

THE SALME SHIP BURIALS

Two Eighth-Century Mass Graves
on Saaremaa Island, Estonia

RECENT RESEARCH



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ACTA Universitatis Tallinnensis: Humaniora

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Recent Research

Edited by Lembi Lõugas and Heidi Luik

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The Salme Ship Burials: Two Eighth-Century Mass Graves on Saaremaa Island, Estonia. Recent Research

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THE VIKING
PHENOMENON

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6. COMBS AND OTHER ANTLER AND TOOTH ARTEFACTS FROM THE SALME SHIP BURIALS

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ABSTRACT

This article focuses on the antler combs and other antler and tooth objects found in the Salme ship burials, Saaremaa, Estonia. In total, twelve combs were found in the two ships, one from Salme I and eleven from Salme II. All of them are large composite combs with a single tooth row, whose shape and ornamentation allows them to be dated to the 8th century. Those analysed by ZooMS proved to be made from elk and reindeer antler. Most parallels of these combs can be found in central Sweden,

while the remaining antler and bone items represent rare types found in the Scandinavian pre-Viking period. They are represented by two blunt arrowheads, a strap end and two bear tooth pendants. All of the non-comb items were found in Ship II.

KEYWORDS: *Salme ship burials, elk and reindeer antler, composite combs, blunt arrowheads, strap end, bear tooth pendants*

INTRODUCTION

The finds from the Salme ship burials are dominated by metal objects such as swords, arrowheads, shield bosses and boat rivets, etc. However, there are also numerous organic finds, including hundreds of gaming pieces made of whalebone and cattle femur heads (Lõugas *et al.* 2023a). In addition to the unique number of gaming pieces, other objects made of osseous materials were also found in the Salme ships. Nevertheless, they are represented by a comparatively small number of specimens. The seven dice made from antler and three made from whale teeth are discussed together with gaming pieces (see Luik *et al.* 2026). Most common among organic finds are antler artefacts represented by combs,

blunt arrowheads, and a strap end mount. Two very unusual bear tooth pendants are also included in this group of finds. These objects are briefly discussed in the chapters of the book presenting the results of the excavation of the Salme ships and the find material (Peets & Luik 2023, 36–37; Luik & Peets 2023, 82–83). Photos of the objects are published on the plates in the find catalogue (Lõugas *et al.* 2023a).

The aim of this article is to provide an overview of antler and tooth items, and the raw materials used to make them. Comparative material from Scandinavia and elsewhere is presented, and the dating and possible origins of the artefacts are discussed.

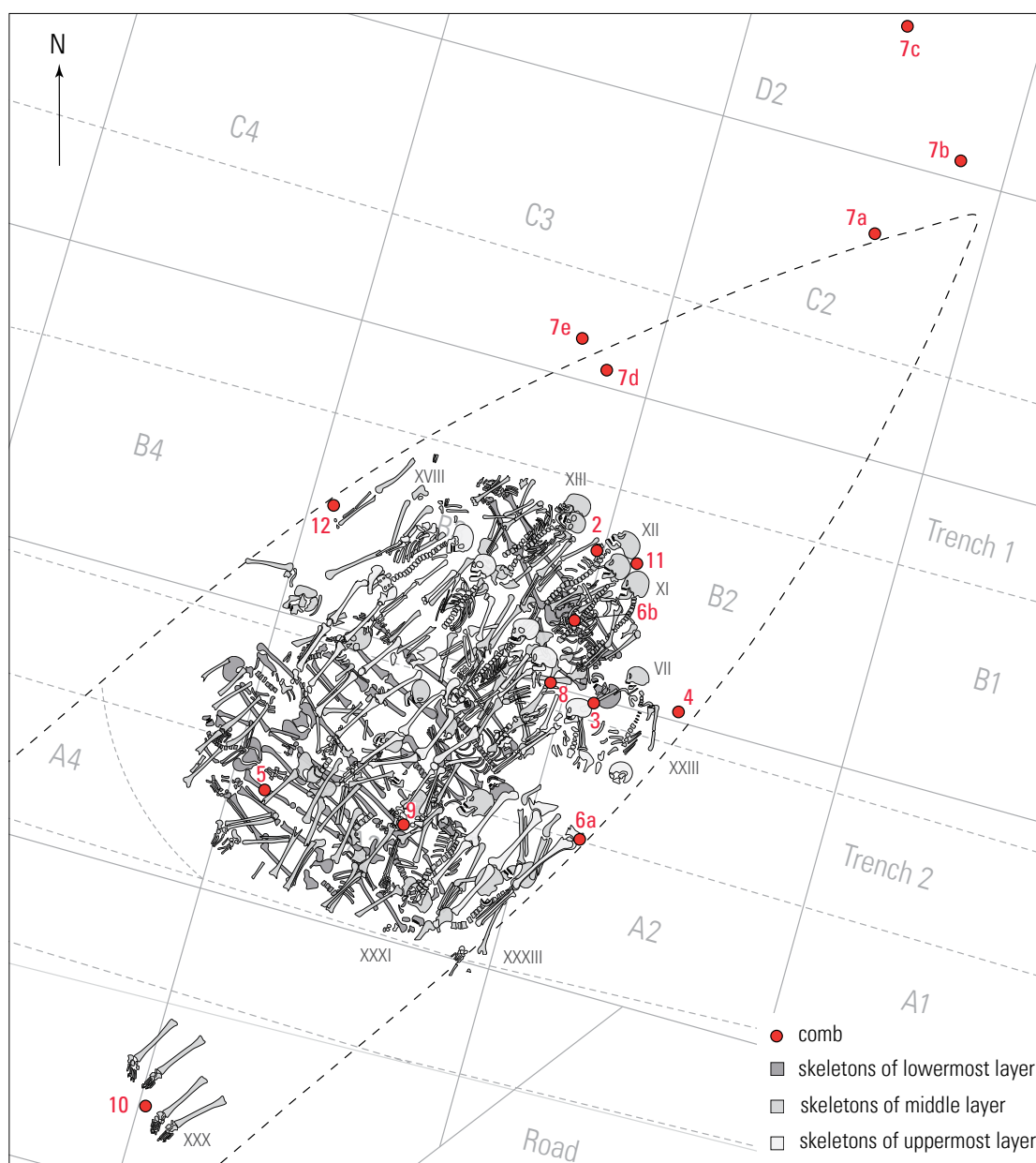


Figure 1. Combs in *Salme Ship II*. Roman numerals indicate the human skeletons mentioned in the article with which the combs can presumably be associated. Comb numbers in the plan correspond to the numbers in Table 1 and Figs 2–4. Map after Lõugas et al. 2023a, modified by Aive Viljus.

ANTLER COMBS

Twelve antler combs, some of which have been preserved more or less intact, and others in quite fragmentary condition, have been found in the excavation area (Table 1). One of them was obtained from Salme I and the remaining 11 from the excavations of Salme II ship (Figs 1–4). In addition, a few small comb fragments cannot be associated with any of the examples mentioned above. Some photos of the combs have already been published in excavation reviews (Konsa *et al.* 2009, fig. 8; Peets *et al.* 2011, fig. 9), and a comprehensive article in

English (Luik *et al.* 2020)¹, as well as a short overview in Estonian (Luik 2020). This article summarises the previously published information, with revisions made based on newer studies (Callmer 2020; Muñoz-Rodríguez *et al.* 2023; Qvistgaard & Sindbæk 2023; Rey-Iglesia *et al.* 2023).

¹ In the Luik *et al.* 2020 article, each comb was given an individual number, which is also used in the current article. Fragments of the same comb that received different find numbers during excavation are marked with letters in addition to the number.

