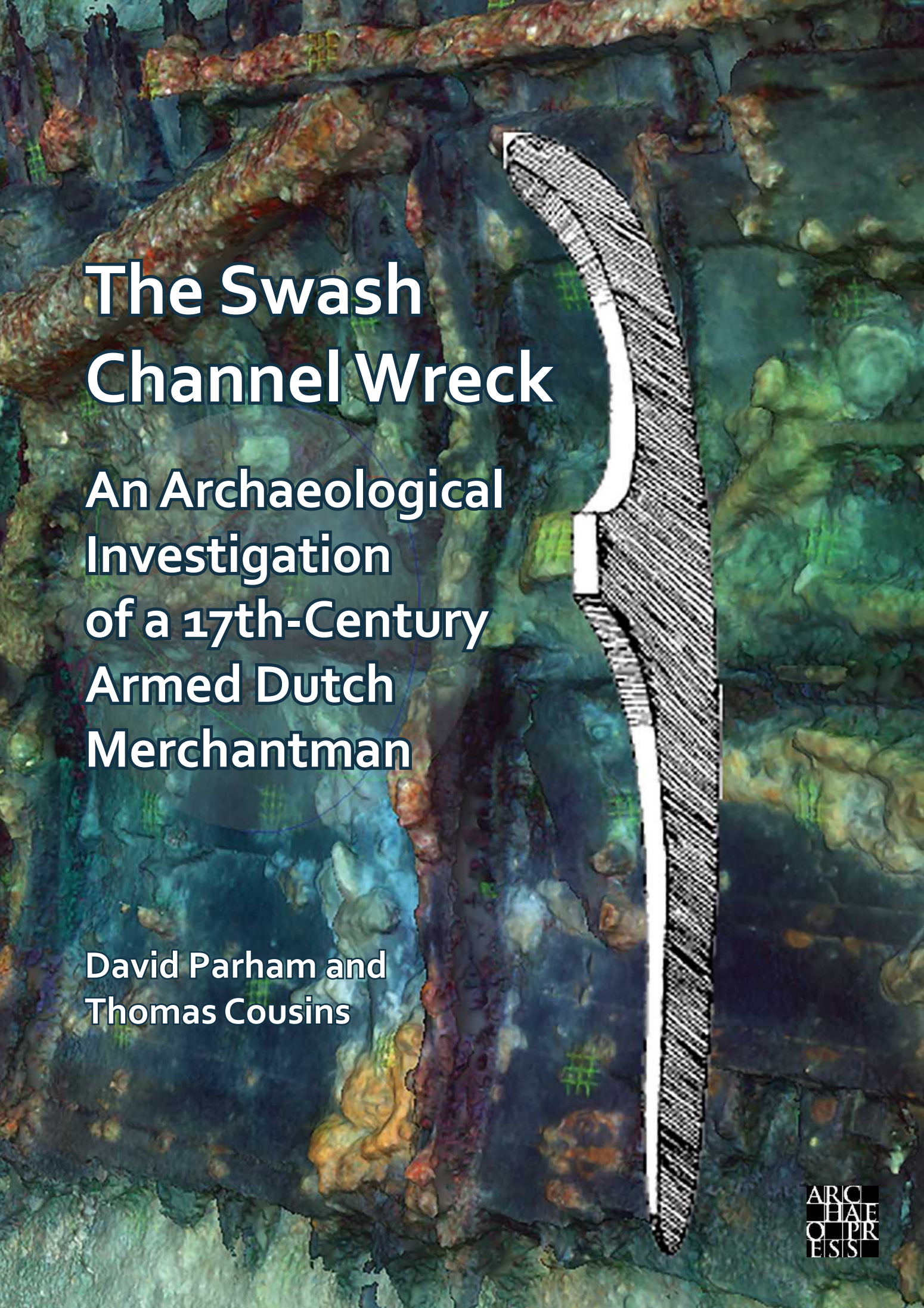

The Swash Channel Wreck

An Archaeological Investigation of a 17th-Century Armed Dutch Merchantman

David Parham and
Thomas Cousins

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with contributions from
Grant Bettinson, Ruth Brown, Duncan Brown, John Brozius, Serena Cant, Peter Davy, Mags Felter, Ian Friel, David Gaimster, Alison James, Toby Jones, Quita Mould, Nigel Nayling, Jenny Oliver, Paola Palma, Ian Panter, Des Pawson, Bronwen Russell, James Spencer, Kevin Stratford, Peter Swart and Tanja Watson

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Chapter 1

Introduction and project background

Summary description

The site is that of a wrecked, early 17th-century armed Dutch merchant ship. It is located on the edge of Hook Sand, a large sandbank known historically as an area of shipping loss, in the Swash Channel in the approaches to Poole Harbour, Dorset on the south coast of the United Kingdom (Figure 1.1).

The wreck site is formed by a spread of archaeological material covering approximately 40m by 50m. This consists primarily of the port side remains of a heavily framed carvel-constructed wooden ship of *c* 40m in length, with associated debris spreading up to 30m to the north-west of the site. Site investigations have focused on four main areas (Figure 1.2):

Area One consisted of the first 18m of the wreck from the approximate bow to midships, covering an area of structure from the turn of the bilge to the start of the forecastle;

Area Two comprised frames from the start of the tumblehome to the top rails and the internal and external planking of the main deck up to the top rails;

Area Three contained the stern from the turn of the bilge to the top rail of the stern castle;

Area Four remained unexcavated but contained the rudder and articulated hull remains which separated Areas One and Three. The structure in Areas One and Three is split approximately 60% of the way along its length from the bow, forming two distinct elements that lie on slightly different orientations.

Designation

The site was designated as a Historic Wreck under the Protection of Wrecks Act 1973, Order 2004/No. 3243 (DCMS 2004). This was made and laid before Parliament on 9 December 2004 and came into force on

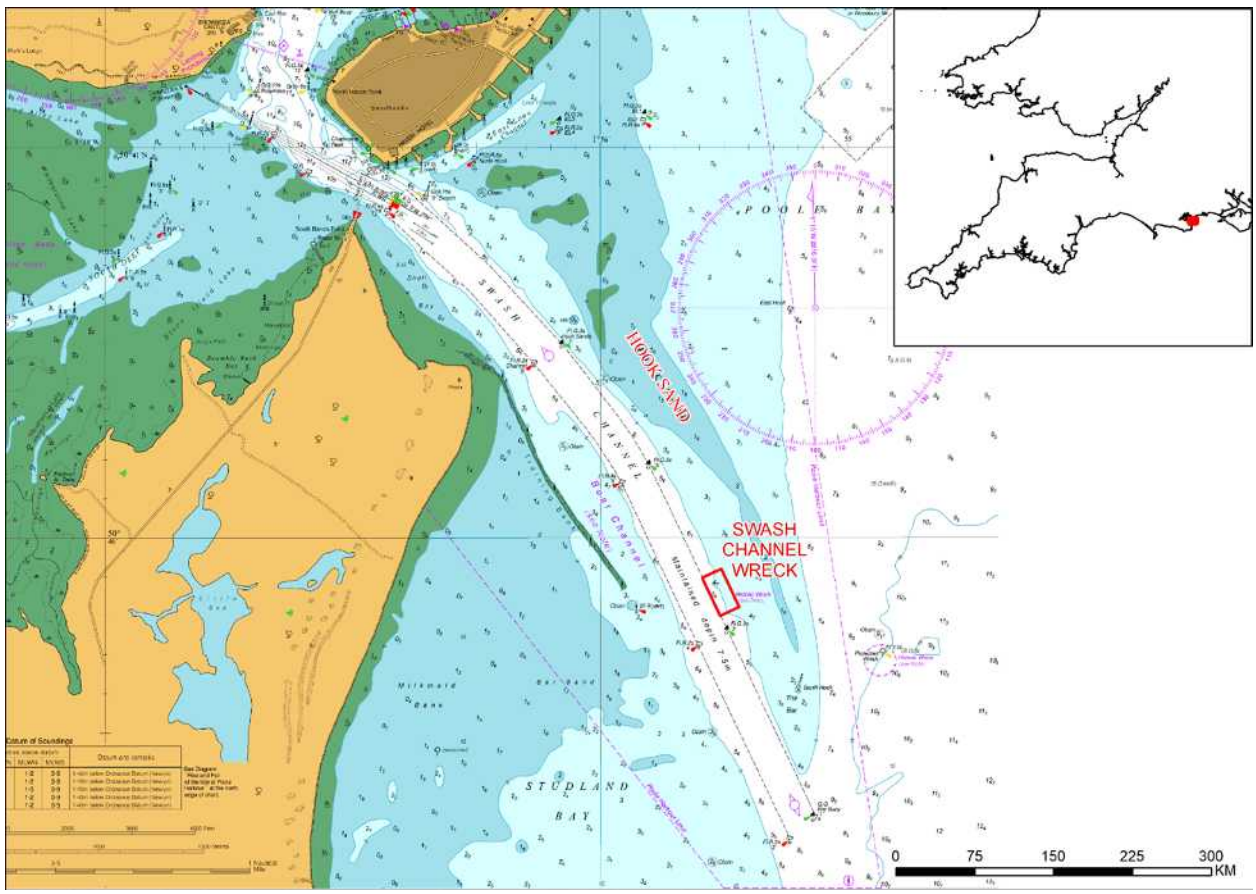


Figure 1.1. Location of the Swash Channel Wreck © British Crown and OceanWise, 2019. All rights reserved. Licence No. EK001-20180802. Not to be used for navigation

Figure 1.2. Site plan of the wreck

10 December 2004. At the time of designation, the then Heritage Minster, Andrew McIntosh, said:

> This is an important wreck both in historical and archaeological terms. It is likely to be well preserved and rare in terms of its quality and the quantity of the surviving structure and is already yielding invaluable information about ships of this period. This Order is particularly timely as the location of the wreck has been publicised and we need to protect it from potential damage by divers visiting the site.

The Swash Channel Wreck was attributed the National Monuments Record (NMR) number 1408546 and the List Entry Number 1000082. The current designation is a rectangular area running parallel to the main shipping channel.

Since the site's designation, Poole Harbour Commissioners (PHC) have held the licence: initially Harbour Engineers Richard Appleton, then Andrew Ramsbottom and currently, as of 2020, Port Hydrographer Steve Pearce. In 2005, the archaeological advisors for the site were Wessex Archaeology. Since 2006 that position has been held by David Parham of Bournemouth University (BU).

Site formation

As early as 1843 it was noted that silting of the access to Poole Harbour was becoming detrimental to the opportunities for trade at the port (Cullen 2017). In 1865, construction began on what became known as the 'Training Bank', a stone embankment running south-west from near South Haven point at the entrance to the harbour. This was designed to train water along its length and speed up the flow in order to improve the scouring effect of the ebb tides, thus increasing the depth of the harbour entrance. Whilst partially successful, the length was increased in 1876 and further work was undertaken between 1923 and 1926. With its final length being 1433m, it increased the channel to approximately 4.2m below Chart Datum (CD).

The first capital dredge of the channel was undertaken in two stages: to 5.2m below CD in 1988/89 and 6.0m below CD in 1989/90. Further work was undertaken in 2004/05 to increase this to 7.5m below CD.

Sediment transport

Unless otherwise referenced, the text below is précised from the SCOPAC (Standing Conference on Problems Associated with the Coastline) Sediment Transport Study. The study relates to the coastline of central-southern England between Lyme Regis (Dorset) and Shoreham-by-Sea (West Sussex) and was conducted by the University of Portsmouth in 1990 and updated in 2004 (Carter *et al* 2004). The ebb-dominant tidal regime in Poole Harbour results in a net south-east (offshore) directed transport of sand delivered to and within the Swash Channel. Conditions in the Swash Channel suggest that sediment transport is strongly dependent upon combined wave and tidal-current action and is most intense under the combination of high-energy wave action and spring tides. During calm conditions (70% of the time), the mean transport rate is limited, with 50–100 times more movement under typical waves (30% of the time) and 500–1000 times more during the operation of storm waves (once per year). Easterly and south-easterly waves can transport sediment westwards from Sandbanks Beach to Hook Sand, where it may become entrained by tidal currents operating within the Swash Channel until swept past the 1500m-long Training Bank; wave modelling suggests that sediment then accretes in inner Studland Bay, having been moved from the Swash Channel and Poole Bar.

Part of the crest of Hook Sand lies above -1m CD, causing refracted waves to break and sand to be driven onshore from the crest. Sand supplied by this pathway may periodically partially infill the Swash Channel (and hence the site) during northerly wind conditions.

Results on sediment transport within the Swash Channel are limited and thus cannot be extrapolated as long-term trends without more detailed knowledge of the interaction of variables. However, chart comparisons covering the period between Mackenzie's 1785 survey and immediately prior to the first capital dredge of the Swash Channel in 1990 revealed that the Swash Channel and Hook Sand were subject to some fluctuation, but were relatively stable in position and platform. This implies a long-term equilibrium between sediment supply and loss.

Studies of the more detailed area around the site were made at the time of its discovery. Comparisons of surveys undertaken between 1910 and 2003 show, as part of the larger changes in Hook Sand noted, a net change in seabed over the site of *c* -1.5m. Studies by HR Wallingford considered that the process which resulted in the uncovering of the site are complex, being linked to the detail of localised scouring around any exposed part of the wreck and large-scale ongoing morphological change in the area of Hook Sand (HR Wallingford 2003). Hydrodynamic modelling conducted by them suggested that whilst sand would erode from the site at periods of significant waves (a once per year event), sand transport patterns indicated that changes in the channel caused by its deepening would result in a slight increase in the potential for accretion. It is suggested therefore that the area in which the site lies is an area of general stability which is fed with sediment predominantly originating from Poole Harbour and occasionally from Hook Sand. Periods of strong tide or wind are known to cause a short-term net sediment loss that moves either to the south-east along the channel to the west or south-west into Studland Bay, which has historically been replenished with sediment from Poole Harbour. The more detailed location of the site, on the edge of the Swash Channel, is one of historic erosion (since 1910) that has resulted in the loss of sediment levels over the site of almost 2m over the last 100 years. The excellent condition of wreck material when originally uncovered indicates that the material was relatively quickly buried when originally lost and has remained buried in the intervening period until an event occurred that began the exposure of the site. This suggests that in the *c* 400 years between the wreck event and the known erosion that has been ongoing since 1910, the seabed around the site must have been stable. Since 1910, the detailed area around the site has been subject to erosion that has ultimately resulted in the exposure of the wreck site in the last decade of the 20th century. (The poor condition of some of the timbers when the site was located indicates that this event occurred several years before 2004.) The erosion has been exacerbated by scour caused by the exposed wreck structure. Studies by HR Wallingford suggested that deepening of the channel would cause a potential for sediment accretion in the area of the site. This has been supported post-dredge by Poole Harbour Commissioners' surveys that show no change in the level of sediment in the general area of the site. The above is at odds with Bournemouth University's sediment monitoring of the actual site, which suggests significant sediment loss. It would be reasonable to suggest therefore that the site is causing its own demise as a result of localised scouring around any exposed part of the wreck.

Nature of the remains

When first found the site consisted of a confusing jumble of ship's structure with a small number of large finds such as cannon and relatively few small finds. Although the detail and understanding of this did increase during the excavation, the general impression of a confused site did not change.

Amongst the oddities of the site were the apparent absence of any cargo, the relatively small number of

guns, and a general lack of finds all together. The ship's structure did not follow the usual layout of a shipwreck site. A typical wreck site consists of the lower hull up to around the turn of the bilge surviving by a combination of ballast / cargo / armament both pinning to the seabed and covering / protecting it. But the site consisted of the port site of the ship surviving from around the turn of the bilge to the top rail of the ship's superstructure – typically those parts of the hull that do not survive.

This structure consists almost entirely of the ship's side lying internal side uppermost on the seabed. It is not intact but broken just astern of the main mast step, pulled part and out by of alignment by *c* 20° above the horizontal. Such a survival is very unusual as the lighter upperworks of a ship are often swept away during or immediately after the initial wreck, while the upper part of the hull, sitting unprotected in the water column, exposed to decaying physical and biological processes, decays over a period of decades, leaving the lower hull buried in the seabed. Whilst the knees that would have supported the ship's transverse beams survive, no trace of any internal structure either *in situ* or as scattered wreckage was observed. A number of disarticulated floor timbers were observed on site and one (**SCW1316**) was washed ashore at a local beach in 2001. These suggest that the lower hull had been present on the site at one point and had subsequently been broken up.

When found in 2005, a number of the timbers had clearly been exposed for a while and showed extensive degradation, with some elements sufficiently degraded for the calcareous lining of large (*c* 500mm) shipworm tunnels to be visible, whilst other timber surfaces appeared undamaged and freshly exposed. The initial years of work on the site (2004–09) were conducted against a backdrop of the continuing exposure of the site. When timbers were newly exposed their surface was fresh, showing no, or very limited signs of damage and with the presence of builder's marks and carved elements clearly visible which rapidly degraded. Whilst the site was typified by increasing exposure of timbers, small finds were limited to only a handful of objects.

Both the layout of the site and the condition and survival of the timbers suggested a site that had been subject to processes of significant damage either as part of its initial wrecking or very soon after this. Contemporary salvage techniques involved the tearing apart of the ship's hull to gain access to the cargo. These techniques are illustrated in Jacob Rowe's *c* 1730 publication *A Demonstration of the Diving Engine* (Rowe 1730). The process involved the removal of the ship's masts by cutting the supporting rigging, then the positioning of a boat or raft of considerable buoyancy above the wreck and the lowering of grappling hooks into the wreck to catch the deck beam. The tide would be allowed to ebb whilst the ropes to the boat would be gradually tightened. At low water the rope would be 'bar tight' (when a line is pulled up tight to the point where it has no deflection, like a bar). The flooding tide would lift the boat, thus pulling the deck out of the ship. At this point anything that was buoyant, such as barrels and loose timbers, would float up to be collected on the surface. Anything that was not buoyant would now be accessible for dragging from the surface. As the deck formed a key structural component in the ship's hull it would vastly increase the chance of the hull failing at its weakest points, the bow and the stern, allowing the sides to fall to the seabed. This could account for the present on the seabed of the port side and upperworks of the ship. A noticeable feature of the wreck when first found was the presence of a large (*c* 200mm diameter) cable on the seabed that passed under the remains of the wreck's bow (Figure 1.3). This did not survive to the excavation stage of the project but the fact it ran beneath the hull may indicate that it was involved in salvage activity.

Evidence from the excavation indicated that elements of the surviving structure may have remained above the seabed surface for some time prior to burial. When excavated, areas of the hull were covered in the attached remains of European Flat (or Native) Oysters *Ostrea edulis*, many of which had reached in excess of 100mm in size. This oyster reaches sexual maturity at 3–4 years old when it is *c* 38mm in size and has a typical life span of 5–10 years, 15 years in some circumstances when it can achieve up to *c* 110mm in size (Jackson 2008). The extensive presence of oysters in the *c* 100mm size range would suggest that some of the hull had survived above the surface prior to burial for at least ten years.

The sample of rock ballast recovered from the wreck consisted of 122 individual boulders. This suite of metamorphic rocks included granites, diorites, basalts and welded tuffs that originate from outside the Dorset area, while within the collection was a small subset of local stone, including possibly tertiary ironstone from the Agglestone Grit, Portland Cherty series, chert and limestone as well as a few other flints and cherts. All the latter are found in the Dorset area, but not in the immediate area of the wreck (R Edmonds, pers comm 2012). The presence of the non-local Dorset stones may suggest that fishing activity occurred over the site post-wrecking, utilising stone net weights.

The archaeological picture therefore suggests a ship of *c* 4m draught, wrecked in relatively shallow water, which is perhaps approaching from the west. Following the loss, it is then rapidly and thoroughly broken-up through an extensive and thorough campaign of salvage. Elements of the hull are left to eroded rapidly

Figure 1.3. Cable potentially relating to the salvage

on the seabed and become buried whilst some parts survive above the seabed long enough to be colonised by marine life prior to burial. The excellent preservation of the material on the site would indicate that the submerged site has remained buried for most of its *c* 380 years. The exact reason for its initial exposure is currently unknown: perhaps the original 1990 dredging impact or perhaps a result of natural coastal processes. The process was already underway by 2001 when timbers from the wreck were found on local beaches.

Studland Bay in the 17th century

Poole Harbour is located on the south coast of England and is a shallow ria, with an irregular coastline of *c* 160km. The navigational entrance to Poole Harbour is via the Swash Channel. To the east of the channel there is a large sand bar known as Hook Sand.

Many archaeological sites are located in and around the harbour, studies of which have provided evidence for the manufacture, trade and exchange of artefacts and produce from prehistoric times through to the present day (Pitman *et al* 2020). Whilst there is evidence of activity throughout prehistory and the Roman period, the harbour's real rise to prominence began when Poole was made Dorset's 'Port of the Staple' for the export of wool in 1433; from this point onwards it grew in importance as a port. During the 17th century the town began trading with Newfoundland, which resulted in Poole becoming very wealthy and by the 18th century it was the principal British port trading with North America, but it experienced a shift in prosperity as the harbour became less accessible due to the Swash Channel silting up. In the 17th century, the main channel into Poole Harbour featured a bar with depths between 10ft (*c* 3m) and 16ft (*c* 4.8m) (Seller 1671, 7), preventing large ships from going into Poole. Studland Bay, however, was a known as a safe anchorage providing good shelter from the prevailing south-westerly winds (Seller 1671). The bay itself is very shallow, with the depths recorded in 1785 being less than 4m at the bar and even shallower within the bay; larger ships were therefore warned not to anchor further in than the point where Durlston Point can been seen from Old Harry (Figure 1.4) (McKenzie 1785).

England, the Netherlands and the wider world in the 17th century

Ian Friel

If well-informed Europeans in the 17th century had speculated as to which nation might succeed Spain as *the* global maritime superpower, they could well have chosen the United Provinces of the Netherlands. England would have come a poor second in the estimation of any geopolitical sage – at least, in the opinion of one who lived outside England.

The Netherlands was a republic, an alliance of sovereign provinces with the States-General at The Hague as its only national body and a war fleet provided by five provincial admiralties. The Swash Channel Wreck was lost towards the end of the 'Eighty Years War' (1568–1648) in which the largely Protestant Netherlands struggled against the Catholic Spanish Empire in an ultimately successful bid for independence. Despite a truce between 1609 and 1621, the war had resumed.

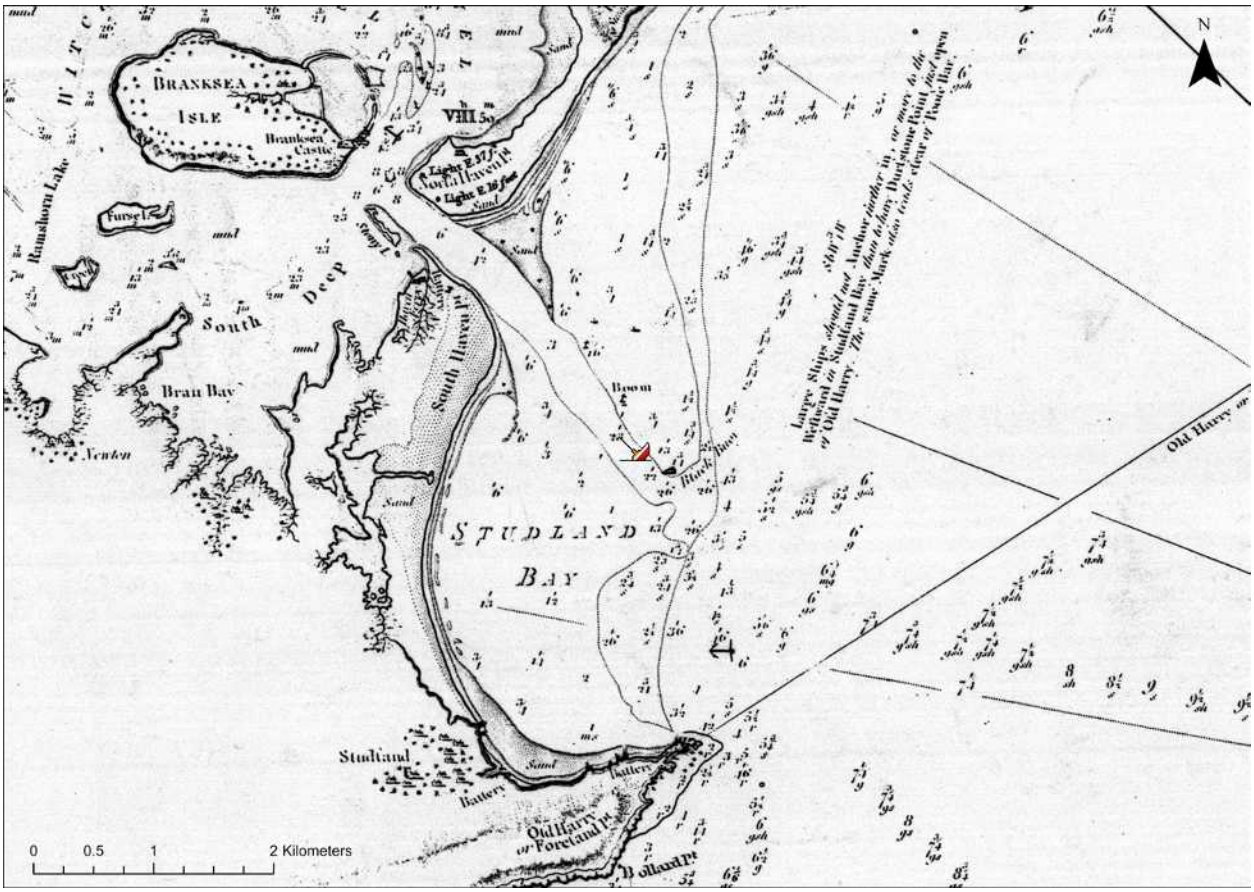


Figure 1.4. McKenzie (1785) Admiralty Chart of Studland Bay from 1785 showing the anchorage and approximate position of the wreck (note the depths are in feet)

It was remarkable that in such conditions the Dutch Republic not only survived, but prospered, though the seafaring towns and cities did better than those inland.

The contemporary English state consisted of England, Wales and their outlying islands. Scotland, though linked to England by a shared 'British' Stuart monarchy, was effectively a separate nation. The Stuart kings James I (1603–25) and Charles I (1625–49) ruled an England that had survived a long maritime war with Spain between 1585 and 1604. Charles I, in particular, had pretensions to make England into a greater international player, but he had neither the finances nor the military and naval power to do so. The royal navy had suffered from the results of incompetence, corruption and lack of funding in the years after 1604. Fortunately for England, these proved to be years of peace. Though the management of the fleet was subsequently improved, it lacked the leadership, manpower and money to conduct effective major operations. These weaknesses contributed to England's humiliating failure in wars against both Spain and France between 1625 and 1630.

Despite their many differences, there were some resemblances between England and the Netherlands as maritime nations. Each had a sea-trading network that reached out across northern and southern European waters, the Atlantic and Asia, and both were prepared to use force to back up their mercantile operations if they felt the need. The two countries also planted small settlements in North America between the early 1600s and 1630, but the survival of these was precarious and it would be many years before any of them amounted to much. Colonies aside, however, the Dutch had the upper hand in matters of sea trade and naval war.

Dutch trade was diverse in nature, whereas much of English overseas commerce still relied on the export of cloth. England did have two successful long-distance overseas trading ventures – the Levant Company, and the East India Company (EIC) – but their contribution to the nation's wealth was limited. Added to this, the EIC's Dutch competitor, the *Vereenigde Oostindische Compagnie* (VOC), was much more securely established in Asia than its English challenger.

The VOC's Atlantic counterpart was the Dutch West India Company (WIC), founded in 1621. The Company had a monopoly on Dutch trade with the Americas and Africa and was empowered to wage war in those continents. The WIC was not always successful, but in 1628 one of its squadrons captured the Spanish treasure fleet – a massive coup. Two years later, the Company began the conquest of Pernambuco in Brazil, a valuable sugar-producing region in the Portuguese portion of the Spanish Empire.

England and the Netherlands were both overwhelmingly Protestant nations, at a time when parts of Europe were embroiled in bitter and brutal religious conflicts between Protestant and Catholic. The two countries had been allies in the long Anglo-Spanish War, and the EIC and VOC did co-operate in fighting the Portuguese in Asia in the 1620s. However, there was also real friction between the two states. In theory, the Dutch believed that the seas should be open to all traders and fishermen, but, amongst other things, the English resented the way that Dutch herring fleets exploited English waters in the North Sea. Conversely, and rather hypocritically, the Dutch often did their best to exclude the EIC from trade in Asia.

Some 21 years after the Swash Channel Wreck was lost, Anglo-Dutch hostility would erupt into the first of three wars between the two countries. A time would come when England was a rising sea power, and the Netherlands would be in decline as a maritime nation, but in 1631 that was still a long way off.

Chapter 2

Archaeological investigations and methodologies

Archaeological investigations before 2006

Increases in shipping size led to a requirement in the 1980s to increase the depth of water in the Swash Channel to 6m. This was the first capital dredge of the Channel and was done in two stages: to 5.2m below CD in 1988/89 and then to 6.0m below CD in 1989/90. In 1990, the dredger *Scaldis* hit an obstruction between buoys 5 and 7 on the eastern edge of the Channel. This brought substantial timbers (**UW6**) and an iron swivel gun (**UW10**) to the surface (Papworth 1995) but the timbers were not recorded. While the gun (**SCW689**) was later identified as being from a much later context, this was the first modern indication that there was a wreck at this location.

As part of an oil exportation scheme the BP Exploration Operating Company commissioned the *Royal Commission on the Historical Monuments of England* (RCHME 1991) to examine the potential archaeological value of western Poole Bay; this survey identified several anomalies in the vicinity of the wreck. At that time maritime archaeological activity in Poole was focused on the Studland Bay Wreck and with limited resources there was no capacity to expand work beyond that which was already on-going and no further action was taken regarding this new discovery (Keith Jarvis, pers comm).

Other indicators that there may have been a wooden wreck in the area included the long history of ships' timbers being washed ashore in Studland Bay, which were often collected by walkers and chopped up for fuel or used for bonfires on the beach. In January 2001, a large 2m-long floor timber (**SCW1316**) washed up on Studland Beach and was reported to the National Trust by a walker who also reported it to Receiver of the Wreck (N Grace, pers comm 26 January 2021). The timber was heavy and in remarkably good condition with no associated barnacles or sea life, suggesting it may have been buried and protected in the seabed of the bay. Another large framing timber was washed ashore in 2008 (**SCW1314**) and was collected and stored submerged in water. This timber possessed a layer of sapwood which meant that it was possible to establish a dendrochronological date for the wood. Subsequent dendrochronological analysis of this timber, funded by the National Trust and undertaken by Nigel Nayling of Lampeter University, showed that it contained a 162-year tree ring sequence with some sapwood surviving on one corner. Significant computer correlations and visual matches were identified between the tree-ring sequence and oak tree-ring chronologies from Germany and the Netherlands. Assuming the timber was German in origin, a sapwood estimate of 10–30 years was applied, suggesting that the parent timber was felled in the date range AD 1619–39 (Nayling 2009).

By the early 2000s, a desire to improve the service for cross-channel ferry and shipping industries lead to a requirement to increase the channel depth by a further 1.5m to 7.5m below CD. Unlike previous dredging schemes, changes in legislation required The Poole Harbour Channel Deepening and Beneficial Use Scheme to provide an Environmental Impact Assessment (EIA). (The aim of EIAsis to protect the environment by ensuring that the relevant planning authority understands any significant effects that a scheme will have on the environment when granting permission for it to proceed.)

In 2004, PHC engaged Wessex Archaeology to undertake the archaeological component of the EIA which included a geophysical survey of the proposed dredge area. A side-scan survey of the Swash Channel identified an anomaly lying in approximately the same position as the 1990 discovery. Subsequent diving operations demonstrated that this was a wooden wreck lying at the side of the channel in some 6–9m of water, with its long axis orientated north-east to south-west.

Wessex Archaeology returned to the site in October 2004 in order to conduct further investigations as part of the undesignated wreck assessment (Wessex Archaeology 2005). Their assessment identified the site as likely being the remains of a large or very large wooden vessel of the mid to late 17th century which could be of national significance. This initial assessment suggested the site was unstable and vulnerable to erosion. Noting the importance of the site, PHC changed their dredging plan to avoid dredging in the vicinity of the wreck to mitigate potential damage to it (Wessex Archaeology 2006a).

Due to its perceived archaeological significance and precarious position so close to the edge of the dredged channel the site was designated as a Protected Wreck in December 2004. In 2005, Wessex Archaeology continued their investigation of the site on behalf of English Heritage with a full designated site assessment. Over 26 days divers assessed the extent of the wreck and the exposed features. The assessment produced a photographic survey and site plan of the exposed

archaeological features (Figure 2.1). The assessment recorded a zone of structure some 20m in length, with evidence for at least two decks. Very few artefacts were identified, but there was evidence of a brick hearth and several iron guns. A number of other isolated timbers were recorded on the perimeter of the site, one of which it was suggested might be a rudder. Importantly, it was found that large sections of the vessel's hull were exposed; top timbers, circular ports and at least one decorative carving were also recorded, all of which were degrading. In order to mitigate this risk Wessex Archaeology used sand bags to create a temporary protection layer over the timbers (Wessex Archaeology 2006b).

Dating material recovered from the site included Rhenish stoneware sherds from a jar or jug; this was unlikely to have been made before 1630, due to the presence of a rosette and the use of cobalt, and unlikely to be later than 1700 when vessel production shape changed. Brick and tile fragments were also recovered, all of which were post-medieval in date (Wessex Archaeology 2006a). The dendrochronological samples were analysed by Nigel Nayling of Lampeter University, and these provided a felling date for a single timber of post-1585 from a tree that grew in Germany or Holland (Nayling 2006). A broad date suggested for the site was between 1585 and 1700, tending towards the first half of the 17th century (Palma and Parham 2006).

Involvement of Bournemouth University

With the site characterised and shielded from dredging, there was an urgent need to establish the character of sediment movement and biological attack. English Heritage and Poole Harbour Commissioners (PHC) approached Bournemouth University (BU) to monitor the level of physical and biological degradation. This was to be undertaken by university staff with specialist skills and would benefit from the use of the extensive BU laboratory base. The work on site would be incorporated into a taught unit on BU's BSc Marine Archaeology programme which aimed to increase capacity within the sector. BU became the PHC archaeological advisors in 2005 and following discussions between the two parties and English Heritage, a proposal to allow for on-going monitoring of the wreck was agreed. This would be undertaken by BU as part of a research/teaching project connected with the Marine Archaeology programme and would be funded by PHC for six years.

The project, which was to be implemented by students and supported by BU's scientific diving team, aimed to complete the survey of the Swash Channel Wreck and establish a strategy for future management of the site which would be run over the following five years. The research and monitoring project was designed specifically for the inclusion of university students, allowing an exceptional opportunity for them to put into practice the skills they were being taught. The archaeological, scientific, and diving expertise of the staff would underpin the project. BU subsequently prepared a Project Design designed to undertake this work in accordance with specifications supplied by, and under a licence issued by, English Heritage.

2006 season

In May 2006, the site was re-located, and it was discovered that the protective hessian sandbags places by Wessex Archaeology in 2004 had degraded, leaving the wreck once again exposed. In addition, new structure could be seen: the site was considerably more extensive than first thought, covering an area some 50m by 40m, with extensive structural remains over 40m by 20m, much of which was unrecorded. The condition of the exposed timbers had visibly deteriorated since 2005, resulting in the break-up of the articulated structure that had been exposed for several years and loss of subsequent archaeological material from the site (Parham and Palma 2009, 16).

The area included several newly revealed timber structures, two cannon and potentially a third one partially buried, as well as fragments of rope. There was also evidence that in some areas the site might contain buried stratigraphy up to 2.5m deep. Given this new information and the tight timescale available for on-site work, it was not possible to survey this new archaeological area during the 2006 season.

New finds were also identified within the originally identified archaeological site, including an approximately 2m length of lead pipe bent around the timber structure, a broken but well-manufactured ceramic handled vessel, a leather shoe sole, part of a wooden stave-built barrel, bricks, and a fragment of rope. Most of the artefacts appeared to be in very precarious conditions, being partially or nearly totally exposed and in a very unstable state of preservation.

It was evident that much more work than was originally anticipated was required. BU negotiated sponsorship with several local organisations, notably Dorset Workboats and Jenkins Marine, to enable this extra work. Following consultation with English Heritage it was planned to excavate and recover the loose artefacts and deliver them to English Heritage for conservation at Fort Cumberland. This recovery was planned to take place during diving operations in August 2006, but this was not possible as the finds were not visible at the time of the dive. This was thought to be due to the dynamic nature of the site: in the case of small artefacts, it is thought they were lost completely while the larger

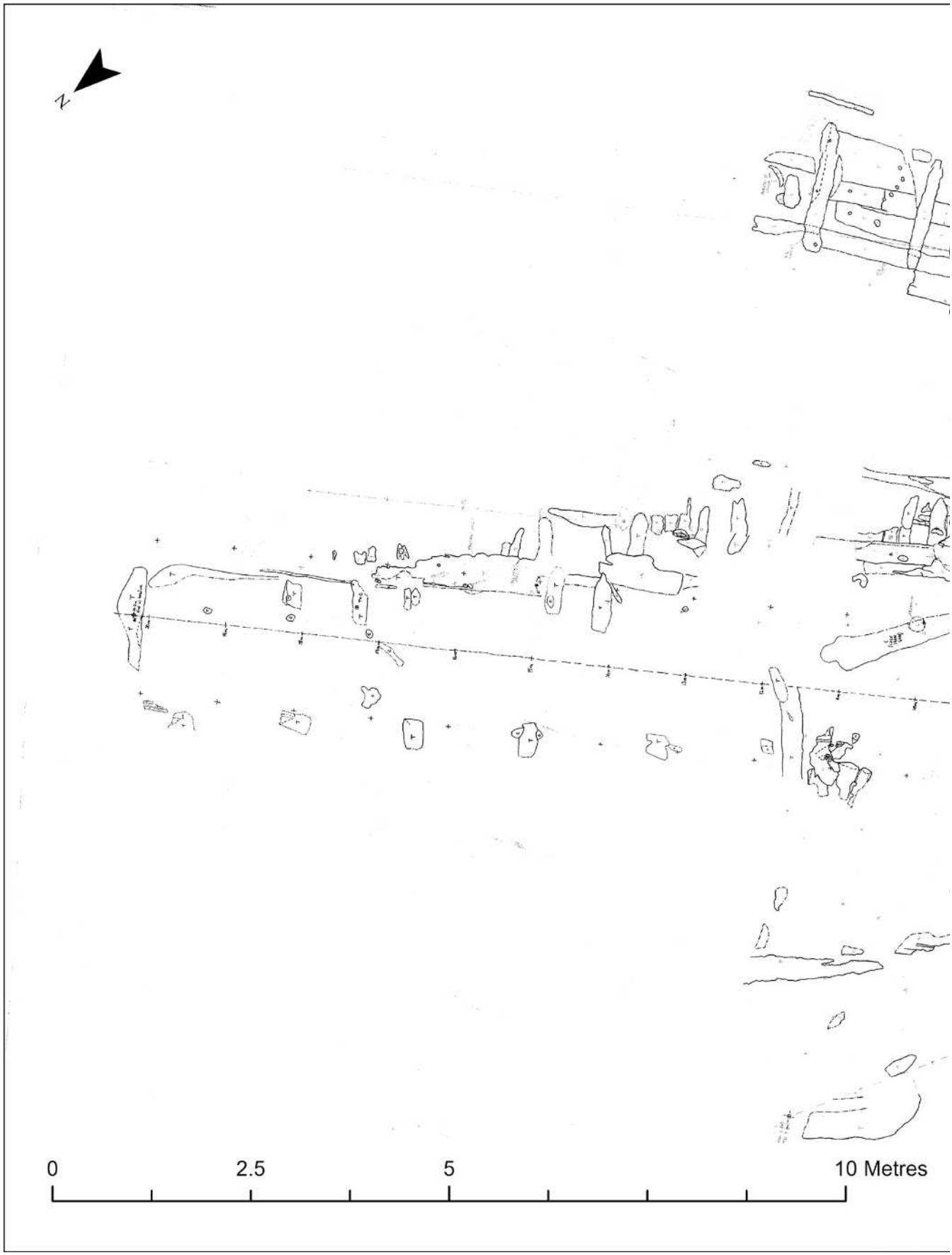
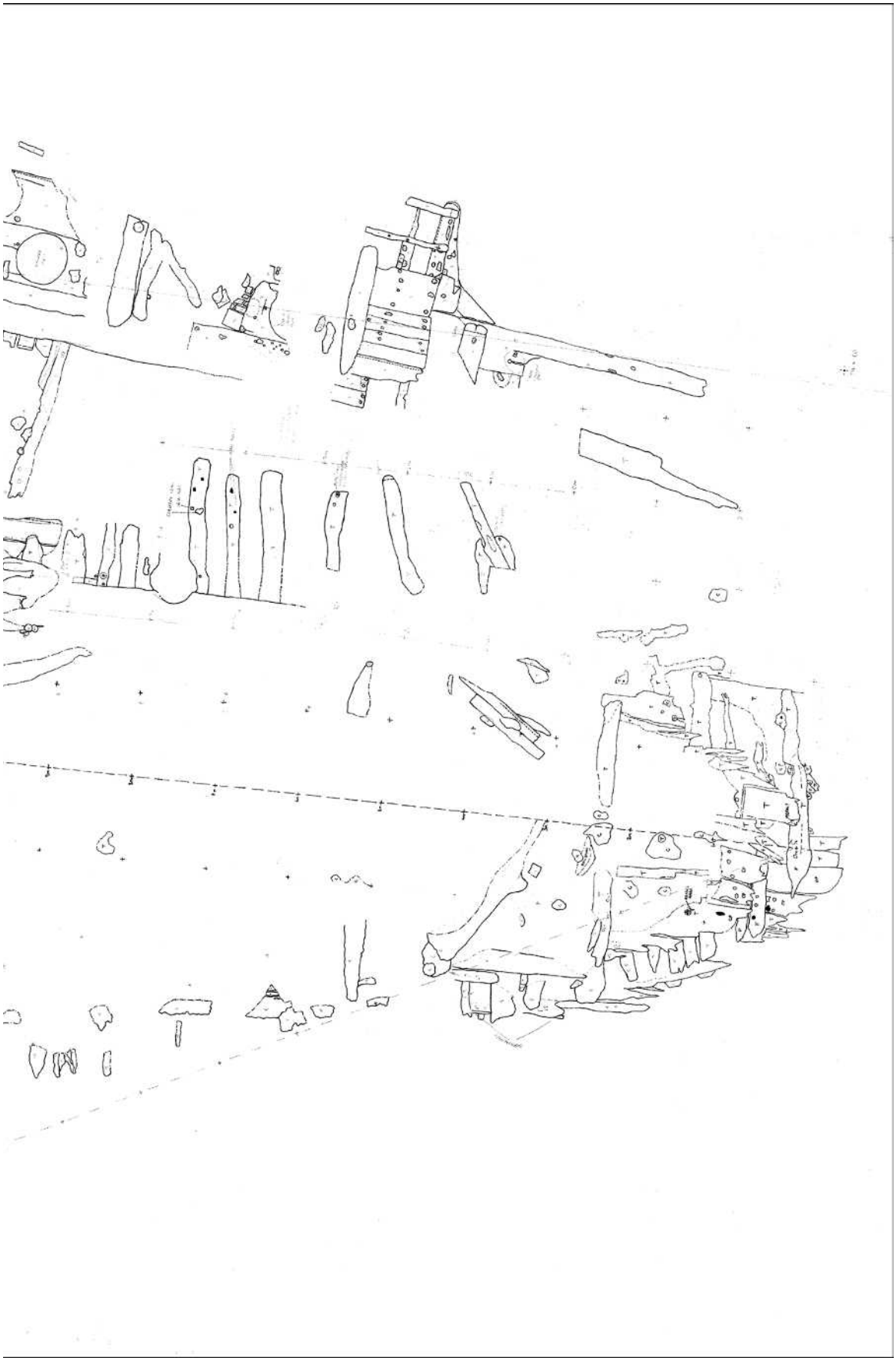


Figure 2.1. Wessex Archaeology site plan (Wessex Archaeology)



artefacts may either have been lost or possibly naturally reburied. During the dives a second wooden artefact, possibly a barrel, was observed.

