

VRAK MAGAZINE #1

THE LOVUND BOAT

THE WRECK OF **PRINSESSAN
ÄPPLET** – VASA'S SISTER SHIP

THE WRECKS OF **SUOMENLINNA**

LYCKEBY'S PILE BARRIERS

A FATEFUL YEAR OF **GRIBSHUNDEN**



PORTRAIT

Carl Olof Cederlund put maritime archaeology on the map.

DIVING GEAR

Gear up and go, with smart stuff above and below the water.



AHOY THERE!

Ellen Ingers from Vrak. What's on at the museum?





Vrak Magazine #1

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HI!

We are thrilled to present our first issue of *Vrak Magazine*. When we started contemplating how to develop Vrak – Museum of Wrecks, we knew that we were going to be charting our own course.



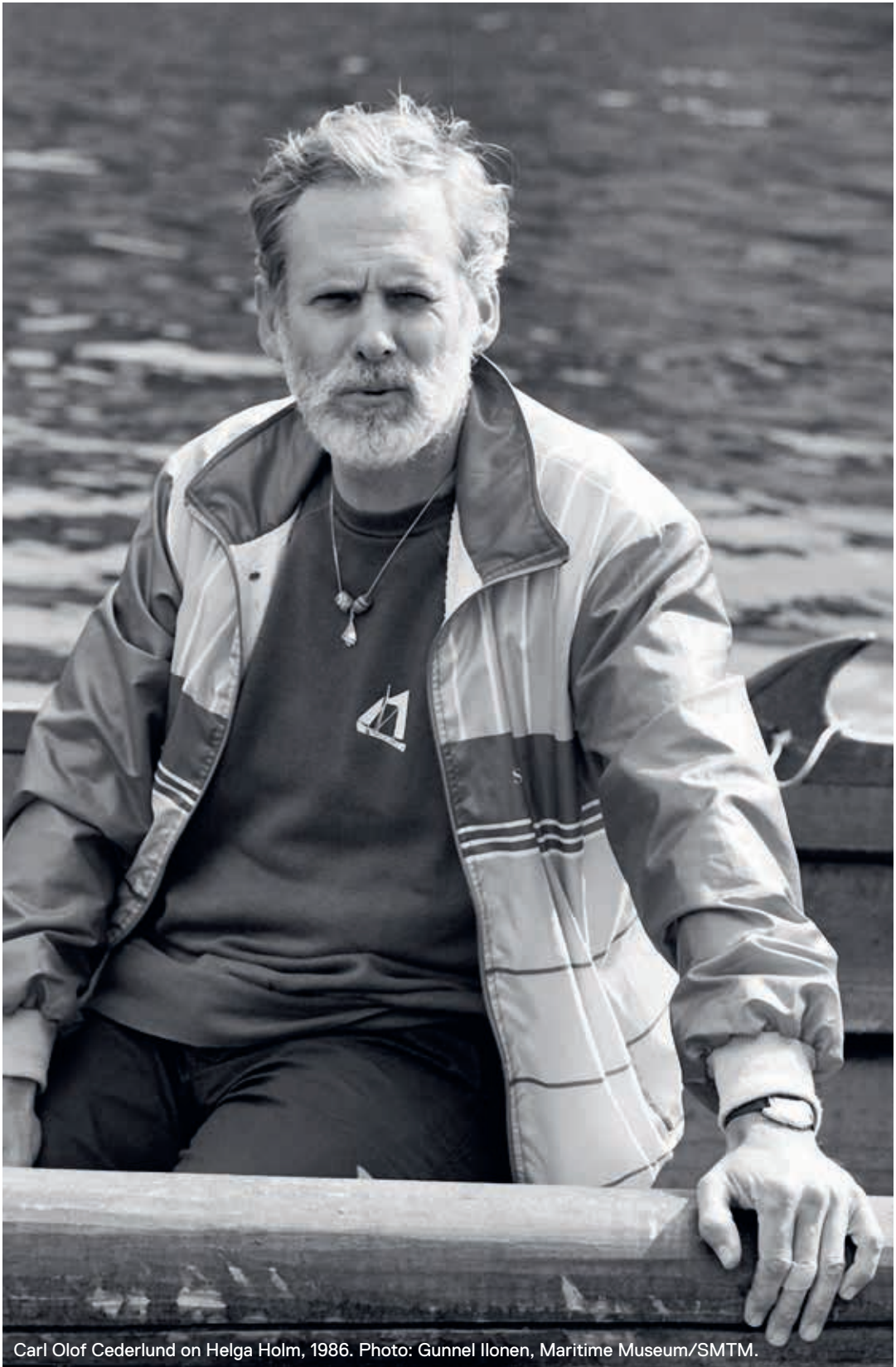
The National Maritime and Transport Museums, which this museum is a part of, already had considerable experience of running and developing museum activities in a variety of areas. But it has always been important for us not only to do what museums usually do, but to actually attempt something people *don't* quite expect from a museum. We envisioned that ours would be a new kind of museum, within a relatively young field. With this perspective, there wasn't much we could lean on. This starting point gave us a lot of freedom – as well as challenges. Our goal is for everyone to understand how much there's left to discover underwater, especially in the Baltic Sea.

Although many museums publish yearbooks, we wanted to do something more contemporary given that we are in a period full of vitality in the field of underwater archaeology. Many marvellous discoveries never seen before are being made. Technology is giving us better ways to map, investigate, analyse and document what rests on the bottom of the sea, at lightning speed. And the maritime archaeology activities being conducted are becoming more and more professional. With *Vrak Magazine*, we aim to capture and reproduce a selection of all the exciting moments happening in our field. Still, we have been careful not to compromise on scientific quality by providing content that aims to remain relevant over time.

In this first issue, you can read about some of the intriguing projects taking place and the results of the initial investigations of *Vasa's* sister ship, *Äpplet*. You also get to meet Carl Olof Cederlund, who helped shape modern underwater archaeology and much more. We hope you enjoy the magazine!

Odd Johansen, Museum Director
Vrak - Museum of Wrecks





Carl Olof Cederlund on Helga Holm, 1986. Photo: Gunnel Ilonen, Maritime Museum/SMTM.

HE PUT MARITIME ARCHAEOLOGY ON THE MAP



*The goal has always been to broaden maritime archaeology
to include different types of shipwrecks and remains
– from the Stone Age to the present day*

By Cecilia Eriksson

Carl Olof Cederlund's career was launched with the excavation of the warship *Vasa*. He later became Sweden's first professor of maritime archaeology, and in 2022 released a book on the history of diving called 'Om dykeriets historia: från Leonardo da Vinci till Anton Ludvig Fahnehjelm'. With the opening of the Museum of Wrecks in the autumn of 2021, he believes that Swedish maritime archaeology has taken a big step forward towards a more all-encompassing view of the future, one that presents a broader perspective on exploring different types of archaeological remains.

Cederlund, who is professor emeritus of maritime archaeology, makes himself comfortable on a sofa in the museum's offices to talk about his long, eventful career. But first, he is eager to talk about his recently published book on the history of diving.

'In the book, I depict how people have

dreamed of being underwater for centuries, and how they've tried to design imaginative diving suits and breathing devices. Especially exciting is the connection to several salvage attempts and dives on the wrecked ship *Vasa*'.

A central motif in the book is the evolution of diving in close interaction with the historical and archaeological research of the underwater world throughout the ages.

A PIONEER IN MARITIME ARCHAEOLOGY

Cederlund's career as an archaeologist was launched with the raising of *Vasa* in 1961.

'It was an instructive period, which also gave me the right contacts to continue with what would become maritime archaeology'.

Vasa's salvage attempts following the sinking in the 17th century had been focused on retrieving the precious bronze guns.

'But in the 1960s, financial resources

were provided to salvage the entire unique, exceptionally preserved 17th-century ship. So, for the first time, it was also possible to perform an excavation like those archaeologists do on land after the ship was salvaged. All objects, big and small, were interesting, as was the context of the finds’.

When Cederlund came to the Maritime Museum in 1967 as head of the Maritime Historical Investigation Department, he gained a new perspective on the mission of maritime archaeology.

‘The amazing work surrounding *Vasa* suddenly turned into dealing with antiquarian matters for the Swedish National Heritage Board. Through it, I saw the full spectrum of archaeological remains that the underwater world offers’.

‘I understood that there were many other remains besides *Vasa* that were at least as compelling to investigate. This broadened the scope of our tasks as maritime archaeologists’. This interest later led to an entire career.

YOUNG ON THE SUNNY SIDE

Let’s travel back in time to hear how it all began. Carl Olof Cederlund was born in 1938 at a maternity clinic on Skeppargatan in Stockholm – a stone’s throw away from the site where *Vasa* sank. Two years later, he moved with his parents to Solsidan (‘the sunny side’) in Saltsjöbaden outside of Stockholm, where he grew up. After his military service, he studied archaeology, ethnology and ethnography (anthropology). He had just graduated with a bachelor’s degree in the spring of 1961 when *Vasa* was to be salvaged.

During the winter, young archaeologists had been hired for the planned excavation after *Vasa* was recovered. Cederlund was one of them.

‘We were all male archaeologists, ten of us including the boss. Since it was a quasi-military project, it was even part of the plans

for the archaeologists to wear helmets in different colours depending on one’s rank: chief archaeologist, site manager, group leader or “private” archaeologist’.

But this arrangement never materialised. Instead, a more flexible organisation was developed that was adapted to the actual tasks at hand during the excavation.

A DELAYED LAUNCH

For Cederlund, it was important to finish his studies before he started working on *Vasa*, which resulted in a period of intense efforts – and an ulcer. So when the old ship was seen above the water for the first time in 333 years, on 24 April 1961, he was at Karolinska Hospital watching the salvage on TV.

‘I missed the first three weeks of the excavation of *Vasa*’s upper deck. The first few days I started working, I got to sit in *Kung Wasa*, an old archipelago steamer that was the archaeologists’ base during the excavation, and go through the catalogues of finds’.

SPECTACULAR AND ALLURING

The salvage operation attracted enormous media attention, both in Sweden and around the world. Immediately following the salvage, *Vasa* was placed on a pontoon in a dry dock. In August, the ship on the pontoon had been moved behind the island of Beckholmen.

‘Throughout the summer, we worked at registering and recovering objects in the mud on board. Both Stockholmers and tourists flocked to see the ancient warship’.

As early as the end of that same year, *Vasa*, which had been moved into an aluminium shed, could be pulled on the pontoon to a mooring, later called the *Wasa* shipyard, between the old naval shipyard and Gröna Lund on Djurgården. The ship *Vasa* could then be exhibited indoors to the public.

‘The *Wasa* Shipyard also had an exhibi-

A keg with musket balls found during the excavation of *Vasa* in 1961. Unknown photographer, Vasa Museum archives/SMTM.



tion of sculptures, coins and many other finds. Several of the objects were still in water-filled aquariums’.

Many people have childhood memories of seeing *Vasa* for the first time there. The shed served as a museum space until the ship was towed in 1988 to the current Vasa Museum, which was inaugurated in 1990. ‘With the temporary building, the *Vasa* committee, together with Anders Franzén and others, were able to put pressure on the government to build a real museum’.

A DYNAMIC TIME FOR ARCHAEOLOGY

It was not obvious at first that archaeology would become Cederlund’s passion. He took evening classes at the University College of Arts, Crafts and Design during high school, intending to study art history.

‘But I was advised by a neighbour who worked at the Swedish National Heritage Board to start studying archaeology because it was more methodical’.

And so began his fascination with the subject, and during his student years he had legendary archaeologists like Greta Arwidsson, Evert Baudou and Mats P. Malmer as teachers.

The staff for the *Vasa* excavation consisted of several professional groups – from divers, archaeologists and technicians to administrative staff. It was quite a large crew, with ties to the Swedish National Historical Museums, National Heritage Board, Nordic Museum and Maritime Museum. The leader of the excavation, Per Lundström, was originally an antiquarian in the Swedish History Museum’s Iron Age division and a highly experienced field archaeologist.

‘Per, who led the archaeological investigation, was a driven and enterprising person, and we talked a lot about exciting finds and other things during our lunches’.

There, at the dining table, a seed was planted for an entirely new scientific field – underwater archaeology. It was an undeveloped area of Swedish archaeology,

and Cederlund immediately understood its potential as a field of research.

As a recently qualified ethnologist in addition to his archaeology studies, Cederlund began by studying the objects found on board *Vasa*. A faience dish and fishing gear on board were among the first finds that piqued his interest.

‘Based on the various objects, you could analyse the social contexts on board. Tools and personal possessions varied substantially depending on whether you were an officer or someone with a lower rank’.

WHITE SPOTS ON THE ARCHAEOLOGICAL MAP

As an investigator for antiquity matters at the Maritime Museum and for the Swedish National Heritage Board in the late 1960s, he saw what an imbalance there was among the different underwater finds throughout the country.

‘I saw that wrecks were not being methodically documented. Oftentimes only whatever was of economic value was removed, and even the 17th-century ship

Riksäpplet was blown up in the 1920s to get at the attractive black oak’.

As early as 1964, Cederlund, together with underwater photographer Sten Lövstrand, photographed a wreck called *Fyrspännaren* in great detail. Many shipwrecks later, he had developed methods for wreck documentation on the seabed. The *Älvsnabben* wreck, the *Jutholmen* wreck and *Anna Maria* are some of the shipwrecks he has examined. In 1967, he wrote a licentiate thesis in ethnology about the Stockholm shipyard where *Vasa* was built.

ESTABLISHED A NEW PROFESSION

The 1960s and 1970s marked a new phase for archaeology, when underwater archaeology was acknowledged and integrated. Networks were formed between museums and other institutions to exchange knowledge about documentation methods and conservation techniques.

‘We were three Nordic maritime archaeologists who were in almost constant contact’, Cederlund said. ‘Myself in Sweden, Arne Emil Christensen at the collection of national antiquities in Oslo, and Ole Crumlin-Pedersen at the Viking Ship Hall in Roskilde, Denmark’.

Suddenly, a lot was happening around the world too – in Denmark, the Viking Age Roskilde ships were being examined, and in Poland, the Swedish warship *Solen* from 1627 was excavated. The Germans excavated and salvaged the medieval Bremer Cog, and in England the same took place with Henry VIII’s warship *Mary Rose*, wrecked in 1545.



Carl Olof Cederlund recording finds from *Vasa* in 1961.

Photo: Unknown photographer, *Vasa* Museum archives/SMTM.

In 1967, looting and vandalism of submerged ancient monuments became a criminal offence in Sweden. In the 1980s, contract archaeology was established, giving rise to new opportunities and more major investigations.

FROM COURSE TO UNIVERSITY CURRICULUM

Cederlund succeeded in making maritime archaeology a university subject, though his plans were not immediately accepted.

‘I was teaching maritime archaeology at the time, first at Stockholm University and later at Medborgarskolan’.

In 1974, when Mats Malmer became professor of Nordic archaeology at Stockholm University, archaeology broadened its scope. In the spring of 1975, maritime archaeology was introduced as an elective course. Cederlund became acting lecturer, but still kept his position at the Maritime Museum as head of department and head of research for maritime archaeology.

In 1984, he received his PhD in archaeology from Stockholm University with a thesis on carvel-built shipwrecks in the Baltic Sea.

But it wasn't until the mid-1990s that maritime archaeology forged its own path.

‘Södertörn University was the opening for the definitive establishment of maritime archaeology at the university level. I became a senior lecturer in maritime archaeology there in 1997 and a professor in 1999’.

When Cederlund retired in 2005, he was succeeded by Johan Rönby, who later became Sweden's second professor of maritime archaeology.

WE HAVE ARRIVED

Cederlund has always wanted to broaden maritime archaeology to include different types of shipwrecks and remains, from the Stone Age to the present day. He thinks that the Museum of Wrecks has succeeded in doing this - demonstrating the rich

breadth of unique cultural heritage that exists under the water.

‘The Museum of Wrecks is now tying it all together. The idea of thinking more broadly is right on target’, he concludes. Cederlund then gets up to head out to Djurgården and visit the museum one more time.

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The wreck site of *Gribshunden*. Photo: Johan Rönby, Södertörn University.

1495

A FATEFUL
YEAR OF

GRIBS- HUNDEN

Monsters, guns and the evolution of shipbuilding

By Ellen Ingers

One of the many spectacular shipwrecks found in the Baltic Sea is *Gribshunden* – the flagship of the former Danish King Hans. The wreck was discovered by the diving club ‘Doppingarna’ in 1971 at Stora Ekön near Ronneby in southern Sweden. After the discovery, the then unidentified wreck became a popular diving destination for many years. Several details and objects lend support to the theory that it was likely a very old ship.

