Estonian Journal of Archaeology, 2007, **11**, 1, 59–79

Liina Maldre

FAUNAL REMAINS FROM THE SETTLEMENT SITE OF PADA

The article deals with the faunal remains recovered from the Viking Age settlement site of Pada during the excavations in 1980–1982. The remains mainly contain bones of domestic animals; wild animals and seals are moderately represented. The main emphasis in animal husbandry lay on cattle, sheep/goat occupied the second position by the number of bone fragments, the third was horse and the smallest was the number of pig bones. Among cattle and horse bones the percentage of those belonging to adult specimens was relatively high, sheep/goats and pigs were mostly butchered young. Domestic animals of the Viking Age were most likely slightly larger than in the Latest Iron Age and in the Middle Ages, but the difference is not large.

On käsitletud viikingiaegsest Pada asulakohast aastatel 1980–1982 kogutud arheozooloogilist materjali. Luuaines koosneb valdavalt koduloomade luudest, metsloomad ja hülged on esindatud tagasihoidlikult. Loomapidamise põhirõhk oli veisekasvatusel, luufragmentide arvukuselt teisel kohal on lambad-kitsed, kolmandal hobune ja põllumajandusloomadest saadi kõige vähem sigade luid. Veise- ja hobuseluude hulgas on suhteliselt palju täiskasvanud isendite luid, lambad-kitsed ja sead on enamikus noorelt tapetud. Viikingiaegsed koduloomad olid oma mõõtmetelt tõenäoliselt veidi suuremad kui hilisrauaaegsed ja keskaegsed koduloomad, kuid erinevused ei ole suured.

Liina Maldre, Institute of History, Tallinn University, 6 Rüütli St., Tallinn 10130, Estonia; Liina.Maldre@mail.ee

Introduction

The first excavations on the settlement site of Pada were undertaken in 1977–1979 under the supervision of Toomas Tamla. Extensive investigations followed in 1980–1982, when an area of 1800 sq m was excavated (Тамла 1978; 1980; 1983). Archaeological finds as well as the ^{14}C analyses indicate that the settlement site was used mainly in the (7th?) 8th–10th/11th centuries; the second hillfort of Pada can be regarded as contemporaneous with the settlement (Тамла 1984, 362). The location of the animal bones recovered from the sites of Pada in the

1970s, including the faunal remains from the second hillfort of Pada is unknown; therefore I cannot compare the material from the settlement site and the hillfort. In view of the fact that the cultural layer of the second hillfort of Pada was thin, poor in finds and severely disturbed by ploughing (Тамла 1980, 379), we may presume that the faunal remains recovered there were rather scanty and most likely quite fragmentary.

The aim of the paper is to establish, on the basis of faunal remains recovered from the Pada settlement site, the species' structure and slaughter ages of the animals. The slaughter ages suggest the aims of animal husbandry – meat animals, draught animals, etc. On the basis of bone measurements the sizes of the domestic animals of the Viking Age are established. The results are compared with the investigation results of faunal remains from other contemporaneous sites of Estonia, as well as the records from Russia and Sweden.

Material and methods

In the present article only the faunal remains recovered from the settlement site of Pada in 1980–1982 are discussed. It comprises approximately 4800 animal bones and bone fragments, 2233 of them (including 1 human bone) determinable. The anatomical and species' composition of the material is presented in Table 1. Besides, a small number of bird (35) and fish (6) bones were found. The scarceness of bird and fish bones is probably due to the excavation methods.

For determining the age of the specimens, the ages of the ossification of epiphyses and the eruption of permanent teeth presented by I. A. Silver (1969) were used. The identification of sheep and goat bones was performed on the basis of the diagnostic traits presented by Joachim Boessneck, Hanns-Hermann Müller and Manfred Teichert (1964). The minimal number of specimens, expressing the smallest possible number of animals in the discussed find complex, was determined, using the method of recurrent bone fragments and their stage of the ossification of epiphyses, or, on jaw bones, the stage of the development of teeth. The minimal number of specimens was calculated separately for each excavation plot and then added together. For the measuring of the bones the method recommended by Angela von Driesch (1976) was used. Only the measurements of the bones with completely ossified epiphyses were used. Nevertheless, some growth of bones immediately after the ossification of epiphyses cannot be precluded. On the basis of recent material it has been established that the diameter of pig bones proceeds to increase slightly also after the ossification of the epiphyses; the continuation of the growth of bones cannot be precluded in sheep either (Davis 1996, 599). The shoulder height of cattle was calculated on the basis of the constants elaborated by Jonni Fock (1966), for the calculation of the shoulder height of sheep the constants recommended by Dietrich Haak (1965) were used.

Table 1. The species' and anatomical composition of faunal remains (number of bone fragments/minimal number of specimens)
Tabel 1. Luuainese liigiline ja anatoomiline koostis (luufragmentide arv/isendite minimaalne arv)

	Cornus/Proc. corn.	*Cranium*	*Mandibula*	*Dentes*	*Vertebrae*	*Costae*	*Scapula*	*Humerus*	*Radius et ulna*	*Ossa carpalia*	*Os metacarpale*	*Ossa coxae*	*Femur*	*Patella*	*Tibia et fibula*	*Ossa tarsalia*	*Os metatarsale*	*Os metapodiale*	*Ossa sesamoidea*	*Phalanges*	Total	%
Bos taurus	6/3	96/11	69/17	117/13	83	40	30/12	32/9	65/19	26/8	50/12	38/12	48/11	1/1	54/22	87/24	57/16	4/2	2/1	92	997/33	44.6
Ovis aries	2/2	14/4	2/1		20	21	4/2	18/12	11/5		12/8	2/1	5/2	1/1	5/2	13/5	14/9			18	162/15	7.3
Capra hircus	6/6	3/1						4/2	7/5		3/2						2/2				25/7	1.1
Ovis aries/ Capra hircus		27/7	47/15	105/20	14	31	18/10	20/9	60/14	1/1	20/6	27/14	22/9	1/1	47/13	5/3	26/7	1/1		2	474/20	21.2
Sus scrofa dom.		25/10	25/12	30/8	14	30	6/5	16/8	21/10		8/5	6/6	3/3	1/1	10/4	4/2	1/1	2/2		4	206/20	9.2
Equus caballus		15/6	13/6	55/9	13	1	3/2	12/6	22/7	5/2	17/5	8/3	6/3	1/1	20/9	37/9	17/8	7/3	1/1	35	288/15	12.9
Canis familiaris			2/2	1/1			1/1		2/2			1/1			1/1	1/1					9/4	0.4
Felis domesticus[1]													1/1								1/1	0.0
Alces alces	14/4															1/1		1/1			16/4	0.7
Bos taurus? Alces alces?									1/1				1/1				1/1				3/2	0.1
Capreolus capreolus?[1]															1/1						1/1	0.0
Sus ferus?				2/2							1/1						1/1				4/3	0.2
Canis lupus?									1								2				3/2	0.1
Castor fiber													1/1								1/1	0.0
Lepus sp.																	2/1	3/1			5/2	0.2
Phocidae		3[2]			7	2		7[3]	1			2	1		6	3	1			3	36	1.5
Rodentia		1																			1/1	0.0
Homo sapiens													1								1/1	0.0
Total	28	184	158	310	151	125	62	109	191	32	111	84	89	5	144	151	124	18	3	154	2233	100
%	1.3	8.2	7.1	13.9	6.8	5.6	2.8	4.9	8.6	1.4	5.0	3.8	4.0	0.2	6.4	6.8	5.6	0.8	0.1	6.9	100	

[1] Probably of a later date.
[2] One fragment belongs to the Grey Seal (*Halichoerus grypus*) (determined by L. Lõugas).
[3] One fragment belongs to the Grey Seal and one fragment to the Harp Seal (*Pagophilus groenlandicus*) (determined by L. Lõugas).

