



RESEARCH RESULTS OF THE SALME SHIP BURIALS IN 2011–2012

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INTRODUCTION

Archaeological research of the ship burials in Salme, Saaremaa were carried out in 2008 (Salme I) and 2010–2012 (Salme II) (Fig. 1). The second burial ship (Salme II) dating from the end of the pre-Viking Age (ca. 650–750 AD) was discovered during scheduled investigations in 2010 (Peets *et al.* 2011). The work was interrupted in 2010 due to severe autumn weather, and the unexplored part of the ship together with skeletons and finds was covered with a nearly 1 m thick layer of sandbags, boards and soil. Archaeological investigations of the site were resumed in 2011. In spring it appeared that the ship remains had survived surprisingly well in their ‘sarcophagus’. When work continued it became clear that the short-time conservation of the site with sandbags was justified – finds and skeletons were well preserved and unclosing of the site took only a few hours.

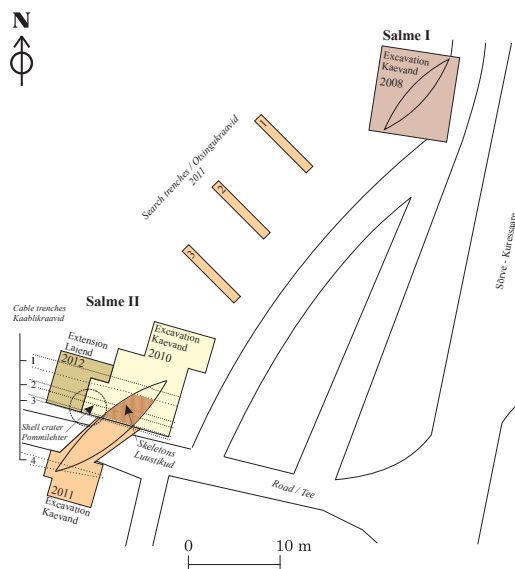


Fig. 1. Location plan of Salme excavations 2008–2012.

Jn 1. Salme kaevandite üldplaan 2008–2012.
Drawing / Joonis: Reet Maldre



Fig. 2. 1 – detail of a sword hilt of gilt bronze, 2 – fragment of a decoration of a scabbard of gilt bronze.

Jn 2. 1 – kullatud pronksist mõõgapideme osa, 2 – kullatud pronksist mõõgatupe kaunistuse fragment.

(SM 10602: 315, 335.)

Photo / Foto: Kaarel-Kaspar Säre

ARCHAEOLOGICAL FIELDWORK IN 2011–2012 The excavation of 2011

A new part of the plot was uncovered in front of the Salme schoolhouse, south of the road between the buildings (Fig. 1), in the beginning of July. We hoped to find a part of the ship contour, which would have justified digging through the asphalt of the road and linking the two parts of the excavation. Digging in the new part revealed that beneath the sod the entire area to be excavated was covered with a thick layer of concrete and debris. The debris, however, also contained archaeological objects – gaming pieces and ship rivets, a fragment of a sword, a pommel of gilt bronze (Fig. 2: 1) and a fragment of a decoration of a scabbard (Fig. 2: 2).

An almost identical match of the scabbard has been found from the Ultuna ship burial in Sweden (Nørgård Jørgensen 1999, fig. 49: 2). Beneath the concrete layer rivet rows came to light on the same level with the north-eastern end of the ship in the excavation of the previous year; therefore we decided to join both parts of the excavation. After the removal of the asphalt the part of the excavation beneath it was dug to the same level with the other two parts, and only then the parts of the excavation were joined and the plot of 2010, which still was covered with sandbags, to avoid possible damage, was uncovered. Now it was possible to study the skeletons and ship remains also in the area beneath the road, damaged by an electric cable (Fig. 1). It appeared that the fallen warriors had been buried in a very small area, and beneath the road and south of it only a few skeletal parts and artefacts came to light. Ship remains were best preserved in the central part, where the skeletons and numerous artefacts lay – there contour parts with 4–6 rivet rows came to light. The ends of the ship had been apparently more damaged by nature (storms, ice hummock, etc.), hence the remains were only preserved to the height of 2–3 rivet rows (Figs 3; 4). The distance between the *in situ* end rivets of the rows was 16.1 m (by laser measure), so the original length of the ship, considering the proportions of the preserved remains, could have been 17–17.5 m or more (see Larsson 2007, 39 ff, fig. 23). Unlike the ship discovered in 2008, this one may have moved by sail and oars. This is suggested by the presence of a vertical keel (preserved in the form of a humus outline) (Fig. 5), which is inevitable for controlled use of a sail, remains of a keelson and various other constructional elements. Its preserved ends allowed to establish its orientation quite accurately – NE–SW (40°), which is the case in most Scandinavian ship burials (Larsson 2007, 271 ff.). Clearing the skeletons revealed that these lay, partly covering each other, in four layers in the central and north-eastern part of the ship, on an area of about 3 × 4 m only (Fig. 1). The dead warriors had been honoured with rich grave goods – single and double-edged swords,



Fig. 3. Remains of the Salme II ship from above: a – with skeletons perpendicular to the ship (burial horizons II and III), b – with skeletons positioned crosswise to the ship (burial horizon IV), c – fully uncovered ship remains.

Jn 3. Salme II laeva jäänused pealtvaates: a – laeva pikisuunas paiknevate luustikega (II ja III matusekiht), b – laevaga risti asunud luustikega (IV matusekiht), c – täielikult väljapuhastatud laevajäänused.

Photo / Foto: Jüri Peets, Reet Maldre

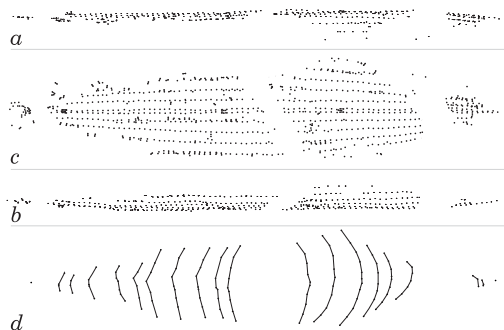


Fig. 4. Location plans of the rivets: a – side view of the western plank, b – view from above, c – side view of the eastern plank, d – cross-sections.

Jn 4. Neetide leiuplaanid: a – läänepoolne parras külgvaates, b – pealtvaade, c – idapoolne parras külgvaates, d – ristlõiked.