GRIBSHUNDEN

This interesting wreck find was later reported to the county administrative board and investigated in the early 2000s by maritime archaeologists from Kalmar County Museum. A number of finds were salvaged, such as gun carriages and a windlass, and samples were taken for dendrochronological analysis. Such samples are taken from the timber and involve comparing the annual growth rings in the wood with a data-

base to obtain information about when the tree was felled and where it grew. The samples from the wreck indicated that the timber used to build the ship had been sourced from somewhere in the northeastern part of France around the year 1483.

Over the years, several researchers from different fields and institutions have examined the wreck, yielding much new information. This, in turn, resulted in the wreck being identified as *Gribshunden* (‘Griffin Dog’), which sank outside Ronneby in 1495. The site of the sinking, the shipwreck and the objects found made a good match with details known about the ship. In historical sources, we can read about how and where the sinking of *Gribshunden* took place.

THE SHIP’S FATE ACCORDING TO HISTORICAL SOURCES

Gribshunden is mentioned in historical sources under slightly different names. The earliest source comes from a letter

written by King Hans when he was on board the ship. The king wrote in Latin, 'navi nostra *Griffone*', which translates as 'our ship the *Griffon*'. But in other sources, the word '*Griffen*' or '*Gribhund*' is used. In this article, however, the ship will be called *Gribshunden*, a widely accepted name.

Before it sank, *Gribshunden* was headed to Kalmar with King Hans for a union meeting. At the time, Hans was king of Denmark and Norway. But he also wanted to be crowned in Sweden, which the Swedish privy council, led by Sten Sture the Elder, tried to delay. The historical records mention that Hans would have brought various possessions that a king on a journey needed. A find discovered during the excavation of the wreck in 2019 might be one such possession - a tankard turned in wood and incised with the symbol of a crown. Analyses have found that the tankard was probably painted red.

During the voyage to Kalmar, *Gribshunden* and the other ships in the party anchored at Stora Ekön outside Ronneby. Later at night, a fire broke out on board that reached the powder magazine, causing the ship to explode and finally sink. However, King Hans survived, possibly thanks to his astrologer, who accompanied him on the journey. He had a sense of foreboding and advised the king not to stay on board the ship during the night.

A SHIP OF THE NEW AGE

What makes the wreck of *Gribshunden* special, apart from its status as a royal flagship, is that it marks a period of transition in northern Europe, when ships evolved from the smaller ship types of the Middle Ages to the giants that would dominate the seas from the 15th century onwards. *Gribshunden* was a ship that was likely considered new and modern in the Baltic Sea, built using the latest techniques. Although its exact size has been difficult to determine, the ship may have been somewhere

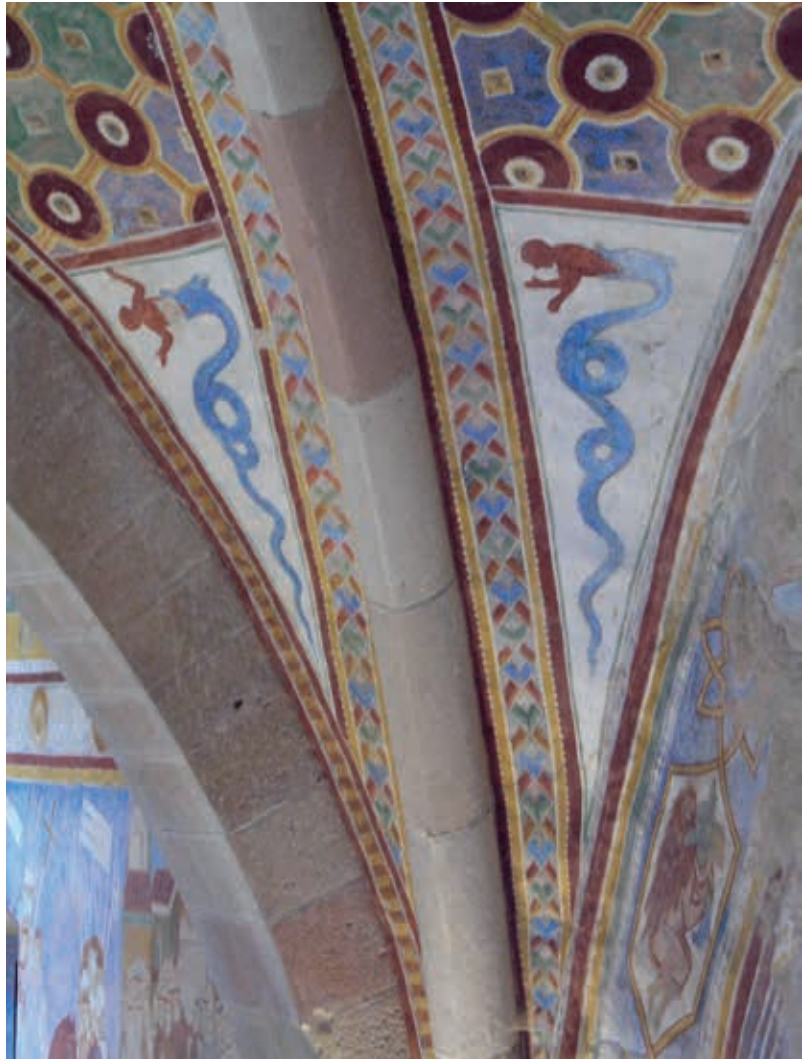
around 30 metres long and up to nine metres at its widest, which was considered a large ship for the time. It was fitted with three masts and both forecastle and sterncastle - superstructures on top of the hull that partly extended beyond it.

The ship's hull was built using *carvel* construction, whereby the planks are laid edge to edge to form a smooth hull side on the outside of the equally smooth frames - the ship's 'ribs'. In northern Europe, though, *clinker* was the usual construction method, in which the edges of the hull planks overlap each other and the underlying frames are fitted with joggles. It turned out that both of the ship's castles were clinker-built, and not carvel-built.

MONSTER AND HUMAN HEADS

Sticking out from the front of the ship, anchored in the wreck's foreward structure, was a monster's head with a screaming human head in its jaws. The monster head was salvaged in 2015 and became a sensation when the images went viral. Interestingly, the head is something often seen on contemporary depictions of similar ships. It can also be linked further back in time, for instance, to the dragon heads that are said to have adorned Viking Age ships, even if we perhaps cannot observe a steady development over time.

In appearance, *Gribshunden*'s monster head can also be linked to a symbol from the Mediterranean region. King Hans' parents, Christian I and Queen Dorothea, visited Italy in 1474 and spent time in Milan and Lombardy, where the princely house of Sforza was based. This dynasty's coat of arms depicts a monster figure that strongly resembles the *Gribshunden* monster. The figure, called the 'biscione', is still the symbol of Milan to this day and appears in automaker Alfa Romeo's logo and car emblem. The biscione is a big blue snake with a human in its jaws. One differ-



Biscione depicted on a wall in the palace of Angherà in northern Italy. Photo: Wikimedia Commons.

ence between the *Gribshunden* monster and the Sforza's biscione is that the latter not only has a protruding head, but a human torso with waving arms in its jaws.

Gribshunden's 'new' ship type, which began to emerge in the 15th century, has been called by slightly different names in different areas of Europe. In Portugal, for example, such ships were called 'nao', but in other places they were simply called 'crauel' or 'kravell', based on how the planking was constructed. In this article, however, this type of ship will be referred to as *carrack* - a name often used to describe it today.

If we turn our gaze from *Gribshunden* to

ships in contemporary depictions, more interesting details emerge, such as nets or canvas fabrics attached to the castle, like a roof over the upper decks. Perhaps this is something that even *Gribshunden* had. An example of its appearance in both depictions and archaeological context is the English ship *Mary Rose*, wrecked in 1545. Several nets can be seen in a contemporary picture of the ship, and remnants of nets have been found on the wreck itself. Built in 1510 in Portsmouth, the *Mary Rose* is a few years younger than *Gribshunden*. The ship, part of King Henry VIII's fleet, sank during a naval battle in the Solent, the



Mary Rose depicted on the Anthony Roll, King Henry VIII's register of the English fleet in the mid-16th century. Photo: Wikimedia Commons.

strait between the Isle of Wight and the mainland. The *Mary Rose* is depicted on the Anthony Roll, a list of the ships that were part of King Henry's fleet.

The netting, or roofs, could serve as protection against projectiles and falling rigging, and to keep enemies from boarding the ship. They could also prevent the crew on a taller enemy ship from seeing the people below and their movements.

What distinguished carracks at the time *Gribshunden* sank was that they had three or four masts, the front ones fitted with square sails and the aft masts with a triangular latin sail. As mentioned earlier, the ships also had high forecastles and stern-castles as well as tops, elevated platforms near the top of the masts. In contemporary depictions, they are often fitted with pikes or other weapons lined up. The early ships had guns that protruded over the gunwales, but later they were fitted with gun ports integrated in the hull.

Carracks are often described as floating castles, with high castles fore and aft resembling castle walls and tops in the masts heads like towers. According to the dominant combat technique at sea, the ships sailed towards each other under fire. After the enemy ship was boarded, hand-to-hand combat ensued while spears and arrows rained down from the castles and tops. The castles were an extremely effective tool in warfare and served as platforms for the archers, who could obtain a clear view of the enemy.

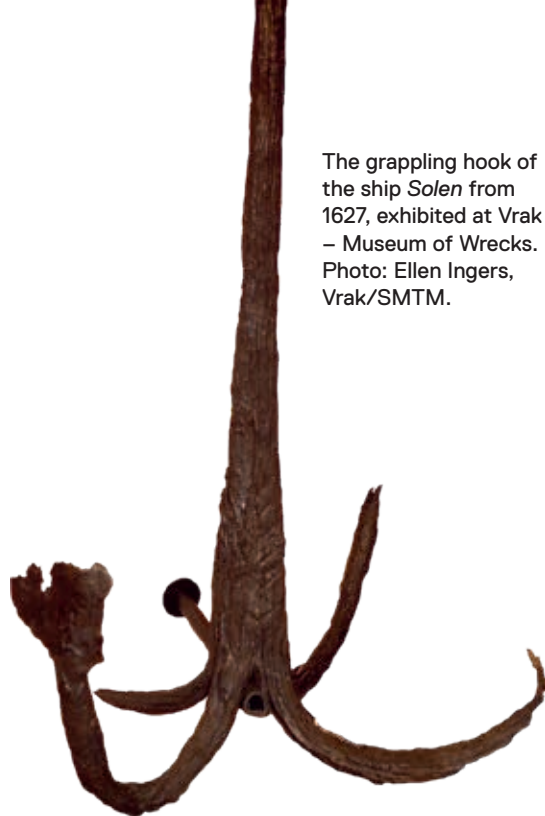
As an aid to boarding, a grappling hook might hang from the bow on a chain, ready to be dropped and caught up in the enemy ships. Grappling hooks are a detail that is portrayed in many contemporary depictions, and have also been found during underwater investigations. On the wreck of the ship *Mars*, which sank during a naval battle off Öland in southern Sweden in 1564, something resembling a grappling

hook has been discovered. *Mars* was part of King Erik XIV's fleet and went down after just one year of service. Grappling hooks can also be found on later ships, such as from the ship *Solen*, which sank in 1627 outside Gdansk. *Solen*'s grappling hook is now on display at Vrak - Museum of Wrecks.

THE DEVELOPMENT OF CARRACKS

Before *Gribshunden* was built at the end of the 15th century, shipbuilding in Europe had undergone several transformations. Carracks evolved from the earlier 14th century cog, a common ship type. Cogs had clinker-built hull sides and a relatively flat carvel-built bottom. They were fitted with a mast and straight stem and stern posts. In cog construction, the clinker planking, from which the ship derived much of its strength, was built first. The frames inside the planking were installed next. Cogs could carry substantial loads, and evolved from having a relatively square shape to a design featuring slightly more rounded hulls. The later ships functioned better when sailing on the open seas, and the bigger vessels also had a more tapered bottom instead of the flatter one from earlier periods. Cogs were frequently used in northern Europe and were even depicted on city seals, such as the seal of the city of Danzig (now Gdańsk) from circa 1400.

This growing development of building cogs using a carvel design, a precursor to carracks, first began in southern Europe and then spread north. A crucial difference compared to older cogs and ships built entirely using the clinker method was that the carvel planking was built on top of a fixed 'skeleton' - the frames - which were instead mounted before the planking. To build the new ships in northern Europe, shipwrights were brought in from southern regions where the new technique was already well known. Builders in northern Europe were accustomed to the carvel



The grappling hook of the ship *Solen* from 1627, exhibited at Vrak - Museum of Wrecks. Photo: Ellen Ingers, Vrak/SMTM.

method. But in addition to the planks being laid side by side instead of overlapping, the process of first building a sturdy skeleton and then attaching the planks might have been more difficult to accept.

WHERE WAS GRIBSHUNDEN BUILT?

Studies of *Gribshunden*'s construction have found that the ship seems to have been built according to the method practiced in southern Europe. Yet the ship's provenance is more difficult to determine. It might have been built somewhere in the north-east of France, where the wood comes from. However, after it was felled, the wood might have been bought by or donated to King Hans for use in Denmark. The ship might also have been built somewhere else by a builder familiar with this new type of ship. One possible location is Danzig, where the construction of carracks began in the 1470s. In 1462, the French carrack *Pierre de la Rochelle* arrived in Danzig and was later abandoned in the city's port for various reasons. The abandoned ship could then



The salvage of *Gribshunden*'s monster figure. Photo: Ingemar Lundgren, Blekinge Museum.

be studied by the city's shipbuilders.

Clearly, King Hans and other powerful people in Denmark had contacts with the Mediterranean and countries in southwestern Europe where the new ships were located. Both the technique and the ships were well known, even if it was something that few in Northern Europe mastered when *Gribshunden* was built. The presence of this type of ship in the Baltic Sea in the late 15th century is not surprising, but is rather a natural consequence of the evolution of the shipbuilding process at the time.

Gribshunden represents a link in a long chain of continuous development that led to the huge warships that came to dominate the Baltic Sea in the early modern period, and that every prince around the sea needed to flaunt his power and ambitions to dominate this sea. From an international perspective, too, the *Gribshunden* wreck is notable. This is because it can be studied to gain a better understanding of the types of ships used when Christopher Columbus sailed to America a few years prior to the sinking of *Gribshunden*, or the ships Vasco da Gama used when he reached India in 1498.

GRIBSHUNDEN AND CONTEMPORARY SHIPS

As mentioned earlier, *Gribshunden* is not the sole example of a shipwreck from the transitional period around the year 1500. There are several wrecks that can be compared to *Gribshunden* – as well as contemporary depictions. Perhaps the most famous example is the *Mary Rose*, built in 1510 just 15 years after the sinking of *Gribshunden*. But there are other interesting points of comparison, such as the above-mentioned *Mars* from 1564 and the so-called "Kraveln" at Franska Stenarna in the Stockholm archipelago. The wreck is believed to have been one of the Swedish King Gustav Vasa's vessels that sank in 1525. "Kraveln" is especially interesting because it is said to have transported guns and material salvaged from the more famous *Lybska Svan*, which ran aground off Öland in southern Sweden earlier that same year. Both ships were part of the fleet that Gustav Vasa built up in the 1520s.

"Kraveln" seems to be constructed in a weaker way than *Gribshunden*. Investigations of the wreck reveal that it might originally have been clinker-built and then modi-

fied into a carvel-built vessel. However, there are several details that *Gribshunden* and "Kraveln" share, such as the bitt beam. This beam was in the forecastle and was used to attach the anchor cable. It can be clearly made out in a variety of depictions of contemporary ships, and protrudes at the side of the castle like a small 'block'. Another similarity between "Kraveln" and *Gribshunden* can be found in the gun carriages that were recovered. Most of them are empty – the gun itself has rusted away. But during the 2021 investigations of the wreck, an upside-down carriage was found where the gun was still located. The gun carriages found on *Kraveln* are almost identical to those of *Gribshunden* and can also be compared with carriage finds from the Cattewater Wreck. This wreck of a carvel-built ship was found near Plymouth, England, in the 1970s and has been dated to the early 16th century.

What distinguishes the guns on *Gribshunden* from those seen on later ships like *Vasa*, which sank in 1628, is that the former's guns were breech-loaded using powder chambers and not loaded through the muzzle. Also in contrast to *Vasa*'s guns, *Gribshunden*'s guns were wrought iron and not cast bronze. They were constructed from iron rods held together with iron straps, the traces of which can be seen in the carriages as small transverse notches.