As part of the programme to establish a stratigraphy for the site an auger survey was undertaken to establish the extent of the mobility of the sand deposit above what was believed to be undisturbed archaeological stratigraphy. The results of the survey revealed a very thin and mobile overburden and it was recognised that the nature of this relatively thin layer of sand and its mobile nature were not conducive to the natural protection of the site.

The mitigation strategy agreed with English Heritage for the site also required that PHC would undertake soundings across the wreck and its environs. This was carried out on two occasions in 2006: in March directly after a dredging of the Swash Channel had been completed, and again in September. The soundings and comparisons were to be carried out twice a year as required under the conditions of mitigation.

Biological attack and bio-fouling had been noted on some of the vessel's timbers as evidenced by calcareous linings some up to 500mm in length (Palma and Parham 2006). In order to monitor the rate of borer attack BU deployed sacrificial wood sample panels on the site at the end of May 2006 with the aim of recovering them at three-monthly intervals.

After three months of deployment, in August 2006 the first batch of samples was recovered and showed evidence of slight (up to 15%) attack by shipworm and moderate (up to 25%) and in some cases severe (up to 50%) attack from crustaceans like *Limnoria* (gribble). Gribble are a small (1–4 millimetres long) marine isopod crustacean that bores into submerged wooden structures. Their tunnels are 1–2mm wide and are just (<25mm) below the wood surface, forming an extensive network of tunnels that undermines and destroys the surface of the timber. Whilst this does immediately undermine the integrity of the structure, it does remove rich archaeological data such as toolmarks present on its surface. These tunnels are perforated to connect their interior to the surrounding water to allow oxygen to enter (Pournou 2020, 299). This requirement prevents them boring into parts of a structure that is buried but if gribble are present they will quickly migrate into freshly exposed material.

In November the second batch of samples was collected after six-months' deployment. Their condition was considerably more degraded that those recovered in August. Their surface had been extensively degraded by the crustaceans *Limnoria* and *Chelura*, which shared the same unlined tunnels, reaching a depth inside the wood of 6mm. A considerable increase in the number and size of shipworms since August was observed and their attack had reached a moderate level. Microscopic examination and X-raying showed a considerable number of overlapping young adults just a few millimetres from each other. It was noted that in due course these would increase in size quickly and consequently enlarge their tunnels inside the wood structure resulting in considerable destruction. This would increase as *Limnoria* degraded the surface layer of the wood structure, making it easier for the shipworm larvae to penetrate the timber and thus infestation levels would continue to increase.

Examination of the pallets collected confirmed that they belonged to native T. *navalis* species, and not the invasive and more destructive L. *pedicellatus* species which at that point had been found elsewhere in the UK. Concern was expressed that with increasing levels of L. *pedicellatus* in UK waters, there was the risk that if they attacked the wreck then damage to the structure would increase.

2007 season: *in-situ* trials

In 2007, English Heritage commissioned Bournemouth University to undertake a scoping study aimed at establishing the most cost-effective solution for the *in-situ* preservation of the site. The project set out to trial three different strategies on the site over a twelve-month period and to establish the efficacy versus financial viability of each method. It was hoped that the results of this research would inform the ongoing management of the site and other maritime sites with similar characteristics.

This was to be achieved by:

1. Deployment of three different methods for *in-situ* stabilisation: geotextile and sandbagging; artificial seagrass; and scaffolding net.
2. The three methods would be laid adjacent to each other, covering a similar section of the wreck, each measuring an area 2.5m 5.0m.
3. Each method would have a series of wooden sample blocks buried beneath them that would be recovered four and ten months later for analysis to establish the effectiveness of the protection.
4. The cost per square metre of each trial type would be established.

Wooden sample blocks

Oak, elm and pine samples were used as these had previously been observed on the wreck. Each block measured 200mm 70mm 25mm in line with BS EN 275:1992 *Wood preservatives. Determination of the protective effectiveness against marine borers* standards.

Diving on site occurred in three-day periods totalling fifteen days during May, June, July, August and November 2007. Work on the site was heavily disrupted by the severe weather conditions that the UK experienced during June and July that year.

Geotextile and sandbagging

An area of the shipwreck measuring 2.5m 5.0m was covered by a 700mm layer of a mix of coarse and fine sand. This was kept in place by a rectangular sandbag bund capped by a geo-textile sheet which was secured in place by a layer of sandbags. This method has previously been used experimentally on different sites across Europe (Palma 2005; Cammidge 2005; Hafner 2006). Terram 4000 was chosen as this is the highest grade of the Terram range which has a smaller pore size of 60µm and a low permeability of 30 l/m² which limits the passage of woodborer larvae.

Synthetic seagrass mats

Synthetic or artificial seagrass mats are mesh mats with attached floating fronds that encourage sediment deposition by slowing down water passing through the fronds, thus facilitating sediment deposition and eliminating scour (Cammidge 2005). The type of mat used was the Seabed Scour Control Systems SGB Netsafe which is made from Type 'S' high tenacity polypropylene which provides the highest resistance to deterioration. This is manufactured to European Standard BS EN 1263 Parts 1 and 2. The mat was secured to the seabed by a layer of sandbags placed on its outer edge.

Scaffolding debris netting

Debris netting is used on scaffolding and construction sites to protect workers, public and property from falling debris. It allows air circulation and considerably reduces rain and wind penetration. The material chosen was a durable Type 'S' high tenacity polypropylene 40 gsm plastic netting. This provides the highest resistance to deterioration and is manufactured to European Standard BS EN 1263 Parts 1 and 2. The method used has been employed experimentally in the Netherlands and in Sri Lanka for the *in-situ* preservation of shipwrecks. The net is placed loosely across the wreck site to capture the sand that is moved along the seabed by tidal currents to create an artificial mound in which the wreck is kept in an anaerobic environment. This mound stops abrasion, scouring, and attack by woodborers. As the mount is sloping, fishing nets do not get caught on parts of the wreck (Manders 2006). The deployment of this method was suggested by English Heritage as a low-cost option, although difficulties had been encountered previously when deployed in the UK (Cammidge 2005, 29). The net was secured to the seabed by a layer of sandbags placed on two of its four edges.

Trial results

The results of the trials of each material are shown in Tables 2.1–2.3.

Biological analyses

Once recovered the samples were washed, digitally photographed and X-rayed. Each sample was then categorised in accordance with grades of attack detailed in BS EN 275:1992 *Wood preservatives. Determination of the protective effectiveness against marine borers* (Table 2.4) which establishes the degradation by the number of galleries dug by these organisms inside a standard measure sacrificial sample and sets out the grading of each of the samples recovered.

Table 2.5 sets out the grading of each of the samples recovered and Table 2.6 gives a summary of the grading from each trial.

Table 2.1: Visual observations: geotexile

Deployment Period	Description
One month	The geotextile trial showed signs of stability. The gaps between sandbags were fully covered with sand; overall the sandbag surface was covered with a fine, thin layer of sediment.
Four months	The geotextile looked very stable and showed sediment deposition and the beginning of algal growth on the sandbag surface.
Ten months	The geotextile showed complete stability. The gaps between sandbags covering the sheet of geotextile were filled with sediment and the sandbags themselves were completely blended under the thick and uniform algal growth. However, when sandbags were lifted to recover the sacrificial samples some superficial water voids were noted underneath. It is assumed that these were caused by settlement of the mound or perhaps some sediment loss before the area reached stability.
Three years	When the trial was removed from the site 3 years later it was still stable and heavily covered in marine life. The timber beneath the structure was in a noticeably better condition than the timber surrounding it.

Table 2.2: Visual observations: synthetic seagrass

Deployment period	Description
One month	The synthetic fronds were floating in the water column. Many dead spider crabs were found entangled in the base of the fronds. 300mm of sediment was found to have been deposited.
Four months	The synthetic fronds were found in very good condition with no crabs present. The deposited sediment had been reduced to 100mm.
Ten months	The fronds had formed a deep 300mm sediment layer within which debris, fronds and the mat of the fronds' system had intertwined to form a deep and difficult to penetrate layer.
Three years	When the trial was removed from the site 3 years later it proved extremely difficult to remove and had provided similar protection to the geotextile layer in the long term.

Table 2.3: Visual observations: scaffold netting

Deployment period	Description
One month	The scaffolding net was found to be heavily mechanically degraded with large holes torn in the net. The net was not floating in the water column as was designed but was close to the seabed where it was entangled on the wreck structure and clogged with algae and sediment. Beneath the net, very little sediment seemed to have deposited on the hull structure and the sacrificial samples were already partially covered by algal growth.
Four months	The net was partially buried and would appear to have worked in limited areas. In some places approximately 100–150mm of sedimentation was noted to have been deposited onto the hull structure, but other areas were left exposed.
Ten months	Only fragments survived, with the hull structure it covered largely exposed.
Three years	Only the securing sandbags remained.

Table 2.4: BS EN 275:1992 Wood preservatives. Determination of effectiveness against marine borers

Grade	Description	Area affected	Conditions and appearance of test wood sample
0	No attack	0%	No sign of attack
1	Slight attack	<15%	Single or few scattered tunnels covering no more than 15% of the area of the specimen as it appears on the X-ray film
2	Moderate attack	15–25%	Tunnels covering not more than about 25% of the area of the specimen as it appears on the X-ray film
3	Severe attack	25–50%	Tunnels covering between 25% and 50% of the area of the specimen as it appears on the X-ray film
4	Failure	>50%	Tunnels covering more than 50% of the area of the specimen as it appears on the X-ray film

Morphological analyses

The samples were deployed for one year but this period proved too short for the development of attack from organisms like fungi and bacteria that develop relatively slowly. Isolated attacks by fungi and bacteria were observed near tunnels made by marine borers but no signs of attack were observed elsewhere on any of the samples.

Physical analyses

During the twelve months underwater almost all the hollow spaces (the lumina) of the wood cells had been filled by water. However, if any decay was present, it could not yet be detected as the Moisture Water Content, Basic Density and Residual Basic Density measurements taken were within the normal wood variability.

Chemical analyses

Chemical analyses of the wood samples showed that the amounts of lignin and holocellulose (sum of cellulose and hemicellulose) were the same as those expected in sound, normal wood.

Financial analysis

All costs were calculated based on installation and materials costs for each trial: protecting an areas of seabed of 12.5m² (2.5m 5.0m) (Table 2.7). Larger areas of seabed protected would clearly offer economies of scale.

Trial conclusions

The results of the trial showed that the most successful method was that of the geotextile with synthetic

Table 2.5: Grading of each sample recovered

No	Trial	Timber	Deployed	Recovered	Grade
S07E2	Control	Elm	04/07/2007	01/06/2008	1
S07E6	Control	Elm	04/07/2007	01/06/2008	1
S07E8	Control	Elm	04/07/2007	01/06/2008	2
S07O5	Control	Oak	04/07/2007	01/06/2008	1
S07O6	Control	Oak	04/07/2007	01/06/2008	1
S07O8	Control	Oak	04/07/2007	01/06/2008	1
S07P1	Control	Pine	04/07/2007	01/06/2008	4
S07P5	Control	Pine	04/07/2007	01/06/2008	3
S07P9	Control	Pine	04/07/2007	01/06/2008	4
S07E4	Geotextile	Elm	24/06/2007	11/06/2008	Lost
S07E1	Geotextile	Elm	24/06/2007	11/06/2008	Lost
S07E9	Geotextile	Elm	24/06/2007	11/06/2008	Lost
SCO1	Geotextile	Oak	24/06/2007	11/06/2008	0
SCO2	Geotextile	Oak	24/06/2007	11/06/2008	0
SCO3	Geotextile	Oak	24/06/2007	11/06/2008	0
SPC1	Geotextile	Pine	24/06/2007	11/06/2008	0
SPC2	Geotextile	Pine	24/06/2007	11/06/2008	0
SPC3	Geotextile	Pine	24/06/2007	11/06/2008	0
S07E10	Seagrass	Elm	27/06/2007	12/06/2008	0
S07E11	Seagrass	Elm	27/06/2007	12/06/2008	0
S07E12	Seagrass	Elm	27/06/2007	12/06/2008	Lost
S07O1	Seagrass	Oak	27/06/2007	12/06/2008	0
S07O2	Seagrass	Oak	27/06/2007	12/06/2008	0
S07O7	Seagrass	Oak	27/06/2007	12/06/2008	0
S07P4	Seagrass	Pine	27/06/2007	12/06/2008	0
S07P6	Seagrass	Pine	27/06/2007	12/06/2008	1
S07P7	Seagrass	Pine	27/06/2007	12/06/2008	1
S07E3	Scaffolding net	Elm	27/07/2007	27/05/2008	3
S07E5	Scaffolding net	Elm	27/07/2007	03/06/2008	3
S07E7	Scaffolding net	Elm	27/07/2007	27/05/2008	4
S07O3	Scaffolding net	Oak	27/07/2007	04/06/2008	3
S07O4	Scaffolding net	Oak	27/07/2007	27/05/2008	2
S07O9	Scaffolding net	Oak	27/07/2007	04/06/2008	3
S07P2	Scaffolding net	Pine	27/07/2007	01/06/2008	4
S07P3	Scaffolding net	Pine	27/07/2007	27/05/2008	4
S07P8	Scaffolding net	Pine	27/07/2007	04/06/2008	4

seagrass coming a close second. The scaffold netting was a complete failure. Geotextile also offered financial savings in comparison with synthetic seagrass, being 65% of the cost of the latter.

Scientific analysis showed that the key factor in the initial rapid degradation of maritime archaeological timber is infestation by marine borers who degrade exposed timber at a considerably faster rate than morphological, physical or chemical processes. The major damage to archaeological information is cause by gribble, which rapidly degrade the surface of the wood, whilst shipworm cause much slower damage to the timbers' structural integrity.

Table 2.6: Grading of samples from each trial

Trial	No Attack	Slight	Moderate	Severe	Failure
Control		56%	11%	11%	22%
Geotextile	100%				
Seagrass	75%	25%			
Scaffold net			11%	44%	44%

Table 2.7: Cost per square metre of each method

Trial	Cost per Square Metre (2007)
Geotextile	£51.11
Synthetic seagrass	£78.92
Scaffold netting	£ 3.06

The trials showed that the degradation could be effectively halted by both the geotextile and synthetic seagrass. The trials did not run for sufficient time to detect physical or chemical processes but did detect the beginnings of morphological damage as evidenced by isolated attacks by fungi and bacteria that were observed near tunnels made by marine borers. In the longer term these processes may become more problematic.

2007 summary

Survey work in 2007 suggested that the wreck consisted of the lower portion of a ship's hull, running from the stern of the vessel forward for approximately two thirds of the vessel's length at which point the lower portion of the ship's hull gradually disappears, and the surviving remains roll into the port bow and detached upperworks. Work on the site also revealed the presence of the ship's rudder which was some 8.4m in length; it had a carving of a male human head on its upper portion. What was clear in 2007 was that the wreck was being exposed at a faster rate than it was possible to record it with the resources to hand and that another, more rapid and cost-effective, approach was needed.

2008 season

By the end of the 2007 season it had become evident that the work required to preserve the exposed material by record (i.e. recording areas of the site prior to their natural destruction) could not be achieved with the resources then available to Bournemouth University. This work also revealed that much of the site was completely unrecorded and with this in mind, English Heritage agreed to meet the costs of a site survey which was undertaken as part of BU's Applied Marine Archaeology Unit. To achieve this a group of 3rd-year students, lead by Tom Cousins and Danni Seliger, were set the task of undertaking a digital photomosaic of the site. The task was achieved by the construction of two 3m 3m tubular plastic frames with a moveable distance bar positioned 200mm above the frame. This allowed nine 1m^2 overlapping photographs to be taken to form a 3m 3m photograph. The frames were moved around the site by following pre-laid rope gridlines to allow the frames to be related to each other. The resultant image covered an area 40m 21m at its furthest extent and provided a rapid and repeatable method of recording large areas of seabed from which a site plan could be created (Figure 2.2).

Whilst this is now an outdated method for photographic recording of sites, at the time it was quite an achievement given the resources and technology to hand and was seen by English Heritage as a very visible way of recording the area of the seabed that was now exposed. It allowed the original survey of the site undertaken by Wessex Archaeology in 2005, just three years before, to be compared to the site as exposed at the time, demonstrating that the site had increased in size by over 300% and that large areas of timbers were exposed to the elements. It was noted that the overall condition of the exposed timber of the site was rapidly deteriorating (Figure 2.3).

2009 season

In March 2009, English Heritage provided funds for a rescue excavation and *in-situ* protection of some elements of the site. The bow structure, which was amongst the first elements of the structure observed when the site was found in 2004, had been subject to erosion ever since, increasing the undercut to approximately 3m from the edge of the surviving structure. This had resulted in what appeared to be the beginnings of structural deterioration, with planking having clearly 'sprung' from the structure and loose planks lying in front of it. It was noted that the overall condition of the exposed timber of the site was rapidly deteriorating and most timbers left unburied had now lost 100% of their original surface and those that had been uncovered for several years were showing signs of having lost a significant amount of their original dimensions. The site was being colonised by marine growth, most notably kelp which was adding to the mechanical stress on the timber. Vulnerable elements such as the rudder and the upperworks of Area Two were temporarily protected by sandbagging. To achieve this, BU deployed 8 tons of 25kg sandbags to the site as well as surveying the areas to the west of the identified remains.

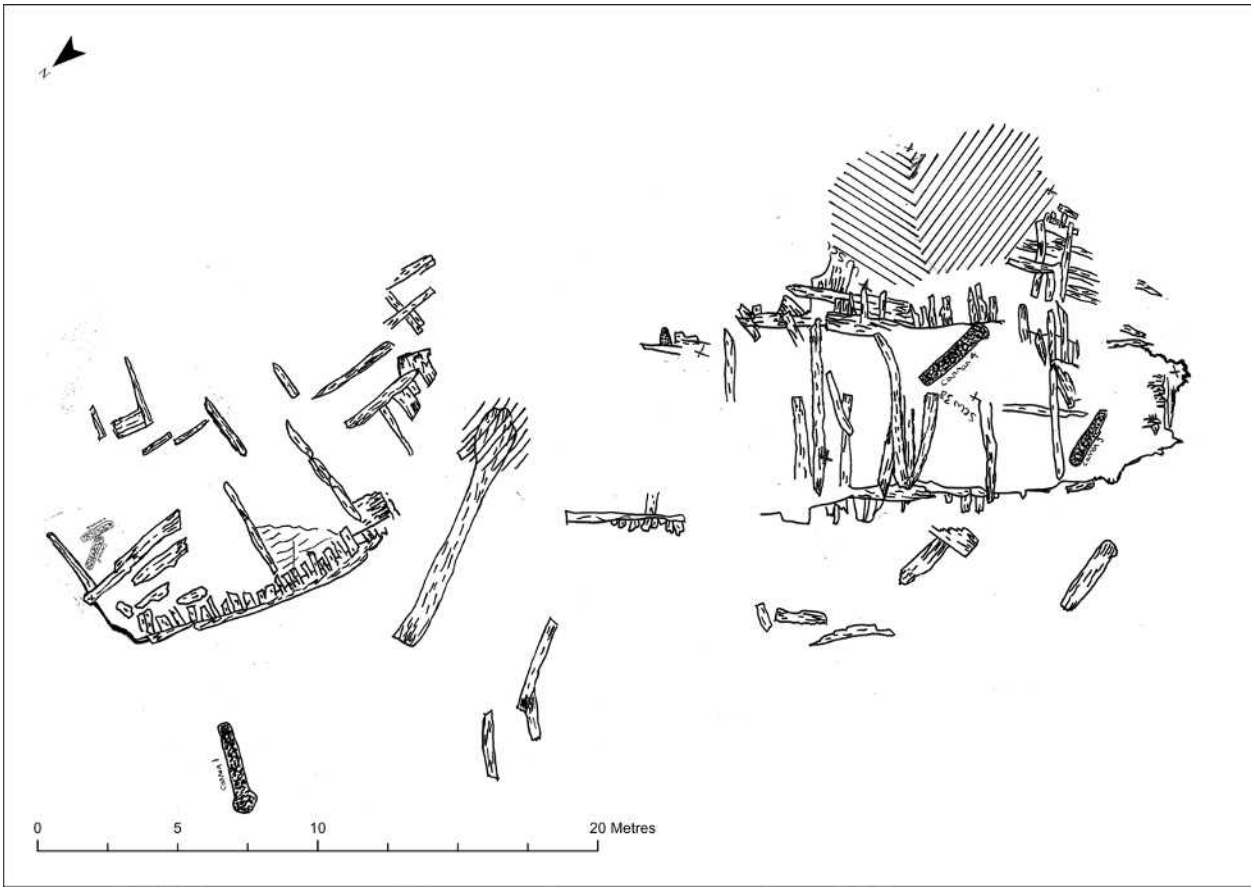


Figure 2.2. 2008 Site plan derived from the photomosaic

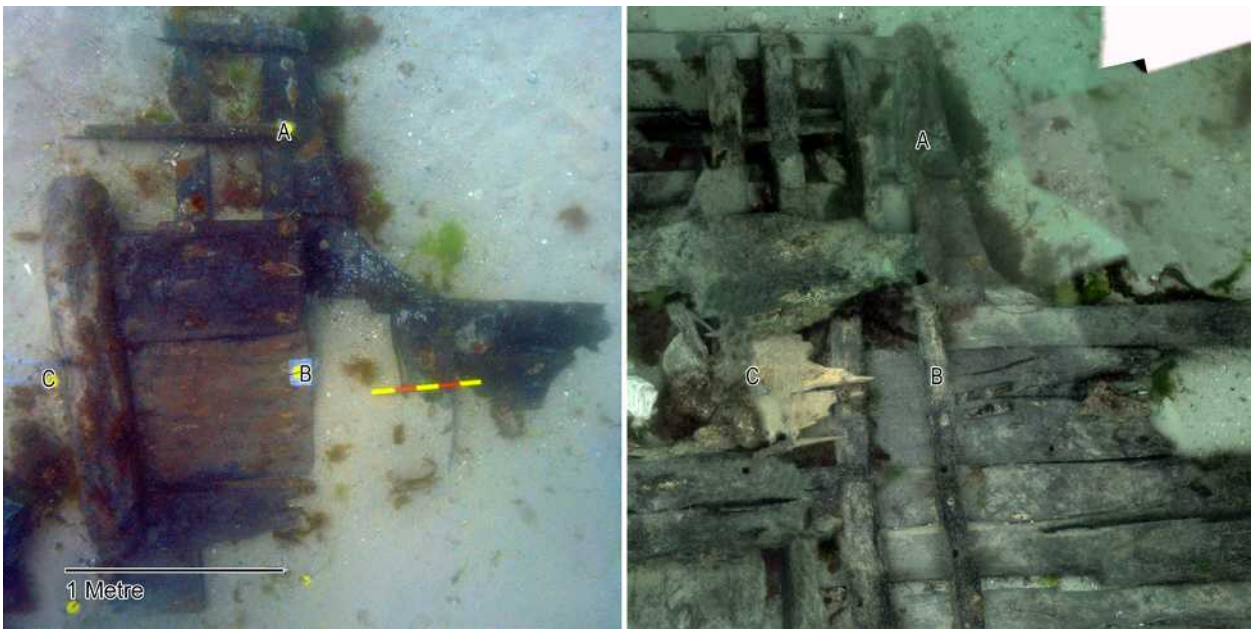


Figure 2.3. Comparison between the same area of the wreck from 2004 (left) and 2010 (right). Note the loss of rails (A), a significant amounts of ceiling planks (B) and a rider (C). Photo: Wessex Archaeology/Bournemouth University

At the request of English Heritage, in September 2009 the Protection of Wrecks Act diving contractor Wessex Archaeology inspected the site and supported Nigel Nayling of Lampeter University in collecting more dendrochronology samples. Wessex confirmed that the site was clearly unstable with 'no indication that the site will regain stability over the long term without intervention'. This assessment resulted in the site being

added to English Heritage's Heritage at Risk Register. The dendrochronology work verified the use of Dutch or German timber with a felling date range of AD 1619–39 (Wessex Archaeology 2009).

Sixteen finds that were at risk were recovered from the site during 2008/2009 and stored in passive conservation at BU under advice provided by Ian Panter of York Archaeological Trust. Poole Museum agreed to become the receiving museum for the site and to curate the finds once conservation was completed.

Freshly exposed areas at the stern of the vessel were recorded using the same techniques employed in 2008.

Results of monitoring work 2006–2009

Monitoring rods: 2006 results

Monitoring rods (mild steel 1m in length) were deployed in August 2006 to record sediment mechanics. These were hammered into the seabed to a depth of 500mm, leaving 500mm projecting. Each rod was then levelled with a diving computer against a primary site datum to provide comparative depth records between each rod. The rods were deployed in two rows parallel to and 12m distant from the centre line of the site. Profile 1 consisted of thirteen rods positioned to the landward, north-west side of the site and Profile 2, fifteen rods positioned to the seaward, south-east side of the site. In both cases the first and last two rods projected beyond the known longitudinal extremities of the site. For Profile 2, two further rods were placed in error but the data from these continued to be recorded and presented. During each month that diving was possible on the site the distance between the upper point of each rod and the seabed was recorded to provide data on fluctuations in seabed levels.

Monitoring rods: 2007 results

Profile 1 (landward, north-west side of the site) showed major changes in the level of the seabed. The outer extremities of the profile – those rods that lay on or outside the transverse extremities of the site – appeared relatively stable. However, those rods that lay directly parallel to the body of the site showed a constant lowering of seabed levels to a maximum of 283mm. This had revealed much new archaeology in the form of scattered shipwreck material, mainly timbers.

Profile 2 (seaward, south-east side) appeared to show a similar, if less pronounced reduction. The outer extremities of the site again appeared relatively stable whilst the central section of the wreck showed a constant lowering of seabed levels, although this time to a lower maximum of 190mm.

The monitoring of sediment rods suggested that sediment movement in the area of the site is from east to west with the wreck acting like a groyne, stopping sediment movement and thus denuding the western areas of the site of sediment. This process was revealing much new archaeology in the form of scattered shipwreck material, mainly timbers and some small finds.

Monitoring rods: 2008 results

Profile 1 (landward, north-west side of the site) showed some, although limited, changes from 2007, with a maximum reduction of 190mm from 2006 levels. Greater sediment loss could be seen at the extremities of the site, with a reduction of up to 100mm, as opposed to 45mm in 2007, at the north-east end and 315mm, as opposed to 105mm in 2007, at the south-west extremity. Profile 2 (seaward, south-east side) showed a much greater degree of sediment loss with a maximum of 350mm in the centre of the site and up to 240mm, as opposed to 9mm in 2007, at the south-west extremity. The 100mm at the north-east end appeared to have stabilised. It was noticeable that when the profile rods were installed in the summer of 2006 no archaeology was visible along the lines on which they were installed but by 2008 many timbers and other material were now clearly visible in the area of Profile 2. It was noted that a number of the monitoring rods were being bent (through between 30° to 90°); no explanation has been established as to why this took place.

Discussions as to the future of the site

The monitoring work demonstrated that the site was rapidly being exposed by natural processes that were eroding the covering of sand, thus exposing the underlying archaeological material to rapid mechanical and biological degradation. Measurements from the sediment monitoring rods installed in August 2006 provided monthly (May – October each year) sediment levels for the site (Figure 2.4) which showed a continuing reduction in sediment levels across the site. The data plotted shows the depth profile, as recorded by the sediment monitoring rods, across the site in August 2006 (the upper line) against the sediment levels recorded in late August 2009 (the lower line), illustrating the loss of sediment during the monitoring programme. From 2006 to 2009 the average loss of sediment over the site was in the order of 310mm over an area of 960m^2, an estimated sediment loss across the site since 2006 in the order of 300m^3 or *c* 500 tons.

Following its discovery, PHC provided considerable support for the site, most notably by altering their dredging plan to avoid dredging in the vicinity of the wreck and thus mitigating potential damage. In

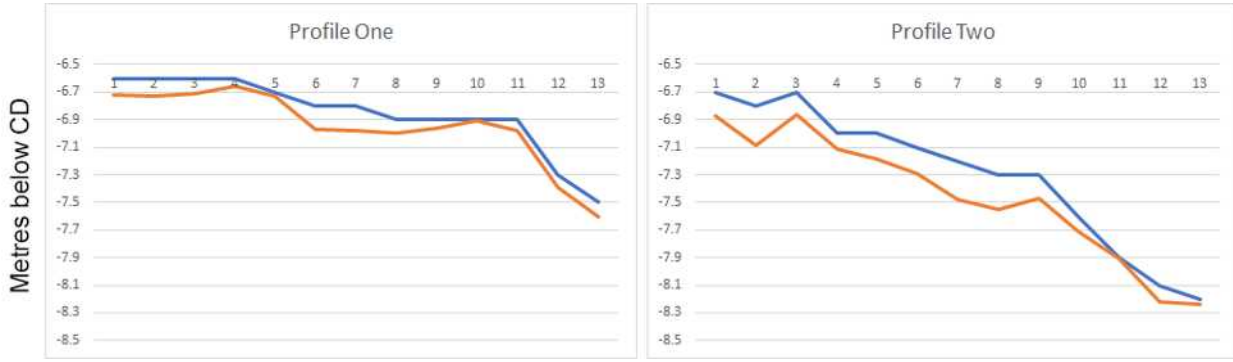


Figure 2.4. Profiles of the sediment loss as recorded on the monitoring rods between 2006 (blue) and 2009 (orange)

addition, they funded the post-dredging monitoring of the site which laid the foundations for the subsequent excavation work.

At the time of the site's discovery the English Heritage management approach was that preservation *in situ* was the preferred option, with no major excavations having occurred in English waters since the *Mary Rose* in the 1980s. The 2007 Management Plan (Dunkley 2007) for the site still stated, 'Policy 8: Through liaison with the appropriate authorities, we will seek to stabilise and afford preservation *in situ* to selected elements of the wreck.' However, the monitoring of the site described above was showing that this approach was not working, with the site being rapidly exposed and lost. In 2009, the site was listed as being 'high risk' on the Heritage at Risk Register and as one of nine maritime sites on the Register, it was to be used as a case study.

Swash Channel was set against the example of the protected wreck of the *Stirling Castle* (1679), a 70-gun third-rate ship that wrecked on the Goodwin Sands during the 'Great Storm' of 27 November 1703. In 1979, the wreck emerged from the sands in a remarkable state of preservation and in 1980 it was protected under the Protection of Wrecks Act 1974. Despite this legal protection and the efforts of a licensed team and a number of archaeologists over two decades, the management decision of unfunded *in-situ* preservation resulted in the gradual decay of the wreck in plain sight, a policy described as active neglect (Gribble *et al* 2009, 20).

Events such as the *Stirling Castle* had led to a feeling that English Heritage were unwilling to undertake excavation. However, this was contrary to actual events, since between 2007 and 2008 six excavation licences had been issued for sites protected by the Protection of Wrecks Act 1973. At the 2009 annual meeting for licensees of sites designated by the Protection of Wrecks Act, English Heritage clarified their position stating that:

> The English Heritage approach to the Protected Wreck sites does not preclude excavation. Such licences are not given lightly and the benchmark for such work is high, but this is not to say that excavation is completely disregarded and history allowed to wash away ... English Heritage are happy to talk to anyone considering applying for an excavation licence and advise them both of the process for applying and the alternatives that might be considered if an excavation licence is not deemed appropriate.

In 2009 there was a big change towards making underwater cultural heritage more accessible. The 2009 Advisory Committee on Historic Wreck Sites (ACHWS) annual report stated:

> As divers we are lucky enough to explore maritime archaeology below the waves but for the vast majority of the population it is out of sight and out of mind. To address this English Heritage have been looking at new ways to engage the public and make maritime archaeology more accessible. (English Heritage 2010, 27)

BU, English Heritage and others put on an Open Day with talks and activities and as part of this, Paola Palma held a MAD (Maritime Archaeology Day) about the wreck at the university. This was BU's most successful exhibition of that year which helped raise the profile of the site both locally and nationally, with attendees coming from across the UK.

Concerned that the Swash Channel Wreck could become the *Stirling Castle* of the 21st-century, English Heritage asked BU to put forward a Project Design for what they thought was the best approach for the future of the site. BU proposed a rescue excavation be undertaken that would involve excavation of the entire site; recording of the surviving ship structure; and recovery of the parts of structure at greatest risk, namely the rudder, upperworks and bow, with the remainder being reburied.

Some saw this as a challenge to the broad presumption of preservation *in situ* that prevailed in UK maritime

heritage policy at the time. There was concern that diverting from that approach would lead to others arguing for similar rescue or research strategies to be approved. However, it was clear that concerns about potentially awkward precedents being set had to be weighed against the loss of the site and the benefits that a properly funded and successful excavation would bring (Wessex Archaeology 2009).

The work required the agreement and funding of English Heritage and needed support from its various specialists to the methods outlined in the Project Design. Internally at English Heritage, Alison James spent a great amount of time working with colleagues and ultimately agreement was reached on a Project Design for the rescue excavation. The entry of the site on the Heritage at Risk Register was a catalyst in helping to build support for the excavation within English Heritage.

The proposed budget for the work was a considerable proportion of English Heritage's maritime budget at the time so a partnership approach was adopted, with funding from English Heritage, PHC and BU as well as support in kind from many other organisations, notably Jenkins Marine, Dorset Workboats, Wessex Archaeology, the Maritime Archaeology Sea Trust and, importantly, Poole Museum who had agreed to be the receiving museum for the finds and archive that would result from the project.

Excavations 2010–13

The excavation of the wreck started in the summer of 2010 with the goal of excavating the wreck from the bow (Area One), nearest to the edge of the Swash Channel itself and most at risk from erosion, back to the stern (Area Three) of the wreck. The section of articulated upper works detached from the main wreck (Area Two) was to be dismantled and recovered to be recorded in greater detail on the surface.

To assist with all the phases of underwater work a large underwater scaffold frame was erected. The frame consisted of 6m 6m sections that could be raised or lowered on 1.5m high legs in order that they could be kept 'hovering' above the hull structure in a horizontal position. The legs of the frame were placed on small sandbags or 'pads' to minimise the impact on the wreck. These pads were pegged to the seabed to ensure that they would not move, and the position of the frame was trilaterated into the site grid. There were, in total, four 6m 6m sections that could be added to each other, covering a total of 144m² of the seabed.

Two such 6m 6m frames were connected to each other and placed at the extent of Area One. When those sections had been excavated, photographed, and catalogued, the next two scaffold sections were added astern of, but connected to, the original ones. The original sections could now be dismantled and added adjacent to the sections still standing. The position of the frame was kept stable physically by the pads which were left in their original places and marked with an upstanding peg; these remained visible when the pads were covered by sediments.

Knowing the exact position of the frame meant that it could be used not only for underwater navigation in poor visibility and for stabilising divers during work, but also for measuring smaller features into the site plan and providing a geo-referenced photo frame for creating the site photomosaic.

The excavation was mainly done by water dredge and airlift and careful hand fanning to avoid archaeological material being picked up by the suction.

Two teams could excavate at any one time by connecting either a short (5m) or long (15m) hose to the dredge. In selected sections when the conditions permitted it an airlift was also used (Figure 2.5).

During work, ropes were strung out across the 6m 6m sections and moved in such a way that they would delineate a 1m 1m excavation area (Figures 2.6). Each such square would be assigned its own underwater finds box and any artefact excavated from the square

Figure 2.5. Diver excavating with dredge

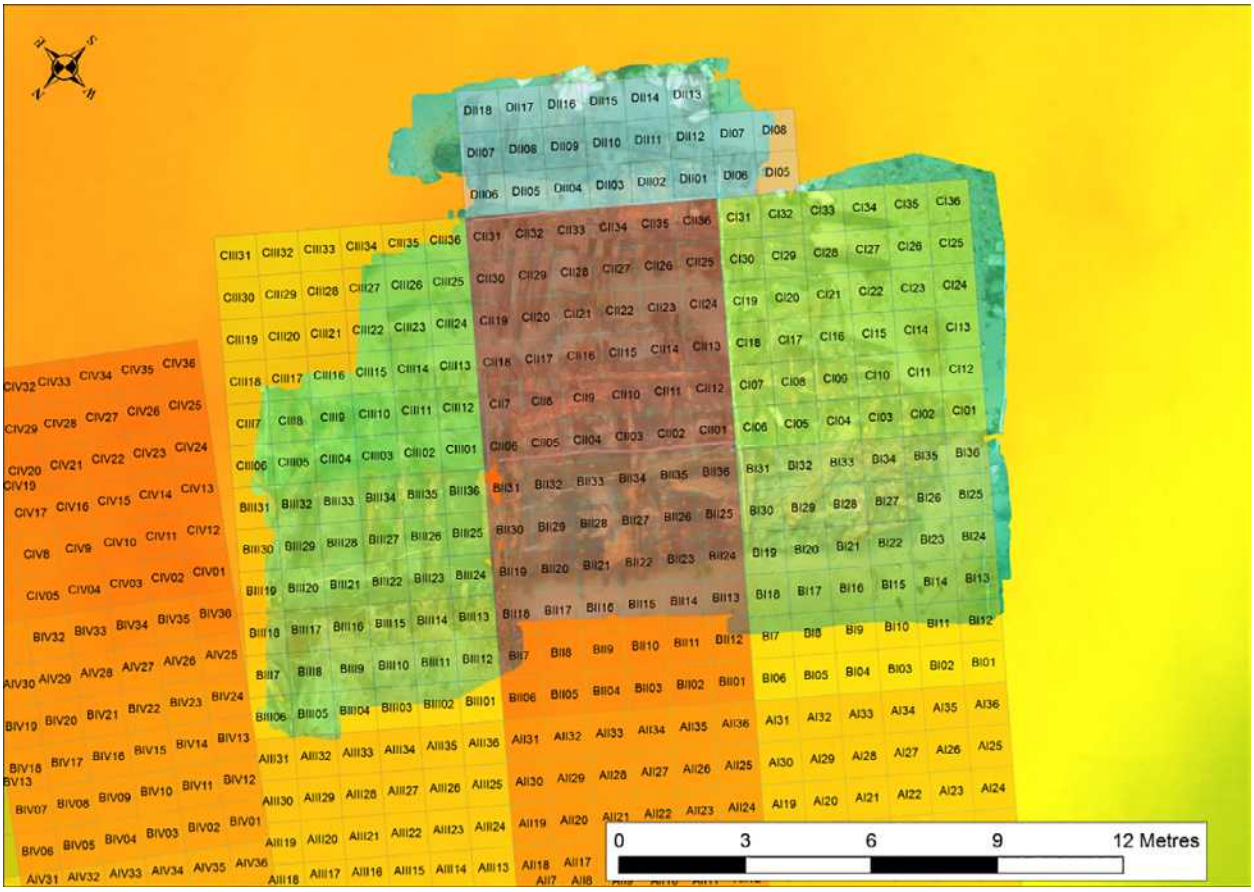


Figure 2.6. Grid system over Area One and Two of the wreck

would be placed in the box. The boxes would routinely be moved to a large holding crate on the seabed where a constant stock of empty boxes was also held. Outsized or fragile artefacts like rope or pulley blocks would be registered separately and raised in a suitable container. At the end of the working day, or as often as it was needed, a holding crate was winched up to the support vessel for processing by the surface team.

Once the crate was on the surface the finds were given an individual number and basic information and a description were entered into a bespoke database with the grid number providing a location for the finds. These finds were stored in large saltwater tanks on the dock before, depending on the material, being transferred to a large freshwater tank in a passive storage facility. Small or delicate finds were placed into suitable containers and kept cool and dark in refrigerators.

Photography

After a section had been excavated, it would be cleaned thoroughly for photography. For this purpose, a sliding photo arm was attached to the scaffold frame. Gridded photographic scales were placed as a ground control every metre with photographs taken every half metre along the photo arm. To ensure the photographs were taken vertically, a spirit level was attached to the camera housing, which in turn was connected to a ball and socket camera mount specifically designed to fit the scaffold frame (Figure 2.7). The site photography was done with a Canon IXUS 75 with an INON UWL105 underwater lens.

Assembling the mosaic

The original photomosaic was assembled by Kitty Foster of Wessex Archaeology using Corel Photo-paint. This was achieved by setting up a grid to match the photo markers and bringing in the photographs one at a time. Only the centre of each photograph was used to minimise warping, the photo interval having been set with sufficient overlap to do this. A feathered mask was placed around each image to avoid too many visible joins. These were then merged and colour balanced to create the final mosaic.

After trialling different methods in 2008 and 2009, photomosaic-based recording was chosen as the fastest, most cost-effective and most accurate method of recording a wreck of this scale (Cousins 2008).