Representation of species and skeletal parts

The overwhelming majority of the remains belong to domestic animals; wild animals and seals are represented moderately (Fig. 1). Cattle *(Bos taurus)* occupy clearly the first place among domestic animals, bones of sheep and goats *(Ovis aries et Capra hircus)* make up slightly less than one third of the faunal remains. Horse *(Equus caballus)* and pig *(Sus scrofa domestica)* are nearly equally represented, the number of horse bones being slightly larger (Fig. 2). A few bones belong to a dog *(Canis familiaris)* and one fragment, though probably of a later date, belongs to a cat *(Felis domesticus)*.

From north Estonian settlement sites of the period we have presently for comparison only the results of the analysis of the faunal remains from the Kaberla settlement site (Vedru 2003, 97–99) and there the relative importance of cattle and horse bones was considerably smaller (31.6% and 6.3%, respectively) and the relative importance of sheep/goat and pig bones was considerably higher – 40.3% and 19.4% (Maldre 2003). The settlement of Kaberla, however, is not a very good site for comparison, since the faunal remains recovered there were scanty and poorly preserved. In the faunal remains from Iru hillfort (excavations of 1953–1957; Lang 1996, 36, 56–68) the relative importance of horse bones was higher than in Pada – nearly 22%, the percentage of cattle bones was slightly smaller (33.4%) and the relative importance of sheep/goat and pig bones about the same as in Pada (Eesti talurahva ajalugu, 1991, 86). In Uugla, western Estonia, cattle bones made up 47%, sheep/goat bones 31%, pig bones 14% and horse bones 8% of all bones of domestic animals recovered from the excavation of 2005 (Maldre 2005). In the Viking Age settlement site of Tornimäe, Saaremaa Island (Mägi 2005) cattle bones made up 32%, sheep/goat bones 49%, pig bones 15%

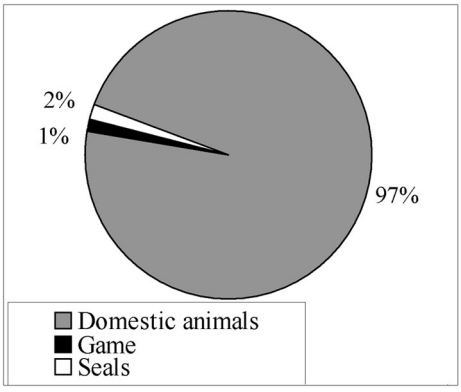

Fig. 1. The relative importance of domestic and wild animals and seals.

Joon 1. Kodu- ning metsloomade ja hüljeste osatähtsus.

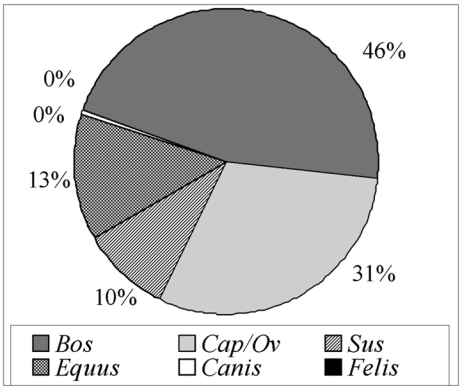

Fig. 2. The relative importance of the species of domestic animals.

Joon 2. Koduloomaliikide osatähtsus.

and horse bones 4% of all bones of domestic animals (Maldre 2006). In the settlement of Linnaaluste, Rapla County (Konsa et al. 2002; 2003) the species' structure in different excavation plots was different but summarily sheep and goat bones constituted about a half, cattle bones about one third, pig bones 13% and horse bones only 5% of all bones of domestic animals (Maldre 2004). In the settlement site of Rõuge in southern Estonia, horse bones constitute almost 40% of all bones of domestic animals while the percentage of cattle bones is 27%, pig bones 20% and sheep/goat bones only 13%. In the faunal remains from the hillfort of Rõuge horse and cattle are almost equally represented (27–28%), the percentage of sheep/goat bones is 20% and pig bones 24% (Паавер 1965, appendix II). In the Viking Age and early medieval settlement sites of Sweden the relative importance of different species of domestic animals also differs quite considerably. The percentage of horse bones varies in them from 1% to 14% (Wigh 2001, 102, 117). According to Venjamin Tsalkin (Цалкин 1956, 176) in Pskov (late 1st millennium) and Staraya Ladoga (7th–9th centuries), cattle bones made up approximately 58% of all bones of domestic animals (dog and cat bones, which were considerably more numerous there than in our material, were not taken into consideration). The percentage of pig bones was 25–30%, sheep and goat bones 7–8% and horse bones 4% in Staraya Ladoga and 10% in Pskov. Among the faunal remains from Staraya Ladoga from the 9th–10th centuries the relative importance of pig bones had slightly increased and that of cattle and horse bones decreased. In other regions of Russia the importance of horse bones was larger than in north-western Russia (Цалкин 1956, 142–143).

The distribution of bones by skeletal parts is presented in Fig. 3. The first thing that strikes the eye in the diagram is the low percentage of horn cores of cattle, sheep and goats. The faunal remains from the Pada settlement are sufficiently well preserved, so the small number of horns cannot be explained by taphonomic losses. We may presume that most of sheep and cattle were hornless. Since skull fragments of hornless sheep occur among the faunal remains, it seems plausible. But the situation is slightly different with cattle. First, not a single skull fragment of hornless cattle has been discovered, not only from the Pada settlement site but also from the whole of Estonian archaeozoological material. Second, the cattle skull fragments from Pada comprise very few bones of occipital part. It looks as if the horns were removed from the skull and discarded in some other place or taken away from the settlement altogether. The high percentage of other skull bones is not caused by the large number of teeth only, fragments of mandibles and maxillae and other skull parts are also numerous. The bones of fleshy parts of carcass (Fig. 3: 3–5) are represented quite equally, regardless of species[1], only the percentage of ribs and vertebrae of horse is somewhat lower. The bones of

[1] I excluded from the figure the ribs of the nearly complete skeleton of a piglet, found from one of the refuse pits, since they would have increased the percentage of ribs and vertebrae to an abnormally high level.

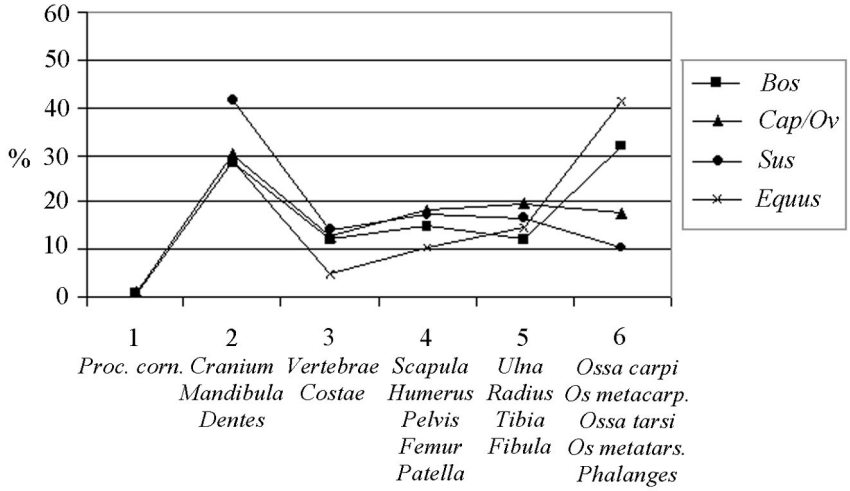

Fig. 3. Anatomical composition of the faunal remains.

