft fragments		12
Proximal Radius/Ulna	16.77	5
Distal Radius/Ulna	17.82	4
Radius/Ulna shaft frags.		47
Carpals	5.51	3
Proximal metacarpal	8.24	5
Distal metacarpal	8.83	7
Metacarpal shaft frags.		10
Proximal femur	98.32	-
Distal femur	100.00	-
Femur shaft fragments		15
Proximal tibia	27.57	-
Distal tibia	29.46	4
Tibia shaft fragments		39
Tarsals	11.20	10
Astragalus	11.23	4
Calcaneus	12.40	7
Proximal metatarsal	15.03	8
Distal metatarsal	16.24	5-6
Metatarsal shaft frags.		67
Unident. metapodial		7
First phalange	3.52	12
Second phalange	3.03	3
Third phalange	1.85	1
Unident. phalange		3

* From Binford 1978 : 73

Fragility of all recovered teeth precluded application of tooth-sectioning methods in order to observe seasonal dental annuli (e.g., Spiess, 1976). Additional support for seasonal interpretation could not be derived from other indicators, such as fetal long bones or antlers still attached to crania. Absence of such finds should not be relied upon for determination of seasonality. The lack of fetal bones in particular, given their fragility, could be attributed as easily to the extensive erosion of faunal remains at the site as to evidence of occupation between the time of calving in mid-May to mid-June and the time of rut in mid-October.

While an interpretation of a winter encampment is supported by the evidence presented above, this certainly does not preclude a more prolonged occupation of the site. Indeed, the presence of the substantial structure(s) represented by the stone pavement(s) argues for more than a brief stay. An assemblage enhanced by further excavation of the site might provide evidence of occupation during other seasons as well.

Butchering Practices

In the context of butchering practices, it is worth noting an intriguing similarity between the Late Prehistoric-Historic site of Lake Tukuto, Alaska and Grubgraben with respect to the common dependence of their inhabitants on reindeer. At Lake Tukuto it was possible to discern both the living floors of 123 houses and numerous extramural middens containing an abundance of reindeer remains. Spiess (1979:155-158) suggests primary dismemberment of the animals occurred during the fall and winter months in the area of the middens. During the fall a higher proportion of mandibles, which contain marrow but are not as rich in this regard as other elements, would have been discarded in those areas rather than being carried into the houses for processing. During the winter months when the need for marrow was greater, there was an increased selection of mandibles. This is reflected by the higher frequency with which mandibles that had been broken open for marrow are encountered within the houses. Spiess (1979:160) also suggests that the hunters of Lake Tukuto may have had a preference during winter months for two year old and three-five year old females, which would have had higher fat content than other reindeer at that time.

In the light of the Lake Tukuto scenario, the greater numbers of animals in the two years old and three-five years old age groups, the winter kills described above, the plethora of broken mandibles associated with the structure at Grubgraben, and the quantities of burned bone recovered during sample water screening acquire a definite pattern. It is suggested, by way of a working hypothesis, that the occupation of the structure did occur during the colder months of the year. I have not been able to distinguish any of the mandibles from Grubgraben on the basis of sex due to their fragmentation and consequently cannot attribute the age-group pattern to the sexual selection apparent at Lake Tukuto. However, the extraction of marrow from mandibles at Grubgraben is reflected by the patterned lack of the basal portion of the horizontal rami of nearly all specimens in the assemblage (Figures VI-2-6, 7). Moreover, the high concentration of broken reindeer, horse, and ibex mandibles and/or teeth in association with the stone pavement was noted throughout the excavation of 1987. It would be fruitful to test this hypothesis with faunal material from extramural features or concentrations at the site in order to see if the Lake Tukuto midden pattern applies to those areas as well.

With regard to patterns of carcass dismemberment, the bones from Grubgraben provide little information. Close inspection of mandible rami and the ends of limb bones revealed few discernible cut marks. A few cervid rib fragments display cut ends. The coracoid process of an *Equus* scapula bears a single cut mark as does a caudal fragment of a *Rangifer* scapula. A fragment from below the lesser trochanter of a right femur, identifiable only as cervid/small bovid, also bears evidence of cutting. The scarcity of such butchering evidence requires some explanation. I would not go so far as to suggest that this indicates the hunters of Grubgraben had scavenged the low GUI elements in the structure from carcasses left by other predators in the vicinity. While such a hypothesis would fit a scenario of a harsh winter encampment, I consider it to be untenable at this time. Signs of carnivore damage on the bones, which might have supported a hypothesis of scavenging, are not evident. I suggest the general scarcity of cut marks reflects the low incidence of certain bones and the erosion of others caused by post-depositional weathering. Proximal and distal ends of limb bones, both upper and lower, and vertebrae are relatively rare in the assemblage (Tables VI-2, 10). This is precisely where one would expect to find the most cut marks (cf. Binford, 1981:105-142). The most common end fragments are distal metapodials (Figure VI-8) but none of these bears any distinct cut marks. It is possible that many of these tell-tale bones were not only smashed for marrow but used for fuel as well. Numerous small pieces of burned bone were noted in association with the structure, particularly in the water screened samples. It is quite possible that much of the evidence of carcass dismemberment literally went up in smoke. Moreover, post-depositional weathering of bones that survived has resulted in the attrition of edges that would have contained cut marks.

The practice of marrow extraction is attested by the abundance of long bone shaft splinters, the most numerous post-cranial remains in the assemblage. Some of these fragments bear impact fractures, which reflect their breakage during this process. The distinctive green-fractured appearance of some distal metapodials (Figure VI-8) also conforms to the pattern created by marrow-bone breakage (cf. Binford, 1981:155). Again, the evidence that these low-GUI elements and mandibles were processed for marrow within the structure (AL 2 and 3) suggests a winter occupation.