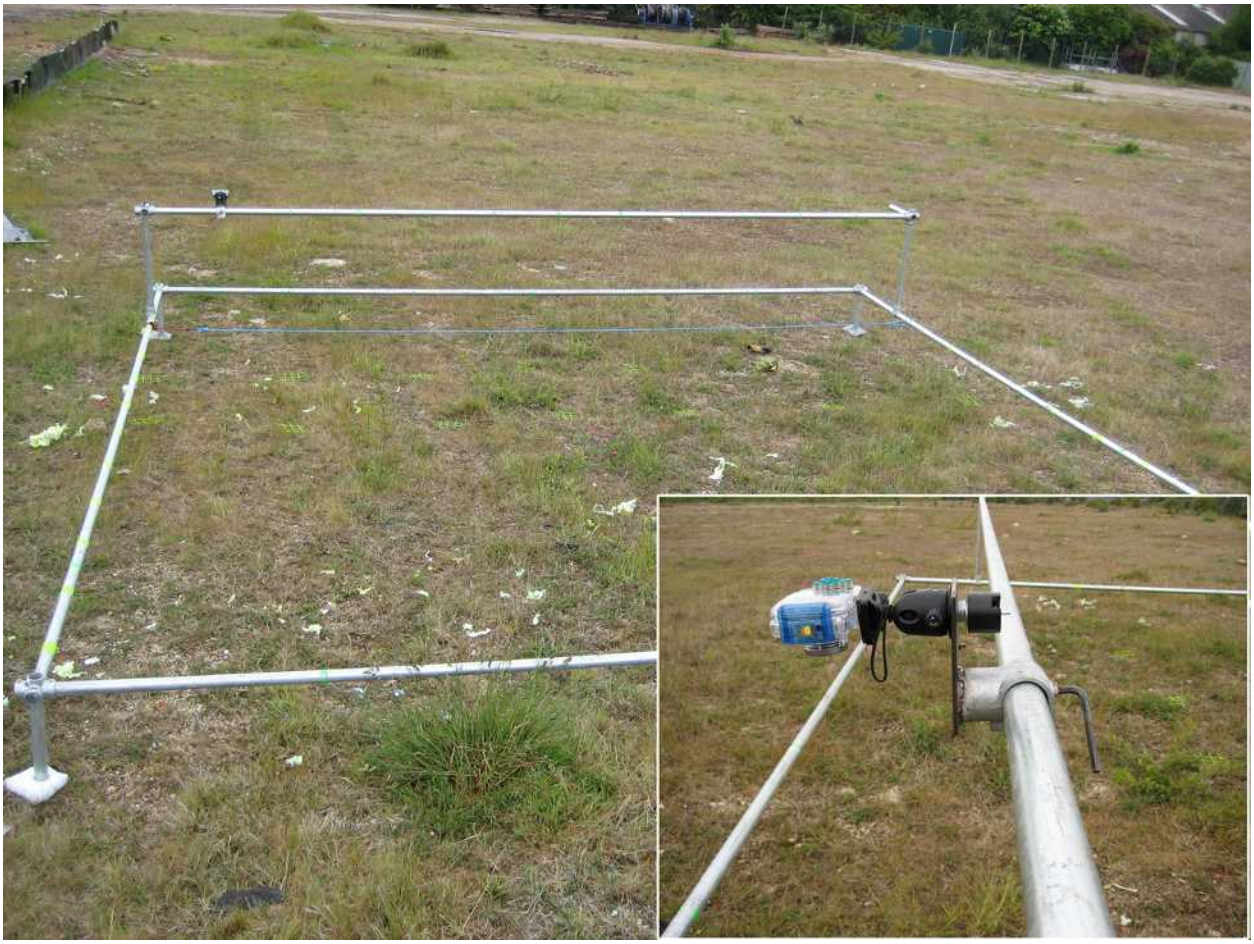


Figure 2.7. The scaffold frame on land with close-up of the camera mount

During the post-excavation phase, these images were reprocessed with Agisoft Metashape, a photogrammetry software package. This programme works by breaking down the images into points which are then aligned with each other to create a 3D model; the spaces between the matched points are filled to create a dense cloud which is then used to create a mesh and generate an orthomosaic (Historic England 2017). This compensates for the differing angles, heights, and len's distortion that the original two-dimensional photomosaic could not do. As the photos were not taken for this purpose there was a lack of surveyed-in photo markers that would be standard in a survey today; however, the various ground-control markers used to align the photomosaic provided sufficient data to scale the final model accurately.

Due to the limited time and budget, only the first 16m of Area One were excavated before the focus was switched to the stern (Area Three). Area Three was not fully excavated but the majority of the over-burden was cleaned from the timbers to allow the structure to be recorded. The gap between the two excavated areas was designated Area Four.

Disassembling of the timbers underwater
James Spencer and Kevin Stratford

Once Area Two was cleaned and recorded using the frames, work began to dismantle the structure to allow it to be raised and recorded in detail on the surface.

Area Two was known to have at least one carving present, with the potential for further carvings located around the circular gunports. The presence of these carvings, combined with the rarity of surviving upperworks of a vessel and the rapid loss of material since its discovery, provided justification for the raising and continued preservation of this part of the remains.

In order to disassemble the main structure of Area Two it was decided to adopt a new technique combining approaches used previously on other archaeological sites in both the terrestrial and maritime spheres, most notably on the Red Bay wrecks (Waddell 1986) and the Newport Ship (N Nayling, pers comm 2010).

The initial task was the removal of the brick and tile galley structure. This was achieved by chiselling through

a midpoint of the grouting for the brick section and using wedges to break off the iron bars connecting the whole structure to the ceiling planks. This technique allowed a considerable area of the galley section to be raised in two large parts, which considerably eased the task of recording and reassembly on the surface.

Each timber was then tagged with a find number and their relationship to each other rapidly recorded in a sketch plan (Figure 2.8). Only basic details of the timbers and features such as modern cuts or damage caused in the excavation were recorded at this stage as it was planned to record them in high detail on the surface.

To dismantle the structure, plastic chainsaw wedges were hammered between the ceiling planking and the frames below on either side of the treenails in order to create enough space to fit a hand saw between the timbers and cut the treenail. This technique was repeated along the length of the timbers, resulting in the rapid disarticulation of the structure with minimal damage to the archaeology. At various points along the length of the timbers iron fastenings had been used to provide greater strength and stability. These metal fastenings proved a greater challenge to detach than the treenails and were cut using a combination of sawing and chiselling, after the wedges had been put in place to lift the timber (Figure 2.9). Following the removal of the ceiling planks the process was repeated to remove the frames from the outer hull planking.

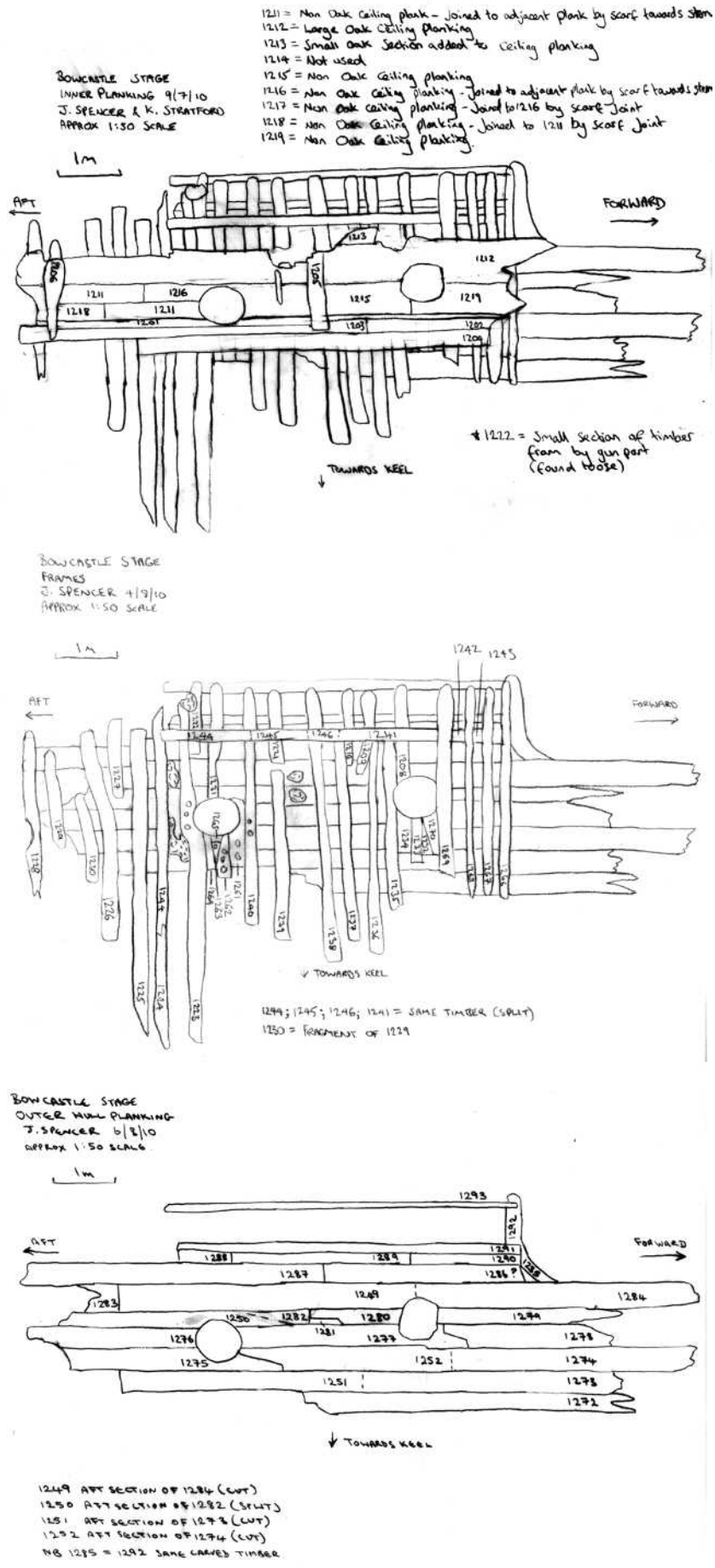


Figure 2.8. Sketch plan of the three stages of construction in Area Two

Figure 2.9. Dismantling the timbers underwater

The outer hull planking was much simpler to remove as the pieces were no longer attached to any structural features. The outer hull timbers included normal carvel planking, carvings, and wale timbers, with the uppermost section of the structure made up from overlapping weatherboarding as seen for the upperworks at the stern on the *Vasa* and other Dutch ships of the period. Four strakes remained, creating two layers of weatherboarding, but there was space between these strakes and the top rail for a further three layers, which were not present.

The level of preservation of this layer meant that some of the timbers were too large to be handled safely either underwater or on the surface at their full surviving length. It was therefore decided to cut any timbers that were more than 6m in length. This was chosen as the maximum dimension since the chamber of the freezer dryer in which their conservation was planned, the longest in the UK at this date, was 6m in length. Selected timbers were cut with a hand saw at a point close to the middle of the length of the timber. Once cut, an extra tag was added to the timbers and recorded on the sketch of that layer.

Following the disassembly of the structure, the timbers were stored under sandbags on the seabed before being placed onto large steel lifting frames and raised.

2011–13 seasons

A combination of photomosaic recording and disassembly of the timbers underwater was undertaken in the 2011 season. It was decided to raise the forward-most 6m of the bow (Area One), which was being undercut by the scouring action from the channel. The 6m 6m scaffold frame was set up over the bow to create a semi-permanent grid to guide the excavations and photography.

The first step was then to cut a line in the wreck using a chainsaw to mark the delimitation of the area to be excavated and disassembled. Using the techniques perfected on Area Two, the timbers in the forward-most 6m of the hull structure in Area One were tagged and added to a sketch plan before being dismantled. It was also decided to create a photomosaic of each layer of the structure; as with the main site mosaic, these images were reprocessed in Agisoft PhotoScan to create

photogrammetric models of the bow, thus allowing the surviving curvature of the vessel to be recorded (Figure 2.10).

The presence of the cannon in the bow presented a problem due to the large amounts of concretion joining the cannon on the inside of the wreck to the chainplates on the seabed below. This build-up of concretion (*c* 10 tons) between the timbers and into the seabed had to be removed by hand using hand tools and pneumatic chipping hammers before the structure could be dismantled. .

The final phase of excavation was the removal of the rudder, which occurred in 2013. This was again complicated by concretion pinning it to underlying wreckage which had to be removed carefully by hand to avoid damaging the rudder and its carving. Transverse spreader beams were attached to the rudder every metre, which were in turn attached to a longitudinal beam by nylon slings. The rudder could then be lifted from the seabed using the onboard crane and transferred onto a bespoke lifting frame underwater without breaking the surface. Once the rudder was secured to this frame it could then be brought aboard the vessel.

As the rudder was 8.4m long and the largest available freeze dryer available to the project was 6m long a decision was made in conjunction with the conservation team prior to the recovery that the rudder would have to be cut. This was done immediately after recovery, with control points being added to the rudder and measured in using a reflectorless total station. A hand saw was used to minimise damage to the rudder and make the subsequent reattachment easier. The cut was made through the rudder post immediately above the blade. The recovery frame was designed so that it could be split in two, enabling the two sections to be transported separately.

In-situ protection

Based on earlier trials by BU (Palma 2009), CISMAS (Cammidge 2005) and others (European Union Culture 2000 Programme, 2005), it was decided that the most cost-effective and suitable method for *in-situ* protection was a combination of geotextile and sandbags to build up a layer of stable sediment and create an anaerobic environment.

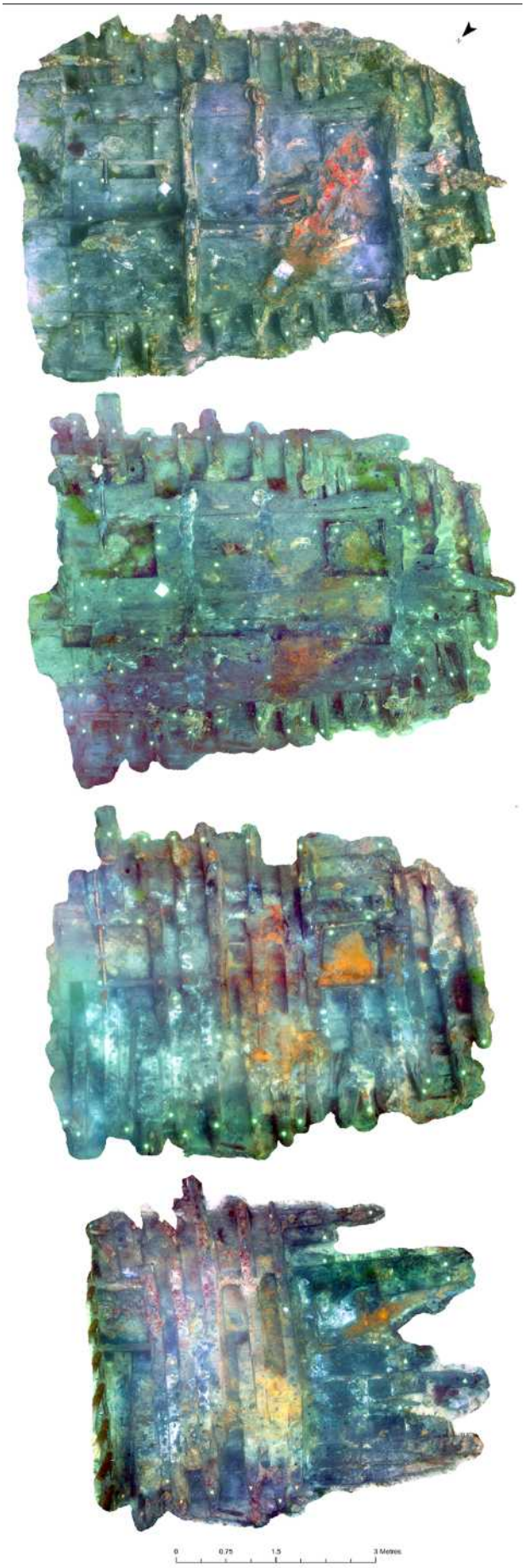


Figure 2.10. Orthophotos of each stage of dismantlement of the bow in Area One from the riders, to the ceiling, frames and part of the planking.

Over 55 tonnes of sandbags filled with 20mm gravel were deployed on the site between 2006 and 2014.

Sandbags were first used to level out the seabed where the structure was being undercut or exposed, such as the knees in the hold. Terram 5000 was then laid over the top and weighed down with sandbags. The entirety of Areas One and Three were reburied using this method. By 2012, the majority of the site was completely buried with only a few sandbags exposed; however, in 2014 extra sandbags were deployed when a small area of the wreck became exposed.

To monitor the site, 75kg concrete sinkers were placed at the bow and stern of the wreck from which a 40m baseline can be run allowing repeatable diver surveys to be conducted over the site and assess if there are any extra areas of the wreck that are exposed or require intervention. In addition, high-resolution multibeam bathymetry surveys are conducted bi-annually to see if there are any larger-scale changes in the surrounding seabed. So far these surveys indicate that the site is stable and remains relatively unchanged since the rudder was recovered in 2013.

Finds recording

All finds including timbers and larger features were assigned a unique number prefixed by the site code **SCW** with basic details recorded into a bespoke Access database. This logs basic descriptions, including materials and find types, and measurements relating to the finds. A sample record is shown in Figure 2.11 for the gun carriage cheek (**SCW52**). In addition to the basic records, various related forms exist within the same database to record find such as blocks or deadeyes in more detail.

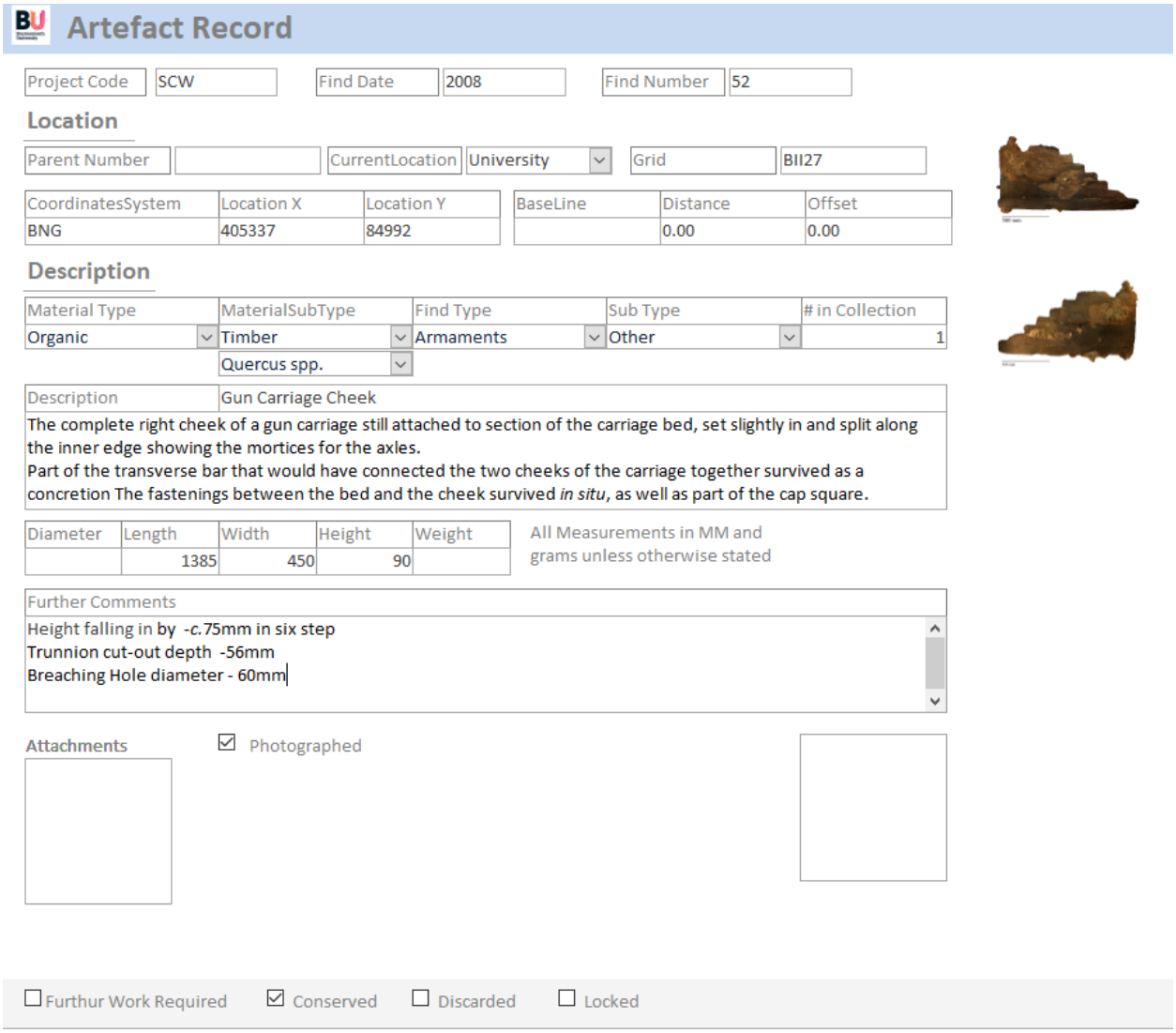


Figure 2.11. Example of the basic database entry

Timber recording

The recording process for the timbers recovered from the site was based on that used for the Newport Ship and was conducted in their facilities between 2013 and 2014. Newport conducted trials to establish the best method for recording and found that 'contact digitising was faster in terms of time and had a higher level of accuracy when compared to traditional tracings' (Jones 2015, 162). Using FaroArm contact digitisers and Rhinoceros3D software it is possible to trace around the timber and highlight features, giving invaluable information on the vessel's construction such as original edges fasteners and tool marks, thus creating a relatively accurate wireframe model of the timber. For more complex or delicate items, such as rigging blocks, a laser scanner was fitted to the FaroArm.

The recording templates were adapted from the Newport Ship templates to better suit the needs of the Swash Channel Wreck timbers where, due to differing construction techniques (carvel rather than clinker), biological action and concretions, different details needed to be recorded. These templates contained multiple layers for each face such as edges, tool marks, treenails and other fasteners, allowing the user to record each layer in sequence (Figure 2.12) (Jones 2015, 142).

The general measurements (length, width, depth and erosion markers) were recorded for all the timbers, with more specific measurements taken for features such as tool marks, joints and fasteners where present.

A digital archive containing the 3D digital files for individual timbers will be made available with the Archaeological Data Service.

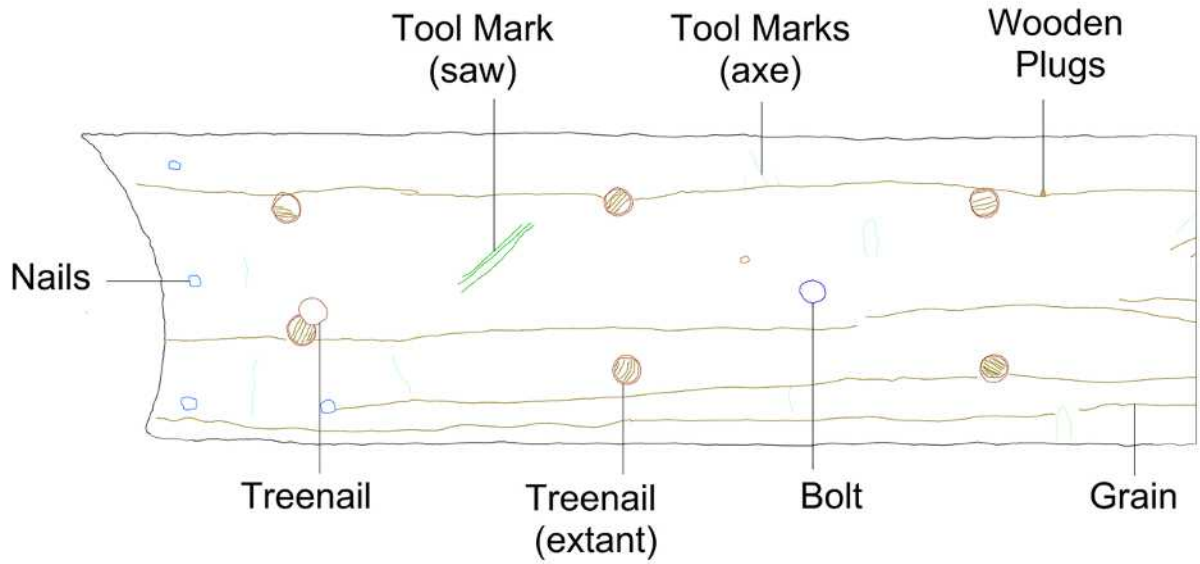


Figure 2.12. Annotated inboard face of a typical ceiling plank

Chapter 3

Excavation results and dendrochronological analysis

Excavation results

Area One

The wreck lay in three main pieces, Area One being the bow of the vessel surviving from the turn of the bilge up to the main deck. The hold of the vessel would have had head room of over 3m and within the hold was a series of large hanging knees and recesses for deck beams supporting the lower deck with its row of square gunports. A series of cuts in the ceiling planking above these mark the line of deck beams supporting the main deck. Circular recesses in the articulated bow structure could clearly be seen during the pre-disturbance work on the site, most notably the images taken by Wessex Archaeology during the initial investigations in 2004 (Figure 3.1), but by 2010 these were severely damaged by biological action and therefore do not show up clearly in the excavation records. This suggests that the hull remains in 2004 were still articulated up to the spirketting of the forecastle.

Area Two

Area Two lay a few metres south-east of Area One and consisted of a section of articulated remains of the upper structure, with frames surviving from the lower deck up to the top timbers. This area contained the galley and several decorative carvings. Recesses for deck beams below the covering board suggests that a weather deck would have been above this. Due to its geographical position on the wreck site this was originally interpreted as the forecastle and was referred to as such in the early literature on the wreck. However, during post-excavation work this interpretation was put into doubt as there would be a significant overlap in frames between Areas One and Two; further analysis showed this section of the ship to have detached from midships, above the unexcavated section (Area Four).

Area Three

Area Three is the stern of the wreck, surviving from the top of the hold to the top timbers and from the stern timber forward. Only a small section of the hold survives below the lower deck. The lower deck continues in a similar fashion to that of Area One with square gu ports and various deck beams and riders supporting the enclosed main deck above. The lower deck in this area also features the transom knees.

The main deck features circular gunports cut into pine (*Pinus sylvestris* L.), quickwork like Area Two, and deck beams and small knees supporting the waterway of the quarter deck above where two smaller guns were found. A gap in the waterway illustrates where the steering stand would be. The position of a covering board with timbers extending beyond these hints at a higher poop deck.

Area Four

Area Four remained unexcavated due to funding and time constraints. The articulated hull structure from Area One extended back at least another 6m, with part of the main deck waterway and the top of the knees visible. This area also held numerous large, disarticulated timbers, staved containers and ballast mounds, with the rudder laying over these on the surface.

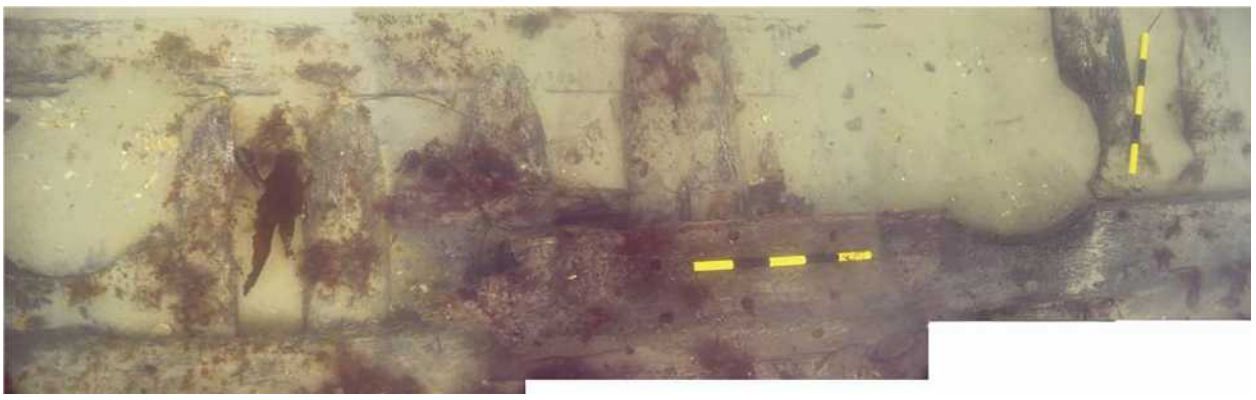


Figure 3.1. Circular gunports on the main deck still articulated to the bow structure as recorded by Wessex Archaeology in 2004

Dendrochronological analysis
Nigel Nayling, University of Wales Trinity Saint David

Tree-ring dating and provenancing of timbers from the ship's hull were undertaken on a number of occasions during the investigation of the wreck. Samples were taken from *in-situ* timbers shortly after the wreck's designation (2005) and four years later (2009) during a programme of more extensive fieldwork on the site. Finally, samples were taken from selected timbers undergoing post-excavation documentation. The results of analysis of a total of 25 timber samples are reported in Nayling (2010).

Samples were assessed on their suitability for tree-ring dating based on English Heritage criteria (English Heritage 1998). These criteria include identification of suitable wood species, followed by an estimation of the number of annual rings present in appropriate samples and the presence of sapwood or bark edge. An assessment of potential for analysis report was completed as part of the updated Post-excavation Project Design.

One of the two samples taken in 2005, **SWASH2014**, was correlated with oak ring-width chronologies from Germany and the Netherlands. These correlations indicated a date for this tree-ring sequence of AD 1435–1575 inclusive. Given the absence of any sapwood on the dated sample, a felling date range for the timber could not be given, but it can be said that the parent tree must have been felled after AD 1575.

A total of thirteen samples were taken in 2009, of which seven had sufficient rings to merit measurement. The relatively high number of samples with an insufficient number of rings reflects the difficulty in assessing ring counts on *in-situ* timbers which have been subjected to degradation by gribble and erosion by physical forces. The tree-ring series from two samples taken from the same framing timber (**SCW100** and **SCW101**) were correlated with each other and a combined raw ring-width series calculated (**SCW100_1**). Two series (**SCW100_1** and **SCW105**) cross-matched against each other with a borderline significant correlation of t=3.5 and the latter of these also correlated with the previously analysed sample **SWASH2014**. These two ring-width series correlated with chronologies from the Netherlands and Germany and also ring-width series from samples on the Norman's Bay Wreck (Nayling 2008) and a floor timber (**SCW1316**) found washed-up on the shore in Studland Bay (Nayling 2009). Both of the dated timbers had complete surviving sapwood and bark edge. One sample (**SCW101**) had bark edge, with the last ring comprising only earlywood vessels implying felling in the spring or early summer of AD 1628. The season of felling of the second sample with bark edge (**SCW105**) could not be determined but the year of felling is the same at AD 1628.

All ten samples taken during post-excavation documentation were measured. The tree-ring series from individual samples were compared with each other and with tree-ring chronologies from Britain and Northern Europe. Significant correlations were found between these ring-width series and a range of European chronologies. Tree-ring series **SCW1327_34**, **SCW1329** and **SCW1331** all dated against northern German and Netherlands chronologies. Sample **SCW1319** (from wale **SCW1274**) correlated highly against Baltic chronologies. One of these dated samples (**SCW1329**) had partial sapwood requiring application of a sapwood estimate to determine the felling date range of the parent tree. Using the sapwood estimate employed by Wrobel and Eckstein for timber from northern Germany of 10–30 sapwood

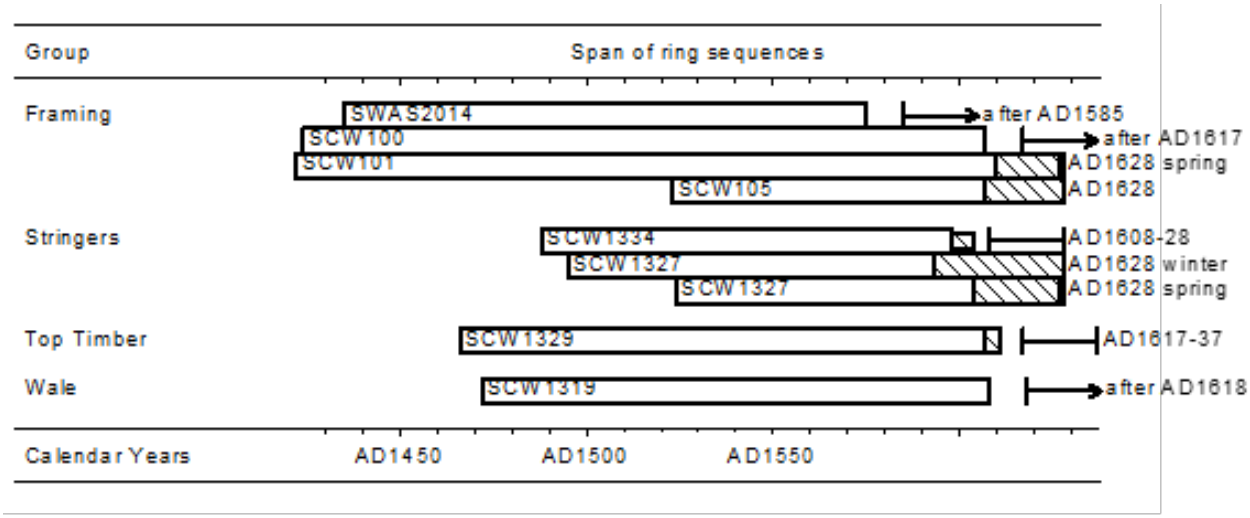


Figure 3.2. Bar diagram of dated timbers from the Swash Channel Wreck.

rings (Haneca *et al* 2009, table 1), this indicates a felling date range for the parent tree of top timber **SCW1227** (sample **SCW1329**) between AD 1617 and AD 1637. Dating of samples with surviving bark edge provides more precise dating for felling of the parent tree of top timber **SCW1208** (sample **SCW1331**) to the spring of AD 1628, and the parent tree deck clamp **SCW2063** (samples **SCW1327 & 1334**) were derived of winter AD 1628. The latter felling date implies that the tree was felled after the end of the growth season (around September AD 1628) but before wood formation began again in the spring of AD 1629. This indicates (if these stringers are seen as part of the ship's primary construction), that completion of the ship could not have taken place before late AD 1628. Some samples correlated with ring-width series in samples from the Norman's Bay Wreck (Nayling 2008) and imported timber such as the floorboards in Dinefwr House, Llandeilo which have a German origin.

Discussion

Dendrochronological studies of structural timbers from the Swash Channel Wreck clearly indicate that the ship was constructed soon after late AD 1628 (Figure 3.2). The majority of the structural timber appears to have been derived from Northern German sources. One wale was converted from Baltic timber, probably sourced from the Gdansk hinterland. The implied sources of timber used for the ship's construction are consistent with the historically attested behaviours of major entrepôts such as Amsterdam which imported non-domestic timber for both its own shipbuilding industries and for export to more western and southern shipbuilding centres.

Chapter 4

The hull remains: description, reconstruction and analysis

The principal record of the hull remains comes from the site photogrammetry and as a result it records mainly the inner structure of the ship, with the exception of the first 6m of the bow which were dismantled and recorded in 2011. In addition to the data captured during the excavation, a total of 135 timbers have been analysed from the wireframe records providing a high level of detail. These include elements relating to the bow, halfdeck, and rudder. While all substantial timbers have been digitally modelled, of these 98 have been measured and fastener numbers assigned. The majority of these came from Area Two (Figure 4.1)

The principal guide to Dutch ship construction in the 17th century is Nicholas Witsen's *Aeloude en Hedendaegse Scheeps-bouw en Bestier* published in 1671. In this work Witsen explains the unique Dutch bottom-based, shell-first shipbuilding method. This work has been translated into English and updated with drawings by Hoving (2012).

Description

There was no evidence for any survival of ship remains, such as the keel, below the turn of the bilge. As the wreck is laying hull side out, most of the structure revealed during the excavation is internal, except for the timbers recovered from Area Two and what can be gathered from the deconstruction of the first 6m of Area One.

Analysis of the recovered and recorded remains has allowed a schematic cross-section of the ship's port side to be developed from the footwale, a thicker ceiling plank marking the turn of the bilge, to the top of the rails (Figure 4.2). The following sections will address the construction and remains of the vessel from the inside to the out.

Knees, riders and deck beams

Four hanging knees supporting the lower deck were noted in the hold around midships, all measuring *c* 2.0m long by 0.3m wide and spaced approximately 1m apart (Figure 4.3). These all featured triangular tenons on the upper edge, presumably to lock into the deck planking or waterways. Due to the site condition the exposed horizontal arms were heavily eroded making it impossible to gauge the original length of the knees.

Above these knees were the remains of the waterway marking the line of the lower deck. One knee (**SCW1310** Figure 4.4) that was recovered tangled around a channel marker buoy in 2011 matched the approximate size

Figure 4.1. Overview of the structural timbers observed or recorded over the site

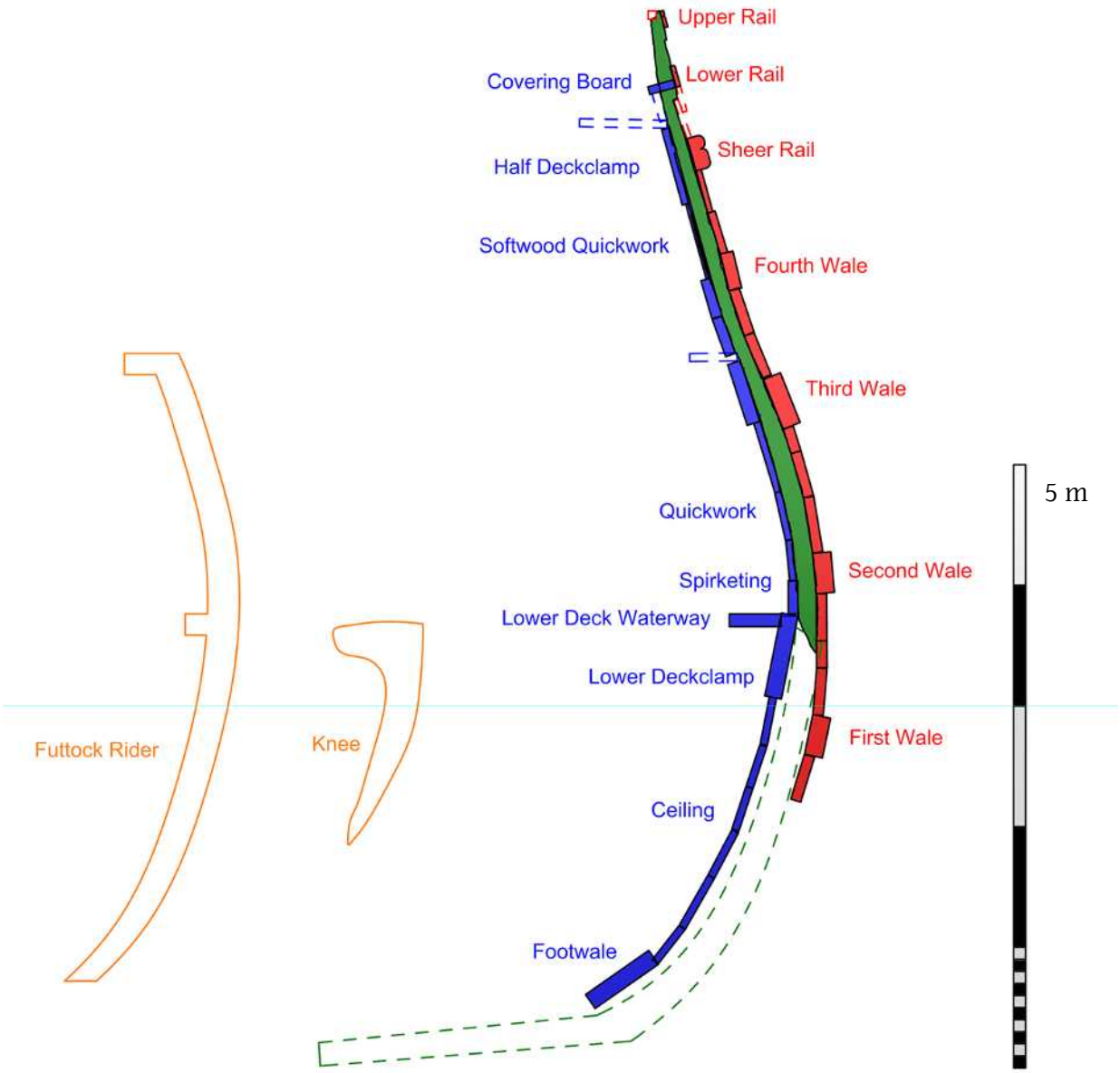


Figure 4.2. Cross-section of the surviving remains at the port midships, based on the recovered timbers and photogrammetry

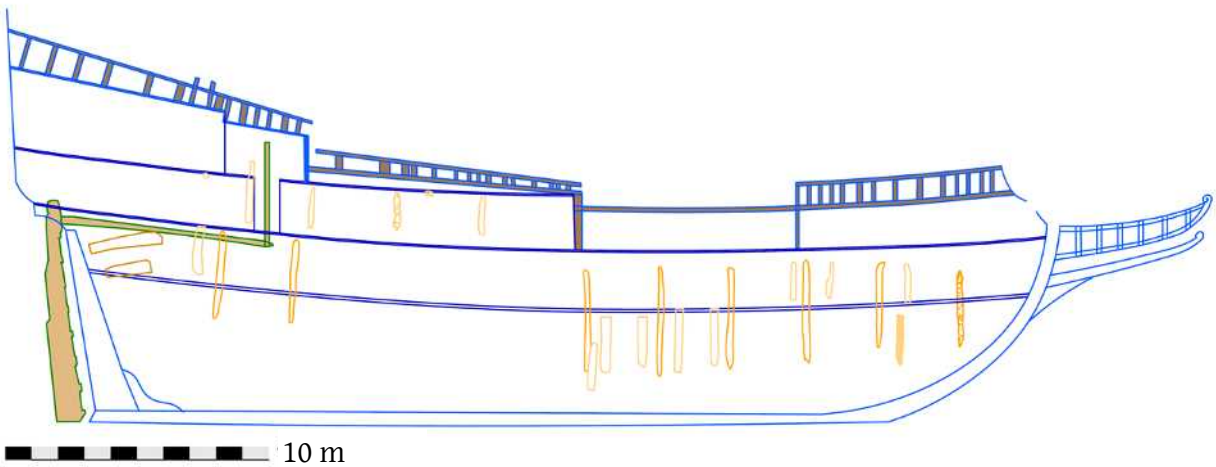


Figure 4.3. Schematic layout of the Swash Channel Wreck showing the knees and riders visible during excavation

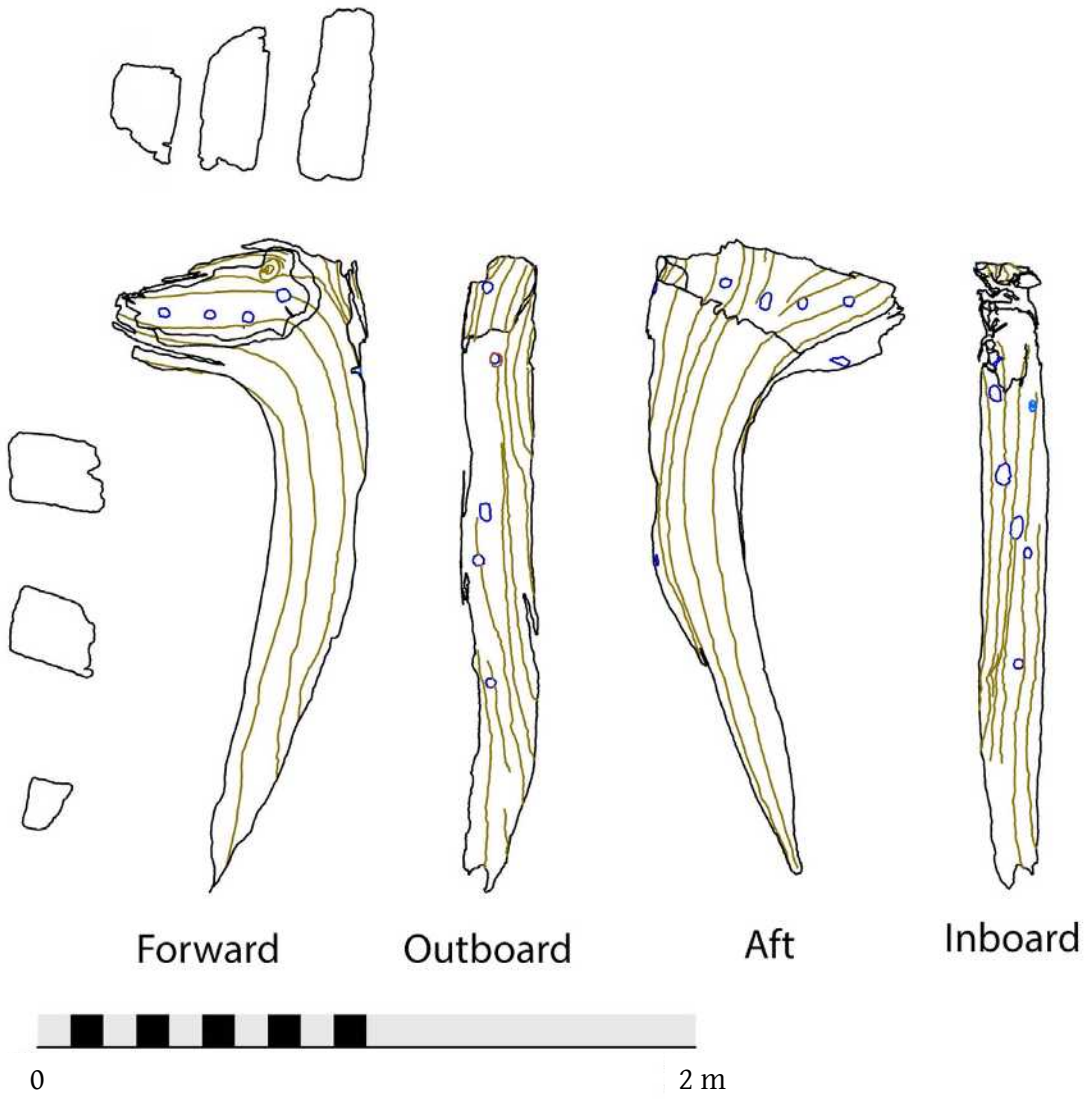


Figure 4.4. SCW1310 disarticulated knee

of the knees still articulated to the hull. It is thought that this knee was the same one that was observed in a disarticulated state near the bow during the 2008 field season but was not seen in subsequent years.