Joon 3. Luuainese anatoomiline koostis.

the distal ends of extremities of different species are, for some unknown reason, very modestly represented. Nevertheless the figure demonstrates clearly that the remains belong to locally butchered animals. The fact that the anatomical structure of horse bones does not differ from other species supports the speculation that horse flesh was also used for food.

The excavations of the Pada settlement site brought to light several refuse pits that also provided animal bones. The species' and anatomical structure of the faunal remains recovered from the pits and the rest of the site did not vary greatly (Figs 4–5).

There are slightly more cattle bones and less sheep/goat and horse bones in the pits. Pig bones are represented almost equally (the nearly complete piglet skeleton (only pelvis and hind limbs were missing) – a total of 39 bones – found from one of the pits I regarded as one bone in the diagram). Seal bones are slightly more numerous in the pits, other game bones (except elk) are represented by single fragments and their distribution may be incidental. The majority of elk bones bore working traces and none of them came to light in the pits.

The anatomical structure of faunal remains from the territory of the settlement site was quite similar for all species. Skull bones of pig are somewhat more represented, the percentage of the distal parts of extremities is equal for horse and cattle and sheep/goat and pig. The distribution of the bones from the pits is irregular, probably caused by the scantiness of the material – the pits provided only 236 determinable bone fragments. On the basis of the investigation results it seems that no substantial difference can be observed between the cultural layer in the settlement and the refuse pits, at least not in the archaeozoological aspect.

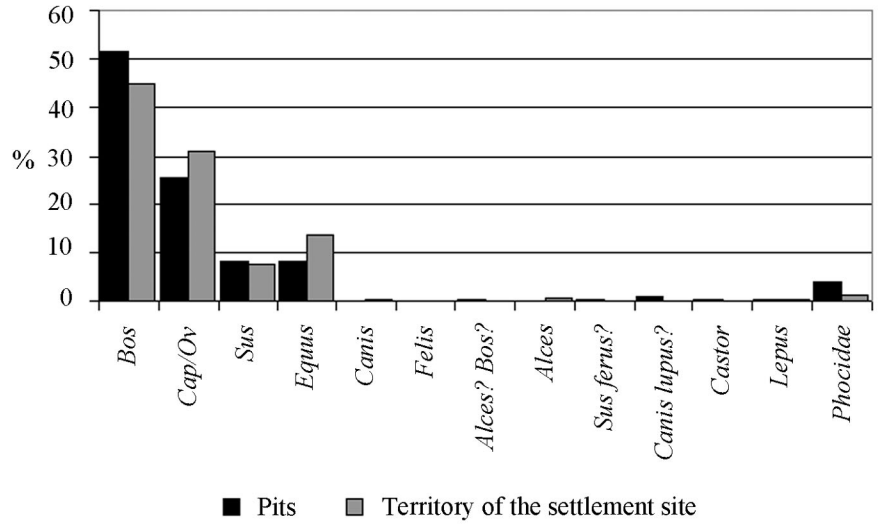

Fig. 4. Representation of species in the pits and on the territory of the settlement site.
Joon 4. Luuainese liigiline koostis lohkudes ja asula ülejäänud territooriumil.

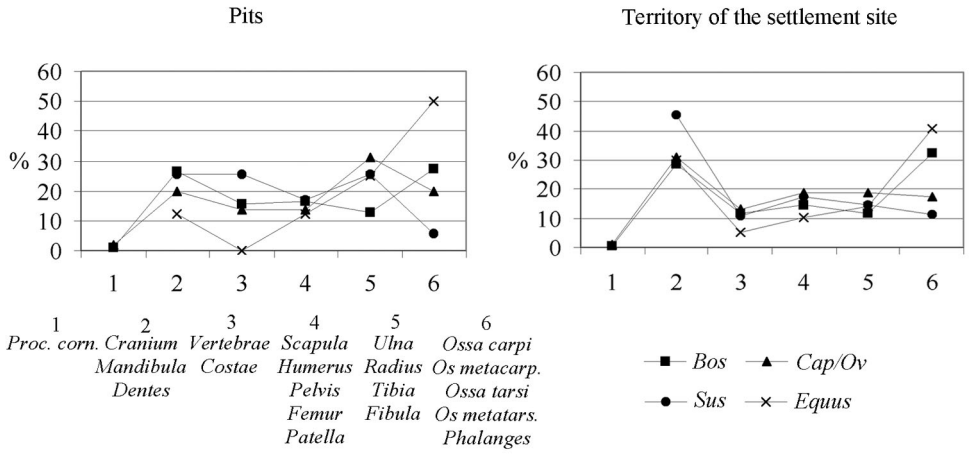

Fig. 5. Anatomical composition of faunal remains in refuse pits and the rest of the excavation.
Joon 5. Luuainese anatoomiline koostis jäätmelohkudes ja ülejäänud kaevandis.

Cattle (*Bos taurus*)

10% of cattle were butchered at the age under 6 months, a few additional percents between 6–18 months. Until the age of 2.5 years the curve ascends slightly. Further the graph becomes salutatory and it can be said that only 30–50%

of the specimens were butchered younger than four years of age (Fig. 6). The older specimens probably formed dairy cattle and draught animals may also be represented. The investigations carried out in Sweden revealed that in Swedish Viking Age settlements 50% or even more of cattle were butchered before the age of 4 (after Wigh 2001, 106, fig. 67), i.e. the situation was quite similar to that in Pada.

Information about the size of cattle raised in Pada is very scanty. On four mandibles it was possible to measure the length of the alveolar row $P_{2\text{-}4}$, which remained between 46.1–53.0 mm (average 49.7 mm). The measurements of limb bones of cattle are presented in Tabs 2–4.

Unfortunately we do not have sufficient data for comparison from other Viking Age settlements and hillforts of Estonia. Nevertheless we can assert that the average measurements of cattle bones from Pada are mostly larger than in the Latest Iron Age hillfort of Varbola and the medieval material of Estonia.

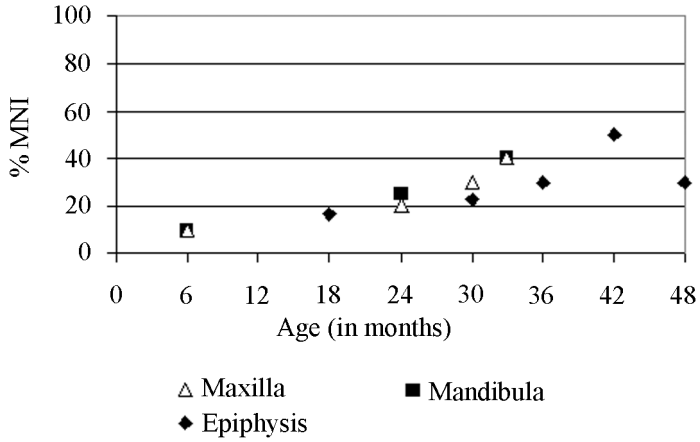

Fig. 6. Slaughter ages of cattles.
Joon 6. Veiste tapavanused.

