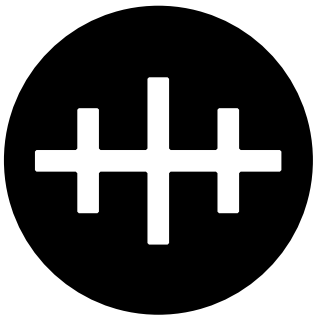
UNDER THE SURFACE

STORIES FROM VRAK – MUSEUM OF WRECKS



VRAK

MUSEUM OF WRECKS

part of the SWEDISH NATIONAL **MARITIME** AND **TRANSPORT** MUSEUMS

UNDER THE SURFACE
STORIES FROM VRAK – MUSEUM OF WRECKS

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LARS AMRÉUS · LEIF GRUNDBERG

FOREWORD

At the bottom of the Baltic Sea lies a unique cultural heritage. No seascapes anywhere else in the world are the same or even similar. The rich, multifaceted remains and the exceptional preservation conditions of the Baltic Sea thus provide a valuable source of knowledge and experiences that affect us all.

Thanks to its special environment and history, the Baltic Sea contains a unique variety of well-preserved shipwrecks and other remains from different eras, many on the same scale as the renowned 17th-century ship *Vasa*. Despite this, few people have had the privilege to access and experience this underwater world. We think it is high time to bring the remarkable heritage of the Baltic Sea to the surface and make it available to everyone. The Swedish National Maritime and Transport Museums have chosen to do this by creating an entirely new museum called Vrak – Museum of Wrecks.

The Baltic Sea has long been one of the world's busiest seas. A unique combination of brackish water, cold, darkness and low oxygen content in the sea enable organic materials like wood to be preserved in almost perfect condition. In recent years, advances in technology and modern maritime archaeology research have contributed to dramatic developments in our understanding of this cultural heritage. These advances also give us new ways to convey knowledge about the remains. With the help of finds and digital technology, we can show and tell about people's relationships to the sea. The museum depicts the entire history of the Baltic Sea, from the Stone Age to the present day, as reflected in the remains on the seafloor. It is a history of trade contacts and ties of friendship, and of difficult questions about war and human tragedies. This is our story.

There is currently no other museum experience in the world that conveys the history of an entire region to a broader public through the cultural heritage preserved under water. But here we are able to reveal this history through close collaboration with stakeholders from the public and private sectors and from academia, in all countries concerned. Every year, maritime archaeologists uncover amazing new finds in the Baltic Sea – and much is left to discover. This gives rise to urgent new research topics and research partnerships.

Vrak – Museum of Wrecks tells about all this in the exhibitions as well as on the museum's website and social media, which are important components of the museum. Through the activities and research of our maritime archaeologists, and through collaborative projects on the Baltic Sea, the museum becomes something greater than the physical building alone. Using a variety of channels, it offers a hub for experiencing our maritime cultural heritage and the work of preserving it.

By telling about the Baltic Sea's cultural heritage, we are helping to preserve its values. But unfortunately, this heritage is under threat due to looting as well as environmental degradation and other human influences. We believe that awareness and knowledge of both the values and the threats are the best way to protect and preserve our common cultural heritage for future generations. This approach also brings the importance of long-term sustainability and international collaboration into sharp focus. Such global issues are central for the Swedish National Maritime and Transport Museums, which include Vrak – Museum of Wrecks together with the Vasa Museum, Maritime Museum, Naval Museum and Railway Museum. Our vision is to broaden people's world view through knowledge that brings about change, unforgettable experiences and engagement.

We would like to thank everyone who has made a contribution to the new museum and to this book. We hope and believe that Vrak – Museum of Wrecks can provide fresh perspectives and insights about our past and our present.

We hope you enjoy discovering the secrets of the Baltic Sea!

Lars Amréus
Director General of the Swedish National Maritime and Transport Museums

Leif Grundberg
Director General of the Swedish National Maritime and Transport Museums 2015–2021

The staircase in Båthall 2 leads to the exhibitions on the upper floor.

ANNA ARNBERG · ODD JOHANSEN · PER WIDÉN (EDS.)

INTRODUCTION

The Baltic Sea is unlike any other sea, with its lack of tides, ice freeze-up in the north, narrow inlet through Øresund Sound and shoreline displacement. Its brackish water creates special conditions for marine life and the preservation of organic materials. In addition, the sea is shallow and not very wide, which affects navigation. These conditions, to some extent specific to the Baltic Sea, are something that people who live and work by the sea or travel across it need to understand and master.

The Baltic Sea is also a sea that remembers. At the bottom lie tens of thousands, perhaps even a hundred thousand, wrecks and other remains, from settlements and defence facilities to mines and sunken ships. Its depths hide testimonies of contacts and alliances, of war and conflict, of life and death, of major historical events and individual lives. It represents a cultural heritage shared by and uniting all the people who have lived and live around the sea.

It is these events, both great and small, that this book explores. *Under the Surface* contains twenty-four chapters that aim to give context to the exhibitions at Vrak – Museum of Wrecks. But the book can also be read on its own, or why not before a visit to the museum? At our disposal we have had maritime archaeologists and researchers from across the Baltic region, in other words people who know the most about what is revealed in these pages. You can read more about the authors at the end of the book.

A SEA IN A BUILDING

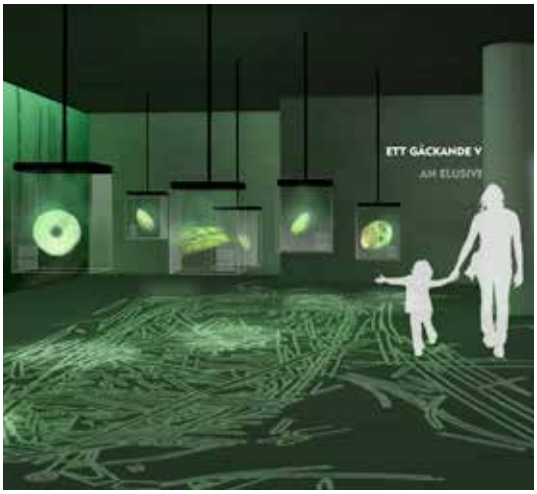
In 2021, Vrak – Museum of Wrecks opened the gates to the underwater world of the Baltic Sea. An entire sea moved into Båthall 2 ('Boat Hangar 2') at Djurgården in Stockholm. In five exhibitions, we take a journey through the Baltic Sea and follow the people who have lived by the sea, lived off the sea and travelled across the sea.

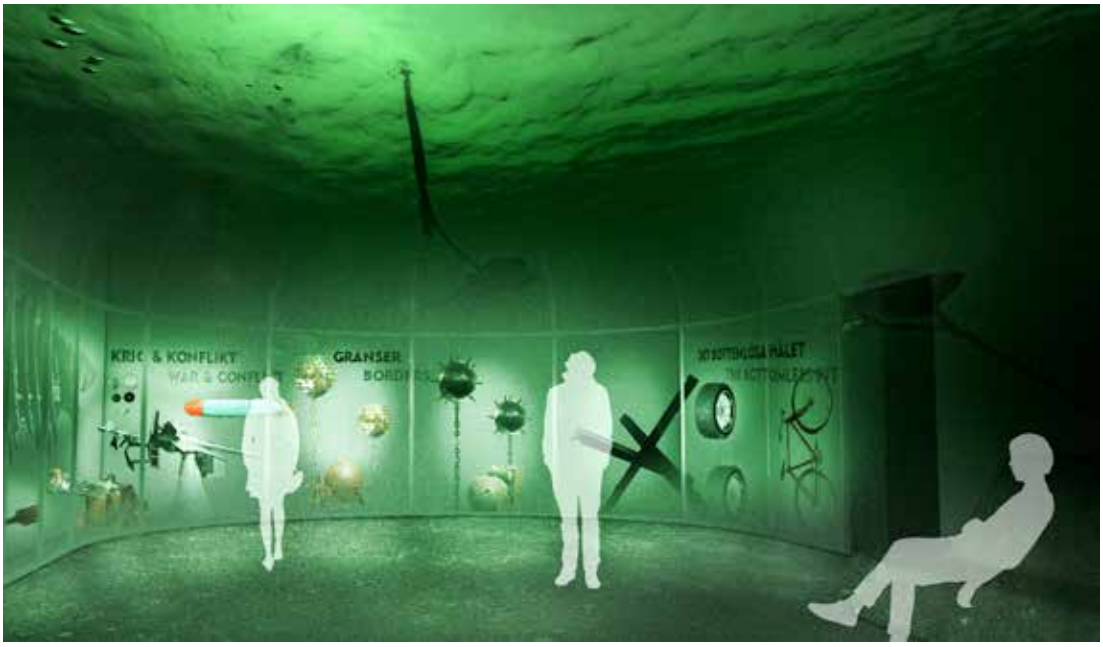
The boat hangar was built in the early 1940s as a storage and repair site for the Swedish navy's smaller boats. The building itself is interesting from a maritime history perspective, but it also embodies a piece of architectural history and is an important part of the

Above: Båthall 2 was designed by the architect Paul Hedqvist. The building was completed in the early 1940s and is now a government-listed building. Only minor changes to the exterior have been allowed in its conversion to a museum. In the interior space, new exhibition rooms and public spaces have been created.

Left: In 'The Assignment', visitors take on the role of maritime archaeologist and solve an archaeological mission, one step at a time.

Below: The ship *Resande Man*, which sank off Landsort in the Stockholm archipelago in 1660, plays a prominent role in the museum. Through a combination of innovative technology and curation, the wreck site is made accessible to visitors even though the wreck itself is located at the seafloor.





The exhibition 'Sea of Memories' introduces the visitor to the rich cultural heritage of the Baltic Sea. Through an evocative, immersive film experience, the audience gets to be part of an underwater adventure. Here, the Baltic Sea speaks in its own voice, telling us about war and conflict, borders, trade and contact. Artefacts from the bottom of the Baltic Sea carry the story of the sea as a source of both life and death.

cityscape. The hangar's architect, Paul Hedqvist (1895–1977), emerged over his lifetime as a central figure both in the construction of public buildings in Sweden, and, not least, for the introduction of functionalism in housing construction. Some of his other merits include the Västerbron bridge in Stockholm and Bromma Airport.

Båthall 2 was thus designed and constructed without any intention to one day house a museum. The building interior underwent extensive renovations prior to the museum opening, with five exhibition rooms split over two floors. The architectural firm Fahlander Arkitekter designed the new space. Their main focus was to create a beautiful, functional and sustainable museum building, as well as to retain and strengthen its historic character. Although we'll never know, of course, whether Paul Hedqvist would have liked the alterations, we think and hope he would have.

A SEA THAT DOES NOT FORGET

A point of departure for building Vrak – Museum of Wrecks was to give visitors the chance to experience and enjoy the cultural heritage at the bottom of the Baltic Sea, without salvaging or making any major alterations to the underwater sites. Instead, remains are displayed using digital technology and objects from museum collections around the Baltic Sea. The sunken past can be experienced in the museum, while the remains themselves are often still on the seafloor for researchers and divers to continue exploring.

The museum takes visitors on a journey through time and to the events behind the unique cultural heritage preserved under the surface of the Baltic Sea. The journey begins during the Stone Age, by the shoreline of Little Belt in Denmark, and ends in 1994 with M/S *Estonia* in the middle of the Baltic Sea.

A sea like the Baltic Sea is brimming with history. The exhibition 'Our Shared Sea' is based on six different remains that communicate the long, interconnected history of the Baltic Sea region. Here, the visitor gets to experience moments from the sea that we share – and that can also divide us.

The exhibitions have been planned and organised by the Swedish National Maritime and Transport Museums (SMTM), developed, designed and produced by Expology, and built by Bruns. The content has been developed by SMTM with the support of the museum's advisory board – an expert network established and coordinated by the museum – and other colleagues around the Baltic Sea. It is our hope that the result, in addition to offering an eye-opening experience, will provide new opportunities to understand the world and our history.

UNDER THE SURFACE

Of all the remains in the Baltic Sea, we have chosen to showcase seven of them in the exhibitions: Tybrind Vig, the Darss Wreck, *Solen, Resande Man, Vrouw Maria, U-479* and M/S *Estonia*. The selection of remains represents a variety of periods and geographies, but they were primarily chosen because they reveal the extensive and interconnected history of the Baltic Sea. Together, they offer an insight into what the Baltic Sea is and has been. A sphere of contacts and conflicts. A source of livelihoods and knowledge. A spring of hope, joy, opportunity, adversity and sadness. All parts of a sea that are as relevant today as they have been over time.

Each one of the remains is dedicated a chapter in this book. The book also places the remains in a broader narrative and provides insights into the communities and contexts they have been part of. Although the chapters can be read on their own, together they give a more complete and complex picture of history.

The book begins and concludes with sections on maritime archaeology and what underwater cultural heritage means to us today. A source of invaluable knowledge and experiences, but when it comes to contemporary wrecks in some cases also a threat and part of the increasingly intense fight against environmental degradation.

MARITIME ARCHAEOLOGY AND WRECKS

THE STUDY OF SUNKEN HUMANITY

JOHAN RÖNNBY · MARITIME ARCHAEOLOGY AND WRECKS

At the bottom it is cold, dark and calm. Materials do not dehydrate, and sedimentation encapsulates and protects artefacts. **It's almost as if time stands still.**

Out in the middle of the Baltic Sea, east of the island Gotska Sandön, a nearly intact ship from around 1650 rests 120 metres below the surface. Round-shaped cargo ships, known as fluits, were the main tool driving the booming Dutch global economy during this time.

JOHAN RÖNNBY · MARITIME ARCHAEOLOGY AND WRECKS

THE STUDY OF SUNKEN HUMANITY

Wherever people have lived and laboured, they have left traces behind – interventions in the landscape itself, buildings and structures, and, to a large extent, different objects and items. Sometimes these things were created and built for the specific purpose of remembering someone or something special. Other times, they emerged as a physical testament of an argument for a particular idea, a boundary to keep others away or something else requiring a manifestation in material form. But they could also be simple remnants of everyday life: things used for one's livelihood, things abandoned and neglected, and things simply thrown away as waste.

TRACES OF HUMANKIND

Archaeology is a scientific discipline that studies the numerous traces humans have left behind. By finding, documenting, reconstructing and, not least, interpreting these remains, we can learn not only about people from other times but ultimately about ourselves.

Throughout the ages, people have used water in different ways: for fishing and collecting aquatic food, for irrigation, and for travel and transport. Structures have been built in connection with various activities along the shorelines and coast, and boats and ships in the widest variety of shapes and sizes have been built over the millennia.

What distinguishes different scientific disciplines and research perspectives is the work method and choice of source material. The field of maritime archaeology is a subject rooted in the study of material remains of human activity associated with seas, lakes and rivers

Entire sections of the landscape below sea level in the southern Baltic Sea have been submerged by rising water levels. The photo shows a fishing trap from the Stone Age site Trudse Hage in the Great Belt of Denmark.

which have been preserved under water. The subject is thus a methodical, source-material based specialisation in archaeology as well as in relation to all the other sciences that study human cultures and societies. Studying different questions and aspects of being human primarily through sunken material remains can be considered the special research perspective and the most distinguishing characteristic of maritime archaeology.

DOWN AT THE BOTTOM

Archaeological material can end up under water for a variety of reasons. Ships can wreck in a storm, or objects might simply be dropped in the water from a pier or quay. It can also be the result of conscious planning, such as for defence installations or fish traps, or the remains of platforms that people have lived on.

Remains that become submerged by rising water levels represent a special category. In this case, entire sections of the landscape might vanish under water. The southern Baltic Sea presents examples of this. On the seabed, you can find tree remains and riverbeds with fish traps from the early Stone Age when the sea level was up to 20 metres lower during certain periods.

Just because some archaeological remains lie under water does not make any difference in theoretical approach from what is known as dry archaeology. The sunken past consists of different types of materials from different eras, and it offers up traces of an incredible variety of events and societal contexts.

There are, however, two things that unite the otherwise often highly diverse maritime archaeological source material in water. First of all, maritime archaeologists use special study methods that utilise technical equipment for diving and underwater documentation. Scans of larger areas can be done using different types of sonar techniques and high-frequency sounds. A maritime archaeologist who wishes to visit, study or excavate the seafloor must, of course, have suitable diving equipment. At greater depths, or for time-demanding dives, archaeologists can use a remotely operated vehicle, or ROV, which is equipped with cameras or perhaps grapple arms and suction equipment for excavation.

WHERE TIME STANDS STILL

Secondly, because the archaeological source material has been deposited and preserved in water, remains from the past are usually of a different nature than those on land. One of the greatest advantages of underwater archaeology is that organic matter is preserved far better in water than on land. The processes and microorganisms that break down organic matter are virtually non-existent in oxygen-poor bottom sediments. The material does not dehydrate, and there is often geological sedimentation in the water that encapsulates and protects objects. Although there are exceptions, the underwater environment is also very stable: the water is cold, dark and still at the bottom. In addition, underwater remains have usually been less exposed to human impact than ancient remains on land.

This favourable preservation environment means that ship hulls, as well as food residues, textiles and waste materials, can be preserved in principle forever down at the bottom of the sea. The often uniquely preserved organic material allows scientists to study part of the archaeological source material which is often lost in land-based archaeological material.

For various reasons, the Baltic Sea provides ideal preservation conditions for sunken remains. For one, the wood-eating shipworm does not thrive in this brackish inland sea as it does in other seas. The Baltic Sea is also murky and cold, with low biological activity, and its deep bottoms do not have waves or currents that can erode the remains. Centuries-old shipwrecks can therefore be preserved at the bottom of the Baltic Sea almost completely intact, with masts standing in place. So, a diving archaeologist can basically 'board' an old ship and encounter a pristine environment where time has almost stood still.

MARITIME CULTURE ...

Maritime culture usually refers to the habits and activities of people living and working by the sea. *Nautical* refers more specifically to activity that involves ships and shipping.

Maritime culture is interesting in comparison with agrarian culture, for example, which is usually the historically dominant one. The conditions for survival in the archipelago's outlying areas have often differed from those in central farming settlements. Moreover, seafarers have often had a unique culture of their own revolving around travel and foreign contacts. Ships in themselves constitute quite a special maritime archaeological source material as modes of transport and technical structures, but also as sunken time capsules.

Furthermore, from a long-term perspective humans and the sea is a maritime topic which can reveal our overall relationship with the physical environment around us. Are there shared connections and structures throughout history that shape our relationship with the sea, a sort of 'maritime durées'? Functional, communicational or mental dimensions that coastal peoples have always shared? Things that fishermen and sailors have done similarly for generations?

In 1564, Erik XIV's newly built flagship *Mars* sank east of Öland during a battle against allied naval forces from Denmark and Lübeck. *Mars* went up in flames and sank in the middle of a fierce naval battle. Shipwreck divers therefore consider themselves as visitors not just to a wreck, but to a well-preserved battlefield. The timbers are black with soot, and cannons and war equipment are everywhere.

... AND BEYOND

Sunken archaeological remains can often be used to great advantage to study both maritime and nautical phenomena. However, there is no reason to limit research too strictly to one type of source material only. Naturally, artefacts and other objects underwater should be understood and analysed together with other archaeological remains. Whether the source material is found in water, at a shoreline or up on land does not really matter. As an archaeologist, answering questions by using information from artefacts associated with water is only one possibility among others.

The potential to achieve interesting results is also greater if the archaeological conclusions are tested in light of theories and research from other disciplines. For example, if written records exist, these are also important to consider. Archaeological source material and historical texts can often complement each other and generate new insights or questions. Good research on humans is almost always multidisciplinary.

Besides this, not all maritime archaeology activities need to revolve around maritime questions or are specifically associated with water – just as all archaeological material found in the forest, mountain areas or arable land need not exclusively involve human interaction with these landscape types. With the help of maritime archaeological source material, many other aspects of human behaviour that are not directly related to the use of seas and lakes can be illustrated and studied. Shipwrecks can, for example, make excellent objects of study for those interested in the history of systematic violence, the foundations of capitalism or gender attitudes.

In 1495, the Danish king John's carvel-built carrack, *Griffen/Gribshunden*, sank outside Ronneby in Blekinge in southern Sweden. In the bow of this warship, which was modern for its time, sat a fearsome monster figure in the process of devouring a human being.

THE MEANING OF THINGS

A central scientific question for a discipline that takes its point of departure in things themselves is the relationship of these things to people and societies. Objects and techniques can be viewed as a result of progress and economic circumstances – as products of culture and symbols of power.

A possible general approach, however, is to emphasise the dialectic nature of material culture. The duality of such a relationship underscores how things and people have been entangled throughout history. We have created things for different needs and purposes. But these things have also compelled us to act, laying the groundwork for and driving social change. For example, carvel-built warships played an essential role in the development of nation states, globalisation and the transition from the Middle Ages to the new modern era in Europe.

As regards Baltic Sea shipwrecks from different eras, their variety of cargo and far-flung places of origin speak volumes about commerce and communication. This makes them especially suitable for a narrative about contacts and change, revealing how history has always been a mixture of things, ideas, cultures and peoples.

A long-term view of sunken remains can also shed light on the diversity of people's behaviours and actions throughout the ages. Using whatever means at their disposal, people have made choices and, for better or worse, shaped their own histories. It is the remnants of these innovations, successes and failures that have wound up at the bottom. Through close encounters with these things, we can recognise ourselves and reflect on the causes of human behaviour over the centuries and in our contemporary society. Perhaps this could even make us a bit wiser in our future choices.

In Tingstäde Träsk on northern Gotland, a large wooden fortress was built in the middle of the shallow lake during the transitional period between the Viking Age and the early Middle Ages. The bottom contains remains of timber chests that the fortress rested upon, in addition to well-preserved building components from various buildings above the platform.

EXPLORING OURSELVES

Encountering a prehistoric forest, a Viking Age blockade of stakes or a well-preserved ancient shipwreck on the seafloor is an evocative experience. Perhaps this experience can also be part of the scientific perspective of maritime archaeology? An unexpected encounter with something strange and exotic, yet a recognition of a piece of humanity deep down on the deserted bottoms of the sea. Both the things themselves and our intimate connection with them become clearer. Visiting the sunken past and the old remains, whether as a diver or through images and film, can thus be a way to reflect on the human condition. The role of technology and underwater exploration in maritime archaeology is in addition a fascinating topic in itself. Maritime research equipment is a kind of 'thing of exploration'.

Curiosity, the thrill of discovery and technological innovations that allow us to explore and learn more are what truly set us apart as human beings. This is especially true of our ability and enthusiasm to work together and solve riddles and mysteries – both above and below the surface.

FROM SHIP TO SHIPWRECK

LOTTA MEJSHOLM · MARITIME ARCHAEOLOGY AND WRECKS

The Baltic Sea hides many wrecks – each of them with **its own story to tell.**

In 2019, two major shipwrecks were found in the Oxdjupet strait in Vaxholm, Sweden. The photo shows the starboard side of one of the wrecks. The great depth of the strait, at 25 metres in the 1650s and 35 metres today, likely explains why the ships were sunk in their entirety and not chopped up, as is otherwise often the case with scuttled end-of-life ships.

LOTTA MEJSHOLM · MARITIME ARCHAEOLOGY AND WRECKS

FROM SHIP TO SHIPWRECK

There are many reasons why ships end up on the seabed as shipwrecks. Sinking in a storm or rough waters is a risk seafarers have had to confront since time immemorial. Ships have also gone down during naval battles or other hostile attacks. Yet another category of wrecks includes ships that are decommissioned, repurposed and sunk to block shipping lanes or used as building materials for quays and piers. The Baltic Sea hides many wrecks – each of them with its own story to tell.

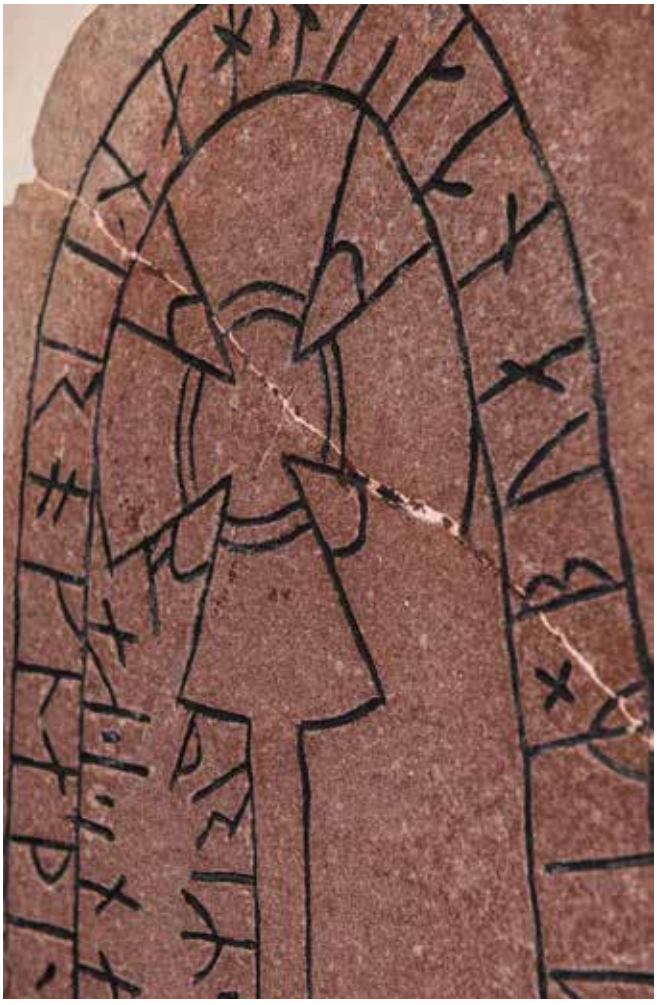
HE DROWNED IN THE HOLM SEA

A rune stone from the 12th century stands in Vallentuna Church outside Stockholm. It was originally erected by a woman named Ingeberg, along with her daughter and sister-in-law, in memory of her husband. The runes tell us that Ingeberg's husband drowned during a shipwreck, probably on the Baltic Sea. The text on the rune stone ends with a poem:

He drowned in the Holm Sea.
His knarr went under,
of the survivors there were only three.

A knarr was a kind of stable merchant ship often used for longer sea passages. The Holm Sea is interpreted as meaning the waters around Bornholm, or some other body of water, on the way to Novgorod (called Holmgard in Viking Age Scandinavia) in Russia. Ingeberg's husband was certainly one of many who vanished while crossing the Baltic Sea. But how common shipwrecks were at the time is something that sources remain silent on. To get an overview of why ships sank, we need to take a step forward in time.

When in 1910 the Swedish National Board of Trade began to record the causes of Swedish



Runestone U 214 is walled inside the tower room of Vallentuna Church north of Stockholm. The inscription tells of a ship that sank, probably in the Baltic Sea.

ship accidents, it appears that one risk factor caused more accidents than anything else – the forces of nature.

In this particular year, 1910, a total of 20 shipwrecks were recorded. Of these, as many as 16 were reported to have been due to 'unavoidable natural causes, stormy weather, etc.' Other causes included inappropriate loading, improper navigation and so on – handling errors, one might say. The figures for the following years are similar; the forces of nature are by far the main reason why ships sank.

THE FORCES OF NATURE

The weather and the winds have likely always been a concern for seafarers. Long ago, people had to rely on observations of cloud formations, how the water moved and what it sounded like, animal behaviours and other natural phenomena to predict an upcoming change in the weather. Many are the depictions of ships that have been wrecked in a storm. One such event took place almost 500 years ago off the island of Gotland, when no fewer than 15 ships of the Danish-Lübeck fleet went under in a fierce storm. It was 27 July 1566. The Danish-

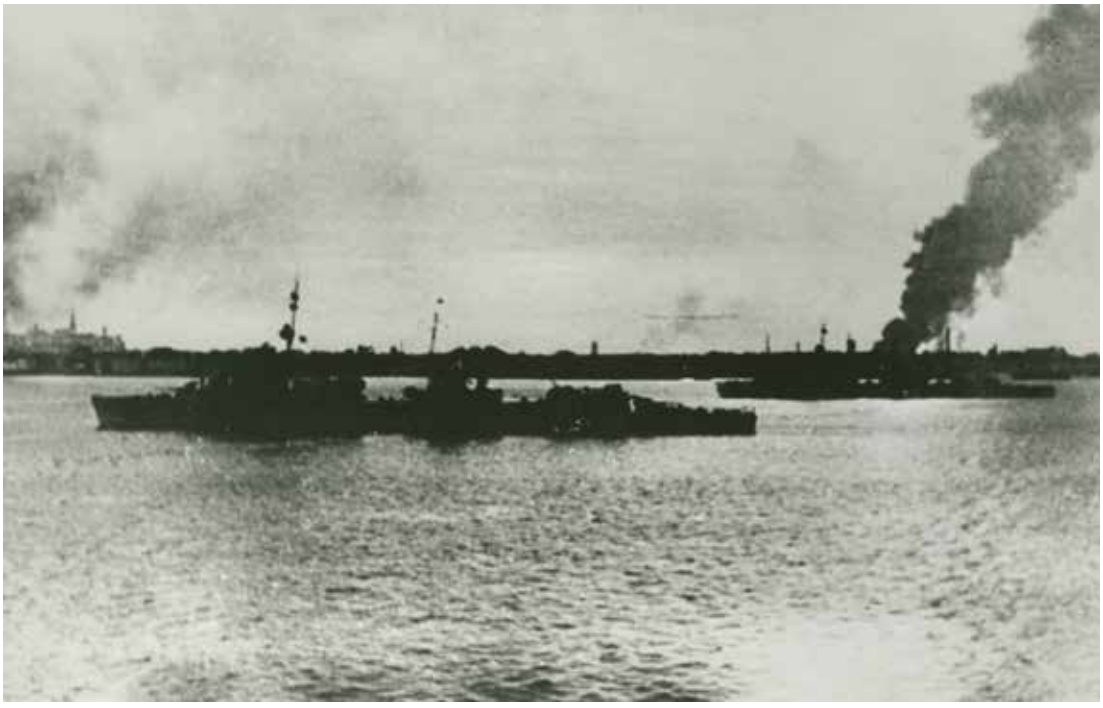
After the disaster of 1566, King Frederick II of Denmark ordered the lord of Visborg Castle to salvage what he could from the stranded ships, in particular the valuable rigging. Objects that remind us of the accident still lie on the seabed along the coast of Gotland, such as this copper bearing from a rigging block. Between 2007 and 2011, remains of the Danish–Lübeck naval fleet were examined by Heritage Underwater Maritime Archaeology Gotland (HUMA).

Lübeck fleet had just fought a major naval battle against the Swedes off Öland. During the battle, a nobleman had lost his head and his life. He would now be buried in consecrated Danish soil. Gotland belonged to Denmark at the time.

Despite warning signs of an approaching storm, the 39-ship fleet anchored off Visby on Gotland. The following night, a strong northwesterly wind began to rage. When the wind grew into a proper storm, attempts were made to haul in anchors and escape to deeper waters – but it was too late. The ships were flung onto the shores and many were destroyed. A contemporary chronicler later marvelled at how these seafaring people could have missed the unfailing signs of an impending storm:

> *The Danes could have well foreseen this [storm] before, because the same [crew] the previous night heard such a wailing cry and rattle under the ships at the bottom of the sea, that all men were amazed by it. And an hour or two before the storm came, the sun was transformed, becoming at once both yellow and green, and many a lament was heard in the air. And even though it was ever so still, the water roared so strangely and resoundingly underneath the ships as if there had been a storm. Then the storm arrived with such haste, as if it had come rushing out of a sack, and lasted for six hours.*

The next morning, it was stated that the storm that had 'come rushing out of a sack' (in other words, unannounced) had caused the destruction of 15 ships and that several thousand people lost their lives. Today, scattered memories of the disaster including guns, ship equipment and personal belongings remain on the sea floor along the west coast of Gotland.



Tallinn, 28 August 1941. The evacuation of Soviet ships from the port of Tallinn to Kronstadt had begun the night before.

ACTS OF WAR

In 1914, a new category of causes was added to the Swedish statistics: 'exploded by a mine'. Acts of war affected six Swedish ships in this first year of World War I, but there would be many more. In the statistics, we can follow the tragic impact of war on the number of lost merchant ships. During the bleak year of 1917, no fewer than 64 civilian Swedish ships were wrecked by mine blasts and naval, air or land attacks.

During the world wars, which brought advances in weapons technology that gave far greater range and precision than before, and with the appearance of submarines and aircraft in warfare, individual events could lead to disasters of an almost unimaginable scale. One such event is the evacuation of Soviet ships from the port of Tallinn, where they were surrounded by German armed forces in the summer of 1941. The evacuation, which began on the evening of 27 August, later came to be known as the 'gauntlet in the Gulf of Finland' or the 'Tallinn disaster'. The event has been described as one of the worst disasters of World War II.

Over the course of a few days, Soviet ship convoys tried to break out of the besieged port to escape to Kronstadt deep in the Gulf of Finland. The evacuation was expected, so the Finnish and German navies had already laid out minefields that blocked the fairway. Under heavy Finnish artillery fire and German aerial bombardment, between 150 and 200 ships, of which several were cargo steamers, would make their way through the dense minefields. The wind had picked up to a strong gale, and later testimony tells us that the ships went down one after the other. No one was allowed to stop when a ship sank; the speed had to be maintained so as not to break the convoy. During the evacuation, at least 25 major merchant ships, 16 warships and two submarines were sunk by artillery fire, aerial bombs and naval mines. Although no one knows exactly how great the loss in human life was during these few days, some have estimated it at 10,000 – probably a low figure.

One December morning in 1910, the steamer *Cedric* ran aground on Argos Grund. Its main anchor was salvaged in 1993 and is today located in the Öregrund Cemetery.

DANGEROUS ROCKS AND SKERRIES

Some places are more accident-prone than others, whether a coastal stretch with treacherous underwater rocks and shallows or a difficult passage around capes and skerries as the wind drives the ships onward. One place known for its unpredictable underwater landscape of hidden rock formations, dangerous shallows and skerries is the Swedish archipelago outside Öregrund in the Sea of Åland. The waters around the underwater rock formation Argos Grund are teeming with wreckage debris from terrible shipwrecks. No one knows exactly how many wrecks are among the rocks. The site is difficult to inventory and the wrecks have disintegrated. But at least six known shipwrecks from the 20th century have been linked to the wreckage there. Perhaps the most dramatic, or most dramatically described, sinking took place on an early December morning in 1910 when the steamer *Cedric* struck Argos Grund.

Cedric was headed north towards Gävle loaded with coal, and the helmsman had set the course a good distance away from the infamous Argos Grund and its light buoy. It was four o'clock in the morning when the second mate and his guard crew came up on deck for the changing of the watch. As the wind and sea pummelled the ship's side, without warning the ship suddenly began to shake. Water came rushing into the engine room at a ferocious speed, and *Cedric* began to sink.

The captain struggled to detach the lifeboat and swing it overboard. The crew was shaken from their slumber and several began climbing the rig to escape the icy sea. With the help of an axe, the lifeboat was finally released – while *Cedric* disappeared into the depths. The crew members were pulled under the water, and only nine out of fifteen made it back up to the surface. Fighting for their lives, they clung to the lifeboat that had floated up with its keel overturned. The men managed to turn the boat around and climb into it, but they were poorly dressed and the winter storm quickly cooled their wet clothes. Within an hour, the cook had frozen to death. After a seven-hour struggle in the lifeboat, only the captain, a deckhand and the first engineer were alive. After another ten hours of rowing, the three managed to get ashore at Ängskär where they were looked after by the villagers.

The wreck of the steamer *Cedric* at Argos Grund has now been identified and is a destination for divers.

REUSE

For a long time, end-of-life ships have been assigned a final mission as filler material for quays, piers and bridges, or as block-ships for defending waterways against attacking enemy forces.

For larger ships to be able to sail into Stockholm, they needed to transit the southern fairway via Baggenstäket or the northern route past Vaxholm Fortress. From the 16th century onwards, ship barriers were built in strategic locations around Vaxholm to control vessel traffic. One of these sites is Oxdjupet, the narrow but deep strait between Värmdölandet and Rindö in the northern fairway to Stockholm.

In 1656, a plan was conceived to sink more ships in Oxdjupet. The idea was to sink the two decommissioned warships *Tu Lejon* and *Neptunus*. But because of a storm that drove the ships into a bay, the attempt failed. The ships still remain there to this day. In the years that followed, numerous ships were sunk in Oxdjupet. In 1667, it was decided that as soon as a warship was not worth repairing it would be sunk there.

In 1839, after 300 years of work, the artificial barrier reef in Oxdjupet was completed. But time was not on the side of the defence planners. Merchant ships had increased in size and demanded greater depths, so the shipping lane had to be opened up again, and the barrier dredged.

Other ships were repurposed into foundations and building materials around Stockholm. Several such wrecks have been examined between Skeppsholmen and Kastellholmen, some of which ended up as a foundation for a bridge between the two islands. And in the bridge embankment of Skeppsholmen's quay, King Gustav II Adolf's proud flagship *Scepter* was found. The ship was decommissioned around 1640, only to be discovered later and identified during archaeological surveys in 2017. More about *Scepter* and the intentionally sunken ships can be found in the chapter 'The Lost Navy'.

AT THE SHORELINE

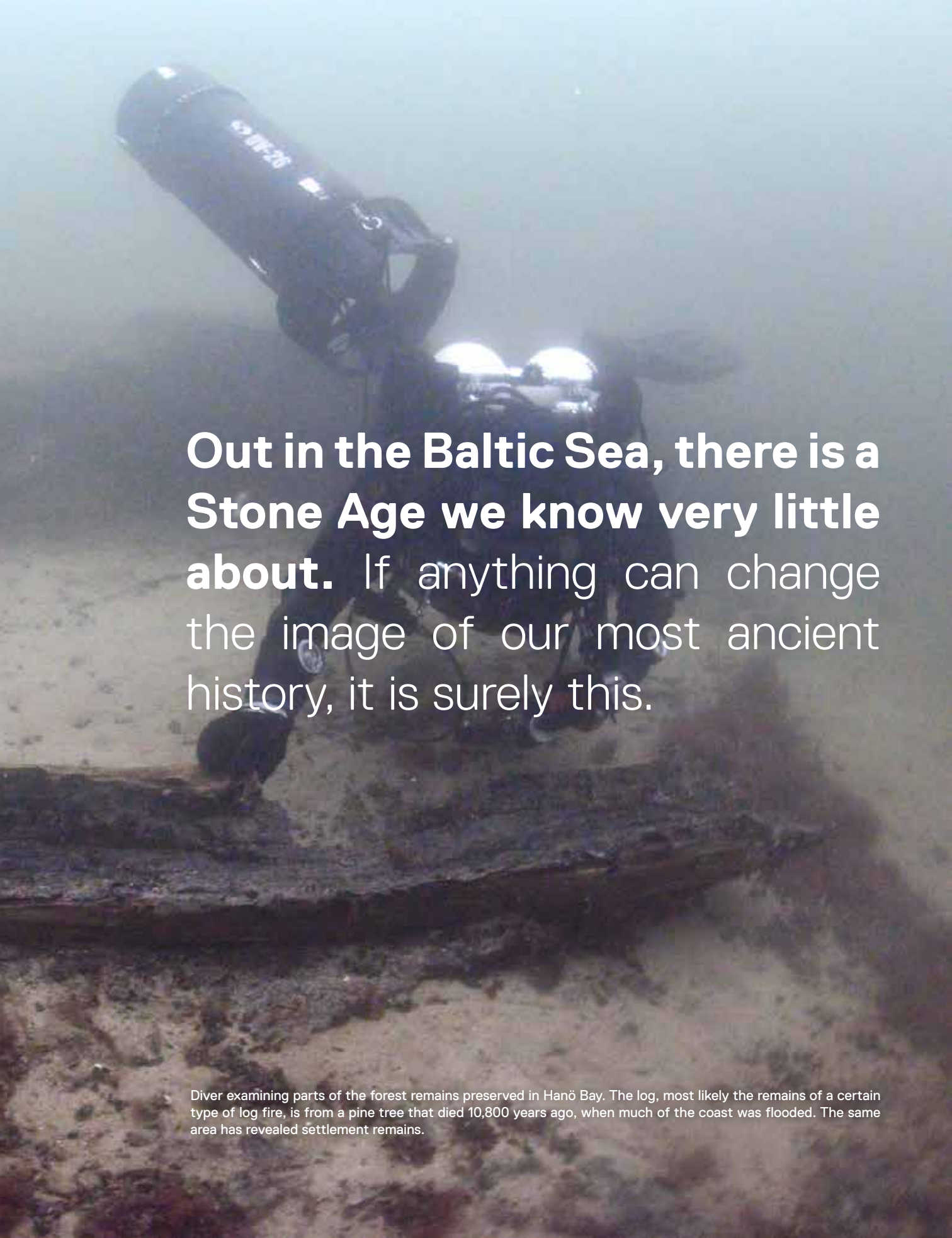
Maritime archaeology is not only about sunken shipwrecks, just as maritime history does not unfold only on ships. For thousands of years, people have settled near coasts, shorelines, rivers and streams, living their lives on the border between land and water. The water levels of seas and lakes have changed over the millennia. What was once land can today be the seabed and tell us about life that was lived on land thousands of years ago. And because the bottom sediments can preserve objects made of materials that have long degraded up on land, maritime archaeological sites sometimes tell a fuller and richer story.

But coastal archaeology can also tell us about more recent times. As with ancient finds, things that have been dropped or discarded at the water's edge can be better preserved than those discarded on land. Along the shorelines of the Iron Age and early Middle Ages, towns emerged, dominated by trade and travel across the water. The finds in the water tell of port facilities and everyday life revolving around the repair and maintenance of boats, as well as goods and trade from near and far.

As we approach our own times, from the end of the Middle Ages to the early 19th century, ships become larger and larger. Once these mighty ships had served their purpose, they could be reused at the shorelines – as ground filler, foundations for docks and piers, or defence systems. All across Europe's port cities, we are treading on the wrecks of great ships that have seen their day and been given new life in places hidden from view.

SEASCAPES

BJÖRN NILSSON · AT THE SHORELINE



Out in the Baltic Sea, there is a Stone Age we know very little about. If anything can change the image of our most ancient history, it is surely this.

Diver examining parts of the forest remains preserved in Hanö Bay. The log, most likely the remains of a certain type of log fire, is from a pine tree that died 10,800 years ago, when much of the coast was flooded. The same area has revealed settlement remains.

SEASCAPES

Take a look at a globe. The contours of the continents against the blue sea. These familiar shapes, which enable us to discern what is land and what is sea, give us a sense of geographical security. This is exactly what our world looks like, isn't it? It is perhaps a challenge, then, to imagine that this distinction between land and sea is highly variable from a greater time perspective. The coastline is anything but permanent, at least from the point of view of Stone Age archaeology. Take those of us who live in the elongated country of Sweden and have the Baltic Sea as our neighbouring sea. Some 12,000 years have passed since the ice age gave way, but the land is still rising – in those areas where the ice was thickest, in central Norrland, by nearly one centimetre each year. In other words, noticeable over a single lifetime.

A type of maritime archaeology exists that you rarely hear anything about. Experts often refer to it to as continental shelf archaeology, but you could perhaps call it flood archaeology. 'Flood' here does not mean the temporary and often catastrophic conditions caused by weather phenomena along coasts and rivers, but rather the more persistent floods caused by climatic, geological and hydrological processes that humankind faces. It is an underwater archaeology that examines landscapes, settlements and archaeological remains on the ocean or sea floor. An archaeology that takes its starting point in sea level changes and how cultures have been affected by them.

THE ICE AGE, OCEANS AND THE BALTIC SEA

When the ice in the last ice age was at its peak, about 23,000 years ago, much of the earth's water was bound at the poles. The shores of the world's oceans thus lay more than 120 metres below present-day sea levels. Europe – if it had existed – would have been almost a third larger at the time. Some areas, on the other hand, were covered in inland ice and were uninhabitable. But it soon got warmer and warmer and the ice began to melt. The sea level rose and land areas flooded. When the ice age came to an end, the shores of the world's

oceans were still about 40 metres below today's levels. But they rose at a brisk pace, by about one centimetre each year.

It may sound simple when we talk in general about global sea level changes, but if you delve into local conditions then the picture becomes more complicated. This is especially true in the region of the Baltic Sea, an inland sea that has direct contact with the ice front. A few points should be kept in mind. Besides keeping track of the change in the world's sea levels, we need to understand the effects of the inland ice depressing the earth's crust and the rebound that follows the ice melting. We also need to understand the behaviour of the Baltic Sea basin during this period.

When the ice sheet began to retreat, exposing the land in present-day Scania in southern Sweden 15–16,000 years ago, the southern Baltic Sea consisted of an ice-dammed lake we call the Baltic Ice Lake. Then, 11,700 years ago, the ice edge stood at the current plateau mountain Billingen in Västergötland, and suddenly – or perhaps catastrophically for those who were there – the ice-dammed lake forced its way out between the glacier front in the north and Billingen in the south. The Baltic Ice Lake was at last discharged, and the sea level fell 20 to 30 metres in the southern part of the Baltic Sea around the coasts of Scania and Blekinge.

At the same time, the first forest, a pine-dominated one, was established. During this low-tide period, which in Scania occurred 8,500 to 11,000 years ago, the Scandinavian peninsula was attached to the continent. It was easy for both humans and animals to colonise. However, the current land uplift caused the Yoldia Sea in Central Sweden to be dammed up quite quickly. Finally, more than 10,500 years ago, the Baltic Sea was again cut off from the salty sea to the west. It is called the Ancylus Lake from that point on, getting its name from a freshwater mollusc found in sediments from the time.

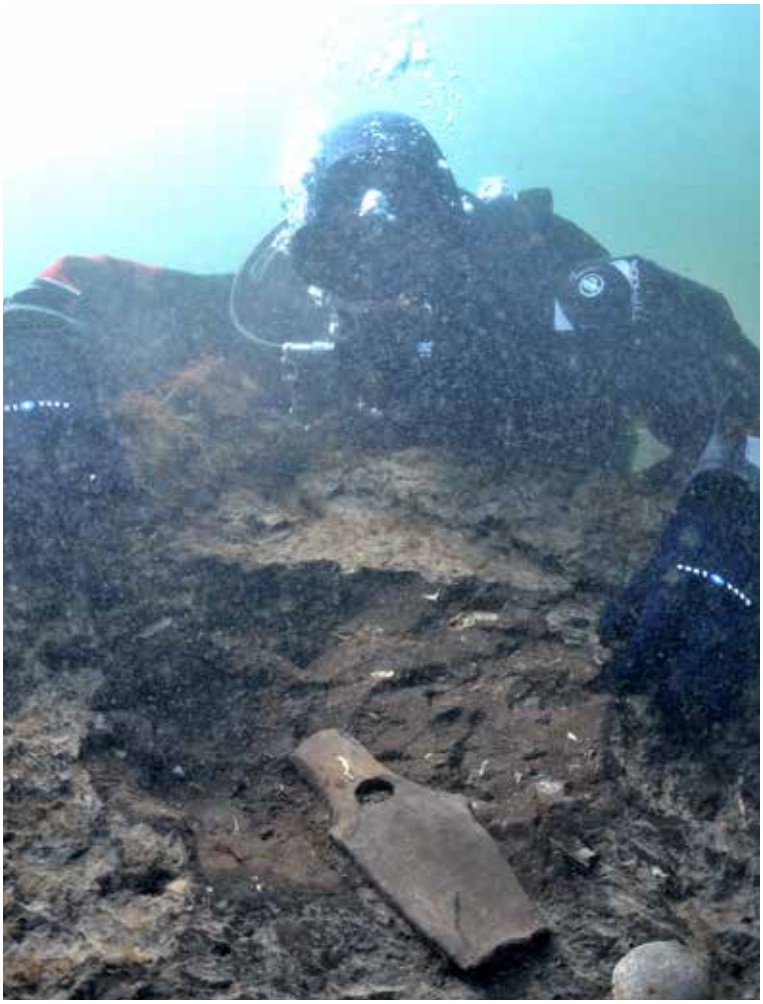
As the world's oceans continued to rise, the southwestern part of the Baltic Sea eventually merged with the seas at the Danish straits, forming 8,500 years ago what we know today as the Øresund Sound. The Baltic Sea became increasingly salty, giving name to the Littorina Sea phase after the marine mollusc found exclusively in the southwestern parts of the Baltic Sea. During the period it could be found as high up as the coast of Norrland in northern Sweden, giving us an indication of the high salinity compared to today's levels.

During much of the Littorina period, between 3,000 and 8,500 years ago, the sea surface level rose much faster than the land in South Sweden. As a result, these shorelines lie above current sea surface levels throughout the country. It is along these coastlines that we find most Stone Age settlements in southern and central Sweden. The reason is twofold: shoreline deposits have been beneficial for cultivation, and to this day we still continue to build near coastal areas. But throughout much of the Stone Age, the Baltic Sea remained a sea with a rich variety of ecological niches. The coastal life, the sea's resources and, not least, the estuaries, constituted the foundation of Stone Age societies. The ever-changing ecological conditions during the Baltic Sea's prehistory and, not least, the constantly shifting sea levels, characterised life in the Stone Age.

THE BALTIC SEA: UNIQUE IN THE WORLD

If we are to understand our most ancient history and the peoples who lived during those times, we must understand the seas. And if we are to understand the Mesolithic, we also need to understand the major settlements along the coasts. In Scania, Blekinge and parts of Halland in southern Sweden, these settlements now lie at the bottom of the sea. The depths reveal an intriguing landscape and an amazing archaeology.

The Verke River is a rather small river in Scania. It winds its way from the Linderöd Ridge and



On Walpurgis Eve 2014, maritime archaeologist Arne Sjöström and quaternary geologist Anton Hansson discovered a polished pickaxe made of elk antler. It was 9,000 years old and was found in the slightly younger refuse layers at Haväng. The find was exposed when a large chunk of mud bank was torn loose during winter storms. The stones next to this are also remains from the settlement, which is unfortunately completely eroded. Only the objects that have ended up on the bottom of the Stone Age river are left.

flows into Hanö Bay on the east coast. About 11,000 years ago, it was probably somewhat larger and flowed into a larger delta-like area together with Helge River. Nowadays, the old estuary is located nearly three kilometres out into the sea at a depth of 25 metres. For 50 years, geologists have known of the presence of remnants of this early Stone Age landscape. Fishermen have caught pine stumps in their trawls, and in the 1980s preserved remnants of the river's lagoons were discovered in the form of banks of organic-rich mud called 'gyttja'. Ten years ago, archaeologists began to take a serious interest in the area. Arne Sjöström from Lund University began to dive, methodically, along the old river. After just a few hours on the site he found what he was looking for – debris from the settlements thrown out into the river. Since organic materials like bones, antlers and wood are well preserved in the prehistoric gyttja mud sediments, he soon realised that this was a unique place which required a more thorough investigation.

Thanks to precise and high-resolution modern sonar technologies combined with geological and archaeological surveys, today we know quite a lot about the Haväng site. For the most part, the settlements at today's flooded river have been completely eroded away by waves from more recent times. On the other hand, everything that is thrown into the river or in the lagoons adjacent to the estuary is preserved along with the remains of several stationary fisheries.

At a depth of 18 metres and several thousand metres from today's coast are remains from some of the oldest coastal settlements in the southern Baltic Sea. The bone in the photo is from an aurochs, an extinct wild ox, and a precursor to a harpoon or other bone tool. Its maker was probably not satisfied with the work and threw it away. The bone is over 10,600 years old, one of the oldest aurochs finds from an archaeological site.

These fisheries made of wood are among the oldest preserved in the world, and they reveal a fully developed mass catching technique from over 9,000 years ago. The discarded debris forms thick layers in some areas. Although no regular archaeological excavations have been carried out, many worked bones have been recovered. The oldest settlements are at least 10,500 years old, and the youngest 2,000 years younger. Few Mesolithic sites show as much scientific potential as this. The findings are mainly from mammals; only a few fish bones or seal bones have been found. This is partly because very little material has been excavated and wet-sieved. But it is clear that the coastal settlement is not similar to contemporary maritime settlements in Bohuslän, for example, on the Swedish west coast. Life at the Yoldia Sea and Ancylus Lake resembles that of the inland settlements at the great lakes. The difference lies in the complex fisheries that are rarely found at the lakes. The remains at Haväng tell of a spatial stability we perhaps do not usually associate with the early Mesolithic communities.

However, the research is in its infancy. The anaerobic sediments deep on the bottom are not simply archives for bones, antlers and flints. With new methods like genetic studies of sediment, in the near future we will be able to say more about the people, animals and plants that lived at the ancient mouth of the Verke River – both in the waters and above. Thanks to

A diver showing us one of the world's oldest stationary fisheries. The guide net is made of long hazelwood shoots and is exposed to the waves.

new screening methods, DNA residues can be found in the muddy depths. The genetic traces in the midden layers tell us about life 10,000 years ago, not only concerning humans and higher forms of life, but the bacterial flora and virus communities of the time. The gyttja mud banks and pine stumps at the bottom of Hanö Bay off Haväng are not only beautiful, but they contain unique archaeological and biological data that can only be found in a few locations in the world.

BLUE ARCHAEOLOGY: A TOPIC OF THE FUTURE

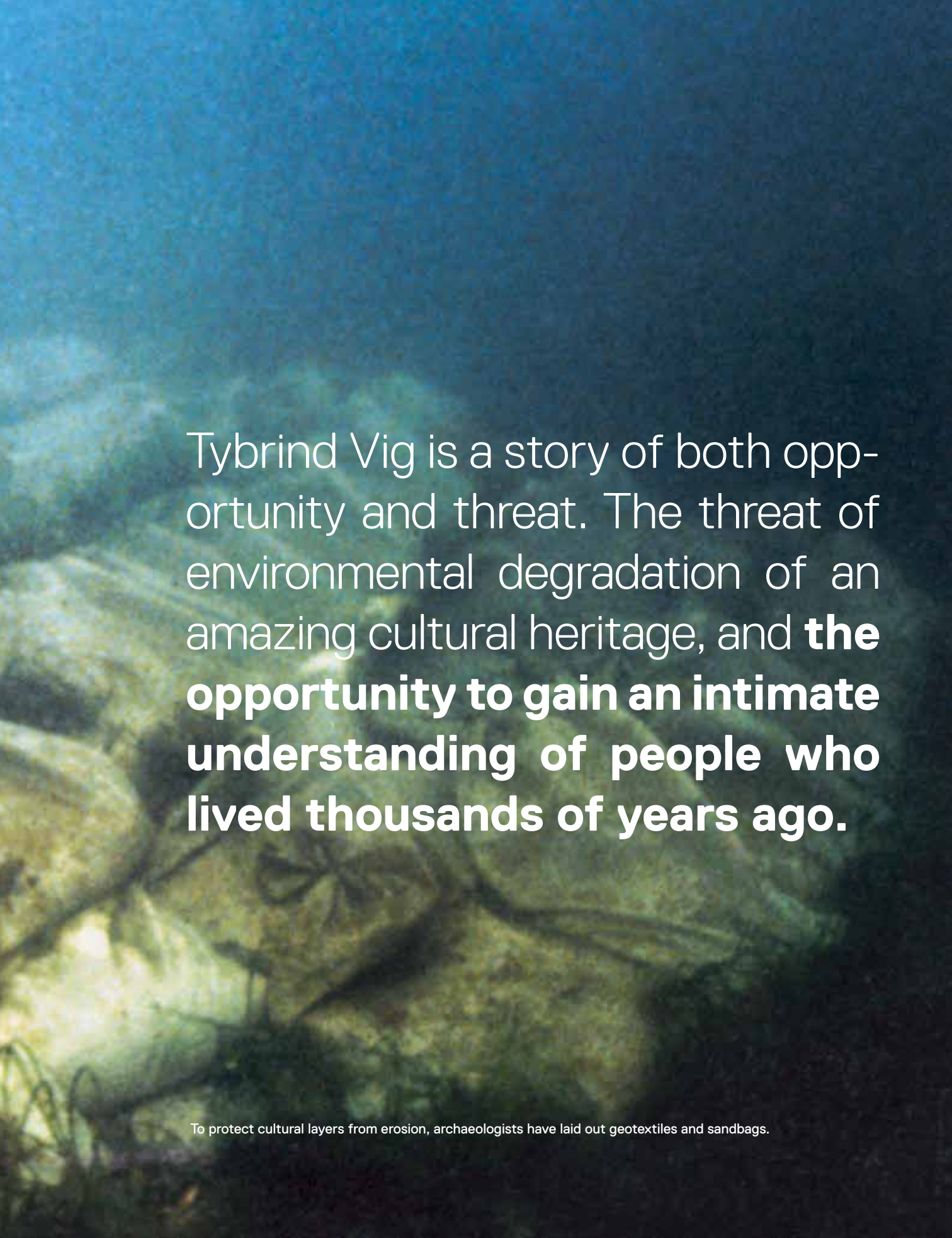
Thanks to research efforts from the last ten years, the number of known Stone Age areas under water has tripled in the area. In 2019, we knew of roughly 70 sites containing preserved remains of Stone Age landscapes off the coasts of Halland, Scania and Blekinge. Most are in the Baltic Sea, and many are completely unexplored. Some consist only of a single find – a few flint flakes at the edge of a river, or an area containing rooted stumps. Others, such as the Haväng site, are more complex.