Conclusions

Faunal remains from Grubgraben reflect a specialized hunting economy focused on reindeer and horse. Other animals, including ibex and large bovid, perhaps the aurochs, served as secondary food sources. Still others, arctic fox, an unidentified mustelid, and a lagomorph provided raw materials for clothing and/or ornaments. The ivory of woolly mammoth, perhaps encountered fortuituously during other activities, may have provided an industrial or artistic medium. The high proportion of fragmented bones with relatively low index food values in association with the structure at the site suggests a winter encampment. This interpretation is supported by the presence of a small sample of reindeer mandibles from animals that perished during the winter months. This does not preclude the possibility that the site was occupied for longer periods. The low diversity of species contrasts markedly with the variety of animals represented in the faunal assemblage from the Gravettian levels at Willendorf II. While some of this contrast may be attributable to differences in local habitats associated with the two sites it is more likely a reflection of the increasing severity of the Pleniglacial climate that prevailed during the Epigravettian occupation of lower Austria. Human groups adapted to the change in climate by hunting the dominant herd animals of the steppe-tundra more intensively. This trend toward specialization was maintained by Magdalenian hunters during the Late Pleistocene, as demonstrated by the predominance of horse and reindeer in the faunal assemblage from Kamegg .

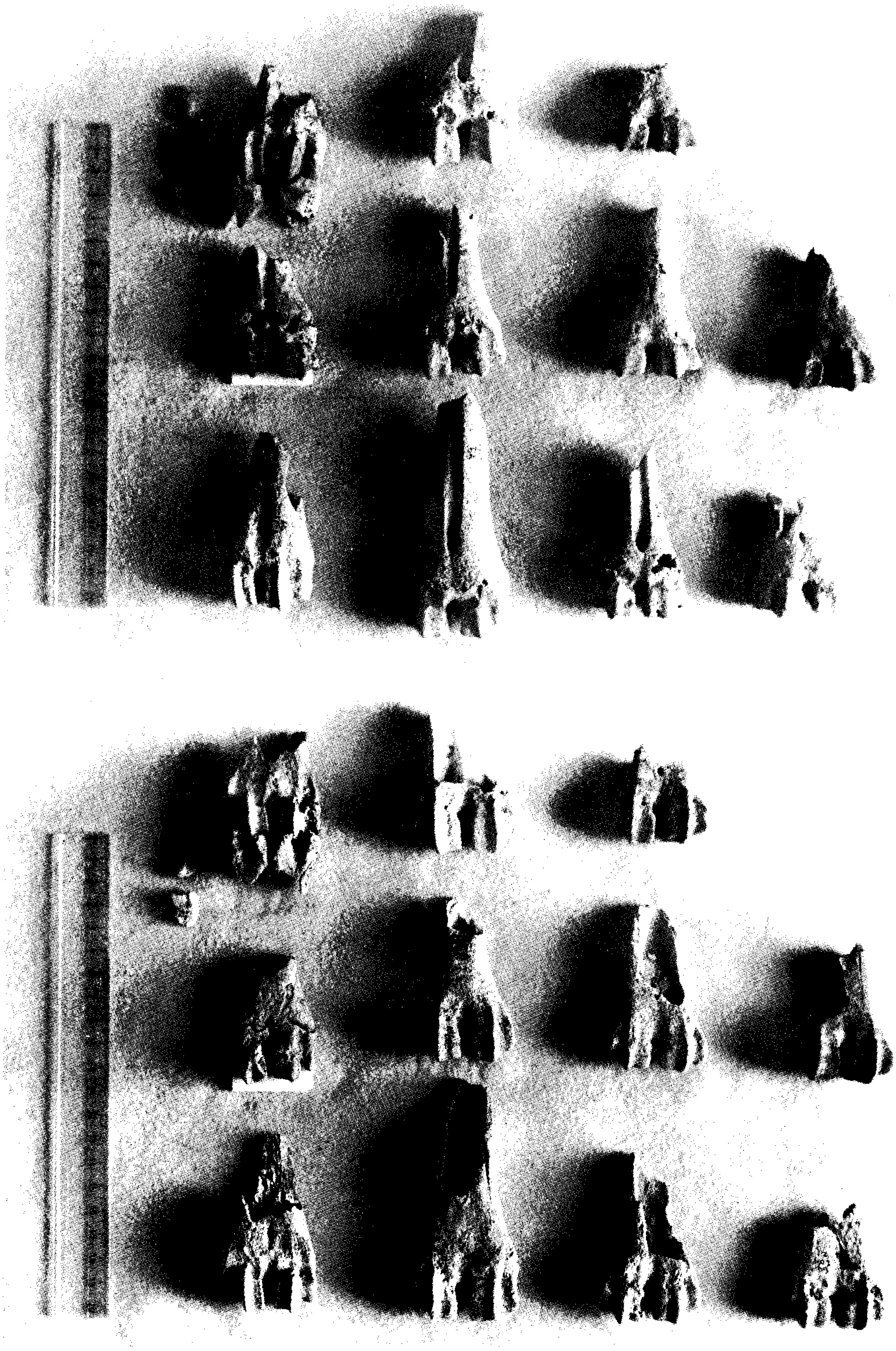

Figure VI-8. Patterned green-bone breakage of distal metapodials of ungulates from Grubgraben : elements in column to left are metatarsals of ibex; those in second column from left and lowest one in second column from right are metatarsals of reindeer; all others are metacarpals of reindeer. Dorsal view in upper photograph and volar view in lower.