THE MEDIEVAL AND EARLY MODERN SMITHY SITE OF KÄKU

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INTRODUCTION

The smithy site was discovered in the spring of 2005 during a survey of the National Heritage Board to inspect the archaeological sites of Western Saaremaa, among them the Viking Age burial site of Käku. When asking for directions to the burial site at the Kusta farm in the Käku village, large lumps of slag laid on the stone fence attracted the attention of Jüri Peets, Ants Kraut and others. The farmer Vladimer Juhandi said that his father had put the slag on the fence decades ago. He led the archaeologists to the site, about 100 metres northward, on the lands of the Sepa farm, where a large boulder was situated. Preliminary investigation with a soil probe and a test pit revealed a thick layer of waste from iron production or a smithy. A radiocarbon sample from the bottom of the test pit dated the site to the 15th – 16th century AD (Tln-2556, Table 1). In the following year of 2006, archaeological excavations, directed by Jüri Peets, were carried out on the site and lots of smithy refuse and scrap metal was found. Archaeological fieldwork continued in the years 2007–2009 and 2012. During the summer of 2012, Ragnar Saage (MA student of TÜ) conducted the excavations on the site under the supervision of Jüri Peets.

In summer 2008, the Käku fieldwork base was used to carry out a series of experiments in forging meteoric iron, with the goal to study the properties of meteoric iron using different forging techniques (cold forging, welding together pieces of meteoric iron and meteoric iron with steel, etc.). Based on this research, Tõnu Narro completed his MA thesis in the Estonian Academy of Arts (Narro 2011).

ARCHAEOLOGICAL FIELDWORK IN 2006–2011

Excavations on the smithy site started in the summer of 2006, with a rectangular trench of 8 × 8 m. The preliminary investigation with the soil probe indicated a possibility that the smithy site consisted of different smithy phases built on top of each

other – the dark refuse layer was 50–70 cm thick. In the course of work it became clear that on the site remains of at least three temporally different medieval smithies existed, besides which mixed material from a briefly used smithy of the modern period was also found (Table 1). A very similar smithy site had been excavated in the years 1989–1990 in the village of Paatsa, Mustjala parish (Fig. 1). In Paatsa, five smithy remains[1] lying on top of each other were found, dating from the 11th to the second half of the 14th century AD (Peets 2003, 181–192).

It was apparent that the topmost phase of the smithy had been disturbed by ploughing and that many of the stones from the smithies' constructions had been reused by the local villagers. Ploughing marks were visible just under the turf layer and a heap of stones was situated next to the boulder close to the smithy. Based on the finds from the uppermost layers, the latest smithy phase could be dated to the second half of the 19th century to the beginning of the 20th century. The artefacts included a socket of a potato hook, industrially produced nails, pieces of a carriage wheel, rectangular nuts, horseshoe nails, etc.

In the 1860s, the land on the island Saaremaa was divided between the farms and consolidated into united lots, which brought on a shift towards capitalist agriculture. This initiated a 'smithy building boom', which lasted until the 1890s. Most of the smithies that were ethnographically recorded during the 20th century were built during that period (Linnus 1950, 39). Before the communal land division, most of the smithies belonged to the wealthier farms, but after the division, farms with average and low income also started to build their own smithies (*ibid*., 40). In that regard, the latest phase of the smithy probably belonged to a small farm and did not have much in common with the professional smiths who worked on the same site more than 150 years earlier.

In the following years (2007–2009) remains of earlier smithies were found. These included a rectangular base of a forge, wall foundations made from stone and several patches of burnt clay, which probably originated from pit forges (Fig. 2). In the

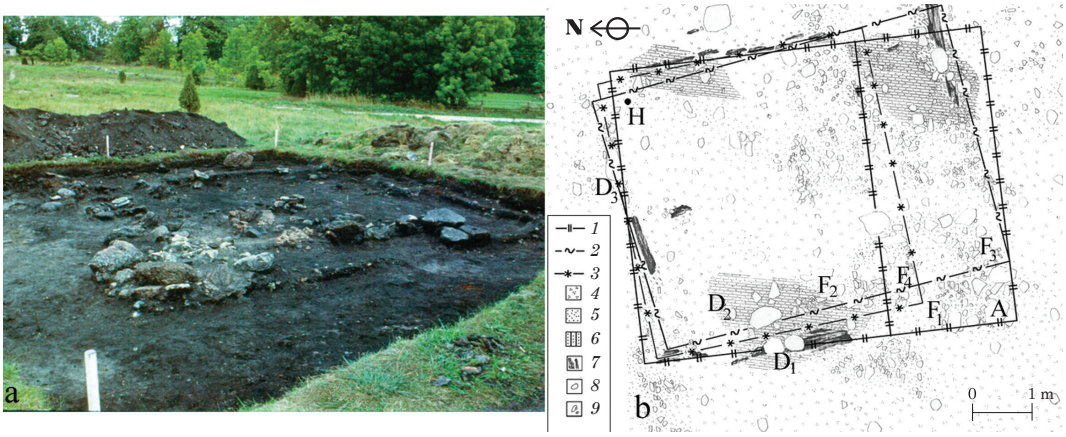

Fig. 1.Smithy site of Paatsa. a – view of the excavation from NW, b – contours of the smithies 2, 3, and 4.
Jn. 1. Paatsa sepikojaase. a – vaade kaevandile loodest, b – sepikodade 2, 3 ja 4 kontuurid.
Photo / Foto: Jüri Peets, Drawing / Joonis: Reti Laanemäe

[1] The remains of the earliest and the latest constructions on the smithy site of Paatsa were preserved very fragmentarily, thus it was not possible to record their exact contours.

year 2008, a rusty patch was found from the south-eastern corner of the trench, which contained a layer (0.5–1 cm thick) of fine iron flakes that reacted to a magnet. Treating the samples from this patch with acetic acid revealed sand and heavily corroded iron powder. Taking into account several grindstone fragments found from the trench, it is possible that the position of a grindstone was located over that patch.

