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Faunal Remains at Man Bac

Junmei Sawada¹, Nguyen Kim Thuy² and Nguyen Anh Tuan²

¹ St. Marianna University School of Medicine, Kawasaki, Japan

² The Vietnamese Institute of Archaeology

This chapter describes the zooarchaeological findings from an analysis of the mammalian remains from Man Bac. Several hundred vertebrate remains were recovered during the excavations of Man Bac between 2005 and 2007. Mammalian and fish bones formed the main component of the recovered vertebrate assemblage. These animal bones provide primary information for an understanding of the subsistence behaviours of the Man Bac community during the neolithic and of the palaeoenvironment of the coastal plain where Man Bac is situated.

Previous studies have examined the past mammalian fauna of northern Vietnam (Vu, 1981, 1984; Vu and Nguyen, 1988; Nguyen and Vu, 2004), however, there is limited available data on the quantity and size of the mammalian archaeological assemblages. This report provides quantitative information for the mammalian assemblage as well as supplying raw data on taxonomic identification and the measurements of bones and teeth (see Appendix 9.1 and 9.2 this chapter).

MATERIALS AND METHODS

The Man Bac faunal assemblage was collected by a combination of *in situ* recovery during excavation and the intensive sieving of two excavation squares (E3 and G1). While it is believed that all vertebrate remains were recovered, realistically it is likely that some very small vertebrate remains (e.g. rats) may have been missed during excavation and recovery. All of the faunal remains were cleaned and labelled with provenance data in the form of site, date, square, layer, and spit. Taxonomic identification of the mammalian remains was based on cranial and dental morphology. Each specimen was provided with a sample number, then identified, to at least order or family, genus and species level if possible (see Appendix 9.1 this chapter). Cetacea and Muridae were identified from post-cranial bones as no cranial remains for these taxa were recovered. The modern mammalian bone collections in the Vietnam Institute of Archaeology in Hanoi, the Raffles Museum of Biodiversity Research in Singapore, and the National Museum of Nature and Science in Tokyo, were used for comparison and identification. Measurements of cranial and dental remains were taken according to Driesch (1976), the raw data of which are presented in Appendix 9.2 (this chapter).

For *Sus scrofa* (pig or boar), the dominant species at Man Bac, age-at-death was estimated using the method of Hayashi et al. (1977) based on tooth eruption and attrition of the upper and lower teeth.

RESULTS

Ten taxa were recognised, including: Muridae (rat), *Canis* sp. (dog), *Aonyx cinerea* (oriental small-clawed otter), *Viverra* sp. (civet), *Rhinoceros* sp. (rhinoceros), *Sus scrofa* (boar), *Muntiacus muntjak* (barking deer), *Cervus* sp. (deer), *Bos* sp. (cattle) and/or *Bubalus* sp. (water buffalo), and Cetacea (whale/dolphin). With the exception of the *Rhinoceros* these taxa still inhabit northern Vietnam (Lekagul and McNeely, 1988; Parr and Hoang, 2008).

Table 9.1 shows the number of identified specimens (NISP) and the minimum number of individuals (MNI) with respect to each layer. NISP and MNI were calculated based on sample-numbered remains. The total NISP is 182, and the total MNI is 37. The mammalian assemblage by percent of NISP is shown in Figure 9.1.

Sus scrofa is the dominant taxon in the Man Bac faunal assemblage (79.1% of total NISP; 54.1% of total MNI). The age composition of the *Sus* remains is shown in Table 9.2 (see also Figure 9.2), and the molar measurements are given in Table 9.3. *Sus* remains may include a few wild boar, but most *Sus* remains are considered to be domesticated. Further information on *Sus* is discussed below.

Family Cervidae (deer) has a significant presence in the assemblage and consisted of *Cervus* sp. (6.6% of total NISP; 8.1% of total MNI) and *Muntiacus muntjak* (1.1% of total NISP; 5.4% of total MNI). *Cervus* remains are similar in size to a medium-size deer, such as *C. unicolor* (sambar), *C. nippon* (sika deer), or *C. eldii* (Eld's deer), and were difficult to identify to the species level.

The Bovinae remains consisted of two molars of a large bovine. They appeared to be *Bos* sp. and/or *Bubalus* sp. There is the possibility that Bovinae were already domesticated in Vietnam during the mid Holocene (Vu, 1981). However, we could not find evidence for domestication of Bovinae in the Man Bac site, since the Bovinae remains are too few and fragmentary.

The Carnivora remains consisted of several skull fragments of *Canis* sp., and the teeth of *Viverra* sp. (*V. zibetha* (large Indian civet) or *V. magaspila* (large-spotted civet)) and *Aonyx cinerea*. Canidae remains include *Canis*, but there is no *Cuon* (Asian wild dog), a species widely distributed in Vietnam. *Canis* was domesticated in Southeast Asia during the neolithic, and *Canis* may have been bred at Man Bac.

Rhinoceros sp. remains consisted of two molars, and are similar to *Rhinoceros sondaicus* (Javan rhinoceros).

The Cetacean remains consisted of only one vertebra and fragments of one limb bone. Family, genus and species were indeterminate.

The Muridae remains consisted of a single femur of a small rat.

