

Underwater archaeological investigations of a shipwreck near the Eemshaven, municipality Eemsmond, (Gr.)

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With contributions by G.M.A. Bergsma & G.J. de Roller

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Location of the shipwreck. Photo: C.G. Koopstra

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1 Introduction

J.B. Hielkema

1.1 Motive for the investigation

Between Norway and The Netherlands, a high-voltage power cable (NorNed) is planned and realised by Norwegian Statnett SF and Dutch TenneT TSO BV. Periplus Archeomare BV carried out a side-scan sonar survey of the bottom of the eastern Wadden sea. As a result of this survey, a small number of locations was selected for further investigation. The main aim was to determine the archaeological potential of these locations. At a distance of 29 meters from the proposed route of the electricity cable, a shipwreck was discovered on location D1.

On the 19th, 20th and 21st of April, 2006, Archaeological Research & Consultancy (ARC bv), Groningen, participated in investigating the potentially interesting locations, D1, D2 and D5, by a diving-unit, carried out by Subcom BV and managed by Periplus Archeomare BV. On behalf of ARC bv drs. C.G. Koopstra and mw. drs. J.B. Hielkema, both senior archaeologists, participated in the fieldwork.

The finds from location D1, consisting of wooden samples from the wreck and a human bone, were studied by drs. ing. G.J. de Roller and mw. drs. G.M.A. Bergsma. Prof. dr. H.R. Reinders, Groninger Institute of Archaeology (RUG) and drs. W. Kerkmeijer, head collection and conservator of the Noordelijk Scheepvaartmuseum, Groningen, were so kind as to provide additional information about shipwrecks in general, including their archaeological potention.

1.2 Area of investigation

The investigated area lies directly outside the Eemshaven port, in the province of Groningen (fig. 1.1). The location of the wreck is a few hundred meters east of the port. The wreck lies on the bottom of the sea, at a depth of approximately 15 m. For the greater part it is embedded in clay.



Figure 1.1 View on the Eems Electricity Facility. Photo: C.G. Koopstra.

1.3 Object information

Province	Groningen
Municipality	Eemsmond
Location	Wadden sea
Toponym	Eemshaven
Map	3G
Coördinates	253.500/608.200
Period	17th century
Type of object	shipwreck
Soiltype	clay deposits and sandripples

1.4 Main object of investigation

The main object of investigation is to determine the kind of the phenomenon and, in the case of an archaeological find, establish its nature and scientific and archaeological value.

1.5 Methods of investigation

On the selected locations the boat Sara Maatje XV anchored and a diver from the company Subcom investigated the area (fig. 1.3). The divers were supplied with an underwater videocamera (fig. 1.4). On deck, the images from the camera could be viewed simultaneously on a small monitor. There was constant radio contact