Fig. 2. Smithy site of Käku in 2008. 1 – presumable location of a grindstone, 2 – presumable forge locations.
Jn 2. Käku sepikojaase 2008. a. 1 – oletatav käiakoht, 2 – oletatavad ääsikohad.
Photo / Foto: Kristjan Sisa

In 2009, fieldwork in Käku was small-scale, because at the same time excavations were going on in Uugla – the only prehistoric iron production site known in Läänemaa, West-Estonia. From the year 2010 to 2012, funding the investigation of the Salme burial complex was the main priority for the Estonian Science Foundation's research grant ETF 7880. In the years 2010–2011, Ragnar Saage studied the settlement of Käku and the surrounding burial sites in his BA thesis (Saage 2011). In this research, the settlement layer of the village was mapped with a soil probe and a GPS, which placed the smithy site to the north-eastern edge of the settlement.

ARCHAEOLOGICAL FIELDWORK IN 2012

In 2012, fieldwork on the smithy site continued and natural subsoil was reached in several places in the trench. About 15 cm of the smithy refuse layer remained within the walls of the smithy. In addition to the stone foundation discovered before, two earlier timber foundations, a slag heap, an irrigation ditch, road fill north-west of the smithy and a limestone pavement were found. The trench was expanded 2 metres towards south and east, increasing the excavation area up to 97 m^2.

All artefacts, plano-convex hearth bottom slags, the horizontal extent of different layers, construction remains and locations of the radiocarbon samples were measured with a total station. In addition, the building remains were documented using a set of pictures, which were later transformed into a 3D model using the photogrammetric software of Agisoft PhotoScan. The smithy phases were called Smithy 1, 2 and 3, starting from the latest, as the natural subsoil was not reached and earlier phases might be found under the pavement of Smithy 3.

Constructions. Smithies 3, 2, 1

Starting from the moment of the earliest, **Smithy 3** was a log house, measuring 4.7 × 4.5 m and covering an area of 21 m^2 (Fig. 3). The smithy had a limestone pavement, which was also present outside the smithy's south-western wall. The pavement also stretched outside the north-eastern wall, but it is not clear whether it was another room of the smithy or an open air working space for the smith. There was a massive forge base against the north-western wall of the smithy. A mixture of sand and clay

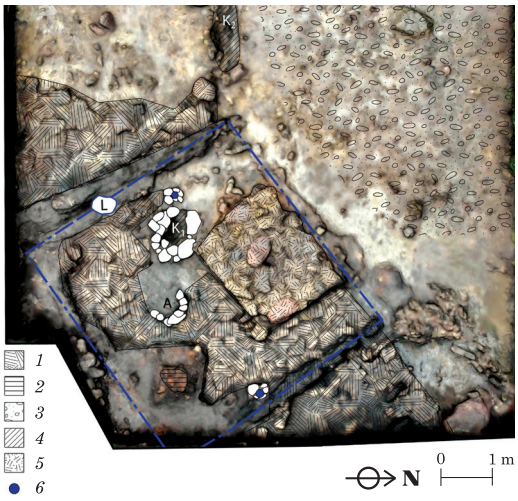

Fig. 3. *Smithy 3. 1 – limestone pavement, 2 – pit forge, 3 – road fill, 4 – areas filled with water, 5 – forge, 6 – post holes; A – anvil stump, K1 – well, K2 – ditch, L – doorsill.*

Jn 3. *Sepikoda 3. 1 – paeplaatidest sillutis, 2 – lohkääs, 3 – teetäide, 4 – veega täidetud alad, 5 – ääs, 6 – postiaugud; A – alasipaku asukoht, K1 – kaev, K2 – kraav, L – lävepakk.*

Photo / Foto: Ragnar Saage

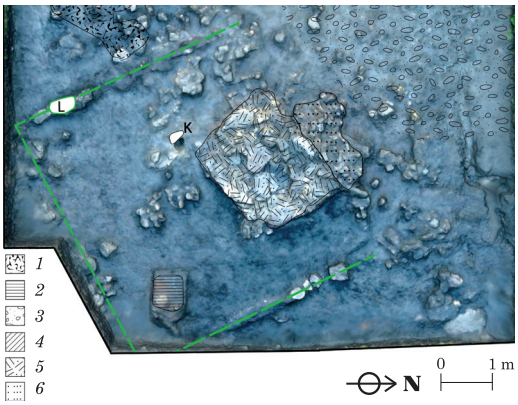

Fig. 4. *Smithy 2. 1 – slag heap, 2 – pit forge, 3 – road fill, 4 – ditch, 5 – forge, 6 – stone pile between the forge and the wall; K – well, the contour line marks the stone that covered the well, L – doorsill.*

Jn 4. *Sepikoda 2. 1 – šlakikuhi, 2 – lohkääs, 3 – teetäide, 4 – kraav, 5 – ääs, 6 – kivilasu ääsi ja seina vahel; K – kaev, kontuuriga on tähistatud kaevu avaust katnud kivi nähtav osa, L – lävepakk.*

Photo / Foto: Ragnar Saage

was used to bind together the stones in the forge base. There was a simple pit forge in the eastern corner of the smithy, which could also belong to Smithy 2. A hole was found in the pavement, which was halfway lined with stones. When looking at its position in the smithy, it would be a good place for an anvil stump. A similar circle of stones could be observed on the level of Smithy 1, which indicates that the position of the anvil stump might have remained the same during all the smithy phases. A shallow 'well', only about 50 cm deep, was found next to the forge. It was lined with stones and it might have served as a small water reservoir, as during the excavations it constantly filled with water from the wet soil.