Table 1. *Salme combs: find context, decoration, raw material*

No	Comb	Find context	Decoration	Raw material/ identification method (GenBank* accession)
1	Comb 1 a–d SM 10601: 272, 273, 231, 232 (Fig. 2: 1)	Ship I, SW end	ring-and-dot motifs, triple edge lines, decorated end plates and back	red deer/fallow deer/elk ZooMS
2	Comb 2 SM 10602: 416 (Fig. 2: 2)	Ship II, middle burial layer, between skeletons XII and XIII (Fig. 1: 2)	double ring-and-dot motifs and arcs, triple edge lines, decorated end plates	elk ZooMS, aDNA (MN810315)
3	Comb 3 a–b SM 10602: 330, 690 (Fig. 2: 3)	Ship II, middle burial layer, between skeletons VII and XI (Fig. 1: 3)	double ring-and-dot motifs, triple edge lines only at straight edge, decorated end plates	elk ZooMS, aDNA (MN810316)
4	Comb 4 a–b SM 10602: 450, 500 (Fig. 2: 4)	Ship II, middle burial layer, skeleton VII (Fig. 1: 4)	double ring-and-dot motifs, triple edge lines, decorated end plates and back	elk ZooMS, aDNA (MN810317)
5	Comb 5 SM 10602: 219 (Fig. 2: 5)	Ship II, mixed layer, presumably skeleton XXXI in the lowermost burial layer (Fig. 1: 5)	ring-and-dot motifs, triple edge lines, decorated end plates and back	elk ZooMS, aDNA (MN810318)
6	Comb 6 a–b SM 10602: 107, 267 (Fig. 4: 6)	Ship II, mixed layer and intermediate soil layer between uppermost and middle burial layer (Fig. 1: 6 a–b)	ring-and-dot motifs, single edge lines, decorated end plates and back	not analysed
7	Comb 7 a–c SM 10602: 167, 142, 144, 214, 153 (Fig. 4: 7)	Ship II, mixed layer (Fig. 1: 7a–c)	ring-and-dot motifs, single edge lines, decorated end plates	not analysed
8	Comb 8 SM 10602: 844 (Fig. 3: 8)	Ship II, lowermost burial layer, skeleton XXIII (Fig. 1: 8)	ring-and-dot motifs, lines forming rhombuses, single edge lines, decorated end plates and back	reindeer ZooMS
9	Comb 9 SM 10602: 894 (Fig. 3: 9)	Ship II, lowermost burial layer, skeleton XXXIII (Fig. 1: 9)	ring-and-dot motifs, single edge lines, decorated end plates	reindeer ZooMS
10	Comb 10 SM 10602: 581 (Fig. 3: 10)	Ship II, middle burial layer, presumably skeleton XXX (Fig. 1: 10)	pairs of short parallel lines, small rectangular dots, single edge lines, decorated back	reindeer ZooMS (two samples)
11	Comb 11 SM 10602: 685 (Fig. 4: 11)	Ship II, middle burial layer, between skeletons XI and XII (Fig. 1: 11)	single edge lines, no other decoration visible (badly preserved)	elk ZooMS, aDNA (MN810319)
12	Comb 12 SM 10602: 742 (Fig. 4: 12)	Ship II, middle burial layer, skeleton XVIII (Fig. 1: 12)	not identifiable (badly preserved)	not analysed

* GenBank NCBI database: <https://www.ncbi.nlm.nih.gov/genbank/> (last accessed 02/02/2026).

LOCATIONS OF COMBS WITHIN BURIALS

In the Salme I ship, most items were not found in their original location due to earlier damage to the burial. Although several items were moved because of the digging of cable trenches through the Salme II ship, a large number of the finds were still located in the undisturbed area of the ship near the skeletons. However, especially in the case of smaller finds in this grave, it was not always

possible to connect specific finds to buried people. This is because smaller objects have moved from their original locations as a result of the decomposition of the corpses and other taphonomic processes such as freezing and thawing.

Only one comb, preserved in four fragments (comb 1 a–d, Fig. 2: 1), was found in Salme I. It was impossible to associate this comb with any buried skeleton. Two of the



Figure 2. Combs 1–5 (SM 10601: 272, SM 10602: 416, 330/690, 450/500, 219). All five combs have triple edge lines with comb 3 having such lines only along the straight edge of the connecting plate. Three combs (2–4) are decorated with double ring-and-dots, two combs (1, 5) have simple ring-and-dots. Comb 2 also has curved lines between ring-and-dot motifs. All combs have ring-and-dots on the end plates and all (except comb 3) also have triple edge lines in this position. Three combs (1, 4, 5) are decorated along their back edges. All combs are made from elk antler: four combs (2–5) from Salme II are identified as elk, one comb (1) from Salme I is identified as cervid, although this is probably also elk. Photos: Reet Maldre and Jaana Ratas.

comb fragments were recovered from the southwestern end of the ship, south of the trench that ran across the mid-section of the ship; one was found in the cable trench near the same end of the ship; and one from a heap of sand in the southeast corner of the excavated area. The fragments had in other words been scattered when workers dug the cable trench that damaged the burial (Luik *et al.* 2020, 9, fig. 9; Peets & Luik 2023, 37, fig. 16; Lõugas *et al.* 2023a, pls 6, 12–14).

The combs from Salme II are stored under 23 find numbers. Among these finds, it was possible to identify 11 combs in different states of preservation (combs 2–12, Fig. 1). Below we will describe the find contexts of the combs, starting with the most completely preserved specimens that were probably lying in situ at the time of excavation. The description ends with the fragments whose original contexts were disturbed during the digging of the cable trenches.

No combs were found in the upper layer of skeletons. In the middle layer, most combs were found in the northern row of skeletons. A nearly complete comb (comb 4 a–b, Figs 1: 4; 2: 4) was located at the southeastern end of the first row and could have belonged to skeleton VII. It was found in grid square B/2, beneath two half-upright broken swords that came to light immediately under the sod layer (Luik *et al.* 2020, 12, table 1: 4; fig. 4: 4; 12; Luik & Peets 2023, fig. 47; Lõugas *et al.* 2023a, pls 95–96).

Another nearly complete comb (comb 3 a–b, Figs 1: 3; 2: 3) was found between skeletons VII and XI. The broken end of the same comb was found in the torso region of skeleton XI. It is difficult to associate with a specific skeleton (Luik *et al.* 2020, 12, table 1: 3; figs 4: 3; 5; 11; Luik & Peets 2023, fig. 47, Lõugas *et al.* 2023a, pls 95–96). Since comb 4 was found next to skeleton VII, it seems more likely that this comb is associated with skeleton XI.

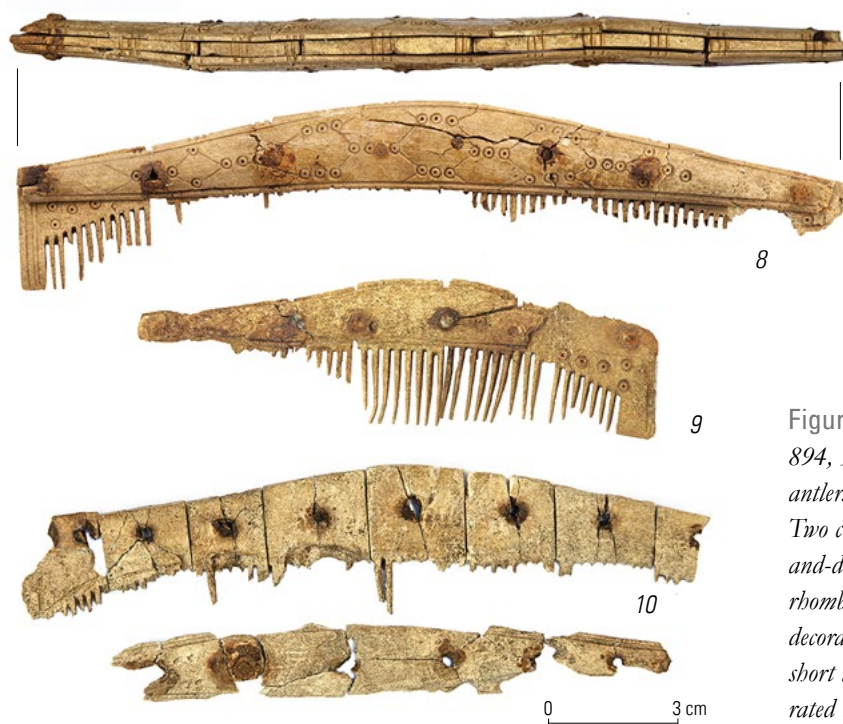


Figure 3. Combs 8, 9 and 10 (SM 10602: 844, 894, 581) are identified as made from reindeer antler. All three combs have single edge lines. Two combs (8, 9) have decoration of simple ring-and-dots, comb 8 also has straight lines forming rhombuses and polygons. Comb 10 has different decoration of small rectangular dots and pairs of short incised lines. Two combs (8, 10) have decorated back edges. Photos: Reet Maldre.