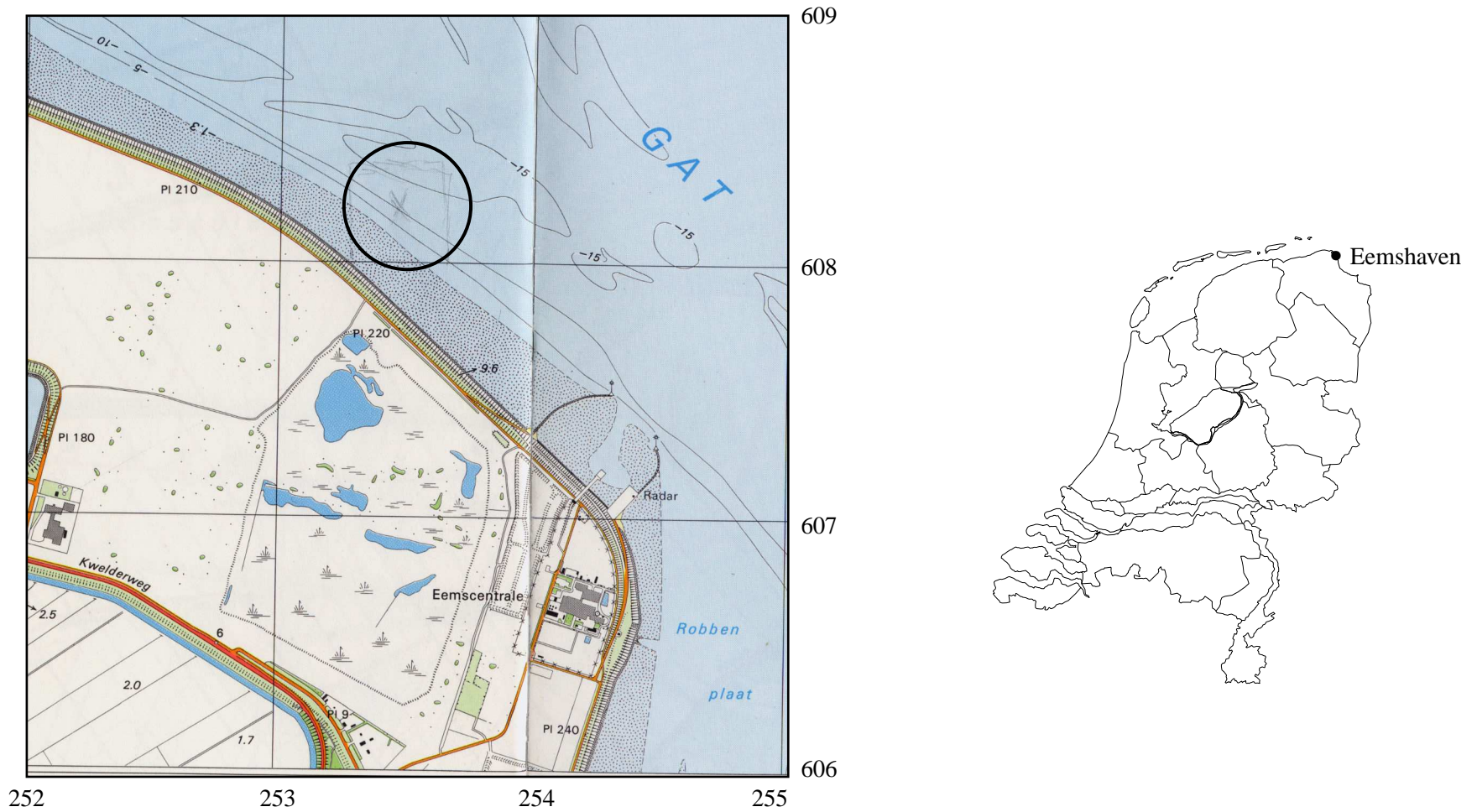


Figure 1.2 Topographical map of the investigated area (circle). Source: Topografische Dienst Nederland.



Figure 1.3 The Sara Maatje XV, in the harbour of the Eemshaven. Photo: C.G. Koopstra.

between the divers and the crew; the divers reported their observations on the spot and were able to ask specific questions or instructions.

Two samples of wooden planks were sawn from the shipwreck and some loose objects were also brought up by the divers. The wooden objects were taken to ARC bv for further research. From the wooden planks two samples were taken for a dendrochronological dating.¹

¹Dendrochronological dates provided by RING Nederlands centrum voor Dendrochronologie, Lelystad.



Figure 1.4 One of the divers of Subcom. Photo: C.G. Koopstra.

2 Results

J.B. Hielkema

2.1 Location D1, the shipwreck

2.1.1 Description of the wreck

On location D1 (fig. 2.1), the divers of Subcom discovered wooden parts of a shipwreck (see details in Subcom report).¹ These wooden remains include large planks from the hull of the ship as well as beams. On these planks mortice and tenon joints are visible. Smaller planks probably belong to a deck. A large round beam that protrudes from the soil might be a mast. Two samples were taken from the planks, in order to obtain a dendrochronological date of the wood. Three loose finds were also collected, a human bone, a pointed stick and a rounded, eroded tenon.

The large measurements of the planks and beams (Dutch: *spanten*) indicate that the ship was of a considerable size. The actual size of the vessel cannot be determined, because most of it is still covered with clay, but it is possibly up to 30 m long. The hull of the ship has a smooth surface, with narrow seams between the planks. The dendrochronological samples indicate that the ship was built after 1667 AD (table 2.1). The wood originates from Niedersachsen, Germany, subregion Mittelniedersachsiges Tiefland.