DISCUSSION

Domestication of *Sus scrofa*

The very high proportion of the mammalian assemblage attributable to *Sus* is very different from the faunal signatures of hunting and gathering communities, such as during the Hoabinhian period (Nguyen and Vu, 2004; Sawada and Vu, 2006). The demographic profile of the *Sus* assemblage (Table 9.2, Figure 9.2) demonstrates a very high proportion of juvenile and young-adult individuals. In general, the observed patterns in domestic *Sus* populations are characterised by an early kill-off

(Hongo and Meadow, 2000; Hongo et al., 2007), although a high proportion of young *Sus* remains alone does not necessarily equate with domestication (Albarella et al., 2006). However, the high number and young-biased age distribution of the Man Bac *Sus* series is indicative of a domesticated population. On the other hand, the morphological features of the Man Bac *Sus* assemblage are consistent with wild pigs, making it difficult to rule out the possibility that some portion of the sample is wild, rather than domesticated.

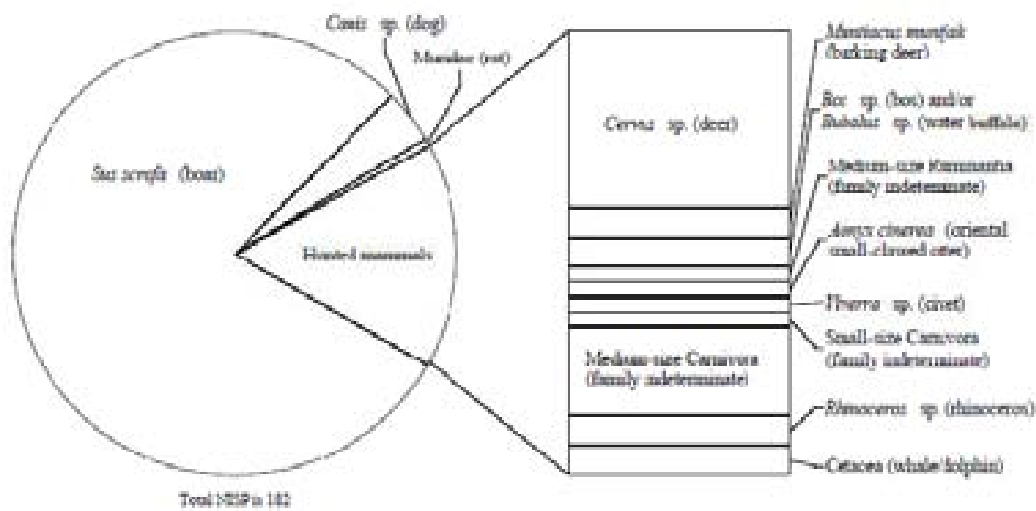


Figure 9.1 Man Bac mammalian assemblage by percent of NISP.

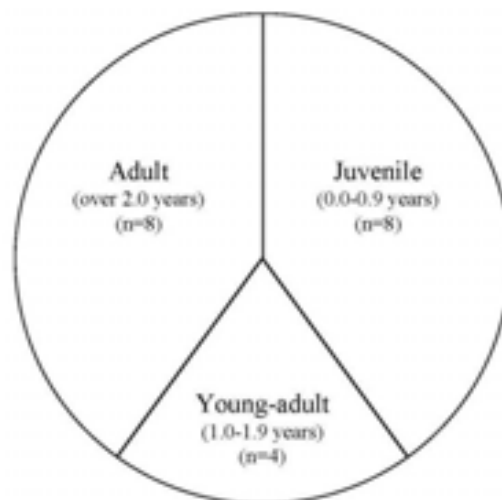


Figure 9.2 Demographic structure of the Man Bac *Sus scrofa*.

Table 9.1 Mammalian fauna of Man Bac.

Taxon	Layer I		Layer II		Layer III		Total	
	NISP (%)	MNI (%)	NISP (%)	MNI (%)	NISP (%)	MNI (%)	NISP (%)	MNI (%)
Order Rodentia								
Muridae (rat)			1 (1.7)	1 (6.3)			1 (0.5)	1 (2.7)
Order Carnivora								
<i>Canis</i> sp. (dog)	3 (2.8)	1 (5.9)	4 (6.9)	2 (12.5)			7 (3.8)	3 (8.1)
<i>Aonyx cinerea</i> (oriental small-clawed otter)	1 (0.9)	1 (5.9)					1 (0.5)	1 (2.7)
<i>Viverra</i> sp. (civet)	1 (0.9)	1 (5.9)					1 (0.5)	1 (2.7)
Small-size Carnivora (family indeterminate)	1 (0.9)	-					1 (0.5)	-
Medium-size Carnivora (family indeterminate)	5 (4.7)	-	1 (1.7)	-			6 (3.3)	-
Order Perissodactyla								
<i>Rhinoceros</i> sp. (rhinoceros)	1 (0.9)	1 (5.9)			1 (5.9)	1 (25.0)	2 (1.1)	2 (5.4)
Order Artiodactyla								
<i>Sus scrofa</i> (domestic/wild boar)	86 (80.4)	10 (58.8)	43 (74.1)	8 (50.0)	15 (88.2)	2 (50.0)	144 (79.1)	20 (54.1)
<i>Muntiacus muntjak</i> (barking deer)	1 (0.9)	1 (5.9)	1 (1.7)	1 (6.3)			2 (1.1)	2 (5.4)
<i>Cervus</i> sp. (deer)	6 (5.6)	1 (5.9)	6 (10.3)	2 (12.5)			12 (6.6)	3 (8.1)
Bos sp. (bos) and/or <i>Bubalus</i> sp. (water buffalo)	1 (0.9)	1 (5.9)	1 (1.7)	1 (6.3)			2 (1.1)	2 (5.4)
Medium-size Ruminantia (family indeterminate)	1 (0.9)	-					1 (0.5)	-
Order Cetacea								
Cetacea (whale/dolphin)			1 (1.7)	1 (6.3)	1 (5.9)	1 (25.0)	2 (1.1)	2 (5.4)
Total	107 (100.0)	17 (100.0)	58 (100.0)	16 (100.0)	17 (100.0)	4 (100.0)	182 (100.0)	37 (100.0)

NISP: number of identified specimens, MNI: minimum number of individuals.

