

Stratigraphic Distribution of Early Holocene Mammals from the Tochibara Rock Shelter Site, Kita-aiki, Nagano Prefecture, Central Japan

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Tochibara Rock Shelter Site²

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Abstract

Mammalian remains, fragments of pottery, stone implements and human bones occur in the sediments about 5.6 m thick which fill the notch of the Tochibara rock shelter site (Fig. 1). The excavated fragments of pottery and radiocarbon dates indicate that the site was formed from the Incipient stage to the Earliest stage of the Jomon Period. The study of the mammalian remains from the site is important for reconstructing the mammalian fauna of the earliest Holocene in Japan, because the sites of that time which yield abundant mammalian remains are actually rare in Japan. Previous studies on the remains are quite insufficient, and the analyses of the remains have not been completed yet. In this paper, the stratigraphic distribution of the remains is described on the basis of the records of the stratigraphic levels of the remains and their systematic analyses. The description reveals that the mammalian assemblage can be divided into following three stratigraphic levels: the level from 0 to -200 cm yielding few mammalian remains, that from -200 to -380 cm yielding abundant large mammalian remains, and that from -380 to -560 cm yielding abundant mammalian remains with various size, in descending order. The changes of hunting activities as well as the change of human utilization of the rock shelter are estimated from the change of the species diversity and the abundance of the remains.

Key-words : Tochibara rock shelter site, Mammalian remains, Jomon Period, Stratigraphic distribution

1. Introduction

In the Late Pleistocene, many notches were formed on cliffs along the Kita-aiki River, a branch of the Chikuma River. The Tochibara rock shelter site was found in one of the notches. The sediments of the site are about 5.6 m thick, and fill the notch, yield abundant mammalian remains, fragments of pottery, stone implements and human bones. On the basis of the fragments of pottery excavated and the radiocarbon dates, the sediments are considered have been formed in the earliest Holocene (the Incipient stage to the Earliest stage of the

Jomon Period). The sites of this time yielding abundant mammalian remains are rare in Japan, and thus, the study of the remains is important for reconstructing the mammalian fauna, human activities and environment of the surrounding area at that time.

Several studies have been conducted on the mammalian remains from the site (Miyao *et al.*, 1980; Miyao *et al.*, 1981a; Nishizawa and Miyao, 1981; Miyao *et al.*, 1982; Nishizawa, 1982; Miyao *et al.*, 1984a; Miyao *et al.*, 1984b; Miyao and Nishizawa, 1985 and Miyao *et al.*, 1987). These studies are, however, insufficient, and the analyses of the remains have not been completed yet.

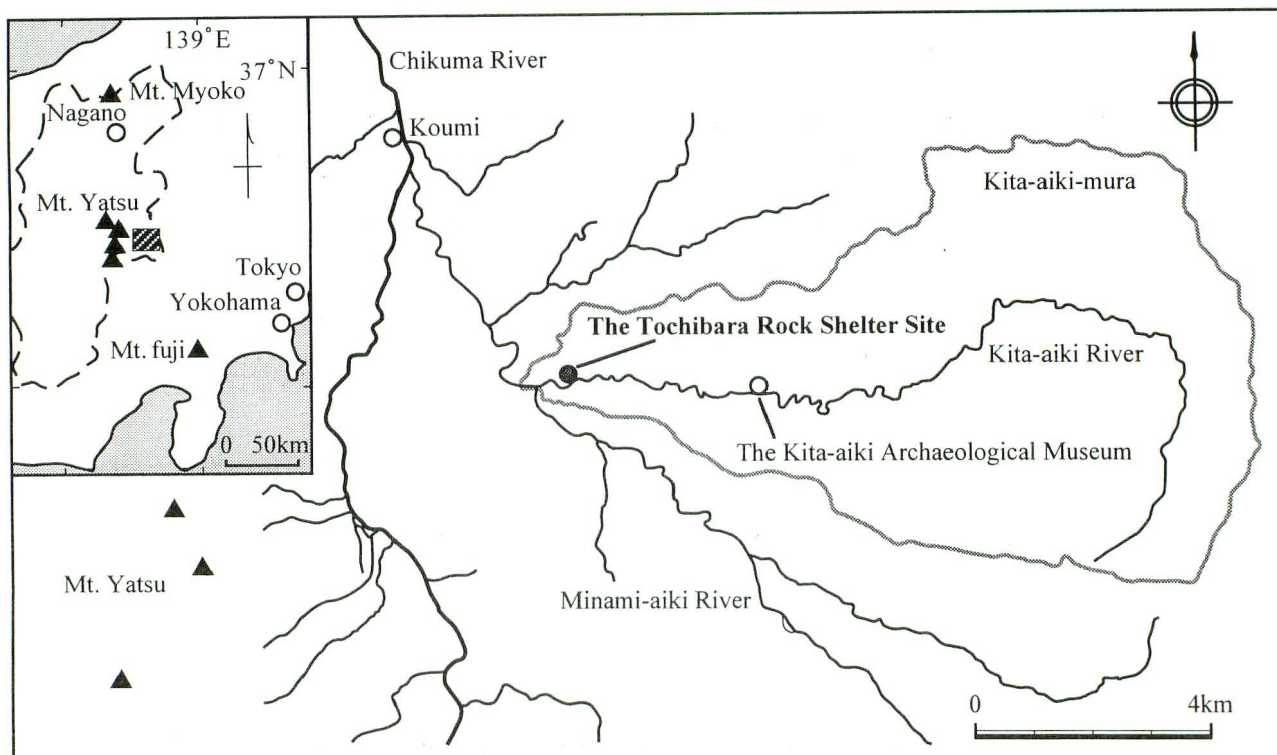


Fig. 1 Locality map of the Tochibara rock shelter site.

In this study, we taxonomically re-examine the remains stored at the Kita-aiki Archaeological Museum, and arrange them in accordance with stratigraphic levels. The reexamination and arrangement reveal the detailed stratigraphic distribution of mammals in the sediments of the site, which is described below.