Something else that can be used to compare *Gribshunden* with other wrecks is the rudder and the hull construction surrounding it. *Gribshunden* probably had an arch over the tiller, which the upper rounded part of the rudder might indicate. This is something that can also be seen in the Anthony Roll, which depicts the stern of the *Mary Rose*. Unfortunately, the rudder of the *Mary Rose* is not intact, with only the tiller and lower parts of the rudder preserved. *Gribshunden*'s rudder can also be compared with that of *Mars*, which possesses a similar design and construction.

THE WRECK AT STORA EKÖN – A SOURCE OF KNOWLEDGE

The shipwrecks discussed in this article present a historical exposé of advances in shipbuilding in different centuries and in a variety of locations across northern and western Europe during watershed moments, as the Middle Ages gave way to the Renaissance and Early Modern period.

The wreck at Stora Ekön is intriguing from many other aspects. The objects found on board can tell us more about individuals, groups and, by extension, society at the end of the 15th century. Through this wreck, the research possibilities are virtually endless. It will surely be thrilling to follow new discoveries at the *Gribshunden* wreck site and whatever future research might uncover. Like an image frozen in time of a king's warship from the late 15th century and human life at sea, *Gribshunden* is a fantastic example of the treasure troves of knowledge the wrecks in the Baltic Sea can offer.

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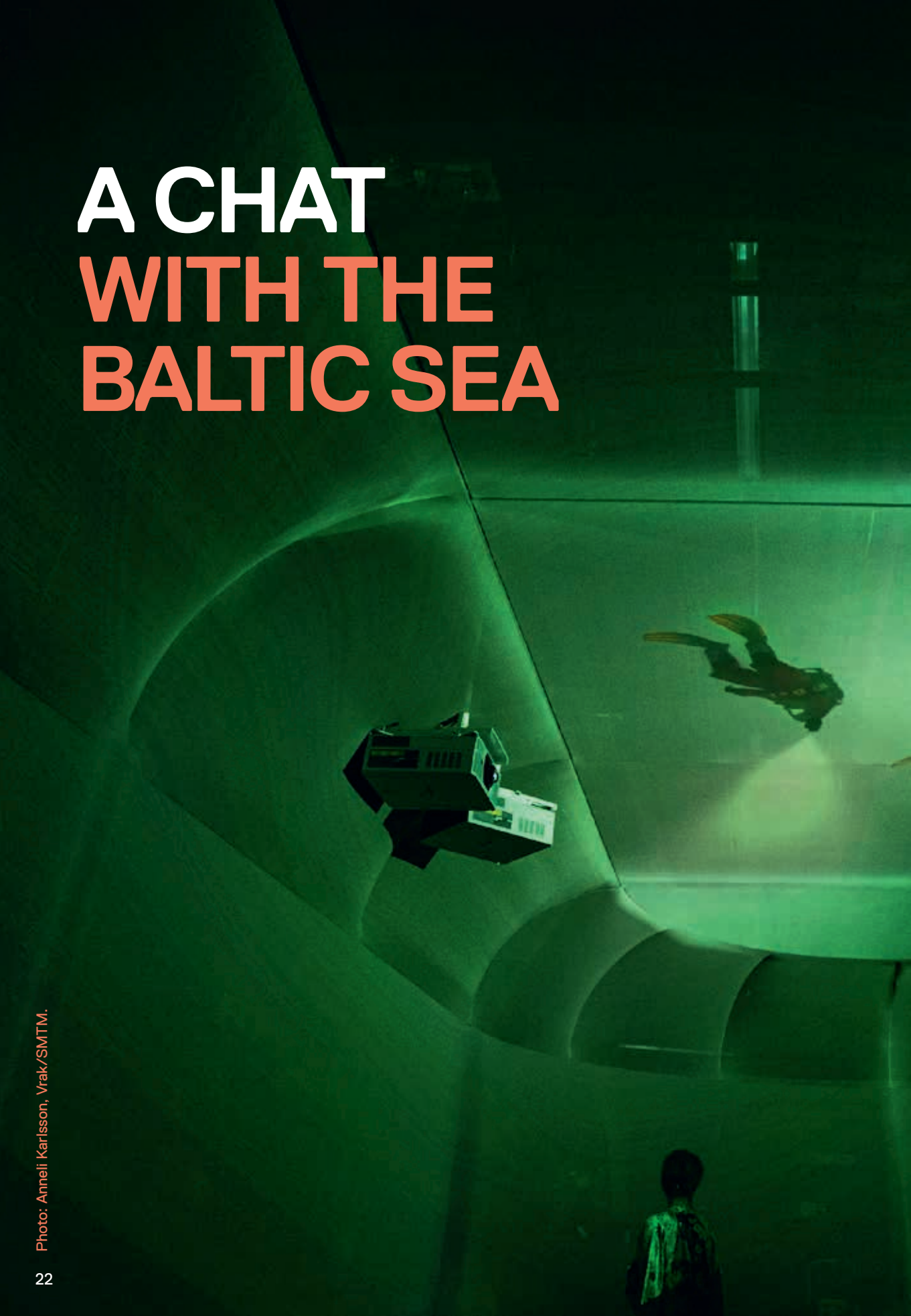


TRAYS, COASTERS AND T-SHIRTS with maritime motifs.



A CHAT WITH THE BALTIC SEA

Photo: Anneli Karlsson, Vrak/SMTM.



In Vrak's large film hall, visitors can hear the Baltic Sea itself speak. The sea where Vasa sank, where the people of the Stone Age hunted seals and where humans later put out mines, tells of our common history. The sea has seen people travel in log boats, which became sailing ships, which became submarines and airplanes. Though the vessels changed, many of them eventually ended up at the bottom of the Baltic Sea...

By Ada Fredelius





“I know you”, says the Baltic Sea in its deep voice. The sea speaks both Swedish and English, which is reasonable considering all the countries that share its coast. The Baltic Sea could surely communicate in Finnish, Estonian and Polish, too, if anyone bothered to speak to it.

I suspect, however, that we have been bad at talking to the Baltic Sea. Few of us here on land would dare to say that we know our sea. At least not very well. Guess it's time to get our act together and work on our relationship.

To begin with, we could write a letter. I'm sure an e-mail would be fine too, but I don't know the address. Plus, a genuine paper letter seems more real when you're addressing a force of nature.

It might sound like this:

Hello, Baltic Sea! Sorry you haven't heard from us in awhile. We're pretty busy up here on land, but you probably already know that. You've seen how we've evolved. Nowadays we can travel by boat between Stockholm and Helsinki in just one night, with a dance floor and duty-free shop to enjoy.

We're aware that you don't always see our best side. We get it. It's sad to be the last one at the party and have to do the cleaning up. We've gobbled up your buffet of natural resources and rewarded you with eutrophication and garbage. Oh, and by the way, sorry for all the electric scooters that have ended up in your waters in recent years. Considering how we have behaved towards you for the past 100 years, we understand if you're mad at us, Baltic Sea.



Photo: Anneli Karlsson, Vrak/SMTM.

At this point in the letter, I'm beginning to struggle. We who live on the land are obviously not good friends of our sea. If we could, we probably would have broken up over a text message. But since we can't, all that's left is to try and be a better friend. Perhaps we could write:

Baltic Sea, we know that your story is ours too. You have preserved the traces of us humans, and thanks to you we have settlements and vessels preserved in a way that no other sea in the world could. (Again, sorry for all the rubbish). We're going to get our act together and learn to know you better. We promise to get better at communicating and at revealing everything you've saved for us – like through an entire museum about the wrecks on your seabed.

/ Hugs from your friends on land

ABOUT VRAK

Vrak - Museum of Wrecks is a maritime archaeological museum that tells the story of people who have depended on the Baltic Sea for 10,000 years.

The museum is located on the island of Djurgården in Stockholm and, together with the Vasa Museum, Maritime Museum, Naval Museum and Swedish Railway Museum, is part of the state-run Swedish National Maritime and Transport Museums (SMTM). We are environmentally certified in accordance with the voluntary international standard ISO 14001.

AND DURING THE THIRD GLASS



A broken clay pipe with an extended stem in hand-sewn leather. Photo: Linda Hermannsen, Archäologisches Landesamt Schleswig-Holstein.

*The wreck of the Swedish ship of the line *Prinsessan Hedvig Sophia**

By Jens Auer

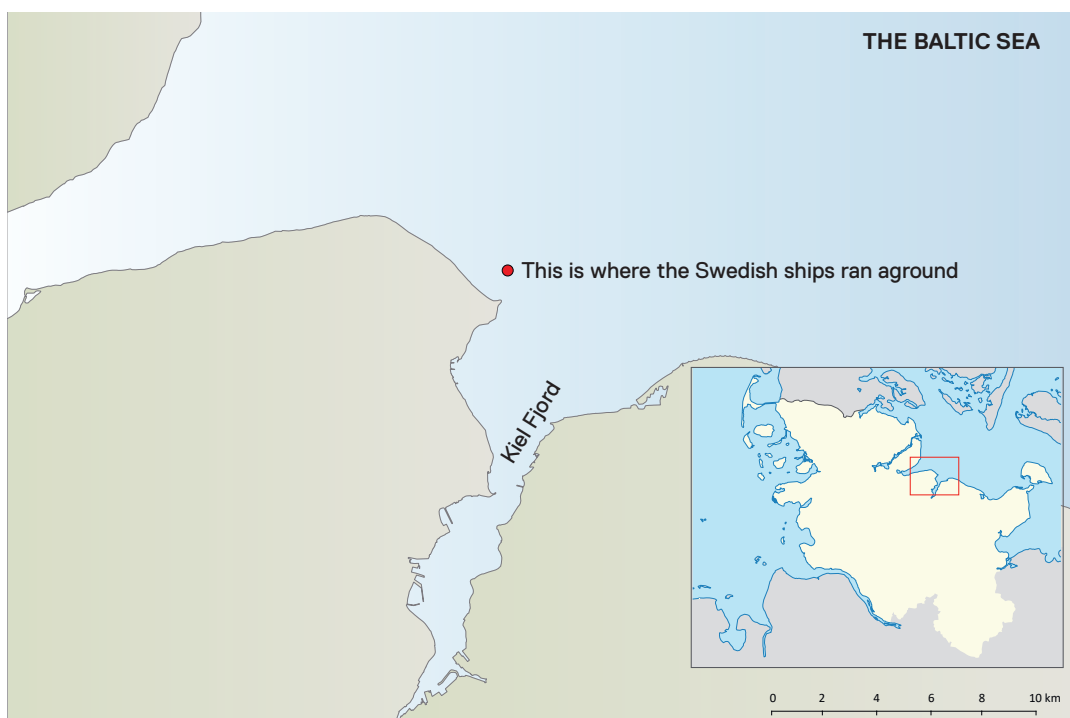
In the early morning of 25 April 1715, a casual observer passing by Bülk, at the entrance to Kiel Fjord in northern Germany, would have witnessed a strange sight. Several Swedish warships lay grounded in the shallow waters near the headland that extends into the Baltic Sea. On board, soldiers and sailors were throwing ammunition and other objects into the sea's grey waters. The thud of artillery echoed across the water. The mainmast of the most impressive warship slowly fell, crashing into the waves with a deafening roar.

On board the Swedish flagship *Prinsessan Hedvig Sophia*, a second-rate ship of the

line armed with 80 guns, stood Karl Hans Wachtmeister, the schoutbynacht (an admiral's rank in the Swedish navy), overseeing the events with a scowl. Resolutely, he drew his sword and cast it into the sea.

But what led up to these events? To find out, we need to return to the year 1970, when Rolf Lorenz, a diver from Kiel, found two cast-iron guns on the seabed near Bülk. His discovery marked the beginning of a long search for the shipwreck these guns belonged to. Although loose objects were repeatedly found on the seabed in the area, it would take 38 years, until 2008, before the shipwreck was discovered and reported to the responsible state authority for archaeology in Schleswig-Holstein.

Archaeological investigations began

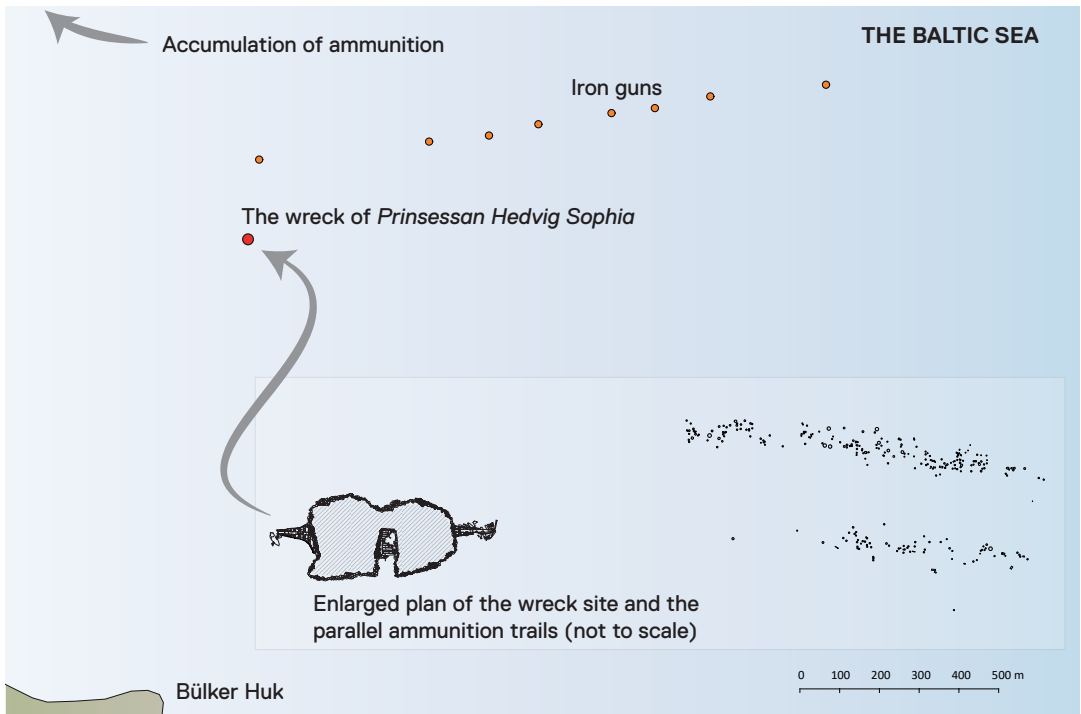


The site where Swedish ships ran aground in front of the Bülk lighthouse at the entrance to the Kiel Fjord. The entire area is now a protected cultural heritage monument. Map: Jens Auer, University of Southern Denmark, based on Wikimedia Commons vector data.

with an initial survey of the site, and the wreck was declared a protected ancient monument. A dendrochronological analysis of some construction timbers indicated a felling date of 1683. Based on this result, the remains on the seabed were assumed to be the wreck of the Swedish flagship *Prinsessan Hedvig Sophia*, which was scuttled by its own crew off Bülk after the Battle of Femern in 1715. This initial assumption could be verified following extensive archival research in 2009 and two excavation campaigns in 2010 and 2011. The excavations were carried out in a collaboration between the State Archaeology Department of Schleswig-Holstein, Kiel University and the Maritime Archaeology Programme at the University of Southern Denmark. The wreck was partially uncovered and documented in situ. In addition, an attempt was made to map and interpret all the remains on the seabed related to the events of 1715.

Lorenz's tireless underwater searches revealed that the discovery was far more than a single wreck site. Archaeological material is scattered across an area of more than 6.4 square kilometres.

The wreck of the Swedish warship lies about one kilometre from the headland of Bülk at a water depth of six metres with the bow pointing west. The ship's 35-metre-long lower hull is covered by ballast stones. At bow and stern, parts of the hull construction protrude from the mound. It is surrounded by a scatter of artefacts, ammunition and ballast stones. Along the seabed, 50 metres east of the wreck, run two parallel 'trails', about 12 metres apart, of heavy 24-pounder ammunition. These so-called gun trails were initially interpreted as evidence that *Prinsessan Hedvig Sophia* was scuttled by her own crew. Roughly 200 metres north of the warship wreck, a 1.5-kilometre-long trail of cast iron 6-pounder guns can be found leading from a water

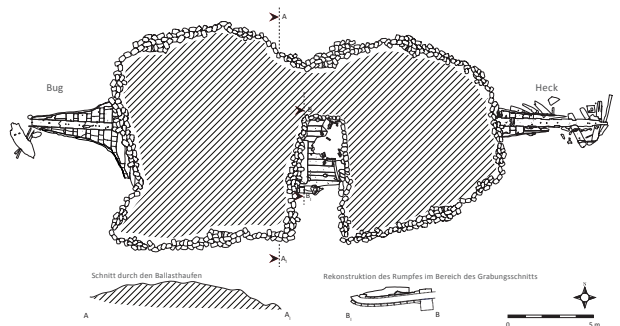


Overview map. The inset image shows the wreck of *Prinsessan Hedvig Sophia* and the ammunition trails. Map/plan: Jens Auer, University of Southern Denmark.

depth of about 10 metres towards the shore.