Drawing / Joonis: Reet Maldre



Fig. 5. Preserved humus outline of the vertical keel. View from the north-east.

Jn 5. Vertikaalse kiilu huumusjäljend. Vaade kirdest.

Photo / Foto: Liina Maldre

Swords

The total of about 40 swords, most of them fragments, were found from Salme II. The number of whole single-edged swords (*scramasax*) was 10. All double-edged swords (*spatha*) had been broken. An X-ray study of the fractures will establish the exact number of swords (see also Peets *et al.* 2011, 36, 37).

Shield bosses

Deliberately damaged shield bosses (14) were found only at the skeletons of the uppermost layer. The large diameter of the shields (90–110 cm) and their close allocation may be regarded as a kind of a shroud or a coffin lid. Some bosses had iron handles,

some of them luxuriously gilded with bronze, shields, of which had preserved, antler combs, shears, two spearheads, etc. The skeletons were blankly strewn with turned whalebone gaming pieces. Numerous arrowheads as well as slashes on the skeletons bear witness to a battle that had taken place (see also Peets *et al.* 2011).

The excavation of 2012

This excavation completed the investigation, started in 2010 to study the mixed fill of the shell crater from WWII (Fig. 1), which contained archaeological finds, and also the soil disturbed by the installation of a third cable in the Soviet times, running beside the crater. The new excavation (28 m²) was linked to the former grid system (Fig. 1). The finds of 2012 include two fragments of single-edged swords, a double-edged sword in two halves¹ (Fig. 6), a fragment of a bone comb, etc.

ARTEFACTS 2010–2012

Rivets

In comparison with the rivets from Salme I all rivets from Salme II are, regardless of their measurements, more massive and forged with a similar ‘handwriting’ (evidently by the same smith), while the rivets of Salme I, including many specimens of similar measurements but different manufacture, seem to be forged by several blacksmiths (Peets & Maldre 2010, 51–55; Peets *et al.* 2011, 38, 39).

¹ The sword was found in an upright position from the mixed soil of the crater beneath the second electric cable (Fig. 1) installed in 2008.

around which fragments of organic matter had preserved (see also Peets *et al.* 2011, 38, figs 5, 7).

Arrowheads and knives

Many arrowheads of different types were found – the total of 91. Most of them had been placed with the deceased as grave goods, but some of them had surely fallen into the ship in the course of a battle (were found *in situ* in the humus zone marking the board of the ship or in the remains of the timber of shields). Some fragments of wooden arrows have also survived together with arrowheads. The artefacts determined as arrowheads may also include some knives. The exact number of knives is still unknown.

Gaming pieces, dice and antler combs

At least 251 (or more) gaming pieces of whale bone and walrus tusk and 7 antler and whale tooth(?) dice were found from the burial ship. Fragments of ornamented antler combs were also numerous – about 15 (see also Peets *et al.* 2011, 34, fig. 9). The only complete set of gaming pieces was found on the lap of skeleton XXXII (Fig. 7).

Textile and timber fragments on artefacts

Many swords, shield bosses, arrowheads and other artefacts have textile and timber fragments preserved on them. In these cases material identification and manufacturing technologies will be studied. Textile fragments belong to fabrics made in different techniques, mostly to the so-called diamond twill technique spread in Anglo-Scandinavian territories (Figs 8; 9). These fabrics were mainly used for making outdoor clothes. Remains of coarse fabric of linen weave may belong



Fig. 6. A double-edged sword found in an upright position from the mixed soil.

Jn 6. Segatud kihist leitud püstiasendis kaheteraline mõök.

(SM 10602: 489.)

Photo / Foto: Liina Maldre



Fig. 7. A full set of gaming pieces in the lap of skeleton XXXII.

Jn 7. Terviklik mängunuppude komplekt luustiku XXXII süles.

(SM 10602: XXXII: 2.)

Photo / Foto: Liina Maldre



Fig. 8. Textile (broken diamond twill) fragment on the sword scabbard (skeleton XXI).

Jn 8. Ruuttoimses siduses tekstiilifragment luustiku XXI mõõgatupel.

Photo / Foto: Liina Maldre

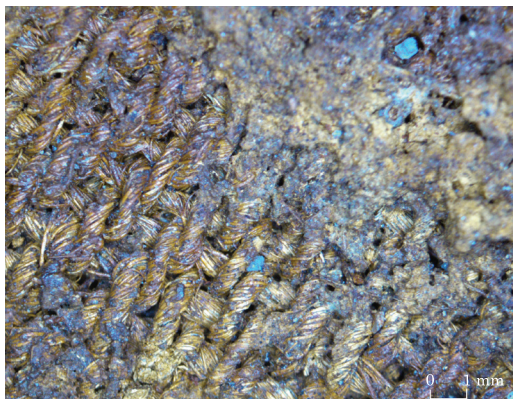


Fig. 9. A detailed view of the textile fragment.

Jn 9. Detail tekstiilifragmentidist.

Photo / Foto: Tarvi Toome

to the sail draped over the bodies. Textile fragments must be analysed also for wool quality and dyes.

HUMAN SKELETAL REMAINS

The excavations of 2011 brought to light the skeletal remains of six people in addition to the 28 discovered in 2010 (Peets *et al.* 2011). The bodies had been placed in the central and north-eastern part of the ship, i.e. north-east of the presumable mast, in four layers: in the bottom layer they had been buried between the ribs of the ship, i.e. transverse to the hull; in the upper three layers the bodies had been placed lengthwise with the ship (Figs 3a; 3b; 10).

The bottom transverse layer of bodies had been laid alternately, the heads of five bodies had heads pointing east, two were buried with their heads westwards (Figs 3b; 10). Most likely the transverse layer was covered with soil before the next bodies (18) were placed upon them in two rows and two layers lengthwise with the ship. The two middle layers had been placed one upon the other without a soil interlayer, but covered

with sand before the last layer of bodies (6) were laid upon them (Fig. 11). The excavation of 2011 indicated that the burial area could have stretched slightly further towards south-west, hence the part of the burial ship that so far had been under the asphalt road was now studied. There, articulated skeletal remains of two more individuals (XXIX, XXX), buried lengthwise with the ship, were brought to light (Fig. 10). From these skeletons only the distal ends of the lower extremities, from knees to foot bones were preserved in their original position near the third cable trench. The rest of the skeleton was missing, although no evident traces of digging could be observed. Around the bones of lower extremities, preserved in original position, a stone setting, which evidently covered the bodies and surrounded the burial area, came to light. Lots of gaming pieces, animal bones, mixed human bones were found in the area. As we know, heavier gale waves and pack ice definitely reached both burial ships of Salme (Konsa *et al.* 2009; Peets *et al.* 2011). It is possible that in this part of the ship the sea had partly washed away human remains, since the bodies had not been covered with a sufficiently thick layer of soil. The skulls of the XXIX and XXX skeletons had most likely reached to the foot bones of the southern or second perpendicular row of the buried in the area of the third cable trench.

