

MAMMAL REMAINS FROM THE GORBATKA WALLED TOWN

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This article focuses on the analysis of mammal bone remains found during archaeological excavations at the ancient walled town site of Gorbatka located in the valley of river Ilistaya within the limits of the namesake village in Primorski Krai, Russia. The site has been known as associated with an administrative center of the Bohai state, and dated to the end of 8th — beginning of 10th century. Cultural layers yielded dwellings, outbuildings, and remains of productive economic activity divided between 5 building horizons. Analysis of mammal bones permitted to separate 18 species of domesticated and wild animals which ancient inhabitants of the site must have been used to a greater or lesser extent. Each identified species has its archaeological value only within and in connection with specific contexts, building horizons, layers, and other objects. In each case the goal was not limited to an assessment of total number of bone finds. Researchers quantified the minimal count of specimens as well as sizes and ages of the animals when possible. The authors paid spe-

cial attention to morphology of the mammals and to preservation of the bones.

The overwhelming majority of the bone remains are attributed to domesticated animals. Those are present in all of the building horizons at the Gorbatka walled town site. This research paper discusses the share of each animal species in the diet and economy of the Bohai population. By total amount of bones and number of species identified at least in minimal presence, pig and dog prevailed. Pigs and dogs were bred at all stages of the site active existence. Dogs were used both as food and as hunting accessory. Cattle and horses served as labor in the first place, their dietary value was less important. The lesser quantity of wild animal bones attests to the lesser importance of hunting for food providing. The hunting though provided fur and horn that played a significant role in regional trade.

Keywords: Bohai state (698—926), Russian Primorye, mammals remains, domestic and wild animals.

INTRODUCTION

The ancient walled town site of Gorbatka coincides with the modern same-name village in Mikhailovski district, Primorski Krai. The site is located on the right bank of river Ilistaya, formerly Lefu, meaning “the bear” in Manchu. Although the river valley lost big chunks of its forests during last 100—150 years, still today the taiga zone begins as close as 4—5 km from the site. In the Bohai times the gap was obviously much smaller.

The earliest peopling of this site is attributed to Krounovskaya culture, early Iron Age. The next stage of peopling falls into the Bohai time, presumably since

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the end of 8th till first half of 10th century. The majority of cultural deposits are dated from that time. The third stage is attributed to the arrival of Korean immigrants to Gorbatka and its environs at the turn of 20th century. In 1997, 2000—2001, and 2003—2005 E.I. Gel'man and her excavation team from Institute of History, Archaeology and Ethnology of the Peoples of the Far East, FEB RAS, conducted a comprehensive archaeological research on the site of Gorbatka (Gel'man 1997, 2000, 2001, 2003, 2004, 2005). The excavated portion inside the town's walled area contained a variety of Bohai cultural artifacts. As work progressed, it became clear that modern buildings tarnished the terrain adjacent to road, and the rest of the site area by Korean *fanzas*. Krounovskaya culture materials were gathered from the farmers' lots in most cases. Nowadays modern buildings positioned precisely alongside the central street occupy the site area. In the Bohai time there was a road in the place of the street.

The area of the site encircled by the wall measures nearly 10 ha. The length of the wall is 1250 m. There are 4 gates without dedicated defense structures about them. Today, the gates are seen as mere gaps in the wall. In front of the northeastern gate there is a prominently raised platform designed as a continuation of the gate. Excavations on the platform yielded remains of a columned building. In the northeast, the platform and the town site itself are approaching an old river cut-off, and the latter becomes connected with the main river flow during floods. It seems possible that in the Bohai time the cut-off was actually part of the moat surrounding the town site.

Cultural layer on the site reaches more than 2 m in depth. Bohai deposits date back to the end of the 8th — beginning of 10th century. Years of excavations yielded five building horizons containing — at different levels, traceable — remains of 12 dwellings, one well, one cellar, and several storage pits (Goroda 2018: 103—108). Excavations have attested to the fact that the density of population kept always being very high although changing from lowest to higher horizons. Dwelling designs change from the lowest (1) to uppermost (5) horizon. In the bottom layer the dwellings are designed as randomly aligned semi-subterranean pit houses with hearth in the backside. Abandoned and destroyed, they gradually got filled up with garbage waste, including bones, from later households. Therefore, only the lowest part of subterranean dwelling pit fillings contained the waste from their actual owners. All of the rest building horizons featured very shallow dwelling pits with a heating system called *kàng* (炕). Mammal remains occur in all five horizons. Previously the Gorbatka bone collection has already been studied, and in part published by other scholars (Panasenko, Gel'man 2008, 2009). This article presents the full-fledged results of the research on the entirety of bone remains obtained from the excavations in 1997—2005.

Credit for the bulk of identification work goes to the Institute of History, Archaeology and Ethnology of the Peoples of the Far East in Vladivostok city. Since modern comparative specimens were not always available, we took reference data from several mammal bone atlases to complement identification shortcomings. We identified each fragment to anatomical element and to taxon when possible. Besides state of epiphyseal fusion of long bones, approximate age, sex and presence of pathology or modification (either by humans or by animals) were also recorded. We measured our samples when possible.

Mammal remains excavated from Gorbatka walled town include at least 18 species. Some unknown species can be identified by comparison with the

Table 1

Quantitative summary of the mammal remains from Gorbatka site

a) NISP (exclude Rodentia fam. and Erinaceidae gen.)

| Animal | Horizon | I | I / II | II | III | IV | V | ? | Total |
|----------------------------------|---------|-------------|-----------|-------------|-------------|------------|-------------|------------|-------------|
| Leporidae gen. | | 7 (2.3) | 5 (22.7) | 23 (5.2) | 6 (1.7) | 2 (2.5) | 6 (2.0) | 1 (1.9) | 50 (3.2) |
| <i>Ursus arctos</i> | | | | 1 (0.2) | | | 2 (0.7) | | 3 (0.2) |
| <i>Ursus thibetanus</i> | | | | | | | | 1 (1.9) | 1 (0.1) |
| <i>Nyctereutes procyonoides</i> | | | | | 1 (0.3) | 1 (1.2) | 3 (1.0) | | 5 (0.3) |
| <i>Vulpes vulpes</i> | | 3 (1.0) | | 3 (0.7) | 3 (0.8) | | 5 (1.7) | 1 (1.9) | 15 (1.0) |
| <i>Canis familiaris</i> | | 86 (28.4) | 6 (27.3) | 131 (29.8) | 112 (31.0) | 21 (25.9) | 77 (26.0) | 14 (25.9) | 447 (28.8) |
| <i>Mustela sibirica</i> | | 3 (1.0) | 3 (13.6) | 3 (0.7) | 2 (0.6) | 1 (1.2) | 6 (2.0) | | 18 (1.2) |
| <i>Meles meles</i> | | 4 (1.3) | | 3 (0.7) | 4 (1.1) | | 3 (1.0) | | 14 (0.9) |
| <i>Lutra lutra</i> | | 3 (1.0) | | | | | | | 3 (0.2) |
| <i>Prionailurus bengalensis?</i> | | | | | 1 (0.3) | | | | 1 (0.1) |
| <i>Equus caballus</i> | | 38 (12.5) | 3 (13.6) | 32 (7.3) | 10 (2.8) | 6 (7.4) | 22 (7.4) | | 111 (7.1) |
| <i>Sus scrofa domestica</i> | | 121 (39.9) | 3 (13.6) | 172 (39.2) | 164 (45.4) | 35 (43.2) | 117 (39.5) | 26 (48.1) | 638 (41.1) |
| <i>Capreolus capreolus</i> | | 10 (3.3) | 1 (4.5) | 27 (6.2) | 30 (8.3) | 8 (9.9) | 26 (8.8) | 4 (7.4) | 106 (6.8) |
| <i>Rangifer tarandus</i> | | | | 1 (0.2) | | | | | 1 (0.1) |
| <i>Bos taurus</i> | | 26 (8.6) | 1 (4.5) | 42 (9.6) | 27 (7.5) | 7 (8.6) | 29 (9.8) | 7 (13.0) | 139 (8.9) |
| Caprinae gen.? | | | | 1 (0.2) | 1 (0.3) | | | | 2 (0.1) |
| Combined | | 301 | 22 | 439 | 361 | 81 | 296 | 54 | 1554 |

Percentage is shown in parentheses.