Table 2. The measurements (mm) of forelimbs of cattle
Tabel 2. Veiste esijäsemete luude mõõtmed (mm)

	Radius		*Os metacarpale*				
	Prox.	Dist.	Length	Prox.	Dist.	Min. width of diaphysis	Diaph. index
Min.		61.1	181.1	52.4	50.8	27.4	14.9
Max.		71.3	183.5	61.7	64.0	27.9	15.3
Avg.	76.5	65.3	182.4	56.2	56.1	27.6	15.1
σ		5.1	1.2	4.7	4.3	0.3	0.2
n	1	4	3	5	9	3	3

Table 3. The measurements (mm) of hind limbs of cattle

Tabel 3. Veiste tagajäsemete luude mõõtmed (mm)

	Tibia dist.	*Talus*			*Calcaneus* length	*Os metatarsale*				
		Lat.	Med.	Dist.		Length	Prox.	Dist.	Min. width of diaphysis	Diaph. index
Min.	51.9	58.3	53.4	36.2			41.5	49.0	26.9	
Max.	64.7	67.0	61.2	45.5			52.0	56.4	28.0	
Avg.	58.2	61.8	56.7	39.3	133.3	214.5	48.3	53.9	27.5	13.1
σ	3.9	2.7	2.3	3.1			3.3	3.4	0.8	
n	16	18	16	17	1	1	7	4	2	1

Table 4. The measurements (mm) of the phalanges of cattle

Tabel 4. Veiste varbalülide mõõtmed (mm)

	Phalanx I				*Phalanx* II				*Phalanx* III	
	Max.	Prox.	Dist.	Diaph.	Lat.	Prox.	Dist.	Diaph.	Max.	Dors.
Min.	49.1	25.7	23.7	20.6	32.9	24.5	19.4	18.8	64.4	49.0
Max.	58.0	34.1	31.4	26.7	39.5	32.8	30.6	25.5	84.2	61.9
Avg.	54.4	29.3	27.6	23.6	36.3	28.6	24.2	21.8	71.2	53.6
σ	2.0	2.3	2.5	1.7	2.1	2.5	3.3	2.2	6.4	3.9
n	23	20	23	21	12	15	13	15	10	10

To calculate the shoulder height of cattle, maximal length of metatarsal and metacarpal bones is generally used. The faunal remains from the Pada settlement contained three wholly preserved metacarpal bones and only one metatarsal bone. The measurements and proportions of all three metacarpals are very similar. On the basis of such scanty material it is not possible to establish whether these bones belong to males or females, but comparing them with faunal remains from Birka (Wigh 2001, 68–69) and the measurements and proportions of Estonian medieval cattle (Maldre 1997, 709; in print) we may assume that they belong to cows. On the basis of the length of metacarpal bones we may suggest that the shoulder height of the animals was about 109–110 cm. The metatarsal bone is very massive and, compared with our medieval record, would suit a bull. In that case the presumable shoulder height of the animal would be even 119 cm.

The faunal remains of Pada also contained cattle bones with pathological features or anomalies. In one of the mandibles the bone of *processus condylaris* has become porous and glistens sporadically, which indicates that during the animal's lifetime the cartilage of the articular surface had been destroyed, most likely by arthrosis. Some teeth with irregular wear were also found. The faunal remains also contained tarsal and carpal bones with pathological changes – in four cases fused *os centroquartale* and *os tarsale III* were found, and one *os carpi*

ulnare had exostoses. One metacarpal and one metatarsal bone had small exostoses at the edges of proximal articular surface; some phalanges with deformations of proximal articular surface were also found. Exostoses could be observed also at the edges of some lumbar vertebraes.

Sheep and goat (*Ovis aries et Capra hircus*)

Mandibles and maxillae and epiphyses of sheep and goat produce quite different diagrams of slaughter age (Fig. 7). No specimen could be established, butchered under the age of 6 months. Faunal remains from Pada did not contain any mandible or maxilla with unerupted first molar. The bones of juvenile specimens were represented, but since it was not possible to establish slaughter age on their basis, they could not be individually included in the diagram. Up to 20% of the animals could have been butchered during the first 12 months, up to one third before the age of 18 months. On the basis of mandibles nearly a half of sheep and/or goats were butchered before the age of two years, but the maxillae and epiphyses give a considerably lower result. Since most of the mandibles and maxillae were preserved only fragmentarily and quite frequently without teeth, the slaughter age of older animals was not possible to establish, the state of epiphyses suggests that slightly below 70% of the specimens were butchered before the age of 3 years, and only about 10% were allowed to live over 3.5 years. Since the percentage of older animals is relatively low, we may assume that sheep and goats were also kept for their meat. Among the faunal remains from Viking Age settlements of Sweden (Pollista and Ängdala) more than 30% of sheep jaw bones belong to specimens butchered before the age of 9 months, the age interval of ¾–2 years is relatively poorly represented, and about 20% of animals have been allowed to

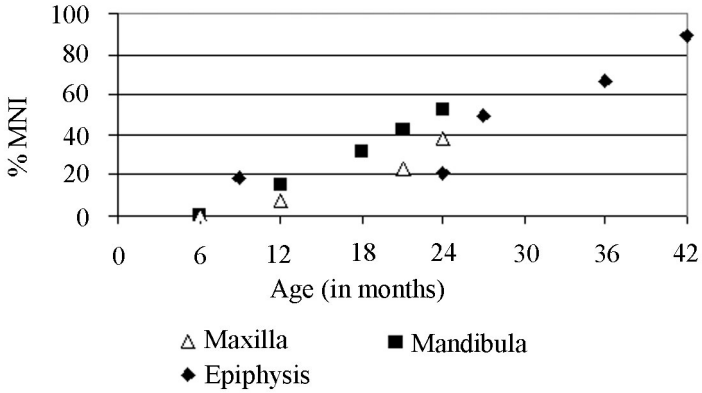

Fig. 7. Slaughter ages of sheep and goats.

Joon 7. Lammaste-kitsede tapavanused.

live over 4 years. Since in Swedish towns sheep of the age group ¾–2 years are clearly over-represented, it seems plausible that animals of this age group were sold in towns as mutton (Wigh 2001, 107).

About the appearance of sheep and goats the faunal remains from Pada provide no substantial information. Although only a few horn cores were found, a sheep skull fragment with a piece of horn core was discovered. The diameters of the bases of horn cores were 21 mm and 31 mm, base perimeter was 90 mm, thus the skull fragment might belong to a horned ewe. Two skull fragments belong to hornless ewes. Horns cores and skull fragments of rams could not be discovered among the remains. Horns cores of goats (females as well as males) were also few and fragmentary.

Sheep and goat bones suitable for measuring were also few among the faunal remains from Pada. It was possible only to measure the length of the alveolar row M^{1-3} of one maxilla (44.5 mm), and the length of the alveolar row P_{2-4} on two mandibles (20.9 mm and 21.8 mm). The measurements of sheep bones are presented in Tabs 5–7.