The knee was heavily eroded but with some original surface preserved underneath concretion. The vertical arm of this knee would have been fixed to the side of the vessel using *c* 30mm diameter iron bolts. Four bolt holes of a similar size ran longitudinally along the horizontal arm, with a small lip surviving on the lower edge where the deck beam would have sat and been bolted onto the knee. The curvature of this knee matches closely with the other hanging knees in Area One. It is thought that this knee was originally located beneath the forward-most gunport where the 12pdr cannon (**SCW25**) had fallen through the deck into the hold.

Witsen (Hoving 2012, 83) places these hanging knees alongside every deck beam, with the vertical arm reaching the turn in the bilge. While this is certainly the case towards the aft of Area One, there was no evidence of knees alongside the deck-beam recesses in the first 12m of the wreck; instead the futtock riders were used to brace the beams, although it cannot be ruled out that knees have been lost during the wrecking process.

Smaller knees were present on the lower deck and in the upper works, again lining up with the deck-beam recesses. **SCW1206** is a small knee or rider recovered from Area Two (Figure 4.5) and consists of a vertical piece of timber with an I-shaped tenon on its lower edge scarfing it onto the thicker oak ceiling beneath; the timber is then shaped to fit into the thicker ceiling planks above with a cut at the top for the deck beam.

In the rearmost section of the main deck in Area Three, there are smaller knees present next to a deck-beam recess. The recess was only 0.16m by 0.16m and appears

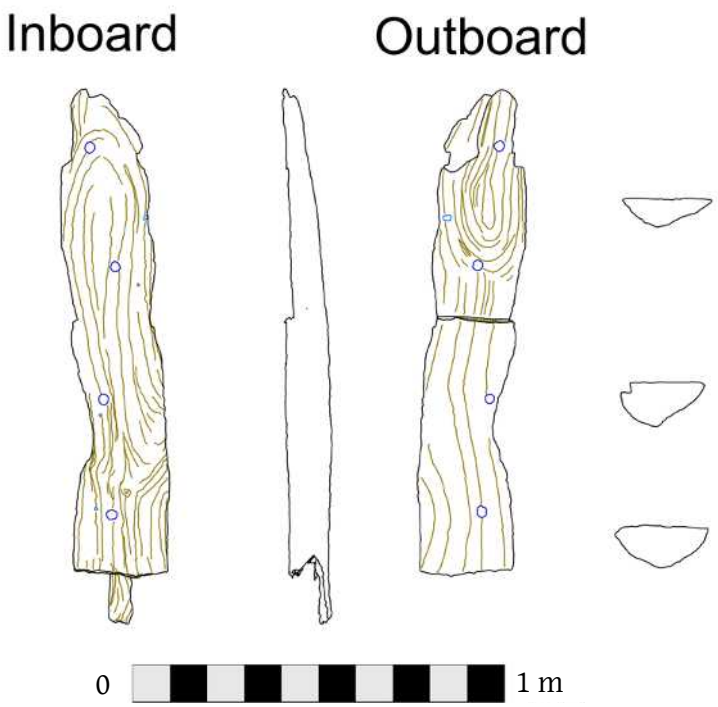


Figure 4.5. SCW1206 knee from the upperworks

to be connected to the framing behind it by an iron bolt (Figure 4.6).

Several riders were also noted on the site running from the turn of the bilge passing through the lower deck up to just below the main deck. Witsen describes these as futtock riders which were used to strengthen ships designed to carry guns or that have been found weak (Hoving 2012, 83) (Figure 4.7). Deck-beam recesses were seen in the ceiling on both the lower and main decks adjacent to these riders, suggesting that they had a secondary purpose as a knee supporting the deck beams. The upper remains of one bilge rider was articulated on the site, running between the last hanging knee and futtock rider; this arrangement was described by Witsen as a *kattespoor* (ibid). This would have formed a bracing around the main mast step, marking the aft end of Area One as the midships of the vessel.

The only recovered futtock rider **SCW2077** (Figure 4.8) ran just forward of the first

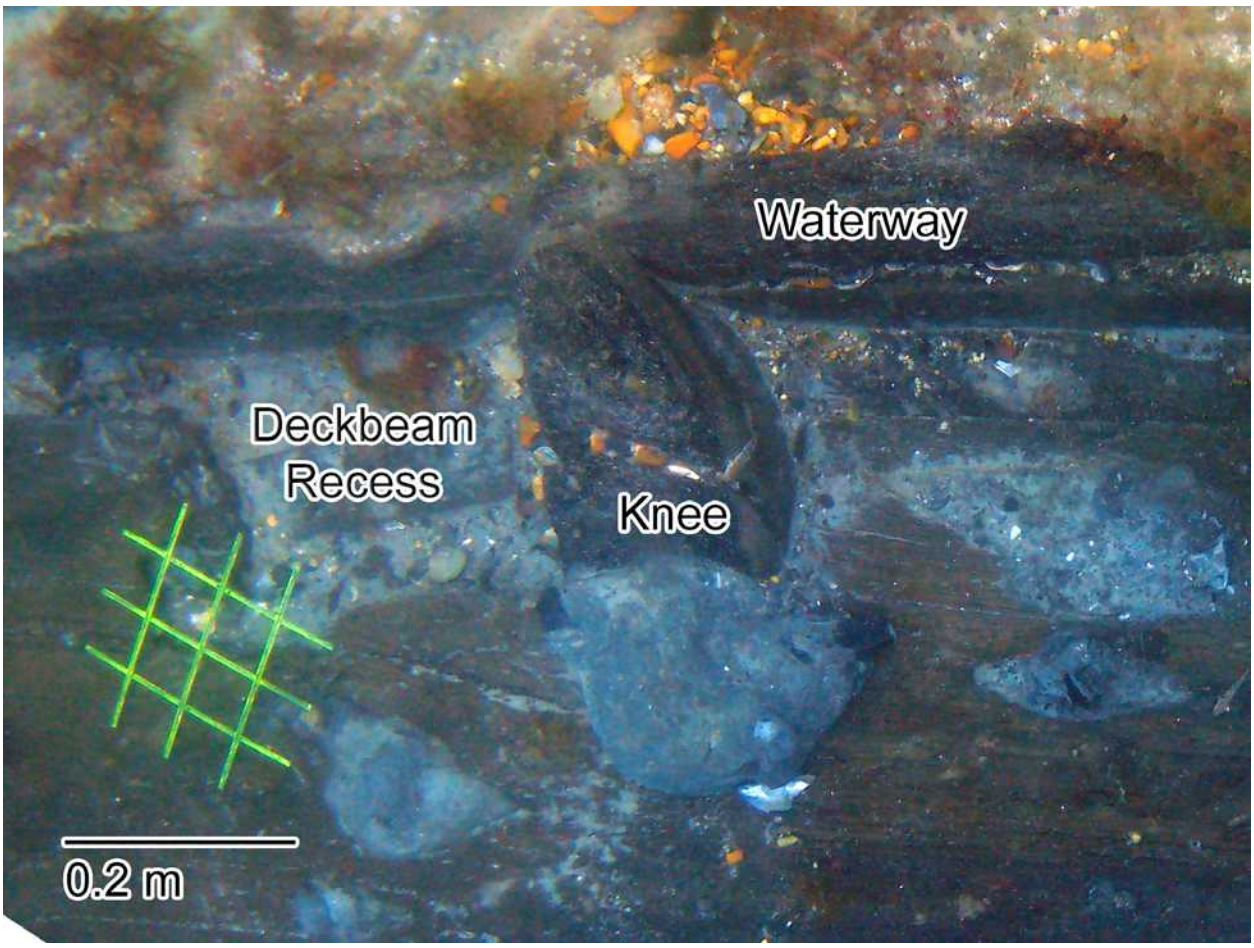


Figure 4.6. Small knee in the stern supporting the quarterdeck

Figure 4.7. Futtock riders and knees in the main hull, inset a futtock rider after Witsen (Hoving, 2012) (not to scale)

gunport in Area One; although much of the original surface and length has been lost, the shape and step to accommodate the main deck clamp above the gunport can be seen in its conversion. The grain follows the curvature of the timber, suggesting it is a grown timber.

The rider was fixed to the hull with *c* 30mm diameter iron bolts along its length and in addition, two oblique bolts ran from the forward face to the outboard face of the timber. These bolts would have been level with the lower half of the gunport, suggesting that they may be something to do with the gun station.

Where the deck beam would have connected to the rider two bolt holes can be seen adjacent to each other but the lower hole only partially goes through the timber, suggesting that the timbers would have been pre-augered or they augered from the beam towards the rider. Either way, the first attempt failed and a second attempt was made. Two *c* 10mm nail holes can be seen above this, most likely where the waterway attached. Due to the condition of the timber it could not be seen if the nails continued to the aft face. A set of bolts can be seen passing at oblique angles through the aft face to the outboard face level with the gunport.

Notches for the deck beams were observed across the site cut into the various deck clamps. Most of these ran alongside the knees or riders as described above. There did appear to be the odd unsupported deck-beam notch suggesting that either a knee or a rider has broken off or they were simply unsupported. These notches are not uniform in shape, indicating the beams were largely unconverted and the notches cut for each one individually. One notch in the upper works still has the remains of its beam *in situ*; this consisted of two separate timbers suggesting either a later repair or making use of available timber (Figure 4.9).

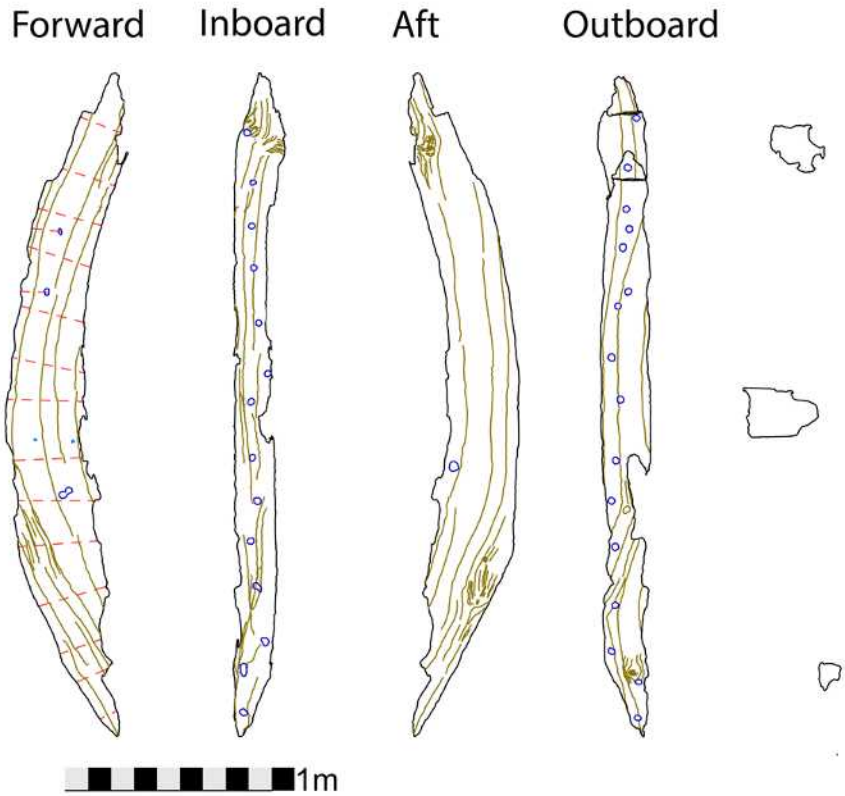


Figure 4.8. Futtock rider SCW2077

Ceiling

Almost all the ceiling planking recovered appeared to have been converted via saws and demonstrates a tangential conversion (Figure 4.10) .

A small section of the footwale survives at midships marking the thicker stringer at the turn of the bilge. Above this there

Figure 4.9. *In-situ* deck beam in the upper works with no supporting knee

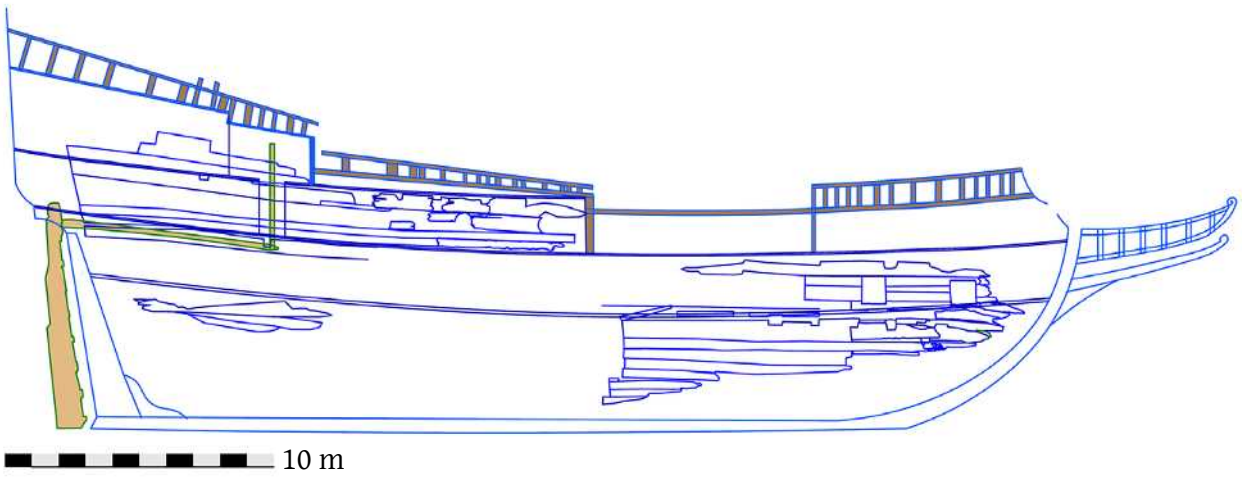


Figure 4.10. Schematic diagram of the ceiling recorded on the site

is *c* 2.2m of common ceiling consisting of 60mm thick oak planks attached to the framing by treenails and iron nails, of which only two small fragments were recovered (**SCW2088** and **SCW2090**). The strakes are of varying and uneven widths and joins are visible at three places on the orthomosaics. Two of these are simple butt joints where the timbers have been laid end to end and nailed onto a frame with no attempt at sealing the gaps between them. The third join is more complicated, with the two timbers in the strake slightly staggered and scarfed together with a variation of a flat scarf. The ceiling plank running above this joint appeared to step over the foremost scarf timber (Figure 4.11). This is the strake that the lower end of the hanging knees is bolted

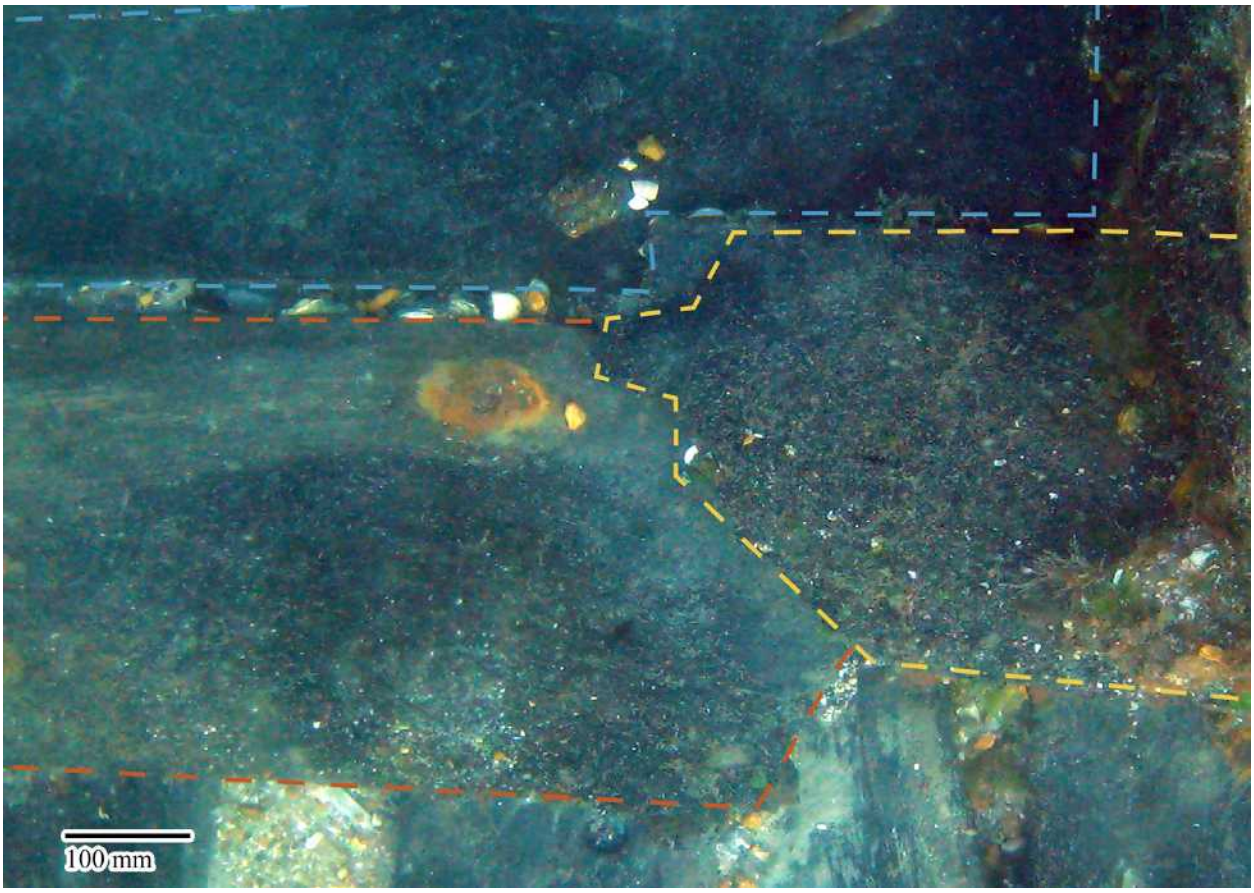


Figure 4.11. Scarf joint on the lower ceiling of the hull

to and the start of the turn of the bilge, so it is likely that this would need to be reinforced and acted as a stringer, hence the more complex joints. It is likely that the lower deck clamp and footwale would have been in place before the ordinary ceiling of the hull.

Above this lay the lower deck clamp, a thicker run of ceiling planks which features the notches for the beams of the lower deck. At *c* 140mm, these timbers were over twice as thick as the normal ceiling. One partial plank **SCW2063** was recovered from this stringer in two fragments (Figure 4.12). The timber features two notches for deck beams; the aft-most cut is interrupted by a modern cut which took place during excavation but would have originally been 450mm long with the plank coming up to half its height at 130mm. The second recess measures 400mm by 200mm. It would have affixed to the framing with two rows of treenails along the main timber and additional treenails in line with the deck beam notches; extra treenails had been placed near to the split between the two timbers suggesting that the shipbuilders knew there was a fault in the wood. **SCW2063** also featured a row of iron fasteners running up along the edge of the second deck-beam recess. This suggests that a knee or a rider was originally in place here but the tearing of the timbers around this area points towards the knee being ripped out during the wrecking process, perhaps affected by the weak stringer. The stringer also featured a scarf joint on its forward end and a carpenter's mark in the form of a '4' (Figure 4.13). The entire lower deck clamp was made up from multiple timbers to maintain its thickness along the length of the vessel, with a graving piece running below **SCW2063** which tapered off aft.

The waterway, a gutter to send any water on the deck to the scuppers, was fixed to the upper edge of the deck clamp between the futtock riders and had been recessed to fit over the beams (Figure 4.14). This is different to Witsen who places his waterway in between the deck clamp and spirketting, another, thicker, ceiling plank being designed to keep the waterway in place and the beams recessed to hold it.

One section of the lower deck spirketting was recovered (**SCW2086** Figure 4.15). This timber had a thickness of *c* 80mm and featured a square rebate at the forward end which continued all the way through the hull, marking a potential scupper.

Above this is the quickwork ceiling, so called because it did not require caulking or precise joinery. This continues up to the main deck clamp (the stringer which supports the beams for the main deck), fitting

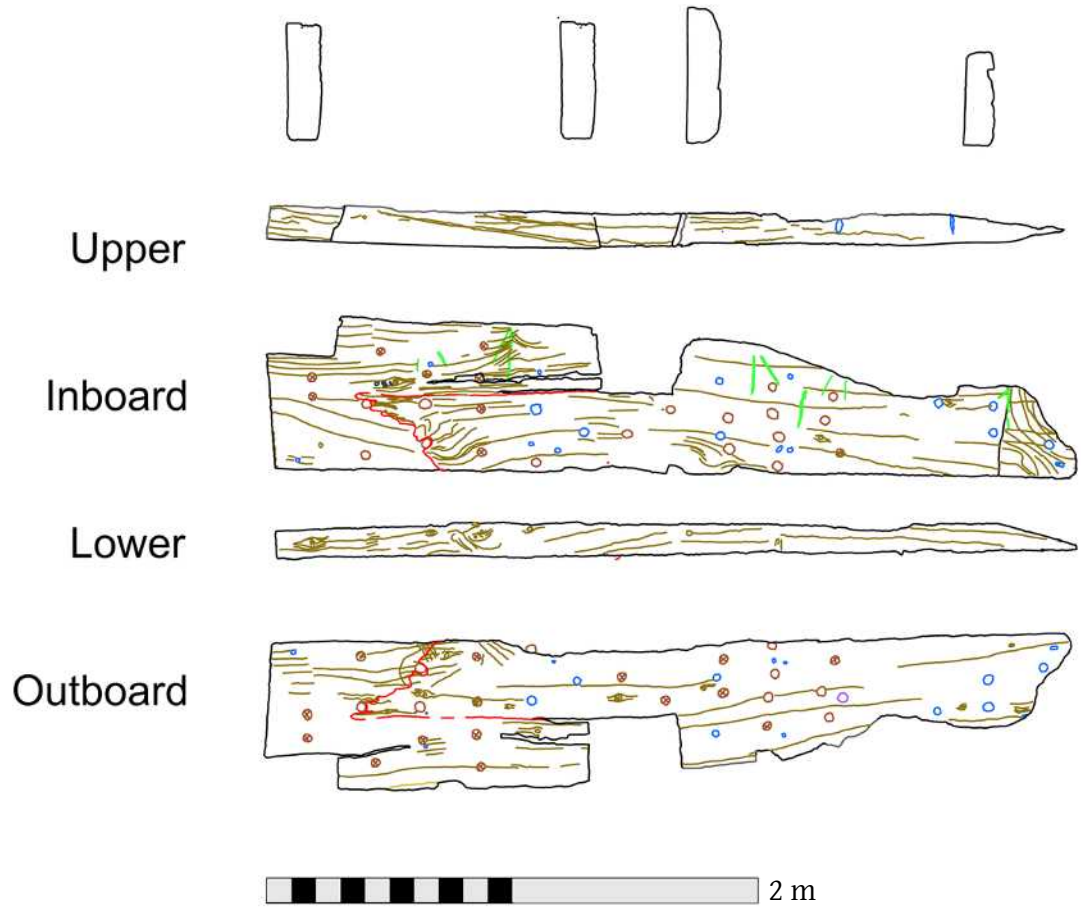


Figure 4.12. Lower deck clamp SCW2063 (note the red line denotes the split between the two fragments which has been re-joined)

Figure 4.13. Timber mark on SCW2063 (scale gradients are 50mm)

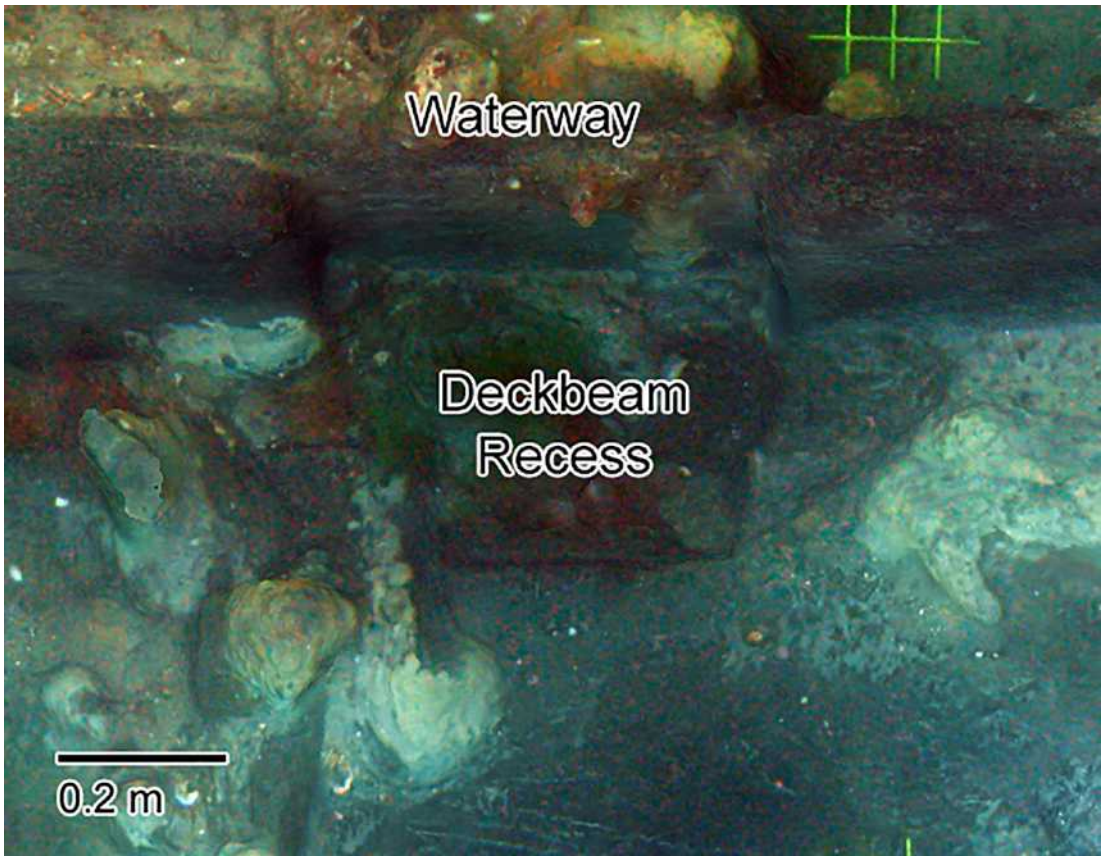


Figure 4.14. Waterway of the lower deck showing the recess to fit over the deck beam

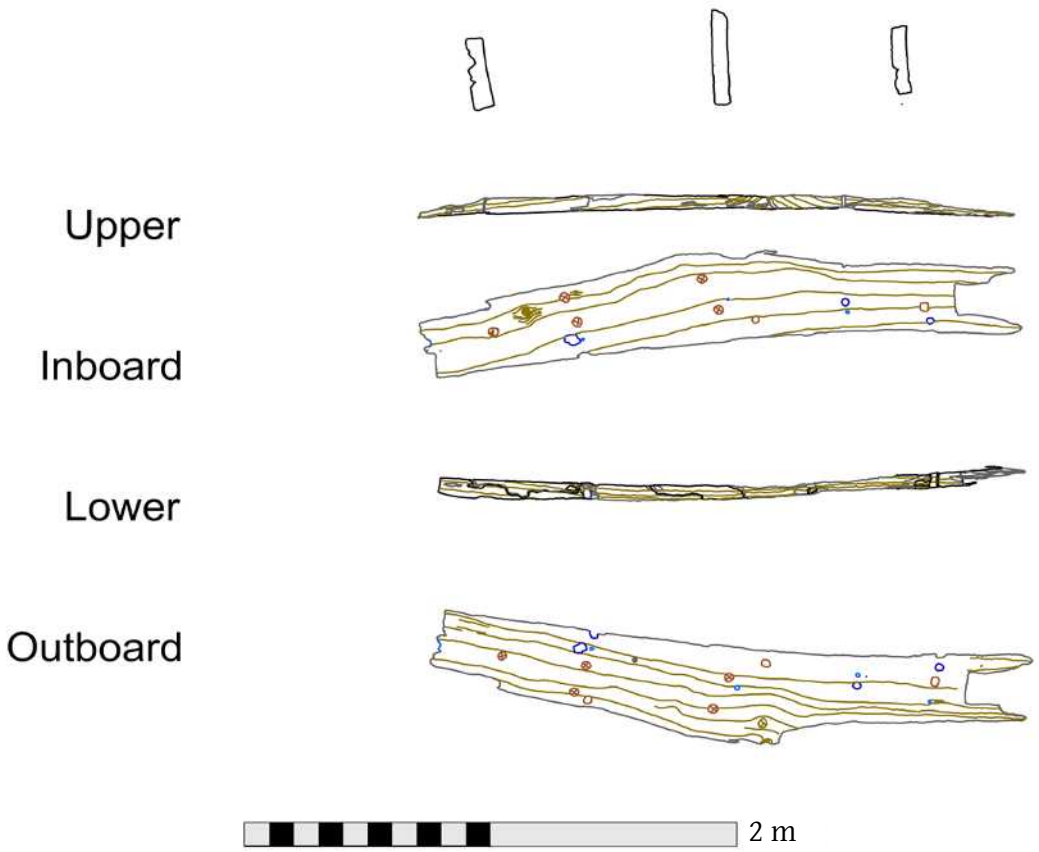


Figure 4.15. Spirketting SCW2086

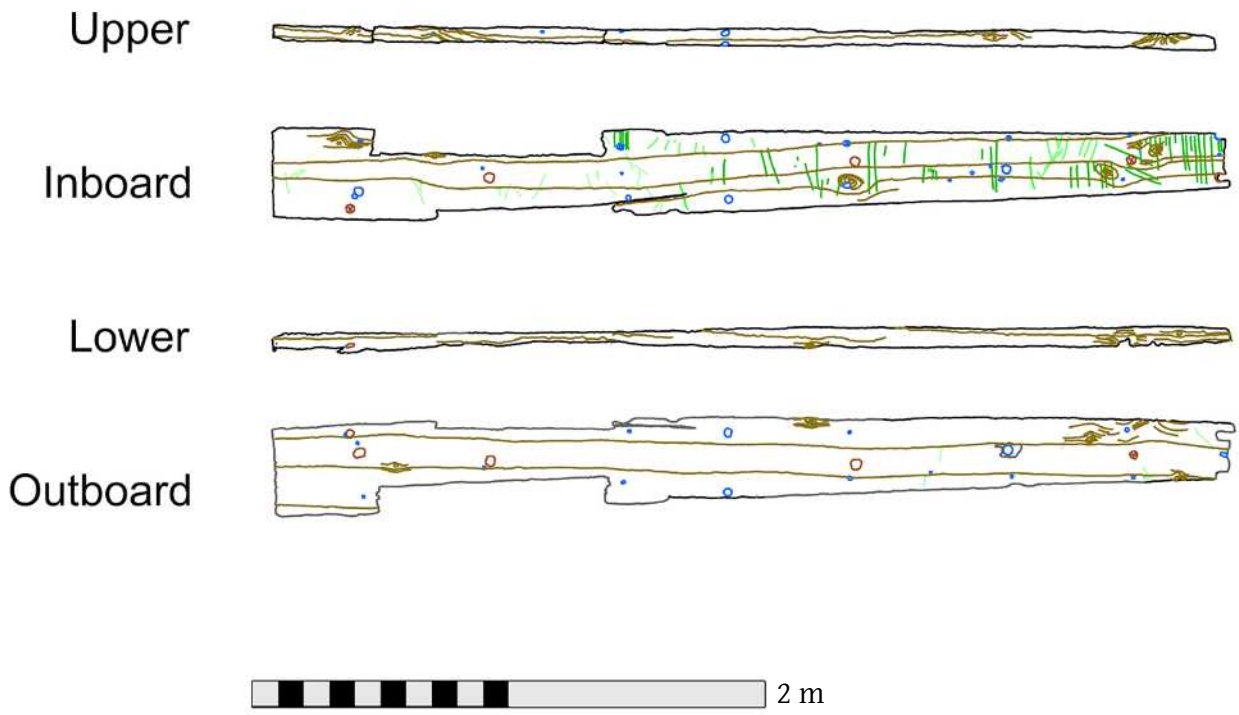


Figure 4.16. Quickwork ceiling SCW2053

around the gunports. Two examples of the quickwork from the lower deck recovered from the site, **SCW2029** and **SCW2053**, were slightly thinner than the common ceiling at *c* 55mm thick and fastened with a single row of treenails to the framing with additional nails either side. **SCW2053** (Figure 4.16) featured a bolthole where a rider would have connected through into the framing behind and was cut to fit around the sill of a gunport.

The ceiling in Area One only survived up to the main deck clamp; after this the pattern would have been repeated with the waterway and spirketting above and quickwork in the forecastle, as seen in Areas Two and Three.

The main deck clamp in the stern was approximately 0.45m high and the waterway appeared to be in line with the ceiling rather than recessed to the beams as seen on the lower deck. Above the waterway the spirketting consists of a strake of oak planking *c* 70mm thick, fixed to the frames using treenails but with additional iron nails, perhaps used as temporary fasteners prior to the auguring for the treenails. Another strake of a similar size sat on top of this, with the timbers joined by butt joints and the ends of the timbers nailed onto the same frame.

The quickwork above this consisted of much thinner (*c* 50mm) Scots pine (*Pinus sylvestris* L.) strakes. A typical example of this is **SCW1215** (Figure 4.17), scarfed together using vertical flat scarfs. The use of softwood in the upper works is commonly seen in Dutch construction as it would save weight and cut down building costs (van Duivenvoorde 2015, 15). **SCW1218** (Figure 4.18) featured a 70mm diameter rebate on the inboard face for the attachment of the main chainplates.

Above this lay the deck clamp for the quarterdeck. Several fragments of **SCW1212** were recovered six years after the excavation (Figure 4.19). This was *c* 60mm thick and was attached to the primary framing using iron nails with the occasional treenail.

The ceiling sequence continued in Area Three at the stern with the waterways and 280mm high spirketting. The quickwork above this was again from Scots pine (*Pinus sylvestris* L.). There is a gap in the waterways of this deck where the ceiling is continuous, marking the room of the steering stand. Forward of this is a large gap in the ceiling, probably where the waterway was in line and would have continued along the weather deck with the spirketting on top.

Covering board

The uppermost part of the ceiling in the upperworks was the covering board, a timber used to cap the top frames between the inner and outer planking. This would be morticed to fit the frames, allowing the top timbers to jut out forming the rails. These were observed at the top of the quarterdecks and poop decks. Three sections of the covering board were recovered *in situ* from Area Two. These show that the covering board was nailed from the top down into the spirketting, from

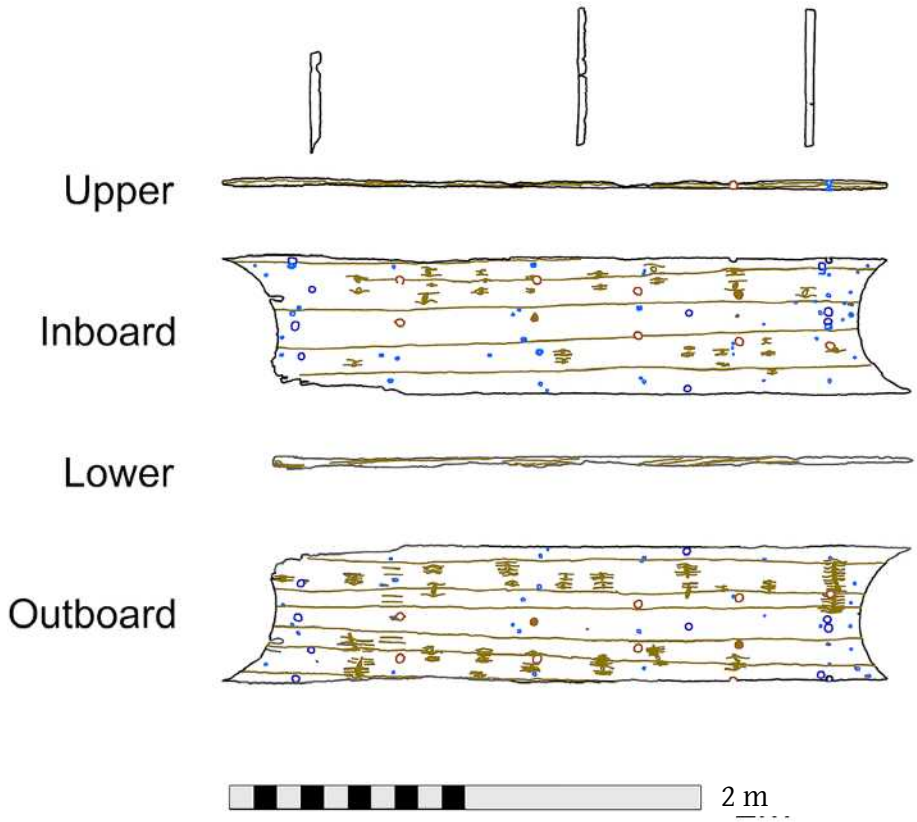


Figure 4.17. SCW1215 pine quickwork from Area 2

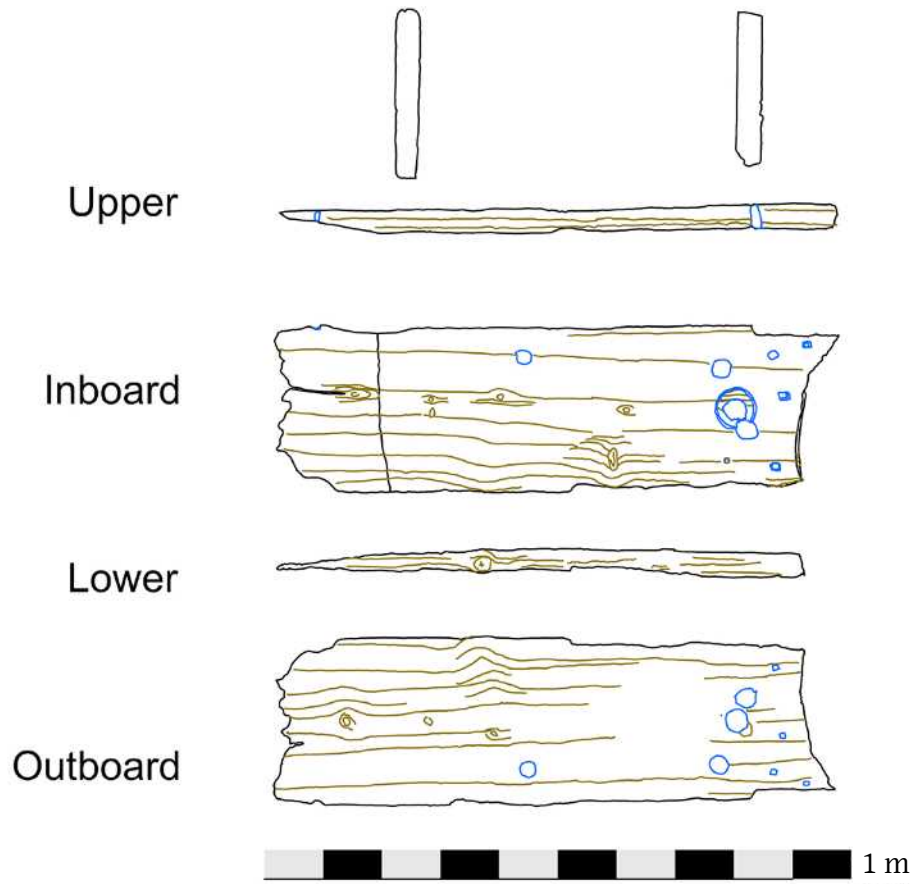


Figure 4.18. SCW1218 showing chainplate bolt and flat scarf

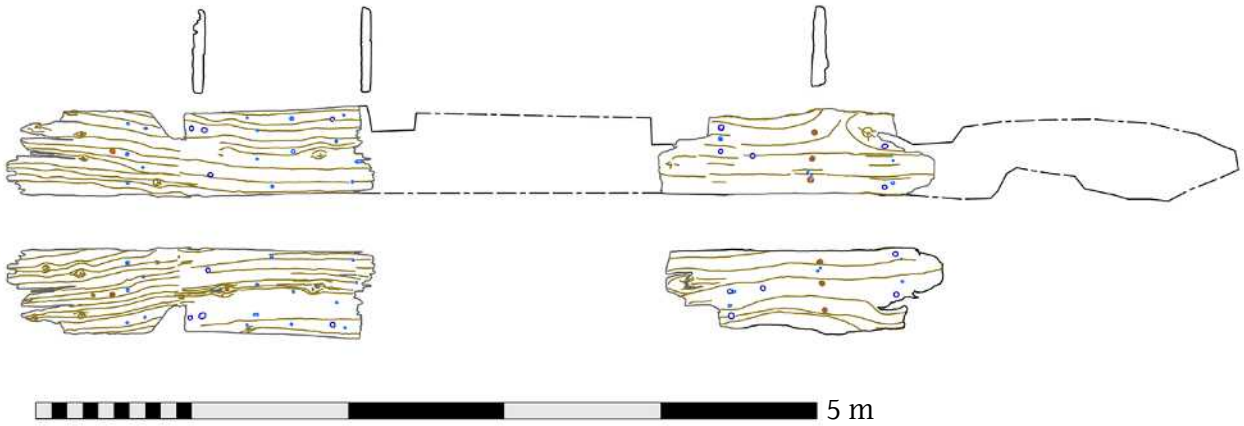


Figure 4.19. Reconstructed deck clamp SCW1212

inboard into the frames, and outboard from the lower rail on the outside of the ship (Figure 4.20).