Table 1 (continued)

b) MNI (exclude Rodentia fam. and Erinaceidae gen.)

| Horizon | I | I / II | II | III | IV | V | ? | total |
|----------------------------------|-----------|-----------|------------|------------|-----------|-----------|-----------|------------|
| Animal | | | | | | | | |
| Leporidae gen. | 1 (4.2) | 2 (25.0) | 2 (6.3) | 1 (3.2) | 1 (7.7) | 1 (4.0) | 1 (12.5) | 9 (6.4) |
| <i>Ursus arctos</i> | | | 1 (3.1) | | | 1 (4.0) | | 2 (1.4) |
| <i>Ursus thibetanus</i> | | | | | | | 1 (12.5) | 1 (0.7) |
| <i>Nyctereutes procyonoides</i> | | | | 1 (3.2) | 1 (7.7) | 3 (12.0) | | 5 (3.6) |
| <i>Vulpes vulpes</i> | 1 (4.2) | | 1 (3.1) | 1 (3.2) | | 1 (4.0) | 1 (12.5) | 5 (3.6) |
| <i>Canis familiaris</i> | 7 (29.2) | 1 (12.5) | 10 (31.3) | 11 (35.5) | 4 (30.8) | 6 (24.0) | 1 (12.5) | 40 (28.6) |
| <i>Mustela sibirica</i> | 1 (4.2) | 1 (12.5) | 3 (9.4) | 1 (3.2) | 1 (7.7) | 2 (8.0) | | 9 (6.4) |
| <i>Meles meles</i> | 1 (4.2) | | 1 (3.1) | 1 (3.2) | | 1 (4.0) | | 4 (2.9) |
| <i>Lutra lutra</i> | 1 (4.2) | | | | | | | 1 (0.7) |
| <i>Prionailurus bengalensis?</i> | | | | 1 (3.2) | | | | 1 (0.7) |
| <i>Equus caballus</i> | 2 (8.3) | 1 (12.5) | 1 (3.1) | 2 (6.5) | 1 (7.7) | 1 (4.0) | | 8 (5.7) |
| <i>Sus scrofa domestica</i> | 7 (29.2) | 1 (12.5) | 8 (25.0) | 7 (22.6) | 3 (23.1) | 5 (20.0) | 2 (25.0) | 33 (23.6) |
| <i>Capreolus capreolus</i> | 1 (4.2) | 1 (12.5) | 2 (6.3) | 3 (9.7) | 1 (7.7) | 3 (12.0) | 1 (12.5) | 12 (8.6) |
| <i>Rangifer tarandus</i> | | | 1 (3.1) | | | | | 1 (0.7) |
| <i>Bos taurus</i> | 1 (4.2) | 1 (12.5) | 1 (3.1) | 1 (3.2) | 1 (7.7) | 1 (4.0) | 1 (12.5) | 7 (5.0) |
| Caprinae gen.? | | | 1 (3.1) | 1 (3.2) | | | | 2 (1.4) |
| Combined | 23 | 8 | 32 | 31 | 13 | 25 | 8 | 140 |

Percentage is shown in parentheses.

skeletal specimens. Table 1 shows the number of identified specimens (NISP), the minimum number of individuals (MNI), and proportion of identified species for each horizon.¹

This report overviews each species, and assesses the use of mammals at the Gorbatka walled town site. Mouse (*Rodentia fam.*) and hedgehog (*Erinaceidae gen.*) are excluded from this research due to the low possibility of intentional use by the people of the time.

1. IDENTIFIED MAMMAL TAXA AND THEIR USAGE

(1) Rabbit (*Leporidae gen.*) (Plate 1: 1–8)²

Fifty fragments belong to rabbits and the MNI count is nine individuals. Some metatarsal bones (horizon II) of a single body and radius and ulna (the pit of horizon V: E-1 area) of a single body occur in each of the assemblages. These finds probably indicate that site inhabitants used to throw away rabbit remains after disjoining them into body parts. Some burnt bones occurred either.

Manchurian hare (*Lepus mandschuricus*) and Mountain hare (*Lepus timidus*) inhabit the Gorbatka walled town area according to the illustrated Encyclopedia of Animals “Животный мир Уссурийской тайги” (Zhivotnyy mir 2004). However, no referential skeletal collection was available at the time of research.

Presumably, rabbits were hunted primarily for their fine fur; the meat must have been a bonus, not the cause.

(2) Brown bear (*Ursus arctos*) (Plate 1: 9–11)

Third phalanx of brown bear occurred in the cover soil of Dwelling No. 4. This phalanx was perforated (Plate 1: 11). Perforated phalanges of bears (*Ursidae gen.*) are also common in other cultures. As other brown bear remains did, a part of a skull (parietal bone and occipital bone) and right ulna occurred in the cover soil of Dwelling No. 8.

Judging from the few bones found, it is difficult to conclude if brown bear's meat was part of human diet routinely at the time. However, the perforated third phalanx may indicate a possibility that brown bear could be an animal highly valued in spiritual symbolism, as we observe in the Okhotsk culture (Uchiyama 2005). If this kind of attitude did exist in the Bohai culture, which was not a hunting and gathering society, it is most interesting to point out what high importance the culture placed on wild animals and the practice of hunting at that time.

(3) Black bear (*Ursus thibetanus*) (Plate 1: 12)

First phalanx of a bear lay in an ash accumulation (Г'Д'-11 area: unknown horizon). This phalanx has no trace of perforated hole. Judging by the size, it is most likely to be black bear's.

(4) Raccoon dog (*Nyctereutes procyonoides*) (Plate 8: 9, 10)

We have identified five fragments as belonging to raccoon dog. However, most of the samples were head parts, so the MNI count is four animals. Only adult raccoon dogs occurred, including a burnt mandible. While their meat and fur skins are likely to have been used as food and materials, they did not seem to be consumed very often judging by the few fragments found.

¹ See Table 7 on page 22 for the legend to all tables.

² See Table 8 on page 23 for the legend to all plates.

(5) Fox (*Vulpes vulpes*) (Plate 8: 11, 12)

We have identified fifteen samples as foxes. This number was three times that of raccoon dogs, but the unearthed body fragments include different parts of a whole body, so the MNI count is no more than five individuals. Foxes are likely to have been used mainly for their fine furs.