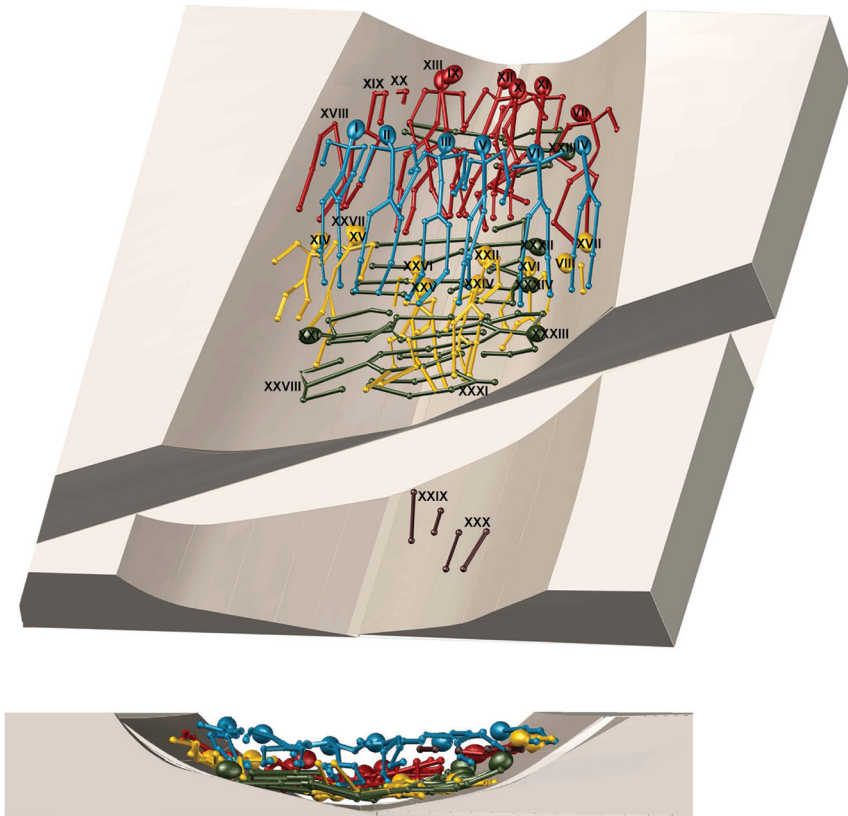


Fig. 10. The distribution of skeletons (based on a 3D model).

Jn 10. Luustike asendid (3D mudeli järgi).

Drawing / Joonis: Reet Maldre

It also appeared that at the eastern board of the ship, in the second, or southern row of the buried (Fig. 10) the skulls VIII in the upper and XVII in the lower layer were located close to each other. At first it seemed that the discovered post-cranial skeleton belonged to the VIII skull and that the skeleton of skull XVII should come to light in the lower layer. Surprisingly the VIII skeleton consisted of a sole skull, which lay on the chest of the XVII skeleton.

Skeletal remains from the disturbed areas

In 2010–2012 a lot of fragmentary and mixed bone material was collected from the excavation of the Salme II burial ship. This was due to earlier constructional excavations in the area, which damaged part of the skeletons. The following refilling and levelling transported the bones quite far from their original location. In small amounts loose bone material was recovered also from the burial area, but mostly it came from the areas of the former pits and from the mixed layer beyond the ship contour. The results of the preliminary analysis of the whole bone material allow us to assert that the remains of at least 34 individuals had been buried in the area disclosed in the excavated area.



*Fig. 11. A sand layer between burial horizons I and II.
Jn 11. Lüivakiht I ja II luustikekihi vahel.
Photo / Foto: Raili Allmäe*

Taphonomy and injuries

The state of preservation of the bone material from the Salme II burial ship varies greatly. In general the skeletons in the topmost row buried longitudinally with the ship (I–VI), and in the bottom layer buried transversely, are best preserved. In the middle longitudinal rows (XVIII–VII/XIV–VIII) (Fig. 10) the state of preservation of the skeletons was more varying. It was better on the eastern side of the ship, the skeletons at the western board were sporadically decayed, only the contours of bones, if anything, could be observed in a layer of organic matter (Fig. 12²). It is certain that the poor state of preservation of the skeletons in the middle longitudinal rows is due to the mode of their burial – both these rows are two-layered, and the bodies have been placed more closely at the western board. The middle skeletons of the south-western-ward row (XXVI and XXV; and XXII and XXIV) were also



*Fig. 12. Skeletons of different state of preservation. View from the east.
Jn 12. Erinevalt säilinud luustikud. Vaade idast.
Photo / Foto: Raili Allmäe*

² Capital letters marking the skeletons on the photos correspond to the Roman numerals in the text (see Appendix 1).

poorly preserved. The poor preservation of bone tissue reduces the possibilities to determine skeletal pathologies, including perimortem injuries. The skeletons, especially in the topmost layer, have also been fragmented by high ground pressure, although they seemed to be intact and in the original position.

In the course of unpacking and cleaning the bones various edged-weapon injuries could be observed on nine skeletons, whereas five of them had at least two injuries. The main injuries were slashes or stabs, most likely caused



Fig. 13. Atlanto-occipital fusion (skeleton XII).

Jn 13. I kaelatüli ja kuklaluu kokkukasvamine luustikul XII.

Photo / Foto: Raili Allmäe

by swords; two skeletons had puncture wounds on the ventral side of the pelvic bone. On five skeletons arrowheads had probably caused injuries of soft tissues. The analyses of skeletal material is ongoing. For determining the extent of traumas, for example, the reconstruction of skulls is essential. An interesting case was skeleton XII on which atlanto-occipital fusion could be observed (Fig. 13). Atlanto-occipital fusion, or occipitalization of the atlas, is one of the most common skeletal abnormalities of the upper cervical spine (Lang 1995, 54). Assimilation of the atlas may cause both orthopaedic and occasionally induce neurological effects (Skrzat *et al.* 2010, 137). For example occipitalization of the atlas may have the following physical features: low hairline, torticollis (abnormal head posture), restricted neck movements and/or abnormally short neck; the conditions may cause headache, neck pain, numbness and pain in the limbs (McRae & Barnon 1953).

