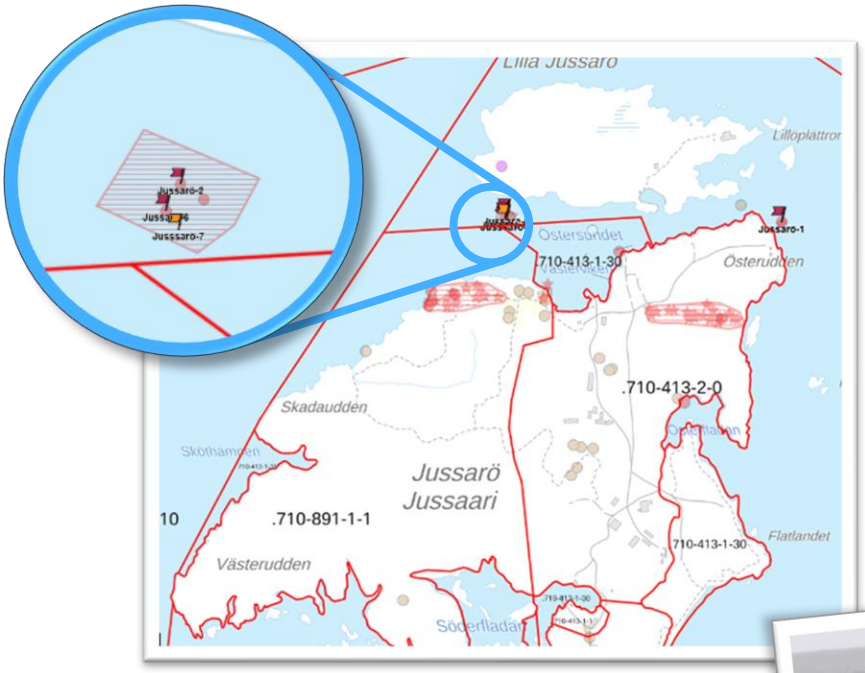
Maritime Archaeological Society of Finland

MAS field work report for the 2025 test excavation of the Jussarö 2, 6 & 7 wrecks



D. Cleasby, MSc Maritime Archaeology
Eero Saarinen, PhD Researcher
Markku Luoto, MAS Chairman

Cover images:

Jussarö 2,6 & 7 wrecksites on a general area map with a close up showing their relative position to each other.

DSV Stella, MV Ramona, MV Unelma and a Zodiac on site while the airlift is active.

Contents

Maritime Archaeological Society of Finland

Introduction

In July 2025 the Maritime Archaeological Society of Finland (MAS) conducted test excavations in the wrecks of Jussarö 2, 6 & 7. This was carried out following the research permit, MV/01285/2025, submitted to and agreed to by the Finnish Heritage Agency (FHA), a permit required to do intrusive wrecksite research. Since the wrecks of Jussarö 6 and 7 were very close to Jussarö 2 and possibly even underneath it and the use of underwater excavation and filtering systems were necessary to investigate all three wrecks, they were applied for as a single research package.

The main aim of fieldwork conducted on the Jussarö 2 wreck was to find traces of the coffee beans, previously observed anecdotally on this 18th century wreck on one of the previous excavations. This study explores whether shipwreck cargo can serve as a reservoir of ancient plant material, focusing on Coffea Arabica beans. The main idea is that coffee beans preserved underwater may retain DNA of sufficient quality for modern genomic analysis. By comparing this ancient DNA with present-day cultivars, the research aims to understand historical genetic diversity, domestication processes, and possible changes in traits such as disease resistance and quality. These would be collected for laboratory analysis to identify the genome of the specific coffee bean strain, which were assumed to be 'Coffea Arabica´ beans.

Image 1: The cover page of the story on this very research on the Finnish University Magazine 2/2026 by Reetta Vairimaa and Veikko Somerpuro (pictures).

This could add to a wider body of academic research to understand variations in different coffee bean types both in the 18th century and through to the present from its origins in the Americas. It could potentially chart changes to the genetic structure of the coffee bean and even provide insights into whether such changes were due to natural environmental changes or deliberate new strains due to deliberate cross-breeding in different ecosystems from its original environments. In addition, identifying the type being traded (or kept for private ownership by crew members) in

the northern and eastern Baltic could provide useful data for charting trade routes in coffee in this period. It may well be possible that the type previously seen in the wreck is very different from that seen in other areas of Europe and could lead to a charting a complex system of coffee trade in Europe, even the wider world, with different coffee beans appearing or evolving in different locales. This is a relatively new and exciting research direction, particularly due to the role of coffee beans extensively and embedded in the culture of the modern world. While overall responsibility for the fieldwork research was held by the maritime archaeologist, David Cleasby, the planning, methodology, execution and ongoing research for the coffee bean project has been carried out by Eero Saarinen, as part of his own PhD research program. The coffee bean project, therefore, mixes an exciting and innovative blend of maritime historical and archaeological objectives with fast evolving methodologies and insights from genetic studies.