(6) Dog (*Canis familiaris*) (Plate 2; 3)

We have identified 447 fragments as dogs. This constitutes 28.8% of the identified assemblage by the NISP count. This number is the second largest after the pigs. By the MNI count (forty individuals: 28.6%), it was the largest. Dog bones occur in all of the horizons. This shows that dogs were common at Gorbatka site throughout the Bohai period.

Mori (Mori 1930) who conducted a research on modern dogs classified the dogs as infants, juveniles and adults according to the state of eruption of their teeth. Thus, infants are dogs less than 3 months of age with only the milk teeth present, juveniles are less than 7 months of age with milk teeth being replaced by permanent teeth, and adults are dogs with exclusively permanent teeth. Table 2-a shows the age proportion of dogs based on the growth of the maxillas and mandibles. According to the table, adult dogs account for less than 40%, while infants and juveniles are dominant. Closer observation of adult dogs reveals that there are only a small number with occlusal wear, and only 2 out of 5 adult dogs from horizon I have shown excessive occlusal wear. Therefore, it is likely that the majority of adult dogs lived only a short while after entering the state of onset of permanent teeth.

Since birth until death, dog can play various roles. If a dog is intended for hunting purposes, a certain degree of training and experience is required; otherwise, even an adult dog is useless, not to mention infants and juveniles. There is every possibility that some dogs might have served as hunting dogs, because the hunting in the Bohai period was indeed practiced, even though infrequently. Judging from the age proportion, however, very few probably might have served as hunting dogs when alive.

Apart from the lopsided age proportion, we have found no dog body parts that would make up the whole specimen, and most remains are damaged, suggesting that dogs must have been consumed after their death. Such is the case with old dogs who might have served as hunting dogs or watchdogs when they were alive. It is evident from the cut marks (Plate 3: 1—4) that owners used to disjoint the dogs after the latter died. When domestic animals are consumed for food, it is common that they are killed while still young. Despite the not so good quality, the dog fur skins are likely to have been in use.

Among the dog remains, noteworthy are metacarpal bones and metatarsal bones from an assemblage found in the cover soil of Dwelling No. 5 (Plate 3: 5, 6). They suggest that ancient site inhabitants used to throw away skinned and disjointed limb bones that had too little meat on them.

One peculiar case where many bones from a single body occurred in a single assemblage drew our special attention (Plate 3: 7—15). The specimen was an infant or a juvenile 3 or 4 months old, with head and limb parts detached from the most of trunk parts (vertebrae and ribs). The bones might have been disturbed after burial, but if the trunk parts were removed intentionally, the reason could be beyond practical, possibly some sort of symbolic rite.

Table 2

Age proportion of *Canis familiaris* and *Sus scrofa domesticus* from Gorbatka sitea) *Canis familiaris*

| Horizon Age | I | I / II | II | III | IV | V | ? | Total |
|----------------|----------|-----------|----------|----------|----------|----------|---|-----------|
| i | 1 (14.3) | 1 (100.0) | 5 (50.0) | 3 (27.3) | 2 (50.0) | 3 (50.0) | | 15 (38.5) |
| i / j | | | | 1 (9.1) | | | | 1 (2.6) |
| j | 1 (14.3) | | 1 (10.0) | 2 (18.2) | 1 (25.0) | | | 5 (12.8) |
| j / ad | | | 2 (20.0) | 1 (9.1) | | | | 3 (7.7) |
| ad | 5 (71.4) | | 2 (20.0) | 4 (36.4) | 1 (25.0) | 3 (50.0) | | 15 (38.5) |
| | 7 | 1 | 10 | 11 | 4 | 6 | 0 | 39 |

b) *Sus scrofa domesticus*

| Horizon Age | I | I / II | II | III | IV | V | ? | Total |
|----------------|----------|--------|----------|----------|----------|----------|-----------|-----------|
| i | 3 (42.9) | | 3 (37.5) | 4 (57.1) | 1 (33.3) | 1 (20.0) | 2 (100.0) | 14 (43.8) |
| i / j | | | 1 (12.5) | | 1 (33.3) | | | 2 (6.3) |
| j | 2 (28.6) | | 2 (25.0) | 2 (28.6) | | 2 (40.0) | | 8 (25.0) |
| j / ad | | | 1 (12.5) | 1 (14.3) | | | | 2 (6.3) |
| ad | 2 (28.6) | | 1 (12.5) | | 1 (33.3) | 2 (40.0) | | 6 (18.8) |
| Sum | 7 | 0 | 8 | 7 | 3 | 5 | 2 | 32 |

Percentage is shown in parentheses.

Mammal remains also bear many gnawing marks left by dogs. It seems feasible to infer that people gave leftovers away to dogs, or dogs scavenged through garbage.

The morphology of the dogs is also worth a great deal of attention because the role of dog, the choice of particular breed, and the dog's place within the fabric of surrounding culture are the factors believed to become reflected in the dogs' morphology. As mentioned above, the site features many cases where individuals had not reached their adulthood, and bone fragments lay scattered and in various states of damage. We have only one complete skull that permits us to observe the morphology of the specimen (Plate 2: 1). Table 3 shows the measurements of this skull. The individual has a robust structure, wide face, and little short nose. Judging from the developed sagittal crest, we presume it to be a male dog. By comparison with the mandibles, we suggest the coexistence of various types of dogs differing in size and shape (Plate 2: 2—5). Table 4 shows measurements of the mandibles and limbs. After applying these values to the withers height formulas created by Yamauchi and Nishinakagawa et al. (Yamauchi 1958, Nishinakagawa et al. 2008) we obtained the following results (Table 3). Minimum: 41.0 cm, maximum: 50.0 cm by Yamauchi's formula, and minimum: 36.3 cm, maximum: 50.9 cm by Nishinakagawa formula. Although the difference between the minimum and the maximum is remarkable, even the largest dog is considerably smaller than female wolves (*Canis lupus*) whose withers height goes well over 60 cm, what consequently puts it in a dog category. Although some specimens at the Gorbatka site possibly are wolves, no remains identifiable as wolves (judging from major body parts) were discovered yet, what means that they might be big dogs.

(7) Weasel (*Mustela sibirica*) (Plate 4: 1—9)

We have identified eighteen fragments as weasels. The MNI count is nine individuals. The discovered body parts range from heads to limbs. The excavators could have missed out the weasels due to the small size of the latter. As is often the case with the weasel group (*Mustelidae gen.*), weasels' furs are likely to have been valued for their fine quality.

(8) Badger (*Meles meles*) (Plate 4: 10, 11)

We have identified fourteen fragments as badgers. This was the second-largest number after weasels in weasel group. The MNI count is four individuals. Unlike weasels, however, the identified fragments mostly include head parts (especially mandibles). They are likely to have been valued for their furs.

(9) Otter (*Lutra lutra*) (Plate 4: 12—14)

We have identified three fragments, all from horizon I, as coming from otters. The MNI count is one single individual. Despite the scarcity of remains, like with the rest of the weasel group, otters are likely to have been valued for their fine furs.

(10) Leopard cat (?) (*Prionailurus bengalensis*) (Plate 8: 13)

The right femur identified as possibly belonging to leopard cat occurred in the cover soil of Dwelling No. 2 (horizon III). This femur represents the juvenile stage because the proximal epiphysis is not fused.