Table 5. Measurements (mm) of bones of forelimbs of sheep

Tabel 5. Lammaste esijäsemete luude mõõtmed (mm)

	Humerus dist.	*Radius* prox.	*Os metacarpale*				
			Length	Prox.	Dist.	Min. width of diaphysis	Diaph. index
Min.	25.4	28.7		19.7	23.5	13.3	
Max.	31.2	29.5		21.9	25.9	14.3	
Avg.	28.9	29.1	132.6	20.7	24.5	14.0	10.8
σ	2.1	0.6		1.0	1.2	0.6	
n	11	2	1	5	3	3	1

Table 6. Measurements (mm) of bones of hind limbs of sheep

Tabel 6. Lammaste tagajäsemete luude mõõtmed (mm)

	Tibia dist.	*Calcaneus* length	*Talus*			*Os metatarsale*				
			Lat.	Med.	Dist.	Length	Prox.	Dist.	Min. width of diaphysis	Diaph. index
Min.	22.6	50.9	25.3	24.7	16.6	121.3	17.6	20.4	10.2	8.1
Max.	29.4	52.2	26.6	25.9	18.3	146.0	18.9	23.3	11.8	8.5
Avg.	25.3	51.4	26.0	25.3	17.2	131.7	18.1	22.0	10.7	8.3
σ	1.7	0.7	0.9	0.8	0.9	10.3	0.6	1.2	0.6	0.2
n	14	3	2	2	3	4	4	4	5	4

Table 7. Measurements (mm) of sheep phalanges
Tabel 7. Lammaste varbalülide mõõtmed (mm)

	Phalanx I				*Phalanx* II			
	Max.	Prox.	Dist.	Diaph.	Lat.	Prox.	Dist.	Diaph.
Min.	31.5	11.1	10.2	8.1	18.0	9.9	9.0	7.6
Max.	36.9	11.7	10.9	9.9	19.9	10.8	9.3	8.4
Avg.	33.0	11.3	10.6	9.1	19.1	10.3	9.1	8.1
σ	2.1	0.2	0.2	0.5	1.0	0.5	0.2	0.4
n	9	9	9	9	3	3	3	3

The metacarpal bones of sheep suggest the shoulder height of 64.3 cm, shoulder heights calculated on the basis of metatarsal bones stay in the interval 55.2–66.4 cm (average 59.9 cm). The shoulder heights in the medieval faunal remains of Estonia are quite similar, but the Viking Age sheep of Sweden were, on the average, a couple of centimetres higher, as suggested by the faunal remains from Birka (Wigh 2001, 95–96).

The health problems observed on sheep/goats mainly concerned teeth. One mandible lacked P_2, another one had M_3 not erupted (the wear stage of M_2 was f, M_3 was visible in the mandible). P_3 in one mandible was slightly askew and P_4 was unevenly worn.

Pig (*Sus scrofa domestica*)

The diagram of pigs' slaughter age (Fig. 8) indicates, quite expectedly, that the bones overwhelmingly belong to young specimens. 10–15% of the specimens have been butchered before the age of 6 months, by the end of the first year apparently about 40% (the result calculated on the basis of epiphyses, however, seems too high). 20% have been butchered before the age of 18 months. In the interval of 18–24 months the curve of slaughter age does not rise, the diagram of epiphyses indicates that the rest of the animals were butchered before the age of 2.5 years. At any rate, no pig bones belonging to an older animal could be found among the faunal remains from the Pada settlement. They might occur among mandibles. In at least one mandible of a sow the P_4 wear stage (TWS) according to Annie Grant's (1982) method was 10 and the wear stage of M_1 was 17–18, which may mean that the wear stage of M_1–M_3 (MWS) was 34–38.

The slaughter ages of pigs in the Viking Age settlements of Sweden indicate that the majority of pigs were butchered at the age of 2–5 years but the teeth of animals older than 5 years also occur among the faunal remains. In urban material, bones of young pigs prevail. Bengt Wigh (2001, 106–107) explained it with the fact that there were more woodlands around settlements, which provided sufficient food for pigs and therefore it was possible in settlements to keep older pigs to get

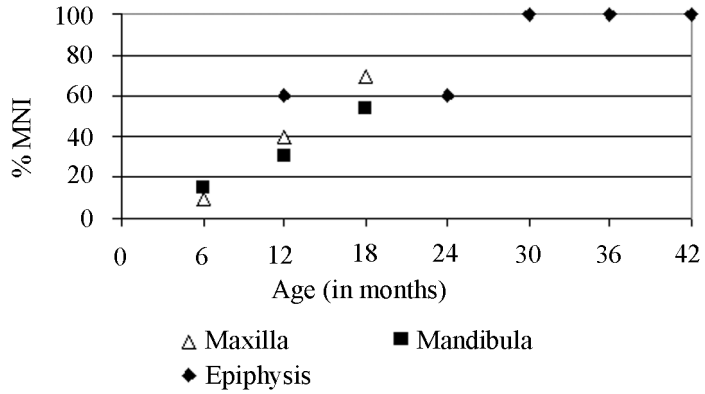

Fig. 8. Slaughter ages of pigs.
Joon 8. Sigade tapavanused.

a larger amount of pork. The percentage of older pigs was higher also in towns with more forested surroundings, e.g. in Sigtuna. In the settlement of Pada the food supply of pigs should not have presented a problem, therefore it remains disputable why the pigs there were butchered so young. As a matter of fact, in the faunal remains from the Viking Age towns the percentage of older pigs was also higher than in the settlement of Pada. For example in Birka slightly less than 80% of pigs have been butchered before the age of 2.5 years and more than 90% before the age of 3.5 (Wigh 2001, 80). Apparently such age structure of pigs sufficed the meat requirement of the inhabitants of the Pada settlement and keeping older animals in larger numbers was neither necessary nor economically efficient.

Among pig bones the measurable ones were few, as always (Tab. 8), since most of the pigs were butchered young. Therefore it is not possible to establish the presumable shoulder heights of pigs.

At least in one mandible of a pig (boar) P_1 was missing, and in the same mandible P_2 and P_3 are located abnormally far from each other.

Table 8. Measurements (mm) of pig bones
Tabel 8. Sealuude mõõtmed (mm)

	Humerus distale	*Radius proximale*	*Tibia distale*
Min.	42.6	26.3	29.8
Max.	38.4	29.5	30.0
n	2	2	2

Horse (*Equus caballus*)

Bone fragments suitable for determining the slaughter ages of horses were also too few. Different bones give greatly varying results (Fig. 9) and on the basis of this scanty information we may assume that up to a quarter of the animals could have been butchered before the age of 2 years. However, the assumption that 50% of the specimens were butchered before the age of 3.5 years seems illogical and this is confirmed also by the results from mandibles and maxillae.

We do not have any information about the slaughter ages of horses from the neighbouring regions to compare with, and on this subject our records do not provide very reliable results either. The measurements of horse bones are presented in Tabs 9–10. The metacarpal bone which was wholly preserved could belong probably to a specimen with shoulder height of 128–136 cm.

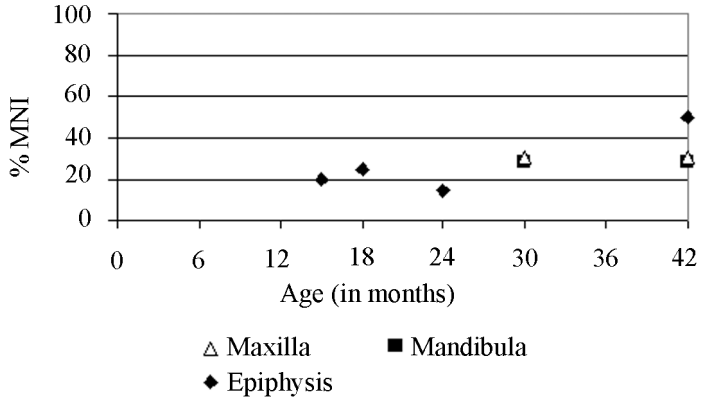

Fig. 9. Slaughter ages of horses.
Joon 9. Hobuste tapavanused.

