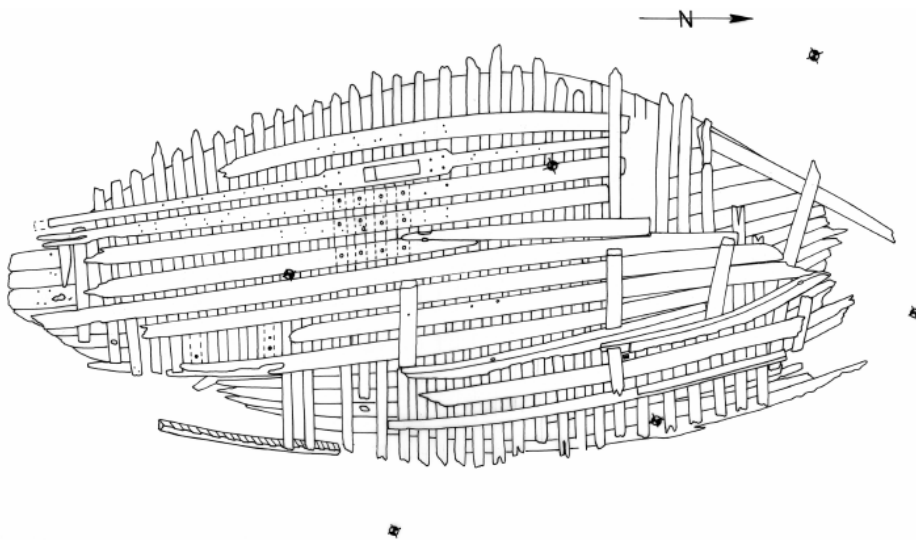


Management plan of shipwreck site Darss Cog



Archaeological State Museum of Mecklenburg-Vorpommern 2004



Education and Culture

Culture 2000

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0. Administrative details

0.1. Date

23.02.2004

0.2. Purchaser

State of Mecklenburg - Vorpommern

0.3. Executed by (contractor)

The Archaeological State Museum of Mecklenburg - Vorpommern

Work executed by the diving team

(J.H. Ehresmann, J. Gerken, M. Gloede, D. Graef, E. Halbwiedl, W. Heuschen, D. Hinz, R. Obst, A. Schablowski, Th. Scherer, C. Schmitz, M. Schrader, I. Tillich)

Report: F. Lüth & Th. Förster

0.4 Approved authorities

The Ministry of Education, Science and Culture in Mecklenburg – Vorpommern

The Archaeological State Museum of Mecklenburg – Vorpommern

Water and Navigation Management North (Approval Authority of the Government)

0.5. Central registration number

Baltic - Area V, Darss, Site 40

0.6. Location research area

Southern Baltic Sea, area east of Darsser Ort

0.7. Coordinates

Measurements by Th. Förster

Seemap: BSH Nr. 162 stretch of water between the island of Rügen and the island of Møn

Scale: 1:100000 (edition 2002)

0.8. Environmental context

Coastal Geology

The coastal area around the site is characterised by a flat coast, which is enclosed by cliffs near Ahrenshoop to the west and by a steep bank near Dornbusch/Hiddensee to the east. While the outer coastal line runs almost straight in an east-west direction from Hiddensee to the slightly concave shaped Darsser Ort, the inland coast towards the inner waters of the Grambow, the Barther, Bodstedter and Saaler Bodden is separated in bays and coves of different shape and size.

The current morphology is a result of strong geological movements. Sediment is removed from the cliffs in Zingst and the west coast of the Darss and due to strong currents, it is transported towards the East-West or South-North and deposited in various sandbanks. At the Darsser Ort a hook of sand was created in this manner.

The bottom of the sea was created by a standstill of the ice during the Pleistocene. With the beginning of the Litorina transgression this area was flooded. Old and flooded islands can be localised at several places. Amongst them, the “Prerowbank” and other large peat banks in front of Zingst belong to this formation. Several passageways existed between the inner waters and the open sea, eg. around Ahrenshoop and Wustrow and in the Prerowstrom. They developed as subglacial erosion grooves and worked as outlets in the postglacial period. The immediate area around the wreck is characterised by the above-described coastal dynamics. The ground on the wreck site consists of fine sand, silt and partly of eroded peat (see 0.14).

Climate

The water temperature of the surface in the Baltic Sea shows clear fluctuations over the year. In the winter time the temperature is about 0 - 2°C. Temperatures of 20°C can be reached in the late summer. The amplitude of the deeper water clearly shows smaller fluctuations. The temperature is between 4 – 10°C.

Only during long cold spells an ice surface is formed in the area of the Darss. Weather situations with western winds prevail and bring mild Atlantic air into the area. Heavy cooling occurs when the south-western Baltic Sea is influenced by weather situations from the northern area or from Russia. Winters with ice formation for a period of two months were registered in 1963, 1970, 1979, 1985, 1987 and 1996.

Winds from the West prevail in the area of the shallow “Darsser Schwelle”. Only during spring and winter accumulations of winds from the East can occur. The average wind velocity is 8 – 14 kn, which corresponds with a wind force 3 – 4 on the Beaufort Scale. The wind direction in the Baltic Sea is changeable and is 25 – 28 % in the average of the year. In long-term measurements it was found out that November is the windiest and May the most windless month.

Influence of tides can be neglected in the area of the Darsser Schwelle as well as in the Baltic Sea. Southwest or Northeast storms may cause major water level fluctuations of about +/- 125 cm.

Higher water levels may cause storm tides. The last storm tide with a height of 3,40 meters led to heavy damage in the nearby village Prerow. Due to sediment movement the Prerow Stream was closed. During the last 25 years another 19 storm tides occurred. Storm tides on the 21.02.2002, 3.11.1995 and 15.02.1995 reached a height of almost 2 meters.