2. The Tochibara Rock Shelter Site

The altitude of the site is 960 meters above sea level. The site is situated in a notch about 7 m above the Kita-aiki River. The notch is a member of the Tochibara notch group, named Risho (2001), which was formed in the Late Pleistocene. The entrance of the notch is 8 m wide, 7 m high, and 8 m deep. The inside of the notch is mostly filled with mud and breccia. Cultural remains (fragments of pottery, stone implements and bone implements), vertebrate remains (mammals, birds, amphibians and fishes), and human bones had been excavated from the sediments, about 5.6 m thick, which fill the notch. The excavation of the site was carried out 15 times from 1965 to 1978 by the team organized by the Anatomical and Geological Department of Shinshu University. The main excavation grids of the site are called grids I to IV (main part of the site) and V (northeast part of the site). In addition to these,

grid I was expanded southwestward during the excavations (Fig. 2). Because of the presence of many fallen blocks and thin layers, it was difficult to classify the sediments stratigraphically (Nishizawa, 1982). Thus, the sediments from each 10 cm thickness were excavated for convenience, instead of recognizing stratigraphic layers. The level at which the remains occurred was exclusively recorded at 10 or 20 cm intervals.

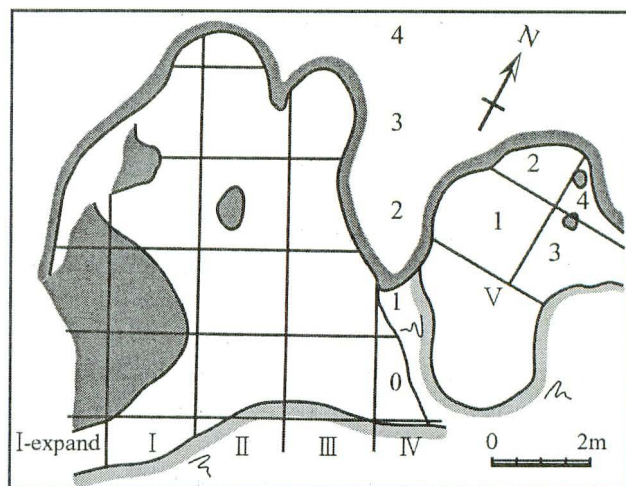


Fig. 2 Disposition of the excavation grids in the Tochibara rock shelter site.

3. Mammalian Remains

Mammalian remains, especially those of large size, are crushed and burned. Cut marks observed on some bones suggest human dissection. Spiral fractures produced by strong blows using hammer stones are observed in some bones. Furthermore, bone and antler artifacts are also found.

Miyao *et al.* (1980) reported that the amount of the mammalian remains obtained by the excavations from 1965 to 1978 are 231 kg. Of the 231 kg remains, we selected remains of middle-sized mammals and those of well-preserved large mammals, totaling 5133 specimens and 28 kg in weight. The remainders of 203 kg are thought of poorly preserved large mammals, including wild boars, deer and bears.

The remains we studied are assigned to the following 16 species belonging to five orders: *Macaca fuscata*, *Lepus brachyurus*, *Sciurus lis*, *Petaurista leucogenys*, *Selenarctos thibetanus*, *Vulpes vulpes*, *Nyctereutes procyonoides*, *Canis lupus*, *Canis familiaris*, *Martes melampus*, *Mustela itatsi*, *Meles meles*, *Lutra lutra*, *Sus scrofa*, *Cervus nippon* and *Capricornis crispus*. The specimen number of each species in each level is shown in Table 1. Furthermore, the number of each skeletal element is shown in the Appendix, where the number of teeth is counted, as if all the teeth are detached from jawbones. On the basis of the data in this table, we can calculate the minimum numbers of individuals (MNI).

On the other hand, Miyao *et al.* (1980) and Miyao *et al.* (1987) referred the mammalian remains obtained by the excavations from 1965 to 1978 to the following 23 forms: *Crocidura dsinezumi*, *Mogera wogura*, *Macaca fuscata*, *Lepus brachyurus*, *Sciurus lis*, *Petaurista leucogenys*, *Eothenomys andersoni*, *Eothenomys kageus*, *Microtus montebelli*, *Apodemus speciosus*, *Apodemus argenteus*, *Selenarctos thibetanus*, *Canis lupus*, *Canis familiaris*, *Nyctereutes procyonoides*, *Vulpes vulpes*, *Martes melampus*, *Mustela sibirica itatsi*, *Meles meles anakuma*, *Lutra lutra*, *Sus scrofa leucomystax*, *Cervus nippon* and *Capricornis crispus crispus*. This list contains seven species more than in the above-mentioned list that we recognized in this study. The remains of the seven species have not been stored in the Kita-aiki Archeological Museum.

The explanations of the remains are given below in each taxon.

Insectivores: Miyao *et al.* (1980) reported a max-

illa of *Crocidura dsinezumi*, and four humeri and a mandible of *Mogera wogura*, although we could not examine these remains. Miyao *et al.* (1980) did not record the grids and levels where the remains had been obtained, except the mandible of *M. wogura* which occurred in a level lower than -500 cm.

Primates: A total of 820 specimens are assigned to *Macaca fuscata* in the present study, although some of them were already studied by Nishizawa and Miyao (1981). Most of them (758 specimens) were obtained from the levels of -280~-340 cm and -440~-540 cm in grids I to IV. They belong to almost all the skeletal elements, including skull, vertebrae and limb bones. Some of the remains are thought of young individuals. The most abundant skeletal element is calcanei (41 specimens), which is followed by femora (36 specimens). Tali, radii and humeri are somewhat fewer (32, 25 and 23 specimens respectively). The number of teeth is 175. Among them, premolars and molars are more abundant than incisor and the canine. MNI is calculated as 22 on the basis of the number of calcaneus.

Lagomorphs: A total of 564 specimens are assigned to *Lepus brachyurus*, although some of them were already examined by Miyao *et al.* (1982) and Miyao *et al.* (1984a). Most of the specimens (411 specimens) were obtained from the levels of -400~-540 cm in grids I to IV. They have almost all the skeletal elements, including skull, vertebrae and limb bones. Only a single P₃ occurred from grid V, but the other remains lack any records of the grid. The most abundant skeletal element is mandibles (41 specimens), which is followed by calcanei (31 specimens). Scapulae, maxillae and ulnae are somewhat fewer (24, 21 and 19 specimens respectively). Of 221 teeth, lower ones are more than the upper ones. MNI is calculated as 21 on the basis of the number of left P₄.

Rodents: Miyao *et al.* (1980) reported the occurrences of *Sciurus lis*, *Petaurista leucogenys*, *Eothenomys andersoni*, *Eothenomys kageus*, *Microtus montebelli*, *Apodemus speciosus* and *Apodemus argenteus*, although we could examine only two rodent species (*Sciurus lis* and *Petaurista leucogenys*).

A total of 108 specimens are assigned to *Sciurus lis* in the present study. Most of them (94 specimens) were obtained from the levels lower than -440 cm in grids I to IV, whereas four mandibles and ten teeth lack any records of the grids and levels in which they occurred. Among the remains, the most abundant skeletal element is mandibles (25 specimens), but the number of teeth is more numerous (71 specimens). MNI is calculated as 15 from the number of lower incisor.