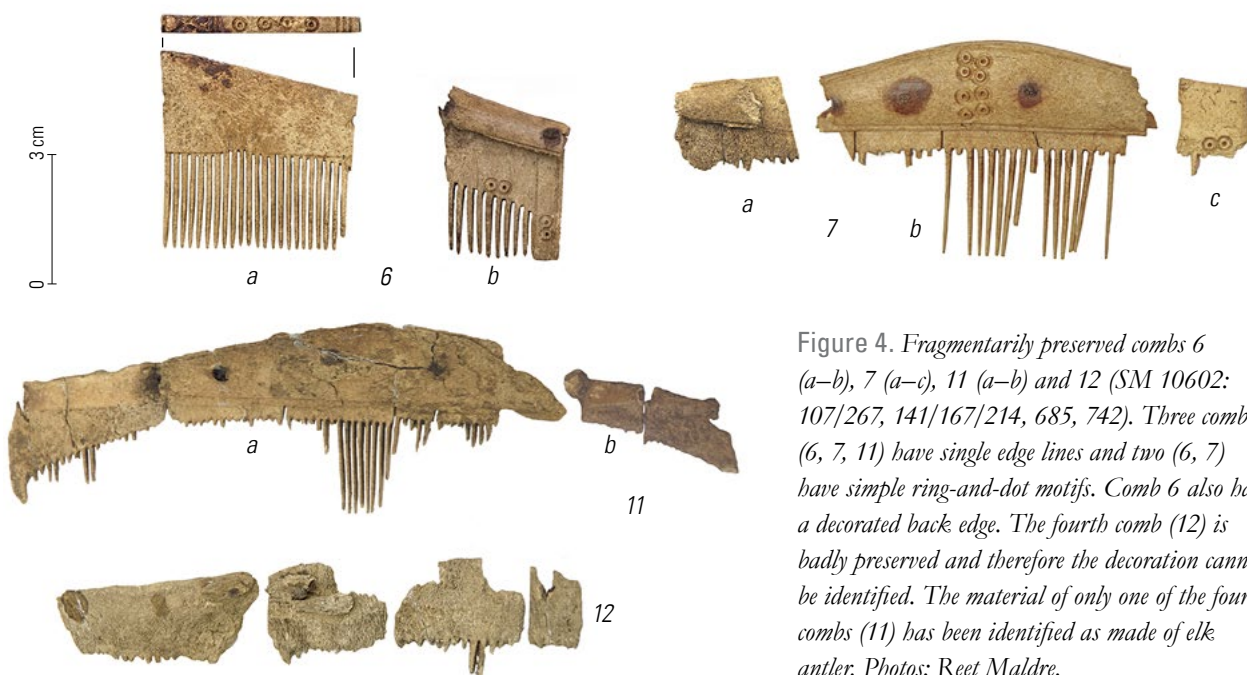


Figure 4. Fragmentarily preserved combs 6 (a–b), 7 (a–c), 11 (a–b) and 12 (SM 10602: 107/267, 141/167/214, 685, 742). Three combs (6, 7, 11) have single edge lines and two (6, 7) have simple ring-and-dot motifs. Comb 6 also has a decorated back edge. The fourth comb (12) is badly preserved and therefore the decoration cannot be identified. The material of only one of the four combs (11) has been identified as made of elk antler. Photos: Reet Maldre.

There is one more comb (comb 11, Figs 1: 11; 4: 11a) that is potentially associated with skeleton XI (Luik *et al.* 2020, 12–13, table 1: 11; figs 4: 11; 19; Luik & Peets 2023, fig. 47; Lõugas *et al.* 2023a, pls 88–89). This was found near the skulls of skeletons X, XI and XII, whose bodies were located side by side, partly overlapping each other. Considering the depth, this comb is most likely associated with skeleton XII or XI. During a later examination of the human bones by Martin Malve, some more

fragments of this comb were found among the bones of skeleton XII, tying the object more closely to this individual (Fig. 4: 11b).

The fourth comb (comb 2, Figs 1: 2; 2: 2), found in the northern skeleton row of the middle burial layer – together with a broken pair of shears and a long rectangular whetstone – was located between skeletons XII and XIII (Luik *et al.* 2020, 13–15, table 1: 2, fig. 4: 2; 10; Luik & Peets 2023, fig. 47; Lõugas *et al.* 2023a, pls 88–89). It

seems more possible that this comb is also associated with individual XII, who was probably the central person in the whole burial (Peets *et al.* 2013, 51, fig. 13). This is the most exquisite comb buried in the Salme ships, with very skilfully made ornaments, especially the unusual motif on the endplate. The ring sword with gilded hilt was also located near this skeleton (Luik & Peets 2023, 75, figs 47–49; Lõugas *et al.* 2023a, pls 88, 92–93).

The fifth comb (comb 12, Figs 1: 12, 4: 12), preserved in a fragmentary state, could relate to skeleton XVIII, which was located at the western side of the ship (Luik *et al.* 2020, 15, table 1: 12, fig. 4: 19; 20; Luik & Peets 2023, fig. 47; Lõugas *et al.* 2023a, pls 85, 87). Near the thorax of this skeleton, damaged by Trench 1, two pendants made of bear canines were found in the mixed soil (see below; Luik *et al.* 2020, 15).

A sixth comb (comb 10, Figs 1: 10, 3: 10) was found in square J/3, in the badly preserved third row of the middle burial layer. It is probably associated with individual XXX (Luik *et al.* 2020, 16, table 1: 10; figs 4: 10; 18; Lõugas *et al.* 2023a, pls 66, 68). The uppermost layers in this part of the grave had been disturbed by various modern construction and levelling activities, altering the position of some artefacts and bones (Luik *et al.* 2020, 16).

At least three combs had been placed with the individuals buried in the lowermost layer of skeletons. The first among these (comb 8, Figs 1: 8, 3: 8) was found beside the left humerus of skeleton XXIII, who was buried in the northeastern end of the layer. It had been placed with its teeth pointing towards the buried man (Luik *et al.* 2020, 16–17, table 1: 8; figs 4: 8; 8; 16; Luik & Peets 2023, fig. 51; Lõugas *et al.* 2023a, pls 106–107).

The second well preserved comb 9 (Figs 1: 9, 3: 9) in this layer was located under the pelvis of skeleton XXXIII, which was the third skeleton, counting from the southwest, in this row (Luik *et al.* 2020, 16, table 1: 9; figs 4: 9; 7; 17; Luik & Peets 2023, fig. 51; Lõugas *et al.* 2023a, pls 112–113).

Of fragments found in upper disturbed layers, one comb (comb 5, Figs 1: 5, 2: 5) was in the central part of the ship in square A/3. This object is most likely related to skeleton XXXI, buried in the lowermost layer, whose torso and head were missing. Presumably both the upper body and the grave goods of this skeleton were disturbed and lifted to the upper layer during the digging of cable trench 3 (Peets *et al.* 2011, 34, fig. 9; Luik *et al.* 2020, 16, table 1: 5; figs 3: 5; 13; Lõugas *et al.* 2023a, pls 69, 71).

Fragments of at least two additional combs (combs 6 and 7) cannot be associated with specific skeletons. A tooth plate from comb 6 (comb 6 a, Figs 1: 6 a, 4: 6 a) was recovered in square A/2 and an endplate was

found together with fragments of a connecting plate at the boundary of squares B/2 and B/3 (comb 6 b, Figs 1: 6 b, 4: 6 b). The loose tooth plate came from the area disturbed by the cable trench 2, while the endplate was found in soil covering the middle burial layer that was not disturbed by later activity. Presumably, this comb was broken before its pieces reached the intermediate soil layer between the top and middle burial layers (Luik *et al.* 2020, 11, table 1: 6, fig. 3: 6a–b; 14; Lõugas *et al.* 2023a, pls 62, 65, 69, 71).

The fragments of comb 7 were also scattered in different places. This comb probably originates from one of the skeletons damaged by cable trench 1 in the middle burial layer. The comb's middle part and fragments of the endplates (comb 7 a–c, Figs 1: 7a–c, 4: 7 a–c) were found in squares C/2 and D/2, outside the ship contour. A fragment of a tooth plate and a single comb tooth (comb 7 d–e, Figs 1: 7 d–e) were recovered from the soil filling the cable trench in square C/3 (Luik *et al.* 2020, 12, table 1: 7, figs 3: 7a–e; 15; Lõugas *et al.* 2023a, pls 62, 65–66, 68).

Additional comb fragments that cannot be firmly associated with any of the combs described above were recovered from soil disturbed by the cable trenches (Luik *et al.* 2020, 12, table 1: 13; fig. 3: 13a–e; Lõugas *et al.* 2023a, pls 73–74).

COMB DESCRIPTIONS

All combs are single-sided and constructed from a series of tooth plates placed between two endplates and fastened with rivets between a pair of connecting plates (for more on the construction of combs see Ulbricht 1978, 52–54, figs 3, 8; Ambrosiani 1981, 94 ff., fig. 48; MacGregor 1985, 74–77, fig. 43).

The combs from the Salme ships are large, the better-preserved examples measuring between 19 and 21 cm in length, and 4.5–5.0 cm across the central point (Luik *et al.* 2020, 18, table 1, figs 9–20). The connecting plates have a wave-shaped or sinuous form with a wide middle part and long narrow terminals. This shape has been defined as concave–convex–concave (e.g. Petré 1984b, 71), curved back (e.g. Brynja 1998), sweeping profile (Callmer 2020) or bell-shaped (Qvistgaard & Sindbæk 2023). All examples feature graduated rows of teeth and the cross section of the connecting plates is characterised by a shallow plano-convex shape (Luik *et al.* 2020, 18–19). Most of the combs are decorated with ring-and-dot ornaments, of which three feature motifs with double rings. These motifs exist in a variety of arrangements, including longitudinal and vertical rows. One comb decorated with double ring-and-dots has very unusual curved lines between these ornaments, and another example with simple ring-and-dots has straight lines forming

