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# ZOOARCHAEOLOGICAL MATERIAL FROM THE PADURE (BELTES) HILL-FORT IN LATVIA: BUTCHERING TECHNIQUES AND THE COMPOSITION OF SPECIES

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**Abstract**

In the excavated Padure (Beltes) hill-fort in Latvia, cultural layers from the Late Bronze Age and the Early Iron Age (Stage 1), and the Middle Iron Age and the Late Iron Age (Stage 2), were detected, which, besides the archaeological material typical of that period, provided abundant zooarchaeological material. This article presents the investigation data from the zooarchaeological material of both stages: the data relate to the butchering techniques used, and the identification of the composition of the faunal species. The investigation was carried out in the bioarchaeological laboratory of the Institute of Baltic Region History and Archaeology at Klaipėda University. As is proven by the investigation, the ratio of domestic animals to hunted wildlife in the two periods compared is not identical. In the second period of habitation of the hill-fort, the number of cattle and sheep/goats decreased, while the number of swine and especially of horses increased. The article also deals with characteristics of butchering techniques of domestic animals and wildlife in both periods of the habitation of the hill-fort, and changes identified in the meat processing. In the second period, the level of processing resulted in greater amounts of meat suitable for food, due to the technical properties of the raw material and the nutritional and commodity value.

Key words: Padure (Beltes) hill-fort, Latvia, zooarchaeology, Late Bronze Age, Iron Age, slaughtering.

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## Introduction

The Padure (Beltes) hill-fort is located on the left bank of the River Venta. It was established on a promontory, separated by deep ravines to the north and the south, and by the steep bank of the Venta on the east. A ditch was dug on the open west side, and a four-metre-high bank was built on the plateau. A total of 280 square metres were excavated in the total plateau area of about 1,900 square metres (Asaris, Vasks 2004, p.19ff; Vasks 2006, pp.64-75; Vasks 2008, pp.63-70). The principal data from the archaeological, pollen and zooarchaeological material, and the chronology of the habitation of the hill-fort, were presented in an article by A. Vasks, L. Kalniņa and L. Daugnora (Vasks *et al*. 2011, pp.73-99).

The hill-fort was inhabited in two stages (Fig. 1). The early stage (areas I and III) included the Late Bronze Age and the Pre-Roman Iron Age, while the late stage (areas II, IV, V, VI, VII and VIII ) included the second half of the Middle Iron Age and the Late Iron Age. Radiocarbon dates indicate that the fortified habitation developed at the end of the 2nd mill. BC, when a wooden palisade was erected (1220–930 cal. BC) (Vasks et al. 2011, 84, fig. 5). Beltes Hill-Fort is so far the only one in western Latvia where Late Bronze Age occupation is confirmed by radiocarbon dating. The area of the hill-fort delimited by the palisade constituted about half of the area that the hill-fort occupied during the Late Iron Age. However, it seems that already in the early phase of occupation, as the population rapidly increased, the inhabited area of the plateau was extended, moving the palisade further to the south-west. Data on structures from that period is scarce: the only thing to be said about them is that they were above-ground structures built of posts with internal stone-lined hearths. Pottery constituted the majority of the finds dating from the early stage. There were several flint, antler and bone tools. In all, 60% of the early pottery was striated. The vessels generally had an S-shaped profile. Decoration on the outside of a vessel was rare. About 11% of the potsherds belonged to what is known as 'early rusticated pottery'. It was the first hill-fort in western Latvia where textile-impressed pottery was found (about 2%).

The investigated zooarchaeological material was collected in the period 2003 to 2006. Archaeological excavations resulted in the discovery of 5,449 bones and fragments of bones in the respective cultural layers, which were analysed. The osteological material discovered at the hill-fort reflected rather distinctly special characteristics of the domestic and wild animal butchering techniques, which were presented statistically and reflected in graphs and tables. The characteristics of the butchering techniques, especially during


Fig. 1. A plan of the Padure (Beltes) hill-fort, indicating the areas excavated in the period 2003 to 2007 (after A. Vasks).

the second period of the habitation of the hill-fort, are manifested by the fact that the parts of carcasses that possessed the greatest amounts of meat were used for food. That was brought out by the slaughtering techniques when breaking down the carcasses and cutting up meat for food.

## Material

The osteological material from the Padure (Beltes) hill-fort was analysed in accordance with the identified cultural layers. The first cultural layer, attributed to the Late Bronze Age and the Early Iron Age (areas I and III, in which 825 bone fragments of domestic and wild animals were analysed), was compared to the second one from the Middle and Late Iron Age (areas II, IV, V, VI, VII and VIII), where 4,624 bones and fragments of bones were excavated and analysed. Zooarchaeological analysis enabled the identification of 1,428 out of the 4,624 bones and bone fragments discovered down to the species level. The percentage calculation of the separated specimens was based on the total sum of the identified finds. In the investigated material, the remains of domestic animals, that is, cattle, swine and sheep/goats, predominated (Tables 1, 2).

## Methods

For the analysis of the osteological material collected at the hill-fort, the identification of bone species, butchering and zooarchaeological material, statistical methods are referred to in the article.

## The identification of bone species

For the zooarchaeological investigation presented in the article, and the comparative analysis of the material, the collections of skeletons and bones of fauna (domestic and wild animals, birds and fish) of the bioarchaeological laboratory at the Institute of Baltic Region History and Archaeology, as well as the collections of bird skeletons accumulated by R. Trainienė and fish skeletons accumulated by V. Daugnorienė,

Table 1. Skeleton bones from the Padure (Beltes) hill-fort (2003-2006)

| Skeleton bones | Cattle | Goat/Sheep | Pig/wild boar | Horse | Wild animals | Birds | Unidentified bone fragments of the species |
|---|---|---|---|---|---|---|---|
| *Proc. cornutus* | 4 | 2 | | | 1 | | |
| *Cranium* | 19 | 22 | 8 | | 10 | 1 | 24 |
| *Mandibula* | 13 | 26 | 25 | 2 | 7 | | 11 |
| *Dentes* | 178 | 72 | 58 | 78 | 17 | | 73 |
| *Vertebrae* | 71 | 25 | 15 | 6 | 27 | 6 | 77 |
| *Scapula* | 10 | 5 | 7 | 2 | 1 | 1 | 17 |
| *Humerus* | 9 | 5 | 9 | | 2 | 9 | 10 |
| *Ossa antebrachii* | 11 | 10 | 17/1 | 2 | 9 | 4 | 10 |
| *Ossa carpi* | 7 | | | 3 | 4 | | 2 |
| *Ossa metacarpalia* | 11 | 10 | 8 | 5 | 1 | 4 | 1 |
| *Ossa coxae* | 4 | 6 | 5 | | 2 | | 14 |
| *Femur* | 12 | 7 | 10 | 3 | 5 | 8 | 8 |
| *Ossa cruris* | 11 | 5 | 7 | 2 | 4 | 3 | 10 |
| *Ossa tarsi* | 26 | 11 | 9 | 1 | 6 | | 4 |
| *Ossa metatarsalia* | 18 | 8 | 10 | 9 | 2 | 2 | 2 |
| *Phalanx* | 41 | 21 | 19 | 9 | 15 | | 6 |
| Small fractured tubular bones unidentified fragments | | | | | | | 3212 |
| Total | 445 | 235 | 208 | 122 | 113 | 38 | 1161 |
| MNI | 17 | 17 | 11 | 7 | 21 | 6 | 79 |
| Age | 1 month; 17-24 month; 24-30 month; 42-48; 36-42; 5-6 year | 1 month; 3-4 month; 6-8 month; 12; 12-18 month; 23-24 month | 12 month; 12-16; 24; 42; 36 month | 8-10 year | | | |

Altogether excavated: 4,373 bones. Identified fragments: 1,161, including 476 teeth and 259 forefoot/foot bones and phalanges. Total MNI: 79.

held at the T. Ivanauskas Zoological Museum in Kaunas, were used. After the exposure of the Padure (Beltes) hill-fort's cultural layer, a relative object signature (special stratigraphy) was recorded. The material was investigated at the University of Latvia in the office of professor A. Vasks. It was sorted out by separating very tiny bone fragments (from several millimetres up to a centimetre). Each larger fragment of a skeleton was examined and classified in accordance with its anatomical structure or the animal species. After establishing the amount of bones of each species in individual hill-fort excavation areas, tables were drawn up (Tables 1, 2) which reflected the species, the number of bones, and the minimal number of individuals (MNI). The osteological analysis partly established the composition of species of wild animals (nine in the first habitation period, and ten in the second) and livestock (four species were identified in both habitation periods) in the environs of the hill-fort. After the accumulation of a large amount of bones of one animal species, the part of the skeleton to which the bone belonged was identified (the research material was compared to contemporary collections of animal skeletons), the number of bone pairs (White 1953), their condition, the time of ossification, sex, tooth wear, and so on. During the excavation, mainly long bones from animal legs and teeth were found. Therefore, tables summarised in veterinary literature were used (Nickel *et al.* 1986), relating to the bone ossification time (Bullock, Rackham 1982) and the change from milk to permanent teeth (Baleišis 1977; Bull, Payne 1982; Grant 1978; 1982; Levine 1982; Magnell, Carter 2007). The very small amount of intact bones and the huge amount of tiny and larger

