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## AN ADDENDUM TO THE STUDY OF SMOKE COTTAGES

In the 1980s and 1990s, large-scale rescue excavations were carried out on several Iron Age settlement sites (Lehmja, Olustvere, Uderna, Vana-Koiola). The investigated area extended over 46,000 square metres. A large variety of dwelling and outhouse remains dating back to different periods were recovered during the excavations, enhancing the existing knowledge of earlier national construction history. The research results presented in the current article offer some new insights into the history of the ancient smoke cottage.

1980.–1990. aastatel viidi mitme rauaaegse asulakoha (Lehmja, Olustvere, Uderna, Vana-Koiola) alal läbi suuremahulisi päästekaevamisi. Kokku ulatub uurimisala üle 46 000 m<sup>2</sup>. Tööde käigus avastati arvukalt eriaegsete elamute ja majandushoonete jäänuseid, mis täiendab meie teadmisi varasema rahvusliku ehitusajaloo vallas. Artiklis on tutvustatud uurimistulemusi, mis pakuvad täiendust muistse suitsutoa arenguloo selgitamisel.

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### Introduction

According to what research has established so far a typical Estonian farm building from the 8th–15th centuries – the so-called smoke cottage – was an oven-heated log house with one or several rooms (Lavi 1997, 114). In a broader sense, the term *smoke cottage* should denote a chimneyless dwelling, irrespective of whether it is being heated by an open hearth or a closed-top oven. Usually, however, the term smoke cottage is being used to refer to a horizontal log dwelling constructed with dovetail-notch quoins and heated by an open rock stove<sup>1</sup> or a flueless stove located in the corner of the main chamber.

In the course of archaeological investigations, smoke cottage remains have been discovered at various settlement sites and sometimes also in earlier cultural horizons of towns; in fact, one of the best preserved house bases known to date was

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<sup>1</sup> In the current article, the term *open rock stove* has been used as a translation for the Estonian word *kerisahi*, denoting a stove with a pile of heating stones on top of it.

unearthed at Sauna Street excavations in the Old Town of Tallinn and in Haapsalu (Lavi 2003b, 153, 155; Pärn 2004, 269–286; Zobel 2001, 121, 124–125, Fig. 111).

The amplest sources of information concerning countryside settlements have been the Lehmja and Olustvere excavation sites; over 1 ha of land was investigated there. Some preliminary results on the building remains have already been published (Lavi & Niinre 1990; Lavi 1997). Significant input to the history of smoke cottages has also been attained from research carried out on the dwelling sites of ancient hill-forts. When studying hill-fort housing patterns, some particularities must be taken into account, for the territorial compactness on these sites has usually conditioned the smallness of buildings, their association with defence structures etc.

On the other hand, investigations have shown that buildings on hill-forts do follow the conventions of contemporary village architecture. As stronghold sites have rarely been contaminated with the construction of new buildings or farming, the house remains have been preserved much better and can thus offer more information.

The current paper will give an overview of how the presented results have supplemented to our knowledge of the ancient smoke cottage as a construction type that has played a very prominent role in the development of Estonian farm architecture.

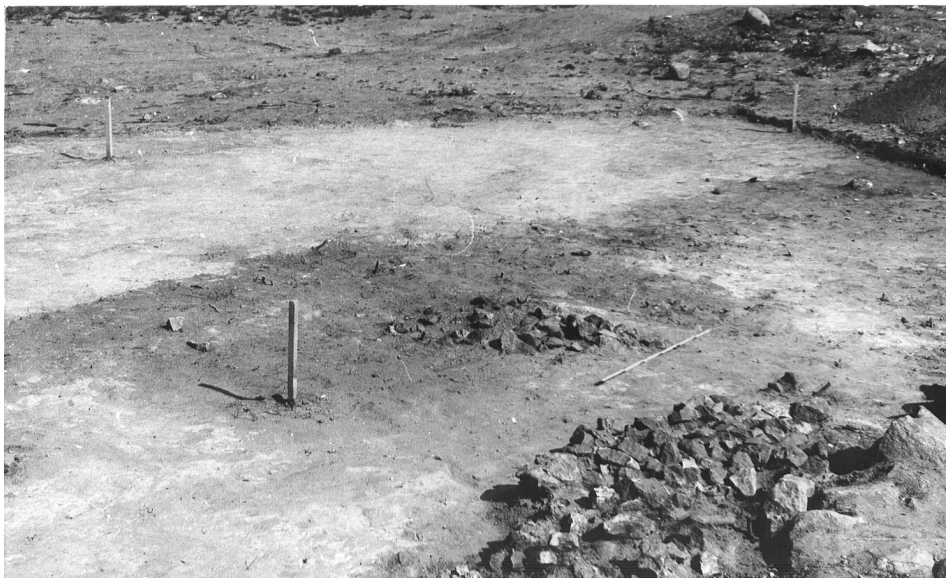
### **Dwelling sites in archaeological evidence**

Hearth-heated dwellings were probably the most common house-type before ovens came into use in the 7th–8th centuries. Even though open fireplaces accumulated far less heat than ovens or stoves, hearths remained in use in some places until the first centuries of the second millennium.

A stone heap that was 1.1 m in diameter and round-rectangular in shape was discovered at **Olustvere Hearth site No. 24**; the heap consisted of 8–15 cm heat-affected cobble-stones that had been set in straight lines along the western and southern sides of the fireplace. Limestone fragments were found on the margins of the heap; it is possible that these may have once been surrounding the hearth site. The base of the hearth had been dug 36 cm deep inside the ground.

A darker patch (3.5–4 m in diameter) could be discerned in the sandy ground surrounding the hearth; this could be indicative of a one-time house sill (Fig. 1). The most suitable place for an open hearth was in the middle of a dwelling.

**Olustvere Excavation VII, Dwelling site No. 2** (in further text: O. VII, 2) was discovered on a West–East oriented slope. The length of the NW–SE oriented house sill was 5.7 m, the width was 4 m (Fig. 2). To achieve even flooring, the higher western side of the building had been dug into the ground to the depth of about 20 cm. Consequently, the outlines of the dredged construction part were visible more clearly. The dug-in logs of the south-western wall had been resting on granite rocks that were 30–50 cm in diameter and lay in tandem; some stones were also recovered from under the NW wall outline.



**Fig. 1.** Olustvere settlement, hearth No. 24. The darker patch of a probable house sill can be discerned on the sandy ground surrounding the hearth. The remains of the earthen stove No. 23 can be seen in the forefront. The view is from the NW side.