Framing

The frames were converted from grown timber with the grain generally closely aligned to the hull's curvature (Figure 4.21). During conversion of the frames, partial or complete sapwood, and even the bark itself was sometimes retained along the edges between faces. The framing style is not continuous and does not appear to form any consistent pattern, meaning that the futtocks are not connected to each other or terminate on a similar strake.

This is a trend that has been noted in Dutch 17th-century construction in general, and more widely in recovered examples of Northern European shipbuilding, where it has been observed that very few frames have been trimmed of all their sapwood to create clean, squared-off framing (Hocker 2004). This type of framing is typical of shell-first Dutch construction and is seen on *Vasa* and *Batavia.* However, the key features to prove this occur in the lower hull which does not survive on this wreck.

The floor timber (**SCW1316**) found washed up on Studland beach in 2001 has since proven to be a dendrochronological match with the Swash assemblage (Nayling 2009). Its angle when compared to the plans of Witsen's *Pinas* created by Hoving (2012) and *Vasa* suggest that it would have been placed towards the aft of the ship before the start of the deadwood (Figure 4.22).

One frame **SCW2075** (Figure 4.23) was recovered from the main body of the wreck; this was from directly beneath the forward-most surviving gunport. The frames were fastened with treenails, through bolts, and

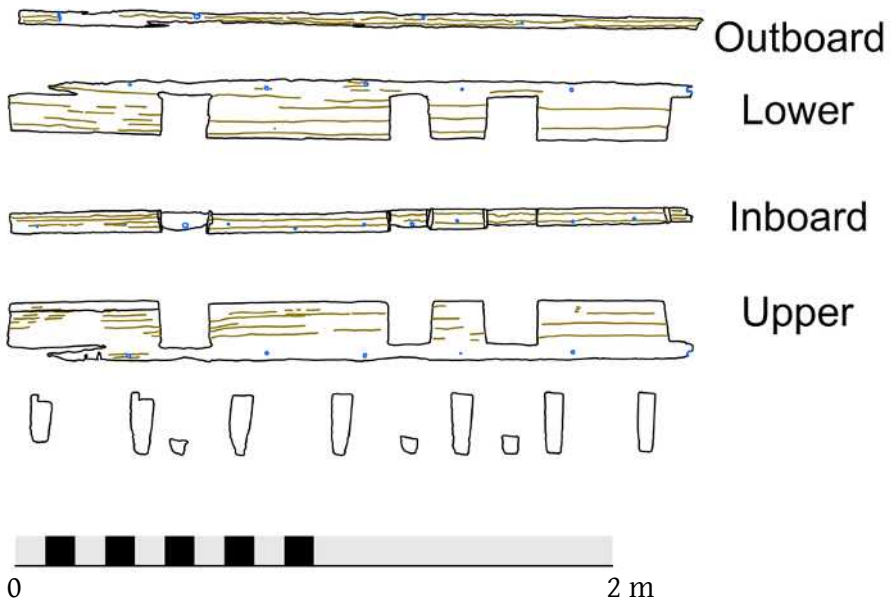


Figure 4.20. SCW1241 a section of the covering board

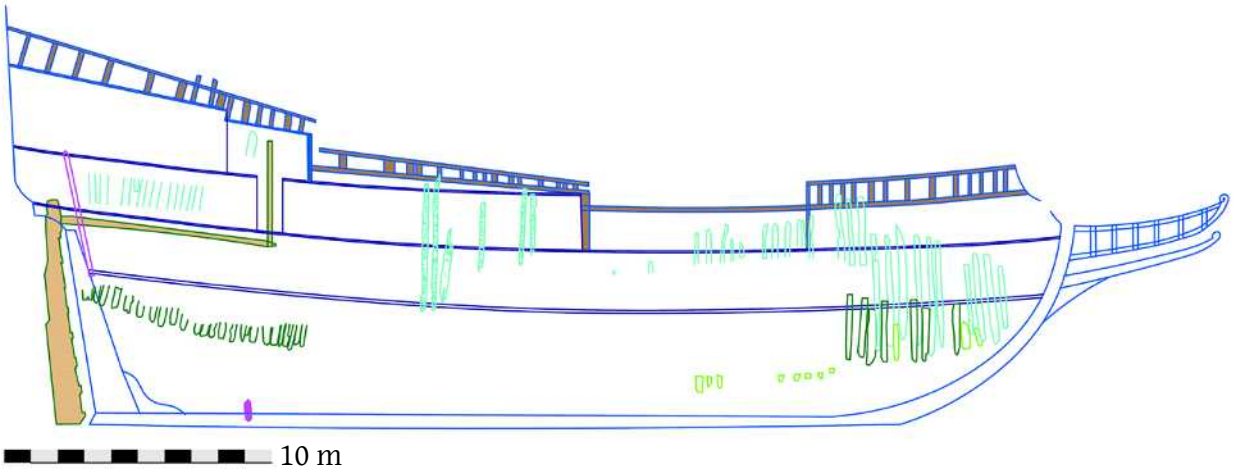


Figure 4.21. Schematic diagram of the framing observed on the site

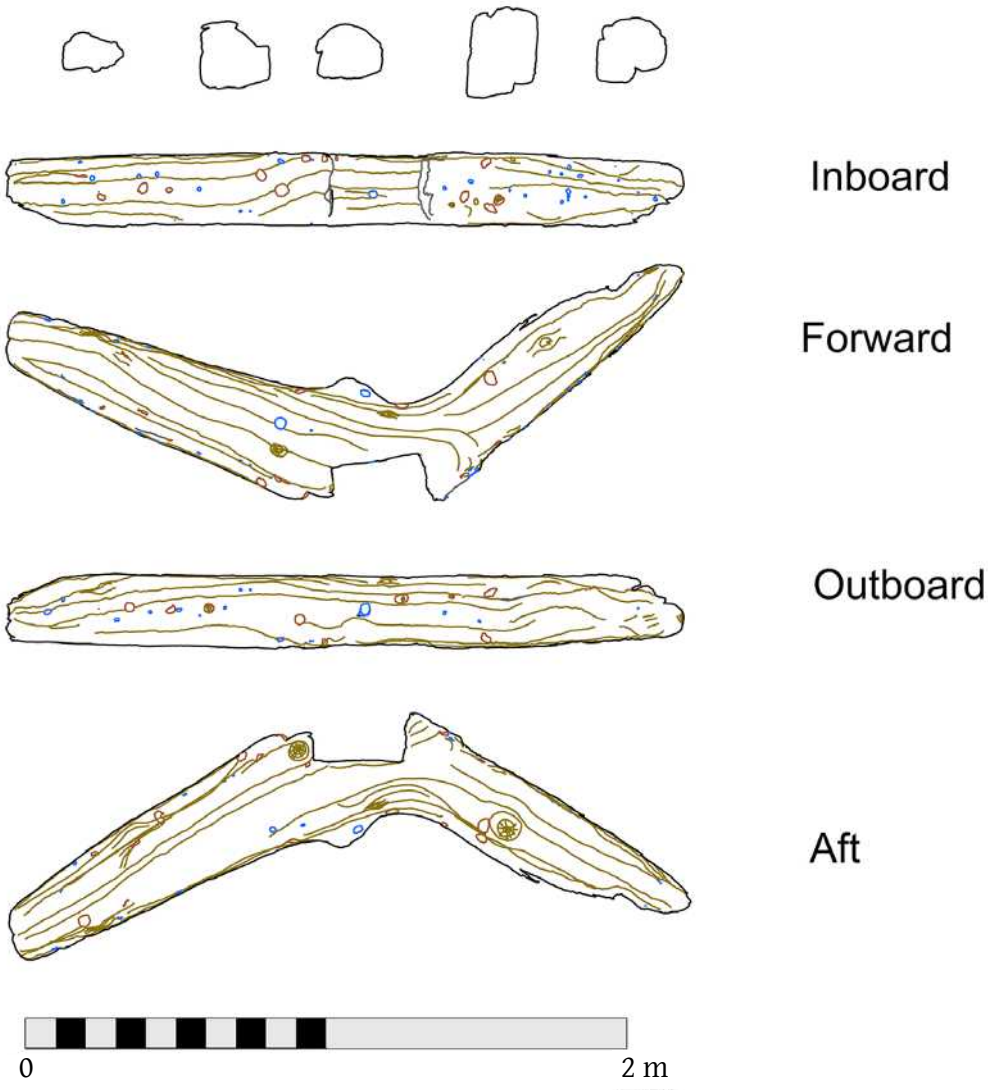


Figure 4.22. SCW1316 floor timber

square-shanked spiked nails connecting the ceiling and external planking to the frames in an irregular pattern. Above the sheer rail, bolts or treenails were used less frequently, with the upper four strakes connected to the frames with iron nails. The rest of the frames were recovered from Area Two and mainly represent top timbers.

Frames **SCW1229**, **1235** and **1239** were smaller futtocks which terminate on the sheer rail before reaching the covering board. **SCW1235** featured a cut for one of the circular gunports. Two bolts had been driven through at oblique angles, most likely associated with the port's ringbolts. On the outboard face of the timber there were traces of additional nails which represent the remnants of the fasteners used to attach one of the carvings around the gunport.

SCW1223, **1224**, **1225, 1236** and **1237** were long top timbers which would have extended from the lower deck up to the covering board. At the lower end of **SCW1225 (**Figure 4.24**)** there was a slight rebate to accommodate the ledge of a square gunport. The large bolt in the inboard face of the frame was likely associated with the ringbolts for the gun station.

SCW1223 scantlings were significantly larger (both in width and depth) than all the other frames, and it demonstrates unusual fastener use on the outboard and forward edge. The timber appears to have split along the line of the treenails that would have affixed it to the hull. This may have happened in the wrecking or contemporary salvage and would help explain how these frames have become detached from the main hull. **SCW1236** and **1237** only survived to the top of the lower deck at their upper extent. The frames above the sheer rail featured a hook which fitted over the last normal strake before being topped with the weatherboarding. From there they extended upwards for 160mm to abut the covering board. On **SCW1236**, there was an auger hole for a treenail which is not present on the external planking; this could be evidence of timber re-use or a repair.

The remaining Area Two frames extended past the sheer rail and the covering board to be capped with the top rail. As with all the framing these were of varying lengths, the lower end of the longest **(SCW1224)** reaching the level of the lower deck. These frames are also joggled at their upper extents for the clinker weatherboarding and were recessed for the last strake. The shortest of

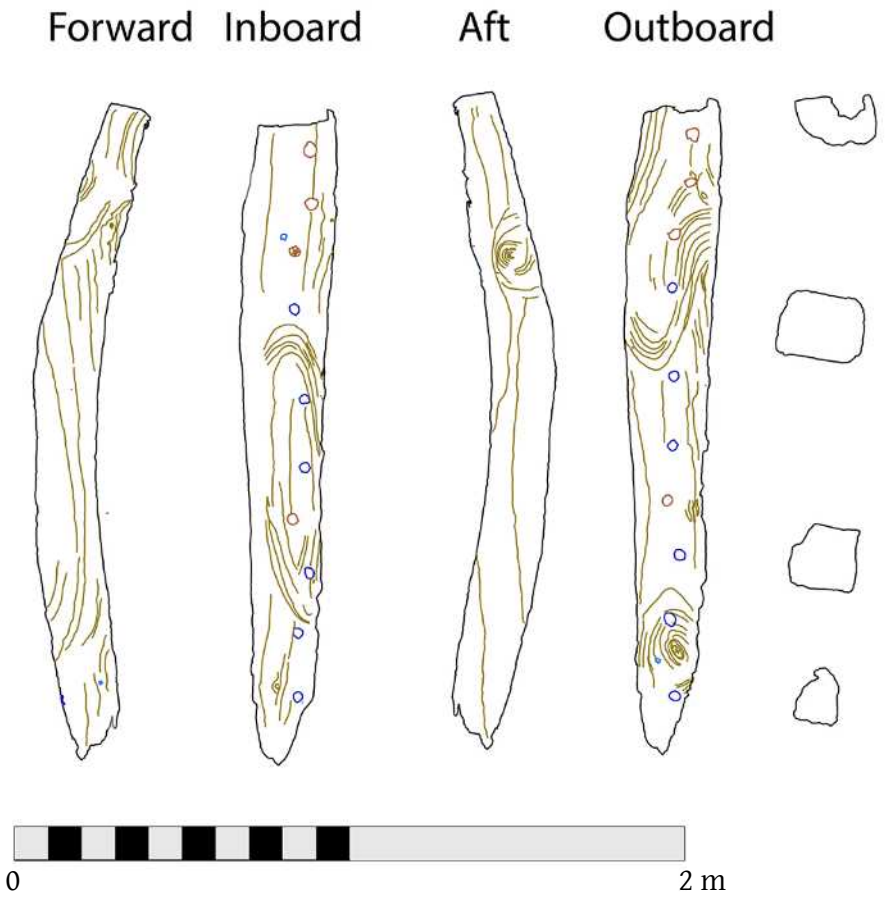


Figure 4.23. SCW2075 frame timber

Figure 4.24. SCW1225 showing the curvature of the tumblehome

these frames (**SCW1227**), measuring *c* 1.5m long, were connected at the base to the sheer rail and served as stanchions for the rails and weatherboarding of the upperworks (Figure 4.25).

In the stern, the framing was exposed on the main deck where the pine quickwork had eroded. The top timbers here, as with the rest of the ship, were rarely converted purely from heartwood, with partial or complete sapwood and bark surviving along edges. As in Area Two, the top timbers extended beyond the covering board to create a rail. The top timbers showed three distinct levels although two timbers seemed to extend above the rail. The stern timber was also visible, marking the position of the transom. No top timbers were seen aft of the stern timber, suggesting that they could have broken off with the counter. Two frames appeared to continue *c* 0.3m past the top rail; as these were in line with the mizzen, these might have been a belaying point for said mast.

The partial remains of a stern timber were *in situ*,marking this vessel as having a square tuck stern. This timber would have continued up to the top of the castles but only survived as high as the quarterdeck.

Gunports

Two different types of gunports were observed on the site: round ports with a diameter of *c* 600mm in the castles, and square ports (*c* 800mm by 800mm) on the lower deck.

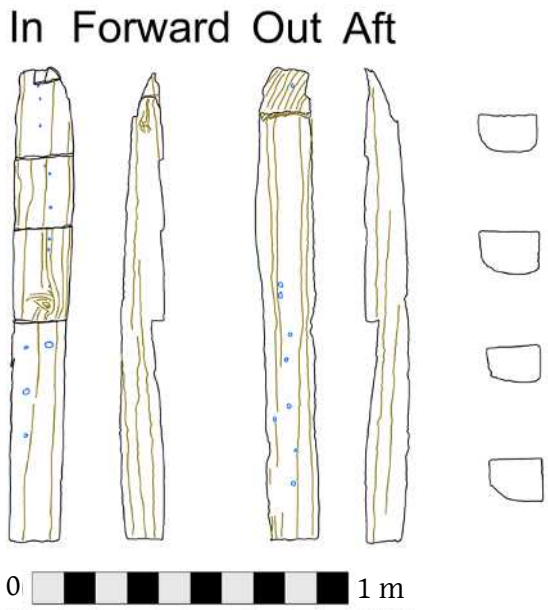


Figure 4.25 Stanchion frame SCW1227 showing the hook for the last strake and the joggles for the weatherboarding and rails

The gunports would have been laid out early in the building sequence to avoid as much cutting as possible. Once the position and number of ports was chosen two large timbers would be placed horizontally at the bottom (sill) and the top (lintel). Small ledges were cut into the frames to support the sills and the lintels were connected by nails as seen on **SCW1225** (Figure 4.24). The ceiling planking was removed around the first two gunports in Area One allowing the framing pattern to be seen clearly (Figure 4.26). These ports were situated between two frames with a third in the centre underneath the sill. Framing timbers of different scantlings continued above the lintel, suggesting that the ports were put in place before the top timbers. The sill sat flush with the ceiling whereas the lintels sat flush with the frames, the ceiling covering them.

Like the square ports on the lower deck, the circular ports of the main deck area were situated between the frames. Instead of sills, however, a series of short irregular triangular framing elements were placed underneath the port, sandwiched between frames (Figure 4.27). A series of these supports can also be seen in the main structure of Area One (Figure 4.28) marking the position of the forecastle. The ceiling in this area was completely eroded showing that they would have sat over a deck beam. Two examples were recovered from the site. These supports have been largely attached using treenails. The presence of these supports articulated to the main bow section suggests that they would be placed level with the main deck.

While many of the gunport lids were missing, the lid of the first gunport in Area One was recovered during the excavation of **SCW25.** The lid (**SCW2071**) (Figure 4.29) measured *c* 930mm in height by 970mm in width and was composed of two layers of timber laid at right angles to each other. The inboard face consisted of three pieces

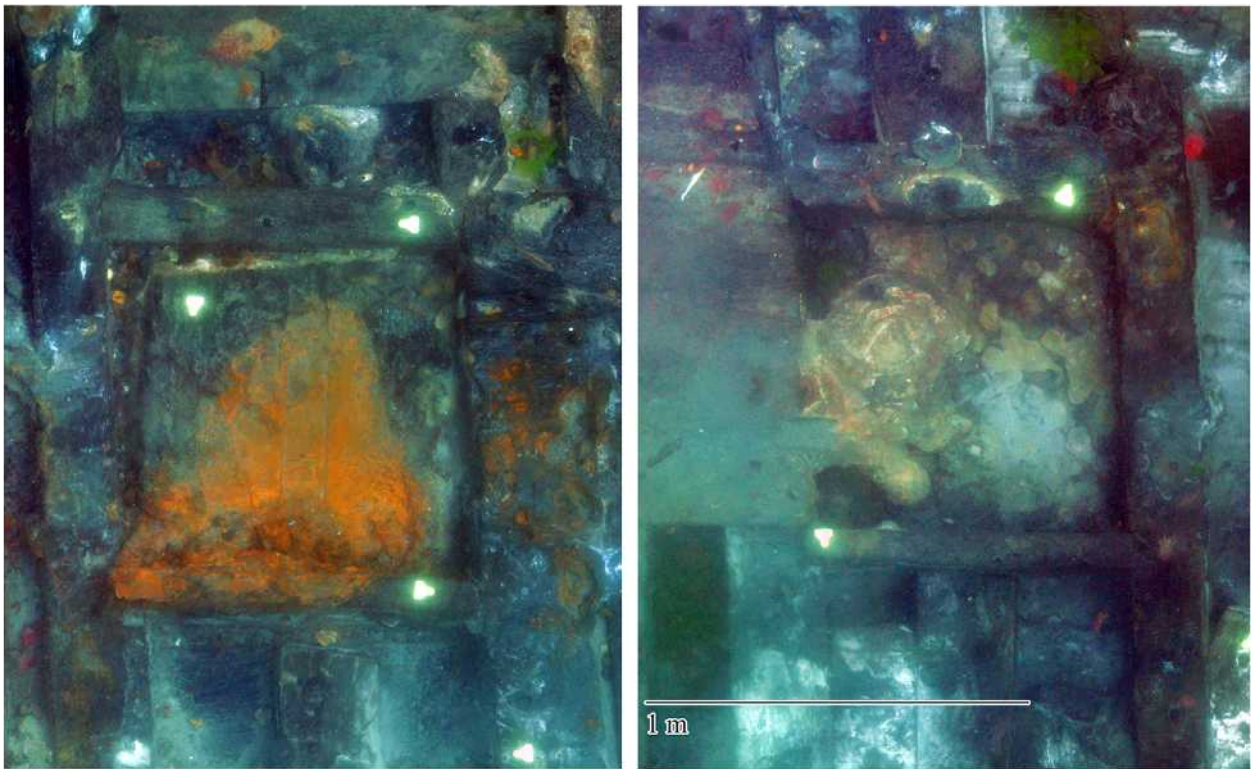
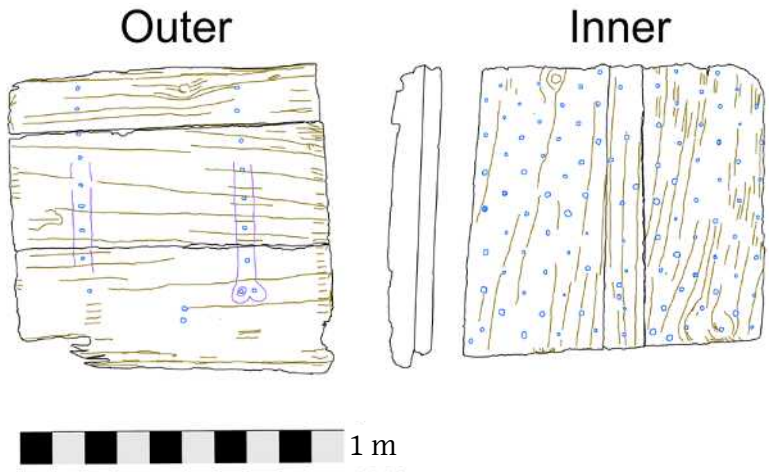


Figure 4.26. Gunports 1 (left) and 2 (right) with ceiling removed

Figure 4.27. Circular gunport in Area Two with ceiling removed (scale in the centre of the port is 200mm)

Figure 4.28. Circular gunport in Area One



of timber placed vertically together to create a flat layer approximately 880mm² and 50mm thick. This layer was fastened to the outer layer with closely spaced nails in a quincunx pattern. The nail holes for the inner staple were also present. The outer layer consisted of three 50–70mm thick pieces of horizontally laid timber placed in such a way as to create a segment of a circle, providing strength, and mimicking the curve of the ship (Figure 4.30). The impressions of two iron hinges *c* 50mm wide either side of the lid were visible; one hinge appeared to terminate with a decorative bone-style end connected by two square nails, but this is not reflected on the other hinge where the last nail terminated in line with the penultimate nail of the left hinge. The nail holes for an outer staple in the lower centre of the lid were also present.

The port lids on *Vasa* and *Batavia* are of a similar construction showing the inner layer with the quincunx nail pattern and an inner staple. The *Batavia* lid, however, is smaller at 586mm by 618mm and the inner layer consisted of pine rather than oak; it also featured a third, outer layer to continue the ship's wale (van Duivenvoorde 2008, 162–4).

External planking

As the site was not full excavated detailed information on the outer hull structure is lacking. In the main hull there was no evidence of double planking, as seen on the *Batavia* and other early 17th-century ships (van Duivenvoorde 2015), but softwood sheathing was noted in the scour pit of Area One. In the forward-most section of Area One, fourteen strakes of hull planking of inconsistent widths were visible although the thinness of some of these strakes suggests that they may be stealers or graving pieces filling in the gaps caused by the curvature of the bow (Figure 4.31).

The lowest two surviving strakes were incomplete, but above these lay an intact strake featuring a flat scarf and graving pieces to make up its width of *c* 400mm. Graving pieces to patch up the vertical scarfs are also seen on the *Batavia* (van Duivenvoorde 2015). This strake featured large tool marks, probably from an adze or an axe. It is likely that this is the first wale of the ship, just above the turn of the bilge (Figure 4.32).

Three strakes above this wale there was a small square rebate of *c* 16mm 16mm at the end of the plank which lined up with the rebate in ceiling plank **SCW2086** for a scupper; Witsen places this in the strake directly below the second wale, suggesting the next strake up is said wale (Hoving 2012).

Figure 4.30. Isometric view of the main deck at midships showing the circular gunport supports in the upperworks

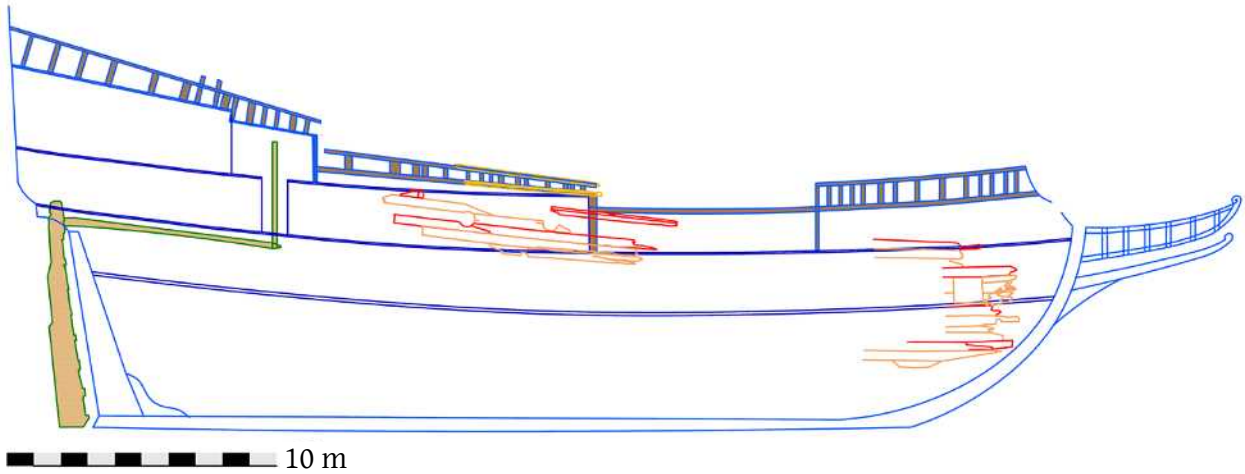


Figure 4.31. Schematic diagram of the external planking visible on the site (red indicates the wales)

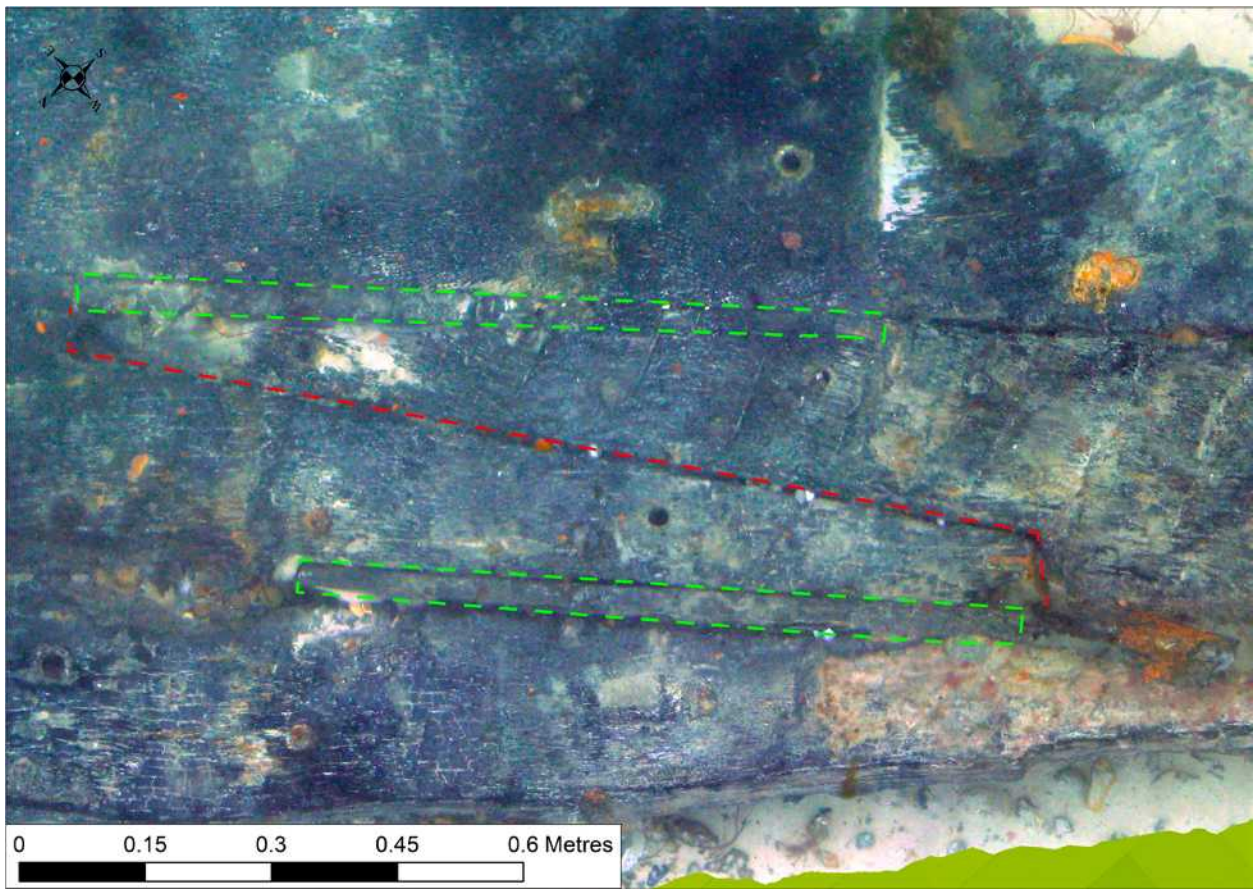


Figure 4.32. First wale featuring a flat scarf (red) and graving pieces (green)

Above the second wale on the lower deck there appeared to be two filling strakes, known as gun fillings (Figure 4.33). The lower was trimmed to fit around the first gunport whereas the upper gun filling was level with the top of the port. Two short sections of these strakes were recovered (**SCW2103** and **2104**): these were *c* 60mm thick and connected to the frames using iron bolts in addition to treenails. The use of bolts in addition to treenails suggests a need to strengthen the hull here, possibly due to the plank being cut to fit around the gunport. Bolting all the way through the various layers of the hull terminating in the rider (**SCW2077**) may also have strengthened the timbers as they curved into the stem. These timbers had small nail holes around the edges suggesting that nails were used to tack the planking in place before adding the treenails and bolts to complete the structure.

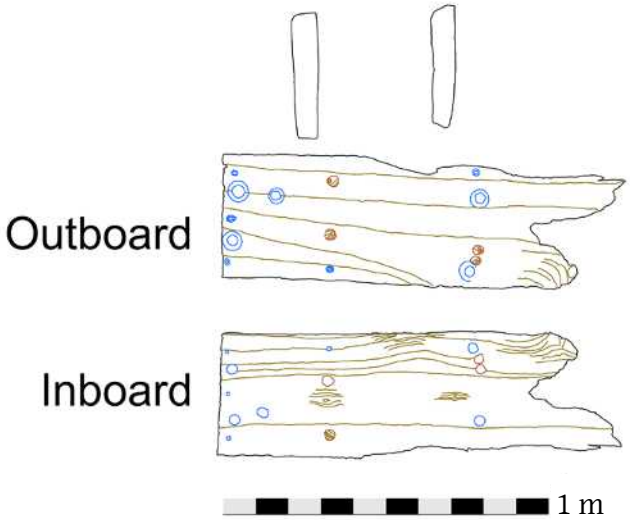


Figure 4.33. SCW2103 gunfilling outer hull planking

Directly above the gunport would have sat the third wale and two more filling strakes; the lower filling strake features a flat scarf and the upper a scupper. The fourth wale would have sat above these and had the fore chainplate attachments.

In Area Two, the hull survived from the two filling strakes above the third whale up to the top rails. The lower of these two filling strakes, **SCW1272** (Figure 4.34), featured a vertical flat scarf, like those seen on *Batavia* (van Duivenvoorde 2015, 84). The filling strake above this, **SCW1273** (Figure 4.35), features a small gap between the two strakes; this slit would be behind the ceiling and frames inside the upperworks, so it is likely that a graving piece originally filled it.

The fourth wale (Figure 4.36) ran just below the circular gunports, with one of the ports cutting into the bottom. The most aft gunport would have been cut into the middle of this wale. This shows that the decks were put in level rather than curving with the outer hull planking, unlike on *Vasa* where they angled the deck to avoid this as it would weaken the hull. This wale is *c* 125mm thick and features a flat scarf between **SCW1274** and **1275**. Large recessed bolts were present along the outboard face of this wale. Iconographic evidence suggests that this would be the level of the channels for the main mast chainplates.

Above this sat two more filling strakes which were fitted around the circular gunports; these featured

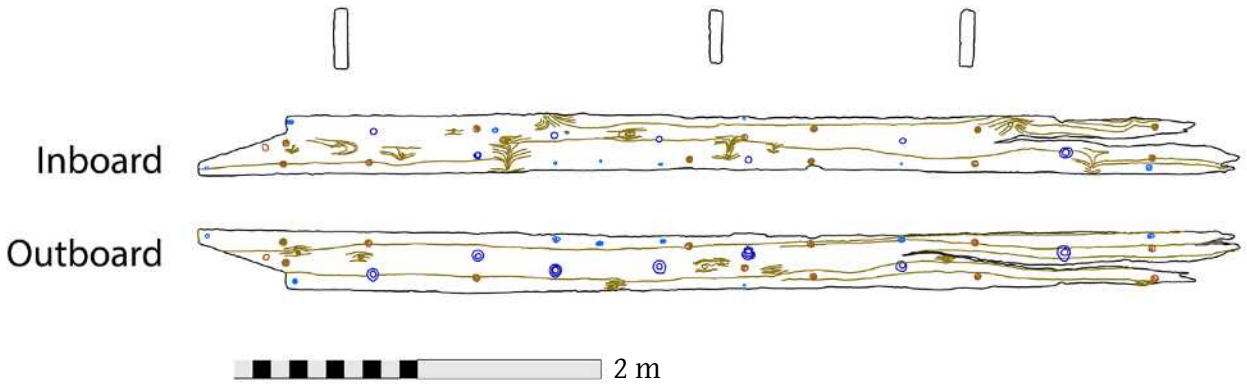


Figure 4.34. SCW1272 filling strake

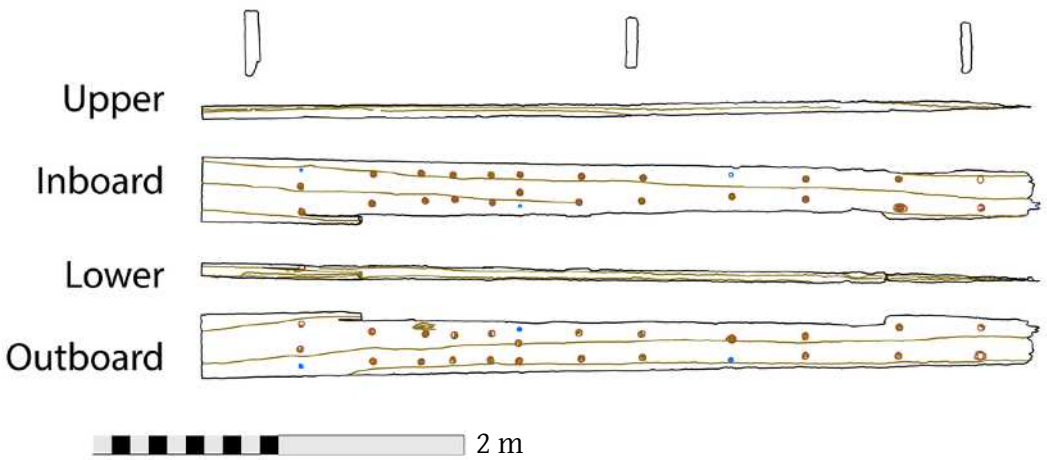


Figure 4.35. SCW1273 filling strake

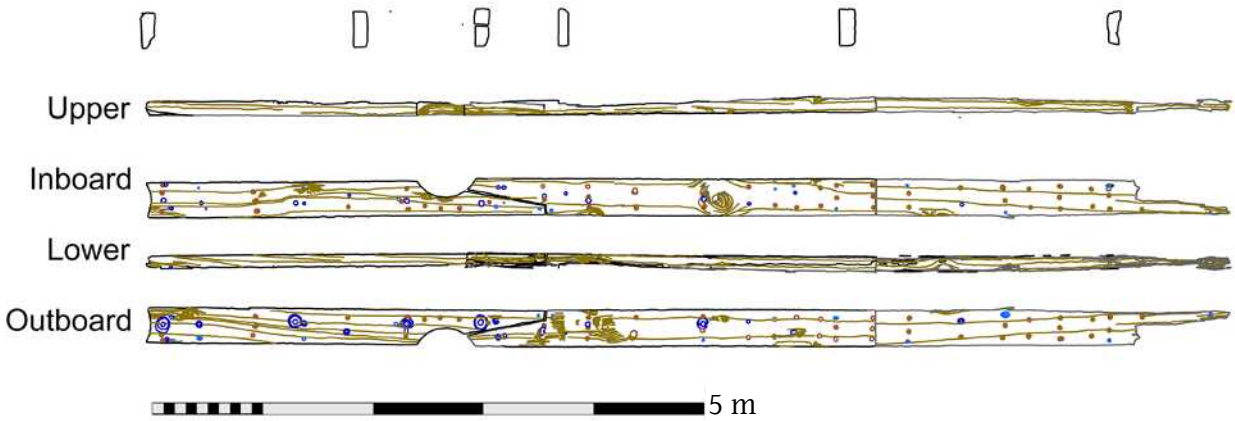


Figure 4.36. Fourth wale SCW1274 and 1275

decorative carving around the outside of the gunports. The lower of these strakes, **SCW1277 (**Figure 4.37), was attached to the framing mainly with treenails but also with bolts alongside the gunports. However, the upper strake, **SCW1250** (Figure 4.38), was only fastened to the frames using square-shanked nails and two bolts at an oblique angle. The planking was 40–50mm in thickness.

Above this sat the uppermost wale known as the sheer rail, a bevelled timber marking the maximum height of the main frame. **SCW1284 (**Figure 4.39**)** marked the area where the upperworks of the stern stepped down to the waist of the vessel. It featured treenails and iron nails where the frames would have continued into the upperworks and a recess for the tail of the Triton carving **SCW1285**. Forward of this recess only iron

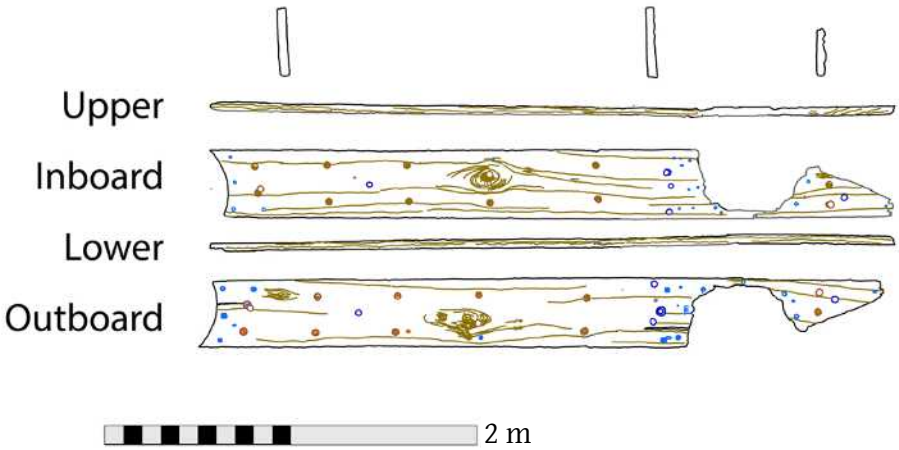


Figure 4.37. SCW1277 filling strake

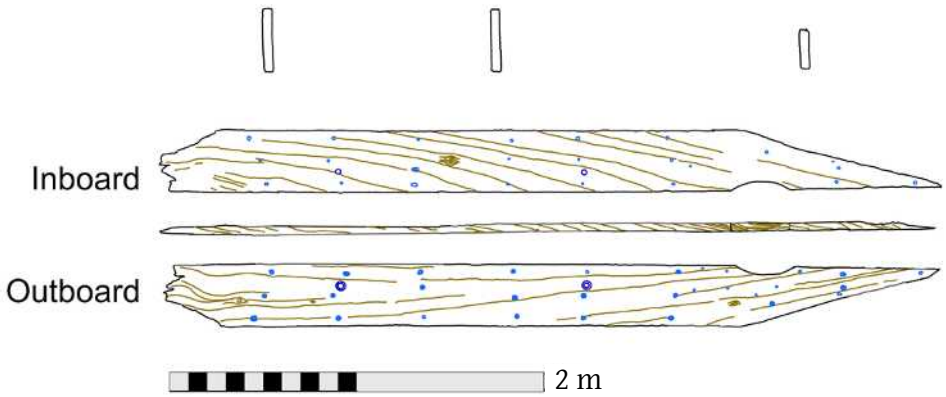


Figure 4.38. SCW1250 filling strake (note the 45 degree cut is modern)

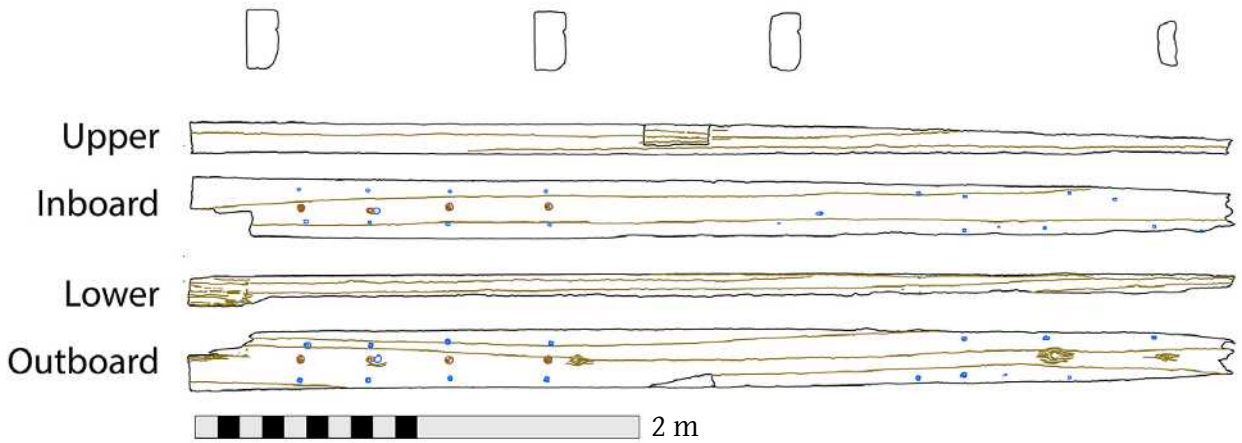


Figure 4.39. SCW1284 sheer rail

nails were present, suggesting that the top timbers of the midships frames were only loosely attached. The wale also began to taper off towards the forward of the vessel suggesting that this was the position of a doorway as seen on the *Prins Willem* (Rijksmuseum 2020).

