

MARITIME MATTERS: THE DANISH EXPERIENCE

By David Gregory

Contrary to the situation in many countries, maritime archaeology in Denmark has always enjoyed the support of terrestrial archaeologists and other academic disciplines. From its beginnings in the late 1950s maritime archaeology in Denmark has proven to be a valued sub-discipline of archaeology and natural science. This paper will discuss the evolution of maritime archaeology within Denmark from the Skuldelev excavations in the late 1950s and the subsequent development of the Viking Ship Museum, the Institute for Maritime Archaeology and culminating in the establishment of the National Museum of Denmark's Centre for Maritime Archaeology in 1993. The focus of the paper will be on how the success of maritime archaeology in Denmark is based upon the multi-faceted nature of the research which has been, and is being, conducted. The areas of research being studied reflect the progressive development of maritime archaeology in Denmark, which includes not only ships and boats, but wider aspects of the maritime cultural landscape. The close relationships between the various institutions at Roskilde, the Danish National Museum and other archaeological and academic institutions nationally and internationally will be illustrated with examples drawn from the thematic group 'Techniques and Auxiliary Sciences in Maritime Archaeology', one of the four thematic areas of research ongoing at the Centre.

Introduction

Contrary to the situation in many countries, maritime archaeology in Denmark has always enjoyed the support of terrestrial archaeologists and other academic disciplines. From its beginnings in the late 1950s, maritime archaeology in Denmark has proven to be a valid sub-discipline of archaeology and natural science. The focus of this paper will be on how the success of maritime archaeology in Denmark is based not only upon the multifaceted nature of research which has been conducted in the past and present, but also how closely interrelated maritime and terrestrial archaeology have been, and still are, in Roskilde. One of the problems frequently encountered when discussing the work at the Centre for Maritime Archaeology is that people often see maritime archaeology as simply being Roskilde, Denmark. It is important to clarify the development of maritime archaeology in terms of the evolution of the three main centres of activity in Roskilde: namely the Viking Ship Museum, The Institute for Maritime Archaeology, and The Centre for Maritime Archaeology. These are quite separate entities but it is their symbiotic relationship and synergistic effects, which need to be understood in order to appreciate the full effects of the Danish Experience.

Early Beginnings

Maritime archaeology in Denmark did not really begin until the late 1950s, and before this, the most notable investigation underwater was that of a shipwreck discovered in Kolding Fjord. In May 1943, a large side-rudder was found by an eel fisherman near the village of Rebæk, and a search for the ship from which it had been lost revealed a wreck further out in the fjord. Using water jets, divers removed over a metre of mud and encountered a number of loose timbers from the upper parts of the ship's sides which were brought to the surface, and eventually sections of the hull were exposed. The timbers were stored in iron barges in the nearby river, which flows into the fjord. The then director of the National Museum of Denmark, Poul Nørland and Knud E. Hansen, the maritime consultant of the Danish Maritime Museum at Kronborg Castle, Elsinore, visited and dived on the wreck site. Hansen was able, in the heavy hardhat diving gear of the day, to make several measurements of the remains. He also documented, through sketches and measurements, many of the loose timbers that had been brought up. All the observations he recorded in a small notebook, along with the photographs made of the salvaged timbers, which form the only

archaeological record of the excavation (Hocker 2000). The wreck was identified as that of a cog, one of the dominant Northern European bulk cargo carrier and most powerful warship of the North and Baltic seas in the High Middle Ages. At the time of the investigation the position of the wreck was fixed from land using theodolite but due to the extremely poor visibility in the water (often less than 1 m) it was not possible to relocate the wreck subsequently. Several attempts to find the wreck proved frustratingly unsuccessful until over 50 years afterwards (see below).