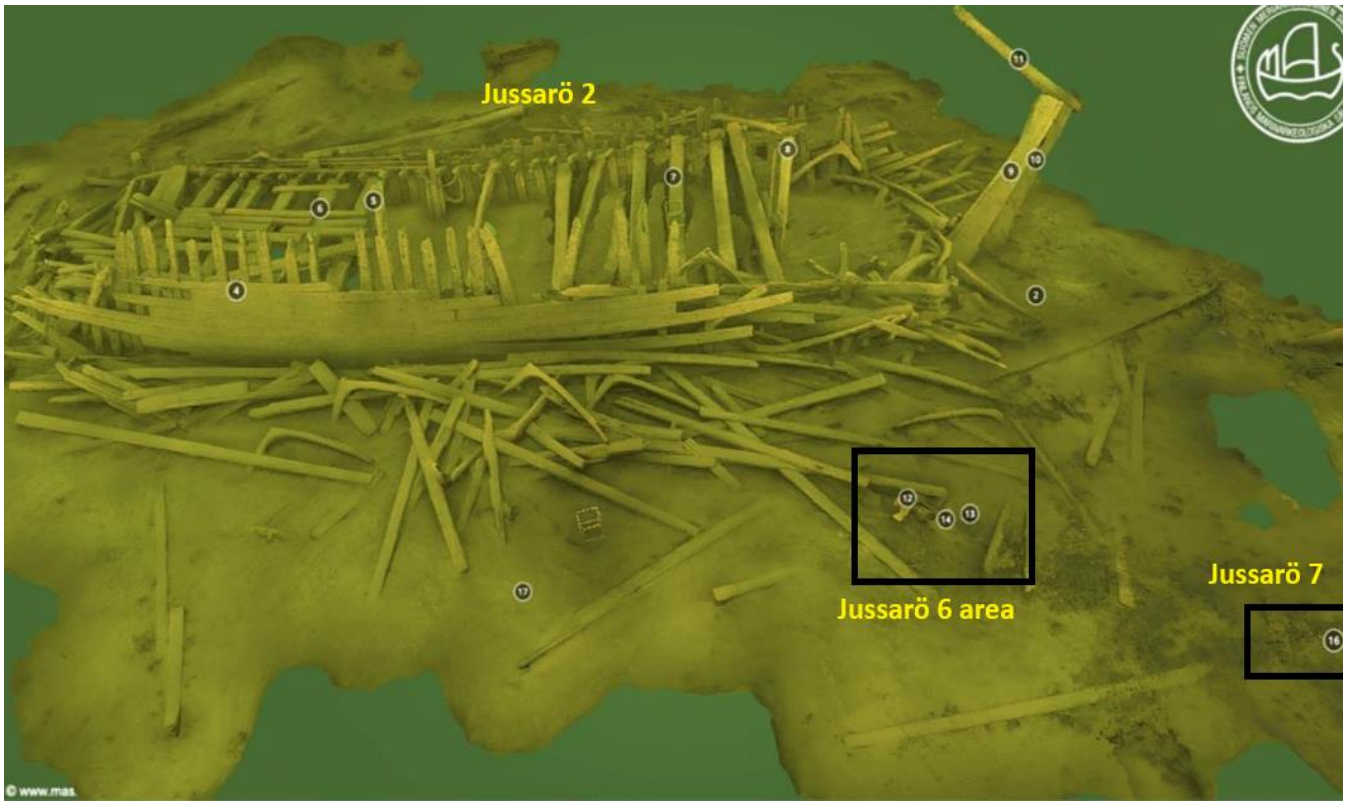


Image 2: Photogrammetric image of Jussarö 2, 6 & 7 wrecks with their respective identifiers

The research on 'wrecks' of Jussarö 6 and 7 had different aims. Timbers observed on previous excavations and site inspections by both the Finnish Heritage Agency (2008) and MAS (2017, 2022-4) did not seem to be of the same nature as those from Jussarö 6. They were thinner and seemed to exhibit more deterioration leading to the hypothesis that they were older and from a different ship. Radiocarbon dating showed them to be considerably older. The aim of the test excavation was to expose the areas around these timbers and identify if in fact they were part of the structure of 1 or possibly 2 older vessels.

If appropriate core timbers were exposed, then dendrochronological samples could be taken to finetune the dates for these new wrecks. This data would provide the planning basis for future more extensive excavations. The presence of several boats/ships on top of each other could generate discussion as to why several vessels ended up in the same place. Their position at the western edge of the channel is likely due to vessels being unfamiliar of the safer routes into the sheltered waters, not aware of the hidden hazards and the currents and winds that might force them onto those hazards. However, until Jussarö 6 and 7 have been investigated it is impossible to state this categorically, and wreckings may have occurred separately due to some form of conflict or deliberate sinking or abandonment.

The MAS 3D Ontology Research Strategy

From a wider perspective, the investigations continued the primary research strategy of the Maritime Archaeological Society of Finland (MAS) to produce a 3D ontology of wrecks in the Baltic Sea for wreck sites in Finnish waters. It establishes the basic initial where', 'what' and 'when' of a wreck. 'Where' means determining the most accurate location of the wreck object in the global coordinate system so that the object can be easily found again. 'What' means 3D modelling of the wreck site with the help of, for example, photogrammetry with an accuracy of at least the resolution of the human eye, and naming the identified structural elements and artefacts, i.e. annotating them in the area in question. 'When' means (e.g. radiocarbon) taking a dating sample from the wreck, in which case it can be at least tentatively dated to the middle/new/most recent age categories and argued as a relic that is more than 100 years old. This process highlights wrecks that themselves offer the possibility of important insights into many more intensive research directions, such as increasing our knowledge of boats found in Finnish waters in the medieval period, or of boats that highlight changes in boat structure and evolution, and which have been pursued in the excavation of the Jussarö 6 and 7 timbers.

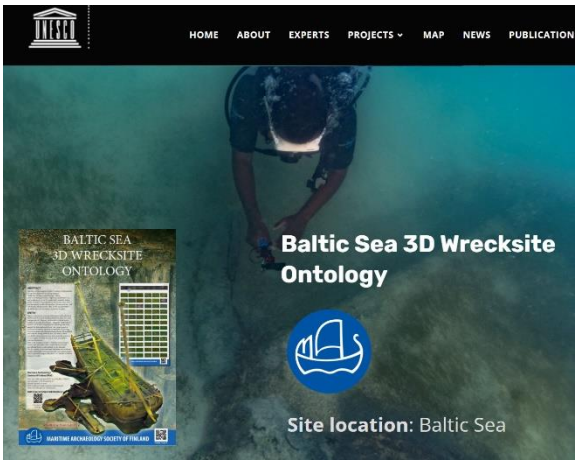


Image 3: MAS ontology research reports at UNESCO underwater cultural heritage website

The data is offered, freely available and open source for fieldwork for both MAS itself and future researchers to organise. The long-term aim of the 3D ontology project is to compile a growing volume of information to form the initial basis for a large-scale ontological database. Academic researchers of different countries can compare their own data of boats they have researched in terms of form, individual elements, age and geographical location to those in the MAS 3D ontology database. Where cross correlations are successfully made many insights can be gleamed, such as the correct identification of a wreck can be made, as with the 17th century Swedish warship *Falken,* identified

in 2025 by Niklas Erikssson of Stockholm University from MAS's 3D model and research of a wreck from Porkkala, Finland. Similarly, a cross correlation could identify the function of a previously unknown boat feature. If 2 wrecks can be linked by cross correlation of their shared elements, and their age and their location factored in, then it is possible to start to reconstruct the routes, whether for military, trade or exploration purposes, between different ports of call and in different periods.

