

Ole Crumlin-Pedersen

Archaeology and the Sea in Scandinavia and Britain

A personal account

Roskilde 2010



Ole Crumlin-Pedersen
Archaeology and the Sea in Scandinavia and Britain
A personal account

This book is Volume 3 in the series *Maritime Culture of the North*
Published by the Viking Ship Museum in Roskilde
Anonymously and externally peer-reviewed
Series editor: Anton Englert
Book design, DTP and English language consultant: Athena Trakadas
Picture editor: Rikke Johannsen
Cover design: Mette Kryger

Copyright © 2010 by the Viking Ship Museum and the author
All rights reserved

Printed in Denmark by Special-Trykkeriet Viborg A/S
Printed on acid-free paper

ISBN 978-87-85180-05-6

Published with support from:

Dronning Margrethes og Prins Henriks Fond
Nordea-fonden NORDEA
FONDEN
Konsul George Jorck og Hustru Emma Jorck's Fond
Knud Højgaards Fond
Velux Fonden

Publications by
the Viking Ship Museum
Vindeboder 12
DK-4000 Roskilde, Denmark

Viking Ship Museum books can be ordered online via:
www.vikingshipmuseum.dk or www.oxbowbooks.com

Front cover: Beach market with reconstructed Viking ships on the east coast of Jutland, at Moesgård near Aarhus.
Photo: Ole Crumlin-Pedersen, August 1974.

I. Studying the archaeology of maritime cultures

The ship as an archaeological object

A ship is a complex technical object – but also much more than that. Just like a modern high-tech ship or a space craft, an ancient ship was a functional unit at the cutting edge of contemporary technology. Thus a ship of the past reflects several aspects of the society for which it was built.

One of these aspects is the aspirations underlying the construction of a ship. Were these simply utilitarian objects used to facilitate transport of men and cargo, or for fishing and hunting sea life, or was the main aim of the construction of particular vessels the desire to display status or military strength, or to serve as a vehicle for making elite contacts?

The construction of a ship was a major undertaking for the people involved, and it could not be undertaken unless a series of conditions were fulfilled. These included the availability of know-how and skilled craftsmen, of materials such as timber, iron, tar, ropes and sailcloth, and not the least the existence of an adequately organised population in social and military terms.

In this book, a number of examples will be given of ship-finds for which these conditions have been studied in detail and in a broad context.

Studying maritime archaeology

In order to undertake qualified analyses of finds of boats and ships, a proper base in archaeology and history of the relevant period is needed, as well as specialist knowledge regarding wood technology, craftsmanship and

tools, boatbuilding, seamanship and performance, and navigation.

However, maritime archaeology covers much more than just ships, since maritime aspects are integrated in several topics within past cultures of the North, here presented briefly as keywords to be covered in some detail in the next chapters:

- Technology
- Transport
- Trade
- Warfare
- Nutrition
- Social structure
- Cult

In relation to land-based, maritime-oriented activities, archaeological study draws on specialist knowledge of climate, hydrography, coastal morphology, as well as on general archaeological subjects such as trade and exchange, urbanisation etc.

In this case as well as for underwater excavations, such finds will have to be studied and published in a process involving specialists from several fields, illustrating the point that archaeology is too important a subject to be left in the hands of traditional land archaeologists alone.

What defines a 'maritime culture'?

When studying the archaeology of maritime aspects of Iron Age and medieval Scandinavia and Britain, some of the basic preconditions for the existence of a 'maritime culture' need to be identified. In a majority of cases these include:

- Easy access to the sea by river or over the coast

- Dependence on the transport of goods and people by boat
- Dependence on fishing and hunting aquatic animals

Here, the terms 'maritime' and 'terrestrial' in relation to cultures are used in order to distinguish between the different approaches of archaeologists. However, one should note that in the past most coastal societies were based on aspects of both environments.

It is worth noting that in the North, the study of archaeology within the late prehistoric and medieval periods started with an emphasis on monuments, fortifications, graves and sacrificial sites, only later to be followed by investigations of rural and urban settlements. It was not until the later part of the 20th century that focus in the present regions was directed upon coastal settlements, central places, wetland sites, navigational barriers, and ships and boats.

The potential of waterlogged sites

For waterlogged sites, the conditions for the preservation of organic materials are often exceptionally good, whether in wetlands or in the seabed, where archaeologists potentially may find considerable quantities of organic objects. Wood and fibres were the most common materials used in past societies, and they are seldom preserved on dry-land sites. This also offers an opportunity for sophisticated natural science analyses of the objects as well as of the environmental context. This is not the least case in regards to underwater sites. They have much to offer, including the 'time capsules' of shipwrecks that in themselves provide unique possibilities to date a wide selection of objects and to study long-distance contacts on the basis of very concrete archaeological evidence from a closed-context find.

Working under water is technically difficult, but maritime archaeology projects must be seen as part of mainstream archaeologi-

cal studies and integrated into these, an approach which has not always been the case in the past. With this background, 'underwater archaeology' is an unfortunate term which should be avoided, since terms like 'mountain archaeology' or 'desert archaeology' for research carried out under those other conditions are avoided for good reasons. In our case it is just archaeology under water!

Considering the rich potential of archaeological evidence in the coastal zones and under water it is worthwhile to consider the preconditions for furthering a national or international research programme in maritime archaeology. Apart from appropriate funding which may be the worst hurdle to overcome, relevant sources for the study and a research tradition to follow or to react against is required. A multifaceted team of researchers, ready to meet the challenge of coping with many technical and physically demanding tasks without losing sight of the research aims and the strategy, is also needed. Qualification as a SCUBA diver alone is not enough, nor is just a degree in archaeology. The members of the team, archaeologists, technicians and volunteers alike, must be able to free themselves from a standard land-based approach and choose the methods best suited under the given conditions to document and analyse the site appropriately. They should not forget to study their sites, whether or not they include ships or boats, as parts of the maritime cultural landscape as is described with a few examples in Chapter 5.

The seafarer's geographical framework

With access to satellite photos of all parts of the globe it is easy today to get an overall impression of the topographical features for any chosen site. Even for an area as large as Europe it may be helpful to use such illustrations to identify features of specific interest, such as the 'maritimity' of certain parts of



Fig. 1.1. Satellite-based map of Europe, illustrating the maritime orientation of Scandinavia, as well as of the Atlantic and the Mediterranean regions. Image: PlanetObserver. Design © 2009 scanmaps.dk.

Fig. 1.2. Maritime regions of Northern and Northwestern Europe. A: the Baltic Sea region, B: the North Sea region, C: the northern Atlantic seaboard.



Europe compared to the more 'landlocked' position of other parts (Fig. 1.1). In this case, southern Scandinavia stands out as a maritime focal point and a threshold between the Baltic and North Seas, not unlike the position of ancient Greece between the Black Sea and the eastern Mediterranean. Britain clearly has had close links to the French coast and further south, and it was well positioned to play a role in the trans-oceanic expansion, following seafarers from Portugal, Spain and the Netherlands on the Seven Seas since the 16th century.

The natural conditions of the seas surrounding Northern and Northwestern Europe separate these into three areas of widely differing nature (Fig. 1.2):

A: The Baltic Sea region. The virtually non-tidal and enclosed Baltic basin stretches from the narrow and shallow inner Danish waters to the Gulf of Bothnia and the Bay of Finland to the east. The major rivers of Eastern and Central Europe transport considerable quantities of sediment into the Baltic and these are deposited along the southern and eastern coasts. Salinity is low, especially in the eastern part.

B: The North Sea region. The tidal and relatively exposed North Sea basin is open to oceanic waves and storms from northerly directions, whereas the southern part of the basin is shallow and less exposed. Here, the major rivers of Northwestern and Central Europe flow through wide estuaries into the basin, causing extensive sedimentation.

C: The northern Atlantic seaboard. This long coastline is exposed to strong winds and ocean swell. The coasts are generally rocky and indented with several fjords/firths and coastal islands, as well as estuaries with a strong tidal impact.

When studying the development of pre-historic local seafaring in these particular coastal regions, a number of different coastal sectors may be identified, each with relatively identical natural conditions within its borders (Fig. 1.3):

Sector A1: The Eastern Route. This region stretches from Swedish Lake Mälaren to the Stockholm and Åland archipelagos and along the southern coast of Finland to Lake Ladoga in Russia with connections via large rivers south and east. This route, primarily inshore and along rivers with occasional portages, was used for trade and other contacts between the Baltic and the Black Sea region from the prehistoric to early medieval periods.

Sector A2: The Islands of Seafarers. The mid-Baltic islands of Gotland, Öland and Bornholm were inhabited throughout prehistory, and their populations were in contact with the present Swedish mainland and the coasts to the south and east. There are no navigable rivers on the islands, and seafaring entailed sailing from beaches and havens along the relatively exposed coasts.

Sector A3: The Gateway to Eastern Central Europe. The southern Baltic coast, east of Rügen Island, is a low-lying moraine plateau with the beds of the Oder and Vistula Rivers forming large estuarine deltas, and a strong coastal sediment transport that forms spits and sandbars in front of bays and river outlets. Within this sector, the large rivers offer ideal navigational opportunities for contact between the Baltic Sea and Central Europe.

Sector A4: The Central Gateway between East and West. The Danish archipelago and the neighbouring coasts on all sides are characterised by several reefs and shallows that present navigational hazards to larger ships. There are few navigable rivers but countless well protected fjords, bays and gently sloping beaches, ideal for beach-based boatmanship. In this sector, all communication between the islands and the surrounding mainland was by boat since the Mesolithic period. At the same time, this region served as a stepping stone for long-distance communication between the Scandinavian Peninsula and Central Europe, and all maritime contacts between the Baltic and the North Sea had to pass through these narrow waters, as they still do.



Fig. 1.3. The main maritime coastal zones. A1: the Eastern Route, A2: the Islands of Seafarers, A3: the Gateway to Eastern Central Europe, A4: the Central Gateway between East and West, B1: the Gateway to Western Central Europe, B/C: the English Channel Region, C1: the Western-most Outposts, C2: the Northern Way.