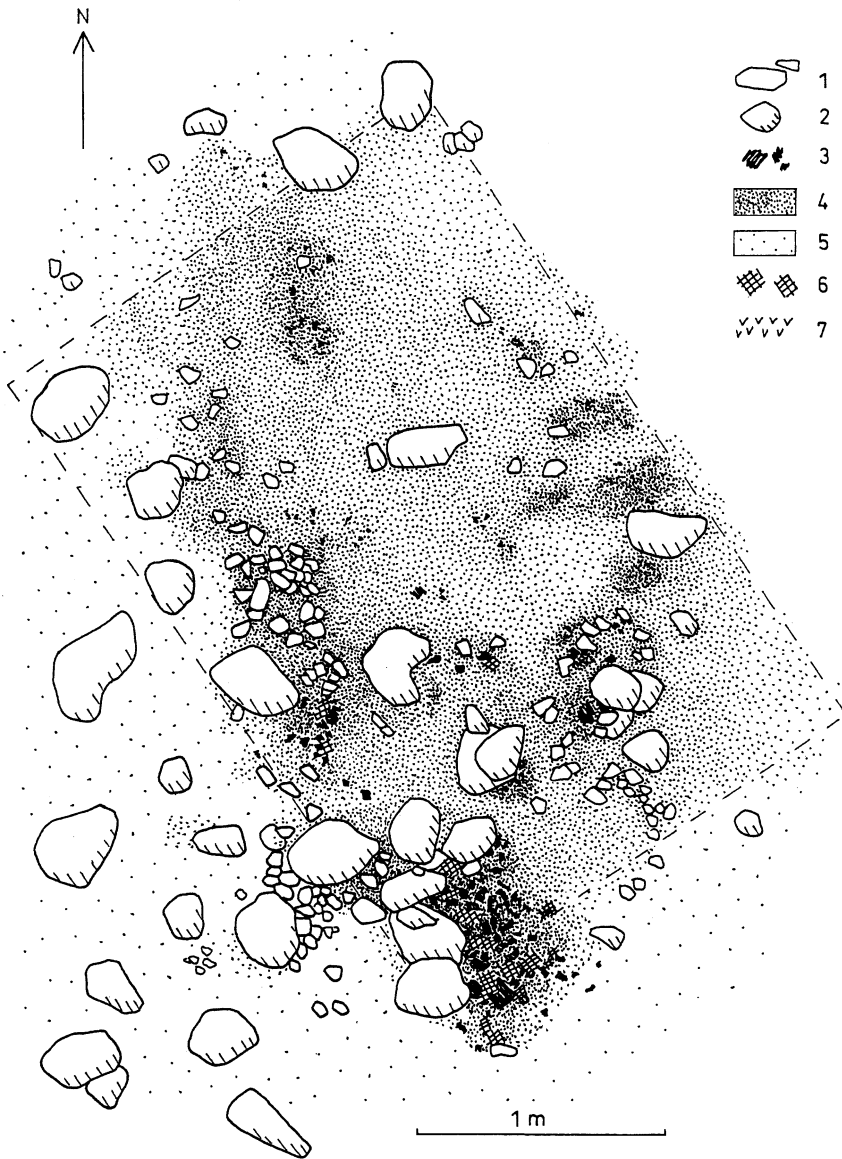
**Joon 1.** Olustvere asulakoht, koldease 24. Tuleaseme ümber on liivapinnal eristatav hoonepõhja tume laik. Esiplaanil saviahju 23 vare. Vaade NW poolt.

In the southeastern corner of the building, the remains of an open rock stove were found, consisting of a jumbled heap (1.7 m in diameter) of granite rocks of different sizes, that had been subject to heat disintegration. In the course of cleaning out the stove location, an abundance of earthen fragments and jointings were unearthed. The scattered firebrand remnants found from all over the house sill may originate from the upper layers of the building – the caved-in roof or the ceiling.

The carbon dating (Tln-577) of the charcoal sample from the house remains produced the date of  $1120 \pm 50$ , calibrated to AD 720–740, 760–890 (1 sigma) and 670–940 (2 sigma).

**House site O. I, 1** belonged to the late Iron Age. The sill stood out on sandy soil as a dark, sooty, at places distinctly detectable rectangular patch (6 × 4.5 m), with its long axis oriented NE–SW (Fig. 3). As the NE end had been dug into the sandy earth the contour of the one-time house sill was visible more clearly on that side. The nearby post-hole containing rubble could be associated with some adjoining construction – e.g. an entrance hall – that rested on a post-frame.

In the NE corner of the house site, probable stove remains were found that were 1.5 m in diameter; beside the stove cobbles, there was also a 35 cm thick layer of heat-affected granite stones and flagstones. The northwestern side of the ruin



**Fig. 2.** Olustvere settlement, excavation VII. Plan of a house sill (O. VII, 2). 1 limestone, 2 granite stones, 3 charcoal remains, 4 charcoal-stained soil, 5 sand, 6 heat-treated clay, 7 rubble.

**Joon 2.** Olustvere asulakoht, kaevand VII. Hooneaseme (O. VII, 2) plaan. 1 päekivi, 2 raudkivi, 3 söejäänused, 4 söesegune muld, 5 liiv, 6 kuumust saanud savi, 7 kivi puru.



**Fig. 3.** Olustvere settlement, excavation I. The northeastern, darker patch of the house sill can be discerned in the sandy ground (O. I, 1). The view is from the NNE side.

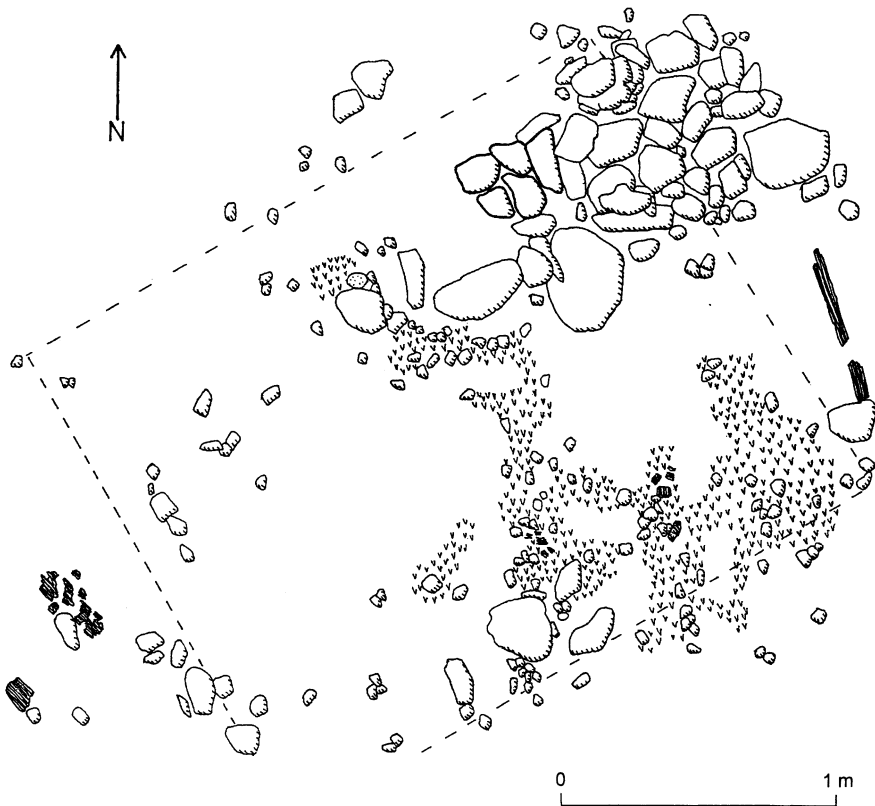
**Joon 3.** Olustvere asulakoht, kaevand I. Liivapinnal eristub selgemalt hooneaseme (O. I, 1) kirdepoolne tumedam laik. Vaade NNE poolt.

was particularly rich in charcoal, which could be indicative of the location of the stove mouth. About 20 silver coins were discovered from a sand pit that was located 3.5 m south of the house sill; some coins still had minor birch-bark fragments attached to them (Lavi 2003a, 6). This is presumably the original finding place of the Olustvere silver hoard that was deposited at the end of the 11th century (*tpq* 1080); in 1978, the majority of the coins and ornaments of the hoard were pushed into a nearby earth mound by a bulldozer (Molvõgin 1994, 286). Considering the close vicinity of the house and the hoard, temporal concurrence between these antiquities can be assumed.