2.1.2 Preservation of the shipwreck

Parts of the shipwreck stick out above the bottom of the sea. The protruding parts that are not covered with the clay deposits, are affected by shipworm (*Teredinidae*)

¹Maritiem Inventariserend veld Onderzoek Wadden zee locatie Eemshaven. Project 2006 0.21, Subcom BV. Concept rapportage.

wood sp.	finds-no	RING-code	nr of rings	1st year	last jaar	t	%PV	p	Calendar	felling date
oak	7	EEW00011	78	1559	1636	5,10	67,30000305	0,005	NLWF1040	after 1656 ± 6 AD
oak	2	EEW00021	70	1578	1647	4,60	67,09999847	0,005	NSSUB6HL	after 1667 ± 6 AD

Table 2.1 Dendrochronological dates, provided by RING.



Figure 2.1 Locations of D1. Photo: C.G. Koopstra.

and angel wing or white piddock (fam. *Pholadidae*, *Parnea candida* sp.). One piece of wood that was brought up by the divers, was completely porous. The divers also noticed that the exposed wood is soft and fragile.

The greater part of the ship however, is embedded in clay deposits. These conditions cause a good preservation of wood and other materials. The quality of the planks that were removed from the ship is good, the wood is still solid and firm. The human bone is also very well preserved.

Since most of the shipwreck is still embedded in clay, it can be assumed that it is well preserved. The ship-inventory and the cargo are likely to be still present in the interior of the ship. The fact that the human bone and small pieces of wood were found on the wreck, probably indicate that the currents are not very strong and that most of the archaeological remains still lie *in situ*.

2.2 Location D5

On this location the bottom of the sea consists of a peaty layer. This layer of peat shows a distinctive relief. One piece of wood is collected from this location.

2.3 Finds

The archaeological finds and samples that were brought up by the divers are described in the chapters 3 and 4 (table 2.2).

location	findsno. Periplus	findsno. ARC	contents
D1 east	1	6	stick
D1 east	2	–	poor preservation
D5	3	1	trunk (?)
D1 west	4	2	plank
D1 west	5	3	human bone
D1 east	6	5	tenon
D1 east	7	4	peat
D1 east	8	8	plank

Table 2.2 Catalogue of the finds.

3 Wood

G.J. de Roller

3.1 Introduction and methods of investigation

From the shipwreck in the Eemshaven, location D1, four pieces of wood were collected for further research (findsnumbers 2, 5, 6 and 7). A fifth piece of wood was collected on a peatbank, location D2 (ARC findsnr. 1). Samples of the planks of the ship were used for dendrochronological dating. The wood was sampled by sawing pieces from the shipwreck. Before studying the wood, it was cleaned with tapwater in order to make visible possible toolmarks.

3.2 Results

3.2.1 Loose find, findsnumber 1

On location D5 a pointed piece of roundwood was collected. This piece of wood has an oval section, measuring 27 by 19 cm. The wood is eroded to a large degree, and therefore it cannot be determined in what manner the point was shaped.

The length of the roundwood is 30 cm and it concerns soft wood from elm (*Ulmus*). The transverse section of the wood is ring-porous. The pores are grouped in more or less long, tangential to slightly oblique bands together with vascular tracheids and paenchyma (Schweingruber 1990). The tangential section shows that the rays vary in length from 30 to 50 cells and they are generally 4 to 5 cells wide. The spiral thickenings in the vessels, typical for *Ulmus*, are, in this case, absent or eroded.

This piece of wood is possibly a part of a tree trunk that originated from the Groningerland and somehow ended up in the Eems

3.2.2 Planks

Plank, findsnumber 2

This is a sample from a larger plank, and sawn on the findspot. The sawn piece is 84 cm long, 28 cm wide, and 6 cm thick. The plank is dated after 1667 ± 6 AD (table 2.1). The wood species is oak (*Quercus*). The transverse section of oak is characterized by broad rays and ring-porousness with a flamelike pattern. The



Figure 3.1 The rounded edge of the plank, ARC findsnumber 2. Photo: L. de Jong.



Figure 3.2 The wooden pegs in the plank and the nailholes, just above the measuring scale. Photo: L. de Jong.

tangential section shows that the rays are uni- to multiseriate. The multiseriate rays are up to 1 mm wide and 5 mm high.

The plank is sawn 'en dosse', which means that on the serrated edge, the year-rings show at an angle. One of the edges of the plank is rounded. This indicates that this side did not join up other woodwork (fig. 3.1). At the transverse section the wood is affected by shipworm (*Teredinidae*) and angel wing or white piddock (fam. *Pholadidae*, *Parnea candida* sp.).