Previous research on the Jussarö 2 site

The wreck of the Jussarö-2 has been studied extensively and its historical 18th century status given it the fixed ancient relic number **MVID#1440**, with Museovirasto web reference: https://www.kyppi.fi/palveluikkuna/mjreki/read/asp/r_kohde_det.aspx?KOHDE_ID=1440, the latest description of which by Riikka Alvik has been summarized below and described more fully in:
Alvik, R. Hylkylöytöjä Jussarön vesillä. *Meren arkeologiaa*, 2023, s. 34-41.

Coordinates:
ETRS-TM35FIN P: 6637712 I: 307630
YKJ P: 6640500 I: 3307722
ETRS89/WGS84 Lat: 59.83223470° Lon: 23.56747204°
ETRS89/WGS84 Lat: 59° 49.9341' Lon: 23° 34.0483'
ETRS89/WGS84 Lat: 59° 49' 56.0449" Lon: 23° 34' 2.8993"

Its location is in the archipelago off Raasepori in the strait between Jussarö and Lilla Jussarö, in the western part of the strait, closer to Lilla Jussarö than to Jussarö. It consists of a wooden sailing vessel with a length of 28 metres and width of 7 metres, sunk at a depth between 14 and 17m. It has several decks visible and is badly damaged with many structural parts coming loose. Some of this destruction has been caused by underwater blasting missions. Some small iron cannons and wooden carriages were lifted in the late 1960s and is likely to be an armed merchantman. The Finnish National Board of Antiquities documented the wreck with volunteer divers in

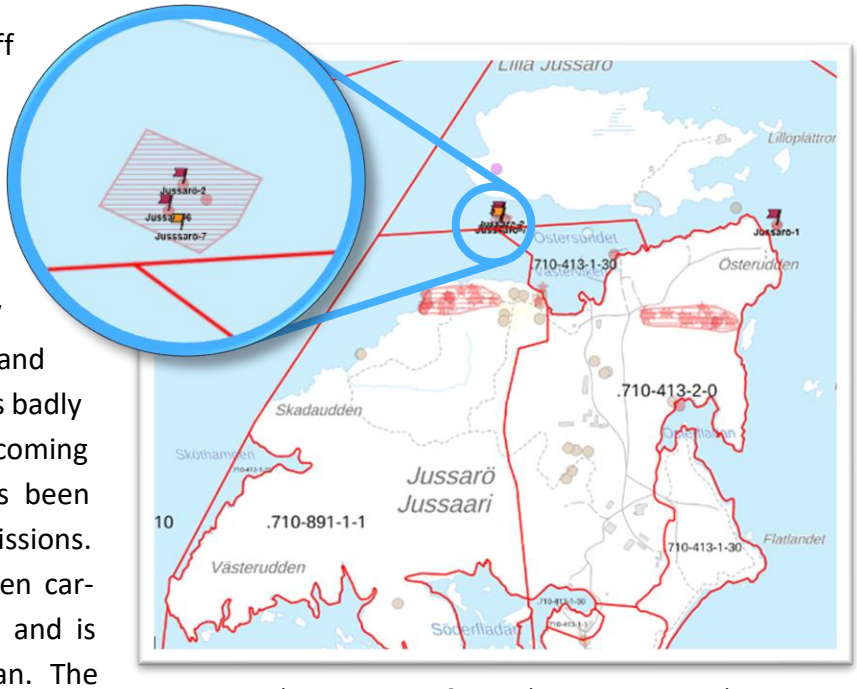


Image 4: The Jussarö 2, 6 & 7 wreksites on a general map.

1969, 1970, 1973, 1978, 1979, 1980 and 1981, and training camps were also organised on the wreck. During the research, items recovered from the wreck included Madeira and Rhein wine bottles, gin bottles, English Leeds porcelain, perfume and medicine bottles, tobacco pipes, oyster shells, pieces of textile, buttons, Russian coins and French mustard jars. Alcoholic products, oysters and mustard were probably part of the ship's cargo. These items sit in the collections of the Finnish National Museum / Finnish Maritime Museum of the Finnish National Board of Antiquities.

The wreck is a merchant ship that sank in the 18th century. Researcher Christian Ahlström attempted to identify the ship, but the identification has not been confirmed. According to Ahlström, the wreck is possibly the Russian brig Graf Nikita (sunk in 1784) or the English Constant Trader (sunk in 1785). The captain of the brigantine Graf Nikita (70 Dutch tons) was Stephan Cornelissen. The ship was wrecked on the way from Lübeck to St. Petersburg on 12 November 1784 near Jussarö gaddarna. Parts of the rigging salvaged from the wreck and a new 101 fathom long 14 ¾ inch thick anchor rope were sold at auction on 28 July 1785 in Etelä-Est (Posttidningar 1785-06-27, Inrikes Tidningar 1785-06-30). The captain of the English sailing ship (frigate or barque) Constant Trader (274 tons) was John Roberts. The ship was wrecked on the way from Bourdeaux to St. Petersburg on 19 August 1785 on an underwater rock near Jonskär, in the archipelago of the municipality of Pohja, off the coast of Ekenäs. Goods salvaged from the wreck were sold at auction in Ekenäs, such as rigging and equipment on 14 December 1785, coffee beans and plums on 31 March 1786, and French red and white wine on 18 May 1786. (Lloyds List 23 September 1785, Posttidningar 1786-04-10, Inrikes Tidningar 1786-02-13, Posttidningar 1785-10-20). Links to the numerous investigations can be found at here.