Smithy 2 was a log house with an earth floor and was traceable by three walls and a forge base (Fig. 4). The dimensions of the smithy were 4.9 × 4.7 m (23 m^2). The placement of the walls did not match with the preceding Smithy 3 (Fig. 5). At the same time, the forge base of Smithy 3 was used to build the forge for Smithy 2. It is unclear whether the north-eastern wall was built right next to the forge or a bit further, as is the case with Smithy 1. Limestone was used as a doorsill in the south-western wall of the smithy, which makes the layout of the smithy very similar to Smithy 3. The shallow well was also used during this smithy phase.

Smithy 1 can be traced by the limestone foundation stones and the large forge base next to the north-eastern wall (Fig. 6). The walls of the smithy must have been made from timber, because the foundation only had one row of stones, which cannot be used as a foundation for a stone wall built without using mortar. However, no signs of timber walls were found, which might indicate that the smithy had

been dismantled on purpose or the construction materials were saved for other buildings after the smithy was destroyed. The smithy had an earthen floor.

Smithy 1 was built on Smithy 2 and looking at the location of the walls, it seems that the walls of the previous phase must have been visible on the ground (Fig. 5). The dimensions of the smithy were 5.1 × 5 m (25.5 m^2). The forge base of Smithy 2 has been raised, but without using any mortar. The space between the north-eastern wall and the forge was filled with a pile of stones. The shallow well next to the forge was blocked with a large stone and covered with clayey soil that resembles the natural subsoil near the smithy. Thus, the well was left hollow – an observation proven, when an archaeologist by accident sunk up to her knee in the well after some heavy rain.

A drainage ditch was found next to Smithy 1, although it might have been also used during the earlier phases of the smithy. Large limestones marked the sides of the ditch and it was situated next to the north-western wall, which means that some of the rainwater from the roof might have been directed towards it.

Some peculiarities in the construction of the forge seem to indicate that Smithy 1 consisted of two different phases, but this question needs further research. The area north-west of the smithy was filled with small stones and might have been used as a road or a yard. In the south-western corner of the trench, a very high concentration of horseshoe nails was found. It is possible that remnants of a horseshoeing rack (Germ. *Notstall*) could be found somewhere outside the south-western corner of the trench.

Smithies 2 and 3 were dated considering both radiocarbon dating (Table 1) and typological analogues with Smithy 1

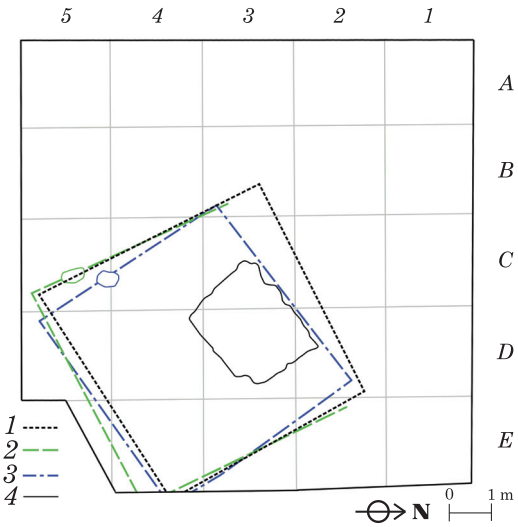

Fig. 5. *Walls of the smithies 1, 2, 3. 1 – Smithy 1, 2 – Smithy 2, 3 – Smithy 3, 4 – forge.*
Jn 5. *Sepikodade 1, 2, 3 seinad. 1 – sepikoda 1, 2 – sepikoda 2, 3 – sepikoda 3, 4 – ääs.*
Drawing / Joonis: Ragnar Saage

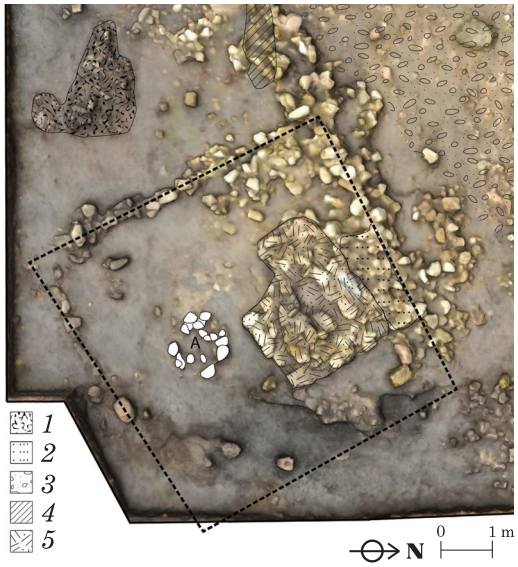

Fig. 6. *Smithy 1. 1 – slag heaps, 2 – stone pile between the forge and the wall, 3 – road fill, 4 – ditch, 5 – forge, A – anvil stump place(?).*
Jn 6. *Sepikoda 1. 1 – šlakikuhjad, 2 – kivilasu ääsi ja seina vahel, 3 – teetäide, 4 – kraav, 5 – ääs; A – alasipaku alus(?).*
Photo / Foto: Ragnar Saage

Table 1. *^{14}C dates from the Käku smithy site. Calibrated using OxCal v4.2.2 (Bronk Ramsey 2009; Reimer* et al. *2009).*
Tabel 1. *^{14}C dateeringud Käku sepikojaasemest. Kalibreeritud OxCal v4.2.2 järgi.*