Table 2. Osteological data from each excavated area at the Padure (Beltes) hill-fort (2003-2006)

| Animals/excavated areas | Cattle | Goat/Sheep | Pig/wild boar | Horse | Wild animals | Birds | Fishes | Unidentified species/Small unidentified fragments |
|---|---|---|---|---|---|---|---|---|
| Area I | 12 | 8 | 14 | 9 | 8 | | 1 | 41/ 194 |
| Area II | 57 | 13 | 31 | 6 | 28 | | 13 | 24/ 331 |
| Area III | 26 | 10 | 31 | 37 | 23 | 6 | 4 | 62/358 |
| Area IV | 34 | 8 | 26 | 20 | 45 | | 13 | 54/503 |
| Area V | 50 | 24 | 26 | 13 | 20 | 1 | 21 | 12/416 |
| Area VI/ | 119 | 22 | 33 | 29 | 37 | 6 | 24 | 23/170 |
| Area VI/ | 33 | 15 | 13 | 3 | 13 | 3 | 15 | 18/293 |
| Area VII | 114 | 141 | 34 | 5 | 61 | 22 | 58 | 42/947 |
| Total identified bone fragments | 445 | 241 | 208 | 122 | 236 | 38 | 149 | 1439 |
| MNI | 17 | 17 | 11 | 7 | 21 | 6 | | |

broken or split bone fragments in the excavated collection (about 74% of the total number of excavated bone finds) prevented comprehensive bone measurement in accordance with the methodology of A. von den Driesch (von den Driesch 1976).

## Animal butchering techniques

Characteristics of the butchering techniques at the Padure (Beltes) hill-fort in the first and second habitation periods were analysed separately for each species identified (swine, cattle, sheep/goats), in accordance with the quantitative distribution of individual animal skeleton parts. In the osteological material from the two habitation periods of the hill-fort, the quantitative distribution of the individual bone composition amount found in the carcass quarters indicated a change in technique of individual animal butchering. This also simultaneously indicated differences in the techniques of butchering all domestic animals that formed in different periods of the habitation of the hill-fort.

The following terms are employed in the article for the discussion of butchering techniques: dietary refuse, processing waste, butcher waste, and others[1] (Milisauskas *et al.* 2012). A carcass is defined as the body of a slaughtered and disembowelled animal (after the removal of the organs from the thoracic and abdominal cavities, bleeding, and skinning). Afterwards, the head was removed by separating the first cervical vertebra from the occipital bone. The feet were cut off through the wrist and heel hock joints.

Cattle carcasses are divided into quarters (Fig. 2). The forequarters consist of the neck, shoulder, chuck/steak, brisket and flanks. The hindquarters consist of the loin, ham and hind leg (the shank/shin part).

[1] The term 'dietary refuse' is used for parts of the body that possess larger amounts of meat, and include the neck, chest, and the front and the hind legs of large animals. Dietary refuse: 1. forequarter: neck (from *cervical vertebra* 1 to 7), thorax (*thoracic vertebrae*, ribs, and sternum), scapula, humerus, the upper forearm (*Ossa antebrahii*) bones, and foreshank; 2. hindquarter: the last thoracic vertebra, lumbar vertebrae, or it may be part of a hipbone named loin, the thighbone (*Femur*) with a patella, a thighbone with a patella, and occasionally a proximal tibia part (upper hind leg), and part of a shin (*Ossa cruris*) and hind shank.
The terms 'processing waste' and 'butcher waste' mean animal bones. The butcher waste includes 1. the head (*cranium*); the horn (*proc. cornutus*); the skull (*cranium*); the mandible (*Mandibula*); the teeth (*dentes*), and the hyoid apparatus lingual bone (*apparatus hyoidaeus*); 2. the forefoot/foot (*skeleton metacarpale/metatarsale*); wrist/ankle (*ossa carpalia/ossa tarsalia*); the forefoot consists of wrist bones, forefoot and phalanges; the hind foot (*skeleton metatarsale*) consists of the hock bones, foot and phalanges; 3. tail (*Coccigea*).

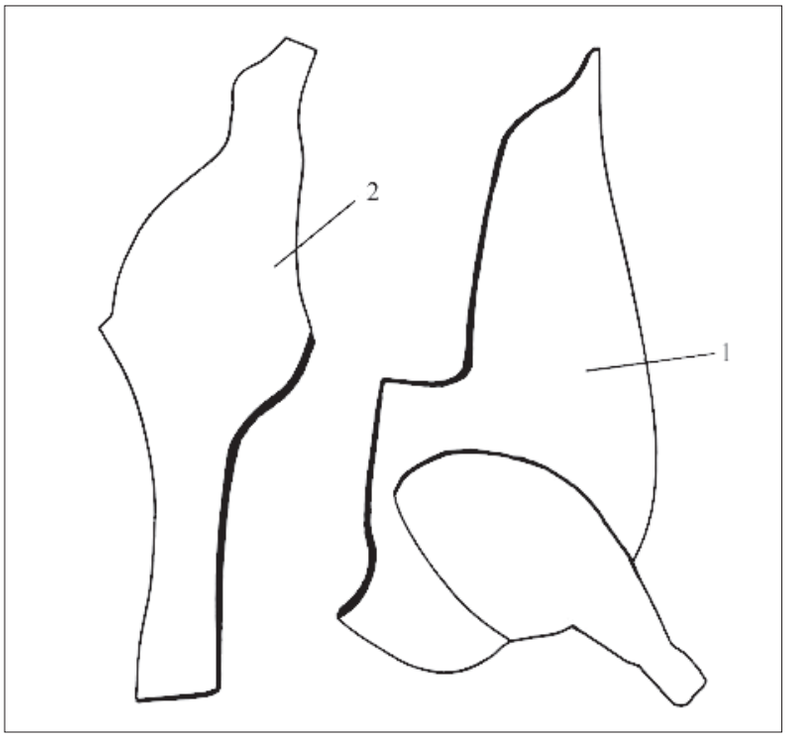



Fig. 2. Carcass quartering 1. The forequarters 2. The hindquarters (drawing by L. Daugnora).

A halved pig carcass, after removing the head, is divided into three main parts: the front, or shoulder part; the hind, or ham part; and the middle, or the flank part. The middle third can be divided into sirloin and flank (Milisauskas *et al.* 2012, p.18ff).

## Statistics

Some of the primary data for statistical analysis were presented in an article by A. Vasks, A. Kalniņa and L.Daugnora (Vasks *et al.* 2011, pp.73-99), in which x2 (chi-square) was used to test hypotheses about the distribution of the variable in the population. The $\chi^2$ criterion shows whether the difference between the empirical and theoretical distributions is meaningful, that is, whether the possessed empirical distribution complies with the theoretical model. For the statistical analysis of the zooarchaeological material from the Padure (Beltes) hill-fort, SPSS statistical package (15.0, SPSS Inc., Chicago, IL) was used[2]. With this, we assessed the indicators of the zooarchaeological materials from the two different periods on the Padure (Beltes) hill-fort: their arithmetical means, errors, and interrelationships in accordance with Pearson's correlation coefficients (r) and their statistical meaningfulness (p). The outcomes were considered as valid at $p<0,001$, $p< 0,01$ and $p<0,05$. The $\chi^2$ criterion is applied to grouped data; therefore, the amount of zooarchaeological material is rather large. One of the aims was to find out how much the bone material and the composition of the animal species differed in individual habitation periods 1 and 2. The established $\chi^2$ reliability was $p<0,001$.

A relative frequency calculation was made, that is, the number of times the bone of the skeleton of an individual animal was repeated in the total amount of bones. The frequency was used in the analysis and assessment of the carcass partitioning and cutting, in other words, an attempt was made to analyse the differences appearing between the amounts of meat intended for food and the processing waste. The data obtained are presented in histograms (Graphs 1 to 4).

[2] The Statistical Package for Social Sciences (later modified to Statistical Product and Service Solutions) was published in its first version in 1968, after being developed by Norman H. Nie, Dale H. Bent and C. Hadlai Hull. The SPSS is one of the most widely used programmes for statistical analysis in the social sciences.