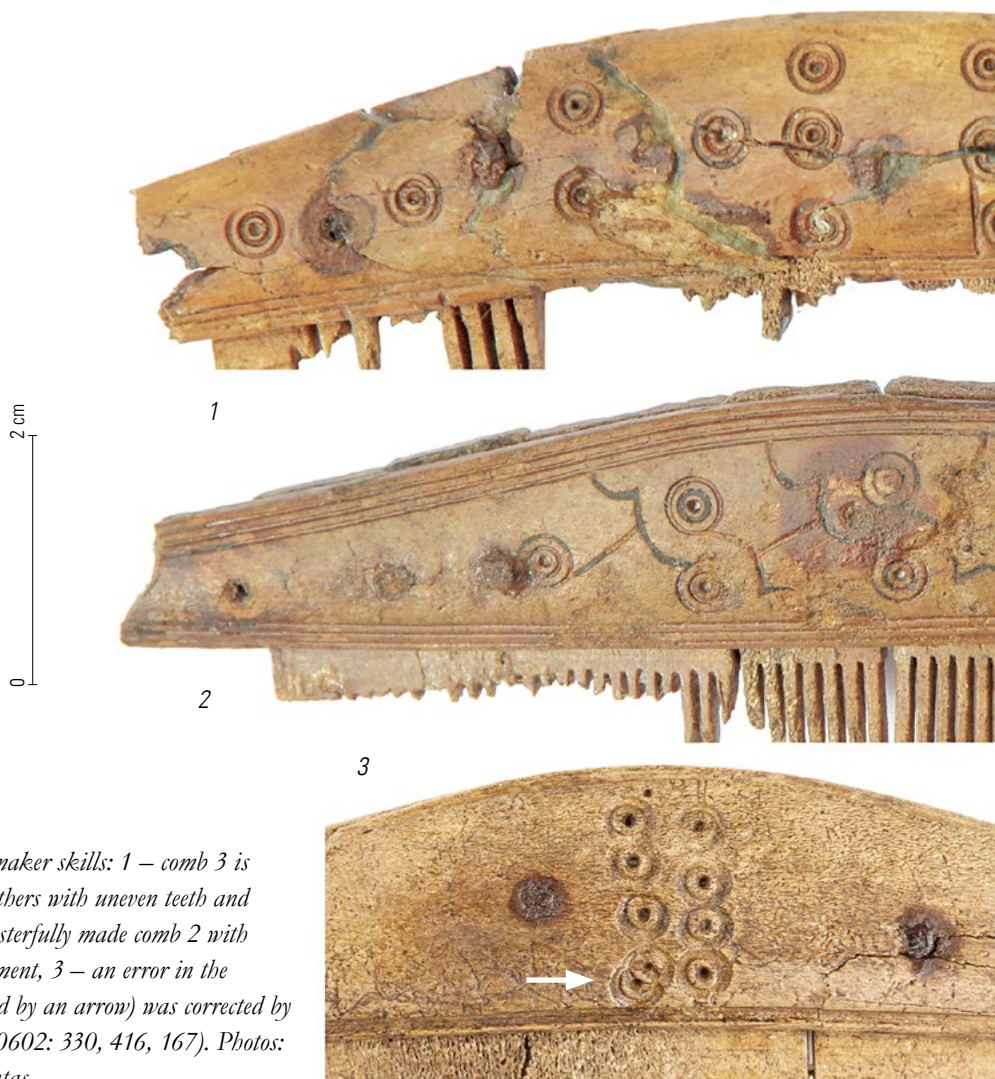


Figure 5. Different comb maker skills: 1 – comb 3 is made more carelessly than others with uneven teeth and irregular edge lines, 2 – masterfully made comb 2 with even teeth and regular ornament, 3 – an error in the pattern on comb 7 (indicated by an arrow) was corrected by drilling a new motif (SM 10602: 330, 416, 167). Photos: Reet Maldre and Jaana Ratas.

rhombuses and polygons. One comb has different decoration in the shape of small rectangular dots and pairs of short incised lines. Most of the combs also feature incised edge lines. Seven combs have only a single edge line close to the connecting plate edges; five combs feature triple edge lines. In one example, these lines only exist along the straight edge of the connecting plate (*ibid.*, 19). All preserved endplates are decorated, mainly in groups of between two and five ring-and-dot motifs. One comb features double ring-and-dot motifs connected with curved lines, echoing the design of its connecting plates. Most of the combs also have edge lines close to their terminals; two combs stand out in that their endplates feature additional lines close to the tooththrow edge. Several combs are also decorated along their backs, i.e. the upper edges of the tooth plates between the connecting plates. In two cases the decoration consists of triple incised lines and in one case of a pair of lines. Two combs have transverse lines and oblique crosses on their backs,

while one also features a ring-and-dot motif. One loose tooth plate has rich decoration with transverse triads, oblique crosses, and four ring-and-dot motifs on its back edge while another loose endplate only has small oblique crosses (Luik *et al.* 2020, 20–21). As is common with other combs from this period, those from Salme are assembled with iron rivets. In some cases they run through drilled holes in the centre of tooth plates, while in others they are inserted in the edges. One comb has rivets close to both ends of each tooth plate, creating the impression of pairs of rivets (*ibid.*, 23). Variations in comb ornament show that different combinations of patterns were used at the same time. Some elements are characteristic of the Vendel Period (c. AD 550–750), while some are typical to Viking Age combs, indicating the beginning of new traditions and/or two parallel workshop practices in the Salme material.

When observing comb making techniques one can notice differences in the skills of the makers (Fig. 5).

Most combs were carefully made, but in some cases can inaccuracies be seen. Differences in the manufacturing skills are of course more visible in better preserved combs. Comb 2, with unique ornament of curved lines, is made in a masterful way, and other combs such as 4, 5 and 8 also stand out in terms of quality with symmetrically carved ornaments and evenly sawn teeth (Fig. 2). However, there are also examples of combs made in a far more careless way. The connecting plate edge lines on comb 3 are irregular, and the teeth have been sawn unevenly. On Comb 7 we can observe an error in the pattern and see that someone has tried to correct the mistake by drilling a new motif (Luik *et al.* 2020, 34–37, figs 21–23). These differences in skills suggest that the combs originate from different craftsmen.

RAW MATERIALS FOR MAKING COMBS

The combs from Salme are all made of antler. In the case of such finely worked objects it is rarely possible to make a visual identification of which species of deer the antler originated from (Ashby 2006, 83 ff.; 2013, 208 ff.). In order to identify which species of deer provided the antler for the Salme combs, nine samples were analysed from eight combs (Table 1: 2–5, 8–11; Luik *et al.* 2020, table 1) using collagen peptide mass fingerprinting (ZooMS), performed at the BioArCh laboratories, University of York. All samples came from comb teeth with the exception of one comb, from which both a tooth and a fragment of a connecting plate were analysed (about the analysing process, see Luik *et al.* 2020, 31). In all, four samples (from three combs) were identified as reindeer (*Rangifer tarandus*), and five as red deer/elk/fallow deer. Since it is not possible to distinguish between the latter species with ZooMS analysis (on ZooMS see e.g. von Holstein *et al.* 2014; Ashby *et al.* 2015), these five samples were subject to ancient DNA analysis in order to distinguish the cervid species (e.g. Speller *et al.* 2014). The extraction was undertaken in the ancient DNA laboratory at the University of York. This analysis confirmed the species to be elk (*Alces alces*) in all cases (see Luik *et al.* 2020, 31–32). ZooMS analysis of one comb fragment from Salme I had previously been undertaken, also at the BioArCh labs. The ZooMS identification for this sample was the same as the aforementioned five combs found from Ship II, i.e. red deer/elk/fallow deer (Table 1). An aDNA analysis was not undertaken on this sample, but on the basis on the other results, elk seems to be the most plausible alternative (*ibid.*).

Reindeer, whose antlers were used to make combs did not live in the lake Mälär region, the assumed origin of most of the burials in the grave. So either the raw material or complete combs must have been imported

to this area from elsewhere in Scandinavia. Today, wild reindeer are primarily associated with Norway and northern Finland, but they were once very common over vast areas of northern Scandinavia, where they were subject to large-scale hunting (e.g. Ashby *et al.* 2015, fig. 3; Røed & Hansen 2015, fig. 4; Lindholm & Ljungkvist 2016; Pilo *et al.* 2018). Combs made of reindeer antler have been identified across large areas of Norway, Sweden, Denmark, Orkney and the Faroe Islands (e.g. Ulbricht 1978; Hansen 2005, 159, 271; Ashby *et al.* 2015; Røed & Hansen 2015). Recently, ZooMS analysis has been conducted on combs from Ribe and Haithabu (Ashby *et al.* 2015; Rey-Iglesia *et al.* 2023; Munoz-Rodriguez *et al.* 2023). In a recent study, ZooMS analysis of so-called Scandinavian-type combs from Ribe, revealed that three of the four combs from the AD 720–740 context were made from reindeer antler. In the fourth case, DNA analysis revealed it was an elk antler comb. Since no reindeer antlers have been found among the production remains of this period, the authors of the study believe that these combs must have been imported as finished products to Ribe, probably from Norway. Two Scandinavian-type combs from a later context (AD 810–860), were also made of reindeer antler (Rey-Iglesia *et al.* 2023; see also Qvistgaard & Sindbæk 2023). As from around the mid-8th to the mid-9th centuries reindeer antlers were also found among production waste, it is possible that later combs were locally made (Ashby *et al.* 2015; Rey-Iglesia *et al.* 2023; Qvistgaard & Sindbæk 2023). Based on ZooMS analysis, 85–90% of the 9th century combs in Haithabu were made of reindeer antler, but at the same time this antler only constituted c. 0.5% of the waste material in the town (Munoz-Rodriguez *et al.* 2023, 1243–1244). It therefore seems that the vast majority of the combs were imported as finished products.