Table 1 Specimen numbers of mammalian species examined in this study showing the stratigraphic distribution in the Tochibara rock shelter site.

Species	Grid→ Level(cm)→	I-IV																								V	Grid and level unknown	total			
		0~	100~	120~	140~	160~	180~	200~	220~	240~	260~	280~	300~	320~	340~	360~	380~	400~	420~	440~	460~	480~	500~	520~	540~				560~	580~	unknown
Order Primates																															
<i>Macaca fuscata</i>		-	-	-	-	1	-	2	5	11	19	52	68	43	29	25	32	26	25	62	93	57	100	69	9	-	-	30	11	51	820
Order Lagomorpha																															
<i>Lepus brachyurus</i>		-	-	-	-	-	-	-	-	9	3	2	5	-	2	1	3	6	19	36	65	85	99	54	16	6	-	-	1	152	564
Order Rodentia																															
<i>Sciurus lis</i>		-	-	-	-	-	-	-	1	9	9	-	-	1	1	-	-	-	-	12	10	20	9	14	1	4	-	3	-	14	108
<i>Petaurista leucogenys</i>		-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	2	5	30	17	35	27	14	4	-	-	4	-	7	147	
Order Carnivora																															
<i>Selenarctos thibetanus</i>		-	-	-	-	1	-	1	-	-	5	2	9	8	2	3	9	16	38	49	40	91	80	25	4	-	-	15	11	19	428
<i>Vulpes vulpes</i>		-	-	-	-	-	-	-	-	2	-	2	-	1	-	-	2	2	3	3	3	18	4	4	-	-	-	2	1	4	51
<i>Nyctereutes procyonoides</i>		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2
<i>Canis lupus</i>		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	2
<i>Canis familiaris</i>		-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	2	2	-	-	-	-	-	-	-	-	6
<i>Martes melampus</i>		-	-	-	-	-	-	-	-	9	7	9	1	1	1	-	5	9	11	22	66	39	51	1	1	-	13	18	29	293	
<i>Mustela itatsi</i>		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	5
<i>Meles meles</i>		-	-	-	-	-	-	-	1	-	-	-	-	-	3	1	-	1	2	12	4	9	14	3	-	-	-	-	-	5	55
<i>Lutra lutra</i>		-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	4	5	2	-	1	-	-	-	-	-	17	31
Order Artiodactyla																															
<i>Sus scrofa</i>		-	-	-	-	-	1	5	9	9	12	5	9	9	9	2	7	7	14	19	25	35	38	18	5	-	-	42	21	37	338
<i>Cervus nippon</i>		-	6	-	2	12	9	15	55	62	46	41	84	71	39	46	70	41	72	137	128	270	262	77	22	18	1	138	252	214	2190
<i>Capricornis crispus</i>		-	1	-	-	-	1	-	1	2	1	4	7	6	4	-	7	1	4	1	7	13	7	5	1	-	-	6	4	10	93

A total of 147 specimens are identified as *Petaurista leucogenys* in the present study. Most of them (140 specimens) were obtained from the levels of -440~-540 cm in grids I to IV. Two maxillae, two scapulae, one ulna and two coxal bones lack any records of their occurrence. Among the remains, the most abundant skeletal element is coxal bones (24 specimens), followed by ulnae and teeth (18 specimens). Radii, humeri, scapulae and femora are somewhat fewer (17, 16, 12 and 10 specimens respectively). MNI is 18, which are obtained from the number of left coxal bones.

The remains of the other rodent species reported by Miyao *et al.* (1980) are two femora of *Eothenomys andersoni*; a mandible of *E. kageus* from the level of -250~-300 cm; a mandible of *Microtus montebelli* from the level of -450~-500 cm; 30 mandibles of *Apodemus speciosus* from the levels of -250~-300 cm, -300~-350 cm, -400~-450 cm, -450~-500 cm and from the level lower than -500 cm; and a humerus and tibia of *A. argenteus*.

Carnivoroves: A total of 428 specimens are assigned to *Selenarctos thibetanus* in the present study. Most of them (398 specimens) were obtained from the levels of -400~-540 cm in grids I to IV. Some limb elements (11 specimens) occurred from grid V, but the other remains (19 remains) lack any record of the grids. Of the specimens, the most abundant skeletal element is metacarpal bones (43 specimens), which is followed by metatarsal bones (42 specimens) and teeth (38 specimens). One of the teeth (canine) had developed into accessory. MNI is calculated as 9, from the number of left fourth metacarpal bone.

The present study identified 51 specimens as *Vulpes vulpes*, although Miyao *et al.* (1987) reported 53 specimens of *V. vulpes*. Most of them (46 specimens) were obtained from the level of -480~-540 cm in grids I to IV. Only one humerus of this species occurred from grid V, the other four specimens do not have any records as to whether they were obtained from grids I to IV or grid V. The specimens examined in the present study comprise skeletal elements, including fragmental skulls and limb bones. MNI are estimated as 5 on the basis of the number of humeri.

Miyao *et al.* (1987) reported 95 specimens of *Nyctereutes procyonoides*, although we could not examine most of the specimens. Only a coxal bone and tibia without the record of occurrence are identified as *N. procyonoides* in the present study.

Miyao *et al.* (1984b) reported one calcaneus, one I³, three upper C, one P₃, one P₄ and two M₁ of *Canis lupus*, although we could not examine them. In the

present study we examined only one calcaneus from the levels of -400~-420 cm in grids I to IV, and M₁ which has no record of the occurrence.

Six specimens are assigned to *Canis familiaris*. All the specimens were obtained from the level of -440~-520 cm in grids I to IV. The specimens comprise three ulnae, two axes and an atlas. Although Miyao *et al.* (1987) reported an upper canine, we could not examine it in the present study. MNI is calculated as 3 from the number of ulnae.

A total of 293 specimens are referred to *Martes melampus* in the present study. Most of them (246 specimens) were obtained from the levels of -260~-380 cm and -420~-540 cm in grids I to IV. Some specimens (18 remains) were, however, obtained from grid V and the other remains (29 remains) lack any record of where they were collected. The most abundant skeletal element is mandibles (34 specimens), which is followed by ulnae (20 specimens). Fragments of skulls (including maxilla), humeri, radii and scapulae are somewhat fewer (14, 13, 13 and 10 specimens respectively). Isolated teeth are more numerous (133 specimens). MNI is calculated as 21 from the number of left mandible or left M₁.