No / Nr	*Lab. No. / Lab. nr*	*Archaeological context / Arheoloogiline kontekst*	*^{14}C BP*	*68.2% (1 sigma) cal. AD*	*95.4% (2 sigma) cal. AD*
P45	Tln-2556	Smithy 1(?), forge / Sepikoda 1(?), ääs	415±44	1435–1496 (58%) 1508–1511 (1%) 1602–1616 (8.9%)	1421–1525 (71.7%) 1557–1632 (23.7%)
P46	Tln-3301	Smithy 1(?), NW wall / Sepikoda 1(?), loodesein	556±55	1316–1355 (34.4%) 1389–1426 (33.8%)	1297–1440
P36	Tln-3482	Smithy 3, NE wall / Sepikoda 3, kirdesein	515±55	1325–1344 (13.3%) 1394–1444 (54.9%)	1299–1370 (29.7%) 1380–1467 (65.7%)
P23	Tln-3483	Smithy 2, SW wall / Sepikoda 2, edelasein	429±50	1423–1495 (61.1%) 1602–1615 (7.1%)/	1411–1526 (74.5%) 1556–1633 (20.9%)
P34	Tln-3484	Post hole in square A5 / Postiauk ruudus A5	481±50	1404–1455	1315–1356 (8.7%) 1388–1495 (85.1%) 1601–1615 (1.6%)

(Saage 2013, 51–53). Smithy 3 was used from the 14th century at the earliest until the end of the 15th century, when it was destroyed by fire. Smithy 2 was built in the 15th century at the earliest and was burned down in the 16th century. The earliest dateable finds like a padlock from the 14th century help to confirm the use of the smithy at that time, but soil from Smithies 2 and 3 has been heavily mixed, which does not allow more precise dating. Smithy 1 was built in the 16th century and seems to have been destroyed and/or dismantled on purpose in the 17th century. Dateable finds that could be linked with Smithy 1 are the pistol wheel lock fragments from the third quarter of the 16th century and the padlocks from the 17th century (Saage 2013, 36–37). The earliest map of the Käku village, that the authors have managed to find, was made in 1794 and it depicts the area of the smithy as unarable land with no building remains (Saage 2011, map 10).

Slag

At the end of the excavations in 2012, 1.3 tons of slag had been collected from the whole trench. The actual amount should be even larger, because the small fraction of slag had not been separated from the soil. A total station was used to measure the distribution of the plano-convex hearth bottom slag, choosing only the hearths bottoms forming at least half of the hearth diameter to be included. The distribution of slag was also measured with buckets squarewise and this correlated well with the hearth bottom slag. The highest concentration of slag was found just next to the smithy door (Fig. 7).

ARTEFACTS

The artefacts from Käku are typical to a smithy site: production waste, semi-finished products and scrap metal. A large portion of its income had come from household tools and farming equipment like knives, scythes, sickles, horseshoeing, kettles, etc. In addition to iron, the smiths worked different copper alloys and bone. The smiths also worked on more demanding products like cutlery and decorative ornaments. It is still uncertain, how padlocks (Fig. 8) and fragments of a wheel lock gun mechanisms (Fig. 9) should be interpreted. These are complex pieces of machinery and the finds

are, at the current state of investigation, regarded as attempts to repair those mechanisms.

Evidence of bone working has been found from all smithy phases, but it seems that it was most active in Smithy 1. The finds consist of raw material, semi-finished products and fragments of finished artefacts, which all indicate the production of various handles (Fig. 10). A powder-horn of red deer antler has been evidently used as raw material for a handle of some sort (Fig. 11). The occurrence of ivory (Fig. 12) seems to suggest that some of the production in Smithy 1 (16th–17th cc) was oriented towards wealthier customers and might be connected with the Loona manor built in the middle of the 16th century (Oja 1994, 121).

Bronze and other copper based alloys were worked by casting and forging. Different alloys used by the smith were identified using a portable XRF (Saage 2013, 26). 37 samples were analysed and the results showed that the smiths had a good insight on the properties of the used alloys. Forged artefacts contained copper and brass. A wider range of alloys were used for casting – the most common alloy was bronze with a high lead content, followed by copper, brass and tin bronze. The concentration of bronze (and other) artefacts along the south-eastern wall of the smithy suggests that a working bench could have been located against that wall.

The metallographic analysis gave lots of information about the raw material that was available to the smiths (Saage 2013, 40). The raw material could be divided into three categories: iron bars of good quality, iron bars from scrap metal and bloom iron containing lots of slag. It was possible to distinguish different stages of bloom iron treatment from lumps to iron bars. Looking at the large amount of slag found from

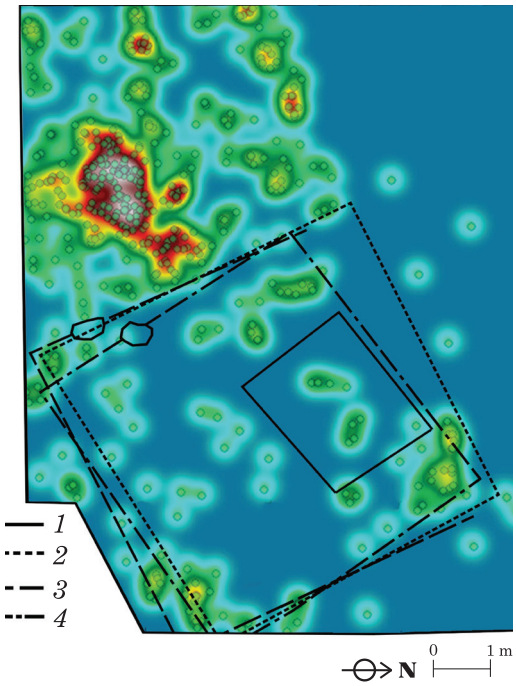

Fig. 7. *The distribution of slag within the trench. 1 – forge, 2 – Smithy 1, 3 – Smithy 2, 4 – Smithy 3.*
Jn 7. *Šlaki jaotus kaevandis. 1 – ääs, 2 – sepikoda 1, 3 – sepikoda 2, 4 – sepikoda 3.*
A map layer depicting the slag intensities / Šlakikookide intensiivsust näitav kaardikiht: Allar Haav

Fig. 8. *Padlocks from the Käku smithy site.*
Jn 8. *Ripplukud Käku sepikojaasemelt.*
(AI 6845: 52, 414, 410, 413, 22, 412, 408.)
Photo / Foto: Ragnar Saage