Flora and Fauna

The saltwater from the North Sea and the freshwater from the rivers create a rich habitat in the Baltic Sea. A salt content of 10‰ can be found in western

parts of the Baltic. The salt content as well as the abundance and diversity of organisms varies in different parts of the Baltic Sea with instreaming water from the North Sea.

The ground at the site area consists of soft and sandy material, where numerous organisms are able to live. Organisms have settled on the cog itself. They normally depend on hard surfaces and cannot be found regularly in this area. The sand and the cog are overgrown with different macro algae, such as *Polysiphonia fibrillosa*, *Pilayella littoralis*, seaweed and common sea grass (*Zostera marina*). Common sea grass is ecologically important as spawn and rearing region for fishes. Around the cog mainly goby (*Gobiidae*) and their young ones, but also other fishes can be found. During the excavation at the Darss Cog a high abundance of different mussels was discovered. Mainly the blue mussel (*Mytilus edulis*) and the common soft shell clam (*Mya arenaria*) were present, but also cockle (*Cardidae*) and the Baltic tellin (*Macoma balthica*) were registered. In the wood of the cog, tunnels of the marine wood borer *Teredo navalis* and possibly *Psiloteredo megotara* were found. Occasionally remains of the common limpet were found in the wood. However, these do not seem to live on the cog. Barnacles settle on the top of ballast stones and some logs.

In addition, crustaceans, such as *Gammarus locusta*, Baltic prawn (*Palaemon adspersus*) and sand crabs (*Carneus menas*) can be found in this area. Occasionally one comes across sea mats (*Membraniporidae*) that belong to the specie of *Hippodiplosia foliacea*.

Human impact

The wreck site is in the national park of Vorpommersche Boddenlandschaft. The national park aims to minimize the human impact in this area. The influence of sports boats can be classified as minimal.

However, fishing with nets takes place in this area. The fishermen know about the wrecks and avoid the places. Damage caused by fishing nets was not found on the cog. Sediment movements caused by humans may cause alterations at the site. Measures concerning coastal protection (groynes, for example) can lead to alterations of the streaming velocity and therefore may alter the deposition of the sediment. Measures concerning coastal protection have to be based on the heritage protection law of Mecklenburg-Vorpommern (DSchG M-V GVbl. MV Nr. 1 from 14.01.1998), which means that alterations around the immediate site of the wreck do not occur. A translocation of sand was approved in 2003. The distance to the cog was 3 km. A security distance of 150 meters was required and agreed upon for the remaining wreck sites around the Darss. Diving sessions revealed that no damage occurred either on the Darss Cog or on any other wreck.

However, a construction of a yacht harbour in the area of Prerow and/or Prerowstream is planned in the future. The setting up of moles or the opening of the Prerowstream to the Baltic Sea could alter the natural coastal dynamic immensely and may endanger the wreck in the end. The diving tourism is not very well developed. Lifeguards or the local diving clubs carry out regular dives.

Sports divers are sensitised by talks and presentations about the protection of the underwater heritage. Some of the divers support examinations and the effort to protect submarine sites.

0.9. Size of research area

The remains of the vessel have a length of 16,50 meters and the width is 7,60 meters. Due to geophysical examinations, we can assume that there are parts of the ship around the hull and they are covered by sediment. As a result, the whole research area covers 50 m x 50 m.

0.10. Depth

The average depth of the wreck site is 6 meters.

0.11. Owner of the terrain

The Federal Republic of Germany.

0.12. Reported by

The wreck is registered without any specific dating in a ship finds catalogue that was written by Dr. Detlev Mohr for the Navigation Museum in Rostock in 1977.

Reports by Thomas Förster, the department for underwater archaeology, the Archaeological State Museum of Mecklenburg – Vorpommern.

0.13. Periods of research

Summer 1976:	Discovery by sports diver Hans Joachim Hämer, Prerow.
Summer 1976: 1977:	First draft of the wreck by Dr. Detlef Mohr, Potsdam. Catalogue of ship finds in front of the Darss by Dr. Detlef Mohr for the Navigation Museum, Rostock.
Summer 1977:	Three dendro samples were taken for dating at the Academy of Science in the GDR (samples could not be dated, due to lacking comparison samples).
Summer 2000:	Report of the find to the Archaeological State Museum of MV.
13. - 30.07.2000:	Initial examination of the site by the Archaeological State Museum supported by the State Association of Underwater Archaeology.
05. - 10.03.2001:	Beginning of the photogrammetric documentation.
27.07. - 12.08.2001:	Trench, the associated area, was examined (in connection with the MoSS Project)
26.04. - 05.05.2002:	Geophysical prospecting (MoSS)
02.08. - 01.09.2002:	Exposing of the forebody and recovery (MoSS)
	Since September 2002: Maintenance and control of the data logger in every three months
21.07. - 31.08.2003:	Exposing of the amidship and afterbody (MoSS)

0.14. Research area

A small bridge on the shore separates the Prerowstream from the Baltic Sea. Until the end of the 19th century a connection existed between the inner waters in the south and the open sea. The shore area of the Darss and Zingst to the east are characterised by a strong coastal dynamic. In this connection fine sand is removed by an East-West current at the coast of Zingst and deposited at the Darsser Ort. The wreck site is located between the point where sand is removed and the point where it is deposited, and therefore it is a geologically neutral spot. Based on Dr. Detlev Mohr's observations from 1977 to 2002, the sediment situation around the wreck has not changed. The bottom at the wreck site consists of fine sand, silt and peat sticking out of the ground. The wreck works as a current obstacle; around it there is a hollow of the depth of 50 cm.

0.15. Deposition of archives

The documents as well as the results of the examinations and finds are deposited in the archives of the Archaeological State Museum of Mecklenburg – Vorpommern.