Initially this first plunge into maritime archaeology was not capitalised upon, but in the 1950s, Ole Crumlin-Pedersen, a young man with a passion for historic ships, studying to be a naval architect, met Olaf Olsen, curator at the medieval department of the National Museum. It was here that the foundations for modern maritime archaeology in Denmark were laid. The catalyst was the investigation of a blocked shipping channel at Peberrenden near Skuldelev in Roskilde fjord. Legend had it that in the Middle Ages the great Queen Margrethe had a stone filled ship sunk across the channel to prevent enemies of the kingdom attacking the city of Roskilde from the sea. Fishermen from the harbour in Skuldelev knew that there was ship's timbers in a winding channel in the fjord but it was not until 1956 when two young sports divers, Aage Skjelborg and Hartvig Conradsén, dived on the blockage and unearthed the frame of a ship that the National Museum subsequently excavated (Olsen and Crumlin-Pedersen 1990). This was an important turning point in the development of

maritime archaeology. Examination of the timber and other earlier finds, which had been brought up through dredging, made it clear that that the wreck was far older than Queen Margrethe's time, in fact from a period several hundred years earlier. The end of the Viking period, about the year 1000 AD, seemed the most probable date. However, after the first couple of excavation seasons it became apparent that the blockage consisted of not one but five wrecks. In 1962 the ships were recovered in a semi wet excavation, where a cofferdam enclosing an area of 1600 square metres, was built and drained. The ships were laboriously cleared of the overburden of stones, which had constituted part of the blockage, and the ships' timbers were surveyed and excavated by pioneering methods. The remains of the five ships formed the basis for a much more accurate assessment of the ship building ability of the Vikings and this assessment will be presented in Ole Crumlin-Pedersen's two volume 'magnum opus' *The Skuldelev Ships*, to be published in 2001.

The Viking Ship Museum

On the 1st February 1962, prior to the raising of the Skuldelev ships, Ole Crumlin-Pedersen was appointed to a post in ship technology and maritime history at the National Museum, which in 1964 developed into The Institute for Maritime Archaeology. Following the excavation of the ships, the task of organising their documentation and reconstruction fell to him in collaboration with the conservation department of the museum. Whilst the timbers were undergoing conservation, plans were made for a



Figure 1: *The Viking Ship Museum, Roskilde* (Viking Ship Museum).

purpose built museum. Interestingly, the excavation of the ships had generated so much interest (during the period between February and October of 1962, 30,000 people visited the site), that there was somewhat of a public and political skirmish as to where the museum should be sited. The towns of Frederikssund, just east from where the ships were found, and Roskilde, at the base of the fjord, were both vying for the museum. When the decision went in favour of Roskilde, there was public outcry and a protest was staged outside the town hall in Frederikssund, demanding that the town should enter discussions to have the ships! As far as is known, this is the only time in the history of Denmark in which an archaeological find has given rise to a march of protest (Skamby 1995, 40)

Nonetheless, the Viking Ship Museum was built in Roskilde (Figure 1) with funding from the Roskilde city council, the Ministry of Cultural Affairs and donations from several large private foundations. It opened in 1969, with Ole Crumlin-Pedersen as its director. The Skuldelev ships themselves are owned by the National Museum but the Viking Ship Museum is privately run. When it opened, the museum did not contain static displays but rather a working exhibition, whereby the conserved ships were reconstructed in the presence of the public so that they could put questions to the museum staff as they worked. Clause 2 of the present statute of the museum states:

The Viking ship museum is a specialist museum for the study of Nordic ship and boat building culture, particularly in the prehistoric and medieval periods. The Museum is to be active within this sphere by collection, registration, research, conservation, exhibition and other presentation of relevant archaeological, historical, ethnological and other material. The Viking ship museum in collaboration with the National Museum's Institute of Maritime Archaeology is to be responsible for carrying out maritime archaeological investigations of prehistoric and medieval ship finds and maritime structures along the coasts of Denmark and in Danish waters unless such investigations have been entrusted by the State Antiquary to other museums. (Damgaard-Sørensen 1999)