During the two archaeological campaigns, the exposed areas at the bow and stern of the wreck were recorded. Additionally, a two-metre-wide trench was excavated through the ballast mound in the midship area, uncovering the remains of the ship's galley as well as numerous artefacts relating to life on board the vessel.

Archival research at the Danish National Archives in Copenhagen produced further information about the events of 1715. In addition to an exchange of letters between the Danish king and the admiral of the victorious Danish fleet, the original logbooks of several Danish ships were preserved. Protocol books, which provide insight into the administration of the Danish warships involved in the encounter, contained muster rolls and overviews of supplies and ammunition. The analysis of the logbook and protocols of the Danish flagship *Prinds Christian* contributed to an understanding



ABOVE: The preserved remains of the wreck of *Prinsessan Hedvig Sophia*. The bow and stern sticking out from the ballast pile. A trench was dug through the amidships section to document the hull's construction. Drawing: University of Southern Denmark.

BELOW: A student from the maritime archaeology programme during the excavation. Photo: Jens Auer, University of Southern Denmark.





A well-preserved canister shot found on the ammunition trail.
Photo: University of Southern Denmark.

of the Danish side of the events.

A BLOODY BATTLE

But back to the 18th century: The Great Northern War (1700–1721) was fought between Sweden on the one side and Denmark-Norway and its allies Saxony/Poland, Russia and later Prussia on the other, with bloody encounters taking place on land and at sea. In April 1715, a Swedish naval squadron under Schoutbynacht Karl Hans Wachtmeister was dispatched to the western Baltic to prevent reinforcements from England from reaching Russia. Wachtmeister's squadron consisted of the ships of the line *Prinsessan Hedvig Sophia* (80 guns), *Nordstjernen* (76 guns), *Södermanland* (56 guns) and *Göteborg* (50 guns), as well as the frigates *Vita Örn* (30 guns) and *Falken* (26 guns). After initial Swedish successes, the tide of war began to turn. The Danish schoutbynacht Christian Gabel was dispatched with eleven ships to seek out and confront Wachtmeister.

According to the logbook of the Danish flagship *Prinds Christian* written by Captain Hoppe, the Swedish squadron was first sighted on 24 April during the eighth 'glass' of the morning watch (8.00–8.30).

Although the wind died down to a complete still, the Danish squadron made every effort to advance against the enemy using the ship's boats to tow the warships. Captain Hoppe wrote that at 9.30, '... we hoisted the Dutch flag under the trestle-tree of the main topmast. A signal to everybody to do their best'. Around 12.30 the Danish squadron arrived at the Swedish detachment '... in order of battle with the wind from port and we were windward of the enemy, and at the same time the Swedish ships in the rear started firing at us, shortly thereafter Schoutbynacht Wachtmeister and the ships directly ahead and astern of him whereupon we also started firing in the name of God ...'. The battle was violent. Already during the first half hour '... all our braces and clewlines were shot off and we took three shot, which could be plugged immediately, our 24-pound carriages were heavily damaged, whereupon I ordered the portside guns to be taken over to starboard while the others were repaired...' Hoppe writes. *Prinds Christian* stayed so close to Wachtmeister's flagship *Prinsessan Hedvig Sophia* that '... it could be reached by three-pounders firing round shot, bar shot and case shot at all times ...'. While the round shot inflicted serious damage to the

ship's hulls, bar shot was used to damage enemy rigging, and at short range grape-shot had much the same effect against deck personnel as modern shotgun ammunition. In addition, sharpshooters were positioned on the tops to take out enemy officers with musket fire.

The battle continued into the evening watch. The Danish squadron kept firing until the third glass (21.00-21.30), when it became too dark to carry on, and the Swedish warships slipped away under the cover of darkness chased by Danish frigates.

What casualties had been sustained on the Danish flagship after nine hours of fierce combat? During the daybreak watch, Captain Hoppe mustered his crew and recorded eight men killed and 28 wounded including a lieutenant whose legs had been shot off.

The damage to the vessel is detailed in *Prinds Christian's* protocol: 'At the waterline at starboard one foot below the waterline six shot, on starboard 52 shot into the hull, on portside a single shot into the hull, topmast of the bowsprit topsail blown to pieces, shot through the foremast just above the parrel, a large piece missing, the main topmast pierced by 12-pound shot, as is the fore topmast...'. The list continues with the standing and running rigging, where substantial damage was sustained as well.

The damage was proportional to the amount of shot fired during the battle. All calibres onboard fired 2,251 shot of various kinds, using approximately 4,676 kilograms of gunpowder.

A DISASTROUS DEFEAT

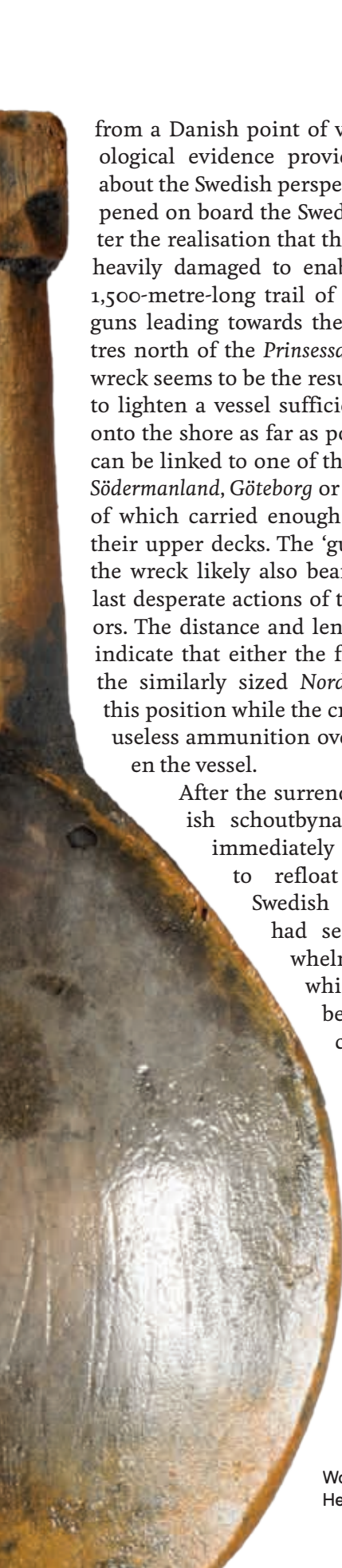
After carrying out provisional repairs, the Danish fleet set sail on the morning of 25 April to seek out the enemy and secure victory. In the meantime, the fast Danish frigates *Løvendals Galley*, *Høyenhald* and *Raa* had already made contact with the enemy.

They succeeded in preventing the escape of the only intact Swedish vessel, the frigate *Vita Örn*, and chased the ship towards the heavily damaged remains of the the Swedish squadron. As the Danish frigates approached the Swedish fleet, they were greeted by a strange sight: all the Swedish warships had run aground near the Bülk headland. A white flag signaled surrender.

The defeated Swedish schoutbynacht Count Wachtmeister was escorted to the Danish flagship by Peter Wessel, the commander of a Danish frigate who would later become famous under the name Tordenskjold. This is what Captain Hoppe records: '... Captain Wessel came on board together with the Swedish schoutbynacht Count Wachtmeister as well as his captain who commanded a ship with the name *Falck*, without a sword, they surrendered with their whole squadron and crew and he reported that he had six feet (about 1.8 m) of water in the ship, which had suffered 17 shots below the waterline, six of which had been fired by us (*Prinds Christian*) in the first broadside, and he had cut his mainmast after he stranded. Schoutbynacht Gabel asked where the count's sword was, to which he answered that a captured man was not allowed to bear a sword, whereupon schoutbynacht Gabel took his sword, which was of silver, from the side and gave it to him, which he also accepted ...'

This episode from the logbook of *Prinds Christian* - if true - provides an interesting insight into the code of honour for naval officers in the 18th century. Even more fascinating is the connection to the archaeological material. Near the wreck of *Prinsessan Hedvig Sophia*, two sword hilts were found. One of these was part of a gold-plated Swedish officer's sword. Although it is impossible to determine whose sword it was, the thought that it might have been the weapon Wachtmeister cast away in anger or despair is a tempting one.

While the written source provides us with insights into the events of the battle



from a Danish point of view, the archaeological evidence provides some clues about the Swedish perspective. What happened on board the Swedish warships after the realisation that the ships were too heavily damaged to enable escape? The 1,500-metre-long trail of 6-pounder iron guns leading towards the shore 200 metres north of the *Prinsessan Hedvig Sophia* wreck seems to be the result of an attempt to lighten a vessel sufficiently to drive it onto the shore as far as possible. The trail can be linked to one of the Swedish ships, *Södermanland*, *Göteborg* or *Nordstjernen*, all of which carried enough 6-pounders on their upper decks. The ‘gun trails’ east of the wreck likely also bear witness to the last desperate actions of the Swedish sailors. The distance and length of the trails indicate that either the flagship itself or the similarly sized *Nordstjernen* was in this position while the crew cast the now useless ammunition overboard to lighten the vessel.

After the surrender of the Swedish schoutbynacht, the Danes immediately began attempts to refloat the stranded Swedish warships. They had secured an overwhelming victory, which could now be crowned by the capture of several enemy ships of the line and frigates. On 18 May 1715, even the Danish king came to Bülk to decorate his officers and examine the Swedish trophies. In the months following the

Swedish defeat, one vessel after the other could be refloated; only the flagship remained trapped, embedded in the sandy seabed until it was finally destroyed in a storm.

On 25 May 1715 all salvage attempts were abandoned, and *Prinsessan Hedvig Sophia* was left and forgotten until the ship was rediscovered, 293 years later.

THE ARCHAEOLOGY OF A CAPTURED MAN-OF-WAR

Although little more than the lower hull is left, the wreck of *Prinsessan Hedvig Sophia* is a treasure trove for archaeologists. The hull provides information about the design and construction of a ship in late 17th-century Sweden. The ship was built by John Francis Sheldon the Younger, son of the English master shipwright Francis Sheldon, and launched in 1692 at the naval shipyard in Karlskrona. After his death that same year, his younger brother Charles completed the construction. Originally, the ship was called *Drottning Ulrika Eleonora*, but was renamed *Wenden* in 1694 and later the same year to *Prinsessan Hedvig Sophia*. The ship was built as an 80-gun second-rate ship of the line and had a length of 160 Swedish feet (47.52 m) between the posts. Her beam, measured inside the planking, was 41 feet (12.18 m) and her draught is stated as being between 19 and 21 Swedish feet (5.64 m and 6.23 m). Neither drawings nor models survive, but based on the master shipwright’s nationality, an English influence on the ship’s design and construction were assumed. However, the results of the excavation revealed many features normally associated with Dutch shipbuilding practices including a shallow keelson assembly and a galley in the hold of the vessel.

Although the wreck of *Prinsessan Hedvig Sophia* was destroyed, abandoned by its crew and subsequently plundered by Danish troops, the archaeological material



The hilt of a Swedish officer's sword, found near the wreck site.
Photo: Linda Hermannsen, Archäologisches Landesamt Schleswig-Holstein.

found among the ballast stones nevertheless provides interesting insights into the lives of the ordinary sailors on board. Besides cordage, fittings and ammunition, fragments of clothing, personal belongings and tableware were discovered. It was impossible to determine how these objects ended up in the vessel's hold. While some items may have been lost during the lifetime of the vessel, others were probably thrown away by plundering Danish sailors or ended up in the ballast as the warship slowly fell apart at its final resting place.

The find of a crudely repaired clay pipe in the trench through the midship area clearly illustrates the hardships aboard a navy vessel. The pipe consists of an unmarked Dutch pipe bowl with a short stem fragment, a sewn leather tube and a short piece of pipe stem. Bite marks on the stem fragment of the bowl indicate that the pipe was in use after it broke. But smoking such an extremely short clay pipe would have been an uncomfortable experience, and

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the owner remedied it by fabricating a new pipe stem from leather. Another piece of clay pipe stem served as a mouthpiece on the other side. Tobacco consumption was highly popular among soldiers and sailors of the 18th century, and contemporary depictions often show them smoking pipes. The pipe modification suggests that its owner might have had a relatively low socioeconomic status and could not afford or obtain a replacement for his broken pipe.

Another item representative of the common navy sailor is the wooden spoon. Each sailor carried his own spoon. The example in the image on the previous page has a roughly carved handle.

Overall, the wreck of *Prinsessan Hedvig Sophia* illustrates how the combination of archaeological and historical sources can provide us with a holistic view of times past and produce a better understanding of the events of April 1715 as well as the people who were involved in them.



The pile barrier between Hästö and Verkö. The picture shows mostly radially cracked oak timbers.
Photo: Jim Hansson, Vrak/SMTM.

CONTROL, CROWN AND CHURCH

12th century pile barriers in Blekinge

By Mikael Fredholm

In the early summer of 2021, maritime archaeologists from Vrak – Museum of Wrecks were commissioned by the county administrative board to investigate a number of archaeological remains in the bay of Lyckeby outside Karlskrona in the Blekinge archipelago in southern Sweden. The efforts consisted of verifying and documenting some previously discovered pile barriers, as well as verifying some information about shipwrecks in the bay. The goal was simply to find out more about the remains that were known to exist in the bay.

PILE BARRIERS

What is a pile barrier and why were they built? The short answer is that rows of piles were driven down at strategic locations to prevent ships from sailing into ports, or further onwards into key shipping lanes. Sometimes they were just rows of piles jutting out above the water's surface, but they could also be supplemented with stones, blockships, floating booms or chains.

The Swedish Antiquities Register con-

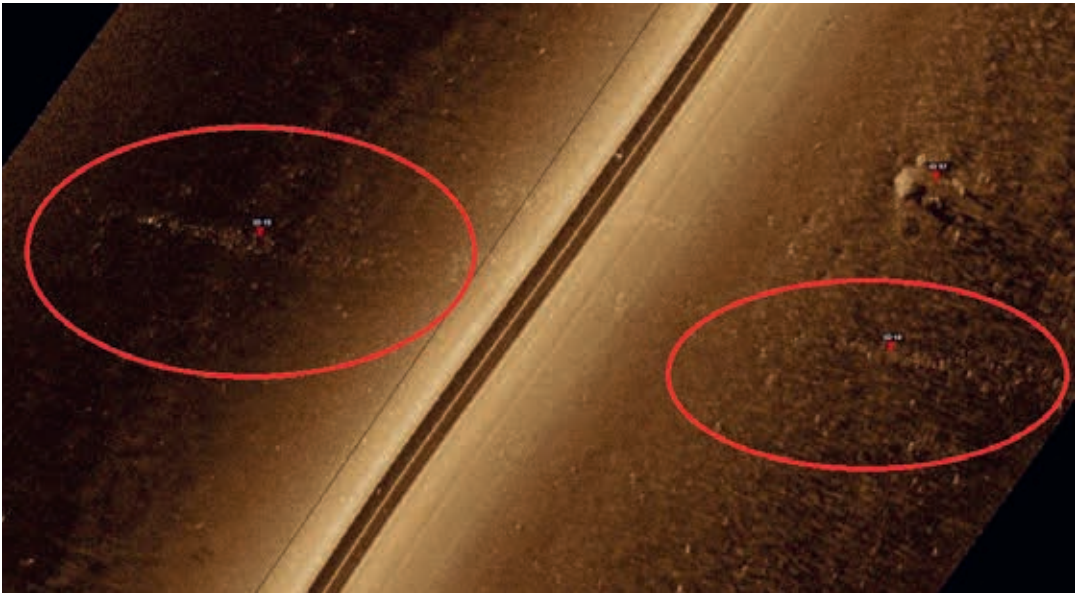
tains registered barrier installations at 88 locations along the Swedish coast, as well as in some of the inland lakes and water-courses. Many are poorly researched, so the knowledge base is lacking. In addition to Lyckebyfjärden, the Blekinge archipelago is home to pile barriers in several locations, like at Bussevik east of Lyckeby, at Listerby in the west, and in other areas.

SURVEYS IN 1995

In Blekinge, several pile barriers were investigated by the Blekinge Museum as early as 1995, one of which is located in the southern inlet of Lyckebyfjärden. The barrier was measured and dated using the carbon-14 method to the late Viking Age or early Middle Ages (895-1170 AD). A small wreck with a younger dating was also found in the barrier.