ARCHAEOZOOLOGICAL MATERIAL

From the archaeozoological material collected in 2011 about 500 mammal bones and bone fragments could be determined; slightly less than a half were dog bones. Of species, sheep and/or goat, pig, cattle and horse were represented. In 2012 137 mammal bones determinable to species were added, more than a half of them dog bones, the rest belonging to cattle, pig, sheep/goat and rodents (Fig. 14; Table 1). Besides mammal bones remains of birds (Table 2) and fish bones and scales (Table 3) were also found.

In the excavation of 2011 animal bones, in general, were spread all over the plot, but they were considerably less in number in the south-western end of the ship and around it. Most of the material was recovered at the level of the upper board plank and higher in the mixed layers, while in the better preserved inside of the ship and in the immediate neighbourhood of the skeletons animal bones were relatively few. In the middle part of the ship, on the bottom and upon the planks of the eastern board there were some bone assemblages that consisted mainly of bird and fish bones, but also contained a few fragments of mammal bones. In 2012 animal bones were found everywhere in the mixed soil, regardless of the depth or distance from the ship; there were considerably less animal bones in the light sand.

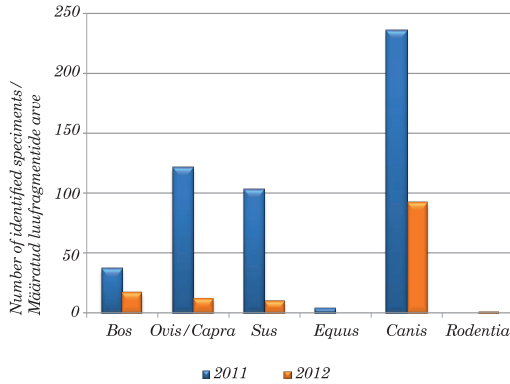


Fig. 14. Species composition of mammal bones collected in 2011 and 2012 on the basis of the number of bone fragments.

Jn 14. 2011. ja 2012. a kogutud imetajaluude liigiline koostis luufragmentide arvu põhjal. Drawing / Joonis: Liina Maldre

Mixed layers

Dog bones constituted a great part of animal bones recovered from the mixed layer. The skeleton of dog I and remains of dog II, found in 2010, were inside the ship at the western board (Peets *et al.* 2011, 42). All dog bones found in 2011 were recovered from under the asphalt road running to the schoolhouse, mostly near the feet of skeletons XXIX and XXX, i.e. at the eastern board. In this part of the excavation remains of at least two adult dogs (III and IV) came to light. Unfortunately the area has been damaged by the construction of the road or even earlier, and so the original location and position of the specimens could not be determined.

Table 1. Species and anatomical composition of animal bones (finds from the excavations of 2011 and 2012). Tabel 1. Imetajaluude liigiline ja anatoomiline koostis (leiumaterjal 2011. ja 2012. a kaevandite alalt).

Species/ liik	Cranium	Mandibula	Dentes	Vertebrae	Costae	Sternum	Scapula	Humerus	Ulna	Radius	Ossa carpi	Ossa metacarpale	Pelvis	Os penis	Femur	Patella	Tibia	Fibula	Ossa tarsi	Os metatarsale	Ossa metapodiale	Ossa sesamoidea	Phalanges	Total/ kokku
<i>Bos taurus</i> cattle veis	2	11	2	13	1	5	6	1					1	6					2				5	55
<i>Ovis/Capra</i> sheep/goat lammas/kits	5	5	26	16	16		4	3	2	3	1	4		8					1	2			6	102
<i>Ovis aries</i> sheep lammas				5	7		2	1	1		1			4		1			3	1	1		6	33
<i>Sus dom.</i> pig siga		1	5	8	11		7	8	4	4			9	11	2	17	10	10	12	4			1	114
<i>Equus caballus</i> horse hobune			3																1					4
<i>Canis fam.</i> dog koer	11	3	15	80	38	6	2	5	7	5	7	15	10	3	7	2	4	5	18	21	4	24	36	328
<i>Rodentia</i> rodents närilised		1	1																					2
Total/ kokku	18	10	61	111	85	7	20	23	15	13	8	16	24	3	36	4	22	15	37	28	5	24	54	638

Table 2. Species and anatomical composition of bird bones (finds from the excavations of 2010 and 2011).
 Tabel 2. Linnuliude liigiline ja anatoomiline koostis (leiumaterjal 2010. ja 2011. a kaevandite alalt).

<i>Biological classification / süsteemaatiline kuuluvus</i>	<i>Mandibula</i>	<i>Vertebra</i>	<i>Scapula</i>	<i>Coracoid</i>	<i>Furcula</i>	<i>Sternum</i>	<i>Humerus</i>	<i>Radius</i>	<i>Ulna</i>	<i>Carpome- tarpus</i>	<i>Phalanx digit alae</i>	<i>Pelvis</i>	<i>Femur</i>	<i>Tibiotarsus</i>	<i>Tarsometat- tarsus</i>	<i>Phalanx digit pedis</i>	<i>Claw</i>	<i>Total / kokku</i>	
<i>Phalacrocorax carbo</i> great cormorant kormoran		1																	1
<i>cf Phalacrocorax carbo</i>									1										1
<i>Anser sp</i> goose hani													1						1
<i>Anas platyrhynchos</i> mallard sinikael-part	1		6	6	2	1	2	1	2	1			1	2					25
<i>cf Anas platyrhynchos</i>				1			2	3			2			1					9
<i>Anatinae indet</i> dabbling ducks ujupart	1					1	1	1				2	2	1					9
<i>Anseriformes, cf Aythya / Melanitta</i> anseriformes (aythya / scoter) hanelised (vart / vaeras)							1												1
<i>Anseriformes middle size</i> keskmise suurusega haneline													1						1
<i>Anseriformes</i> hanelised							1												1
<i>Accipiter gentilis</i> goshawk kanakull															1	2	1		4
<i>Falco peregrinus</i> peregrine falcon rabapistrisk				1															1
<i>Falco cf peregrinus</i>																		1	1
<i>Falco cf cherrug</i> saker falcon stepipistrisk			1							1									2
<i>Falconiformes indet</i> pistriskulised									1										1
<i>Gallus gallus</i> hen kana														1					1
<i>Galliformes indet</i> kanalised														1					1
<i>cf Galliformes indet</i>														2					2
<i>Larus marinus / hyperboreus</i> great black-backed gull / glaucous gull merikajakas / jääkajakas														1	1				2
<i>Cephus grylle</i> black guillemot krüüsel														1					1
<i>Cephus grylle ?</i>														1					1
<i>Columba livia / oenas</i> domestic pigeon / stock dove kodutuvi / õõnetuvi				1															1
Total / kokku	2	1	8	8	2	2	7	5	4	2	2	2	5	11	2	2	2	2	67

Table 3. Species and anatomical composition of fish bones (finds from the excavations of 2010–2012).