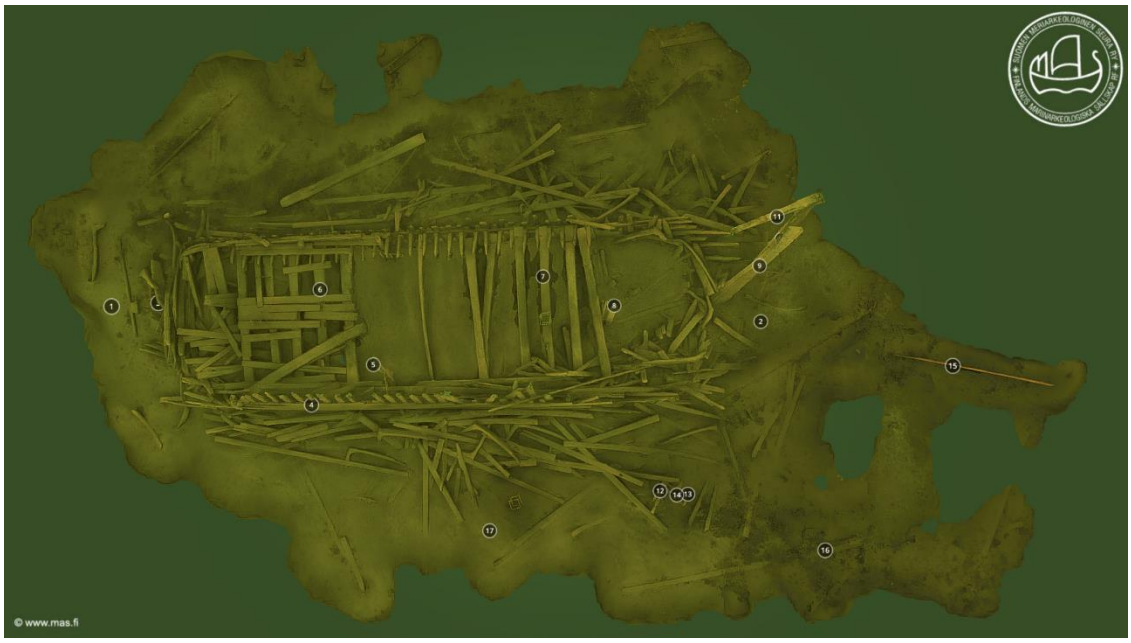


Image 5:

A bird's eye view of the wrecksites on a 3D-model in Sketchfab web pages by MAS

Discovery of the Jussarö 6 & 7 timbers

In 2008 The Finnish Heritage Agency found what looked like older timbers, including arches, ribs and an anchor windlass, from a vessel or possible two vessels, which looked very different from that of the 18th century Jussarö-2. On the basis of their apparent age under Finnish blanket protection of vessels over a hundred years they were given the following fixed ancient relic ID numbers:

Jussarö 6 - MVID# 2667 on the National Heritage Register (kyppi.fi)

Jussarö 7 - MVID# 1000054020 on the National Heritage Register (kyppi.fi)

In 2017 MAS initially 3D modelled the whole area and repeated visits and revisited it for modelling from 2022-24. The most recent model, to which features of the wreck have been described and annotated on the model (see images 2 and 5). The circled areas were for the later planned test excavations.

The MAS team took four radiocarbon C14 samples over several visits from the timbers that had been previously hypothesized as Jussarö 6 and Jussarö 7 (see appendices for calibration curves)

Sample 1 from the 'Jussarö 7' long plank produced a calC14 1780s AD date.

Its close date to Jussarö 2 and its comparable timber size to Jussarö 2 led to it being discounted as a separate wreck and simply debris from Jussarö 2. See appendices.

Sample 2 from Jussarö 6, taken 2023, produced a calC14 of 1417 – 1474 AD (95%)

Sample 3 taken from the upright timber produced a calC14 of 1389 – 1435 AD (61%)

Sample 4 taken from the arch timber produced a calC14 of 1432 – 1520 AD (81%)

Samples 2-4 could quite possibly from the same wreck considering the C14 range overlaps and even include timbers added as a repair. Certainly, they were not from Jussarö 2. To define their true nature would need dendrochronological sampling of multiple timbers from the core structure. Excavation would allow access to these core timbers and, equally important, prove if the timbers are part of the whole structure.

Image 6: Annotated segment of 3D model, showing the upright timber sampled (12), the arch (13) and the anchor windlass (14)

Excavation methodology

Due to the depth an airlift was built and tested before deploying to the site. Due to the closeness of the areas to be dredged a position was sought between Jussarö 2 and Jussarö 6 so that the weights to hold the head down would not damage the main wreck and outer timbers. An adjustable corrugated flexible nozzle was attached to the dredge head so that it could be moved more easily to new positions and even stretch to both the stern area of Jussarö 2 and Jussarö 6 areas. Where its range was insufficient it was carefully moved, avoiding unnecessary damage to any underlying debris or structure. Divers worked in pairs, one operating the airlift and the buddy observing circumspect safety awareness, controlling the power lever for the airlift and recording the process with a camera. The suction power applied by the airlift was adjusted according to the process being applied. There was a considerable amount of silt in the wreck from centuries of environmental deposition and a great deal of evidence of broken refuse left by previous excavations. In these cases, the airlift was operated at relatively full power. Visibility was at times difficult to maintain with so much silt, but full diligence as to what was being sucked up observed and controlled as much as possible. If tiny coffee beans were present in this mixed silt they would be picked up in the filtration system. Where excavation was made around timbers or cultural items the suction power was turned down considerably.

The airlift exhaust was funnelled up on the back of the boat where it was filtered through a series of boxes with holed grills inside and ultimately fine nets, with holes big enough to drain off seawater but small enough to retain whole of fragments of coffee beans. A full net was inspected by the maritime archaeologist, David Cleasby, for evidence of cultural material from Jussarö 6 & 7 area, and in the case of Jussarö 2 by both the lead researcher for the coffee beans project, Eero Saarinen and David Cleasby.