The length of the NNW–SSE directed outline of **House site O. VII, 3** was visible for 5 m, the width for 4.5 m. As this house sill was also located on an eastward-slanting slope, the higher, western side of the building had been dug into the ground down to the sand layer. Disintegrated stove remains were located in the NNW corner of the house sill, where thicker stone layers were uncovered, mostly consisting of granite stones (measured around 35 cm in diameter) and stove rocks that had been entirely disintegrated by heat.

Traces were found of a 5–8 cm thick layer of clayey soil containing sand and clay fragments that had become orange-coloured by heat. This material seems to have crumbled from the upper part of the building. The radiocarbon dating (Tln-578) of the house remains gave  $910 \pm 50$  BP and was calibrated to AD 1040–1170 (1 sigma), AD 1020–1220 (2 sigma).

More frequently, remains of medieval smoke cottages have been discovered at settlement excavations. The house sill of the **O. IV, 1 site** was noticeable for its dark cultural layer and a stove base that were both rich in finds (Fig. 4). The diameter of the rectangular house sill was about 5–5.5 m. The stove had been



**Fig. 4.** Olustvere settlement, excavation IV. Plan of a house sill (O. IV, 1).

**Joon 4.** Olustvere asulakoht, kaevand IV. Hooneaseme (O. IV, 1) plaan.

located in the north-eastern corner of the building, with its mouth facing westward. The traces of a 60 × 80 cm furnace had been preserved at the stove-mouth, consisting of evenly laid granite stones (Fig. 5) that had an average diameter of 30–35 cm and were covered by a 10 cm thick layer of charcoal. The back of the furnace was made of a limestone slab positioned edgewise (measures 30 × 50 cm; thickness 11 cm), which seems to have been originally supported by a wall of granite rocks that measured 30 to 50 cm in diameter. Some of the granite stones from the sidewalls of the stove have also been preserved. An ash-pit may have been situated at the stove-mouth, but the outlines cannot really be recognized in the highly charcoal-stained layer. In the area around the stove, fragments of home-made bricks were found from among the stove rocks. The  $^{14}\text{C}$  analyses (Tln-459) of the building remains gave the date  $550 \pm 50$  BP, with the calibrated date ranging from AD 1310–1350; 1380–1430 (1 sigma), 1290–1410 (2 sigma).



**Fig. 5.** Olustvere settlement. Remains of an open rock stove in a house site (O. IV, 1). The view is from the western side.

**Joon 5.** Olustvere asulakoht, hooneaseme (O. IV, 1) kerisahjupõhi. Vaade lääne poolt.

The described dwelling had been connected to other buildings in the vicinity by a stone-paved lane (1.5 m wide and 15 m long) cutting across the surrounding wet grounds (Lavi 1997, 125).

**House site O. IV, 4** had been situated at the bottom of a dell, in damp ground. The long axis of the house was WSW–ESE oriented and some granite stones have been preserved under the house walls. Due to the dampness of soil, traces of 13–22 cm wide wedge-split floor-boards had been preserved inside an area of 4 × 3 m (Lavi 1997, 104–105). In the northwestern corner of this area, the remains of some horizontal logs were found. It is quite possible that the wooden floor had rested at least partly on supporting beams. Remnants of variously directed fire-brands were discovered from under the floor, which probably originate from some caved-in ceiling or roof construction. The radiocarbon dating (TIn-546) analyses of the floorboards produced the result 670 AD ± 80 years, calibrated to AD 1260–1320, 1340–1400 (1 sigma), 1210–1430 AD (2 sigma).

On a slightly SW slanting sandy elevation, there could be discerned a darker, rectangular spot with its long axis orientated ENE–WSW – **House site O. III, 1**. The width of the house sill could be detected for 3–3.5 m and the length for 4.5 m. This house appears to have been erected on a slope and its higher, ENE side has been dug in the sand to the depth of about 20 cm. Hearth remains could be discerned in the southwestern corner of the house base, where fragments of heat-disintegrated granite cobbles lay in a sooty layer. A 35 cm deep household pit could be detected near the remains of a supposed open rock stove. Some pieces of a broken wheel-thrown pottery vessel were recovered from there (AI 4998: 1066), its neck bearing traces of charred cord. Judging by the finds, these house remains seem to originate from the early medieval period.

**Lehmja House site No. 3** (in further text: L. 3) had the outside dimensions of 4 × 4.7 m, and its long axis was aligned WSW–ENE (Lavi 1997, 95). As the construction had been located on the edge of a northward slanting area, a foundation of granite stones with an average diameter of 45 cm had apparently been laid on the damp soil under the northern wall (Lavi 1997, 103). The inside part of the foundation was notably darker than the layer outside the wall-line. On a higher and drier ground, only a few stones had been set under the house corners.

The long axis of the open rock stove had been oriented NNW–SSE, with the stove standing in the SW corner of the chamber and its opening facing NNW (Fig. 6). The general dimensions of the stove were 1.5 × 1.3–1.4 m and its eastern and western side walls (40 cm wide on average) had been laid of large limestone slabs with an average thickness of 10 cm (38 × 80, 37 × 90 cm). In contrast, the stove base that had been preserved at the back wall of the stove remains had been laid of three layers of flat-topped granite rocks (diameter 35–45 cm) that may also have carried some extra wall-stones from upper layers. The base of another limestone wall was discovered from behind the stove wall. The length of the furnace ranged up to 95 cm, the width was 50–60 cm; the hearthstone represented a





**Fig. 6.** Lehmja settlement. Remains of a stove in a house sill (L. 3). The side walls of the stove have been laid of limestone slabs, the base under the back wall of the hearth has been built of granite. The view is from the NW side.

**Joon 6.** Lehmja asulakoht, hooneaseme (L. 3) ahjuvare. Ahju külgeseinad on laotud paeplaatidest, tulepesa tagaseina alus on raudkividest. Vaade NW poolt.

large, broken limestone slab that still bore traces of charcoal and ashes. Inside the dark cultural layer, the outlines of the ash-pit remained vague, though edges of a charcoal-stained patch about 40 cm in diameter could be discerned at places. The charcoal found from between the stove remains and the eastern house wall could have originated from a plank bed that had stood there. The date (Tln-1092) obtained from the charcoal sample that was unearthed from beneath the stove remains was  $430 \pm 35$  BP, calibrated to AD 1437–1479 (1 sigma), AD 1421–1517 (2 sigma).

### Pit-houses

In addition to the remains of aboveground houses and buildings with partly dug-in foundations, there have also been discovered some pit-house sites that have been dug into the ground within the full range of their ground area.

The remains of a pit house **L. 12** (inside dimensions 4.5–3.5 m) had been dug 1 m deep into natural sand, with its long axis oriented WNW–ESE. The walls of the dug-in part had been dry-laid by fitting together quarry stones and limestone slabs; also the locally common huge natural flagstone slabs had been used (Fig. 7). The entrance to the building was located in the middle of the western wall, being



**Fig. 7.** Lehmja settlement, house sill (L. 12). The dug-in wall of the pit-house consists of granite stones and natural limestone boulders. The view is from the NW side.