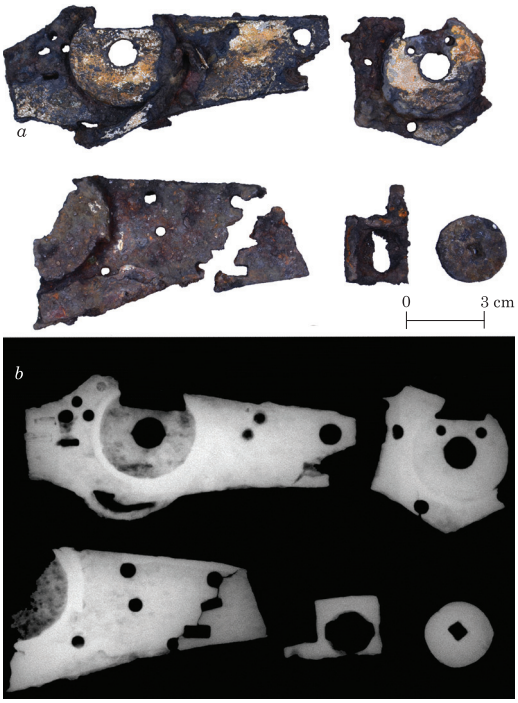

Fig. 9. *Details of a wheel lock of a gun.*
Jn 9. *Püstoli ratasluku detailid.*
(AI 6845: 155, 249, 158, 86, 90, 108.)
Photo / Foto: Ragnar Saage

Fig. 10. *Bone and antler handles from the Käku smithy site.*
Jn 10. *Luust ja sarvest pidemeid Käku sepikoja asemelt.*
(AI 6845: 16, 97, 46, 92, 63, 80, 243, 33, 47, 10, 37, 406.)
Photo / Foto: Ragnar Saage

the site, forging iron blooms into iron bars seems to have been an important source of income for the smith.

The metallographically analysed knives showed different forging patterns, but demonstrated an overall good skill of welding and choice of raw material (Saage 2013, fig. 6; table 2). The production quality was better than in the contemporary material studied from the rural cemeteries (Peets 2003, 259). At the same time, the forging patterns and the quality of the material resemble the production of the 12th and early 13th century smiths (Peets 2003, 254). This raises new questions, because, at the present state of research, it is not possible to determine if this is a regional difference of the island of Saaremaa or a peculiarity of the Käku smithy site.

OSTEOLOGICAL ANALYSIS

Overview of the material

More than 1100 fragments of bones (including bone artefacts and their fragments) have been found from the Käku smithy site. The first three years of excavations, especially 2008, produced a relatively small number of finds. In the year 2012, when the trench was extended, numerous bone artefacts were found from different layers of the site. Animal bones and fragments of bone artefacts were found from the turf layer until the deepest levels of the excavation and larger concentrations of animal bones were not observed.

The bones are in average condition and consist of fragments of different size and level of preservation. Less than 10 bone fragments have been burned. Figure 13 shows the ratio of worked bone (identified and unidentified bone fragments and artefacts), bones identified up to species or genus level and unidentified bones.

Worked bone

The exact number of worked bone fragments is yet to be determined. Although the bone fragments are easily distinguished from other types of artefacts, it is difficult to separate bone working waste and semi-finished products from the rest of the bones. For example, some of the tubular bones have been split lengthwise, which could be either intentional or a natural process occurring in the soil. The same can be said about some of the cutting marks. The preliminary results are displayed in Table 2.

The most exotic artefacts are undoubtedly the ones made from ivory (Fig. 12). However, there is no evidence suggesting that ivory was processed in the smithy. Another exceptional group of finds are red deer antlers, especially their processing waste (Fig. 14).

Fig. 11. Fragments of powder-horn of red deer antler with the ornament depicting a horse and a rider.
Jn 11. Hobust ja ratsanikku kujutava hirvesarvest valmistatud püssirohusarve fragmendid.
(AI 6845: 132, L63, 73.)
Photo / Foto: Ragnar Saage

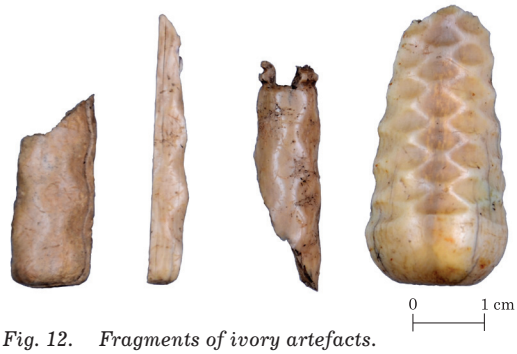

Fig. 12. Fragments of ivory artefacts.
Jn 12. Vandlist esemete katked.
(AI 6845: 26, 407, 8, 48.)
Photo / Foto: Ragnar Saage

Animal bones

The majority of the identified bones belong to domestic animals. The ratio of the dominating species differs from year to year (Fig. 15), but this could be due to the low number of specimens or some other reasons. A more accurate analysis, based on stratigraphy and layer contexts, will follow when the excavations will be finished in 2013. The distribution of species and skeletal elements of all the identified bone material is presented in Table 3.

The most numerous animals based on the number of bone fragments are sheep/goat. The greater number of sheep bones compared to goat bones indicates that the majority of bones identified as sheep/goat, belong to sheep. The second most numerous animal is cattle, with the pig being slightly less represented. It is surprising to see quite a lot of horse bones. At least two adult horses and two probable foals were identified.