Image 7: Tray and filter bag to receive material from the sea bottom

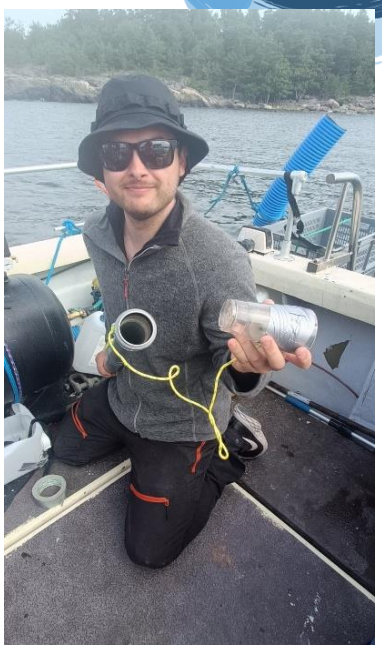


Image 8: Eero Saarinen devising a sampling tube to extract beans

Jussarö 2 coffee beans extraction methodology - Previous site excavation reports mentioned barrels as part of the cargo. Since coffee was historically transported in barrels (Manders and Kuijper 2015), the investigation focused on locating these artefacts and on pumping the stern area to access deposits where coffee remains were most likely preserved. Eero Saarinen devised sample tubing to extract coffee beans from barrels in the silt that might contain coffee beans (see image 4). Plastic tubes were inserted into the sediment inside the barrels, and one end was sealed to create negative pressure. The tubes were then carefully pulled out, preserving the sediment structure, and sealed at the other end. The quality of preservation of the beans and their genetic integrity would be best served by capturing them from sealed barrels or those partially opened by site formation processes. Sampling from open barrels was considered preferable but offerred less chance of survival. Where barrels of an approriate type were seen with intact lids a small amount of pressure would be applied to gai access and destructive force minimalised enough just to gain entry to the contents. It was considered highly likley that coffee beans may survive in the silt but to a far more degraded state. This is why all the material from the ejector exhaust would be hand scrutinised by Seero Saarinen, who had become familiar from other studies the likely form of the beans after exposure to the elements for over 200 years.

The search was not tightly demarcated to the stern because it was understood that the wreck contents had been disturbed many times by excavation and moved by underwater currents to some extent so

that coffee bean barrels may have moved over time but also that loose beans may lie in the masses of sediment. Therefore, the dredging area would be expanded as necessary in an ever-widening circle.

Coffee beans that were collected from either method would be stored on the boat in wet, cool conditions and at the shortest convenience transferred to the laboratory for analysis. This analysis would hopefully determine the genome of the beans. It was also an interesting question as to their state of preservation if they were salvaged from barrels or general wreck silt deposits. It was expected that the majority of the beans would be destroyed by the DNA analysis process ans none would survive to be prreserved or require conservation.

Jussarö 6 & 7 excavation methodology - Excavation of the Jussarö 6 timbers would initially be made alongside the upright timber, arch and anchor windlass, and then progress downwards slowly to search for potential core timbers below. It would be considered a priority of the process not to dislodge the timbers already present, which would destabilise any structure as well as constitute a hazard for divers from falling debris if the excavation trench became deeper. Excavation of the Jussarö 7 timber area would be considered as less of a priority because its date seemed to show it to be debris from Jussarö 2. However, a cross-trench approach placed near 'Jussarö 7' could in theory pick up the far ends of Jussarö 6 if a boat did in fact lie in that orientation. This area would be excavated if time allowed.

The aim of the excavation was to make a test trench to explore aspects of structure. The recovery of finds was not a prime focus but of course would be noted and recorded. Sealed contexts would not be excavated to preserve their integrity. Individual items would be recorded in situ and excavation made to avoid them. Objects of high value, such as their ability to identify a vessel or its age, such as ceramics,

Image 9: Intended and actual excavation coverage for Jussarö 2, 6 & 7

would be recorded in situ and their image reviewed by the maritime archaeologist, preferably in situ but also on the surface. A decision would be made in concert with the Finnish Maritime Agency whether their value was high enough to warrant raising or using in situ preservation. Responsibility for conservation analysis, storage and costs would lie with MAS or if their cultural or monetary value was high enough with the Finnish Heritage Agency. However, in all but exceptional cases, objects would be preserved in situ and recorded professionally on the sea bottom and where possible in their original contexts, which would also be left intact. The removal of the masses of silt was to expose the wreck structure, not to dig into its inner contexts.

General project results

Due to harsh weather conditions and a few days setting up the necessary excavation infrastructure for the site, such as the moorings for the boat acting as the excavation platform for the airlift compressor and the filter system for finds from the extracted silt and water, a reduced time was allowed to excavate for both the Jussarö 2 and Jussarö 6 & 7 sites. It was impossible to have 2 sets of compressors and 2 sets of dive teams. Initially more excavation occurred on Jussarö 2 (3 days) and later more on Jussarö 6. Jussarö 7 was not touched at all, although this was less of a concern as a previous radiocarbon date had placed it closer to the date of Jussarö 2. It should be noted that apart from rougher water prohibiting diving at times other wrecks were being explored in the Jussarö area, so divers were not always available. Image 5 below is extracted from the research permit application, showing the intended research sites in yellow. The excavations performed are highlighted with orange (Jussarö-2) and with blue (Jussarö-6). On both sites the excavated area resulted in only 1-2 square meters and didn't reach the cultural layers but were merely limited to removal of the top silt layers. It is too early to say a great deal about the potential success of these excavations, but they will be continued in 2026.

The main beneficial result of the excavation was the proof of concept that the airlift excavation equipment and techniques worked well and at that depth. A stable surface boat platform for the equipment could be erected at short notice and allow for similar projects to be set up and gain productive results within a day or so. In particular, the construction of the filtering system at relatively low cost from domestic commercial outlets meant that this process could be repeated successfully.