0.16. Legal status

The wreck is under § 2 Abs. 5 DSchG MV classified as a historical monument. It is protected by § 5 Abs. 2.

0.17. Recognized threats

- Natural erosion
- Fishing activity
- Sport diving
- Wood borers
- Bacteriological attacks

1. Introduction

1.1. Previous studies

After the finding of the wreck was reported to the Archaeological State Museum, scientific examination of the object took place in 2000 – 2001, with the aim of dating the wreck and documenting it in situ. Then, a photogrammetric documentation of those parts of the wreck that jut out of the sea bottom was carried out. The results were analysed in connection with a final dissertation at the University of Neubrandenburg. In addition, a first model was produced.

D. Mohr, Katalog der Schiffsunfälle an der Ostseeküste des Fischland und Darss zwischen Dierhagen und Müggenburg. Katalog für das Schiffahrtsmuseum Rostock. Unveröffentlichte Arbeit. (Magdeburg 1979).

D. Mohr, Schiffswracks an der Ostseeküste von Fischland und Darss – eine Übersicht. Nachrichtenblatt Arbeitskreis Unterwasserarchäologie Band 8. (Hemmenhofen 2001). 59-66.

T. Förster, Neue Wrackfunde zwischen Rügen und Darsser Ort. Nachrichtenblatt Arbeitskreis Unterwasserarchäologie Band 7. (Hemmenhofen 2000). 50-54.

T. Förster, Alltagsleben auf spätmittelalterlichen Schiffen – Neue archäologische Untersuchungen an Wrackfunden vor der Küste von Mecklenburg – Vorpommern. In: K. Krüger / C.O. Cederlund, Maritime Archäologie heute. (Rostock 2002). 232-236.

T. Förster, Die Darsser Kogge – Der aktuelle Stand der Untersuchungen. Nachrichtenblatt Arbeitskreis Unterwasserarchäologie Band 10. (Hemmenhofen 2003). 87-93.

MoSS Newsletter 2/2003

H. Jöns, Aktuelle Forschungen zur Erhaltung, Überwachung und Visualisierung nordeuropäischer Schiffswracks – Das „Culture 2000“-Projekt „MoSS“. Skyllis 2004 (in preparation).

1.2. Historical context

- Maritime trade in the late medieval period
- Trading ships with a route between North and Baltic Sea

2. Assessment of the site

2.1. Description of research assignment

2.1.1. Reference to working standards

- The diving work is carried out following the regulations of the professional association Richtlinien für den Einsatz von Forschungstauchern (Guidelines for Employment of Scientific Divers) (ZH 1/540, April 1988).
- The standards for Archaeological surveys and investigations of the Association of the German State Archaeologists
- Internal MoSS Standards for sampling

2.1.2. Research objectives

The examination of the Darss Cog has the following aims:

- The documentation of the current state of the wreck
- The clarification of the construction of the ship
- The recording of the environmental circumstances around the wreck (monitoring)
- The long-term in situ protection of the wreck (safeguarding)
- The presentation of the wreck for the public (visualizing)

2.1.3. Expected results

The following results are anticipated:

- The clarification of the current and future threats to the wreck
- The reconstruction of the ship's last voyage, based on the remaining cargo and the personal belongings of the crew
- The dating and establishing of the wreck's and the cargo's provenance
- The virtual reconstruction of the wreck
- The determination of a strategy concerning the long-term protection of the wreck

2.1.4. Aim / wishes of purchaser

- The development of a routine for the protection of endangered wooden shipwrecks in the southern Baltic Sea
- Further development of photogrammetry as a method of recording wrecks efficiently

2.1.5. Imposed research conditions

From the beginning, the research project "Darsser Cog" had a guideline to minimise the intervention in the wreck site. The intention was to examine the entire wreck site without destruction and to use geophysical investigation methods. Only the preserved hull would be exposed for photogrammetry. Objects from the area would be lifted exclusively. Finally, the removed sediment would be replaced so that the original state was reconstructed as thoroughly as possible.

2.1.6. Evaluations in between

After the biological threat caused by different organisms, especially *Teredo navalis*, was discovered, it was decided to protect the exposed wooden parts of the construction. A covering system developed in the Netherlands is used for the protection. The entire wreck is covered by synthetic gauze that works as a sediment trap for the sand particles. On top of the wreck, there will be increased sedimentation and protecting layers of sand will cover the wreck.

2.2. Working procedure

2.2.1. Research methods

Monitoring

- The recording of the physical and ecological condition of the site (two data loggers were installed at the site)
- The setting up of a test field to examine the biological activity at the wreck
- The examination of the state of the wood with drill resistance measurements

Visualising:

- The geophysical survey of the wreck and the connected area (side scan sonar, geo radar)
- The photo and video documentation
- Recording the construction (using photogrammetry as a basis for a reconstruction)

Safeguarding:

- Testing the covering system developed in the Netherlands under the circumstances in the Baltic Sea

Archaeological excavation and documentation

- The location of the wreck by means of aerial photographs and GPS
- The dating of the wreck by means of dendrochronology
- Surveying the wreck by means of triangulation
- Exposing the wreck using a water dredge (hydrolift)
- Lifting and documentation of the exposed finds

2.2.2. Imposed work conditions

None

2.2.3. Density of perceptions grid

The aim of the project was to set up the grid of perception very dense to gain as much information about the wreck site as possible. This means in particular:

- The recording of the wreck and the area by a side scan sonar, aerial photographs and inspections by divers
- The stratigraphy was examined by a sediment sonar and a geo radar. The excavation within the hull provided further information about the stratigraphy

inside the wreck.