NISP and MNI were calculated based on cranial and dental remains (except Muridae and Cetacea).

Table 9.2 Age composition of the *Sus* dental remains.

	< 7-8 months		7-8 months		19-20 months		31-32 months		43-44 months		55+ months		Total	
	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI
Layer I	3	2	10	4	5	1	2	1	2	2	0	0	22	10
Layer II	0	0	5	2	2	2	1	1	5	3	0	0	13	8
Layer III	0	0	0	0	1	1	0	0	2	1	0	0	3	2
Total	3	2	15	6	8	4	3	2	9	6	0	0	38	20

Age-at-death estimations are according to Hayashi et al. (1977).

Table 9.3 Length of molars of *Sus scrofa* (mm).

Tooth	Late Neolithic Man Bac				Modern wild ^(a)				Modern domestic ^(a)				Iron Age Noen U-Loke ^(b)			
	N	Mean	SD	Range	N	Mean	SD	Range	N	Mean	SD	Range	N	Mean	SD	Range
UM1	10	17.8	1.3	15.4 - 19.7	-	-	-	-	-	-	-	-	66	14.4	1.1	11.6 - 16.8
UM2	11	22.8	1.6	20.3 - 26.3	-	-	-	-	-	-	-	-	50	17.2	1.6	14.0 - 20.0
UM3	5	35.5	2.3	33.5 - 38.7	-	-	-	-	-	-	-	-	14	32.8	2.6	29.5 - 38.0
LM1	4	18.8	0.3	18.3 - 19.0	-	-	-	-	-	-	-	-	129	15.2	1.2	13.0 - 21.4
LM2	3	23.1	0.7	22.5 - 23.8	-	-	-	-	-	-	-	-	75	18.6	1.3	15.9 - 22.8
LM3	4	42.9	2.7	39.0 - 45.0	13	42.7	3.8	31.1 - 51.5	7	26.8	3.3	20.2 - 36.9	14	35.6	4.1	28.4 - 44.8

Abbreviations for tooth types are as follows: UM is upper molar, LM is lower molar.

(a) data from Ishiguro et al. (2008), (b) data from McCaw (2007).

Molar dimensions of the Man Bac *Sus* series, Iron Age domestic *Sus* remains from Noen U-Loke, Thailand (data from McCaw, 2007), and the lower third molar measurements of Vietnamese modern domestic and wild pigs (data from Ishiguro et al., 2008) are shown in Table 9.3. The lower third molars of the Man Bac *Sus* series are significantly larger than both modern domestic pigs ($p < 0.001$) and Noen U-Loke domestic *Sus* ($p < 0.01$) using Turkey's multiple range test, while they are comparable in size to modern wild boar (Figure 9.3). The other teeth of the Man Bac *Sus* assemblage also tend to be larger than those of the Noen U-Loke remains, although there were no data for equivalent teeth of wild and Vietnamese domestic pigs.

Body, cranium and tooth size tends to decrease through domestication from wild to domestic forms (Flannery, 1983; Zeder, 2006). Ishiguro et al. (2008) noted that the tooth size of Vietnamese modern wild pigs is larger than modern domestic pig teeth, with the tooth size distribution of these groups clearly separate. Figure 9.3 demonstrates that domestic *Sus* third molars in mainland Southeast Asia have reduced in size from the neolithic through to the present. Similarities in dental metrics between Man Bac *Sus* and Vietnamese modern wild pigs suggests a similarity between the two. It is not improbable that Man Bac *Sus* are at the initial stages of pig domestication in Vietnam.

Vu (1981) argued for the presence of domestic *Sus* remains at the mid Holocene Da But site of Con Co Ngua. However, Higham (1996) notes that Da But sites show no evidence for the cultivation of plants, and were likely hunter-gatherer and fishing settlements. Bellwood (2005) stated that *Sus* might have been domesticated during the neolithic in Vietnam, but clear evidence has not been found. This analysis of the Man Bac *Sus* series adds new evidence for the likelihood of *Sus* domestication in northern Vietnam by at least 3,500 BP. To clarify the timing and nature of *Sus* domestication in mainland Southeast Asia, there is a need for more work in this region.

Palaeoenvironment and Mammal Hunting

The Man Bac mammalian remains, with the exception of the Muridae and domestic *Sus/Canis*, were hunted animals: *Aonyx cinerea*, *Viverra*, *Rhinoceros*, *Muntiacus muntjak*, *Cervus*, Bovinae, and Cetacea. The habitats of these wild

Table 9.4 Primary habitats of the hunted mammals from the Man Bac site.