Stone Age research and long-term archaeology are challenged by time itself. Events that progress slowly and are hardly noticeable over a human lifetime move swiftly and suddenly if we zoom out and take a long-term view. Even the Stone Age landscapes seem alien – in their forms, their climate, and animal and plant life. But the long term provides ample time for reflection. It offers perspective and exposes humankind in its most varied forms – it is humanly unhuman.

The seas, especially a sensitive sea like the Baltic, require reflection and knowledge over a long time scale. This is true not only when considering questions of culture, but very much so for biological and ecological issues. Those of us who study Stone Age landscapes on the seabed have a vital mission: to bring the maritime archaeological perspective to the surface and to clarify the needs and dependencies between culture and communities as they relate to the sea. Out in the Baltic Sea, there is a Stone Age we know very little about. If anything can change the image of our most ancient history, it is surely this.

TYBRIND VIG

MATILDA FREDRIKSSON · AT THE SHORELINE



Tybrind Vig is a story of both opportunity and threat. The threat of environmental degradation of an amazing cultural heritage, and **the opportunity to gain an intimate understanding of people who lived thousands of years ago.**

To protect cultural layers from erosion, archaeologists have laid out geotextiles and sandbags.

TYBRIND VIG

Hidden deep down in the seabed of Little Belt, a strait separating the Danish island of Funen from Jutland, are the remains of a 7,000-year-old Stone Age settlement. The settlement, called Tybrind Vig, was active during the period archaeologists call the Mesolithic. Large swaths of what is today seabed along the southern Baltic coast were land during this period. The settlement was situated by a sheltered lagoon, and the people who lived there hunted, fished and collected both mussels and plants.

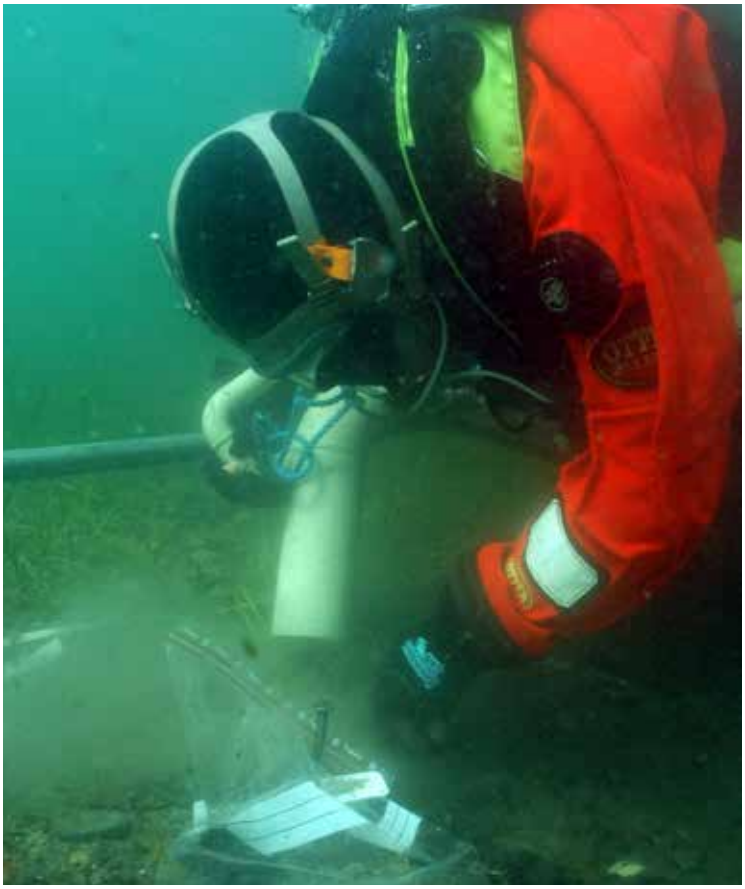
Today, the remains of the Tybrind Vig settlement are submerged under water. This is because the site was gradually swallowed by the rising sea level. Thanks to the shoreline displacement, artefacts of organic material have been preserved far into modern times, even the present day. The cultural layers in Tybrind Vig lay sheltered and hidden until the 1950s, when sport divers found objects sticking up out of the seabed. In the 1970s, the first archaeological excavations began. Tybrind Vig thus became one of the earliest excavated Stone Age settlements under water.

Over decades of maritime archaeological excavations, logboats with decorated paddles, fishing and hunting gear, and many objects of wood and bast have been uncovered and analysed. Such degradable materials are usually not found by archaeological surveys of Stone Age settlements on land. Therefore, maritime archaeological investigations of submerged Stone Age settlements can provide insights into a world of objects that has long been lost on land.

But why are some Stone Age settlements submerged under water, when others are far inland? And what can studies of the bones and objects discovered through such investigations tell us about life in Tybrind Vig?

REVEALING ARTEFACTS

Although several thousands of years have passed since people lived at the Stone Age settlement of Tybrind Vig, we may still gain an understanding of the inhabitants through the archaeological investigations. We can obtain information about how they lived, what they



Maritime archaeological investigation at the Stone Age site of Tybrind Vig, Denmark.

ate, what items they made and used, and the various activities they engaged in. Archaeology even offers a glimpse into individual life stories.

During the Mesolithic, most people in South Scandinavia moved between different locations within a larger area to make use of nature's resources. So far, no remains of housing have been found through the archaeological excavations in Tybrind Vig. However, rich cultural layers have been uncovered revealing both preserved objects and waste. Analyses of these remains have enabled us to understand that the settlement was used at different times of the year, probably not all year around. The objects and dating analyses connect the settlement to the late Kongemose and Ertebølle cultures.

Proximity to the sea was vital to the people of Tybrind Vig. The settlement was situated by a lagoon, making it possible to fish, collect mussels, and hunt marine mammals like seals, porpoises and other types of whales. Fishing nets and creels have been found, in addition to fish hooks and leisters. The fact that the people of Tybrind Vig ate fish is also evident in the traces of a meal cooked one day about 7,000 years ago. Several pottery fragments have dried food crust on them with traces of fish bones from cod, fish scales and plant fibres.

The people in Tybrind Vig probably enjoyed a fairly varied diet. The excavations revealed a large amount of hunting gear, such as bows with arrows in addition to bones from terrestrial mammals like red deer, roe deer and wild boar. The cultural layers also contain traces of plant-based foods including nuts, fruit kernels and various types of plants. Shells from mussels were also found. All indicate that the foods came from both land and sea.

But hunting in Tybrind Vig did not focus on food alone. Analyses of animal bones show

Marten skeletons. Incision traces on the craniums, lower jaws and pelvic bones show that the animals were skinned for their fur. Their bodies were then thrown into the strait.

that different species were treated differently. For larger animals, such as red deer, roe deer and wild boar, most of the carcass was utilised. The meat was eaten, and antlers and bones were used as raw materials to create items like axes, fish hooks and harpoons, while skins from red deer and roe deer were tanned into leather. Smaller animals like martens and ferrets, on the other hand, seem to have been hunted solely for their fur. Evidence of fur production is shown by the traces of incision marks on the skeletons where the carcass was skinned before being thrown into the strait.

In addition to making objects from bones and antlers, people also crafted many objects out of wood and bast. Four logboats and fourteen heart-shaped paddles have been found, as well as creels, leisters, shafts for stone and antler axes, bows with arrows and much more. Among the more sensational artefacts are textile fragments of bast and four paddles decorated with painted relief. Tybrind Vig's textile fragments are among the oldest in Europe. Since they are so small, it is difficult to determine what they were a part of. Textile analyses show that they were made with honeycomb and buttonhole stitches. The people of Tybrind Vig thus used a combination of textiles, leather and fur. Perhaps these were not only used for clothes, but for items like tent canvas or bags.

Traces of pottery making were also found. The distinctive vessels with pointed bases characteristic of the Ertebølle culture are present, but lack the decorative shallow depressions common in many contemporary settlements of the time. Among the objects are also small oval blubber lamps. They are similar in function to ordinary oil lamps, where a wick is placed

A diver at the site observed a partly exposed cranium, which belonged to a young woman placed in a double grave with an infant.

so it slightly extends above the fuel, in this case blubber extracted from marine mammals. The blubber lamps are smaller both in size and in number compared with those of other nearby settlements. Since no large quantities of seal or porpoise bones have been found in Tybrind Vig, it is possible that the blubber was produced elsewhere. Perhaps it was taken from another settlement or acquired through bartering.

It is likely that different groups had contact with each other across a wider area, which is underlined by the presence of Ertebølle pottery across vast swathes of southern Scandinavia. The logboats found in Tybrind Vig point to the same conclusion. Their design is adapted for long-distance transport, with the longest boat seating as many as ten people. The boats were probably used as a means of transport between settlements, but also for travelling to collective meeting places, for shorter trips and for fishing in the surrounding area. The logboats contain finds of ballast stone and hearths on a bed of compact sand. The hearths may have been used for night-time fishing, where the light would have lured fish to the surface to be speared with a leister.

DOUBLE GRAVES

Not only artefacts and animal bones were found during the maritime archaeological excavations. Two double graves and scattered bones from at least sixteen individuals were also found. Unfortunately, it is uncertain whether the scattered bones belong to the settlement

The second double grave excavated at Tybrind Vig contained a man and woman, placed on their backs closely together.

of Tybrind Vig. They could, for instance, originate from the Battle of Tybrind Vig in 1658.

There is a roughly 800-year time span between the double graves. The oldest grave is roughly 7,500 years old, and contained what was assessed to be a man and a woman who were placed on their backs closely together. The younger grave is roughly 6,700 years old. It contains a young woman and an infant, placed over her chest. Skeletal analysis shows that the child was probably less than three months old, and the woman was a teenager 14–16 years of age. We do not currently know what relationship they had with each other. However, the results of the analysis show that the woman suffered from prolonged gingivitis, and the infant from a painful bone tissue disease. It is likely that the graves belonged to a larger burial site.

A LANDSCAPE IN FLUX

During the Mesolithic, Tybrind Vig lay by a sheltered lagoon. But the surroundings of the former settlement have changed since then. Today Tybrind Vig lies at a depth of 2–3 metres, and about 250 metres from the shoreline.

As the inland ice sheet melted, the Earth's crust underwent an isostatic adjustment in Scandinavia. This means that the crust, which had previously been depressed by the kilometre-thick inland ice, slowly rebounded as the weight eased. The boundary along which this rebound occurs is called the transgression line and runs diagonally through all of Denmark. This means that the northeastern part of Funen that was depressed by the ice was gradually rising while the southern and western parts – where Tybrind Vig is located – were submerged

by the rising water levels from the melting ice. The Stone Age settlements either rise higher up in the landscape or become submerged, depending on where they are located in relation to the transgression line.

It is apparent that the people in Tybrind Vig noticed the shoreline displacement since their activities were moved further inland in correlation to the rising sea levels. The oldest finds are therefore placed further out in the strait than the later ones.

THREATS AND PRESERVATION

Both the landscape and the environment are still undergoing changes to this day. Environmental changes are one of the reasons why Tybrind Vig and other remains of Stone Age settlements in the Baltic Sea have been discovered. A major contributing factor is eutrophication from agriculture, which has led to increased algal blooms in the sea. When the algae die, they sink to the bottom, forming a blanket that suffocates the underlying vegetation. And when the vegetation disappears, so does the protection it provides since it binds sediments. This becomes particularly noticeable in areas with sandy bottoms, because the sand is easily washed away by the waves and currents. Stone Age settlements that have been protected in the seabed for thousands of years are eroding. The culture layers are therefore easier to detect, but also face the threat of being destroyed and washed away. In Tybrind Vig, archaeologists are attempting to prevent this by laying out geotextiles and sandbags.

Today, Tybrind Vig is both a story of the threat of environmental degradation to an amazing cultural heritage, and the opportunity to gain an intimate understanding of the people who lived thousands of years ago.

Tybrind Vig is currently part of exhibitions at Moesgaard Museum, Langelands Museum and Vrak – Museum of Wrecks.

IN BIRKA'S HARBOUR

HÅKAN ALTROCK · AT THE SHORELINE

Rigging parts and linden bast ropes were common finds in the divers' test pits. Textiles, which wrapped around a stick served as tar swabs, still smelled of tar or pitch.

During archaeological excavations in the Viking Age harbour area of Birka, archaeologists uncovered a vast array of objects including a wooden spoon.

IN BIRKA'S HARBOUR

The knarr, a Viking Age cargo ship, glides slowly towards the island, aided by a still evening breeze. The absence of trees on Birka distinguishes it from surrounding land masses, as does the smoke from the trading post's hundreds of fires. These fires revealed themselves to the crew even before they finally appeared from beyond the other side of the big bay after leaving behind the frustrating near-windless fjord. As they get closer, they sight a greenish-grey cluster of buildings surrounded by a land embankment. In the surrounding waters, piers jut out as if they were extending the many narrow alleys and, like spokes in a wheel, make their way down to the harbour.

It is the first time the crew has come to Birka, or, for that matter, to a trading post like this one. Filled with expectation, they moor at one of the piers under the curious eyes of the townspeople. One of the inhabitants carries a cloth pouch whose opening is attached to a zigzag-carved wooden frame. Suddenly, he drops it. The pouch falls into the dirty water with an inglorious flop. Shouting, the man jumps onto the ground in an attempt to grab it. But the bag must have contained something heavy, for it quickly vanishes beneath the surface. The man is soon swallowed up by other people who are also making their way out onto the pier.

VIKING AGE BIRKA

Birka was founded at the end of the 8th century. The town was a place where people traded goods from both the east and the west. Initially, trade was mainly focused on Western Europe, Northern Germany and the West Slavic southern Baltic coast. Trading posts along the Russian riverways would later come to dominate the trade.

Raw materials like amber, slate, salt and sandstone were brought into the town, while fur products and iron were exported. Birka was also a production site for metal and textile goods, and for bone and antler handicrafts which were exported. Luxury items, such as patterned silk ribbons with silver thread, were also made here. Trade in thralls also took place, as the finds of handcuffs and neck irons suggest.

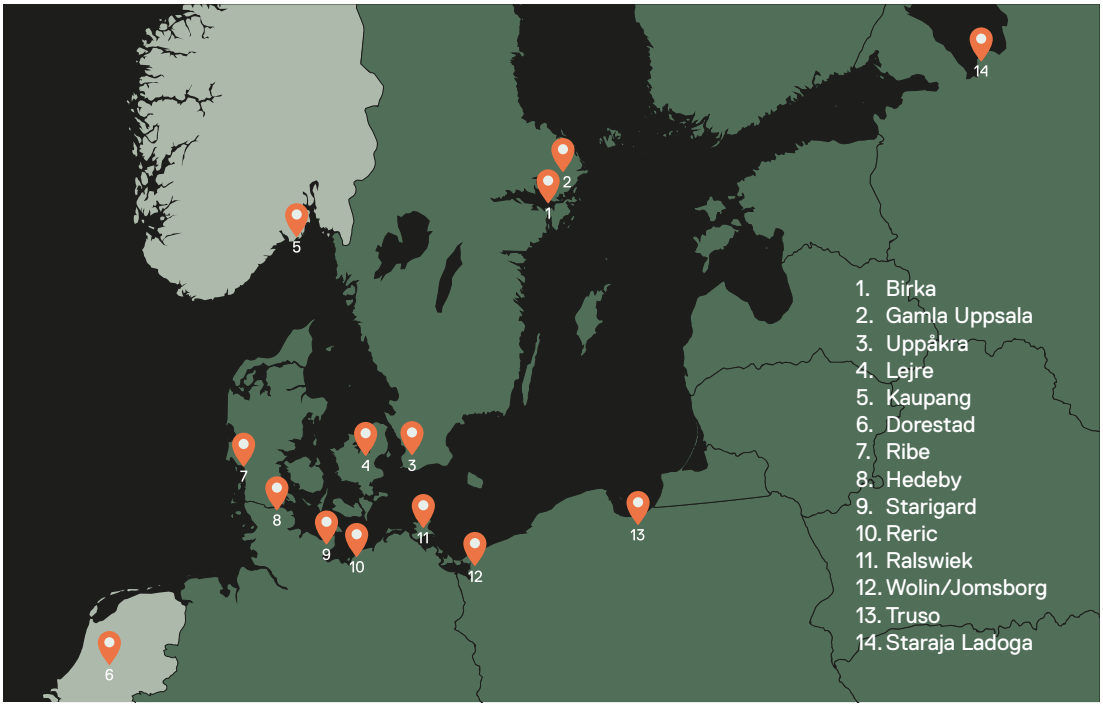
One of the objects from the harbour area of Birka is a pair of jaggedly cut wooden strips that probably framed the opening of a now lost cloth pouch, perhaps dropped from the pier by some town dweller more than a thousand years ago.

One of the crew members climbs up onto the pier. He is soon pummelled with questions: Where are you from? What have you brought? Where are you headed? He answers in a rush and shoves his way out of the crowd to avoid more questioning. After spending two weeks on a boat, it's a bit too much all at once. The man stretches stiffly and takes a curious look around.

At the far end of the bay, a small ship is being repaired. The ship is careened with the help of the halyard hauled and tied to a pole on the shore to expose one of the sides for repairs. Next to the ship stands a man waist-high in water, at the ready with a new treenail, while another man inside the ship noisily hammers out the old broken one with a wooden mallet. They've been at it for some time now, and several broken pegs can be glimpsed floating around in the water.

A slightly smaller boat, newly built and wood untreated, lies at the shore. The boat's surface is covered in black as a man with a tar swab coats it with tar. But suddenly, the woollen rag wrapped around the swab handle comes off and falls onto the ground, which is covered in wood shavings and sand. The man lets out some audible oaths of anger, which for a moment cut through the cacophony of the harbour. He reaches down for the sticky lump of cloth, which is now full of sand and shavings. Irritated, he hurls it into the harbour, where it sinks to the bottom while rainbow-coloured rings spread across the surface.

Our crewman turns around and takes a deep breath. His nostrils fill with a mixture of rotting food scraps, mud, tar and the smoke from hundreds of household fires. He is met with a



Map with locations in the trading network Birka was part of.

raucous cacophony of voices and cries. Mixtures of languages and words that are brand new to him. Clothes made of glossy fabrics and patterns he has never seen before.

For our crewman, Birka probably seemed like an alien world compared with the life he was used to outside the town. The extensive trade contacts, the variety of cultures and people who gathered here, and the unusual goods rarely seen beyond the town's ramparts helped to create their own urban culture, in everything from costumes to burials.

A NETWORK OF MERCHANT TOWNS

But Birka was not an isolated phenomenon during the Iron Age. The site was part of a network of early towns that emerged in the Baltic Sea region during the 8th and the early 9th century.

Along the Rhine, the town of Dorestad was established already in the 7th century and played a prominent role in the brokering of handicraft products from the Frankish Empire. Ceramics, glass and wine were major export goods in Dorestad, as were products made of wood, bone, antler and fabrics.

The town of Ribe in western Jutland, Denmark, emerged in the 8th century. Ribe provided merchants with items like glass beads, bronze jewellery and combs.

Kaupang, a trading outpost, was located at the Oslo fjord in Norway. The location provided access to Norwegian commodities, while allowing inhabitants to maintain good control over trade with the British Isles and Ireland. Here, traders could get hold of soapstone, iron and whetstones, and textile products.

Hedeby in southeastern Jutland grew into a major town with an impressive harbour. This came partly at the expense of the trading post at Reric, whose inhabitants were relocated to

Tar swab with broken wooden handle. The swab consists of a roll of tar-soaked fabric and is one of several such swabs found in Birka's waters.

Hedeby by the Danish king Godfred in the early 9th century. The location at the bay of Schlie, where the peninsula of Jutland is at its most narrow, enabled the town to control the trade route across Jutland between the Baltic Sea and the North Sea. A wide range of crafts were practised in Hedeby, including bronze casting, shoemaking, the manufacture of combs and beads, and textile production. Coins were also made here, the first in the Nordic countries.

Starigard/Oldenburg in eastern Holstein, now Germany, was founded around the year 700. Excavations reveal that the town was an important port, with long-distance contacts. Oval brooches, ring brooches, Norwegian whetstones and soapstone pots suggest close contact with Scandinavia.

On the southern Baltic coast we find the town of Truso, located on the Wisła River in present-day Poland. The town traded goods from the Baltic Sea region and the Frankish Empire. Trade in amber, and in products made of amber and antler, was extensive. Finds of boat rivets in large quantities in the town's harbour area testify to the repair and construction of boats.

On the island of Rügen, in what is now Germany, the town of Ralswiek was founded around the same time as Birka. Here, amber, iron, bones and antlers were worked and ceramics produced. Boats were also built.

Further along the southern Baltic coast of what is today Poland, we find Wolin, which was likely the Viking Age Jomsborg or Jumne. Here, at the mouth of the River Oder, trade between the Baltic Sea and the hinterland could be controlled. Archaeologists have discovered traces of ironworking, comb making, and tools for making textile and leather products. Amber was also worked here.

As for trade along the Russian riverways, Staraya Ladoga was one of the most important trading centres and served as a port for trade eastward. Traces of metalworking, bead production

Excavation between two pieces of timber in one of the pits in Birka harbour.

and textile production have been found, as well as bone, antler and amber working.

It is believed that these early towns evolved to satisfy the needs of regional leaders for luxury goods. The towns represented a new type of trading centre. Skilled craftwork and trade had already been underway in various areas, especially in central locations such as Lejre in Denmark, Uppåkra in present-day southern Sweden and Gamla Uppsala in central Sweden. These central sites were political, religious and economic power centres, and hubs for the areas surrounding them. They were places where sacred rituals were held, and where markets were run and legal matters settled.

The early towns were associated more with long-distance trade and craftwork, and seemingly lacked the same strong regional ties. The surrounding hinterland did not seem to have had access to the town's products to any great extent, since very few of the goods from Viking Age towns made their way into neighbouring areas – despite the fact that these areas supplied much of the towns' firewood and other necessities.

The towns relied heavily on communication routes. Waterways offered natural trade routes, and nearly all Viking Age towns were located by the water. Water was the bloodstream of trade and transport, and the town's harbour its heart.

THE HARBOUR IN BIRKA

Our crewman is gradually acclimatising himself to the pulse of the harbour. At the careened ship, the two boatbuilders have finally detached the broken cross-beam knee that is part of the boat's inner frames and acts as a reinforcing skeleton. Some of the treenails that held the timber in place resist being hammered out. Instead, they are sawn off in the narrow gap formed between the knee and the planking. Others had already been broken off.

One of the finds from the harbour area is an anchor stone with remaining bast rope.

With a splash, the men roll the timber into the water. The timber slowly drifts away towards the wooden pier, where it gets stuck among stakes and planks until it finally sinks to the bottom and a millennium of oblivion.

A new knee is being fitted into the boat. Others are working on stays and shrouds. The worn linden bast rope is about to be replaced. Any parts that cannot be repurposed for less critical ropes are dumped mercilessly into the smelly harbour water. On the shore, next to the larger ship, the tar swabber has made a new tar brush by wrapping strips cut from a pair of worn woollen trousers around the stick and tying it with a bast string.

Along the inner side of the wooden pier surrounding the harbour, some men are busy replacing one of the pier's stakes, which had started to rot and was cracked into pieces by a drifting ship during the last storm. When the tar swabber takes a closer look, he realises that it is a keel, or a keel material. Perhaps this nearly intact piece contained an overgrown rotten branch, which would have weakened a finished keel so much as to warrant discarding it and finding a new piece of wood. But now this piece in oak will be used for a different purpose, and will surely last longer than the pier's pine stakes.

ARCHAEOLOGY IN THE HARBOUR

It's hard to tell what the harbour of Birka actually looked like, although archaeological investigations have given us many clues. During the 1970s, dives were conducted in the harbour area. Among other finds, the divers discovered a large number of stakes and extensive cultural layers on the sea bottom.

Because of land uplift, the shoreline from the 10th century has retreated about 5–6 metres. This means that parts of the harbour area that were under water during the Viking Age are

One of the maritime archaeologists is measuring a boat keel in the muddy waters of the harbour area.

today dry land. During 1969–1971, archaeological excavations were conducted in Svarta Jorden ('the Black Earth') with the aim of locating the Viking Age shoreline and harbour facilities. Archaeologists uncovered cultural layers as well as poles and packed stones, which were used as foundations for piers. In the 1980s and 1990s, some of the poles in the water were measured using total stations. It appeared that the poles were quite uneven, and together with the presence of packed stones indicates that the poles might not have been part of a barrier as was once believed.

During 2004–2014, the harbour area was examined using various methods, from mapping with sonar and divers to test pit excavations. The main focus of interest was the function of the harbour and the towns' significance and role in the Baltic Sea region.

The archaeological investigation confirmed that the poles were not part of a barrier of the kind we are familiar with from the period. However, it was difficult to say what the site might have been. It was most likely a multi-functional structure.

The pole construction was heavily degraded, and even though remains of timber structural components were found we do not know how they were fitted in relation to each other. However, a certain regularity in these components can be noted. There are several pieces of timber with rectangular through-holes. These may have been part of a yoke structure. A variety of wood components with pins were also found, indicating that they were placed vertically, as well as timber with recesses of various kinds. The recesses may indicate some type of log-built structure. It is reasonable to assume that the town had piers and quays extending out from its shorelines. Possibly, it is the traces of these piers that are scattered across the seafloor outside Svarta Jorden.

FINDS IN THE HARBOUR

If the stake site raised more questions than answers, the finds in the harbour area tell us all the more. Up on land, objects made of wood and textiles often decayed while iron and bone were better preserved. In the harbour's bottom layer, iron was instead rusted while wood, ropes and textiles remain more intact. Underwater and land archaeology have thus complemented each other in the understanding of the everyday lives of the townspeople.

In Birka's harbour, people busied themselves with boat repairs and perhaps even new boat construction. All the discarded wooden pegs testify to this. Rigging parts and linden bast ropes were also among the common finds in the divers' test pits. Textiles, which when wrapped around a stick served as tar swabs, still smelled of tar or pitch.

A piece of a boat keel was found sticking out of the sea bottom at an angle. It was carved out, but the absence of nail holes indicates that it was never inside a boat. Perhaps its maker discovered that it was not up to par after it was carved, and so instead used it in the wooden structure out in the harbour.

Despite many finds that can be linked to boats, the shipwrecks themselves are conspicuously absent in Birka. In the harbour of Hedeby, however, wrecks were discovered, but the harbour was dammed before a major excavation of the bottom took place. A find of a well-preserved Viking Age ship ranks high on any maritime archaeologist's wish list. And it is likely that shipwrecks from the Iron Age are also hidden in the waters off Birka. They simply need to be found! They probably lie well hidden under the sediment, perhaps at a slightly greater depth where ice and waves can't damage them.

DEPARTURE

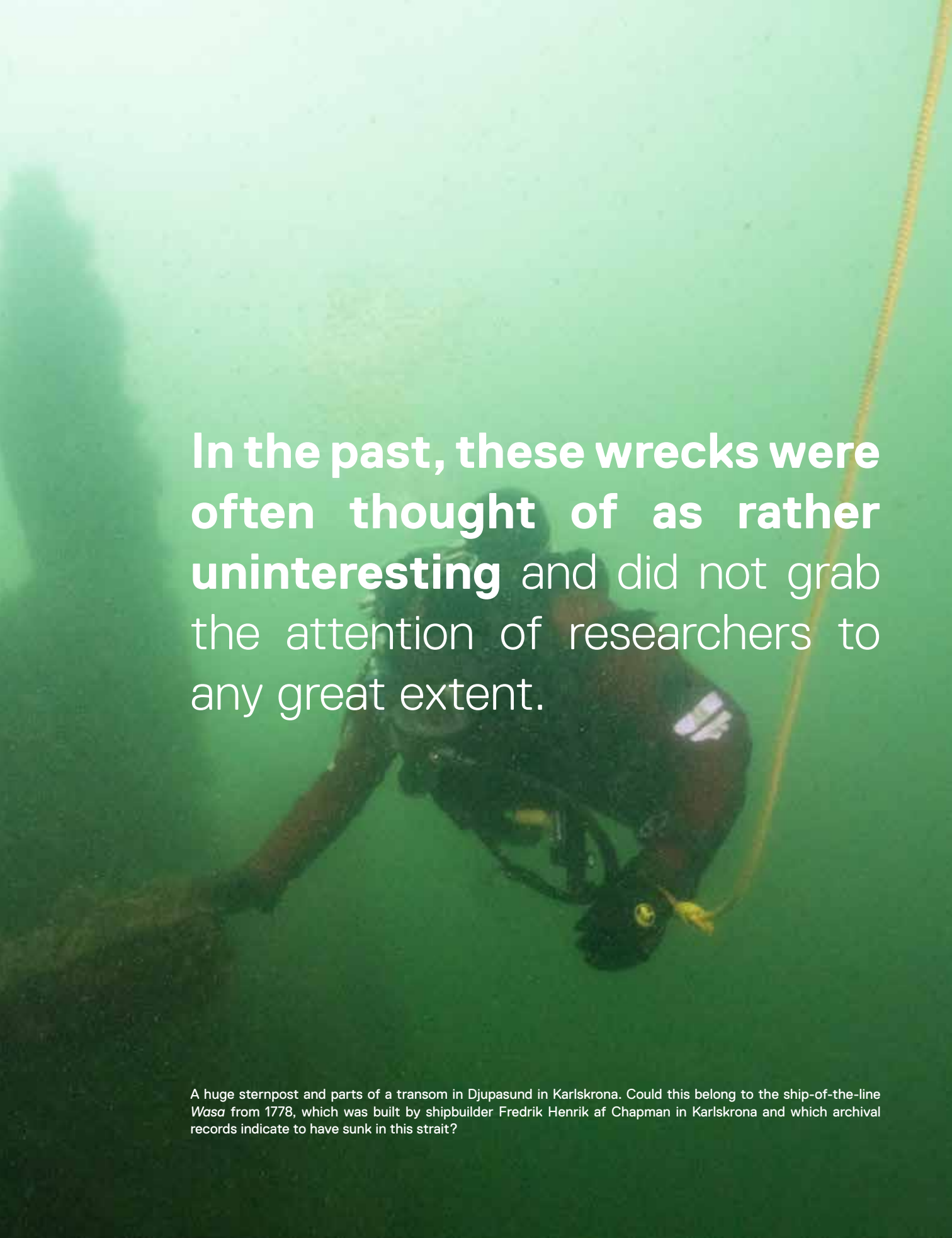
After a few days, the crew has sold their cargo and loaded new items on board. Although the wind is not perfect, according to the helmsman it will turn even more in their favour towards the evening – giving them just enough time to cross the bay and turn into the narrow strait that leads east towards the large cluster of skerries they have to pass before encountering the open sea and the countries to the east, their next stop.

The ship that was being repaired at the far end of the harbour is ready, like they are, to cast off. They have agreed to sail together, since they are going in the same direction and may be able to help each other. The risk of attack cannot be ignored. After the sun has reached its highest point in the sky, they finally make their way out of the town on the treeless island.

An old man sitting in his unsteady dinghy at the edge of a bank of reeds casts his line. He seems pleased with his catch as he proudly holds it up to view as the ships pass by. With great haste, the man begins to pull in the end of the rope tied to his anchor stone, as if he wanted to catch up with them and speak to them. But the rope around the stone that is lying on the seafloor suddenly breaks, sending him tumbling backwards in the boat with feet flying in the air. Luckily the boat stays on an even keel, but the man makes quite a sight. The scene is met with peals of laughter from the crew of the two ships as they hoist their sails and slowly slip away across the bay, into the oblivion of history.

THE LOST NAVY

JIM HANSSON · AT THE SHORELINE



In the past, these wrecks were often thought of as rather uninteresting and did not grab the attention of researchers to any great extent.

A huge sternpost and parts of a transom in Djupasund in Karlskrona. Could this belong to the ship-of-the-line *Wasa* from 1778, which was built by shipbuilder Fredrik Henrik af Chapman in Karlskrona and which archival records indicate to have sunk in this strait?

THE LOST NAVY

Thanks to the conditions in the Baltic Sea, an incredible number of shipwrecks have been preserved. Among them are many that were deliberately sunk, often old end-of-life warships. Some of these wrecks are located at the seafloor, but others can be found in wall filler for quays and in foundations for structures like bridges or piers. In the past, these wrecks were often thought of as rather uninteresting and did not grab the attention of researchers to any great extent. This might seem strange considering that they can provide us with so much knowledge about the naval history of previous centuries, and not least about the development of both shipbuilding and society as a whole.

STOCKHOLM

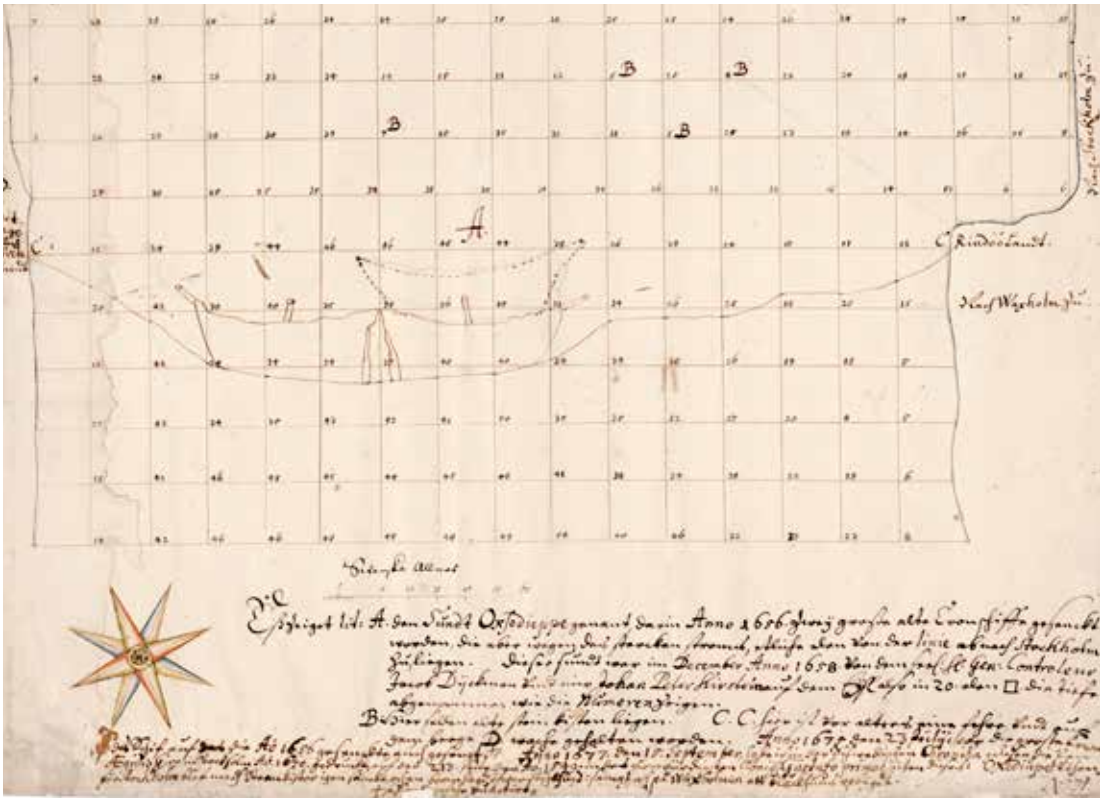
As far as possible, structural parts from end-of-life vessels were repurposed for use in new ships. What was left over – usually just the ship's hull – was used as filler to expand land areas or build new installations.

In Stockholm, many wrecks have been found in quays during land redevelopment. And there is other historical evidence as well that points to the existence of wrecks involving Stockholm's quays. Carl Friedrich Hauswolff's map from 1739, for example, marks out 46 possible wrecks just within the area around Skeppsholmen and Kastellholmen in central Stockholm. When this water area was examined by maritime archaeologists in 2015, as many as 15 different kinds of shipwrecks were detected. Beneath the surface lurks an entire landscape of large oak hulls that were once proud ships with both long and storied histories.

At the end of the ships' useful service life, some of them were used as a foundation for a bridge between Skeppsholmen and Kastellholmen that was built around 1640. Others have been used as filler material, pier foundations, or for shipyard functions like careening docks. The latter were structures used to lower down large ships and boats to carry out maintenance, including caulking (driving fibre-soaked tar into the seams between planks with a caulking iron and mallet), replacing the planking, or nailing sheathing onto the hull as protection against shipworm or to make the hull watertight.

During maritime archaeological investigations between Skeppsholmen and Kastellholmen in Stockholm, 15 shipwrecks were found. The photo shows the wreck of one of the ships that came to rest in a bridge that was built between the two islets around 1640. The ship dates to the end of the 16th century.

Carl Friedrich Hauswolff's map from 1739 shows 46 wrecks marked in the area around Skeppsholmen and Kastellholmen in Stockholm. Some of the wrecks have been located during dives, while others have not been found. Perhaps some of the wrecks mark existing remains, while others mark places where there were plans to sink additional ships?



A sketch from 1659, updated in 1675, showing plans to sink another large warship in the Oxdjupet strait at Vaxholm and stack it on top of two already sunken ships.

The area also contains ships both big and small that were not part of such installations but appear to have been discarded – most likely sunk or allowed to sink without having been repurposed.

VAXHOLM

Ships could also be used as part of defence systems, for instance to block off straits. One of the oldest historical references in Sweden is from 12th-century Foteviken at Höllviken in Scania, where retired ships were filled with stones and sunk, probably for use as a barrier.

From the 16th century onwards, end-of-life ships were more frequently reused in different types of installations. This was partly due to new technology, which allowed for building larger ships that could carry more and bigger guns, which in turn enabled ships to attack from seaward and fire at longer distances. To protect the cities, defence installations had to be moved further away from the city centre.

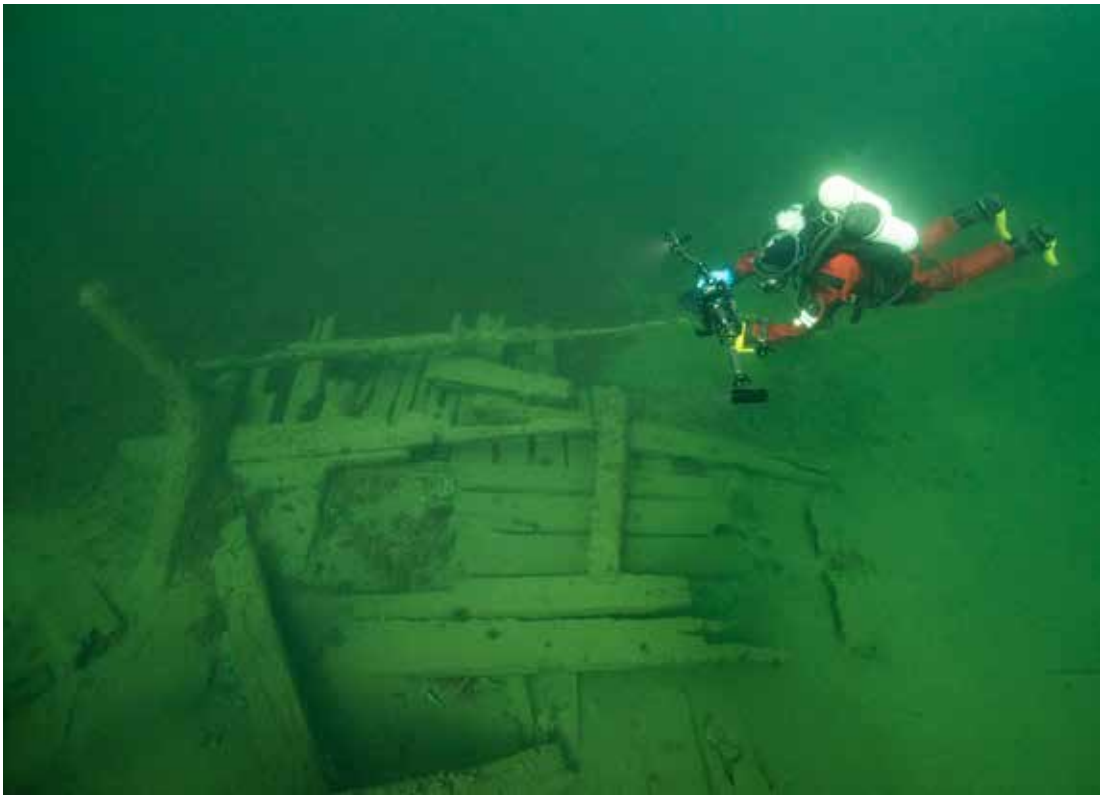
The island of Vaxholm, about 20 kilometres from Stockholm, is a good example. Stockholm has two inlets, one via Vaxholm where larger ships could pass and one via Baggenstäket in the south, which was only navigable for smaller ships and boats. There are reports from Vaxholm that in the mid-16th century, ships were already being sunk and used to build different structures in the straits. The idea was to move Stockholm's external defence further away, and Vaxholm was chosen for its strategic location. By installing such underwater structures, Sweden aimed to direct attacking enemies towards Vaxholm's heavily armed fortress.

The wreck of one of many warships that was deliberately sunk in the waters around Vaxholm at the northern inlet to Stockholm. End-of-life ships have often been assumed to lack interesting details and objects, but this is not the case. In the centre of the photo is a five-metre-long knight with four sheave holes, which was fitted with pulley blocks that were used to hoist and lower sails. The wreck has been dated to the mid-17th century and might be the warship *Maria*.

Archival information indicates that large older warships were sunk and reused in Vaxholm. In order to block the straits and protect Stockholm, everything from jetties to enormous pyramids made of stone were constructed, along with floating boom systems. One of the more astonishing plans can be found in a sketch from 1659. To close off Oxdjupet, a deep strait that winds its way past Vaxholm, two large warships were sunk and placed across the roughly 180-metre-wide strait. But apparently that wasn't enough. According to the sketch, plans were in the works to create an even more effective barrier by sinking an additional ship and stacking it on top of one that was already sunk.

In November 2019, maritime archaeologists at Vrak – Museum of Wrecks conducted dives in Vaxholm and discovered the wrecks of two large ships in Oxdjupet, one of the straits. Initially, they were suspected of being one or two sister ships of the *Vasa* ship (1628) – *Äpplet* (1629), *Kronan* (1632) or *Scepter* (1636) – which according to the records are said to have been sunk here. To verify this hypothesis, more studies were carried out including additional measurements and sampling. The dimensions of the ships matched *Vasa's* sister ships, but the dendrochronological analysis said otherwise. The oak had been felled in 1646/47, in other words, after *Äpplet, Kronan* and *Scepter* were built. In addition, the measurements showed that the deck beams were shorter than *Vasa's*. Our efforts to identify the wrecks had to continue.

In the archives, there is a mention of two warships built in 1648 that were sunk together in the strait in 1677: *Maria* (650 tonnes) and the slightly smaller *Apollo* (550 tonnes). This information agrees nicely with the time period and the archaeological findings, in which one



Porthole on one of the wrecks – possibly the ship *Södermanland* – that was sunk in the Djupasund strait as part of Karlskrona's defence.

wreck was slightly smaller than the other. *Maria* was built on Skeppsholmen in Stockholm, and *Apollo* in Wismar in Germany. Both of them had – just like *Vasa's* sister ships – long and exciting histories. For example, both ships sailed with *Resande Man* in 1660, a warship whose fate is described elsewhere in this book. So although the wrecks in the Vaxholm strait did not turn out to be *Vasa's* sister ships after all, the experience still represented archaeology at its best.

KARLSKRONA

Sunken ships are not just a phenomenon particular to Stockholm and its environs, but are evident in several locations throughout the Baltic Sea. Karlskrona in southern Sweden is another example. The city, founded in 1680, was built around the new shipyard and naval base that would replace Stockholm as the navy's primary base.

It is noteworthy that wreck remains from ships built at the end of the 17th century or the following century are rare in Stockholm. These ships instead appear to have been sunk and repurposed in Karlskrona. Scores of end-of-life ships were used as ship barriers, foundations and defence installations. End-of-life ships could also be placed at the bottom of shallow waterways to create a kind of fortification known as a blockship. The warship *Blekinge* (1682) is a likely example of such a construction.

During archaeological investigations, more shipwrecks have been uncovered and identified. One interesting area is a strait called Djupasund, where at least five large ships have been put out to block the strait and defend Karlskrona. Another intriguing site lies east of

Dendrochronological sampling of one of the wrecks at Suomenlinna. The frames and inner planking of the wrecked skeleton.

the naval harbour at Smörasken – a fortification that was never completed – where a pier was to be built in the 17th century. Although the pier itself was never built, ten ships of different types were neatly sunk on the site before the work was cut short. The wrecks are relatively well preserved and do not appear to be chopped down to the waterline as was otherwise common.

SUOMENLINNA

Suomenlinna (Swedish: Sveaborg) in Finland offers another good example of how a large number of ships were reused for similar purposes as in Karlskrona. This defence installation, which to this day represents Sweden's most expensive defence project, began in 1748 when Finland was part of Sweden. Here, 13 wrecks have been found that are thought to be reused along with about 25 wrecks that have been discarded. The wrecks were amongst other things used as breakwaters and jetties.

END-OF-LIFE SHIPS AS STORYTELLERS

The archaeological investigations conducted in Stockholm, Vaxholm, Karlskrona and Suomenlinna clearly reveal that many ships from the Swedish naval fleet live on as wrecks – many more than previously recognised. But what information can an end-of-life ship actually provide? What sizes and ship types were used? How much of the ship was utilised prior to sinking? And what stories can an old chopped-up ship tell us?

When the quays on Skeppsholmen in Stockholm were to be renovated in 2017, Gustav II Adolf's flagship *Scepter* had lay hidden for several hundred years. The ship was repurposed as a foundation for a careening dock where ships were repaired around 1640. Note how the piles from the careening dock go straight through the wreck. The photo also shows *Scepter's* heavy trimming in the stern and, above the interior trim, riders. Both were used to carry up the heavy gun decks and relieve the hull.

One wreck in particular, from a quay on Skeppsholmen in Stockholm which was examined in 2017, proves that even an end-of-life ship can carry a wealth of information. The wreck emerged during excavation work in the quay, when piles from an older careening dock were removed. It turned out to be the remains of a robustly built warship.

A dendrochronological analysis showed that the wood came from Swedish oak trees felled during the winters of 1612/13 and 1613/14 in the eastern Mälaren region. Equipped with these findings, we turned to the archives and could quickly see that only four ships were built in Sweden during that period: *Scepter* (36 guns), *Riksnyckeln* (28 guns), *Harbo Lejonet* (20 guns) and *Jupiter* (20 guns). *Riksnyckeln* sank in 1628 at Viksten in the Stockholm archipelago, so that ship could be excluded. *Harbo Lejonet* and *Jupiter* were too small compared with the wreck found in the quay. Only one alternative remained: *Scepter.*

The archaeological excavation provided useful information about *Scepter's* construction. Among other revelations, it turned out that *Scepter's* hull profile is nearly identical to *Vasa's*, only on a slightly smaller scale. This is perhaps not very surprising. Both ships were built by Dutch shipbuilders who probably constructed their ships in similar ways in terms of design and hull shape. *Scepter* was probably significantly lower than *Vasa* and probably had only one covered gun deck. The length of the keel is about 32–33 metres, compared with *Vasa's* 38 metres. But *Scepter* was still quite large for warships of its generation.

Scepter's interior revealed several exciting finds, ranging from household items to cannonballs and charging tools. Traces of handicraft work were also found, such as carved crosses in

Swedish ships blocking Danzig (Gdańsk) in 1627. According to archival records, one of the ships that took part in the blockade was *Scepter*.

various pieces of timber from the shipwrights of Biskops-Arnö where *Scepter* was built – an almost eerily tangible link back in time to a shipyard from the early 17th century.

GUSTAV II ADOLF'S FIRST FLAGSHIP

When the Swedish king Charles IX died in the autumn of 1611, he left Sweden in a predicament. The country was poor, and its army and navy in bad shape. Moreover, Sweden was at war with three countries at the same time – Denmark, Poland and Russia. Charles IX's son, Gustav II Adolf (Gustavus Adolphus), took over the crown at just 16 years old. Considering the circumstances, the king was set to face an uphill battle. Early in his reign, the young king thus decided to revamp the country's armed forces.

Gustav II Adolf's half-brother, Karl Karlsson Gyllenhielm, who returned home in 1613 after twelve years in Polish captivity, played a large part in the young king's plans. Together, they resolved to build more ships for a modern and powerful fleet that could be wielded for the purpose of Swedish expansion in the Baltic Sea region.

One of these new ships was *Scepter*. The archives contain several documents that mention the ship's construction, which together with the dendrochronological dates and archaeological observations helped to identify the wreck as *Scepter* (alternatively spelled *Sceptor* and *Septor* in the archives). *Scepter* was built under the leadership of the Dutch shipbuilder Isbrandt Johansson. Construction began in the autumn of 1612, when Johansson re-

During the archaeological excavation, a wooden mallet was found that was probably part of the wreckage of *Scepter*. Wooden mallets like this were used for hammering in pegs or plugs for sealing purposes.

ceived his power of attorney and order to start building a ship on Biskops-Arnö in eastern Mälaren. These early dates, which show that the timber was felled during the winter months of 1612/13, correlate perfectly.

The archives also tell us that no ship timber was available for construction at the end of 1613, because the timber ordered by the bailiffs had not yet arrived. After Johansson wrote a letter of complaint to the admiralty in Stockholm, the ship's captain Joen Lackej was tasked with felling the necessary oak wood. Here, we also capture the type of timber that was felled during the winter of 1613–14.

The first time we come across *Scepter* as a sailing ship is in August 1618 in a letter to Alexander Forath, captain of the ship *Hannibal*, which was on its way from Stockholm to join the fleet. At the time, Gustav II Adolf was on *Scepter*, which he had designated as an admiral's ship. A captivating eyewitness account from 1620 gives us an idea of what it looked like inside the cabin where the king was staying.

> *The ship Scepter, on which Gustaf II Adolf and the Count of Pfalz travelled to Germany in the spring of 1620, had a spacious cabin upholstered in gilded leather on a green background, the ceiling in green taffeta, and the small cabin with red double taffeta, ceiling and all covered in fabrics …*

In 1621, Gustav II Adolf decided to invade what was then called Livonia, now Estonia and Latvia. The first goal was to conquer Riga, a key trading hub and therefore strategically important. A total of 148 ships departed Sandhamn in the Stockholm archipelago and set course for Riga. *Scepter* led the fleet, with the king himself on board in charge of the high command. The fleet immediately ran into a severe storm. Several ships were forced to ride out the storm at sea for three days before attempting to attack the coast. *Scepter*, badly battered, eventually made its way to Pernau (now Pärnu) in Estonia. From there, the king had to make his way over land to Riga.

After the entire fleet had dispersed in the storm, it reconvened at the Daugavgriva roadstead. But another storm arrived, wreaking extensive damage to several ships. Masts were cracked and repairs had to be made before they finally got underway. *Scepter* soon ran into new problems. It hit an underwater rock, compelling the rest of the fleet to cast anchor again and wait for the ship. Later that day, it managed to free itself from the rock and could at last sail onwards to Riga.

Scepter's early years were eventful, to say the least. Later on, both the naval fleet and *Scepter* were mainly used for surveillance missions, including the blockade of Danzig (now Gdańsk) in 1627. The chapter *Solen* describes this event in more detail. Historical sources mention that *Scepter* needed to be repaired from time to time during these missions, which also aligns well with observations in the archaeological records.

THE LOST NAVY

Scepter is an excellent example of what an end-of-life ship can tell us, partly due to archaeological results as well as through the amazing stories the wreck can convey about the ship and the era it belonged to.

These deliberately sunk and recycled ships – a lost and forgotten fleet – have great potential to provide new information and knowledge about the evolution of shipbuilding and about Sweden and the wider Baltic Sea region. In partnership with Stockholm University and the Finnish Heritage Agency, Vrak – Museum of Wrecks is thrilled to embark on a journey that reveals the history of this lost navy through a dedicated research programme, 'The Lost Navy. Sweden's "blue" heritage circa 1450–1850', running from 2021 to 2026. *Scepter* presents a magnificent example of the intersection where archaeology and historical sources meet, and pieces of a puzzle finally fall into place. It almost feels like magic in the making.

SURFACING CONFLICTS

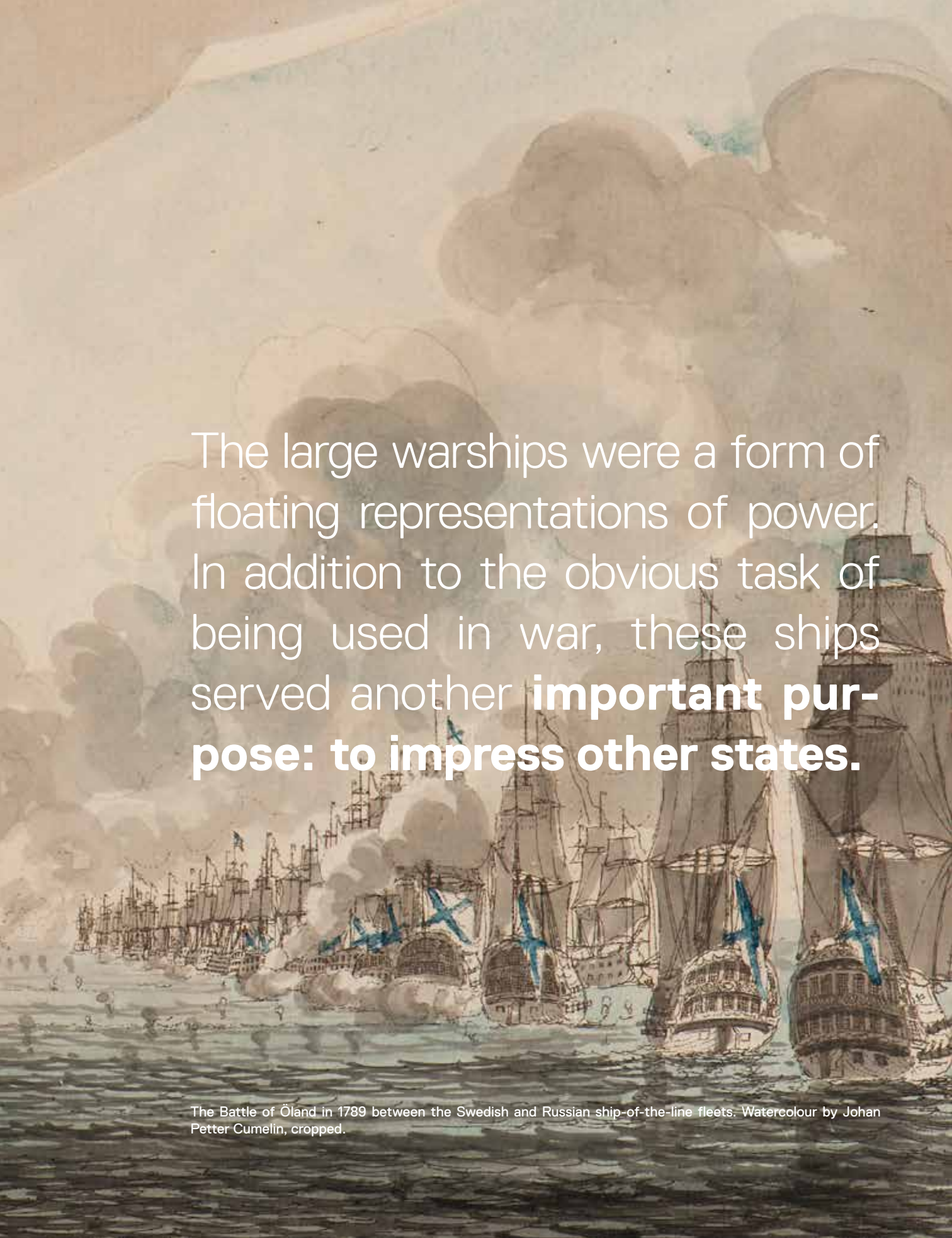
With the rise of the state in the 16th century, the sea and the ability for dominating various trade routes grew more important. The development of artillery and shipbuilding also made it possible to dominate the waterways in a different kind of way. The sea became a place where ever larger ships, served by ever larger crews and carrying ever larger guns, engaged in battle. The biggest ships boasted more than a hundred guns and could carry hundreds of people, and today their wrecks represent sunken battlefields.