Sector B1: The Gateway to Western Central Europe. In the past, the coast from southwestern Jutland over the German North Sea coast to the maritime regions of the Netherlands and Belgium was continuously under transformation. The rivers here transport huge quantities of sediment from Central Europe into the North Sea. Silt and sand is transported along the coast and re-deposited along the shore and on tidal flats. Today, the effects of these factors have been reduced by the building of dykes, and large land reclamation schemes have changed the geography of the region entirely.¹

Sector B-C: The English Channel Region. The coasts of northern France as well as those of England and Wales represent a link between the North Sea and Atlantic regions, and have common features in coastal configuration, strong tides, and exposure to the open sea.² The indented coastlines and the estuaries of local rivers provide harbouring possibilities for vessels maintaining contacts

1. Kossack *et al.* (eds) 1984, 1: 51-82; Reinders 1999.
2. McGrail 1997a: 10.1.

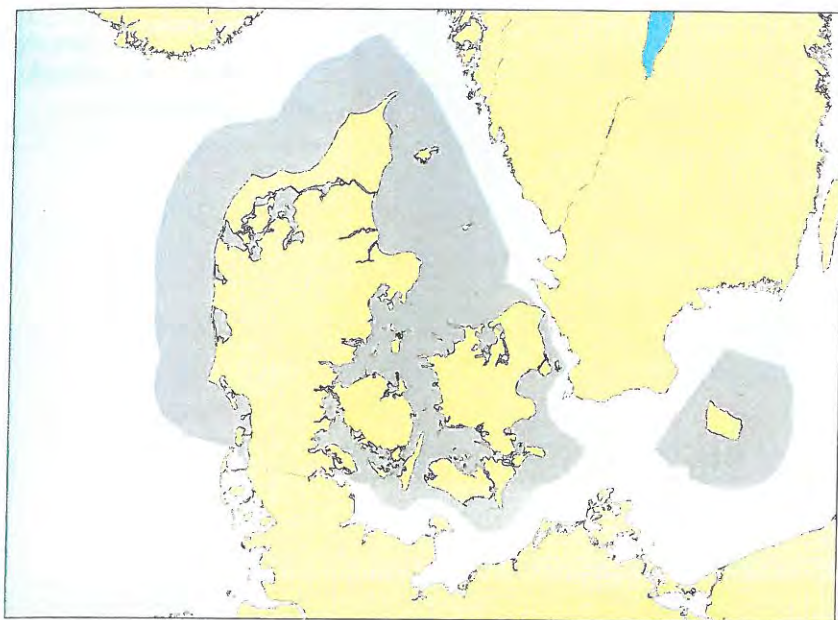
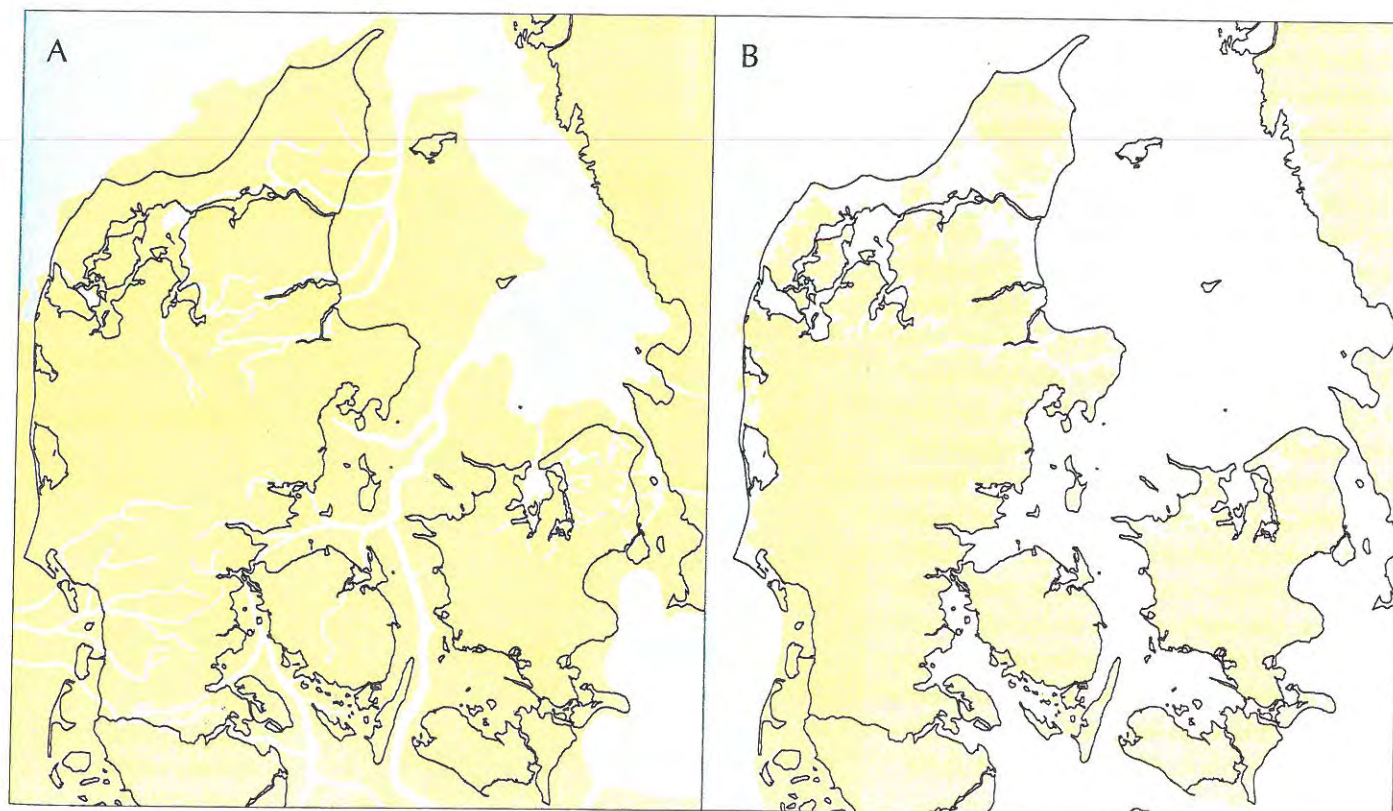


Fig. 1.4. The underwater heritage protection area of Denmark (shaded).

Fig. 1.5. Changes in the Danish coastline are evident: compare the present-day coastline to that of ca 6500 BC (A) and 4500 BC (B). After Helleesen & Tuxen (eds) 1988.



locally as well as across the sea, and the rivers give access to the interior of England and France.

Sector C1: The Western-most Outposts. The coasts of Ireland and Scotland are strongly exposed to North Atlantic weather conditions. Many parts of the rugged coastal landscape have no foreshore. In some of the narrow creeks only light boats that can be easily pulled out at high tide can be used. Some parts of the sector, however, offer themselves to regular shipping from firths and river estuaries.

Sector C2: The Northern Way. The western coast of Norway constitutes a continuous rugged coastline with deeply indented fjords and several small coastal islands. The name Norway ('the way to the North') is a striking demonstration of the fact that in the past, practically all settlements here were oriented towards the sea with maritime transport as a prerequisite for contact and communication, internally as well as externally.

The Danish scene: submarine Stone Age

Taking the Danish scene as a starting point, it is interesting to note that the total heritage protection area of Denmark is in fact twice as large as the present terrestrial area of the country. This is due to the fact that the underwater area under Danish jurisdiction equals the dry land area (Fig. 1.4). Against this background it is evident that there is a need to provide sufficient resources within the Danish archaeological establishment to cope with the numerous challenges of maritime archaeology.

The geological formation processes which shaped the Danish landscape since the Ice Age, ending ca 10,000 BC, present an important clue to the submerged archaeological sites in Danish waters, and they highlight the relativity of modern coastlines. The changes in the coastal configuration during the period 6500-4500 BC (Fig. 1.5) indicate that most of the settlement sites of the early periods are now lying below the present sea level, since people were primarily living along the coast and inland waters in order to avoid the dense primeval forest covering the land.³

Consequently there is quite a huge archaeological potential in locating Stone-Age sites in Danish waters. In the waters south-east of the island of Funen, about 60 submerged Mesolithic sites have been located (Fig. 1.6). A few of these have been thoroughly excavated, for instance at Tybrind Vig, where an Ertebølle-culture site has yielded a series of marvellous finds, including logboats, carved, ornamental paddle blades (Fig. 1.7) and even textiles manufactured from bast fibres.⁴ Fish hooks, harpoons and eel spear prongs are also found in many other areas (Fig. 1.8), including the Dogger Bank site in the North Sea, which illustrates that Doggerland formed a land bridge between Denmark and England until the 7th millennium BC.

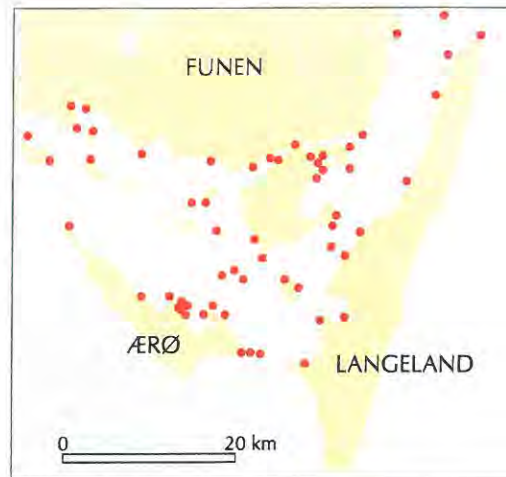


Fig. 1.6. Submerged Mesolithic sites found in the waters south-east of Funen. After Jensen 2001.