Taxon	Primary habitat	NISP (%)	MNI (%)
<i>Aonyx cinerea</i> (oriental small-clawed otter)	River and estuary	1 (4.5)	1 (7.7)
<i>Viverra</i> sp. (civet)	Forest	1 (4.5)	1 (7.7)
<i>Rhinoceros</i> sp. (rhinoceros)	Forest with a good supply of water	2 (9.1)	2 (15.4)
<i>Muntiacus muntjak</i> (barking deer)	Forest	2 (9.1)	2 (15.4)
<i>Cervus</i> sp. (deer)	Lowlands, grassland, forest	12 (54.5)	3 (23.1)
<i>Bos</i> sp. (bos) and/or <i>Bubalus</i> sp. (water buffalo)	Forest and grassland (<i>Bos</i> . Sp), open forest and swamp in lowlands	2 (9.1)	2 (15.4)
Cetacea (whale/dolphin)	Sea	2 (9.1)	2 (15.4)
Total hunted mammals		22 (100.0)	13 (100.0)

Habitat data is based on Lekagul and McNeely (1988) and Parr and Hoang (2008).

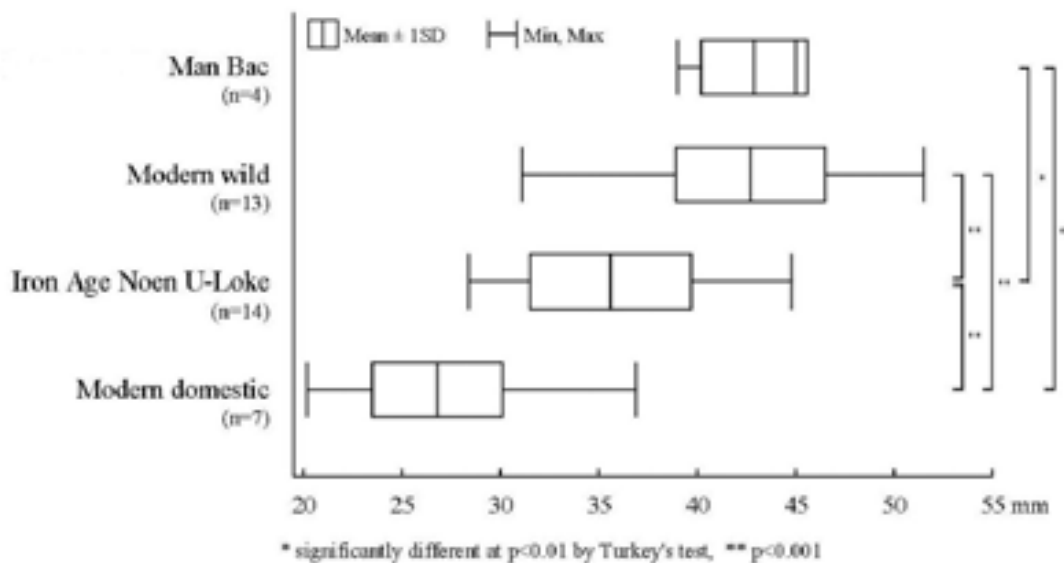


Figure 9.3 Length of lower third molars of the Man Bac *Sus* series, Iron Age domestic *Sus* remains from Noen U-Loke in Thailand (data from McCaw, 2007), and Vietnamese modern domestic and wild pigs (data from Ishiguro et al., 2008).

mammals were quite varied and included forest (*Viverra* sp., *Rhinoceros* sp., *Muntiacus muntjak*, *Cervus* sp., *Bos* sp., *Bubalus* sp.), grassland (*Cervus* sp., *Bos* sp.), watered places in lowlands (*Aonyx cinerea*, *Rhinoceros* sp., *Bubalus* sp), and the sea (Cetacea) (Lekagul and McNeely, 1988; Parr and Hoang, 2008; Table 9.4). Such varied habitats represent considerable environmental diversity in the vicinity of Man Bac during occupation of the site. Forests, grassland and lowlands can still be seen in the modern landscape near Man Bac, although there are some differences in terms of distance from the sea and probable vegetation types between the present and some 3,500 years ago.

It would appear that the occupants of Man Bac utilised a diverse range of environments for hunting and foraging. Habitat diversity aside, the behaviours and body sizes of the Man Bac mammalian series varied for different species. For instance, the head-body length of *Aonyx* is 40cm whereas that of *Rhinoceros* is over 3m (Lekagul and McNeely, 1988). Given the diversity in both the local environment and physical characteristics of the mammals, Man Bac people likely also lay claim to a diverse range of hunting skills, depending on the type of mammal targeted. Notwithstanding this however, the amount of hunted wild mammal remains (12.1% of total NISP; 35.1% of total MNI) is far less than that of the *Sus* remains. The number of species of hunted wild mammals from the Man Bac site is 7 taxa, which is rather meagre when compared to the species richness of northern Vietnam in the Holocene (Nguyen and Vu, 2004; Parr and Hoang, 2008). In contrast, the Hoabinhian pre-food production sites of northern Vietnam revealed 20 or more species of wild mammals (Nguyen and Vu, 2004; Sawada and Vu, 2006). The taxa-poor mammalian assemblage of Man Bac suggests hunting may have been more of a supplementary or secondary subsistence activity, despite the likelihood that they possessed efficient hunting skills. The initiation of domestication during the neolithic reduced the prominence of mammal hunting, and at Man Bac the key mammalian food source was domesticated (but still morphologically wild) pigs.

CONCLUSIONS

The Man Bac mammalian assemblage consisted of numerous domestic pig remains with a small number of hunted wild mammals, including several species of deer, bovids, carnivores, rhinoceros and cetaceans. The Man Bac community relied on domesticated pigs as the main mammalian food source, although they likely had sophisticated hunting skills allowing them to target a range of wild mammals in a variety of habitats in relative proximity to the site. The morphology of the pig remains suggests that they were at an initial stage of domestication. The zooarchaeological information of the Man Bac mammalian assemblage analysed in this chapter plays an important role in understanding the food-acquisition strategies of early agricultural societies in northern Vietnam.