Table 9. Measurements (mm) of horse bones
Tabel 9. Hobuseluude mõõtmed (mm)

	Radius dist.	*Os metacarpale* III				*Talus*			*Os metatarsale* III		*Tibia* dist.
		Max.	Prox.	Dist.	Diaph.	Lat.	Med.	Dist.	Prox.	Dist.	
Min.	70.5		42.5		28.3	50.3	50.3	44.2	46.9		62.0
Max.	71.7		48.1		32.5	58.3	57.3	51.4	49.3		75.4
Avg.	71.0	216.5	44.8	45.7	30.4	54.7	54.6	47.9	48.1	43.8	67.0
σ	0.6		2.4		3.0	2.6	2.5	2.7	1.7		4.8
n	3	1	4	1	2	9	10	8	2	1	9

Table 10. Measurements (mm) of horse phalanges
Tabel 10. Hobuste varbalülide mõõtmed (mm)

	Phalanx I				*Phalanx* II			
	Max.	Prox.	Dist.	Diaph.	Max.	Prox.	Dist.	Diaph.
Min.	76.3	49.8	38.5	28.8	38.5	46.2	39.9	40.4
Max.	86.0	56.3	45.4	35.2	49.4	52.8	49.8	44.7
Avg.	80.6	53.2	41.8	32.3	43.9	49.0	45.0	41.4
σ	3.7	2.3	2.1	2.3	4.9	2.8	3.6	1.9
n	10	9	11	10	4	5	6	5

In one mandible of a horse M_3 is shortened, one P_2 has a considerably more worn rostral part and one P_2 has a more worn caudal part. Several tarsal bones have exostoses and changes probably caused by inflammations – in one case III and IV tarsal bones are fused, in one case III and IV tarsal bones and *os tarsale centrale* are fused. Two calcanea and two astragali also have exostoses; one of these calcanea was probably fused with astragalus. One pathological calcaneus and astragalus belong to the same specimen (Fig. 10a). Most of the pathological tarsal bones come from the right hind limb. Large exostoses can be observed also on the sides of one I phalanx; articular surfaces are not damaged (Fig. 10b).

Since horse bones and cattle bones have been crushed similarly, it may be assumed that horse flesh was used for food as well. This is also confirmed by knife

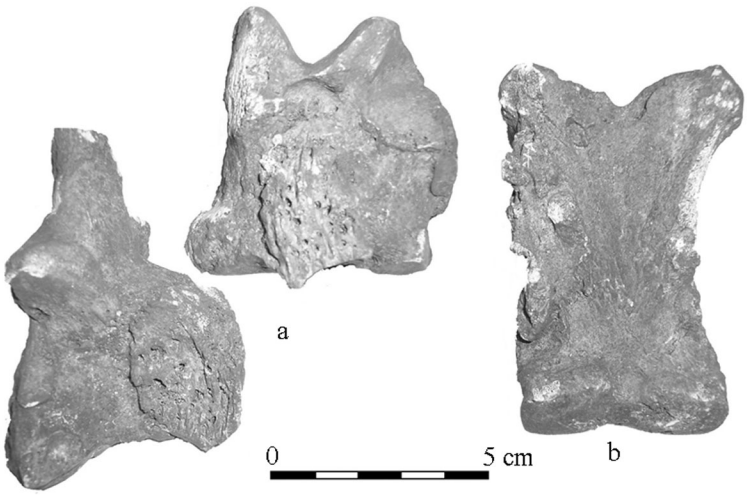

Fig. 10. Horse bones with pathological changes. a calcaneus and astragalus, b I phalanx.
Joon 10. Patoloogiliste muutustega hobuseluid. a kand- ja kontsluu, b I varbalüli.

cuts on some bones. Large (III) metacarpals and metatarsals of horses were used to make skates; small ones (II and IV) could have been used as awls (Luik & Maldre 2005, 264–266).

Hunting

The analysis of faunal remains indicates that hunting did not belong among the main occupations of the inhabitants of the Pada settlement – only 1% of all bones belong to wild animals and 2% to seals. The importance of fishing also seems to have been insignificant, but since the excavations were urgent rescue excavations, it is possible that most of fish bones remained unnoticed. Elk (*Alces alces*) bones are mostly antler fragments with working traces and fragments of antler artefacts. The antlers may have been found in the forest and thus have no connection whatever with hunting. A fragment of a metacarpal bone (II or IV; with working traces) and a fragment of astragalus might suggest hunting. Deciding by their size, four bones (2 teeth, 1 metacarpal and 1 metatarsal fragment) could belong to wild boar (*Sus scrofa ferus*) and three bones (radius and 2 metatarsal fragments) to wolf (*Canis lupus*). Beaver (*Castor fiber*) is represented by one femur, and hare (*Lepus sp.*) by five bones (2 metatarsal and 3 metacarpal/metatarsal bones). Since odd bison (*Bison bonasus*) bones have been found from the Rõuge settlement and hillfort (Паавер 1965, 293) and Pähklimägi of Viljandi (Saks & Valk 2001), and maybe also from the hillfort of Unipiha (Paaver 1970), which all have been dated similarly, I paid special attention to the largest bones of bovids, but no bone could be identified as bison's. Seals' (*Phocidae*) bones are relatively rare – only 36 fragments. All parts of carcass are represented (Fig. 11). It is pointless to analyse the anatomical composition of seal bones in greater detail on the basis of such scanty material.

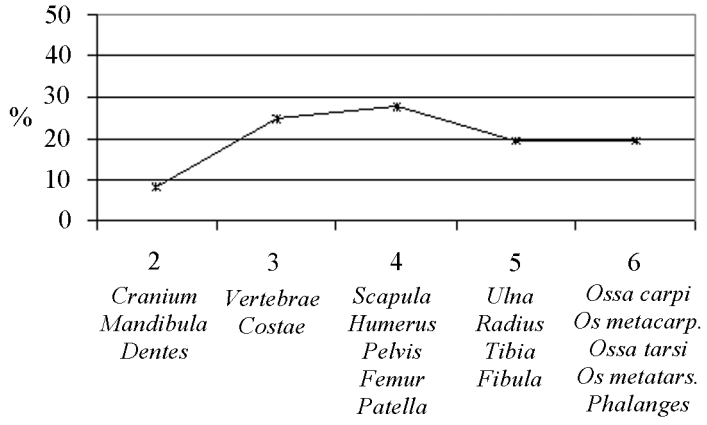

Fig. 11. Anatomical composition of seal bones.

Joon 11. Hülgeluude anatoomiline koostis.

Among seal bones juvenile, young and adult specimens are represented. One sacrum bears knife traces. Pathological changes were not observed on seal bones.

Game and seal bones are rare also among the faunal remains from the Iru hillfort – wild animals 1% and seals 2% of all determined animal bones (Paaver 1966). Among the faunal remains from the settlement site of Kaberla the ratio of bones indicating game and seal hunting is about the same (Maldre 2003). Among the finds recovered from the Uugla settlement site, western Estonia, in 2005 game and seal bones are missing altogether (Maldre 2005). The faunal remains from both Kaberla and Uugla also contained only a few fish bones. The percentage of seal bones is considerably higher among the faunal remains from the Tornimäe settlement site, Saaremaa Island (12.5%), and a number of fish bones were also found here (Maldre 2006). An interesting case is the Viking Age settlement site of Linnaaluste: in two excavation plots game bones were missing altogether, three fragments of elk antler were found from one excavation, and in one excavation game bones (elk, beaver, bear) constituted nearly 15% of all determined bones (Maldre 2004). The relative importance of game bones is considerably higher in the faunal remains from south Estonian Viking Age sites: in the settlement of Rõuge game bones constitute 48% and in the hillfort of Rõuge even 57% of all bones (Паавер 1965). Among the faunal remains from the Unipiha hillfort the percentage of game bones is somewhat lower – 21% of all determined bones (Paaver 1970). In southern Estonia main game were beaver and elk whose bones constitute about 90% of all game bones from the settlement as well as the hillfort of Rõuge. Faunal remains from the hillfort of Unipiha were scanty – only 57 game bones were found, 18 of them belonging to beaver and 17 to elk.