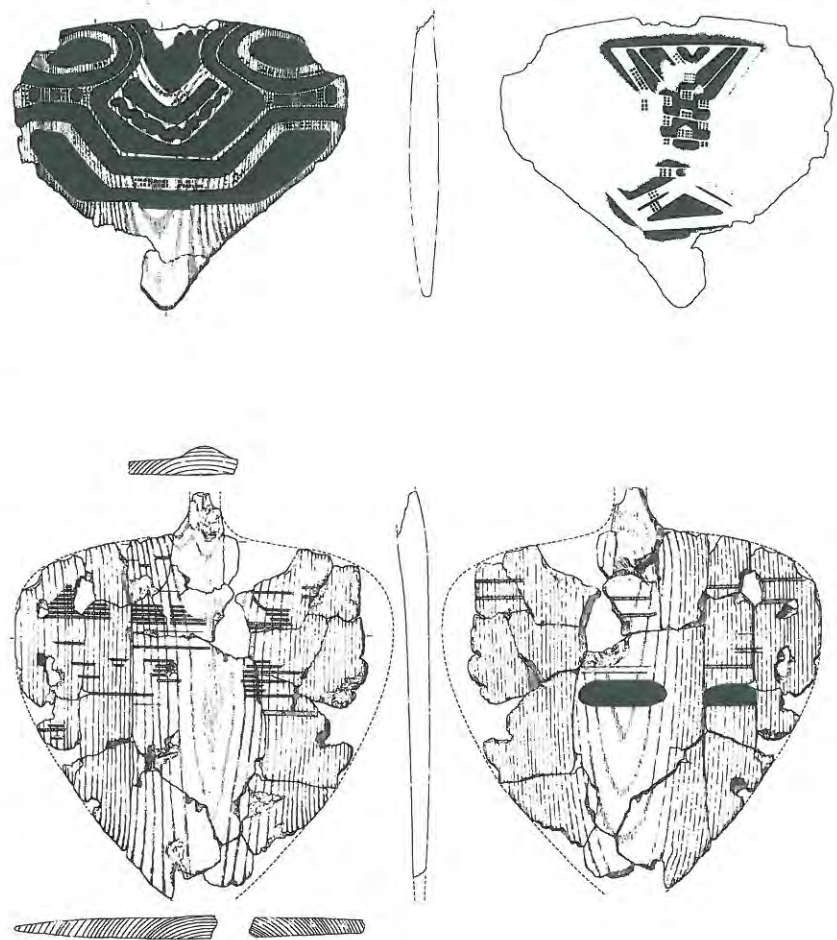


Fig. 1.7. Ornamental paddle blades from the Ertebølle site Tybrind Vig. After Andersen 1987.

- 3. Jensen 2001.
- 4. Andersen 1987.
- 5. Lemée 2006.

Fig. 1.8. Mesolithic harpoons and fish hooks found in Danish waters. Photo: L. Larsen, National Museum of Denmark.

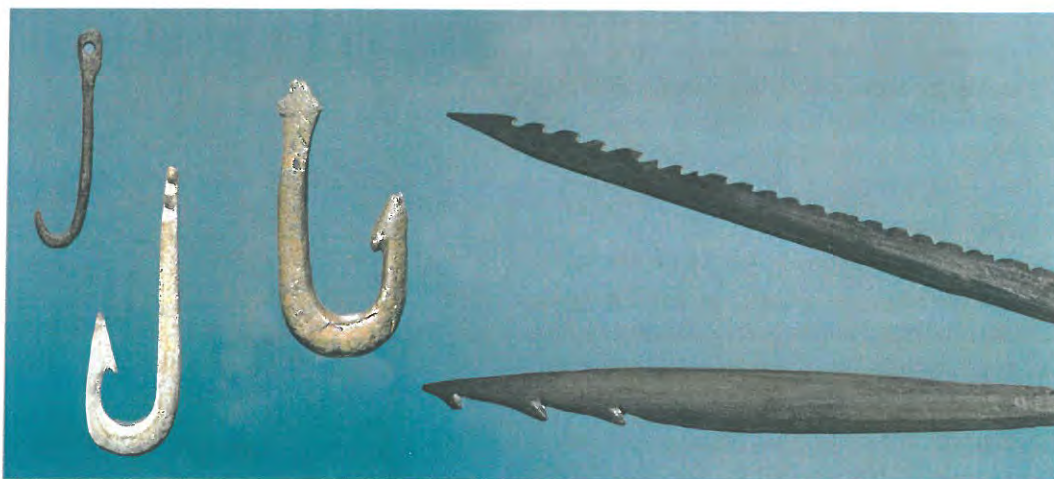
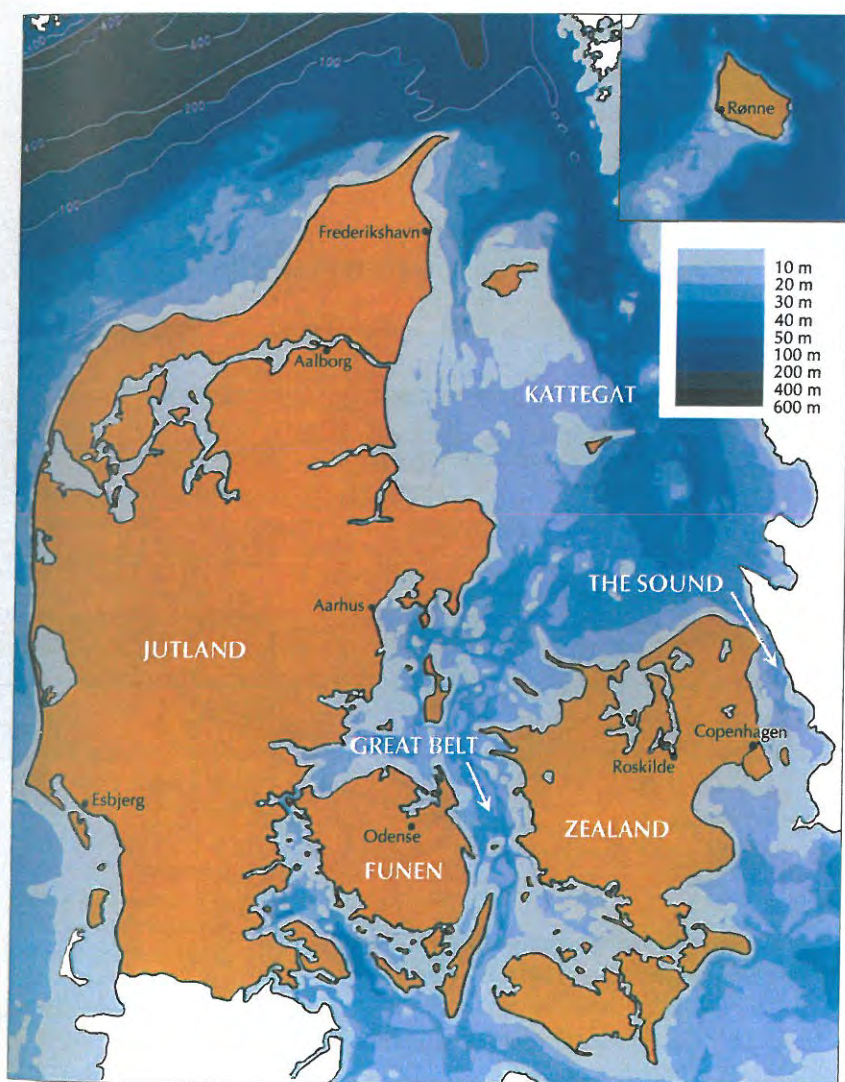


Fig. 1.9. Hydrographical map of Danish waters. After Danmarks Natur 3.



Hydrography and shipping lanes

During the subsequent periods, Danish waters have held the position of that of a narrow gateway between the Baltic and North Sea basins, as well as between Scandinavia and Central Europe. The shipping lanes leading through the Sound and Great Belt were dangerous to follow for navigators who were used to sailing on the open seas, and since the Middle Ages thousands of ships did not make the passage but ended up as wrecks here.

Practically all parts of Danish waters (Fig. 1.9) are shallow enough to allow ordinary diving. Thus they are open to archaeological investigation, and the positions of hundreds of wrecks are known. During some forty years of activities within this field I have primarily concentrated my own work on finds of ships of the 10th-14th centuries, mostly found along the coast or in silted-up bays and harbours. But several wrecks of ships from the 15th century onwards are found in harbours as well as in the open sea, and even a number of Iron-Age and Viking-Age vessels on land in sacrificial bogs and burial mounds have been studied intensely by Danish archaeologists. Some of these finds, especially the early ones, will be described in the next chapters.

Maritime archaeology also has a great potential in Britain and Ireland for studies at the local, regional, and international level, as demonstrated by finds ranging from Bronze-Age boats⁶ to the large Newport cargoship of the mid 15th century⁷ and the warship *Mary Rose*, which sank in 1545.⁸

In Scotland, one would expect to find further evidence relating to the Viking-Age northern contacts between Scandinavia, Britain and Ireland⁹ (Fig. 1.10), as well as traces of maritime activities during other periods of history. For southern England, the contact zone included the North Sea and Channel coasts, with access via the large rivers deep into the heart of Central Europe, and further down the Atlantic coast over the Bay of Biscay to the Iberian Peninsula¹⁰ (Fig. 1.11).

The Skuldelev ships

In Denmark, archaeologists in general did not take a serious interest in the maritime aspects of archaeology until the 1960s. Chance finds of medieval ships, such as a report about the Skuldelev ships from the 1920s,¹¹ were of no interest since they did not represent Viking ship graves, in contrast to the Ladby ship¹² excavated in 1936-37.

Other important ship-finds were also excavated earlier, such as at Nydam, a Late-Roman sacrificial site with ships, excavated 1859-63,¹³ and the Pre-Roman Hjortspring sacrificial war canoe site, excavated in 1921-22.¹⁴ But these vessels were primarily studied as they were parts of a recognised archaeological context: a war booty offering (Fig. 1.12).