- The documentation of the wreck site by means of conventional survey methods as well as by photogrammetry
- In addition, all findings were recorded by photo and digital video techniques
- The comparison of the measurements gained from the MoSS Project with the ones from the measuring stations of the IOW and STAUN

2.2.4. Natural sciences, applied sciences and other research

The following institutions and related sciences are involved in the examination of the Darss Cog:

- Dating and analysing of the wood by the Laboratory for Dendrochronology of the Deutsches Archäologisches Institut Berlin (German Archaeological Institute)
- Determination of material composition by the Rathgen Forschungslabor Berlin (Rathgen Research Laboratory)
- Photogrammetric survey by the University of Applied Sciences Neubrandenburg and Rostock
- The examination of the area by a side scan sonar was carried out by the Bundesamt für Seeschifffahrt und Hydrographie (Federal Authority for Seafaring and Hydrography)
- Aerial photographic documentation of the wreck and the connected area by Mr. Otto Braasch
- Analysis of the archaeo-zoological material (bones, fish remains) by the University of Kiel
- Geophysical survey by the companies Texplor and SOSO
- Scientific analysis of cargo parts (sulphur, whetstones, ballast) by different laboratories (Helge Askvik, Institutt for geovitenskap of the Bergen University (N), Ian A. Simpson, School of Biological and of Environmental Sciences, University of Stirling, UK)
- Analysis of the caulking material by Dr. Susanne Möller-Wiering, Schleswig

2.3. Research results

2.3.1. Environmental research

Permanent contact and exchange of information with the pilot O. Braasch, Landshut, made it possible to explore and observe the entire area around the cog. The condition of the Darss Cog and the transport of sediment within the wreck area are monitored during regular inspection flights.

The cog was located in springtime in a depth of over 6 meters. Because of the depth and the water conditions, there is a limited possibility to distinguish details. In the site area, eight anomalies were located and investigated by divers. The objects do not belong to the cog find and date from later periods. An 18th century wreck is located in a distance of 150 meters and a 19th century wreck lies 500 meters away from the cog. 1800 meters east of the cog there is a carvel built ship with a stone cargo dating from the 16th century. The rest of the anomalies are a navigational aid of stone (water depth gauge) and four other wooden ships

from the 13th, 18th, 19th and 20th century.

It is certain that the cog sank in the 14th century in the old mouth of the river Prerowstrom. Aerial photographs show the Darss Cog and the surrounding wrecks as anomalies in the mouth of the river.

The side scan sonar, a Klein 2000 Side scan sonar with a capacity of 500 KHz and with a survey area of 75 meters, was given by the Federal Authority for Seafaring and Hydrography. The close cooperation with this authority, which is responsible for maritime survey, has led to the location of 193 shipwrecks since 1993. Because the cog area was too shallow for Deneb, the survey and wreck search vessel, the sonar fish was towed from a small survey unit - the dinghy Deneb 1. The position of the cog was recorded exactly. The scanning of the seabed proved that no drifted parts of the wreck lie around openly and are subject to destruction.

Two data loggers and a test station were placed near the Darss Cog in the summer of 2002. Measurements are taken in every three months and wood samples are taken after six and twelve months. The measurements and wood samples are sent to the Mary Rose Trust.

With the nearby measuring station of the IOW and STAUN, a comparison of the dates can be carried out.

2.3.2. Physical condition

2.3.2.1. Finds visible on surface

Parts of the starboard side are visible but otherwise the starboard side is sloping into the sediment. Fore stem, parts of the bottom, keel sown and the outer part of the bulwark jut out of the ground.

2.3.2.2. Completeness

The starboard side is preserved 80 %. The forebody and amidship are almost complete, only the afterbody shows destruction. The exposed port side is due to currents damaged to a greater extent. However, many parts of the construction can be found around the wreck under the sediment. The part of the construction that has preserved as a unit has a length of 16,50 m and a width of 7,60 m. Due to covering sediment, the starboard side is well preserved.

2.3.2.2.1. Completeness of wreck parts

Inside and around the wreck construction parts can be found, such as the after stem, crossbeams, the knee, and deck beams. They have broken off in the course of time and have relocated. Based on geophysical measurements, it can be expected that a major part of the inventory is preserved in deeper layers of the sediment around the wreck.

2.3.2.2.2. Stratigraphy intact

The stratigraphy around the wreck is intact; merely the surface of the bottom is disturbed due to currents that brought in recent finds and materials.

2.3.2.2.3. Mobilia in situ

There are still remains of the mobilia on board. Due to the depth of 6 meters, the items could not be salvaged. Over the time sediment has covered them. Not even light cargo, such as dried cod, was washed out, and numerous pieces are found inside the wreck. In the wreck there are:

- Inventory and maritime equipment
- Cargo
- Personal belongings

2.3.2.2.4. Relation between mobilia and wreck parts

Objects were mainly found inside the preserved hull. When studying the stratigraphy it becomes clear that the content of the sinking ship accumulated at the bottom of the ship and was then covered by sediment.

It was noted that heavy metal objects remained in the hull. Lighter objects such as fish remains and textiles were preserved only when they are trapped between the frames or under ballast. In a small room in the frontship a barrel with sulphur was found. Many items probably fell out of the ship during the sinking and may now be covered by sediment like the wreck itself.

2.3.2.2.5. Relation between mobilia

Based on the distribution of the finds, equipment such as a plumb line, ropes and a lantern were located in the forebody. This area was used to store clothing as well; there are remains of clothes and two pair of shoes in the area. The amidship contained ballast and cargo that consisted of sulphur, reindeer antlers, whetstones and dried cod. The afterbody was used to accommodate passengers and the crew. This can be seen thanks to cooking and drinking ware.

2.3.2.2.6. Stability of natural environment

The parts of the ship that can be found in the sediment are in a stable environment. In contrast, those parts of the ship that jut out of the ground are strongly exposed to environmental conditions.