WRECK DISCOVERIES IN 2018

In 2018, Lyckebyfjärden was sonar-mapped by Karlskrona municipality prior to the laying of a water pipe. Vrak's maritime archaeologists were commissioned by the



Sonar image from the pile barrier discovered in 2018. The middle area shows the tracks of the sonar boat. The piles, which are circled, appear as blurred dots to the right and left. Sonar image: Vrak/SMTM.

county administrative board to review this sonar documentation before the pipeline was laid.

In conjunction with this, previous archaeological investigations were studied. It was found that the sonar map fit the barrier examined in 1995. When the sonar data was analysed, it became clear what this barrier looked like in the sonar documentation. Back at the office, the sonar files continued to scroll on the computer screen. After a while something similar was seen again, north of the well-known barrier. Vrak's team had found a previously unknown pile barrier, which in the sonar documentation appeared to be about 200 metres long.

PILE BARRIER SURVEY IN 2021

Three years passed without the chance to dive and verify the new find. But in the spring of 2021, Vrak's archaeologists was tasked by the county administrative board, this time, to investigate several remains in Lyckebyfjärden, including the barrier that

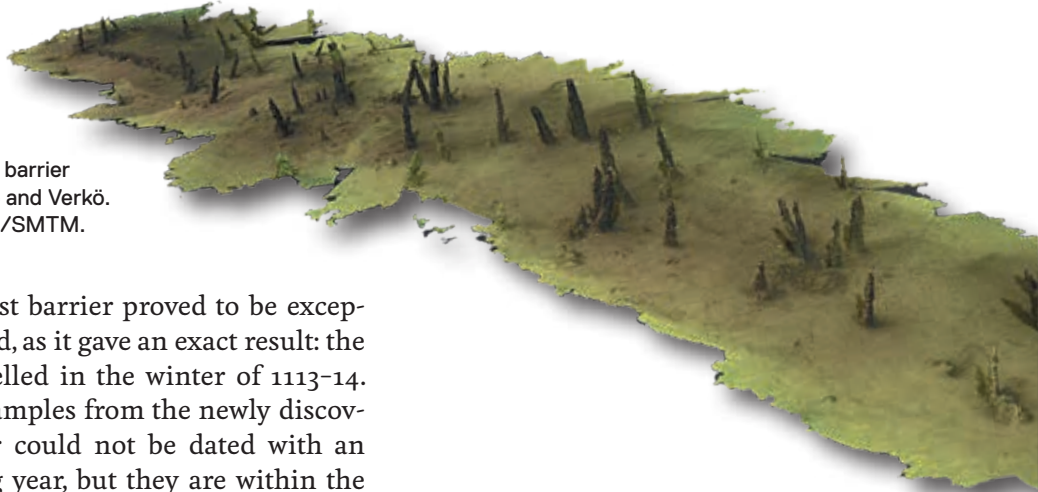
was documented in 1995 and the one that was discovered using sonar in 2018.

During the initial dives, the latter barrier was verified. It turned out to be twice as long as indicated in the sonar data. The pile barrier was just over 400 metres long and spanned nearly the entire strait between the islands Hästö and Verkö. The reason that the entire barrier is not visible on sonar is because the western half lies below the bottom sediment, while the eastern half protrudes 10–40 centimetres above the seabed.

Also, a wreck reported in the 1970s was to be searched for. But instead of finding a wreck, another pile barrier not far from the above-mentioned barrier was discovered. The museum's maritime archaeologists assessed that the person who reported the wreck had really seen the barrier, which in poor visibility might appear as eroded frames or wreckage, sticking out of the sediment.

During the 2021 survey, samples were taken for dendrochronology from the 2018 barrier that was found in addition to the newly discovered one. A sample of oak

Part of the pile barrier
between Hästö and Verkö.
3D model: Vrak/SMTM.



from the first barrier proved to be exceptionally good, as it gave an exact result: the wood was felled in the winter of 1113-14. The other samples from the newly discovered barrier could not be dated with an exact felling year, but they are within the same time period (the early 12th century). The assessment is that all three of the mentioned barriers were probably built at the same time.

The pile barriers are about five metres wide, with densely placed piles of pine, but there are many in radially cracked oak, too – meaning that the logs had been worked with an axe and split like ‘pieces of cake’ viewed from above. In some places, very eroded piles can only be felt under the seabed. But sometimes, like at the barrier between Länsman and Verkö, they protrude 60 cm above the seabed. The water depth at the site is just over two metres.

It is not possible to discern that the piles were driven in any regular arrangement. Perhaps the piles were installed in the area at various points over a long period of time, or perhaps the irregular ‘forest’ of piles was deliberately constructed. In any case, the objective of obstructing maritime trade was achieved. It is likely that several generations of piles exist. But to know for sure, several dendrochronological dating calculations must be made.

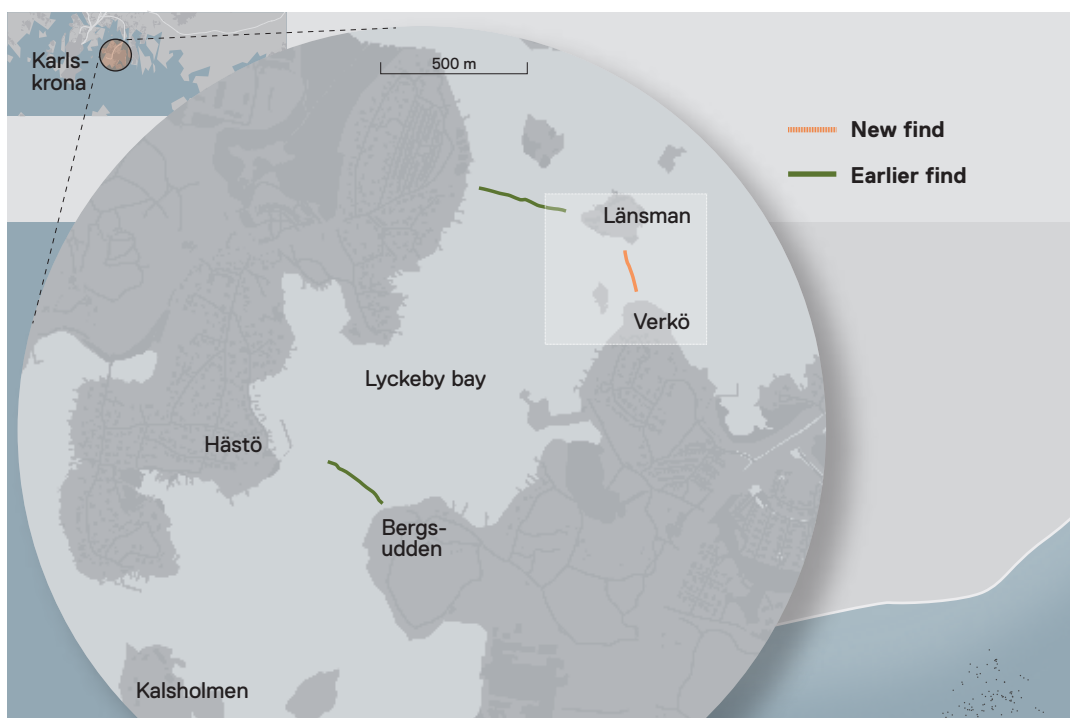
LYCKEBY IN 11TH AND 12TH CENTURY DENMARK AND BLEKINGE

Although the barriers in Lyckeby are not unique in their kind, there are several sites in Blekinge with Viking Age and medieval pile barriers. This indicates that during the

period, defending and controlling maritime traffic into the Blekinge archipelago, which at the time was a peripheral area belonging to the emerging Danish state, was vital. According to the chronicler Adam of Bremen, the people of Blekinge were christianised in the 1070s, then as part of the Danish area. Blekinge was quickly incorporated into the organisational structure of the church, under the bishop of Lund.

North of the three mentioned pile barriers, at the outlet of the Lyckeby river, a settlement from the Middle Ages could be found – the town of Lyckå and its castle. Parts of the city layer have been archaeologically investigated, but there are no datings to the 12th century. However, we do have information that a church was built in Lyckå in the 1100s. The city of Lyckå is first mentioned in 1449, but a town had probably been formed there earlier. A stone church was built in 1474, when an older wooden chapel was demolished. Lyckå lost its town charter in 1600, probably because it was no longer financially profitable.

At the outlet of the Lyckeby river (‘Lyckebyån’), ruins of the castle remain to this day featuring the foundation of two towers. The castle was the seat of Lyckå county, but it is unclear when it was built. It would likely have been completed by 1452, when historical records state that the Swedes seized the stronghold. It is possible that there was some form of castle earlier



Map of Lyckeby bay north of Karlskrona and the newly found barrier between Länsman and Verkö.
Design: Alexander Rauscher.

in the Middle Ages, but this is unclear. Among the castle ruins, pottery from the 14th to the 17th century has been found.

Iron was a major part of Blekinge's trade, which makes it likely that it was a contributing factor to Lyckå's location. The location was strategic, as the road ran along the coast of Blekinge and crossed the Lyckeby river here. The road led further north to Varend (Småland) where the iron came from that was transported to Lyckå. One of the most vital iron production areas was southern Varend at the source of the Lyckeby river. This meant that Lyckå was well positioned for reaching trading posts around the southern Baltic Sea.

POWER STRUGGLES AND THE RISE OF THE DANISH STATE

According to Danish historical research, the 12th century played a pivotal role since it laid the foundations for the powerful Danish kingdom under Valdemar I, king

of Denmark from 1154 to 1182, and later Valdemar II (Valdemar the Victorious), king from 1202 to 1241. The 12th century is considered a transitional phase from an archaic, local social structure – a clan society – with weak royal power, to an estate or class society with a stronger monarchy, church and aristocracy.

Some scholars believe that the latter structure better describes what the more established power structure looked like in the 13th century onwards. These scholars argue that political power cannot be viewed as emanating solely from the individual king, but that rather several factions were competing to rule Denmark during the 12th century. In the second half of the 11th century, Sven Estridsson was already attempting to get a more stable grip. But even in the beginning of the 12th century, various factions were engaging in fierce battles to achieve dominance, with four different family lines from Estridsson competing for influence, in particular

through Erik Ejegod and Canute the Holy. In the struggle, they sought support from families who wielded regional power.

In the early Middle Ages, Estonia was a crusade target that was attacked by Danes and Swedes, among others. But for several generations, the Estonians themselves had sailed across the Baltic Sea plundering and ravaging. In addition, both Saxo, the 12th-century Danish historian, and Absalon, bishop of Roskilde from 1158 to 1192, mention the Vendian seafaring pirates.

To sum up, the barriers can probably be linked to the emerging Danish monarchy and the church, which needed to protect land and property against looting and attacks from the peoples on the other side of the Baltic Sea and powerful rival families. They might also have served another function, namely to control the people in the province of Blekinge.

MORE RESEARCH IS NEEDED

There are two straits leading to Lyckå, and although one of them is poorly studied we do have information about a pile barrier southeast of Verkö. A contemporary barrier likely existed either there or east of Länsman, or otherwise one could have sailed up the eastern fairway towards Lyckå unimpeded.

A further investigation of these areas, in addition to a dendrochronology analysis of the carbon-14-dated barrier in 1995, could potentially answer the question of whether there was a continuous arrangement of pile barriers for the defence of Lyckå around the year 1100.

Although the piling likely originates from several generations of piles, this cannot be ascertained without making several dendrochronological dating attempts.

Vrak - Museum of Wrecks has initiated a pile barrier project, and Blekinge Museum is conducting a project that focuses on barriers in Blekinge.

Further investigations, both on land and

in the waters closer to Lyckå, can hopefully reveal whether there were port facilities, for example at the site of the town of Lyckå or the outlet of Lyckeby river, during the time the pile barriers existed.

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Vrak's maritime archaeologists on their way to saw samples for dendrochronology samples between Länsman and Verkö.

Photo: Mikael Fredholm, Vrak/SMTM.





The cannon sloop *Diana* under sail. Photo: Mikael Holmström.

FROM FOREST TO SEA

The wrecks of Suomenlinna

By Minna Koivikko

For ages, warships represented some of humanity's most complex creations. Their wrecks are now critical objects of study concerning the consequences of war for societies and people's lives. In the Baltic Sea, archaeological investigations have made it possible to gain many fresh insights into these old ships, partly thanks to the excellent preservation conditions in the brackish Baltic sea. There are an exceptional number of wrecks of old warships in certain areas. One such area can be found in Finland, at the inlet leading into Helsinki. The site is called Suomenlinna in Finnish, but originally it had the Swedish name of Sveaborg.

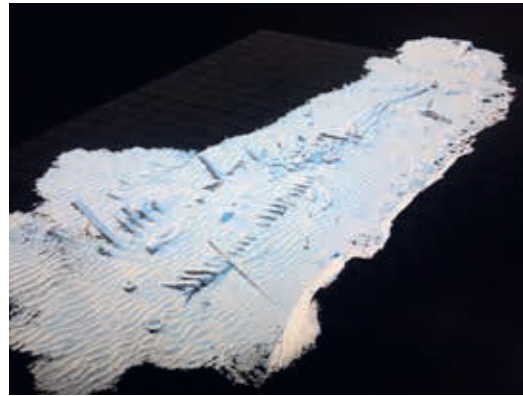
SUOMENLINNA AND THE UNDERWATER LANDSCAPE

The decision to build Suomenlinna, a sea fortress, was made by the Swedish parliament in 1747, when Finland was still part of Sweden. The suitability of the area as a naval base was a key factor in the choice of location. Suomenlinna is now a UNESCO World Heritage Site. A still-operating dry dock, where ships were built for the archipelago fleet in the 18th century, offers a glimpse into its maritime past. This fleet, designed for combat in an archipelago en-

vironment, was one of the most advanced military branches of its time, with the most important bases in Stockholm and Suomenlinna. Substantial financial resources were consumed for the design and construction of the bases, as well as for the ships belonging to the archipelago fleet.

Of the hundreds of vessels in the archipelago fleet, only drawings of them remain. But the Suomenlinna Museum still houses a preserved boat from the 18th century. In addition, some of the ships from the Swedish period lie as shipwrecks on the bottom of the sea where they can be studied by maritime archaeologists. A new research project, *'The end of glory days? A biography of the Swedish wrecks as "blue" heritage of Sveaborg'*, is examining the history of these ships from forest to sea as part of a joint research programme between the Centre for Maritime Studies at Stockholm University (CEMAS), the National Maritime and Transport Museums (SMTM/Vrak - Museum of Wrecks) and the Finnish Heritage Agency. The programme is called *'The Lost Navy - Sweden's "Blue" Heritage circa 1450-1850'*.

Over the course of its history, Suomenlinna twice changed hands and states, while oral traditions and archival records on what lies beneath the water - the underwater landscape - have disappeared. For



ABOVE: A 3D model of the wreck at Susisaari was the starting point for the archaeological surveys in the summer of 2022. Model: Kari Hyttinen and Pasi Lammi, 2021, Finnish Heritage Agency.

LEFT: The cannon sloop *Diana* brings history to life and provides comparative materials for research. Photo: Mikael Holmström.

this reason, the archaeological material, especially the wrecks, constitute unique sources of a past age. The Suomenlinna World Heritage Site comprises 80 hectares of land and an equally large water area, yet the sea fortress's sphere of influence extends beyond this. When Finland submitted an application in 1991 for it to be granted World Heritage status as a fortress relic, underwater relics had been receiving scant attention, despite the fact that the surrounding waters were a major part of the sea fortress. Underwater cultural heritage was not deliberately neglected, but was simply not part of the debate at the time. Back then, underwater remains were generally considered 'loose objects', not as elements that were integrated in the landscape. Underwater objects are still not part of people's everyday experiences and are easily overlooked. For this reason, highlighting and researching them is vital. Modern documentation methods are indispensable for visualising underwater remains, and with their help a hidden landscape can be revealed to the public.

NINE WRECKS – TRACES OF THE FINNISH WAR OF 1808–1809?

For decades, our ideas about the underwater world of Suomenlinna have been shaped through the cooperation of government authorities, volunteer divers, private companies and students. Observations from the Suomenlinna water area were collected in the wreck archive of the Maritime Museum of Finland at an early stage. The oldest presentation dates back to 1969. Later, in the 1980s, Harry Alopaeus of the Finnish Heritage Agency compiled the observations in an article.

Efforts to compile shipwreck data later emerged in a PhD dissertation on maritime archaeology that focused on ships found in the waters surrounding Suomenlinna. The current research project clarifies in more detail the history of nine selected shipwrecks.

Were they perhaps part of the fleet at the fortress during the Finnish War of 1808–1809?