Summary

The menu of the inhabitants of the settlement of Pada contained mainly meat of domestic animals, suggestions of game are few and fowl and fish also seem to have been of no importance. Game bones are generally rare among the Viking Age finds from northern Estonia. The percentage of seal bones is relatively high only in the Tornimäe settlement, Saaremaa, evidently owing to the fact that the settlement was located on the coast while the other investigated settlements were located at some distance from the sea.

The anatomical composition of faunal remains indicates that, more or less, all parts of carcass are represented. It means that animals were raised on the spot. The anatomical structure and crushing of horse bones do not differ much from the respective features in cattle bones, which suggests the use of horse flesh for food. Special mention should be made of the fact that the faunal remains contain very few horns of cattle, sheep and goats. This makes an impression that horns (together with occipital bones) were taken to some other place. Horns and bones of distal parts of limbs are often associated with hide working; these bones were left attached to the hides that were sent to tanner (Schibler 1991). Among the

faunal remains from Pada, however, only horns are clearly under-represented; metacarpal and metatarsal bones as well as phalanges occur in large numbers. The small number of horns among faunal remains has been observed also in other Estonian Viking Age settlements.

In animal husbandry cattle dominated. Nearly a quarter of cattle were butchered before the age of 2 years, 30–50% of cattle were butchered before the age of 4 years. Such age structure suggests mainly dairy cattle and draught animals but raising cattle for beef was not insignificant either. Slightly less than one third of determined animal bones belong to sheep and goats. On the basis of bones determined to species sheep seems to have prevailed, the percentage of goats was apparently low. Most of the sheep were butchered before the age of 3.5 years. The absence of bones of small lambs can be explained by the fact that lambs provide very little meat. The importance of pig breeding was evidently moderate in Pada. Since pigs are always bred for pork, it is only natural that most of the pigs were butchered young. Still it is somewhat surprising that no carcass bones, suitable for age determination, were found belonging to a specimen older than 3.5 years. Nevertheless, some mandible fragments (at least one of them belonging to a sow) might belong also to older specimens. Horse bones were even more numerous than pig bones and they include remains of juvenile, young and adult specimens. The diagram of slaughter ages of horses was similar to that of cattle but since the number of bone fragments suitable for age determination was small, the results may be arbitrary. Most likely such age and species' structure of animals/herd was optimal considering natural conditions and the fact that probably animals were reared only for local use.

The faunal remains from Pada provide very little information about the size of the animals. They were probably somewhat larger than at the end of the Iron Age and in the Middle Ages but the differences were not substantial. The faunal remains also included bones with pathological changes, mainly tooth anomalies; on some cattle and horse bones the traces of inflammation of carpal and tarsal joints could be observed.

Acknowledgement

The author wishes to thank Liis Soon who translated this paper.

References

Boessneck, J., Müller, H. H. & Teichert, M. 1964. Osteologische Unterscheidungsmerkmale zwischen Schaf (*Ovis aries Linné*) und Ziege (*Capra hircus Linné*). – Kühn-Archiv, 78, 1–129.

Davis, S. J. M. 1996. Measurements of a group of adult female Shetland sheep skeletons from a Single Flock: a baseline for zooarchaeologists. – Journal of Archaeological Science, 23, 593–612.

Driesch, A. 1976. Das Vermessen von Tierknochen aus vor- und frühgeschichtlichen Siedlungen. München.

Eesti talurahva ajalugu. Olion, Tallinn, 1991.
Fock, J. 1966. Metrische Untersuchungen an Metapodien einiger europäischer Rinderrassen. Dissertation. München.
Grant, A. 1982. The use of tooth wear as a guide to the age of domestic ungulates. – Ageing and Sexing Animal Bones from Archaeological Sites. (BAR British Series, 109.) Oxford, 91–107.
Haak, D. 1965. Metrische Untersuchungen an Röhrenknochen bei Deutschen Merinolandschafen und Heidschnucken. Dissertation. München.
Konsa, M., Lang, V., Lainemurd, I. & Vaab, H. 2002. Archaeological excavations at settlement site I of Linnaaluste. – AVE, 2001, 74–81.
Konsa, M., Lang, V. & Loolaid, L. 2003. Settlement site III of Linnaaluste from archaeological complex of Keava. – AVE, 2002, 51–55.
Lang, V. 1996. Muistne Rävala. Muistised, kronoloogia ja maaviljelusliku asustuse kujunemine Loode-Eestis, eriti Pirita jõe alamjooksu piirkonnas. (MT, 4.) Tallinn.
Luik, H. & Maldre, L. 2005. Bone and antler artefacts from the settlement site and cemetery of Pada in north Estonia. – From Hooves to Horns, from Mollusc to Mammoth. Manufacture and Use of Bone Artefacts from Prehistoric Times to the Present. Proceedings of the 4th Meeting of the ICAZ Worked Bone Research Group at Tallinn, 26th–31st of August 2003. (MT, 15.) Tallinn, 263–276.
Mägi, M. 2005. Viking Age harbour site at Tornimäe, eastern Saaremaa. – AVE, 2004, 65–75.
Maldre, L. 1997. Big and small Bovids from mediaeval towns in Estonia. – Anthropozoologica, 25–26, 707–714.
Maldre, L. 2003. Aruanne Kaberla asulakohalt 2002. a. kogutud arheozooloogilisest materjalist. Manuscript at the Institute of History.
Maldre, L. 2004. Aruanne Linnaaluste I ja III asulakohast kogutud loomaluudest. Manuscript at the Institute of History.
Maldre, L. 2005. Aruanne Uugla asulakohast 2005. aastal kogutud loomaluudest. Manuscript at the Institute of History.
Maldre, L. 2006. Aruanne Tornimäelt 2004. a. kogutud loomaluudest. Manuscript at the Institute of History.
Maldre, L. In print. Koduloomaluud keskaegsest Tallinnast. (MT.) Tallinn.
Paaver, K. 1966. Iru kindlustatud asula kaevamisel 1953.–1957. a. kogutud luumaterjali määramise esialgsed tulemused. Manuscript at the Institute of History.
Paaver, K. 1970. Unipiha linnuse 1970. a. luumaterjali määramise esialgsed tulemused. Manuscript at the Institute of History.
Saks, P. & Valk, H. 2001. Loomaluude leiud Viljandi Pähklimäelt. (Viljandi Muuseumi aastaraamat, 2001.) Viljandi, 2002, 52–58.
Schibler, J. 1991. Tierknochen als Informationsquelle zu Handwerk, Ernährung und Wirtschaftsweise im Mittelalter der Nordwestschweiz. – Methoden und Perspektiven der Archäologie des Mittelalters. Tagungsberichte zum interdistsiplinären Kolloquium vom 27.–30. September 1989 in Liestal (Schweiz). (Berichte aus der Arbeit des Amtes für Museen und Archäologie des Kantons Baselland. Archäologie und Museum, 20.) Liestal, 145–156.
Silver, I. A. 1969. The ageing of domestic animals. – Science in Archaeology. Eds D. Brothwell & E. S. Higgs. London, 283–302.
Vedru, G. 2003. Archaeological excavations in Kaberla and Lagedi villages. – AVE, 2002, 97–103.
Wigh, B. 2001. Excavations in the Black Earth 1990–95. Animal Husbandry in the Viking Age Town of Birka and its Hinterland. (Birka Studies, 7.) Stockholm.