Such cat group (*Felidae gen.*) members as leopard (*Panthera pardus*) and lynx (*Linx Linx*) inhabit the area surrounding the Gorbatka site (Zhivotnyy mir

Table 3

Measurements of bones and estimated withers height of *Canis familiaris* from Gorbatoka site

a) Skull

| Horizon | Measurements (mm) | | Estimated withers height (cm) | |
|-------------------|-------------------|--------|-------------------------------|-----------------------------|
| | | | Yamauchi (1958) | Nishinakagawa et al. (2008) |
| V (dwelling No.8) | pr - i | 187.4 | 49.3 | 47.7 |
| | pr - ba | 159.8± | | |
| | pr - n | 90.6 | | |
| | n - i | 99.2 | | |
| | pr - br | 142.4 | | |
| | br - i | 50.2 | | |
| | pr - oa | 78.7 | | |
| | ba - br | 58.3± | | |
| | zy - zy | 108.0± | | |
| | ect - ect | 45.8 | | |
| | 7 - 7 | 38.2 | | |
| | au - au | 55.5 | | |
| | eu - eu | 65.1 | | |
| | ent - ent | 29.6 | | |
| pr - sta | 89.4 | | | |
| ft - ft | 31.3 | | | |

Table 3 (continued)

b) Mandible

| Horizon | Part (L/R) | Measurements (mm) id - c.mid | Estimated withers height (cm) | |
|-------------------------------|------------|---------------------------------|-------------------------------|-----------------------------|
| | | | Yamauchi (1958) | Nishinakagawa et al. (2008) |
| I | MAN(L) | 120.7± | 43.4± | 38.8± |
| II (dwelling No.10) | MAN(L) | 146.4 | 50.0 | 50.9 |
| III | MAN(L) | 120.3± | 43.3± | 38.7± |
| III (dwelling No.2) | MAN(L) | 131.1+ | 46.5+ | 43.2+ |
| III (ash (Γ'-10)) | MAN(L) | 118.3+ | 42.6+ | 37.9+ |
| V (dwelling No.3) | MAN(L) | 116.7+ | 42.1+ | 37.4+ |
| V (dwelling No.3) | MAN(L) | 132.8+ | 47.0+ | 43.9+ |
| V (downpart on dwelling No.5) | MAN(L) | 125.8+ | 45.0+ | 40.8+ |
| I | MAN(R) | 126.7 | 45.3 | 41.2 |
| I | MAN(R) | 132.2+ | 46.8+ | 43.7+ |
| II | MAN(R) | 127.7+ | 45.6+ | 41.7+ |
| II | MAN(R) | 126.0+ | 45.1+ | 40.9+ |
| II (dwelling No.10) | MAN(R) | 117.8± | 42.5± | 37.7± |
| III | MAN(R) | 115.3 | 41.6 | 36.9 |
| V (dwelling No.3) | MAN(R) | 123.7+ | 44.4+ | 40.0+ |
| V (dwelling No.8) | MAN(R) | 113.6 | 41.0 | 36.3 |

Table 3 (continued)

| Horizon | Part (L/R) | Measurements (mm) full length | Estimated withers (cm) | |
|--------------------------|------------|----------------------------------|------------------------|-----------------------------|
| | | | Yamauchi (1958) | Nishinakagawa et al. (2008) |
| II V (dwelling No.11) | HUM(R) | 126.3* | 41.2 | 39.1 |
| | MC3(R) | 56.9 | - | 43.1 |
| I II | MC5(R) | 42.5 | - | 38.7 |
| | FEM(L) | 178.5* | 49.3 | 52.0 |
| II (dwelling No.4) | MT3(R) | 52.4 | - | 36.9 |
| II (dwelling No.4) | MT4(R) | 54.3 | - | 37.1 |
| II (dwelling No.4) | MT5(R) | 45.9 | - | 35.6 |

* Estimated length by Nishinakagawa et al. (2008).

2004). However, the authors are inclined in favor of leopard cat judging by size of the sample.

Leopard cats are known to have been hunted for their fine fur. We do not believe though that it was a frequent prey at the time because the only one bone is too scarce an evidence.

(11) Horse (*Equus caballus*) (Plate 5; 6)

We have identified 111 fragments as horses. The MNI count is eight individuals. The number of excavated horse remains is relatively large, even if nowhere near that of dogs or pigs. Horse remains occurred in every horizon. All body parts were present, but seldom in perfect condition. The spiral fractures of horse remains indicate that owners broke the bones before skeletonization took place, in order to obtain nutritious bone marrow. The bones lay scattered; the excavations yielded no whole body.

We inferred the sex of the horses from the presence of maxillary canines. We unearthed from horizon I only two maxillas where we could confirm the presence of canines. Both were male with canines (Plate 5: 1).

The death age of horses can be judged by the state of epiphyseal fusion of long bones and the state of eruption and occlusal wear of their teeth. Our observation revealed that the majority of horses reached adulthood. To estimate the death age of horses we used a formula accounting for the crown height of premolars and molars (Nishinakagawa 1991). Table 4 shows the results gained by applying measured crown heights to the formula. The results reveal that the age ranges from 3 to over 20 years, and animals aged over 7 years account for nearly 80% of the total. This also indicates that horse remains mainly consist of adult horses, including old horses. Two tibias with distal epiphyses not fused occurred at Gorbatka (Plate 6: 5). Since in this case the fusing period is estimated at approximately 2 years of age (Schmid 1972), it indicates that a few horses died in less than 2 years.

The lopsided horse age proportion shows that owners used horses as labor force while the animals were alive. Supposedly, they used them as a means of transportation too, and for cultivation. Although live horses served as work force, the fact that all horse bones were scattered all over the place, and broken intentionally, evinces that people ate horsemeat after the animals died. Cut marks on horse bones indicate that humans disjuncted horse carcasses (Plate 5: 4, 6; 6: 4).

The authors have measured the best preserved adult horse specimens. After applying the measured values to the withers height formula (Nishinakagawa 1991), the gained values ranged between 110–140 cm (Table 5), with the majority of them describing middle-sized horses of approximately 130 cm. Horse remains excavated in other ancient and medieval sites in Japan also mainly consist of middle-sized horses. The discovered specimens permitted to infer that big horses were not the tamed ones on this site, or even if tamed, they might be traded to people in other regions.

(12) Pig (*Sus scrofa domesticus*) (Plate 7; 8: 1–8)

We have identified 638 fragments as pigs. This number represents 41.1% of the identified assemblage by the NISP count. The MNI count is 33 individuals (23.6%). These indicate that pigs were common as the dominant species along with dogs in Gorbatka walled town. Pig bones were occurred throughout all of the horizons.