DISCUSSION

The latest (19th century to the beginning of the 20th century) smithy was active for a short period – the thin topmost layer was mixed with Medieval and Early Modern finds. It is possible that the smithy was rebuilt in its location, because it was already considered non-arable land, since it contained a large amount of slag and stones. Attempts to cultivate the site of the smithy has revealed slag particles in the whole village –

Table 2. Distribution of bone artefacts and worked bone.
Tabel 2. Luuesemete ja töödeldud luumaterjali jaotumus.
Compiled by / Koostanud: Liina Maldre

Species / liik	*Antler / sarv*	*Ivory / vandel*	*Costae*	*Radius?*	*Femur?*	*Tibia*	*Os metatarsale*	*Phalanges*	*Flat bone / lameluu*	*Tubular bone / toruluu*	*Bone / luu*	*Total / kokku*
Bos taurus cattle veis			1				1	2				4
Ovis aries / Capra hircus sheep / goat Lammas / kits			1			4	2					7
Equus caballus horse hobune				1		1	2					4
Cervus elaphus red deer punahirv	10											10
Alces alces? Cervus elaphus? elk? red deer? põder? punahirv?	6											6
Elephantidae elevantlased		4										4
Unidentified / määramata					2				1	16	12	31
Total / kokku	***16***	***3***	***1***	***1***	***2***	***5***	***5***	***2***	***1***	***16***	***12***	***66***

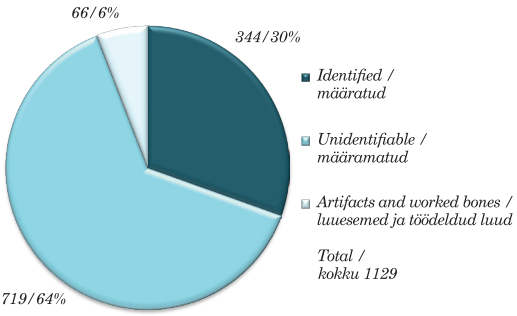

Fig. 13. Structure of the bone material (2006–2012).
Jn 13. Luuainese struktuur (2006–2012).
Drawing / Joonis: Liina Maldre

the soil is especially dark and rich in finds on the southward lands of the Sepa (Est. Smith's) farm. On the outskirts of the village, north-west of the excavation, the Nigu farm houses, owned by the bailiff of the Loona (Klausholm) manor, had been located (see Saage 2011, map 10, 11). It is possible that the smithy also belonged to this ensemble.

Compared to other sites of rural smithies of different periods studied in Estonia (e.g. Paatsa, Tarumaa, Päite, Uugla), the large share of the recovered animal bones and fragments of bone artefacts among the find material strikes the eye. Artefacts made of ivory are rare finds in Estonia: a thin double one-piece comb from the Lehmja settlement, a similar comb fragment, a handle and an ivory fragment from the Keila manor ensemble, a handle from the Lihula settlement and three ivory handles from Roosikrantsi street in Tallinn, all dated to the 16th – 18th centuries (Luik 2009, 24 and references there); a fragment of an elephant tusk from Kauba street in Viljandi (*ibid*., fig. 9); also from Viljandi, a fragment of a double one-piece comb (Haak *et al*. 2012, 319) and a chess gaming piece were found (*ibid*., 314; Sander 2011, 55). According to Kalju Paaver (1965, 238) there are no red deer bones from late Holocene sites in Estonia and there are very few from Latvia. There were fragments of red deer antler and possible red

deer bones found from the Teutonic Order castle of Viljandi (Haak *et al.* 2012, 308–309, 321). It is likely that deer antler was imported, yet it cannot be ruled out that the northern range of the red deer reached Estonia. As there are very few bones of game in our archaeo-zoological material from the I–II millennium, it is very hard to determine which species could have lived here and how numerous they were. Besides, species with a low population density might not appear in the material consisting mainly of kitchen waste.

The distribution of skeletal elements of the archaeo-zoological material is rather typical to kitchen and butchery waste found from settlements. The main species of domestic animals – sheep/goat, cattle, pig, and horse –

Fig. 14. Worked red deer antler fragments.
Jn 14. Töödeldud hirvesarvekatked.
(AI 6845: 92, 156.)
Photo / Foto: Liina Maldre

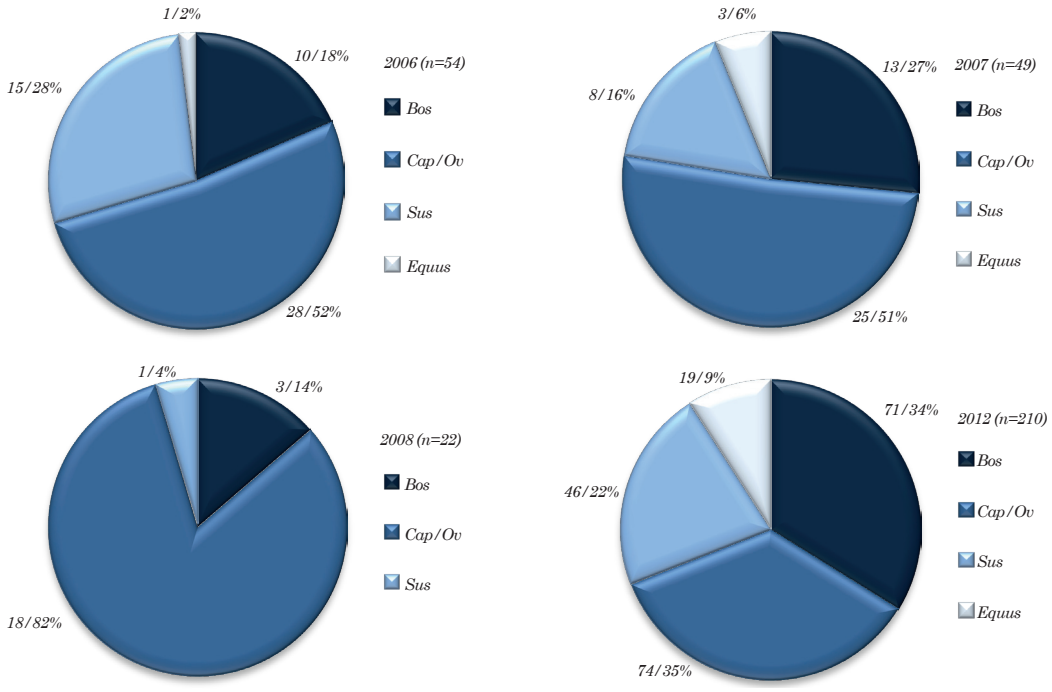

Fig. 15. Number of the dominant domestic animal species in different years.
Jn 15. Põhiliste koduloomaliikide luude suhteline arvukus kaevamisaastate kaupa.
Drawing / Joonis: Liina Maldre