Паавер К. Л. 1965. Формирование териофауны и изменчивость млекопитающих Прибалтики в голоцене. Тарту.
Тамла Т. 1978. Исследование городища и поселения в Пада. – TATÜ, 27: 4, 353–357.

Тамла Т. 1980. Предварительные результаты падаской экспедиции в 1978–1979 гг. – TATÜ, 29: 4, 378–382.
Тамла Т. 1983. Селище в Пада. – TATÜ, 32: 4, 302–306.
Тамла Т. 1984. Первое городище и хронология комплекса археологических памятников в Пада. – TATÜ, 33: 4, 360–362.
Цалкин В. И. 1956. Материалы для истории скотоводства и охоты в древней Руси. (МИА, 51.) Москва.

Liina Maldre

PADA ASULA ARHEOZOOLOOGILISEST MATERJALIST

Resümee

Artikli eesmärgiks on Pada asulakohast kogutud loomaluude põhjal välja selgitada karja liigiline struktuur ja loomade tapavanused, mis viitavad omakorda loomapidamise eesmärkidele – lihaloomad, tööloomad jne. Luude mõõtmete alusel on püütud kindlaks teha viikingiaegsete koduloomade suurust. Tulemusi on võrreldud Eesti teistest sama perioodi muististest kogutud loomaluude analüüsitulemustega, samuti Rootsi materjalidega.

Esimesed kaevandid tehti Pada asulas Toomas Tamla juhendamisel aastail 1977–1979, ulatuslikumad arheoloogilised uuringud toimusid seal aastail 1980–1982. Nii arheoloogiline leiumaterjal kui ka ^{14}C-analüüsid näitavad, et asula põhiliseks kasutusperioodiks oli 7 (?)/8.–10/11. sajand. Artiklis on käsitletud aastail 1980–1982 Pada asulast kogutud arheozooloogilist materjali.

Pada asula elanike toidulaual oli põhiliselt ainult koduloomade liha, ulukilihale viitavat materjali on väga vähe, ka linnulihal (sh kana) ja kalal ei paistnud erilist tähtsust olevat. Linnu- ja kalaluude nõrk esindatus võib olla põhjustatud ka kaevamismetoodikast. Jahiloomade luid on põhjapoolse Eesti viikingiaegses materjalis üldse väga vähe. Hülgeluude osatähtsus on võrdlemisi suur ainult Saaremaal Tornimäe asulakohas, kuid kõige tõenäolisemalt on see põhjustatud asjaolust, et nimetatud asula paiknes täiesti rannikul, ülejäänud uuritud asulakohad asetsesid aga merest mõnevõrra kaugemal. Lõuna-Eestis oli küttimine viikingiajal märgatavalt intensiivsem: Rõuge linnuse luumaterjalis moodustavad ulukiluud koguni 57% kõigist määratud loomaluudest.

Loomaluude anatoomiline koostis näitab, et rohkemal või vähemal määral on esindatud kõik kerepiirkonnad. Hobuseluude anatoomiline struktuur ja purustuse aste ei erine oluliselt veiseluude omast, seetõttu võib arvata, et ka hobuseliha tarvitati toiduks. Eraldi väärib äramärkimist asjaolu, et materjalis on väga vähe veiste, lammaste ja kitsede sarvjätkeid. Seega jääb mulje, et sarvjätked (koos kuklapiirkonna luudega) on viidud kuhugi mujale. Sarvjätkeid ja jäsemete distaalsete osade luid seostatakse sageli nahkade töötlemisega, need luud jäeti parkimisele viidavate nahkade külge. Pada asula materjalis on siiski ilmselgelt ala-

esindatud ainult sarvjätked, kämbla- ning pöialuid ja varbalülisid sisaldab luuaines arvukalt. Sarvjätkete väga väikest hulka on täheldatud ka teiste Eesti viikingiaegsete asulate arheozooloogilises materjalis.

Karjakasvatuse põhirõhk oli Pada asulas veisekasvatusel. Ligikaudu veerand veistest tapeti enne 2-aastaseks saamist, 30–50% veistest tapeti enne 4-aastaseks saamist. Taoline vanuseline struktuur viitab eelkõige piimakarjale ja tööloomadele, kuid päris tähtsusetu ei olnud ka veisekasvatus liha saamise eesmärgil. Veidi alla kolmandiku määratud loomaluudest kuuluvad lammastele ja kitsedele. Liigini määratud luude hulga põhjal näib, et valdavalt oli tegemist siiski lammastega, kitsede osatähtsus oli ilmselt suhteliselt väike. Enamik lammastest tapeti enne 3,5-aastaseks saamist. Väikeste tallede luude peaaegu täielik puudumine materjalis on põhjendatav asjaoluga, et talledelt saab väga vähe liha. Seakasvatuse osatähtsus oli Pada asulas suhteliselt tagasihoidlik. Kuna sigu peetaksegi ainult liha saamise eesmärgil, siis on ka loomulik, et enamik neist tapeti noorelt. Siiski on mõnevõrra üllatav, et materjalis pole mitte ühtki vanuse määramist võimaldavat kereluud, mis oleks kuulunud üle 3,5-aastasele isendile. Mõned alalõualuude fragmendid (neist vähemalt üks kindlasti emise oma) võiksid kuuluda siiski ka vanematele isenditele. Hobuseluid on arvuliselt isegi rohkem kui sealuid ja nende hulgas on nii juveniilsete, noorte kui ka täiskasvanud isendite jäänuseid. Hobuste tapavanuste graafik on üsna sarnane veiste omaga, aga kuna vanuse määramist võimaldavate luufragmentide hulk on väike, siis võivad tulemused ka juhuslikud olla. Tõenäoliselt oli karja selline liigiline ja vanuseline koostis optimaalne antud looduslikes oludes ja tingimustes, kus loomi kasvatati ainult enda tarbeks.

Loomade suuruse kohta annab Pada asula materjal suhteliselt vähe infot. Loomad olid tõenäoliselt mõnevõrra suuremad kui rauaaja lõpul ja keskajal, kuid erinevused polnud väga suured. Materjalis esineb ka patoloogiliste muutustega luuleide: põhiliselt hammastiku arenguanomaaliaid ja veistel ning hobustel ka deformeerunud randme- ja kannaluid. Arheozooloogiline materjal näitab, et küttimine ei kuulunud kindlasti Pada asula elanike põhitegevuste hulka: metsloomade luid on 1% ja hülgeluid 2% kogu luuainesest. Põdraluudest moodustavad enamiku töötlemisjälgedega sarvefragmendid ja sarvesemete katked. Nende puhul võib olla tegemist ka metsast korjatud sarvedega ja küttimisega ei pruugi sellel üldse mingit seost olla. Jahipidamisele võiksid viidata kämblaluu fragment (II või V; töötlemisjälgedega) ja kontsluu katke. Suuruse järgi otsustades võiks neli luud (2 hammast, 1 kämbla- ja 1 pöialuukatke) kuuluda metsseale ja kolm luud (kodarluu ja 2 pöialuu fragmenti) olla pärit hundi skeletist. Kobras on esindatud ühe reieluuga ja jänes viie luuleiuga. Suhteliselt vähe (ainult 36 fragmenti) on hülgeluid. Esindatud on kõik kerepiirkonnad. Hülgeluude hulgas on nii juveniilsete, noorte kui ka täiskasvanud isendite omi. Patoloogilisi muutusi pole hülgeluudel täheldatud.