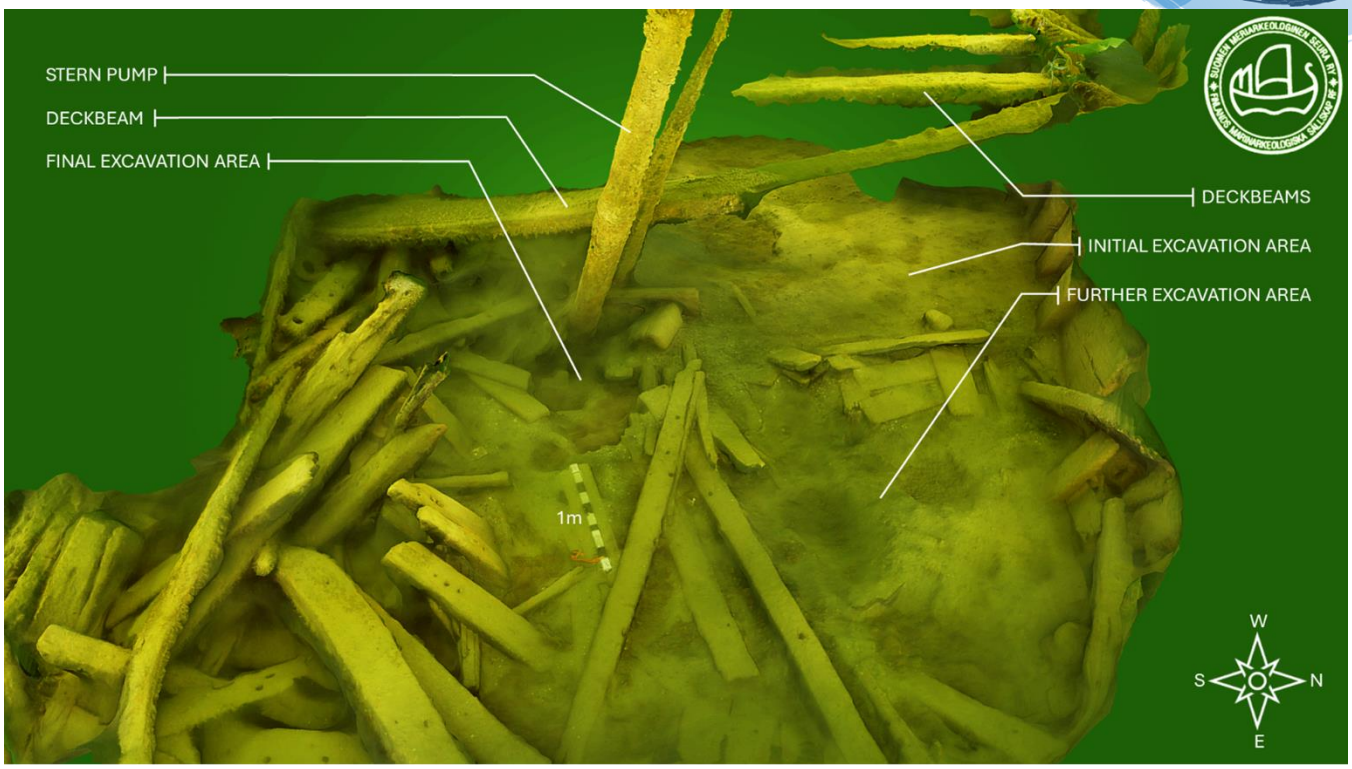


Image 10: Photogrammetric image of completed inner hull excavation

Coffee beans research results

Image 10 shows the final extent of the excavations in Jussarö 2, with a viewpoint by the sternpost facing towards the bow. The test excavations were started in the initial excavation area under the last remaining deck beams on the stern end. This area had been twice fully excavated in the 70's and 80's. Thus, the area was selected for testing the new airlift equipment and for training the volunteers. There was a thick layer of silt which had been disturbed many times over the years so it was considered a reasonable area where newcomers could orientate themselves both to the wreck and the airlift with no possibility of damaging cultural layers. The darker spots in the image represent small test pits. In hindsight one can say that too much emphasis was put on the delicacy of the excavation in the beginning. However, once everything was proved to work well, the excavation was moved towards the stern on the "further excavation area", where three larger test pits were made. Again, they appear as darker spots in the image. None of these pits yielded any finds and on probe sounding with rods it was deemed that the silt layer is probably more than one meter thick. With the silt consisting of being very fine and wet mud which did not stay in place it would have required a very large test pit to get to the culture layer on the bottom to find coffee beans in their original stored place.

However, a small pile of clam shells, not typical for the Baltic Sea, were spotted right by the pump, indicating that that spot might not have been excavated earlier. Also, it was concluded that if the coffee beans were clogging the pumps of the Vrouw Maria ship, then maybe they could be found in the bottom of the pump in Jussarö 2 as well. Therefore, the final day of excavating at Jussarö-2 was spent digging the "final excavation area" by the pump. No finds were recorded there either as the timeframe was too short to get to the culture layer. Further excavation in this area is deemed most likely to produce finds, as it appears to be "in situ".

In addition to excavating the silt nearer the stern 2 barrels were seen nearer the bow and multiple samples taken with the negative pressure tube shown before.