**Joon 7.** Lehmja asulakoht, hoonease (L. 12). Maakoja süvendatud osa sein koosneb raudkividest ja looduslikest paerahnudest. Vaade NW poolt.

flanked by granite and limestone walls on both sides (Lavi 1997, 115, Fig. 8). It seems that only the underground part of the house had been constructed of stone, thus comprising a foundation for the timber walls of the building (Lavi 1994, 70). This has most probably been a corner-joined horizontal log house that had a hallway-like extension with a dug-in doorway on its western side.

A rather regularly laid  $1.7 \times 1.3$  m stone base had been preserved of a large open rock stove that had been situated in the northeastern corner of the building. The mouth of the stove had probably stood on the western side of the stove, thus facing the doorway. After the house was ruined, the stove remains were dismantled, leaving an abundance of stove rocks and traces of charcoal and ashes to be found in the northwestern corner. This corner also yielded fragments of primitively made bricks that were brittle and unevenly fired and probably originated from the stove construction as well. In the course of cleaning out the house base, variously oriented firebrand remains were found, some of which may originate from the caved-in roof (or ceiling) constructions.

The find material of this modest dugout-like dwelling includes some surprising finds for a mere village building, like the shards of stoneware and Rhine relief-moulded ware with plant ornaments that were in their time characteristic rather of medieval town culture. The  $^{14}\text{C}$  analyses (TIn-1412) of the charcoal taken from the house remains yielded the date  $440 \pm 35$  BP, calibrated to AD 1428–1462 (1 sigma); AD 1410–1504 (2 sigma).



**Fig. 8.** Olustvere settlement, remains of Stove No. 27. On the right, there is a stone heap that has remained from the open rock stove; the remains are adjoined by a dark spot denoting the position of the ash-pit.

**Joon 8.** Olustvere asulakoht, ahjupõhi 27. Paremalt kerisahjust säilinud kivivare, millega liitub leeseeme tume laik.

The long axis of the house site **O. XIV, 2** (dimensions  $6 \times 4$  m) was oriented NE–SW, the building had been dug 0.5 m deep into natural sand. The house sill was full of stove rocks, with the richest stone layer being concentrated in the northwestern corner of the building. The remains of a rectangular stove base could be detected there. It should be noted that contrary to the usual practice, the building lacked stone foundations; thus both the dug-in and the aboveground wall parts must have been built of corner-joined horizontal logs. The pit-house site has been dated to the first half of the 2nd millennium (Ланг & Соколовский 1984, 372).

## Hearths

Due to the temperate and humid nordic climate, one of the chief requirements for a dwelling in Estonia has always been the existence of a hearth – in a smoke cottage, the presence of an open rock stove or a flueless stove. Quite often, hearth-stones are the only traces left from one-time log houses. The information gained from excavating stove sites depends a lot on the construction material of the stove. In the northern part of the country, limestone has been the most common building material; in the south, however, stoves have been built mainly of granite stones, which have usually become so scattered after the disintegration of the building that little data can be acquired about the construction of the stove. In the following section a few examples will be given as to what kind of data can be attained from excavating stoves in smoke cottage remains.

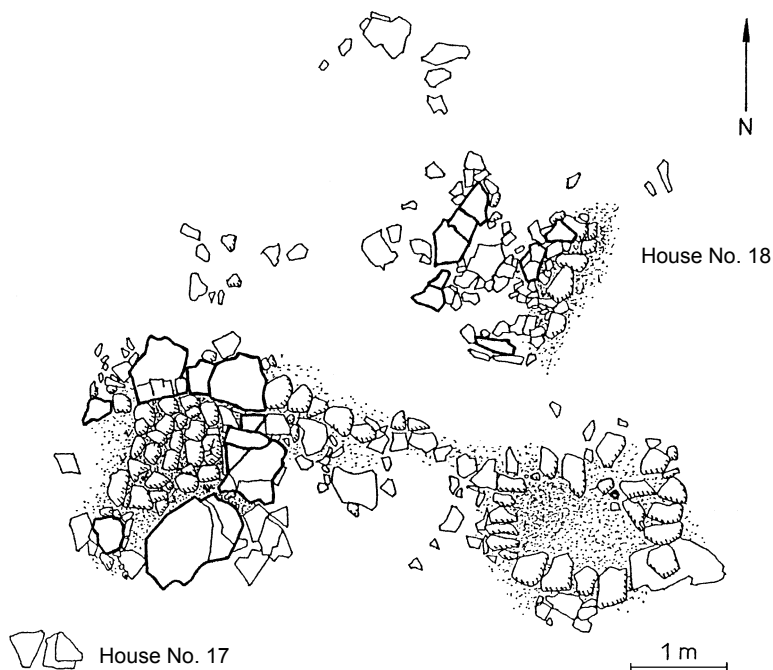
**O. I Hearth No. 2** had been preserved as a 2 × 1.8 m heap of granite stones of different sizes; the northern end of the heap contained relatively more charcoal rubble and stove rocks (8–4 cm in diameter) that had been disintegrated by heat. It is worth noting that some clay jointings were recovered at this site, some of those containing bits of wickerwork (AI 4998: 103, 104). The stove mouth was probably located at the northern side of the remains.

Only a heap (1 m in diameter) of heat-affected granite stones that were 18 to 40 cm in diameter had survived the bulldozer working on the site of **O. III Furnace No. 27**. A pot-shaped depression – the ash-pit (Fig. 8) – was located in the immediate vicinity of the eastern side of the heap; the pit had filled up with 2–7 cm thick, charcoal- and ash-coloured, overlapping streaks. In cleaning out of the ash-pit, fragments of early medieval pottery were found.

The **L. 18 House site** was actually recognized by the presence of stove remains. The latter were NNE–SSW oriented and measured 1.5 m in length and 1.4 m in width, with the mouth of the stove facing north (Fig. 9). The furnace dimensions measured 1 m in length and 50 cm in width. Some limestone fragments had been preserved at the stove base, probably originating from one or several larger hearth-stones. The walls of the stove had been constructed from quite substantial flag-stones 40–50 cm wide, the furnace sides of the slabs had acquired a slightly orange colouring from the heat. Also some quarry stones had been used for constructing the stove walls, as seems to be indicated by the head-sized granite stones that were found on the margins of the eastern wall line (Fig. 10).

According to some observations, the length of this NNE–SSW oriented building was 5–5.5 m and the width about 4 m, with the stove being situated in the SSW corner of the house. The <sup>14</sup>C analyses (Tln-1517) of the charcoal that was gathered from the stove floor yielded the date 780 ± 44 BP, calibrated to ±AD 1225–1270 (1 sigma); AD 1172–1278 (2 sigma).