Miyao *et al.* (1987) reported two mandibles and an ulna of *Mustela itatsi*. One of the mandibles, having no teeth, was obtained from the level of -400~-450 cm and the other mandible with P₂, P₃, M₁ and M₂ was obtained from the level of -500~-550 cm. Beside these, only one mandible with P₂, P₃, M₁ and M₂ was examined in the present study.

In the present study, 55 specimens are assigned to *Meles meles*. Most of them (50 specimens) were obtained from the level of -440~-520 cm in grids I to IV. The other remains (5 remains) have no records as to where they were collected. The remains examined are composed of skeletal elements including, skull and limb bones. They also include 12 isolated teeth. MNI is estimated as 8 from the number of coxal bones.

In the present study, 31 specimens are assigned to *Lutra lutra*. Some of them (14 specimens) were obtained from the level of -420~-540 cm in grids I to IV. The other remains (17 remains) have no record of their occurrence. Almost all of the specimens examined are limb bones. MNI is estimated as 2 from the number of right femur or right talus.

Artiodactyls: A total of 338 specimens are identified as *Sus scrofa* in the present study. Miyao *et al.* (1981b) reported the occurrence of abundant teeth remains, but we could not examine few teeth of this species. Most of the remains (280 specimens) were obtained

from the levels of -220~-280 cm, -300~-360 cm and -420~-540 cm in grids I to IV. They comprise almost all the skeletal elements, including skull, vertebrae and limb bones. Some bones are considered as belonging to young individuals. Fragmental skulls, including maxilla and mandible, patellae and tarsi (21 specimens totally) were obtained from grid V, and the others (37 specimens) have no record of their occurrence. The most abundant skeletal element is mandibles (50 specimens), which is followed by tali (40 specimens). MNI is estimated as 21 from the number of right talus.

A total of 2190 specimens are assigned to *Cervus nippon* in the present study. Most of them (1524 specimens) were obtained from the levels of -220~-260 cm, -300~-340 cm and -420~-540 cm in grids I to IV. They comprise almost all the skeletal elements, including skull, vertebrae and limb bones. Some bones are considered to belong to young individuals. A total of 452 remains, including maxillae, mandibles and tarsi, were obtained from grid V, and the others (214 remains) have no record of their occurrence. The most abundant skeletal element is mandibles (170 specimens), and 1082 isolated teeth are included in the examined collection, where premolars and molars are more numerous than incisors and canines. MNI is estimated as 65 on the basis of the number of right M₂.

A total of 93 specimens are referred to *Capricornis crispus* in the present study. Most of them (79 specimens) were obtained from the levels of -280~-360 cm and -460~-540 cm in grids I to IV. Two fragments of skulls, a humerus and a carpus were obtained from grid V, and the other 10 remains have no records of their occurrence. The most abundant skeletal element is calcanei (14 specimens), which is followed by tali (12 specimens). MNI is estimated as 9 from the number of left calcaneus.

4. Stratigraphic Distribution of Mammalian Remains

In the previous studies on the mammalian remains, grids I to IV are not distinguished from grid V, but the former are spatially separated from the latter. Moreover, the sediments of the former have not been correlated with those of the latter, although Fujimori (1996) stressed that it was necessary to correlate them with each other. In the present study, therefore, the mammalian remains from grids I to IV are exclusively examined and their stratigraphic distributions are described, but those from grid V are not studied.

In grids I to IV, the number of the mammalian

remains examined are counted in each level (Fig. 3). The remains which are not examined here (138 kg totally) are added to those examined, and their total weight is figured in each stratigraphic level in Fig. 4. These figures show that the remains occur mainly from the level of -200 to -560 cm. On the other hand, the numbers of talus and calcaneus are counted in each level, and are shown in Figs. 5 and 6. These figures also show that these bones mostly occur from the levels of -200 to -560 cm. Various species of mammals are obtained from the level of -380 to -560 cm, while only larger mammals, including deer, wild boar, monkey and bear occur mainly from the levels of -200 to -380 cm. Few mammalian remains, represented by deer, occur from the levels of 0 to -200 cm. These stratigraphic differences in the occurrences of the mammalian remains result in recognizing the following three levels: 0~-200 cm with few mammalian remains, -200~-380 cm with numerous large mammalian remains, and -380~-560 cm with diversified mammalian remains.

Discussion

Most of the mammalian remains are considered to have been broken and burned artificially, and they were found in association with stone implements and fragments of pottery. It is obvious that mammals were hunted by Jomon people during the early Holocene for food, materials for tools and for other purposes. Thus, the studies on the mammalian remains provide much information on human activities during the early Holocene, especially information on the relationships between humans and mammals.

In the mammalian remains, *C. nippon* is most abundant, which is followed by *M. fuscata*. MNI of *C. nippon* attains to 65 individuals which exceed that of *M. fuscata* (22 individuals). The remains of *C. nippon* occur from almost all the levels (Table 1). This indicates that the main game animal was deer during the early Holocene.

The sediments of this site with thickness about 5.6 m can be divided into the three levels on the basis of the stratigraphic distribution of the mammalian remains (Fig. 3, 4). Although few mammalian remains were obtained from the levels of 0~-200 cm, Nishizawa (1982) reported that seven individuals of humans had been buried in these levels. This suggests that the notch of the site was scarcely used as a dwelling but was mainly used as a grave in the stage of 0~-200 cm.

In the stage of -200~-560 cm, humans mainly used the notch as life spaces, including those for dwelling,