When Suomenlinna surrendered and became Russian in 1808, the more than

100 ships of varying sizes acquired a new nationality. The research study is based on the above-mentioned dissertation. It has no straightforward single methodology, but employs a heterogeneous web of observations and interpretations. These include underwater archaeological observations as well as studies of historical source material prepared by various individuals. The method can of course be questioned, but the study aims to encourage people to find out something about themselves, their roots and their own relationship with the maritime environment.

A CANNON SLOOP?

One of the wrecks being studied at Suomenlinna is in open seas, where the water is usually clearer and the conditions better for making diving observations. Among other purposes, the wreck previously functioned as an object of study for underwater documentation for research divers. Under the working title ‘the wreck at Susisaari’, course participants have documented a gun and a gun carriage in addition to the wreck. A possible connection between the gun, the carriage and the wreck has not yet been confirmed. It is possible that the gun instead originated from the fortress and that it ended up in the water during an explosion. During the winter of 2021, as a prelude to the new project, a 3D model of the wreck was created. Further investigations will hopefully provide more information about the ship.

The cannon sloop was a type of ship designed by the shipwright Fredrik Henrik af Chapman in the second half of the 18th century. This shallow-draft ship was ideal for the shallow, difficult-to-navigate Finnish and Swedish archipelagos. It could be smoothly manoeuvred either by sailing or rowing, and was built according to a new tactical mindset. The first two cannon sloops of the archipelago fleet were completed in 1776. The largest of them was

19 metres long and 4 metres wide, though the draught was only about 0.8 metres. The ship with two folding masts and ten pairs of oars carried a crew of 55 men. After the ship type proved its serviceability, many cannon sloops were built.

In the 2010s, surviving drawings were used as a starting point for building a cannon sloop adapted for modern shipping in Suomenlinna. Shipwright Mikael Holmström designed a ship that takes visitors on adventurous sea tours around Suomenlinna. The cannon sloop was named *Diana* after a ship used by Augustin Ehrensvärd, the designer and team leader for work at the fortress during the construction of Suomenlinna. In 1747, Ehrensvärd was sailing on a ship named *Diana* when he was looking for a suitable building site for a fortress off the coast of Finland after being tasked to build a fortification.

Thanks to historical drawings, it might be possible to find out whether the wreck at Susisaari – when dug out of the sand – is the remains of a cannon sloop. But what other methods can we use to reconnect old wooden wrecks to their historical context? Wood samples from a shipwreck might offer a clue to the date of the ship’s construction, and the area where the tree grew can sometimes be determined. This, in turn, opens up new opportunities to find information in the historical records. The research project ‘The end of glory days? A biography of the Swedish wrecks as “blue” heritage of Sveaborg’ is also collaborating with forest ecologists and seeks to identify Chapman’s forest inventory taken in 1757–58. At that time, the aim was to find high-quality pine timber for warships, as the oak forests in many areas had already dried up. Sourcing pine that was suitable for shipbuilding posed a challenge, and during the inventory the best trees were found in the Torne Valley in northern Finland and Sweden. Another interesting topic to reflect on is whether the origin of the pine wood in the wrecks can



The Hahtiperä wreck was found by chance during construction work in 2019.
Photo: Minna Koivikko, Finnish Heritage Agency.

be determined by comparing it with forest inventory data.

Comparative studies are a fundamental part of an archaeological survey. When investigating wrecks, new finds are compared with previous ones. In addition to the reconstructed cannon sloop *Diana*, an important object of comparison in shipbuilding is a wreck that was discovered in Oulu in 2019. The wreck, named after its place of discovery, Hahtiperä, is probably a wrecked transport ship from the late 17th century. In addition to purpose-built warships, the navy needed a variety of ships

of varying sizes in order to perform maintenance tasks. The lower parts of the hull of the Hahtiperä wreck have been well preserved in the damp sand where it lay. The wreck was salvaged in parts, and its hull provides a good opportunity for more detailed research on the use of pine as a shipbuilding material. It helps us to understand how preserved wrecks and wreck parts should be studied in order to link the archaeological material to its historical context.

CHALLENGES AT SUOMENLINNA

Other research challenges at Suomenlinna relate to the site's role as a strategic military base from which archival material has either been intentionally destroyed or split up in various archives over the years. Analysing archival records requires extensive language skills, a familiarity with old handwriting, and an understanding of how different documents were created. Fortunately, The Lost Navy is an interdisciplinary research programme in which naval history experts play a key role. The archaeological material is a kind of archive, too, and its interpretation requires not only interdisciplinarity but creativity - after all, it reveals more about the history of humans rather than ships alone.

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Ahoy there!

Ellen Ingers from Vrak – Museum of Wrecks tells us what's new.



- *Trying to dive without getting wet by using our VR headsets is really popular with our visitors, so now we have added more stations in the archaeological exhibit "The Mission".*

- *We're also trying out new ideas for our guided tours so we can reach new audiences. So, for instance, we have one about maritime environments in video and computer games.*

Sounds like fun!

What else can we look forward to?

- *The Dive Tank House is a super-cool place, and we've deepened our collaboration with the Swedish Diving History Association. We're helping to create more buzz and show it to more and more people to spark their interest.*

The Dive Tank House is next door to Vrak – Museum of Wrecks. Photo: Anneli Karlsson, Vrak/SMTM.





The sculpted face of a lion at the wreck site of *Äpplet*. Photo: Jim Hansson, Vrak/SMTM.

ÄPPLLET – VASA'S SISTER

Progress, symbolism and prestige

By Patrik Höglund and Jim Hansson

Within the research programme 'The Lost Navy', maritime archaeologists from Vrak – Museum of Wrecks, together with the Swedish navy, carried out surveys at Vaxholm in the Stockholm archipelago. In December 2021, a huge shipwreck with gun ports on two levels was discovered. Almost immediately, the archaeologists were able to establish that the wreck had major similarities with the famous warship *Vasa*, which sank in 1628 and now can be studied in its own museum.

In the spring of 2022, the joint investigations of the wreck at Vaxholm continued. They revealed that most of the hull was preserved up to the lower gun deck. The upper parts appear to have collapsed in and around the wreckage, but the hull still protrudes about six to seven metres above the bottom – a mighty sight. On the port side aft, a large section of the ship's side lies flat on the bottom. The aft hull section of the starboard side slopes diagonally outwards with several gun ports intact.

According to the literature and archival records, many ships were sunk at Vaxholm, including *Vasa*'s three so-called sister ships, *Äpplet*, *Kronan* and *Scepter*. The size of the newly discovered wreck indicated that it could be one of these ships.

DOCUMENTATION

Several timbers from the wreck, deck beams in particular, were initially documented. Accurate measurements of deck beams have successfully been used before for wreck identification, in combination with archival studies. In addition, many details on the ship were documented and interpreted, some of which strongly resemble the equivalent on *Vasa*. An arrangement of timbers strengthening the hull from the inside, called futtock riders, that go through two decks is identical to the ones on *Vasa*, as is the shape of these timbers. The design of the gun ports also resembles *Vasa*'s. There were therefore many indications that *Vasa* and the wreck at Vaxholm were constructed at the same time, by the same shipbuilder and with details by the same carpenters.

LENGTH, WIDTH, DECK BEAMS AND WOOD SAMPLES

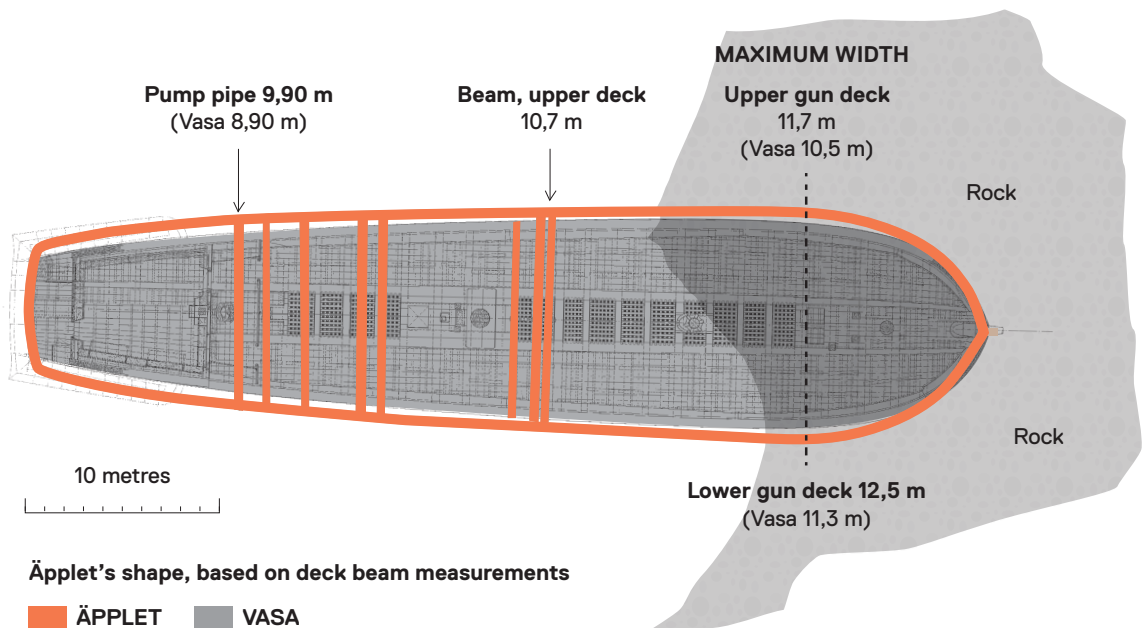
When the master shipwright Henrik Hybertsson died in the midst of *Vasa*'s construction, his second-in-command, Hein Jakobsson, took over and completed the ship. According to Jakobsson's own statement, when he later built *Äpplet* he had it built considerably wider than *Vasa*. The length between the stem and sternposts was similar – 47.67 metres (160.5 Swedish feet),

but the width was increased by over a metre to 12.62 metres (42.5 feet) on *Äpplet*. These measurements referred to the ship's widest dimensions inside the planking, and are referred to in 17th-century sources as 'the width inside the skin'. *Vasa's* width inside the planking is about 11.3 metres. This means that *Äpplet* probably had different proportions and a slightly different hull shape than *Vasa*. So how did the measurements compare with the wreck at Vaxholm?

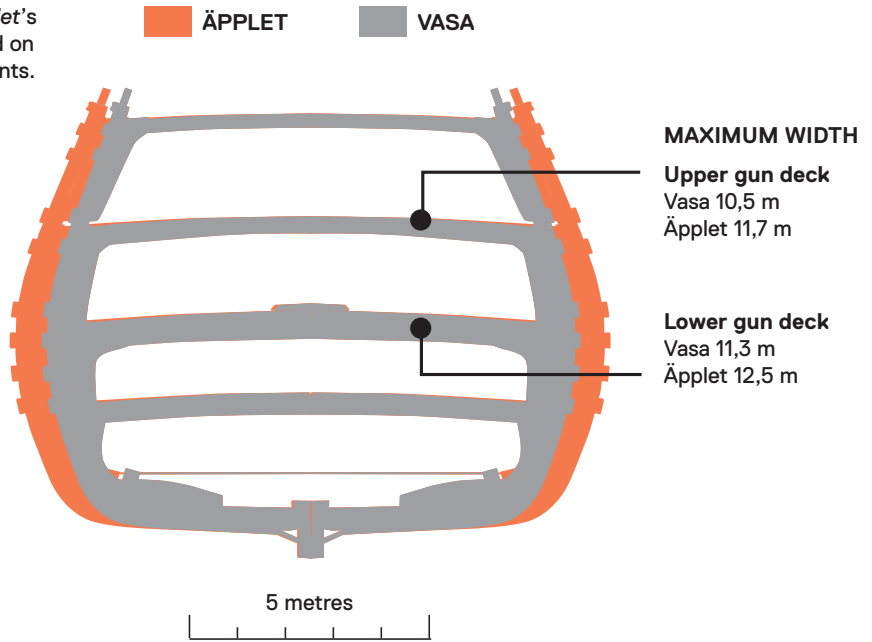
The lower part of the sternpost is in its original position. It has been possible to use it to get a reasonably good idea of the wreck's length. Much of the wreck's bow area, mainly the port side, is covered with secondary rocks from later periods, making it difficult to assess exactly where the bow is. However, the starboard side of the hull can be followed where it turns off forward, and the possible remains of a stem have been observed in the rocks. The length between the sternpost and the probable bow measures just over 47 metres. The width has been easier to document by measuring seven intact deck beams from different deck levels as well as a pump pipe

from the upper gun deck. The beams and the pump pipe have been documented in terms of their length, height and width. They were also measured against a longitudinal tape measure, stretched from the stern towards the bow. This way, it was possible to reconstruct the hull shape in plan view. The method assumes that the beams do not protrude through the hull and that they can't be too short. This means that the length measure of the beams produces a highly precise shape. The reconstruction drawing clearly illustrates that the stern section of the wreck is considerably wider than *Vasa's*. It also shows that the widest part inside the planking, now partly covered by stones, should be around 12.5 metres, whereas *Vasa* measures 11.3 metres. This agrees with historical sources.

Wood samples for analysing tree rings (dendrochronology) indicated felling in the spring of 1627. In addition, the samples pointed to the use of mainly oak from Ängsö, an island in lake Mälaren west of Stockholm – the same growing stock that *Vasa* was built with. The dendrocurves of *Vasa's* timbers were thought to be completely unique, but now we know that two



Reconstruction of *Äpplet*'s width and shape, based on deck beam measurements. Drawing: Jim Hansson, Vrak/SMTM. Design: Alexander Rauscher.



ships were built using oak from the same location.

ÄPPLET IDENTIFIED

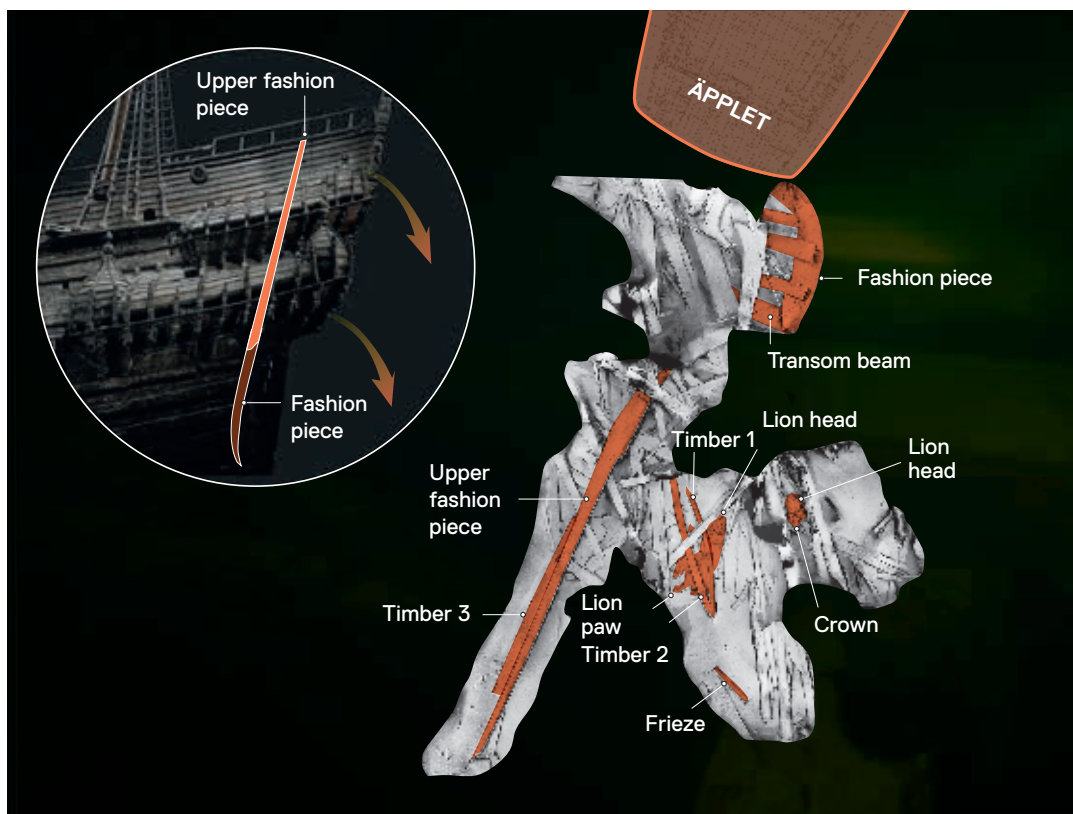
Measurements, construction details, wood samples and archival records showed unequivocally that the wreck could not be *Kronan*, *Scepter* or any of the other ships that are said to have been sunk at Vaxholm. The results all pointed in the same direction: the wreck at Vaxholm is *Vasa*'s sister ship *Äpplet*.