**O. II, Furnace No. 23** comprises a rectangular, 1.5 × 0.8 m heap of granite stones (8–12 cm in diameter) that have been disintegrated by heat (Fig. 11). Beside charcoal, a notable abundance of heat-treated clay fragments were found



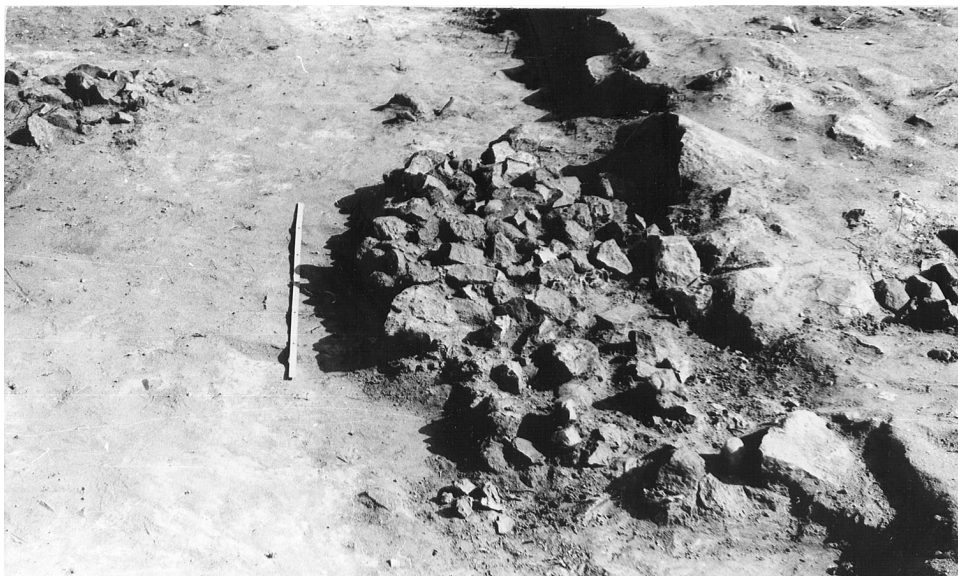
**Fig. 9.** Lehmja settlement. Plan of a house sill (L. 18).

**Joon 9.** Lehmja asulakoht, hooneaseme (L. 18) plaan.



**Fig. 10.** Lehmja settlement. Remains of a stove in a house sill (L. 18). Some limestone slabs laid in the side and back walls of the stove have been preserved. The view is from the NNE side.

**Joon 10.** Lehmja asulakoht, ahjupõhi hooneaseme (L. 18) alal. Säilinud on ahju paest laotud külge- ja tagaseina plaate. Vaade NNE poolt.



**Fig. 11.** Olustvere settlement, hearth No. 23. The base of the earthen stove has been laid from granite stones.

**Joon 11.** Olustvere asulakoht, tulease 23. Saviahju põhi on olnud laotud raudkividest.

from the stove remains. This seems to have been the site of an early medieval flueless stove and the clay fragments probably originate from the clay cupola that formed the upper part of the stove.

### **Constructional remains**

Smoke cottages have mostly been built on the ground; only a few smoke cottages with fully dug-in foundations have been discovered. Partly dug-in buildings, however, do occur. This is due to the fact that prehistoric and medieval villages were often situated on slopes, on the border between higher and lower areas. In order to achieve an even floor, the house part that was located in the higher grounds had to be dug in slightly. The dredging line is especially well visible in those places where the dug-in part was dredged into natural sand (e.g. O. III, 1; O. VII, 2).

To prevent the underground wall-logs from fast decay, the walls of dug-in smoke cottages were often supported by a few stones or a full, foundation-like stone formation. Alternatively, we know of some examples where stone foundations occur under house walls that have been erected on the lower and damper sides of a slope (e.g. L. 3). Consequently, it can be stated that in smoke cottages, stone formations (or stone foundations) were used not beneath whole buildings, but rather under single walls.

When explaining what may strike one as surprising at first sight, the conditions of every single building should be considered separately. That is to say, it becomes obvious from the smoke cottage research data that the need for constructing stone formations below house walls was significantly conditioned by the actual location of the building, for example by its being situated on the higher or lower side of a slope. If the building was erected on the higher – and also relatively drier – part of a slope, the walls may have lacked a stone base (e.g. O. III, 1; cf. also Lavi 1997, 103, Fig. 5). However, if a house had been built on the lower and overly wet side of the slant, the stone foundation would have been laid under the wall facing the damper side, while no stone formation was necessarily added beneath the higher, dug-in walls (e.g. O. IV, 2; L. 3).

Thus it seems that there has been an attempt to minimize the importance of stone foundations, using stone constructions only where they were indispensable for preserving timber walls. It is quite likely that timber walls were considered more heatproof, as stone foundations may have let cold air come through.

Very few remains of smoke cottage **walls** have been preserved. The discovered constructional remains indicate that most smoke cottages were built as corner-jointed horizontal log constructions. In some cases it has been noted that the disintegrated wall outlines can be reconstructed by following the stretches of used stove rocks once positioned at the outside walls of the building (Лави *et al.* 1983, 316).

Some of the firebrand remains spread sporadically all over the building sites can be associated with **the upper parts of buildings**, possibly originating from caved-in ceilings or some roof construction details (O. VII, 2, 3; L.12). At the O. VII, 3 house site, there were discovered 3–5 cm thick layers of clayey sand that had turned red from heat; those layers probably originated from a crumbled heat insulation layer in the ceiling. The roof must have been built from a poorly heat-resistant, but humidity-proof material – most probably wedge-split boards.

Presumably, smoke cottages usually had earthen **floors**. However, traces of wedge-split, 13–22 cm wide floor boards were discovered at the O. IV, 4 house site; the floor remains had been preserved due to favourable preserving conditions in the surrounding wet soil. In some places traces of horizontal wood fragments could be detected under floor boards – these may have originated from supporting beams positioned under floor boards. From under the floor, stove rocks were found, which were probably meant to separate the wooden floor constructions from the wet ground. Traces of wedge-split floor-boards (15–20 cm wide, 4–5 cm thick) were also found from some of the house bases at the Lõhavere hill-fort (Тыниссон 1987, 181).

Except for sites with highly humid soils, wooden floors have very rarely been preserved in the cultural layer. An indirect indication of one-time wooden floors may be the sand patches sometimes discovered at house sites.

## Discussion

The presented review of research results has given an opportunity to improve our understanding of the construction and evolution of the ancient smoke cottage. Preserved traces of wooden buildings being rare and often arguable, it is important to outline some of the more important features here as the results of large-scale settlement excavations offer some indicators for distinguishing traces of smoke cottages in settlement layers.

Stove rock formations may be taken as one of the indicators for recognising a house sill. After the house had been demolished, the remains, and the top stone layers of the stove in particular seem to have been dispersed to create an even ground. Quite obviously, it was not possible to leave an untidy piece of wasteland in the middle of a densely populated ancient settlement. It seems that in many cases the stove remains have been dispersed all over the house base, resulting in the emergence of stove rocks in the relatively intensive and rich cultural layer of the house sites.

On the basis of the Olustvere excavations VII and IX it has been presumed that used and broken stove rocks have later been utilised for insulating the outer walls (e.g. O. VII, 1) and the ceiling and roof of the dwelling (Лави *et al.* 1983, 317). However, it seems dubious that broken stones – a very porous material with limited capacity for heat-insulation – could have been used for purposes of thermal insulation. It is much more likely that the belts of broken stove rocks found in house yards and around the dwellings were used for filling up and paving the wet grounds. In such cases, excavations tend to yield dense, often multi-layered strata of stove rocks that lack the traces of more intensive cultural layers that are characteristic of the stove rock heaps found inside house sites.