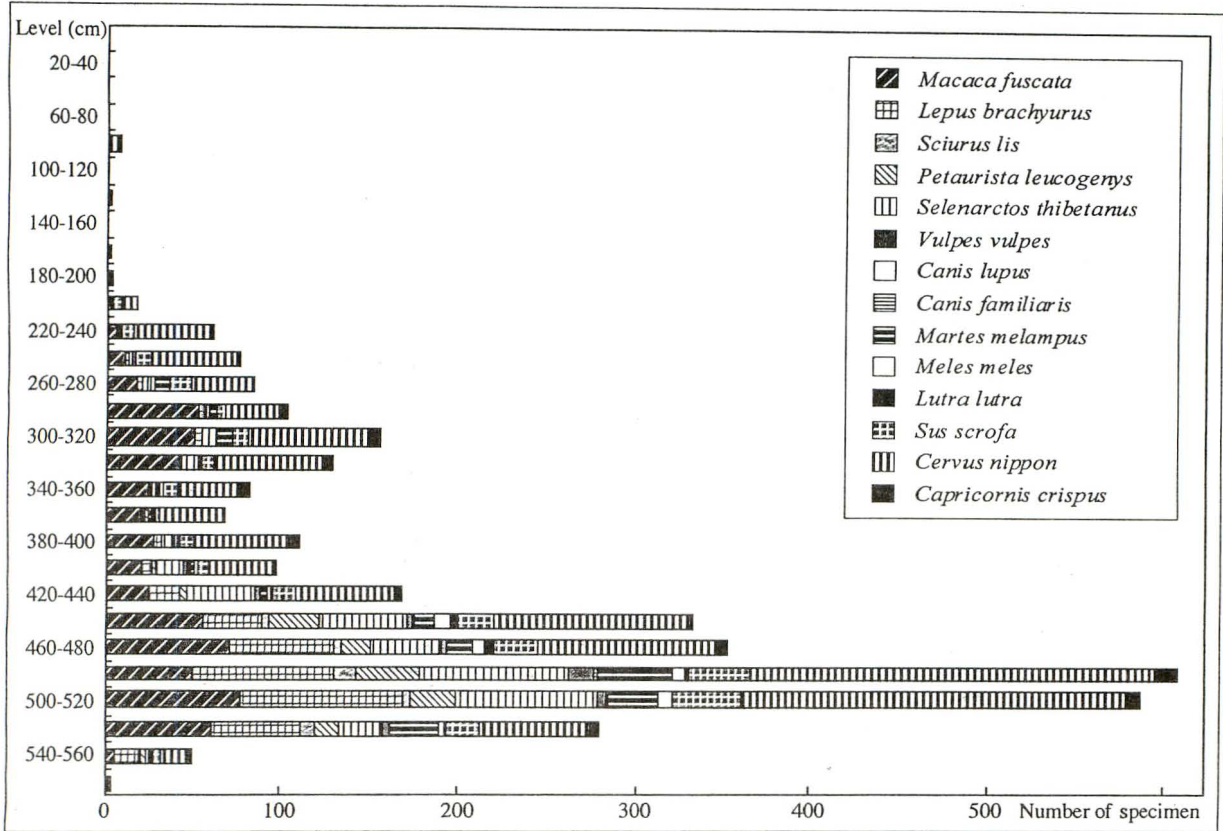


Fig. 3 Specimen numbers of the mammalian remains from grids I to IV showing the stratigraphic change of the relative abundance in each species. The remains examined in this study are exclusively counted.

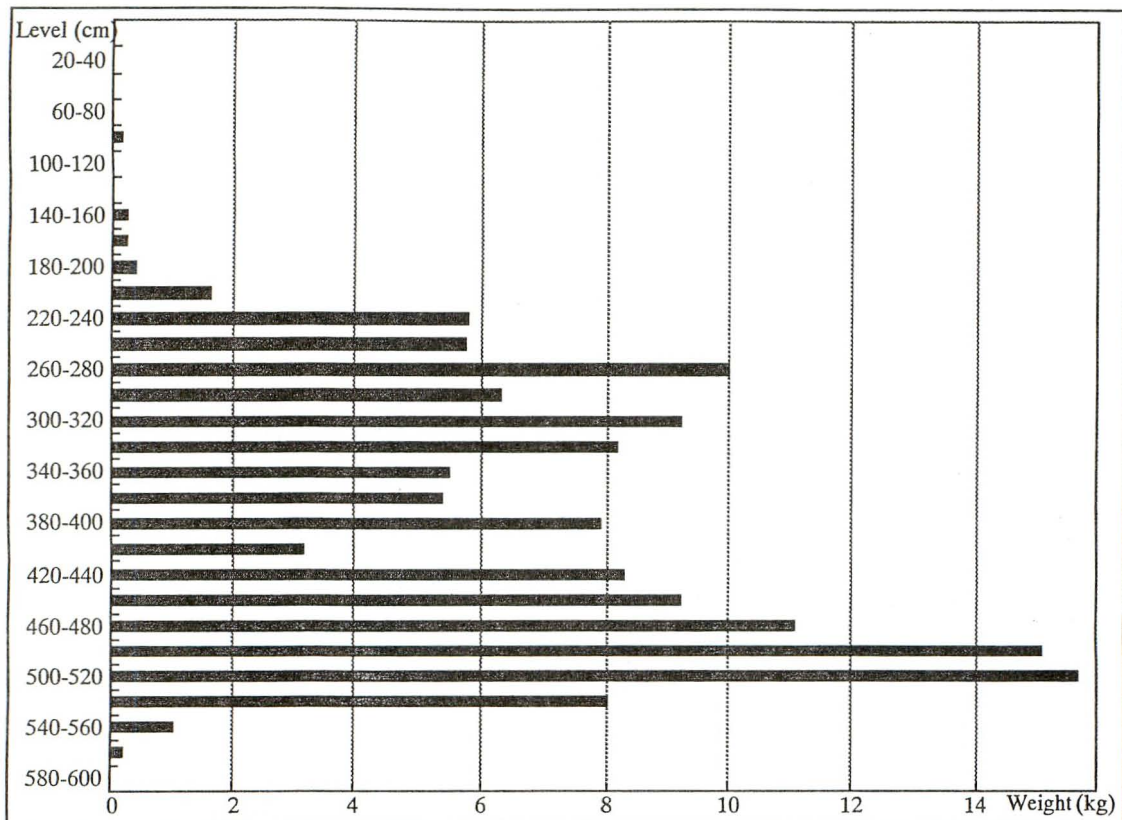


Fig. 4 Weight of the mammalian remains from grids I to IV in each stratigraphic level. The total weight is 138 kg.