The turning point came 1957-59 with underwater investigations by a small National Museum team led by Olaf Olsen and myself. We were mapping a stone barrier in Roskilde Fjord that blocked the most direct sailing lane to the town of Roskilde to the south from the open sea to the north of the fjord (Fig. 1.13). The site close to the village of Skuldelev proved to contain the remains

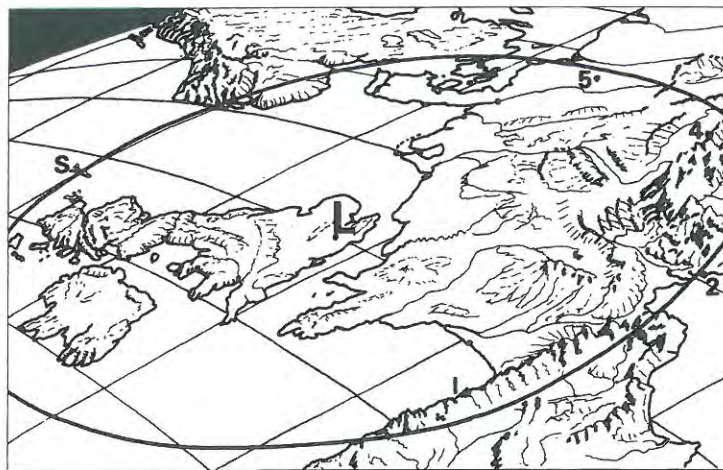


Fig. 1.10 (top). Viking-Age contacts from Norway to Britain, Ireland and beyond. After Cunliffe 2001.

Fig. 1.11 (bottom). The contact zone of southern England. After Morrison 1973.

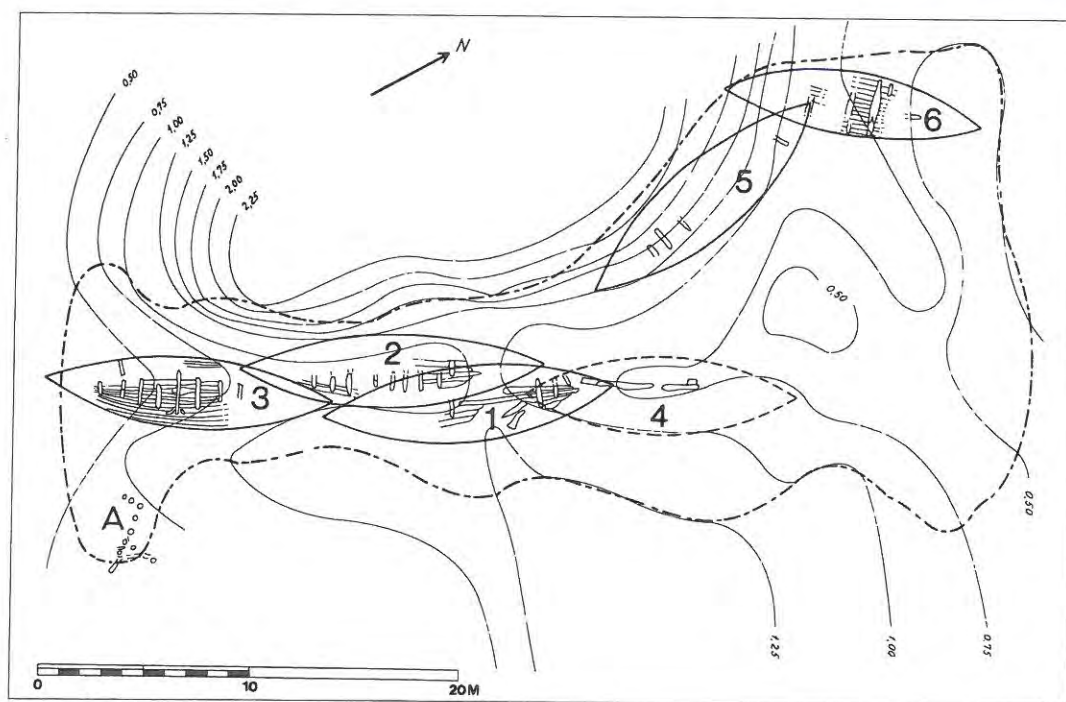


Fig. 1.12 (above). Early ship-finds in Denmark, investigated before 1960 by the National Museum. 1: Nydam, 2: Hjortspring, 3: Ladby, 4: Skuldelev.



Fig. 1.13 (right). The topography of the Roskilde Fjord area, illustrating the long and difficult sailing route from the open sea at Kattegat (top, left) to the town of Roskilde (at blue dot). A red dot marks where the Skuldelev ships were found. After Crumlin-Pedersen & Olsen (eds) 2002.

Fig. 1.14. The 1959 plan of the Skuldelev ships, straddling on top of a clay threshold across the Peberrende channel. In fact, there were only five ships, not six, since the wrecks 2 and 4 are both parts of the longship Skuldelev 2. After Olsen & Crumlin-Pedersen 1969.



6. See Chapter 2.
7. Roberts 2004b.
8. Marsden (ed.) 2009.
9. Crawford 1987; Graham-Campbell & Batey 1998.
10. Cunliffe 2001.
11. Crumlin-Pedersen & Olsen (eds) 2002: 23-24.
12. Thorvildsen 1957; Sørensen 2001.
13. Engelhard 1865.
14. Rosenberg 1937.

of five ships from the first half of the 11th century¹⁵ (Fig. 1.14). In 1962, following the three summer seasons of diving, the Skuldelev site was drained using a cofferdam and excavated, using techniques inspired from the work conducted under water (Fig. 1.15). Subsequently the thousands of ship fragments were recorded in detail, conserved, and brought carefully to the new purpose-built Viking Ship Museum in Roskilde where they were restored during a lengthy process that could be followed by visitors to the museum¹⁶ (Figs 1.16-1.17).

The establishment in 1964 of the Institute of Maritime Archaeology (Danish: Skibshistorisk Laboratorium) of the National Museum, and the official opening in June 1969 of the Viking Ship Museum as a 'daughter museum' with a director in common, created a base for further studies and experiments in maritime archaeology.

The Skuldelev ships themselves were subjected to intense analytical and experimental activities resulting in reconstructions and trials of all five ships. Since the find comprised a large and a small warship, a deep-sea and a coastal cargo ship and a fishing vessel, we were here given a unique chance to study the great range of ships used in the North during the 11th century (Fig. 1.18). This was done after determining the date and origin of each of the ships by reproducing them at full scale in authentic materials and techniques using copies of Viking-Age tools (Figs 1.19-1.21). In the next chapters I will return to several of the results thus achieved.

Over the years, the experience from the experimental ship programmes of the Viking Ship Museum in Roskilde and elsewhere in Denmark have been described in several publications.¹⁷ There has been a strong interest and local participation in the construction and use of full-size reconstructions of Viking ships around the country and several of the ships built elsewhere are of a quality that makes them fit match-race partners to the Viking Ship Museum's own reconstructions (Fig. 1.22).



Fig. 1.15 (top). Excavation of the Skuldelev ships within the cofferdam in 1962. After Crumlin-Pedersen & Olsen (eds) 2002.

Fig. 1.16 (bottom). Restoration of the Skuldelev 1 cargo ship in the Viking Ship Museum in Roskilde. After Crumlin-Pedersen & Olsen (eds) 2002.

15. Olsen & Crumlin Pedersen 1959.

16. Olsen & Crumlin-Pedersen 1969; Crumlin-Pedersen & Olsen (eds) 2002: 87-95.



Fig. 1.17. Interior of the Viking Ship Museum with the Skuldelev 1 and 3 ships in the foreground. Photo: W. Karrasch.

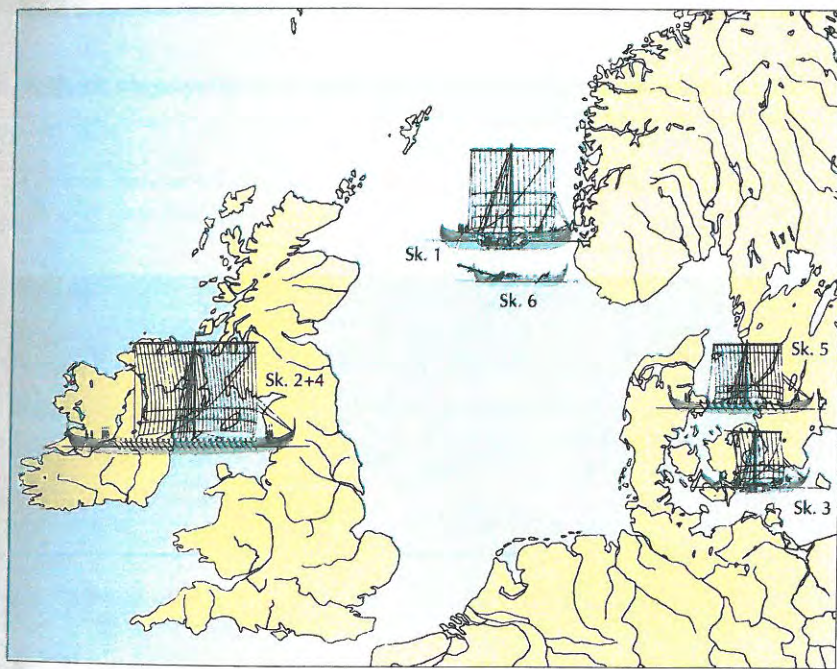


Fig. 1.18 (above). Reconstruction sketches of the five Skuldelev ships, placed in the areas where they were originally built. After Crumlin-Pedersen & Olsen (eds) 2002.

Fig. 1.19 (right). Cleaving oak for the planking of the longship reconstruction of Skuldelev 2. Photo: W. Karrasch.



17. Crumlin-Pedersen & Vinner 1986; Andersen & Andersen 1989; Vadstrup 1993; Andersen *et al.* 1997; Vinner 2002; Juel 2005; Bill *et al.* 2007; Karrasch 2008.

Roar Ege

Skuldelev 3 skibet som arkæologisk eksperiment



Fig. 1.20. The first publication on the Viking Ship Museum experimental archaeology boat programme, describing the construction and initial sailing trials of the Skuldelev 3 reconstruction. Andersen et al. 1997.

Fig. 1.22. Sailing trials on the Roskilde Fjord between the two Skuldelev 3 reconstructions Roar Ege and Sif Ege. Photo: W. Karrasch.