The biggest problem is caused by the shipworm infestation (*Teredo navalis*, a mollusc of the family Teredinidae). A monitoring programme on the *Teredo* problem initiated by the State Authority for Environment and Nature shows that the shipworm has adapted to the conditions of the Baltic and that the situation is not going to ease.

2.3.3. State of preservation

The parts of the wreck that are in the ground are preserved very well. In a very good state of preservation are also those wreck parts that were covered by sediment in the immediate area during the breakage of the ship.

2.3.3.1. Organic wreck parts

Wooden parts under the sediment are very dense and have sharp edges. Items made of plant material, bone or leather are preserved very well, too. But parts jutting out of the ground are abraded and partly heavily infested with *Teredo navalis*.

2.3.3.2. Metal wreck parts

Nails and sintels are completely corroded and have formed iron concretions.

2.3.3.3. Organic mobilia

Wooden objects, textiles, leather, bones and fish remains are excellently preserved. See point 2.3.2.2.3.

2.3.3.4. Metal mobilia

Bronze and copper items under the sediment show almost no damage. Exposed bronze is affected by corrosion. So far no iron objects are found.

2.3.4 Cultural-historic and archaeological data

2.3.4.1. Identification

Identification of the ship is not yet possible. Since there are almost no written reports on ships from the 14th and 15th century, identification is probably not possible at all.

2.3.4.1.1. Cultural context

The Hanse (trading alliance) characterised the social development in Europe and especially in the Baltic from the 12th century to the 17th century. Maritime trade on North and Baltic Sea is the most important foundation for the economical power of the Hanse towns in the late medieval period. The tradesmen of the Hanse needed efficient means of transport for the merchandise transfer on sea. In contrast to the trade on the minor developed road system, a trader with ships could transport a great many products over the open sea or river system in a rather short time.

The organisation of the maritime trade is not only influenced by ships as means of transport, but also by the goods provided. The development of Hanse towns as trade centres for maritime and terrestrially transferred goods depended on the location and the accessibility for ships. There was a strong connection between the Hanse, the development of towns, and the organisation of the economy and ships.

Archaeologists achieve important information thanks to the examination of ship finds and cargoes, the recording of harbours and the consulting of other archaeological sources. Together with maritime items, evidence of the economy, traffic, technique, settlement and social history are preserved, which in combination with other sources contribute to the research of the Hanse.

The examination of the Darss Cog offers an important historical source for the history of transport. The wreck as a complete archaeological find may provide complex information about the technology of shipbuilding, cargo capacity, sea traffic, items of trade and routes, the crew, and the every day life on board.

2.3.4.1.2. Century

The 14th century.

2.3.4.1.3. Exact dating

Construction: The wood for the vessel was felled between 1298 and 1313, so that the construction time of the ship is presumably at the beginning of the 14th century. Based on comparison with wood chronologies the oak timbers originates from the lower Weichsel area.

Sinking: Barrel staves, which have the same origin as the other timbers and point to a fell date around/ after 1335, indicate the sinking date. Further dating is possible by using small finds. Two bronze tripods (Grapen) are marked with a town mark of Lübeck and Greifswald. These marks were demanded since 1354, as stated in the “Setthingen” of the Hanse towns.

Dating indicates that the Darss Cog sank 40 – 50 years after it was built.

2.3.4.1.4. Function

A trading ship.

2.3.4.1.5. Type

A cog, flat bottom – Frisian tradition

2.3.4.1.6. Operating area

A so-called “Umlandfahrer”, a ship that only sailed around Kap Skagen, from Norway to the Baltic. Based on the finds, the trading area was the Baltic, North Sea and maybe the Atlantic.

2.3.4.1.7. Propulsion

One master with square sail.

2.3.4.1.8. Size

The wreck's length: 16,50 m and width: 7,60 m

The reconstructed length: appr. 21 m and width: 7 m

2.3.4.1.9. Material

Oak, nail connections made of wood and iron.

2.3.4.1.10. Building tradition

Frisian building tradition, carvel-built bottom, clinker-built sides.

2.3.4.1.11. Inventory

An abundance of the inventory was found inside the wreck in situ. Ballast with a weight of 3 t was mainly stored in the amidships area. From the stone material samples were taken, but the results are not complete. In order to not damage the stringer, gaps were filled with coarsely cut sticks of alder and beech. A weaved mat made of willow rods had a similar function. The mat was found under the ballast. A 4,30 m long walking plank has an eyelet to tie ropes to it. This supports the volume of trade in harbours. The pine plank was worked with a broadaxe or a so-called “Dechsel” and it was given a mark. During the voyage it was stored next to the keelson, where it was found.

A so-called notch wood was used to count the goods. The accepted products were registered with a cut in the wood.

A plumb line was an important part of the equipment of Hanseatic navigators and a line was found in the bow area. A little gap on the underside of the plumb line was originally filled with wax and made it possible to examine the sediment on the ground. Due to frequent use the underside of the plumb line is compressed. A small bronze disc was found that might have been a part of an hourglass. They came into use in the 14th century and were used as navigation instruments up to the 18th century.

A lantern served for light on board. The lantern consists of a base of wood, around which there was wrapped a rectangular piece of leather. On the back there was space for a door made of a thinly scraped horn sheet. The door could be closed by hooks. Everything was held in place by bronze rings.

Ropes made of bast and hemp were used on board. This can be seen thanks to different remains. One of the hemp ropes is made of three plaited strands and has a diameter of 4 cm.

Preserved textile fragments are currently being analysed. They are either from the sail or from the clothing of the crew.

In the afterbody and the amidships area there were found two completely preserved bronze tripods and fragments of three bronze vessels. Both the tripods show casting and town marks of Lübeck and Greifswald. Based by comparison with similar objects and material analysis carried out by the Rathgen Research Laboratory, it can be said that a three-legged bronze can that was found in the wreck originates from Wales. From a bigger bronze cauldron only the eyelets for hanging and remains of the body were found.