The appearance of steam and further advances in artillery technology during the 19th century did not make the ships themselves smaller, but their crews shrank in number as the number of guns decreased. The greatest maritime disasters of the 20th century thus do not take the form of massive naval battles, but rather involve fleeing masses of people huddled together on large ships that were sunk. Their escape could take place in a relatively organised fashion on large vessels, such as during the evacuation of the Soviet fleet from Tallinn in 1941, or the German retreat in 1945 when tens of thousands of people died. But escapes could also be haphazard affairs, in small boats, as when more than 30,000 people set out from the Baltic states toward Finland and Sweden in the final stages of World War II.

In the 20th century, the sea also became three-dimensional in a way that had not been experienced before. Mines, submarines and aircraft claimed many lives during the wars, but also made people adapt to the new threats. When suspected submarines threatened coastal areas during the Cold War, old-fashioned, low-tech methods came to affect the local population when straits and shipping lanes were cordoned off using anti-submarine nets.

THE MIGHTY SHIPS

PATRIK HÖGLUND · SURFACING CONFLICTS



The large warships were a form of floating representations of power. In addition to the obvious task of being used in war, these ships served another **important purpose: to impress other states.**

The Battle of Öland in 1789 between the Swedish and Russian ship-of-the-line fleets. Watercolour by Johan Petter Cumelin, cropped.

THE MIGHTY SHIPS

Big warships were among the most complex creations of their time. Building them demanded an enormous amount of resources and skills. They were expensive to maintain, difficult to manoeuvre, technologically advanced and contained a variety of modern inventions, such as navigational instruments, pumps and ingenious weaponry.

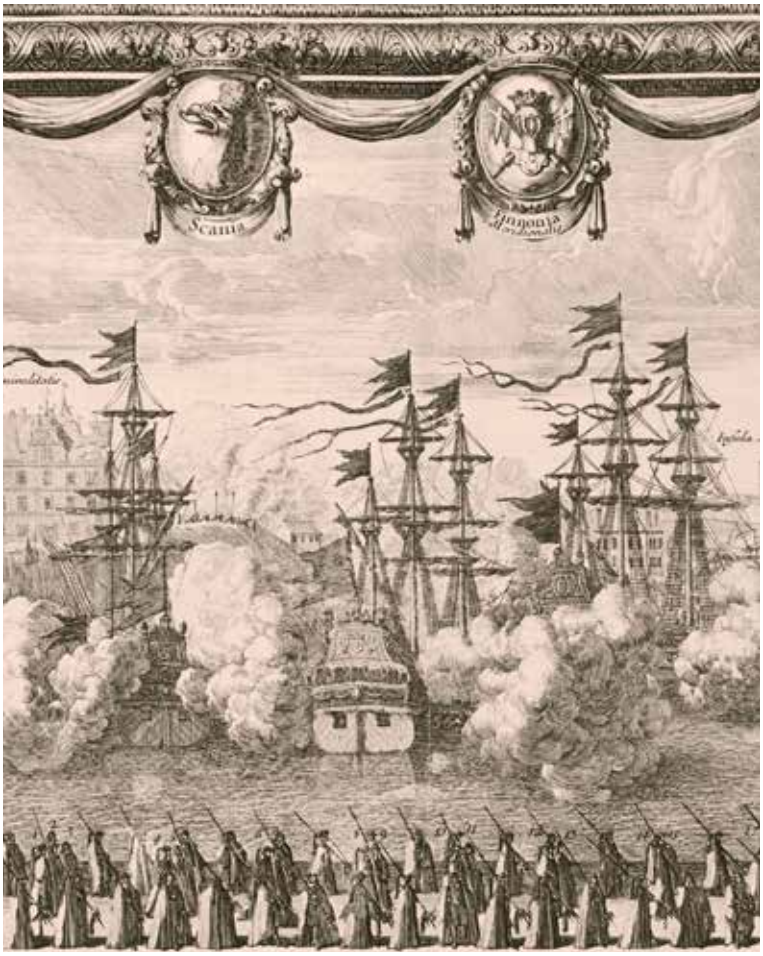
In several countries, huge warships with guns on several decks had already been built in the 16th century. One example is the Swedish ship *Mars*, which was wrecked in battle in 1564. Archaeological investigations of *Mars* have revealed that the ship's decks were arranged in a manner reminiscent of later warships.

In the latter part of the 16th century and the first half of the 17th century, smaller, cheaper and more manoeuvrable ships were usually preferred in northern European fleets and few ships had multiple gun decks. The basic features of these warships were similar in many countries, even though each country and each shipbuilder had their own ideas about the ships' construction and design.

A SAILING PALACE

In the European princely states that grew in power from the 16th century onwards, magnificent castles, imposing statues and grand triumphal arches were essential ways of demonstrating the power of kings and nobles. The large warships, too, were a form of floating representations of power. In addition to the obvious task of being used in war, these ships served another important purpose: to impress other states.

In many countries, such as Sweden and Denmark, naval ships were often moored in the capital city for the general public to see. The ships could be admired there by foreign envoys and merchants and were often used in important state ceremonies, such as coronations and funerals. One example is when the Swedish admiral Nils Stiernsköld, who had been killed in the Battle of Oliwa in 1627, was brought home. *Vasa* and other ships lay at anchor in Stockholms Ström, the innermost basin of the Baltic Sea in Stockholm, and fired a salute.



Navy ships salute during the funeral of Swedish King Charles X in Stockholm. Copper engraving by Erik Dahlbergh, cropped.

The decorative art that adorned the warships showed off the country's military prowess and ambitions of power. Ideological messages were carved into the sterns of the ships, where they portrayed the true faith, the age-old traditions of the kingdom and the undeniable legitimacy of the ruling dynasty.

THE SHIPPING COMMUNITY

A fully manned warship was something of a rarity and was found almost exclusively during wartime. At sea, the ultimate consequence of the war was a showdown with the enemy – a naval battle. These were extremely rare, but the very ability to maintain a fleet ready for combat was sufficient for rival states to bear in mind this potential threat.

Although a naval fleet had a complex and resource-intensive organisation, with hundreds of different smaller ships mainly used for purposes ranging from timber and food transport to blockades and merchant ship protection, this organisation ultimately aimed to maintain a fleet capable of meeting – and defeating – the enemy. It was only during naval wartime campaigns that the ships were fully manned and the fleet completely prepared to engage in combat.

Several hundred people of many different ranks and roles might be huddled together on a warship: admirals, captains, officers, priests, cooks, ship's boys, soldiers and seamen. A variety

Svärdet up in flames at the Battle of Öland in 1676. Close-up of Anders Homan's epitaph in Kalmar Cathedral.

335 years after *Svärdet* sank in 1676, the wreck was found at a depth of 80 metres. Part of the hull has suffered fire damage, and damage from cannonballs is also visible in some areas.

of social groupings, professions, abilities and ages were all represented on board. Representatives of the highest echelons of society were present on the ships, as well as people from lower walks of life. In many ways, a warship was a society in miniature – a ship community – reflecting the organisational structures and conditions that existed during its time.

Still, the people on board should not be considered as a mirror image of the surrounding society. For example, the considerable group of women in society was often absent. Probably more frequently than previously believed, women could indeed live and travel on a warship. But this usually occurred when the ship was being used for transport in peacetime or at least under safe conditions, or when the ship was in port. Even though we can question whether most individuals were on board voluntarily, and considering that the vast majority could not leave the ship whenever they wanted, everyone on board was nevertheless united as a community. A form of social bond existed which brought the occupants together. All were subordinate to the ship's commander and the fleet as an organisation, and were required to comply with the organisational structure and rules of the fleet.

STATUS AT SEA

Unlike on land, time spent on a warship inevitably involved some clear limitations and expectations regardless of position, due to factors like cramped spaces and the temporary nature of the stay on board. Of all the factors that affected people's relationships on board, the most important one was space – or rather, the lack of it. Overcrowding was certainly nothing unusual in pre-modern society, but on a fully manned warship it was inescapably palpable. The allocation and assignment of physical space represented a clear demarcation of social status on these ships. Determining where people of different statuses were allowed or not allowed to spend time was a way to maintain the social order on board. Other ways of indicating status were through personal equipment and belongings that people took with them.

In addition to documenting the ship and its construction, maritime archaeological surveys of warships can provide clues to the course of events leading to a sinking and possible salvage attempts. The equipment, personal and otherwise, that is often preserved in the wreckage and surrounding sediment can tell us about society during this time and the lives of the people on board the ship.

In general, very little historical information is available regarding the crew's own equipment on board a warship. Archaeological material from Swedish warships like *Solen* (1627) and *Vasa* (1628) have constituted the main sources of knowledge. Investigations of another Swedish warship, *Kronan*, wrecked in 1676, have shown that the number of objects brought on board by the senior officers took up vast amounts of space.

Besides the roomy, comfortable accommodations at the disposal of the few officers on board, at least compared with the seamen, the variety of items the officers brought with them is striking. In particular, the officers needed items to display their status on different occasions and in different environments. They thus brought along private equipment and clothing for all sorts of uses. This could include anything from saddles and swords to pistols and hunting weapons, as well as hats and silk stockings, tableware and wine bottles, spices, pickled fruit and table clocks, musical instruments, books and writing implements. Most of the equipment was stored not in the officers' living quarters in the cabins, but in an abundance of chests that were stowed on the orlop deck.

The seamen stored their belongings collectively in chests or barrels. Typical items included a tankard and a bowl that they drank and ate from together, knives and spoons, a few articles of clothing, haberdashery, and pieces of fabric and leather intended for repairs.

Chests with spices and tobacco from *Kronan*.

BATTLE AT SEA

In the 16th and much of the 17th century, naval combat tactics involved trying to get the enemy into a leeward position in order to gain the wind and approach the ship, fire the guns and, if the enemy was considered weakened enough, board the ship. Having many soldiers ready for boarding, or defence, was a great advantage in battle. The skilled commander manoeuvred his ship so that he could fire on the enemy ship's weakest point, the stern, '... by firing the length of its ship...', as it says in a Swedish order from 1628. If a cannon shot hit its target from astern, it could continue down the entire length of a deck and cause massive devastation.

In the second half of the 17th century, naval warfare tactics underwent a change. With the innovative line-of-battle tactic, ships formed a line and each ship sailed in the wake of the ship ahead of it. Using this method of combat, the ships could protect each other's bows and sterns while firing broadsides at the enemy. Such a tactic obviated the need for engaging in close combat with the enemy and boarding their ships; it sufficed to fire repeated broadsides and then await the enemy's surrender. Large, heavily built ships with many guns now became more important than ships with many soldiers on board. Small, weakly armed ships were shot to pieces. This prompted many naval states to begin building larger, heavily armed, purpose-built warships.

The introduction of line-of-battle tactics was a lengthy and complicated process. It required far more training and exercises for officers and crew than before. A fleet's ships had to conduct naval exercises together, and the ships needed to become more uniform. The first rather disastrous attempts in Sweden to engage in something resembling line formation

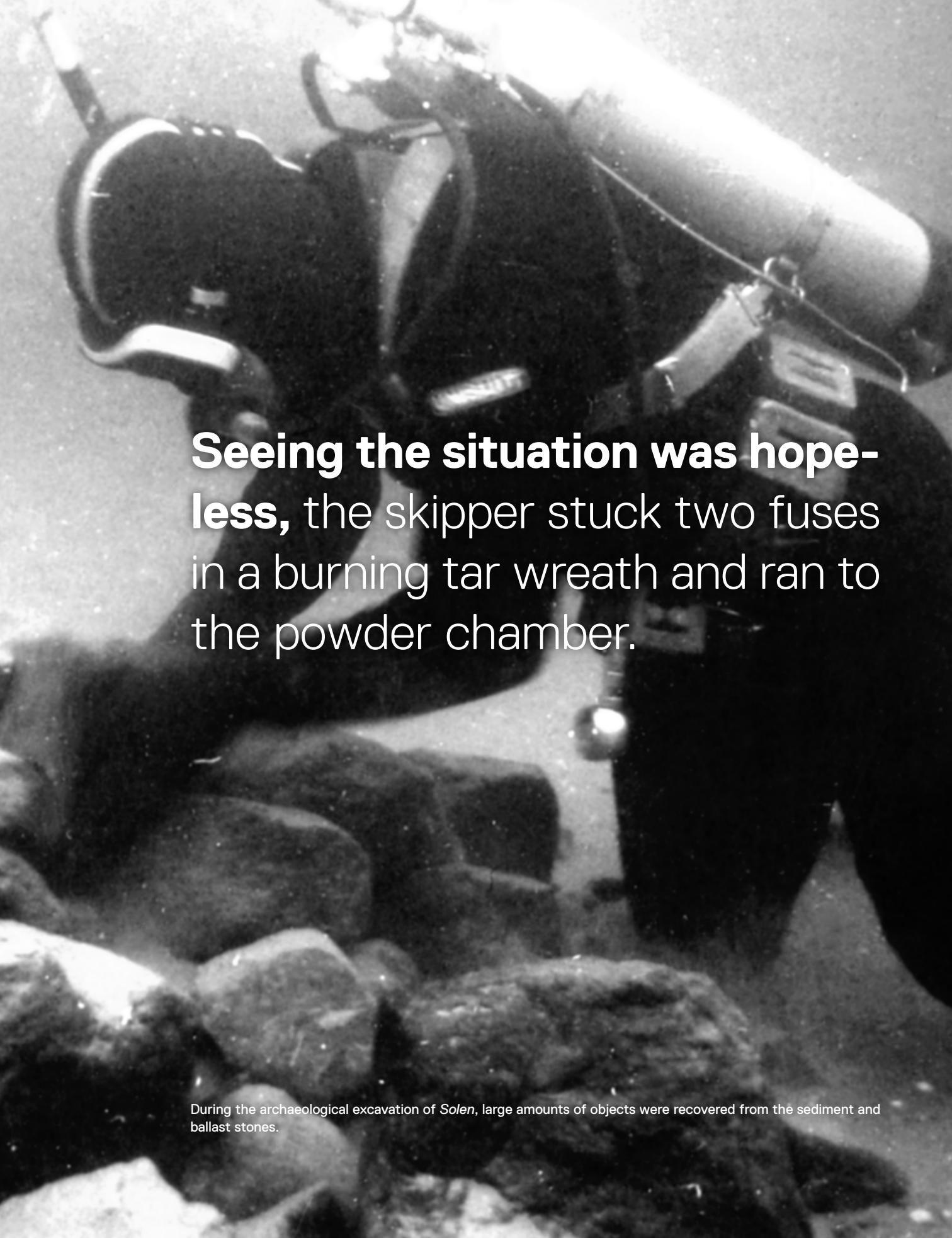
The huge warships carried hundreds of crew members. Detail of 'Dutch Ships in a Calm Sea' by Willem van de Velde the Younger, 1665.

were made at the battles of Bornholm and Öland in 1676 against the Dutch and Danes. At the trial following the failed battles in which the navy lost its two largest ships, *Kronan* and *Svärdet*, it was remarked that many of the officers were incompetent and had not mastered the tactically crucial line-of-battle signals. It was also tersely noted that 'The Dutch no longer board as they used to...'.

The first Swedish line-of-battle fleet is perhaps the fleet that was mobilised in 1689. Its ships were, in principle, all adapted to be part of a battleline and were reasonably equal in terms of both armaments and sailing capabilities. This type of ship was referred to as a ship of the line. With the emergence of such ships and the transition to line-of-battle tactics, the composition of the crew – mainly through a drastically reduced number of soldiers – changed in a way that remained permanent until the sailing warships made of wood were replaced by steam-powered warships made of iron.

SOLEN

ELŻBIETA WRÓBLEWSKA · SURFACING CONFLICTS



Seeing the situation was hopeless, the skipper stuck two fuses in a burning tar wreath and ran to the powder chamber.

During the archaeological excavation of *Solen*, large amounts of objects were recovered from the sediment and ballast stones.

SOLEN

Solen was a Swedish vessel sunk in the Battle of Oliwa in 1627. To prevent *Solen's* surrender, its skipper blew himself up together with the vessel by detonating the powder chamber. The Battle of Oliwa has been regarded in Poland as the only major naval battle of the old Polish navy, but is mostly seen as a minor skirmish in Swedish naval history.

The wreck of *Solen* was discovered in 1969 during construction works on the Northern Port in Gdańsk. The nearly 6,000 artefacts recovered from the wreck illustrate various aspects of the crew's life and reveal the structure of the ship itself. When excavation of the ship was completed, the preserved part of *Solen's* hull was hauled to another, safer location.

THE VASA FAMILY AND THE DYNASTIC DISPUTE

Sigismund III Vasa, who in 1587 was elected king of Poland and duke of the Grand Duchy of Lithuania (Polish-Lithuanian Commonwealth), was the son of the Polish princess Catherine Jagiellon and the Duke of Finland – from 1569 King John III of Sweden. After the death of his father, Sigismund inherited the Swedish throne, but was dethroned in 1599 after a civil war where the opposition was led by his uncle, Duke Charles of Södermanland, who was consequently proclaimed King Charles IX by Swedish parliament in 1604.

Following these developments, the Polish-Lithuanian Commonwealth was drawn into long and devastating wars with Sweden, which among other reasons were caused by the dynastic dispute through Sigismund's claim to the Swedish throne and fuelled by religious intolerance, since Sigismund was a Roman Catholic and Duke Charles a hard-line Lutheran. After the death of Charles IX in 1611, the Swedish throne was passed on to his son, Gustav II Adolf.

For as long as he lived King Sigismund III did not abandon his efforts to regain the Swedish crown, and he would call his cousin Gustav a prince 'usurper'. The war between Poland and Sweden therefore continued, and part of Gustav II Adolf's war plan was to take control of the Baltic navigation routes and coasts together with the major ports and customs cham-

Sigismund III Vasa, son of Polish princess Catherine Jagiellon and John III of Sweden. In 1587, Sigismund was elected king of the Polish–Lithuanian commonwealth. After his father's death, he too became king of Sweden but was dethroned in 1599. The picture is cropped.

bers. Because the naval forces of the First Polish Republic were small, he gained absolute domination over them, at least in the initial phase of the conflict.

THE BLOCKADE OF DANZIG'S PORT

In 1626, the war between Sweden and Poland entered a phase particularly threatening to the Polish state. Earlier, the conflict had been staged in Livonia, present-day Latvia, almost entirely occupied by the Swedes. After the conquest of Riga in 1621, Gustav II Adolf's focus turned to Royal Prussia and the area of the Vistula River Mouth. Having conquered Pillau, in present-day Baltiysk (now Russia) and many Prussian towns, the Swedes landed at the gates of Danzig (now Gdańsk). The prime goal of Gustav II Adolf was to overpower the city, or at least force it to declare neutrality towards Sweden.

The Swedish king never achieved his goal. Sigismund III understood that in order to achieve political success in the Baltic region and prevent the blockade of the largest Polish

The watercolour depicts Swedish warships collecting customs duties and guarding the inlet to Pillau, now Baltiysk. The picture also shows Dutch merchant ships and some smaller boats. The site, which served as a base for the Swedes, is located just east of Gdańsk.

port, he had to build a fleet. And so he did. In November 1626, when he was paying a visit to Gdańsk, the king inspected his warships. It was then, too, that he established the Royal Naval Commission of Sigismund III, which reported to the Grand Royal Field Commander Stanisław Koniecpolski and was headed by the king's chamberlain, Gabriel Posse.

In May 1627, a mighty squadron of Swedish warships began to block the Gdańsk port from the sea. The Polish king's order, which prohibited any attacks on the enemy if the enemy ships were to outnumber Polish vessels, made it impossible for the commissioners to take any actions aimed at unblocking the port. It was only in November of the same year, after the withdrawal of more Swedish ships, that the royal commissioners could consider taking up arms. It was late autumn and the Swedish sailors were exhausted. They were running short of supplies and many of them suffered from scurvy. They did not expect to be attacked, and with winter approaching they were expecting to return home.

THE SIEGE OF DANZIG BAY

The encounter between the squadron of six Swedish warships and Polish vessels took place before the Gdańsk roadstead, on 28 November 1627. The Polish fleet was tactically divided into two squadrons of five vessels each. The first was headed by *Sankt Georg*, the admiral's ship, and the other by *Meerman*, the vice-admiral's vessel. The forces of the Polish king were commanded by Admiral Arend Dijckman from the Netherlands.

The Polish fleet used so-called swarm tactics, meaning that the admiral's ship took the initiative and chose the enemy vessel, while the other ships supported and protected

In November 1627, the Swedes lifted the blockade of Danzig, now Gdańsk. It was late autumn and many were exhausted or sick. With the winter coming, they hoped to return home. The Polish navy sees its chance to attack. The Battle of Oliwa, painted by Adolf Boy.

the flagship. Major events during the battle included the defeat of *Tigern*, the Swedish Admiral's warship, the deaths of Polish Admiral Arend Dijckman and Swedish Admiral Nils Stiernsköld, and the blowing up of the *Solen* warship.

The fight with the approaching *Solen* was started by the Polish vice-admiral's *Meerman*. After some time, the soldiers of Sigismund III gained an advantage and were finally able to board the Swedish ship. Seeing the situation was hopeless, the Swedish skipper stuck two fuses in a burning tar wreath and ran to the powder chamber. The urgent and fearful cries of the crew were interrupted by a powerful explosion. *Solen* sank into the sea. Apart from the admiral, the explosion claimed the lives of master Alexander Forath, 22 soldiers and a deckhand. Why did the Swedes decide to blow up the ship? They were simply obeying instructions of warfare. Costly warships, built over years and fitted with valuable guns, simply could not get into the enemy's hands.

AFTERMATH

As a direct result of the battle, the inconvenient blockade of the Gdańsk port was lifted. However, in the spring of 1628, the Swedes blocked Gdańsk again, hindering the navigation and drawing substantial income from the customs imposed on merchants. Not only was the Polish fleet unable to prevent it, but Polish vessels mooring near the Wisłoujście stronghold were attacked in July by Gustav II Adolf's vessels.

The Battle of Oliwa had no major impact on the general course of the war for the Vistula River Mouth (1626–29), and is considered by the Swedes as a minor battle in the years-long

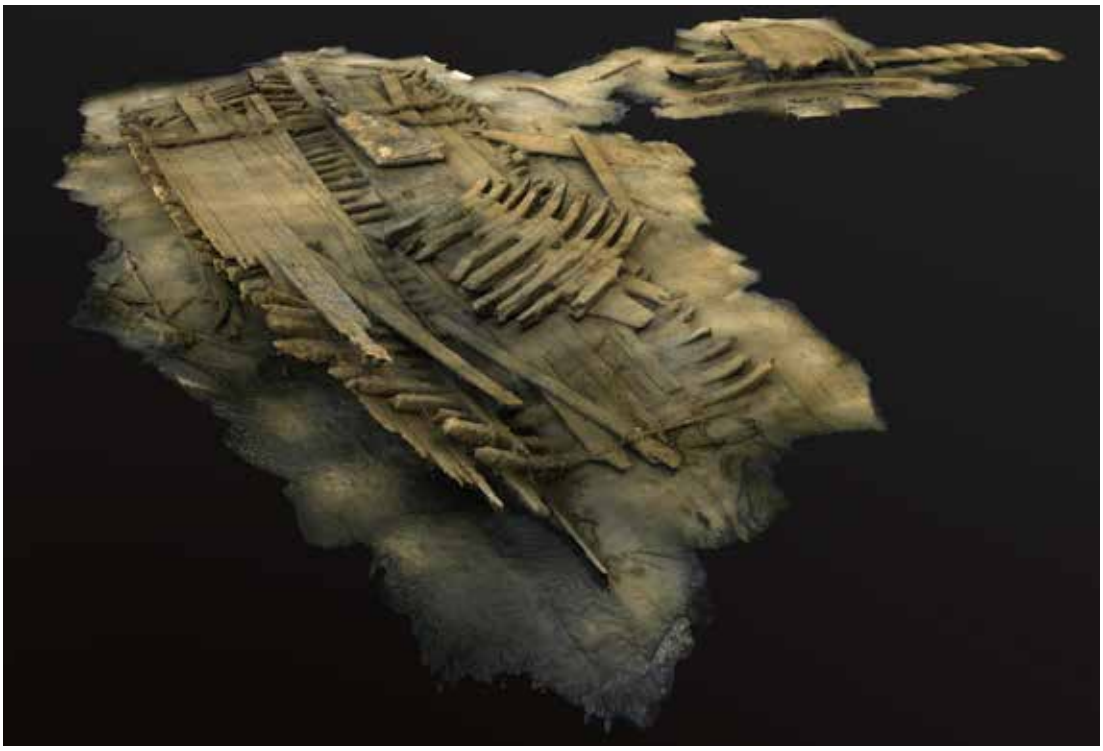
In 1969 the shipwreck of *Solen* was discovered at the anchorage of the future Gdańsk's northern port. It lay 16 metres deep and most of it hull was scattered over the seabed. During the archaeological excavation of *Solen*, more than 6,000 objects were recovered from the sediment and ballast stones. Everything from personal belongings to rigging details and guns. The findings tell of the battle at sea and the ship's wrecking, but also about life on a warship during a prolonged blockade.

period of fighting between the two Baltic states. For Poland, however, it grew to become one of the most commonly known victories of the old Polish navy. The battle was a signal sent to other rulers of the time that the young, recently formed fleet of Sigismund III Vasa was strong enough to oppose Sweden, then the preeminent maritime power. The loss of *Solen* (The Sun in English) was commemorated in a saying popular at the time: 'at Gdańsk, the sun sets at noon'. It was coined soon after the battle in order to popularise the Oliwa victory.

The Polish royal propaganda was mainly targeted at the Baltic Sea cities, Denmark and the Habsburgs. Its purpose was probably to convince its audience of the growing strength and significance of the royal fleet, which was intended to serve as proof that the Polish king was an important player and a welcome ally in the rivalry for domination of the Baltic Sea.

As the Polish king, Sigismund III Vasa hoped to carry through the most important part of his plan – an invasion of Sweden by sea with the help of the emperor, the Spanish, and the Hanseatic cities (Catholic Holy League fleet). Nobody, however, wanted to engage their forces or provide funds to carry out the Polish king's plan, which the monarch painfully learned of when he sent his fleet to Wismar in 1632.

The war between the First Polish Republic and Sweden for the Vistula River Mouth (Royal Prussia) was discontinued on 26 September 1629 when a truce was signed in Altmark (now Stary Targ). In 1635, the Truce of Altmark was renewed in Stuhmsdorf (now Sztumska Wieś) for an additional 26 years, its conditions slightly altered.



After archaeological excavations, the wreck was moved to another underwater location to protect and preserve it. This is a photogrammetric image of the moved wreck.

WHERE THE SUN HAS SET

The *Solen* wreck landed on the bottom of the Baltic Sea in a location indicated by historic records as the site of the Battle of Oliwa, i.e. before the roadstead of Gdańsk – at the height of the monastery in Oliwa, today a district of Gdańsk.

Over time, the structure of the ship had become almost entirely destroyed. What was preserved was a sizeable fragment of the bottom, covered in ballast stones. Loosely scattered around it lay parts of the ship's hull, such as planking, remains of the stern construction, and pieces of the rudder.

The ship survived in that condition up to 1969, when the sea bottom near the entry route to the Gdańsk port was dragged to detect any navigation obstacles, revealing two wrecks at a depth of 14–16 metres. *Solen* was one of them. The site was explored primarily during 1975–1981 under the supervision of the director of the Maritime Museum in Gdańsk, Przemysław Smolarek.

Not only the location, but also the appearance of the wreck and the nature of its artefacts suggested that this must be *Solen*. Traces of the explosion bear witness to this conclusion. The dates on the guns and especially on the coins were highly informative. The oldest gun was cast in 1560, and the newest sometime in the 1610s, while none of the coins were minted after 1627, the year when the two fleets clashed.

OBJECTS ONBOARD

The rich collection of artefacts discovered on the wreck and in its vicinity offers a nearly comprehensive portrait of what the armament and fittings of a man-of-war in the Baltic Sea looked like in the first decades of the 17th century. It makes an interesting comparison with the artefacts retrieved from *Vasa*, the Swedish royal vessel which sank off Beckholmen in Stockholm one year after the Battle of Oliwa. As the largest vessel at the time in the Baltic Sea, *Vasa* was fitted with powerful, fairly uniform guns. *Solen's* artillery, on the other hand, was made up of guns of various origins and calibres.

The 20 bronze guns which were retrieved from the wreck represent a nearly complete armament of the vessel, although not all of them seemed to be intended for *Solen's* gun deck. A dozen or so guns bear the sheaf mark and initials CDS (Carolus Dux Soedermanlandiae) or GRS (Gustavus Rex Sueciae), plus dates. Two gun barrels were cast in Lithuania: one for the Polish king, Sigismund II Augustus Jagiellon, the other most likely for a member of the Radziwiłł magnate family; two others were probably cast at the Moscow gun foundry of Tsar Ivan IV the Terrible.

The set of gun barrels retrieved from the *Solen* wreck, today at the National Maritime Museum in Gdańsk, is certainly one of the most precious collections of exceptional fact-revealing value for historians who study the development of Swedish artillery. The unusual diversity of the calibres of the guns cast over a period of more than 50 years, not found in other museum collections, makes it possible to draw far-reaching conclusions as to the stages and directions of this development.

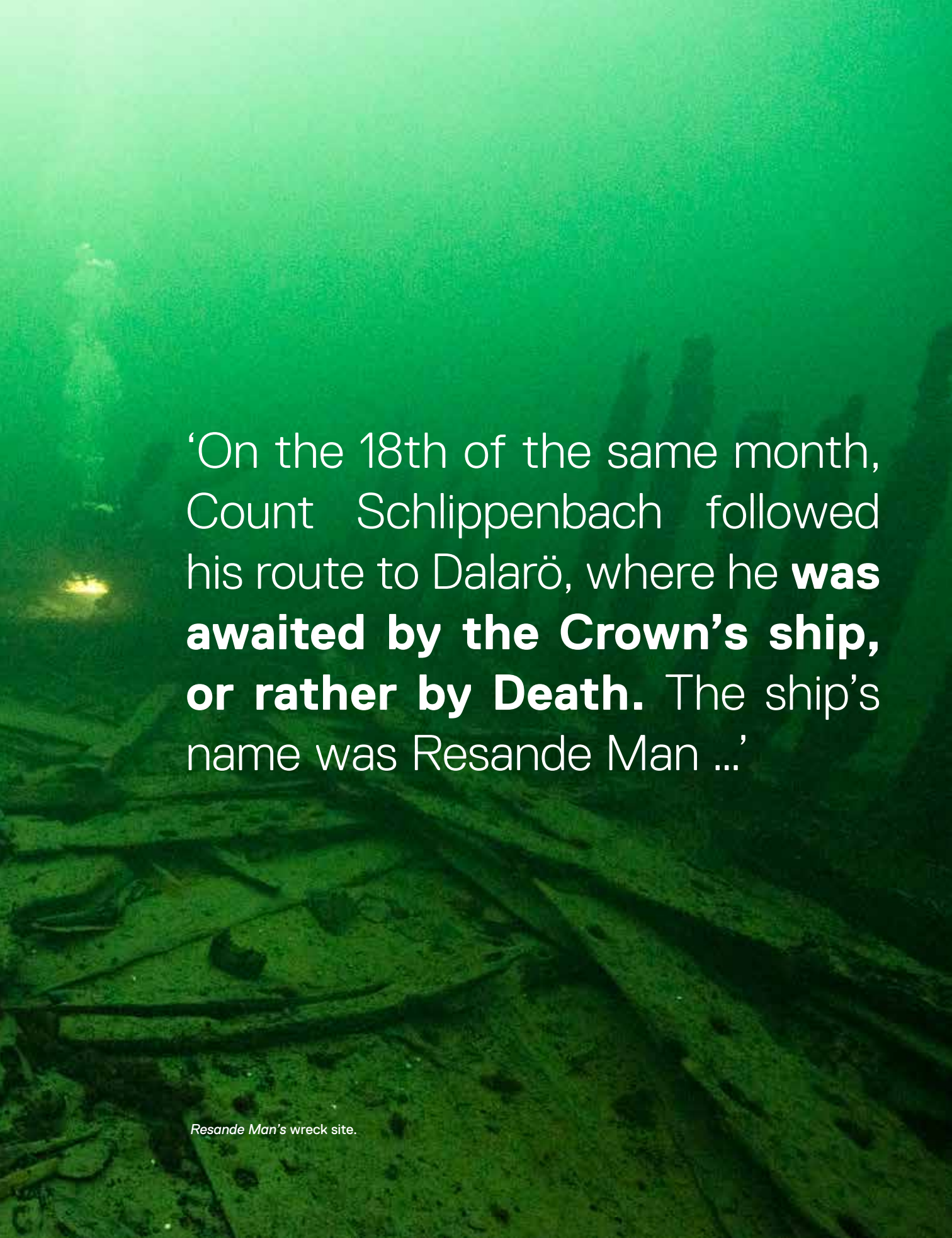
Other artefacts related to *Solen's* artillery include parts of gun carriages, as well as gun accessories such as powder ladles, rammers, cleaning brush fragments and cannonballs of different weights, sizes and types. Compared with this, the surviving hand weapons and their accessories, such as muskets and their ammunition, powder cases and remains of side arms, seem rather modest.

Sailors' personal belongings, such as leather clothing, clay pipes and sailor bag handles made of reindeer antlers, represent another valuable group of artefacts, with largely reconstructed kitchenware and tableware constituting a sizeable group in the museum's collection. Other extracted artefacts include anchors, navigation instruments and elements of the rigging, such as the mainmast bitt, blocks, deadeyes and ropes. Also retrieved from the wreck was a collection of Swedish silver coins and copper rectangular coins, the so-called clipped coins.

To this day, the *Solen* wreck remains one of the most interesting archaeological sites explored by the Polish archaeologists from the National Maritime Museum in Gdańsk over the last 50 years. Following conservation and reconstruction work, artefacts from *Solen* are now on display both in the rooms of the National Maritime Museum in Gdańsk and at Vrak – Museum of Wrecks in Stockholm.

RESANDE MAN

PATRIK HÖGLUND · SURFACING CONFLICTS



‘On the 18th of the same month, Count Schlippenbach followed his route to Dalarö, where he **was awaited by the Crown’s ship, or rather by Death.** The ship’s name was Resande Man ...’

Resande Man’s wreck site.

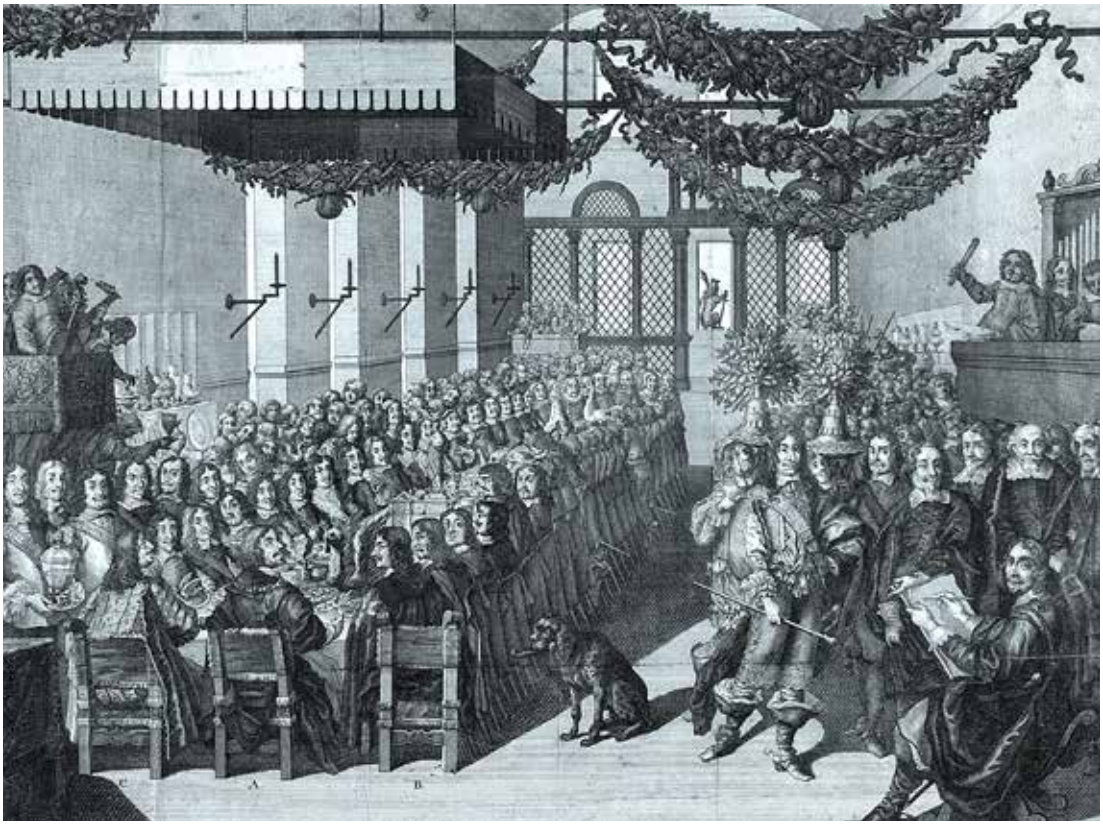
RESANDE MAN

Theatrum Europaeum, a chronicle published in Europe in the 17th century, contains a dramatic story about an event that took place over the course of a few stormy autumn days in 1660 in the Stockholm archipelago – the sinking of the ship *Resande Man*. On board was an important diplomatic mission, an embassy, led by the privy council member and Count Christoph Carl von Schlippenbach. Ambassadors usually brought bountiful gifts with them that would facilitate diplomatic efforts.

The Count drowned when the ship sank, but one of the survivors, embassy secretary Andreas Bjugg, recorded the dramatic shipwreck. Bjugg's account spread far and wide, and along with rumours circulating about the riches on board, *Resande Man* became a legendary, sought-after ship. For a long time, many searched in vain for the lost ship. It was not until 2012 that the wreck of *Resande Man* was at last discovered.

WAR, PEACE AND DIPLOMACY

When the Swedish warrior king Charles X suddenly fell ill and died in February 1660, Sweden was at war with several countries including Poland (at the time, the Polish–Lithuanian Commonwealth) and Russia. The Swedes achieved peace with most of their enemies progressively throughout the year, and in April 1660 the first real peace was concluded with Poland in more than 100 years. During Sweden's autumn parliamentary session that same year, it was decided that a number of embassies would be sent to foreign powers, including Poland, for various negotiations. It was customary for embassies to bring gifts. Larger embassies would often take a case of magnificent silver on board, or exclusive items such as hunting weapons and caparisons for decorating horses. Besides the need for the envoy to be an experienced person of high stature, the number of gifts also had to reflect the significance of the mission. The gifts gave a touch of glamour to the embassy as it paraded in, and helped to ease negotiations.



The Peace Banquet in Nuremberg after the Thirty Years' War. von Schlippenbach stands on the right as Charles X's chamberlain and holds a chamberlain's staff in his hand. Copper engraving by Wolfgang Kilian (1581–1662) after a painting by Joachim von Sandrart (1606–1688).

THE AMBASSADOR

The seasoned diplomat Christoph Carl von Schlippenbach was one of the Europeans who had gone into service for Sweden during the Thirty Years' War, and he swiftly climbed the ranks. von Schlippenbach became Charles X Gustav's chamberlain and played a key role in the negotiations of the Peace of Westphalia in 1648.

Before Queen Christina's abdication in 1654, von Schlippenbach was appointed colonel of the High Guard and promoted to count. After Charles X Gustav's ascent to the throne, he received a slew of diplomatic assignments. von Schlippenbach was then appointed president of the War Collegium as well as the Privy Council. After the king's death, he became one of Sweden's commissaries at the peace congress which in 1660 led to the Oliwa peace treaty with Poland. Later that year it was decided that von Schlippenbach would return to Poland, this time to lead an embassy for talks on an alliance directed against Russia.

RESANDE MAN

Resande Man was one of the Swedish navy's smaller warships, with an armament of about 20 guns. Warships are usually relatively easy to follow in historical sources. *Resande Man's* history and origins, however, are shrouded in mystery. We find the first mention of a ship named *Resande Man* in December 1659 when, together with the three ships *Solen*, *Ängeln* and *Jägaren*, it was being wintered in Korsør in western Zealand during the war with Denmark.

Oil painting of the sinking of *Resande Man*. Cropped. The painting is in the possession of the Lilliestierna family.

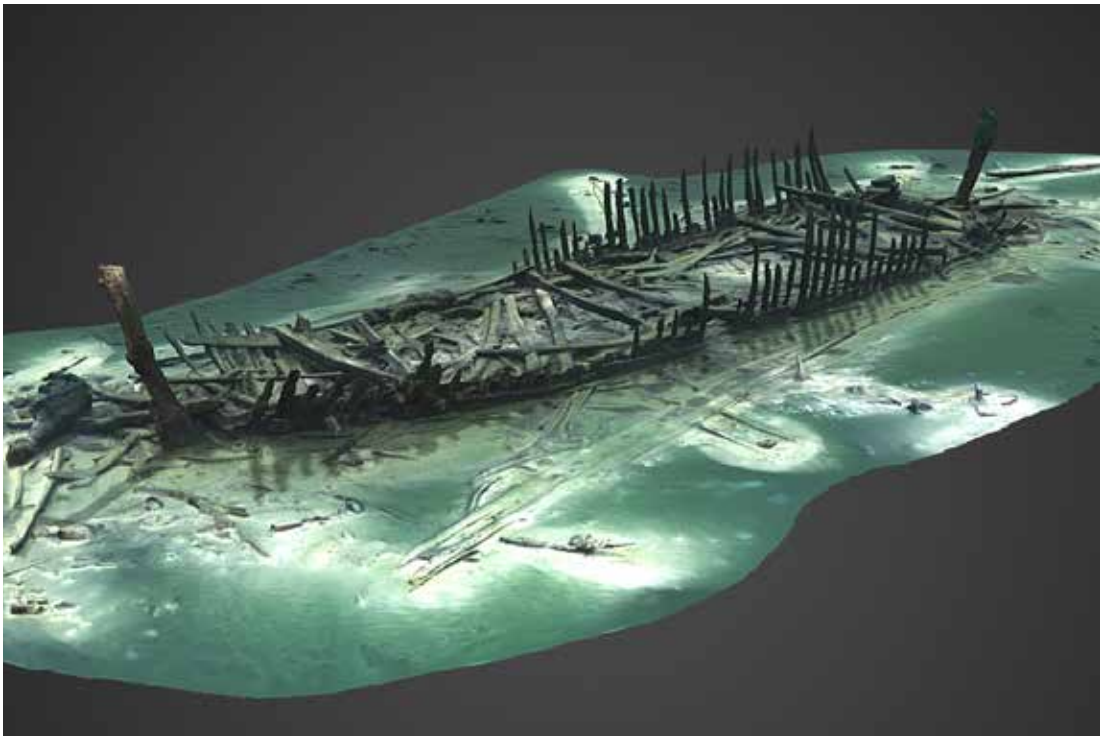
There were more than 30 people on board at the time. In the summer of 1660, *Resande Man* took part in a squadron transporting Swedish troops home from Poland. In autumn of the same year, *Resande Man* was chosen to bring von Schlippenbach's embassy to Poland.

THE LAST VOYAGE

On 18 November 1660, von Schlippenbach took the land route to Dalarö in the Stockholm archipelago. Along with several prominent individuals, he boarded *Resande Man*. Captain Hans Månsson commanded the ship.

A few days later, the ship weighed anchor for the journey south. The chief pilot, who had fallen ill, remained ashore, and the ship sailed off without a replacement for him. On board was a less experienced apprentice pilot. In addition to the count, other passengers on the ship included captain Månsson's wife-to-be, the embassy secretary Andreas Bjugg, Bjugg's secretary and valet Lars Svensson, the head waiter Pfennig, and the French chamberlain Bourdois, as well as two servants, a waiter and the Polish Queen's private secretary. The crew numbered slightly over 50 men. All in all, 64 people were likely on board.

Outside Landsort in the southern Stockholm archipelago, they encountered headwinds and stormy weather so decided to drop anchor. As the weather worsened during the night of November 23 and turned into storm, the ship began to drag anchor after having lost an anchor that morning. After a while, the crew was forced to cut the anchor cable of the other main anchor. The ship drifted towards some rocks, and von Schlippenbach, the captain's betrothed, the head waiter Pfennig, two servants and two crew members tried to reach a nearby skerry using a smaller boat. But because there were no oars in the boat, it could not be manoeuvred. A powerful wave capsized the boat and everyone drowned, save the count.



3D model of *Resande Man's* wreck site. The frames still rise high on *Resande Man*.

When the captain saw his beloved wife-to-be disappear in the waves, he allegedly jumped into the sea. 'Because he could no longer have her by his side in this life, he wished to join her in death.' Meanwhile, *Resande Man* ran aground and sprung a leak. Despite being pumped frantically, the ship quickly took in water. With great difficulty the crew managed to launch the large ship's boat, and more than twenty people left the ship in it.

von Schlippenbach managed to swim back to the ship and was dragged on board. Those who remained tried to rescue themselves by climbing up the masts. The count, exhausted and chilled to the bone, had a rope tied around him in an attempt to raise him up onto a mast top. At that moment, the ship slipped off the rock and sank to the depths below. von Schlippenbach and all on deck were swallowed up by the waves. Braving the icy wind and sleet, a few people managed to cling onto the mainmast top, which still poked up above the water's surface.

It was discovered that there were only two oars in the overloaded ship's boat, one of which cracked immediately. But by rowing and paddling with one oar and a handful of planks, Bjugg and the others managed to make it ashore and finish off quite an adventurous journey.

In the darkness, the survivors saw a glimpse of light from a farmhouse. When they arrived, at first they were not let in. Only after threats ensued – and because they could pay for themselves – were the frigid survivors let inside. Early the next morning, Bjugg was able to call for help and the survivors in the mast top were found. Two were so chilled to the bone that they froze to death as they approached land. Several corpses were later recovered from the sea, including von Schlippenbach's.

On 26 November, Bjugg reported to the Stockholm Council: 'Then secretary Bjugg described the shipwreck that occurred in the archipelago at Herrhamra inside Landsort, where ambassador Schlippenbach and an additional 37 people disappeared ...'

AFTERMATH

After the accident, both the captain and von Schlippenbach were criticised for sailing without a capable pilot and with a ship that was reportedly leaking. During the shipwreck 38 people died and 26 were rescued, including the Queen of Poland's secretary and a few individuals from von Schlippenbach's company. von Schlippenbach was laid in state in Stockholm and then buried in Klara Church. In 1663 he was buried in Saint Mary's Church in Stettin (today Szczecin in Poland).

In the year following the sinking, Hans Albrecht von Treileben salvaged guns, anchors, sails and rigging from the ship. Some cases containing coins were also reported to have been salvaged. von Treileben had introduced the diving bell in Sweden in 1658 and later salvaged guns from *Vasa*, among others.

THE EMBASSY SECRETARY'S STORY

The main source for *Resande Man's* sinking is a written account given by Andreas Bjugg. In addition, a painting exists depicting the course of events using both text and imagery which was probably commissioned by Bjugg himself. Bjugg had made a career as a clerk in Charles X Gustav's field office during the Danish wars of 1657–1660. A new embassy was organised after *Resande Man* wrecked, this time under the leadership of the privy council and Admiral Sten Bielke. Bjugg took part this time around as well, as embassy secretary. Many diplomatic assignments then followed, and he was knighted under the name Lilliestierna in 1675. He died in 1679.

Accounts of the tragedy can also be found in a letter from the privy councillor Krister Horn and in the chronicle *Theatrum Europaeum*.

Thanks to the dramatic nature of the course of events and their detailed descriptions, along with the promise of possible 'treasures' on board such as coins and gifts, many people have been fascinated by *Resande Man*. Whether there were indeed gifts on the ship and what they consisted of is not known, although *Theatrum Europaeum* mentions that the nation's 'jewels' (which could possibly be read as meaning 'valuables' in general) and 7,000 Swedish riksdaler were on board. Count von Schlippenbach also likely had plenty of personal equipment on board to mark his status as privy councillor and count, in addition to what was more or less his own travel funds. Among other objects, the count's silver service, stored in a red chest, was lost.

During the 20th century, several people have searched in vain for *Resande Man*. The vulnerable location in the archipelago inside Landsort furthered the idea that the ship had been destroyed over the years. Also, erroneous historical sources regarding the depth of the wreck site have made searches more difficult.

RESANDE MAN FOUND

In May 2012 a group of divers called Grebbestads Marinarkeologiska Sällskap, which had been searching at length for *Resande Man*, found a promising wreck northeast of Landsort. Surveys and inspections were then carried out at the site on several occasions. These have confirmed that the shipwreck likely consists of the remains of *Resande Man*.

The wreck stands upright at a depth slightly more than 15 metres, below a rock formation on an almost flat sandy bottom. The ship had three masts, and the mast step for the foremast is clearly visible in the bow area. The mainmast partner is in two pieces slightly farther aft. Several rig details, such as deadeyes and blocks, are scattered across the wreck site. The stem

Resande Man contained a vast number of objects when it wrecked. Here, you can see casket bottles that may have belonged to von Schlippenbach or someone else from the embassy. The bronze wheel has probably been positioned in the mainmast or in a bitt on the deck.

and sternpost are preserved in their original lengths, and the distance between them is just short of 26 metres. The length of ships was calculated in the 17th century precisely in 'length over the stem', in other words, the distance between the stems. The ship had been graced with a beak-head, which was built on the stem but now lies in front of it. The foresection contains a horizontal capstan for the anchors – a windlass. In addition, there are four anchor buoys, so-called markers.

The planking is only preserved a bit up on the hull. Fallen sections of the planking lie at the bottom, mostly outside the starboard side. Eroded frames are preserved in several locations along the ship's sides. *Resande Man* appears to have had one main deck, and it is uncertain if there was a lower deck beneath it. Aft of the mainmast, there was a quarter deck over the main deck, and it is likely that the ship also had a forecastle in the bow.

Bricks and firewood under the quarter deck point to the presence of the galley. In the part of the ship covered by the quarter deck are a variety of objects that are not directly ship-related, such as casket bottles and household items. Aft of the wreck is a conical metal tube, which might have acted as the drainpipe of the officers' toilet. This should thus have been located in the starboard quarter gallery, one of the ornate protruding sections along the sides high in the ship's stern.

Four iron guns were discovered at the wreck site, with parts of their carriages intact. Many gun carriage wheels are scattered across the wreck site, and outside the starboard side lies a nearly complete gun carriage. Its location is perhaps evidence of von Treileben's salvage operations. The wreck also contains a variety of cannonballs and other ammunition.

Despite previous salvage operations and the vulnerable location of the wreck site, much of the ship appears to be preserved, albeit in a collapsed state. Because large sections of the main deck were not likely broken up during the 17th century salvages, much of the equipment that was on board in November 1660 probably still exists below this deck.

IS IT REALLY RESANDE MAN?

Several factors indicate that the discovered ship is indeed *Resande Man*. The site of the wreckage, the type and size of the ship, as well as traces of the gun salvaging are consistent with existing historical sources. Objects on the wreck suggest the second half of the 17th century. The ship certainly could not have wrecked before 1649, since a copper plate coin that was salvaged was minted sometime between 1649 and 1657.

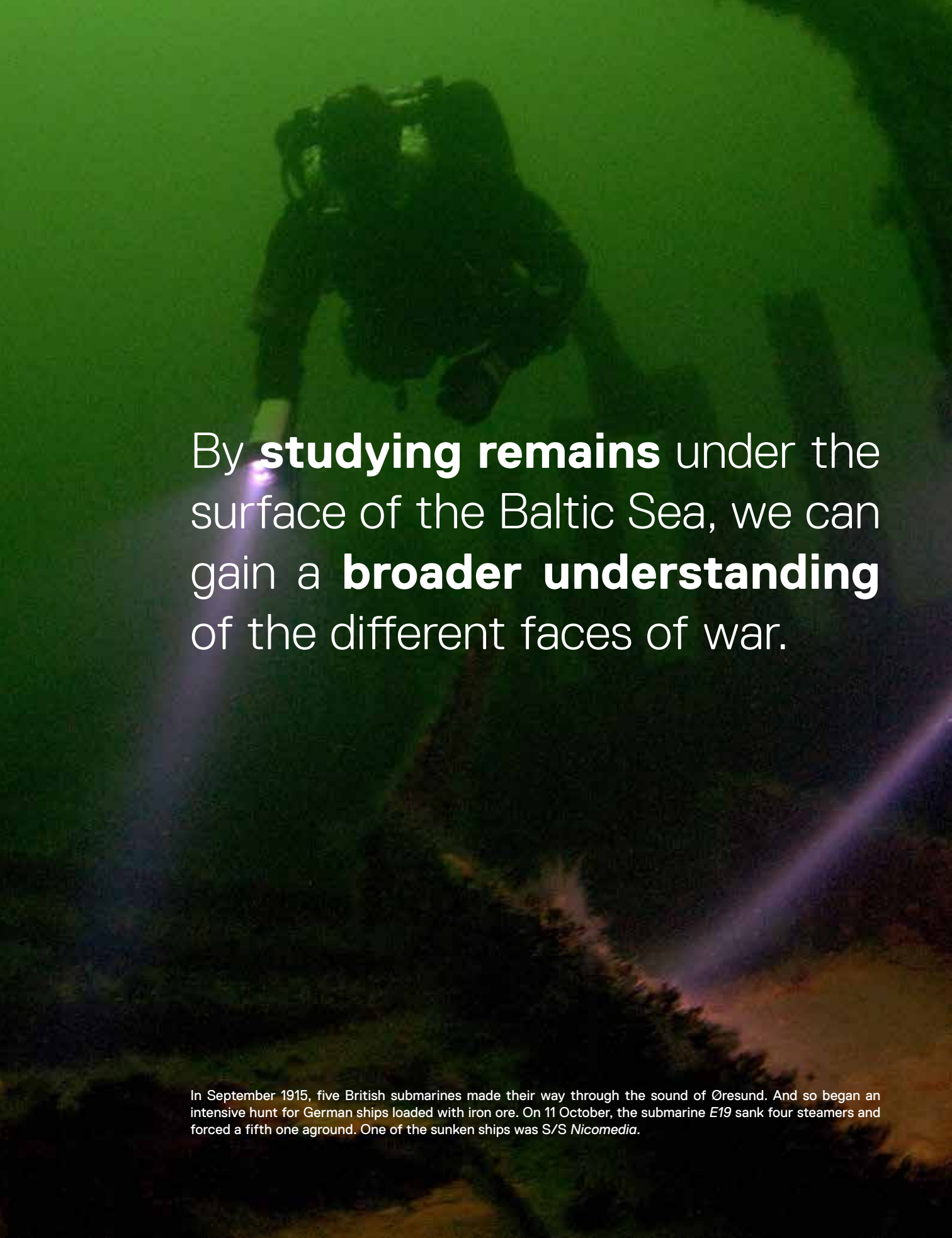
This is in line with the results of the wood samples taken to date the tree rings, which indicate that the wood was felled sometime during 1642–47. This reinforces the assumption that the wreck is in fact *Resande Man* and that the ship was built in the 1640s. If the wood had been felled after 1660, it must belong to another wreck. The provenance of the wood has been more difficult to ascertain. It is only possible to determine that the felling regions were in Northern Europe.

The wreck site's depth can also be confirmed by historical sources, although according to one source it should lie in deeper water. All in all, these indications suggest that *Resande Man* has finally been found. The ship and its dramatic history are now one of the main attractions at Vrak – Museum of Wrecks.

In *Resande Man's* aft section, many objects that belonged to people of higher status have been discovered, such as tin and casket bottles.

A CENTURY OF CONFLICTS

ANNA MCWILLIAMS · SURFACING CONFLICTS



By **studying remains** under the surface of the Baltic Sea, we can gain a **broader understanding** of the different faces of war.

In September 1915, five British submarines made their way through the sound of Øresund. And so began an intensive hunt for German ships loaded with iron ore. On 11 October, the submarine *E19* sank four steamers and forced a fifth one aground. One of the sunken ships was S/S *Nicomedia*.

A CENTURY OF CONFLICTS

Throughout the ages, the Baltic Sea has served as both border and contact area between people. Trade, travel, war and borders have ebbed and flowed, leaving in their wake material traces at the bottom of the sea. By studying the traces of conflict under the surface, we gain an understanding of the individual events, contexts and processes of change that we might not otherwise see.