In the plank there are remains of five oak tenons (Dutch: *toognagels*), 3 cm in diameter (fig. 3.2). The wooden tenons are fixed with square pegs. On the inner side of the plank the tenons protrude, on the outside they are neatly smoothed with the surface of the plank (fig. 3.3). On the inside the plank was attached to another piece of wood. There remains at least about 50 cm of the sampled plank, to the left of the tenons (cf. fig. 3.2). This indicates that this plank probably is part of the gangway, rather than from the hull of the ship. For if it were a part of the hull, the tenons would be placed at a closer distance, within 50 cm, to join the hull

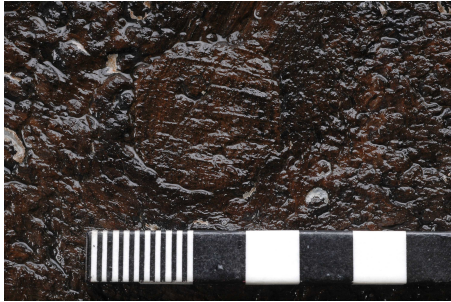


Figure 3.3 The smoothed side of the tenon, diagonally the square peg that was used to fix the tenon. Photo: L. de Jong.



Figure 3.4 The imprint of the head of the wrought iron nails. Photo: L. de Jong.

to the beams or timbers.¹

Apart from the tenons, there are three nailholes visible. The nails are hit through the plank from the outside towards the inside. The imprints of the nails are clearly visible (fig. 3.4). Welded nails with a square or slightly rectangular section were used.

Plank with findsnumber 7

This sample measures 34×30×6 cm. On the transverse section it is affected by shipworm and/or angel wing. The plank is made of oak. It has two rounded edges, which indicates that this side of the plank did not join up other woodwork (fig. 3.5). In the plank an oak tenon is constructed (fig. 3.6). Comparable to the sample of findsnumber 2, this tenon protrudes on the inside of the plank. At the outside it is neatly smoothed with the surface of the plank. This plank is made of a tree that was felled after 1656 ± 6 AD (table 2.1).

3.2.3 Tenon (?) and stick

Wooden tenon (?), findsnumber 5

Findsnumber 5 is presumably a tenon, and it is made of oak. The length is 12 cm and the section is oval, 3 by 4 cm. This piece is very weathered and rounded, very likely by tidal currents (fig. 3.7). So originally it may have had a different shape and function, and the assumption that the object is a tenon, might be incorrect.

Wooden stick, findsnumber 6

This artifact is made of willow (*Salix*). Willow is diffuse- to semi-ring-porous. The pores are solitary, in groups or in short, radial files. The tangential section shows uniseriate rays with an average height of 10 to 15 cells. It has large and simple ray-vessel pits.

¹Friendly pers. comm. prof. dr. H.R. Reinders, Groninger Institute of Archaeology, State University of Groningen.



Figure 3.5 The two rounded edges of the plank, ARC findsnumber 7. Photo: L. de Jong.



Figure 3.6 The tenon on the outside of the plank. Photo: L. de Jong.



Figure 3.7 The possible wooden tenon, ARC findsnumber 5. Photo: L. de Jong.

The object is a round wooden stick, pointed on one side, the other side is broken. The length is 25 cm and the diameter is 2,5 cm. Because it is incomplete, it is not possible to determine the function of this artifact.

3.3 Conclusions

Two samples of planks were sawn from the shipwreck near the Eemshaven. Because they are rounded on one side, they appear to belong to an end of a construction. The samples probably represent parts of the gangway.

An eroded and rounded piece of wood possibly represents a wooden tenon, belonging to a mortice and tenon joint from one of the planks of the ship. The pointed piece of roundwood was taken from another location and has no connection to the shipwreck.

The parts of the ship that are exposed to sea-organisms are to a greater or lesser extent badly affected by angel wing or white piddock and shipworm. However, the greater part of the wreck is embedded in compact clay and is, most likely, very well preserved. The good conditions of preservation probably include the inner structure as well as the organic remains of the ship inventory.

Selection for storage

After the study and documentation of the wooden remains by the senior specialist, the two planks (findsno. 2 and 7) will be preserved and the loose finds will be discarded.