Fig. 1.21. Full-scale reconstructions of the five Skuldelev ships sailing on the Roskilde Fjord in 2007. Photo: W. Karrasch.



Site	Find	Dating	Excavation
Skuldelev	5 shipwrecks	11 th century	1962-64
Slusegård	boat graves	2 nd -3 rd centuries AD	1965
Ellingå	shipwreck	12 th century	1968
Lynæs	shipwreck	12 th century	1975
Vejby	shipwreck	14 th century	1976-77
Kyholm	shipwreck	13 th century	1978
Kollerup	shipwreck	13 th century	1978
Hedeby	shipwreck	10 th century	1979
Fotevik	5 shipwrecks	11 th century	1981-82
Fribrødre	shipyard	11 th century	1982-86
Uggerby	shipwreck	ca 1800	1984
Stinesminde	shipwreck	17 th century	1987-89
Gedesby	shipwreck	14 th century	1988-90
Nydam	3 ships	3 rd -4 th centuries AD	1989-93
Lille Kregme	shipwreck	14 th century	1992
Gislinge	boat wreck	12 th century	1993

Table 1.1. Boats and ships surveyed and excavated during the period 1962-93 by the National Museum of Denmark and the Viking Ship Museum.

Fig. 1.23. Excavation in 1990 of a small coastal trader from ca 1330 at Gedesby in the silted-up Bøtø Nor, southern Falster. Photo: W. Karrasch.



Other Danish ship-finds

However, the Skuldelev ships were not the only ones to be dealt with in the years following their excavation in 1962. During the period 1962-93 a considerable number of boats and ships, dating between the 2nd and the 18th centuries AD, have been surveyed and excavated by the National Museum of Denmark and the Viking Ship Museum (Table 1.1). These finds include Roman Iron-Age boat graves and new excavations at the Nydam site, as well as numerous Nordic ships of the 10th-14th centuries and medieval cogs of the 12th-14th centuries, exemplified in Figs 1.23 and 1.24.

These excavations laid a heavy strain on the conservation department of the National Museum, and consequently some of the finds had to be transferred, after being documented in detail, to long-term storage well below the groundwater level in selected locations with sandy soils. The hectic field activity allowed little time for the detailed analysis and publication of the finds, except for preliminary reports along the way. Luckily, a way was found to overcome part of this problem.

The Centre for Maritime Archaeology in Roskilde

In Denmark, a National Research Foundation was created in 1991 with the aim to promote scientific research in Denmark by enabling potentially promising scholarly groups to develop into centres of excellence at an international level. Here, the proposal for establishing a Centre for Maritime Archaeology was the one to be chosen out of six archaeology proposals, and consequently, our centre was established in 1993 under the National Museum, closely linked to the Viking Ship Museum and situated in Roskilde (Fig. 1.25). Funding was initially provided for only a five-year period, then prolonged

for another five years (which was the maximum possible according to the general principles of the foundation). Consequently the centre closed in 2003. As the public funding for museums, including the two host institutions, was reduced at the same time, the research potential in Denmark were set back seriously, except for the experimental work which was continued to a climax with the *Sea Stallion* voyage to Ireland and back in 2007-08.¹⁸

The aims of the centre during its period 1993-2003 were to promote research and development of maritime archaeology, nationally and internationally, within three thematic sectors:

1. *Maritime aspects of archaeology*, stating that maritime archaeology must relate to the general discussion among archaeologists and historians of conditions of life in the past, and should be fully integrated into mainstream archaeology.

2. *The archaeology of watercraft*, seeing the study of boats and ships as a key to some of Mankind's most challenging creations, and to a clearly focused examination of the conditions for maritime contacts.

3. *Development of tools and techniques in Maritime Archaeology*, seeing the need for further development in this field, bridging the arts and the sciences.

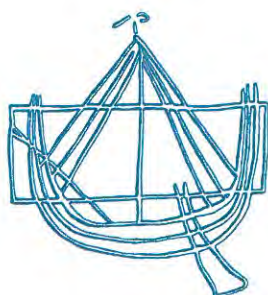


Fig. 1.25. An image of a ship cut into a soft chalk-stone during construction of the 12th-century parish church of Himmelev, just outside Roskilde. This motif was taken as the logo for the Centre for Maritime Archaeology of Roskilde 1993-2003.



Fig. 1.24. The raising in 1977 of the bottom part of a cog, built ca 1375 in the Gdańsk region and wrecked shortly afterwards at Vejby Strand, northern Zealand. The ship sailed in ballast after having sold its Baltic cargo in Western Europe. At the wreck site were found 110 English gold nobles. Photo: O. Crumlin-Pedersen.

Publications

A number of projects within the first sector were initiated at the centre, some of which are described in Chapters 5 and 6. They primarily relate to maritime aspects of pre-historic and medieval settlements, warfare, voyages and cult, and the results have been published in a number of books, mostly in English, including five volumes in the Publications from the National Museum series from Copenhagen (Fig. 1.26).

The results of the work in the ship archaeology sector are mainly published in the *Ships & Boats of the North* (SBN) monograph series from Roskilde, giving detailed analysis and descriptions of various important archaeological ship-finds in context. The five volumes printed thus far present the Viking-Age ship-finds in the harbour of Hedeby,¹⁹ the re-analysis of the burial mound and ship from Ladby,²⁰ the archaeology and history of the Skuldelev barrier and its ships (men-

18. Bill *et al.* 2007; Karrasch 2008.

19. Crumlin-Pedersen 1997a.

20. Sørensen 2001.

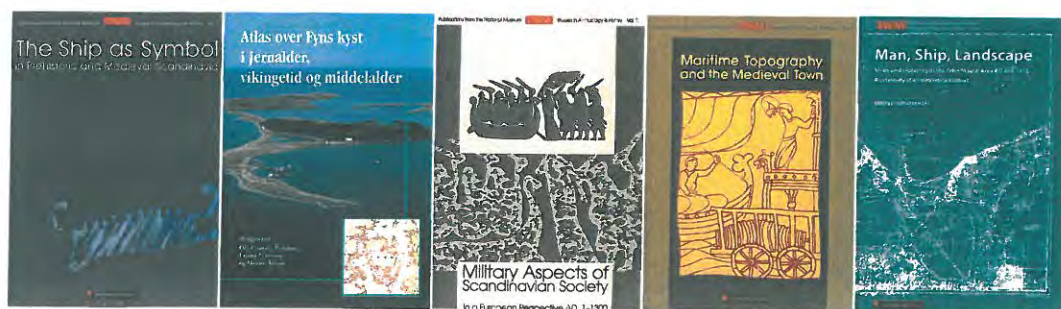
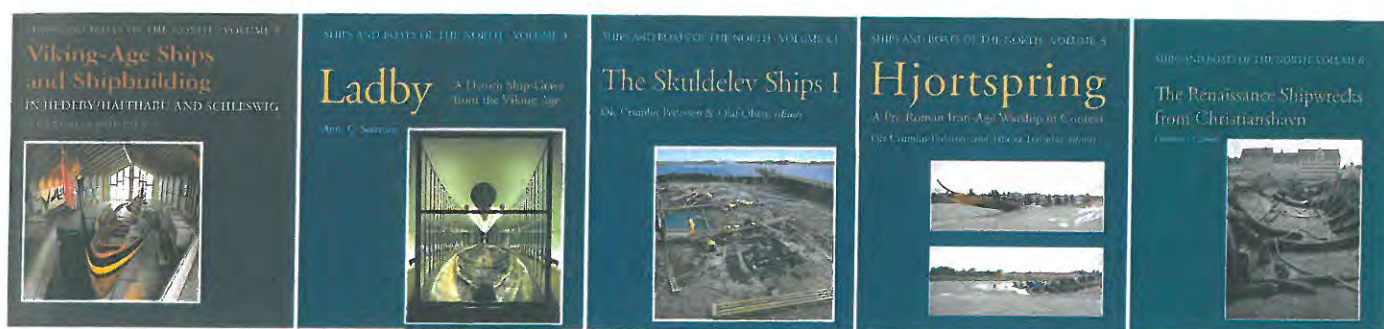


Fig. 1.26. Some of the major publications 1995–2004 from the Roskilde Centre's research programme on Maritime Aspects of Archaeology.

Fig. 1.27. Publications 1997–2007 within the Viking Ship Museum's Ships and Boats of the North monograph series.



tioned above),²¹ the analysis and trials of the Pre-Roman Iron-Age Hjortspring boat from southern Denmark,²² and a series of 16th- and 17th-century ships from Copenhagen casting new light on the early phases of carvel construction for ocean going ships²³ (Fig. 1.27).

Several other publications within the *Ships & Boats of the North* series are now in preparation, including Iron-Age and medieval ship-finds as well as the full report on the experience with the Skuldelev reconstructions. The volumes in this series are written by the archaeologists and other members of the staffs who have undertaken the primary research and experimental studies of each group of finds; and as was the case for the previous volumes, the monographs are published as cooperative projects between the Viking Ship Museum and other involved

museums and academic institutions, in Denmark and abroad.

In the third sector, the development of tools and techniques, several projects were initiated within the fields of conservation, documentation, and remote sensing, as well as a naval architectural analysis of ancient ships.²⁴ Examples are the use of digital documentation and visualisation using the *Faro-Arm* technology to record the Hjortspring reconstruction, and it was also used for documenting the elements of the Kolding cog from ca 1200 in order to join these into a complete image of the ship as found²⁵ (Fig. 1.28). Since this project, the technology has been applied to recording objects in various archaeological contexts, including the large quantity of ship's timbers from the 15th-century Newport ship in Wales.