The remains at the bottom of the Baltic Sea bear witness to the conflicts of the 20th century. Their location reflects trade routes, battlefields, mine lines and escape routes. These remnants are key to our understanding of what conflicts might look like, as well as the insight that the same conflict can take on different forms in different places and for different people. In some areas wrecks are stacked on top of each other, revealing a high level of war activity. Other areas have far fewer wreck remains. In many coastal locations, the conflicts left so many ship remains behind as to create major accessibility problems and had to be salvaged and moved out of the way. This was a striking feature in the aftermath of World War II.

In a war situation, it is often difficult to strictly distinguish between the military and the civilian. By studying physical remains beneath the surface of the Baltic Sea, without dividing them into categories such as military, commerce or civilian, we can gain a broader understanding of the different faces of war. Studies of material remains in the sea also allow us to shift between a macro and a micro perspective, giving us an understanding of the major events of war. At the same time, descriptions and statistics make less sense without an understanding of individual events and their effects on different people.

WAR IN THREE DIMENSIONS

The beginning of the 20th century saw technology evolve at lightning speed. Enthusiasm

In September 1919, the steamer *E. Russ* left Bordeaux in France carrying food, cars, motorcycles, clothes, medicine, cigarettes and alcohol. After World War I, the Liquidation Committee of the US Army had been established to dispose of equipment stocks in Europe. *E. Russ* was on its way to Tallinn when the ship hit a floating mine on 15 September.

ran high for testing innovative methods and new technologies, something that is reflected in the remains below the surface. The Baltic Sea, through its topography, is ideal for mine warfare. It features long shallow coasts, bays and straits that can be blocked off with mines. Although naval mines have existed since the 18th century, it was only during World War I that they began to be used on a larger scale. Of the roughly 65,000 mines estimated to have been laid during the war, many remain on the seafloor.

During World War I, we can also see how submarines and aircraft are put to use on a larger scale and how the 'war room' becomes three-dimensional in a new way. The surface of the Baltic Sea was no longer the only theatre of war – threats could surface from the depths or from above. Aircraft technology was relatively undeveloped and planes were used more for reconnaissance than for direct warfare.

Studies of submarines indicate technical problems, especially in terms of balance and manoeuvring. One example is the Russian submarine *Som*, which collided with the steamship *S/S Ångermanland* on 24 May 1916 off Grisslehamn in the Sea of Åland. Although the steamship remained unscathed, the submarine sank, leaving behind a wreck that was found only much later in 2015.

A collision with a steamship also led to the sinking of the first Danish submarine *Dykkeren*. The year was 1916 and the place was off Taarbæk on the Danish coast. The submarine's sternmost hatch was ripped off, water gushed into the engine room and the boat sank to

During World War I, Swedish exports of iron ore were vital to the German war efforts. For England, it was equally vital that the ships never reached their destination. Lifebuoy from the steamer *Director Reppenhagen*, which was sunk in 1915 by the British submarine *E19* along with four other merchant ships.

a depth of nine metres. In other words, it did not take much to put these machines out of service and cause wrecking. One crew member died in the incident, while the others were rescued.

Four wrecks lie off the south coast of Öland that illustrate the strengths of these submarines. The British submarine *E19* had entered the Baltic Sea and sunk four German merchant ships in a single day: *S/S Walter Leonhardt, S/S Gutrune, S/S Director Reppenhagen* and *S/S Nicomedia*. In addition, the cargo steamer *Germania* grounded. Here we see a clear relationship between civilian trade and the military, and the difficulty in distinguishing them. The fact that crews were allowed to leave enemy ships before they were sunk also testifies to a more 'gentlemanly' attitude towards the enemy in the infancy of submarine warfare than what would later become the *modus operandi*.

THE MANY FACES OF WAR

Remains from World War II illustrate how different areas of the Baltic Sea were impacted by the war in different ways. In the Gulf of Finland they reveal colossal military losses, in particular resulting from the evacuation of the Soviet fleet from Tallinn in August 1941 to escape the onslaught of the German army. Just over 65 Soviet ships including military, transport and merchant ships went under, with upwards of 14,000 dead after the ships had crossed mines and come under attack by German–Finnish troops.

The wreckage in the Gulf of Finland also bears witness to the long-standing mission of containing the Soviet fleet. The physical materials include everything from wrecks of

During the First and Second World Wars, a huge number of mines were used in the Baltic Sea, which, because of its topography, proved ideal for this type of warfare. A great many mines still remain at the bottom of the sea. This one was discovered during archaeological investigations at Gålö in the Stockholm archipelago. During World War II, there was a secret military facility at the site that trained seals and birds to observe and uncover submarines and mines.

military ships, submarines, and merchant and transport vessels to mines, mine anchors, anti-submarine nets and aircraft wreckage. The remains clearly show how the gulf was closed off by German and Finnish troops. Mines and anti-submarine nets were laid to deny access to surface vessels and submarines while bolstering military fortifications on land, from which ships or aircraft could be shot down if mines could not reach them. Some Soviet submarines still succeeded in overcoming this obstacle course of death, but many perished trying to enter and exit the bay.

Other parts of the Baltic Sea contain traces of the massive movement of people, especially refugees, which took place at the end of the war. This is particularly evident along the Polish and German coasts. Wrecks of the great ships *Wilhelm Gustloff, Goya* and *General von Steuben* off the Polish coast are the most well-known. They were passenger ships used in *Operation Hannibal,* which aimed to evacuate German soldiers and civilians from areas of present-day Poland before the Soviet army arrived. The ships were sunk by Soviet submarines, and their wrecks have been discovered by divers. During the mass evacuation, virtually all ships and boats that could be mustered were used. Many went under without being registered, so far more vessels involved in the operation lie at the bottom of the sea than the records indicate.

Another group of people also evacuated by ship during the final stages of the war, but who take up fewer pages in the history books, are concentration camp prisoners who were forced out on death marches as the Allies approached. Of those who reached the coasts, many were stowed on ships and barges. Some were sent on horrific sea voyages, while others died before they left shore. The bodies of those who died before departure were cast off into the sea. Few physical traces of these voyages are registered. But they can be recreated to some extent

The Gotland ferry *Hansa* suddenly vanished on 24 November 1944. The wreck remains at the bottom of the sea, but debris and objects from the ship floated ashore after the sinking. One of these is *Hansa's* ship's clock that was found by a fisherman on 6 December 1944. The hands have stopped at 05:57, the time of *Hansa's* sinking. Eighty-four people died. Later investigations revealed that it was fired at by a Soviet submarine. The incident demonstrates the difficulty of separating civilian shipping from the events of war.

through photography and other documentation, for example from the investigations that were conducted prior to the criminal tribunals after the war ended.

Along the Swedish coast, we find traces of another aspect of the war. Sweden declared neutrality early on in World War II. Nevertheless, it actively engaged in trade with Germany, as evidenced by the remains in Swedish waters. Here we find wrecks from merchant ships carrying iron ore to German ports that were torpedoed by Soviet submarines. Examples include *Ada Gorthon, Luleå* and *Margareta*. Wrecks of German merchant ships, such as *Gerda Ferdinand* and *Köln* on Argos Grund off the coast of Roslagen, also remind us of this extensive trading. The wrecks of two Soviet submarines in Swedish waters reveal the danger even for those who were on the attack. They were sunk by Finnish submarines tasked with protecting merchant shipping.

However, Sweden's position as a neutral country – which some might question considering the merchant shipwrecks mentioned above – is evident through a different type of relic: aircraft wrecks. During World War II, the importance of aviation in warfare increased significantly. But the aircraft were vulnerable to damage, which sometimes meant that they could not return to their base but instead were forced to make emergency landings. In such situations, Sweden was considered the best landing option to avoid falling into the hands of the enemy.

Between 1939 and 1945, Sweden became the landing site for over 300 foreign aircraft. Not all of them reached their destination, though, but instead met their fate as wrecks at the bottom of the Baltic Sea. The wreck of *Clay Pigeons*, an American Boeing B-17 bomber named by its crew, lies broken in two off the coast of Oskarshamn. The aircraft, based in Thurleigh in

On 13 June 1952, a DC-3 aircraft disappeared over the Baltic Sea. The aircraft belonged to the Swedish Air Force and was officially on a navigation exercise. The investigation was long kept secret. After the wreck was located in 2003 and then salvaged, the event gained renewed momentum. The salvage took place using new technology, where both the wreck and sediment were uncovered in sections using freeze dredging technology. The wreck could then be investigated.

Britain, changed course towards Sweden with engine problems following a bomb attack on Germany in May 1944. Divers have testified to the surrealness of diving on aircraft in Swedish waters that dropped bombs over Berlin. The war seems so close, both in space and time.

COLD CONFLICT

The end of World War II ushered in a transformation of the Baltic Sea from one type of conflict area to another. While disarmament was underway, and ports and coasts were cleared of wrecks that hindered shipping, a new type of conflict crept in – a cold conflict.

The methods for maintaining control of the Baltic Sea became increasingly secretive. The physical traces are harder to detect, and the proximity in time means that many documents are still classified. However, fewer material remains in the absence of a 'warm war' does not mean that they don't exist. As more remains are discovered, more documents become available and more research is conducted, our understanding of the remains of the period and their nature increases. They don't always look like what we expect from traces of war, but they are there just the same. What limits us is rather our understanding of them.

One of the most famous remnants of the Cold War is the wreck of the DC3 – a Swedish aircraft that was shot down by Soviet aircraft while conducting aerial reconnaissance off the Baltic Sea's eastern coasts. The wreck has been salvaged and is now on display at the Air Force Museum in Linköping, Sweden.

A less well-known case is *Turbulent Turtle*, an American PB4Y-2 privateer plane, which

was used for aerial reconnaissance against the Soviet Union and shot down off the coast of Latvia in 1950. The wreck has not yet been recovered.

The archives also contain details of a series of ships that disappeared, sank or were abandoned for unexplained reasons. Among these we can count the ship *Kinnekulle*, which was found drifting by a fishing boat in 1948 – frozen and without a crew – and was towed into a Swedish port. It had been on its way from Ustka in Poland to Helsingborg in Sweden carrying coal briquettes when the crew was met by a fate unknown to this day.

The ship *Sten Sture* was en route from Gdańsk to Helsinki when it vanished in 1947. The wreck was discovered in 1997 off the coast of Gdynia. A previous explanation for the ship's sinking is that it set off a mine. Although studies reveal an explosion on board, the damage points to an explosion on top of the deck rather than from a mine in the water.

More ships have disappeared over the years and have never been recovered. Plenty of rumours have abounded, including talk about crew members in Soviet prison camps. The archives contain references to the work of the Ministry of Foreign Affairs in searching for an explanation of these events. One can read correspondence with representatives and diplomats operating in, and from, the Soviet Union and with relatives of missing crew members. A tricky balancing act emerges here between foreign diplomacy and accommodating the needs of one's own citizens and relatives.

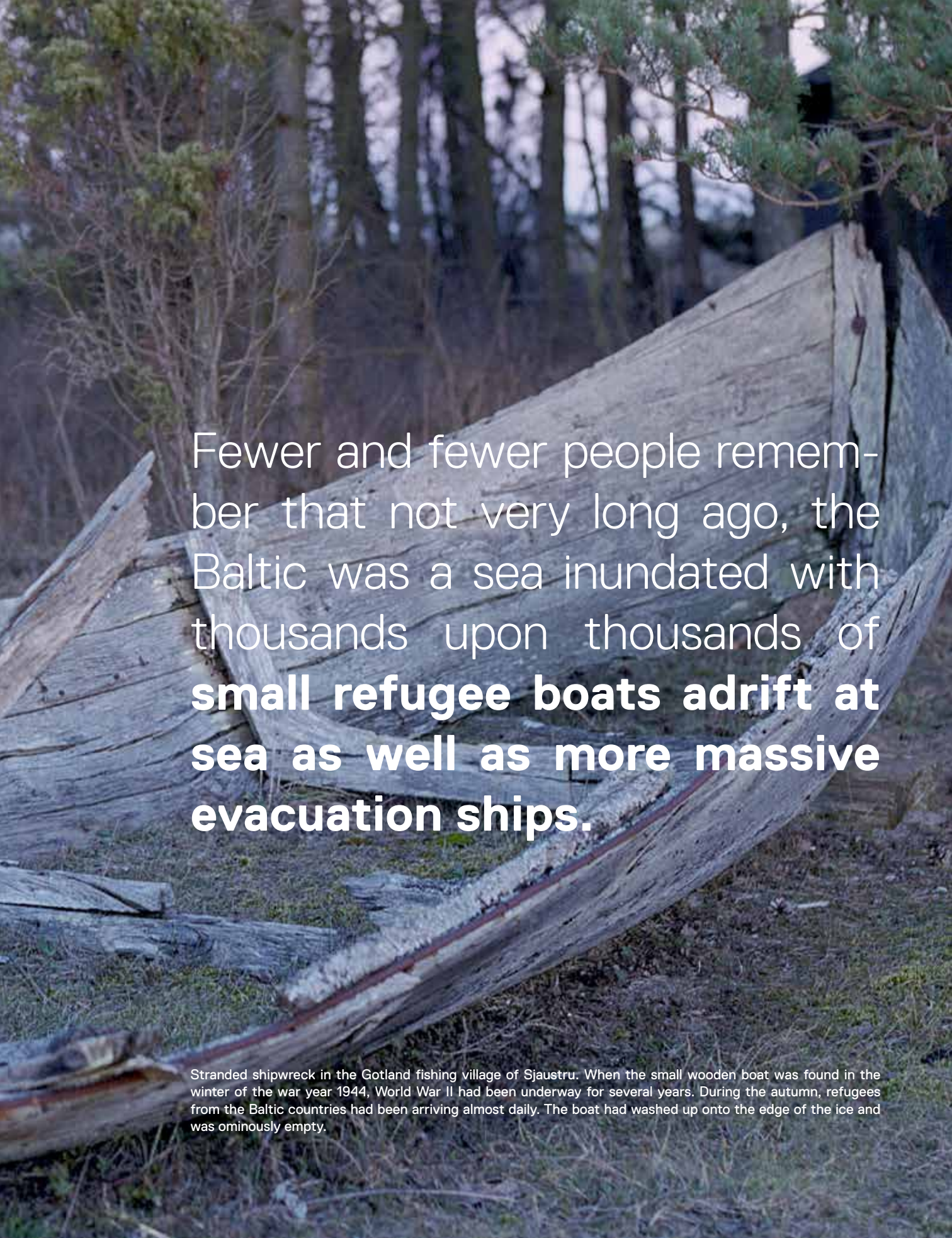
FOLLOWING THE TRACKS

The physical remains discussed in this chapter show that we need to broaden our perspective of what we consider as war remains. Viewing military ships as part of the wreckage of war is no surprise. But the many wrecks of merchant ships, fishing boats and other civilian vessels show that war impacts many more people in a variety of ways. In a conflict, the boundary between what is and is not an act of war is blurred, something that is also reflected in the remains on the seafloor.

Baltic Sea remains from the wars of the 20th century show us not only how different geographical areas were affected in different ways, but that no one is left untouched by the conflicts that took place. Studying remains – both in order to understand individual events and to learn more about major developments – is an important part of understanding that conflicts can take on different forms in different places and during different periods. There is much we have yet to uncover which is still hidden beneath the surface. But one thing is certain: our history of this century, as for others, will evolve as new findings are discovered, compelling us to reinterpret our perceptions.

THE SEA OF ESCAPE

MIRJA ARNSHAV · SURFACING CONFLICTS



Fewer and fewer people remember that not very long ago, the Baltic was a sea inundated with thousands upon thousands of **small refugee boats adrift at sea as well as more massive evacuation ships.**

Stranded shipwreck in the Gotland fishing village of Sjaustru. When the small wooden boat was found in the winter of the war year 1944, World War II had been underway for several years. During the autumn, refugees from the Baltic countries had been arriving almost daily. The boat had washed up onto the edge of the ice and was ominously empty.

THE SEA OF ESCAPE

Our last century has been called the era of war and escape. Never before in history have so many people been on the move. For millions of them, an ocean or a sea – the South China Sea, the Black Sea, the Atlantic, the Baltic Sea or the Mediterranean – needed to be crossed along the way. So the sea is not merely an arena for traditional maritime activities like hunting, fishing, trade, warfare and communication, but it provides a vital escape route. Along with the sailor, the fisherman, the explorer and the sea warrior, the 'boat refugee' escaping persecution can now join the legions of many well-known seafaring figures.

Escape by boat is the most dangerous form of escape, and often the only path left to take when other routes are blocked. At sea, people fleeing their homelands are at the mercy of the elements and their lives depend on the often substandard craft they travel in. Ironically enough, the wide and deep waters have been mobilised in order to maintain border control – a natural barrier which can only be overcome by putting one's own life in danger. And when the seas are part of a theatre of war, those who flee run the risk of being subjected to hostile attacks during their journey. Escape boats remain exposed on the high seas, and hiding proves difficult. Yet the waters possess a unique ability to quickly swallow up the traces of failed escape attempts. Since escapes often take place in secret, far from all the missing escape boats have been recorded.

In the Baltic Sea, the biggest maritime disasters are specifically related to refugee escape. The very worst, in terms of human lives lost, occurred during World War II. Millions of people were driven out to sea as a result of the conflicts, even as the sea passages became more unsafe than ever. Patrol vessels and coastal batteries guarded the coasts. Mines and submarines lurked under the surface. Fighter and reconnaissance planes circled in the air, with orders to even attack any commercial vessel circulating outside the permitted zones. Both large evacuation ships, whose holds were filled with children and the sick, and small fishing boats with undocumented migrants who at any time risked being targeted by hostile fire, were caught in the midst of this battlefield.

Evacuation of Finnish refugees in autumn 1944. During the war years, tens of thousands of children were shipped between Turku and Stockholm to avoid the ravages of war. Over time, the evacuation was increasingly redirected to train transport.

One of the first flows of migrants across the sea consisted of Finnish war children. During the war years, a total of about 20,000 children were shipped between Turku and Stockholm in various stages to avoid the ravages of war. Due to ice formation and the danger of encountering submarines, the journeys were often heavily delayed and, in the worst case, could take several days. In the boats, where the holds were hastily adapted for their new cargo, the conditions were punishing. 'Stowed in the hold we sat, children of all ages and some adults who were supposed to look after us. There was a lot of crying among the little ones', recalls Annikki Blomqvist, who was seven years old when she boarded a ship in Turku at Christmas time in 1939 for her first of a total of three boat trips to Sweden during the war years. The journeys across the sea were by no means risk-free. On several occasions, the boats were attacked by Soviet submarines and aircraft alike. A convoy ship was sunk, and although the transshipment continued throughout the war, the evacuation was increasingly redirected to train transport.

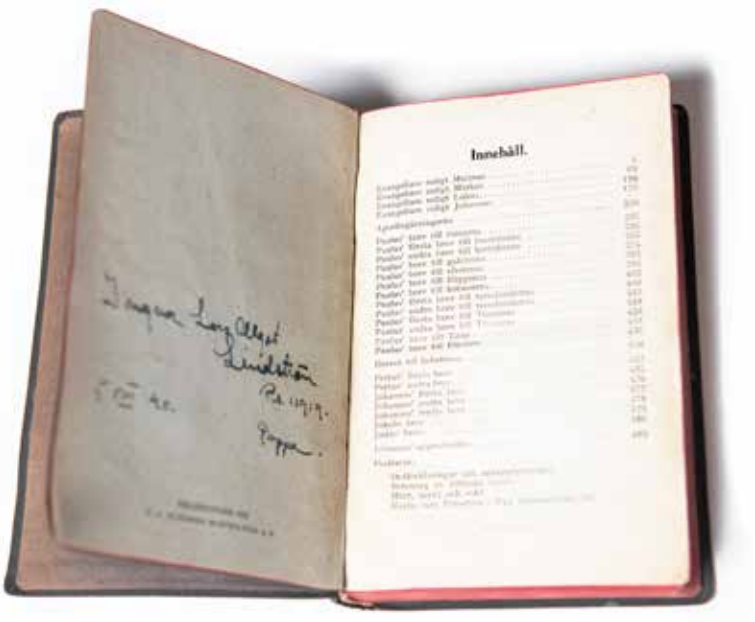
The world's biggest naval rescue operation was triggered by the collapse of the Third Reich. On board 790 boats from the German naval forces and merchant navy, around 2 million refugees were transported to German and Danish port towns along the southwestern Baltic coast. Since the evacuation of civilians was not a priority, this activity was carried out under chaotic conditions. People crowded into all conceivable corners of the hulls and suffered miserable sanitary conditions, sometimes without being sure of their destination. The

In early 1945, Soviet troops were advancing rapidly in the Baltic Sea region. German troops and scores of refugees were being forced into German and Polish port cities, and the evacuation of people became necessary. On 30 January 1945, one of the evacuation vessels, *Wilhelm Gustloff*, was hit by torpedoes from a Soviet submarine. Today the wreck is classified as a war grave.

convoy was, as a rule, substandard, and so the disasters at sea were not long in coming.

From 1 January 1945 until the German surrender in early May, 1,444 German ships were sunk in the Baltic Sea causing the deaths of more than 20,000 people. Most of these were refugees. Among the wrecked ships were the luxury steamer *Wilhelm Gustloff,* the *Hansa* and *Hamburg* from the Hamburg-America line, and *Cap Arcona*. From *Wilhelm Gustloff,* which transported 5,000 refugees, came horrific witness accounts of what happened after three torpedo hits shook the hull. *General von Steuben* was sunk not long afterwards, taking 3,500 people with the ship down into the depths. But the worst sinking in the history of the world took place when the passenger ship *Goya* was sunk by Soviet submarine torpedoes off Stolpe Bank (today Utska) on the night of 17 April 1945. It was carrying 6,000–7,000 refugees and wounded fighters. Only 165 people were successfully rescued.

By contrast, the largest disorganised escape during these years occurred in an east-west direction from the Baltic states to Sweden, sometimes via Finland. 'The Great Escape', as the event has been called in history, stemmed from the annexation of the Baltic states by



One of the few belongings Lars Lindström took with him during his escape was his confirmation bible, in which his mother had stuck a Swedish 50-krona note. For the money, Lars bought a pair of new pants on arrival, as the ones he was travelling in were ruined during the crossing.

the German and Soviet occupying powers. In the autumn of 1944, when the Red Army approached the Baltics for the second time, the escape escalated. In total, more than 30,000 people – mostly Estonians but also Latvians, Lithuanians, Ingrian Finns, Russians and Germans – crossed the sea bound for Finland and neutral Sweden.

Refugees from the Baltic region were transported in all kinds of vessels. In general, possible escape boats were quite rare since small fishing boats were as a rule either destroyed or placed under control and surveillance, while larger vessels were used for the purposes of the war. For those who could not escape on their own and were not allowed to board any of the evacuation ships, the remaining options included using the boat of an acquaintance or accompanying refugee smugglers who, under the cover of darkness, travelled back and forth across the sea on transit boats. The escape routes available to someone were often determined by random coincidences – if any possibility of escape at all presented itself. Not infrequently, members of the same family were allowed to make their escape across the sea under completely different terms, and reunification could take several years.

OVER THE BALTIC SEA

One of those who stepped into a boat to flee west illegally over the Baltic Sea was 17-year-old Lars Lindström. He had recently been drafted into the German army, fearing that he would either be sent to the front or forced to participate in firing squads to kill Jews and other civilians. At the same time, he sensed that the Red Army would soon retake Estonia. But this did not make his situation any better, since he had escaped from an ordered deportation to Siberia during the Soviet occupation.

After having explored potential escape routes to Finland, Lars and his younger brother were told one day that they could travel in a boat scheduled to leave later that afternoon bound for Sweden. So he ran home in great haste, said goodbye to his parents, grabbed a lightly packed bag and went to the agreed meeting point. The boat successfully departed without being discovered. Once out at sea, they caught up with a small boat that was struggling in the waves and was also headed west. It was a tiny boat, only 4–5 metres long, carrying

In the autumn of 1944, the Swedish navy was commissioned to help boat refugees land. Here, eleven people who departed Saaremaa are rescued. The escape boat sank shortly thereafter.

a heavy load – only its upper strake rose above the waterline. To serve as protection against the sea, a tarpaulin had been attached using some cross-beam poles and nailed to the hull sides. Two small children and three adults crowded together in the suffocating dark space underneath the tarpaulin.

It was decided that the larger boat would take the smaller boat in tow since it was running low on fuel. Lars had to take his place in the smaller boat, while his brother remained in the larger one. Thus began a more than 30-hour-long journey across the sea. Lars continually toiled to keep the boat dry and balanced over the rail in an attempt to extend the towing ropes with bits of rags, which on several occasions had torn apart and threatened to leave them to their fate out at sea. At the break of dawn Finnish Utö was sighted, and by dawn the next day the first crests approaching the Swedish shoreline were seen up ahead. In lee behind the outer skerries, the company could at last breathe easily. Lars tore up his Siberian passport and draft card and flung the pieces into the sea.

A year later, Lars and his brother were able to join the rest of their family. Their mother, who was ailing, had secured a spot on a Swedish evacuation ship, M/S *Juhan*, which had received permission to transfer sick Estonian Swedes. After the parents managed to obtain a false medical certificate for their daughter, she was also placed on the passenger list. Their father, too, who just before departure was informed that he would be arrested the next day, managed to escape notice and hide in a baggage compartment, thus sneaking aboard the ship along with the stowaways.

UNEXPLORED HERITAGE

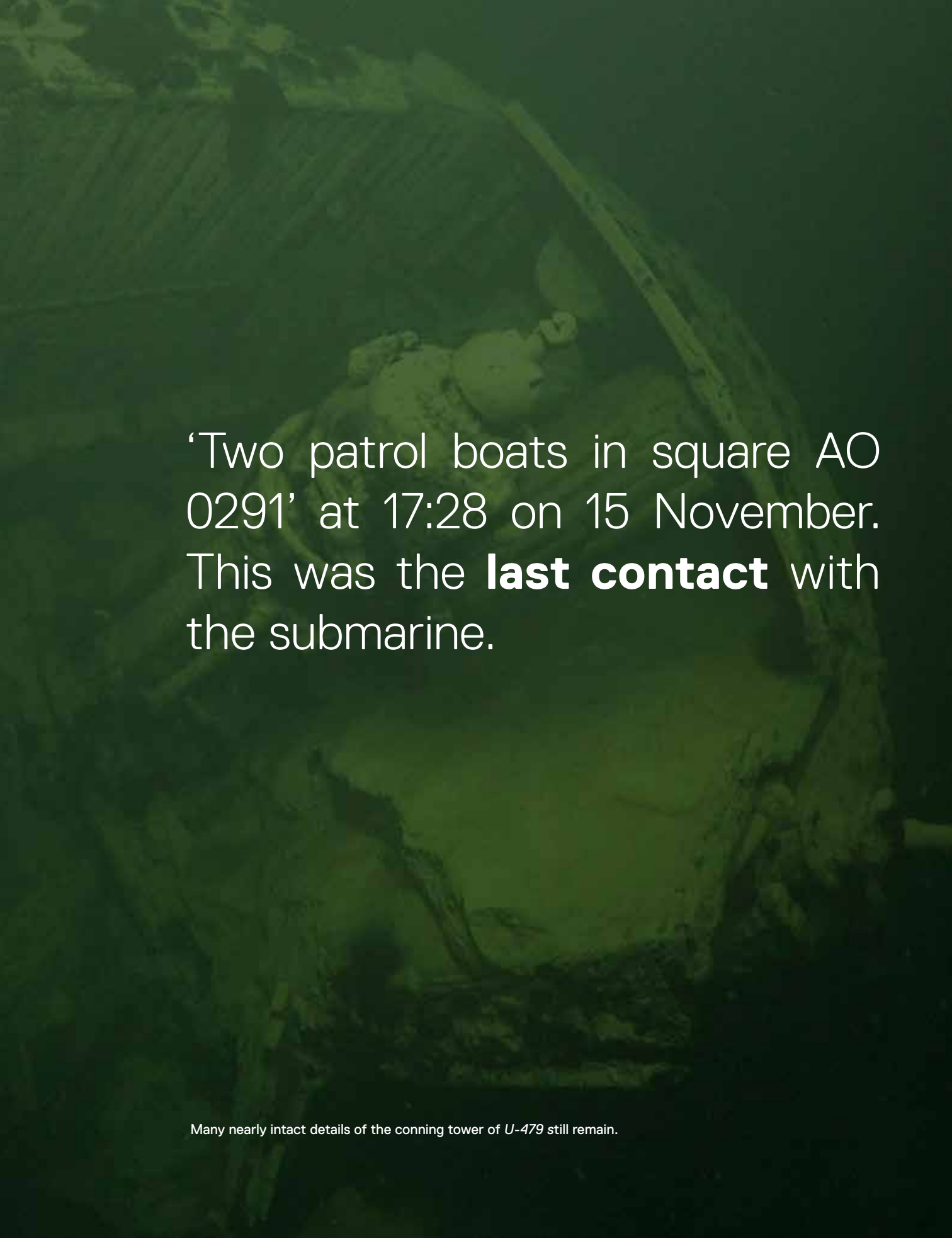
Even after World War II, refugee boats have continued to cross the Baltic Sea, albeit much more sporadically. They have carried with them defectors from the Soviet Union, asylum seekers from Saddam Hussein's Iraq and people from war-torn Syria. When such events take place, they make splashy headlines. As time goes by, fewer remember that not very long ago, the Baltic was a sea inundated with thousands upon thousands of small refugee boats adrift at sea and larger, heavier evacuation vessels.

The documents that Lars so eagerly cast off when his escape was over got swallowed up and disintegrated in the depths of the Baltic Sea, never to be seen again. No traces were left behind to reveal the drama he and the others in his party experienced as they journeyed across the sea. But scattered along Sweden's shores, one can still spot the traces of small refugee boats that crossed the sea during the war years. On the seafloor lie hundreds of weapons thrown overboard at the end of the voyage by armed refugees, as well as sewing machines, bags and other items that had to be relinquished to lighten the often deadly loaded refugee boats. While the large evacuation vessels have been localised at the bottom of the sea, the wrecks of smaller boats that carried undocumented refugees still remain to be identified. Some of them have probably been found but not recognised, since they usually look like ordinary coastal vessels – though perhaps containing remnants of tarpaulins, spinning wheels and household items.

The submerged traces of those who fled are still largely unknown and unexplored. They embody a cultural heritage which is concealed and somewhat unfamiliar, but nevertheless has an important story to tell. These traces are reflected in the Baltic Sea as a sea of escape, and bear witness to the ordeals people are prepared to face if they can imagine a brighter future somewhere beyond the horizon.

U-479

MAILI ROIO · SURFACING CONFLICTS



‘Two patrol boats in square AO 0291’ at 17:28 on 15 November. This was the **last contact** with the submarine.

Many nearly intact details of the conning tower of *U-479* still remain.

U-479

In 2009, the wreck of the German submarine *U-479* was discovered in Estonian territorial waters approximately seven miles northwest of Osmussaar at a depth of 93–94 metres. The discovery was made by the Estonian Maritime Administration during a routine sea-bed survey. Several years later, in 2014, the wreck was identified as a VIIC Type U-boat by the Estonian diving company Tuukritööde OÜ using a ROV (remotely operated vehicle). That same year, the wreck was designated as a cultural monument and identified as a *U-479*.

The *U-479* wreck is still intact, with its hull and wooden decking relatively well preserved. The wreck rests on its starboard side at an angle of almost 90 degrees. The gun turret in the aft is visibly torn from the hull. Since there is no trace of a trawl on the wreck and many small details are still intact, there is no reason to believe that the tear was caused by trawling. It is more likely a result of metal fatigue and gravity.

The wreck is partially buried in the seabed; the stern has sunk deeper in the sediment, while the bow rises slightly higher. On port side, near the sail, there is clear damage from a mine explosion, which obviously caused the sinking. There is no other visible damage to the hull. The bow and stern cannons are in good order and sit on their mounts. The anti-aircraft guns have fallen over, but are close to their original positions.

3D model of *U-479*. The wreck lies at a 90-degree list at a depth of more than 90 metres in the Gulf of Finland. It bears traces of a powerful explosion to the hull at the command tower, probably caused by a mine.

VIIC TYPE U-BOAT

The *U-479* was a VIIC Type U-boat. The Type VII U-boats were the most widely used type of German World War II U-boat. The Type VIIC design changes were the result of new, modern hydrophone (a passive listening device) and S-Gerät sonar (active listening equipment) deployments, which required more space. The space for the installation of new electronic equipment can be considered an innovative change. To accommodate the new technology, a new hull section and an additional frame in the middle of the control room needed to be added, increasing the length of the boat by 60 cm.

The VIIC class submarine had an astonishing submerging speed – a depth of 150 to 165 metres was reached in only 30 seconds. Maximum depth was 280 metres. Maximum surface speed was 17.7 knots and 7.6 knots while submerged. A total of 568 VIIC class submarines entered service. The boat usually housed a commander, two watch officers, a head mechanic and 40 sailors.

BACKGROUND

In the summer of 1944, the German navy was preparing to offer substantial support to ground troops in countering a major Red Army offensive. Their aim at all costs was to avoid the Soviet Baltic Fleet breaking out of Kronstadt and threatening the iron ore shipments from Sweden. To this end, the Germans brought large warships back to Estonian and Finnish ports – destroyers, mine trawlers and torpedo boats but also submarines. These were mainly Type VIIC U-boats of the 8th training flotilla based in Gdańsk. Due to a lack of targets suitable for submarines, since the Russians only operated with small vessels in the Baltic, German submarines met with little success in the eastern areas of the Gulf of Finland.

On 28 June, a *U-boat Führungsstab* (submarine command) was set up in Kotka to assume control of their activities in the Gulf of Finland. The chief of the submarine command, Captain Lieutenant Albrecht Brandi (nicknamed Cherry-Brandy), was a former *U-967* commander in the Kriegsmarine. The German submarines would be based in Tallinn, Helsinki and Kotka. In the summer of 1944, a total of 15 German submarines were active against the Russians in the Gulf of Finland. Among them was *U-479*, which arrived in Helsinki on 11 July 1944.

U-479

The *U-479* was built at the Deutsche Werke AG shipyard in Kiel. It was launched on 14 August 1943 and commissioned on 27 October that same year. The displacement of *U-479* was 769 tons (surfaced), 871 tons (submerged) and 1070 tons (total). The pressure hull was 50.50 metres long and 4.70 metres wide, while the outer hull measured 67.23 by 6.20 metres. The submarine´s height, measured from the keel to the top of the conning tower, was 9.60 meters and the draught 4.74 metres. The diving speed was 32.8 kilometres/hour surfaced and 14.1 kilometres/hour submerged. The maximum operational depth was set at 230 metres and crush depth at 250–295 metres.

The boat was part of the 5th U-boat Flotilla before moving on to the 8th Flotilla. The submarine failed to sink any enemy boats during missions. The first combat patrol took the vessel from Kiel to the south coast of Norway, after which it was dispatched to the Gulf of Finland, from July 1944 until September of the same year. During a first patrol between 13 July and 1 August, the submarine achieved its only attack of note, torpedoing the Soviet submarine chaser *MO-304* in Vyborg Bay on 18 July. The *MO-304* was damaged but did not sink.

The *U-479* began its fifth and last patrol on 27 October 1944 under the command of

The image shows significant damage to the hull at the conning tower, a gap, and boards from the wooden deck.

Friedrich-Wilhelm Sons. The boat was active on the 'Biber' position, SE of Hanko. After 7 November it was diverted to position 'Maus' northwest of Osmussaar. The *U-479* sent its last message: 'Two patrol boats in square AO 0291' at 17:28 on 15 November. This was the last contact with the submarine. Four attempts to contact the boat were made, and all failed. The submarine was presumed lost on 12 December. It likely hit a Russian mine or a type of floating mine. Fifty-one men perished.

STORIES ABOUT THE U-479

The activities and fates of submarines are often surrounded by speculations that are either confirmed or refuted with the discovery of the wreck. The story of the *U-479* is no different. Apart from trying to stop the Soviet navy from leaving the Gulf of Finland and doing reconnaissance work, the German submarines also received other missions. In August 1944, the *U-479* received orders to stop refugees from Estonia getting to Sweden. There are no indications in the preserved war diary that the *U-479* managed to find and sink any refugee boats, but eyewitness accounts have described how submarines attacked refugee boats.

In 1944, up to 80,000 people fled from Estonia to the West. The main reason for escaping was fear of imprisonment and deportation after coming under Soviet rule again. As part of this wave of refugees, on the evening of 21 September 1944 a motorboat owned by local seafarers, the Niitsoo family, set off from Saaremaa with 26 people on board. Their escape proved to be dramatic. As the boat approached Gotland around eight o'clock in the morning, the stern was unexpectedly and deliberately rammed by a German submarine with yellow identification stripes. The boat took in water rapidly and began to sink. Some people managed to stay afloat by clinging to the sinking boat; others quickly drowned. The submarine crew looked on indifferently as the refugees struggled in the waves. One of the

The Flak M42 gun of *U-479*.

refugees was able to swim to the submarine and call out for help in German. The crew then threw out a line, helping ten refugees to safety. The rescued were subsequently transferred to a German merchant ship.

The wreck of the *U-479* was identified in 2014. Up until then, a popular theory was that the *U-479* had been sunk by the submarine *Lembit*, which had accidentally rammed the German vessel under water. The *Lembit* is a pre-WWII submarine that served in the Estonian navy and later in the Soviet navy and is today owned by the Republic of Estonia.

In mid-December 1944, the *Lembit* was returning to its base in Finland on its way back from a raid near Klaipeda. On 12 December, the vessel hit something under water off the island of Utö in Finland. The crew felt the boat thrust suddenly and the bow lift; there was a crushing noise under the keel and then the stern was lifted as the *Lembit* seemed to slide over a large obstacle before regaining its balance. The crew surfaced and reportedly saw oil and small wooden planks in the ship's wake. According to reports from oncoming boats, there were no Russian submarines in the area. Assuming they had hit a German submarine, the crew reported this to their command. An inspection revealed that the only sign of a collision was a dent on the cover of the starboard side torpedo shoot on the bow of the *Lembit*. No definitive evidence of a collision with a German submarine was ever found.

The *Lembit* submarine has taken on different meanings throughout different periods of history. In 1985 the submarine was opened to the public as a war memorial and branch of the Museum of the Soviet Baltic Fleet. Along with other artefacts, it was used to celebrate the 40th anniversary of the victory over Nazi Germany. Therefore, the amplification of the story of the *U-479* sinking in historical writing was ideologically appropriate.

Today, the *Lembit* is important as a surviving pre-war Estonian warship. It received the honorary nomination of 'Vessel No.1' in the Estonian navy. As a museum ship, it is now on display in the Seaplane Harbour.

A DIVERSE 20TH-CENTURY HERITAGE IN ESTONIAN WATERS

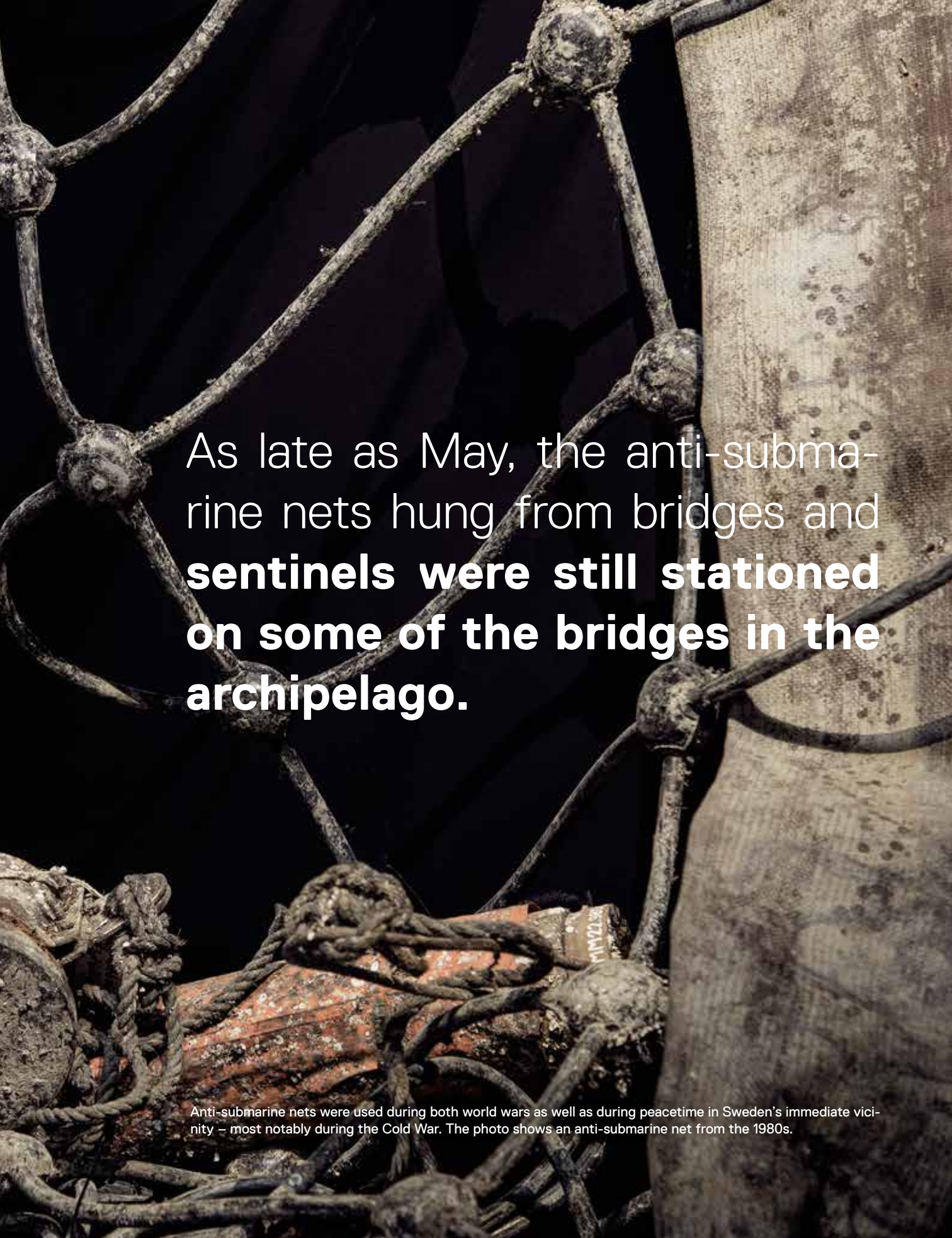
In the 20th century alone, more than 500 vessels are known to have sunk in Estonian waters. The Estonian National Heritage Board received support from the European Maritime and Fisheries Fund during 2018–19 to map environmentally hazardous wrecks. With the widespread introduction of fuel oil at the beginning of the 20th century, the risk of pollution from sunken wrecks emerged as a threat. In addition to the pollution caused by fuel oils, ghost fishing nets and explosives are two more aspects of shipwrecks that pose a threat to the environment. Today, every coastal state must identify and address the possible environmental hazards of sunken 20th-century maritime heritage and the *U-479* wreck was part of that project.

The wrecks of World War II are highly sensitive and complex underwater sites where the interests of different states, environmental and heritage protection issues intersect. There is also great public interest in these sites – which on the one hand requires ensuring the peace of what may well be the final resting place of human casualties, while on the other hand requiring accessibility in situ wherever possible.

World War II shaped people's destinies. The memories of these events are often painful and affect many of us to a higher or lesser degree personally, bringing history closer and helping us understand events that evoke conflicting feelings. Today, the wreck of *U-479* is first and foremost a maritime grave and a physical legacy of the tragedies of World War II.

ANTI-SUBMARINE NETS

ANDREAS LINDEROTH · SURFACING CONFLICTS



As late as May, the anti-submarine nets hung from bridges and **sentinels were still stationed on some of the bridges in the archipelago.**

Anti-submarine nets were used during both world wars as well as during peacetime in Sweden's immediate vicinity – most notably during the Cold War. The photo shows an anti-submarine net from the 1980s.

ANTI-SUBMARINE NETS

Sweden has not been at war since 1814. But during major conflicts close to its borders – as during the two world wars – it has nevertheless needed to protect its coastline against intrusion by foreign powers. One way was to block bays, straits and other arteries to prevent entry. After submarines were introduced in the service of war during World War I, new requirements for protective measures emerged since submarines could make their way below the surface. This is when anti-submarine nets enter the scene. Anti-submarine nets were used during both world wars, as well as during peacetime in Sweden's immediate vicinity – especially during the Cold War.

During the 1980s, thousands of reports of suspected underwater operations were submitted to the Swedish navy. Submarine hunts thus became one of the navy's most important duties. Such hunts could take place in several locations at the same time. They were a vague yet threatening reminder of heightened tensions, and of the risk that Sweden could become embroiled in war. Locally, war-like situations could arise. This was the case in Karlskrona in 1983 and 1984, when anti-submarine nets were deployed to stop suspected intruding submarines.

PROTECTION AGAINST ATTACKS BY SEA

Anti-submarine nets can be seen as a part of humankind's ancient quest to protect itself from attacks by sea. Booms, which were laid out in the water and guarded by ships, were long able to prevent enemy ships from entering an area. But booms became less effective in the early 20th century, when submarines came to be regarded as a weapon to be reckoned with in naval warfare.

When World War I began in 1914, many fleets, including the Swedish one, had acquired submarines. These submarines initially had a great advantage, since there were few countermeasures against a submarine that was submerged. Over time, aerial reconnaissance, sonar,

In the 1980s, the navy received thousands of alarms about suspected foreign submarines in Swedish waters. Where the submarines came from and why they were interested in Sweden is still being debated by researchers and the media alike. The only sure identification was of the Soviet *U137*, which ran aground in October 1981 in a restricted military zone near the city of Karlskrona in southern Sweden.

depth charges and special submarine-hunting vessels – known as destroyers – were developed for the purpose of detecting and stopping submarines. The downside was that they were complicated and expensive. A simpler and cheaper option was to use anti-submarine nets, a construction of metal wires that are assembled into a mesh net.

The contributions of the submarine during World War I did not meet the high hopes of some of its supporters. Some believed that they would transform the playing field for naval warfare and even make it impossible for surface vessels to venture out to sea. But in the end, the threat to moving warships proved rather modest.

On the other hand, the submarines posed a major threat to merchant ships and to warships at anchor. Anti-submarine nets were thus used to protect ports, but also to prevent submarines from crossing certain passages. During World War I, for instance, the British laid anti-submarine nets in the English Channel to stop German submarines. The nets successfully served as a deterrent to the German submarines, which avoided trying to get through.

An anti-submarine net 80 kilometres long was pulled across the Gulf of Finland during World War II, and in Sweden the nets were used in locations like the Øresund Sound and the waters around Gotland. It was common for the anti-submarine nets to be supplemented with minefields and vessels that guarded the nets. The bows of the submarines were eventually equipped with special net cutters, allowing them to penetrate the nets.

Anti-submarine nets were used in attempts to prevent submarines from penetrating areas that required protection, such as ports. But as is often the case in military contexts, such strategies breed counter-strategies. Submarines were equipped with net cutters to penetrate the nets. The Swedish submarine *Makrillen* with a net cutter in its bow, late 1960s.

ANTI-SUBMARINE NETS DURING THE COLD WAR

Anti-submarine nets have also been put to use during peacetime in Sweden, particularly in the 1980s. For many Swedes, the last decade of the Cold War came to be associated with submarine incidents and submarine hunts. Although hunts for submarine intruders were nothing new, the nature of the violations was changing. When a submarine was spotted and an alert issued by the navy, it did not immediately leave Swedish waters. Instead it travelled even further in, as if playing a cat-and-mouse game with its pursuers.

Where the submarines came from and why they were interested in Sweden is still being debated by researchers and the media alike. The only sure identification was of a Soviet submarine, *U137*, which ran aground in October 1981 in a restricted military zone near Karlskrona in southern Sweden.

Submarine hunts have become a dominating image of Sweden in the 1980s. Many such hunts took place and garnered intense media coverage, fuelling a sense of threat. No one knew what was going on beneath the surface or what made Sweden so interesting for a foreign country's submarines. We still don't know. The 1980s submarine hunts are debated to this day, with new theories surfacing and being discussed.

In the early 1980s, the Swedish navy was ill-prepared to address submarine intrusions. Submarine-hunting equipment had been largely abolished in the 1970s, since the protection of commercial shipping during wartime was no longer a priority. In order to reduce the reliance on maritime commerce in wartime, large stocks of necessities were built up in peacetime. Because protection of shipping was not a priority, the navy did not practise anti-submarine warfare to any great extent. It therefore took time to rebuild expertise and acquire the necessary equipment, such as ships, sonar and weapons, which could force an intruding submarine to the surface. The goal was not to sink the intruder, but to find out which country it came from. Compelled to be inventive, navy personnel attempted to use and improve on equipment that already existed.

Anti-submarine nets and ships were not the only tools deployed in the hunt for submarines – helicopters were also used. The navy's helicopters were equipped with sonar to listen for submarines. The photo shows one of the navy's helicopters using its sonar during a submarine hunt in the Stumholm Canal in central Karlskrona. The fact that these hunts took place so close to Karlskrona caused great concern among the local population. Many were asking themselves why there were foreign submarines in the area and whether they were part of preparations for war against Sweden.

Anti-submarine nets were a tool that could be easily acquired and used, not least in archipelagos and near cities. The nets could prevent a submarine from entering certain areas, but they were also used to prevent one from getting out when the navy located a potential submarine. One such occasion was during the submarine hunt in Hårsfjärden outside Stockholm in October 1982.

SUBMARINE HUNTING IN THE LOCAL NEWS

Research on submarine incidents often addresses the question of why the number of incidents was so high in the 1980s, as well as attempts to reveal the perpetrator. Testimonies also exist from those who participated in the hunts. However, not much has been written about how the wider population experienced the situation. Examining local news coverage gives us a picture of the impact on local communities. In addition to the *U137* incident, the city of Karlskrona was witness to two large-scale, high-profile submarine hunts in 1983 and 1984. Both were closely covered by two local newspapers, *Blekinge Läns Tidning* (*BLT*, the Blekinge County newspaper) and *Sydöstran*. Let's now turn our focus to reports on the submarine hunt in February 1984.

The submarine hunt was a protracted and intensive operation that lasted upwards of a month, and the newspapers were filled with speculation and more or less rousing reports about what was happening. At most, more than 1,000 men took part in the hunt at the same time. Since the troops were regularly replaced, we can assume that several thousand soldiers and sailors took part in the hunt.

During the incident, virtually all anti-submarine warfare resources available in Sweden at the time were put to use. Loaded weapons were deployed against suspected submarines and frogmen. Twenty-three depth charges, 28 shock charges and 63 hand grenades were set off to stop the perpetrators. In addition, firearms were used on some fifteen occasions. Anti-

submarine nets blocked all outlets from Karlskrona to prevent submarines from entering and leaving the inner parts of the archipelago. The nets were gradually supplemented with mines.

During part of the 1980s, the navy can be said to have found itself in a warlike state. The commander of Karlskrona's naval base claimed that the navy was waging war in peacetime during the submarine hunts, and that the only difference was that if there were a war there would be many more people performing the work.

One can agree that a war-like situation was underway in Karlskrona when reading local newspaper reports from February and March of 1984. In an article dated 13 February 1984, *BLT* describes the situation:

> *On the bridges stand grim soldiers with loaded weapons, keeping watch all around them. Control has been tightened for anyone trying to pass these bridges. Several police patrols are also present in the area, prepared to intervene if necessary. Some shipping lanes have been blocked with double anti-submarine nets. All around, there is absolute silence. Everyone is on the lookout and listening intensely, both above and below the water.*

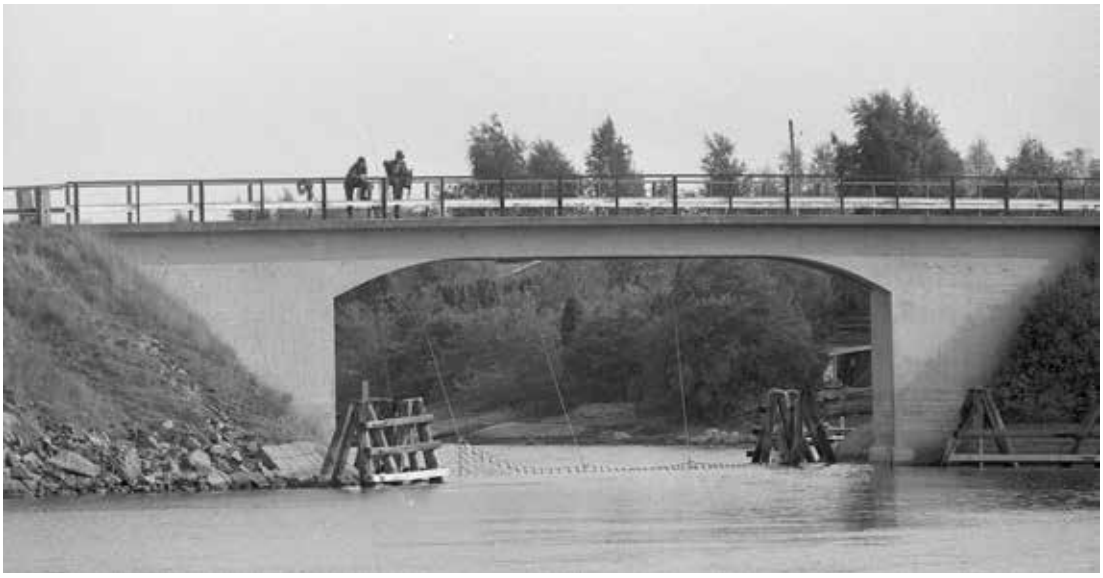
Local newspaper reports prove that many locals initially perceived the events of the 1984 submarine hunt more like a thrilling spectacle. But many learned how serious the matter was when the navy set off several heavy-depth charges outside Verkö, not far from Karlskrona's centre. The same newspaper writes that half the city's population woke up to the shaking of the ground far into the city. The detonations were heard all the way to Nättraby, about seven kilometres away from the site. The newspaper's reporter noted: 'many were also worried – very worried.'

The reports in local newspapers testify to a highly tense situation, with the heavy involvement of the military. The ring around Karlskrona viewed from the archipelago became more and more tightly closed off, with the help of bridge surveillance, anti-submarine nets supplemented with mines, and shock charges. Identity checks were carried out on people travelling through the archipelago. A spokesperson at the Swedish Defence staff information unit explained that not even the tiniest mini-submarine could get out – nor could a frogman for that matter, he added.

In this context, the anti-submarine nets played a vital role in the surveillance. On land, the armed forces remained on the lookout for people who might help the suspected submarine by sending information about where the navy was searching for the submarine or providing assistance to frogmen. The military searched an apartment in central Karlskrona in pursuit of a transmitter, and suspected frogmen were on several occasions pursued on various archipelago islands.

Police officers equipped with submachine guns and dogs conducted searches in summer cottage areas to hunt down suspicious agents. The military sentries, who were often conscripted, were on edge. They fired their weapons on several occasions, throwing hand grenades at suspected frogmen. The newspaper *Sydöstran* notes: 'It is rumoured that soldiers have collapsed due to nervousness and excitement. They must constantly stand at the ready to prevent an escape attempt by an unknown intruder, who might not even exist.'

Military sentries carrying loaded weapons controlled traffic to and from the archipelago islands and carried out identity checks of drivers and passengers. In the end, the checks escalated to include military vehicles and police cars as well. *BLT* underscored the seriousness of the situation. In an editorial, the paper stated that there was every reason to be concerned – after all, no one could really understand why the submarines were so interested in Karlskrona. It stated that:



Karlskrona experienced two major submarine hunts during the 1980s. In 1984, anti-submarine nets blocked all outlets from Karlskrona to prevent submarines and mini-submarines from entering and leaving the inner parts of the archipelago. The nets were gradually supplemented with mines and shock charges. The photo shows anti-submarine nets under a bridge at Skällö in the Karlskrona archipelago.

> *if we summarise everything that our military leadership has confirmed or stated thus far, then we must all clearly see that the situation is serious [...] no one can fail to feel a sense of insecurity, reminiscent of what was experienced during the days of the Second World War. At that time, though, we were dealing with things we were familiar with and understood. But now even the military doesn't know everything about what is taking place in our own waters.*

Inhabitants of the archipelago were most affected by the submarine hunt, with roadblocks and identification checks to and from their homes. Local fishermen were banned from fishing in the area, causing them to lose income, and had to enter and exit their home port in a convoy. But judging from reports in the local newspapers, most of them seemed resigned to accepting the situation. One archipelago resident noted: 'We've got used to it and barely react anymore.' The archipelago's inhabitants were mainly irritated by the thorough checks on access roads to the islands, an irritation that grew more noticeable the longer the submarine hunt continued. *Sydöstran,* however, reported that children were afraid. A 10-year-old boy said, 'I'm getting used to soldiers. But when they aim, you think they're going to pull the trigger. It's really hard.'