In the case of Salme it is possible that reindeer hunting communities also produced combs (e.g. Christensen 1986; Rosvold *et al.* 2019), although it is also possible that antler was brought to the Mälär region as a raw material for local comb makers. The similarities in form and ornament of the Salme combs, whether they were made from elk or reindeer antler, may support this proposal. In the same way, the Scandinavian-style combs from reindeer antler and elk antler found in Ribe are quite similar to each other (Rey-Iglesia *et al.* 2023, fig. 2). The similarities and differences between combs from the Salme ship burials have been compared in more detail in a previously published article (Luik *et al.* 2020, 33) and are presented in the captions of Figures 2–4. To sum up, both identified materials point to Scandinavia, where reindeer antler is linked to the upland areas of present-day Norway and the northern parts of Sweden. The habitat of elk is much

wider, from the forested region of southern Sweden to those in the far north.

When discussing workshop traditions in Scandinavia and in western Europe, Johan Callmer has concluded that typological variation has been quite small, and presumably artisans were closely connected. One exception was in the late 8th and early 9th centuries when the influence of the North Sea region can be observed. Callmer has assumed that craftsmen from this area could have settled in Scandinavia in this period. At the beginning of the 9th century, the types became standardised again, which in his opinion was in contrast to the situation in western Europe (Callmer 2020, 162). Combs from Salme are quite similar in shape. Even if they have a variation in decoration, the shapes and sizes of the combs are generally the same (Luik *et al.* 2020, 33), so they fit into the tradition of the Scandinavian workshops.

COMPARING MATERIAL FROM SCANDINAVIA AND DATING COMBS

A longer discussion of material comparison and dating is presented in Luik *et al.* 2020, 24–31 and table 2; the most important results and references to later publications are briefly reproduced here.

It should be emphasized that before the find of the Salme ship burials, only a few single composite combs had been found in Estonia, and combs pre-dating the Viking Age are particularly rare in this part of the Baltic region in general (Luik 1998, 21–34, figs 7–17, pl. I; Aun 2009, 93, fig. 14: 1). They are far more numerous in Gotland and central Sweden (lake Mälars region), giving rise to several publications about combs from different periods (e.g. Nerman 1935, 1969; Ambrosiani 1981; Thunmark-Nylen 1991; Brynja 1998). Comprehensive studies are available for combs from central Sweden dated to the Roman and Migration Periods (Brynja 1998), as well as for later Viking Age combs (Ambrosiani 1981). At the time of writing the article about combs from Salme, there was no comprehensive study of Vendel Period combs for the whole of central Sweden. However, Bo Petré has dealt with combs in several books about grave fields on Lovön island in lake Mälars, in which he has analysed the characteristic features of combs, and compiled chronologies accordingly (Petré 1984a, 1984b, 1999, 2000, 2011). Combs from several other cemeteries have also been published (e.g. Lamm 1962; Holmqvist 1970; Waller 1996; Sander 1997; Melin & Sigvallius 2001).

In 2020, Johan Callmer produced an article, providing an overview of Scandinavian comb typology between AD 700 and 900 (Callmer 2020, 145–162). In this article's chronology, Callmer focused mainly on the ornament of

the combs and to a lesser extent on the shape of the connecting plates, but to save space, he did not include the decorations on the end plates and on the upper edges of the tooth plates (*ibid.*, 145–146). The shape of the cross-section of the connecting plates is also not clear from drawings or descriptions. In Callmer's chronology, Salme combs are mainly types 1–4 (*ibid.*, 146–148, fig. 7.2). Based on the shape of the back contour, types 1 and 4 are similar to the combs from Salme, but the end plates of Salme combs do not taper as much as in Callmer's type 1. In addition to the shape, several examples of Salme combs are also similar to examples of Callmer's types 1 and 4 in that the edges of the connecting plates have triple edge lines and the end plates are also decorated with ring-and-dot motifs and lines on the edge. However, there are also combs with only one edge line in Salme, such as type 2 and 3 combs according to Callmer's typology. One of Salme combs, comb 8, has an ornament of rhombuses formed by lines connecting the dots-and-circles, and single lines at the edges, like Callmer's type 2 combs, although the shape of the back is more similar to types 1 and 4 combs. Combs with the back contour characteristic of type 1 came into use as early as the 7th century and were also common around AD 700, remaining in use until about the middle of the 8th century (Callmer 2020, 146–148). Regarding the variants common within this type, Callmer refers to studies of finds from the Lovö cemeteries (Petré 1984b). According to Callmer, this shape is typical of Scandinavia and has no prototype in continental Europe (Callmer 2020, 148). Type 2, which has a similar ornament of rhombuses, like one of the Salme combs but with a different back shape, came into use in the first half of the 8th century. This type also developed in Scandinavia, although some such combs are also known in Frisian areas. Most have been found further east in Scandinavia and around the Baltic (*ibid.*). Shortly thereafter, type 4 developed, in which the shape of the connecting plates is similar to the combs of type 1. This is characterised by both triple lines on the edges of the connecting plates and dot-and-circle motifs with double lines (*ibid.*). In summary, in Callmer's typology, the types to which the Salme combs are most similar can be dated to the 8th century. During the second half of this century, a series of new ornaments were introduced (Callmer 2020, 148 ff., fig. 7.3) that do not appear on the Salme combs.

Combs similar in shape to the combs from Salme are also known from Ribe, where they are called early Scandinavian-type combs and date to the AD 720–740 period (Rey-Iglesia *et al.* 2023, fig. 2; Qvistgaard & Sindbæk 2023). As mentioned in the subsection on comb materials, they are made of reindeer and elk antler, like the Salme combs.

Since Callmer's article presents only some of the characteristic features of the combs, here we will again mention the features used by Bo Petré in dating the combs. According to him, characteristic features that enable the dating of the combs are the cross-section of tooth plates and connecting plates, the back contour of the comb, the number of edge lines, and the shape and placement of ring-and-dot motifs (Petré 1984b, 71–78; 1999, 188–189; 2011, 299–303, 331–334).

Characteristic features of combs from Salme, are their 'curved' back contour, toothplates of straight cross section, and connecting plates of plano-convex cross section. According to Petré, such features are characteristic of the 7th–8th centuries (Petré 1984b, 75–78; 2011, 331–334). According to Thorleif Sjøvold in northern Norway combs with curved backs were used in the 7th–8th centuries (Sjøvold 1974, 238–239, pls 13: b, 27: k–l, 28: g, 32: n–o, 55: d). Combs with 'rounded' backs (i.e. with connecting plates tapering evenly toward the ends) were used simultaneously with combs with 'curved' backs (e.g. Brynja 1998, figs 37, 51; Petré 1984b, 71, 78), but became the exclusive form in the 9th century (e.g. Tempel 1972, pl. 8: 8, 9, 11; Ambrosiani 1981; Arne 1934, 59, pls III: 10, IV: 4, 5, VII: 1; Sörling 2018; Hyenstrand 2018). According to Callmer's typology, comb types with convex backs came into use in the first half and middle of the 8th century (types 2 and 5; Callmer 2020, 148, fig. 7.2).

Decorative features characteristic of the Salme combs are single or triple edge lines; none of the combs from Salme features double edge lines. In the Mälars region and Gotland, single edge lines were used from the Roman Period onward, with triple lines being introduced in the 6th century. However, in combination with morphological features similar to the Salme combs, they occur primarily between the late 6th and 8th centuries (Petré 1984b, 75; Nørgård Jørgensen 1999, pls 108: 14, 110: 4, 20; 131: 12). Double edge lines, used on connecting plates of plano-convex cross section, are assumed to have come into use in the second half of the 8th century and are typical of the Viking Age (Ambrosiani 1981; Petré 1984b, 75–78; 2011, 331–334; Thunmark-Nylén 1991, 115, fig. 1). However, combs in the first half of the 8th century could also have double edge lines, as can be seen in some combs found in Ribe (e.g. Rey-Iglesia *et al.* 2023, fig. 2).

Double ring-and-dot motifs – as can be seen on three combs from Salme – were more typical of earlier periods and were used primarily on combs with

connecting plates of wedge-shaped cross section. However, such decoration occasionally appears on connecting plates of plano-convex cross section (e.g. Petré 1984a, A 115: 3; 1999, A 4: 7, A 46: 14). Ring-and-dot motifs with single rings are much more common on these objects. As mentioned above, according to Callmer (2020, 148) dot-and-circle motifs with double lines were characteristic to type 4 combs used in the 8th century, while groups of ring-and-dot motifs are typical of combs from the 7th to 8th century (Petré 1984b, 76–78; 2011, 331–334).