Table 4
Measurements of teeth and estimated death age of *Equus caballus* from Gorbatka site

| Horizon | Upper/Lower | L/R | Height (mm) | | | | | | Estimated age |
|-------------------|-------------|-----|-------------|------|----|----|------|------|--|
| | | | P2 | P3 | P4 | M1 | M2 | M3 | |
| I | upper | L | | | | | | | 20 years and 10 months |
| I (well) | upper | L | ← | 36.5 | | | → | | 9 years and 8 months ~ 11 years and 1 month |
| II | upper | L | 56.3 | | | | | | 3 years |
| III | upper | L | | | | | 66.0 | | 4 years and 7 months |
| V (dwelling No.8) | upper | L | | 45.0 | | | | | 8 years and 5 months |
| I | upper | R | | 35.0 | | | | | 11 years and 7 months |
| II | upper | R | | | | | | 33.3 | 11 years and 6 months |
| I (well) | upper | R | ← | 45.8 | | | → | | 7 years and 1 month ~ 8 years and 4 months |
| I (well) | upper | R | ← | 40.0 | | | | | 8 years and 7 months ~ 9 years and 11 months |
| V | upper | R | ← | 41.8 | | | → | | 8 years and 1 months ~ 9 years and 5 months |
| I | lower | R | 64.4 | | | | | | 4 years |
| II | lower | R | 30.6 | | | | | | 11 years and 6 months |
| IV | lower | R | | | | | | 25.5 | 12 years and 11 months |

Table 5

Measurements of teeth and estimated death age of *Equus caballus* from Gorbatka site

| Horizon | part | F/H | L/R | measurement (mm) | | | | | | | estimated withers height (cm) |
|--------------------------------------|------|-----|-----|------------------|------|--------|------|----|------|-------|----------------------------------|
| | | | | GL | HP | Bp | BFp | Dp | SD | Bd | |
| I (dwelling No.7) | RAD | | L | | | | | | | | 138.8 |
| | RAD | | L | 71.2+* | 69.6 | | | | | | 122.0+ |
| | RAD | | R | 77.5* | | | | | | | 132.3 |
| V (dwelling No.8) | MC3 | | L | | | | 31.6 | | | | 132.9 |
| III (around stone of dwelling No.13) | FEM | | L | | | 127.3* | | | | | 147.3 |
| I (dwelling No.7) | TIB | | L | | | | | | | | 132.3 |
| | TIB | | R | | | | | | | | 131.9 |
| | TIB | | R | | | | | | | | 139.3 |
| | CAL | | R | 106.0* | | | | | | | 129.9 |
| III (storage pit) | MT | | L | | | 47.6* | | | | | 127.0 |
| | MT | | R | | | 49.5* | | | | | 130.3 |
| I | MP | | | | | | | | | 51.1* | (F)143.2 (H)137.1 |
| I | PH1 | F? | L? | 81* | | | | | | | (F)130.2 (H)133.4 |
| | PH1 | H? | | 75.8* | 50.0 | | | | | 41.0 | (F)114.8 (H)123.7 |
| II | PH1 | | | 80.3* | 51.7 | | | | 33.0 | 44.2 | (F)128.4 (H)132.2 |
| | PH1 | | | 80.0* | | | | | | | (F)127.6 (H)131.7 |
| III (storage pit) | PH1 | | | 84.3* | 53.9 | | | | | 44.5 | (F)137.5 (H)138.6 |
| | PH1 | | | 81.5* | | | | | | 42.9 | (F)131.4 (H)134.2 |

Table 5 (continued)

| V (dwelling No.8) | PH1 | H? | L? | 83.0* | | | | | (F)134.8 (H)136.6 |
|-------------------|-----|----|----|-------|------|--|--|------|-------------------|
| I | PH2 | | | 44.5* | 51.9 | | | 49.3 | (F)136.4 (H)130.4 |
| I | PH2 | F? | | 42.7* | 47.2 | | | 46.1 | (F)131.2 (H)125.0 |
| I | PH2 | F? | | 45.7* | 50.5 | | | | (F)139.5 (H)133.6 |
| I | PH2 | | | 48.6* | 53.6 | | | 49.0 | (F)145.1 (H)140.2 |
| II | PH2 | | | 48.0 | 56.5 | | | 47.2 | (F)144.1 (H)139.0 |
| V | PH2 | | | 43.4* | 47.9 | | | 44.2 | (F)133.3 (H)127.2 |
| V (dwelling No.8) | PH2 | | | 45.2* | 48.2 | | | 45.7 | (F)138.3 (H)132.2 |
| II | PH3 | H | | 60.0* | 32.0 | | | | 138.4 |
| V (dwelling No.8) | PH3 | H | | 62.9* | 38.0 | | | | 130.5 |

* Measurement using estimated height.

In this report we refer to all Suidae as pigs, but specimens may include wild boar (*Sus scrofa*) which is not easy to discriminate from pig morphologically. An effort to discern pigs from wild boars at Gorbatka walled town site is the task awaiting some future researcher. As will become evident below, Suidae are mostly young individuals, what presumably indicates that most of them were slaughtered intentionally at infant or juvenile stage primarily for meat. In some cases, two of the 4th premolars erupted abnormally (Plate 7: 4), and in one case front and back alveoli partly overlapped (Plate 7: 5). These instances were likely caused by shortened jaws, a phenomenon of domestication. We excavated one humerus from horizon V, and identified it clearly as domesticated pig judging from the shape (Plate 8: 2).

We have found no whole skeleton. Most pig bones are damaged, and the bottoms of the mandibles are often broken (Plate 7: 8), supposedly in order to acquire bone marrow. Cut marks left on pig bones indicate that people disjuncted the animals (Plate 8: 1). While there is a possibility that pig skins might have been used too, we have found no archaeological evidence to that just as yet.

The sex of the pigs can be judged by the size and shape of canines and canines' alveolus. Remains with large canines and alveolus are male, while those with smaller ones are female. This site yielded quite small male bones, and we attribute this fact to the influence of domestication (Plate 7: 5).

We judged about the death age of pigs by the state of eruption of their teeth and epiphyseal fusion of long bones. Based on the research results about wild boars achieved by Hayashi et al. with regard to maxillas and mandibles, individuals at the stage when milk teeth still remain and the first molar tooth erupts are classified as infants; individuals at the stage when the second molar tooth erupts are classified as juveniles; and individuals at the stage when two or three pairs of cusps from front of the third molar have erupted are classified as adults. Infants refer to wild boars aged from 6 months to approximately 12 months, juveniles from a year and a half until approximately 2 years, and adults 2 years and a half after or older. However, it is said that pigs grow faster than wild boar.

Table 2-b shows the age proportion based on teeth eruption. According to it, non-adults constitute the majority of specimens, with no more than 20% adults. Infants account for almost 45% of the total, what typifies the age proportion of domestic animals used for food. Only a small number of adults are likely to have been used for breeding. It is inferred from the excellent palatability and large volume of meat that pigs contributed greatly to the society at that time as a major food source.

(13) Roe deer (*Capreolus capreolus*) (Plate 9: 1—13)

We have identified 106 fragments as roe deer, and the MNI count is 12 individuals. Excavated were two maxillae with milk teeth still in place (Plate 9: 5, 6).

The bones lay scattered when excavated, many damaged. Presence of processed roe deer antlers and antler implements (Plate 9: 1, 2) indicate that antlers were popular as raw material. Deer fur is also likely to have been in demand.

As the plate shows, we have found various sizes of roe deer bones (Plate 9: 3, 4). Among those the smallest individual is bigger than musk deer (*Moschus moschiferus*). Judging by skeletal specimens of roe deer, sizes differ between male and female, and individual differences are possible too.

(14) Reindeer (*Rangifer tarandus*) (Plate 9: 14)

A processed antler of reindeer occurred in horizon II. It was evident that reindeer antlers served as raw material the same way as roe deer antlers did. However, since we have found no other bones apart from the antlers we needed to conclude that reindeer was a rather rare prey.