The submarine hunt began to be scaled down in mid-March, with no offending submarine or divers found. But traces from the hunt remained for a long time. As late as May, the anti-submarine nets hung from bridges and sentinels were still stationed on some of the bridges in the archipelago. In the view of the armed forces, this was simply something the local population had to get used to. A heightened level of preparedness was still needed.

A single underwater object like an anti-submarine net can tell many stories, often about war and preparedness during wartime. But these nets can also teach us about how the Cold War affected Sweden, nationally and locally. They tell a story of anxiety and fear during peacetime – a time of peace that could even resemble wartime.

SURFACING CONTACTS

The Baltic Sea has always been an important trade route. Wrecks and wreck sites can tell us about the contacts people had and the goods they used during different periods. They also shed light on how these goods have changed over the ages and the different routes they have taken depending on markets, ships and power relationships. During the Middle Ages and early modern times, copper and iron were shipped from Sweden and hemp and timber from Russia and the Baltic states to the Netherlands, France and England, and sometimes to more distant shores. Salt and luxury products, such as wine and wool fabrics, were transported to the Baltic Sea.

Ports were swarming with merchant ships with high rigs, ones filled to the brim with cargo and easy to sail. Single-masted cogs and hulks during the Middle Ages and Dutch fluits in the 17th and 18th century were common sights. During the 19th century, steamships filled with grain pushed ahead across the Baltic Sea on their way to England. Russia and the Baltic states were the main suppliers, but large quantities of oats were also exported from Sweden.

Passenger transport expanded on a large scale with the arrival of steam in the early 19th century, first along the coasts and soon after over the seas. During the post-war period, people and automobiles – and in some cases, even trains – were transported on large ferries operating between Finland, Poland, Germany, the Baltic states and Sweden in increasing numbers. Roll-on roll-off ships, or ro-ro ships, also began to be built and increasingly grow in size. Automobiles and trucks are driven on and off these ferries for easy loading and unloading. The Estonia disaster testifies to the extensive Baltic Sea travel and to the nature of the sea as both a threat and an opportunity.

BALTIC TRADE

FRED HOCKER · SURFACING CONTACTS

Fluits were especially well suited to the transport of timber, and could be sailed by only a handful of crew.

The winter of 1709 was a cold one. The fluit ship *Anna Maria* lay frozen in Dalarö harbour awaiting the spring. Among other objects, the hold contained wooden planks.

BALTIC TRADE

In terms of geography, the Baltic is a nearly land-locked sea, but its economic organisation is similar to a river flowing westward. In the last millennium, maritime trade within the Baltic has been relatively limited in comparison to trade between the Baltic and the larger world. By the Renaissance, this had grown to a flood of goods moving westward in one of the richest commercial arteries in the world, with a smaller flow of western European products coming back 'upstream'. The rivers draining into the Baltic from the south, such as the Oder, Vistula, Dvina and Neman, made a vast and productive hinterland accessible, while connecting the Baltic to distant trade networks to the east and south. Even the less extensive river systems of Scandinavia provided a route to bring valuable commodities to an international market.

LUXURY GOODS ...

Baltic products were already popular in the Bronze Age – a ship wrecked off the coast of Turkey around 1300 BC was carrying, among many other luxury goods, amber beads, which probably came from the Baltic. In the Viking Age, Scandinavians used the rivers of Eastern Europe to trade with the Black Sea and Mediterranean, carving their runes in distant landmarks such as the great church of Hagia Sophia in Constantinople. Frisians, Germans and Danes using the streams across the neck of the Danish peninsula connected the Baltic with Western Europe. Much of the basic exchange in this system took place at temporary beach markets or annual fairs, but international emporia grew up at the transhipment points in these systems, such as Heiðabýr (Haithabu or Hedeby) on the Schlei and Julin (Wolin) on the Oder. These early trading networks were based primarily on luxury goods, products which had relatively high value for the space they took up in a ship's hold, in an oxcart or on a merchant's back. Transport costs were high, due to small ship size and high risk, and there was not yet an international demand for significant quantities of bulk goods.

Copper ingots from Sweden found on a 15th-century wreck in the Bay of Gdańsk in Poland. The Copper Wreck (W5 wreck) is described further in the chapter about the Osmund wreck.

... AND BULK GOODS

As a general rule, it is impractical to ship fuel, basic foodstuffs and building materials over land more than one day's journey to market. Once a town can no longer fuel, feed and house itself within that radius of transport, it has to import these basic necessities and its growth is limited. Before the advent of rail transport, this meant that most large cities developed on the coast or inland waterways. By the Middle Ages, European towns, especially those prospering around the North Sea, were outgrowing their ability to support themselves from the nearby countryside. They created a demand for bulk commodities, such as grain and timber, which the Baltic region was equipped to meet.

German colonisation of the Baltic coastline eastward to what is now Estonia from the late 12th century created a network of linked entrepôts and merchants who were able to organise the collection of the raw materials needed in the Low Countries, France, England

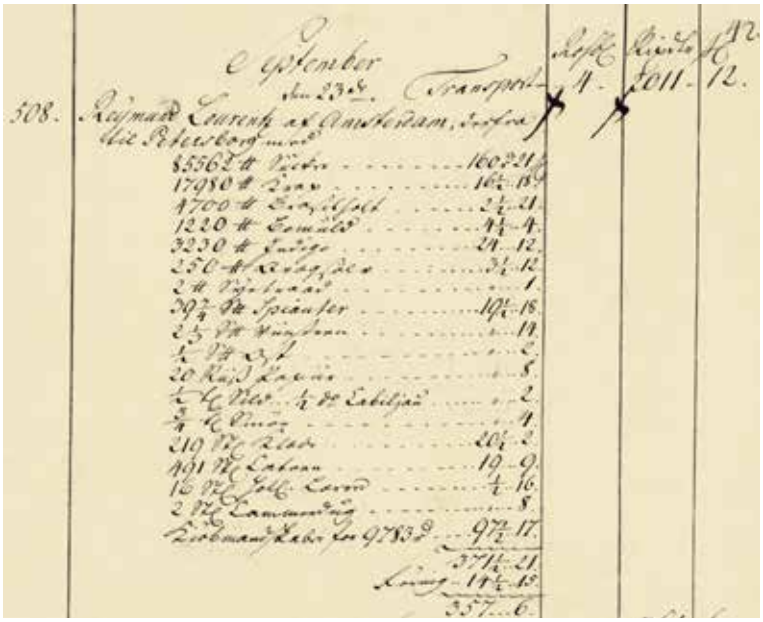
The Kollerup cog in Denmark under excavation. The wreck is from around 1150.

and as far away as Spain and Portugal. The Polish plain provided grain, the forests timber, and the growth of the Scanian herring fishery provided a seemingly inexhaustible protein source. The forests yielded secondary products, such as tar and potash, while land and sea continued to produce the luxury goods for which the Baltic had originally been known: amber, furs, wax and honey. Sweden provided an important component for the developing industries of Western Europe in metals: copper and iron. The German merchants who drove this trade brought back desirable manufactured goods, such as wine and woollen cloth, as well as considerable specie, but the central component of the return trade was salt, mostly from the Bay of Bourgneuf in western France. Salt was essential for the preservation of food, including the fish being shipped west, and the Baltic had no significant salt production of its own.

THE HANSE

As a result of their control over these vital products, German merchants, organised into trade associations known as Hanse, were able to cooperate on an economic level which superseded the capability of the fractured political landscape from which they came. As a result, they became a political power in their own right, able to negotiate treaties with foreign kings and even wage wars. German merchants sat on the governing councils of foreign cities, such as London and Stockholm, and maintained their own compounds, kontoren, in major ports. They were perceived as a single political entity, the Hanseatic League, but were riven by internal tensions created by differing economic interests and geography.

In the 15th century, German dominance of Baltic trade began to wane in the face of competition from the west. German merchants had long preferred to tranship goods across the neck of the Danish peninsula rather than risk the dangerous waters of the Skagerrak and Kattegat. This had allowed Lübeck and Hamburg to prosper as the effective termini of the transhipment route, but some merchants, sometimes called *ommelandsvaarder* ('those who sail around the land'), were already braving these waters to avoid the high transaction costs



Documents from the Øresund Sound customs house provide valuable insight into Baltic Sea trade from 1497 to the mid-19th century. In the 17th century, almost three-quarters of the vessels engaged in trade between the Baltic Sea and Western Europe were based out of the Netherlands. The document in the photo is from 23 September 1771, when Captain Reynoud Lourens and his crew entered the Danish customs station and declared *Vrouw Maria's* contents with passage number 508.

of unloading goods in Lübeck and reloading them in Hamburg; a wreck of c. 1150 at Kollerup on the northern Danish coast may be an early example of this practice. Dutch merchants in particular preferred this route, and avoided Hanseatic middlemen by sailing directly to the sources of important commodities, bypassing the markets established in coastal towns. By rigorous attention to the small details of capital and operational costs, bold navigation, and superior financial organisation, Dutch merchants eventually displaced the Hanse in taking Baltic goods to the West.

THE SOUND DUES

For those sailing into and out of the Baltic, the Sound (Öresund/Øresund) between Zealand and Scania was the principal route. This created an irresistible opportunity for the kings of Denmark, who controlled land on either side. In 1429, Erik of Pomerania established a toll on all non-Danish ships transiting the Sound, with the proceeds going directly to the crown. This toll, the Sound Dues, remained in effect until 1857, creating constant tension with other Baltic countries, especially Sweden, and with the merchants of North Sea countries trading in the Baltic. The records it produced provide a vast data set for the study of Baltic trade. These show that already in 1497 (the first year for which records survive), the majority of ships passing through the sound were based in the Low Countries, primarily the provinces of Holland and Zeeland. At the peak of their dominance in the 17th century, almost three-quarters of the ships engaged in long-distance trade between the Baltic and the West were Dutch.

ON DUTCH KEELS

Although the Dutch are more widely known for their command of the trade with the Far East through the Dutch East India Company (VOC), the trade with the Baltic generated far more wealth, and was a vital component in the commercial success which created the

Dutch Golden Age in the 17th century. In order to maintain control of this income stream, the Dutch repeatedly intervened in Baltic wars or backed one side against another, usually choosing the weaker side to prevent one country from achieving hegemony. In the early 17th century, this usually meant siding with Sweden, especially after Christian IV raised the toll or closed the Sound to foreign shipping. After Torstenson's War in 1644–45, which broke Danish control of the Sound, the Dutch tended to ally with Denmark to prevent Sweden from gaining undisputed control.

GRAIN, TIMBER, FISH, IRON AND HEMP

From the Middle Ages onward, the core of Baltic trade was bulk commodities which had relatively low value for the hold space they occupied, but for which there was an insatiable demand and a steady supply. Grain was probably the most important of the goods exported from the Baltic, so much so that the unit in which it was measured, the last (about 3 m^3), was used to define the size of merchant ships, in the same way that wine tuns defined the size of Atlantic ships. The Polish grain trade collapsed in the middle of the 17th century and never really recovered, as consumers in Western Europe quickly found alternative sources, but the last survived as the essential measure of ship size.

After grain, timber and forest products accounted for the greatest volume of long-distance cargoes. Polish oak in particular was in high demand. Western shipbuilders believed it was less durable than English oak, but could not ignore its ready availability, especially in larger dimensions. The Polish forests were dense stands of large, straight trees. It was exported as baulks, as roughly sawn plank, and in vast quantities as barrel staves. On Sweden's west coast, the Skaftö Wreck from the 1440s is a good example of mixed raw materials, with timber and barrel staves which were loaded in Danzig (today Gdańsk) and headed westward. In addition to oak, the Baltic provided excellent stands of pine suitable for masts or conversion into tar. Wood was also exported as potash, wood ashes which have been leached; the potassium compounds in potash were essential to a wide range of manufacturing processes.

While cured herring had been part of the triad (with grain and timber) on which the Hanse had based its medieval prosperity, the Baltic herring fishery collapsed in the early 15th century. At about the same time, Dutch fishermen discovered even bigger stocks in the North Sea and began exploiting them, contributing to the explosive growth of Dutch maritime power after 1400.

In the Middle Ages, the traditional materials used for making rope since at least the Neolithic were largely replaced by hemp. This could be spun efficiently by wheel into long threads or yarns suitable for weaving or laying into rope. Although hemp was widely grown, the eastern Baltic produced fibre of exceptional quality. Combined with timber and tar, as well as Swedish iron, hemp was one of the essential sinews of naval power, so all of the western European naval powers kept an eye on Baltic events and intervened if they felt that their access to critical naval stores was threatened.

SHIPS AND SHIPPING

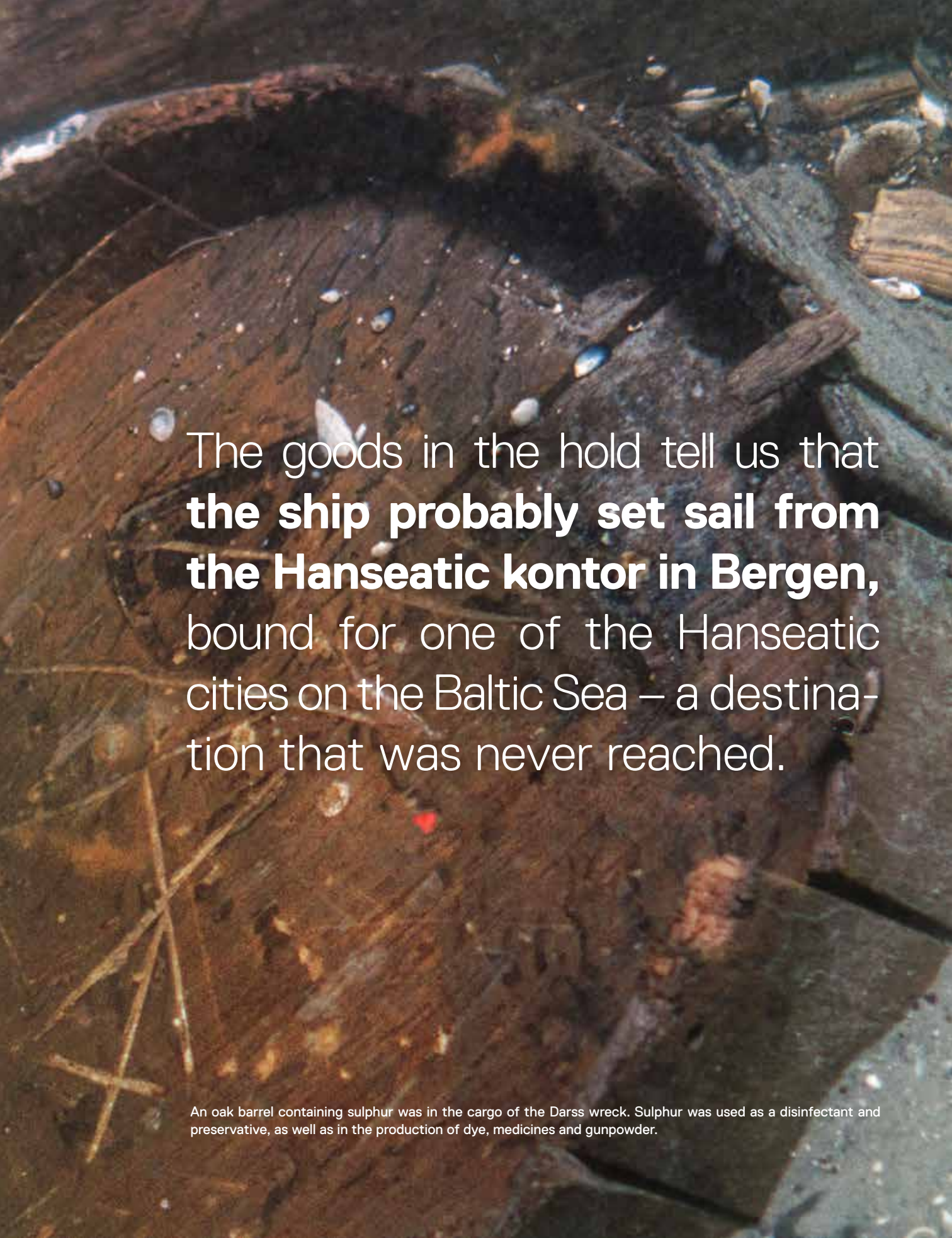
The emphasis on bulk cargoes made specific demands on shipping. For a commodity with low value for its weight or volume, long-distance transport could double its price at the destination. To maintain competitive prices, ships had to minimise operating costs. Bulk cargo vessels tended to emphasise capacity, with simple rigs to minimise the number of crew needed. Hull forms were efficient rather than graceful. In the Middle Ages, cogs with flat

The majority of Baltic long-distance trade from the Middle Ages onwards revolved around bulk commodities, such as grain, timber, hemp and fish. Detail of a barrel bottom with grain from the wreck Fula Gubben in the Stockholm archipelago. The discovery of a Bartmann jug and a coin minted in 1732 dates the sinking to the mid-18th century.

bottoms, hard bilges and a single mast maximised capacity at low cost. By the 17th century, many Dutch shippers were using fluits, long, narrow flat-bottomed hulls with square ends and a tall, simple three- or four-masted rig. These were especially well suited to the transport of timber, and could be sailed by only a handful of crew.

THE DARSS WRECK

NOELIA MADRIGAL SEQUEIRA · SURFACING CONTACTS



The goods in the hold tell us that **the ship probably set sail from the Hanseatic kontor in Bergen,** bound for one of the Hanseatic cities on the Baltic Sea – a destination that was never reached.

An oak barrel containing sulphur was in the cargo of the Darss wreck. Sulphur was used as a disinfectant and preservative, as well as in the production of dye, medicines and gunpowder.

THE DARSS WRECK

In 1977, rescue divers discovered a shipwreck in the southern Baltic Sea. The wreck was found in the area around the mouth of the Prerow River near the Darss Peninsula on Germany's Baltic coast, lending its name to the Darss Wreck. Both the hull and cargo of the Darss Wreck are exceptionally preserved. They can tell us not only about the ship's construction and sinking, but about the trade routes, production centres and goods that were essential for the medieval trading network of the Hanseatic League.

Since 2000, the wreck has been the subject of several research projects that have documented and examined the site, including the EU project MoSS – 'Monitoring, Safeguarding and Visualizing North-European Shipwreck Sites'.

PERSONAL POSSESSIONS AND CARGO

A huge variety of objects were discovered during the archaeological excavation of the wreck site. They include metal vessels, roof tiles, fishing net weights, a sounding lead, a pewter box, a fishing net needle, whetstones, a lantern made from leather and metal, sulphur, animal bones, reindeer antlers, horncore, wooden sticks and wooden barrels. Some of the objects, such as the vessels, the sounding lead, the lantern and the fishing net needle, probably belonged to the crew, while the whetstones, reindeer antlers and wooden sticks were likely part of the cargo.

A dendrochronological analysis of the ship timber and wooden barrels from the cargo dates the ship to the first half of the 14th century. The ship's oak timber was felled sometime between 1298 and 1313, and the wood in the barrels around 1335. Both the ship's timber and the wood from the barrels grew somewhere along the Wisła River in present-day Poland. Based on the period style, the metal vessels found in the wreck can be dated to around the first half of the 14th century.

Also among the finds was a globe-shaped bronze tripod pot. Bronze pots were durable, high-quality kitchen equipment and the pot was used for cooking food. A cast mark appears along the edge of the pot resembling the city of Lübeck's coat of arms. The pot was possibly

A dendrochronological analysis of the ship timber and wooden barrels from the cargo dates the ship to the 14th century. The timber grew along the Wisła River in present-day Poland.

cast there. Similar finds make it possible to date the pot to the first half of the 14th century. Casting and origin marks began to be used in the Hanseatic cities in the year 1354. The pot could therefore have been cast sometime after 1354.

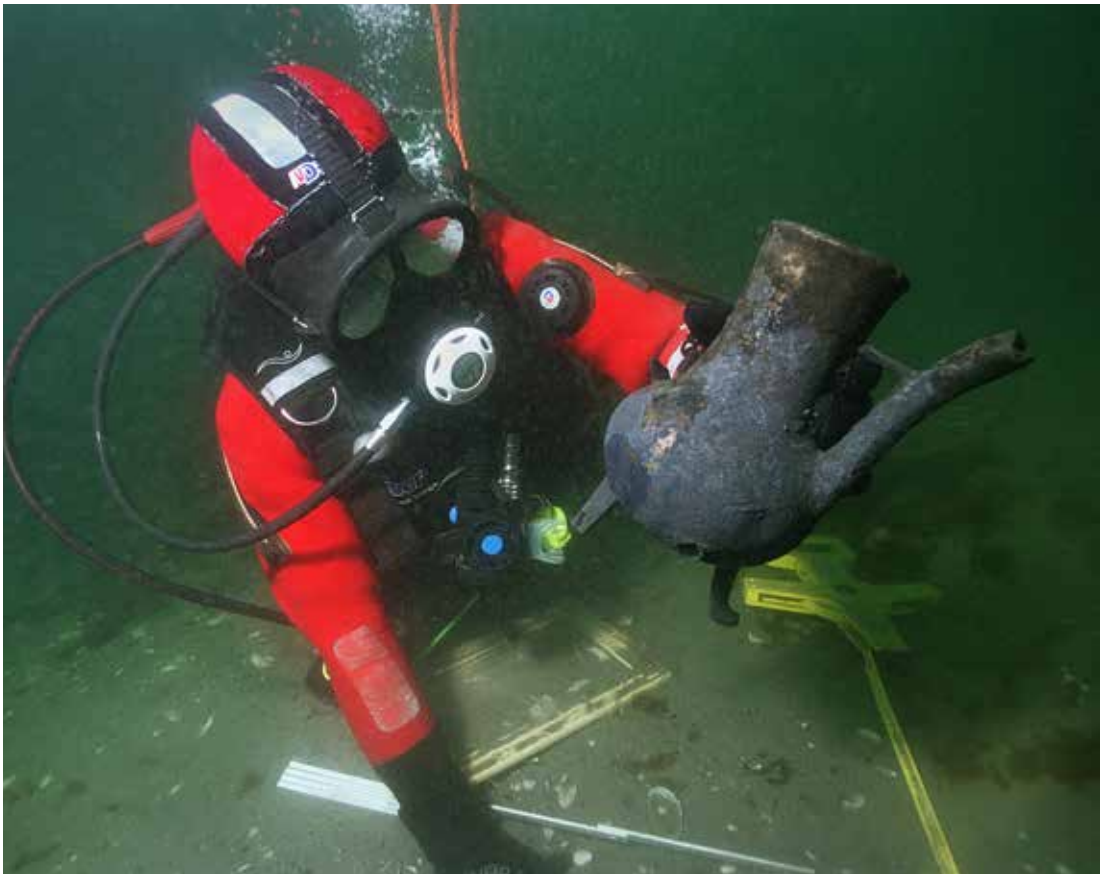
A tripod ewer made from bronze with a tube-shaped spout was also found. Simple bronze ewers like this were found in most households during the Middle Ages and were used to pour and store water. The surface of the jug is damaged, and the handle and one leg are missing. The only fully preserved leg is narrow and round, with a paw-shaped base. The ewer is typical of the 14th and 15th centuries, and the shape of such jugs did not change during the period. Both the origin of manufacture and the original production year are unclear, but the Hanseatic city of Dinant in present-day Belgium was a centre for the manufacture and export of bronze goods at the time, so it is possible that the jug from the Darss Wreck came from there.

Another object among the preserved metal vessels was a pewter tankard with a handle, of a type with a curved bottom and narrower neck, which in German is often called 'Hansekanne'. The handle bears an inscription, 'AVE REG', which is short for Ave Regina, meaning Hail O Queen and referring to the Virgin Mary. The underside of the lid depicts a crucifixion scene, a cast of a pilgrim's badge. The pewter tankard was probably a personal possession of one of the crew members. Tankards like this one were used for drinking beer and were usually reserved for the upper echelons of society, who could afford to buy vessels of pewter. Others had to settle for wooden or ceramic ones.

These jugs were used and popular mainly during the 14th and 15th centuries. The shape and material were stable and thus ideal for use at sea, but they were used throughout

Globe-shaped tripod in bronze. A cast mark resembling the city of Lübeck's coat of arms appears along the edge.

Tankard. The handle bears the inscription 'AVE REG', which refers to the opening words of one of the church's prayers or a greeting to the Virgin Mary, and the underside of the lid portrays a crucifixion scene.



Tripod ewer in bronze with tube-shaped spout for warming and pouring out water.

Northern Europe, from the Netherlands over the German Hansa areas and southern Baltic coast up to Scandinavia. The jugs were produced primarily in the cities of Hamburg, Lübeck, Danzig and Rostock, but also in the Nordic countries.

The jug from the Darss Wreck has a broad and compact shape, revealing that it was manufactured in the late 13th century or early 14th century. The pilgrim marking in the lid is probably from the Gottsbüren pilgrimage site in Hesse, where a miracle is said to have occurred in 1331. Gottsbüren is known to be the provenance of such badges from the early 1330s displaying crucifixion scenes, so the jug could very well have been cast during that period.

THE FINAL JOURNEY

But when did the ship sink? The dating of the metal objects and wooden barrels in the cargo allows us to narrow the time frame of the sinking. The ship itself appears to have been built in the early 14th century, although some of the objects are considerably newer than the planks in the ship's hull. The 'Hansekanne' and wooden barrels indicate that the ship could not have sunk before the mid-1330s. Instead, it is likely that it wrecked sometime after 1354, after having sailed for 40–50 years.

The objects on board tell of the ship's last itinerary and shed light on the Hanseatic

The wreck contained heaps of bones from fish that were part of the ship's cargo. The bones come mainly from cod, a species that was used for stockfish – air-dried unsalted fish. The species of the bones in the photo is unknown.

trading centres and routes. The distinguishing features of Hanseatic trade included the sale of finished goods, food supplies, raw materials and luxury items in ports outside one's hometown, and the purchase of semi-finished products, raw materials and finished goods that merchants brought back to their own ports and artisans in northern Germany and the Baltic Sea region.

In Hanseatic cities like Lübeck, Danzig and Visby, raw materials and semi-finished goods were then processed into finished products which could be resold. The cargo from the Darss wreck contains both raw materials and semi-finished products. Two reindeer antlers with traces of commenced processing attest to the trade from Norway with this material. Antlers were a popular material often used to produce everyday objects, such as combs.

The cargo also contained an oak barrel filled with sulphur. Sulphur was used as a disinfectant and preservative, and could also be used to produce dyes and medicines. It was also an essential component in the production of gunpowder. With the introduction of firearms in the 14th century, sulphur grew in importance as a commodity.

The sulphur in the cargo of the Darss Wreck originated from Iceland, which – with its volcanic landscape – since the Viking period has been known for mining and trading in this raw material. Iceland was under Norwegian control in the Middle Ages, and all trade with

the island had to take place via Norway. The sulphur on the Darss Wreck must have come from the Hansa office in Bergen.

Whetstones from the wreck's cargo are a good example of Hanseatic trade in semi-finished products. The stones probably come from Norway. Schist from Eidsborg, a village west of present-day Oslo, was a popular material for producing grindstones and whetstones, and had been mined and sold since the early Middle Ages.

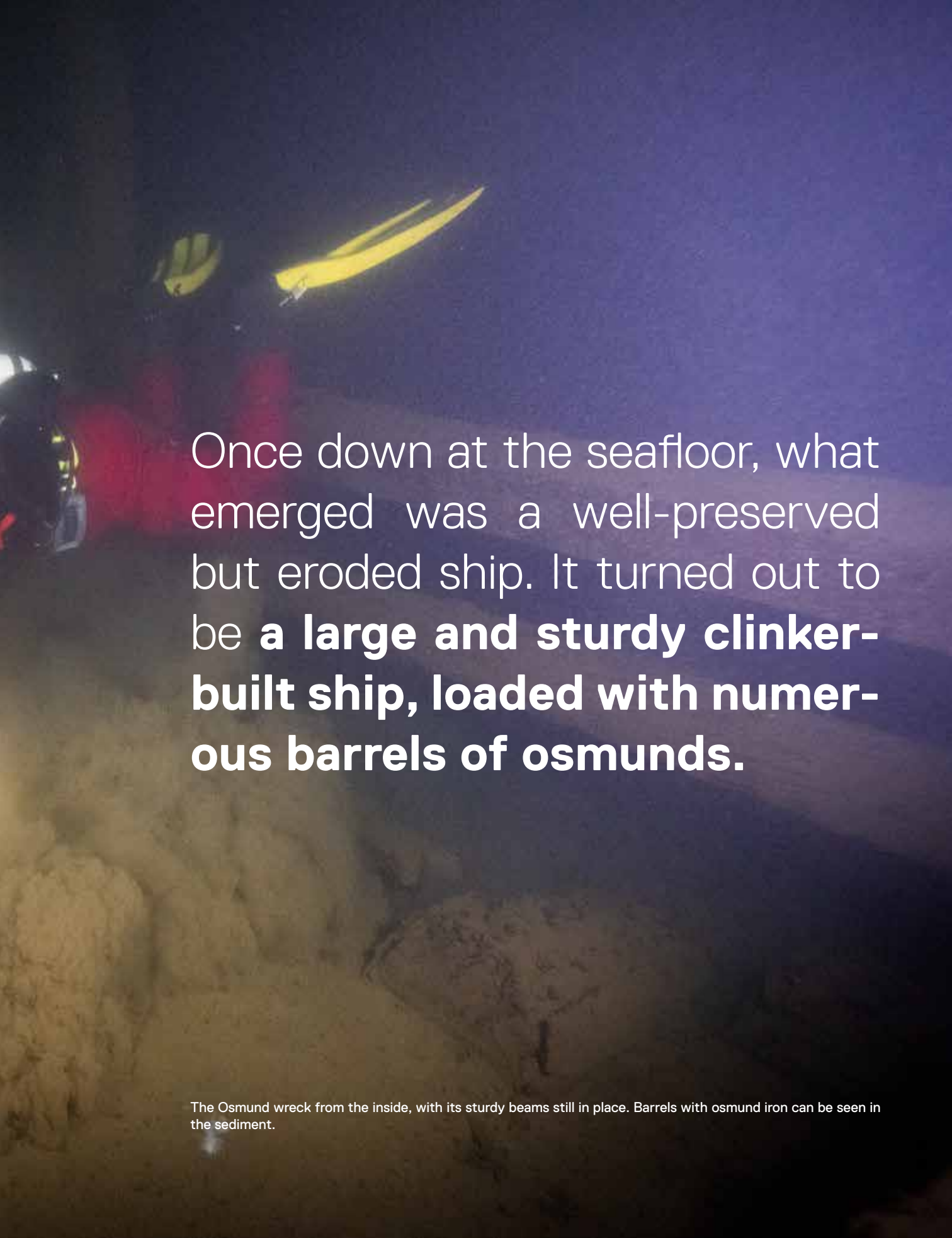
In addition, large quantities of fish bones and wooden skewers or sticks from the ship's cargo were found in the wreck. The fish bones come mainly from cod, a species used for stockfish – air-dried, unsalted fish that was eaten throughout much of Europe. We know it is stockfish because the findings almost exclusively consisted of vertebrae and bones from the shoulder area of the fish, and virtually no fish heads.

Stockfish are produced by first cleaning the fish, removing the head and stretching out the carcass using a pair of wooden skewers. The fish is then hung on racks and allowed to air dry. Stockfish were produced in the Middle Ages almost exclusively in Norway, where cod were fished along the Atlantic coast. Bergen served as the centre of trade in this product. The fish, like the reindeer antlers and whetstones, thus seem to come from this area.

The Darss shipwreck testifies to the extensive trade in Northern Europe and the far-reaching network of Hanseatic merchants, production centres and kontoren around the North Atlantic and Baltic seas that characterised the Hanseatic period. The artefacts found in the wreck tell of the ship's final journey. After safely crossing the North Atlantic, the ship sank in the southern Baltic Sea. The goods in the hold tell us that the ship probably set sail from the Hanseatic kontor in Bergen, bound for one of the Hanseatic cities on the Baltic Sea – a destination that was never reached.

THE OSMUND WRECK

JIM HANSSON · SURFACING CONTACTS



Once down at the seafloor, what emerged was a well-preserved but eroded ship. It turned out to be **a large and sturdy clinker-built ship, loaded with numerous barrels of osmunds.**

The Osmund wreck from the inside, with its sturdy beams still in place. Barrels with osmund iron can be seen in the sediment.

THE OSMUND WRECK

In 2017, a wreck was discovered just north of Dalarö in Stockholm's central archipelago. The wreck is interesting both because it is so old – from the 16th century – and because it belongs to a transitional period between medieval and modern shipbuilding. But above all, its uniqueness lies in the type of cargo it contained – fist-sized lumps of iron called osmunds. The first of its kind found in Sweden, it has been named the Osmund wreck after these historically significant iron lumps.

A SHIP LOADED WITH OSMUNDS

> *The iron you are requesting from Stockholm for the construction of Kalmar Castle cannot be sent so late in the year, as the letter came to the bailiff here in Stockholm so late in the autumn that it has not been possible to prepare a delivery of iron. However, we understand that a ship loaded with both osmunds and bar iron has been stranded at Öland. The iron has been salvaged. Therefore, as the owners of the salvaged iron are now here in Stockholm, we have negotiated with them the use of the salvaged iron for both the construction of Kalmar and Borgholm buildings. We will pay them back with as much iron as that which they can prove they delivered to you on our behalf. We have written to Lasse Lukussonn whom you can contact and request as much iron as needed from him for Kalmar and then draft a receipt stating how much was delivered.*

These lines summarise the content of a letter sent by the Swedish king John III to his bailiff at Kalmar Castle in November 1575. One of the king's ships that was en route to the castle had run aground at Öland. John III had Kalmar Castle rebuilt at the time, and that was where the ship was headed carrying a cargo of iron.

Intriguingly enough, a similar cargo was found on the recently discovered shipwreck in the Stockholm archipelago, which is also nearly contemporary with the king's ship. Although

The wreck's clinker-built hull is intact and the planking is severely eroded. Just the rivets are holding it together. The frame is sticking up 3–4 metres. On the inside you can see the shelfpiece.

this wreck is the first of its kind found in Sweden, it is far from being the only iron-laden ship that operated on the Baltic Sea at this time. The Osmund wreck offers us a glimpse of the 16th century while providing a fantastic opportunity to study iron trade during the period.

DOWN AT THE BOTTOM

It all started with a sonar indication captured by Niklas Ekström from the diving charter company we rented a dive boat from. Our plan was actually to document another wreck for Vrak – Museum of Wrecks. Studying this indication was our backup option in case we were unable to get out to that site due to heavy winds. One day when a strong wind was blowing, we decided to inspect what appeared to be an older shipwreck as indicated by the sonar image. So it was pure coincidence that we dived at all on the wreck. The site offered the dive boat good protection against the fierce winds, and our diving preparations began.

The shipwreck reportedly lay at a depth of about 28 metres. Once we were down at the seafloor, what emerged was a severely eroded ship. It turned out to be a large and sturdy clinker-built ship, just over 20 metres long and almost eight metres wide, and loaded with numerous barrels of osmunds. Previously, only a few wrecks with iron in their cargo have been found in Sweden, none of them containing osmunds. This in itself is remarkable, since osmund iron was one of the most commonly exported goods from Sweden for a considerable period of time. On board the wreck is also one of the earliest known examples of modern forged bar iron.

3D model of the Osmund wreck site. Note the barrels aft of the mainmast.

A pipkin and what is likely a bronze pot just below the galley. Unfortunately, the Osmund wreck has been looted since the photo was taken, and the pipkin is no longer on the wreck.

An inspection of the wreck revealed that the hull sides were largely intact, while the hull planks were so heavily eroded that in several places only the rows of rivets in the scarfs remain where the planks overlap, holding them together. The ship is sturdily built, with an arrangement of beams that reinforces the hull together with riders – vertical timbers that support the beams on the inside of the hull.

The mainmast is still in its original position. It points up to the water's surface, while the foremast lies at an angle on the sea bottom at port side. At the end of both masts you can see the indentations from a block pulley used to raise and hoist the square sail. A hefty round log, the bowsprit, lies in the bow. The 3D model of the wreck shows that the mainmast is shifted slightly aft, which at first led us to believe that the ship only had two masts. But dives in April 2020 revealed what is likely to be a thin mizzenmast, which also had a sheave hole with the disc still in place. In that case, it would have sat higher up in the hull, in the stern's superstructure, and the ship would then have had three masts.

A GLIMPSE INTO THE 16TH CENTURY

Following the discovery of the Osmund wreck, we have returned to the wreck site on several occasions. Nowadays, the wreck is part of a joint research project with Jernkontoret, the Swedish steel producers' association, which we hope will provide plenty of new knowledge

To the right of the osmund barrels is an elongated object, perhaps a chamber cannon. To the right of this, towards the hull, are bundles of bar iron.

about early industry, transport history and ironworking. This research collaboration also extends to Poland and Germany, which also have wrecks containing osmunds. Together, we hope to capture the history shared by the Baltic Sea countries, which is the reason why these particular project collaborators have come together.

From what we know today, the Osmund wreck ship probably sank in the 1550s or somewhat later. Three wooden samples from barrels in the wreck indicate that the timber was felled sometime in the 1540s. Dendrochronology is an important tool for determining the age of ships and cargo, as well as for making comparisons and placing the ship in its historical context. It is likely that the wood in the barrels came from the eastern Baltic.

Wood samples have also been taken from the ship itself. The more massive structures, such as beams and frames, come from Uppland. The wood was probably felled in the 1540s, indicating that the ship was likely built during this decade. But other dates from the ship pique our interest as well. One such date might provide clues about another phase in the ship's history. In the somewhat more delicate ship parts, such as the planking and interior trim, the dating differs from that of the more massive structures. Here, the wood was felled around 1553 or soon after. In addition, this wood comes from other areas of the Baltic Sea, probably from southern Finland. The planking and interior trim are parts of a ship that usually wear more quickly and are therefore replaced first. So, it is likely that we are looking at a repair of the ship.

The sinking date of the Osmund wreck in the 1550s or 1560s is, in addition to the date of the presumed repair, indicated by the cargo's contents. The ship was fully equipped and several personal belongings were found.

The wreck contains a brick galley, most of which has fallen down from its position on the starboard side aft. A copper pot still remains in the hearth. Below the galley are a vessel and

The shipwreck has more than 30 barrels, most of which seem to contain osmunds. Two barrels containing osmund iron are pictured in the photo.

a large barrel. There also used to be a pipkin from the 1540s, but unfortunately the wreck has been looted and the pot stolen, and so invaluable information has been lost. In the space under the galley, a bit brace was also found.

On the deck just fore of the galley rests a weighty iron object roughly three metres long and 20-25 cm in diameter. In the corrosion you can see what may be iron straps that have enclosed the object, suggesting that it could be a gun barrel – probably from a chamber cannon. However, further studies are needed to say for sure.

About 30 barrels and two bundles of bar iron can be discerned in the Osmund wreck's load. The pieces of bar iron are placed neatly along the hull in the stern. Parts of the wreck are covered with sediment, so more barrels are likely to be hidden in the ship. Although most of the barrels contain osmunds, we know that some also contained other things, most likely tar or perhaps butter. Analyses of the samples taken can hopefully give us a more accurate answer.

The ship was probably three-masted, and had a castle in the stern and probably one in the bow. It is also clinker-built according to the Nordic tradition, so it may very well be what was known as a hulk – the largest merchant ship of the period whose construction was inspired by the cog. But what's so special about a large clinker-built ship carrying osmund iron?

SWEDEN AND IRON

The history of iron in Sweden harks back to the Bronze Age. Smelting in bloomeries, which mainly utilised sea and bog ore deposits, has been practised since at least the 7th century BC. It continued to be practised throughout the Iron Age, and even later alongside the more specialised blast furnace technique.

The production of iron intensified during the Middle Ages in the Bergslagen region with the introduction of the blast furnace. This was because the need for iron grew as the kingdom became modernised. Mining rights emerged mainly as a response to the domestic need for iron, and the various mining districts were regulated by royal privileges.

Control of the iron trade was critical, as it likely constituted medieval Sweden's primary economic resource. The importance of Stockholm also grew thanks to its geographical location, which provided the capability to control both exports and domestic iron trade. It was logical that the city was used as the port for exporting iron from these mining districts across the Baltic Sea.

OSMUND IRON AND BAR IRON

The fact that bloomery sites declined in importance during the 14th century is likely related to competition from blast furnaces. The blast furnaces' iron bars were cheaper than the bloomery products. The malleable iron from the blast furnaces was hammered into smaller lumps, which were called osmunds, giving rise to the name of this type of iron.

Osmunds were a kind of iron bar with a specific weight of around 280 grams. The historian and archbishop Olaus Magnus wrote in the 16th century about Swedish ironworking. He stated that the iron was smelted using water wheels and then divided into ingots of a special size. The ingots were placed in containers before being shipped both within and outside the country's borders. He was probably describing osmunds in barrels like those from the Osmund wreck.

Osmunds were a type of standardised product which could also be used as a form of payment for leases or taxes – similar to the way farmers at the time could pay using a certain number of barrels of rye. A good example comes from the monastery in Riseberga. In a letter from Karl Knutsson in 1440, the king confirms that the monastery had the right to extract iron ore in the Nora mining district in Närke, and that all who wanted to extract iron ore there 'owed the church and bishop 30 osmunds'.

In the 16th century, the Swedish king Gustav Vasa sought to replace osmund iron with bar iron, probably because he wanted more control over production. While the bar iron required a larger organisation with tools like water-powered hammers, osmunds could be produced with lesser means on a farm. It was therefore more difficult for the Crown to control.

The oldest traces of bar ironmaking that we know of from historical sources date back to 1528. The bar iron began to be exported in the first half of the 16th century, but production only got off to a serious start when osmund forging declined. At the beginning of the 17th century, osmund iron was still the dominant product. Over the course of the century, iron production evolved and exports of bar iron increased significantly.

SWEDISH IRON EXPORTS

From the mid-13th century to the 19th century, Sweden was one of the world's leading iron producers for extended periods of time. From the mid-16th century, it is possible to compare exports of osmund iron from various Swedish ports. Stockholm led production, exporting between 2,000 and 3,000 tonnes per year. The port of Gävle was also significant, with up to 500 or so tonnes annually, while the other ports seem to have had less extensive exports of osmund iron.

From the same time period, data are available showing total iron exports. Exports of osmund iron totalled between 3,000 and 4,000 tonnes per year in the second half of the

16th century. Bar iron increased sharply in importance from a few hundred tonnes around the mid-16th century to over 1,000 tonnes in the second half of the 16th century and early 17th century.

The major importers were the North German ports, with Lübeck–Hamburg the biggest at the close of the 14th century. Exports to English ports were less extensive but still substantial. At the end of the 15th century, the Netherlands played an increasing role as an importer of Swedish iron. A century later, Danzig (Gdańsk) was the biggest importer of Swedish osmund iron. In Danzig, osmund iron was forged into bar iron and exported onwards to Western Europe.

One of the first known examples of the type of bar iron discovered on the Osmund wreck can be seen on Vädersolstavlan – an oil-on-panel painting of Stockholm created in 1535. At Järntorget, in what today is Stockholm's Old Town, you can see pieces of bar iron leaning against a building façade. The bar iron on the Osmund wreck was manufactured just a few years after the painting was completed, and is one of the oldest archaeological finds of bar iron made by water-powered hammers.

OSMUND WRECKS

Despite the extensive exports of iron from Sweden, shipwrecks with iron cargo are very rare. Finds of osmund iron on wrecks are even rarer. There are currently only three known wrecks that can surely be said to have osmund iron in their cargo: in addition to the Osmund wreck, the so-called Mönchgut 92 in Germany and the Copper Wreck (W5) in Poland. The findings from the latter are on display at the National Maritime Museum in Gdańsk.

The Mönchgut 92 wreck was found in 2010 during investigations within the Nordstream project. Although only fragments remain of the shipwreck, an area of the ship measuring about 8 × 6 metres has been preserved under a protective layer of ballast and cargo. The cargo consisted of copper ingots – probably from Bergslagen in Sweden – and five barrels of osmunds. The ship is clinker-built, and the oak was felled in northern Europe and dated to the winter of 1448–49. The barrels containing the osmunds were also made of oak, felled in Sweden in 1454. The ship was probably a larger cargo ship built in the Nordic style.

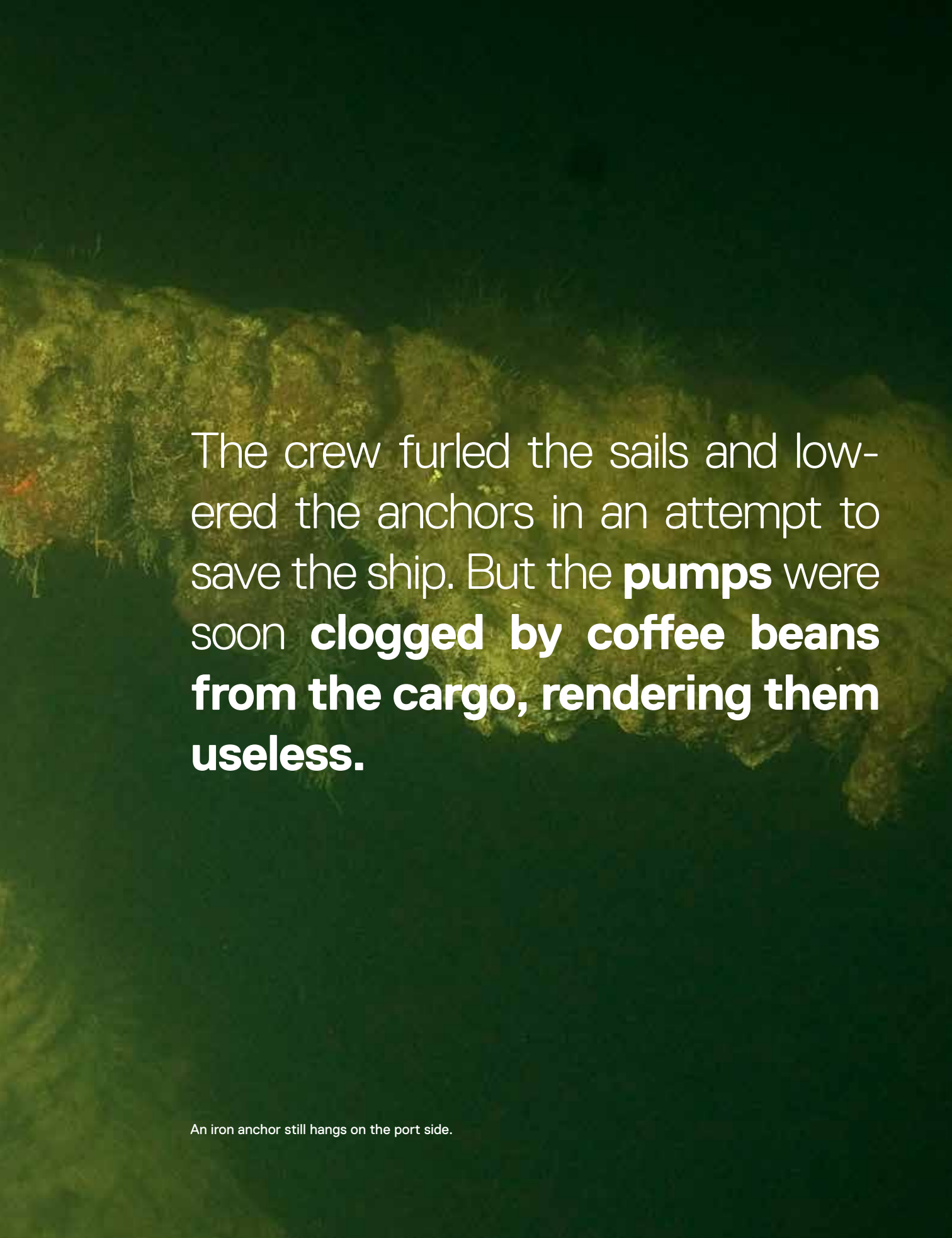
The Copper Wreck was found in 1969 outside Gdańsk. Just like the Osmund wreck and Mönchgut 92, the ship is clinker-built. And like the Osmund wreck, it also has strengthened beams with knobs on the outside of the hull. The wreck was loaded with copper ingots and barrels of osmunds. The ship dates back to 1400, and the barrels of osmunds to 1408. Both the ship and the barrels were likely manufactured locally near Gdańsk.

Although shipwrecks with iron cargo are thus rare as archaeological finds, ships of the time like these were probably very common around the Baltic Sea and in its ports. But where are these wrecks with their cargos of iron? They were hardly unsinkable, so there must be another explanation for why they have not been discovered. Perhaps people have seen rusty crusts but interpreted them as something other than the fabled osmunds? Perhaps there are more shipwrecks out there, hidden in the depths with their osmunds?

For now, we can consider these three wrecks as exceptional timekeepers and research objects that have much to tell us about iron and copper exports in the Baltic Sea. What did the ships look like, and what routes did they take? What share of the trade was Sweden involved in? Was there cooperation across the Baltic Sea? These are questions that such shipwrecks can answer.

VROUW MARIA

RIIKKA ALVIK · SURFACING CONTACTS



The crew furled the sails and lowered the anchors in an attempt to save the ship. But the **pumps** were soon **clogged by coffee beans from the cargo, rendering them useless.**

An iron anchor still hangs on the port side.

VROUW MARIA

The snow ship *Vrouw Maria* set sail from Amsterdam bound for Saint Petersburg on 5 September 1771 with shipmaster Reynoud Lourens and his crew of nine men, its round hull filled with valuable cargo. On the evening of 3 October, the voyage ended when the ship struck a rock south of the island of Jurmo at the entrance to the Gulf of Finland.

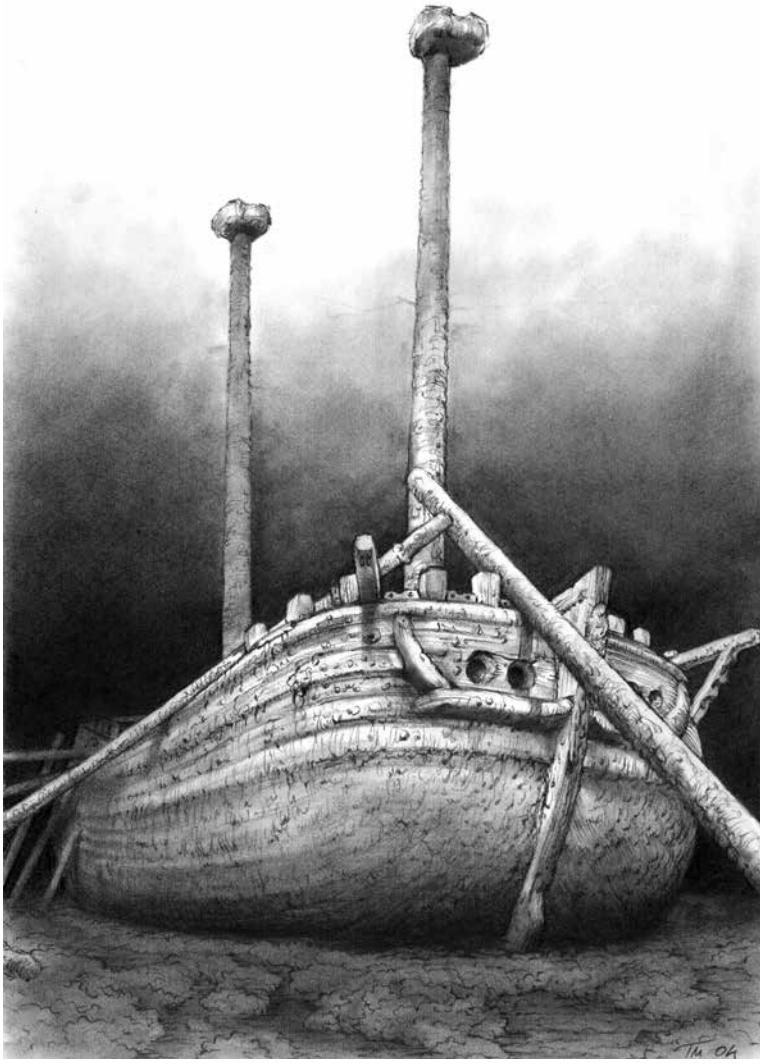
Today, 250 years later, the well-preserved wreck of *Vrouw Maria* rests almost entirely intact on the sea floor at about 41 metres' depth. The lower parts of the two masts are still standing and their tops reach a depth of approximately 21 metres.

VROUW MARIA'S LAST JOURNEY

In the 18th century, the sea route through the Gulf of Finland was one of Europe's busiest, with important port towns such as Reval (Tallinn), Narva, Vyborg and Saint Petersburg along its shores. The journey from Amsterdam to Saint Petersburg lasted approximately two months. The customs station in Elsinore, Denmark, was reached in about three to four weeks. Ships usually sailed to Saint Petersburg from early May until the beginning of November, since conditions in late autumn were often risky. The early onset of darkness, rocky coastline of Finland and cold, strong winds combined with substandard maritime safety were often the cause of accidents.

The shipmaster of *Vrouw Maria*, Reynoud Lourens, was originally Danish, but according to the Sound Toll Registers his home harbour was Amsterdam. Since 1766 he had been sailing from Amsterdam to Saint Petersburg annually until 1774, also visiting other European ports like Livorno in Italy. It seems he was a highly experienced shipmaster. When he set sail in September 1771, there were at least 34 freighters who had chosen *Vrouw Maria* to carry their goods to Saint Petersburg – including many deliveries to the Russian court.

On this last and unlucky voyage, the cargo of *Vrouw Maria* – according to the toll registers – consisted of sugar, dyestuffs, Brazil wood, zinc, mercury, cloth, foodstuffs like cheese, butter and fish products, and unspecified goods. Among this last group was a collection of paintings



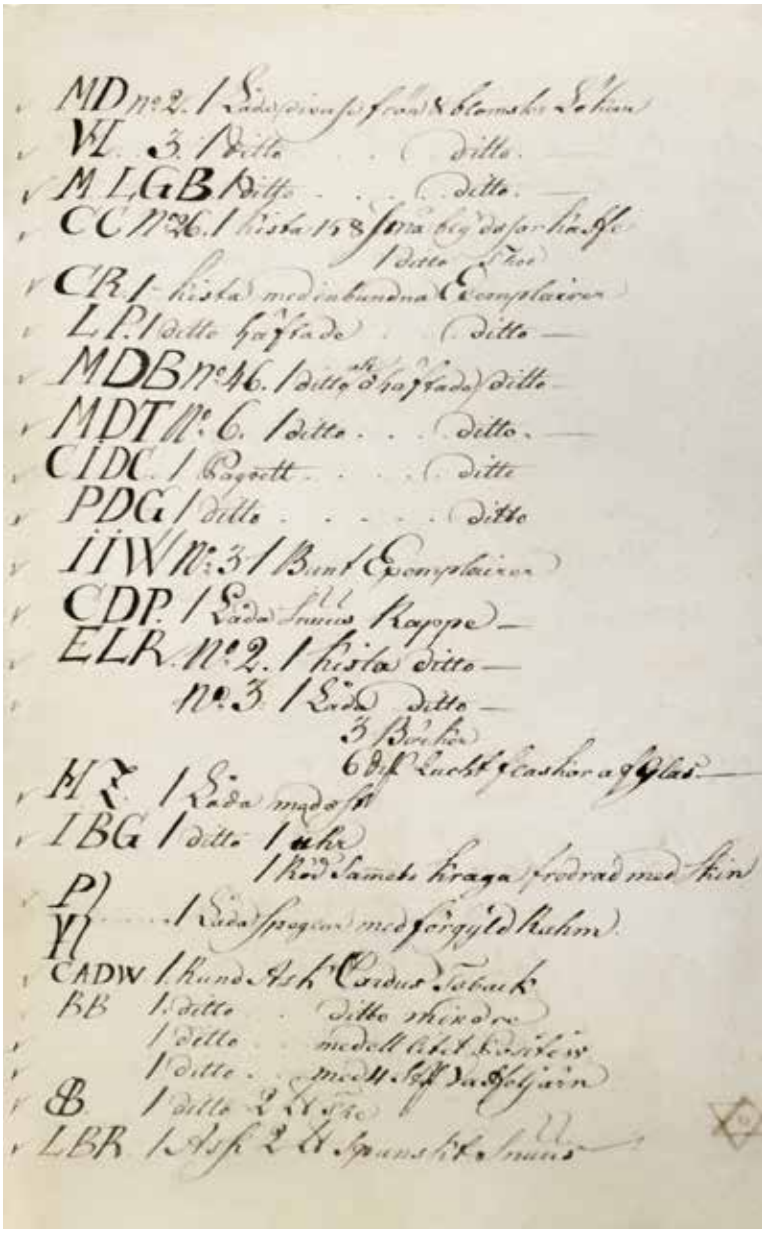
Vrouw Maria seen from the bow. The wreck rests on an even keel 41 metres deep in the Finnish archipelago. Illustration by Tiina Miettinen, Finnish Heritage Agency.

bought in Amsterdam for the Russian Empress Catherine the Great. The paintings explain the very high value declared in the Sound Toll Registers, when on 23 September 1771 shipmaster Lourens and his crew entered the Danish toll station to declare the ship's contents with passage number 508.