In many cases, the finds that are connected with everyday human activities (pottery shards, tools and utensils) are concentrated within the limits of former living quarters (e.g. O. IV, 1). This is also quite understandable as in a dimly lit room, the pieces of broken vessels or other fallen objects were simply trampled into the earthen floor. When the house was being destroyed, the pottery kept on shelves must also have tumbled and shattered, with the pieces eventually ending up in the floor.

Hearth remains are one of the most important criteria for recognising former dwelling sites in settlement layers. Stone hearths occur both in later Iron Age and medieval dwelling sites, but their importance was declining rapidly. Having remarkably less thermal capacity than stoves or ovens, open hearths did not even manage to heat up the chambers, let alone facilitate baking or intensify the threshing process (Lavi 1997, 87).

The main heating device in a prehistoric smoke cottage was an open rock stove (sometimes a flueless stove). Next I will be trying to elaborate on the main features that have been characteristic of the smoke cottage stoves of the period and the constructional details that distinguish these stoves from the later-time ovens in barn-dwellings (barn-kilns). One of the significant criteria is the size of the



stoves. At excavations of smoke cottage stove sites, a stone formation with area of 1.8–2.5 m<sup>2</sup> is usually unearthed; the actual furnace usually takes up 0.3–0.6 m<sup>2</sup>. For example, the stove remains at the Lõhavere hill-fort site measured 1.5 by 1.2 m (i.e. the total area was 1.8 m<sup>2</sup>), the length of the furnace was 0.7–0.8 m, the width 0.4 m (total area 0.3 m<sup>2</sup>) (ТЪНИССОН 1987, 182). The height of furnaces can be determined on the basis of crumbled stove walls at hill-fort sites, as those stone formations have not been broken by later construction activities. Thus the height of the stove furnaces on the Pada and Soontagana hill-forts has been estimated to have reached 30–40 cm and at Varbola, even 50–60 cm (Тамла 1984, 361; Tõnisson 1981, 48). Similar stove bases have also been discovered by excavations on the Lõhavere hill-fort (Tõnisson 1981, 50). The small size of the stove and the furnace present a striking difference from the massive 17th century kiln stones that were 6–7.5 m<sup>2</sup> in total area, with furnaces taking up 1 m<sup>2</sup>. The larger size brought about some development in the upper side of the oven, raised the volume of stove rocks, and, what is most important, stimulated an increase in thermal capacity.

From the constructional point of view, it should be noted that in the limestone distribution area of northern Estonia, the furnace and often also the stove walls were set on the ground or on top of a larger flagstone, which differs remarkably from the massive, compactly laid stone foundations (the so-called thermal pillow) of later kiln stones. In southern Estonia, the furnace base could be made up of an evenly fitted layer of granite stones. The back wall of the furnace has often been made of a larger stone – either a limestone slab or a flat quarry stone (Fig. 5). Stove sites with analogous construction techniques have been excavated on several hill-forts (Varbola, Soontagana, Valjala).

Also the couple of stove remains that were unearthed at the stronghold of Põide (Kahutsi) on Saaremaa contained stones at the back of the furnace that had been set standing edgewise (Lõugas & Mägi-Lõugas 1993, 9–10, Photos 5–10). A similar stove base from Varbola has been dated to the 13th–14th centuries (Tõnisson 1981, 50). At the Lehmja settlement site, the furnaces of several open rock stoves also seem to have had an edgewise fitted granite rock for their back wall. It is possible that the closing of the back of the furnace with a limestone slab or an edgewise fitted flat granite rock was induced by the need to intensify the draught upwards (rather than into the back of the stove) into the rock top of the stove, which is the chief heating element in this heating device.

There are examples of similarly constructed back walls from western and northern Estonian stoves dating back to the end of the Iron Age and the Middle Ages; in later time ovens, this technique was rarely used. There are a few similar cases dating back to the 16th and 17th centuries from the Lehmja settlement site (L. 14, 16), but those particular cases share some other notably archaic characteristics as well. Analogous stove remains have also been found from the 13th–14th century settlement excavations of Snappertuna (Karja) in southern Finland (Haggrén *et al.* 2003, 18).

Another interesting particularity is the custom of erecting an extra stone wall behind the stove. The heap of quarry stones found adjacent to the stove remains at

the O. IV, 1 site probably originated from a similar wall. Also at Varbola, the stove ends were supported by walls of flatwise laid granite stones and limestone slabs (Tõnisson 1981, 49). The main function of those extra walls seems to have been the enhancing of fire-precaution measures, i.e. separation of the hearth from the inflammable timber wall. It is quite possible that such stone walls may have actually extended outside of the building, which would be a similar constructional phenomenon as the one that can be observed in ethnographic sauna-houses (real “mini-versions” of smoke cottages) even nowadays (Habicht 1972, 38–40).

In southern Estonian smoke cottages, the walls girding the stove furnace were laid of larger granite stones that also conserve heat. In northern Estonia, ancient stove-makers had to combine the two available construction materials – limestone and granite. The usually flat, easily processed limestone slabs enabled the building of much more stable walls than the usually obscurely shaped quarry stones. In contrast with granite, however, limestone is not easily heatable and when overheated, it disintegrates into lime. The ancient stove-builders thus tried to make use of the virtues of both of these building materials. At the Pada hill-fort and the 8th–10th century settlement site, both fully limestone stoves and stoves combining granite and limestone were unearthed (Тамла 1983, 302–303; 1984, 361).

It is quite obvious that both for heating and bread-baking, it was important to have the heat more evenly stored not only in the top of the stove, but also in its walls. Therefore it was also tried to fit granite stones inside limestone walls. An interesting solution had been found for a 13th–14th century open rock stove at Varbola, where an extra wall of granite stones had been added to the inner side of the chamber-side wall, thus comprising a heat-conserving internal wainscot (Tõnisson 1981, 50).

At rescue excavations on the Kuusalu 9th–13th century settlement, open rock stove remains were discovered in which both the back and side walls of the construction had been laid of granite stones (20–50 cm in diameter), with edgewise limestone slabs resting against its outside walls (Крпайт 1981, 408–411). This, however, should not in fact be viewed as some peculiar constructional technique. It seems quite likely that the furnace walls were built of granite rocks to ensure more even heating, while limestone slabs were used for constructing the upper part of the stove. After the building was destroyed, the limestone slabs slid down, some of them remaining standing against the granite walls.

The walls of the stove remains discovered at excavations on Põide stronghold had also been mostly built of granite stones. Some edgewise standing limestone slabs could be detected from around a couple of the stove remains (Nos. 1, 3), giving the impression that the stoves had been built into vertical limestone hoppers (Lõugas & Mägi-Lõugas 1994a, 28; 1994b, 390). The latter may have served the function of supporting the granite construction. No hopper-like analogues are known from the Estonian mainland. As the limestone girding was discontinuous, it may be possible that in this case, too, the flagstones actually originated from the upper layers of the stoves.

Very few traces have survived from the upper parts of stoves. Some brick fragments have been found from medieval stove remains (O. IV, 1; L. 3; L. 7; L. 12). These home-made, weakly fired bricks are usually so crumbled that it is impossible to determine their past function in the stove construction. Such bricks were presumably used for building arches over the stoves for bearing heaps of stove rocks – a technique that has also been observed when studying the remains of 17th-century barn-kilns (Lavi 2001, 63).