Presumably pots and cans made of metal were preferably used on board due to a greater stability. But it is also possible that these bronze receptacles were part of the cargo. Parts of wooden vessels and spoons may belong to the galley, too. Numerous small lead weights in the front ship indicate that maybe a fishing net was carried along. Probably the net was used to supplement the menu with fresh fish. Besides fish, also meat and fruits were served, which is indicated by bones, hazelnut shells and cherry stones.

2.3.4.1.12. Cargo

The lifted cargo consists of fish remains, reindeer antler, whetstones, sulphur and roofing tiles. Fish remains belong to cod and sturgeon and another smaller specie. Based on the findings, fish was transported without head and in bundles, wrapped up in bark mats. On two mats, which are about 120 cm in length and 40 cm in width, fibre remains of the strings were found. On one of these mats a cut mark is found. Numerous wooden sticks were exposed in the immediate area of the fish remains. These are probably sticks from the drying or smoking of the fish. Based on the abundance of this material it is believed that a major part of the cargo was dried cod or smoked fish.

The many reindeer branches are probably raw products for the production of combs, game pieces, beads and other goods. They were traded by sea from their country of origin (northern Sweden and Norway) around the end of the Middle Ages.

Whetstones and slates probably come from Eidsborg in Norway. Coarsely worked stones were transferred as sticks with a length up to 20 cm and were bundled up to bundles of about 20 kg by simple plant fibres. The sulphur in the cog was probably traded from Iceland over Bergen as so called brennistein. The mineral was shipped in an oak barrel, which was not only marked with a branded shield but also with seven cut marks from traders. The barrel is 75 cm high and has a diameter of 50 cm. Based on chronological analyses it was produced in 1335. Roofing tiles indicate the transport of building materials. Since only a small amount of these was found on the wreck, they might have been part of the cargo from an earlier voyage.

Hard coals between the ballast can be fuel or part of an earlier cargo. Based on the cargo, it is clear that this cog was a so-called “Umlandfahrer” that came from Norway and sailed around Kap Skagen. Whether the further journey was towards the nearby roadstead in Stralsund by the Gellen in front of the island Hiddensee or towards Danzig and Elbing in the mouth of the river Weichsel is not clear yet.

2.3.4.1.13. Personal belongings

Two pair of shoes that are stored in the forebody are part of the personal belongings of the crew members. The uppers of one of the pairs are perforated in an artistic manner with a wheel-like pattern. The shoes were laced up onto the foot using strips. Besides the already mentioned textile fragments, a bronze button can be connected to the clothing of one of the crewmembers. Additionally there is a little wooden toggle that can be interpreted as a gown fastening.

Based on their marks, a water bottle and a Hanse can of tin are part of the personal belongings of the crewmembers or passengers. A leather stopper was found in the container for closing it. The Hanse can is named after its distribution area and it is decorated by a cross scene on the inside of the lid. On the handle you can find the inscription AVE REG(ina). Also a wooden handle of a gimlet or an awl is supplied with owner marks. A disc made of tin might be a gaming piece or lid of a receptacle.

2.3.4.2. Constructional features

The part of the construction that has preserved as a unit has the length of 16,50 meters and the width of 7,60 meters. Due to covering sediment, the starboard side is preserved with 19 strakes. On the heavily damaged portside 4 strakes are visible. The first four planks create a flat bottom and are placed together in a carvel manner (flush laid). The individual planks have a width of 45-50 cm. From the 5th to the 17th of the strakes, they are clinker built. The planks overlap each other on the longer side and they are 30 cm wide. The 18th and the 19th of the strakes are again carvel built to the bulwark and are connected by futtocks. The caulking material is made of animal hair in the flat areas of the bottom and of moss in the clinker built area. The moss caulking is covered by thin strips of oak, which are nailed to the planks in a distance of 10 cm with iron clips, the so-called sintels. The connection between overlapping clinker planks is provided by iron nails. Nails were driven into the wood in a distance of 8 - 12 cm. The tips of the nails were twice bended on the inside and driven back into the wood.

Due to the wreck's position, the keel is only hardly discernible. It has a width of 30 cm and it measures about 10 cm in its cross section. The keel plank is connected to the fore stem, which is grooved for the first four rows of planks. All the remaining planks jut out over the stem and surround it. Because of this construction, and evidence for bolts, it is thought that an outer stem was put in front of it. The inner stem was supported by bow strips, from which four are preserved. Around the afterbody the construction is more destroyed. However, next to the wreck the after stem and other construction parts could be found. These parts probably belong to the quarterdeck. The after stem is almost entirely preserved and has a length of 6,33 m. For the first four planks, stair like gaps are cut into the beam. The other planks join the stem in a linear rebate.

The vessel is supported by 34 frames from the inside. The frames are connected to the hull by oak nails with a diameter of 3,5 cm. The distance between the frames is 15 - 20 cm. They consist of floor timbers and futtocks, which are connected by scarfs. The first five floor timbers are made of V-shaped angled wood. The timbers are supported by futtocks running from the starboard to the portside. Because parts of the cargo were found in this area, it is possible that a small storage room was created in this manner. The keelson starts at the fifth floor timber and it is 10,60 m long and 70 cm wide at the thickened section of the mast step.

The mast step itself is 70 cm long and 30 cm wide.

An incorporated ledge in the mast step served for wedging the mast tight. From the outside supporters were fixed to the mast. Their position is still visible due to nail holes and the construction parts that are shifted but still in the wreck. The interior of the ship is partly lined with 6 stringer planks, which are 40 cm wide and are joined to the frames by wooden and iron nails. It is presumed that the portside was designed in a similar manner. The outside of the wreck was coated with pitch, which is preserved on the surface of the wreck. The inside of the wreck was preserved by controlled burning of the stringer planks.