The reconstruction of the Skuldelev ships in the museum continued throughout the 1970s and 80s, attracting a constantly large number of visitors from all over the world. In 1983, Ole Crumlin-Pedersen, wishing to concentrate on the work of the Institute for Maritime Archaeology, asked to be relieved of his duties as the director of the Viking Ship Museum. This position was taken over by Jan Skamby, the curator at the museum. It was also at this time that the first of the copies of the Skuldelev ships were built; *Roar Ege* (Andersen *et al.*, 1997) a copy of Skuldelev 3, which was followed in 1985 by *Helge Ask*, a copy of Skuldelev 5. As it was envisaged that copies of the three remaining Skuldelev ships would



Figure 2: The Museum Island and the Viking Ship Museum (Viking Ship Museum).

be built, an expansion of the museum was planned. This expansion took the form of *The Museum Island*, which was constructed¹ adjacent to the museum and opened in 1997 by the Queen of Denmark (Figure 2). It has been an enormous success, boosting the number of visitors to the Viking Ship Museum by over 20% to almost 200,000 in 1998. With the 'new and improved' Viking Ship Museum visitors receive a very much hands-on experience of maritime archaeology and what it actually entails - from excavation, to conservation, to experimental archaeology and test sailing. For example, a typical visit may include the Archaeological Workshop, where visitors can see recently excavated finds being cleaned and documented prior to conservation. After visiting the museum itself to see the conserved Skuldelev ships, visitors can see the building of wooden vessels (since its opening in 1997 replicas of Skuldelev 6, *Kraka Fyr*, and Skuldelev 1, *Ottar*, have been built and the copy of the remaining ship, Skuldelev 2-4, is presently ongoing), and see the small flotilla of traditional Nordic sailing craft harboured around the Island. Finally, it is possible to take a trip on the fjord in some of these vessels.

The Institute for Maritime Archaeology

With the increase in the numbers of sports divers in the early 1960s, more and more shipwrecks were being discovered and the Institute for Maritime Archaeology was responsible for dealing with the information on shipwrecks which sports divers were finding in the territorial waters of Denmark. This led in 1963 to the first legislation to protect shipwrecks in Denmark with the *Act concerning the protection of historic shipwrecks* which made clear for the first time the rights of ownership to the historical relics in territorial waters that might be discovered by users of the sea. Among other things the act determined:

That objects, including wrecks, which are found on the seafloor in Danish territorial waters belong to the state unless an individual can substantiate his claim to ownership and that the state antiquary is to make such arrangements as he deems necessary for the protection and salvaging of the objects ...belonging to the state.

Loose finds that were more than 150 years old were also to be handed over to the state without the finder being able to claim salvage money, although the state antiquary was authorised to pay a remuneration based on an assessment of the cultural value of the find and of the treatment that had been accorded to it after salvaging. The act has been revised over the years,

the age criterion has been lowered to 100 years, and the preservation of ancient monuments on the seafloor, such as non-shipwreck related sites and artefacts has been provided for.

In 1984 the responsibility for the submerged cultural heritage was divided between the Ministry of Cultural Affairs and the Ministry of the Environment. Registration, surveillance, protection and preservation were considered tasks related to the environment, while excavation and treatment of archaeological finds on the seabed were to be handled by the State Antiquary and cultural historical museums. In 1983 the Maritime Archaeological Reference Group (MARE) was established to promote the burgeoning growth in maritime archaeological activity. The MARE Group advised the Danish Archaeological Board and the Ancient Monuments Board in matters concerning the submerged cultural heritage. It consists of representatives from a wide range of museums and institutions all with a vested interest in maritime archaeology; the National Museum, the National Forest and Environment Agency, the Danish Maritime Museum at Kronborg and the Danish Royal Naval Museum in Copenhagen, with Langelands museum representing the local museums. After a lectureship in maritime archaeology was established at Copenhagen University, this university also became involved in the work of the group. Furthermore, the Institute for Maritime Archaeology since 1970 has nurtured a good working relationship with Danish sports divers, which has been helped by the development of the Danish Scuba Diving Association's Archaeological Committee. A conference on marine archaeology is held every third year where professional and volunteer maritime archaeologists meet to present ongoing projects. Participation in surveys or excavations organised by museums is encouraged. Divers are also encouraged to participate in educational voyages with the National Museum's three-masted schooner *Fulton*, which includes both professional museum employees and sports divers. It is refreshing to see such a relationship when in Denmark, as with many other countries, there are still so few professional maritime archaeologists when compared to the amount of archaeology which lies in or on the seabed. In many instances, the sports divers act as the eyes and ears for the various museums.