Tabel 3. Kalaluude liigiline ja anatoomiline koostis (leiumaterjal 2010.–2012. a kaevandite alalt).

Species/ liik	Cranium	Frontale	Ossa pharyngica	Palatinum	Maxillare	Dentale	Articulare	Quadratum	Hyomandibulare	Keratohyale	Vomer	Præoperculare	Operculare	Interoperculare	Vertebrae praecaudales	Vertebrae caudales	Supracleithrale	Cleithrum	Basipterygium	Parasphenoideum	Pinnae	Squamae	Total/ kokku
<i>Esox lucius</i> pike haug				2	1	3	1	1			1				1	2		2		1			15
<i>Rutilus rutilus</i> roach särg		1													2			1					4
<i>Leuciscus leuciscus</i> dace teib				2											6	6							14
Cyprinidae cyprinids karplased				1											8	2							11
<i>Perca fluviatilis</i> perch ahven	1				1				1	1		5	2	2	19	9	1	4	3		4	28	53 +
																							28

Only the hind leg bones from tibia to phalanges of one dog (III) were preserved *in situ*, the proximal part of the tibia was slightly above the topmost preserved rivet row. It had been a largish animal, by the size of bones it resembled dog I found in 2010. 50 cm south of the proximal end of the tibia of dog III, outside of the topmost preserved rivet row a larger agglomeration of dog skull and mandible fragments were found, all coming from the same skull. Whether it belonged to dog III or dog IV, remained unclear. The excavation of 2012 also unearthed dog bones. Remains of at least six dogs were recovered from the excavation of the Salme II ship.

Bones of cattle, sheep/goat and pig were spread all over the excavation area, but these, too, were more numerous beneath the road. All parts of carcass were represented, more or less, but horn cores of cattle, sheep and goats were completely missing. Most of the cattle bones found in 2011, some of them bearing traces of cutting and chopping, came to light at the eastern board, together with dog bones and in their immediate vicinity. In the same area sheep or goat bones were also numerous, with all carcass parts represented in varying degree. Pig bones were somewhat less numerous in that area; cutting and chopping traces could be also observed on several pig bones.

Of bird bones from the Salme II ship (excavations of 2010–2011) 67 bones and bone fragments could be determined (Table 2). In 2012 a few additional bird bones were discovered, but these have not been determined yet. The topmost and mixed layers of the excavation of 2010 included single bones of great black-backed gull or glaucous gull, domestic pigeon or stock dove, peregrine falcon and hen; also some bones of *Galliformes indet* and a bone of *Anatinae indet* that could not be determined to species

were also found. The majority of bird bones discovered in 2011 came from beneath the road near the third cable trench, a few bones were found also in the upper layers near the eastern board. The bones belong to great cormorant, goshawk, peregrine falcon; two bones belong to a *Falconiformes indet.*, larger than peregrine falcon and smaller than gyrfalcon. By size it could also belong to saker falcon, but that species does not occur in Estonia and the neighbouring territories, neither have bones of saker falcon been found in the burials in Sweden (Sjösvärd *et al.* 1983, 140–141; Tyrberg 2002, 228). The goshawk bones found may all belong to the same young female specimen. A skeleton of a female goshawk was found also in the Salme I ship (Allmäe *et al.* 2011, 103). Unfortunately all bones of hawks and falcons of the Salme II ship came from the mixed layers near the third cable trench, which makes it impossible to establish whether the birds had been placed in the ship whole or not. By the location of the bones it is possible that the hawks and falcons or their parts had been originally placed at the feet of the dead buried at the southwestern end of the row, but not quite on the bottom of the boat (all bones of raptors came to light higher than the bottom transverse layer of the skeletons).

Fish (table 3) were represented in the mixed layers by single bone finds. The right *Dentale* of a pike belongs to a specimen about 55 cm long, a right *Operculare* of a perch to a specimen about 35 cm long and a right *Frontale* to a roach about 30 cm long.

Part of the ship with burials

Already in 2010 smaller or larger assemblages of animal bones were found upon and between human skeletons (Peets *et al.* 2011, 43), the same can be said about 2011. Of species pig and sheep were represented. The only bird bone found in the immediate neighbourhood of the skeletons was the coracoid of a mallard near the right femur of skeleton XVIII. At the pelvis of skeleton XIII there was a single fish bone – left *Maxillare* of a pike belonging to a specimen about 60 cm long.

From the bottom of the ship and upon board planks

Bone assemblages recovered from the bottom of the ship and immediately upon the planks of the eastern board deserve special attention. They consist overwhelmingly of fish and bird bones, with a small portion of mammal bones belonging mainly to pig. Bone assemblages were located in the uncovered part of the ship, and partly in the area deeper beneath the legs of skeletons XXIX and XXX.

The bone assemblages recovered upon the planks of the eastern board may be analysed together. Mammals were represented here by a fragment of a cattle rib and 8 pig bones. Determinable bird bones in these assemblages (15) belong to mallard, at least four specimens are represented. 53 of fish bones and 12 scales were determinable. All scales belong to perch, 5 bones to pike, 32 to perch, 2 to roach, 12 to dace and 3 to cyprinids undeterminable to species. Fish bones suggest specimens of various size i.e. very small (perch *ca.* 10–15 cm and pike 30–40 cm) as well as larger (perch *ca.* 20–30 cm; large pike was missing in this assemblage) specimens were represented.