The connection of double ring-and-dot motifs with curving lines seen at connecting plates of Salme comb 2 has quite a close parallel in a Vendel Period grave in Spelvik (southwest of Stockholm) (Lamm 1962, fig. 9: B) and Löta in Bettna (SHM Inv. No 13974). Patterns of ring-and-dot motifs with connecting lines forming rhombuses (as on comb 8) are also known on the combs from Lovön Island (e.g. Petré 1984a, A 11: 5, A 78: 5, A 118: 6; 2011, A 4, A 9, A 17). Similarly decorated combs are known from 8th- to 9th-century contexts in northern continental Europe (between Germany and northwest Russia), but as already mentioned, these examples lack the 'curved' back contour characteristic of the combs from Salme and the examples mentioned above from central Sweden (e.g. Tempel 1979, fig. 25; Davidan 1992, 19, figs 3, 53; Sörling 2018, 154–155, no 655; Callmer 2020, 148, fig. 7.2: 2A, 2B).

The decoration of comb back edges is a feature of the late Migration Period and Vendel Period (5th–8th centuries) (e.g. Nerman 1969, pls 37: 398, 40: 417; Brynja 1998, 58, 71, e.g. comb nos 143, 144, 164, 166, 173, 178, 180; Petré 1999, A 24: 3, A 48: 5, A 41: 3; 2011, A 72; Qvistgaard & Sindbæk 2023, figs 14.17–14.18), though occasionally it does occur on later combs (e.g. Thunmark-Nylén 1991, 118; Sörling 2018, 144–178).

In summary, the characteristic features of combs from Salme can be dated as shown in table 2 in Luik *et al.* 2020. The combs from Salme are reliably dated to the 8th century, which fits well with the burial's established date of *c.* AD 750 based on radiocarbon dates and the typology of other artefacts (Konsa *et al.* 2009, 61–62, fig. 9; Peets *et al.* 2011, 29, 34–39, table 1; 2013, 57; Peets & Maldre 2010; Price *et al.* 2016, 1022, 1032–1036; Löugas *et al.* 2023b), or slightly later (Aguiraija-Lätti *et al.* 2026). Based on both the appearance and material of the combs, we can conclude that they originate from Scandinavia, probably from central Sweden.

OTHER OBJECTS MADE OF OSSEOUS MATERIAL

The rest of the objects made of osseous material – antler arrowheads and a strap end, and bear tooth pendants – are rarely found in Scandinavian pre-Viking and Viking Age sites. All were found in Salme Ship II and cannot be definitely associated with specific skeletons (Fig. 6; Luik & Peets 2023, 82–83).

ANTLER ARROWHEADS

There are two blunt arrowheads made of antler. Fragments of the first were found together and are registered under one find number (Fig. 7: 2). In the other case, one fragment was located some distance away from the other, resulting in two different find numbers (Fig. 7: 1).

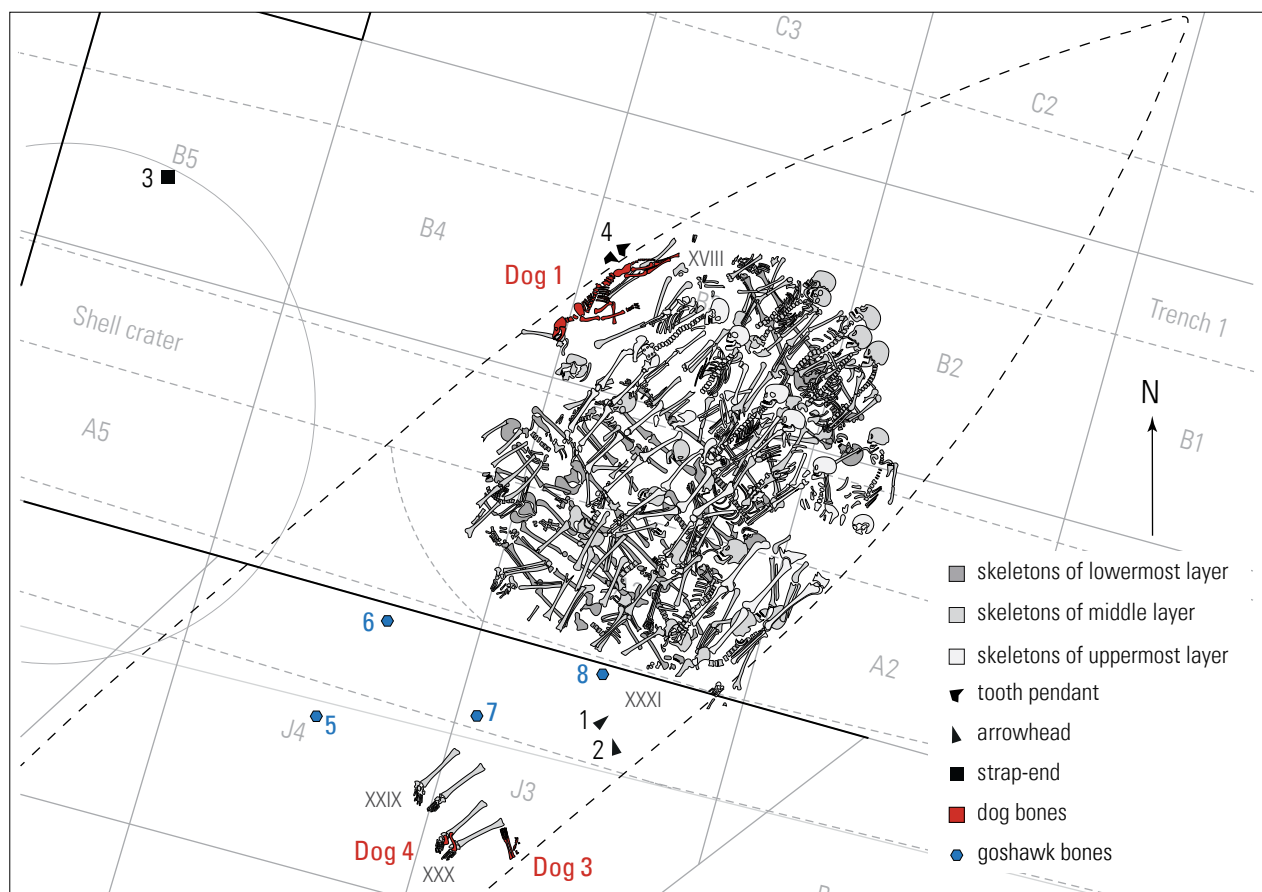


Figure 6. Locations of antler artefacts (1–3), tooth pendants (4), and dog (Dog 1, 3 and 4) and goshawk (5–8) bones in Salme II. The Roman numerals indicate the human skeletons mentioned in the article, with which these items can presumably be associated. The artefact numbers on the plan correspond to the numbers in Figure 7. Map after Lõugas et al. 2023a, modified by Aive Viljus.



Figure 7. Two blunt antler arrowheads (1, 2), fragment of antler strap end (3) and two bear tooth pendants (4) (SM 10602: 220/248, 287, 224, 266). Photo: Jaana Ratás.

The arrowheads are made from cervid antlers, more precisely from the tip of an antler branch. From which species has not been determined. A longitudinal slit has been made at the narrow end to shaft the arrowhead. All fragments were found in a mixed layer from cable trench 3 (Fig. 6: 1–2; Lõugas *et al.* 2023a, pls 69, 71, 74). They are probably related to one of the southernmost skeletons, either XXIX or XXX in the middle burial layer, of which only the ends of lower extremities have been preserved, or to the partially destroyed skeleton XXXI in the lowermost burial layer (Fig. 6).

Blunt arrowheads made of antler and bone (and also entirely of wood) have been used in the northern areas of Eurasia for hunting birds and fur animals, so as not to damage the feathers and fur. Nevertheless, their shape deviates from the Salme specimens as they have a round hollow for the shaft, not a slit. Further, this type appears from the 11th century onwards (e.g. Sirelius 1919, fig. 20; Zachrisson 1976; Smirnova 1994, 143–156). However, arrowheads slit for the shaft are also known and these tend to date between the 7th to 10th centuries. Two such arrowheads have been found in Valsgärde burial 7 (Carlson 2021, 16, fig. 10), one from a cremation grave at Husby in Vagnhärad parish (SHM 19224: e19) and one from grave 2 at Kumla (Hed Jakobsson *et al.* 2019, 128, fig. 85); all of them dated to the Vendel Period. One example, presumably also belonging to the Vendel Period, is known from Runsa fortress (Bornfalk Back 2023, 143). The same type of arrowhead was used also in northern Norway from the 7th century onwards (Sjövold 1974, 291–292, pls 32: b–m, 75: g). A similar arrowhead from the Viking Age was found at Birka (Sörling 2018, 28–29, fig. 549). Another similar arrowhead from the Rösta IV man's grave in Jämtland dated to the 10th century has a longitudinal slit for the shaft, but also a spiral groove on the sides that was probably used to secure the head to the shaft (Kjellmark 1939, 40–41, fig. 3; Holm 2015, 100, fig. 3.9).