Table 3. Distribution of species and skeletal elements of the bone material (2006–2012).
Tabel 3. Luuainese liigiline ja anatoomiline koostis (2006–2012).
Compiled by / Koostanud: Liina Maldre

Species / liik	*Cranium*	*Mandibula*	*Dentes*	*Vertebrae*	*Costae*	*Scapula*	*Humerus*	*Radius*	*Ulna*	*Ossa carpi*	*Os metacarpale*	*Pelvis*	*Femur*	*Tibia*	*Fibula*	*Ossa tarsi*	*Os metatarsale*	*Ossa metapodiale*	*Phalanges*	*Total / kokku*	%
Bos taurus *cattle* *veis*	4	8	41	4	5	2	2	1		1	4	1	1	1		3	5	6	8	97	28.2
Ovis aries *sheep* *lammas*	3	2	2				5	1	1	2	2					3	3		1	117	
Capra hircus? *goat?* *kits?*		1								1										2	41.9
Ovis/ Capra *sheep/goat* *lammas/kits*	7	7	32	13	2	3	6	4			11	1	5	12		2	6	4	2	25	
Cap/Ov? Capreolus ? *sheep/goat? roe deer?* *lammas/kits? metskits?*				2																2	0.6
Sus domesticus *pig* *siga*	7	4	17	4	6	4	2	1	1	2	2	4	2	2	1	3		1	9	72	20.9
Equus caballus *horse* *hobune*		2	3			1		1				1		2		3	4	1	2	21	6.1
Felis domesticus *cat* *kass*							1													1	0.3
Canis fam.? lupus? *dog? wolf?* *koer? hunt?*			1																	1	0.3
Vulpes vulpes? *red fox?* *rebane?*														1						1	0.3
Mustela nivalis *least weasel* *nirk*	1																			1	0.3
Lepus sp. *hare* *jänes*							1				1									2	0.6
Cricetidae *hamsterlased*	1																			1	0.3
Arvicola terrestris? *water vole?* *vesirott?*			1																	1	0.3
Total / kokku	***23***	***24***	***97***	***23***	***13***	***10***	***17***	***8***	***3***	***6***	***20***	***7***	***8***	***18***	***1***	***14***	***18***	***12***	***22***	***344***	***100***

are all represented. In addition to antler (including fragments of a reused powder horn[2]), several fragments of worked long and flat bones were found, which all indicate local bone processing. Although numerous worked bone and bone artefacts were found, there is no reason to suggest that the majority of the animal bones was selected for raw material.

[2] Powder horns made from elk antlers have been found from Viljandi and Tartu (Haak *et al.* 2012, 313).

CONCLUSIONS

The smithy site of Käku was used by many generations from the 14th to the 17th centuries. The general layout of the smithy (forge, anvil, door, etc.) had remained the same even though the smithy had been burned down at least twice. The smiths working there were skilled craftsmen, who had access to raw material of good quality. The smiths had worked with padlocks and pistol wheel locks, which are complicated mechanisms to master. Exotic materials like ivory and red deer antler indicate that some of the production was orientated towards wealthier customers. Most of the artefacts were household and farming tools, while a great part of the slag originated from reheating iron blooms and forging them into iron bars. The latest phase, which started in the second half of the 19th century, when the site was probably used by a farmer, had little in common with the professional smithy phases.

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KÄKU KESK- JA VARAUUSAEGNE SEPIKOJAKOHT

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Muistis avastati 2005. a kevadel Muinsuskaitseameti Lääne-Saaremaale organiseeritud arheoloogiaobjektide inspektsiooni ja Käku viikingiaegsete kalmete ülevaatamise ning leiuteadete kontrollimise käigus. Kohapeal mullapuuriga ja väikese proovikaevisega tehtud pinnaseuuringud osutasid paksu kultuurkihiga muistise, kõige tõenäolisemalt sepikoja- või rauasulatuskoha olemasolule; proovikaevisest korjatud söeproov andis objekti dateeringuks 15.–16. sajandi (Tln-2556, tabel 1).

Arheoloogilised uurimistööd Käku sepikojaasemel algasid 2006. a suvel. Eelmisel aastal tehtud tulevase kaevandiala sondeerimistulemused mullapuuriga osutasid võimalusele, et tegemist on muistisega, mis koosneb üksteise peal asuvatest sepikodade jäänustest. Analoogilise konfiguratsiooniga sepapajakohta uuriti aastatel 1989–1990 Mustjala vallas Paatsal (jn 1). Kuna kohe pärast mättakihi eemaldamist Käku pajapaiga 64 m^2 (8 × 8 m) põhiilmakaarte suhtes orienteeritud kaevandilt tuli päevavalgele hulgaliselt sepikojaga seostuvat materjali (rauaräbu, ääsitükid, sepajätted, esemekatked, kabjanaelad jms) ning kuna oli teada, et objekti kultuurkihi paksus on 50–70 cm, võis juba uuringute algfaasis tõdeda objekti mitmekihilisust. Järgmistel aastatel (2007–2009) hakkasid välja joonistuma varasemate sepikodade kivikonstruktsioonide elemendid, sh ka kividest laotud enam-vähem nelinurkse põhiplaaniga ääsialus ja eriaegsete sepikodade vundamendikivide read ning mitmed põlenud savilaigud – tõenäoliselt lohkääside jäänused (jn 2).