SUMMARY

The Man Bac faunal assemblage provides primary information regarding both the ancient environment and subsistence strategies during the neolithic in northern Vietnam. Mammalian remains formed the main component of the excavated vertebrate assemblage at Man Bac which consisted of a large proportion of domestic pigs and a small number of wild mammals, including several species of deer, bovids, carnivores, rhinoceros and cetaceans. The Man Bac community utilised a range of environments and animal habitats as part of their hunting strategies. However, the relatively small proportion of hunted animals compared to domesticated pig remains suggests a reliance on pigs for their main source of meat. It is believed that Man Bac pigs represent an early stage of domestication.

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Appendix 9.1 Taxonomic identification.

Sample No.	Taxon	Skeletal part	l/r	Layer	Spit	Square	Remarks
MB05-184	Muridae (rat)	Femur	r	II	14	b1	
MB07-002	<i>Canis</i> sp. (dog)	Mandible (with I2, C, P2-P4, M1-M2)	l	II	10	f2	
MB05-041	<i>Canis</i> sp. (dog)	Maxilla (with M1 and M2)	r	I	7	d4	
MB05-104	<i>Canis</i> sp. (dog)	Maxilla (with M1)	r	II	14	e1	
MB07-013	<i>Canis</i> sp. (dog)	Maxilla (with P3, P4, M1, and M2)	l	II	11	e2	
MB05-024	<i>Canis</i> sp. (dog)	Maxilla (with P4)	r	I	6	d5	
MB05-037	<i>Canis</i> sp. (dog)	Tooth (UM1)	l	I	7	b5	
MB05-088	<i>Canis</i> sp. (dog)	Tooth (UP4)	l	II	10	c4	
MB07-047	<i>Aonyx cinerea</i> (oriental small-clawed otter)	Mandible (with P3, P4, and M1)	l	I	7	b4	
MB07-020	<i>Viverra</i> sp. (civet)	Mandible (with C and M1)	r	I	8	e1	
MB05-049	Small-size Carnivora (family indeterminate)	Tooth (LC)	l	I	7	e4	
MB05-039	Medium-size Carnivora (family indeterminate)	Mandible (ramus of mandible)	l	I	7	c1	
MB05-053	Medium-size Carnivora (family indeterminate)	Mandible (ramus of mandible)	r	I	7	a4	
MB05-115	Medium-size Carnivora (family indeterminate)	Mandible (ramus of mandible)	r	I	4	e3	
MB05-047	Medium-size Carnivora (family indeterminate)	Tooth (fragment of canine)	?	I	7	c2	
MB05-029	Medium-size Carnivora (family indeterminate)	Tooth (LI3)	l	I	6	d5	
MB07-037	Medium-size Carnivora (family indeterminate)	Tooth (UC)	r	II	11	d2	
MB05-119	<i>Rhinoceros</i> sp. (rhinoceros)	Tooth (fragment of molar)	?	I	6	a4	
MB05-120	<i>Rhinoceros</i> sp. (rhinoceros)	Tooth (LM1)	l	III	14	b2	
MB05-135	<i>Sus scrofa</i> (domestic/wild boar)	Fragment of skull	?	I	8	f6	
MB05-136	<i>Sus scrofa</i> (domestic/wild boar)	Fragment of skull	?	I	8	f6	
MB05-137	<i>Sus scrofa</i> (domestic/wild boar)	Fragment of skull	?	I	8	f6	
MB05-145	<i>Sus scrofa</i> (domestic/wild boar)	Fragment of skull	?	I	6	e2	
MB05-146	<i>Sus scrofa</i> (domestic/wild boar)	Fragment of skull	?	I	6	e2	
MB05-160	<i>Sus scrofa</i> (domestic/wild boar)	Fragment of skull	?	I	7	b5	
MB05-206	<i>Sus scrofa</i> (domestic/wild boar)	Fragment of skull	?	I	4	f3	
MB05-207	<i>Sus scrofa</i> (domestic/wild boar)	Fragment of skull	?	I	4	f3	
MB05-208	<i>Sus scrofa</i> (domestic/wild boar)	Fragment of skull	?	I	4	f3	
MB05-218	<i>Sus scrofa</i> (domestic/wild boar)	Frontal bone	?	I	6	e1	
MB05-151	<i>Sus scrofa</i> (domestic/wild boar)	Frontal bone	r	I	7	c3	
MB07-051	<i>Sus scrofa</i> (domestic/wild boar)	Incisive bone (with I2 and I3)	l	I	7	f2	Teeth unerupted