Above the sheer rail is the '*vertuining*' or upper works – another two strakes ran aft of frame **SCW1266**, marking the start of the enclosed rooms under the half deck. Above this sat the lower rail, **SCW1291** (Figure 4.40), connected to the covering board. As indicated by the joggles on the stations and top timbers, clinker planks would have continued to the upper rail, **SCW1293** (Figure 4.41). Photographic evidence from the site when it was first discovered in 2004 shows a cap rail fixed to the inboard face of the top timbers, fitting into the recesses seen on said frames (Figure 4.42). A series of holes in the upper face of **SCW1293** indicates that there may have been another run of railing as seen on *Vasa*.

Hull sheathing

From the 16th century onwards, in order to protect the structural timbers of a ship's hull from marine fouling and borers such as shipworms and gribbles, a layer of softwood planking was nailed to the outside of the

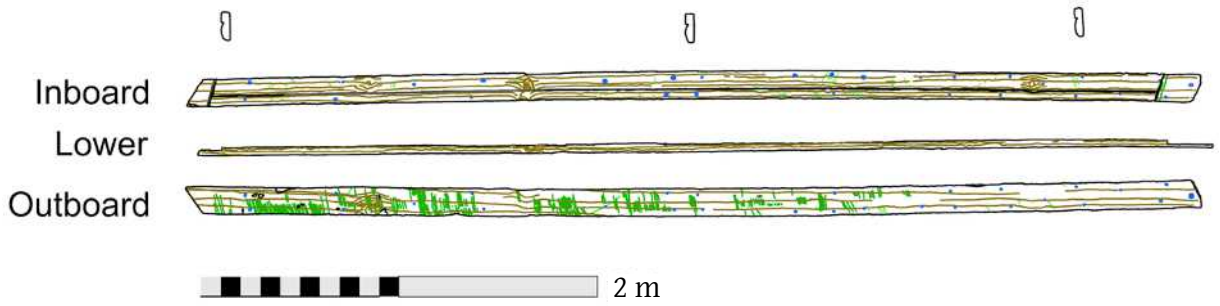


Figure 4.40. SCW1291 lower rail

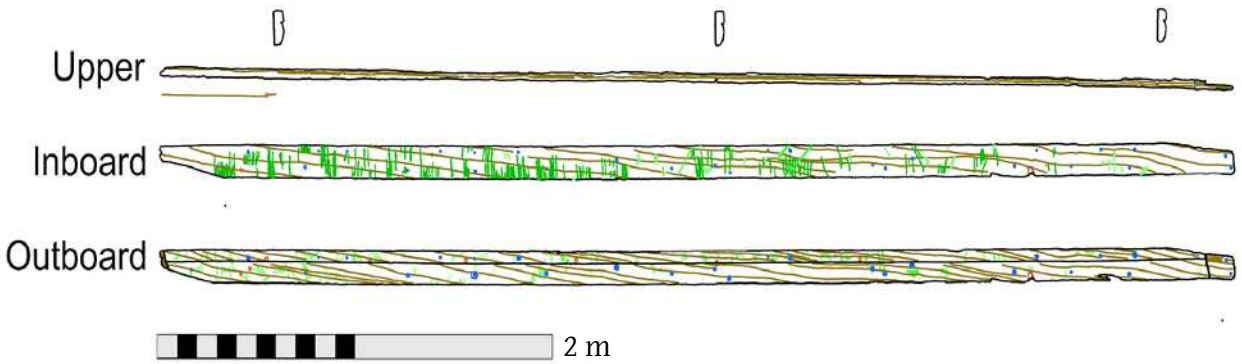


Figure 4.41. SCW1293 upper rail

Figure 4.42. Missing rail shown in the 2004 photographs from Wessex Archaeology

hull, often with a layer of pitch and hair between this and the hull itself to act as an additional barrier (van Duivenvoorde 2009).

The layer of softwood sheathing nailed to the hull of the Swash Channel Wreck was just over 30mm thick and probably made of the same Scots pine as the quickwork (*Pinus sylvestris* L.). It had been nailed onto the hull with iron nails of which only concretion products still existed. Whether these nails were spaced closely enough to create a complete corrosion barrier on the outside of the sheathing is still an open question, but it was observed that the underlying *c* 5mm thick layer of animal hair between the sheathing and the hull had almost completely crusted over with corrosion products which in turn would have enhanced the protective properties of this layer considerably. The hair material clearly contained some black tar-like material, but no further information can be given on the nature of this substance.

Two examples of pine sheathing – **SCW2123** and **SCW1318** – were recovered from the forward-most section of Area One. This sheathing shared similar construction details to that of *Batavia* (van Duivenvoorde 2015): a rebate has been carved into the sheathing to accommodate the bolts on the external planking, the matting has then been applied, and the sheathing attached to the hull. The recess is some 33–40mm in depth and *c* 60mm wide. The bolts had a round shank 30mm in diameter. The sheathing has been attached solely using square-shanked nails with square heads.

The lower 4.1m of the rudder was also sheathed in this way, presumably to just above the waterline. It consisted of 20–30mm thick pine sheathing with a layer of animal hair and tar sandwiched between the pine planks and the rudder timbers. The sheathing was attached with iron nails at roughly equidistant spacing and had been specially formed around the pintles. The edges of the sheathing had been chamfered at their forward and aft edges and applied transversely to the main body with three metal nails on each side of the rectangular planks. In terms of building sequence, it would appear the rudder was sheathed before it was hung.

Chainplates

Chainplates are long iron straps which attach the deadeyes to the ship's hull. These would have been fixed to the wales with large bolts just above the gunports and then run up through the channels and bound around the lower deadeyes. The channels projected out the side of the vessel to keep the shrouds away from the hull.

The positions of the fore and mizzen chainplates have been established from the concretions in the bow and stern. The fore and main chainplates would have been bolted to the wale above the gunport on the lower deck with the channels on the next wale up. However, it appears that the lower chains may have been bolted though the filling strake and into the spirketting within the hull. The channels for the main mast appear to be on the fourth wale; one of the circular gunports cuts through this wale aft of the recorded boltholes, suggesting that there was either a break in the channels

or this defined the end of the main mast channel. The concretions for the mizzen chainplate appear to line up with the ones on the sheer rail, as seen in the model of the *Prins Willem* and contemporary drawings (Rijksmuseum 2020).

Galley

Keeping a fire aboard a wooden ship would come with a significant risk to the vessel but the ability to cook food and maintain the crew's welfare was arguably one of the most important tasks of any trading vessel during long voyages out at sea. As Ray (2009, 12) has noted, 'knowledge of shipboard cooking in the 17th century is extremely limited', with only a few examples of galleys surviving such as on board *Vasa* and the remains of a Dutch warship from 1677 in Tobago (Batchvarov 2016). Although these are both similar in date to the Swash Channel Wreck, the positioning of the galley in a warship was chosen for maximum security and minimum interference with the handling of the guns so it was placed deep within the midships hold, although it should be noted that the galley of the East Indiaman *Avondster* (w.1659) was also located midships (Parthesius 2005). On most merchant ships like the Swash Channel Wreck cargo space is of maximum priority, leading to the galley being placed in the upper decks of such vessels.

Witsen (Hoving 2012) places his galley on the lower deck of the port side of the vessel, level with the main mast, and describes a room six feet (1.8m) wide and four feet (1.2m) long, sheaved with copper and the hearth built out of bricks, the chimney coming out onto the deck above. However, this position would have been impractical on a ship of the Swash's layout as the deck above was also enclosed, thus the area interpreted as the Swash's galley would have been on the main deck, enclosed in the rooms under the half deck (Area Two).

The surviving galley consisted of an area *c* 1.3m by 1.3m situated between two knees: **SCW1205** and another further forward, based on the position of a deck beam recess in the deck clamp for the quarter deck (**SCW1212**) (Figure 4.43). Square mid-red floor tiles *c* 190mm 190mm and 25–31mm thick with vertical sides were mortared directly on to the pine quickwork (**SCW1215**), making the area level with the spirketting (**SCW1202/1203**) and the deck clamp (**SCW1212**). In front of this was a stretcher bond brick structure with iron bands laid in a rough 'N' pattern bolted to the spirketting beneath and the deck clamp above. The bricks ranged in length from 175mm to 184mm, in breadth from 82mm to 90mm, and in thickness from 37mm to 45mm, the variation in size being due to differential shrinkage during firing. The bricks have slightly rough edges implying that

Figure 4.43. The galley *in situ*

finely sanded moulds were used and they are similar in size to the statute-size brick for Leiden (18392 39mm) (Batchvarov 2016) which were prescribed by Witsen for use in galleys (Hoving 2012). There was no evidence of copper sheathing between the ceramic building material and the hull, as described by Witsen, and nor is it clear if the brick structure was extra insulation or part of the hearth.

Decorations

Some five carvings were recovered from the wreck: two tritons, two circular gunport surrounds, and the head of the rudder. Carvings of these types and styles would have featured in most Dutch ships of the period, suggesting that those recovered from the wreck represent only a small sample of the original decorations on the ship.

The tritons (Figure 4.44) would have been attached to the rails marking the step down from one deck to another. **SCW18** was found loose in 2008 in the stern of the vessel (Area Four) and was likely part of the stepdown from the poop deck to the half deck. The carving has heavy eyelids, a moustache and Van Dyck beard, as well as a helmet from which curls peep out underneath, shoulder scrolls which terminate in prominent pectoral muscles, and a curved terminal decorated with spiral foliate ornament interspersed with scales.

The second triton (**SCW1285**) was found still attached to the top rails in Area Two with its tail being scarfed into the sheer rail. This triton is also helmeted with prominent upcast eyes, moustache, beard and luxuriant curls, and like the other he has a lower body covered in scales and foliage. His body is executed with scrolls, this time on his chest rather than at his shoulders, overlying prominent pectoral muscles. He has a 'six-pack', beneath which his abdomen appears swollen and his hips are also delineated by scrolls.

The use of tritons as decorative stepdowns on the rails between decks appears to be common in 17th-century Dutch vessels and is seen on contemporary ship models including the *Prins Willem* (Rijksmuseum 2020; Figure 4.45), the mid-17th-century Dutch votive model ship held by the National Maritime Museum, Greenwich (SLR0365), and on the *Vasa*. In the contemporary models these were usually painted a golden colour.

Carvings SCW1254 and **SCW1256** (Figure 4.46) both form parts of the framing for the circular gunports in Area Two.

SCW1254, which surrounded the forward-most complete gunport, consists of a single carved individual with a distinctive face, a large bulbous nose, and individually carved teeth. Its body is of a similar style to the tritons with large pectorals and a swollen abdomen. The continuation of the leaf-like scales on the lower half of the body makes it likely that it would have a tail continuing around the lower half of the gunport. Its wings continue almost seamlessly onto a separate timber and have a degraded central feature, perhaps originally a 'swag' of fruit decoration or mask,

Figure 4.44. Tritons SCW18 (left) and SCW1285 (right)

Figure 4.45. Stern view of the Prins Willem (1651) showing golden tritons on the step downs of the rails and decorations around the circular gunports. Note the bow-most triton is stepped into the sheer rail similar to SCW1285 (Rijksmuseum 2020)

Figure 4.46. Gunport carving SCW1256 and SCW1254

as survives on **SCW1256**. It would probably have been mirrored by a second cherub like **SCW1256** to create the full frame surrounding the port.

SCW1256, which surrounded the gunport to the stern of **SCW1254**, features two heads with wings and a central grotesque animal mask. It has suffered more damage than **SCW1254** and does not survive below the shoulders. It is likely that these carvings would also have been painted or gilded a golden colour.

Similar carvings would probably have surrounded all the circular gunports on the main deck and further tritons would have decorated the stepdowns between rails. In particular, a common feature on Dutch vessels of the time was to have a large triton sweeping into the beak head and a lion figurehead as described by Witsen (1671). The stern would have been highly decorated, with the transom featuring the coat of arms of the town of origin or a symbolic depiction of the ship's name (Hoving 2012, 133).

The rudder

The rudder (Figure 4.47) had a total length of 8.44m from head to foot and 7.30m from the centre of the tiller mortice to foot; much of the iron of the pintles and bandings remained well-preserved under thick layers of concretion. The main structure consisted of three longitudinal timbers: the principal piece, which extended the whole length of the rudder, was square in profile and was approximately 0.5m^2. The top features a carved head in a Baroque style above the cut for the tiller mortice; this would have probably sat under the counter of the stern like the lion on *Vasa* and the headed rudder on the contemporary drawing of the *Salamander* (Figures 4.48).

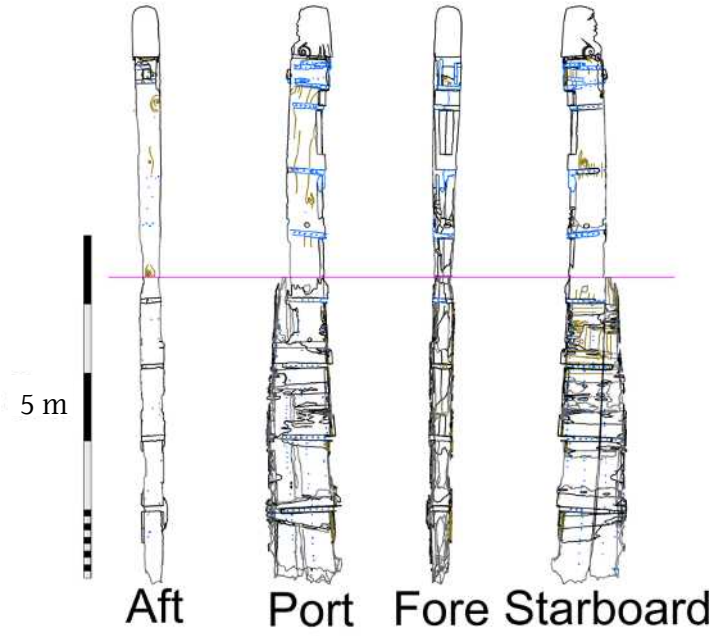


Figure 4.47. Wireframe of the rudder (the pink line denotes where it was cut in half)

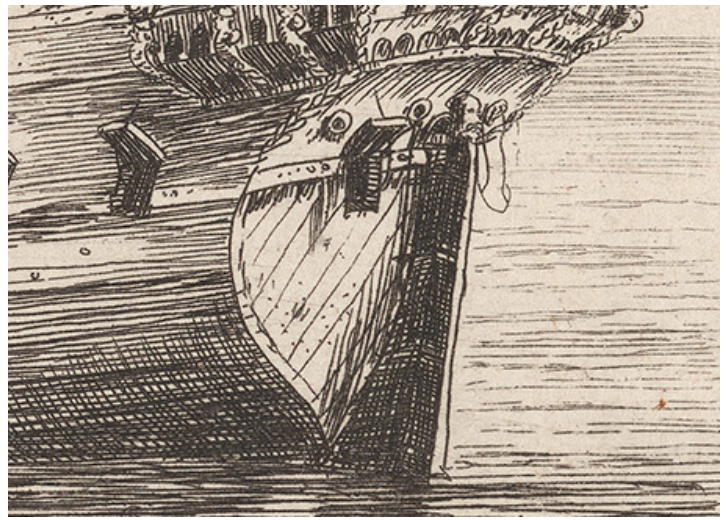


Figure 4.48. Carved head on the rudder of the VOC ship *Salamander* by Reiner Nooms (1652–54)

The tiller mortice is tapered towards the aft and reinforced with iron bands. The aft end of the tiller was still *in situ* and was framed by small wooden batons and locked in place with an iron pin. The tiller would have originally been over 7m long, running under the main deck to below the steering stand where a whipstaff would attach to the forward end. This would have been run through a fulcrum bearing known as a rawle on the main deck, thus allowing the rudder to be steered though leverage. The whipstaff itself would have extended up into the quarter deck.

Lower down the rudder is widened with a middle and after piece to give it its triangular form, the three pieces being held together by the bolts of the pintles which sat in a rebate carved along the side of the rudder. The forward face of the main piece features triangular rebates where the pins of the pintles would have hung down and fitted onto the gudgeons of the stern post to make the gap between the rudder and the stern as small as possible to avoid fouling of the rudder.

The rudder features three large pendant holes in the main piece for lifting and positioning onto the gudgeons. When the rudder was in position, ropes would be run through these holes to prevent the rudder floating away if the fittings were damaged (Landström 1988). In an extreme emergency the pendants could be used to steer the rudder. The pendant holes are 50–75mm in diameter but the holes are not equidistantly spaced, the second being 950mm below the first and 770mm above the third.

Carving on the rudder

The head of the rudder is well-defined and has very strong features under a plumed helmet framed by curls which peek out from under the headgear and cascade down the sides of the face (Figure 4.49). The carving's features are all prominent, the eyebrows being drawn together with frown lines above the bridge of the nose in an expression of concentration. The eyes are deeply carved and slightly bulging, with heavy upper and lower lids; the most notable features are the 'bags under the eyes' and deeply bored pupils. The nose is abraded but is well-defined, hooked, with flared nostrils. His moustache is sufficiently luxuriant to cover his upper

Figure 4.49. Laserscan of the rudder carving (scale: 0.5m)

lip and he has a small goatee. The neck is covered by a helmet band or chin strap, below which appears to be some form of undergarment, and a collar with 'lapels'.

Carved heads on rudders known as '*Roerkop*' appear to be unique to Dutch ships of the period (Rotterdam Maritime Museum 2019) and were often detachable. The most common subjects for *Roerkop* are 'the Admiral, Flora, Mercury, the Turk and the reclining lion' (Hep Scheepvart Museum 2011). Given the 'warts and all' style of this carving it is likely that it represented a real person rather than a mythical figure, probably a well-known admiral of the time.

Tool marks

Due to active erosion on the seabed, nearly all the original timber surfaces have been lost, with the limited data available being found underneath concretion where these surfaces had been protected. The marks provide only isolated examples of tool use and it is therefore difficult to synthesise conclusive trends about tool marks across the whole ship. In general, more tool marks can be observed on the inboard faces of the planking than the outboard, but as stated above, this may well be more a product of survival than use.

Some of timbers, such as the framing timber SCW1224, have clear evidence of saw marks preserved (Figure 4.50). This is particularly obvious on the planking and sheathing elements.

In limited areas where the original surface survives such as on frame **SCW1226**, the use of other tools can be seen such as the use of a narrow-bladed chisel used to cut a rebate (Figure 4.51) and an axe or adze used in trimming the timbers (Figure 4.52).

Fasteners

In total over 1709 fasteners have been recorded from the entire assemblage (inclusive of the rudder and bow timbers). Some 830 of these fasteners are continuous, passing directly though the timber from the framing to the ceiling. Non-continuous fasteners, where the joining timber has not been recovered, make up much

Figure 4.50. Saw marks shown on SCW1224

of the record. As the strakes progress up the side of the vessel the fasteners generally change from treenails to iron nails. There are traces of small blind (spike) nails on the ceilings – these were probably used to tighten the planking on to the frame or attach internal features.

Treenails

Evidence for 215 treenails have recorded across the timber assemblage. The treenails have an average diameter of *c* 35mm; the few outliers are probably due to distortion. Sixty-seven of the treenails show evidence of square wooden pins driven from the outboard face (Figure 4.53).

All treenails pass straight through outer planking, through the frames and into the ceiling, with no clear oblique angles. Dutch ships of the period would have featured a wedge on the inboard face (van Duivenvoorde 2015) but due to the condition of the site, none of these was observed. One treenail was wedged from the outboard in the upper works.

Recessed bolts

Evidence for two types of recessed bolts was seen in the assemblage in the form of concreted holes. The larger bolt had an average diameter of 40–42mm and an average head diameter of 120mm while the smaller bolts had an average diameter of 31mm and an average head diameter of 57mm. Examples of both can be seen on the knee **SCW1275** (Figure 4.54).

Most are driven from the outboard face; those showing compression on both the inboard and outboard surfaces can be classified as clinch bolts.

Reconstruction

Units

Witsen's ship measurements use the Amsterdam units and since there are 11 inches to the Amsterdam foot (283mm), this should be kept in mind

Figure 4.51. Marks seen in a rebate in frame SCW1226

Figure 4.52. Axe marks on SCW1226

Figure 4.53. Treenail with square wooden pins present

Figure 4.54. Recessed bolt on the outboard face of SCW1275

when trying to infer dimensions from his formulae. If the identification of the Swash Channel Wreck as the *Fame* of Hoorn is correct (see Chapter 8), the ship may not have been made in these units as the city of Hoorn, despite being only 30km away from Amsterdam, used a different measuring system with a foot which equalled 276mm (Hoving 2012, 37). To prevent confusion the main dimensions of the ship will be expressed in metric units.

Hull form

The only other 17th-century ship built in this style with the upperworks surviving that has been studied archaeologically is *Vasa*. However, the design of this vessel is slightly different as the main deck was turned into an enclosed upper gundeck, making the ship a three-decker and as such, it has a slightly different internal arrangement. Other records that can be compared to the archaeology on the Swash Channel Wreck include the reconstructions of Witsen's *Pinas* by Hoving (2012) and *Batavia* as well as contemporary ships' models and drawings. By comparing these sources to the archaeological remains of the Swash Channel Wreck a basic reconstruction and layout can be achieved (Figure 4.55). Figure 4.30 shows an isometric cross section of the hull.

Inferred dimensions

The exact length, beam and depth of the original ship represented by the Swash Channel Wreck is hard to predict from the hull remains as the midships section of the wreck site (Area Four) was not excavated. Articulated hull structure continued from Area One into Area Four, but a clear break can be seen in Area Three, where Area Two is believed to have detached from the main structure. Therefore, the dimensions and characteristics of this area cannot be established with certainty.

It was also noted that Area One was heavily scoured underneath, with a loss of over 1m of structure between 2004 and 2010. The longitudinal curvature of the hull in the three areas was also compromised as without the support of the ship structure and the water pressure to hold it all in place, the timbers would have sprung out to flatten on the seabed.

However, from the archaeology that does survive it has been possible to obtain some of the key measurements of the ship and use these to infer the others.

The furthest recorded articulated structure in the bow aft to the transom knee was *c* 40m, but as noted above this measurement provides only a guide to the length of the ship.

Witsen states that the ideal ship's beam should be a quarter of the ship's length and a tenth for the height

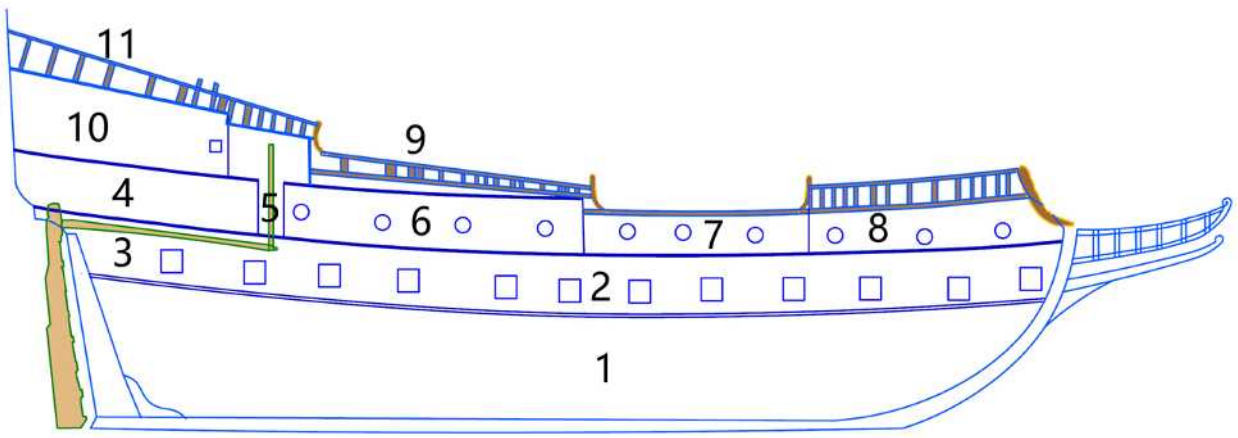


Figure 4.55. Reconstruction of the Swash Channel Wreck: (1) hold; (2) lower deck; (3) gun room; (4) Captain's cabin; (5) steering room; (6) half deck; (7) waist; (8) forecastle; (9) quarterdeck; (10) cabins; (11) poop deck

(Hoving 2012, 36) giving a length to beam ratio of 4:1, and a length to depth of 10:1, so with one measurement it may be possible to infer the ideal measurement for the others. However, it should be noted that not all ships stuck to this formula and it would be adjusted depending on the use and purpose of the ship. For example, *Batavia* was much deeper and narrower with a ratio of 4.4:1 and a length to depth of 8.3:1 (van Duivenvoorde 2015, 224).

The original depth of the ship hold can be inferred from the site plans, as although the floor of the ship is not present, a small section of the foot wale survives. The distance between this and the waterway of the lower deck is 3.4m. The rudder was sheathed for the first 4.1m, and as the ship was probably sheathed up to the lower deck waterway, this measurement possibly represents the depth from the lower deck to the bottom of the keel. Thus the top of the keel is somewhere between these measurements. The median distance between the two measurements gives a depth of 3.75m, so using the standard measurements this would give an overall length of 37.5m and a beam of 9.3m, close to the dimensions of the articulated remains on the site.

Another method of estimating the length of the ship is from the width of the rudder, with both Witsen and Van Yk setting out similar rules for the width of the rudder in relation to the length of the hull. Witsen sets a width of 4 inches for every 12 feet (100mm for every 3.6m) and Van Yk 3 inches for every 10 feet (75mm for every 30m) (Hoving 2012, 170).

The widest part of the Swash Channel Wreck rudder is 1094mm, giving a length of 36.9m by this formula, although it should be noted that the rudder is heavily degraded and a discrepancy of even a few millimetres will create a compound error using this method.

Two other approximate measurements for the ship can be obtained from the rudder: the distance from the shoe up to the tiller mortice (7.3m) provides the height of the ship from the bottom of the keel up to just below the top of the main deck at the stern, where the tiller would enter the ship to be controlled by the whipstaff. This gives a height to the main deck at the stern of 7.3m. From the sheathing on the rudder, a waterline at *c* 4.1m can be inferred, although it would likely have been sheathed above this line, probably to the lower deck scuppers.

These two formulae both suggest a ship of around 37m with a beam of 9.3m and depth of hold of 3.7m. This is close in length to Witsen's *Pinas* as drawn by Hoving (2012). The rudder also lines up from toe to tiller and the floor timbers and knees recovered fit comfortably in the hull model. There are, however, some slight differences on the height of the decks, upper works and number of gunports, but as Witsen himself states, his work is only a guideline, not a strict set of rules and shell-first style ships were usually built by eye (Hoving 2012).

Decks

At the midships in Area One a small section of thicker ceiling planking at the turn of the bilge, likely the foot wale, marks the lowest surviving section of the hold (Figure 4.56). Large hanging knees support the waterway of the lower deck demarcating the hold and as established above, it could have had a depth of 3.75m. Only a small section of the hold survives in the stern (Area Three) and there is no evidence of an orlop deck or any other subdivisions such as the magazine, gunners' store and bread room.

The lower deck can be inferred from the deck clamp for the main deck in the bow (Area One) and the waterways in the stern (Area Three). This had a height of *c* 2.1m or 7.4 Amsterdam feet, which is tall for the period, with *Batavia* having a clearance of only 1.486m, and the *Pinas* and *Vasa* a 1.7m clearance. This is closer in size to the deck height of a 'war yacht' (7ft; 2.1m) or 'merchant yacht also to be used in war' (6.5ft; 1.9m) as listed in the VOC 1653 charter (van Duivenvoorde 2015, 248–9)

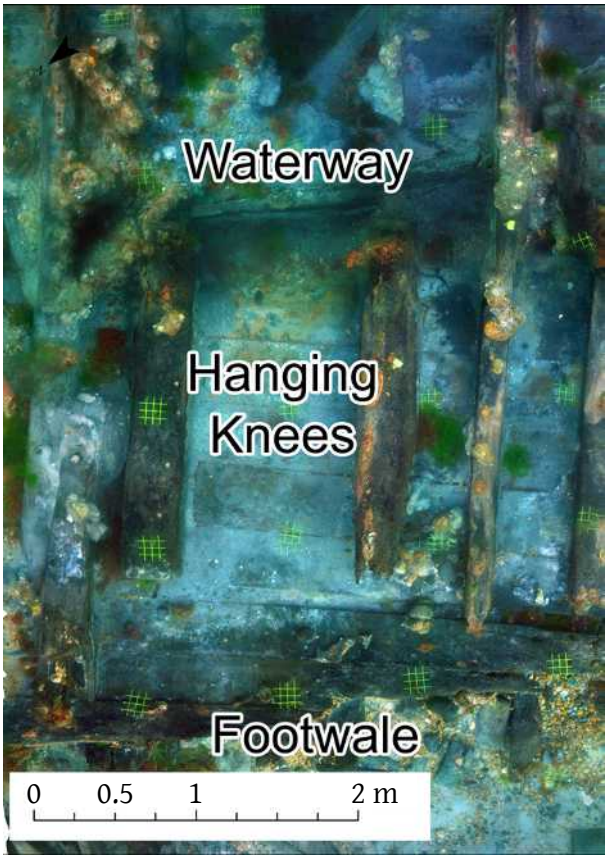


Figure 4.56. The hold at midships

suggesting that the vessel would have been capable of serving as a warship. At the aft of the lower deck would be the gunroom; a small softwood subdivision was noted on the transom knees in this area, suggesting that they used the knees as a shelf for storage (Figure 4.57).

On the main deck in Area One several circular gunports were cut into the surviving frames suggesting a forecastle, which may have had a weather deck. The length of the forecastle cannot be established but in the various contracts for ships of this period listed by Hoving (2012, 216–26) these are all around 8m long. Alternatively, the ship could have had an open deck in the bows.

Between the forecastle and the main mast lay the waist. This would have had sides up to the sheer rail, a height of *c* 1.4m. Laying directly behind the main mast is the enclosed half deck (Area Two), which contained the ship's galley. There is evidence on the foremost frame, **SCW1266** (Figure 4.58), of partitioning with a series of nail holes; this is corroborated by the original Wessex Archaeology reports from 2004 which noted the ceiling planks all ending on this frame (Figure 4.59).

Behind this lay the steering stand, with a knee rider marking the captain's cabin aft of this where various high-status artefacts such as the pewter flagons (**SCW889** and **897**), brass tap (**SCW965**), and magnifying glass (**SCW888**) were all found. The articulated hull structure only reached as far as the stern timber, but it is extremely likely that there would have been a counter stern aft of this.

Above the captain's cabin at the stern, the waterways were found *in situ,* marking the deck level of the upper cabins. The two smaller guns were located here, and a small, framed port. The waterway continues as far as the knee rider of the deck below where there is continuous ceiling up to the top of said rider (Figure 4.60). This is where the top whipstaff would have passed up through the quarterdeck; a gap in the ceiling occurs *c* 1m forward of this indicating where the waterway, and therefore deck, starts again. A step down in the length of the top timbers marks the start of the quarter deck which continued over the half deck to the midships, ending at the second triton carving.

The covering board above this step marks the start of the poop deck and was probably the original location for the first triton recovered in 2008. This continues aft for *c* 3m going over the top of the steering stand. There is a small step of 0.2m raising the height in the cabins to *c* 2.5m. This is as far as the archaeology survives but it is likely the deck continues into the counter. On *Vasa* and the reconstruction of *Batavia* an extra cabin is aft of here, used to keep chickens (Vos 1990).

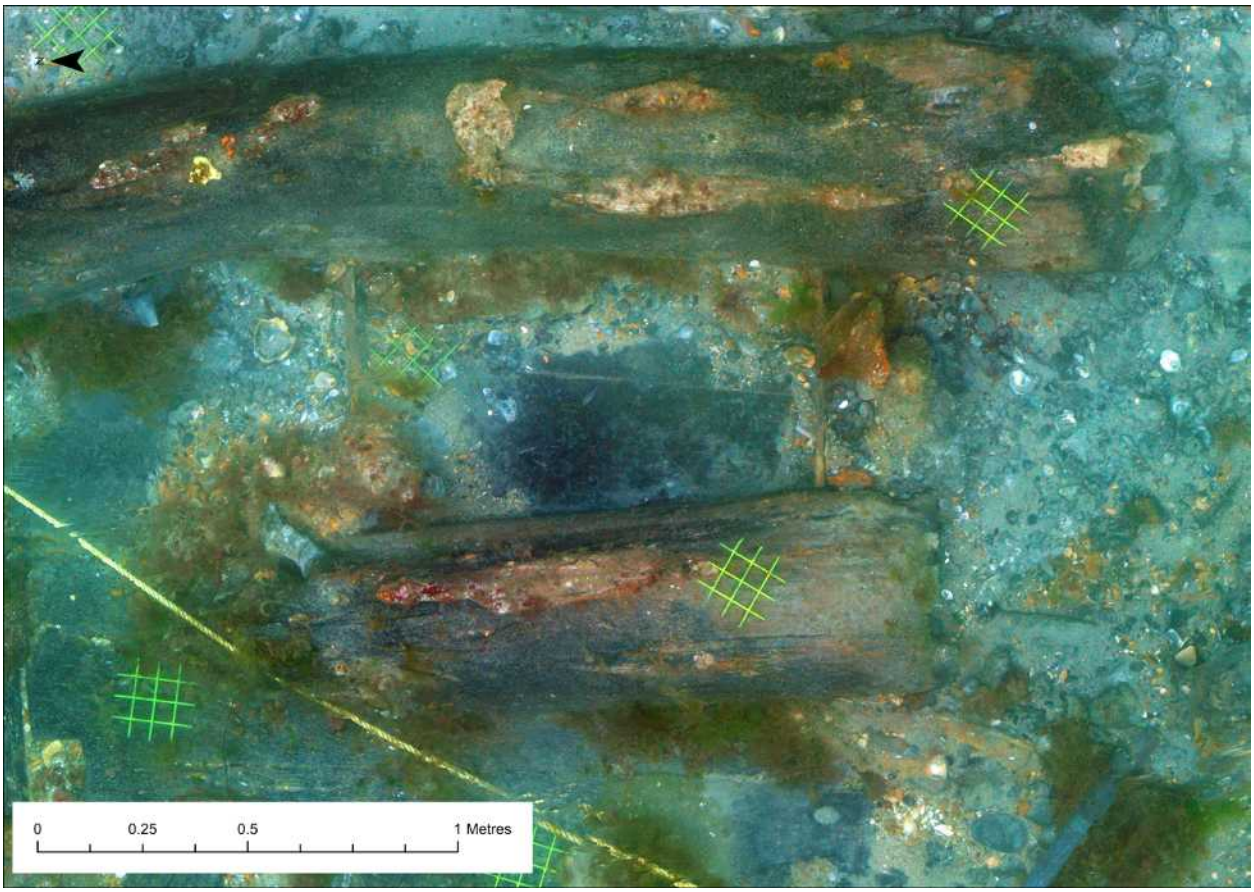


Figure 4.57. Shelves of the transom knees

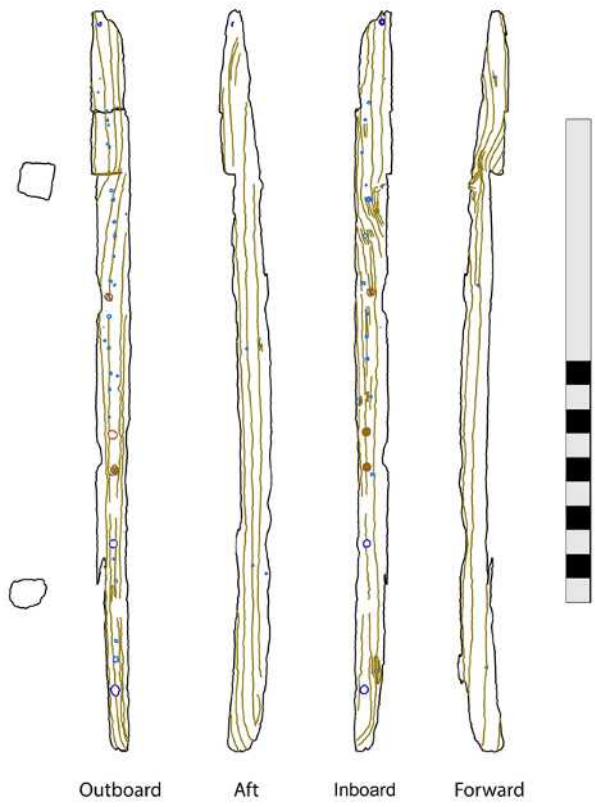


Figure 4.58. SCW1266 forward-most top timber of Area Two

Figure 4.59. Termination of the half deck in 2004 (Wessex Archaeology)

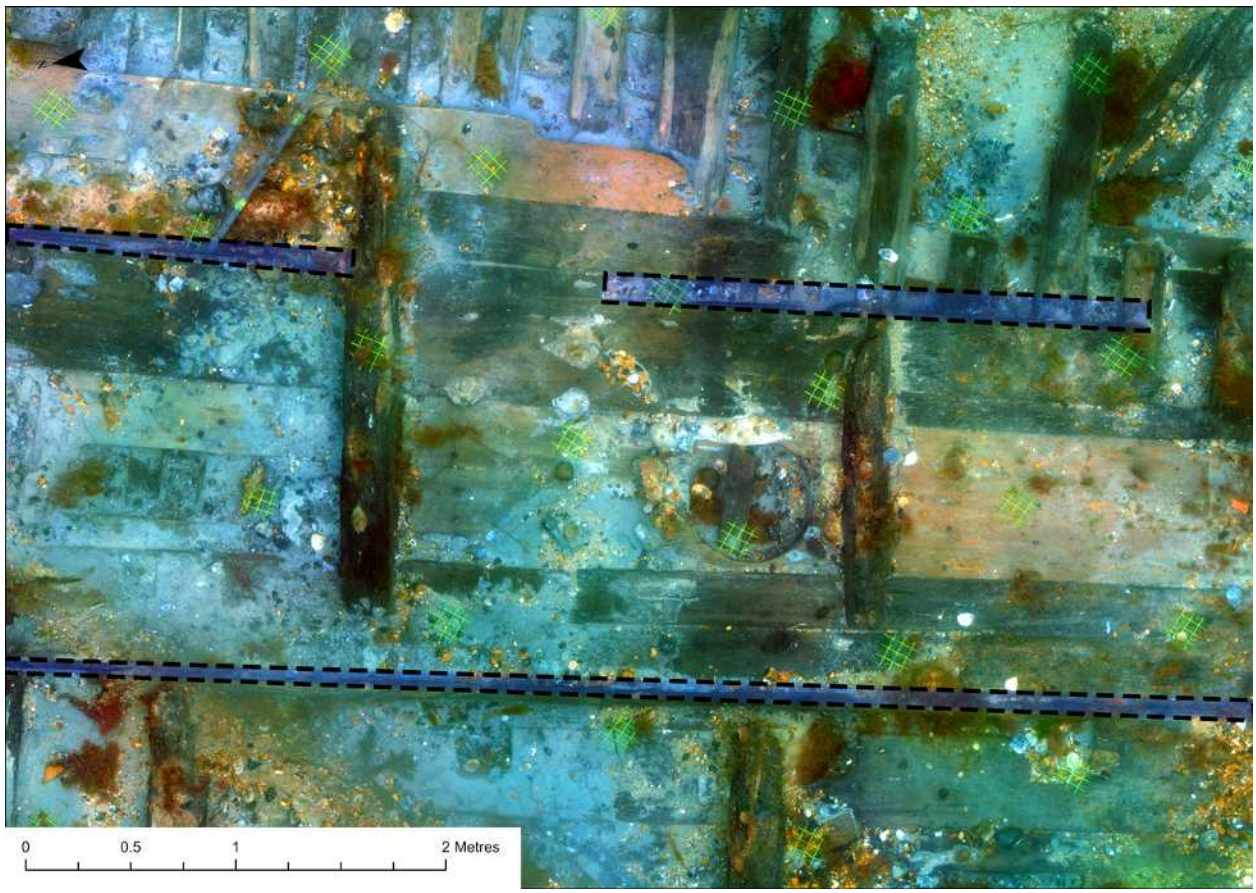


Figure 4.60. Waterways (highlighted in blue) on the main deck of Area Three showing where the steering stand would have been located

Chapter 5

The rigging assemblage

Introduction

The closest parallels to the Swash Channel Wreck in size, material culture and construction are the contemporary Dutch East Indiamen such as *Batavia*. These were three-masted vessels with square sails on the fore and main mast, and lateen on the mizzen. *Batavia* also had a 'mizzen topmast, main topmast, main topgallant, fore topmast, fore topgallant, spritsail, and sprit topsail with square sails' (van Duivenvoorde 2008, 7).

With the limited Swash Channel Wreck rigging assemblage that survives it is not possible to reconstruct a rigging plan, but the components can be examined and compared to other archaeological sites such as *Vasa*, 'the only relatively intact ship to allegedly have a 17th-century Dutch rig' (Howe 2011, 249), and *La Belle 1684* (Corder 2007), as well as historical sources such as Nicolaes Witsen (Hoving 2012, 282–3) and contemporary models.

The foremast chainplates are located between Areas One and Two along with associated rigging elements such as blocks, deadeyes and cordage. A concretion in the stern section marks where the mizzen mast chainplates are located trapped under the hull (Figure 5.1). In addition, the main mast chainplates are represented in Area Two.

Elements of rigging are unusual survivals on shipwreck sites as they are often swept away during the wrecking process or salvaged, so the survival here of both standing and running rigging, with rope still rove though blocks and deadeyes, is uncommon.

In the past, much cordage found on wrecks has tended to be ignored due to the difficulty in bringing it to the surface and subsequently analysing and conserving it (Sanders 2010). Cordage from the Swash Channel Wreck was examined and recorded by Des Pawson, Liz Pawson and Tom Cousins. The sail cloth (**SCW707**) was conserved by Marie Jordon of the Newport Medieval Ship Project.

Cordage

The cordage varies from a single yarn used as a whipping, through to part of a large cable. The material is thought to be mostly hemp (*Cannabis sativa*) based on pollen analysis (Gleba 2016). The state of the material varies in condition from reasonably solid and stable to totally broken-down fibres beyond recognition. In many instances the act of examination caused destruction of part, or the whole, of the sample.

Alongside the metric diameters of the cordage, Dutch measurements for the circumference of all the larger sizes of cordage will be used in this report: for example, 24mm diameter (3″ circumference). Until the advent of metrification in the 1970s, cordage had been measured in circumference, which was much easier than trying to measure the diameter of large material. This will allow contemporary publications with rope tables to be easily and directly consulted by researchers.

Small stuff (small cordage), generally below ¾ inch in circumference, will be given only in metric as these materials were, in the past, usually described by the number of yarns and/or weight per length.

It must be noted that rope is not an engineered material, so all measurements and specifications must be taken as a guide. Some materials varied along their length, while pushing and pulling samples would change their size; in a semi-decayed state care had to be taken when judging the size of the rope. Thus, it can be that rope given as 1″ or 1⅛″, or even 1½″, could be the same size. The fact that the material is waterlogged could also mean that it has swollen.

Due to the condition of the rope, wear patterns could not be identified. It had been hoped that the angle of lay of the rope could be recorded, together with the turn of the strand (how long one strand takes to make a complete turn), but because of the problem of pushing and pulling described above, this proved to be impractical in most cases. Counting yarns was difficult with very delicate samples, especially in the larger samples, so there could easily be a variation of a few yarns in these measurements.