According to *Vrouw Maria's* logbook, the ship passed Bornholm on 27 September and sighted Gotland and the parish of Östergarn on 2 October on a calm day. The voyage then continued towards the Gulf of Finland.

RUNNING AGROUND

On the evening of 3 October amidst stormy winds, *Vrouw Maria* hit a rock during evening prayers. The next big wave pushed the ship off the rock. But another wave followed and the ship hit yet another 'blind rock' and started to leak. Although *Vrouw Maria* lost its rudder, the crew still managed to sail the ship to shallower waters. The crew furled the sails and lowered the anchors in an attempt to save the ship. But the pumps were soon clogged by coffee beans



Among the salvaged objects from *Vrouw Maria* were books, fabrics, indigo, silver, paintings, cheese, tea, coffee, snuff, ornamental items and flower bulbs.

from the cargo, rendering them useless. As seawater entered the hold, the water turned sweet from melting sugar.

Over the course of several days, shipmaster Lourens and his crew tried to save the ship and its cargo, spending the nights on a small island nearby out of fear of the ship's sinking to a deeper location during the night. They were soon helped by local men from the Northern Diving and Salvage Company. Some of the cargo and personal belongings of the crew were salvaged, such as several barrels and a chest, ship's equipment and kitchenware. But most of the cargo in the cargo hold was lost.

On the fifth day, when the crew came to continue the salvage, the ship was gone.

The list of what was salvaged indicates six paintings. This painting by Jan ten Compe is the only one that researchers have been able to locate and identify. The painting is in the Amsterdam Museum collections.

UP FOR AUCTION

When the ship had sunk, the shipmaster, crew and salvaged goods were transported to Turku. There the value of the goods was assessed. The ship's equipment, kitchenware and shipmaster's cargo were sold at auction. The salvaged cargo consisted of flower seeds and bulbs, books and prints, cloth, indigo, gold-framed mirrors, silver, paintings, cheese, tea, coffee, snuff and decorative items such as ivory eggs and bird's nest baskets. Various kinds of cloth and dyes are mentioned both in the Sound customs ledgers and in the list of salvaged goods.

Unfortunately, the art collection bought for Empress Catherine the Great was not on the list of salvaged goods. The art had been bought from a collection of the recently deceased Dutch merchant and art collector Gerrit Braamcamp. The collection had been auctioned in Amsterdam in 1771 and consisted of Italian and Dutch art – 313 paintings in total – including lacquer, silver works and furniture.

The representative of Empress Catherine the Great at this auction, Prince Dmitry Alekseyevich Gallitzin (or Golitsyn), served as both the Russian ambassador in Holland and as imperial art agent. This was a dual role that was common in the 17th and 18th centuries. The Braamcamp collection was well known for its high quality, and Gallitzin was therefore given order to purchase art works for Catherine's collection, but he also bought for himself. Some of the paintings Gallitzin bought were salvaged, as opposed to those of Catherine the Great's, which were all lost with *Vrouw Maria*.

From different sources – among them annotated catalogues from the auction – the art

historian Clara Bille has determined that there are eleven or twelve paintings missing from the Braamcamp collection. They are most likely the paintings intended for Catherine the Great and lost with *Vrouw Maria*. Among them were masterpieces by the revered animal painter Paulus Potter and by Gerard (Gerrit) Dou – a student of Rembrandt van Rijn. During the 18th century, Dou was viewed as an even better and more interesting painter than his teacher. Among the paintings by Dou in the catalogues was an allegorical triptych possibly depicting the lifelong training of an artist – this was considered the jewel of the Braamcamp collection and the best and most well-known painting of Dou´s entire production. Willem Joseph Laquy copied this triptych in 1770, and 'Allegory of Art Training' is preserved in the Rijksmuseum´s collection in the Netherlands.

As a consequence of the lost art collection, an intense diplomatic correspondence was initiated between Sweden and Russia as soon as the news of the shipwreck reached the Court of Russia. Count Nikita Ivanovich Panin, the foreign minister of Russia, discussed the preservation status and conservation of the art from the potential wreck discovery with his Swedish counterpart Count Ulric Scheffer, Baron Fridrich Ribbing, the County Governour of Åbo and Björneborg Baron Christopher Rappe as well as with Carl Fithie, the diving commissioner in Turku.

Some serious attempts to find the wreck ensued, as reported by the local salvage company officer. Unfortunately, and to the great disappointment of the Empress, the searches failed. In the correspondence between Catherine the Great and the French philosopher Voltaire, he expressed regret over Catherine's loss of the art. The insurance most likely covered the loss of the cargo and the ship, but the art was irreplaceable.

A part of the salvaged goods was sold in Turku. Other items were transported to Saint Petersburg – an extraordinary move. Usually everything was sold at auction, and the profits shared between the salvage company and the owner.

THE WRECK OF VROUW MARIA

Vrouw Maria was lost and forgotten for more than 200 years, until some documents about the ship were unearthed from the archives by the historian Christian Ahlström in the early 1970s. Since then the wreck has once again sparked much interest. A systematic search of the wreck site began in 1998. In 1999 the wreck was found in a collaboration between Christian Ahlström and a group of volunteers led by the diver Rauno Koivusaari.

The *Vrouw Maria* wreck is almost intact, lying on its keel on the sea bottom at a depth of 41 metres. It is approximately 26 metres long and seven metres wide. The upper deck and the stern part of the hull were damaged in the accident or during the salvage operation, when the ship was still floating. The lower parts of the two masts are still standing, with their tops at a depth of approximately 21 metres.

The hull is very well preserved. The galley is in the bow and cabin in the aft with the cabin's floor one metre below the main deck. A small deck house between the main mast and bilge pumps used to exist, but it is now collapsed on the deck. The total length of the cargo hold is approximately 19 metres. The height from the sea bottom is approximately 3.6 metres in amidships, and from the bow 5.5 metres. All parts of the hull studied to date are made of oak.

EXCAVATIONS AND AFTERMATH

After the initial excitement of the ship's discovery on the first day of the search, and huge media attention, came a series of effects both positive and negative.

The clay pipes in *Vrouw Maria's* cargo were made in Gouda in the Netherlands.

The Finnish Heritage Agency gave permission to lift a few artefacts to verify the date of the wreck, its origin and, if possible, its identity. The investigation revealed that almost the entire cargo hold was covered in clay pipes. The clay pipes were of Dutch origin, but no clay pipes were mentioned in the cargo list. It is possible though that they were part of the unspecified cargo mentioned in the toll registers. The divers also found a zinc ingot, which matched the toll records and attested to the identity of the ship as *Vrouw Maria*. Likewise, the result of a dendrochronological analysis of two samples did the same, showing that the ship was most likely built during the mid-18th century.

The wreck's discovery was a huge boost for maritime archaeology and history, sparking plenty of positive excitement. But the discoverers expressed reservations over the management of the process following the discovery. The ownership of the wreck was questioned by some of the discovery team, and several court cases followed. The debate continued in the newspapers and other media for years, and discussions about possibly raising the wreck still occasionally crop up. Often the attention is focused on the lost art and salvaging it. But it is highly unlikely that any of the artworks have survived, due to leaking seawater that destroys the canvases and dilutes the colours. The value of the ship today does not lie in its treasures, but in the entire wreck site and the remarkable story.

The wreck's discovery sheds light on the unique underwater cultural heritage of the Baltic Sea. Research on the wreck began in 2000 by the Maritime Museum of Finland, which is part of the Finnish Heritage Agency. Various research projects followed, such as the EU project 'Monitoring, Visualizing and Safeguarding North-European Shipwreck Sites' and 'Vrouw Maria Under Water'. Lots of new information has been revealed from the environment and preservation of the site, contents of the cargo and features of this well-built, amazingly preserved ship.

Research results support the written record and the identity of the ship as *Vrouw Maria*, although some of the goods in the cargo are not mentioned in the toll records. Research on the structures of the ship and cargo is not completed, but more thorough research and a possible lifting of the wreck would demand many resources and international cooperation. The wreck was last monitored in 2018, and plans are in progress for making a 3D model. Because the degradation processes are slow and the ship is well protected, in situ preservation has been decided on at the moment.

Leisure diving, fishing and anchoring in the area are prohibited because of the cultural-historical value of the wreck, but also because the wreck is located in a nature reserve at Archipelago National Park. The site is safeguarded by the Border Guard, with a surveillance camera on a nearby island.

VROUW MARIA, OUR COMMON HERITAGE

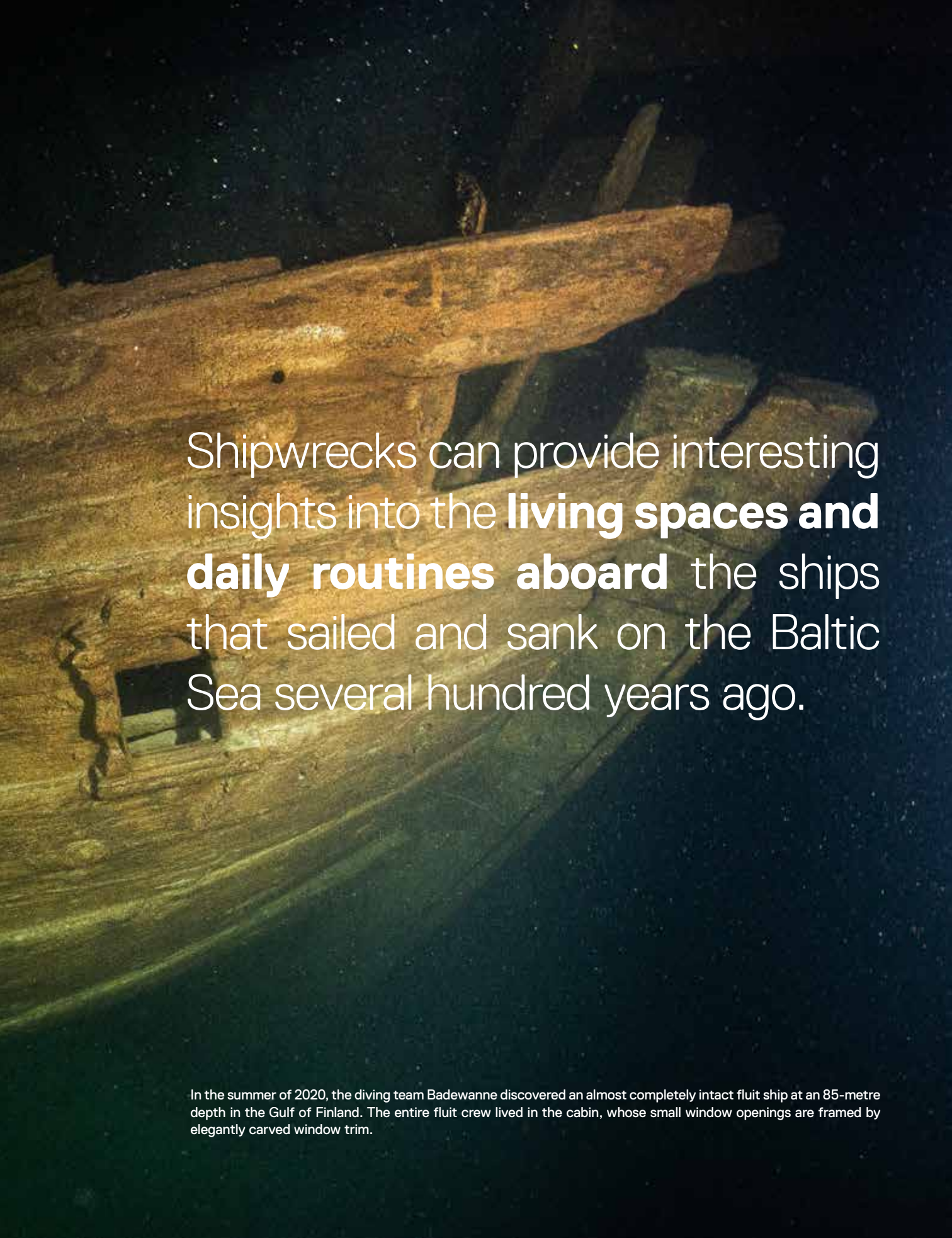
Vrouw Maria is a merchant ship that represents maritime trade, networks and the very global world of its time. It is now part of our common cultural heritage, one which reveals connections across the world through the contents of its cargo. *Vrouw Maria* also exemplifies shipwrecks as a rich resource for archaeological and historical research and memories of our past. The possibilities for research through a wreck like this are extensive. Findings like the wreck of *Vrouw Maria* represent technical skills, provenance, contacts, and networks of people and the distribution of goods, skills and ideas in early modern times.

Today, diving and other activity at *Vrouw Maria* is permitted only for research purposes and monitoring. As mentioned, the wreck is located in the middle of a nature reserve, where all human activity is restricted. So, the new era in *Vrouw Maria's* life is in museums and on the internet. Here, the remarkable story with its familiar historical characters can be presented and the findings shown to all – findings that represent life in the 18th century with colonial goods, new habits and ideas.

Shipmaster Lourens would probably be quite surprised by the fate of his ship. Even though the ship is a wreck now, *Vrouw Maria* is highly appreciated as part of our maritime past and accessible to the public through both the Maritime Museum of Finland in Kotka and Vrak – Museum of Wrecks in Stockholm. Hopefully, we can continue the research and write new chapters in the story of *Vrouw Maria* for a long time to come.

SUNKEN BUILDINGS OF THE BALTIC SEA

NIKLAS ERIKSSON · SURFACING CONTACTS



Shipwrecks can provide interesting insights into the **living spaces and daily routines aboard** the ships that sailed and sank on the Baltic Sea several hundred years ago.

In the summer of 2020, the diving team Badewanne discovered an almost completely intact fluit ship at an 85-metre depth in the Gulf of Finland. The entire fluit crew lived in the cabin, whose small window openings are framed by elegantly carved window trim.

SUNKEN BUILDINGS OF THE BALTIC SEA

The well-preserved shipwrecks in the Baltic Sea often come from the medieval period or more recent times. Extensive written records exist for these periods that have been examined by researchers from a wide range of scientific disciplines. From an archaeological point of view it might be relevant to ask, what questions can only be studied from shipwrecks?

One way to approach this question is to consider wrecks as historic buildings. Most people who have entered an old house, from the poorest fisherman's hut to the most extravagant palace, have probably experienced how their visit gives them a sense of the life of the people who once lived there, perhaps hundreds of years ago. This kind of experience can shape a different understanding of the past than one gleaned from reading documents, for example.

Buildings provide physical possibilities while simultaneously setting limitations on human action. Everyday routines, activities and rituals associated with everything from eating and sleeping to working or hygiene are given their physical setting and are directed to some extent by the building itself. How rooms are connected through openings, doors and passages, which spaces are shared and which are separate or private, shape the prerequisites for certain behaviours and, by extension, social relations among those who occupy them.

Everything needed to sustain human life on board a ship or other vessel, from the most basic facilities for daily routines like cooking, meals and shelter to social relationships and hierarchies, must be accommodated within the well-demarcated, clearly defined shells of the hull. Well-preserved shipwrecks thus offer excellent opportunities to study and get an intimate look at everyday life on board, an aspect of the past that has seldom made any impression in other source materials.

A window that allowed light into the cabin of the so-called Jutholmen wreck. Clay pipes, bottles and a total of seven spoons were found inside the cabin. Perhaps each person had their own personal spoon on board?

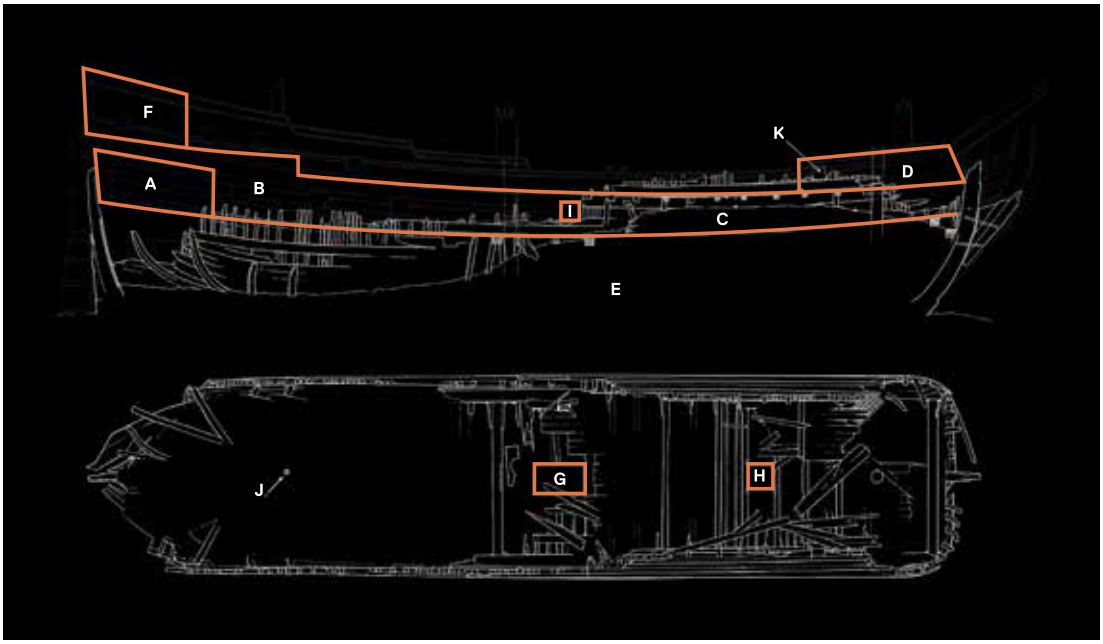
INSIDE THE FLOATING CITY BLOCK

Although warships usually receive most of the attention in maritime archaeology, the vast majority of all wrecks are merchant vessels. A substantial number of them represent a type of ship called fluits. According to a chronicle from the town of Hoorn in the province of North Holland, the first fluit was built there in 1595. In the century that followed, they would become northern Europe's most common merchant vessel. They were simple and cheap to build and could be sailed with a relatively small crew, often fewer than ten people. In the 17th century, the Netherlands dominated trade on the Baltic Sea. Between 1627 and 1631, for example, 65 percent of Swedish exports through Øresund Sound travelled on Dutch keels.

Like most other contemporary ships, fluits were built without the aid of construction drawings. Despite the fact that thousands of more or less identical fluits were in continuous transit between the Baltic Sea, Amsterdam and Europe's colonies, detailed accounts of what they actually looked like are remarkably few. There was simply no need to describe them, and they seem to have been so commonplace as to elude any particular notice.

Because fluits were used in global trade, wrecks of these ships can be found all over the world. However, only those sunk in the Baltic Sea have entire hulls that have been preserved into our times. Virtually intact specimens rest on the seafloor off the coast of Estonia, in the Gulf of Finland, in the Stockholm archipelago, in Kalmar Strait and in many other places. Taken together, they offer a fascinating porthole into the everyday life on board the most common merchant ships in early modern Europe.

Surveys of wrecked fluits reveal that the spatial arrangements follow a clear pattern, with



Sectional drawing and plan of the unusually large fluit *Anna Maria's* hull. A fire caused the ship to sink in 1709. The burnt section is indicated in a contemporary drawing. The letters indicate the following: A: cabin, B: galley, C: lower deck, still loaded with pinewood planks, D: beakhead, E: the hold loaded with iron goods, F: poop, G: hatch for the hold, H: hatch, I: cargo port, J: bilge pump, K: porthole.

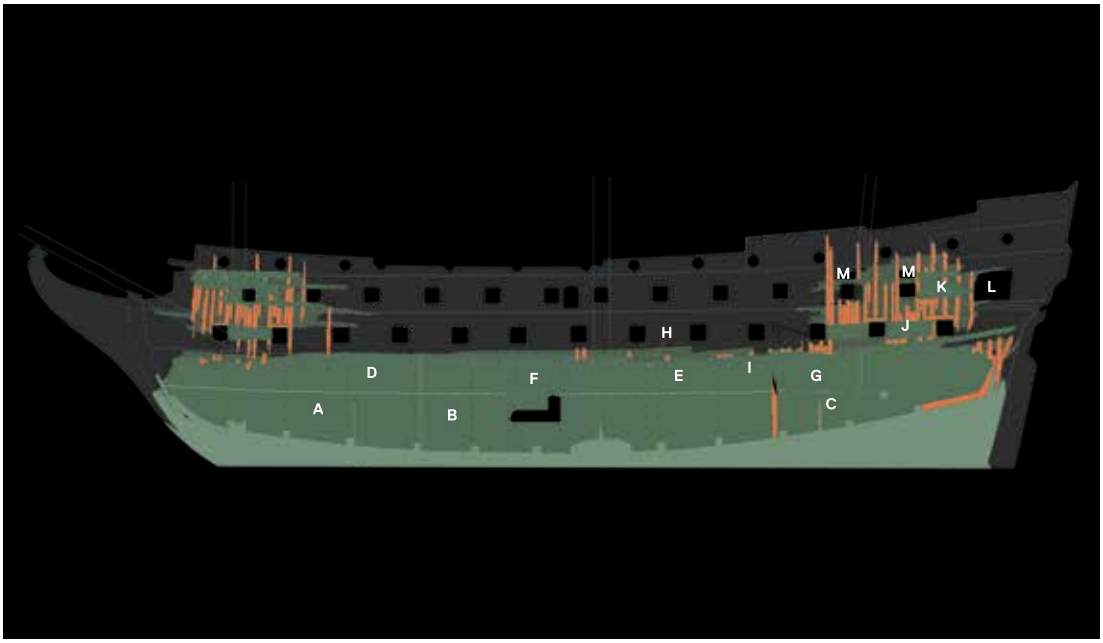
demarcated spaces for cargo, stowage and lodging. This last category is perhaps the most interesting because the layout provides an insight into the social relationships on board. The relatively small crews of between seven and fourteen people were lodged in the stern under the so-called quarter deck. The space was divided by a transverse bulkhead that separated the galley – the ship's kitchen – from the cabin far aft. The hearth was made from bricks and was the sole source of heat on board.

To get into the cabin, you had to pass by the hearth. The cabin was fitted with small windows, but there was hardly any light or airy space. The ceiling height ranged from 1.5 to 1.8 metres depending on the size of the fluit. The cabin functioned as the primary living and sleeping spaces, and it was there that the crew stowed their personal belongings. Most of the fluits had only one privy, which was thus used by everyone on board. This also appears in the cabin, along the port side below one of the windows.

Surely most people have noticed that mealtime routines shape social relationships, both in the workplace and in their private lives. Eating together can build a sense of community. Conversely, separated areas for eating can be used to mark differences. Preserved furniture suggests that the crew aboard the fluits gathered for communal meals around the same table inside the low, confined cabin space.

It is clear that the fluits' spatial arrangements hardly allowed for any individuality, or that everyone on board was separated into different categories. They worked as well as ate and slept close to each other. This contrasts somewhat with a popular romanticised notion of life on board sailing ships, with a strict hierarchy and rigid discipline. The spatial arrangements on board the fluits instead express a sense of community.

While a crossing from Amsterdam to one of the harbours around the Baltic Sea took a few



Reconstruction of rooms aboard the regal ship *Riksäpplet*, which sank in 1676. A: storage department, B: hold, C: powder magazine, D: room for the anchor cable, and lodging for lower ratings, E: firewood storage, lodging for lower ranks, F: galley, the cook's quarters in the vicinity, G: lodging for the lower commands and the 'cockpit' where those wounded during action were taken, H: pump dale, I: bilge pump, J: gunner store where some non-commissioned officers lived, Q: main cabin, R: opening towards the quarter galleries, S: window openings.

weeks, the stay at the destination could be much longer. While awaiting cargo, bureaucratic procedures or suitable sailing weather, a moored fluit could be laid up for weeks or months on end. Those who arrived at Baltic Sea harbours in late autumn could be forced to overwinter. During these periods, the fluits served as the environment where crews lived and passed the days away.

The fluits constantly moved back and forth between the world's trading metropolises, and their exteriors adorned with sculptures and other decorative elements were designed to blend into the urban context. The characteristic appearance of the fluits thus helped to reshape the environment in which they were moored. In cities from the 17th and 18th centuries, moored fluits formed floating city blocks.

INSIDE THE WAR MACHINE

While fluits sailed with few people on board, the situation was quite the opposite aboard warships. Loading and firing a single muzzle-loading gun could require up to eight people – the equivalent of an entire crew on a fluit. A major part of a fully functioning sailing warship consisted of humans; several hundred were required to fire devastating salvos at the enemy.

For this overcrowded war machine to work, each person had to remain in their assigned role in relation to ranks and duties. In general, the spaces that were aft and higher up aboard a warship were more exclusive than those found in the foremost part. The people on board were defined based on where they were lodged on the ship, as is evident from written sources. 'Common seamen' refers to the vast majority of seamen and soldiers who lived among

The Swedish fleet's small vessel *Bodekull* measures just 19 metres from bow to stern, but its interior is still arranged as to maintain hierarchies and chain of command.

the guns, while those who were lodged in and gathered in the more comfortable and lavish areas in the ship's stern were referred to as *kajutfolk* in Swedish, meaning 'cabin people'. The latter included officers, their families and prominent guests.

Sunken warships can provide interesting insights into how this concentrated and densely populated environment was organised, from the decorated, bright and airy cabins in the ship's stern to the dark, cramped, damp and confined quarters below deck, occupied by the majority of people aboard. The space on these ships was divided for the purpose of separating people into different movement patterns which were not allowed to overlap. Privies for the common seamen were located in the beak-head and the corresponding facilities for cabin people in the quarter galleries, a kind of enclosed balcony fitted with windows that was accessible from the cabin.

It is perhaps not so surprising to discern a division between officers and 'commons' aboard a Swedish warship like *Riksäpplet*, where about 450 people boarded for the last naval campaign. But the fact that even smaller warships exhibit the same consistency in separating the high from the low is almost even more interesting. An illustrative example is the Swedish navy's ship *Bodekull*, which was launched in 1661 and wrecked in 1678. The ship is richly decorated with sculptures and relatively heavily armed, although it measures no more than 19 metres from bow to stern. Although *Bodekull* is considerably smaller than most contemporary fluits of the period, the division between common seamen and the officers lodged in the cabin is clear.

One way to maintain roles at mealtimes is to clearly separate the activity of cooking from the dining table. The act of serving thus becomes even more conspicuous. Studies of wrecks

of Swedish warships, such as *Mars*, *Vasa* or *Riksäpplet*, reveal that they had heat-generating, glowing-hot hearths capable of delivering food to hundreds of men placed down in the hold, fore of the mainmast, where the seamen congregated. On board *Bodekull*, where the space below deck was too small and, besides that, frequently used for the navy's flour transport, the hearth is instead located in the bow, a comfortable distance away from the cabin.

At first glance, it can sometimes seem as if maritime archaeology gets lost in technical discussions about diving, documentation methods or accounts of expeditions. But it offers much more beyond these discussions. The purpose of fieldwork is to form the basis for analyses and interpretations. Shipwrecks can provide interesting insights into the living spaces and daily routines aboard the ships that sailed and sank on the Baltic Sea several hundred years ago. They allow us to confront communities and human conditions which, in some cases, resemble the times we live in today but which, just as often, seem quite different. It is in this moment that archaeology truly begins.

WITH STEAM AND GRAIN

MIKAEL FREDHOLM · SURFACING CONTACTS

Vulcan was on its way from Kronstadt to Bremen carrying 500 tonnes of rye in its cargo when, on 28 May 1873, it **stranded, capsized and sank southeast of Fårö.**

Vulcan s engine is visible in the foreground, and its boiler in the background.

WITH STEAM AND GRAIN

At the end of the 19th century, the three steamships *Castlewood, Vulcan* and *Princess* sank off the east coast of Gotland along with cargos mostly of grain. Their wrecks were examined by maritime archaeologists at Vrak – Museum of Wrecks in 2018 and 2019. Dives were carried out to investigate the archaeological evidence remaining from the wrecks and the historical information they left behind. All three ships were built in the second half of the 19th century. Unfortunately, *Castlewood* and *Vulcan* sank after only one year in service. *Princess* operated for 19 years before meeting the same fate as the others.

The wrecks of *Princess*, *Castlewood* and *Vulcan* illustrate how falling freight costs from the 1870s onwards drove an increase in the export of grain by steamship via the Baltic Sea. They are also quintessential examples of the age of industrialisation and the evolution of ship technology after 1850, when steam-powered vessels made in new materials like iron and steel slowly came to displace wooden sailing ships. The age of industrialisation has greatly shaped today's society, and its remnants can offer vital clues for understanding our own times.

STEAMSHIP TRANSPORT

In the 19th century, traditional sailing ships began to face competition from new steam-powered ships, which evolved over the century to become more reliable, faster, bigger, stronger and more economical in operation. This development of steam navigation led to a steady decline in sailing ships' share of transport, and eventually to their demise.

During the 18th century, experiments using steam-powered boats started to take off. One of the earliest boats that proved somewhat successful at being practical and useable was the French *Pyroscaphe* from 1783. Britain and the United States had also seen progress, and

The stern of the steamship *Castlewood* seen from the starboard side.

steam-powered passenger ships were put into service during the first decade of the 19th century.

The history of the Swedish steamboat is considered to have begun with the *Witch of Stockholm*, also called the *Waterwitch*, completed in 1816. However, early steam engines consumed large amounts of fuel and the ships were usually equipped with paddle wheels, which was not ideal for the open seas or bad weather. The first steamships operating in northern Europe in the early 19th century were expensive to operate and had limited cargo capacity.

Due to the shortcomings of steamships, sailing ships were still able to compete successfully with steamships during the first half of the 19th century. In the 1860s, the number of sailing ships around the world peaked.

A major step was taken towards steamship domination on the world's oceans in 1869 with the opening of the Suez Canal in Egypt, shortening the route from Europe to India. In the 1870s, when more advanced steamships could be built at a lower cost, they increasingly took over more of the goods transport from the sailing ships. In the second half of the 19th century, iron-hulled ships began to gain in prominence and later gave way to steel hulls, resulting in more durable vessels that could maintain higher speeds.

Several inventions were crucial for the ability of steamships to replace sailing ships. In addition to the modern propeller, another significant innovation was the so-called compound steam engine in steel, which the wrecked steamships off Gotland were equipped with. In this type of engine, steam expanded in two or more chambers and the engine was strong enough to hold hot steam at high pressure. These engines were more fuel-efficient and reliable, and so could manage greater loads and longer hauls at sea.

Princess's cargo contained large quantities of wooden logs. They are possibly pit props for mines.

Painting of *Vulcan* from 1873, the year of the shipwreck.

GRAIN TRANSPORT ACROSS THE BALTIC SEA

Since the Middle Ages, grains and cereals have been shipped from the Baltic Sea region to Western Europe. In the 15th century, for example, Dutch skippers began to visit ports in the eastern Baltic Sea more regularly to transport grain primarily to the Netherlands. The increased need for imported grain to make bread is considered by many historians as the driving force behind the increase in Dutch trade in the Baltic Sea. The merchants around the Baltic Sea bought salt, herring and cheap clothing from the Dutch, among other goods.

In 1636, the value of grain imports to the Netherlands amounted to one-third of the total import value. Grain was an important commodity in the 18th century, too. One 18th-century wreck, the so-called Koster wreck in the Stockholm archipelago, serves as an example. Analyses of the grain samples taken from the wreck show that 64 percent of the samples consisted of barley and 30 percent of wheat.

In the 19th century, England became the largest importer of wheat from the Baltic Sea region. At the end of the century, rye became more common in shipping since the cheaper cereal grains could be exported at a profit when freight costs fell. By the First World War, rye, oats and barley had passed the more expensive wheat in quantity. The three steamships examined off Gotland typically carried the cheaper grains, rye and oats.

In the first half of the 19th century, steamships already contributed to falling freight costs on shorter routes to some extent, such as the Baltic Sea–England route. From the 1870s onwards, freight costs were generally driven down to a greater extent; abolished restrictions led to increased commerce while new and improved steamship structures made transport faster and cheaper. As industrialisation began to boom, freight shipping increased in scope especially with regard to grain transport.

THE THREE WRECKS

The three steamships that are now wrecks near Gotland had all departed from Kronstadt outside Saint Petersburg in Russia when they sank on the east coast of Gotland between 1873 and 1888. The oldest ship, *Princess*, was built in 1869 in Hull, England. In 1872, *Vulcan* was launched in Bremen, Germany, and the youngest and largest, *Castlewood*, took to the waters in 1878 in Newcastle, England. Although none of the hulls of the three wrecks are intact, they can nevertheless offer fantastic diving experiences and provide us with archaeological information.

PRINCESS

The steamship *Princess* was a so-called well-decker and had four watertight bulkheads. It had a combined deck with a bridge and a poop deck in the stern with a forecastle in the bow. 'Well' refers to the well where the large cargo hatch was located. The total length of the vessel was 75 metres.

Princess was on its way to London with a cargo of oats when it ran aground at Östergarnsholm off Gotland on 23 July 1888. On 28 July 1888, a story about the maritime declaration related to the sinking appeared in the newspaper *Gotlands Allehanda*. It says that a salvage steamer was sent for but had not yet arrived on the morning of 24 July. At noon came the salvage steamer Hermes, which attempted to get the ship afloat again. When *Princess* began to leak, the rescue attempt was abandoned, but the cargo was transferred to the salvage steamer. The captain and his crew left the ship during the day. On the morning of 25 July, *Princess* broke in two at midships. The bow remained on the rock, while the stern sank down to a depth of 13 fathoms.

On its last voyage, *Castlewood* was en route from Kronstadt to Rotterdam. The photo shows the large steam engine from aft.

The Merchant Shipping Acts, which contain descriptions of maritime events, show that the court of justice in Hull concluded that the cause of the sinking was a poor course from Hiiumaa in Estonia, and that necessary and swift action was not taken when land was unexpectedly sighted. The cargo was said to have consisted of 1,200 tonnes of rye and some timber on deck.

In addition to the written records detailing the cargo's contents of timber and oats, which was partly salvaged, the examination of the wreck revealed that the consignment contained pieces of lumber. These might be so-called pit props, a common commodity exported to England for use in its mining pits. The dive survey also revealed coal of various sizes in the forepart of the wreck, along with what appeared to be bales of hemp or other fibrous material.

VULCAN

The *Vulcan* cargo steamer was launched in Bremen, Germany, in 1872. The ship, like *Castlewood* and *Princess*, was fitted with a two-cylinder compound steam engine. *Vulcan* was on its way from Kronstadt to Bremen carrying 500 tonnes of rye in its cargo when, on 28 May 1873, it stranded, capsized and sank southeast of Fårö. The entire crew of 18 men were saved. On 23 June, a wreckage auction was held in Fårösund for two ship's boats, sails, blocks and cordage.

No drawings or photographs of *Vulcan* have ever been found. However, a painting of *Vulcan* exists along with a photograph of a sister ship, *Diana*, which was built the year after *Vulcan* at the same shipyard. The painting and photograph give an indication of what *Vulcan* might have looked like.

The preserved length of the *Vulcan* shipwreck is approximately 40 metres of the original ship's length of 45 metres, with parts of the prow, stern including rudder and the entire boiler with preserved engine. Large parts of the hull, however, are broken in pieces and sections of it lie flat on the seafloor.

CASTLEWOOD

The steamer *Castlewood*, launched in 1878, had a decidedly short career. Its maiden voyage entailed bringing coal from Tyne in Newcastle, England, to New York, USA. The plan was also for the ship to take a route via the Mediterranean, the Black Sea and to India via the Suez Canal, but it sank soon thereafter in November 1879.

On its last voyage, *Castlewood* was carrying 22,000 barrels of rye and 4,000 barrels of flaxseed en route from Kronstadt to Rotterdam in the Netherlands. On 15 November 1879, a snowstorm was in full force when the ship ran aground on Laus Holmar (Lau islets) off Gotland and began to take in water. The ship slipped off the rock, drifted southwards, and sank. The entire crew were able to rescue themselves in the lifeboats. On 15 December 1879, an auction was held in Ronehamn for two lifeboats from the wreck.

Today *Castlewood* is preserved on the seafloor in its full length of about 85 metres, with the ship's large engine in the middle of its remains, as well as relatively well-preserved fore and aft sections. Parts of the frame with hull plating rise a few metres above the bottom. The upper parts of the frame are cracked, and together with decks and hull sides have either fallen into the wreckage or out onto the bottom.

WRECKS AS A SOURCE OF KNOWLEDGE AND EXPERIENCES

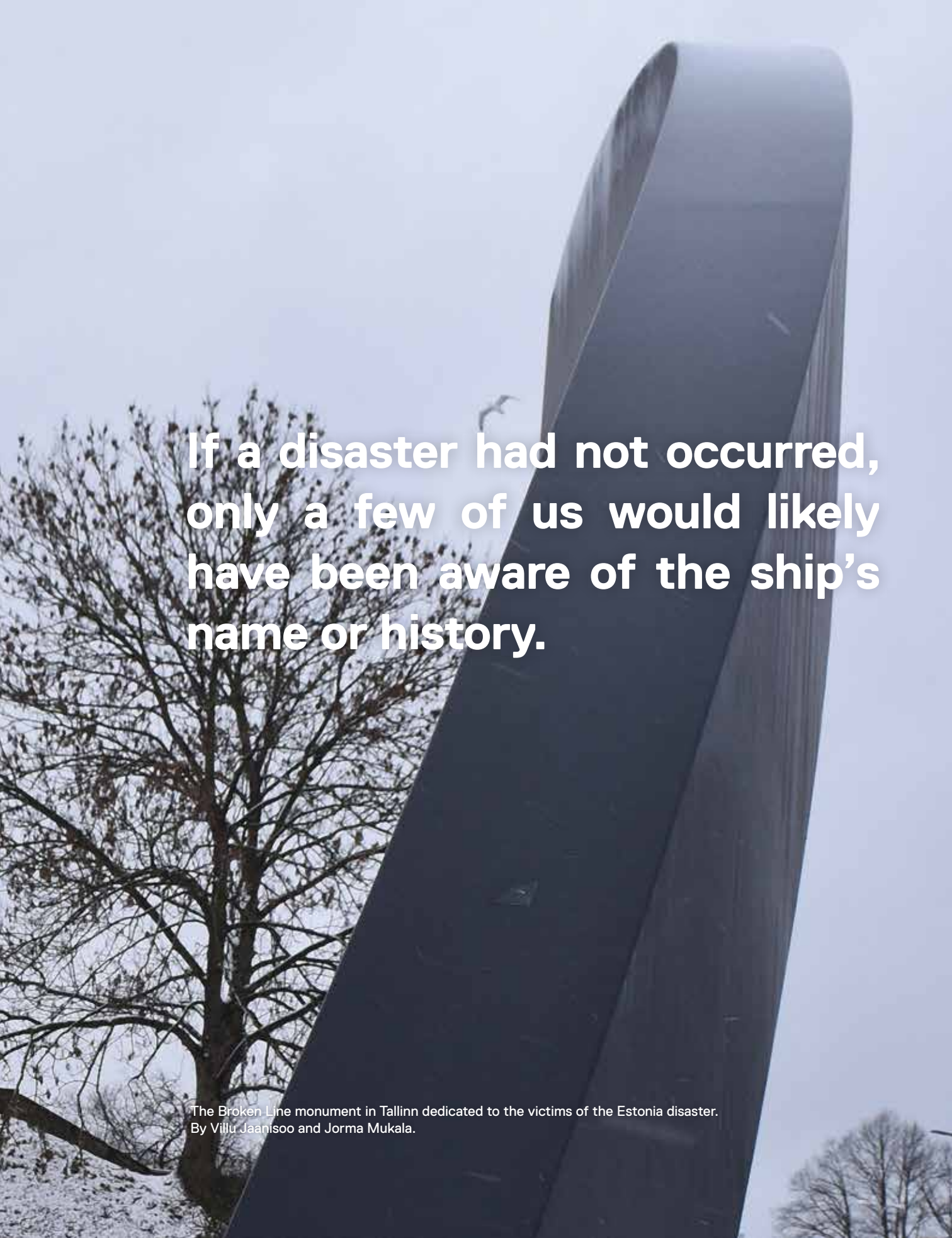
Visiting the wrecks off Gotland is an amazing diving experience for archaeologists and recreational divers alike. This is especially true of *Castlewood*, the biggest and best preserved of the three wrecks, whose large steam engine and two boilers make an impressive sight. Visiting a historical artefact, whether under water or on land, can also inspire reflection and provide a perspective on history. Perhaps it can be likened to a museum visit.

The three shipwrecks are also interesting to archaeologists because the material remains can complement the picture historical sources give us of the ship's construction and cargo. Although Baltic Sea archaeologists are spoiled thanks to the many completely intact sunken ships, there are advantages to these less intact shipwrecks: they are more open and accessible for studying things like steam engines, internal hull construction and cargo spaces.

Since photographs and drawings of the vessels are often missing, archaeological studies can complete the picture of what they looked like. Particularly in the case of *Vulcan* and *Castlewood*, which both sank after just one year and are not included in Lloyd's Register of Shipping, archaeological surveys can broaden our knowledge of the ships, their cargo and their construction.

M/S ESTONIA

HANS-LENNART OHLSSON · SURFACING CONTACTS



If a disaster had not occurred, only a few of us would likely have been aware of the ship's name or history.

The Broken Line monument in Tallinn dedicated to the victims of the Estonia disaster. By Villu Jaanisoo and Jorma Mukala.

M/S ESTONIA

When M/S *Estonia* left Tallinn on 27 September 1994 at 19.15 Estonian time, nothing was out of the ordinary. It was the evening departure of a class of ship that was quite common in the late 20th century. In the industry, this ship class is often called a ro-ro passenger ship. 'Ro-ro', or roll-on roll-off, refers to the trucks, trailers, cars and wheeled cargo that drive on and off a ship by themselves. Ro-ro ships can be cargo-only carriers or, in this case, a combination carrier of cargo and passengers.

Estonia's departure was just one of the many departures that year of trucks, passenger cars, vans and buses parked on car decks with crew members and passengers on adjoining decks. If a disaster had not occurred, only a few of us would likely have been aware of this ship's name or history.

BALTIC SEA SHIPPING

Trade on the Baltic Sea has probably existed for as long as its bordering countries have been populated. Despite the different dangers out at sea, crossings by sea were the easiest and fastest option. Much larger quantities of cargo could be transported by boat than by road, something that holds true to this day.

The kingdom of Sweden, with possessions on all shores of the Baltic Sea, has historically had a great need for efficient shipping. Goods, troops and passengers have always moved between the countries. For Sweden's part, there was also a need for safe and regular transport of all the messages and directives to be sent from Stockholm to distant governors and commanders – partly in the Baltic states, but especially in Finland, which constituted the eastern half of Sweden at the time – all to keep the state apparatus intact and the kingdom secure.

The more general use of the postal service in later years also prompted a desire for more regular deliveries, more or less year round, across the sea. Even though new nations have been formed, borders have shifted, and freedom has come and gone, the need for transport across the Baltic Sea has only grown. Some slowdowns naturally took place during wartime

M/S *Estonia* in the Stockholm archipelago in September 1994. In 1993, the ship was chartered by Estline AB and went into service under the Estonian flag.

while other transport needs intensified, not least the need to provide supplies and materials to the warring armies.

In 1870, the Swedish postal service acquired the steamship *Postiljon* for mail deliveries between Sweden and Finland. At the time, Finland was no longer Swedish but a governorate belonging to Russia. But the need for a postal service between Grisslehamn in Sweden and Eckerö on Åland remained. The mail used to be transported in rowboats and sail boats, and when the ice lay the postal carriers had to cross the ice. This was also true when the ice was too thick and the steamship could not get through.

PASSENGER TRAFFIC

Passenger traffic between Sweden and Finland started at the end of the 19th century when Finska Ångfartygs AB (the Finland Steamship Company) deployed the passenger steamship S/S *Express* on the Hanko–Stockholm line. The ship was not long-lived on that route. But in 1898 S/S *Bore* departed from Turku to Stockholm, which can probably be said to be the beginnings of passenger traffic to Finland that takes place to this day – largely on the same route. The service route was a simple one, with departures from Turku on Saturday evening and return trips from Stockholm on Wednesday evening. But just a few years later, the passenger volume was so great that the shipping company bought another ship, S/S *Bore II*.

Ships also operated out of Tallinn, Pärnu and Riga to and from Sweden. A forerunner of the M/S *Estonia* was the passenger steamship S/S *Estonia*, which was purchased from

Before 1993, when M/S *Estonia* was chartered by Estline, the ship had several owners and names – *Viking Sally, Silja Star* and *Wasa King.* The ship was commissioned in 1979 by Rederi AB Sally for service between Finland and Sweden and was built at Meyer Werft in Papenburg, Germany.

Norway and put into service in 1937. That route suffered major disruptions during World War II, unsurprisingly, and during the years when Estonia and the other Baltic countries were occupied. But traffic between Sweden and Finland was constantly growing, as were the ships themselves, which seemed to grow in size and capacity for every new build. In 1960, approximately 500,000 passengers travelled between Sweden and Finland/Åland. That figure grew to 2.8 million by 1975, and by 1994 had jumped to 6 million.

Ro-ro passenger ships were already being commissioned in the late 1950s on the route between Sweden and Åland. This ship class proved to be very successful on this route. M/S *Skandia* was delivered to the shipping company Silja Line in 1961, followed by a sister ship, M/S *Nordia*, the next year. They were quite modern for their times. For example, they were equipped with a nursery, sauna and a cinema – all to give the 1,000 passengers an enhanced experience on board. The traffic became incredibly extensive, with the ships providing an almost daily year-round service.

M/S ESTONIA

In 1989, while Estonia was still part of the Soviet Union, an agreement was signed between the Swedish shipping company Nordström & Thulin and Estonia's transport committee on traffic between Tallinn and Stockholm. Regular service started in June 1990 and continued after 1991, when Estonia gained independence. The first ship was M/S *Nord Estonia*, a ship built in Denmark in 1971 with capacity for 1,065 passengers and 300 cars. The ship was marketed abroad to the shipping company Estline. *Nord Estonia* provided service until February 1993, when it was replaced by M/S *Estonia*.

The shipping line Rederi AB Sally, formed back in 1937, ordered M/S *Viking Sally* in 1979 for service between Finland and Sweden – a modern ro-ro passenger ship with all the amenities that passengers could wish for. The ship was built at the Meyer Werft shipyard in Papenburg, Germany. Like most similar ships of its day, it was equipped with a bow visor, a loading ramp and two loading ramps in the stern. The design had proved to be ideal for these ro-ro vessels. As with railroad car ferries, lorries and passenger cars could drive on board at one end of the ship and drive off at the other without having to be turned around. In addition, it had suspended car decks that could be lowered and used in the summer, when truck traffic was

The photo shows a rescue swimmer heading down from a helicopter towards a life raft. The accident made it quite clear that helicopters are the most effective tool for rescuing people from the water or life rafts.

not as extensive but more holidaymakers travelled between the countries.

When Rederi AB Sally owned the ship, the company's logo and the letters 'A J' were welded onto the prow in reference to Algot Johansson, the company's founder and owner. Despite ownership changes, repainting and the disaster, the logo is still visible on the bow visor. *Viking Sally* was launched on 26 April 1980 and went on its maiden voyage in June of the same year on the Stockholm–Mariehamn–Turku route. The ship operated on this route for ten years until it was chartered out in 1990 and renamed *Silja Star*. There was another change of owner later that year, and the ship, now renamed *Wasa King*, was put into service between Vasa in Finland and Umeå/Sundsvall in Sweden.

In 1993 the ship was sold to Nordström & Thulin AB and Estonian Shipping Company, which in turn chartered it out to Estline AB. The ship was now put into service under the Estonian flag. Until its sale in 1993, the vessel had sailed under the Finnish flag and under the supervision of the Finnish authorities. On 1 February, *Estonia* made its first trip between Tallinn and Stockholm.

Most people associate *Estonia* more with passenger traffic than with freight traffic. Naturally, this is the result of extensive and successful marketing that promotes good food, duty-free shopping, partying or relaxation, and experiences both on board and ashore. The shipping companies have little need to market to a wider audience that they also ship automobile spare parts, clothes, animal feed and anything else that can be hidden in trucks and trailers on the lower decks. They are simply marketed as passenger ferries, and most of our own contact with them has been in the capacity of passenger. However, the scope of this type of passenger traffic on the Baltic as well as other seas is a relatively recent phenomenon.

MAYDAY

On 27 September 1994, *Estonia* departed Tallinn bound for Stockholm. There were between 1,000 and 1,070 passengers on board. Around 01.00 on 28 September, there were indications that water had seeped into the car deck. The ship then quickly took on a 15-degree list. The Mayday distress call, which is recorded, was sent at around 01.22. By then, the main engines and diesel generators had stopped. Just less than 10 minutes after the Mayday call, the ship had apparently developed an 80-degree list. At that point, the emergency generators had

also stopped and battery lights remained the only available option.

At 01.29, the last radio contact with *Estonia* took place when the bridge officers sent the estimated position to Silja Line's M/S *Silja Europa*, which had been communicating with *Estonia*. Both Viking Line's M/S *Mariella* and *Silja Europa* then set a course for the scene of the accident. The search and rescue centre in Turku had also picked up the radio traffic and made contact with additional vessels that were moving towards the given position. The radio traffic was picked up by several coastal radio stations, including in Sweden, which started putting hospitals and helicopters on standby.

At about 01.48, *Estonia* disappeared from the radar screens of nearby ships and was assumed to have sunk completely. The first ship to appear on the scene was *Mariella*, which could communicate over radio only that the ship was not visible, sighting a great many lights from life jackets and life rafts in the water. At half past two, *Silja Europa* also arrived on the scene.

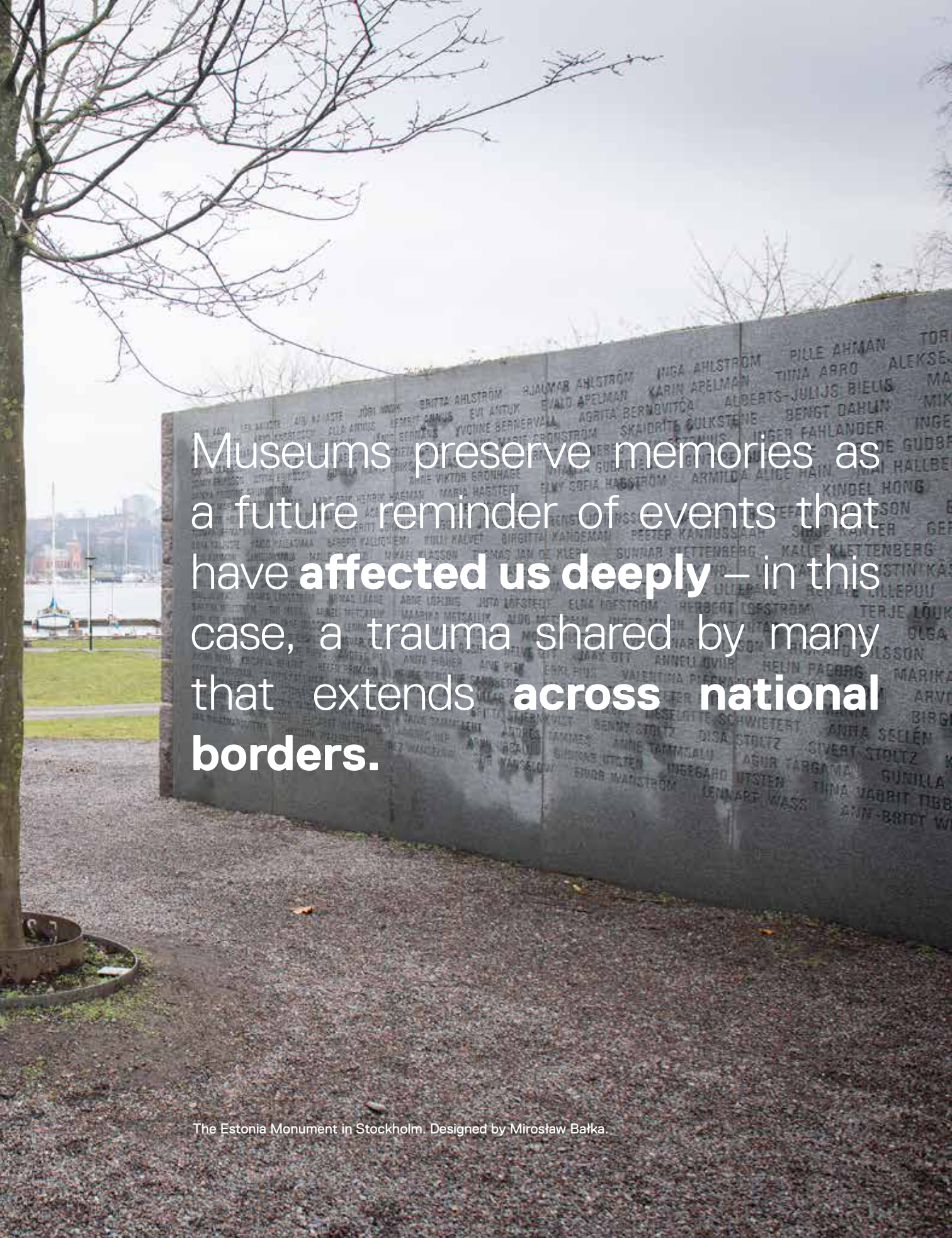
Shortly after 03.00, a helicopter from the Finnish maritime rescue services (designated OH-HVG) arrived on the scene of the accident and successfully rescued 37 survivors during the night. Just before four o'clock, the first Swedish helicopter (Q 97) arrived on the scene and managed to rescue 15 people. The last survivors were found around 09.00, and the helicopters were instructed afterwards to also attempt to recover the bodies of the dead from the sea.

Twenty-six helicopters from Finland, Denmark, Estonia and Sweden took part in the effort, and an array of vessels arrived on the scene in the morning hours and later into the day. The accident made it quite clear that helicopters are the most effective tool for rescuing people from the water or life rafts. Out of a total 137 people rescued, 104 were picked up by helicopter. Although the exact number of passengers on board could not be established at the time of the disaster, official statistics indicate that a total of 852 people died including passengers, crew members, entertainers and trainees.

The accident left lasting traces on passenger traffic across the Baltic Sea, but also on other routes. A sharp drop in passenger traffic was one obvious after-effect of the accident. The term 'bow visor' became more widely recognised, of course, bringing with it an extremely negative connotation. Several shipping companies had their bow visors welded shut, and passenger ships without bow visors noticed an uptick in popularity. Safety activities, ship inspections and rescue resources have been put under the microscope, and like other maritime disasters the Estonia accident has hopefully taught maritime transport operators some lessons. These lessons help make transport by sea safer for everyone and, when accidents do happen, can provide us with more swift and efficient rescue operations.

MEMORIES OF A DISASTER

SUSANNA ALLESSON NYBERG · SURFACING CONTACTS



The Estonia Monument in Stockholm. Designed by Mirosław Bałka.

MEMORIES OF A DISASTER

On 27 September 1994, M/S *Estonia* set off from the port of Tallinn in Estonia bound for Stockholm. Encountering stormy weather, the ship sank in open waters between Finnish Utö and Estonian Hiiumaa. Sweden and Estonia in particular were devastated by the accident – the Baltic Sea's worst peacetime disaster. This tragic event has come to be known as the Estonia disaster.

MUSEUMS AND MEMORIES

Museums collect and preserve memories of various events in the form of stories and material objects. These events, as with the Estonia disaster, can weigh heavily upon us. For the survivors and those who lost a loved one, their own memories will endure for a long time to come. Museums preserve collective memories as a future reminder of a historic disaster that has affected us deeply – in this case, a trauma shared by many that extends across national borders.

Objects from M/S *Estonia* can be found at the Estonian Maritime Museum in Tallinn and the Maritime Museum of Finland in Kotka. This chapter is about the collection at the Swedish National Maritime Museum in Stockholm, Sweden, where the author works as a collections curator.