Between 1964 and 2001 the Institute for Maritime Archaeology has investigated almost 80 historic wrecks by means of excavation or partial excavation (Hanne Marie Myrhøj and Jørgen

Dencker pers. comm.). Some of these have been pure research projects whereas some have resulted from a threat to the cultural heritage from construction work or the threats of the natural environment. Many of these investigations have been in cooperation with other special units from the National Museum, with local museums, with major specialised museums such as the Danish Maritime Museum and the Royal Danish Naval Museum, or with the National Forest and Nature Agency. For a more detailed account of this work, the reader is referred to Rieck (1995). However, these investigations have provided boat and ship find material dating from the Early Stone Age to the 19th century and in type from simple log boats to the great battleships of the navy (Figure 3).

Another function of the Institute for Maritime Archaeology has been the preservation of ships in order to maintain some of the floating cultural inheritance. In 1970 the National Museum received as a gift the three-masted schooner *Fulton*, built in 1915 and used in trade between Denmark and Newfoundland. The ship is now run by the Fulton Foundation and used for social-educational purposes including taking sports divers to be trained in methods of archaeology by museum staff. Apart from the *Fulton* there are four other ships owned by the museum, which have all been restored and are sailed by members of the museum and members of the 'friends of the museum'.

The Centre for Maritime Archaeology

In 1992 an invitation from the newly established Danish National Research Foundation was sent to all Danish universities and research institutions to apply for financial support for major projects of high international standing. From the outset, the foundation made it known, that archaeological research was considered to be a potential field for support so that proposals for research projects from that quarter would be welcomed. Ole Crumlin-Pedersen as head of the Institute of Maritime Archaeology submitted a project for the promotion of the field of maritime archaeology. In May 1993 a grant of 40 million kroner, about 4 million pounds, was made to establish for a 5 year period the National Museum of Denmark's 'Centre for Maritime Archaeology'. The basic aims of the Centre were to promote maritime archaeological research, which should be conducted by a broad range of doctoral, post-doctoral, and research scientists (both Danish and International), the results of which should be

published at a national and international level. Following the success of the first five-year period the Danish Research Foundation awarded the Centre a further five years funding (1998 – 2003). In 1999 Ole Crumlin-Pedersen, wishing to concentrate on his own research and promote other younger researchers at the Centre, handed over the directorship of the Centre to Søren H. Andersen. He was previously a Lecturer in prehistoric archaeology at Århus University and has worked extensively with Mesolithic finds in Denmark, co-ordinating projects both on land and underwater. The second five year period of funding has seen an expansion in research to include the wider issues of maritime archaeology. The research presently going on at the Centre falls into four main themes:

1. Man and the Sea in the Stone Age and bronze Age.
2. Seafaring and Society in the Iron Age, Viking Age and Middle Ages.
3. Ships and Boats in Antiquity, the Middle Ages and the Renaissance.
4. Techniques and Auxiliary Sciences in Maritime Archaeology.

A number of separate research projects in each group have been carried out at the Centre during this time². The organisation of the first three thematic groups follows a wide time span and includes many aspects of maritime archaeology. For example, the first thematic group includes work on the Mesolithic site at Tybrind Vig in Denmark and analysis of the many log boats from this period. The second thematic group includes subjects as diverse as fishing in the Viking Age and Middle Ages to sea defences and military organisation in Denmark from AD 200 to 1300. The third thematic group spans from research into Denmark's oldest known boat find, the Hjortspring Boat, up to large sea-going vessels of the Renaissance period.