Davis (1711, 39) points out that the number of yarns won't necessarily be consistent with the circumference of the rope:

> For Hawser laid ropes they will be the same bigness when made as measures in the Yarn. So if you will make a Rope of 3 inches, take as many yarns as you think fit to make it; then measure it: if it measures to big, take some out; but if too little, put in more.

Figure 5.1. Distribution of the rigging elements recovered from the wreck

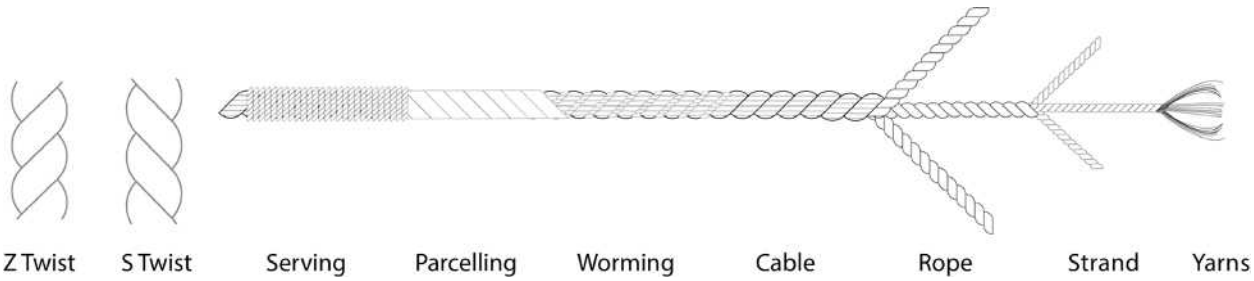


Figure 5.2. Terminology of rope

Even with modern machine-spun fibres, there can be a variation from one example to another of a standard-size rope, even from the same manufacturer.

Where small stuff has been used as servings, seizings or whippings, the actual process tends to flatten the round yarns, resulting in a slightly larger diameter than the true size.

Terminology (Figure 5.2)

Serving is the wrapping of rope with another rope and *parcelling* is wrapping using canvas; this would be done to ropes which were 'in danger of fretting against any part of the ship, masts, or yards' such as the shrouds (Mainwaring 1644, 220).

> Worming is the laying of a small rope or line between the strands of a cable or hawser. The use of which is to help to strengthen the cable or rope to which it is used. The Flemings use this to new ropes; others to old ropes that are almost decayed.
>
> (Mainwaring 1644, 258)

Cable or Cablet Usually three but occasionally four ropes twisted together.

Rope Usually three-strand (known as hawser), but sometimes four strands twisted together around a heart.

Strand Consists of any number of yarns twisted together.

Yarns Many fine fibres spun together.

S and Z indicate the direction of twist in the unit of cordage. These would alternate when building up the rope: for example, three Z-twist hawser would be combined to make an S-twist cable.

Splice is a semi-permanent method of joining two ropes or two parts of the same rope by partly untwisting and then interweaving or tucking their strands.

As most of the material recovered from the Swash Channel Wreck is rope of three-strand, Z-laid construction, known as a 'hawser', it will be referred to as 'rope' and the three-strand, Z-laid description will not be repeated. If it has some special feature or construction this will be described in full.

Blocks and tackle

A block is an object containing one or more sheaves inside a shell (Figure 5.3). These were produced in various shapes and sizes but only standard elliptical blocks were recovered from the Swash Channel Wreck. One or more blocks could be combined with a rope to create a tackle. The rope would be roved through the block across the sheaves, giving a mechanical advantage when lifting objects or controlling force, such as the strain put on the ship's rigging. On sailing ships, blocks are used for many purposes, but the primary use is as part of the vessel's running rigging: i.e. that rigging used for raising, lowering and controlling the sails. The use of block and tackle is not limited to the rigging – some blocks recovered from the site related to the moving of cargo and guns.

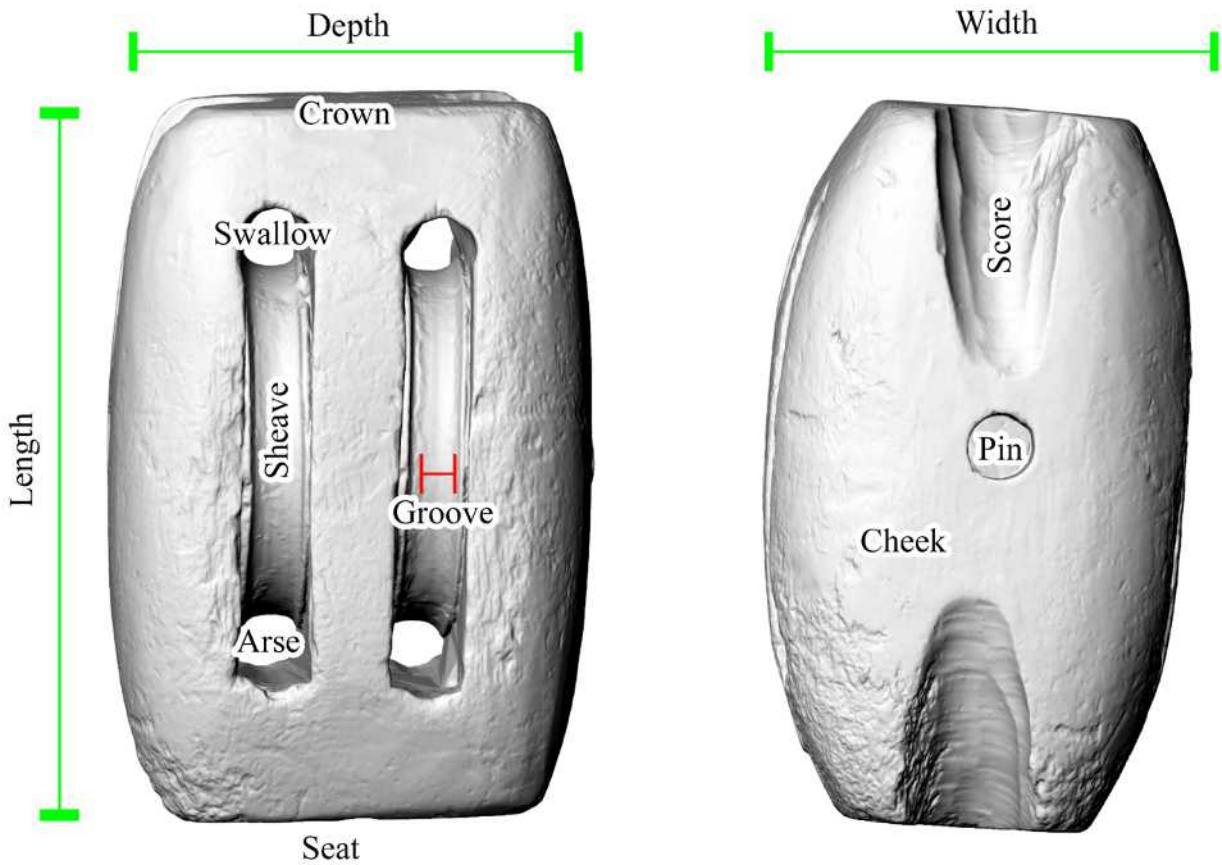
The rigging blocks from the Swash Channel Wreck are all similar in form, being elliptical with side-by-side sheaves. However, they do vary in size, ranging from small, single-sheave blocks *c* 100mm long, some of which formed part of a tackle, to a large, triple-sheave block 450mm in length.

SCW50

SCW50 is a large, oval-shaped single-sheave block measuring approximately 470mm 315mm 145mm thick (Figure 5.4). Similar blocks were found on *Vasa* and described as '(single-sheave) sub-type 4. Broad, flat, lenticular blocks ... a specialised and somewhat delicate sub-type' (Howe 2011, 115); these were thought to be part of *Vasa*'s mast tackles (Stolt and Hocker 1981), with a swallow of *c* 50mm. Howe (2011, 234) points out 'there are far fewer of these blocks than would be expected if they were from the mast tackles. Yet, no other clear use for such specialised blocks can be determined.'

Possible winding tackle SCW51 and SCW588

SCW51, a double block (containing two sheaves) and **SCW588**, a triple block, are two large elm (*Ulmus*



Arse: The lower gap between the shell and the sheave
Cheek: Side of the block
Crown: Top of the block
Groove: The cut in the sheave to grip the rope
Pin: The central axis of the block
Score: The cut in the shell for the strop
Seat: Bottom of the block
Sheave: The wheel
Shell: Outer casing of teh block
Swallow: The part of the block the rope is reaved through

Figure 5.3. Terminology of blocks

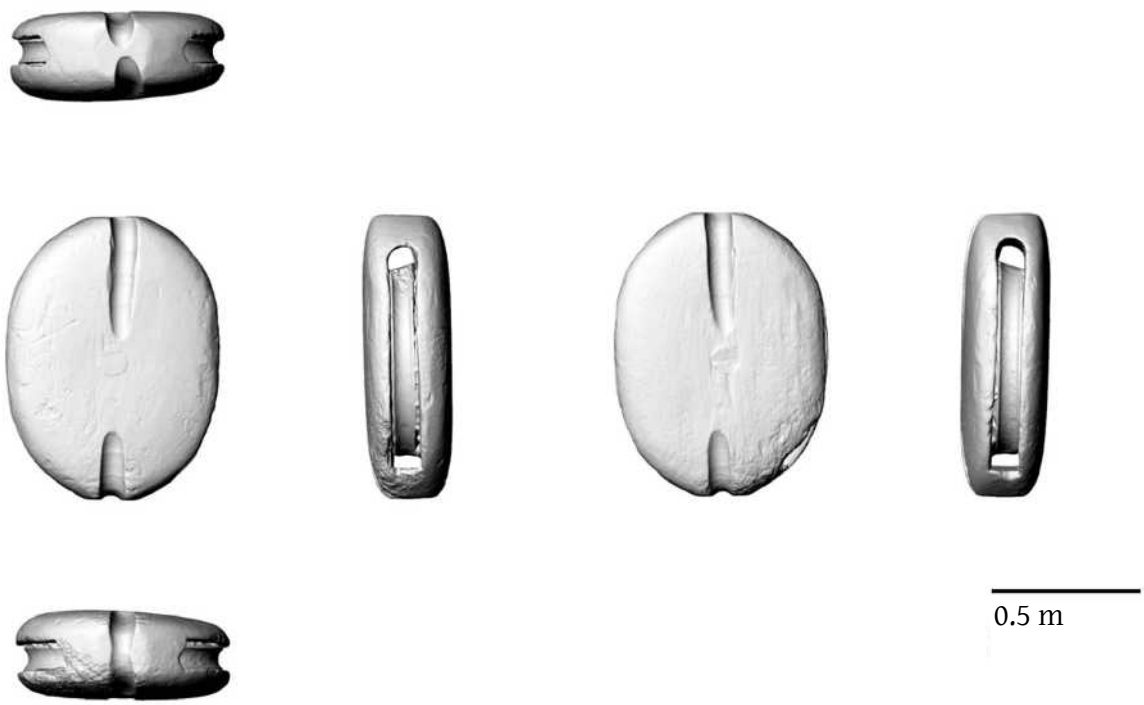


Figure 5.4. SCW50 large single sheave block

spp.) blocks of the same size and style both measuring *c* 450mm in length. Both contain 220mm diameter ash (*Fraxinus excelsior* L.) sheaves (Figure 5.5). A pair of similar blocks were recovered from *Vasa* (Fnr 12885 and 12884) and have been interpreted as part of the winding tackle (Howe 2011, 229). The top triple block would be attached to a pennant from the main masthead with a guy to the foremast (Anderson 1974, 106). The tackle is rigged in a double luff of gyn to the lower block giving a 5:1 mechanical advantage and allowing the loading of heavy objects such as the main guns (Figure 5.6)

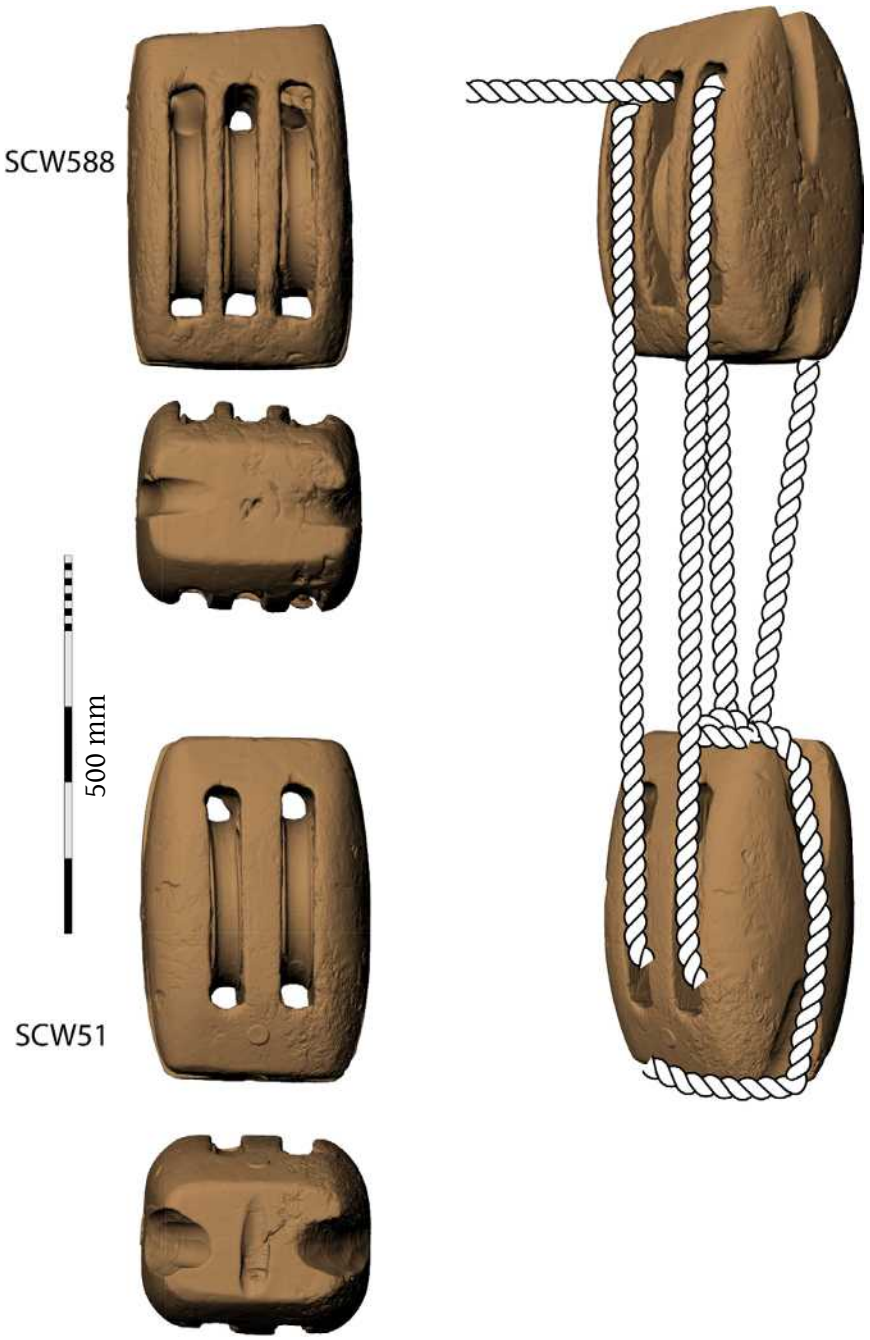


Figure 5.5. SCW51 and 588 in an example of a gyn tackle

Double-sheave block SCW541

SCW541 is an elliptical block with two sheaves side by side in the same plane with an approximate shell length of 260mm. Double blocks such as these would have had many uses on a vessel. Given the location of the block on the wreck site it is likely that this is part of the gun tackle and would have been paired with a similar-sized single block such as **SCW806.**

Single sheave Type 1

Single-sheave blocks are one of the most common types found on wrecks as they can be used in a 'variety of capacities' (Howe 2011, 103).

SCW806 has a shell length of *c* 270mm with a width of 180mm. It was found complete with a small section of its strop containing a decayed splice (**SCW807**).

SCW187 consisted of the cheek of a pulley block complete with the pin and sheave. **SCW540** consisted of a pulley cheek. During recording they proved to be a perfect match and formed one single-sheave block with an elliptical shell measuring *c* 140mm 110mm (Figure 5.7).

SCW926 (Figure 5.8) is similar in form and size to **SCW187**, with a length of 150mm and a width of 110mm. This block was found complete with its strop. The strop consists of an 18mm diameter (2¼″ circumference) rope, seized with a throat seizing and a round seizing; the short end is whipped. This rope is three-strand, Z-laid, and each strand has six yarns. The throat seizing and the round seizing are both made with a two-ply, S-laid line, about 2.5mm in diameter; the plain whipping is made with a single Z-twist yarn. There was also a piece of the 10–12mm diameter (1¼ – 1½″ circumference) rope reeved through the block.

At the base of the block there is a smaller rope (**SCW929**), 10–12mm diameter (1¼ – 1½″ circumference), eye-spliced with two tucks round the larger rope to create a becket (part of the tackle spliced around the strop); this

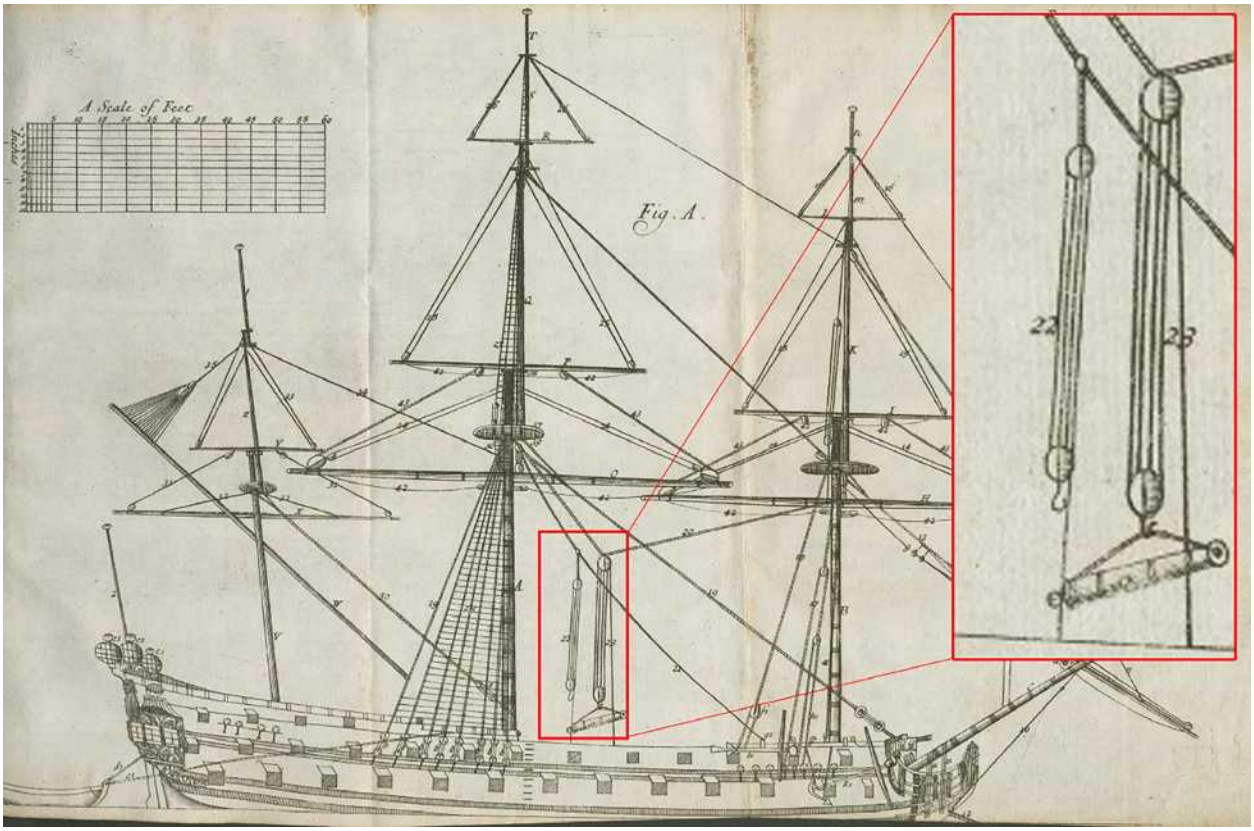


Figure 5.6. Winding tackle shown on *Sutherland* (1711) for moving the guns

tail measured 590mm long but would originally have been longer and part of the same rope reeved through the block.

This would probably have formed part of tackle where the 10–12mm line becketed to the base of the strop ran to a second block, either a double or a single, and back through in a gun-tackle purchase if single or a luff if double. The larger rope forming the strop and tail could have been tied-off to a fixed point or alternatively reeved through another block forming a runner and tackle (Figure 5.9). This type of tackle effectively adds mechanical advantage to a whip and is seen on a few places aboard a ship including on a larger scale the

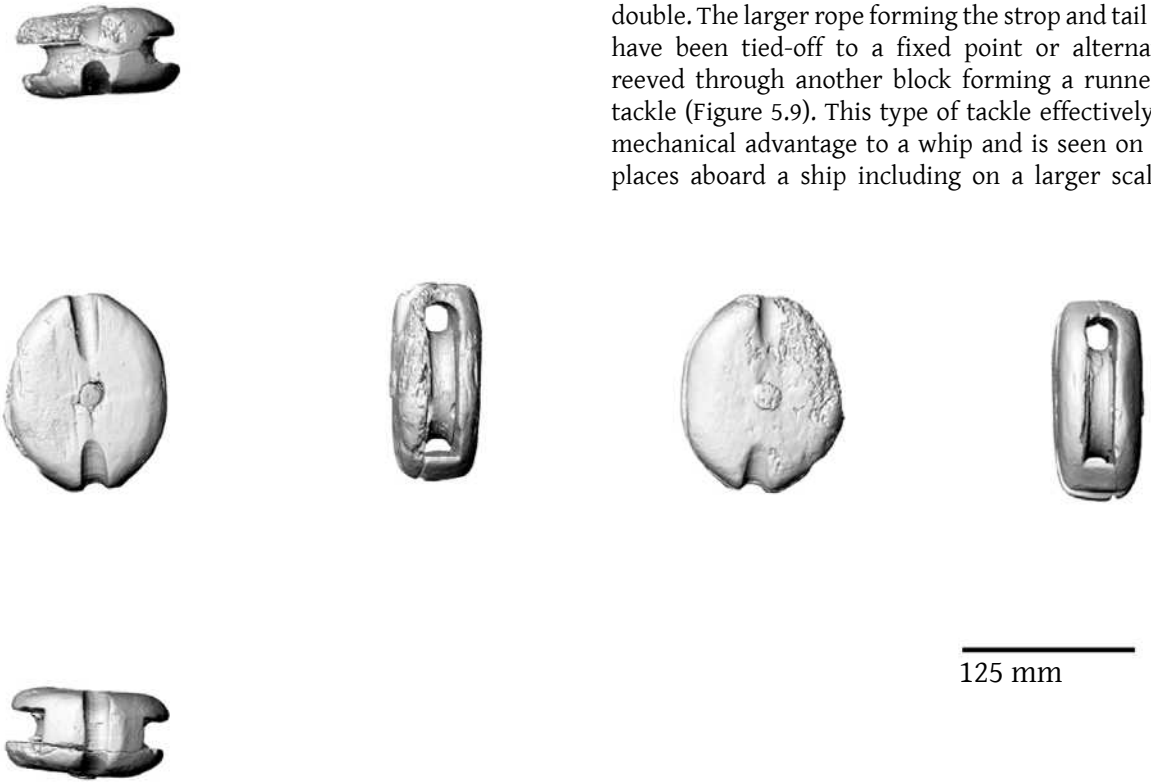


Figure 5.7. SCW187 and 540 reconstructed into a complete block

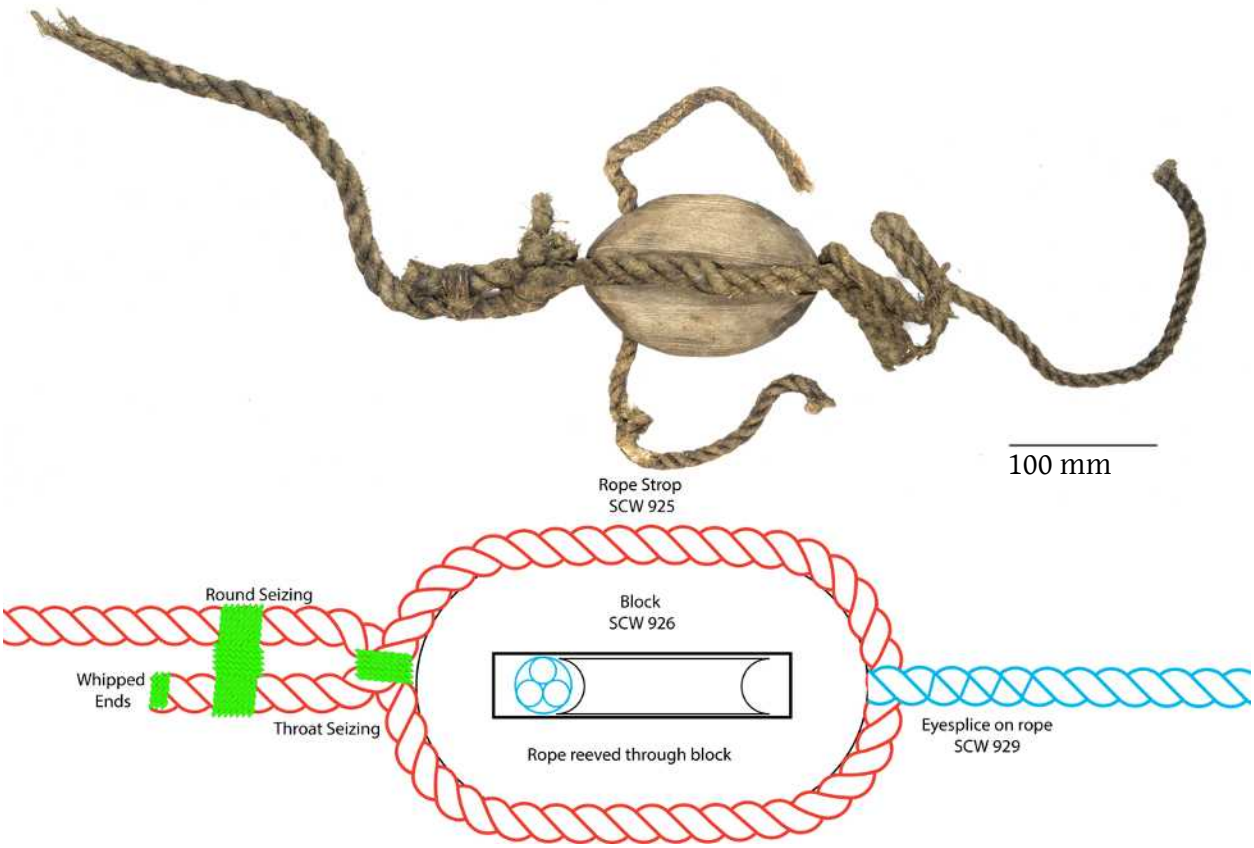


Figure 5.8. SCW926 with associated cordage alongside a schematic diagram of the rigging

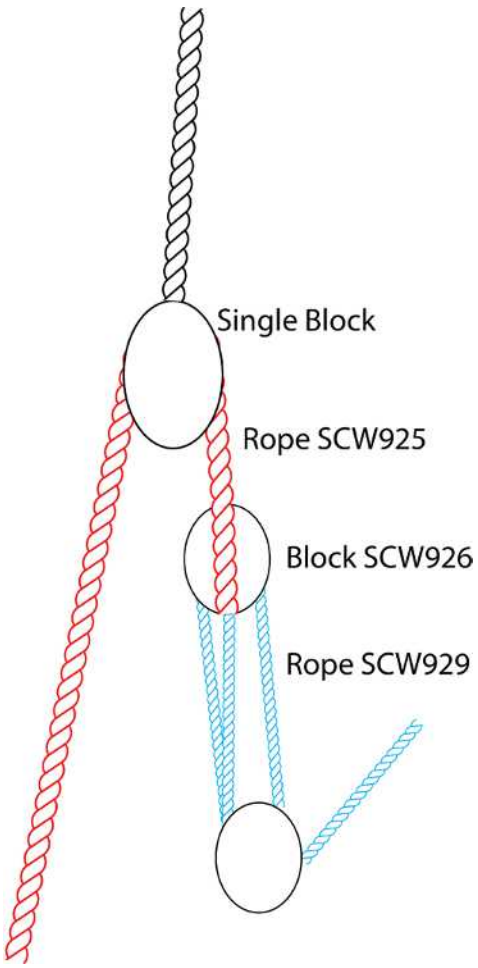


Figure 5.9. Runner and tackle

tensioning of the back stays (Longridge 1977, 232). This type of rig is also seen on the tackle for opening the gunports although this is not seen on *Vasa* and is possibly a later development.

Small c 100mm single-sheave blocks

Five blocks recovered from the site are small, single-sheave blocks with a length of *c* 100mm. Some of these were found complete with ropes and formed tackle.

SCW435 was found complete with a strop, made from 10–12mm diameter (1¼–1½″ circumference) rope, joined with a short splice consisting of just one tuck each way (Figure 5.10). (Standard practice today is normally three, but occasionally two. However, Ashley (1944) states that this is often used on the strops of single blocks, thicker blocks requiring more tucks.) The strop was seized to form a soft eye, but the condition was such that it was not possible to determine the exact material used; there was evidence of frapping turns as well as basic wrapping turns.

SCW927 has a partially cracked shell, with a *c* 16mm diameter (2″ circumference) eye-spliced strop with three tucks and a long tail. In addition, a 16mm rope was found reeved through the block (Figure 5.11). The long tail and lack of a becket suggests that this block would have formed a type of whip tackle or be connected to a series of other blocks such as a brace. The small size of this block points to light use only.

Figure 5.10. SCW435 next to its strop

Figure 5.11. Block SCW927 with eye-spliced strop

SCW918 is a rope and tackle formed from three of the small single-sheave blocks (**SCW922, 923 and 924)** and connected by rope (Figure 5.12).

SCW922 had a strop, spliced with minimum tucks, like **SCW43;** one end shows four yarns, but it is possible that one yarn has been lost. The strop is seized forming a soft eye. A single rope was reeved through **SCW922** and **SCW923**.

SCW923 and **SCW924** were seized into the bights by a double span consisting of long piece of three-strand, Z-laid rope. Each strand appears to have five yarns forming a strop round each block and was spliced using a short splice with minimum tucks (probably just one tuck each way, as with **SCW435** and **SCW922**). This continuous strop, or span, was *c* 880mm overall between the blocks; there was a short piece of rope reeved through **SCW924**, suggesting it may well be connected to another block in the same way that **SCW922** and **SCW923** were connected.

The continuous strop or double span would probably have been attached to an object such as a bolster

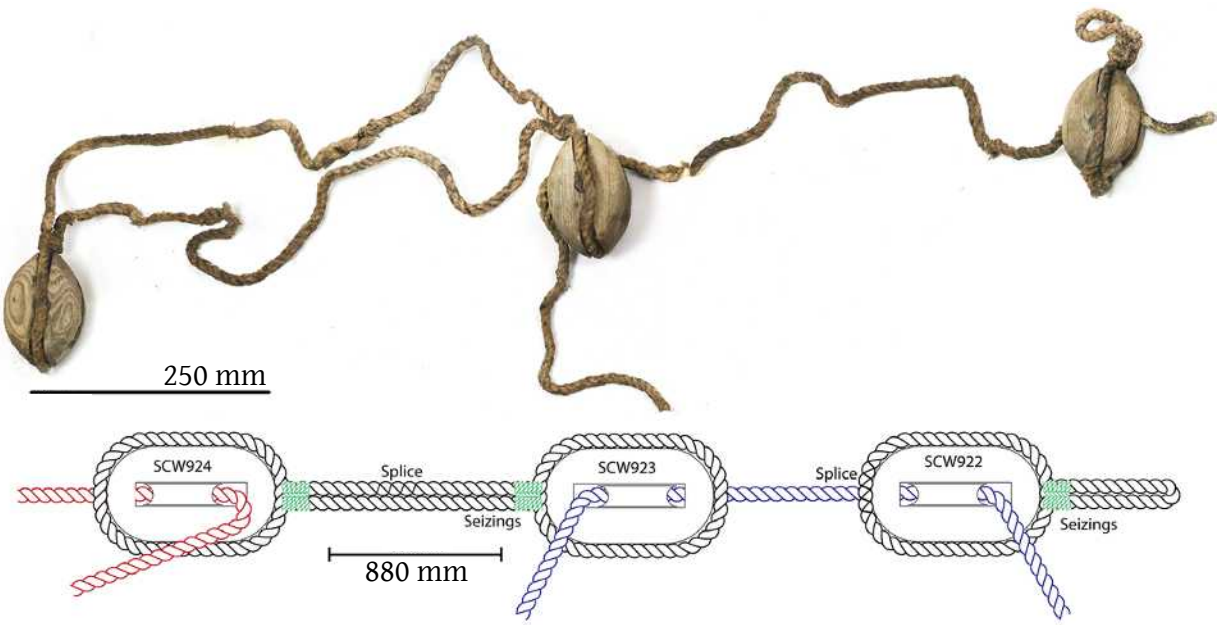


Figure 5.12. Tackle SCW918 alongside a schematic view

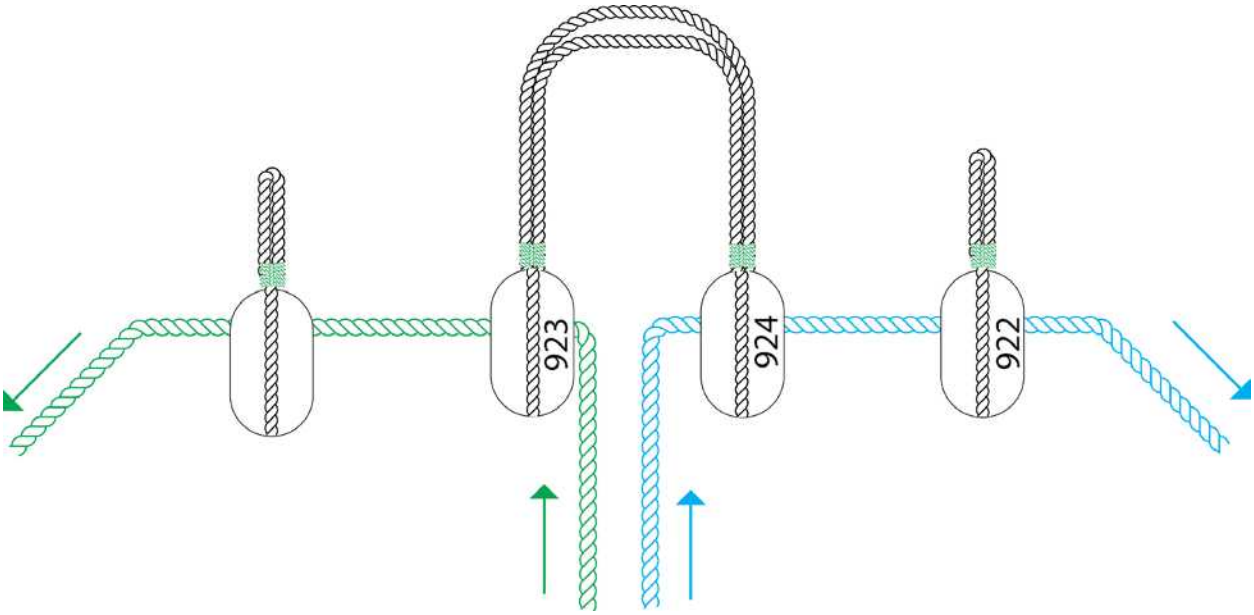


Figure 5.13. Possible reconstruction of the tackle SCW918

hanging evenly on either side. The lack of beckets on the blocks shows that they could only have been rigged in a form of whip tackle suggesting that **SCW922** acted as a guide in a double whip tackle. It is likely that a fourth block such as **SCW435** would have been present, mirroring **SCW922; t**his would allow an object to be pulled up at two points evenly either side of a structure such as a mast, effectively giving a 4:1 mechanical advantage (Figure 5.13). This type of rig is commonly seen on the halyards to haul the yard up the mast but on a much larger scale.

Due to the small size of this tackle in comparison to the ship, it could be hypothesised that it belongs to the rig of the ship's boat.

Standing rigging

Standing rigging consists of the fixed ropes and associated deadeyes and hardware which support the masts of the vessel. Several elements of standing rigging were recovered from the Swash Channel Wreck, including sections of the shrouds: the lines which support the mast from side to side, from the chainplates to the upper deadeyes, and parts of the shroud lines themselves (Figure 5.14).

The shrouds and stays would have been served to protect them from chafing and moisture. Witsen (Hoving 2012, 117) states

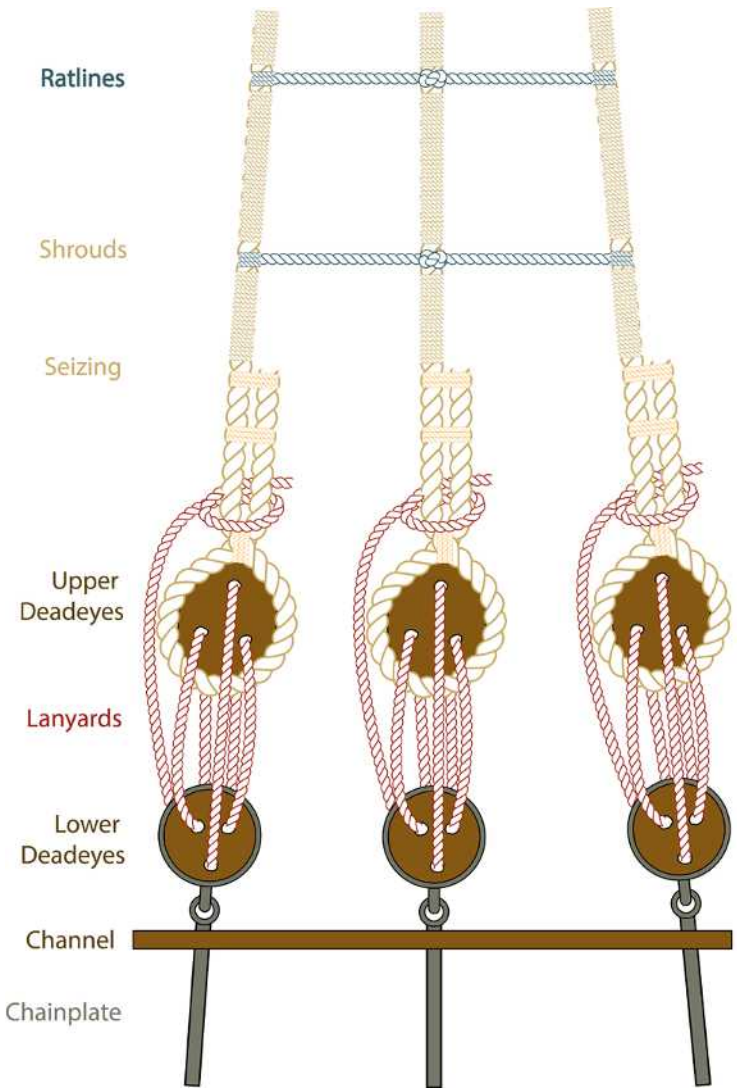


Figure 5.14. Schematic diagram of the shrouds based on the standing rigging recovered from the wreck

that before serving, 'the rope had to be wormed and parcelled'; no evidence of parcelling can be seen on any of the Swash Channel Wreck samples but potential stay or shroud **SCW888** had evidence of both worming and serving.

The shrouds would have been rigged in pairs with the middle of the shroud seized to the mast head whereas the stays would be looped over and spliced onto themselves, forming a noose which was prevented from fully closing by a mouse.

Chainplates

A series of large concretions between Areas One and Two were interpreted as chainplates but were left *in situ* (Figure 5.15). Long concretions were also present on the site where the fore and mizzen chainplates would have bolted through the hull, suggesting that some of the remaining plates could still be *in situ,* trapped under the hull.

In Area Two, a row of 40mm (1½″) diameter bolts were present on the strake just below the circular gunport (**SCW1275**). These bolts would have fastened though the framing and internal ceiling planking suggesting that this represents the area where the channel would have been bolted onto the hull, with the chainplates bolting further down on the main section of the wreck. There are larger bolt holes on one of the filling strakes below but not directly inline. This would place the lower deadeyes level with the circular gunports on the main deck, as seen on *Vasa* and other contemporary depictions and models.

The most intact and exposed chainplate on the site (Figure 5.15) was *c* 1.5m long from the end to the base of the circular strap, which had an external diameter of *c* 0.75m. As these measurements were taken from the concretion they provide only a rough idea as to the size of the original object. A second chainplate appeared to still be *in situ*, corresponding with the backing plate concretion within the hull.

Deadeyes

A deadeye is a wooden block, usually round or oval shaped, with three holes piercing its face and a grooved outer edge to fit either a rope strop or iron strap. The lower deadeye would be attached to the hull via the chainplates and a lanyard would then be run through the holes in the deadeye to a corresponding deadeye stropped to the shrouds, creating purchase and allowing them to be adjusted as part of the standing rigging.