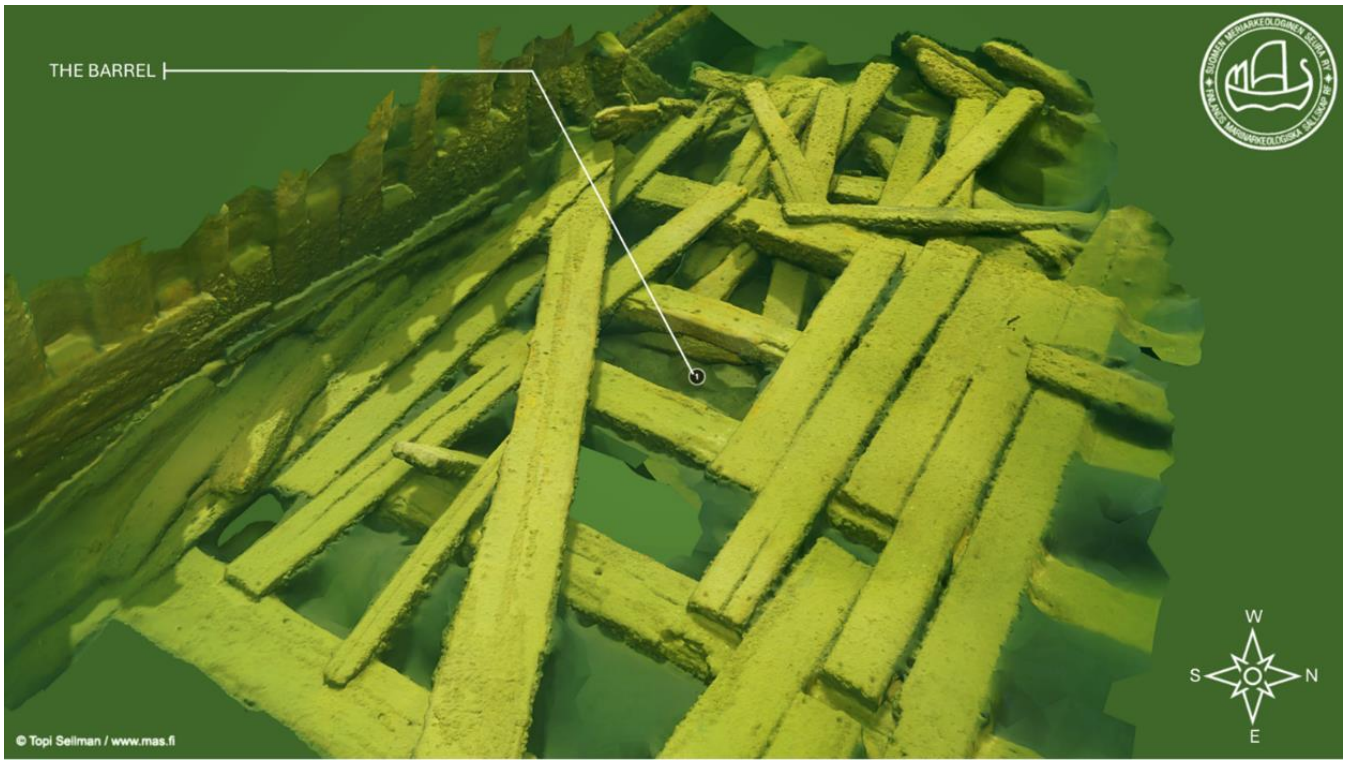
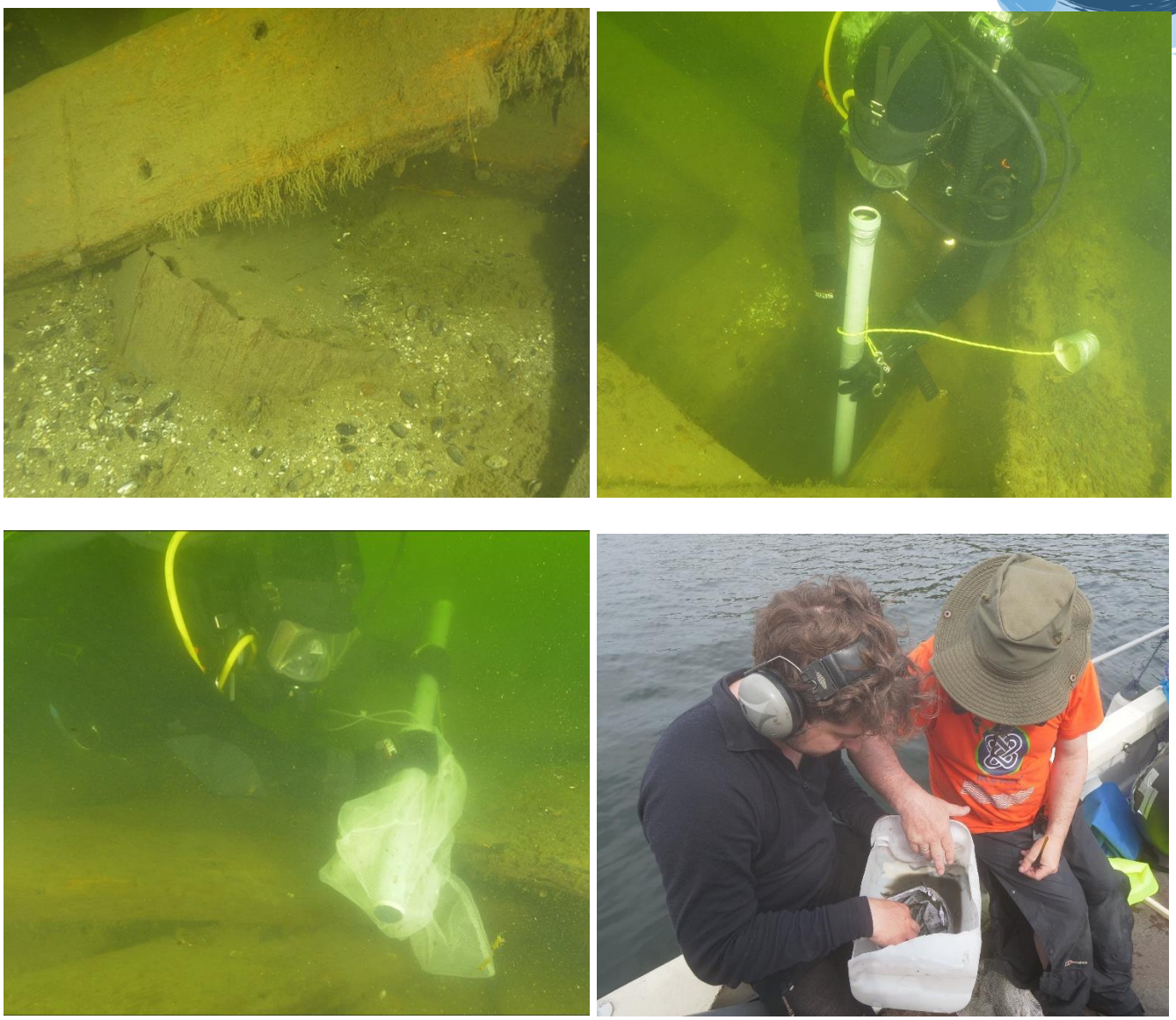


Image 11: Position of a barrel found under deck beams nearer the bow



Images 12 -15: Finding a barrel, sampling it and checking for coffee beans.

However, no beans were recovered from them. However, some progress was made refining the extraction methodology by refining the sampling tubes. It is unclear if these barrels in fact contained coffee beans or infact some other cargo. It maybe that there were beans inside that decayed or that the sample tubes did not reach sufficiently into the barrel. The research was to some extent hampered by the limitations to the intrusiveness of the research permit applied for and granted by the Finnish Heritage Agency. It was clear that the recovery of just bean samples would be considered minimally intrusive, minimally destructive and with potentially high research value. However, the project could have been far more successful if actual barrels were raised intact and removed carefully in sealed containers in case

of contents spillage. This was not applied for because it was more intrusive and would have run into potentially high costs for conservation and not necessarily good results it the barrels turned out to be empty or too degraded.

The absence of finds in this study does not exclude the possibility that coffee beans are still preserved within the wreck. Only the uppermost sediment layer was removed, and deeper, older deposits remain unexamined. It is therefore likely that potential material, if present, is located below the disturbed surface layers.