One of the current projects, which represents the wider aspects of maritime archaeological research, is a current investigation into harbours and towns in Medieval Denmark by Dr. Jan Bill. Towns formed important nuclei in the medieval system of transport and communication, partly because they were centres of consumption and partly because of their role in the commercial exchange system. Transport often meant shipping, as this was the most efficient way of transporting bulk goods, and for that reason many towns were situated at navigable waters, with their harbours being essential to their existence.

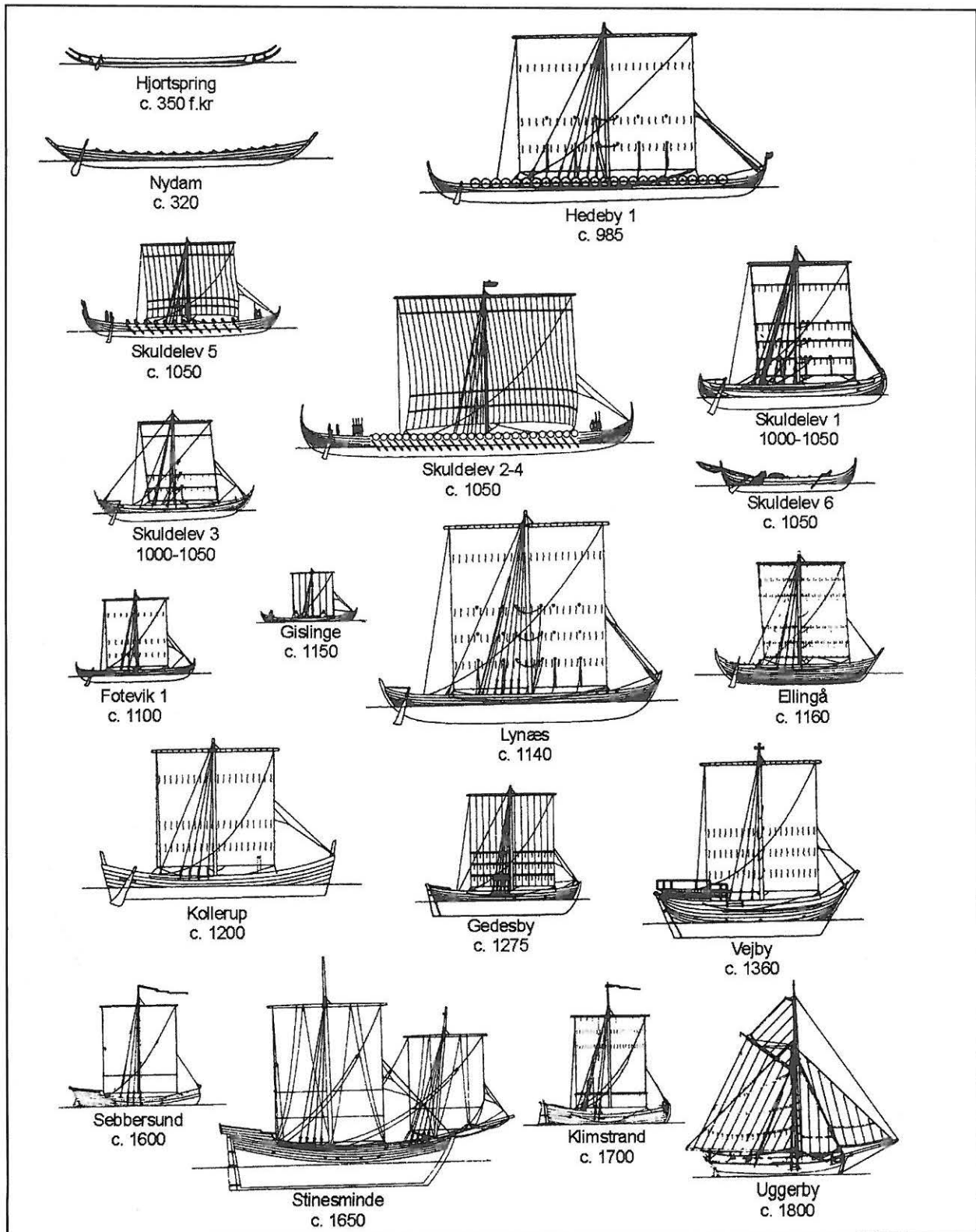


Figure 3: Two millennia of Danish ship finds (Morten Gøthche, National Museum of Denmark).

The project on harbours and towns in Medieval Denmark focuses on the towns' role in the transport system as a means to investigate their organisational development. The archaeological material indicates the transport infrastructure, especially harbour

installations, was both individually and collectively run. It is the hypothesis of the project, that the task of establishing and maintaining adequate transport infrastructure provided one of the stimuli for urbanisation. This hypothesis is being tested by

mapping the development of transport infrastructure in the medieval towns, and analysing their presence in relation to factors other than political organisation; for example landscape, transport technology and political leadership. In the event that the patterns observed cannot be explained satisfactorily by these factors, it may be relevant to suggest changes in the organisational structure of towns on the basis of changes in their spatial organisation.

The project is being developed on two levels. First, based on historical maps and cadastres, the resource and transport landscape in which the towns and harbours are situated and their accessibility from land and sea is being analysed. For this purpose, selected themes from the relevant historical maps have been digitised. Thematic maps including historical and archaeological information on, for example, productivity and church building/demolition, have