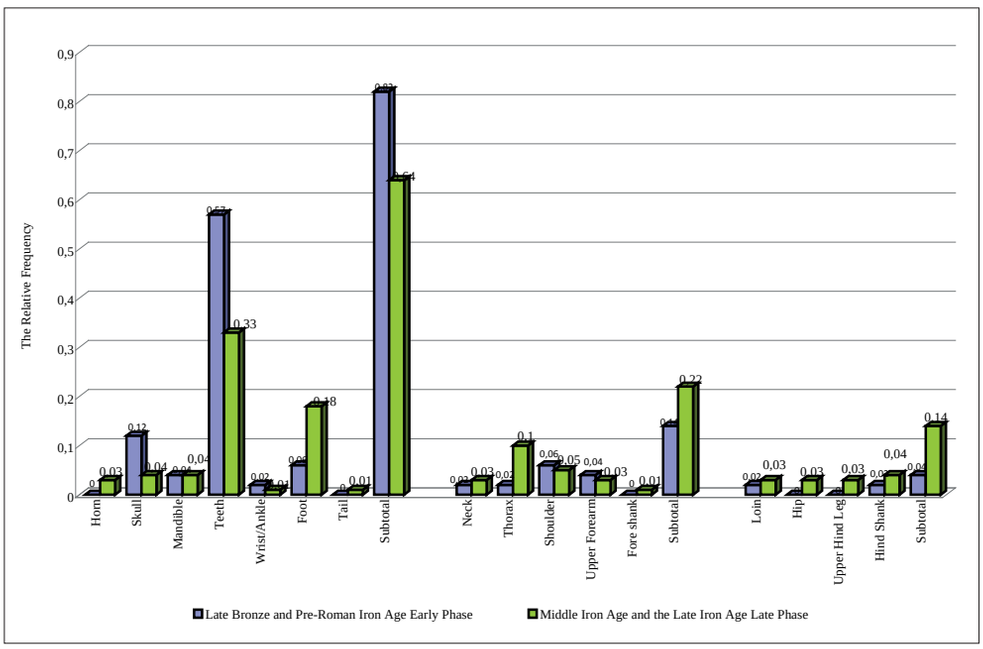
## Results

### 1. Anatomical study of skeletons

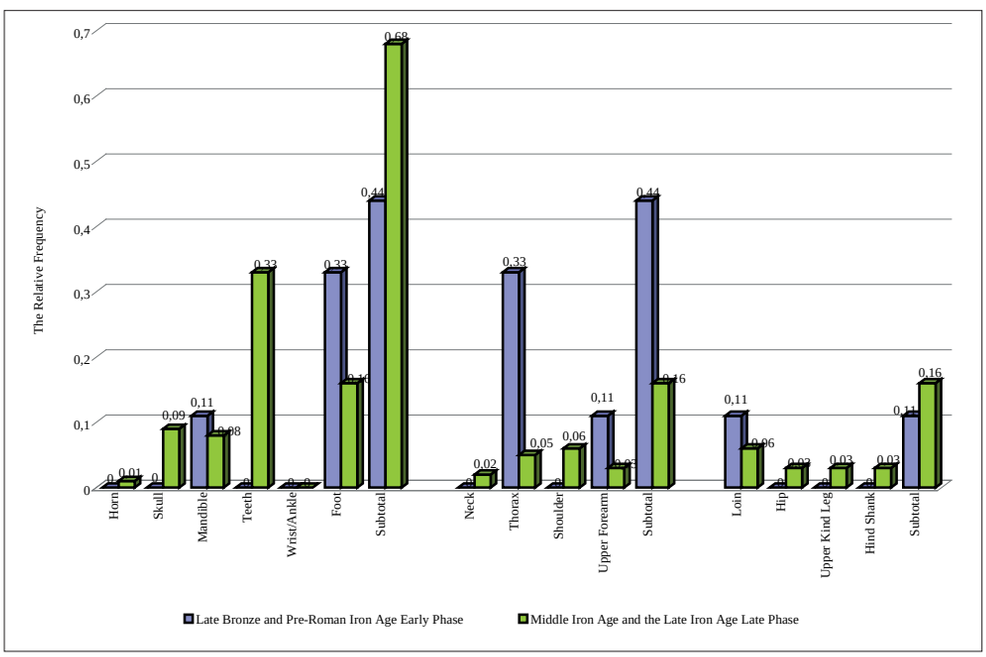
In tables 1 and 2, we present the investigation outcomes of the zooarchaeological material from the Padure (Beltes) hill-fort habitation periods 1 and 2, MNI, and the ages of the animals (Tables 1; 2). The analysis of the zooarchaeological material from habitation period 1 (Late Bronze Age and Pre-Roman Iron Age), that is, the total amount of bones from 825 domestic and wild animals, resulted in establishing 211 cases of bone species, and 62 cases of parts of an anatomical skeleton. In macroscopic studies of the bone fragments, 38 bones were attributed to cattle (*Bos bovis*) (MNI 3), and they include a large amount of teeth or pieces of teeth (17 units); 18 bones were attributed to sheep/goats (*Ovis aries/Capra hircus*) (MNI 2, including one case of an age of under 24 months); 45 bones were attributed to swine (*Sus suis*) (MNI 6, including three cases of an age of 24 to 30 months; over 36 months; and under 42 months); 46 bones were attributed to horses (*Equus caballus*) (MNI 2, including one stallion colt), with the majority of bones being teeth or parts of teeth (30 fragments). Some bones of wild animals were also found: 16 bones were attributed to bison/aurochs (*Bison bo-*

*nasus/Bos primigenius*), including several with cut marks, as well as one cut sawn horny outgrowth (*proc. cornutus*); while one thoracic vertebra belonged to an elk (*Alces alces*). Moreover, the bones of a red deer (*Cervus elaphus*) (one fragment, MNI 1), a bear (*Ursus arctos*, two fragments, MNI 1), a beaver (*Castor fiber*, two fragments, MNI 1), and marten (*Mustelidae family*, three fragments, MNI 2) were detected. From among the species of fish, only some vertebrae of a pike (*Esox lucius*) were found.

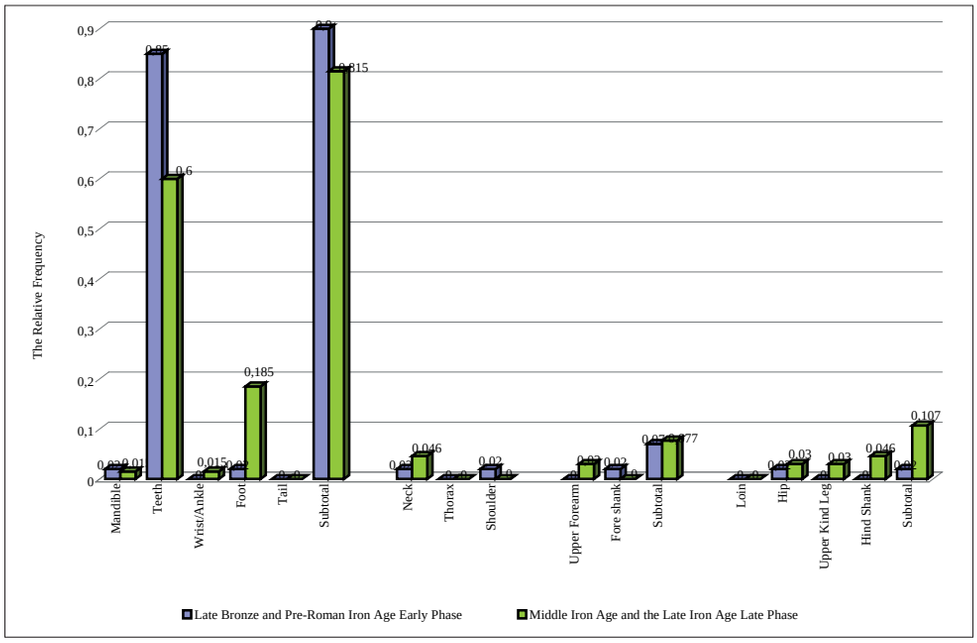
A total of 3,492 bones were attributed to the second period of habitation, including 11 burnt bones (Tables 1, 2). The species characteristics were established in 984 cases, and the anatomical skeletal characteristics were established in 107 cases. In the collection from the second period, a very large amount of broken tubular bones (947 units) and the same amount of small broken fragments and bones with cut marks, were discovered. The finds include a carved piece of a sheep/goat bone, and a case of pathology of horse tarsal



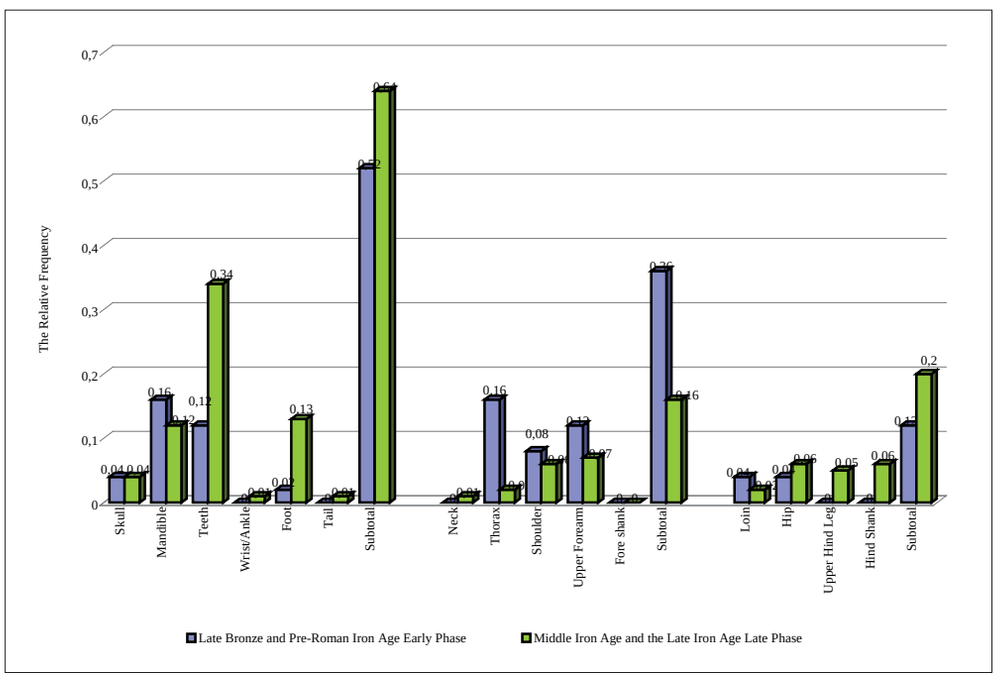

Graph 1. Summary of cattle (*Bos bovis*) body part distribution by type of refuse at the Padure (Beltes) hill-fort (after S. Sovaitė).