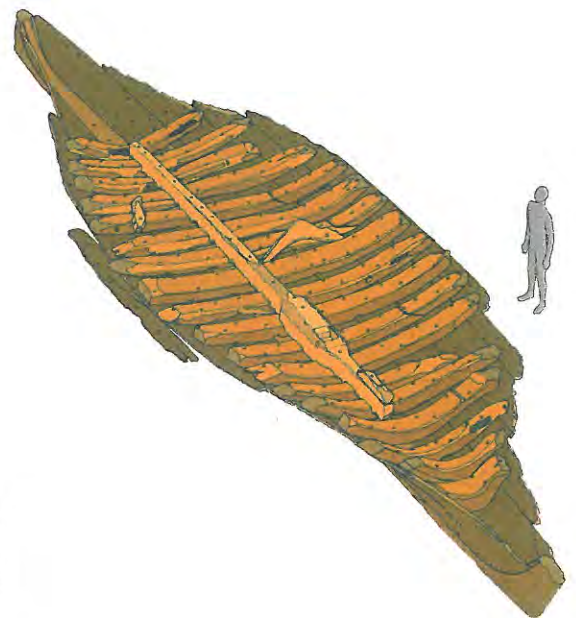
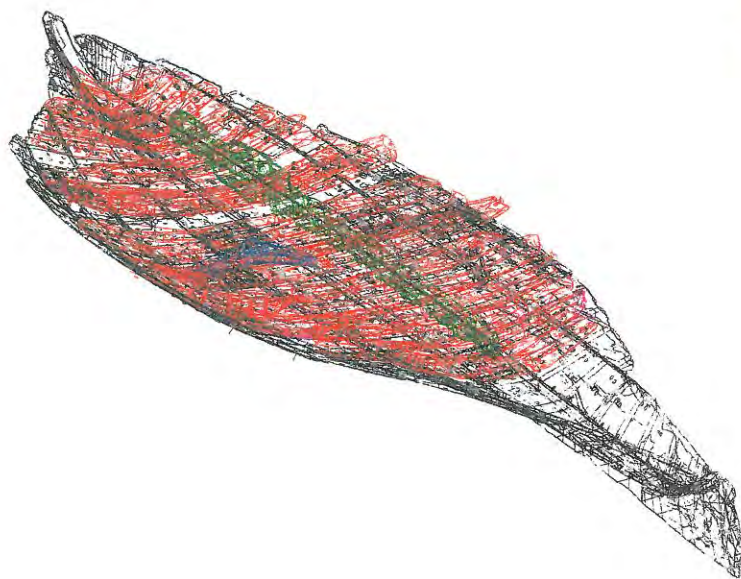
21. Crumlin-Pedersen & Olsen (eds) 2002.

22. Crumlin-Pedersen & Trakadas (eds) 2003.

23. Lemée 2007.

24. Jensen 1999.

25. Hocker 2002; Hocker 2006.



Two examples

In order to exemplify the potential of the maritime archaeological sources in a broader context, I will present two examples of archaeological ship-finds from Denmark. These illustrate the value of in-depth studies of the evidence and reveal not only highly important aspects of nautical technology and skills but also other contexts. These include:

1. Hjortspring - as an indicator of Iron-Age mobility and organisation.
2. Skuldelev 2 - as part of the aftermath of the conquest of England in 1066, and as a valuable archaeological experimental key to the study of shipbuilding resources and the logistics of warfare at sea in the 11th century.

Hjortspring, a large war canoe of the Pre-Roman Iron Age

The first example is the unique 4th-century BC war-booty sacrifice at *Hjortspring*, excavated in 1921-22 on the island Als in southern Denmark by Gustav Rosenberg of the National Museum.²⁶ In a small former lake he uncovered the remains of a ca 18 m-long war canoe and a large number of weapons, including 169 spears and lances, 11 swords, 64

shields, and traces of 10-12 chain mails. Peat cutting had destroyed large parts of the find, and the boat remains of lime wood were as soft as cheese, confronting Rosenberg with severe problems in excavating, recording, recovering and interpreting the elements, not the least of which was the boat itself (Fig. 1.29).

Its main construction elements were represented but the shape and details were without parallels in other known boat-finds. Luckily, Rosenberg had a background as wood carver so that he could approach the task with a profound understanding of the

Fig. 1.28. The wreck of the *Kolding cog* from ca 1200 documented with the Faro-Arm digitising equipment and visualised with Rhinoceros® software. After Hocker 2002 and 2006.

Fig. 1.29. A part of the *Hjortspring boat*, cut off from other parts by peat diggers' pits. After Rosenberg 1937.



26. Rosenberg 1937.
27. Rosenberg 1937; Crumlin-Pedersen & Trakadas (eds) 2003.
28. Crumlin-Pedersen & Trakadas (eds) 2003: 37-43.
29. Crumlin-Pedersen & Trakadas (eds) 2003: 44-53.
30. Crumlin-Pedersen & Trakadas (eds) 2003: 54-102.
31. Crumlin-Pedersen & Trakadas (eds) 2003: 103-136.

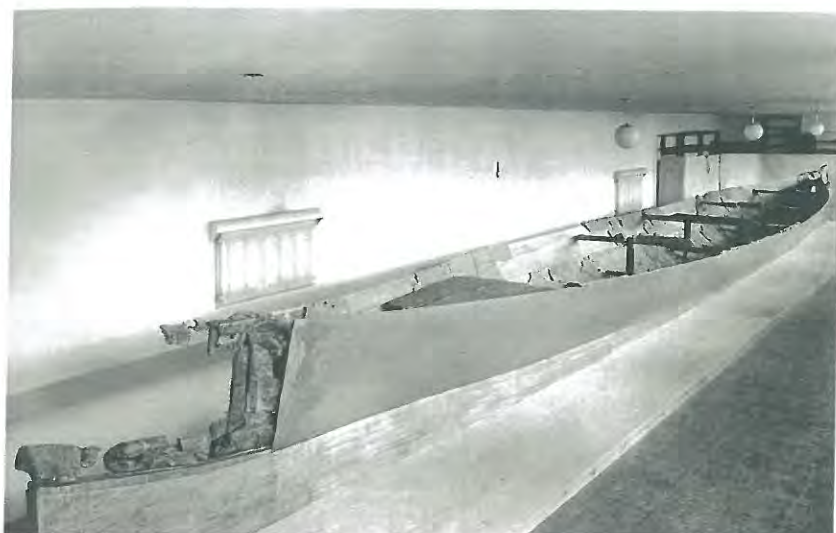
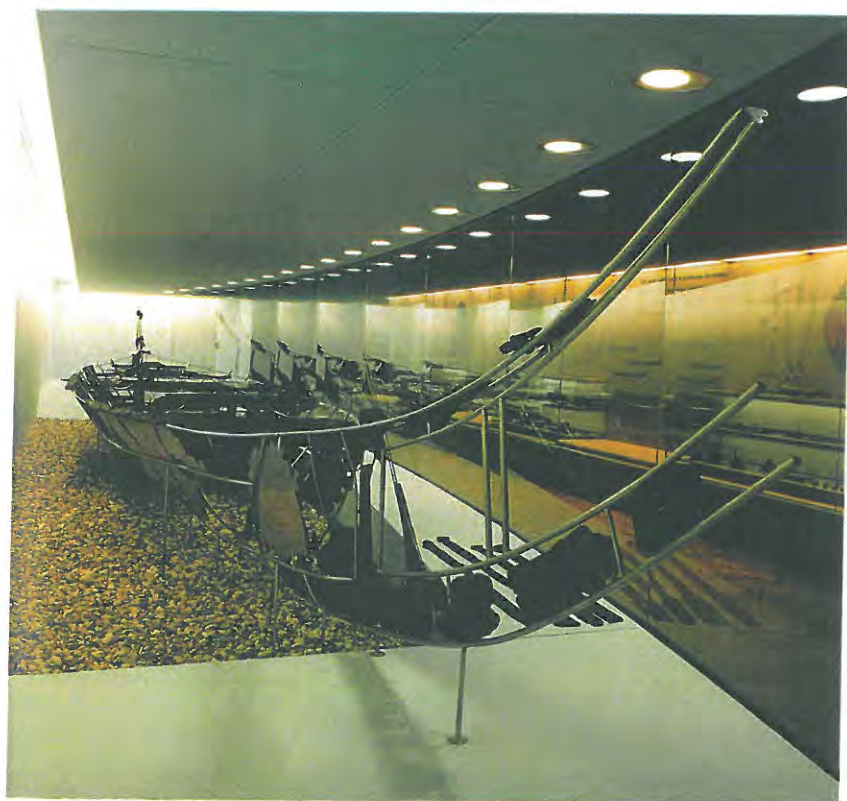


Fig. 1.30. The 1937 display of the Hjortspring boat after conservation in the National Museum. After Crumlin-Pedersen & Trakadas (eds) 2003.

Fig. 1.31. The display of the Hjortspring boat in the National Museum after the re-conservation in the 1980s. After Crumlin-Pedersen & Trakadas (eds) 2003.



nature of the evidence and bring all preserved parts safely to the National Museum. Rosenberg was also responsible for the conservation and restoration of the boat, culminating in 1937 with the publication of the find and the display in the renovated National Museum the same year²⁷ (Fig. 1.30).

Unfortunately, the alumn method used for the conservation was affected by changes in the humidity in the basement room chosen to display the find, resulting in a partial disintegration of the interior of the wooden parts. Consequently a complete re-conservation had to be carried out in the 1970s using PEG 4000.²⁸ In the 1980s, the boat was re-restored in a new display that gives a better impression of the delicate lines of the vessel (Fig. 1.31).²⁹ At the same time a re-assessment of Rosenberg's work was carried out, confirming his reconstruction in practically all details.

In 1991 a local group formed on Als, where the boat was originally found, who decided to build a full-scale reconstruction of the vessel using copies of Iron-Age tools and working in close contact with the National Museum and the Viking Ship Museum.³⁰ The resulting boat, *Tilia Alsie*, was launched in 1999 as an excellent example of the high standards of the craftsmanship of Scandinavian or Baltic boatbuilders in the 4th century BC (Fig. 1.32).

After intense sea trials during 2000-01, the project was published in 2003 with a discussion of the finds-complex as well as the details of the experiment, including the recorded potential of the boat in amphibious warfare.³¹ The sea trials of the reconstructed Hjortspring boat were carried out with a highly-trained dragon boat crew of paddlers who were probably the best match to a team of 20 young Iron-Age warriors. Trials were undertaken during long periods of calm weather as well as in rough weather with 1-m high waves. In both conditions the boat demonstrated good seaworthiness, even in rough seas, although the slender structure



Fig. 1.32. Recording of the forward end of the reconstruction Tilia Alsie of the Hjortspring boat (left) and the results (below). After Crumlin-Pedersen & Trakadas (eds) 2003.