On certain parts it can be seen that some spots were covered with wet fabric or finished with a so-called “Dechsel” or broadaxe. In the rising ship’s construction the stringer planks are followed by three stringers above and below the crossbeams that offered lengthwise stabilisation and deck fastening. The three preserved crossbeams break through the hull at the 12th and the 13th of the strakes. They have a diameter of 35 x 35 cm. The upper side is shored up by knee shaped angled timbers. The knee was fastened to the crossbeam by wooden nails with a diameter of 4,5 cm. This construction provides a great extent of crosswise stability. A round and rectangular opening in the hull probably worked as a deck drain to let the water run out. At different points of the hull, knotholes and smaller damages were repaired by using stoppers or small boards.

The original length of the one-mast vessel can be reconstructed to 21 meters and the width to 7 meters. Amidships the wreck shows heavy deformation. In this area some of the stringer planks and frames are broken. It can be assumed that the cog stranded or run aground so that the ship’s bottom flung open, came free again and finally sank down.

3. Cultural valuation of the Darss Cog

3.1. Experience aspects (quality)

3.1.1. Aesthetic values

3.1.1.1. Visibility

The wreck, which was only partly visible when discovered, will be covered by sediment and gauze after the documentation work is finished. Merely a hillock of sand will indicate the wreck when the covering is carried out successfully.

3.1.1.1.1. Visibility as a landscape element

Due to the covering sediment, the wreck is not a visible part of the underwater landscape.

3.1.1.1.2. Visibility as an exposition element

The wreck itself cannot be used as an exposition element since it is covered. Only the protection system can be explained.

3.1.2. Memory value

3.1.2.1. Historical value

Cogs are symbols of the Hanse Association and the rapid alteration of the economical system of the end of the Middle Ages. Pictorial illustration of cogs from the 14th century can be found on town seals mainly. Original finds of cogs are rather seldom. Since the Darss Cog belongs to the earliest examples of cogs produced in the Baltic area, it is a significant source of information and an important archaeological archive.

3.2. Physical quality

3.2.1. Structural integrity

The complexity of the wreck and its inventory is most probably preserved. During the excavation, finds were lifted inside the hull only, which means that the major part of the ensemble is still in situ.

3.2.1.1. Presence of ship construction

The Darss Cog is the best-preserved cog in the Baltic Sea. In a unique manner, parts of the equipment and cargo are preserved as well. The gained data and information from the documentation enable a reconstruction of the ship and an insight into the organisation and carrying out of the maritime trade in the Hanse period.

3.2.1.2. Completeness of the wreck parts

The starboard side is preserved 80 %. Fragments of the portside, the deck and quarter deck are shifted away from the construction but can be found near the site. The still existing parts of the construction enable a reconstruction of the Darss Cog to a large extent.

3.2.1.3. Stratigraphic conditions

The stratigraphy around the wreck is not disturbed when it comes to the geophysical measurements. The influence of the coastal dynamic on the stratigraphy has to be monitored by regular checks.

3.2.1.4. Mobilia (portable antiquities) in situ

The mobilia inside the ship was in situ during the excavation. After it was recorded it was lifted and conservation work is currently carried out. It is likely that there are more well-preserved mobilia around the wreck. It may have shifted about during the sinking and the breakage of the ship and is probably in an outstanding state of preservation due to the protecting sediment.

3.2.1.4.1. Relation between mobilia and ship parts

The small finds from the wreck correspond with the construction and sinking date of the 14th century.

3.2.1.4.2. Relation between mobilia

The finds are in a functional and chronological connection to each other. The distribution of the finds leads to the assumption that the interior of the ship was functionally separated. Since an abundance of finds could be located in the well-preserved forebody and amidships, some items were probably shifted out of the afterbody, which is more damaged.

3.2.1.5. Stability of the natural environment

The wreck is in a relatively stable state. The exposed timbers are subject to currents, erosion and infestation by organisms (especially *Teredo navalis*), but the hull in the sediment has reached a stable balance. The covering system interferes in these natural processes. The advantage is that the covering system works against the infestation by *Teredo navalis*, which is the major threat for the wreck.

3.2.2. State of preservation

3.2.2.1. Wreck parts

The starboard side in the sediment is very well preserved, and in contrast the port side is more destroyed by *Teredo navalis* infestation. The aim is to stop this process by means of the covering system.

3.2.2.1.1. Organic material

Besides the wreck parts, organic material such as wooden tools, textiles, leather, antler, bone and fish remains are preserved very well. As soon as these finds are exposed, currents erode them.

3.2.2.1.2. Metal

Metal objects are subject to electrolysis, depending on their location to each other. Bronze and objects containing copper are well preserved. Iron objects are heavily corroded.

3.2.2.1.3. Composite

Tannic acid in the oak planks has a negative influence on the preservation of iron. Also electrolysis between different metals on an object causes corrosion of iron.

3.2.2.2. Artefacts

3.2.2.2.1. Organic material

The organic materials are wood, leather, bones, antler, fish remains and textiles, which are very well preserved underneath the sediment.

3.2.2.2.2. Inorganic

Inorganic materials such as metal, stones and bricks are fragmentary or well preserved depending on the location.

3.2.2.2.3. Composite

Small finds such as iron, wood or metal objects interact with each other, which results in a different state of preservation.

3.3. Quality of archaeological information

3.3.1. Grade of Uniqueness

The Darss Cog is the best-preserved cog in the Baltic. Not only the ship construction but also the extensive remains of the cargo and equipment are preserved. Furthermore, the whole ensemble contains important information about equipment on board and traded cargo.