Graph 2. Summary of the sheep/goat (*Ovis/capra*) body part distribution by type of refuse at the Padure (Beltes) hill-fort (after S. Sovaitė).




Graph 3. Summary of the horse (*Equus cabalus*) body part distribution by type of refuse at the Padure (Beltes) hill-fort (after S. Sovaitė).




Graph 4. Summary of the swine (*Sus suis*) body part distribution by type of refuse at the Padure (Beltes) hill-fort (after S. Sovaitė).

bones (*osteoarthrosis: osteoarthrosis/osteoarthritis chronica deformans tarsi*). Moreover, a pendant made of a hock bone of a carnivorous animal (most likely a wolf or dog) (*Canis lupus/Canis canis*) was identified. After the bone analysis was carried out, 407 bone fragments, some of which had cut marks, were attributed to cattle (MNI 12) (Tables 1, 2). Among them, one individual was about 0.5 to one month old, the second 17 to 24 months, the third under 28 months, the fourth and the seventh 42 to 48 months, the fifth 24 to 30 months, the sixth 36 to 42 months, the eighth 18 to 24 months, the ninth 24 to 30 months, the tenth 42 to 48 months, and the rest were between five and six years old. Among the cattle bones, a large amount of teeth (41) and phalanges (six bone fragments) were found. A total of 224 goat/sheep bones were found, attributed to 11 individuals. An analysis of the goat/sheep bones allowed for the identification of the age of individual animals: under one month, three to four months, six to eight months, 11 months, 12 to 16 months, and 18

months, while two individuals were 24 months, and the rest were 24 to 30 months. A goat's horny process outgrowth (*proc. cornutus*) was identified, and one third of the goat/sheep bones consisted of teeth and vertebrae. Bone fragments identified as a tusk and a part of the upper jaw were likely to have belonged to a boar (*Sus scrofa*). The examination of the horse bones resulted in the identification of 49 fragments (MNI 3), with one of them thought to have belonged to a colt. Another horse was found to have had osteoarthritis and ossification of the interroseous ligaments of the foot (*ligamentum interosseum)* (Daugnora, Thomas 2005, pp.68-74). Among the bone material belonging to horses, 29 teeth were detected, including one molar with caries, a spinal vertebra, part of a foot bone, and one phalanx. Alongside the bones of domestic animals, the bones of wildlife were discovered, with cut marks left from the slaughter of the animals. A total of 33 bone fragments were found to belong to a bison/aurochs, and six bone fragments with cut marks to an elk. Moreover, three bone fragments of a deer (*Cervus elaphus*), four bones of a bear (*Ursus arctos*), 12 bone fragments (MNI 2) of beaver (*Castor fiber*), three bones of a wolf (*Canis lupus*), a fox (*Vulpes vulpes*), and members of the *Canidae* (*Canidae, Canis familiaris*) and Mustelidae (*Martes martes L.*) families, as well as isolated bone fragments of a hare (*Lepus europaeus*), were found. The bones of a vole (*Arvicolla terestris*) were identified, whose chronology remains unclear. A total of 29 vertebrae attributed to pike and 22 bird bones that belonged to the *Anatidae* family, its *Anserinae subfamily*, and *Phasianidae* family, *Gallus Gallus Domesticus* subspecies, were found.

## 2. Study of livestock butchering

During the investigation, a large number of cut marks were detected on bones and fragments of small split bones of both domestic and wild animals in the collections of osteological material from the cultural layers of both habitation periods of the hill-fort, which show that the people of the local communities slaughtered animals in their residential territory. What relative frequencies of animal skeletons and processing waste and characteristics of domestic animal slaughtering in the first millennium BC and the second half of the first millennium AD were established in the analysis of both periods of the hill-fort's habitation?

**Cattle.** As is proven by the cattle histogram (Graph 1), in the first habitation period, parts of the skull and isolated teeth predominated. In the first habitation period, the processing waste accounted for 82% (the first period of habitation: 0.82), and in the second, 64% (horns, forefoot/foot bones, phalanges: 0.64%). In the first habitation period, as is proven by an analysis of the carcass forequarter, we can see that the relative frequency of front part bones is higher, especially in an analysis of the thorax of the animal (vertebrae and ribs). In the second period of habitation, the amount of the hind part skeleton increases (0.1%).

Significant differences were observed: in the first habitation period of the hill-fort, the thoracic and cervical vertebrae were not cut through the sagittal plane, while the first cervical *vertebra* was separated from the head and cut through the sagittal plane. The ribs were separated from the *thoracic vertebrae* through the points of the rib attachment. The muscles of the front legs were cut from the chest.

In the second stage of butchering the animal, the head was severed from the body, and the front leg from the chest. The thoracic part butchering technique. The first cervical vertebra was separated from the head by cutting through the sagittal plane. In the *thoracic vertebrae*, spinous processes (mainly in the wither height of thoracic vertebrae), or the vertebral arch, were cut off, as in the excavated material vertebral bodies (especially of the lumbar part) were found. The ribs were divided into three parts: the proximal part of the rib, consisting of the rib head, the *tubercle* and the upper part of the rib body; the rib body; and the distal part of the rib. Individual segments of the *sternum* remained, and the rib cartilage was seldom found. In the lumbar part, from the lumbar vertebrae, transverse processes were cut off, and the vertebral arch could be severed; therefore, in the habitat, individual parts of *vertebrae* were found (spinuous and transverse processes or the body). The sacrum was cut accross, by severing the first or the second segment; therefore, the wings of the *sacrum* and/or rear sacral segments were usually found. The tail *vertebrae* were found either single, or the first caudal *vertebra* grown to the last sacral segment.

The front leg butchering technique. In the severing of the shoulder arch bones, the distal part of the *scapula* was severed from its proximal part, or the distal part of the *scapula* could be not severed from the proximal humerus part, or it could be severed at the shoulder joint. The *humerus* was divided into two parts: closer to the proximal end of the bone, and at the *humeral trochlea* (the distal part of the *humerus*). The distal part of the *humerus* was severed from the body in two places: above the coronoid fossa (*fossa coronoidea*) or through the very humeral trochlea (*trochlea humeris*). The elbow joint was severed by cutting through the joint itself, when the humeral trochlea was cut from the inner (*medial*) side, in order to sever the elbow joint (the proximal forearm bones). The forearm bone could

be severed by cutting off the proximal part of the forearm bone or the distal part of the bone from the body, while the remaining parts of the leg, the ankle, forefoot and toes, were severed as processing waste.

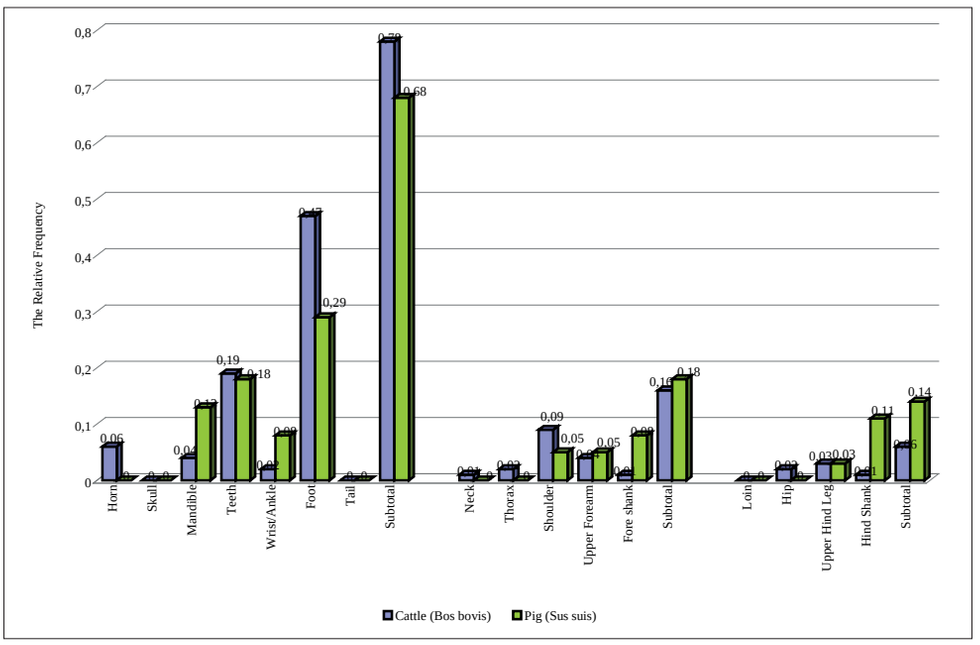
The hind leg butchering technique. The most frequently discovered part of the pelvic bone was an acetabulum, which was most frequently cut off from the iliac bone (*os ilii*), the sciatic bone (*os ischii*), and the pubic bone (*os pubis*), or a separate wing of ilium (*ala ossis ilii*), or an acetabulum with part of a sciatic and a pubic bone. That kind of division was caused by the fact that the bone was very large, and the femoral head ligament attached to the acetabulum formed an impediment. The femur was divided into three parts: the proximal (the femoral head and the ridge), the body, and the distal part (the patella and the patellar groove track). The femoral head and the ridge were found severed from the femoral body, or all the proximal part was cut off from the femoral body. The distal part of the femur was cut through the *femoral fossa* or below it. For the *tibia*, the proximal part was cut off by leaving the body and/or cutting off the distal part. Moreover, the hock and foot bones and phalanges were separated. The *talus* and the *calcaneus* were also cut off, as that way the shank parts were more easily separated from the shin bones.