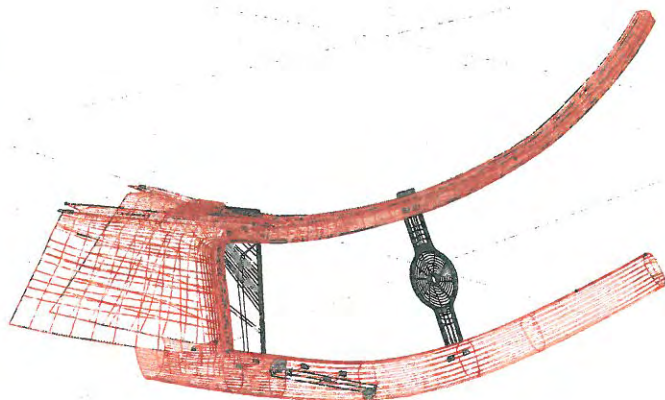


Fig. 1.33. Sea trials with the Hjortspring reconstruction Tilia Alsie in 2000-01. After Crumlin-Pedersen & Trakadas (eds) 2003.





Fig. 1.34. Rock carving, probably 3rd-2nd century BC, from Hammer in southeastern Norway. After Gjesing 1936.

of the boat was strongly stressed when being driven through the crest of waves or riding over the top of a large swell (Fig. 1.33).

A small drummer in the bow marked the paddling rhythm, resulting in a recorded sprint speed of 7.6 knots, and a cruising speed of 4.7 knots which could be maintained for several hours. When paddling in shifts, the speed was only reduced by a single knot, thus allowing paddling to continue all day long with only short pauses on the beach to arrange for eating and other human needs. With a travelling distance of 50-100 km per day, interrupted by nights spent on the beach at convenient places along the route, a fleet of such vessels would have had a radius of action in fair weather of up to 300-400 km.

Consequently, the amphibious army which was defeated on Als, leaving behind a boat and weapons for four boat crews, could have come from anywhere in the inner Danish waters or western Baltic. This situation may have been a strong incentive in the formation of regional chiefdoms during the Pre-Roman Iron Age to defend local settlements from plunder and slave-taking.³²

At the same time, the Hjortspring boat's profile is reminiscent of the ships depicted in Scandinavian Bronze-Age rock carvings and on bronze objects.³³ Therefore, it is highly likely that the Hjortspring boat also reflects the construction principles used during the Bronze Age. The rock carving from Hammer, Norway (possibly from the Early Iron Age), is a good example of the similarity of contemporary iconography with the well-documented appearance of the Hjortspring boat, in profile under way (Fig. 1.34).

The history of Skuldelev 2, a Dublin-built 11th-century longship

The second example relates to the longship, *Skuldelev 2*³⁴ (Fig 1.35). Dendro-analysis shows that the ship was built from planks that had been cleft from trees felled in the Dublin region, and that the tree for the keelson had been felled in the spring or early summer of 1042³⁵ (Fig. 1.36). Planks in the bottom indicate that the ship was repaired locally after ca 25 years. Nevertheless, the ship ended its active days being scuttled far away in Roskilde Fjord in Denmark in the 1070s. Now the remains of the ship are conserved and exhibited in the Viking Ship Museum in Roskilde.

The presence of this find obviously calls for an attempt to find explanations for the transfer of the ship across the North Sea at some stage between the late 1060s and the 1070s.³⁶ These years were crucial in the history of England with King Harold Godwinson

Fig. 1.35. The *Skuldelev 2* ship exhibited in Roskilde. Photo: W. Karrasch.



32. Crumlin-Pedersen & Trakadas (eds) 2003: 201-207.

33. Kaul 1998; Coles 2005.

34. Crumlin-Pedersen & Olsen (eds) 2002: 141-194, 326-330.

35. Bonde & Crumlin-Pedersen 1990; Crumlin-Pedersen & Olsen (eds) 2002: 66-67.

36. Crumlin-Pedersen & Olsen (eds) 2002: 326-330, with references.

being killed at Hastings 1066 whilst trying to repel the Norman Conquest. His family fled, and the sons organised counter-attacks from Dublin in 1068 and 1069 in southwestern England, without lasting effects. In 1069 the Danish king, Svein Estridsen, sent a fleet of 240 ships to the Yorkshire region and drove out the Normans from there, but his army did not succeed elsewhere and had to return home the next year.

These attempts to restore Anglo-Saxon or Danish kingship in England have been considered as independent raids, but it is time to reconsider this position in the light of the evidence from Skuldelev. In a later Danish source³⁷ we are told that after the death of King Harold, two of his sons and a daughter came to visit their distant relative, King Svein of Denmark. We are not told about the date or purpose of their visit, only that the daughter was sent to Russia to marry Prince Vladimir there.

With our present state of knowledge, it is very probable to state that the Irish-built longship Skuldelev 2 was one of the ships used for the voyage from Dublin to the royal court in Roskilde. The purpose of sending the ships was probably to establish an alliance to force the Normans out of England with a combined pincher operation, which took place in 1069 with the elder son sending a fleet from Dublin to Cornwall and Svein sending his large fleet to the Danish-oriented region of York.

The *Anglo-Saxon Chronicle* reports that when the Danish fleet sailed off in 1070, most of the ships returned to Denmark, whilst others returned to Norway and some to Ireland. This indicates that the Skuldelev 2 longship was not the only one that had been sent from Ireland to Denmark, and it strengthens the theory of a proper coordinated diplomatic mission prior to the two campaigns in 1069. However, the longship did return to Denmark, if it was one of the huge fleet of ships sent to England by the Danish king in 1069, only to be scuttled a few years later.

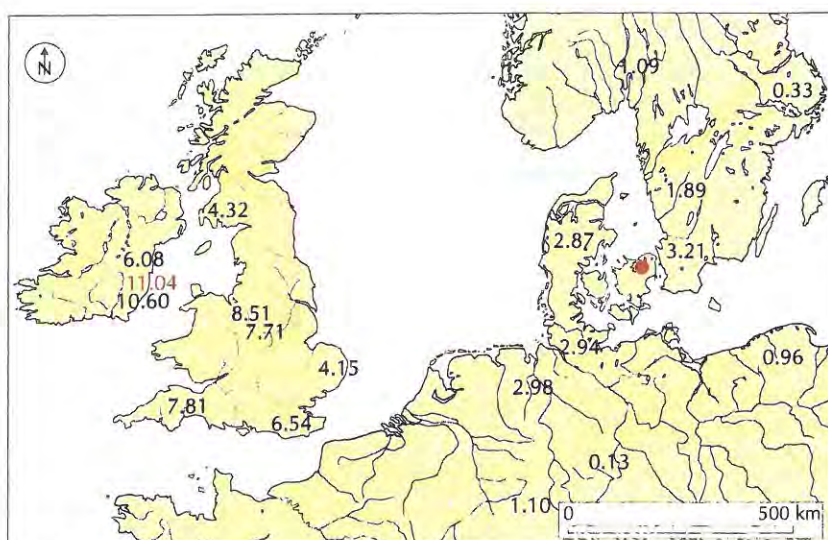


Fig. 1.36. The origin in the south-eastern part of Ireland for the original hull planks in Skuldelev 2 is demonstrated by the t-values, reflecting the correspondence between the dendro-samples from the ship and base curves for oak from various regions of Northern Europe. After Crumlin-Pedersen & Olsen (eds) 2002.

Shipbuilding resources and craftsmanship

With such a historical background as outlined above, it was seen as a valid experimental archaeological project to build a full-scale reconstruction of the Skuldelev 2 longship in Roskilde and to test it in the Irish waters for which it was originally built. However, in building a reconstruction, one is forced into considering a whole series of questions related to the quality and quantity of the natural resources needed for building such a vessel, not to mention a whole fleet of ships.³⁸

For the reconstruction of the longship, 27 large, high-quality oak and ash trees were used for planks, keel, keelson and beams, 285 specially-grown large branches for the frames and other crooked timbers, and considerable quantities of iron for nails and tools, as well as wood tar and paint, wool for caulking the seams (Figs 1.37-1.39). For the extraction of iron and tar for one ship alone, over 150 cubic metres of wood were needed. This gives

37. Saxo, Book 4. Olrik & Ræder (eds) 1931: 308.

38. Bill *et al.* 2007.

Fig. 1.37 (right). Cutting away the upper branches of an oak tree for radially-cleft planks for the longship reconstruction. Photo: W. Karrasch.



Fig. 1.38 (far right). Compass timber for cutting a floor timber for the longship. Photo: W. Karrasch.

Fig. 1.39 (below). Processing wood-tar in a tar pit in Finland for the longship. Photo: W. Karrasch.

Fig. 1.40 (right). Building the longship reconstruction: the assembly of the keel, stem and hood-ends for the planking. Photo: W. Karrasch.





Fig. 1.41. Bottom planking has been mounted to keel and stems, with temporary support from underneath. Photo: W. Karrasch.

a perspective on the heavy toll on human as well as natural resources needed for building and maintaining the Viking fleets, and it points to a strong control of logistics and organisation.

The Skuldelev 2 reconstruction project in 2002-04 also provided a good understanding of the craftsmanship needed for the con-

struction process of the hull. The ships at that time were built up from their keels and stems as slender shells of planks which were then strengthened by floors and side timbers (Figs 1.40-1.43). Beams were inserted over each floor timber to carry the floor boards, and the 60 rowers sat in pairs on narrow thwarts spaced only ca 70 cm apart.



Fig. 1.42. The floor timbers were individually cut to fit the plank shell before being mounted in the ship with treenails through the plank. Photo: W. Karrasch.