been produced as well. Based on this material, the medieval resource and transport landscape is being reconstructed. Second, the project also analyses the internal structure of towns. For this purpose, archaeological and historical information on the layout of each town is being systematically collected and analysed with regard to the spatial arrangement of transport, handling and storage facilities. By comparing the investigations of all the studied towns, regional, chronological and/or topographical patterns and their causes are being sought and described. Unexplained global and regional patterns will be discussed in the light of the already existing knowledge about the organisational development of the medieval town such that a possible contribution to our understanding can be formulated.

Techniques and Auxiliary Sciences in Maritime Archaeology.

Three ongoing projects in the fourth thematic group will be discussed in a little more detail here as the work of this group epitomises the research essence of the Centre, namely its interdisciplinary nature, co-ordination with other institutions and their synergistic effects. Three projects to be discussed are: *in situ* preservation of Nydam Mose; development of documentation techniques; and Geophysics in Marine Archaeology.

In situ preservation in Nydam Mose

The site of Nydam Mose, close to Sønderborg in the southern part of Jutland, is one of the classic sites in Danish archaeology. The presence of archaeological

finds in Nydam was discovered in the middle of the 19th century and a series of excavation campaigns at this time revealed the remains of three large clinker built rowing vessels and a wealth of organic and metal artefacts. Dating of the artefacts showed that the local Iron Age population used the area as a sacrificial site over a time span of more than 300 years between the third and fifth century AD. At this time, the area was a small freshwater lake and on several occasions offerings of 'war booty', taken from defeated armies, were made into the lake. Around AD 500 the lake became overgrown and evolved into a bog and nowadays the area is a water meadow.