4 Human bone

G.M.A. Bergsma

4.1 Introduction

During the underwater research on a shipwreck in the Eemshaven, a human upper arm bone was found. This human bone was brought to the surface for further examination.

4.2 Methods of investigation

The bone was carefully cleaned, before it was given to the author for physical anthropological research. Gender-diagnosis and age-estimation are the most important elements in physical anthropological research. Besides, the length of the individual, and indications for pathology and trauma can also be examined. The analysis of gender and age is based on standards from the Workshop of European Anthropologists (1980).

4.3 Results

The examined bone is a complete, right *humerus* (upper arm) of an adult individual (fig. 4.1). In order to keep the bone intact, it is decided not to cut a section through the bone, in order to be able to investigate the bone structure for a calculation of the age. Another useful indication for the age of the individual is the fact that at the location where the *diaphyse* fuses with the *epiphyse*, for some years a line of growth can be observed. Because this line of growth is absent on this particular bone, it indicates that the individual was certainly over thirty years old.

The gender of the individual cannot be determined on a humerus by means of metrical characteristics. A more or less subjective indication for the gender is the robustness of the bone. In general, male bones are heavier, bigger and show more distinct muscle-attachments than bones from female individuals. This humerus shows well-developed muscle-attachments, but the bone is not very robust. Because the context, being a ship-wreck, one would expect the individual to be male. Physical-anthropological evidence, however, can offer no decisive answer.

Because the humerus is complete, it is possible to execute a calculation of the body length. For this calculation it is assumed the individual represents a white



Figure 4.1 Human humerus, posterior. Photo: L. de Jong.

male. The calculations suggest a length of $174,6 \pm 4,05$ cm for the individual. If the humerus belonged to a white female individual, the bodylength might have been $171,5 \pm 4,45$ cm.

The posterior side of the head of the humerus, shows signs of eburnation. Eburnation occurs when the cartilage is afflicted, which causes the joints to grate directly over each other. This leads to a polishing of the bone surface. In combination with porosity, eburnation is a result of degenerative arthritis.

4.4 Conclusions

The studied bone is a right humerus from an adult individual. The context of the find, together with morphological indications, suggest it belonged to a male individual. Considering the long stay in saltish water, the bone is very well preserved.

For two reasons, the age of the person cannot be determined. On the one hand the humerus would have to be cut into halves to take measurements for age-determination. On the other hand there are no other parts of the skeleton present for extra indications for the estimation of the age. The length of the individual, in the case of being male, might be $174,6 \pm 4,05$ cm. The humerus shows eburnation, caused by degenerative arthritis.

5 Conclusions

J.B. Hielkema

5.1 Summary of the main results

Near the Eemshaven a shipwreck was discovered, that dates from the latter part of the 17th century. Dendrochronological dating of wood from this ship indicates that the ship was built after 1667 AD. The relatively huge size of the planks and beams indicate that it may be a large seafaring ship. The remains that are still embedded in the clay, are well preserved. The parts of the ship that are exposed, however, are afflicted by shipworm, white paddock and probably other sea-organisms. This means that erosion of the ship will continue, unless some action is undertaken to consolidate the condition of the shipwreck.

5.2 Navigation in the 17th century

In the 17th century Holland was an important seafaring country. This century was known as the Golden Age. The VOC (*Verenigde Oost-Indische Compagnie*, Dutch East India Company) appeals to the imagination, but in the 17th century, trade with the Baltic areas was more important. The location of the wreck must be associated with trade on the Baltic, rather than the East Indies. A VOC-ship from Amsterdam would not travel by a northern route, but instead go southward. The location of the shipwreck is close to the estuary of the Eems, which could mean that the ship was on its way to Emden.

The main products that were traded from the Baltic are wood and grain. The ships that went to the Baltic had to pass the Sont. From these ships, the route and cargo were listed. Almost 50% from the vessels that passed the Sont came from the Dutch Republic (<http://esf.niwi.knaw.nl/esf1998/projects/sont/html/bron.html>).

Types of ships that were much used for trade with the Baltic in the 17th century include *fluit*, *katschip*, *smak*, *galjoot* and *bootschip*. The *fluit* was one of the most common trading ships in Europe. These *fluiten* (flutes) were pear-shaped, narrow and long (fig. 5.1). Because of this construction, the *fluiten* had a relative small main deck, measuring approximately 35–40×5.5 m. In this way high taxes could be avoided, which were imposed by Denmark in the Oresund, and which were calculated per square meter of the main deck.