THE MEMORY OF ESTONIA

Three months after the Estonia disaster, the Maritime Museum in Stockholm hired two ethnologists, Åsa Bringlöv and Marianne Ericsson, to collect stories and objects from the disaster. They conducted more than 20 interviews, among them interviews with eight survivors and seven people who took part in the rescue efforts. In the documentation project, four personal histories of the deceased were recorded by some of the close relatives. The

interviewees recounted their experiences or talked about a loved one they lost shortly after midnight on 28 September 1994. The interviews are available in the archives of the Maritime Museum.

The museum collections also contain several objects related to the disaster, such as personal belongings that were donated during the interviews. Other objects were received later, for example during the production of the museum's exhibition 'Estonia' in 2005.

LIFE JACKET

'And it was like this – in the raft, under my hand, suddenly there was a life jacket. And so I thought that God must have given it to me (laughs). The jacket kept me warm. I needed that.'

Maiga Järvi worked in the duty-free shop on *Estonia*, and was awake in her cabin when she felt the ship heel sharply. Acting with lightning speed, she climbed out the cabin window and ended up right on an open life raft. Maiga says that the man who finally came down from the helicopter and picked her up didn't say a word.

'Not a word. But I know that when I was on the helicopter, I held his hand. And he took off his glove, and squeezed my hand back. But not a word.'

Maiga was one of seven people who were rescued by the ship *Silja Europa* six hours later. Aboard *Silja Europa*, a seaman took her life jacket after Maigi was taken off her wet clothes and was being warmed up by the passengers who huddled around the people rescued from *Estonia*.

'And there on Silja Europa, it was fantastic. One person warmed my feet and another my hands. And one woman warmed my back with her body. Ah...it was amazing. They stayed with me all day. They didn't leave me alone.'

The life jacket that Maigi wore during the disaster has a collar for head support. It has a floatation panel only on the front so that the wearer can be quickly turned face up in the water. All three names of the ship appear on it: *Viking Sally* on one side, and *Wasa King* and *Estonia* on the other side. At the time of the disaster, there were 2,298 life jackets for adults and 200 for children on board *Estonia*. Each one had whistles, but no lights. This was not a requirement for shorter international trips. Several people testified that the life jackets seemed to be outdated and had too short bands. Many also lost their life jackets when they ended up in the water. The jackets were also said to have been stored together in threes, making it difficult to detach them from each other.

Object: Life jacket
Accession no: SM 27788
Colour: Orange-red
Description: Life jacket with reflectors and waistband
Text on the object: WASA KING, VIKING SALLY, ESTONIA

ALARM CLOCK AND LORRY KEY

Mikael Öun was in his cabin and had set his alarm clock to wake up. When the ship first began to heel, the clock fell to the floor. Like the other items he had packed, it ended up against the door, which was now leaning sharply downwards. The battery fell out and the hands stopped turning a few minutes past midnight.

'I hope it's totally rusted away now, so that it won't be possible to move the hands.'

Mikael had to open the door inwards and upwards to get out of his cabin, so he grabbed the clock to get it out of the way. Mikael was travelling on the ship after dropping off an aid shipment in Estonia. While the alarm clock and a key to the Scania lorry he was driving are now museum objects, the empty lorry remains on the car deck and the battery cover of the alarm clock in the cabin.

Object: Alarm clock
Accession no: SM 27787
Colour: Blue, white, black numbers
Description: Analogue quartz watch with dial and hands
Text on the object: QUARTZ

Object: Lorry key
Accession no: SM 27794
Colour: Stainless steel, black, blue
Description: Key to a lorry with plastic key fob, text on blue background
Text on the object: SAAB-SCANIA Södertälje Tel. 0755-814 07 AEC 769

WRISTWATCH

During the night of the sinking, this wristwatch was worn by Lars-Olof Lamke, who survived the disaster. In an interview, Lars-Olof talks about his experiences. He had been to Tallinn with a good friend as a tourist. The hands on the watch stopped at 01:31 a.m. Estonian time. The hour hand has come off and is missing. 20 minutes later, *Estonia* had sunk.

Object: Wristwatch
Accession no: SM 28618
Colour: White metal, black
Description: Citizen brand wristwatch. Black leather band, blue face.
Text on the object: CITIZEN (defective), QUARTS, TUF 28 (date) CQ, CRYSTRON

NAMEPLATE

The collections of the Maritime Museum contain a nameplate donated by Tiina Mölder. She worked in the Baltic Bar, on deck 6, and was wearing her uniform at the time the ship sank. As Tiina was making her way to her cabin, the ship began to capsize. She quickly got hold of a life jacket and came out on deck. The strong list sent her flying into the water, but she managed to climb onto a rubber raft and was rescued by M/S *Mariella*.

Object: Nameplate
Accession no: SM 27796.A
Colour: Yellow or yellowed white, blue text and edge
Description: Plastic nameplate with Estline shipping line logo and text
Text on the object: ESTLINE Tiina Baltic Bar

SHIP MODEL

Wasa King was renamed *Estonia* when a new owner took over in 1993, and was put into service on the Tallinn–Stockholm line. The country of Estonia had been independent since 1991, and the ship *Estonia* became the pride of the Estline shipping company – a direct link between a former Soviet state and Western Europe.

At the time of purchase, Estline ordered three identical models of *Estonia* in 1:50 scale from model builder Olev Roes. One model was to be placed on board, and the other two were for the offices in Stockholm and Tallinn. In parallel with his job as a pilot, Olev completed the first model, which is currently on display at the Estonian Maritime Museum. The week before the sinking of 28 September 1994, he completed the model of the ship in his home. 'It was hard to have the model at home at the time,' he says, referring to the time after the sinking. He contacted the museum in Tallinn, which accepted it. It was placed in the entrance, lit by candles. The ship model became part of the mourning process, and mourners were given a place they could go to. The shipping company decided to donate the model to the museum, and today it is part of the museum's exhibitions. The order for the two additional models was cancelled.

When Olev was later asked by the Maritime Museum in Stockholm if he would consider building another model, he questioned the idea at first. 'The souls that are there today, would they agree to this, my making a model of that boat now?' Yet despite his hesitation, he accepted the order. He believed that with his knowledge as both a seaman and model builder and armed with drawings and hundreds of photos, he was the best candidate for making a replica of the previous ship model of *Estonia*.

Object: Ship model
Accession no: SM 27806
Colour: White, blue, black
Description: Ship model of the passenger ferry M/S ESTONIA in 1:50 scale.
Text on the object: ESTONIA, TALLINN (stern). ESTONIA (bow). ESTLINE (hull side)

HALF-SHIP MODEL

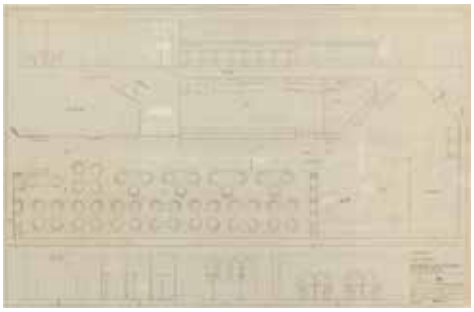
In September 1994, the public learned what a bow visor was. It was the part of M/S *Estonia* that came into sharp focus and whose shortcomings, according to the accident commission's report, are said to have caused the accident. To demonstrate its design, the Maritime Museum in Stockholm made a model of *Estonia's* foresection with its opening bow visor. Two model builders from the museum, Jan Claesson and Stefan Bruhn, built the model in 1:75 scale for the exhibit 'Estonia' in 2005.

Object: Ship model, half-ship model
Accession no: SM 28503
Colour: White, blue
Description: Half-ship model of the passenger ferry M/S Estonia, in 1:75 scale.
Text on the object: ESTONIA

INTERIOR DESIGN BLUEPRINT

Rolf Carlsson was employed at Baltic Marine Service in Nacka and worked mainly on interior design for passenger ships. In 1993 he was commissioned to redesign parts of *Estonia's* interior. The company closed down in 2013, and this copy was offered to the Maritime Museum. The blueprint is a proposal for the refurbishment of a pub on deck D. The original blueprints were sent to the ship owners.

Soon after the sinking, it became clear that the passengers who still had not gone down to their cabins for the night had the best chance of survival. Several of them sat in *Estonia's* bars, partly to socialise but also because the rough seas scared many of them. The restaurants had closed, but the bars and one café were open. From the bars, which were high up in the ship, these passengers were better positioned to get out.



Object: Blueprint, interior design
Accession no: 2013:31:5
Description: Drawing on paper, copy. Reconstruction blueprint of interior design of pub on deck D of M/S Estonia. Alternative IV.

BOW VISOR

Estonia's bow visor was located on 18 October 1994, about one nautical mile (just over 1.5 kilometres) west of the wreck. A month later, it was salvaged and taken to Hanko in Finland for investigation. In December 1997, the final report of the joint accident commission was submitted for Estonia, Finland and Sweden. The bow visor had been a central subject of the investigation.

In the autumn of 1999, the Maritime Museum in Stockholm was given the bow visor. After temporary placements in Södertälje harbour and on Älvsnabben in the Stockholm archipelago, it was moved on 29 September 2005 to a climate-controlled building on Muskö built by the Swedish Fortifications Agency. The floating crane *Lodbrok* transported the bow visor by sea to Muskö. Crane lorries received and lifted it into place in the cradle provided by the Maritime Museum. The bow visor is placed upside down. Because the upper, wider part is heavier, it acts as the base.

M/S *Estonia's* bow visor is the Maritime Museum's 'most difficult' object – a highly sensitive piece, both from an ethical perspective and from an antiquarian conservation point of view. Weighing roughly 60 tonnes, it entails quite a few logistical challenges. Nevertheless, based on the great significance of the bow visor, the museum has decided that it is important to preserve this object as part of our collective cultural heritage.

The centre of the bow visor features a substantial dent. The damage will, of course, not be repaired. It is precisely the traces of events that make the object unique. The testimonies of such objects give us exactly what museums collect: stories and memories.

Estonia used to be red before it was painted white, and was named *Viking Sally*. In the damaged section where the white colour has worn away, the red glows like a wound that is far from being healed.

Object: Bow visor
Accession no: SM 28294.A
Colour: White, blue, red
Description: Bow visor of steel, with a heavy indentation in the bow. Corrosion damage.
Text on the object: AJ

TO THE SURFACE

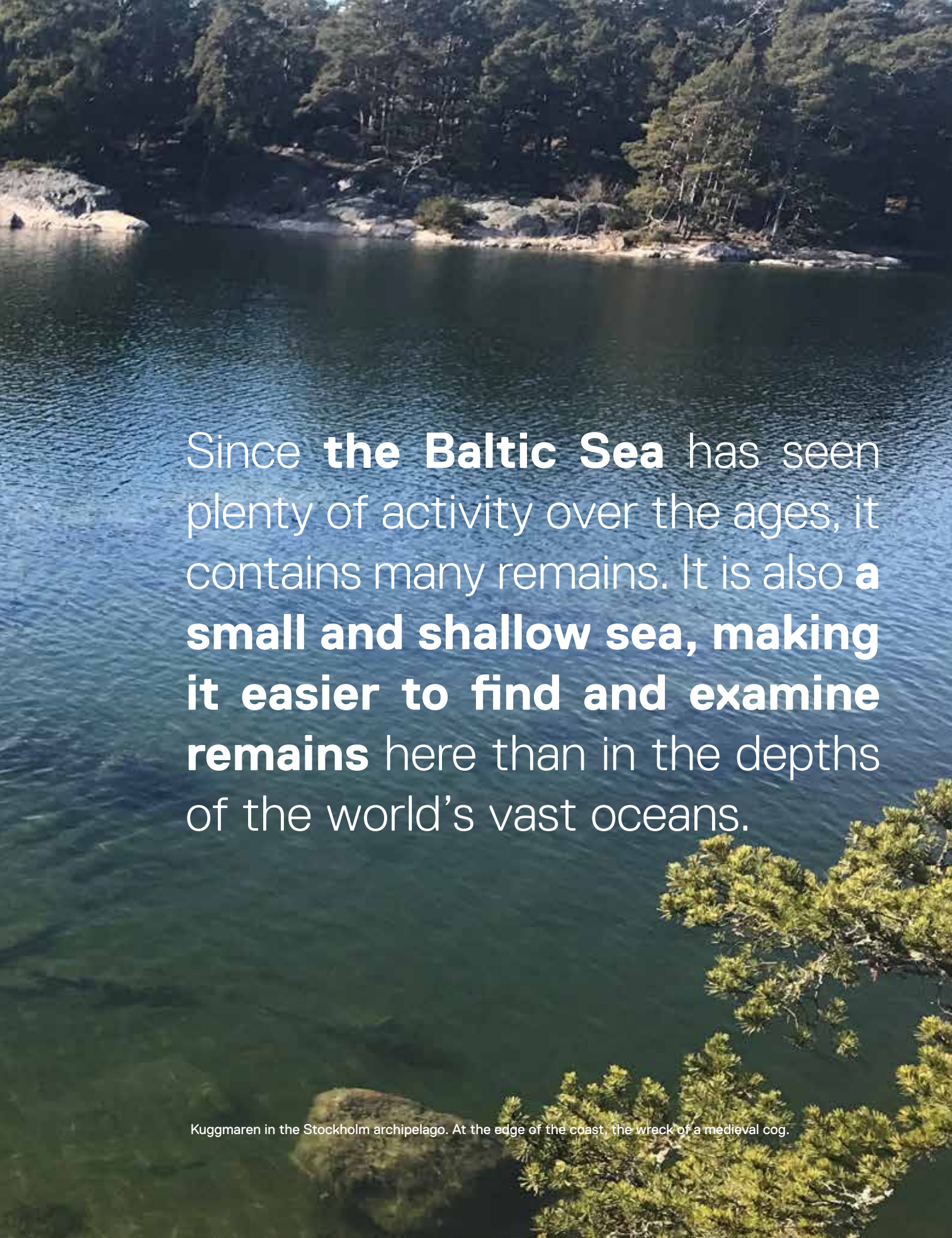
Maritime archaeology is constantly evolving, propelled by new technologies that offer new ways to access and better understand our sunken cultural heritage. Its focus has shifted from salvages and major excavations to non-destructive archaeology. Remotely operated vehicles, for one, now allow us to examine shipwrecks at enormous depths.

Equipment has become better and simpler, enabling more people to go diving, and special dive parks have been created in recent decades. And thanks to dive guides, marked trails and information signs, a previously inaccessible cultural heritage has revealed itself. For those who don't dive themselves, virtual diving experiences are available through film and 3D models. The invisible is thus made visible, and the remains are 'lifted up' to the surface.

Shipwrecks, however, are not just fascinating time capsules that can provide us with knowledge and experiences. They can also contain oil and chemicals that threaten to damage the surrounding environment if they leak from tanks and holds. Sunken ships from the 20th century in particular have been shown to pose a threat to animals and plant life, and efforts are underway in countries bordering the Baltic Sea to identify and address environmentally hazardous wrecks.

MISSION: MARITIME ARCHAEOLOGY

MARCO ALÍ · **MIKAEL FREDHOLM** · TO THE SURFACE



Since **the Baltic Sea** has seen plenty of activity over the ages, it contains many remains. It is also **a small and shallow sea, making it easier to find and examine remains** here than in the depths of the world's vast oceans.

Kuggmaren in the Stockholm archipelago. At the edge of the coast, the wreck of a medieval cog.

MARCO ALÍ · MIKAEL FREDHOLM · TO THE SURFACE

MISSION: MARITIME ARCHAEOLOGY

A maritime archaeologist shares some of the same work methods as land archaeologists. We dig, measure, describe and draw. But underwater archaeology has its own special conditions and often requires different methods to find, investigate and document wrecks and other remains. This chapter is about how maritime archaeologists discover, examine, date and document remains. It focuses on maritime archaeology in Sweden, where the authors work.

ARCHAEOLOGY IN SWEDISH WATERS

Maritime archaeology is a scientific subject that studies human material culture and remains associated with water. This can involve shipwrecks, harbours, piers, boathouses or places where people have lived or worked for a certain period of time. We study these remains to learn more about our history, and thus to gain a greater understanding of ourselves and the society we are part of.

Since the Baltic Sea has seen plenty of activity over the ages, it contains many wrecks and other remains. It is also a small and shallow sea, making it easier to find and examine remains here than in the depths of the world's vast oceans. The Swedish National Heritage Board's online database for archaeological sites and monuments, Fornsök, currently lists more than 6,000 localised wrecks (including wreck data) in Swedish waters, in addition to 400 port facilities and dock areas as well as thousands of other remains without accurate positioning.

New remains are often discovered during activities like hydrographic surveying or development projects on sites that are scheduled for dredging, construction, or the installation of electric cables or pipelines. The type of archaeology carried out for land development is called contract archaeology. The archaeological work is then conducted as a public works

Documentation of the wreckage from the steamship *Vulcan*, which sank in 1873 southeast of Fårö on Gotland. As an aid, the archaeologist has a folding rule and notebook.

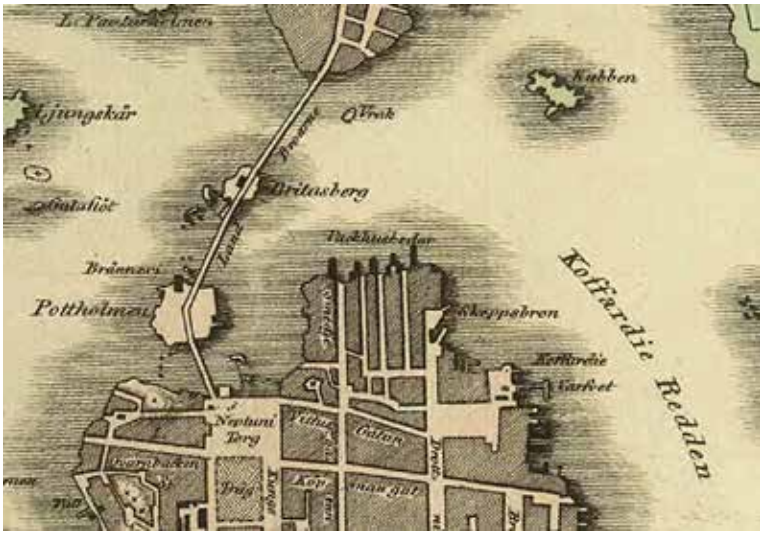
project, and the county administrative board of the relevant county assesses the need for archaeological investigations.

Maritime archaeological investigations are also conducted in research projects by universities or museums. In those cases, finds are examined because they can provide great knowledge

HISTORIC ENVIRONMENT ACT AND DIVING

In Sweden, ancient remains are protected by the Historic Environment Act. A wreck that sank before 1850 is considered an ancient remain. Other types of remains must have existed before 1850. Newer remains can be declared ancient remains by the county administrative board if there are specific grounds due to their cultural and historical value. Diving is often permitted on ancient monuments, but it is prohibited to disturb, remove, excavate, cover, alter or damage ancient remains without permission. But certain areas and wrecks do have a diving ban and require special permission to visit.

Although legislation in other countries around the Baltic Sea can vary, the rule of thumb is to use caution and safeguard underwater cultural heritage.



Section from a map of Karlskrona in Blekinge, 1813. Notice the wreck (in Swedish, 'vrak') pictured in the water a bit northeast of Britasberg.

about a specific period of time or because they can shed light on a particular topic. Examples of such research studies include *Kronan* off Öland and *Gribshunden* in Blekinge's archipelago. Anyone thirsty for more information about these two ships can visit Kalmar Läns Museum's permanent exhibit on *Kronan*, or Ronneby Municipality's offices in Ronneby for an exhibit on *Gribshunden*.

ARCHAEOLOGY UNDER THE WATER

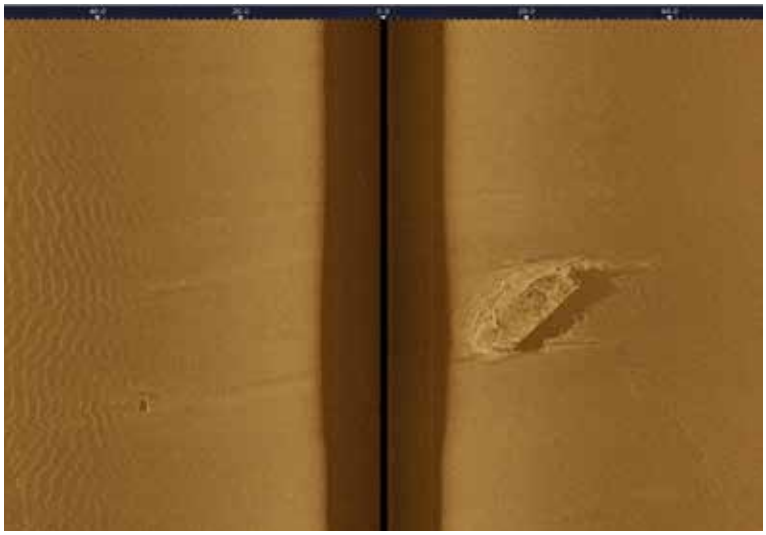
There are several ways to locate remains under water. Besides modern electronic mapping equipment, historical maps can be used to find areas with underwater remains. Registered objects can be found in the Fornsök database.

In preparation for a contract archaeology project, maritime archaeologists often first ask themselves: What remains can be found in an area, and what is the best way to find them? A search in the Fornsök database is a good first step, but land-based activities and studies of historical maps can also give good indications of where underwater remains might be located. More often than not, an area needs to be mapped in some way.

Uncovering something hidden beneath the water's surface is no easy task. Prior to any development, the seabed is often mapped. This sometimes reveals new wrecks and remains. New shipwrecks are also found by the Swedish Maritime Administration and the Navy, who do extensive bottom mapping. And in some cases, recreational divers have discovered wrecks. Thanks to the development of hydroacoustic measurement systems that use sound pulses, search technology has recently become more accessible to a broader public.

SIDE SCAN SONAR AND MULTIBEAM

One of the most common instruments used by maritime archaeologists to map the bottom is side scan sonar. It offers a quick and affordable way to scan large areas and is popular because it produces good results. A side scan sonar emits and receives acoustic signals both downwards and to the side. A computer then converts the signals and displays the contours of the seabed and other objects on a screen. Whatever sticks up is seen in the sonar image – the higher something sticks up, the easier it is to see. Even the shadows of the object sticking



Sonar image of a possible 18th-century wreck about 30 kilometres southeast of Ystad in Scania. The wreck has degraded and sticks up one metre above the bottom.

up are sometimes visible. The density of the objects also results in different signals. Hard materials, such as stone or metal, give strong signals. Softer or waterlogged objects, such as wooden shipwrecks, give a weaker signal and so are harder to see than stone and metal.

Another way to map the bottom is by using multibeam sonar, which emits a cluster of sound waves in the shape of a fan. The waves hit the bottom and then bounce back. The information is presented as a three-dimensional map of the seabed in digital format. With this method, larger areas can be mapped in less time than with side scan sonar. It is an effective way to map the bottom and measure water depth, but collapsed shipwrecks that do not stick up much can be difficult to detect.

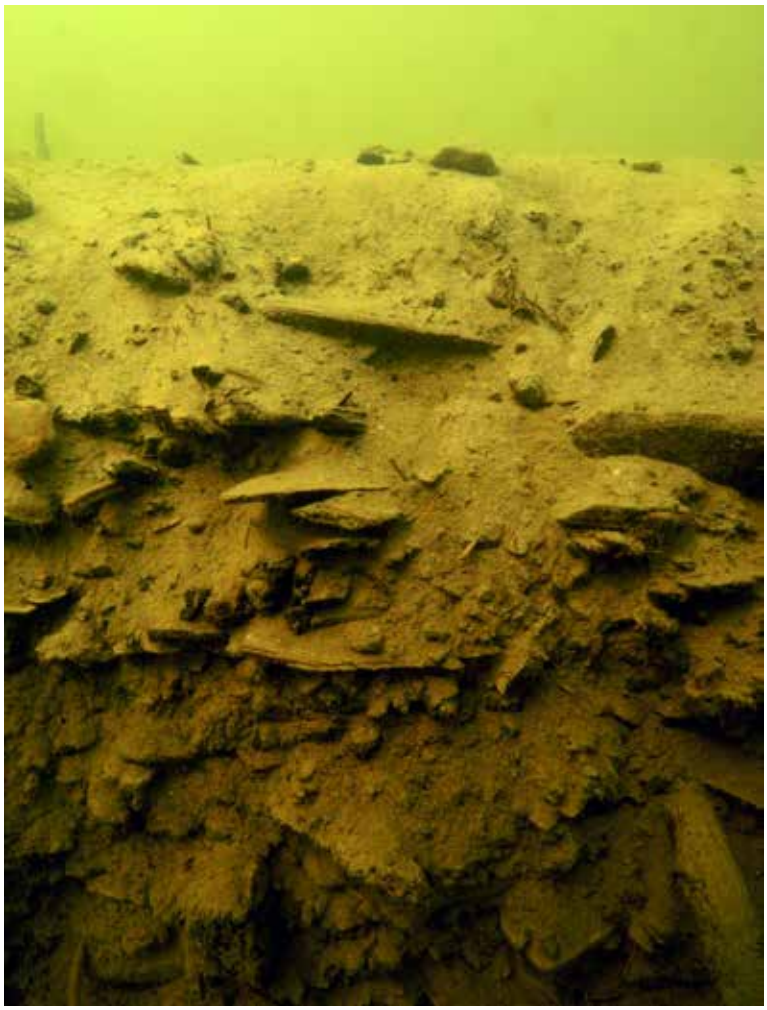
ARCHAEOLOGICAL DIVING AND ROVS

When an object is identified using side scan sonar or multibeam, it often has to be studied more closely to ascertain whether the object is a wreck or other kind of archaeological remain. This can be done, for example, by diving or by using a remotely operated underwater vehicle, or ROV.

Diving archaeologists examine an enormous variety of remains under the water. Shipwrecks, sea-lane blockages, port structures, fishing facilities or cultural layers – soil mixed with residues from human activity. Or waste thrown away from a Stone Age settlement or seaside tavern, or traces of the hustle and bustle of activity that took place in the port of Birka. Cultural layers can contain dateable finds and tell us about the activities that occurred on the site throughout history.

Archaeological diving requires training, equipment and careful preparation, not least because the diver has limited time to get the work done. This decreases with the depth of the dive, and the work is often done in limited visibility. The diving archaeologists at Vrak – Museum of Wrecks are certified professional divers who are allowed to work down to depths 40 metres below the water's surface. At greater depths, a robot such as a ROV comes in handy.

There are several types of ROVs that can replace or complement some of the diver's tasks. They are mainly used to quickly examine an object, or at depths that are inaccessible to the diver or if the dive time for a project is too short.



The baulk profile of one of the test pits in the Viking Age harbour in Birka. The cultural layers contained large amounts of wood shavings, as well as spoons, bag handles, ropes and treenails.

ARCHAEOLOGICAL INVESTIGATION AND DOCUMENTATION

When maritime archaeologists investigate a shipwreck, they look for clues that can provide answers about the age of the wreck, the type of ship and its purpose. They focus on construction details and objects that might be on the wreck. When investigating a cultural layer, the focus is on the objects as well as the thickness, dating and composition of the cultural layer. Based on the date and condition of the cultural layer, the archaeologists can then assess how a settlement, fishing facility or port facility was used and developed over time.

Compared with the number of land-based archaeological excavations, there are few underwater archaeological excavations. In contract archaeology, this is because underwater tasks – for example, laying cables – can often be redirected to another location. This way, development can take place without inflicting damage on any ancient remains. If a cable cannot be laid in another location, the county administrative board may decide to conduct an archaeological investigation. The maritime archaeologist's job is then to investigate and document the ancient remains, uncover finds, and report on and convey the results.

In terms of research investigations, larger underwater excavations were more common up until the mid-1990s. Nowadays, however, it is very rare for a major, or complete, excavation of a wreck to be carried out. When digging does take place, only smaller trenches are

3D model of a gun at the Dalarö wreck/*Bodekull* in the Stockholm archipelago. Although 3D models are often made of entire shipwrecks, they can sometimes be created for specific details, as shown here. The advantage to this is that a higher resolution can be obtained.

usually dug out in an attempt to answer targeted questions. One example is the excavation of *Gribshunden*.

Modern-day investigations instead focus more on preservation and non-destructive archaeology, in which the archaeologist documents the wreck on site using modern technology. This way, the remains can be 'lifted' to the surface without the need to salvage any wreck or object. Organic material, such as wood, is preserved well in the brackish waters of the Baltic Sea. Leaving the remains at the bottom also keeps the costs of conservation and long-term storage down. In addition, remains that stay at the bottom are available for future experiences and research.

There are many different ways to document remains. In addition to photography, film and drawings, 3D photogrammetry can be used. To make a 3D model, the archaeologist needs to photograph or film a relic from all angles. The resulting footage is then processed into a three-dimensional model in a computer program. 3D models have great research potential, since they can be made available online to both researchers and the general public. They can be used for things like taking measurements and viewing hull shapes.

The 3D documentation process has also given the museum world the chance to open up the Baltic Sea's cultural heritage in new ways. A good example is the ship *Resande Man*, which sank off Landsort in 1660 and which has its own exhibition at Vrak – Museum of Wrecks. Through 3D documentation, the wreck site has been made available to visitors without the need to salvage objects.

DENDROCHRONOLOGY AND CARBON-14 DATING

The Baltic Sea offers excellent preservation conditions for organic matter, providing exceptional opportunities for dating. To determine the age of an object – without having an

artefact that can be dated – wood samples can be taken for dendrochronological analysis or, if there are not enough tree rings, for carbon-14 analysis.

Dendrochronology is a method used to analyse tree rings in wood. Maritime archaeologists select and saw off pieces of wood from an object like a wreck. The pieces should contain as many tree rings as possible, preferably from the tree's outer rings which are the youngest. The wood samples are then analysed by a specialist who uses reference curves to hopefully determine which year the wood was felled and where the tree grew. Knowing both the date and the area where the tree grew can help the maritime archaeologist identify which ship was wrecked. It should be kept in mind, however, that the tree's native growing area can differ from the ship's building location, even though they are usually one and the same.

Carbon-14 analysis is a dating method that instead utilises the decay of the radioactive carbon isotope carbon-14 (^{14}C). This isotope is found in all living things, but stops being absorbed when an organism dies. In this way, the time that has elapsed since the time of death can be measured by examining how much of the isotope remains. Because carbon-14 analysis gives a less exact dating than dendrochronology, dendrochronology is often preferable.

A DEEP DIVE INTO THE ARCHIVES ...

Following a dive survey, the search for information continues in the archives. Archives can contain crucial data about a shipwreck that can be matched to the position, design and dating of a wreck. Researchers must also familiarise themselves with previous research in order to better understand and interpret their findings. For example, comparisons using previous research about a particular type of ship can help to date and understand the wreck being examined.

Ship remains from time periods that have written sources and map materials can sometimes be identified using archival data. But in order to narrow the search and be successful, as many details as possible should be known about the wreck before the work begins. One such success story is the identification of the wreck of *Anna Maria* in Dalarö in the Stockholm archipelago. When the researcher Christian Ahlström searched the archives, he already had information about the wreck site, previous archaeological surveys, the cargo and the dendrochronological analysis of the timber, which pinpointed the felling year to

The Nåttarö wreck in the Stockholm archipelago lies deep in the sediment. The wreck has not been examined, but the 3D model can give you an idea of how much of it might be preserved.

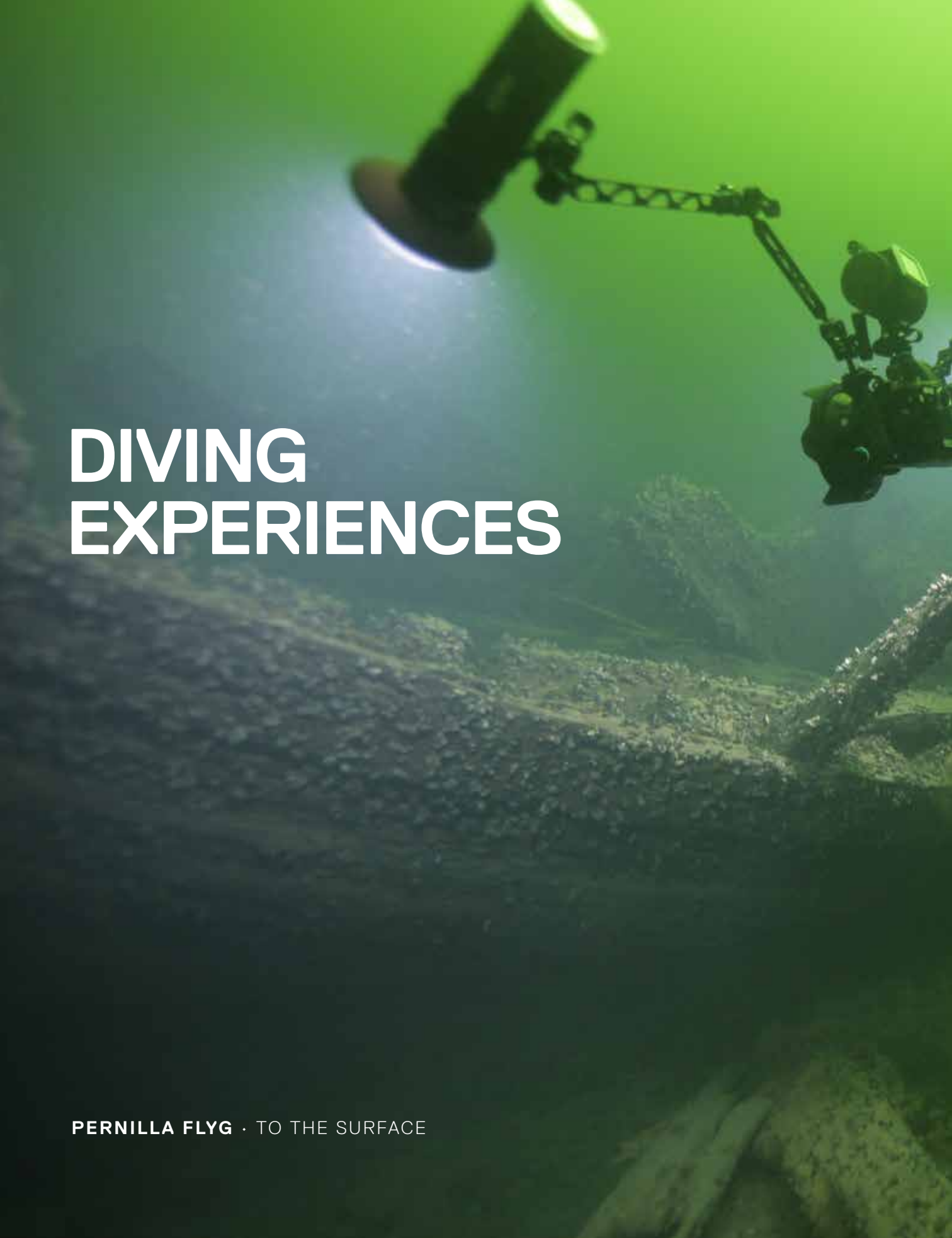
Archaeologists document finds using photos, film and drawings. Underwater, they draw on a waterproof drafting film attached to a slate.

the winter of 1707–08. He was thus able to limit his search of archival material to the years following these dates. In the archives, he found details of *Anna Maria's* sinking in 1709 which were consistent with the wreck and the dating.

... AND INTO THE SECRETS OF THE BALTIC SEA

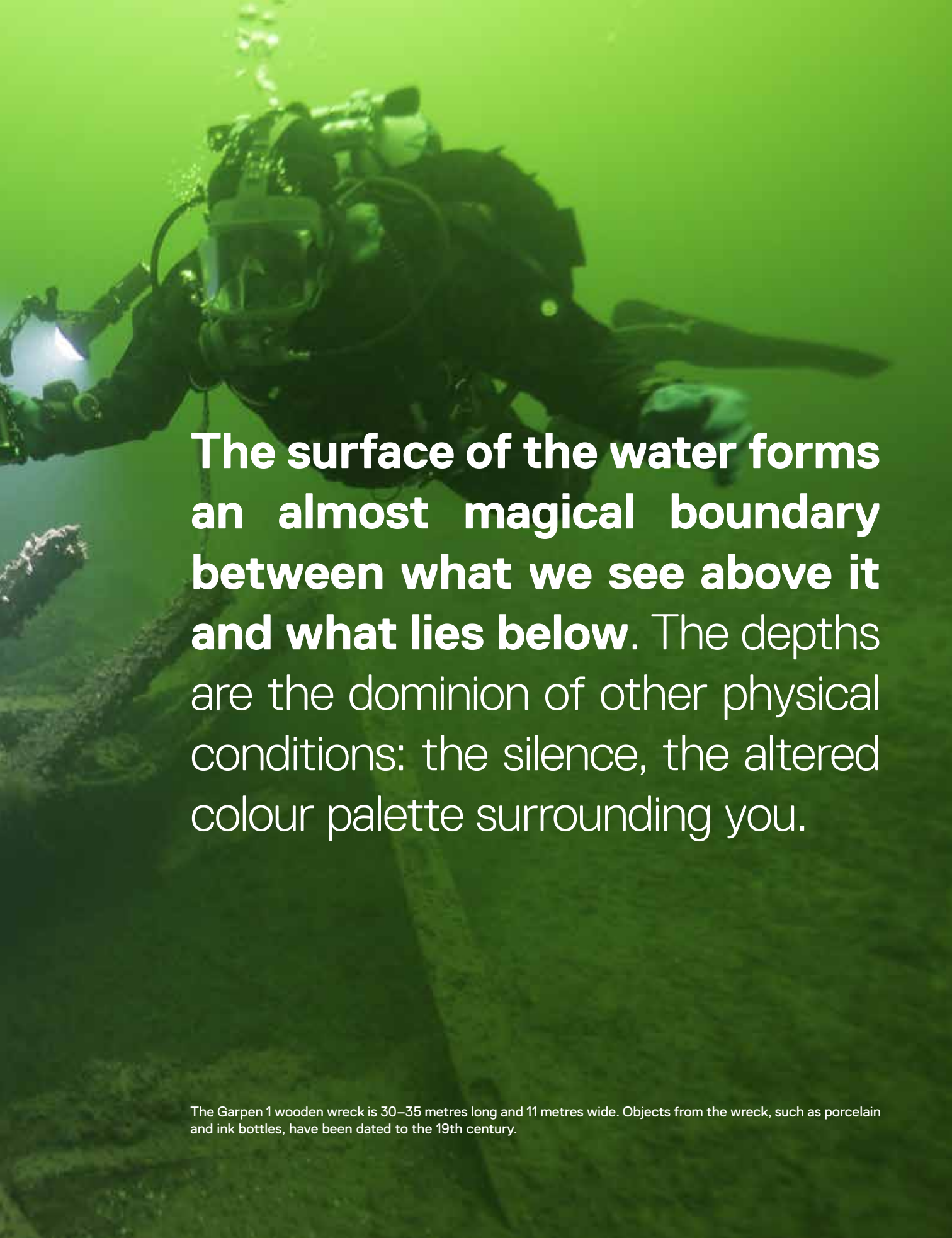
The final steps in any archaeological investigation are reporting and archiving. Reporting, archiving and making archaeological research available is important not only for archaeologists and researchers, but for the general public's ability to access and use the results – both now and in the future.

The maritime archaeological exploration of the Baltic Sea has only just begun. Thanks to its well-preserved remains – both the known and the yet undiscovered – the Baltic Sea has great potential to contribute new knowledge and fresh perspectives on the shared history of the Baltic Sea countries. This type of knowledge can rarely be obtained through written sources or from land archaeology. The Baltic Sea is an archaeological gold mine that we have barely scratched the surface of. A mighty undertaking surely awaits the maritime archaeologists of the future.



DIVING EXPERIENCES

PERNILLA FLYG · TO THE SURFACE



The surface of the water forms an almost magical boundary between what we see above it and what lies below. The depths are the dominion of other physical conditions: the silence, the altered colour palette surrounding you.

The Garpen 1 wooden wreck is 30–35 metres long and 11 metres wide. Objects from the wreck, such as porcelain and ink bottles, have been dated to the 19th century.

DIVING EXPERIENCES

Few places can rival the Baltic Sea when it comes to well-preserved shipwrecks. Here, hundreds of thousands of ships have travelled over the centuries and many have wrecked and sunk to the bottom. Many have been found, and even more await discovery. In saltier seas, wrecks quickly degrade. But here, they endure – invisible and thus unknown to most people. Some are graves, some are age-old relics, and many still have cargo and objects on board, and they can all tell us something about their times.

A SEA OF STORIES

The tasks of a maritime archaeologist include examining wrecks, documenting them and communicating about them. When and why did the ship sink? Where did it come from, and where was it going? Where and how was it built, who was on board and why, and what kind of cargo was on board? How was the ship decorated, and what significance did this have in the society that ordered the ship's construction?

The wrecks have much to teach us about shipbuilding, trade, war and social structures. In short, they expand our knowledge of history and people's lives and fill the gaps where other stories end. Each wreck carries its own story. We can identify many wrecks that have been uncovered, but not all. If we fail to identify the exact ship that wrecked, we can still glean a lot of information regarding date and function, for example, by ascertaining the ship type and construction method.

The potential to convey knowledge and stories about our history is enormous, and it is a grateful task. The surface of the water forms an almost magical boundary between what we see above it and what lies below. The depths are the dominion of other physical conditions: the silence, the altered colour palette surrounding you, the distorted perspective that makes

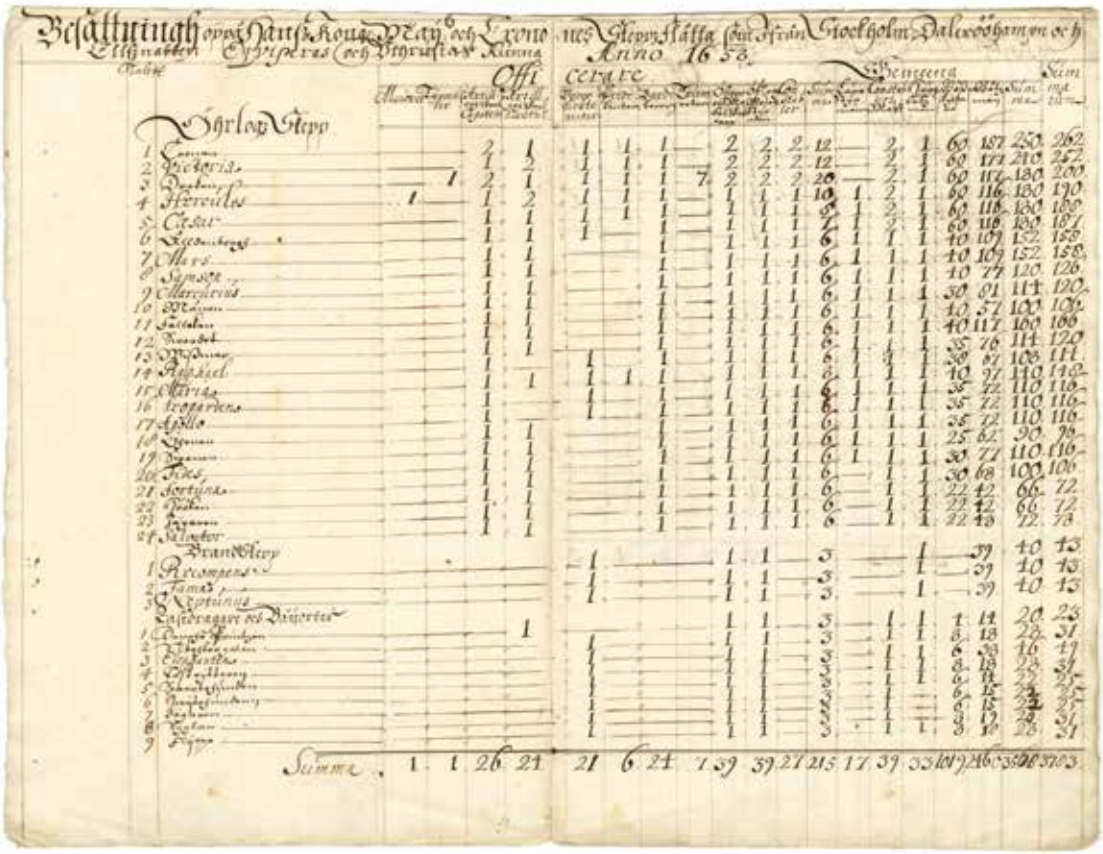
Inspection of the Jutholm wreck, a fluit ship loaded with tar and iron which sank around 1700 at Jutholmen in the Stockholm archipelago. The Jutholmen wreck is included in the Dalarö shipwreck area, a culture reserve within the Dalarö Dive Park.

things look bigger than they really are. And the shipwrecks are intriguing in themselves. The fact that their stories bear witness to founderings and even disasters and violent death does not diminish their seductive power.

But because the wrecks are invisible to all those except divers, they can also make attractive targets for looters. And the more people who dive on them, the greater the risk of wear and tear. There are, however, ways of managing this threat which will preserve our underwater cultural heritage for future generations. One way to achieve this is to make the wrecks available to as many people as possible. This might seem like strange reasoning. But we know that people care about places they can form a relationship with, and stories connect the visitor to both the place and the experience.

WANT TO DIVE ON A WRECK?

You've got to be careful when diving on shipwrecks – partly for your own sake, and partly for the sake of the wreck. In Sweden, any wrecks of ships that sank prior to 1850 (and sometimes later) are considered ancient remains. You are welcome to dive as long as no diving ban is in effect, but do not touch the wreck – you could damage it – or remove anything from it. Although legislation can vary depending on the country, the rule of thumb is to use caution around older wrecks.



Ships ready to be equipped for combat and transport at the harbours of Stockholm, Dalarö and Älvsnabben in 1658.

DIVE PARKS

One way to spread knowledge about the wrecks is through dive parks – a collective term for places where people can, one way or another, visit culture or nature under the water. Many dive parks exist around the world. Quite a few of them are places containing sunken ships and airplanes for adventurous recreational divers, and some offer purpose-sunk sculptures for art experiences below the water's surface.

The Baltic Sea offers plenty of ideal locations for dive parks, but so far only a handful of dive parks are in operation that allow divers to visit authentic shipwrecks on the bottom. These dive parks consist of collections of ships, individual older wrecks that are well-preserved, wrecks from a specific time period, or areas containing wrecks in combination with distinctive natural surroundings. They are often situated next to interesting attractions on land, close to restaurants and overnight accommodations.

DIVE PARKS IN SWEDEN ...

The small coastal community of Dalarö, located just southeast of Stockholm, used to be a vital hub for Baltic Sea shipping. The Swedish naval fleet was stationed there, and Dalarö was home to Stockholm's outermost customs station. As proof of this, many wrecks can be found in the area. Several of them are exceptionally preserved, and three of them are part of Sweden's first maritime cultural reserve – the Dalarö shipwreck area.

Garpen 1 west of Hanko in Finland has long been a popular diving destination. There is an information plaque at the wreck site and a buoy for mooring boats. From the buoy, a dive rope leads down to the wreck.

- The merchant ship *Anna Maria,* built in Amsterdam in 1694. Sank on 6 February 1709 following a fire on board, loaded with planks and bar iron.
- The Jutholmen Wreck, which sank circa 1700. The wreck is unidentified, and was named after its location next to the island of Jutholmen.
- *Bodekull* (the Dalarö Wreck), a frigate built around 1660 in Karlshamn, Sweden. Was built on order of the reigning Swedish king, Charles X Gustav. Sank in 1678.

Diving is only allowed on these three wrecks together with a specially trained dive guide. There are several operators in Dalarö who offer excursions with trained guides. To enhance the diving experience while protecting the wreck, the Swedish National Maritime and Transport Museums (SMTM), which includes Vrak – Museum of Wrecks, has produced laminated wreck maps. The maps direct divers around the wreck and identify details and objects of interest. The museums have also produced a brochure that describes the wrecks in the culture reserve and a selection of other wrecks in the waters off Dalarö. Together, they form the Dalarö Dive Park. Several of the wrecks have mooring buoys that facilitate mooring without disturbing the wrecks.

The waters outside the old ironworks Axmar, just north of Gävle along Sweden's east coast, are home to wrecks mainly from the 19th century. A dedicated website and information signs provide details about the wrecks, as well as the marine animals and plant life found in the area.

A dive park is being planned for the Naval City of Karlskrona, a world heritage site, which contains several wrecks of cultural interest. This dive park will have ties to Dalarö Dive Park;

3D model of the wreck of the fluit ship *Anna Maria,* a merchant ship that caught fire in 1709 when it lay frozen in at Dalarö harbour. The wreck shows clear signs of fire damage.

most of the Swedish naval fleet was transferred from Dalarö to Karlskrona at the end of the 17th century because the waters there were often ice-free during the winters.

... AND AROUND THE BALTIC SEA

For several years SMTM has been collaborating with organisations in Estonia and Finland, most recently in an EU project called Baltacar. The aim of the project was to make the wrecks more accessible. Together with the project partner Haninge Municipality, SMTM has further developed Dalarö Dive Park. The partners have focussed on developing more information about the wrecks and creating 3D documentation on the three wrecks in the cultural reserve, *Anna Maria,* the Jutholmen Wreck and the Dalarö Wreck/*Bodekull*. Haninge Municipality primarily worked on developing an exhibition concept and holding a series of workshops to inspire entrepreneurs who want to organise excursions in the dive park.

In Estonia, the National Heritage Board of Estonia has created signage and buoys at wrecks located in the open sea off the islands of Saaremaa and Hiiumaa. The wrecks are from World War I and the Estonian War of Independence.

In Finland, the Finnish Heritage Agency has updated the Baltic Sea's first dive park at the wreck of the ship of the line *Kronprins Gustav Adolf,* which sank off Helsinki in 1788. At Hanko and Kimito Island, several wrecks have been made available including merchant ships from the 17th and 19th centuries.

DIGITAL DIVING

Not so long ago, it was difficult for a museum to reach and communicate with a bigger audience than one that fits within the walls of an exhibition. It was especially challenging

CGI of the Dalarö wreck/*Bodekull* with animated diver, based on over 10 000 high resolution images.

to connect with people who do not visit the physical museum. But new technological and digital solutions are opening up unexplored opportunities. Museums around the world are experiencing an increase in the number of online visits to their websites, social media and collections. Digital is more flexible than physical, and allows museums to quickly adapt and change as new discoveries and research findings come to light.

People spend much of their time in front of screens. Perhaps that's where they will encounter the underwater world for the very first time. And, of course, 'digital diving' is available to so many more people than on-site diving is. The use of modern technologies can make this experience a truly captivating one. Augmented reality (AR) and virtual reality (VR) technologies provide that extra dimension to people's experiences.

AR can be described as a way to create a constructed layer on top of reality. Using an AR solution, a visitor might be able to walk along a quay and use their mobile to 'see' what lies at the bottom nearby. Or why not a reconstruction of the ship as it looked like before it sank? With a VR solution, someone could experience what it feels like to dive on a shipwreck. VR can be said to 'replace' reality. Visitors can get such an experience at museums like Västervik Museum, where they can visit the wreck of the warship *Mars* that sank in 1564, and at Vrak – Museum of Wrecks.

The physical wreck site/dive park can also be made available digitally. Underwater footage, either pre-recorded or live from remotely operated underwater vehicles (ROVs) or divers, can be shown on screens aboard a vessel. Here, too, VR glasses can enhance the experience.

To use any of these methods, the wreck must first be properly documented on film or, perhaps even better, using high-resolution photography. Maritime archaeologists at Vrak – Museum of Wrecks often take this approach: shoot the entire shipwreck in high-resolution, in a methodical way. The images can then be assembled into a 3D model. Besides serving as input for 3D animations and other purposes, they can be used as a knowledge base. For

example, you can visit the wreck over and over again without ever going under water, and study the construction details and other things of interest to a maritime archaeologist. A 3D model also makes an excellent aid when planning a dive. It provides an updated status of the wreck, helping experts to monitor any changes and detect whether anything at the site has been damaged or altered since the time of documentation.

A REALLY GOOD STORY

But technology alone does not do the trick when attempting to reach a wider audience. Both the technical equipment and the methods behind diving and 3D documentation can be interesting in themselves, of course, but attracting the interest of a larger audience requires a focus on storytelling. Many sources abound for reconstructing the story of a wreck. In Sweden, for example, plenty of information is available in archives and collections at the National Archives and the maritime museums. Reports, dissertations and other literature also offer useful clues, as do online platforms like the DigitaltMuseum, Wikipedia or Fornsök, the Swedish National Heritage Board's database for archaeological sites and monuments.

Recently discovered shipwrecks that can provide new knowledge are sometimes found by recreational divers or organisations that are interested in what hides beneath the surface, such as the Swedish Maritime Administration, the Swedish Marine Police and the Swedish Coast Guard. Maritime archaeological surveys reveal a wealth of information. Construction details, photographs, film footage and more all help to build up a solid knowledge base. Different analysis methods help archaeologists to date the wrecks and determine the origin of the ship's timber and sometimes the contents of its cargo.

All these sources are threads that can be woven into compelling stories. And these stories will be even better if they manage to convey the special nature of the underwater environment: the silence, the pressure, the distorted perspectives, the unusual colour palette. If museum visitors are given the opportunity to envision a well-preserved wreck lying quietly on the cold, dark seafloor – that's when their imagination can really take off. The visitor will then be receptive, prepared to absorb knowledge about the ship before it sank. Where did it come from and where was it going? Where and how was it built? What cargo did it contain? Who was on board, and why did it wreck? In short, the wreck has come to life.

ENVIRONMENTALLY HAZARDOUS WRECKS

For many wrecks a different kind of story is beginning to evolve – one about dangerous substances impacting the maritime environment and **the major damage to animals and nature caused by emissions from wrecked ships.**

On 31 May 2003, the bulk carrier *Fu Shan Hai* collided with the container ship *Gdynia* just north of Bornholm. *Gdynia* was damaged but was able to continue, while *Fu Shan Hai* took in water and began to list. The Swedish coast guard towed *Fu Shan Hai* 1.5 nautical miles before abandoning its efforts. Soon after, the ship sank to the bottom. The next day, a coast guard aircraft reported that *Fu Shan Hai* had leaked about 40 cubic metres of oil into the water north of Hammerodde. The oil reached the coast of Scania on 3 June.

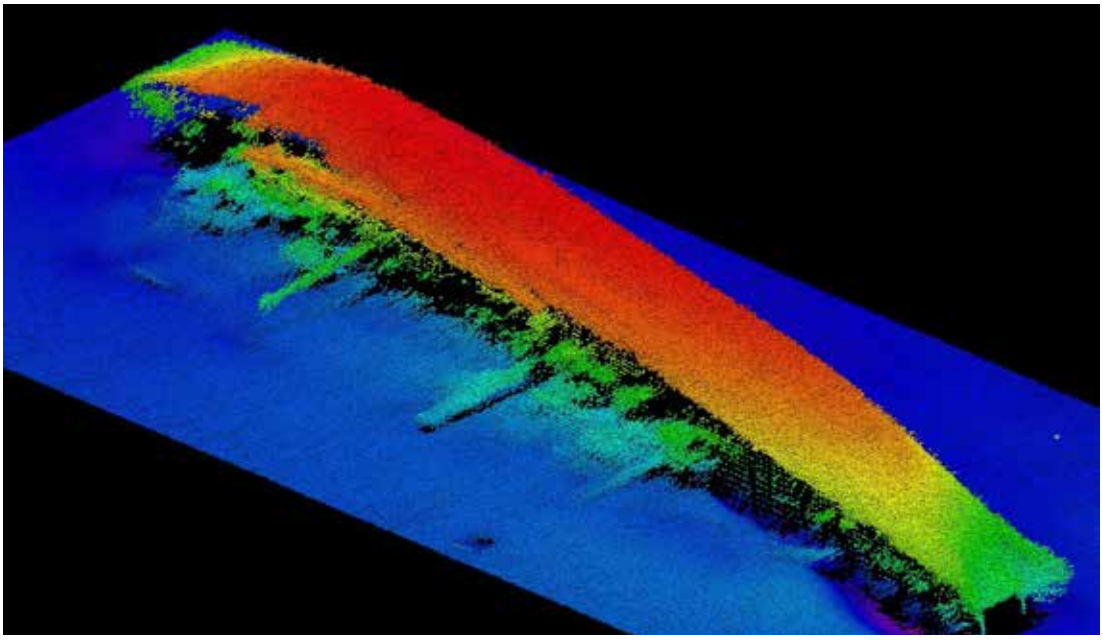
ENVIRONMENTALLY HAZARDOUS WRECKS

During the winter of 2005, large amounts of oil appeared in the waters just north of Måseskär on the Swedish west coast. It turned out that the oil came from the Norwegian ship *Skytteren* which sank in 1942, and at its peak the discharge totalled nearly 400 litres per day. The leakage from *Skytteren* became a wake-up call for a problem that had previously been overlooked. How much oil do shipwrecks in Swedish waters contain in their holds and bunker tanks, and when can it be assumed that the oil will reach the surface? Where does the oil risk ending up and, above all, how is the environment potentially impacted?