39. Crumlin-Pedersen 1997a: 130-140, 275-284.
40. Andersen & Andersen 1989.



Fig. 1.43. Bottom section of the longship reconstruction amidships, before mounting the beams over the floor timbers and the keelson with its supporting knees. Photo: W. Karrasch.

Fig. 1.44. Copies of Viking-Age tools, made for use in the construction process as well as for tool-mark analysis. Photo: W. Karrasch.



In all details, the tools and processes depicted on the Bayeux Tapestry for the construction of ships for William's fleet (see Fig. 3.9) were confirmed by studies of finds of tool marks. These marks are present on the remains of this and other ships, as well as in tool chests that could be reconstructed on the basis of finds from contemporary settlements and graves (Fig. 1.44).

Experimental studies by the Viking Ship Museum indicate that the manufacture of cordage and sail for such a longship would originally have been an equally demanding undertaking, in terms of man-hours, as the building of the hull itself. Extensive research has been carried out at the museum in relation to rope makers' processing of lime bast and horse hair for the cordage and in weavers' and sail makers' preparation of the wool required for the sail. These materials would have been put to standard use in Danish Viking ships, and they are used with good results in some of the reconstructed vessels from Roskilde. However, this part of the work is still at an experimental stage.

For the Irish longship reconstruction, the 112 square metres of sail was made of linen and the 2,200 metres of rope were hand-made of hemp. These materials may have been used in Ireland during the 11th century so that the reconstructed rig and sail come close to the original in this respect.

From the excavation of the harbour basin of Hedeby, numerous finds of toggles, blocks etc. for the rigging of Viking-Age ships have been found,³⁹ and they have served as patterns for this part of the rigging (Fig. 1.45). The position of the mast was known from the mast-step in the keelson, and the height of the mast and the size of the sail were deduced from considerations of hull size and shape. This estimate had a good base in the traces of fittings and holes for the rigging in some of the other ships (especially Skuldelev 3) as well as from experience gained in sailing other Viking ship reconstructions.⁴⁰

Sea trials and voyages

At the launch in 2004 of the Skuldelev 2 reconstruction (Fig. 1.46), the vessel was given the name *Havhingsten fra Glendalough* (The Sea Stallion from Glendalough in English).⁴¹ The training of the large number of crew started right after the launch with the aim of carrying out extensive sea trials over the next years.

Initial rowing and sailing trials took place in Roskilde Fjord and the Kattegat in 2005 for trimming the vessel and training the large crew (Fig. 1.47). In 2006 followed the first open-sea long-distance voyage, taking the ship to Norway and back (Fig. 1.48). The ultimate test was taking the *Sea Stallion* to the Orkneys and from there into its original home waters, the Irish Sea, en route for Dublin in 2007 (Fig. 1.49). This was indeed a severe test that was passed without any serious problems for the ship and crew, except for the rudder fastenings which broke twice and caused some dangerous moments. On the return voyage to Roskilde through the English Channel in 2008, strong withies were used instead of rope for fastening the rudder, and this prevented problems in spite of the weather, which in some parts of the passage strained the ship seriously with turbulent seas and 2-3 m-high waves (Fig. 1.50).⁴²

While under way, the crew of 61 persons of both sexes each had less than one square metre of open deck space at their disposal (Fig. 1.51). Here they would have to stay for 24 hours a day, working in four-hour watch shifts, much of the time with the rain pouring down on them, regardless of whether they were awake or asleep. Since the ship could sink immediately if flooded, an extensive set of safety equipment was carried onboard, and the ship was followed all the way by a tender. Fortunately, no serious accidents happened during this voyage, although during the Viking Age ships were sometimes lost at sea as is known from runic inscriptions and other sources.⁴³

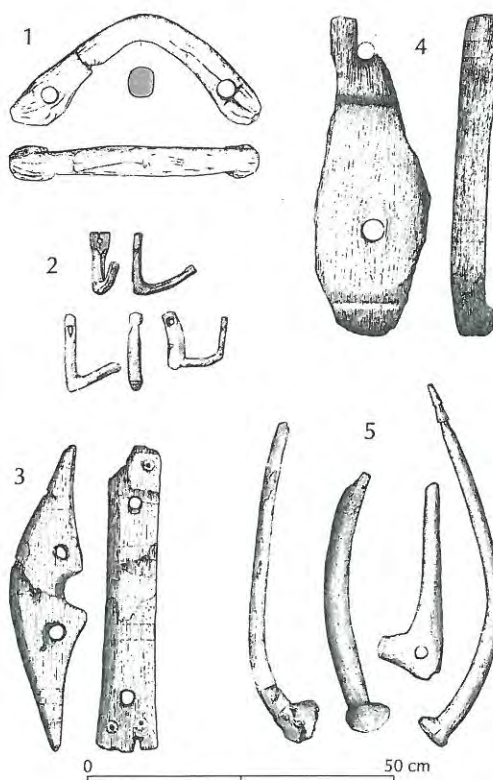


Fig. 1.45. Rig-related objects found in the Viking harbour of Hedeby. 1: parrel for the yard, 2: hooks, 3: sheet cleat, 4: part of a block house, 5: shroud pins. After Crumlin-Pedersen 1997a.



Fig. 1.46. The launching of the Skuldelev 2 longship reconstruction in Roskilde in 2004. Photo: W. Karrasch.

Fig. 1.47. The first rowing trials with the full crew of 60 rowers. Photo: W. Karrasch.



Fig. 1.48. The Sea Stallion en route to Norway in 2006. Photo: W. Karrasch.



Fig. 1.49. The Sea Stallion in the Irish Sea in 2007. Photo: W. Karrasch.



41. As a tribute to the Irish origin of the original ship, the name given refers to the Glendalough Valley south-east of Dublin, from where the original timber may have been taken by the 11th-century shipbuilders.

42. www.vikingshipmuseum.dk.

43. Jesch 2001: 178-179.

Due to the need to meet the deadline for arrival in Dublin on the outbound voyage, the skipper accepted a tow for crossing part of the North Sea (231 nautical miles), but for most of the remaining 2,251 nautical miles sailed by the *Sea Stallion* during 2007-08 (Fig. 1.52), the propulsion was by sail with occasional rowed passages – needless to say there was no engine onboard! For the documentation of the seaworthiness of the ship under sail and oars, extensive recording equipment was installed onboard. This enabled a continuous documentation of course and speed, and a logbook was kept to record all events of navigational importance (Fig. 1.53). The data from all the recordings undertaken during this experiment are now being analysed, and the results are due to be part of the next Skuldelev volumes in the *Ships and Boats of the North* series.

Although the scholarly analyses of the conditions for using the longships by Viking societies around the Norse world is the main aim of the project, there is of course also a need for communicating the experience and its results to the general public. This was evident already at the launch of the longship in 2004 when 10,000 people gathered in Roskilde to watch the Danish queen give the ship its name just before it slid into the water (see Fig. 1.46).

During the Dublin voyage there was extensive TV coverage by Danish and Irish channels, and BBC2 had a crew onboard the ship all the way to Dublin. Additionally, several other news media have been onboard during the voyage. Several popular books and articles have already been published in 2007-08 and more will no doubt follow soon.⁴⁴

Between the 2007 and 2008 voyages, the longship was lifted out of the water and set on display at the National Museum in Dublin (Fig. 1.54), drawing a huge number of visitors to see the reconstructed longship as a monument of Ireland's Viking past and a symbol of past and present cultural links between Ireland and Denmark.



Fig. 1.50. *The Sea Stallion crossing the North Sea on the way home to Roskilde in 2008. Photo: W. Karrasch.*

Fig. 1.51. *No cabins or hammocks, just sleeping around the clock on top of the oars! Photo: W. Karrasch.*





Fig. 1.52. The route followed by the Sea Stallion 2007-08, covering 2,482 nautical miles between Roskilde, Denmark, and Dublin, Ireland.

Fig. 1.53. The safety and recording equipment on-board the Sea Stallion. Photos: W. Karrasch.



44. Bill *et al.* 2007; Kastoft 2007; Karrasch 2008.

The return voyage of the *Sea Stallion* to Roskilde in the summer of 2008 (see Figs 1.50-1.52) went through the Irish Sea into the turbulent waters around Land's End, then along the English Channel coast into the North Sea and back to Denmark via the Limfjord. On 9th August, 2008, the skipper and crew were welcomed back in Roskilde (Fig. 1.55) after a remarkable voyage of 2,482 nautical miles (4,597 km), spending almost 500 hours at sea. A complex and daring archaeological experiment had been concluded, providing data and experience of unique importance for our understanding of the conditions for seafaring a thousand years ago.

I hope this introduction has served the purpose of illustrating the potential of maritime archaeology finds, not the least ship-finds, which may give us a realistic contact with several aspects of life in societies of the past that are otherwise beyond the experience of most modern archaeologists.

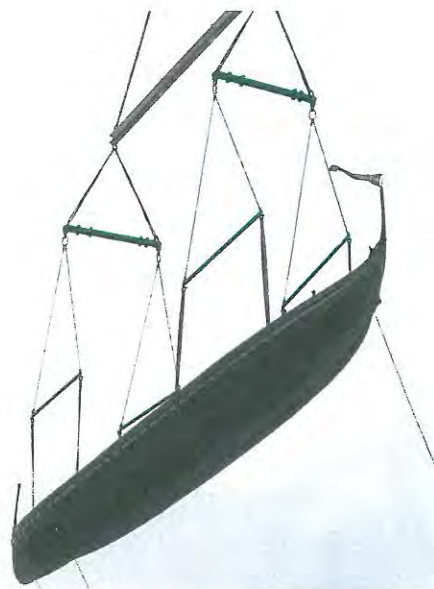


Fig. 1.54. The *Sea Stallion* being lifted in 2007 into the courtyard of the National Museum of Ireland, Collin Barracks, for display until the return voyage in 2008. Photo: M. Nielsen.



Fig. 1.55. The *Sea Stallion* arriving back into the museum harbour at Roskilde in 2008. Photo: W. Karrasch.

1. Crumlin-Pedersen forthcoming.
2. Sindbæk 2003.
3. Ellmers 1985.