In the 1990s, under the direction of Flemming Rieck from the Institute for Maritime Archaeology, excavations were reconvened in order to discover further remains of the vessels which may lie in the bog. Between 1991 and 1996 literally thousands of artefacts were unearthed (Figure 4) and it is expected that many more artefacts of wood, iron, precious metal, bone, leather, amber and glass still remain on

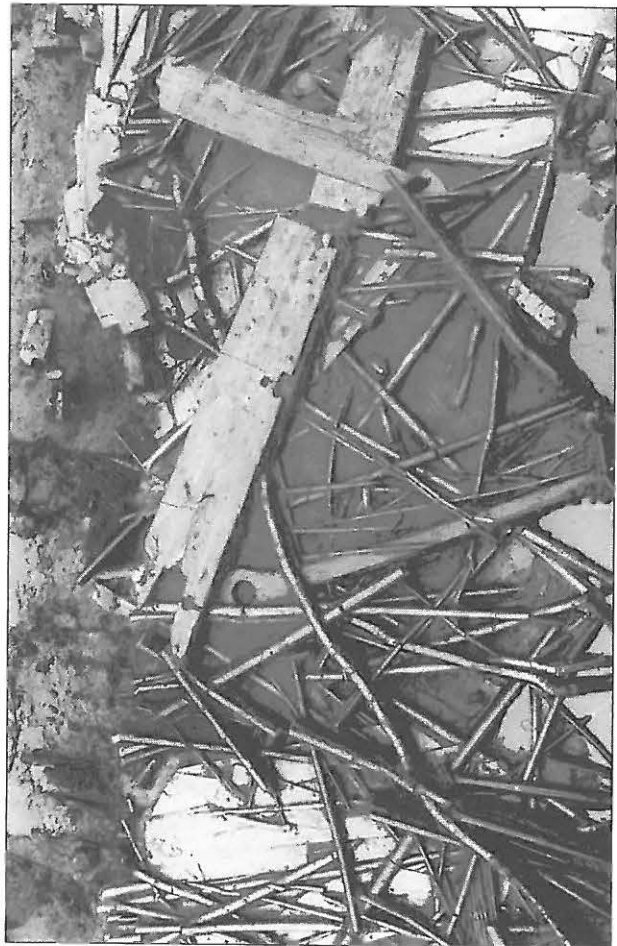


Figure 4: Nydam Mose under excavation in 1994 showing a multitude of artefacts (Per Poulsen, National Museum of Denmark).

site. Due to the high cost of excavation, documentation, conservation and storage of artefacts, a decision was made to stop full-scale archaeological excavations in 1996 and investigate the feasibility of preserving the site *in situ*. In collaboration with the National Museum's metal and organic sections of the conservation department and natural science department a programme to characterise and monitor the chemical and biological nature of the environment in the bog was implemented in 1996 (Sørensen and Gregory, 1998). Preliminary results indicate that the finds are in a completely waterlogged, slightly acidic, reducing environment with very low levels of dissolved oxygen. These results indicate the optimal conditions for preserving wooden artefacts. However, by themselves they do not say anything about the *actual* state of preservation of the artefacts. Thus in 1999 a small-scale test excavation was conducted in order to obtain 'fresh' artefacts for study. In collaboration with colleagues from the Department of Wood Science, at the Swedish University of Agricultural Sciences, wooden artefacts were examined to study their state of preservation and the likelihood of their further deterioration given the present environmental conditions in the bog. The results (Gregory, 2000a) indicated that in all artefacts examined there was very little cellulose left and only the lignin skeleton held the wood together. Those artefacts in the upper layers of the excavation appeared more deteriorated as boring insects had attacked them. Soft rot was present in the outer 1-2 mm of all artefacts, and below this and throughout the artefact deterioration was caused by erosion bacteria - importantly these operate only in waterlogged and near anaerobic conditions and will only attack cellulose and not lignin. The major concern for the future microbial deterioration of wood is whether brown and white rot can cause deterioration, as these will destroy the remaining lignin. Under the present environmental conditions, this is extremely unlikely as the conditions are unfavourable for their survival, but to confirm this, laboratory experiments were conducted to see what effect brown and white rot had on the artefacts. Preliminary results (Charlotte Björdal pers. comm.) show that as long as the site remains waterlogged the artefacts will not undergo further deterioration. Further work analysing the metal artefacts and the potential for their further deterioration is currently ongoing in collaboration with the Danish Technical University.