MB05-133	<i>Sus scrofa</i> (domestic/wild boar)	Mandible (angle of mandible)	l	III	18	b1	
MB05-150	<i>Sus scrofa</i> (domestic/wild boar)	Mandible (condylar process)	l	I	5	e6	
MB05-110	<i>Sus scrofa</i> (domestic/wild boar)	Mandible (with dm2, dm3, and M1)	l	II	10	c1	M1 erupting
MB07-007	<i>Sus scrofa</i> (domestic/wild boar)	Mandible (with dm3)	l	II	9	e3	
MB05-116	<i>Sus scrofa</i> (domestic/wild boar)	Mandible (with I2 and C)	r+l	I	7	c1	Female
MB05-011	<i>Sus scrofa</i> (domestic/wild boar)	Mandible (with M2 and M3)	l	I	6	f1	M3 erupting
MB07-060	<i>Sus scrofa</i> (domestic/wild boar)	Mandible (with M2 and M3)	l	I	8	d3	
MB05-118	<i>Sus scrofa</i> (domestic/wild boar)	Mandible (with P2-P4)	r	I	7	c1	
MB07-001	<i>Sus scrofa</i> (domestic/wild boar)	Mandible (with P3 and P4)	r	II	12	d4	
MB05-038	<i>Sus scrofa</i> (domestic/wild boar)	Mandible (with P4 and M1)	r	I	7	d1	P4 erupting
MB05-142	<i>Sus scrofa</i> (domestic/wild boar)	Maxilla (alveolar process)	?	I	6	b6	
MB07-046	<i>Sus scrofa</i> (domestic/wild boar)	Maxilla (alveolar process)	r	II	12	b1	
MB05-002	<i>Sus scrofa</i> (domestic/wild boar)	Maxilla (body of maxilla)	l	I	5	f5	
MB05-045	<i>Sus scrofa</i> (domestic/wild boar)	Maxilla (body of maxilla)	r	I	7	b5	
MB07-023	<i>Sus scrofa</i> (domestic/wild boar)	Maxilla (body of maxilla)	r	I	6	e3	
MB05-062	<i>Sus scrofa</i> (domestic/wild boar)	Maxilla (with C)	l	I	8	f6	Male
MB07-008	<i>Sus scrofa</i> (domestic/wild boar)	Maxilla (with C, P2, and P3)	r	II	9	b3	Male
MB05-035	<i>Sus scrofa</i> (domestic/wild boar)	Maxilla (with dm1)	l	I	7	b5	
MB05-067	<i>Sus scrofa</i> (domestic/wild boar)	Maxilla (with dm1-dm3)	r	I	9	a3	
MB05-006	<i>Sus scrofa</i> (domestic/wild boar)	Maxilla (with dm1-dm3, and M1)	r	I	6	e2	
MB07-056	<i>Sus scrofa</i> (domestic/wild boar)	Maxilla (with dm1-dm3, and M1)	r	II	10	d2	
MB05-026	<i>Sus scrofa</i> (domestic/wild boar)	Maxilla (with dm2 and dm3)	l	I	6	d6	
MB07-057	<i>Sus scrofa</i> (domestic/wild boar)	Maxilla (with dm2 and dm3)	l	II	12	b3	
MB05-034	<i>Sus scrofa</i> (domestic/wild boar)	Maxilla (with dm3 and M1)	l	I	7	b5	M1 erupting
MB07-050	<i>Sus scrofa</i> (domestic/wild boar)	Maxilla (with dm3 and M1)	r	I	7	f2	
MB07-011	<i>Sus scrofa</i> (domestic/wild boar)	Maxilla (with dm3, M1, and M2)	r	III	15	c1	
MB05-077	<i>Sus scrofa</i> (domestic/wild boar)	Maxilla (with M1 and M2)	r	II	10+11	a4	M2 erupting
MB05-114	<i>Sus scrofa</i> (domestic/wild boar)	Maxilla (with M1)	l	I	4	e3	
MB05-139	<i>Sus scrofa</i> (domestic/wild boar)	Maxilla (with M1)	r	I	7	c6	
MB05-083	<i>Sus scrofa</i> (domestic/wild boar)	Maxilla (with M2 and M3)	l	II	10	a5	
MB05-073	<i>Sus scrofa</i> (domestic/wild boar)	Maxilla (with M2)	r	II	9	a6	M2 erupting
MB05-108	<i>Sus scrofa</i> (domestic/wild boar)	Maxilla (with M3)	r	II	12	d1	
MB05-003	<i>Sus scrofa</i> (domestic/wild boar)	Maxilla (with P2)	l	I	5	f2	
MB05-102	<i>Sus scrofa</i> (domestic/wild boar)	Maxilla (with P2-P4)	l	II	13	b1	
MB05-025	<i>Sus scrofa</i> (domestic/wild boar)	Maxilla (with P3 and P4)	r	I	6	f4	
MB05-001	<i>Sus scrofa</i> (domestic/wild boar)	Maxilla (with P4 and M1)	l	I	4	f3	
MB05-036	<i>Sus scrofa</i> (domestic/wild boar)	Maxilla (with P4 and M1-M3)	l	I	7	b5	M3 erupting