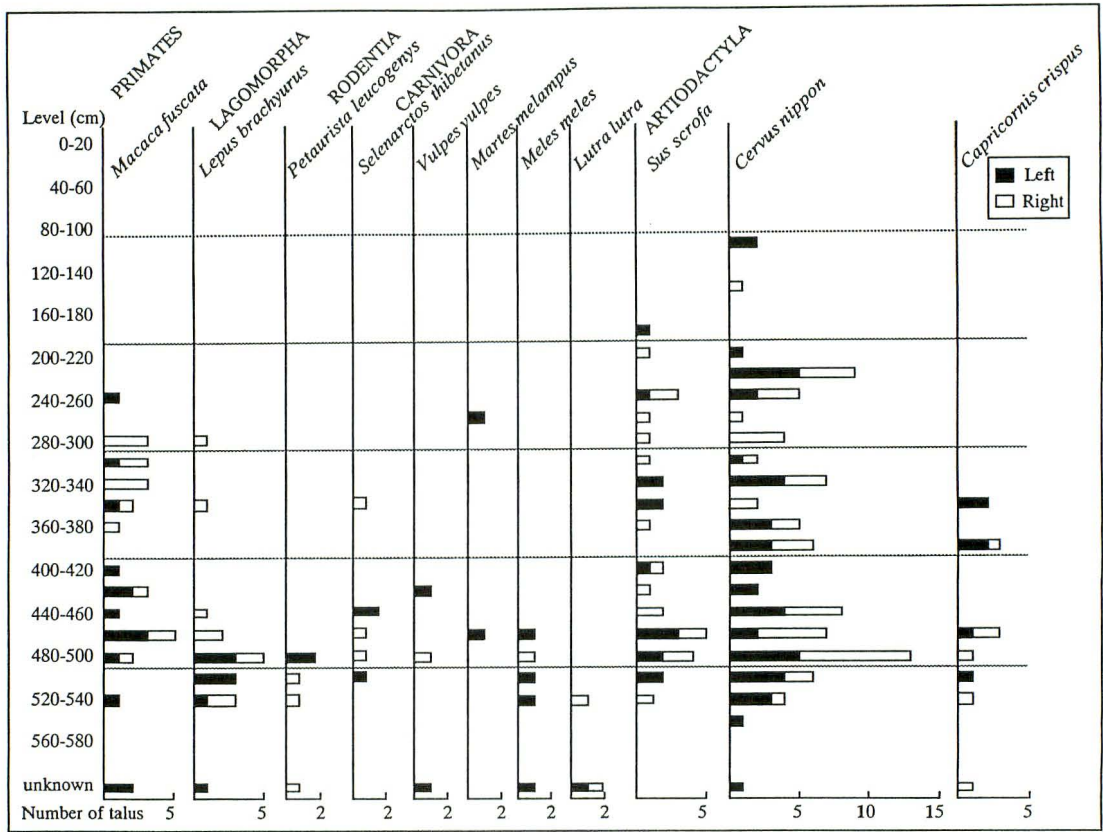


Fig. 5 Number of mammalian talus from grids I to IV showing the stratigraphic change of its abundance.

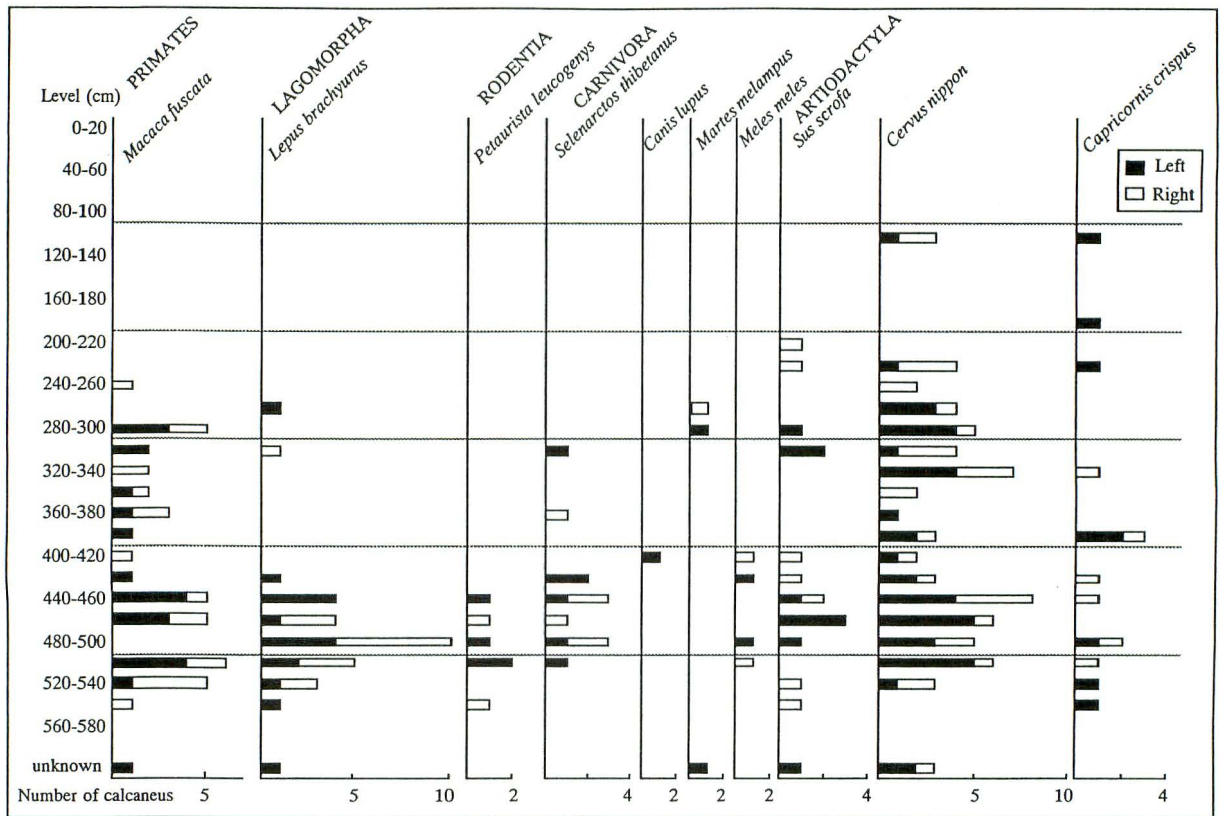


Fig. 6 Number of mammalian calcaneus from grids I to IV showing the stratigraphic change of its abundance.

eating, cooking, and garbage dump. The main game animals were the larger mammals such as deer, wild boar and monkey in the stage of -200~-380 cm, while diversified mammals were hunted in the stage of -380~-560 cm.

5. Conclusion

A total of 5133 mammalian remains stored in the Kita-aiki Archaeological Museum are examined in the present study. They are assigned to the following 16 species belonging to five orders: *Macaca fuscata*, *Lepus brachyurus*, *Sciurus lis*, *Petaurista leucogenys*, *Selenarctos thibetanus*, *Vulpes vulpes*, *Nyctereutes procyonoides*, *Canis lupus*, *Canis familiaris*, *Martes melampus*, *Mustela itatsi*, *Meles meles*, *Lutra lutra*, *Sus scrofa*, *Cervus nippon* and *Capricornis crispus*. Among them, *C. nippon* is most abundant. This indicates that this species was the main game animal in this area during the Incipient stage and the Earliest stage of the Jomon Period. The stratigraphic distribution of the mammalian remains also suggest the temporal changes of hunting activities and human utilization of this rock shelter site at that time. The sediments in grids I to IV can be divided into the following three stratigraphic levels: 0~-200 cm with few mammalian remains, indicating that humans used the notch as a grave, -200~-380 cm with numerous large mammalian remains indicating active hunting of large mammals, and -380~-560 cm, with diversified mammals indicating active hunting of various kinds of mammals.