In the bone assemblage on the bottom of the middle part of the ship there were 3 pig bones, two of them bearing chopping traces; most of the bird bones in this assem-

blage came from mallard (up to 17 finds from juvenile, subadult and adult specimens). One or two bones belong to black guillemot, one to goose. Of fishes pike (8 bones), perch (20 bones), roach (1 bone), dace (2 bones) and cyprinids undeterminable to species (8 bones; evidently perch or dace) were represented; 16 perch scales were also found. Here, too, fish were rather small (perch *ca.* 10–15 cm and pike 20–45 cm). A few mallard bones were also found upon the board planks beneath the skeletons and upon the boar planks in the southwestern part of the ship.

These bone assemblages raise the question whether they represent material placed in the ship in the course of a burial, or rather trash that lay about on the bottom already earlier, or natural sediment in the uncovered part of the ship. Since the assemblages also contain mammal bones, and one femur of a duck has a cutting trace on it, and in view of the fact that the remains mostly belong to mallards only, we can evidently rule out the purely natural origin of these assemblages.

DISCUSSION

Studying the finds after conservation we discovered that the actual age of the weapons need not be in correlation with the ‘event’, i.e. artefacts from different phases of the Vendel Period occurred together in the same complex. Particularly it stands for shield bosses, single-edged swords and the luxurious gilt decorations of the sword hilts. Therefore extremely accurate comparative-typological investigation of all weapons is necessary, as well as metallographic and SEM–EDS analyses to establish their origin and manufacturing technologies. Since the ‘event’ was of a very short duration it will provide us with an opportunity to define possible technological varieties on a single moment of prehistory, which certainly cannot be achieved by analysing finds from e.g. graves of settlements and hill forts. To specify the origin of the material used for rivets and other iron objects, additional ¹⁴C investigations of carbon in their metal by the AMS method will be required; this will also be a test of the suitability of the method for dating iron objects. The results of the analyses of two rivets from Salme I gave the age 5813±40 BP and 2702±31 BP.³ The occurrence of fossil carbon would suggest the production of iron somewhere in the northern or mountainous region of Europe, where the recurrence of forest is slow and at iron smelting charcoal was replaced by charred peat (Macadam 1888, 93–95).

Hence the main object of the current studies is to date the site as accurately as possible. For this a series of ¹⁴C analyses by AMS method, mainly of skeletal parts, has been designed. The localization of the geographical region of the post-natal inhabitancy of the warriors is at least as important. For that purpose we intend to study enamel of their teeth by methods based on the ratio of stable isotopes, primarily Sr 87/86. Most likely possible close kinship can be ascertained by DNA-analyses.

The orientation of the Salme ships, to the points of the compass, was NE – SW. It is possible that such orientation of the ship of dead was based on the notion about the Milky Way, which at midnight lies over the firmament in approximately the same direction, as the way of souls. Since the dead in their ship-sarcophagus were differently orientated regarding the points of the compass – with heads towards north-east, along the ship, in three upper layers, and alternately towards east and west, crosswise to the axis of the ship in the bottom layer. Hence the right orientation of the ship was essential, not the orientation of the dead.

³ Respectively Hela 2149 and Hela 2150.

Besides the arrowheads found in the organic layer preserved from the boards of the ship and the shields, numerous injuries on the bones also give firm evidence of an armed conflict. Preliminary investigations have revealed definite slash and/or stab traces on at least nine skeletons, whereas five of them have more than one injury.

A few horse bones recovered from the mixed soil in 2011 should be mentioned as interesting finds. In 2010 and 2012 no horse bones were found, and the species was also missing in the Salme I ship, neither do the finds from the Salme ships include details of horse equipment. The connection of these bones with the burials remains uncertain for the time being.

In search for new possible ship remains three trenches (1 × 8 m), transverse to the orientation of the investigated ships, were dug in the higher part of the coastal ridge between them (Fig. 1). The depth of the trenches was determined by the bottom level of the investigated ships, which was about 1 m below the ground level. In trench profiles at least four layers of gravel of different texture, containing larger pebbles (diameter up to 10 cm) occurred; these layers were separated by intermediate belts of fine gravel and sand in which single specimens or small agglomerations of remains of tests of lagoon cockles (*Cerastoderma glaucum*) and Baltic macoma (*Macoma balthica*) occurred. It is possible, that the gravel layers containing larger pebbles have been produced by heavier gales or ice hummocks that finally shaped the coastal ridge that covered the ships. No objects were found that could be related to prehistory or ship remains. Including the excavations of 2008 and 2010–2011, the whole area of the higher coastal ridge between the two ships has been investigated; the absence of ship remains in the area between the excavations and the Kuressaare–Sörve road was established already in 2008 by the exhaustive study of the profiles of the cable trench that had damaged the Salme I ship and the investigation of the excavated soil. Hence it is likely that even further investigations in this particular area will not reveal any more ship remains; however, the soil in the neighbourhood, repeatedly levelled due to construction activities, may contain artefacts from the ships, and so the area will remain under state protection of heritage conservation.

SUMMARY

On the basis of our studies we may assert that fieldwork at the site of the Salme ships have been completed and further research will be carried out in laboratories as the ‘archaeology indoors’. Conservation and artefact studies will continue. The Salme burial complex is unique in whole Europe, distinguished from other ship burials of similar date and with analogous find material by the large number of the buried and the singleness of the burial practices and the rituals it reflects. The find material from the mass graves of Scandinavian warriors, probably fallen in armed conflict, is rich, and surely also a statistically significant sample of the equipment of warrior seafarers, dating from a single event that took place during a few days at the dawn of the Viking Age (ca. 650–750 AD). The closed nature of the Salme ensemble allows us to study the find material concentrating on the datings of some artefact groups and manufacturing techniques being in use at the moment of the ‘event’.

The results of laboratorial investigations will allow us to observe the Salme burial complex in the cultural-historical context of Europe, primarily of the Baltic Sea region. There, aspects of the beginning, extent and nature of Scandinavian expansion, as well as of shipbuilding, martial arts (including Scandinavian professional soldiers) and burial customs, rise to the fore, allowing to discuss many issues in a new light and forms a good base for wider international cooperation.

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Appendix 1. Correspondence of the numbers and letters of the skeletons.

Lisa 1. Luustike numbrit ja tähtede vastavus.