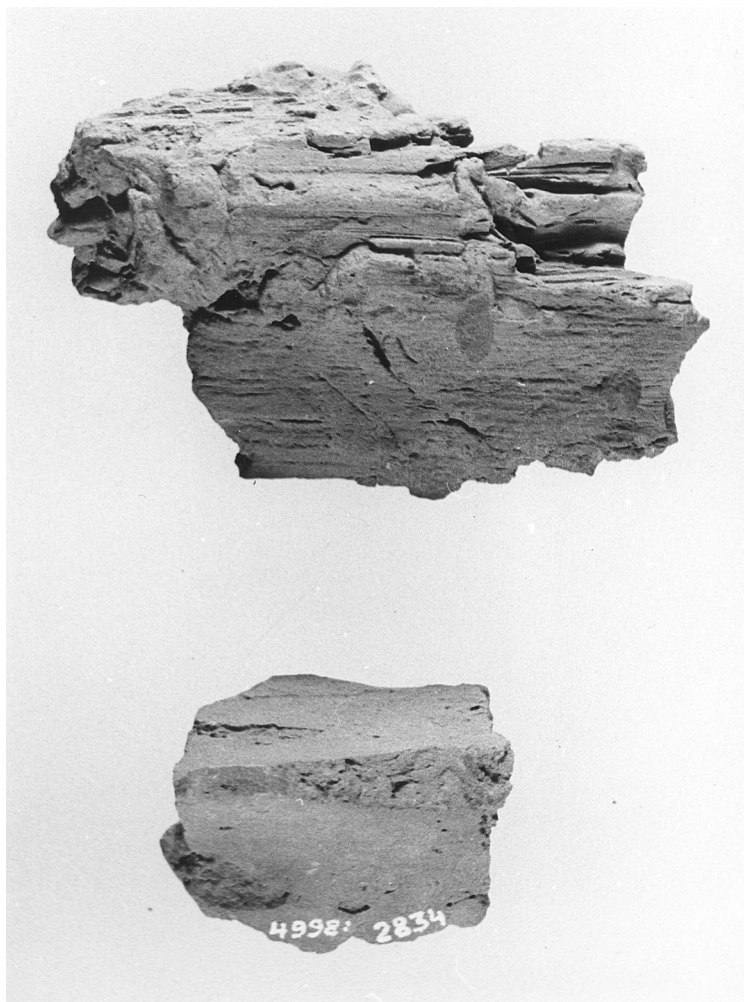
It has not always been possible to determine the location of the ash-pit during the excavations of stove remains. If the ash-pit does not actually extend down to the layer of natural sand, it is often difficult to recognise the fireplace in the often richly charcoal-stained house base. Also in the case of the 18 stove remains that were investigated at the Lõhavere hill-fort settlement, it was assumed that most of the stoves had lacked open fireplaces, as cooking had been done over a separate hearth (Tõnisson 1981, 54). It seems that such separate ingles may have been used in warmer seasons or for cooking specific foods, as in a colder season the main place for cooking must have been the open fireplace in front of the stove. By the end of the prehistoric era, leavened bread had become the main type of sustenance in this area and bread could only be baked inside an oven. Therefore it must be presumed that the Lõhavere stoves were also used not merely for heating the chambers, but also for cooking; most probably, there have been open fireplaces also in front of those stoves, but they have not been detected in the cultural layer, not only for the reasons listed above, but also because of poor preservation conditions.

As the width of a fireplace usually depended on the width of the furnace (40–60 cm on average), the fireplaces in smoke cottages were about half narrower than those of the barn kilns. The research results from the excavations of the Olustvere stove remains No. 2 indicate the possibility that there may have been a spark catcher situated above the stove-mouth – a hearth hood made of clay-moulded wickerwork. It is also worth mentioning that the furnace bottoms and fireplaces in the stove remains of Viking Age and later Iron Age hill-forts have usually been on the same level, often being actually situated on one and the same large limestone slab. In the Varbola hill-fort, however, the fireplaces standing in front of the stove remains were usually situated 10–20 cm below the furnace bottoms. The latter characteristic connects these stoves to later-time barn-kilns.

The Olustvere fireplace No. 23 can be given as an example of a flueless stove. A 30 cm thick layer of earth was discovered from under the stove base, comprising a clearly discernible rectangular spot in the sandy ground. There seems to have been situated a timber frame that had been filled with a mixture of sand and soil. The stone base of the stove rested on the wooden frame and was covered by an earthen hood. It follows that the stove was not a typical earthen oven set on a wooden frame, but rather a combined heating device that had its base built of stone, while the hood was made of clay (Lavi 1997, 111).

Traces of sand that had become coloured by heat and had presumably been used for insulating the upper parts of buildings (the roof, or more likely, the ceiling) were also found at the Lõhavere hill-fort excavations. The sand probably originates

from a ceiling constructed of thinner round beams. It has been suggested that the ceiling beams had been covered by sand and moulded with clay from the downside, thus explaining also the pieces of clay jointing that have been found from the house site (Тыниссон 1987, 181). The explanation seems disputable, as it is not very likely that the clay jointings would stick to the lower sides of smoothed logs. It is much more likely that clay was used to caulk the gaps between the beams from the upside, which also kept the insulating sand layer from crumbling. Triangular jointing fragments have also been found from the house sites of Olustvere (O. VII, 2; 3); judging by the shape (Fig. 12), those pieces, too, should



**Fig. 12.** Olustvere settlement. House sill (O. VII, 2); clay jointings, probably originating from a round-beam roof.

**Joon 12.** Olustvere asulakoht. Hoonease (O. VII, 2), tõenäoliselt palklaest pärit savitihendid.

originate from the clay caulking of ceiling beams (e.g. AI 4998: 2661, 2684, 2731). Also the pit-houses with dug-in bases have actually been smoke cottages. Most of the remains of such dwellings have been discovered from medieval settlement sites. In the 18th and 19th centuries, such buildings were used on temporary basis, like for example the fishing cabins in the coastal areas (Lavi 1997, 115).

A positive characteristic of the pit-houses is their remarkable heat-retaining capacity in cold season. On the other hand, such buildings tend to suffer from flooding in the spring or during heavy rains, as ground water tends to infiltrate through the dug-in walls. It was therefore more practical to erect the pit-house on a higher place that offered better possibilities for draining the ground water. Dug-in pit houses lacking stone foundations were also threatened by a quick decay of timber walls in the damp ground. Pit-house-type buildings do not generally fit with the Estonian maritime climate with heavy rainfalls and this may also be the reason why they were not widespread in the pre-historic and medieval times.

### **Conclusion**

The remains of wooden constructions are scarce and can often be interpreted in a variety of ways (Lavi 1997, 90). A more profound understanding of the subject matter does emerge on the basis of a compendious evaluation of the research material, where data gained from investigating one house site supplements new nuances for interpreting another. The investigation process could be likened to the enterprise of adding pieces of a jigsaw to the fragmented picture of the house-type that was typical of the constructional culture of its time. The presented examples illustrate the possibilities offered by the research material both for supplementing information to architectural studies and interpreting nuances that come to light in the course of excavating cultural layers.