It is necessary for us to continue the studies of the numerous remains of this site from the viewpoints of various scientific fields. For example, Kawamura (1981) summarized the temporal size change of mammals during the Quaternary. Kawamura (1991, 1994) also showed the mammalian faunal change from the Late Pleistocene to Holocene in Japan. On the basis of the data obtained from the site, we intend to discuss the detailed size and faunal changes in separate papers, which will be published in the near future. The present paper only shows the significance of the mammalian remains from the site for future interdisciplinary researches, and we intend obtaining more adequate understandings of the remains by the researches.

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Appendix Numbers of each skeletal element of each mammalian species showing the stratigraphic distribution of each element in the Tochibara rock shelter site.
All the teeth on upper and lower jaws are counted, as if they are detached from the jaws.

Appendix (No. 1)		I-IV																				V	Grid and level unknown	total										
Species and element	Level(cm)→	0~	100~	120~	140~	160~	180~	200~	220~	240~	260~	280~	300~	320~	340~	360~	380~	400~	420~	440~	460~	480~	500~	520~	540~	560~	580~	unknown						
Order Primates																																		
<i>Macaca fuscata</i>																																		
Fragment of skull	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	2	1	1	1	2	3	4	2	-	-	-	-	1	-	2	21	
Maxilla	L	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	2	-	2	1	-	-	-	-	1	-	-	8		
	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	3	3	-	-	-	-	-	-	-	8		
I ¹	L	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	4	
	R	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	3	
I ²	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	2	
	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
Upper C	L	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	-	-	4
	R	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	1	-	1	-	1	-	-	-	-	-	-	-	4	
P ¹	L	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	1	1	-	-	-	-	-	-	-	-	1	-	-	5	
	R	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	1	2	-	1	-	-	-	-	-	-	-	-	-	6	
P ²	L	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	1	1	-	-	-	-	-	-	-	-	1	-	-	5	
	R	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	1	2	1	3	-	-	-	-	-	-	-	-	1	10	
M ¹	L	-	-	-	-	-	-	-	-	-	-	-	-	1	-	2	-	-	-	1	1	-	2	2	-	-	-	-	-	-	-	-	7	
	R	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	1	-	-	-	3	3	1	-	-	-	-	-	-	-	10	
M ²	L	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	1	1	-	1	-	-	-	-	-	-	-	-	-	5	
	R	-	-	-	-	-	-	-	-	-	-	-	-	2	-	1	-	-	1	-	1	3	4	-	-	-	-	-	-	-	-	-	12	
M ³	L	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	1	2	-	-	-	-	-	-	-	-	-	1	7	
	R	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	2	1	-	-	-	-	-	-	-	-	4	
Upper P	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	
Upper dP	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	2	
Upper dM	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	2		
Mandible	L	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	
	R	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	3	-	-	1	1	-	-	1	1	2	7		
I ₁	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-	-	1	4		
	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	1	-	-	-	-	-	-	1	4		
I ₂	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	
	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	
Lower C	L	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	
	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	
P ₁	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	2	-	-	-	-	-	-	1	-	-	-	4	
	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	1	-	-	-	3	
P ₂	L	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	2	-	1	-	-	-	-	-	-	1	6	
	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	1	-	-	-	-	-	-	-	1	-	-	1	5	
M ₁	L	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	3	-	1	-	-	-	1	-	-	2	9	
	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	1	-	4		
M ₂	L	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	2	-	4	1	1	-	-	1	1	-	1	1	12		
	R	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	1	-	-	3	-	1	-	1	-	-	-	-	-	-	-	7		
M ₃	L	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	1	-	1	-	1	-	1	1	-	-	6		
	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-	-	-	-	-	-	-	-	3		
Lower dl	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1		
	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1		
Lower dC	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	2		
	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1		
Lower dP	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1		
	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	2		
Lower dM	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1		
	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1		
Atras	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	1	2	2	-	-	-	-	-	-	1	8		
Axis	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	1	1	-	-	1	1	1	-	-	-	-	-	-	-	7		
Cervical vertebra	-	-	-	-	-	-	-	-	1	-	2	1	-	-	-	-	1	1	-	-	2	-	1	1	-	-	-	-	-	-	-	11		
Thoracic vertebra	-	-	-	-	-	-	-	-	1	3	1	-	-	1	-	-	-	1	-	1	-	2	-	2	-	-	-	-	-	-	-	11		
Lumbar vertebra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	2	-	-	-	-	-	-	-	4		

Appendix (No. 8)

Species and element	Grid→		I-IV																		V	Grid and level unknown	total												
	Level(cm)→		0~	100~	120~	140~	160~	180~	200~	220~	240~	260~	280~	300~	320~	340~	360~	380~	400~	420~	440~			460~	480~	500~	520~	540~	560~	580~	unknown				
Radius	L																							1	2							2		6	
	R																								2	3	1								8
Ulna	L																								3	2	1								13
	R																							1	2	1									10
Metacarpal																																			1
Coxal bone	L																																		4
	R										2														1	2									6
Femur	L																								1										2
	R																								1										3
Tibia	L																								1										1
	R																									1									1
Fibula	L																								1										1
	R																								1		1								3
Calcaneus	L																																		2
	R																																		1
Talus	L																																		2
Metatarsal																																			1
Phalanges																																			1
<i>Mustela itatsi</i>																																			3
Mandible	L																																		1
P ₁	L																																		1
P ₂	L																																		1
M ₁	L																																		1
M ₂	L																																		1
<i>Meles meles</i>																																			
Fragment of skull																																			1
Temporal bone	L																																		1
	R																																		1
Maxilla	L																																		1
	R																																		2
i ²	R																																		1
i ³	R																																		1
p ²	L																																		1
	R																																		1
p ³	L																																		1
	R																																		1
M ¹	L																																		1
	R																																		1
Mandible	L																																		3
	R																																		2
M ₁	L																																		1
	R																																		1
M ₂	L																																		1
	R																																		1
Scapula	L																																		2
Humerus	R																																		2
Radius	L																																		5
	R																																		2
Ulna	L																																		1
	R																																		2
Coxal bone	L																																		8
	R																																		2
Femur	L																																		1
	R																																		2
Tibia	L																																		1
	R																																		4
Talus	L																																		1
	R																																		1