<i>Row / rida</i>	
<i>1st row / 1. rida</i>	I (A); II (B); III (C); IV (F); V (D); VI (E)
<i>2nd row / 2. rida</i>	VII (G); IX (I); X (J); XI (K); XII (L); XIII (M); XVIII (R); XIX (S); XX (T)
<i>3rd row / 3. rida</i>	VIII (H); XIV (N); XV (O); XVI (P); XVII (Q); XXII (V); XXIV (Ö); XXV (Ä); XXVI (Ö); XXVII (Ü)
<i>4th row / 4. rida</i>	XXI (U); XXIII (W); XXVIII (X); XXXI (Y); XXXII (Z); XXXIII (Ž); XXXIV (Š)

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SALME MUISTISTEKOMPLEKSI UURIMISTÖÖDE TULEMUSTEST 2011–2012

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Salme muististekompleksi arheoloogilised uuringud toimusid aastatel 2008 (Salme I) ja 2010–2012 (Salme II) (jn 1). Teine eelviikingiaja lõppu (u 650–750 pKr) dateeritav matuselaev (Salme II) avastati plaaniliste uurimistöde käigus 2010. a. Kuna sellel hooajal jäid tööd halbade sügiseste ilmastikuolude tõttu pooleli, jätkusid need järgmisel suvel. Väliuuringud Salme muististekompleksil lõpetati 2012. aastal.

Uus kaevandiosa avati 2011. a juuli alguses hoonetevahelisest teest lõuna pool Salme koolimaja esisele muruplatsile (jn 1). Kohe mättakihi all hakkas päevavalgele tulema muinasleide, sh mõõga kullatud pronksist pidemenupp ja samast materjalist mõõgatupekaunistuse katke (jn 2). Mõnevõrra sügavamal paljandusid samal tasandil eelmise aasta kaevandis avastatud kirdepoolse tääviosaga neediread, mistõttu otsustati mõlemad kaevandiosad ühendada, st eemaldada tee asfaltkate.

Selgus, et langenuid sõdalased olid maetud väga väikestele aladele (u 3 × 4 m) laeva kesk- ja kirdeosas. Tee all ning sellest lõunapoole jääval kaevandialal leidis vaid üksikuid skeletiosi ning esemeid. Kõige paremini olid laevajäänused säilinud luustike ja rohkearvuliste leidudega keskosas, kus neetidest ja huumuseviirgudest kontuurid olid säilinud 4–6 rea kõrguselt. Laeva matusetalituse ajal pinnasega katmata otsmised osad olid ilmselt loodusjõudude poolt (tormid, rüüsi jää jms), enam räsitud, mistõttu jäänustest oli säilinud vaid 2–3 needirida (jn 3; 4). Säilinud jäänuste proportsioone arvestades võis laeva algne pikkus olla 17–17,5 m või enam. Laev liikus tõenäoliselt nii purje kui ka aerude abil. Sellele osutavad huumusejäljena säilinud kontuur vertikaalsest kiilust (jn 5), mis on purje kontrollitud kasutamiseks vältimatu, jäänused oletatavast kiilsonist ja mitmed muud konstruktsioonelemendid. Matuselaev oli paigutatud kirde–edela sihis asimuudiga 40°.

Luustike väljapuhastamise edenedes selgus et need asusid osaliselt üksteist kattes neljas kihis langenuid sõdalased olid varustatud rohkete panustega – ühe- ja kaheteralised mõõgad, neist osa luksuslike kullatud pronksist pidemetega (sh püstasendis 2012. a kaevandi segatud kihti sattunud kaheteraline mõök) (jn 6), kilbid, millest säilinud tahtlikult mõlgitud kuplad, sarvkammid, käärid, 2 odaotsa jms. Luustikud olid sõna otseses mõttes üle külvatud vaalaluust treititud mängunuppudega. Kahjuks oli ainsa tervikliku komplektina säilinud nupukogum luustik XXXII süles (jn 7). Toimunud lahingust annavad tunnistust arvukad nooleotsad ja luustikel olevad raieläljed. Paljude esemete metallosadel oli säilinud tekstiilfragmente ja puidujäänuseid (jn 8; 9).

2012. a kaevandiga lõpetati 2010. a umbes pooles ulatuses uuritud II MS-aegse pommilehtri (jn 1) leide sisaldava segatud täidise läbiuurimine. Salme 2012. a leidude hulka kuuluvad 2 üheteralise mõõga katket, 1 kaheteraline mõök kahe tükina (jn 6) jms.

Põhiosa kogu Salme II leiumaterjalist moodustavad laevaneidid. Salme I needid on võrreldes Salme II-st pärinevatega väiksemad. Salme II-st leiti kokku u 40 mõõka, neist enamik fragmentidena. Terveid üheteralisi mõõku (*scramasax*) oli 10. Kõik kaheteralised mõõgad (*spatha*) olid katki murtud. Mõõkade täpse arvu kindlakstegemiseks on alustatud murdekohtade röntgenuuringutega. Tahtlikult vigastatud kilbikuplad (14) leiti vaid ülemiste kihtide luustike juures. Arvestades kilpide suurt läbimõõtu (90–110 cm) ja nende tihedat paiknemist, võib kilpe pidada omalaadseks surilina või kirstukaaneks. Väga palju leiti erinevat tüüpi nooleotsi – kokku 91. Nendest enamik oli pandud maetutele kaasa panustena, osa aga olid kindlasti sattunud laeva lahingu käigus. Mõnede otsikutega koos on säilinud ka osa noolevarrest. Nooleotstekst määratud esemete hulgas võib olla nuge. Nugade täpne arv on veel teadmata. Matuselaevast leiti kokku 251 (või enam) vaala- ja morsa(?)luust mängunuppu ja 7 sarvest ning vaalahambast(?) täringut. Rohkesti leiti fragmentaarseid ornamendiga sarvkamme – u 15. Paljudel mõõkadel, kilbikupaldel, nooleotstel jt esemetel on säilinud riide- ja puidujäänuseid. Nende puhul on alustatud materjalimääranguid ja valmistamistehnoloogilisi uuringuid. Tekstiilijäänused pärinevad erinevas tehnikas valmistatud riidest, millest enamik pärineb anglo-skandinaavia aladel levinud nn ruuttoimeses tehnikas valmistatud kangast (jn 8; 9). Selliseid kangaid kasutati peamiselt ülerõivaste valmistamisel. Labases koes jämeda kanga jäänused võivad pärineda aga maetutele peale laotatud purjest. Tekstiilfragmentidele tuleb teha villa kvaliteedi- ja värvianalüüsid.