2008. a tuli kaevandi kaguosas nähtavale roostekarva laik, mille 0,5–1 cm paksune täidis koosnes peenikestest magnetile reageerivatest laastudest ja roostepurust. Kuna olime leidnud ka käiakivitükke, oletasime käiapaika. Äädikhappega töötlemise järel selgus, et proov sisaldas peale liiva ka peent, peaaegu täiesti läbiroostetanud rauapuru. See kinnitas varasemat oletust, et roostekarva laik koosnes nn käiapurust. 2009. a kaevandi üldpilt ekspeditsiooni lühiajalisuse tõttu oluliselt ei muutunud.

Kaevamised jätkusid 2012. aastal, mil kaevandit laiendati ida ja lõuna suunas 2 m võrra ning kaevandi kogupindalaks sai 97 m^2. Koos varasemate tulemustega eristati kaevandis vähemalt kolme üksteise peale ehitatud sepikoja jäänused vahemikust 14.–17. sajand. Arvestades asjaolu, et kaevand on lõpetamata, said sepikoja järgud nimetatud nende leidmise järjekorras sepikoda 1–3.

Sepikoda 3 oli ristpalkehitis, paekivist sillutise ja suure maakividest ääsiga (jn 3). Sepikoda 2 oli muldpõrandaga ristpalkehitis, mille puhul oli kasutatud varasema järgu ääsi (jn 4). Seinte asukoht oli eelmisest järgust mõnevõrra erinev, millest võiks järeldada, et sepikoja taastamisel oli peamine ääsi asukoht (jn 5). Sepikoda 1 oli tõenäoliselt ristpalkehitis, kuigi sellest järgust pole põlenud palgijäänuseid säilinud (jn 6). Seinte asukohta märgib pae- ja maakividest, ühe kivirea laiune vundament. Šlaki jaotuse mõistmiseks mõõdeti sisse kõik poolsfäärilised šlakikoogid, mis moodustasid vähemalt poole ääsi läbimõõdust. Kõige suurem šlakikogus leiti sepikojast väljaspool, uksest paari meetri kaugusel, mis tõenäoliselt oli esmane šlaki teisaldamise koht (jn 7).

Sepikojad 2 ja 3 on dateeritud peamiselt palkidest võetud radiosüsiniku-dateeringute järgi (tabel 1): sepikoda 3 jääb selle põhjal 14.–15. sajandisse ja sepikoda 2 15.–16. sajandisse. Esemeline aines lubas küll dateerida sepikodade kasutusaega tervikuna, kuid oli liiga segatud, et selle abil määrata sepikodade 2 ja 3 ajalisi raame. Esemetüpoloogiate järgi dateeriti kõige hilisem sepikoda 1, kust leiti 16. sajandi kolmandal veerandil kasutusele võetud püstoli ratasluku katked ning tabalukud, mida hakati tootma 17. sajandil.

Käku sepikoja esemelises aineses esinesid tootmisjäägid, pooleli olevad ja purunenud esemed ning vanaraud. Rauast esemete puhul domineerisid majapidamistarbed ja põllutööriistad: noad, katlad, vikatid, sirbid, kabjanaelad jms. Samas leidus sepikojas ka keerulisemaid esemeid nagu ripplukud (jn 8) ja püstoli rataslukkude detailid (jn 9), mida praeguse uurimisseisu juures on käsitletud kui paranduseks toodud esemeid. Rauast nugade tarbeks on kohapeal valmistatud luust ja sarvest noapidemeid, millele viitavad tooraine, töötlusjääkide ja valmis esemete esinemine (jn 10). Punahirve sarvest tehtud ratsaniku kujutisega püssirohusarve on kasutatud toormaterjalina mingi teise eseme valmistamiseks (jn 11). Lisaks leiti sepikojast mitme vandlist valmistud noapideme katked (jn 12), mis viitab sellele, et osa sepikoja toodangust oli mõeldud rikkamale klientuurile, näiteks 16. sajandil rajatud Loona mõisa tarbeks.

Sepikojas töödeldi ka erinevaid vasesulameid valamise ning sepistamise teel. Esemetest tehtud spektraalanalüüs näitas, et sepal oli hea ülevaade sulamite omadustest ja koostisest. Metallograafilised analüüsid andsid uut infomatsiooni sepa kasutatud tooraine kvaliteedist ning tehnoloogiatest, mida sepp rakendas terariistade valmistamisel.

Käkust on 2006.–2012. a kaevamiste käigus kogutud 1129 luufragmenti (sh luuesemed, esemekatked ja töötlemisjälgedega luud) (jn 13). Luuleide ja -esemekatkeid esines alates kamarakihist kuni praeguste sügavaimate korristeni. Töödeldud luufragmentide täpne arv on esialgu veel ebaselge: luuesemed ja nende katked

eristuvad ülejäänud materjalist suhteliselt hästi, töötlemisjääkide ja toorikute tuvastamisel tekkis küsitavusi. Esialgsed materjalimäärangud on toodud tabelis 2. Kõige haruldasem leiurühm on elevandiluust valmistatud esemete katked, tähelepanu väärib ka hirvesarve, eriti just töötlemisjääkide (jn 14), esinemine leiumaterjalis. Eesti hilisholotseeni muististel hirveluid üldiselt ei ole, tegemist on kas sissetoodud toorainega või on punahirve levila Eesti aladeni siiski ulatunud. Töötlemata luuainesest valdav osa kuulub koduloomadele. Põhiliste liikide luude suhteline osatähtus on erinevate aastate kaevandites mõnevõrra erinev (jn 15), see võib olla põhjustatud nii materjali vähesest kogusest kui mingitest muudest asjaoludest. Luuainese liigiline ja anatoomiline koostis on toodud tabelis 3. Anatoomilise koostise poolest on tegemist tüüpilise toidu- ja tapajäätmete seguga, miski ei viita spetsiaalselt esemete valmistamiseks kogutud luudele.