SCULPTURES AND 3D

In March 2023 the museum's maritime archaeologists, together with the navy, continued their investigations. Their focus was now on developing a 3D model of the extremely complex wreck site. Examining the bottom area around the collapsed stern was prioritised. Were there sculptures in the area, or had they been removed before the ship was sunk? Almost immediately, a large sculpted face of a lion was found. A paw, a tail and another lion's face were later spotted nearby - here was the entire

Swedish coat of arms, which had originally appeared on the transom. On top of this, additional wood-carved sculptures were found around the stern.

The 3D model is still under development, and more dives will be needed before it can be completed. The model will then form the basis for a more thorough reconstruction of the hull's shape and appearance. In addition, more of the wreck's construction details must be documented and compared with *Vasa* to find similarities and differences. But documentation of fashion pieces and transom beams in the stern already reveals that *Äpplet*'s stern is over a metre wider than *Vasa*'s. The survey also reveals that the total height of the stern is 1-2 metres higher than *Vasa*'s - a noteworthy result. There are plenty of questions we can now ask and answer thanks to the clues offered by another piece of the puzzle in the evolution of shipbuilding. Were the dimensions and proportions of the hull the only things that were changed on *Äpplet*? Were any other changes made? And were modifications made to the ship's superstructure, or was the deck height reduced to counteract instability? Hein Jakobsson



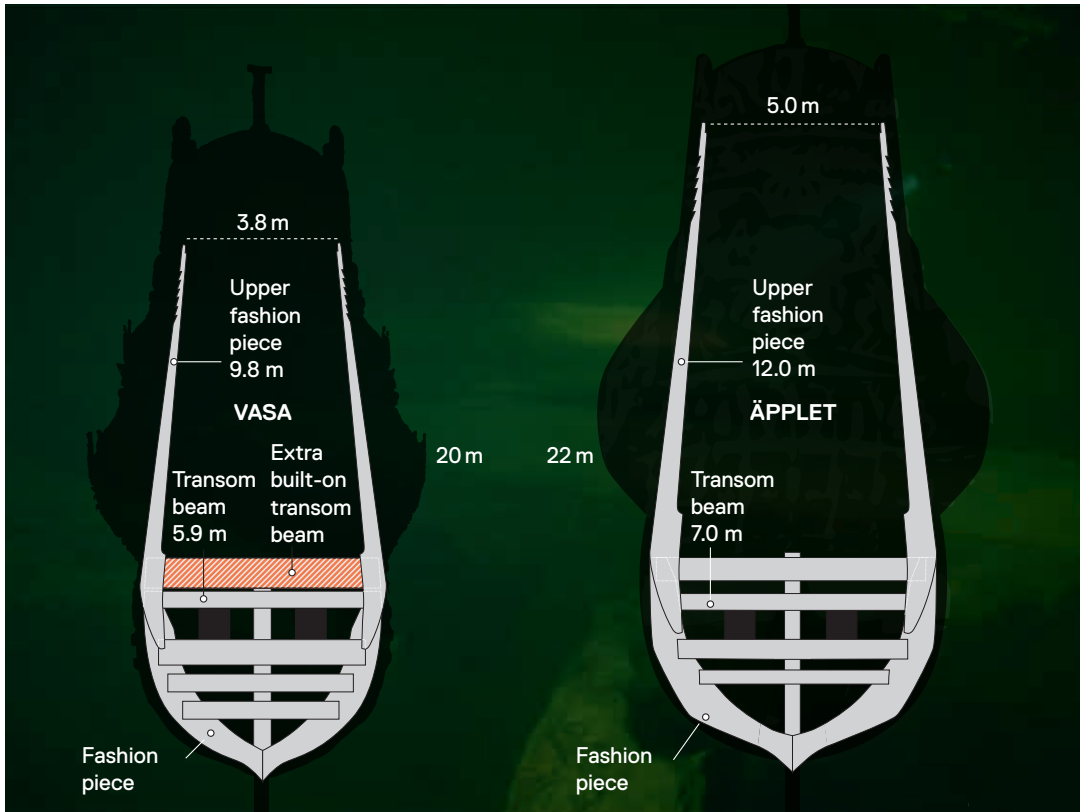
The entire stern has collapsed aft and downward to the bottom
 Drawing: Jim Hansson, Vrak/SMTM. Design: Alexander Rauscher.

was working at a time when Sweden was testing new waters and experimenting so that it could succeed in constructing large ships with good sailing characteristics and heavy artillery on board. The path proceeded from the unstable *Vasa* via *Äpplet* onwards to the more seaworthy *Scepter*, built in 1634. This evolution can be compared, for example, with the development of fighter aircraft in modern times. Several attempts - and some accidents - are expected before builders come up with a satisfactory solution.

ÄPPLET AND THE MIGHTY SHIPS

In January 1625, Gustav II Adolf signed a contract for the construction of several ships, including two large warships. One of these, later named *Vasa*, began to be built at

Stockholm's shipyard in the spring of 1626, the other about a year later. The latter ship is mentioned by name in historical sources for the first time in early 1628. It was called *Äpplet* and was probably launched in late spring that same year. In a letter dated November 1628 from the admiral Klas Fleming to the king, it is stated that 'Äpplet is for the most part finished and the masts have been installed, only the carvings and sculptures are the most incomplete'. *Äpplet* seems to have been rigged and armed by the summer of 1629, and possibly placed on standby at Dalarö in the Stockholm archipelago that same year. Besides *Vasa* and *Äpplet*, Another two large ships were built in Stockholm. *Kronan* and *Scepter* were launched in 1632 and 1634, respectively. In addition, *Göta Ark*, a ship of the same size, was launched in Gothenburg in 1634.



Äpplet's reconstructed stern cross-section. Noteworthy is that *Äpplet*, besides being considerably wider, was probably also 1-2 metres taller than *Vasa*. Drawing: Jim Hansson, Vrak/SMTM. Design: Alexander Rauscher.

ÄPPLET IN THE SERVICE OF THE NAVY

When Sweden intervened the Thirty Years' War in June 1630, *Äpplet* took part in the shipping of troops to Germany. The fleet consisted of 25 warships and an array of other ships, plus a total of about 12,000 men divided into four squadrons. The king led the first squadron on board *Tre Kronor*, which might seem noteworthy considering that *Äpplet* was newly built and the biggest ship in the fleet. Instead, admiral of the realm Karl Karlsson Gyllenhielm was on board *Äpplet* leading the second squadron. Among those on board the ship were a large number of soldiers who were to be landed in Germany - a total of six companies of up to 900 men. Including the navy's personnel, there were more than 1,000 people on *Äpplet* at the crossing. On 26-28 June, the

troops were landed at Peenemünde. *Äpplet* and several other of the largest ships were sent home at the end of July and stationed at Dalarö.

THE QUEEN AND THE GALLEY RAT

In the summer of 1631, the navy shipped more troops and supplies to Germany. In addition, Queen Maria Eleonora was on board the ship *Nyckeln*, since she wished to meet her husband Gustav II Adolf, who had spent the entire winter in Germany. During the crossing, the ships got separated due to fog and bad weather. When the fleet reassembled at Stralsund and the troops disembarked, *Nyckeln* was missing. *Äpplet* and a few other ships were dispatched on a search, and Maria Eleonora was found on Öland where she had sought

Lista

Nya S: Kongl: M: Fleetflattas Besättning 3 Sjöflokter Soldater Switzerie Jutzbed
 Klattans af löpande ifran i Domburg, Sijts oes förse och Datum den 1 Augusti Anno

Skeppet	Sjöflokten			Soldater			Summa
	Besättning	Sjunde	Dödes	Besättning	Sjunde	Dödes	
Scepter	200	10	1	211	125	9	135
Äpplet	209	3	-	212	133	1	131
Swärth	78	26	7	118	40	22	69
Recompens	56	30	15	101	29	17	46
Patricia	174	6	1	181	77	23	101
Ödenborg	132	7	4	140	93	2	96
Sanzon	69	43	5	117	32	28	65
Orsello	57	21	2	80	54	3	57
Alman	60	-	-	60	60	-	60
Solen	31	9	-	40	20	8	28
Ullebrunn	38	10	-	48	31	-	31

Details of the fleet's manning and the number of sick and dead at Rügen in 1645. *Scepter* and *Äpplet* are listed at the very top. Swedish National Archives, cropped. Photo: Patrik Höglund, Vrak/SMTM.

shelter from the storm. When *Äpplet* was moored at Kalmar, sailor Erik Jakobsson, nicknamed 'the galley rat', seized the chance to escape. Jakobsson had previously been found guilty of stealing from other sailors, though he had been pardoned. But because of his repeated bad behaviour, he was now sentenced to death.

During the period 1632–1643, *Äpplet* and the other large ships do not seem to have been in use very much. There was no direct threat from any other fleet on the Baltic Sea, and small and medium-sized vessels best managed shipments, surveillance missions and other matters. These were more seaworthy and did not require the same manning and armament as the biggest ships. The exceptions were when *Scepter* took part in a troop transfer in 1638 and when *Kronan* did the same in 1640.

THE WAR AGAINST DENMARK 1643–1645

At the end of May 1644, the fleet, consisting of around 40 ships, assembled at Dalarö. Admiral Klas Fleming was in command of *Scepter* in the first squadron. The large ships *Kronan* and *Göta Ark* led the second and third squadrons. The only large

ship missing was *Äpplet*. Queen Christina paid a visit to the fleet prior to her departure, and the naval articles – the navy's legal texts – were read out to the crews. On 1 July, the Danish and Swedish fleets encountered each other in the inconclusive Battle of Colberger Heide off the Bay of Kiel. In October that same year, the united Swedish-Dutch fleet won a major victory over the Danish fleet at the island of Femern. None of the large ships engaged in the battle; instead, medium-sized ships with many soldiers on board were relied upon.

In May 1645, the fleet, including *Äpplet*, *Kronan* and *Scepter*, assembled at Dalarö. Admiral Erik Ryning was in command on board *Göta Ark*. This seems to have been the only time all four of the largest ships had gathered for a naval expedition. Persistent headwinds delayed a departure from the archipelago to 20 June. Gotland was reached in stormy weather, where *Göta Ark*'s mainmast was broken and the ship was sent home. Once the fleet had reassembled and provisioned at Rügen, they set sail for Copenhagen in August. There, Ryning received the news that peace had been concluded, and the fleet sailed back home.

THE PERIOD 1646–1655

During this period, which was mostly a peaceful one on the Baltic Sea, the large ships were used sparingly, and *Göta Ark* was decommissioned in 1650 after only 16 years of service. In the autumn of 1654, *Scepter* and four other ships picked up Charles X Gustav's future consort, Hedvig Eleonora, in Eckernförde in Holstein.

WARS WITH POLAND, DENMARK AND THE NETHERLANDS, 1655–1660

In the invasion fleet that sailed for Poland with Charles X on board in July 1655, *Scepter* participated, though not *Kronan* or *Äpplet*. When war with Denmark broke out in 1657, it was instead *Kronan* that was part of Klas Bielkenstierna's fleet, which in September encountered the Danish fleet at Møn. After two days of fighting, the Danes retreated to Copenhagen to carry out repairs. *Kronan* also took part in the Battle of the Sound in October 1658, when the Swedish fleet tried to prevent the Dutch from coming to the aid of besieged Copenhagen. The hastily equipped *Scepter* was on its way to join the fleet, but was ordered to return home after the battle. The following year, both *Scepter* and *Kronan* took part in the naval engagements in the Sound with the fleet, which was now based in Landskrona in southern Sweden. As early as March 1660, *Scepter* sailed out with a squadron to keep an eye on the enemy in Copenhagen. When peace with the Danes was concluded, the fleet, including *Scepter* and *Kronan*, returned home to Stockholm in June.

THE LARGEST SHIPS ARE SCUTTLED

In March 1656, *Äpplet*, *Kronan* and *Scepter* were deemed to be in need of extensive repairs. *Kronan* and *Scepter* were repaired, but after a review in December 1658, *Äp-*

plet was considered a hopeless case due to the abundance of rotten parts requiring replacement. In addition, several vital timbers were warped and out of position. In 1659, the ship was scuttled in a strait at Vaxholm. It was not until 1675 that *Scepter* was sunk together with *Kronan*, probably in the same strait.

WHY WASN'T ÄPPLET USED MORE OFTEN?

Hein Jakobsson was aware that *Vasa* was unstable. But this was a common problem with large warships, with European fleets having several examples of ships that could barely sail and sometimes had to be girdled, meaning that extra planking was added at the waterline. With the ships *Äpplet*, *Kronan* and *Scepter*, Jakobsson developed the idea of large ships capable of carrying heavy artillery on two complete gun decks. *Äpplet* was no successful ship, and the fact that Gustav II Adolf did not use it as a flagship in 1630 indicates that it never became a seaworthy vessel. The extremely wide-hulled *Kronan* was probably not very seaworthy either, despite its being put into service in several naval campaigns. Nor did *Göta Ark*, built in Gothenburg, seem to have been a successfully built ship. It was not until *Scepter* that Jakobsson achieved a heavily armed yet relatively seaworthy warship.

The largest ships were rarely used. They were expensive to maintain, didn't sail very well, and were not as versatile as small and medium-sized ships. In 1636, when negotiations were being held to sell *Äpplet* and *Göta Ark*, Admiral Fleming declared that 'the great ships lie here mostly like ziraths'. That is, they were mainly anchored at Skeppsholmen looking magnificent. The Swedes even tried to sell *Äpplet* in 1639 and 1641, together with *Kronan*. According to the historian Jan Glete, probably no Swedish warship has been up for sale as often as *Äpplet*. The large ships that Gustav II



Vaxholm Fortress. Detail from *Suecia antiqua et hodierna*, National Library of Sweden. Copper engraving after a drawing by Erik Dahlberg, 1668.

Adolf had been passionate about building large warships but were simply not considered a winning concept. It was not until a few decades after the king's death in 1632 that building large warships took off again in Sweden.

ÄPPLET'S CREW AND ARMAMENT

According to an armament plan from 1629, *Äpplet* was intended to carry 74 guns, of which 56 were powerful 24-pounders. This means that the idea of unitary armament, with 24-pounders on the two gun decks - as on *Vasa* the year before - was still relevant. The unitary armament remained in place the following year, when the major overshipping of troops to Germany took place. In those years, *Äpplet* was by far the most powerful ship of the fleet.

In 1632, when the newly built ship *Kronan* was launched, the idea of unitary armament seems to have been abandoned. From this point on, the armament plans show only 24-pounder guns on the lower gun deck. The upper one was usually fitted with 12-pounder guns. *Äpplet* and the other three large ships were thus planned to carry roughly the same number of guns on board, about 60-70, of which about 26 24-pounders were on the lower gun deck.

An early manning plan from 1628 states that *Äpplet* should have the same number of sailors, 133, as *Vasa*. A few categories are missing from the list, including cook, steward and priest. The number of sailors, including these unlisted ones, should have totaled around 145. Soldiers were not included in the plan. A list from 1645 survives that specifies the navy's manning during the naval campaign that year. *Äpplet* is stated to have a crew of 346 men, of which 212 were sailors and 134 soldiers. Even though in 1658 *Äpplet* was hardly capable of taking part in a naval campaign, manning plans were drawn up for the ship. As with *Kronan* and *Scepter*, a manning of 264 sailors and 154 soldiers - a total of 418 men - was planned for *Äpplet*.

WHY WAS ÄPPLET SUNK AT VAXHOLM?

Since the mid-16th century, various methods have been used to block the straits around Vaxholm. In addition to stone caissons and similar structures, records indicate that at least 12 ships were deliberately sunk between 1656 and 1677. Often, for defensive purposes, decommissioned ships were scuttled at strategic locations during a war or in the face of an impending war. The main sea route to Stockholm passed Vaxholm. The more southerly route passing Baggensstället was only navigable for smaller vessels and was easy to block. The strategically vital Vaxholm straits, on the other hand, required great efforts to achieve a strong defence. At the time, decommissioned ships offered a good quick solution to close off the various straits in the area.

In July 1656, due to the war with Poland, the defences at Vaxholm were bolstered with deliberately sunk ships. A Dutch fleet had sailed into the Baltic Sea and anchored

off Danzig (now Gdańsk). Stockholm was perceived to be under threat, and the navy was stationed at Älvsnabben to protect both the city and the archipelago. The threat from the Dutch fleet was the likely reason for scuttling ships at Vaxholm in 1656. The sinkings of 1659 were also carried out in connection with war. This time, the threat came once again from the Dutch as well as from Denmark. Ships were also sunk during the Scanian War of 1675-1679. At Vaxholm, maritime archaeologists from the Museum of Wrecks have already examined *Apollo* and *Maria*, two medium-sized warships built in 1648 and sunk in 1677.