Abbreviations for tooth types are as follows: I is incisor, C is canine, P is premolar, M is molar, d and unicast letters are deciduous teeth, U is upper, L is lower.

Appendix 9.1 (Continued 1).

Sample No.	Taxon	Skeletal part	I/r	Layer	Spit	Square	Remarks
MB05-111	<i>Sus scrofa</i> (domestic/wild boar)	Maxilla (with P4 and M1-M3)	l	II	13	b1	
MB07-052	<i>Sus scrofa</i> (domestic/wild boar)	Maxilla (with P4 and M1-M3)	r	II	11	d4	M3 erupting
MB05-057	<i>Sus scrofa</i> (domestic/wild boar)	Maxilla (with P4, M1, and M2)	r	I	7	b3	M2 erupting
MB05-084	<i>Sus scrofa</i> (domestic/wild boar)	Maxilla (with P4, M1, and M2)	r	II	10	c3	
MB05-225	<i>Sus scrofa</i> (domestic/wild boar)	Nasal bone	?	I	6	a4	
MB05-147	<i>Sus scrofa</i> (domestic/wild boar)	Nasal bone	l	I	6	a4	
MB05-148	<i>Sus scrofa</i> (domestic/wild boar)	Nasal bone	r	I	6	b4	
MB05-174	<i>Sus scrofa</i> (domestic/wild boar)	Temporal bone	l	I	?	cd7	
MB05-315	<i>Sus scrofa</i> (domestic/wild boar)	Temporal bone	r	II	12	d1	
MB07-010	<i>Sus scrofa</i> (domestic/wild boar)	Temporal bone	r	II	11	a'3	
MB05-031	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (fragment of incisor)	?	I	6	c3	
MB05-131	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (fragment of LC)	?	III	18	b1	
MB05-125	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (fragment of Ldi1 or Ldi2)	?	III	15	a5	
MB05-007	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (fragment of molar)	?	I	6	e2	
MB05-018	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (fragment of molar)	?	I	6	b6	
MB05-048	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (fragment of molar)	?	I	7	d5	
MB05-052	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (fragment of molar)	?	I	7	a4	
MB05-059	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (fragment of molar)	?	I	8	a3	
MB05-072	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (fragment of molar)	?	II	8	d3	
MB05-082	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (fragment of molar)	?	II	10+11	a2	
MB05-092	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (fragment of molar)	?	II	10+11	c2	
MB05-096	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (fragment of molar)	?	II	12	b3	
MB05-097	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (fragment of molar)	?	II	12	b3	
MB05-106	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (fragment of molar)	?	II	14	c1	
MB05-128	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (fragment of molar)	?	III	12	c3	
MB05-130	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (fragment of molar)	?	III	12	d2	
MB05-182	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (fragment of molar)	?	II	10+11	b2	
MB05-251	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (fragment of molar)	?	I	7	a4	
MB05-252	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (fragment of molar)	?	I	7	a4	
MB05-253	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (fragment of molar)	?	I	7	a4	
MB07-028	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (fragment of molar)	?	I	6	d1	
MB05-126	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (fragment of premolar)	?	III	16	a2	
MB05-132	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (fragment of premolar)	?	III	18	b1	
MB05-064	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (LC)	l	I	8	f3	Male
MB05-117	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (LC)	l	I	7	c1	Female
MB05-023	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (Ldi2)	l	I	6	e4	
MB05-093	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (Ldi2)	l	II	10	f6	
MB05-074	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (Ldi2)	r	II	9	b3	
MB05-123	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (Ldi2)	r	III	15	c3	
MB07-042	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (Ldi2)	r	II	9	e3	
MB07-044	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (Ldi2)	r	II	13	b3	
MB05-046	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (Ldm3)	r	I	7	e6	
MB05-090	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (LI1)	l	II	10+11	c1	
MB05-103	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (LI1)	l	II	13	a6	
MB07-015	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (LI1)	l	I	8	d1	
MB07-043	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (LI1)	l	II	9	b3	
MB05-076	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (LI1)	r	II	9	f6	
MB05-015	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (LI2)	l	I	6	b4	
MB05-075	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (LI2)	l	II	9	d3	
MB05-065	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (LI2)	r	I	8	b5	
MB05-124	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (LI2)	r	III	15	a5	
MB05-030	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (LI3)	r	I	6	c3	
MB05-129	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (LM1)	l	III	12	a5	
MB05-070	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (LM1)	r	I	9	a2	Unerupted
MB05-091	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (LM1)	r	II	10+11	c2	
MB07-048	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (LM2)	l	I	10	d4	
MB07-058	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (LM2)	l	III	14	a'3	
MB05-010	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (LM2)	r	I	6	f3	
MB07-049	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (LM3)	l	I	10	d4	
MB07-059	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (LM3)	l	III	14	a'3	
MB05-080	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (LM3)	r	II	10+11	a2	
MB05-021	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (LP2)	r	I	6	b6	
MB05-058	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (M3 fr)	?	I	7	b3	
MB05-040	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (UC)	l	I	7	e1	Female
MB07-004	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (UC)	r	I	7	c1	Male
MB07-025	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (Udi1)	l	II	13	f4	
MB05-019	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (Udm2)	l	I	6	b6	
MB05-004	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (Udm3)	l	I	5	e6	

9. FAUNAL REMAINS

Appendix 9.1 (Continued 2).