Documentation: The reconstruction of the Ladby Ship

The Ladby ship is Denmark's best-known ship grave from the Viking period. Buried on Fyn in the tenth century, the ship was excavated between 1934 – 1937. However, all that survived was the remains of the rivets and nails that had held the ship together. At the end of 1993, Anne Sørensen began a doctoral research project (Sørensen, 1998) at the Centre to re-evaluate the ship grave. Part of this work included an attempt to produce a new and up-to-date reconstruction of the ship. A reconstruction of this type required information about the shape of the hull and the building techniques employed. The shape of the hull could be determined because of the thorough recording of the distribution of the 2000 or so iron nails and rivets which had survived in the ground. Similarly, analysis of the type and length of nails used would yield information about the construction of the ship. In order to determine the hull shape in a precise and accessible way a unique and innovative 1:10 model was made by Vibeke Bischoff, a boat builder employed at the Centre. Based on cross sectional drawings from the excavation a series of 18 adjustable templates were built (Figure 5). The templates were constructed with a ruler lying horizontally above. Fixed between this and a wooden runner were aluminium pins, one for each side plank of the ship, which came vertically down. The end of each pin was fitted with a little metal eye in order to position a strip of Perspex which ran the length of the ship. These strips indicate the lines of the nails (the rows of the planks). The pins could be individually moved up and down, out or in making it possible to adjust the cross sections. The ruler above made it possible to read the cross measurements for each nail line. In this way it was possible to construct the lines of the ship, as it was found. Knowledge of the types of nails used in the construction of wooden ships, and knowing the location of those found in the excavation, made it possible to identify the various stages of decomposition of the ship after its burial. Thereafter the individual pins could be moved up and down to allow for nails which had moved post-deposition and thus work backwards to create an outline of the ship prior to its burial.

To assist the development of the ship-outline model the excavation plans were transferred to computer to facilitate analysis and visual imaging of the large quantity of data. The recreated

feature was clearly a shipwreck, with a row of frame ends protruding from the mud down either side and a heavy central timber (Figure 7). These features again corresponded well with Hansen's sketches even to the location and shape of the keelson timber. Divers investigating the wreck confirmed that after 57 years the cog had again been found, and it will form part of another of the Centre's projects on Scandinavian cog finds, of which there are nine presently known.

Discussion

The success of Danish maritime archaeology has been in no small part due to Ole Crumlin-Pedersen. His passion, drive and foresight lead to the development of the Viking Ship Museum, the Institute for Maritime Archaeology and the Centre for Maritime Archaeology. However, they would not have been brought to fruition if it were not for the effort and teamwork of a number of like-minded people. It is perhaps this which makes Danish

maritime archaeology (and archaeology) such a success. I have discussed the inclusion and involvement of the public and volunteers in archaeology and the investment from both government and private institutions. Denmark of course does not have a monopoly on these. However, the altruism that pervades Danish society makes the difference. It is this, in my opinion, which has enabled the development of the three institutes in Roskilde, the co-operation between the various institutions discussed and the stringent legislation to protect the submerged cultural heritage for future generations.

The current grant for the Centre ends in August of 2003. Typically, plans are already afoot to create a 'Maritime Archaeology Centre at Roskilde', which would bring all three of the Institutions in Roskilde together under one umbrella. Only time will tell if this becomes a reality but with more than three decades of experience, it would seem the most logical step forward to enhance the already exciting Danish Experience of maritime archaeology.

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1. It should also be mentioned that during the building of the museum island nine more clinker ships built in the Scandinavian tradition were discovered and excavated and are at present being documented and conserved with the aid of a £½ million grant from the A.P. Møller foundation which is part of the Mærsk group.

2. Details can be found in the Centre's biannual newsletter, available from the Centre, or several editions can be found on the Centre's homepage <http://www.natmus.dk/nmf/nyhed/indexGB.htm>

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