ABOUT SHIP NAMES

Many Swedish ships from the 17th century had the same names. When a new ship was built and christened *Kronan*, for example, and another ship already had the same name, the existing one could be called *Gamla Kronan* ('Old Crown') and the newly built one *Nya Kronan* ('New Crown'), or simply *Kronan*. The Stockholm area contains wrecks of an older *Vasa*, an older *Scepter* and a younger *Äpplet* than the ships of the same name mentioned in this article. Understandably, they are easily confused.

FURTHER READING

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FACTS ABOUT ÄPPLET AND VASA

Äpplet, 1629

Master shipwright: Hein Jakobsson

Length: Approx. 47.5 metres

Max. width to the outside of the plank: approx. 12.8 metres

No. of guns: 66-74

(26-56 heavy 24-pounders)

Sailors: 145-264

Soldiers: 134-154 (planned for 300 in 1628)

Launched: 1628, intentionally sunk in 1659

Vasa 1628

Master shipwrights: Henrik Hybertsson and Hein Jakobsson

Length: 47.5 metres

Max. width to the outside of the plank: 11.7 metres

No. of guns: 64

(48 heavy 24-pounders)

Sailors: 145-?

Soldiers: planned for 300 in 1628

Launched: 1627, sunk in 1628



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COMPILED BY: Marco Ali, Vrak/SMTM.
PHOTO AT LEFT: Jaco Bothma, Empire Photo,
Shutterstock 727286620

A **HANDHELD MIRROR** lets you keep an eye on your surroundings. With its convex mirror, you can also signal on the surface, check that everything is in the right place during a dive, or see if your equipment is leaking.



A **SCOOTER** (DPV, diver propulsion vehicle) is used to cover large areas during a dive. You save both power and air during the dive, plus the scooter is fun to use, too. Newer models have a built-in GPS.



FINS MADE OF NATURAL RUBBER
Children are sure to love these fins made of recycled rubber. This model has a closed heel and an opening for toes.



IN THE VRAK ANTHOLOGY, leading maritime archaeologists and historians take us to hidden and forgotten wrecks down in the depths. They turn over ship's planks and crawl under the skin of the sailors who perished in a storm on the seas.

A **STROBE LIGHT** is great for hanging on your shot line before you start diving. With its strong pulsating light, a diver can see it from a distance and get a reference for where the dive started.



DIVE FLAG
Make it a habit to always put up a dive flag while there are divers in the water.

The flag should be large and visible from all sides.





Inside the new shipwreck museum in Lovund, Norway. The boat parts will be installed in this steel cradle when they are fully conserved. Outside a ferry is headed to the mainland. Photo: Tori Falck, Norwegian Maritime Museum.

THE LOVUND BOAT

... and a different kind of shipwreck museum

By Tori Falck and Stephen Wickler

Vrak – Museum of Wrecks in Stockholm presents a rich maritime cultural heritage of diversity and depth. The museum’s creators have decided to tell the stories of the ships while leaving most of the objects themselves on the seabed, protected by the cold and brackish waters of the Baltic Sea. Apart from cold waters and maritime archaeology, a completely different shipwreck project is underway, in different surroundings, on the small island of Lovund in northern Norway. Lovund is a two-hour ferry ride from the mainland, close to the Arctic Circle. In this place people have always depended on what the sea has to offer, and consequently on boats. Only two boat wrecks from the Middle Ages have been discovered in the region, of which the Lovund boat is one. This makes it virtually unique. To this day, fish represent the main source of income on Lovund.

TO EXCAVATE OR NOT TO EXCAVATE?

The Lovund boat was found in 1976, when sand was being picked up in the small bay at Hamnholmen on Lovund. Tromsø Museum was notified, and the visible parts of the boat were documented. Since then, the locals have expressed a strong desire to ex-

cavate the boat and display it on the island in a separate boat museum. In view of the boat’s long-term preservation, it was considered an advantage not to leave it lying on the seabed. Because even if the water here is cold, it provides a habitat for the dreaded shipworm (*Teredo navalis*) and the ‘Gribble’ (*Limnoria lignorum*), which both like to eat away at oak. The boat was covered in a metre-thick layer of sand, yet the timber continuously decomposed at a rate that was unknown and undocumented. An underwater archaeological excavation for preservation and exhibition purposes is not only a time-consuming process, but highly expensive. Despite this, the project eventually became a reality. After a preliminary survey in 2016, a full

The excavation in June 2017.

Photo: Tori Falck, Norwegian Maritime Museum.



excavation was carried out the following year as a collaboration between an interest group at Lovund, the Norwegian Arctic University Museum in Tromsø, and the Norwegian Maritime Museum in Oslo.

Shipwreck diving is a fascinating hobby. By leaving the wrecks in the Baltic Sea where they are, they have great value as an experience for divers. But not all wrecks are ideal to experience in situ. Since the Lovund boat lay in shallow waters, fragmented, caved in and completely covered in sand, it provided no other experience than to stimulate the imagination of the locals. Theater plays and stories were created about the ship's unknown, mysterious history. With the planned museum, new stories are being crafted. Based on our current understanding of the boat, the museum will provide an arena for conveying the long history of the Helgeland coast and its ties to the sea and vital fishing activities. In the Middle Ages, boats served as the connection between the north-Norwegian coast and the market in Europe via the Hanseatic city of Bergen. Nowadays, primarily salmon is farmed at Lovund and then transported by land in trucks.

DOCUMENTATION AND CONSERVATION

The boat parts have been freeze-dried in preparation for their final resting place in the island's magnificent new building. Before the boat was placed in the freezer, it was documented part by part using digital 3D tools. Rivet holes and tool marks were carefully drawn. After freeze-drying, the wood was then treated with polyethylene glycol (PEG), the same as *Vasa* was treated with. PEG is a water-soluble wax that replaces degraded cellulose in the cells of the wood. The degradation is caused by the gradual breakdown and eventual displacement of cellulose when wood remains in water. The freezing process forces out the last drops of water from the wood, prevent-

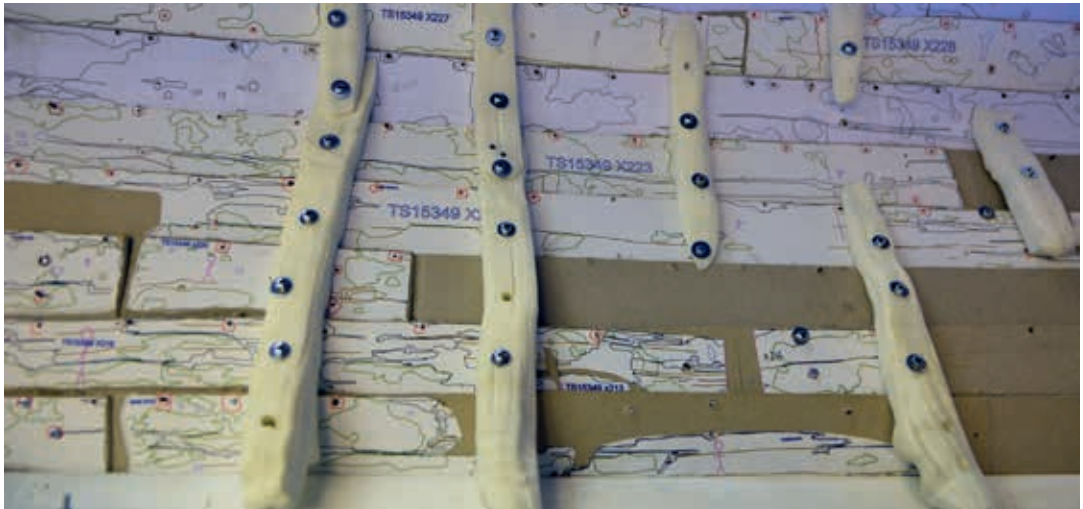
ing unwanted cracks when the boat parts are put on view for the public. This work will mainly take place on the island in order to avoid unnecessarily moving the highly fragile, fragmented boat material.

In autumn 2021, a steel cradle was put up in the new museum building so that the boat parts can be installed in it when the conservation is completed. The cradle was created by blacksmiths Steven Carpenter and Jan Remøe. Its shape is based on a 1:5 scale model of the boat, which was built according to the digital documentation from the excavation. The method used was a combination of 3D-printed plastic parts, mainly of the keel and frames, and paper printouts of the boat's planking that was drawn. The drawings were then glued to cardboard, in the same scale and thickness as the planks originally had. The model builder then illustrated the boat-building process by first stretching the keel and stems, and then building up the hull side plank by plank. The fragmented state of the boat posed the greatest challenge when building the model. Many parts were missing, and much interpretation was needed to arrive at a credible result.

THE BOAT

Although the Baltic Sea is a treasure trove of shipwrecks, the Atlantic coast of northern Norway is not as fortunate, with a mere handful of wrecks. In fact, only one other ship find from the Middle Ages is known. Incredibly, this late medieval find was discovered on the neighbouring island of Træna and the wreck excavated in 1959.

The Lovund boat was likely built around 1460 with oak timber from trees growing in southern Norway. It was a cargo vessel 12 metres long and fitted with a square sail. The boat had an open cargo hold and probably a small deck aft, though few definite traces remain. The hull is clinker-built, with 11 overlapping hull planks. The planks are held to-

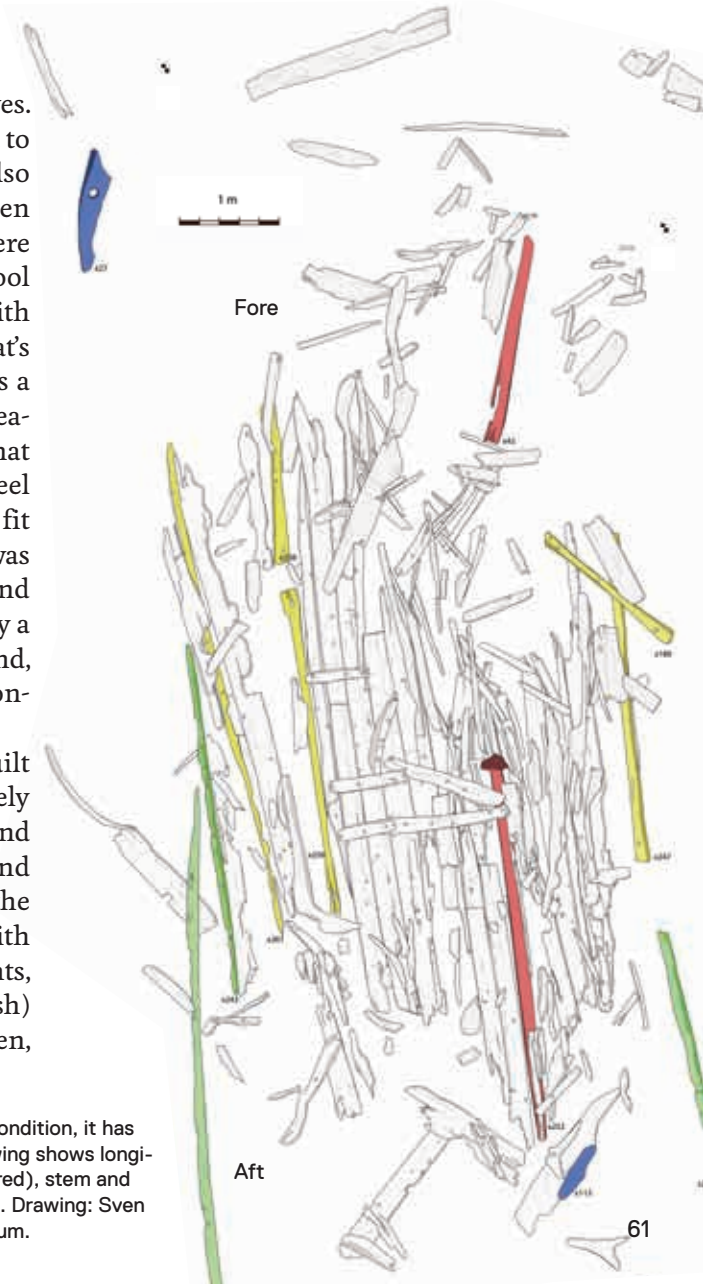


Detail from the model made in a 1:5 scale.
Photo: Tori Falck, Norwegian Maritime Museum.

gether by iron rivets with square roves. Between the planks, twisted wool helped to keep the boat watertight. The boat was also sealed using big pieces of woven woollen strips, especially in the many areas where repairs had been made. Both the wool and textile strips were impregnated with tar. About 20 frames make up the boat's skeleton, and at the sheer strake there is a relatively robust inwale. The exterior featured two rows of applied rub rails that also helped to strengthen the hull. The keel is robust, with a rabbet that serves to fit the garboard planking. The sternpost was straight, while the stem was curved and had two holes for cordage. Although only a small fragment of the sternpost was found, it was enough to produce a credible reconstruction.

The Lovund boat is a fairly simply built open vessel, yet with its strong keel, closely spaced frames, transverse beams, inwale and rub rails, it was robust enough to withstand the harsh weather conditions along the northern Norwegian coast. The boat, with a hardy crew accustomed to the elements, probably transported dried fish (stockfish) from the cod fishery in the north to Bergen, the trading city in the south.

Field drawing. Although the boat is in fragmentary condition, it has nevertheless been possible to reconstruct. The drawing shows longitudinal reinforcements that are colour-coded: keel (red), stem and sternpost (blue), inwale (green) and rub rail (yellow). Drawing: Sven Ahrens and Rune Borvik, Norwegian Maritime Museum.



A LOT OF KNOWLEDGE IN SMALL FINDS

Something we have spent much time ruminating on is why so much of the boat remained at Hamnholmen. Although we did not find any cargo, plenty of boulders that don't look like ordinary ballast were found in the hull. Were the rocks used to scuttle the boat? There is no doubt that the boat was old and leaking. This is demonstrated by thick layers of tar smeared on the hull long after the boat was built. Traces of repairs, in which barrel staves were used to replace bad planks, were also documented.

The boat had no cargo on board, and most of the finds can basically be defined as 'rubbish' - but rubbish that tells a compelling story about the boat as a living being over time. Meal leftovers consisting of bones from cattle, farm animals like sheep and pigs, and fish bones from cod, haddock and pollock tell us about people's diets. Artefacts lost on board also include woollen textiles, wooden nails and wooden dowels, as well as the only known find of parchment that we know of from a wreck in Norway. Reusing and repurposing objects was clearly a fundamental principle for those who used the boat. This includes worn-out leather shoes and parts of leather garments as well as other items made of leather, such as a lid for a storage box and a bag made of cow leather and sheepskin or goatskin. Except for the shoes, all the leather pieces show traces of having been re-cut.

A benchstone over 50 centimetres long was found at the aft end of the keel. A benchstone is a larger kind of whetstone that is used lying flat on something, such as a workbench. Two small lace-up shoes from different pairs of shoes, belonging to a woman or a child, had been placed under the benchstone as a kind of pillow. The most interesting and informative find was a thick lump of pitch lying on the keel between the mortise of the sternpost and the benchstone. A number of small finds and

plant remains were found in the lump of pitch and have been interpreted as debris from the bottom of the hull that was randomly mixed with the pitch. These finds proved to be a unique knowledge bank that sheds light on the activities that took place on board as well as life during the latter half of the 15th century. The lump of pitch contained items like wooden dowels, a pointed stick and fire-making flint refuse, as well as plant debris like wood chips, birch bark, twigs, charcoal, hazelnut shells, moss and cereal seeds. In addition, traces of animals were found - feathers, burnt crab claws, fish skins with scales, and small bones from fish and cattle. Plant analyses carried out by archaeobotanist Jens Heimdal have identified barley and oat cereals, as well as juniper berries, at least eight common weed types associated with farming, hops and bog myrtle (*Myrica gale*). The latter two are often used to brew beer.

The museum's inauguration is scheduled for 2024, and the museum hopes to inspire many people to make the long trip out to Lovund to visit the scenic island and its new museum.



A whetstone found in the aft of the boat.
Photo: Mari Karlstad, the Arctic University Museum of Norway.

FURTHER READING

Lovundbåten - fra utgravning til utstilling. Facebook group.

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WRITERS IN THIS ISSUE

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“ One of the standout features of the museum is how it seamlessly combines education with entertainment. It offers a real treasure trove of knowledge, presented in a captivating way.

Review by museum visitor Jai