Sample No.	Taxon	Skeletal part	I/r	Layer	Spit	Square	Remarks
MB05-033	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (Udm3)	r	I	7	b5	
MB05-014	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (UI1)	l	I	6	b4	
MB05-050	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (UI1)	l	I	7	a3	
MB07-039	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (UI1)	l	I	7	c3	
MB05-022	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (UI2)	r	I	6	e1	
MB05-008	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (UI3)	l	I	6	e2	
MB05-155	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (UI3)	r	I	6	a3	
MB05-017	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (UM1)	l	I	6	b6	Unerupted
MB05-032	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (UM1)	l	I	7	b5	
MB05-066	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (UM1)	l	I	8	f2	Unerupted
MB05-028	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (UM2)	l	I	6	c2	
MB05-060	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (UM2)	l	I	8	a3	
MB05-127	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (UM2)	l	III	17	c2	
MB07-053	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (UM2)	l	II	7	a'6	
MB07-054	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (UM2)	l	II	11	a1	
MB05-051	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (UM2)	r	I	7	a4	Unerupted
MB05-107	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (UM3)	l	II	14	a1	
MB05-122	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (UM3)	l	III	14+15	a2b2	
MB05-054	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (UM3)	r	I	7	a3	Unerupted
MB05-061	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (UP1)	r	I	8	a3	
MB05-020	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (UP2)	l	I	6	b6	
MB05-013	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (UP2)	r	I	6	b4	Unerupted
MB05-079	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (UP2)	r	II	10+11	a4	
MB05-078	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (UP3)	r	II	10+11	a4	
MB05-068	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (UP4)	l	I	9	d1	
MB05-105	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (UP4)	l	II	14	b1	
MB05-081	<i>Sus scrofa</i> (domestic/wild boar)	Tooth (UP4)	r	II	10+11	a2	
MB05-109	<i>Muntiacus muntjak</i> (barking deer)	Antler	?	II	11	a1	
MB05-112	<i>Muntiacus muntjak</i> (barking deer)	Frontal bone and antler	l	I	5	d5	
MB05-172	<i>Cervus</i> sp. (deer)	Antler	?	I	7	d5	
MB05-087	<i>Cervus</i> sp. (deer)	Mandible (with dm3)	r	II	10+11	b1	
MB05-156	<i>Cervus</i> sp. (deer)	Occipital bone	m	I	7	b5	
MB05-043	<i>Cervus</i> sp. (deer)	Tooth (fragment of premolar)	?	I	7	f4	
MB05-044	<i>Cervus</i> sp. (deer)	Tooth (fragment of premolar)	?	I	7	f4	
MB05-101	<i>Cervus</i> sp. (deer)	Tooth (LM3)	r	II	13	b2	
MB05-094	<i>Cervus</i> sp. (deer)	Tooth (UM1)	r	II	11	e3	
MB05-009	<i>Cervus</i> sp. (deer)	Tooth (UM2)	l	I	6	e2	Unerupted
MB05-095	<i>Cervus</i> sp. (deer)	Tooth (UM2)	r	II	11	e3	
MB05-089	<i>Cervus</i> sp. (deer)	Tooth (UM3)	r	II	10	f4	
MB05-056	<i>Cervus</i> sp. (deer)	Tooth (UP2)	l	I	7	b3	
MB05-086	<i>Cervus</i> sp. (deer)	Tooth (UP2)	r	II	10+11	a1	
MB07-005	<i>Bos</i> sp. (bos) and/or <i>Bubalus</i> sp. (water buffalo)	Tooth (fragment of molar)	l	II	11	d2	
MB05-055	<i>Bos</i> sp. (bos) and/or <i>Bubalus</i> sp. (water buffalo)	Tooth (LP3)	l	I	7	b3	
MB05-027	Medium-size Ruminantia (family indeterminate)	Tooth (fragment of molar)	?	I	6	c2	
MB05-330	Cetacea (whale/dolphin)	Limb bone (shaft)	?	III	15	a1	
MB05-171	Cetacea (whale/dolphin)	Vertebra	m	II	12	a6	

Appendix 9.2 Raw data measurements of the Man Bac mammal remains (mm).

<i>Sus scrofa</i> (domestic/wild boar)									
Sample No.	Skeletal part	l/r	LP2-LP4 length	UM1 length	UM2 length	UM3 length	LM1 length	LM2 length	LM3 length
MB05-006	Maxilla (with dm1-dm3, and M1)	r		19.70					
MB05-010	Tooth (LM2)	r						23.84	
MB05-011	Mandible (with M2 and M3)	l						22.54	45.00
MB05-017	Tooth (UM1)	l		19.33					
MB05-028	Tooth (UM2)	l			20.26				
MB05-032	Tooth (UM1)	l		17.69					
MB05-036	Maxilla (with P4 and M1-M3)	l			26.34				
MB05-038	Mandible (with P4 and M1)	r					18.93		
MB05-051	Tooth (UM2)	r			23.39				
MB05-054	Tooth (UM3)	r				33.89			
MB05-057	Maxilla (with P4, M1, and M2)	r		15.35					
MB05-060	Tooth (UM2)	l			23.26				
MB05-066	Tooth (UM1)	l		17.19					
MB05-070	Tooth (LM1)	r					18.97		
MB05-077	Maxilla (with M1 and M2)	r		17.50	21.11				
MB05-080	Tooth (LM3)	r							43.90
MB05-083	Maxilla (with M2 and M3)	l				33.47			
MB05-107	Tooth (UM3)	l				34.10			
MB05-110	Mandible (with dm2, dm3, and M1)	l					18.28		
MB05-111	Maxilla (with P4 and M1-M3)	l		16.75	23.27	37.10			
MB05-118	Mandible (with P2-P4)	r	39.73						
MB05-122	Tooth (UM3)	l				38.72			
MB05-127	Tooth (UM2)	l			22.36				
MB05-129	Tooth (LM1)	l					18.88		
MB07-011	Maxilla (with dm3, M1, and M2)	r		18.49	22.95				
MB07-048	Tooth (LM2)	l						22.90	
MB07-049	Tooth (LM3)	l							43.84
MB07-050	Maxilla (with dm3 and M1)	r		18.18					
MB07-052	Maxilla (with P4 and M1-M3)	r		17.66	22.98				
MB07-053	Tooth (UM2)	l			22.85				
MB07-054	Tooth (UM2)	l			21.58				
MB07-060	Mandible (with M2 and M3)	l							38.97
Mean			-	17.78	22.76	35.46	18.77	23.09	42.93
SD			-	1.25	1.56	2.32	0.33	0.67	2.69
<i>Cervus</i> sp. (deer)									
Sample No.	Skeletal part	l/r	UM1 length	UM2 length	LM3 length				
MB05-094	Tooth (UM1)	r	22.32						
MB05-095	Tooth (UM2)	r		27.16					
MB05-101	Tooth (LM3)	r			31.79				