2011. a kaevamistega lisandus 2010. aastal kindlaks tehtud 28-le luustikule veel 6 inimese luulisi säilemeid. Laibad olid maetud oletatavast mastikohast kirde poole neljas kihis: alumises olid need maetud laeva kaarte vahele, seega risti laeva kerega; ülemises kolmes kihis aga laevaga pikisuunas (jn 3a, b; 10; 11). 2011. a kaevamised näitasid ka seda, et matuselaev võis ulatuda veidi kaugemale edela suunas, sest uurimise alla võeti seni asfaltkatte alla jäänud matuselaeva osa. Seal leiti veel kahe, piki laeva maetud, indiviidi (XXIX,

XXX) artikuleeritud skelettide jäänuseid (jn 10). Samuti selgus, et kahel lähestikku asetseval koljul (VIII ülemises kihis ja XVII alumises kihis) olid ülejäänud luustiku kereosad vaid madalamal asetseval ning VIII luustik koosnes ainult koljust, mis paiknes XVII skeleti rinnal (jn 10). Salme II matuselaeva luumaterjali säilivus oli väga erinev. Üldiselt on paremini säilinud luustikud kõige pealmises laevaga pikisuunas maetud reas (I–VI) ja kõige alumises laevaga risti maetud kihis. Keskmistes kahekihilistes laevaga pikisuunas maetud ridades (XVIII–VII/XIV–VIII) oli luustike säilivus varieeruvam, kohati olid luustiku jälgitavad vaid kontuuridena orgaanikakihis (jn 12). Pinnasurve tõttu olid paljudel näiliselt hästi säilinud luudel mikropraod, mistõttu ülesvõtmisel lagunesid luud sageli kildudeks. Välitööde, luude lahtipakkimise ning puhastamise käigus täheldati 9 luustikul erinevaid vigastusi, kusjuures 5 neist esineb vähemalt kaks vigastust. Peamiselt leiti lõiketeraga (töenäoliselt mõõgaga) tekitatud vigastusi kolju- või jäsemeluudel; kahel luustikul on näha torkehaavad puusaluude sisepinnal. Viie luustikuga olid seotud nooleotsad viisil, mis võimaldab oletada, et need tekitasid pehmete kudede vigastusi. Märkimist väärib ka luustik XII, kellel tuvastati kaasasündinud kraniovertebraalne anomaalia – 1. kaelalüli (*atlas*) ja kuklaluu kokkukasvamine (jn 13).

2011. a arheozooloogilisest materjalist õnnestus määrata ligikaudu 500 imetajaluud ja -fragmenti, 2012. aastal lisandus segatud kihtidest veel 137 liigini määratavat katket (jn 14; tabel 1). Lisaks imetajaluudele leiti ka lindude jäänuseid (tabel 2) ning kalaluid ja -soomuseid (tabel 3). Loomaluud paiknesid 2011. a kaevandis hajusalt üle kogu ala põhiliselt ülemistes segatud kihtides, laeva edelapoolses otsas ja selle ümbruses oli luid siiski vähem. Laeva keskosas laeva põhjas ja idapoolse parda laudade peal olid mõned luukogumid, mis koosnesid valdavalt linnu- ja kalaluudest, kuid sisaldasid ka üksikuid imetajaluude fragmente. 2012. aastal oli loomaluid kõikjal segatud tumedas pinnases, sõltumata sügavusest ja kaugusest laevast; heledas liivas oli loomaluid märgatavalt vähem. Suure osa materjalist moodustavad koeraluud. *In situ* on laeva idapardas säilinud ühe koera (III) tagajalgade toes sääreluudest kuni varbalülideni. Kokku saadi Salme II laeva kaevandist vähemalt kuue koera jäänuseid. Veiste, lammaste/kitsede ja sigade luid saadi üle kogu kaevandi. Rohkemal või vähemal määral on esindatud kõik kerepiirkonnad, täielikult puuduvad veiste ning kitsede ja lammaste sarvjätked. Salme II laeva (2010.–2011. a materjal) linnuluudest oli vähemalt kuni seltsini võimalik määrata 67 luud ja luufragmenti (tabel 2); laeva põhjas olnud luukogumites olid valdavalt sinikael-pardi luud. Kalad (tabel 3) olid segatud kihtides esindatud üksikute luuleidudega, valdav osa kalaluudest oli laeva põhjas pardalauadel olnud luukogumites. Laeva matustega osast saadi inimluustike pealt ja vahelt vähesel määral sea- ja lambaluud, üks linnu- ja üks kalaluu.

Praeguseks võib konstateerida, et väliuuringud Salme muististekompleksil on lõppenud ja uurimistööd toimuvad edaspidi laboratoorses tingimustes. Jätuvad konserveerimis- ja esemeuurimuslikud tööd. Teistest analoogilise leiumaterjali ja dateeringuga laevmatustest eristab Salme matusekompleksi ja teeb selle ainulaadseks kogu Euroopas, matuselaevadesse maetute suur arv ja kasutatud matmisviisi ning selles kajastuvate rituaalide ainukordsus. Töenäoliselt relvakokkupõrkes hukkunud skandinaavlastest sõdalaste ühishaudade leiuväline on rikkalik ja kindlasti ka statistiliselt arvestatav valim sõdalaste-meresõitjate inventaariumist, mis pärineb ühest viikingiaja koidikul (u 650–750 pKr) toimunud ja vaid mõne päeva väldanud sündmusest. Kuna tegemist on suletud leiukompleksiga, võimaldab leiumaterjal ja selle uurimine täpsustada mõnede esemerühmade dateeringuid ja „sündmuse“ hetkel kasutusel olnud valmistamistehnikaid. Seega on juba käimasolevate uuringute keskseks ülesandeks muistise võimalikult täpne dateerimine. Probleemi lahendamiseks on kavandatud seeria ¹⁴C analüüse peamiselt skeletiosadest AMS meetodil. Lisaks osteoarheoloogilistele uuringutele on vähemalt sama oluline sõdalaste sünnijärgse elukoha geograafilise piirkonna lokaliseerimine. Selleks kavatakse uurida nende hambaemali stabiilsete isotoopide, eelkõige Sr 87/86 suhtel põhinevate meetoditega. Võimaliku lähisuguluse tuvastamist võimaldavad töenäoliselt DNA analüüsid.