The bones of falcons that were in the Salme ship burials (Konsa *et al.* 2009; Allmäe *et al.* 2011; Maldre *et al.* 2018; Maldre 2023; Maldre & Lõugas 2023) indicate that, among other activities, the men in the ships were also engaged in hunting as falcons were used to hunt birds (e.g. Gotfredsen 2014; 2018). When hunting birds, blunt arrowheads were preferred, especially if one wanted to use bird feathers without spoiling them with blood. Feathers were needed for example for arrows, and traces of feathers have been found in the Valsgärde boat burials, where they probably filled pillows that were placed in the grave (Berglund & Rosvold 2021).

Four of five goshawk (*Accipiter gentilis*) bones, probably belonging to one female individual, were found in the same cable trench as the two blunt arrowheads (Fig. 6: 5–8;

Maldre & Lõugas 2023, 91, table 6; Lõugas *et al.* 2023a, pls 129–130). Surrounding the feet bones of skeleton XXX, bones of two dogs (Dog 3 and 4) were found (Fig. 6; Maldre & Lõugas 2023, 90–91, fig. 60; Lõugas *et al.* 2023a, pls 126–128) as well as the bones of a mallard (*Anas platyrhynchos*), which was possibly a prey bird (see Nuut *et al.* 2026). Perhaps both the arrows suitable for bird hunting as well as the goshawk, and perhaps also the dogs, belonged to the same person.

ANTLER STRAP END

The antler strap end (Fig. 7: 3; Lõugas *et al.* 2023a, pl. 71) is made of cervid antler, probably an elk. Only the part of the object with a rectangular, elongated hole for attaching to the belt has been preserved. The original shape and length of the object are unknown. The strap end was found in square B/5, on the edge of the World War II shell crater next to the ship burial (Fig. 6: 3; Lõugas *et al.* 2023a, pl. 69); its original location is unknown.

Antler and bone strap ends are very unusual but can turn up in unusual circumstances. For example, multiple bone and antler mounts (SHM 25849: 1) are known from Vendel Period grave 1 at the Täby 140 grave field in Uppland. Nevertheless, most of the known finds date from a later period than the Salme burials, i.e. from the 9th–11th centuries. A few such objects are known from the United Kingdom, for example London, York, Chester and Leicester. Some of these have a series of holes for attaching to a strap, but at least one has a similar elongated opening as the fragment found in Salme (MacGregor 1985, 105, fig. 60: k–m; MacGregor *et al.* 1999, fig. 902: 5697, 6800; Griffiths 1991, 260–261, pl. 2: 13–14). An ivory specimen has been found in Lund, its mounting part is broken, so it is not known whether it had holes or an elongated opening (Blomqvist & Mårtensson 1963, 190–191, 293, fig. 205); the object was found in an area where most of the finds belonged to the 1020–1050 period (*ibid.*, 289). There are several other examples from the United Kingdom, Ireland, Sweden, the Czech Republic, Poland, etc., including a specimen from Wolin (Poland) which also has an elongated opening (Vlasatý 2020).

With the exception of iron brooches (see Nordfors 2026), this strap end is one of the very few belt or dress items in the boat burials. Metal buckles, belt dividers, strap ends, belt rings, decorative studs, etc., associated with straps, belts and sword belts, are known in both Vendel Period and Viking Age burials in Scandinavia (e.g. Nørgård Jørgensen 1999, 68, 112 ff., figs 42, 51, 63, 100–103), although they have not been found in the Salme ship burials. However, belts and other dress-related items are very rare in middle and late Vendel Period burials in central Sweden.

BEAR TOOTH PENDANTS

Two very unusual items from Salme II were two bear tooth pendants found as a pair and registered under one find number (Fig. 7: 4; Peets *et al.* 2011, 38; Lõugas *et al.* 2023a, pl. 71). They were in square B/3 in spit 9, near the west side of the ship (Fig. 6: 4; Lõugas *et al.* 2023a, pl. 69). Both pendants possibly belonged to skeleton XVIII, the westernmost individual in the northern row of the middle burial layer. The skeleton of a large hunting dog (Dog 1) was placed on the legs of skeleton XVIII (Fig. 6; Maldre & Lõugas 2023, 89–90, fig. 60).

Both pendants are brown bear (*Ursus arctos*) canine teeth with the root part cut off and a hole made that runs from the front to the back of the tooth, not from one lateral side to the other, as is common for example for Estonian and Latvian bear tooth pendants. A hole drilled in this way would cause the tooth to hang on the string with one lateral side facing forward. Such a position is characteristic, for example, of bronze pendants imitating bear tooth pendants, which are known mainly from Finland (Kivikoski 1965; Asplund 2006, figs 1–2; Kivisalo 2008, fig. 1) as well as from Latvia and Estonia (Zariņa 2006, fig. 135, 148; Spirģis 2008, fig. 1, 190; Kiudsoo *et al.* 2012, fig. 9; Kiudsoo 2021).

CONCLUSIONS

Objects made of antler and teeth are not numerous in the Salme ship burials but they are highly relevant for several reasons. First, the combs are important for dating as they have features characteristic of the 7th–8th centuries. This dating fits well with the burial's established date of c. AD 750, based on radiocarbon dating and typological studies of other artefacts. Based on parallels, most of the combs from Salme probably come from the Mälär region in central Sweden, where combs very similar to them are found. The material of three combs – reindeer antler – suggests the possibility that either these combs or the material used for making them, and perhaps even the production, originated from upland areas in present-day Norway or northern regions of Sweden.

The assumption that combs were made in the northern inland regions is supported by the fact that many 'smiths' graves are known from that region, containing tools that would have been especially suitable for processing antler and wood (e.g. Christensen 1986; Guldberg 2014). Furthermore, there is perhaps a repeating pattern of little evidence of comb making centres during the early parts of the Viking Age and earlier, as with the few examples of reindeer antler in Ribe and Hedeby (see above).

In Sweden, bear tooth pendants from the Late Iron Age, Viking Age and the Middle Ages are known for example from Birka, Björkå, Önsvala, and Sigtuna, although they are not numerous (Gräslund 1973, 170; Magnell 2023a; 2023b, 219). A couple of bear tooth pendants have also been found in a flat grave in Marisletta in northern Norway (Sjövold 1974, 166, pl. 27: d–e). There are considerably more bear claws in burials in Scandinavia, which indicate the bear skin placed in the grave (Grimm 2013; Lindholm & Ljungkvist 2016; Ljungkvist & Lindholm 2023; Magnell 2023b, 217, 219).

To the east of the Baltic Sea, bear tooth pendants are found in Viking Age and Late Iron Age sites from Estonia and Latvia (e.g. Luik 2001, 12, fig. 7: 1–2; Luik & Maldre 2005, fig. 12; Zariņa 2006, fig. 135, 173 ff.; Spirģis 2008, figs 103, 162, 171 ff.). In addition to the bronze pendants imitating bear fangs, a few real bear tooth pendants are also known from Finland (Kivikoski 1965, 24–25, fig. 1: 2; Asplund 2006; Kivisalo 2008). The scarcity of real tooth pendants in Finland might be related to the poor preservation of bone materials in the soil there.

Combs were important grave goods in Scandinavia. In the Mälär region, in Vendel Period and Viking Age cemeteries, combs are common in graves irrespective of the gender or age of those buried (see for example Petré 1984b, 70). Sometimes a comb is the only item that was placed with the deceased in the grave. It is worth noting that not all the buried men had combs in Salme. There was only one comb in Salme I, although seven people were buried there. In the Salme II ship, there were at least 11 combs and 34 skeletons, meaning that about a third of the buried men there had a comb. Although some of the grave goods may have been lost when the burials were broken up with the digging of cable trenches, certainly not in such a quantity that it would seem possible that a comb was originally placed with every buried person, although neither was there a comb near every skeleton that was not broken up by the cable trenching. Presumably, the smaller number of combs compared to central Sweden is related to the fact that these are mass graves of fighters who fell in battle on foreign territory. In the opinion of Jüri Peets, some of the men's personal belongings, including combs, might have been lost or left behind somewhere during the battle, and therefore

could not be included in the burials as grave goods (pers. comm.). Whatever the explanation is, the lack of combs contributes to the impression of the ships partly bearing traits of burial practices from central Sweden as well as an improvisation made on foreign soil under very particular circumstances. Apparently, some people have been given a more personal set of burial goods than other.

The rest of the objects discussed in this article are interesting because they are rather rare in the find material of Scandinavia at the time. In the case of these finds, each type was probably grave goods for only one person, because the arrowheads and tooth pendants represented by the two specimens were close together in both cases and were probably originally located near one individual.

The arrows are unusual, but not surprising from a burial perspective as there are several parallels. In this case, their particular value lies in the fact that they give us some insights into the activities of the Salme warriors during their journey and on the island. They were equipped for bird hunting probably both for the fresh meat and perhaps also for leisure.