**Sheep/goat.** An analysis of the relative frequency of sheep/goat skeletons (Graph 2) demonstrated the absence of teeth in the first period of the habitation of the hill-fort; however, a larger amount of the foot, thoracic, and the back part bones occurred, some of them with cut marks. In the second period of habitation, sheep/goat teeth accounted for 0.33% of the total amount of excavated sheep/goat bones. Similar cut marks left in the division of the sheep/goat spine lumbar part were also detected in the settlement at the foot of the Opstainiai/Vilkyškiai hill-fort (cf. Jarockis 2011, pp.43-45) (Fig. 3).

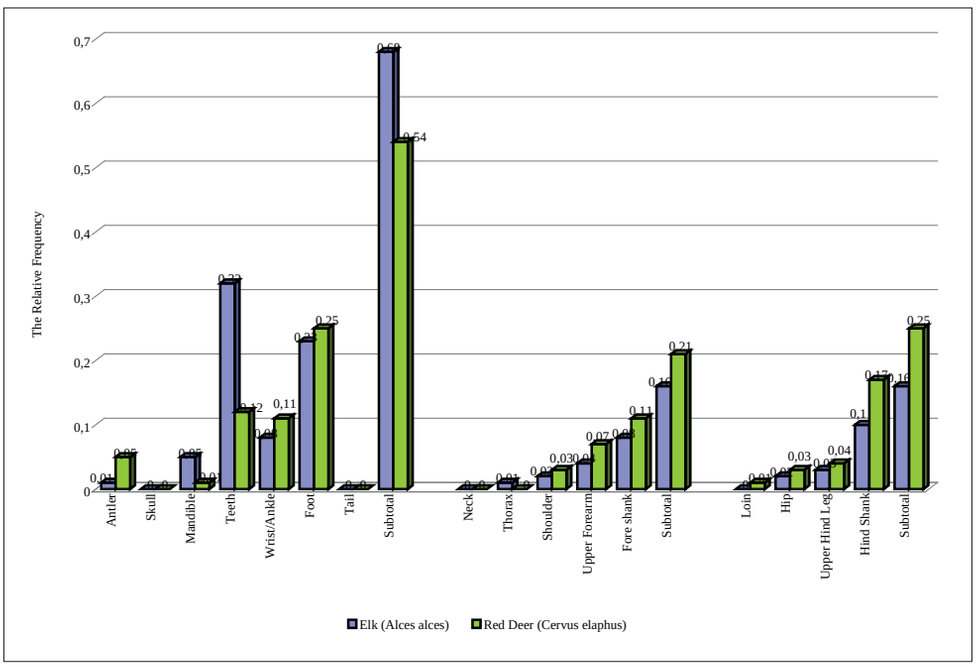
**Horse.** As is proven by the horse skeleton analysis (Graph 3), in the area of the first period of the habitation of the hill-fort, 41 fragments of horse bones were discovered (including 35 teeth and parts of teeth), and in the second period, 65 horse bone fragments (including 39 teeth and parts of teeth). In both periods, teeth accounted for the majority of the excavated bones by their relative frequency: 0.85% in the first period, and 0.60% in the second period. In the second period, the bones of the foot accounted for 0.18% of the total excavated bone amount from that period.

**Pig.** As is proven by the pig skeleton analysis (Graph 4), in the first stage of the habitation of the hill-fort, teeth clearly predominated and accounted for 0.34% by their relative frequency; while in the second stage, bones of the jaw, thorax, teeth and the upper forearm predominated.

Fig. 3. Cutting off the transverse processes of a sheep/goat lumbar vertebrae: the settlement at the foot of the Opstainiai (Vilkyškiai) hill-fort (photograph by G. Slah).



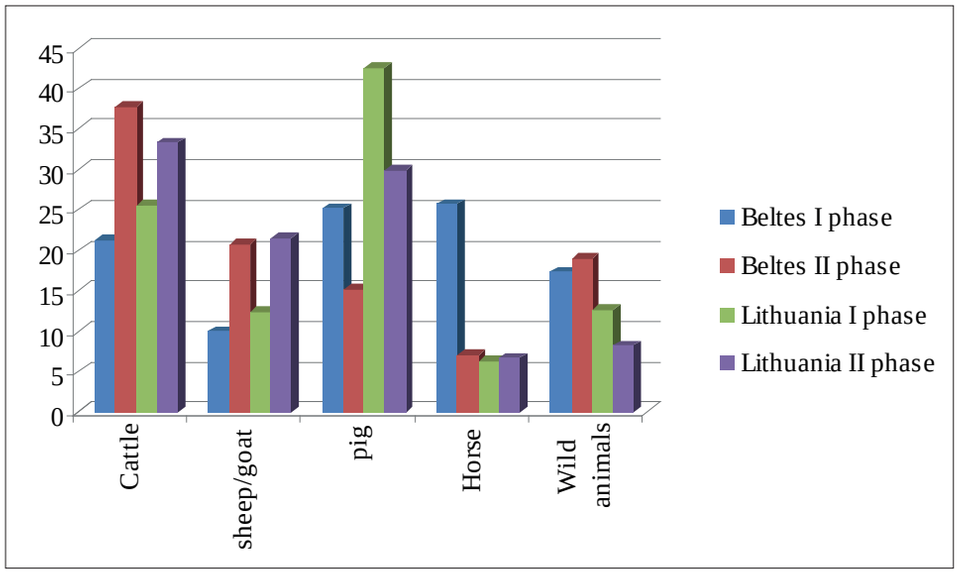

Graph 5. Summary of the cattle (*Bos bovis*) and swine (*Sus suis*) body part distribution by type of refuse at the Kretuonas 1C settlement (NISP: Number of Identified Specimens) (after S. Sovaitė).




Graph 6. Summary of the elk (*Alces alces*) and red deer (*Cervus elaphus*) body part distribution by type of refuse at the Kretuonas 1C settlement (NISP: Number of Identified Specimens) (after S. Sovaitė).

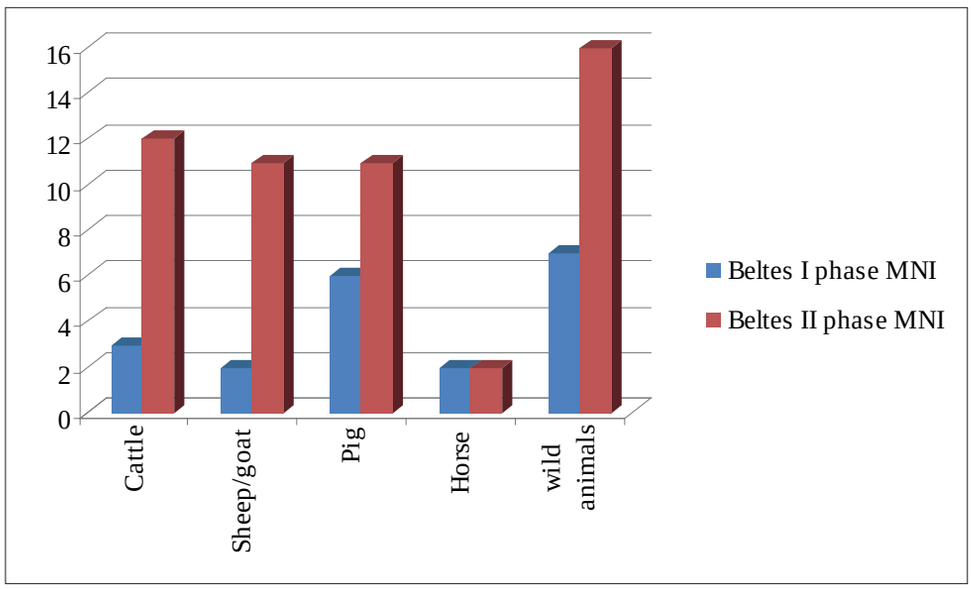
## Discussion

A comparison of the distribution of domestic animals in the first habitation period of the Padure (Beltes) hill-fort with Lithuanian hill-forts from the same period demonstrates that, by the percentage of bones, horses and swine predominated, and cattle and sheep/goats were represented to a lesser extent (Graph 7). In accordance with the MNI, in the second period of habitation, the number of all domestic and wild animals increased, except for horses (Graph 8). If we compare the percentage of swine and cattle bones excavated at Padure with the percentage of osteological material from Lithuania from the same period, we can see that in Lithuania and Belarus, in settlements of Brushed Pottery culture, more swine and cattle were kept (Lukhtan 1986, pp.3-19; Egoreichenko 2006, p.44). Similar numbers of domestic animals were kept in Polish Pomeranian and Mazurian Lake District settlements from the same




Graph 7. The percentage composition of domestic and wild animals at the Padure (Beltes) hill-fort, and in Lithuanian settlements from the same period (after L. Daugnora).