3.3.1.1. Chronological information

The cog's construction time can be dated to the turn of the 13th and the 14th century. From this period, another 17 cogs are known in the area of the Baltic and North Sea. They all differ in their state of preservation and archaeological quality.

3.3.1.2. Regional information

The cog is a trading ship of the southern Baltic. The building place was probably in the area around Elbing. No similar finds in the same state of preservation have been discovered yet.

3.3.2. Significance of information

3.3.2.1. Geographical significance

Thanks to this wreck and its cargo, equipment, and personal belongings, not only the late medieval trade routes and transported goods but also the living and working conditions on board can be examined. The Darss Cog shows how the ship builders in the southern Baltic area adopted the Frisian-Western European building tradition. The Cog is an important indication of the migration of the people for German settlement into the East.

3.3.2.2. Historical or archaeological significance

The construction of the Darss Cog, which was built at the beginning of the 14th century, shows many parallels to the Bremen Cog of 1380. The origin of the wood leads to the assumption that it came from the area of the river Weichsel. The shape of the hull and details in the construction indicate a building tradition that originates from the Frisian North coast. This find proves that a technology transfer took place in connection with the German East settlement and the foundation of many Hanse towns in the 13th century. Another sign of this is a ship's illustration on the town seal of Elbing from 1350. The picture resembles the appearance of the Darss Cog.

3.3.3. Representativity

Since only strongly stylised illustrations of cogs are known, the examination of this wreck is extremely significant. The wreck of the Darss Cog has many similarities to other known cogs, especially the Bremer Cog. The Darss Cog resembles the type of the late medieval cog very well.

3.4. Conclusion

The Darss Cog possesses a high heritage value, since it is the best-preserved cog find in the Baltic. Based on the construction and the inventory, the find enables us to gain important knowledge on maritime voyages and maritime trade in the Hanse period. A diverse spectrum of information was gained during the previous examinations of the wreck in connection with the MoSS Project. Furthermore, the complex find gives information on the equipment on board and the transported goods.

4. Site management

4.1. Cost - benefit analysis and general conclusion

The financing of the project by the European Union and the State of Mecklenburg – Vorpommern enabled basic scientific research on the wreck.

Results of the project can be presented by visualizing it in a museum, and entrance fees and money from sponsors can be collected. The results are also a basis for further research concerning shipping in the Hanse period. Likewise it has to be taken into account that by means of the protective measures high quality and valuable heritage is preserved.

4.2. Site management agenda

4.2.1. Safeguarding

The forebody of the wreck was covered with gauze in the summer of 2002 according to the Dutch model. In the spring of 2003 it was established that the gauze despite the anchor chains and weighing down with sediment had come free and was torn apart. Due to this, all parts of the gauze jutting out of the ground will now be weighed down with sand sacks.

The official maritime sign Warnstelle (a buoy warning sign) was placed near the wreck to help to avoid damage caused by navigation and fishing activities. Additionally, anchor stones limit the damage of the wreck and immediate stratigraphy. Anchor stones were placed in the neighbourhood of the site so that vessels can be attached to them instead of the site itself.

Local sports divers and fishermen were informed and involved in the project by means of a special exhibition and different meetings. The coast guards were advised of the position and meaning of the wreck. The guards now have the wreck in their regular patrol plan.

For the future it is planned to check the site twice a year in order to inspect its condition. It is also extremely important to involve local authorities and institutions, such as the Darssmuseum, the administration of the National Park as well as the divers from the German Life Guard Association (DLRG), and local fishermen, in the future observations of the wreck.

4.2.1.1. Legal safeguarding

The legal protection of the wreck is based on the Heritage law of Mecklenburg – Vorpommern remains.

4.2.1.2. Physical safeguarding

The state and the condition of the wreck will be observed at regular intervals (twice a year). The coast guards make sure there are only authorised divers at the site. The warning buoy guarantees that anchors or nets cause no damage. Any diving activity will be noticed immediately.

During the control dives a regular examination of the condition of the hull is carried out. The information gained from the data loggers will play an important role in this in the near future.

4.2.2. Monitoring

Two data loggers were set up at the wreck site. Despite technical difficulties the loggers have recorded data about the environmental condition on site since the August of 2002. At the same time a test station was set up near the wreck from which two samples are already taken. The information was forwarded to the monitoring group of the MoSS Project for further analysis.

A heavy movement of the sediment was observed in front of the Darss. Using aerial photographs, it became clear that 2500 meters to the west of the cog there is another wreck from 1333. It was uncovered from protecting sediment. Recording of the data continues. Test samples are taken at predetermined intervals. It is recommended to gain more comparison measurements from other wrecks nearby and to check the wreck in every two years. An important aim is to determine the eastern border of the infestation by *Teredo navalis*.

As was shown by the wreck from 1333, aerial photographs should be used in this geologically active area to record alterations at the wreck site and its immediate surroundings.

4.2.3. Visualizing

Because the wreck will be totally covered by the gauze in the future for reasons of safeguarding, the wreck itself cannot be visualised in situ. During the documentation a lot of photographs were taken, videotaping was done and drawings were made, and these data can be used for exhibitions, film productions or publications about the Darss cog.

4.2.4. Finance

A regular observation of the Darss Cog site and other shipwrecks is urgently necessary. This could be carried out by the State Association of Underwater Archaeology of Mecklenburg - Vorpommern, which could be responsible for the annual checks in honorary capacity. Approximately 500 • per year are requested for the observation (checks twice a year).

4.3. Date of re-assessments / re-evaluation

As already mentioned, during the observations the condition of the wreck has to be examined. As recommended by the monitoring group, not only samples but also further check measurements by data loggers should be taken. Additionally, the condition of the wreck should be examined by making test trenches around the covering system on a regular basis.

It is therefore necessary to check the condition of the wreck in every six months.