(15) Cattle (*Bos taurus*) (Plate 10; 11)

Identified as coming from cattle were 139 fragments, the MNI count was 7 individuals. They occurred in all horizons. We have never found the whole body, and in most cases cattle bones were in the broken state. Our explanation suggests intentional disjuncting and breaking for meat and bone marrow after the animal's death. Cut marks from the disjuncting process are confirmed (Plate 11: 1, 5, 7).

While there occur some juvenile individuals with epiphyses not fused, adults predominate in number. Like horses, cattle could perform hard labor, such as cultivation and transportation, and, apart from that, gave milk, as pointed out by Alekseeva E.V. (Alekseeva, Boldin 1986, 1994).

After calculating the estimated withers height of cattle based on the measured values of major limb bones, we obtained the resulting numbers between 100 and 120 cm (Table 6). We presume this indicates that tamed cattle were not so big.

(16) Goral or Sheep/Goat (?) (*Caprinae gen.*) (Plate 8: 14, 15)

The metacarpal bone and metatarsus bone similar to *Caprinae* occurred in horizons III and II respectively. The bones were wider and flatter than roe deer's. Although those could belong either to goral (*Nemorhaedus caudatus*) or sheep/goat (*Ovis sp./Capra sp.*), proper identification was impossible because of the lack of referential skeletal specimens.

2. CHARACTERISTICS OF MAMMAL USAGE

As is evident from the above overview of identified species, one of the most notable characteristics of mammal usage in Gorbatka walled town is the practicing of domestic animal breeding. Dogs and pigs account for approx. 70% of the total NISP counts and for approx. 50% of the total MNI counts. When adding horses and cattle to the above two species the total figure accounts for 86% of all NISP counts, and for 60% of all MNI counts.

Since dogs are smaller in size than pigs, horses or cattle, it appears that dogs' contribution to the food subsistence system was not as great as the large number of the collected remains might suggest. However, one can easily infer that ancient humans could regard omnivorous and docile dogs as a food source unparalleled in that it was securely granted and brought minimal burden about it. This inference finds support in the fact that the excavated, albeit in small numbers, wild animals were hunted with the use of dogs. The reason why the dogs were actively exploited in the Gorbatka walled town was that the dogs were easier to tame, and able to play multiple roles in the fabric of human society.

Pigs are domestic animals bred for food. The MNI count is smaller than that of dogs, but considering the meat volume per single body, pigs must have been a far greater source of food than dogs. The large percentage of infants and juveniles implies that young pigs' meat was commonly consumed.

In terms of meat volume, horses and cattle made a greater contribution to the community food stock than we can infer from the large number of the excavated remains. In the case of horses and cattle however, their major role was hard work

Table 6

Measurements of bones and estimated withers height of *Bos taurus* from Gorbatka site

| Horizon | Part | F/H | L/R | Measurement (mm) | | | | | | | | | | Estimated withers height (cm) | Note | | | |
|--------------------------------------|------|-----|-----|------------------|-----|------|---|----|----|-------|-------|--------|-------|-------------------------------|------|-----|---|--|
| | | | | GL | GLI | GLpe | H | Bp | LG | BG | DPA | DC | Bd | | | DLS | | |
| II (dwelling No.4) | SC | | L | | | | | | | 58.3* | 55.4* | | | | | | 119.5 / 128.1 | |
| II | HUM | | L | | | | | | | | | | | | | | 106.9 | |
| III (dwelling No.2) | HUM | | R | | | | | | | | | | | | | | 111.7 | |
| II | ULN | | R | | | | | | | | | 65.1* | | | | | 122.5 | |
| V (dwelling No.8) | FEM | | R | | | | | | | | | | 49.6* | | | | 123.9 | |
| II (dwelling No.4) | TIB | | L | | | | | | | | | | | | | | 102.0 | |
| V (dwelling No.8) | TIB | | L | | | | | | | | | | | | | | 116.2 | |
| I | AST | | L | | | | | | | | | 56.8* | | | | | 102.8 | |
| III | AST | | L | | | | | | | | | 56.6+* | | | | | 102.3+ | |
| III (around stone of dwelling No.13) | AST | | L | | | | | | | | | 57.9* | | | | | 105.2 | |
| III | AST | | R | | | | | | | | | 61.6* | | | | | 112.8 | |
| V (dwelling No.3) | AST | | R | | | | | | | | | 66.6* | | | | | 121.8 | |
| II | CAL | | R | | | | | | | | | 118.5* | | | | | 109.5 | |
| III | CAL | | R | | | | | | | | | 125.0* | | | | | 114.6 | |
| IV (dwelling No.6) | MT | | L | | | | | | | | | | | | | | 114.9 | |
| I | PHI | | | | | | | | | | | 54.0+* | | | | | F: (3rd) 117.3+ (4th) 117.8+ H: (3rd) 113.6+ (4th) 116.7+ | |
| II | PHI | | | | | | | | | | | 55.6* | | | | | F: (3rd) 120.9 (4th) 120.5 H: (3rd) 117.2 (4th) 120.4 | |
| II | PHI | | | | | | | | | | | 54.3* | | | | | F: (3rd) 117.9 (4th) 118.3 H: (3rd) 114.3 (4th) 117.4 | |
| II | PHI | | H | | | | | | | | | 51.4* | | | | | H: (3rd) 107.5 (4th) 110.2 | |

Table 7

Legend for Tables 1–6

| ANT | antler | MP | metacarpal / metatarsal | SK | skull | VL | lumbar vertebrae |
|------|-------------------|------|-------------------------|-------|--------------------|------|--------------------|
| AST | astragalus | MT | metatarsal | (CON) | occipital condyle | VS | sacral vertebrae |
| AT | atlas | MT2 | 2nd metatarsal | (FRO) | frontal bone | VT | thoracic vertebrae |
| AX | axis | MT3 | 3rd metatarsal | (NAS) | nasal bone | | |
| C | carpal | MT4 | 4th metatarsal | (OCC) | occipital bone | p: | proximal |
| CA | caudal vertebrae | MT5 | 5th metatarsal | (PAR) | parietal bone | m: | middle |
| CAL | calcaeus | PAT | patella | (TEM) | temporal bone | d: | distal |
| CLAV | clavicle | PEA | pelvis with acetabulum | (TYM) | tympanic bone | fr: | fragment |
| FEM | femur | PEL | pelvis | (ZYG) | zygomatic bone | i: | infantile |
| FIB | fibula | (IL) | ilium | STE | sternum | j: | juvenile |
| HO | horn | (IS) | ischium | T | tarsal | sa: | sabadult |
| HUM | humerus | (PU) | pubis | TC | central tarsal | ad: | adult |
| HY | hyoid bone | PH | phalanx | TIB | tibia | (L): | left |
| MAN | mandible | PH1 | 1st phalanx | TMD | mandibular tooth | (R): | right |
| RAM | ramus of mandible | PH2 | 2nd phalanx | TMX | maxillary tooth | (F): | front |
| MAX | maxilla | PH3 | 3rd phalanx | TTH | unidentified tooth | (H): | hind |
| MC | metacarpal | PMX | premaxilla | UL | ulna | | |
| MC2 | 2nd metacarpal | RAD | radius | VB | vertebral body | | |
| MC3 | 3rd metacarpal | RIB | rib | VC | cervical vertebrae | | |
| MC4 | 4th metacarpal | SC | scapula | VE | vertebrae | | |
| MC5 | 5th metacarpal | | | | | | |