OPERATION PERFORMANCE

When German armed forces attacked Norway on 9 April 1940, several Norwegian cargo ships lay at anchor in Swedish ports. Both the Norwegian government, which was exiled in Great Britain, and the German occupying power made claims on the ships. Since the problem of ownership could not be solved, the ships were seized and, as a result, forbidden to leave Swedish waters. In early March 1942, ten embargoed boats were being held in the Port of Gothenburg. The commanders' plan was to slip out of the port and make their way to England, where the ships and their crews would be transferred into British service and the cargo used in the British war industry.

The escape, which went under the code name *Performance*, got underway on 31 March 1942. The ships left the Port of Gothenburg and embarked on the perilous journey that would ho-



Multibeam image of the Norwegian ship *Skytteren,* which sank on 1 April 1942 at Måseskär off Lysekil on the Swedish west coast. The wreckage, near the sensitive archipelago both in terms of marine environment and beach areas, can potentially contain large quantities of oil.

pefully end in a British port. But of the ten Norwegian ships that left Gothenburg, only two managed to reach their final destination. Two others returned to Gothenburg, and the remaining six were sunk by German warships or by their own crew in order to avoid falling into German hands. One of the sunken vessels was the 170-metre-long former whaling ship *Skytteren,* which today lies at a depth of close to 75 metres off Härmanö, just south of Lysekil.

OIL

Environmentally hazardous substances that might be on board sunken vessels can consist of oils in different forms, such as diesel for ship fuel or as cargo in the hold of ships or placed on deck. The cargo might be in liquid form, in tankers for example, or in solid form as dry goods in closed containers or dedicated cargo ships.

Tanker cargo can consist of various types of liquid substances including crude oil, kerosene, hydrochloric acid or ammonia. Dangerous dry bulk cargo can include different types of fertilisers. One example is the Chinese cargo ship *Fu Shan Hai*, which wrecked just north of Bornholm in 2003, loaded with 66,000 tonnes of fertilisers.

Oil on ships, whether as bunker fuel or cargo, can pose two types of threats. For one, major discharges can occur when huge amounts of oil are released following a collision or grounding. Secondly, smaller leaks can occur over a longer period of time. Even a minor discharge – when oil is released in the form of droplets – can develop into a major discharge if it takes place over a long period of time or if the wreck suffers damage, for example from vessel anchoring.

In 2009, the Swedish Maritime Administration was commissioned by the government to conduct an inventory and risk analysis of ship remains that could pose an environmental

On 31 October 2006, *Finnbirch* departed Helsinki bound for Aarhus. The ship sank in tempestuous weather east of Öland due to a shifting of the cargo on board. In 2019 and 2020, two oil salvage operations were led by the Swedish Agency for Marine and Water Management. *Finnbirch*, located at a depth of 82 metres, has been emptied of 148.2 cubic metres of environmentally hazardous oil. The photo shows the oil spill from the ship.

threat, especially due to oil. The assignment ended in 2011 with the report 'Miljörisker från fartygsvrak' ('Environmental Risks from Shipwrecks'), which included a list of 31 shipwrecks along the Swedish coast that were judged to pose a potential threat to both people and the environment. The assignment also included developing a risk analysis tool to calculate the likelihood of an oil leak from a shipwreck and the areas the oil could spread to based on prevailing winds. Information on the 31 shipwrecks has been compiled from archival data together with data from recreational divers and ship owners.

Examples of managing environmentally hazardous wrecks can be found in several locations across the Baltic Sea. One example is the *U-479* submarine, as described in an earlier chapter.

The Swedish Maritime Administration was given a new government assignment in 2014, in consultation with the Swedish Agency for Marine and Water Management, the Swedish Coast Guard and other agencies, to develop a method to investigate the presence of oil on board wrecks, and to determine the possibility of identifying any environmental consequences near wrecks that could pose a threat to the environment.

The government has also tasked the Agency for Marine and Water Management to investigate and clean up ships, and the agency has used the list from 2011 as a starting point. Of the 31 wrecks assessed to pose a potential threat, five were cleaned up by summer 2020: *Thetis, Sandön, Hoheneichen, Lindesnäs* and *Finnbirch*. No oil was found on *Sandön* and *Hoheneichen*, which means that the oil on board at the time of the sinking has leaked. On *Thetis* 730 litres were recovered, on *Lindesnäs* 299 cubic metres and on *Finnbirch* 148.2 cubic metres. The recovered oil was disposed of for recycling or destroyed.

The 2014 assignment was extended for an additional year. Part of the work consisted of investigating a larger group of vessels near Måseskär Lighthouse on the Swedish west coast.

The tanker *Lindesnäs* sank in a snowstorm in 1957 en route from Nynäshamn and Norrköping. The ship was laden with 1,732 cubic metres of kerosene when it sank 10 kilometres east of Oxelösund. In 2019, the Swedish Agency for Marine and Water Management began work on draining *Lindesnäs* of oil. During the operation, a 46-metre-long ghost net was also found on the wreck, and in it two dead seals.

These ships, which were deliberately sunk by the Allies right after the end of the Second World War, are often referred to as the 'gas ships' because they are suspected of containing chemical weapons, including mustard gas. The 'gas ships' are located not far from where *Skytteren* sank, but they have no relationship to it beyond their geographical location.

GAS SHIPS AT MÅSESKÄR

At the end of the Second World War, representatives of Great Britain, the United States and the Soviet Union met in several locations across Europe to discuss how to manage the German empire after peace was reached. One of the problems that required a solution was the disposal of German munitions in stores in Germany and in the areas annexed by Germany. It was decided to destroy all the war material left behind, including large quantities of ammunition, in an appropriate manner. A common method of getting rid of leftover ammunition was to simply dump it into the sea. Many vessels were sunk in the same way, often in very deep waters.

The remaining warships of the German navy, both completed and under construction, were divided into three categories, A, B and C. Category A were those in good condition and could be used immediately, and Category B ships could be repaired or completed within 3–6 months. Category C ships could not be repaired or completed within 3–6 months. Category A and B ships were divided among the war's victors: the United States, Great Britain and the Soviet Union. Category C ships would be scrapped or, if this was not possible, sunk in deep water in a predetermined area off the Swedish west coast.

In addition, a great many cargo ships were chosen to be loaded with ammunition, including chemical weapons, and then sunk in an area of water further north in Skagerrak, on the

Torpedoes from the torpedo transport vessel *Gnom* at a depth of approximately 230 metres at Måseskär on the Swedish west coast.

same latitude as the Norwegian port city of Arendal.

The Category C ships were taken to the German port city of Kiel. From there, they were towed in the summer of 1946 in five convoys and were sunk about 200 metres deep in an area between Tjörn on the Swedish west coast and Skagen in northern Denmark, roughly 35 kilometres west-northwest of the Måseskär Lighthouse. The methods for sinking the vessels were many. They were detonated, filled with water, fired at with artillery, or rammed by the tugboats that had taken them to the site.

The National Archives in London contains records detailing which ships were sunk, as well as how and where. A total of 47 vessels were included in the five convoys. The largest was the former cruiser *Berlin*, at a length of 114 metres. Seven of the ships sank before the convoys reached the predetermined area off the Swedish coast, and one was sunk at an enormous depth off Arendal in Norway. The British documents describe in detail the status of the vessels before the convoys depart Kiel. One ship is reported to be laden with scrap iron and one with torpedoes, although according to the documents, the warheads must have been removed.

A survey of the seafloor carried out in 2015 by the Swedish Maritime Administration in that area of water revealed 28 vessels. They were documented using multibeam and side scan sonar, instruments used to examine the seafloor. Some of the wrecks were also examined and documented using a remotely operated underwater vehicle, known as a ROV. The ship's remains were well preserved in most cases, increasing the chances of identifying them. Following a review of the film footage, photographs and results of the multibeam and side scan sonar surveys, four wrecks have been identified thus far, and there are good prospects

for identifying more. No ammunition, except for torpedoes with mounted warheads, were found at the wreck sites.

Many of the cargo ships loaded with ammunition containing different types of chemicals were found during surveys of the sea bottom off Arendal. No fewer than 37 ships were discovered at depths of over 500 metres. Substantial quantities of ammunition are scattered around several of them.

A preliminary conclusion indicates that the ships included in the five convoys which sank at Måseskär on the Swedish west coast had not been loaded with chemical weapons. No ammunition was found during the shipwreck investigations, apart from about 30 torpedoes on the torpedo carrier *Gnom*. Furthermore, the methods used to sink the ships indicate that no explosive cargo was on board. Despite this, bottom studies in the area have revealed traces of various chemical substances including arsenic, which can be linked to the type of chemical weapons containing mustard gas.

Low concentrations of mustard gas in the sediments were found in the area in 1992, and studies from 2016–2017 measured low concentrations of the chemical substance Clark 1 in lobsters, flatfish and northern prawns.

New studies will aim to investigate which wrecks contain chemical warfare agents, the extent of their distribution and possible environmental impacts.

Considerable amounts of chemical weapons were also dumped in the Baltic Sea. Experts believe that about 55,000 tonnes were dumped in the Baltic Sea after the war, including in the Gotland Deep and the Bornholm Deep. Approximately 50,000 objects were uncovered during surveys in the Gotland Deep, of which 10–15,000 are believed to be chemical weapons.

MULTIFACETED STORIES

Numerous sunken and wrecked vessels from different periods are dotted along Sweden's nearly 2,400 kilometres of coastline. Many wrecks can be found along the Swedish Baltic Sea coast, and many more in the Baltic Sea as a whole. Many of these ships' remains are intimately tied to stories that can be as amazing as they are terrifying: stories of violent death and of rescue efforts that were as incredible as they were successful.

But now a different kind of story is also being told – one about dangerous substances impacting the maritime environment and the major damage to animals and nature caused by emissions from the wrecked ships. Our ships' remains, which make fantastic places to visit for recreational divers and are often the source of dramatic stories, also play a part in the increasingly intense fight against environmental degradation.

The galeas *Jehu* sank one December night in 1825. The journey from Stockholm to Sundsvall with a load including pig iron came to an end when its pumps froze in the cold. The ship started leaking and went down to the bottom. In 1991, a clinker-built wreck was found in Sundsvall Bay that matched the description.

ANNA ARNBERG · ODD JOHANSEN · PER WIDÉN (EDS.)

EPILOGUE

The Baltic Sea's memory is both deep and wide. Under the surface of the sea, we find an archive of everything from major world-changing events to small everyday items – things that in the moment might have been perceived as insignificant, that never ended up in the history books, but that have been preserved and now form the nuances of history.

The Baltic Sea's memory broadens our perspective and gives us the chance to see the world with new eyes – both what is today and what has been. It gives us the keys to history, but also makes us understand that we will ourselves form the new cultural layers. Our approaches to the sea – as a surface of contacts or conflicts, as recreation, a resource, a source of knowledge or a bottomless hole – shape our relationship with future generations and their opportunities to experience the present as well as history.

A SEA WITH A HISTORY

As the book's authors have shown, the cultural heritage of the Baltic Sea holds endless possibilities. It contains knowledge of events, places, times, people, and the ebb and flow of life. Its wealth of well-preserved remains is in a class of its own, unparalleled anywhere. So even though we have had an entire book at our disposal, we have only managed to scratch the surface.

The seafloor contains even more traces from the most ancient history, as well as from eras that are closer to our own. Here are remains of sailing ships, steamboat shipping and sawmills along the coast of northern Sweden, traces of contact and trade across the Bothnian Bay as well as those further south to the world beyond Øresund Sound. Here are traces of the different faces of war and of events which, despite their origins in a not too distant past, can seem far away nowadays. Like when the Baltic Sea was a sea of escape.

New remains are discovered every year, adding more layers and shades of nuance to history. The fluit in the Gulf of Finland that opens the chapter 'Sunken Buildings of the Baltic Sea', the Osmund Wreck and the Nåttarö Wreck are among them. Other vessels remain to be located, such as the small and rickety boats that carried people fleeing across the sea but all too often met with defeat.

Above: On 26 August 1916, *Wellamo* departed Sundsvall bound for Kokkola in Finland. The ship followed the Swedish coast up to Holmsund before suddenly yawing eastward. North of the Tankar lighthouse, the captain saw that they were being pursued by a German submarine, the *U-47.* The ship desperately tried to escape, but in vain. The submarine fired warning shots and *Wellamo* was forced to stop. The crew was advised to abandon ship immediately since it was about to go down. When everyone had taken their places in the lifeboats, the submarine opened fire; after being hit by 16 shots, *Wellamo* sank. The photo shows a wooden bench in the wreckage.

Below: On 18 November 1928, lighthouse crews and pilots at Bjuröklubb's pilot station saw repeated distress signals from a vessel. But because of the harsh weather, no one could come to the rescue. Later in the day, the pilots learned that it was the Polish cargo steamer *Robur II* they had seen. The crew and the ship's dog, Lux, had saved themselves and reached the shore, but the ship itself was nowhere to be found. Nine years later, *Robur II* was located at a depth of 26 metres, and its anchors and ship's clock were salvaged. After that, the wreck site fell into oblivion and was only rediscovered in 1988.

Above left: Tunadal, just north of Sundsvall, is known for its sawmill industry. Prior to dredging and filling in the harbour area, an archaeological investigation was carried out. Up until the mid-20th century, rectangular barges were often used at sawmills for loading and unloading. Rectangular barges that were examined date from the end of the 18th century until the beginning of the 20th century. The image shows the corner of one of them.

The armoured cruiser *Prinz Adalbert* belonged to the imperial German navy. During the First World War, the ship first served in the North Sea and was then transferred to the Baltic Fleet. *Prinz Adalbert* was torpedoed twice during the war – in October 1915, so badly that the ship went down. One of the torpedoes hit the ship near its ammunition store. The explosion was incredibly powerful, blowing the cruiser up into two parts. Only three of the 675 crew members survived.

INFINITE AND FINITE

The Baltic Sea contains many thousands of wrecks and other remains. In this book, you have become acquainted with about a hundred of them. While the cultural heritage of the Baltic Sea is exceptionally rich and can seem almost endless, it is fragile. If a relic is destroyed it will never come back, and it is the volume and variety that create the nuances. Damage is often irreversible and the threats are numerous: looting, trawling, eutrophication, natural degradation and ignorance. The list can get quite long.

For a museum whose collections lie on the seafloor, preservation and sustainable use are of course essential. In addition to exploring and making accessible the cultural heritage at the bottom of the Baltic Sea, an important part of the museum's work also involves preserving it for the future. Most often, this is best done in cooperation with others.

AN EYE-OPENER

Like the Baltic Sea itself, the threat to its cultural heritage often knows no borders. In our experience, this is also true for the solutions. Because whether the aim is to end looting or to limit eutrophication, the key to success often lies in collaboration – among organisations, professions and the general public and across national borders. Here, at the intersection between different stakeholders – private and public – we believe that Vrak – Museum of Wrecks has a major role to play, as a partner, opinion leader and eye-opener.

One of the most significant lessons from the dive park projects we have been involved in is that accessibility and sustainable use of cultural heritage often provide the best protection. That knowledge, along with a feeling of inclusion, makes people care about and want

Off Nåttarö in the Stockholm archipelago lies a shipwreck sunk into the bottom sediment. It appears that it is completely untouched. Cargo and other objects likely remain. The chapter 'Mission: Maritime Archaeology' contains a 3D model of the wreck site. Details of the construction, such as the beams protruding through the hull sides, are reminiscent of medieval ships.

to protect cultural heritage. Simply put, if you have a relationship with something you're likely to safeguard it.

Our hope is that the museum will have a similar effect. By providing a place for encounters, research and experiences, it will strengthen people's engagement in discovering and protecting what is hidden beneath the surface. And through its exhibitions, events and digital offerings, it will help make the invisible visible and the unknown known.

A DEEP DIVE

An important part of Vrak – Museum of Wrecks also consists of the maritime archaeology work carried out by the museum as well as by other stakeholders in Sweden and around the Baltic Sea. Maritime archaeology offers a continuous supply of new knowledge and experiences to spark interaction in the museum's various channels, both analogue and digital.

Because if there's one thing we already know, it's that the journey does not end here, even if the book does. In fact, it has just begun. So take a deep breath and get ready for a deep dive into the history, past, present and future, of the Baltic Sea.

AUTHORS' PICKS

Under the Surface aims to deepen and expand the exhibitions in Vrak – Museum of Wrecks. Twenty-two authors, who in turn have drawn inspiration from wide-ranging research efforts, have contributed their expertise to this book. This section gives them the chance to tell about themselves and their research and to offer tips for learning more. Happy reading!

JR

THE STUDY OF SUNKEN HUMANITY

Johan Rönnby is professor of maritime archaeology at Södertörn University.

People have always used water, for fishing, irrigation, warfare, travel and shipping. For more than 30 years, Johan Rönnby has been a diver and researcher leading underwater archaeology projects on everything from prehistoric landscapes and Viking fortifications to large early-modern warships.

'Wherever people have lived and laboured, they have left traces behind. Through archaeology, we can learn not only about people from other times but ultimately about ourselves.'

JOHAN'S READING TIPS:

Adams, Jonathan & Rönnby, Johan (eds.) (2013). *Interpreting shipwrecks: maritime archaeological approaches*. Southampton: Highfield

Rönnby, Johan (2007). Maritime durées: long-term structures in the coastal landscape. *Journal of Maritime* Archaeology 2007:2. Southampton

Rönnby, Johan (ed.) (2019). *On war on board: archaeological and historical perspectives on early modern maritime violence and warfare*. Huddinge: Södertörns högskola

LM

FROM SHIP TO SHIPWRECK

Lotta Mejsholm holds a PhD in archaeology and has worked at Vrak – Museum of Wrecks.

Extreme weather, rough waters, war or deliberate sinking. There are many reasons why ships end up on the seabed as shipwrecks. Lotta Mejsholm is a researcher in both childhood archaeology and maritime archaeology, and has contributed to the exhibitions in Vrak – Museum of Wrecks.

'The shipwrecks at the bottom of the Baltic Sea are an invaluable source of knowledge, but they also provide insights that can't be experienced through reading alone. Like how devastating war can be. Such an insight came to me the first time I dived on a cargo ship that had been torpedoed.'

LOTTA'S READING TIPS:

Ericson Wolke, Lars & Hårdstedt, Martin (2009). *Svenska sjöslag*. Stockholm: Medström

Smirnov, Alexej (2002). *Svensk historia under vattnet: vrak i Östersjön berättar*. Stockholm: Wahlström & Widstrand

Wetterholm, Claes-Göran (2002). *Dödens hav: Östersjön 1945*. Stockholm: Prisma

BN

SEASCAPES

Björn Nilsson holds a PhD in archaeology and works at Lund University.

The anaerobic sediments in the Baltic Sea do not simply serve as archives for bones, antlers and flints. They also contain DNA residues that can tell us about life 10,000 years ago. Björn Nilsson is heading a project on flooded Stone Age landscapes called Blue Archaeology. A common thread that connects his research is the role of archaeology in various environmental sciences.

'Stone Age research in the Baltic Sea is still in its infancy. But with new methods, in the near future we'll be able to say more about the people, animals and plants that lived near the sea – both in its waters and above the surface.'

BJÖRN'S READING TIPS:

Bailey, Geoff N. et al. (eds.) (2020). *The archaeology of Europe's drowned landscapes*. Cham: SpringerOpen

Benjamin, Jonathan et al. (eds.) (2011). *Submerged prehistory*. Oxford: Oxbow Books

Hansson, Anton (2018). *Submerged landscapes in the Hanö Bay: early Holocene shoreline displacement and human environments in the southern Baltic Basin*. Diss. Lund: Lunds universitet, 2018

MF

TYBRIND VIG

Matilda Fredriksson is an osteoarchaeologist and has worked at Vrak – Museum of Wrecks.

Tybrind Vig is one of the first Stone Age settlements to be examined underwater. Matilda Fredriksson has studied the results carefully during her work on the exhibitions at Vrak – Museum of Wrecks. As an osteoarchaeologist, she has analysed bones from both the Viking Age site Birka and the ship *Mars* (1564).

'The Stone Age settlement in Tybrind Vig is fascinating. Hidden in the sediment are lots of well-preserved objects. And graves, which are particularly interesting for me as an osteoarchaeologist.'

MATILDA'S READING TIPS:

Andersen, Søren H. (2013). *Tybrind Vig: submerged Mesolithic settlements in Denmark*. Højbjerg: Jutland Archaeological Society

Pickard, Catriona & Bonsall, Clive (2007). Late Mesolithic coastal fishing practices: the evidence from Tybrind Vig, Denmark. In: Hårdh, B. et al. (eds.). *On the road: studies in honour of Lars Larsson*. Stockholm: Almqvist & Wiksell International

Uldum, Otto C. (2011). The excavation of a Mesolithic Double Burial from Tybrind Vig, Denmark. In: Benjamin, J. et al. (eds.). *Submerged prehistory*. Oxford: Oxbow Books

HA

IN BIRKA'S HARBOUR

Håkan Altrock is a maritime archaeologist at Vrak – Museum of Wrecks.

What was it really like to arrive at Birka's Viking Age harbour? Nobody currently knows. But if anyone can come close to an answer, it's Håkan Altrock. Altrock has previously worked as a craftsman guide at Birka and a carpenter at the Vasa Museum, and has both built and sailed replicas of Viking ships.

> *'The longest I've ever sailed is from Sigtuna to the Caspian Sea. The journey took place along the riverways of the ancient Gardarike and Serkland, the same trade routes that many of the merchants in Birka were familiar with.'*

HÅKAN'S READING TIPS:

Arbman, Holger (ed.) (1943). *Birka: Untersuchungen und Studien. 1 Die Gräber: Text*. Stockholm: Vitterhets-, historie- och antikvitetsakad.

Clarke, Helen & Ambrosiani, Björn (1993). *Vikingastäder*. Höganäs: Wiken

Olsson, Andreas (2017). *Maritima Birka: Arkeologisk rapport över marinarkeologiska undersökningar av kulturlager och pålanläggning i vattenområdet utanför Svarta jorden på Björkö 2004–2014*. Stockholm: Sjöhistoriska museet

JH

THE LOST NAVY

Jim Hansson is a maritime archaeologist at Vrak – Museum of Wrecks.

You know a day like that, when everything fits into place. This was the case for Jim Hansson in June 2017. The dimensions and details of the shipwreck, the tree-ring samples, the historical sources – everything. A perfect match.

> *'It was almost spooky when everything came together. The felling years, the shipyard books, Gustav II Adolf's trip to Riga, the grounding and repairs. The traces of what we can read about in the history books were there, in the scrapped ship on Skeppsholmen.'*

JIM'S READING TIPS:

Glete, Jan (2010). *Swedish naval administration, 1521–1721: resource flows and organisational capabilities*. Leiden: Brill

Hansson, Jim (2019). *Scepter: arkeologisk utredning och schaktningsövervakning*. Stockholm: Vrak – Museum of Wrecks

Koivikko, Minna (2017). *Recycling ships: maritime archaeology of the UNESCO World Heritage Site, Suomenlinna*. Diss. Helsingfors: Helsingfors universitet, 2017

PH

THE MIGHTY SHIPS

Patrik Höglund is a historian and maritime archaeologist at Vrak – Museum of Wrecks.

What was life like on a warship? Patrik Höglund specialises in the social conditions that prevailed aboard warships in the early modern era. There were a variety of groupings and people with different occupations and of different ages on these ships.

> *'A warship was a community in miniature that reflected its time. There was a kind of social bond on board that united the occupants, from admirals and captains to chefs, soldiers and seamen. All in small spaces.'*

PATRIK'S READING TIPS:

Draeseke, Trevor & Höglund, Patrik (2012). Dygden – a Chapman built ship of the line. *Skyllis: Zeitschrift für Unterwasserarchäologie*. Vol. 12

Hocker, Frederick M. (2011). *Vasa*. Stockholm: Medström

Lavery, Brian (2010). *Royal tars: the lower deck of the Royal Navy, 875–1850*. Annapolis, MD: Naval Institute Press

EW

SOLEN

Elżbieta Wróblewska is a historian and works at National Maritime Museum in Gdańsk.

The several thousand objects recovered during the excavation of *Solen* are today at the National Maritime Museum in Gdańsk, Poland. Elżbieta Wróblewska is manager for the project 'A monograph of the wreck of the warship Solen'. In cooperation with the Swedish Naval Museum in Karlskrona, she has previously helped produce the exhibition 'Skeppet Solen och drabbningen utanför Gdańsk 1627' about *Solen* and the Battle of Oliwa near Gdańsk.

> *'The objects from Solen give a nearly comprehensive picture of what the armament and equipment looked like on a warship in the first decades of the 17th century. They also provide unusually rich insight into the life of the crew.'*

ELŻBIETA'S READING TIPS:

Fenrych, Wiktor (ed.) (2001). *Akta i diariusz Królewskiej Komisji Okrętowej Zygmunta III z lat 1627–1628*. Gdańsk-Gdynia: Pracownia historii Wyższej Szkoły Morskiej

Koperkiewicz, Adam (1986). *Solen*. Gdańsk: CMM

Smolarek, Przemysław (1990). Wreck W-6. A Preliminary Report. In: Nadolski, A (ed.). *Fasciculi Archaeologiae Historicae. Fasciculus IV,* Wrocław-Warszawa-Kraków

PH

RESANDE MAN

Patrik Höglund is a historian and maritime archaeologist at Vrak – Museum of Wrecks.

In November 1660, the navy's warship *Resande Man* sank. The wreck is located in Stockholm's southern archipelago but also claims a central position in Vrak – Museum of Wrecks. Patrik Höglund, who has worked as a maritime archaeologist for over twenty years, has had a prominent role in arranging the exhibition.

> *'With the help of 3D technology and underwater videography, we have wanted to bring the wreck site into the museum. Or rather, take the visitor down to Resande Man.'*

PATRIK'S READING TIPS:

Einarsson, Lars (1997). Artefacts from the Kronan (1676): categories, preservation and social structure. In: Redknap, M. (ed.). *Artefacts from wrecks: dated assemblages from the late Middle Ages to the Industrial Revolution*. Oxford: Oxbow Books

Hansson, Jim & Höglund, Patrik (2019). *Resande Man: vård- och skyddsplan*. Stockholm: Vrak – Museum of Wrecks

Rönnby, Johan (ed.) (2019). *On war on board: archaeological and historical perspectives on early modern maritime violence and warfare*. Huddinge: Södertörns högskola

AM

A CENTURY OF CONFLICTS

Anna McWilliams is associate professor of archaeology and researcher at the Swedish Defence Research Agency.

The remains at the bottom of the Baltic Sea are important for our understanding of the conflicts of the 20th century. Anna McWilliams is a researcher in the field of contemporary archaeology and specialises in the material remains of conflict. A war can have many faces, and the traces of conflict can look very different depending on where you are.

> *'The remains at the bottom of the Baltic Sea help us to understand the parts of war we don't find in archives and other historical source materials.'*

ANNA'S READING TIPS:

Arnshav, Mirja & McWilliams, Anna (2015). *Stalins ubåtar: en arkeologisk undersökning av vraken efter S7 och SC-305*. Huddinge: Södertörns högskola

Grooss, Poul (2017). *The naval war in the Baltic 1939–1945*. Barnsley: Seaforth Publishing, a division of Pen & Sword Books Ltd

McWilliams, Anna (forthcoming). *Heritage in absentia*

MA

THE SEA OF ESCAPE

Mirja Arnshav holds a PhD in archaeology and is a research coordinator at the Swedish National Maritime and Transport Museums.

The 20th century has been called the era of war and escape. Along the Baltic Sea coast there are still traces of several of the boats that enabled people to flee. Mirja Arnshav has studied traces of escape over the Baltic Sea, both in the landscape and in people's memories.

> *'The marks left behind on the seafloor by those who fled are still largely unknown and unexplored. They embody a cultural heritage remaining for us maritime archaeologists to discover, one that has an important story to tell.'*

MIRJA'S READING TIPS:

Arnshav, Mirja (2020). *De små båtarna och den stora flykten: arkeologi i spåren av andra världskrigets baltiska flyktbåtar*. Diss. Stockholm: Stockholms universitet, 2020

Hammerman, Margareta (ed.) (2014). *Estlandssvenskarnas flykt över Östersjön: flyktberättelser och namnförteckning över anlända 1940–1945*. Stockholm: Svenska odlingens vänners förlag

Wetterholm, Claes-Göran (2002). *Dödens hav: Östersjön 1945*. Stockholm: Prisma

MR

U-479

Maili Roio is a maritime archaeologist at the National Heritage Board of Estonia.

World War II wrecks are complex remains at the intersection of environmental and cultural heritage. With the extensive introduction of heating oil in the beginning of the 20th century, the wrecks now pose a threat to the environment. Maili Roio is involved in managing Estonia's maritime cultural heritage and has extensive experience in maritime archaeology studies.

> *'The examination of U-479 was carried out in a project that was surveying environmentally hazardous wrecks. But the study has provided valuable archaeological knowledge, too. Now we know that the submarine most likely ran into a mine.'*

MAILI'S READING TIPS:

Arnshav, Mirja (2020). *De små båtarna och den stora flykten: arkeologi i spåren av andra världskrigets baltiska flyktbåtar*. Diss. Stockholm: Stockholms universitet, 2020

Krzyształowicz, Marek (2011). *Type VII. Germany's most successful U-boats*. Annapolis, Maryland: Naval Institute Press

Landquist, Hanna (2016). *Environmental risk assessment of shipwrecks: model development and application*. Diss. Göteborg: Chalmers tekniska högskola, 2016

AL

ANTI-SUBMARINE NETS

Andreas Linderoth holds a PhD in history and is a research coordinator at the Swedish National Maritime and Transport Museums.

Submarines and the introduction of this invisible weapon in the service of war in the early 20th century make fascinating topics. To defend against submarines, inventions like anti-submarine nets emerged. Such nets were used during the Cold War of the 1980s, when the Swedish navy received thousands of reports of suspected intrusions by foreign submarines. Andreas Linderoth studies naval history during the 19th and 20th centuries, with a focus on the Cold War.

> *'Submarine hunts of the 1980s were a clear reminder of the risk that Sweden could become involved in war, and they stirred up strong feelings of anxiety. Anti-submarine nets were deployed during submarine hunts near the coast to stop submarines from penetrating an area.'*

ANDREAS'S READING TIPS:

Bynander, Fredrik (2003). *The rise and fall of the submarine threat: threat politics and submarine intrusions in Sweden 1980–2002*. Diss. Uppsala: Uppsala universitet, 2003

Linderoth, Andreas (ed.) (2011). *Kriget som aldrig kom: 12 forskare om kalla kriget*. Karlskrona: Marinmuseum

Linderoth, Andreas (2014). En nedsänkbar torpedbåt: Svenska sjöofficerares syn på de första ubåtarna. *Historisk tidskrift 2014:3*

FH

BALTIC TRADE

Fred Hocker holds a PhD in archaeology and is director of research at the Vasa Museum.

The Baltic Sea has always been vital for trade and networks, and as a way out into the world. Fred Hocker is the director of research at the Vasa Museum and previously worked at Texas A&M University and the National Museum of Denmark. His research interests include the evolution of shipbuilding and shipping, the maritime economy and social structures on board.

> *'In terms of geography, the Baltic Sea is almost an inland sea. But when it comes to economic organisational structure, the sea looks more like a river flowing west.'*

FRED'S READING TIPS:

Hocker, Fred & Daly, Aoife (2006). Early cogs, Jutland boatbuilders and the connection between East and West before AD 1250. In: Blue, L. et al. (eds.). *Connected by the Sea*. Oxford: Oxbow

von Arbin, Staffan, et al. (forthcoming). Tracing trade routes: Examining the cargoes of the 15th-century Skaftö wreck. *International Journal of Nautical Archaeology*

Ossowski, Waldemar (ed.) (2014). *The copper ship: a medieval shipwreck and its cargo*. Gdańsk: Narodowe Muzeum Morskie

NMS

THE DARSS WRECK

Noelia Madrigal Sequeira is an archaeologist and student at the University of Münster.

What can cargo say about a ship? Noelia Madrigal Sequeira has asked that question during her studies of the Darss wreck. In the hold of this medieval ship were reindeer antlers, sulphur, raw materials for whetstones and much more.

'The hull and cargo of the Darss wreck are unusually well preserved for being located in the southern part of the Baltic Sea. They can tell us about the ship's construction and the sinking, as well as trade routes, production centres and the people on board.'

NOELIA'S READING TIPS:

Förster, Thomas (2003). Die „Darsser Kogge": der aktuelle Stand der archäologischen Untersuchungen. *Nachrichtenblatt Arbeitskreis Unterwasserarchäologie 10*

Mehler, Natascha (2011). Schiffe, Steine, Schlamm und Scherben: die Archäologie der Hanse. In: Graichen, G. et al. *Die deutsche Hanse: eine heimliche Supermacht.* 2. Aufl. Reinbek bei Hamburg: Rowohlt

Mehler, Natascha (2015). The Sulphur Trade of Iceland from the Viking Age to the End of the Hanseatic Period. In: Baug, I. et al. (eds.). *Nordic Middle Ages – artefacts, landscapes and society: essays in honor of Ingvild Øye on her 70th birthday.* Bergen: University of Bergen

JH

THE OSMUND WRECK

Jim Hansson is a maritime archaeologist at Vrak – Museum of Wrecks.

What's fun about maritime archaeology is the mix of knowledge that has been built up over a long period of time and the insight that new discoveries can quickly alter the playing field. The Osmund wreck is a good example.

'Before the shipwreck was discovered, you couldn't scrape together more than a single barrel of osmund iron despite scouring through every single museum storage space in Sweden. Now we have a ship with probably over thirty barrels and the potential to revolutionise research. Pretty amazing, actually.'

JIM'S READING TIPS:

Auer, Jens & Schmidt, Jens-Peter (2018). *The "Copper Wreck" medieval site, Ostsee VII, Mönchgut, Fpl. 92*

Ossowski, Waldemar (ed.) (2014). *The Copper Ship: a medieval shipwreck and its cargo.* Gdansk: Narodowe Muzeum Morskie

Wallander, Anders (2015). Osmundar i svenskt arkeologiskt material. *Järnet och Sveriges medeltida modernisering.* Stockholm: Jernkontoret

RA

VROUW MARIA

Riikka Alvik is a maritime archaeologist at the Finnish Heritage Agency.

The sheer variety of things a shipwreck can contain is what sparks Riikka Alvik's interest. Riikka was responsible for the archaeological research part of the project 'Vrouw Maria Underwater' and is now developing new interdisciplinary methods for analysing and interpreting the findings from shipwrecks.

> *'The research opportunities through wrecks like Vrouw Maria are enormous. The contents of the cargo bear witness to connections across the world.'*

RIIKKA'S READING TIPS:

Ahlström, Christian (1997). *Looking for leads: shipwrecks of the past revealed by contemporary documents and the archaeological record*. Helsinki: Suomalainen tiedeakatemia

Alvik, Riikka (2013). Things on board: the interpretation of three 18th century shipwrecks from the Gulf of Finland. In: Rönnby, J. & Adams, J. (eds.). *Interpreting shipwrecks: maritime archaeological approaches*. Southampton: Highfield

Gelderblom, Oscar (2003). Coping with the perils of the sea: the last voyage of Vrouw Maria in 1771. *International Journal of Maritime History, Vol. XV, No. 2*

NE

SUNKEN BUILDINGS OF THE BALTIC SEA

Niklas Eriksson is an associate professor of archaeology at Stockholm University.

In addition to being a type of craft, ships are also buildings that can give us insights into living spaces and everyday routines on board. Niklas Eriksson's research covers maritime archaeology and historical topics, usually with a focus on ship architecture.

> *'The well-preserved wrecks of the Baltic Sea provide fantastic opportunities to get a more intimate look at everyday life on board. Such aspects of the past are seldom revealed in other source materials.'*

NIKLAS'S READING TIPS:

Eriksson, Niklas (2014). *Urbanism under sail: an archaeology of fluit ships in early modern everyday life*. Diss. Huddinge: Södertörns högskola

Eriksson, Niklas (2017). *Riksäpplet: arkeologiska perspektiv på ett bortglömt regalskepp*. Lund: Nordic Academic Press

Eriksson, Niklas (2018). A new view of the 'Edesö wreck': identifying the Swedish naval vessel Bodekull, built 1659–1661 and sunk 1678 from written sources. *The International Journal of Nautical Archaeology, vol. 47.2*

MF

WITH STEAM AND GRAIN • MISSION: MARITIME ARCHAEOLOGY

Mikael Fredholm is a maritime archaeologist at Vrak – Museum of Wrecks.

The large steam engine and the two boilers on *Castlewood* make for an impressive sight. As a maritime archaeologist, Mikael Fredholm's tasks include everything from analysis of sonar data to dive surveys of ship remains.

> *'Visiting the three shipwrecks off Gotland was a great diving experience. It's also fun to have been able to provide more knowledge about what the steamships looked like and how they were loaded. Especially since we don't have any photographs or drawings.'*

MIKAEL'S READING TIPS:

Gardiner, Robert & Greenhill, Basil (eds.) (1993). *The advent of steam: the merchant steamship before 1900*. London: Conway Maritime

Griffiths, Denis (1997). *Steam at sea: two centuries of steam-powered ships*. London: Conway Maritime

Olsson, Carl-Gunnar (1996). *Svensk kustsjöfart 1840–1940: passagerar- och lastångfartyg i annonserad linjefart under 100 år: fartyg, rederier och linjer*. Stockholm: Föreningen Sveriges sjöfartsmuseum i Stockholm

HO

M/S ESTONIA

Hans-Lennart Ohlsson is senior advisor at the Swedish National Maritime and Transport Museums.

Hans-Lennart Ohlsson has worked at the Swedish National Maritime Museum in Stockholm for more than thirty years, both with the museum's collections and as museum director. When M/S *Estonia* sank in 1994, he was curator at the collections unit and was involved in receiving the bow visor in the museum's collections.

> *'Today, Estonia's bow visor is located at the Muskö naval base south of Stockholm. It is an important object, not only as a museum object and for the preservation of the memory of this unimaginable accident, but for the ongoing investigations into the shipwreck. Few museum objects are still relevant in this way more than 25 years after they were collected.'*

HANS-LENNART'S READING TIPS:

Laidwa, Hans (1982). Från konkurrens till samsegling: en återblick på Finlandstrafiken *Sjöfarten på Stockholm 1932–1982: Ångfartygs-befälhavare-sällskapet 1857-1982: minnesskrift vid sällskapets 125-årsjubileum*

Rinman, Thorsten (1990). *Rederiet: Johnson Line under 100 år*. Göteborg: Rinman & Lindén

Sjöström, Pär-Henrik (2009). *Vägen över havet: från pionjärer till marknadsledare*. Göteborg: Breakwater

SAN

MEMORIES OF A DISASTER

Susanna Allesson Nyberg is an archaeologist and curator at the Swedish National Maritime Museum in Stockholm.

Susanna Allesson Nyberg worked at the Maritime Museum when M/S *Estonia* sank in 1994, and has been part of shaping the museum's relationship to the disaster. The Maritime Museum's collections contain objects and stories from the ship and the night of the shipwreck.

> *'It's difficult, but it's also important. These objects help us remember a disaster that has affected us deeply and that extends beyond national borders.'*

SUSANNA'S READING TIPS:

Nystrand von Unge, Elin (2019). *Samla samtid: insamlingspraktiker och temporalitet på kulturhistoriska museer i Sverige*. Diss. Stockholm: Stockholms universitet, 2019

Silvén, Eva & Björklund, Anders (eds.) (2006). *Svåra saker: ting och berättelser som upprör och berör*. Stockholm: Nordiska museets förlag

Sjöhistoriska museet (2010). *100 ting ur samlingarna/100 objects from our collections*. Stockholm: Föreningen Sveriges sjöfartsmuseum i Stockholm

MA

MISSION: MARITIME ARCHAEOLOGY

Marco Alí is a maritime archaeologist at Vrak – Museum of Wrecks.

Underwater archaeology has its own special conditions and often requires different methods than those used on land to find, investigate and document remains. In addition to archaeology and history, Marco Alí is passionate about digital documentation techniques.

> *'I've thought a lot about how, as a maritime archaeologist, I can benefit from the rapid development of technology both as a diving archaeologist and in my work with the museum Vrak – Museum of Wrecks.'*

MARCO'S READING TIPS:

Adams, Jonathan (2010). *A maritime archaeology of ships: innovation and social change in late medieval and early modern Europe*. Oxford: Oxbow

Muckelroy, Keith (1978). *Maritime archaeology*. Cambridge: Cambridge U.P.

Unger, Richard W. (1980). *The ship in medieval economy 600–1600*. London: Croom Helm

PF

DIVING EXPERIENCES

Pernilla Flyg is an archaeologist at Vrak – Museum of Wrecks.

How do you make maritime heritage accessible to more people? This is a question that Pernilla Flyg has long asked herself. The key, she thinks, is to try and see it all with someone else's eyes, someone who does not know what lies beneath the surface of the Baltic Sea.

> *'Here, my experience as an entrepreneur in the private sector has been important. It's made it easy for me to take an outside perspective – a clear advantage when it comes to attracting people to something that is often both unknown and invisible.'*

PERNILLA'S READING TIPS:

Flyg, Pernilla (ed.) (2019). *Creating a dive park – from idea to reality.* Stockholm: Statens maritima och transporthistoriska museer

Roio, Maili (ed.) (2013). *Shipwreck heritage: digitizing and opening access to maritime history sources.* Tallinn: Muinsuskaitseamet

Roio, Maili & Siitan, Kersti (eds.) (2019). *Baltic history beneath surface.* Tallinn: National Heritage Board of Estonia

GE

ENVIRONMENTALLY HAZARDOUS WRECKS

Göran Ekberg is a maritime archaeologist at Vrak – Museum of Wrecks.

Although shipwrecks can be amazing sights, they can also cause damage to animals and nature. Göran Ekberg has worked as a maritime archaeologist for over 30 years and has taken part in several surveys and investigations. Since 2009, some of these have involved environmentally hazardous wrecks.

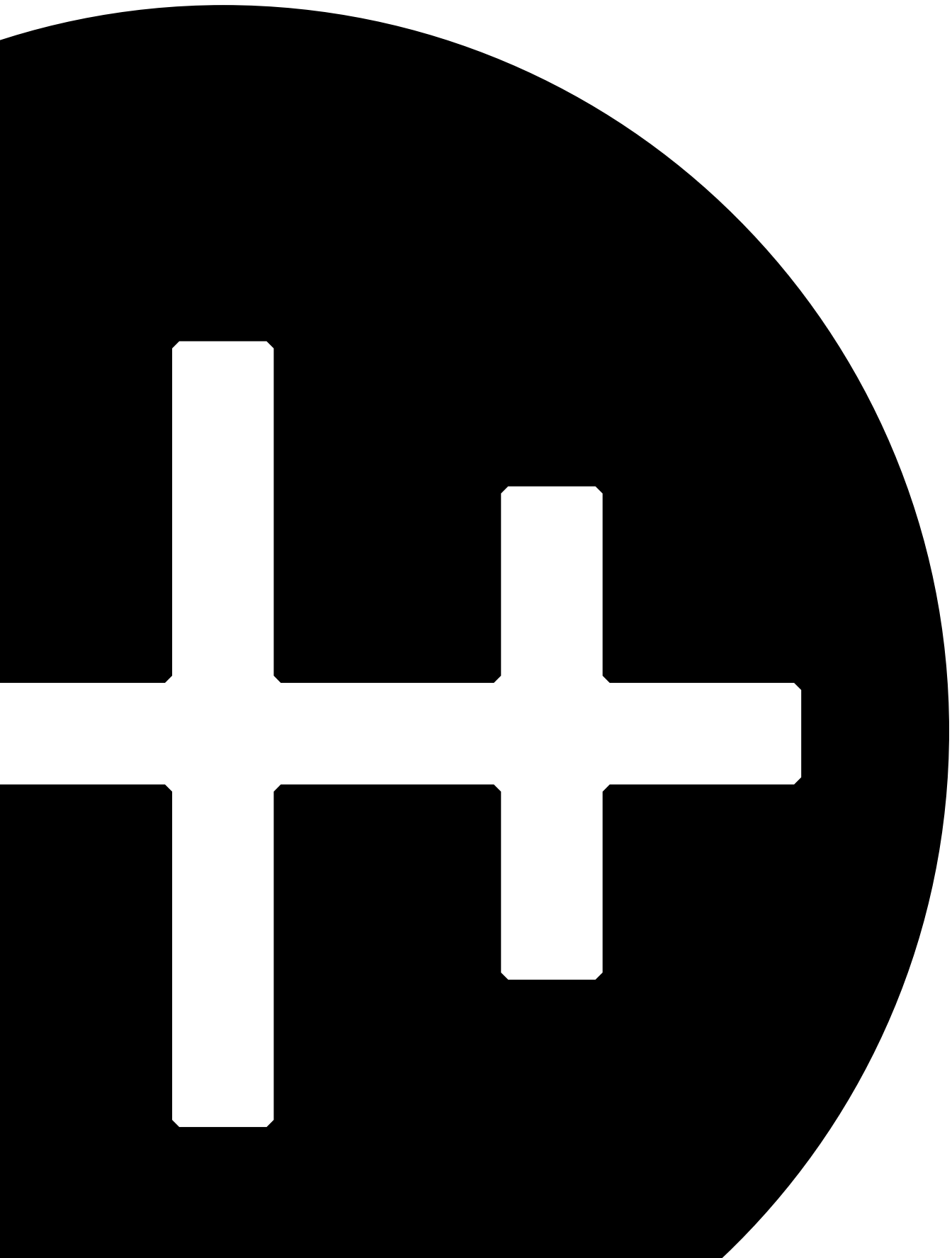
> *'When I started out as a maritime archaeologist, environmentally hazardous wrecks weren't something that was talked about very much. Then came the investigation of Skytteren. Today, environmentally hazardous wrecks are part of the increasingly intense fight against environmental degradation.'*

GÖRAN'S READING TIPS:

Arison III, Lindsey H. (2013). *European disposal operations – The sea disposal of chemical weapons*

Sjöfartsverket (2011). *Miljörisker från fartygsvrak*

Sjöfartsverket (2014 and 2015). *Miljörisker sjunkna vrak I och II. Undersökningsmetoder och miljöaspekter*



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VROUW MARIA

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FROM SHIP TO SHIPWRECK

P. 26. 'He drowned in the Holm Sea [...] were only three." U 214, Upplands Runinskrifter 214.

P. 28. 'The Danes could [...] for six hours.' From Gyldenstierne, Axel, The History of the Nordic Seven Years' War, which has been accredited to Gyldenstjerne. In: Rördam, Holger (1875). Monumenta Historiae Danicae, Historiske Kildeskrifter og Bearbejdelser af Dansk Histoire især fra det 16. Aarhundrede, 1 r. 2 vol. Copenhagen, pp. 356–359. Translated into English from a translation to Swedish in HUMA 2010:38; HUMA.

THE LOST NAVY

P. 70. 'The ship Scepter [...] covered in fabrics ...' English translation of quote in Hand, Johan (ed.) (1879). Historiska handlingar D. 8, Nr 3, Johan Hands dagbok under k. Gustaf II Adolfs resa till Tyskland 1620. Stockholm: Samf. p. 4.

THE MIGHTY SHIPS

P. 80. '... by firing the length of its ship ...' Flemings instruktion 1628. In: Sveriges sjökrig: 1611–1632. (1937). Stockholm: Marinstaben, appx. 8, pp. 264–268.

P. 81. 'The Dutch no longer board as they used to...' English translation of quote from Kommissorialrättens protokoll angående sjöstriderna 1676. In: Lundgren, Kurt (2001). Sjöslaget vid Öland: vittnesmål - dokument 1676–1677. Kalmar: Lingstad bok & bild, pp. 196–197.

RESANDE MAN

P. 93. 'On the 18th [...] name was Resande Man ...' English translation of quote freely translated from Theatrum Europaeum: 1660:2 – 1665, Teil IX. p. 82.

P. 97. 'Because he could no longer [...] join her in death.' English translation of quote from Theatrum Europaeum: 1660:2– 1665, Teil IX. p. 83.

P. 97. 'Then secretary Bjugg [...] 37 people disappeared ...' English translation of quote from Det odelade kansliet. Rådsprotokoll, Huvudserie, SE/RA/1111/A1/32d (30/9–19/12 1660), Image ID: R0001562_00304. Riksrådets protokoll 26/11 1660.

THE SEA OF ESCAPE

P. 115. 'Stowed in the hold [...] the little ones.' English translation of quote from Ortmark Stymne, Sinikka (ed.) (2003). Krigsbarns erinran: snäll, lydig och tacksam. Stockholm: SinOA, p. 76.

P 117ff. Lindström, Lars Algot, interview, 15 November 2017.

ANTI-SUBMARINE NETS

P. 134. 'On the bridges [...] below the water.' English translation of quote from Blekinge Läns Tidning, 13 February 1984.

P. 134. 'many were also worried – very worried.' English translation of quote from Blekinge Läns Tidning, 15 February 1984.

P. 134. 'It was rumoured that soldiers [...] who might not even exist.' English translation of quote from Sydöstran, 27 February 1984.

P. 135. ‘if we summarise […] in our own waters.’ English translation of quote from Blekinge Läns Tidning, 21 February 1984.
P. 135. ‘We’ve got used to it and barely react anymore.’ English translation of quote from Blekinge Läns Tidning, 25 February 1984.
P. 135. ‘I am getting used […] really hard.’ English translation of quote from Sydöstran, 29 February 1984.

THE OSMUND WRECK

P. 162. ‘owed the church and bishop 30 osmunds.’ English translation of quote in Wallander, Anders (2015). Osmundar i svenskt arkeologiskt material. In: Järnet och Sveriges medeltida modernisering. Stockholm: Jernkontoret, p. 124.

MEMORIES OF A DISASTER

P. 201ff. Swedish National Maritime Museum (archives), Estoniadokumentationen (the Estonia documentation).

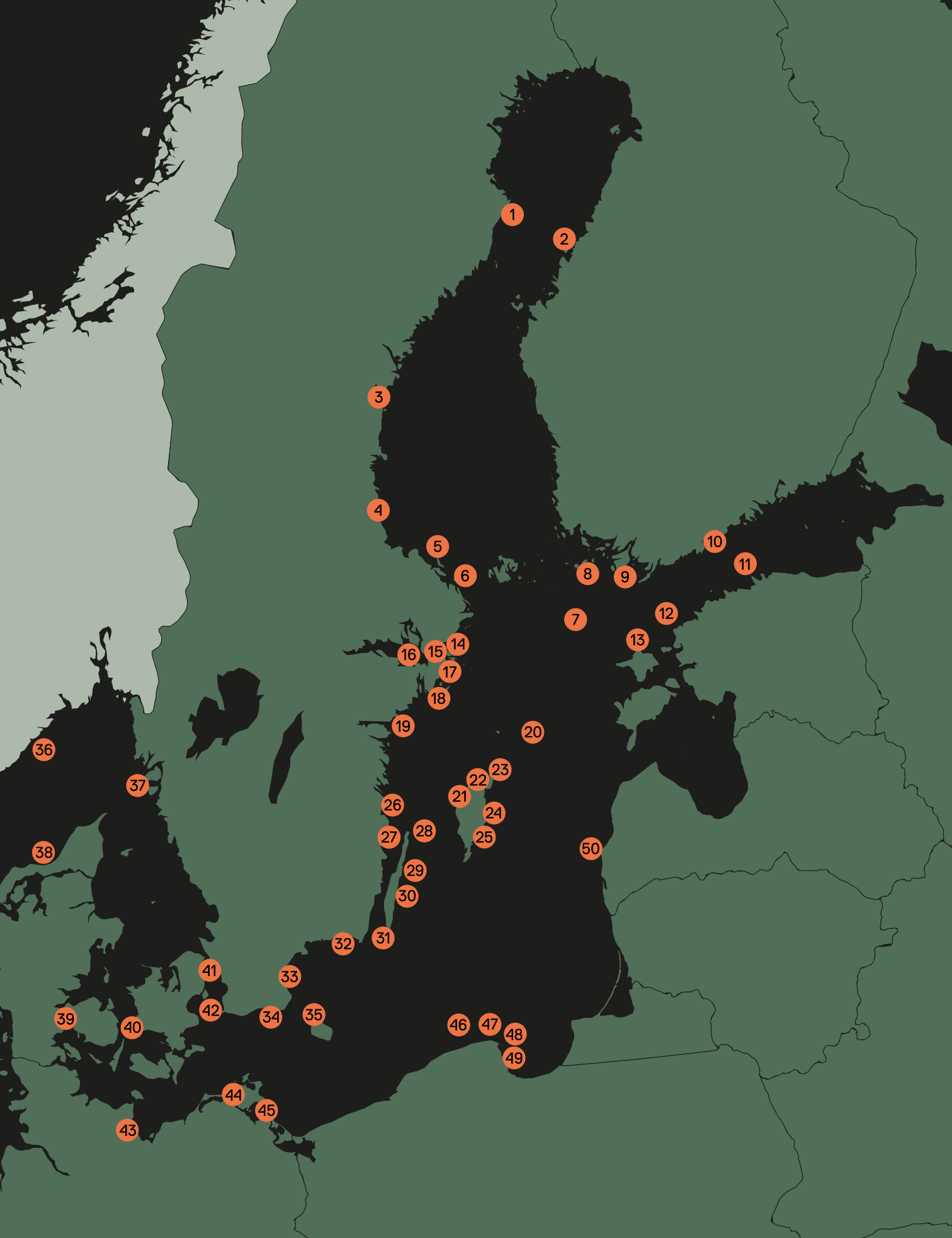
SITE MAP

1. *Robur II*
2. *Wellamo*
3. *Jehu* and shipwrecks in Tunadal
4. Shipwrecks in Axmar
5. *Cedric*, *Gerda Ferdinand* and *Köln*
6. *Som*
7. *Estonia*
8. *Vrouw Maria*
9. Garpen 1
10. *Kronprins Gustaf Adolf* and shipwrecks in Suomenlinna
11. The gauntlet in the gulf of Finland/the Tallinn disaster
12. *U-479*
13. *E. Russ*
14. Shipwrecks in Vaxholm, Oxdjupet included
15. *Vasa*, *Scepter* and shipwrecks in the waters around Skeppsholmen and Kastellholmen in Stockholm
16. Birka
17. *Anna Maria*, The Dalarö wreck/*Bodekull*, the Fula gubben wreck, the Jutholmen wreck, the Kuggmaren cog, the Osmund wreck, *Riksäpplet* and Gålö
18. The Nåttarö wreck and *Resande Man*
19. *Lindesnäs* and *Margareta*
20. The DC-3 and fluit ship east of Gotska Sandön (the Spökskeppet wreck)
21. The disaster 1566 and *Hansa*
22. Bulverket
23. *Vulcan*
24. *Princess* and the shipwreck in Sjaustru
25. *Castlewood*
26. *Luleå*
27. B-17/*Clay Pigeons*
28. *Mars*
29. *Finnbirch*
30. *Ada Gorthon*, *Kronan* and *Svärdet*
31. *Director Reppenhagen*, *Gutrune*, *Nicomedia* and *Walter Leonhardt*
32. *Gribshunden* and shipwrecks in Karlskrona, Djupasund and Smörasken included
33. Haväng
34. *Hoheneichen*, *Sandön* and presumed 18th-century shipwreck off Ystad
35. *Fu Shan Hai*
36. Shipwrecks off Arendal
37. The Skaftö wreck, *Skytteren*, *Thetis* and shipwrecks off Måseskär, *Berlin* and *Gnom* included
38. The Kollerup cog
39. Tybrind Vig
40. Trudse Hage
41. *Dykkeren*
42. Shipwrecks in Foteviken
43. *Cap Arcona*
44. The Darss wreck
45. The Mönchgut 92 wreck
46. *Wilhelm Gustloff*
47. *General von Steuben*
48. *Goya*
49. The Copper wreck (W5), *Solen* and *Sten Sture*
50. *Prinz Adalbert*

Each mark on the map can indicate multiple remains, and the positions are approximate.

MORE REMAINS

Throughout the ages, the Baltic Sea has enabled people to travel and make contact. The sea is like a cultural heritage treasure chest whose unique environment allows for the preservation of shipwrecks and other remains. To discover more remains and learn more, visit the museum's website at vrak.se.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