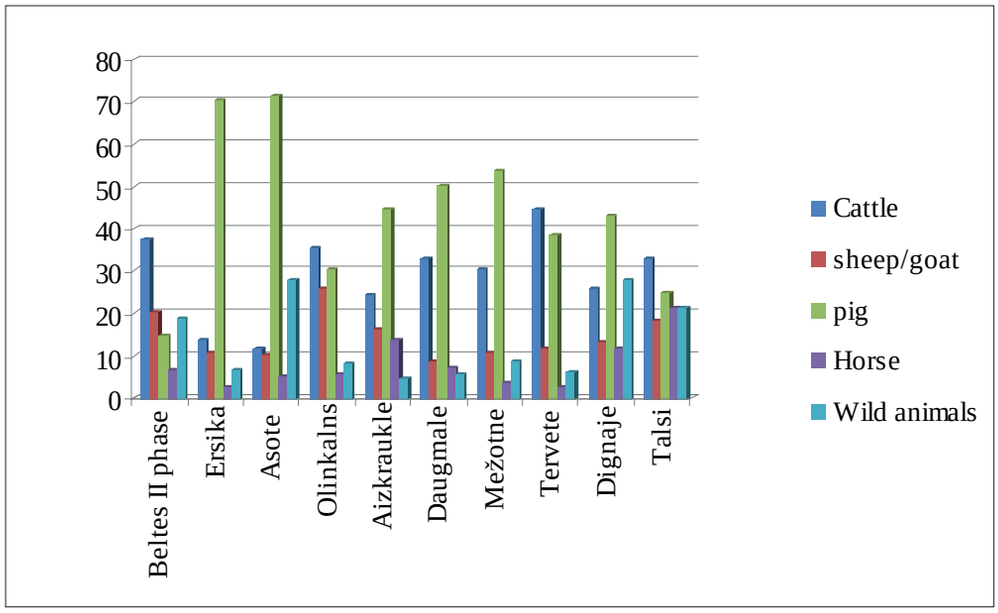



Graph 8. The minimal number of individual animals in the first and second habitation periods at the Padure (Beltes) hill-fort (after L. Daugnora).

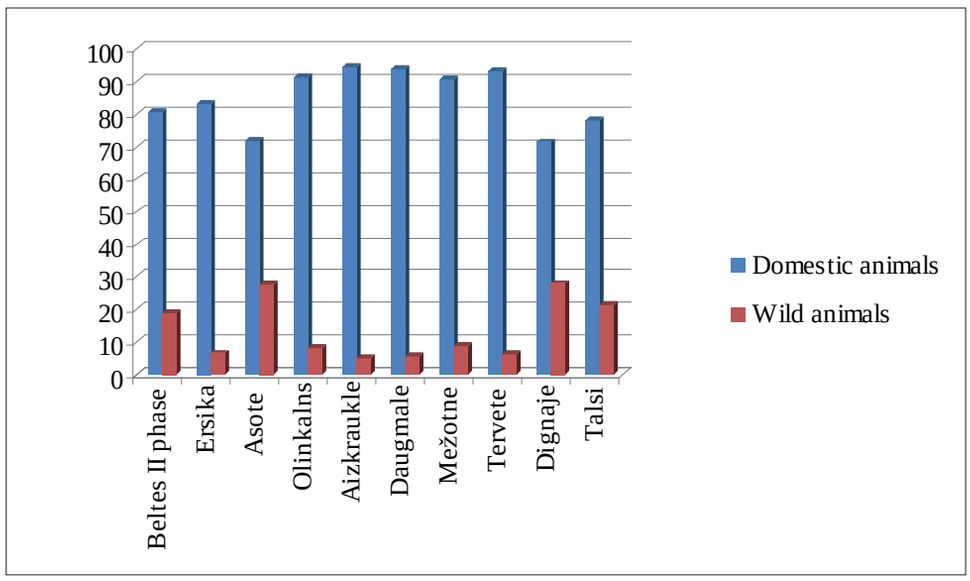
period. There, as in the osteological material from the Padure (Beltes) hill-fort, cattle and sheep/goats predominated, and the total number accounted for 46% of all domestic animals (Makowiecka, Makowiecki 2005, p.353; Piątkowska-Małecka, 2007, p.163ff). At Padure, the ratio was somewhat higher. The amount of cattle and sheep/goat bones accounted for almost 75% of all the bones of domestic animals (Graph 11). The wild game amount from the same period was slightly higher.

The amount of wild game at the Padure (Beltes) hill-fort could have been the same as in the Hallstatt and Early La Tène periods in Western Europe. There, wild animals hunted for meat were still an important source of food (Trebsche, 2013, p.227).

A comparison of the amount of swine in the second period of habitation at the hill-fort with the total percentage of swine bones discovered at Latvian hill-forts from the same period shows that at Padure, a smaller number was kept, while the percentage of bones of other domestic animals was similar (Graph 9). The percentage of bones of wild animals at Padure was higher than at other Latvian hill-forts from the same period, except for Asote and Dignāja, where the percentage of bones of wild animals was higher than in the Padure



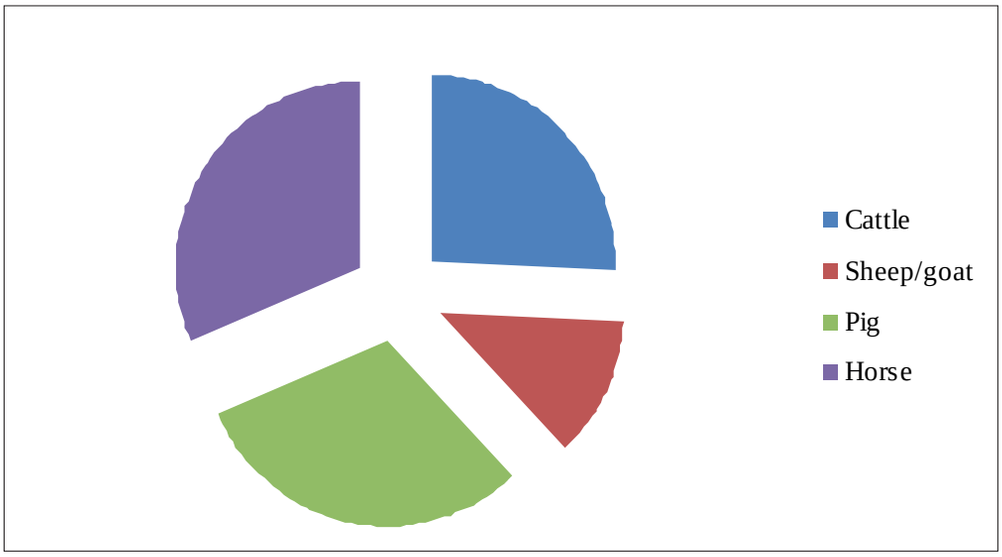

Graph 9. The number of species of domestic and wild animals detected in the second habitation period at the Padure (Beltes) hill-fort, and in Latvian settlements from the same period (after K. Paaver 1965; L. Daugnora).




Graph. 10. The number of domestic and wild animals detected in the second habitation period at the Padure (Beltes) hill-fort, and in Latvian settlements from the period (after K. Paaver 1965; L. Daugnora).

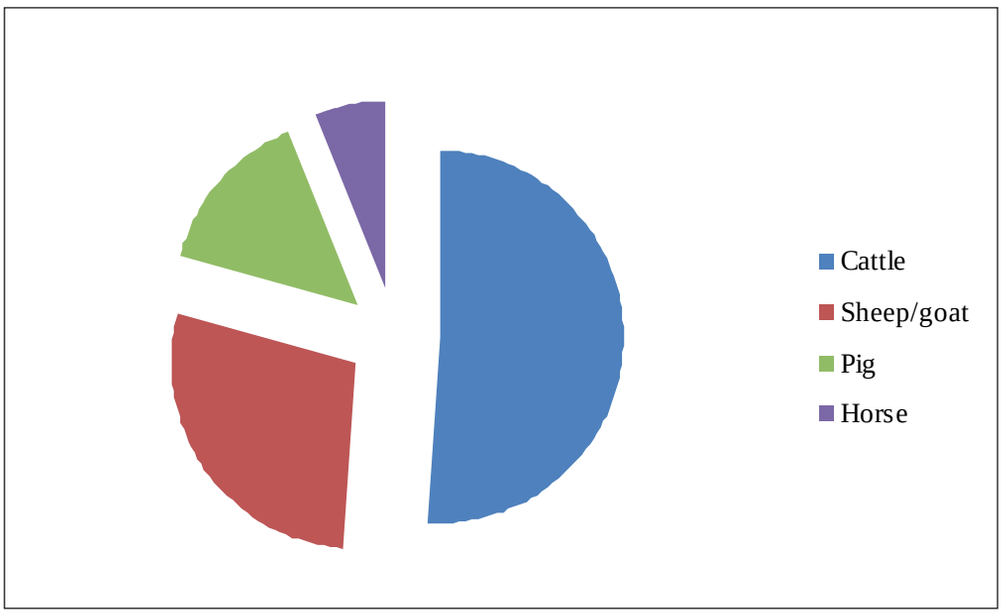
(Beltes) hill-fort osteological material (Graph 10). In the second period of habitation at Padure, the amount of cattle and sheep/goats decreased significantly; however, the number of swine and horses (Graph 12) increased, just as in other East European settlements from that period (Razluckaja 2004, pp.147-155) that have been investigated.