For example, it is important to try to survey the characteristics of a layer to find out whether the layer consists of dispersed stove remains or whether the used rocks from the stove top have been used for filling and paving the damper sections of the yard. It is also important to consider the constructional nuances of 16th and 17th century barn-kilns that contribute to more accurate dating of the excavated stove remains.

Only preliminary overviews have currently been published of the large-scale excavations that were carried out on settlement sites in the 1980s. The presentation of these excavation results – their interpretation and subsequent inclusion in the thesaurus of archaeological science – is a task still waiting to be tackled.

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## Ain Lavi

## TÄIENDA VAT MUISTSE SUITSUTOA UURIMISLOOLE

## Resümee

Eesti ala tüüpiliseks taluelamuks kujunes 8.–15. sajandil muistne suitsutuba. See oli ristnurkühendusega, ühe- või mitmeruumiline palkhoone, mida köeti keris-, vahel ka umbahjuga.

Suitsutubade ehitusajaloo kohta on üksikuid andmeid kesk- ja uusaegsetes kirjalikes allikates, teatud infot annab ka etnograafiliste suitsutubade arhailisemate vormide uurimine. Peamiseks uurimisallikaks on siiski asulakohtade ja linnamägede arheoloogiliste kaevamiste materjal. Huvitavaid leide on saadud ka keskaegsete linnade varasemate kihtide uurimisel. Eesti seni paremini säilinud suitsutoaasemed ongi avastatud Tallinna vanalinnast Sauna tänava kaevandist. Kõige mahukam materjal pärineb siiski Lehmja ja Olustvere asulakohtade kaevamiselt, kus uurimisala ületas 1 ha. Artikli eesmärgiks on anda ülevaade mainitud asulakihtide iseloomulikumate suitsutoaasemete uurimistulemustest. Vanemate ehitiste näited pärinevad I aastatuhande viimasest veerandist (joon 2), esineb ka hilisrauaajast pärit elamute jälgi (joon 3). Enamik avastatud hoonepõhjades on keskaegsed (joon 4–7, 9–11).

Suitsutubade eriliigiks on maapinda süvendatud põhjaga maakojad (joon 7), mille jäänuseid on seni leitud peamiselt keskaegsete asulakihtide uurimisel. Maakojatüüpi elamu positiivse küljena võib esile tuua parema soojapidavuse külmal aastaajal. Samas oli süvendatud põhjaga ehitiste puhul mureks kevaditi või suurema saju ajal pinnavee imbumine läbi seinte tupp. Üldiselt tuleks maakojatüüpi elamuid Eesti suhteliselt niiskes kliimas pidada ebasobivaiks ja seetõttu polnud need ei muinas- ega keskaegsete taluehitiste hulgas eriti levinud. Küll esineb asulakihtides osaliselt süvendatud põhjaga suitsutoaasemeid. Nimelt on kallakul asunud hoonete alal horisontaalse põrandapinna saamiseks kõrgem külj maha kaevatud. Süvendatud osas on sel juhul puitseinte alla laotud üksikuid kive või vundament (joon 2). Niiskema ala piiril asuval hoonel oli kivivundament laotud hoopis madalama, märja pinnasega seina alla. Kuna kivivundament halvendas hoone soojapidavust, rajati neid vaid kohale, kus see oli hoone säilimiseks hädavajalik. Tõenäoliselt oli enamik suitsutubadest muldpõrandaga. Paatsa linnamäe uurimisel Saaremaal on avastatud plankudest, Lõhavere linnamäe ja Olustvere keskaegse hoonepõhja (O. IV, 2) alal kisklaudadest põrandate jäänuseid. Hooneasemete alal leitud kolmnurkse kujuga savitihendid ja kuumust saanud liivakihid võivad pärineda hoonete ülaosast, näiteks lae soojustuskihist (joon 12). Sel juhul võis elamuid katta madal kisklaudadest katus.

Elamu üheks olulisemaks tunnuseks põhjamaistes oludes on küttekolle. Varasemaid kivikoldeid hakkasid alates 7.–8. sajandist asendama hoopis suurema soojamahutavusega keris-, kohati ka umbahjud pindalaga keskmiselt 2,4–2,5 m<sup>2</sup>, millest tulepesa moodustas 0,3–0,5 m<sup>2</sup>. Tulepesa kõrgust on olnud võimalik määrata linnamägede uurimisel avastatud mahavarisenud ahjuseinte põhjal, mille varesid ei ole hilisemate ehitiste ega maaharimisega lõhutud. Nii on Pada ja Soontagana linnamägedel arvatud tulepesade kõrguseks 30–40 cm, Varbolas isegi 50–60 cm. Keskaaja lõpul ahjude pindala suurenes, ulatudes 17. sajandi reheahjude puhul üldpindalalt juba 6–7,5 m<sup>2</sup>-ni.

Peamiselt läänepoolses Eestis on mitme linnamäe (Valjala, Soontagana, Varbola) uurimisel avastatud ahje, mille tagaseinaks on olnud suurem serviti laotud paeplaat või lapik raudkivi, mida vahel tagantpoolt toestas tugimüür. Võimalik, et seda tingis vajadus tõhustada tulepesas tõmmet mitte läbi tagaseina, vaid läbi

ahju ülaosa kerise, mis oli ju küttekolde peamiseks soojustuselemendiks. Analoo-  
gilisi ahje esines hiljemgi (näiteks Olustvere IV, 1, joon 4–5), kuid keskaja lõpul  
see ehitusviis põhiosas kadus. Ahjude külgseinad võidi ehitada paeplaatidest, mis  
aga oluliselt ei soojenenud. Samas on selge, et nii ahju kui soojaallika, aga ka  
leivaküpsetamise koha puhul oli oluline soojuse salvestumine mitte ainult ülaosa  
kerises, vaid ka külgseintes. Seetõttu müüriti ahju paeseina tihti raudkive, mis  
aitas kaasa küttekolde ühtlasemale soojenemisele. Varbola 13.–14. sajandi keris-  
ahju puhul oli ahju toapoolse külgseina sisekülje vastu laotud raudkividest lausa  
topeltmüür, mis seega moodustas soojust konserveeriva sisevooderduse.

Ahjude ülaosa konstruktsiooni jälgi on säilinud harva. Hiliskeskaegsete ja  
uusaja alguse ahjuvarede alal on avastatud primitiivse, koduse valmistamisviisiga  
telliste tükke, mis tõenäoliselt pärinevad kerise kandevõlvidest. Ahjusuu ees,  
tihti samal alusplaadil, on asunud lahtise tulega toiduvalmistamiskoht – lee. Hästi  
eristuvad liivapinda süvendatud lee (tuhkhaua) piirjooned, samas kui süsises  
kultuurkihis võivad need mõnikord ka märkamata jääda. Lee laius sõltus ena-  
masti ahju tulepesa laiusest: kui suitsutoa puhul oli see keskmiselt 40–60 cm, siis  
16.–17. sajandi rehielamute puhul võis lee laius ulatuda juba kuni 1 meetrini.

Rauaaegsete asulakohtade suurkaevamiste kohta on seni ilmunud peamiselt  
uurimistulemusi tutvustavaid lühiülevaateid. Nende kaevamistulemuste esitamise,  
interpretatsiooni ja arheoloogiateaduse varamusse lülitamise osas seisab seega veel  
ees mahukas töö.