Table 8

Legend for Plates 1-11

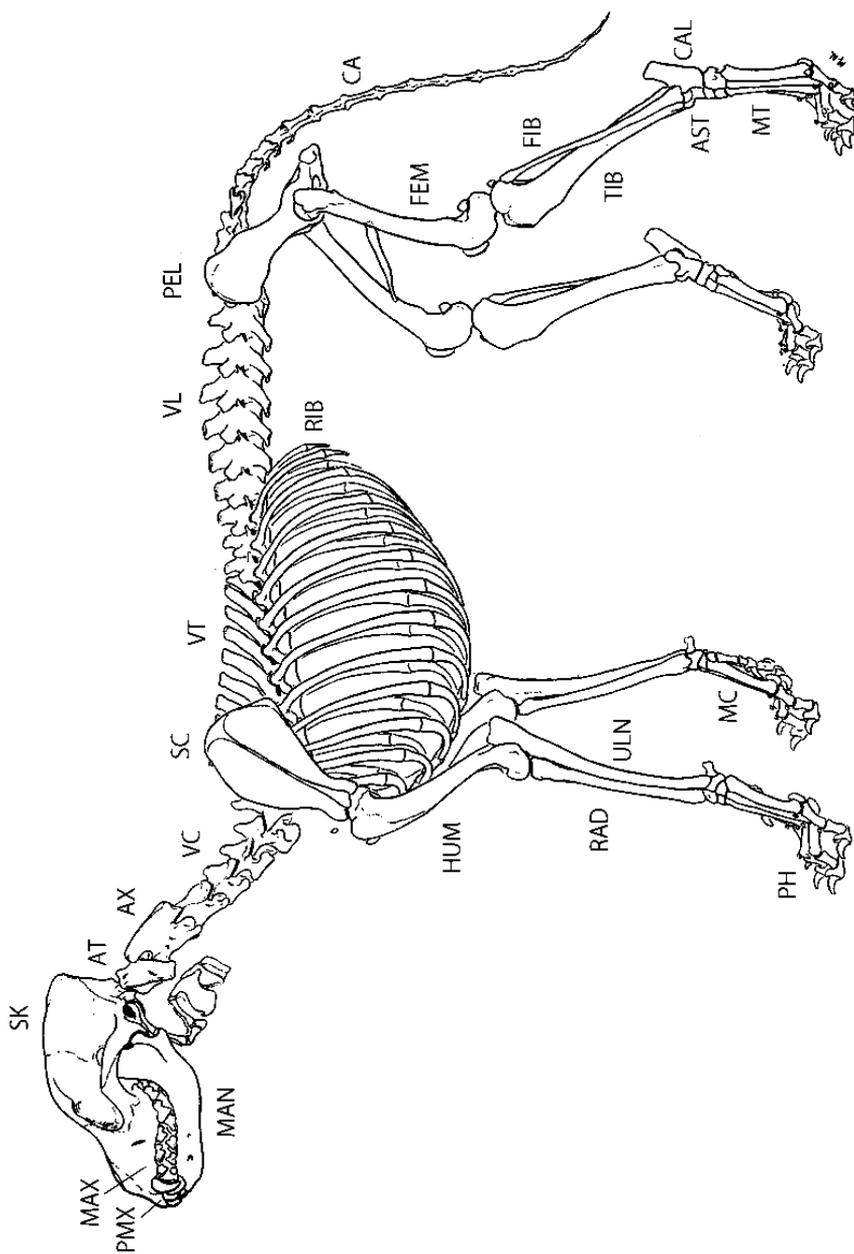


Plate 1



Ursus arctos (9-11)

Ursus thibetanus (12)