There are insignificant differences in the characteristics of animal butchering at Padure between the first and second habitation periods. Domestic animals were slaughtered and butchered in similar ways. In the slaughtering technique of cattle, sheep/goats, horses, and even pigs, first they were skinned, and then parts of the body were cut off (the carcass was dismembered). The latter process differed little during the investigated period, as the skeletal structure of both domestic and wild animals was similar. When writing this article, an experiment with a goat was carried out in the Experimental-Trassological Laboratory at Klaipėda University: it was slaughtered, skinned and dismembered, by means of three flint knives made of broad pieces of flint with slightly rounded points. From a technical point of view, the process was similar to the butchering techniques of the Bronze Age. The dismembering




Graph 11. The number of domestic animals in the first habitation period at the Padure (Beltes) hill-fort (after L. Daugnora).






Graph 12. The number of domestic animals in the second period of habitation at the Padure (Beltes) hill-fort (after L. Daugnora).

process took place in the following way: the belly was sectioned over a white line by separating the abdominal muscles to the right and left. The internal organs were removed: the multi-chamber stomach, the small and large intestine, the small and large omenta, and the spleen. The genitals and kidneys were removed, followed by the liver; then the diaphragm was cut out; and the trachea, lungs and heart were removed. Before cutting off the legs, the ankle joints were severed, as well as the forearm bones from the forefoot bones. Having cut the muscles of the shoulder girdle and the chest, the front limb was separated from the chest. Afterwards, by the last rib, through the last *thoracic vertebra* from the first lumbar vertebra, the spinous processes and the long back muscles were separated. And, having turned the front part of the chest, we separated it from the back part of the carcass (Fig. 4). The forequarter and the backquarter, as parts of the carcass, could already be cut into smaller pieces. Flint knives were not sufficient any longer. For the further portioning of the carcass, flint or stone axes were needed, which enabled the carcass to be cut up into smaller parts. It was only during this process that split marks, cuts and incisions appeared on the surface of the rib, vertebrae and long tubular bone that were discovered during the investigation. In this process, the carcass was sorted out and divided by the quality and value of the meat. The experiment in butchering that was carried out was similar to the characteristics of butchering at the Padure (Beltes) hill-fort during the first habitation period.

Fig. 4. Cutting off the transverse processes of a sheep/goat lumbar vertebrae (photograph by G. Slah).

In the second habitation period, domestic animals were butchered by the same techniques; however, iron tools were used for the breaking down the carcass. Therefore, in the carcass breakdown process, larger animal bone parts were broken (*vertebrae, sacrum, scapulae, pelvic* bones and *femora*), and they were detected more frequently than in the first habitation period at Padure. In the osteological material from the second habitation period, the differences indicated could also be related to larger amounts of slaughtered animals, with the carcasses intended for sale (for more information, see the article by K. Seetah et al. in the present volume). Therefore, the sorting out of the carcass was reflected in the cut marks remaining on the bones (Greenfield 2006, pp.147-163) and bone breaking (Daugnora, Girininkas 2009, pp.46-56).

In the osteological material from the Padure (Beltes) hill-fort, no cut or incision marks were detected on the tibia or the calcaneus, or on the last thoracic and the first lumbar vertebrae, since, when separating one bone from another, the soft tissues of the joint were cut leaving no marks on the osteological material. The cuts or incisions were only produced in breaking down the carcass and cutting the meat. As an example, a cut mark on the long segment (*stylohyoid*) of the aparatus hyoideus bone of a sheep/goat discovered in the osteological material from the second period of habitation can be provided.

The butchering techniques at the Padure (Beltes) hill-fort did not differ in a significant way between the first and second habitation periods. Differences may have been noticed merely in the tools for slaughtering and in their use. In the first period, flint knives and axes could still have been used; while in the second, the same tools were employed, but they were already made from iron. A large amount of tubular and other split bones witnessed the use of axes for their splitting.

For comparison, graphs of the relative frequency of bones of domestic animals (cattle and swine) and wild animals (an elk and a red deer) from the Kretuonas 1C settlement from the Early Bronze Age are provided (Graph 5), in which the amount of processing waste (the head, the mandible, the forefoot/foot bones, and phalanges) (0.78% of cattle and 0.68% of swine) is shown. This allows us to argue that no significant differences were detected between the osteological material from the Kretuonas 1C settlement from the Bronze Age (Daugnora, Girininkas 2009, pp.46-56) and the later material from the first period of habitation at Padure. An analysis of the forequarters and/or the hindquarters of animal carcasses did not show any great changes either.

## Conclusions

1. In the first habitation period at the Padure (Beltes) hill-fort, the following species of domestic animals were identified: cattle, 38 bones (MNI 3); goats/sheep, 18 bones (MNI 2); swine, 45 bones (MNI 6); and horses, 46 bones (MNI 2). The composition of wild animal species is not diverse, as animal husbandry prevailed in the economic activity of the communities. A total of 16 bones were attributed to bison/aurochs (MNI 1), one to elk (MNI 1), one to red deer (MNI 1), two to bear (MNI 1), two to beaver (MNI 1), and three bones to the *Mustelidae* family (MNI 2). As for fish, only pike vertebrae were discovered.

In the osteological material from the second habitation period at the hill-fort, 407 bones were attributed to cattle (MNI 12), 224 to goats/sheep (MNI 11), 116 to swine (MNI 9), and 49 to horses (MNI 3). Among the bones of wild animals, 33 were identified as belonging to bison/aurochs (MNI 3 ), six to elk (MNI 2), three to deer (MNI 1), four to bear (MNI 2), 12 to beaver (MNI 2), one each to wolves, foxes and the Canine family (MNI 1), three to the *Mustelidae* family (MNI 1), and one to hare (MNI 1). A total of 29 vertebrae attributed to pike and 22 bird bones belonging to the *Anatidae* family and *Phasianidae* family were discovered.

2. During the investigation, the process of animal butchering was established, and this differed insignificantly between the first and second habitation periods at the Padure (Beltes) hill-fort. In an investigation of the butchering technique, characteristics of the breakdown of the carcass were established, which changed in the second period of habitation, due to the improvement of tools. In both habitation periods at the hill-fort, the first cervical vertebrae of the animals were severed from the head by cutting through the sagittal plane, and in the second by cutting the spinous processes of the *thoracic vertebrae* and the tranverse processes of the *lumbar vertebrae*. In the first habitation period at the hill-fort, the ribs were separated from the *thoracic vertebrae* through the rib attachment places, and in the second by dividing them into three parts. These changes were caused due to the breakdown of the carcass by means of iron axes. In both cases, the limbs were severed from the animal's body by disarticulating the wrist, forefoot, hock and foot from the bones above. The scapula, pelvic bones and the principal tubular bones of both limbs were divided into three parts. Cut marks were detected on the bones of both domestic and wild animals, typical of meat cutting and joint severing. In the second period of habitation at the hill-fort, the differences in the osteological material caused by cutting up quarters into smaller pieces may be related to larger amounts of slaughtered animals, with carcasses already intended for sale.

3. The use of the chi square (x2) method for the calculation of relative frequency in an analysis of the composition of the species excavated in the first and second habitation periods at the Padure (Beltes) hill-fort demonstrates a high reliability ($p<0,001$). The hypothetical calculation of how many times the skeletal bone of an individual animal was repeated in the total amount of identified bones showed that, during the first and the second periods of habitation, the ratio of meat intended for food and the processing waste was statistically unreliable. Therefore, we can argue that the technique of the breakdown of carcasses in both hill-fort habitation periods changed insignificantly.

## References

### Literature


ASARIS, J., VASKS, A., 2004. Arheoloģiskie izrakumi Padures pilskalnā un apmetnē. *In: Arheologu pētījuni Latvijā 2002. un 2003. gadā*, Rīga, 19-23.

BALEIŠIS, R., 1977. *Briedis*. Vilnius: Mokslas.

BULL, G., PAYNE, S., 1982. Tooth eruption and epiphyseal fusion in pigs and wild boar. *In:* R. WILSON, C. GRIGSON AND S. PAYNE, eds. *Ageing and sexing animal bones from archaeological sites. British Archaeological Reports. International Serie*s, vol. 109, Oxford, 55-72.

BULLOCK, D., RACKHAM, J., 1982. Epiphyseal fusion and tooth eruption of feral goats from Moffatdale, Dumfries and Galloway, Scotland. *In:* R. WILSON, C. GRIGSON AND S. PAYNE, eds. *Ageing and Sexing Animal Bones from Archaeological Sites, Oxford: British Archaeological Reports. International Series*, vol. 109, Oxford, 73-80.

DAUGNORA, L., GIRININKAS, A., 2009. Butchery in the Early Bronze Age. *Archaeologia Baltica*, 12, 46-56.

DAUGNORA, L., THOMAS, R., 2005. Horse burials from Middle Lithuania: a palaeopathological investigation. *In:* J. DAVIES, M. FABIŠ, I. MAINLAND, M. RICHARDS, R. THOMAS, eds. *Diet and health in past animal populations: Current research and future directions (Proceeding of the 9th ICAZ Conference, Durham 2002*). Oxford, 68-74.

EGOREICHENKO, A.A., 2006. *Kultury shtrikhovannoi keramiki*. Minsk: Belorusskii gosudarstvennyi universitet.