The *katschip* resembles the *fluit* in many aspects. The *galjoot* is a type of coaster with side swords. The *bootschip* is more or less similar to the *fluit* and the



Figure 5.1 Fluitschip, ca. 1650. Painting: J.Th. Blankenhoff.

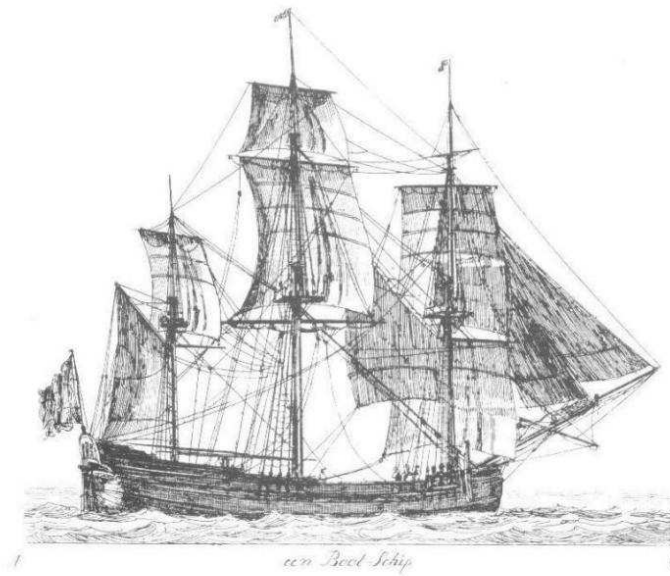


Figure 5.2 “Bootschip zeylende voor de wind”. Etching: G. Groenewegen (1754 – 1826).

galjoot, but the *bootschip* was not only used as a trading ship, but also for whaling (fig. 5.2). The shipwreck that lies in the Eemshaven, might be from one of the types mentioned above.

6 Recommendations for further research

J.B. Hielkema

6.1 General remarks

A shipwreck contains important archeological data, because it is a so called ‘closed find’. This kind of archeological find is not contaminated by earlier or later human activities, but the event itself is preserved as a whole in the archaeological record. This means that at the time of the loss of a ship, the (damaged) vessel, including its cargo, is for the most part or completely preserved. The only restriction is that parts of it may be eroded, afflicted by sea-organisms or shifted by currents.

Careful documentation of the ship, including details of its construction, as well as of all the finds, can provide a great deal of information. It can teach us about the way the ship was built and equipped, the type of cargo may indicate the type of trade and the destination of the ship, tools can indicate various activities and personal possessions, together with possible human remains, can give us details about the ship’s crew.

6.2 Possibilities for further research

The origin and the destination of the investigated shipwreck is still unknown to us, as is the cargo of this ship. By investigating in archives it might be possible to find out which ships are wrecked in the late 17th century in the northern part of the Wadden sea. By studying journals, lists of ship’s inventories, drawings and sketches, shipmodels etc. more information about this ship might be gained. For example the name of the ship, the date of its building or wrecking, as well as the ship’s contents, provide clues for its origin.

If historical information can be found in archives, its value will be extremely great. The ship possibly wrecked in a heavy storm. In this period several heavy storms were recorded, like a storm in 1717, when the sea reached up to the city of Groningen. These storms may give us some clue where to start searching for the ship in the archives. But because the chances are little that written information about this particular ship can be traced, the aim of further investigation lies mainly in establishing its archaeological importance. This means that information must be obtained from the wreck itself.

One of the aspects concerns further measuring of the ship, in order to be able to determine the type of ship, for example measurements can be taken of the height, length, width, the size of the upper deck and other relevant measurements. It is also important to get insight in the type of cargo. The cargo can inform us about the function of the ship, as well as its origin and possible destination. Finally the tools and personal belongings can inform us about the crew and where they came from.

The presence of a piece of a human skeleton indicates the ship sunk rapidly, without the crew being able to escape the ship. After the wreck it was swiftly buried in clay, which implies that most of the ship and its contents remain *in situ*, and the parts that are embedded in the compact clay, are well preserved.

The organic remains that are exposed to sea organisms like shipworm and angel wing, are vulnerable to decay. Apart from further investigations, it is also recommended to think about ways of protecting the protruding parts of the vessel against further decay.

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