Appendix (No. 11)

Species and element	Grid→ Level(cm)→	I-IV																	V	Grid and level unknown	total										
		0~	100~	120~	140~	160~	180~	200~	220~	240~	260~	280~	300~	320~	340~	360~	380~	400~				420~	440~	460~	480~	500~	520~	540~	560~	580~	unknown
I ₁	L	-	-	-	-	-	1	-	1	-	-	-	-	1	-	-	-	-	1	-	1	2	-	-	-	-	-	1	3	2	13
	R	-	-	-	-	-	-	1	1	-	1	1	3	4	2	1	-	-	1	1	-	3	-	2	-	-	-	1	3	3	26
I ₂	L	-	-	-	-	-	-	1	-	-	1	1	3	-	1	-	1	2	1	2	1	-	-	-	-	-	-	-	2	2	18
	R	-	-	-	-	-	-	1	1	-	1	-	-	-	1	-	-	1	-	-	2	3	-	-	-	-	-	1	2	-	13
I ₃	L	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	2	1	-	-	-	-	-	-	-	-	1	8
	R	-	-	-	-	-	-	-	-	1	-	-	1	1	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	5
Lower C	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2
	R	-	-	-	-	-	1	1	1	1	-	1	1	1	-	-	1	-	2	2	-	1	3	1	-	-	-	5	5	1	28
P ₂	L	-	-	-	-	-	-	1	1	1	1	1	1	1	1	1	1	2	-	-	3	-	2	6	2	-	-	8	2	3	40
	R	-	-	-	-	-	-	1	1	1	1	1	2	1	2	1	-	2	1	5	-	4	1	1	1	-	-	-	6	4	34
P ₃	L	-	-	-	-	-	1	1	1	1	2	1	1	1	1	1	2	-	4	1	-	5	6	1	1	-	-	4	4	3	39
	R	-	-	-	-	-	-	1	1	1	2	1	1	3	2	1	1	1	-	4	1	4	1	4	1	1	1	-	3	7	40
P ₄	L	-	-	-	-	-	1	1	-	1	3	2	1	1	1	-	4	-	3	2	1	3	3	3	8	2	2	5	6	4	64
	R	-	-	-	-	-	1	1	-	1	3	2	1	1	1	-	4	-	3	2	1	4	1	4	1	1	-	4	4	1	34
M ₁	L	-	-	-	-	-	-	-	1	1	3	-	2	1	-	1	-	1	4	1	2	1	-	1	-	-	-	2	4	6	31
	R	-	-	-	-	-	-	-	1	1	3	-	2	1	-	1	-	1	4	1	2	1	-	1	-	-	-	2	4	6	31
M ₂	L	-	-	-	-	-	1	1	1	4	-	2	1	3	2	3	-	5	3	3	3	8	2	2	-	-	-	5	6	4	64
	R	-	-	-	-	-	-	1	3	3	3	2	1	5	-	1	-	3	4	2	9	5	-	-	-	-	-	7	12	6	65
M ₃	L	-	-	-	-	-	1	-	2	-	4	1	-	1	-	-	2	1	3	2	5	2	8	1	-	-	-	4	6	5	48
	R	-	-	-	-	-	-	2	-	1	-	3	1	-	1	-	1	-	2	3	2	4	-	1	-	-	-	5	6	7	39
di ₁	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
dP ₂	L	-	-	-	-	1	-	-	1	-	-	-	2	1	-	-	-	-	1	1	1	-	-	-	-	-	-	1	1	2	12
	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	1	1	-	1	-	-	-	-	2	-	-	6
dP ₃	L	-	-	-	-	1	-	-	1	-	1	-	4	1	-	-	-	1	1	1	-	2	-	-	-	-	-	1	3	-	17
	R	-	-	-	-	-	-	-	1	-	1	-	1	-	-	1	-	-	1	-	1	-	1	-	-	-	-	2	1	-	9
dP ₄	L	-	-	-	-	1	-	-	1	-	-	1	2	-	-	1	1	2	1	-	-	2	1	-	-	-	-	3	4	-	20
	R	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	2	-	2	3	-	-	-	-	-	4	-	-	13
dM ₁	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
dM ₂	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1
Lower I	-	-	-	-	-	-	-	-	-	-	1	-	-	-	4	-	-	-	-	1	-	2	-	-	-	-	-	2	3	2	15
Lower M	-	-	-	-	-	-	-	-	-	-	-	2	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	-	8
Upper or Lower																															
I	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1
P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
M	-	-	-	-	-	-	-	-	-	-	-	1	2	-	-	-	-	-	-	-	-	1	-	-	-	-	-	3	1	-	9
Tooth	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	5	1	2	-	-	-	-	6	13	29
Deciduous tooth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	5	9
Atlas	-	-	-	-	-	1	-	-	2	2	-	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	10
Axis	-	-	-	-	-	-	1	1	-	1	1	1	1	-	-	-	-	-	1	1	2	-	-	-	-	-	-	-	-	-	10
Cervical vertebra	-	-	-	-	-	-	-	-	-	-	1	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	4
Thoracic vertebra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7
Lumbar vertebra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	4
Sacral bone	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Caudal vertebra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
Sternum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Rib	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	1	-	-	1	4	-	-	-	1	-	1	10	
Scapula	L	-	-	-	-	-	-	2	-	-	-	1	1	-	-	-	-	1	2	-	-	-	1	-	-	-	1	-	-	9	
	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	1	-	-	1	2	-	7	
Humerus	L	-	-	-	-	-	-	1	-	-	-	1	-	-	3	-	1	-	1	4	5	-	-	-	-	-	-	-	-	16	
	R	-	-	-	-	-	-	2	-	-	-	1	1	1	-	-	2	1	4	3	-	-	-	-	-	-	1	-	3	19	
Radius	L	-	-	-	-	-	-	1	-	1	-	1	1	1	3	-	-	-	1	4	6	2	-	-	-	-	-	-	2	23	
	R	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	1	-	4	8	1	1	-	-	-	1	-	-	18	
Ulna	L	-	-	-	-	-	1	-	-	-	1	-	-	2	-	-	-	-	1	2	-	1	2	-	1	-	-	-	4	13	
	R	-	-	-	-	-	-	-	-	-	1	-	1	2	-	-	-	1	2	2	4	3	-	1	-	1	1	-	5	23	
Carpal bone	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	1	8	8	1	-	-	-	-	1	3	26	
Metacarpal	-	-	-	-	-	-	1	1	-	-	1	-	1	2	-	-	-	-	4	2	12	9	2	-	-	-	3	-	10	48	