Plate 2



Canis familiaris

0 5cm

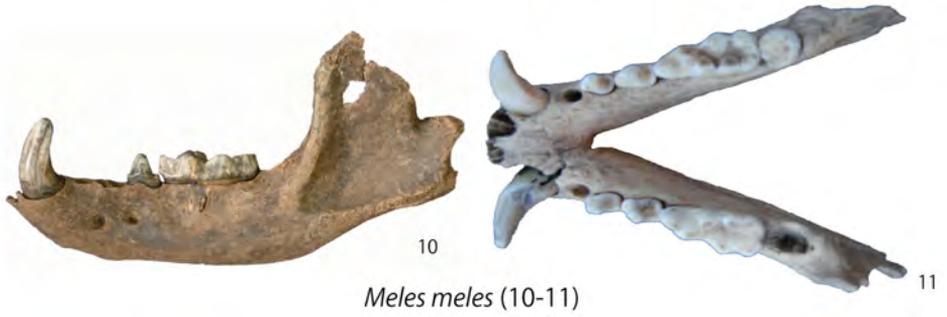
Plate 3



Canis familiaris

0 5cm

Plate 4



0 5cm

Plate 5

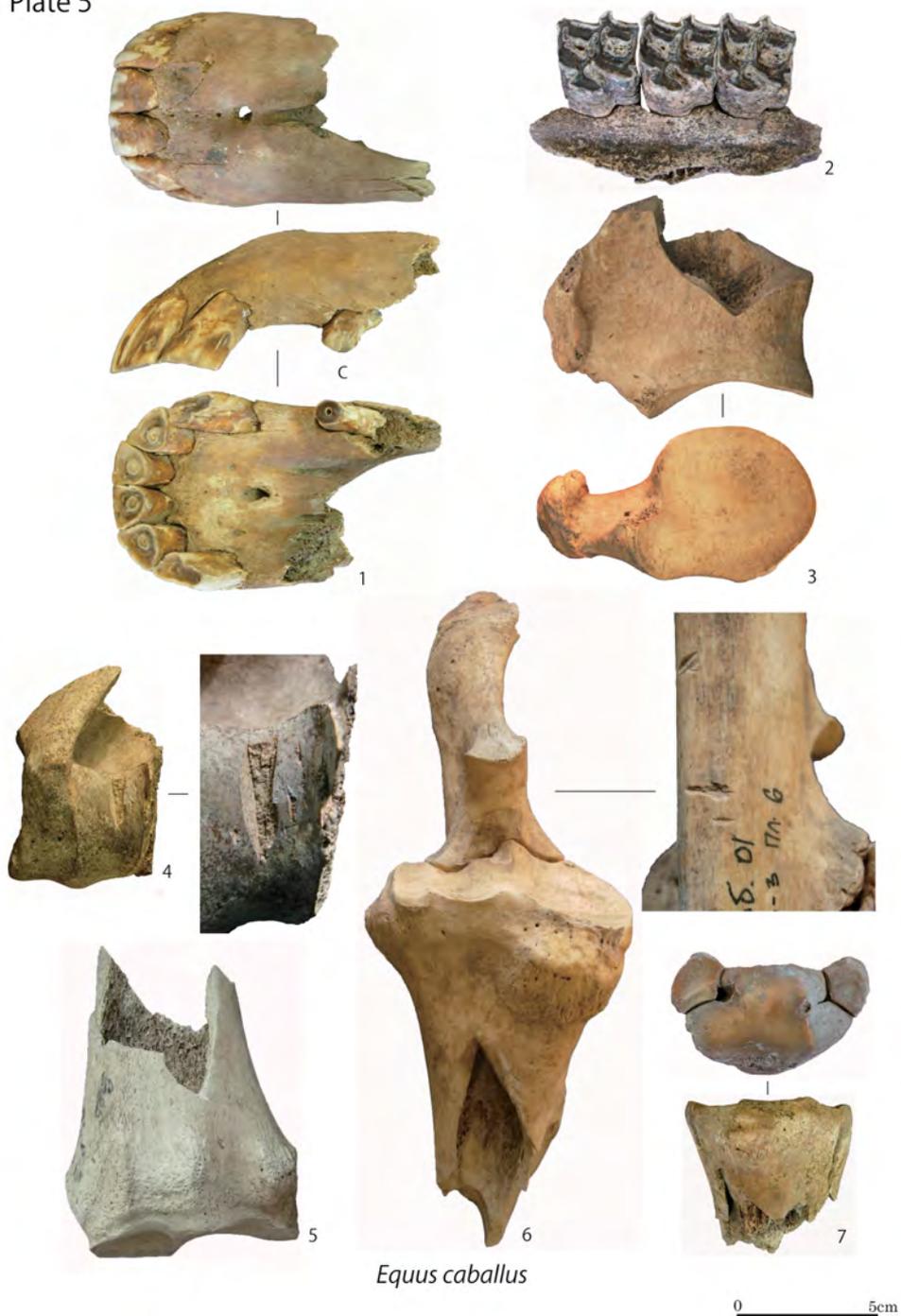


Plate 6



Equus caballus

0 5cm

Plate 7



Sus scrofa domesticus

0 5cm

Plate 8



Sus scrofa domestica (1-8)



Nyctereutes procyonoides (9-10)



Vulpes vulpes (11-12)

0 (1-12) 5cm



Prionailurus bengalensis? (13)



0 (13-15) 5cm

Caprinae sp. (14,15)

Plate 9



Plate 10



Plate 11



that was expected from them during their living years, as adults were predominant in the bulk of the bones. When the animals were getting older, injured or ill, they were likely to have been consumed, and that fate was their secondary function. In the Bohai period, as exemplified by the case of Hongzunyuchang (寧安虹鱒魚場) Bohai Graveyard site (Heilongjiangsheng 2009), horse bones happened to occur in the burial ground. Such a peculiar circumstance did not repeat itself in Gorbatka walled town, what we believe indicates that horses were deemed to have been practical domestic animal. Horses excavated from Gorbatka site mainly represent middle-sized animals with withers height of approximately 130 cm. Gorbatka walled town is located close to the production area of the so-called “Horse of Shuaibin” (率賓), a key product in the Bohai area. Therefore, if the morphology of horses receives further investigation, some important clues about how trade in East Asia developed at that time will be obtained. Additional efforts should be done to deeper understand the morphology of horses by gathering factual data from new excavations.

When we examine faunal remains reported from the excavations in the area expanding from Bohai to Dongxia (东夏), we see that domestic animal breeds are common in all collections. When analyzing the rate of domestic animals more closely we discovered that the share of dogs and pigs at the Gorbatka site was closer to that of Konstantinovka settlement-1 site (Alekseeva, Boldin 1994) and Nikolaevsky-II walled town (Alekseeva, Boldin 1986) in the Bohai period. Thus the Gorbatka walled town can be reported as a place where typical domestic animal breeding was practiced in the Bohai period. With the share of dogs and pigs gradually decreasing after the Bohai period, as exemplified by Novogordevsky and Shaiginsky walled town sites, the main breeding target was shifting to cattle and horses (Uchiyama 2007). We have found no major differences in Gorbatka in this respect as the breeding of dogs and pigs steadily continued from horizon V through horizon I.

The utilization of wild animals was less common than that of domestic animals, but it appears so that hunting was indeed practiced even though sporadically. The reason why we believe hunting was practiced to some extent is that fine furs, antlers, and the taste of wild meat must have been in great demand (Uchiyama 2012). Even if we go beyond the Gorbatka site limits, the number of the identified animals with fine furs is very small as a rule. With regard to this fact Alekseeva E.V. et al pointed out the possibility that hunters butchered fur animals immediately on the hunting grounds (Alekseeva, Boldin 1986; Alekseeva, Shavkunov 1983). Since furs are typical merchandise around the region, the acknowledgement of habitual hunting for fur is closely related to the understanding of inter-regional trade interactions during the Bohai period.

The excavated wild animal species include those that are rare visitors in the Gorbatka environs, such as reindeer. Despite being a natural habitat for the excavated species the place yielded only a small number of bones attributable to wild animals. We must also take into consideration that the excavated wild animals may include not only those directly procured by local Gorbatka people but also those brought here from somewhere else via trade as well.

CONCLUSION

The number of mammal remains excavated from Gorbatka walled town is quite large, and most of them are in good state of preservation. There still are many unclear points to be elucidated upon, especially regarding the use of animals in the

Bohai period. In that respect, Gorbatka site plays a vital role in promoting research on these issues. Moreover, with five horizons recognized, after accomplishing the task of recognizing as many as five cultural horizons it is intriguing that we can trace the history of animal use back in this distant past.

Although this report deals with some cases where we were unfortunate at identifying particular species, we were able to unequivocally evince that domestic animal breeding, focused on dogs and pigs, prevailed (as the numbers suggest) over the use of wild animals. In other words, the lifestyle of the community under our study depended in the most part on domestic animals. This statement applies to other sites attributed to the Bohai period. We examined the intended use, morphology and other traits of identified mammals. Since the amount of available remains is limited, we look forward to continuing the research into the use of animals during the Bohai period by way of comparative analysis involving a broader scope of data with inclusion of prospective future yields.

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ОСТАТКИ МЛЕКОПИТАЮЩИХ ИЗ ГОРОДИЩА ГОРБАТКА

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Статья посвящена изучению остатков костей млекопитающих, найденных в процессе археологических исследований городища Горбатка, расположенного в долине р. Илстой на территории одноимённого села в Приморском крае. Памятник являлся административным центром государства Бохай и датируется концом VIII — началом X в. В культурных отложениях исследованы жилые и хозяйственные постройки, остатки производственной деятельности, которые относятся к пяти строительным горизонтам. По результатам анализа костных остатков млекопитающих выделено 18 видов домашних и диких животных, использовавшихся населением средневекового города. Идентифицированные виды рассматривались в зависимости от археологического контекста и соотносились с разными строительными горизонтами, слоями и объектами. Учитывалось как общее количество найденных костей, так и минимальное количество выделенных особей, по возможности устанавливались размеры и возраст животных. Большое внимание уделялось морфологическому анализу млекопитающих, сохранности костей.

Было установлено, что подавляющее большинство собранных во всех строительных горизонтах городища Горбатка костных остатков принадлежало домашним животным. В статье обсуждается значимость разных видов животных для диеты и хозяйственной деятельности бохайского населения. По общему количеству костей и минимальному числу выделенных видов преобладали свиньи и собаки, которые постоянно разводились во все периоды существования городища. Собаки использовались не только в пищу, но и для охоты. Крупный рогатый скот и лошади в первую очередь имели большое значение для работы, а во вторую — использовались в качестве пищи. Меньшее количество костей диких животных свидетельствовало как о вспомогательной роли охоты для диеты, так и о добыче этих животных в основном в целях обеспечения населения пушниной и рогами, которые имели важное значение в межрегиональной торговле.

Ключевые слова: государство Бохай (698—926), российское Приморье, костные остатки млекопитающих, домашние и дикие животные.

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