Future work could focus on two targeted areas. Firstly, as stated before, further excavation at the stern near the pump system may be justified, as coffee beans could have entered the bilge at the time of sinking and accumulated in areas where water was removed. Secondly, the midship area offers a promising context for systematic sampling, as the sediment layer is considerably thicker. Tube coring in this area would allow multiple test samples to be collected efficiently, increasing the likelihood of detecting coffee remains without the need for large-scale excavation, as even a small number of beans would be sufficient for analysis.

Confirming the existence of Jussarö 6 as a separate wreck

Image 16 represents the completion of excavations at hypothesized Jussarö 6 wrecksite from a plan view. Annotations 1-9 show:
(1) the airlift
(2) attached to the main counterweight of 200kg and to the secondary weight of 40kg, which enables moving the airlift from one excavation spot to another by transferring the secondary weight thereby. (3) the 1-meter scale bar.
(4) the steel guiding rods along within which the excavation was done in near zero visibility.
(5) 1,3-meter glass fiber sounding rods used to pinpoint where the excavation should be continued.
(6) the anchor windlass of Jussarö-6.
(7) the potential stempost
(8) and (9) stepped frames protruding from the bottom silt, which descend vertically and likely represent the frames of the Jussarö-6 wreck.
All the other timbers in the picture are likely from the Jussarö 2. It is extremely difficult to distinguish their origin without determining the wood material. Jussarö 2 is built of oak and Jussarö 6 from coniferous timbers thereby making it possible to separate the two wrecks even if mixed together.
It is impossible at present to determine the shape of Jussarö 6. Excavation should continue in the summer of 2026 to expose more of the wreck and take dendrochronological samples from core structural timbers.

Image 16: Image of completed excavation in Jussarö 6 area

Other issues

In the process of excavating the Jussarö wreck it was clear that there was considerable amounts of modern debris on the wreck. There were lengths of modern ropes bringing a risk of diver entanglement. In addition, equipment from previous archaeological excavations littered the wreck and debris field around. These were removed wherever possible to improve diver safety and reduce environmental damage such as microplastic dissemination. All this is in line with MAS' policy of sustainable and responsible best practice (see image 17).

The project provided an excellent opportunity to consolidate the experience of divers with archaeological excavation and involve the excitement of revealing objects not seen for some 250 years. As MAS is a Nautical Archaeological Society (NAS) affiliated group and participates in the NAS training programme, the experience provided opportunities to amass excavation NAS Part 3 points, which are not commonly provided in underwater fieldwork.

Future research on Jussarö

MAS is organising a return to Jussarö in the summer of 2026. Excavation will be conducted to secure samples of the coffee beans. In the meantime, Eero Saarinen has been promoting the potential of this type of research in both plant DNA and maritime archaeological fields with considerable interest shown in the Finnish media and internationally at September 2025's IKUWA conference. It is equally anticipated that Jussarö 6 will turn out to be an important medieval vessel and highlight the importance of Jussarö island as a significant sheltered harbour in the Finnish archipelago.

Image 17: modern debris removed from the wrecksite

References

Grönhagen J. 1980, Jussarö i sukellusleiri. *Työpäiväkirja 23.6.-27.7.1980*

Martijn M. and Kuijper W., 2015. Shipwrecks in Dutch Waters with Botanical Cargo or Victualsi, in Bakels, Corrie & Hans Kamermans (eds.). *Analecta Praehistorica Leidensia 45*. Leiden, Leiden University Press. p. 141-173.

On behalf of the Maritime Archaeological Society of Finland,

19.4.2026

David Cleasby, Maritime Archaeologist | Markku Luoto, MAS chairman | Eero Saarinen, PhD researcher

Maritime Archaeological Society of Finland

Appendices - Jussarö radiocarbon datings

Sample 1

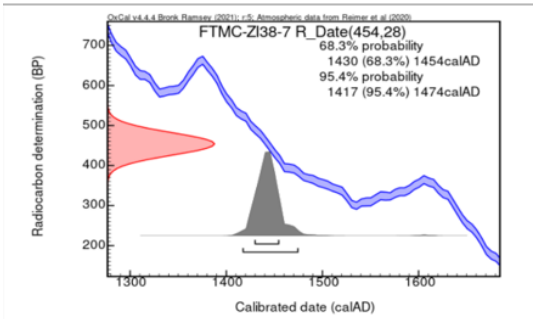


Fig. 7. Radiocarbon date 454±28BP (red), part of the calibration curve (blue) and the calibrated probability density function (grey) calculated in OxCal.

2023 C14

calC14 1417 – 1474 (95%)

Sample 2

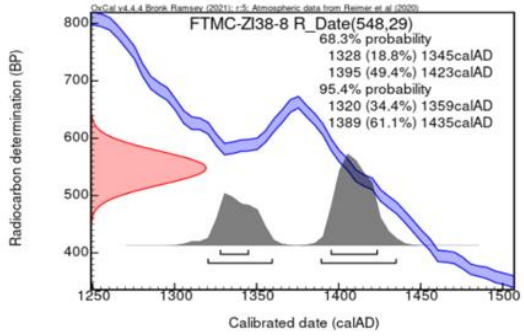
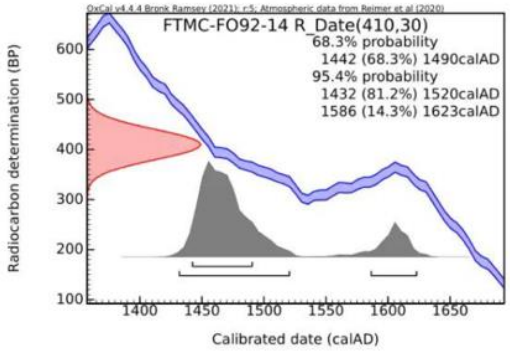


Fig. 8. Radiocarbon date 548±29BP (red), part of the calibration curve (blue) and calibrated probability density function (grey) calculated in OxCal.

2024 Upright timber

calC14 1389 – 1435calAD (61 %)

Sample 3



2024 Arch sample

calC14 1432 – 1520calAD (81%)

Sample 4 - Long plank sampled

C14 - 1780s calAD