The bear tooth pendants are important as this is the only known late Iron Age case of a pair of teeth in a burial and an example of how these pendants were worn. We know from the Frösön find that most of the hunted bears probably had their canines cut out (Zachrisson & Iregren 1974; Magnell & Iregren 2010). One

reason why we lack them in graves might be that the dominant cremation burial practice is very destructive for all kinds of teeth. Therefore, no one has probably ever tried to find or observe any potential bear teeth among the thousands of excavated cremation burials in central and northern Sweden. Nonetheless, these pendants are both eye catching and among the few non-martial items that can be associated with an individual in Salme II.

The combs found in the Salme ship burials are significant because they form a closed complex containing the largest number of combs known that are proven to have been used in the same period. Although the general appearance of these combs is similar, the ornament motifs used in their decoration, some of which can be associated more with the Vendel Period and some with the Viking Age, illustrate the transition from one period to another. Thus, the combs found in the burials support the significance of the Salme find as marking the beginning of a new era.

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KAMMID NING TEISED SARVEST JA HAMMASTEST ESEMED SALME LAEVMATUSTES

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RESÜMEE. Artiklis käsitletakse Salme I ja II laevmatustest leitud kamme ning teisi sarvest ja loomahammastest valmistatud esemeid. Suurem osa neist leidudest on saadud Salme teisest laevast (Salme II), ainult neli katket, mis ilmselt pärinevad ühest kammist, leiti esimesest laevast (Salme I). Luumaterjalidest tehtud esemeid ei ole laeva leidude koguarvuga võrreldes kuigi palju.

Kõige rohkem on sarvest ja hammastest esemete hulgas kammide katkendeid, mis pärinevad vähemalt 12 kammist. Kammide tähistamiseks kasutame artiklis numbraid, mis anti neile juba varasemas kamme käsitlevas artiklis (vt Luik *et al.* 2020). Nagu mainitud, on Salme I laevast leitud kamm (kamm 1) säilinud nelja katkena. Salme II laevast leitud kammide katkendid on 23 leiunumbri all ning pärinevad vähemalt 11 kammist (kammid 2–12). Nende hulgas on nii terviklikumalt kui ka katkendlikumalt säilinud kamme. Osa neist asus laevas luustike läheduses oma algses asukohas, kuid osa oli matusepaika läbivate kaablikraavide kaevamiste tõttu eemale sattunud (jn 1). Andmed kammide leiukonteksti ja nende võimaliku kuulumise kohta mõne konkreetse luustiku juurde on esitatud tabelis 1.

Kõik kammid on oma kujult suured ühe piireaga kammid, mis on osadest kokku pandud – üksteise kõrvale

asetatud piiplaadikesed on rauast neetide abil kinnitatud kahe ühendusplaadi vahele. Paremini säilinud kammide pikkus on 19–21 cm. Neile on iseloomulik kaarjas seljakontuur ja lamekumera läbilõikega ühendusplaadid. Nii ühendus- kui ka otsaplaatide servas on ühe- või kolmekordsed kontuurjooned. Enamik kamme on kaunistatud silmakestest moodustatud mustritega ja mitmel kammil on ornament ka ühendusplaatide vahel nähtaval piiplaadikeste seljaosal (tabel 1; jn 2–4). Kammide puhul võib täheldada erinevusi neid valmistanud meistrite vilumuses (jn 5).

Sellised sarvest ühe piireaga kammid on Eesti leiuaaines haruldased. Salme kammid on kõige sarnasemad Kesk-Rootsist Mälari järve piirkonnast leitud kammidega. Neile iseloomulikud tunnused olid levinud 6.–9. sajandil, seejuures on osa neist tüüpilisemad 6.–8. sajandile, teised aga 8.–9. sajandile ja seega saab kõik kammid dateerida 8. sajandisse, mis sobib Salme matustest leitud teiste esemete ja samuti ¹⁴C-dateeringutega.

Kammide valmistamiseks kasutatud sarvede takso- noomiliseks määramiseks analüüsiti Yorki ülikoolis Salme I laeva kammikatket ning üheksat II laeva kammidest võetud proovi, mis pärinesid kaheksast kammist (tabel 1). ZooMS-analüüsiga tehti kindlaks, et neli proovi (kolmest kammist) on põhjapõdrasarvest (kammid 8–10). Üle-

jäänud viie proovi (kammid 1–5 ja 11) tulemuseks saadi punahirv/põder/kabehirv, kuna ZooMS-i abil pole neid liike võimalik üksteisest eristada. Viie Salme II kammi puhul selgus vana DNA analüüsiga, et tegu on põdra sarvega, Salme I kammist DNA-analüüsi ei ole tehtud, kuid tõenäoliselt on seegi põdrasarvest. Ka mõlemad materjalid toetavad kamme võimalikku päritolu Skandinaaviast – Rootsi ja Norra aladelt.

Ülejäänud esemed on esindatud ainult ühe või kahe eksemplariga ja on kõik leitud II laevast (jn 6). Kahe sarvest tõmbi nooleotsa (jn 7: 1–2) katkendid leiti läbi laeva kaevatud kaablikraavi 3 alalt. Seetõttu ei saa neid kindlat ühegi *in situ* paiknenud luustikuga siduda, võimalikena tulevad kõne alla vaid keskmise ja alumise matusekihi luustikud, mida on kraaviga lõhutud (jn 6: 1–2). Tõmpe nooleotsi kasutati Euraasia põhjapoolsetel aladel karusloomade ja lindude küttimiseks, peamiselt alates 11. sajandist. Kuid Salme eksemplaridega sarnaseid nooleotsi, millel on varretamise jaoks pikilõhe, leidub Rootsis juba alates 7. sajandist. Väärib märkimist, et samas kaablikraavis oli ka pistriku luid (jn 6: 5–8), keda võidi kasutada linnujahil. Selle kraaviga lõhutud luustiku XXX algses asukohas säilinud jalaluude juures oli kahe koera skeletiosi (jn 6) ning sinikaelpardi kui tõenäolise jahisaagi luid (vt Nuut *et al.* 2026). Võimalik, et nii linnujahiks sobivad nooleotsad kui ka pistrik ja võib-olla ka koer(-ad) kuulusid ühele isikule.

Sarvest rihmaotsiku katke leiti väljastpoolt laevakontuuri, II maailmasõja aegse mürsulehtri servast ja selle algne asukoht pole teada (jn 6: 3; 7: 3). Sarvest ja luust rihmaotsikuid on teada mitmelt poolt Euroopast, kuigi need on üsna harva esinevad leiud. Enamasti dateeritakse need hilisemasse perioodi, 9.–11. sajandisse, kuid Rootsist Upplandi piirkonnast on teada ka vendeliaegseid eksemplare (6.–8. sajand).

Kaks karukihvast ripatsit leiti laeva läänepoolse parda lähedalt (jn 6: 4; 7: 4) ja need võisid kuuluda

keskmise matusekihi põhjapoolse rea läänepoolseima luustiku XVIII juurde, kelle jalgade peal asus suure koera (koer 1) peaaegu terviklikuna säilinud skelett (jn 6). Karukihvast ripatseid on Rootist ja Norrast teada nii rauaajast kui ka viikingi- ja keskajast, kuigi mitte arvukalt. Skandinaavia matustes leidub tunduvalt rohkem karuküüniseid, mis on seotud karunaha asetamisega hauda. Rohkem on karukihvast ripatseid ja/või neid jäljendavaid pronksripatseid teada Läänemerest ida poolt – Lätist, Eestist ja Soomest. Tähelepanuväärne on, et Salmes leiti kihvripatsid paarina ja võib arvata, et need kuulusid ühele isikule. Seni pole Rootsis selliseid ripatseid rauaagestest matustest kahekaupa leitud.

Kokkuvõtvalt võib mainida, et kuigi artiklis käsitletud leiud ei ole Salme laevmatustes arvukalt esindatud, on need siiski märkimisväärsed. Kammid on olulised matusekompleksi dateerimise seisukohalt, nende kuju ja ornament on iseloomulikud eelkõige 7.–8. sajandile ja seega kinnitavad muude materjalide põhjal tehtud dateeringuid, s.o ligikaudu aasta 750 pKr. Salme kammid on teadaolevalt suurim samaaegselt maapõue sattunud suletud kompleksist pärinev leiukogum. Kuigi üldjoontes on kammid omavahel sarnased, on neil nii vendeli- kui ka viikingiajale iseloomulikke jooni, mis võib viidata nende valmistamisele kahe perioodi vahelisel üleminekuajal. Nii kamme välimus kui ka kasutatud materjal osutab nende päritolule Rootsi või Norra aladelt. Kesk-Rootsi vendeli- ja viikingiaja matustes on kammid üheks kõige tavalisemaks leiuks ja neid leidub peaaegu igas hauas. Salme laevmatustes on kamme siiski palju vähem kui sinna maetud indiviide. See võib olla seotud matmispaiga spetsiifilisusega: tegu on võõral territooriumil lahingus langenud sõjameeste ühishaudadega. Ülejäänud leiud on huvitavad eelkõige nende harulduse tõttu. Karukihvad ja nooleotsad, samuti laevadest leitud pistrike ja koerte luud viitavad, et sõjameeste tegevuste hulka võis kuuluda muu hulgas küttimine.