GRANT, A., 1982. The use of tooth wear as a guide to the age of domestic animals. *In:* R. WILSON, C. GRIGSON AND S. PAYNE, eds. *Ageing and Sexing Animal Bones from Archaeological Sites*, Oxford: British Archaeological Reports. International Series, vol. 109, Oxford, 91-108.

GRANT, A., 1978. Variation in dental attrition in mammals and its relevance to age estimation. *In:* D. BROTHWELL, K.D. THOMAS, eds. *Research problems in Zooarchaeology*, 3. London, 103-106.

GREENFIELD, H.J., 2006. Slicing cut marks on animal bones: diagnostics for identifying stone tool type and raw material. *Journal of Field Archaeology*, 31, 147-163.

JAROCKIS, R., 2011. Opstainių (Vilkyškių) piliakalnis ir papėdės gyvenvietė. *Archeologiniai tyrinėjimai Lietuvoje 2010 metais.* Vilnius, 43-45.

LEVINE, M.A., 1982. The use of crown height measurement and eruption wear sequences to age horse teeth. *In:* R. WILSON, C. GRIGSON AND S. PAYNE, eds. *Ageing and Sexing Animal Bones from Archaeological Sites, Oxford: British Archaeological Reports. International Series*, vol. 109, Oxford, 223-225.

LUKHTAN, A., 1986. Skotovodstvo i okhota v Vostochnoi Litve v I tysiacheletii do n. e. (po materialam gorodishcha Narkūnai). *Istorija*, 25, 3-19.

MAGNELL, O., CARTER R., 2007. The chronology of tooth development in wild boar – a guide to age determination of linear enamel hypoplasia in prehistoric and medieval pigs. *Veterinarija ir zootechnika*, 40 (62), 43-47.

MAKOWIECKA, M., MAKOWIECKI, D., 2005. Stan badań nad użytkowaniem zwierząt w okresie rozwoju postłużyckich ugrupowań „Pomorsko-Kloszowych". *In:* M. FUDZIŃSKI, H. PANERA, eds. *Aktualne problemy kultury Pomorskiej*. Gdańsk, 349-360.

MILISAUSKAS, S., KRUK, J., PIPES, M-L., MAKOWICZ-POLISZOT, D., 2012. *Buchering and meat consuption in the Neolithic. The Explotation of Animals at Bronocice.* Kraków: Wydownictwo-Drukarnia Ekodruk s. c.

NICKEL, R., SCHUMMER, A., SEIFERLE, E., 1986. *The anatomy* of the *domestic animals*. Berlin: Verlag P. Parey.

PIĄTKOWSKA-MAŁECKA, J., 2007. Animal bone remains from the Early Iron Age settlement in Jeziorko. *In:* M. MAKOHONIENKO, D. MAKOWIECKI, J. CZERNIAWSKA, eds. *Eurasian Perspectives on Environmental Archaeology*. Poznań, 163-166.

SEETAH, K., PLUSKOWSKI, A., MAKOWIECKI, D., DAUGNORA, L., 2013. New technology or adaptation at the frontier? Butchery as a signifier of cultural transitions in the medieval Eastern Baltic. *Archaeologia Baltica*, 20, 59-76.

PAAVER, K., 1965. F*ormirovaniie teriofauny i izmenchivost' mlekopitaiushchikh Pribaltiki v golotsene*. Tartu: Akademia nauk Estonian SSR.

RAZLUCKAJA, A., 2004. Nowe badania materiatow osteologicznych z grodzisk Białoruskiego Podźwinia. *In:* J. M. HOFFMANN, J. SOBIERAJ, eds. *Prutenia Antiqua*, I. Olsztyn, 147-155.

TREBSCHE, P., 2013. Hunting in the Hallstatt and Early La Tène Cultures: the economic and social importance. *In:* O. GRIMM AND U. SCHMÖLCKE, eds. *Hunting in northern Europe until 1500 AD. Old traditions and regional developments, continental sources and continental influences. Papers presented at a workshop organized by the centre for Baltic and Scandinavian Archaeology (ZBSA) Schleswig*, June 16th and 17th, 2011. Neumünster, 215-238.

VASKS, A., 2006. Arheoloģiskie izrakumi pie Ventas. *In:* A*rheologu pētījuni Latvijā 2004. un 2005. gadā.* Rīga, 64-75.

VASKS, A., 2008. Arheoloģiskie izrakumi Padures (Beltu) pilskalnā 2006. un 2007. gadā. *Arheologu pētījuni Latvijā 2006. un 2007. gadā,* 63-70.

VASKS, A., KALNIŅA, L., DAUGNORA, L., 2011. Beltu pilskalns. *Arheoloģija un etnogrāfija.* XXV, 73-99.

WHITE, T.E., 1953. A method of calculating the dietary percentage of various food animals utilized by aboriginal people. *American Antiquity*. 18(4), 396-398.

VON DEN DRIESCH, A., 1976. *A guide to the measurement of animal bones from archaeological sites*. Harvard University Press.

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# PADURE (BELTES) PILIAKALNIO (LATVIJA) OSTEOLOGINĖ MEDŽIAGA: RŪŠIŲ PASISKIRSTYMAS IR SKERDIMO TECHNOLOGIJA

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## Santrauka

2003–2006 m. Latvijoje tyrinėtame Padure (Beltes) piliakalnyje (ištirtas 280 m$^2$ plotas) aptikti vėlyvojo bronzos ir ankstyvojo geležies (I etapo) bei vidurinio ir vėlyvojo geležies amžių (II etapo) kultūriniai sluoksniai, kuriuose, be tiems laikotarpiams būdingos archeologinės medžiagos, gausiai rasta zooarcheologinės

medžiagos. Ankstyvajame sluoksnyje aptikta brūkšniuotosios keramikos, titnago, kaulo ir rago dirbinių, iš akmenų sukrautų židinių. Aptikta daug piliakalnio vėlyvojo apgyvenimo etapo geležinių darbo įrankių, ginklų. Piliakalnyje aptikti 624 iš kaulo, rago, titnago, geležies pagaminti darbo ir buities įrankiai, 8 460 puodų šukių (brūkšniuotu, lygiu, grublėtu, tekstiliniu paviršiais). Piliakalnio apgyvenimas nutrūko XII/XIII a. riboje. Šalia piliakalnio yra buvusi didelė gyvenvietė. Sprendžiant pagal radinius, X–XII a. Beltes piliakalnis tapo ekonominiu centru, kuriame buvo plėtojami amatai ir prekyba.

Straipsnyje pateikiami abiejų etapų zooarcheologinės medžiagos tyrimų duomenys, kurie yra susiję su gyvūnų rūšinės sudėties ir skerdimo technologijos nustatymu. Piliakalnyje buvo aptikti 5 449 naminių ir laukinių gyvūnų kaulai, kurie buvo tiriami Klaipėdos universiteto Baltijos regiono istorijos ir archeologijos instituto Bioarcheologijos laboratorijoje. Pateiktuose grafikuose (11, 12 pav.) matyti rūšinė naminių gyvulių ir laukinių gyvūnų kiekio santykio (7 pav.) kaita. Medžiagos tyrimai rodo, kad santykis tarp auginamų naminių gyvulių ir medžiojamų žvėrių abiejuose lyginamuose etapuose nėra vienodas. Piliakalnio I apgyvendinimo etape tarp naminių gyvulių didesnį kiekį sudarė galvijai ir ožkos / avys.Tuo tarpu piliakalnio apgyvendinimo II etape padidėjo kiaulių ir arklių kiekis.

Straipsnyje analizuojami ir gyvulių bei žvėrių skerdimo technologijos ypatumai abiejuose piliakalnio apgyvenimo etapuose. Tyrimo metu buvo nustatyta, kad gyvulių skerdimo eiga Padures (Beltes) piliakalnio apgyvenimo I ir II etapuose mažai pakito. Tiriant skerdimo technologiją, nustatyti skerdenos dalijimo požymiai, kurie piliakalnio apgyvenimo II etape, tobulėjant įrankiams, pakito. Abiejuose piliakalnio apgyvenimo etapuose gyvūnų pirmasis kaklo slankstelis buvo atidalijamas nuo galvos, kertant per sagitalinę plokštumą, II etape – nukertant keterines krūtinės ir skersines juosmens slankstelių ataugas. I etape šonkauliai buvo atskiriami nuo krūtinės slankstelių per šonkaulių prisitvirtinimo vietas, o II etape – dalijant į tris dalis. Abiem laikotarpiais galūnės būdavo atskiriamos nuo gyvūno kūno bei atidalijant riešą ir plaštaką bei kulną ir pėdą nuo aukščiau esančių kaulų. Mentė ir dubens kaulai bei pagrindiniai abiejų galūnių vamzdiniai kaulai būdavo dalijami į tris dalis. Tiek naminių, tiek laukinių gyvūnų kauluose aptikta įkartų, kurios būdingos pjaustant mėsą ir atskiriant sąnarius. Piliakalnio apgyvenimo II etapo osteologinėje medžiagoje pastebima skirtumų, atsiradusių dalijant nuokirtas į smulkesnes dalis, kurie gali būti siejami su smulkesniu gyvulių skerdenos dalijimu, nes skerdenos jau buvo skiriamos prekybai.