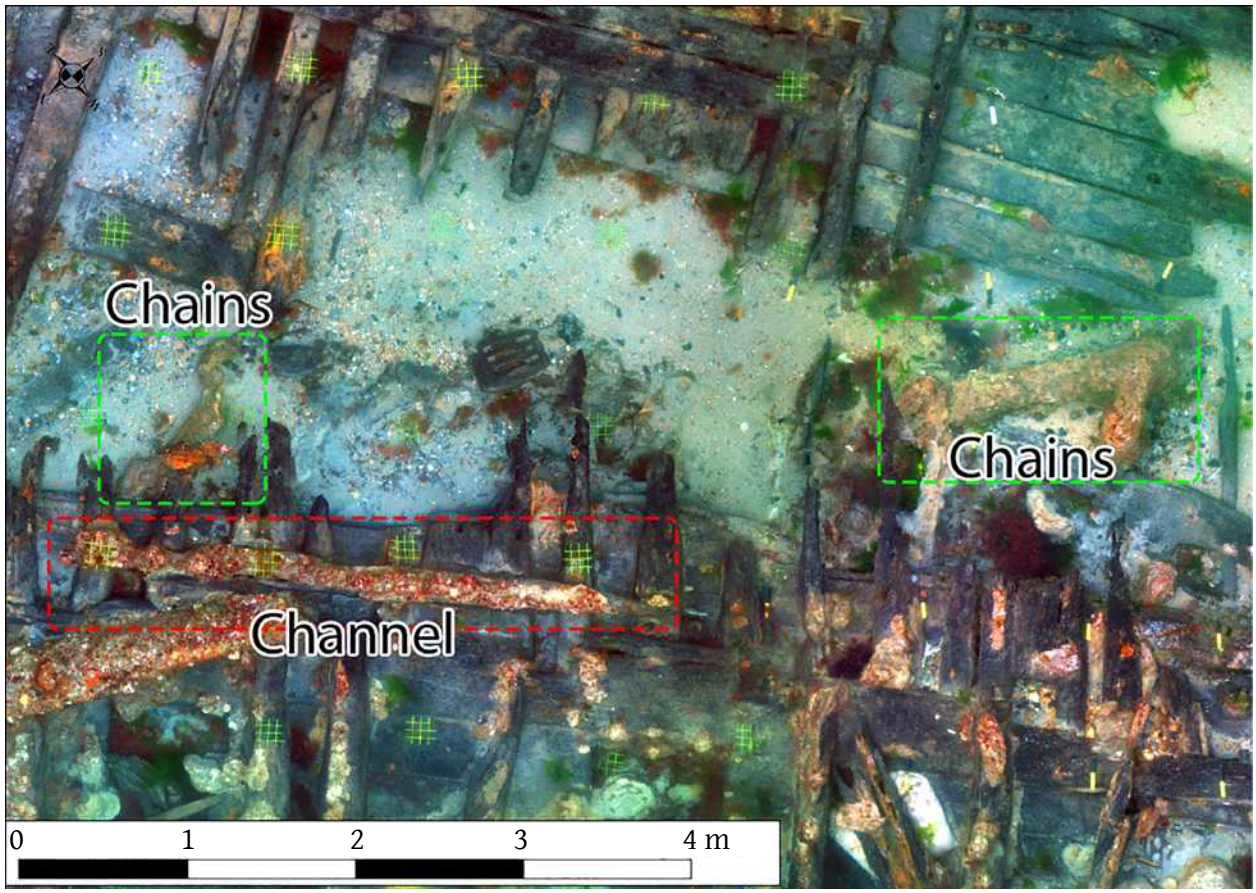


Figure 5.15. Chainplates in the bow

Figure 5.16. Deadeyes recovered from the wreck

Nine deadeyes (Figure 5.16) were recovered from the site; these were cleaned and laser scanned. All the deadeyes have three holes for the lanyards: seven are of a similar size but vary slightly in shape; one is a similar shape but much smaller; and the final one is circular with iron strapping. All the deadeyes apart from **SCW512**, which is circular, are pear-shaped with a flat base, flat-faced and have a vertical wood grain. They sit somewhere in shape between the pear-shaped vertical grain deadeyes found on various wrecks of the late 16th/ early 17th century and the more rounded horizontal-grained deadeyes found on *Vasa* (1628), although some of the smaller examples from the *Vasa* are of a similar style to those of the Swash Channel Wreck (Tsai 2022).

Most of the deadeyes measure *c* 370mm 300mm and are thought to be from the shrouds of the foremast. A ship the size of the Swash Channel Wreck would have eight deadeyes on each side on the main mast, seven on the fore, and four on the mizzen (Hoving 2012, 149). As the seven large oval deadeyes were all recovered from the area between Areas One and Two it could be that these are the upper deadeyes from the port shrouds of the foremast. All these deadeyes were made from oak blocks except for **SCW649** and **SCW658** which were made from beech (*Fagus sylvatica* L.).

SCW512 is the only circular deadeye found on the site. It was found near the fore chainplates surrounded by concretion which contains its iron strapping. This suggests that **SCW512** is one of the lower deadeyes attached to the chains. The grain on **SCW512** runs horizontally across the deadeye rather than vertically as seen on the other deadeyes from the site but like most of the deadeyes recovered from *Vasa* (Tsai 2022).

SCW648 is much smaller than the other deadeyes in the assemblage and was found just forward of Area Two; it is possible that this was used on the smaller shrouds or stays of the bowsprit or from the topmasts. Alternatively, the deadeye could have been from the rigging of a smaller ship's boat.

Shroud ropes

The lower end of the shroud would be looped through the upper deadeye, forming a strop. One of these was recovered from the wreck complete with a tied-off lanyard (**SCW667**). The shroud line was 64mm in diameter (8″ circumference) with a throat seizing in what appears to be 8mm diameter (1″ circumference), with three yarns in each strand (Figure 5.17). The lanyard was composed of 34mm diameter (4¼″ circumference) rope and was made off around the seizing on the stay.

Several pieces of cordage have been interpreted as belonging to the shrouds or the stays. These lines were approximately 52–58mm diameter (6½–7¼″ circumference) which is thinner than the strop for the deadeye, but they may have been compressed by their serving, giving the appearance of a thinner rope.

SCW520 consists of three small sections of serving 56–58mm diameter (7–7¼″ circumference), with *c* 75 yarns to a strand. The material used for serving is S-laid, three-strand stuff, about 4–5mm diameter, with each strand a single Z-laid yarn.

SCW666 is two sections of 56mm diameter (7″ circumference) Z-laid hawser; each strand has *c* 69 quite coarse yarns. Both pieces have the remains of serving in 5–6mm diameter, S-laid, three-strand stuff, the strands being single yarn, Z-laid. One piece, 460mm long, has part of a built-up 'mouse' and another has evidence of ratlines, in the form of a clove hitch tied in Z-laid rope, 12mm diameter (*c* 1½″ circumference). There appears

Figure 5.17. Deadeye strop SCW667

to be a break in the serving where the clove hitch is tied which would prevent it from slipping down the line.

SCW794 is a Z-laid piece of 48mm diameter (6″ circumference) rope, the strands being S-laid, from Z-laid yarns, which is complete with worming and serving. The serving has been applied against the lay (of the rope) i.e. in an S direction. There was no canvas parcelling at all. The material used for serving is 5–6mm diameter, S-laid, three- strand stuff, with the strands a single yarn, Z-laid. The worming is approximately 8mm diameter, Z-laid, three-strand stuff, each strand S-laid, consisting of three Z-laid yarns. Whilst the sample may well have been tarred, there is no excessive tar or grease. As **SCW794** is unlikely to be part of the same shroud as the other artefacts recovered, this line may have been from another part of the rigging, a stay or alternatively each shroud was not produced to an exact standard.

Ratlines

Ratlines are ropes that would have been tied to the shrouds to form a ladder to allow the sailors to get aloft (see Figure 5.14). These would be eye-spliced and lashed to the outer shrouds and tied with clove hitches on the middle shrouds.

Two artefacts show potential evidence of ratlines. **SCW666,** which had a clove hitch as mentioned above, and **SCW534,** where the remains of lashing or seizings made from a single yarn, about 3.5mm in diameter, were found. This practice was not common until the 18th century and is quite rare in 17th-century ships, where it is thought that they were simply tied onto the shrouds (Anderson 1974).

Mouse

A mouse is a build-up on a line to increase its diameter, preventing loops from sliding down. Falconer (1780, 202) describes thus:

> Mouse; a sort of knob, usually in the shape of a pear, wrought on the outside of a rope by means of spun-yarn, parcelling ... It is used to confine some other securely to the former, prevent it from sliding along its surface. These mouses are particularly used on the stays of the lower mast, to prevent the eye from slipping up the mast, a circumstance which would render it extremely difficult to remove the stay from the masthead, when necessary.

Two examples of 'mouses' have been found in the cordage assemblage. These are on **SCW221** and **SCW666** (Figure 5.18) and have been interpreted as part of stays although as mentioned above, there is also evidence that **SCW666** may be a shroud.

SCW221 is a Z-laid hawser approximately 52mm diameter (6½″ circumference). The mouse is in very poor condition but would have been *c* 12″ in circumference when complete. The poor condition of the mouse allowed its composition to be ascertained: a possible layer of serving using a 4–5mm stuff, followed by a few layers of some heavier small stuff that on investigation was found to be a three-strand sennit or

Figure 5.18. Mouse made up on SCW666

Figure 5.19. Sail cloth stitched to the boltrope

plait, each strand made from three yarns; the whole lot was then served over with a three-ply, S-laid material, *c* 4mm diameter. The 3 3 yarn sennit was about 20mm wide. There are two slightly differing ways in which such a sennit can be laid up (it is a matter of how the bundle of three yarns is twisted) but the delicate nature of the semi-decayed stuff made it impossible to confirm in this instance.

Mainwaring (1644, 220) explains a sennit thus:

> Sennit is a line or string made of rope yarn (commonly 3, 6, or 9, which are divided in three parts and plaited one over the other as they plait horses' manes)

This sennit would have been made up from yarns drawn from part-worn cables or ropes known as 'junk'.

Sailcloth

A large mass of sailcloth (**SCW707**) was recovered from the site in the area to the west of the stern. This consisted of hundreds of fragments of extremely degraded cloth of which only a few large fragments survive. Several pieces of the cloth were still attached to the cordage.

The cloth was made from untwisted plant-based fibres, most likely hemp (*Cannabis sativa*), that lie flat and are on average 0.5mm wide. The fabric is of a tabby weave, with several layers of thin cloth laminated together to make the sailcloth. Only the weave of the topmost layer is visible in the laminated fragments. The set is approximately 10 strands/cm but is noticeably looser in some areas.

The sailcloth appears to have been woven into strips which are sewn together with lapped seams and an angled stitch made from a thicker, darker brown thread. The seams do not go all the way through the laminated layers, implying that lamination occurred at some point after the strips were sewn together.

Boltropes

Two sizes of three-strand Z-laid hawser boltropes were recovered from **SCW707**: 16mm diameter (2″ circumference) consisting of seven yarns and 8mm diameter (1″ circumference) consisting of four yarns, both with a lay of *c* 30°. They are sewn to the sail between the strands, pulling the sailcloth into the cutline (Figure 5.19). Back stitches have also been observed on some of the surviving lines and where the cringles splice to the boltropes (Figure 5.20).

The 2″ rope has been provisionally identified as the leech-rope, with several cringles spliced along the lengths and secured by two tucks into the rope; the best surviving example is present on **SCW989** which contains a complete cringle at one end and a partial splice at the other, approximately 90cm (3ft) distance from each other (Figure 5.21).

The thinner 1″ rope is thought to be the head rope, which would take less strain than the foot and leech ropes because of the way this part of the sail is attached to the yard (Bartoš and Sanders 2012). Running parallel to the 1″ line is a row of small stuff which is looped and stitched into the tabling to create the robands, which are spaced approximately 210mm apart (Figure 5.22).

Figure 5.20. Front and back stitches on the cringle

Figure 5.21. SCW989 cringle spliced into the leech-rope

Figure 5.22. 1-inch rope and Roband stitched into the tabling

The same set up and similar dimensions can be seen in the narrower of *Vasa's* sails (Bengtsson 1975)

Miscellaneous rigging

Cleats

Two cleats (devices for securing a rope) were found in the stern of the wreck (**SCW708 and 754**). Both are wooden, of similar dimensions and of classic horn style (Figure 5.23).

SCW708 still had two associated pieces of rope, one 630mm long, one 700mm long. Both were approximately 14mm diameter (1¾″ circumference) and the strands were S-laid, from five Z-laid yarns. This is a similar-size rope to the lines reeved through the small blocks, suggesting these cleats formed part of a tackle.

Hanks

Three partial rope hanks have been found on the Swash Channel Wreck (**SCW241, SCW359** and **SCW788**). The ends of a bundle of rope would have been used to keep the rope from unravelling, allowing for easy storage. The examples recovered were all tied in the same way, showing consistency of practice. It is not known if this is how the rope was supplied by the ropemaker, or if it had been carefully tied up for long-term storage.

SCW788 (Figure 5.24) is the most complete of the hanks, with both ends surviving. Estimated to be at least 100m of rope, approximately 9–10mm diameter (1⅛ – 1¼″ circumference), each strand S-laid, from four Z-laid yarns. It was originally made up as a coil or hank measuring more that 650mm long, which it currently measures in a very relaxed state.

Figure 5.23. Cleats SCW708 (left) and SCW754 (right)

Figure 5.24. SCW788 rope hank

SCW241 consists of a quantity of rope in very poor condition; only one end of the hank survives. It is 9–10mm diameter (1⅛ – 1¼″ circumference) with each strand S-laid from four Z-laid yarns. **SCW359** is a very decayed 400mm bundle of rope, 64mm diameter (8″ circumference), with a bundle or hank wrapped round it of three-strand, Z-laid, 9mm diameter (1⅛″ circumference) rope.

Conclusions

Rigging

The deadeyes, in combination with the chainplates, shroud ropes, strops, lanyards, ratlines and mouse recovered from the Swash Channel Wreck, provide enough elements to recreate part of the standing rigging of the foremast.

It is interesting that no specialised blocks, such as fiddle blocks or lift blocks, were recovered, as found on other wrecks such as *La Belle* (Corder 2007) and *Vasa* (Howe 2011). This lends weight to the theory that the ship was salvaged at the time of wrecking, with only small parts of the rigging surviving when they were trapped underneath the wreck.

Ropework

The actual techniques used by seamen working on the rigging in the 17th century can clearly be seen in various samples examined. Some confirm practices that have continued to be used for several centuries and are illustrated in seamanship works from the late 18th and 19th centuries, including throat seizing, round seizing, worming, serving, and whipping.

The absence of parcelling on all served ropes lends weight to observations made by Sanders (2010, 21) that parcelling may not have been common practice, despite what is written in many texts.

The minimal tucks in most splices, sometimes as little as one, provide an insight into what happens when 'knotting and splicing' to make or repair rigging – what is the minimum necessary, rather than what by today's standards is considered safe and secure.

The condition of the material meant it was very difficult to be certain that a true measurement was being taken, due to the soft nature of many of the samples and the possibility that pushing or pulling the rope would vary the size. It was also a matter of judgement as to how tight to pull the measure when taking the circumference. It was more straightforward to count the yarns in a strand with wet rope. Whilst the counting of yarns tended to destroy part of the sample, in the smaller sizes there was little room for error and in the larger sizes, perhaps the possibility of miscounting by only a few yarns, ensuring accurate data was recorded. The condition of the cordage prevented any judgement as to the contemporary quality of the cordage was. The actual method of making up for storage, as exemplified by sample **SCW788**, may give an insight in to how the rope would have been delivered to the ship.

Chapter 6

Armaments and defence

Introduction

Life at sea in the 17th century was dangerous and the ability to take the ship into hostile waters and defend itself and the crew was paramount. Throughout the 17th century the various Dutch republics were at war with Spain and other European powers and it was also common for merchant ships to be requisitioned by the government for war as and when necessary. For example, the Dutch East Indiaman *Prins Willem* (b.1649) was used as the flag ship of the Dutch Navy during the battle of Kentish Knock. The decision on the number of gunports the ship would have must have taken place in the design phase of the construction, although it should be noted that in times of peace, ships may have carried fewer guns and crew than the gunports suggest.

Evidence for armaments

Given the unexcavated area (Area Four), it is not possible to ascertain the precise number of gunports the ship would have had. In Area One there is evidence for six square gunports on the lower deck (**GP1–6**) and four circular ports on the main deck (**GP12–15).** Area Two has evidence of four circular gunports (**GP16–19**); the stern-most of these survived in half profile and is likely the other half of the forward-most circular gunport in Area Three, which has one additional circular gunport (**GP20**) and three square gunports on the lower deck (**GP9–11**) (Figure 6.1).

The average spacing (forward edge to forward edge) between the gunports on the Swash Channel Wreck is *c* 2.9m which fits with the typical spacing seen on a Dutch ship of this period; Witsen decribes them as being spaced along the hull every six to twelve feet (1.8–3.6m) (Hoving 2012, 204). This would suggest that there are at least two extra gunports in the unexcavated Area Four (**GP7–8**). This spacing and number of gunports is consistent with *Vasa's* main gundeck, which has fourteen gunports along its length, spaced at an average of *c* 2.9m (Fred Hocker, pers comm 23 November

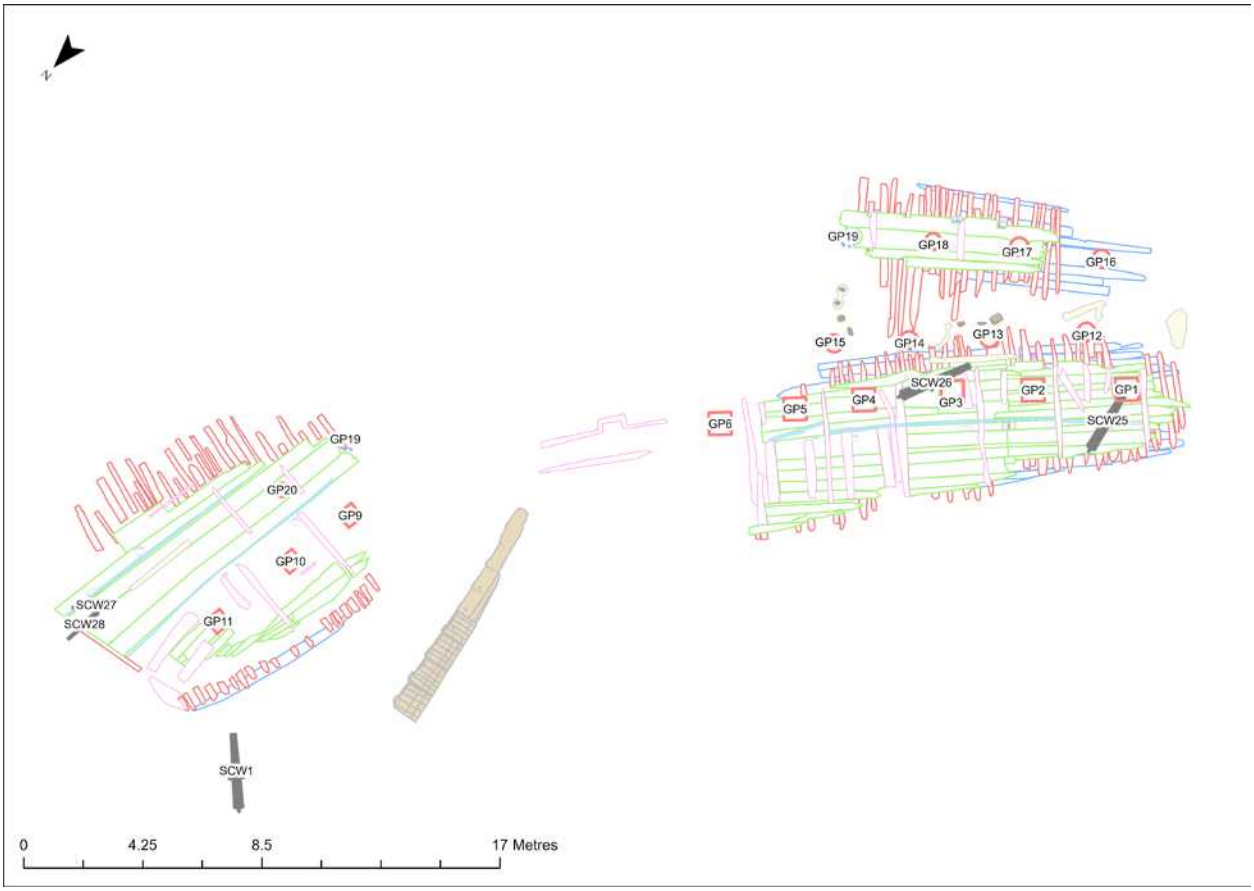


Figure 6.1. Gunports and guns present on the site (NB: gun SCW2 is 30m to the north-west of the main wreck site)

Figure 6.2. Gun ports of the *Prins Willem* (1651) showing 13 square ports (red) on the lower deck with an additional two ports in the stern hold (green) and nine circular ports on the main deck (blue) (Rijksmuseum 2020)

2016), and the proposed gun layout in the *Batavia* (van Duivenvoorde 2008).

In addition to this, the lack of curvature in the structure around **GP1** suggests there may be at least one gunport forward of this position for the bow chasers on both decks. Two small guns were found on the quarterdeck and pictorial evidence of contemporary ships places extra gunports in the gun room below the main deck at the stern.

This would make the vessel capable of mounting a minimum of 36 carriage-mounted guns, but likely closer to 40–42, not including stern chasers or gunports on a lower deck at the stern as seen on contemporary drawings and models of Dutch Indiamen such as the *Prins Willem* (Figure 6.2).

On 22 August 1630, the large VOC ships were ordered to carry 'twenty-four heavy iron cannon, six bronze cannon, and two mignons of iron or copper' (van Duivenvoorde 2008, 137) but it should be noted that the arming of ships in the 17th century was done on a more *ad hoc* basis, increasing and decreasing with times of war and peace (Brown 2014), so the ship herself may have been only lightly armed at the time of wrecking. Indiamen were also occasionally rented to the Dutch Navy in times of war, for example the VOC ship *Prins Willem* became a flagship during the third Anglo-Dutch War in 1652 when its armament was increased from 24 to 40 guns (Hoving 2012, 12).

The guns

The surviving armament of the Swash Channel Wreck consists of five iron guns still present on the seabed; one larger gun which was recovered in 2013 (**SWC25**); and one small gun that was recovered by a dredger in 1990 from the area of the wreck (**SCW689**) (Papworth 1995).

The cannon are split into three groups:

- Group One includes those that are *c* 2.7m in length: **SCW1**, **2**, **25** and **26**
- Group Two are *c* 1.6m in length: **SCW27** and **28**
- Group Three is the small gun: **SCW689**.

Group One

These guns are interpreted as part of the main armament of the ship. **SCW25** and **26** are associated with gunports **GP1** and **GP3** respectively. **SCW1** was slightly off-site at the stern of the wreck and **SCW2** was located *c* 30m north-west of the articulated hull remains.

One gun from this group, **SCW25**, was located within the area that was disassembled in 2011. The gun was trapped within a large pool of concretion and as a result, it had to be stripped of its concretion underwater to enable work to continue. After the gun was broken free it was moved slightly off-site where sacrificial anodes were attached before it was raised, along with the rudder, in 2013. This allowed the gun to be studied in more detail than the others in the group which remain undisturbed *in situ*.

The gun's surface was in a poor condition so taking exact measurements was difficult. The tampion is still *in situ* and the gun was still loaded, but as the seal was not intact the shot had corroded into the gun and no gunpowder could be recovered. No identifying marks could be seen on the base ring, trunnions or the body of the gun but this may be due to the surface damage.

The gun has a length to the base ring of 2570mm and a bore of 120mm, suggesting it fired a 12lb shot (5.4kg). In order to work out the original weight of the gun, a model was created in Rhino 3D software using a combination of diameters taken along a baseline laid

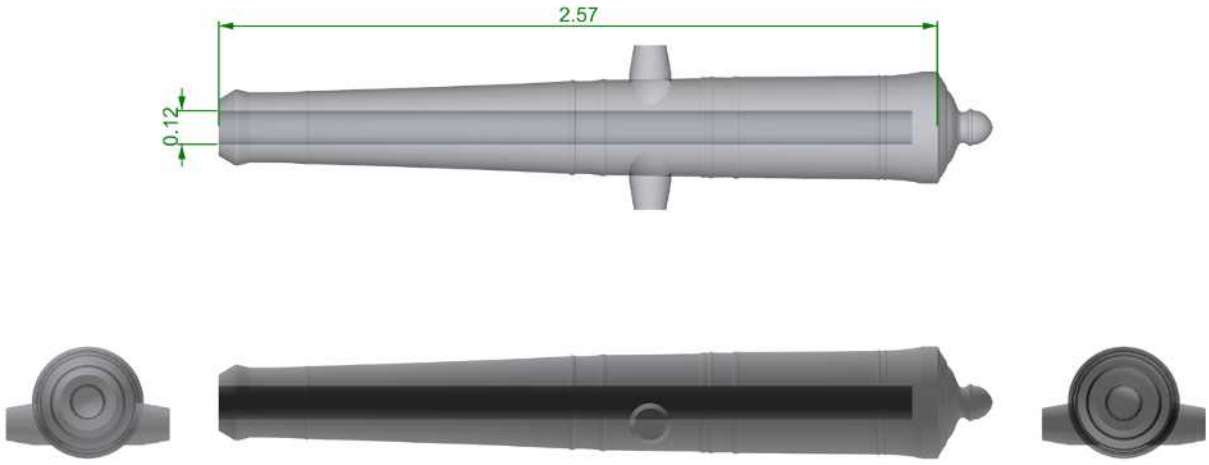


Figure 6.3. 3D reconstruction of SCW25

out from the muzzle to the base ring and complemented with photogrammetry to provide an accurate model of the cascabels and mouldings (Figure 6.3); the bore was estimated back to the vent hole. From this a volume of 0.194m^3 could be established, giving the gun a weight of 1.3–1.5 tonnes depending on the density of the iron (6.8–7.8 tonnes/m^3); this converts to 2672–3065 Amsterdam ponds (2.086 ponds = 1kg) (Green 1989).

The gun is an example of a Finbanker, made in the Finspång Ironworks in Sweden. These guns were a copy of the English pattern being cast in the early 17th century, with round cascabel balls and two broad bands either side of the trunnions (Brown 2014) and having 'more fillets supporting the astragal than normal' (Blackmore 1976, 150). The Dutch were one of the largest markets for the export of the weapons, with Finbanker guns being found on many VOC shipwrecks such as *Lastdragger*, *Vergulde Draeck* and *Kennermerland* (Brown 2014). Guns of a similar size were recovered from *Batavia* (Green 1989), most notably **BAT8723** which is of a similar length and bore (van Duivenvoorde 2010).

During the excavation of **SCW25**, its apron (**SCW690**), five round shot (**SCW905, 906, 907, 908 and 909**), parts of the breeching rope (**SCW696**), and associated lashing (**SCW694**) were recovered. A leather bucket (**SCW863**) and grindstone (**SCW547/548**) were also recovered from the vicinity of this gun and may be associated with it.

Group Two

The two smaller guns, **SCW27 and 28** (Figure 6.4) were found next to each other in the stern of the wreck, sat on the waterway of the quarterdeck. These guns were not excavated so the measurements are taken from the concretion rather than the guns themselves.

SCW27 measured *c* 1.6m with a muzzle face diameter of 0.25m and **SCW28** had a length of 1.5m with a muzzle face diameter of 0.23m. Guns of approximately this length carried by VOC ships would typically fire a 4lb shot with a bore of 81mm (Brown 2014). The canister **SCW740** had a diameter of 82mm and would fit well with this, although two round shot, **SCW904 and 1366,** were recovered with diameters of 89 and 92mm, suggesting that they may be 6-pounder guns.

It is also possible that these guns are the type described as 'mignons of iron' in the 1630 VOC decree. The names of guns can be misleading as they were not standardised until the 18th century and the sizes and weights differed between countries. Norton (1628) describes *minions* as being 7½′ (2.3m) with a 3¾″ bore (92mm) but only firing a 3¾-pound shot although it should be noted that these are English gun sizes and not Dutch.

Group Three

This gun **SCW689** (Figure 6.5) was recovered by a dredger in 1990 from the edge of the Swash Channel and was believed to be associated with the site. The gun was stripped of its concretion at the time of its recovery and remained unconserved until stabilised by York Archaeological Trust in 2010.

The gun has a length of 930mm to the base ring and a bore of 30mm and is missing one trunnion. This gun is much smaller than the rest of the assemblage and no shot has been recovered of this calibre. One possible interpretation for this is a swivel gun, and while there is no evidence of a tiller or yoke, it is likely that these would have been of wrought iron and trapped within the concretion. While parallels can be seen in Dutch guns of the period, these are of bronze rather than iron construction (van Duivenvoorde 2010).

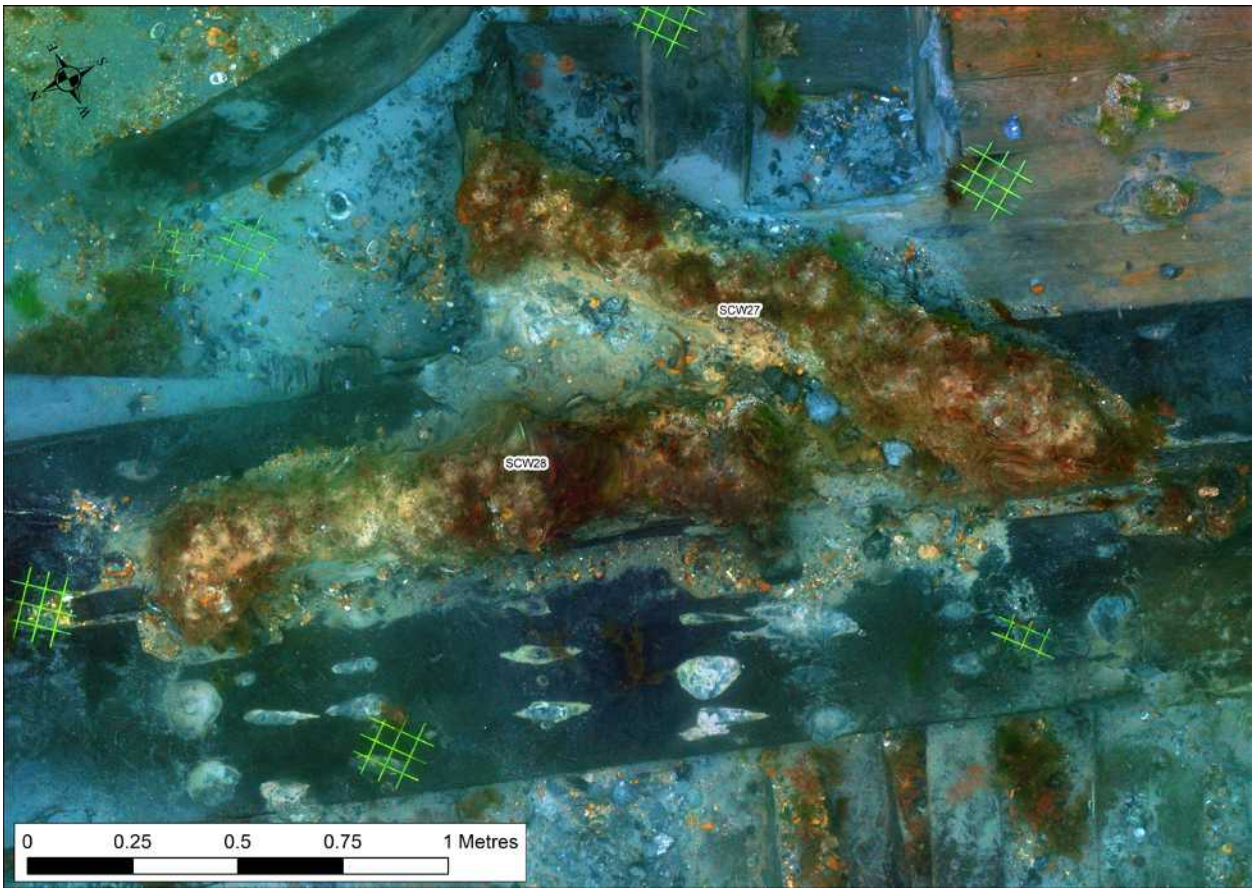


Figure 6.4. SCW27 and 28 *in situ*

Figure 6.5. Gun SCW689

Casting small calibre iron guns – called *robinets* or *falconets*, and later ½ or 1-pounder swivel guns – was difficult, especially in iron where a balance must be found between making the wall of the gun thin but not too thin. There was also the challenge of removing the spindle cleanly after the bore was drilled, not an easy task with larger guns and even less so with smaller ones (Brown 2014). Guns of this type were not common until the early 18th century and were mainly used on smaller naval vessels and auxiliary ships, as well as aboard Post Office packets and excise cutters as anti-personnel weapons for repelling boarders.

The earliest known example of a cast-iron gun of this type is from the Beaufort Inlet Wreck site dating to 1721, nearly 100 years after the loss of the Swash Channel Wreck, shedding doubt on the provenance of **SCW689** and suggesting it is likely to be a later intrusion to the area.

Aprons

An apron is a sheet of lead that covers the vent of cannon to keep the charge dry (Blackmore 1976). Three aprons were recovered from the wreck:

SCW386 (Figure 6.6) is in exceptionally good condition and was found loose on the site so it was not subject to any concretion. Four small holes can be seen with fragments of the line used to tie the apron to the gun.

Figure 6.6. SCW386 gun apron

The impressions of the first reinforcing ring and the base ring can also be seen in the lead; these match the approximate dimensions of the reinforcements on **SCW25,** suggesting it would have been used on one of the main guns.

SCW690 was recovered in association with **SCW25** from within its concretion. It is heavily iron-stained but features such as the holes used to lash the apron to the gun can be seen.

SCW695 is a small fragment of lead with holes which has been provisionally interpreted as part of an apron.

Gun carriages

Four of the finds from the site relate to gun carriages. A possible truck (**SCW37**) which is trapped in concretion in the second gunport (Figure 6.7) has a diameter of *c* 320mm and a central diameter of *c* 100mm; this was not recovered. A cheek of a gun carriage (**SCW33**) and a gun bed (**SCW1425**) complete with part of the axle (**SCW1298**) were recovered. Although the elements are from different carriages they are of a comparable size and are assumed to hold the same size of gun (Figure 6.8)

SCW52 – cheek

The complete right cheek of a gun carriage was found and recovered in the 2008 season (Figure 6.9). The cheek was still attached to a section of the carriage bed, set slightly in and split along the inner edge, showing the mortices for the axles. Part of the transverse bar that would have connected the two cheeks of the carriage together survived as a concretion The fastenings

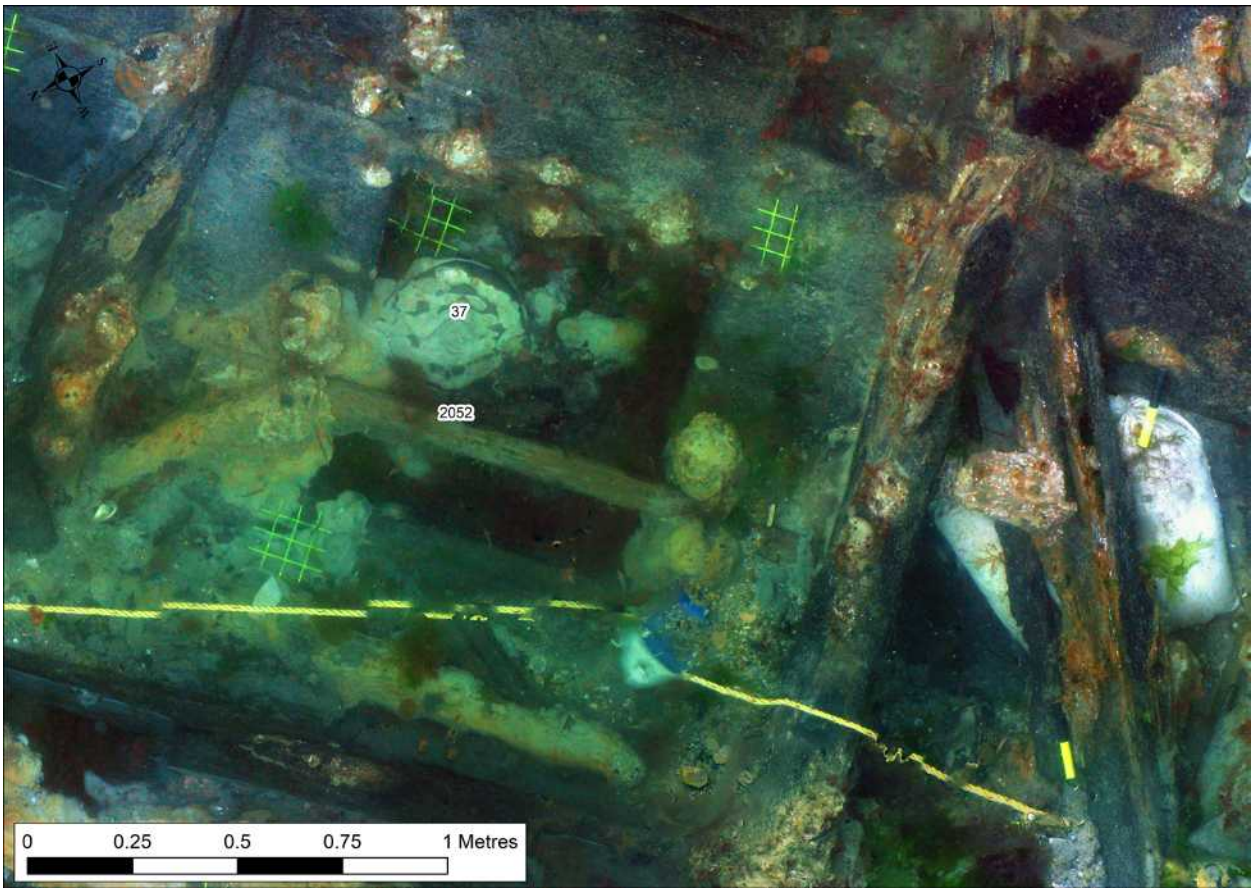


Figure 6.7. Truck SCW37 *in situ* inside gunport 2; also present is a possible handspike SCW2052 crossing the port

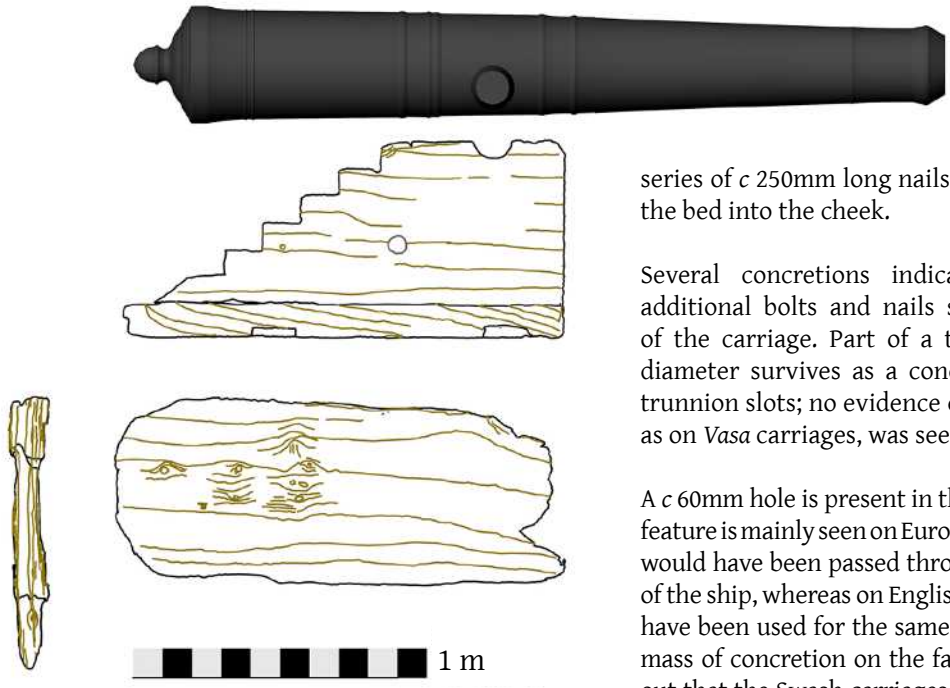


Figure 6.8. Gun carriage elements shown in relation to SCW25

between the bed and the cheek survived *in situ*, as well as part of the cap square.

The cheek is made from a single piece of oak (*Quercus* spp.) measuring *c* 1385mm 540mm 90mm with its height falling by *c* 75mm in six steps. A semi-circular trunnion cut-out has a depth of 56mm (approximately half the diameter of the trunnions – 110mm – on **SCW25)**; this would have been enclosed by the cap square. The bed is secured to the cheek by a series of large *c* 30mm diameter iron bolts, the first of which, forward of the trunnion cut-out, running from the cap square down through the bed. The second bolt runs from behind the trunnion cut-out, and a third approximately halfway along the carriage on the first step. A final large nail secures the last step to the bed. In addition to this, a series of *c* 250mm long nails have been driven up from the bed into the cheek.

Several concretions indicate that there may be additional bolts and nails supporting the iron work of the carriage. Part of a transverse bar *c* 30mm in diameter survives as a concretion 220mm below the trunnion slots; no evidence of a wooden transom, such as on *Vasa* carriages, was seen within the concretion.

A *c* 60mm hole is present in the centre of the cheek. This feature is mainly seen on European carriages where a rope would have been passed through to secure it to the side of the ship, whereas on English carriages ringbolts would have been used for the same purpose (Smith 2001). The mass of concretion on the face of **SCW52** does not rule out that the Swash carriages had both types of securing mechanism. A large section of rope with a diameter of *c* 68mm (**SCW696**) that was found lying alongside the gun has been interpreted as a breeching line.

SCW1425 – gun bed

The bed (Figure 6.10) was recovered in 2013 along with various timbers dismantled from Area One; it is also made from oak (*Quercus* spp.) and measures 1538mm 625mm 100mm, of which only part of the original surface survives. The bed is slightly wider at the stern, increasing from *c* 595mm at the front of the carriage to *c* 625mm at the rear, which has a rounded end.

Mortises for the axles can be seen along the edge of the bed; however, the area in which the front axle would have been attached is heavily damaged and only one axle mortise is visible. The loss of the original surface means it is not possible to see if there were any bolts or nails supporting a wooden transom.

Figure 6.9. SCW52 carriage cheek

Figure 6.10. Gun bed with axle *in situ*

SCW1298 – rear axle

The square-sectioned axle-tree survives to the width of the bed and as with the rest of the recovered gun carriage element, this is also made from oak (*Quercus* spp.). As only part of the original surface survives, a rough cross-section of *c* 120mm 120mm has been estimated. Part of the right axle arm survives but there is no original surface; what remains is circular in section with a diameter of *c* 100mm, matching up with the truck **SCW37**. The hole for the lynchpin is present but has suffered significant biological damage so only a rough diameter of 45mm has been recorded. As with the bed (**SCW1425**), not much of the original surface remains except for the square profile on the left side of the axle which was protected by concretion.

The axle was shaped to fit level and into the mortises on the bed, with large nails used to attach the axle to the bed, as seen on the X-ray of cheek **SCW52**. In addition to this, there appear to be extra nails tacking the axle to the bed which do not go all the way through. These were perhaps inserted to prevent any lateral movement or are later repairs. It is likely that the rear trucks would have been smaller than the front to allow the gun to sit level on the cambered deck (Caruna 1994).

Gun tackle

Block **SCW541** was found trapped in concretion close to the muzzle of the recovered cannon suggesting it may have formed part of the gun tackle. This double block would have been paired with a single block of a similar length, such as **SCW806,** and arranged in a luff purchase giving a mechanical advantage of three (see Chapter 5). The double blocks would be attached to eyebolts alongside the gunports with the single blocks attached to the carriage; the guns could then be hauled into the firing position or secured against the side of the ship.

Associated lines

A large quantity of rope (**SCW693 and 803)** which was wrapped around the cannon (**SCW25**) beneath the concretion was recovered (Figure 6.11). The conjoined pieces have some strands at right angles to the others, forming part of the gun's lashing, the right angle (frapping) turns being used to tighten the original turns. This suggests that the guns were stowed and lashed down whilst at sea.

In addition to this, two large pieces of S-laid cable (**SCW696**) (Figure 6.12), comprising of three Z-laid

Figure 6.11. Rope lashed around SCW25

ropes, with S-laid strands made up of Z-laid yarns, were recovered. An important feature of the samples was that the cable was wormed with a smaller Z-laid, three-strand piece of small stuff, *c* 11mm in diameter, with a long lay of 32 degrees. There appeared to be tar and/or grease deep in the cuntline amongst this worming. These lines were recovered lying alongside the cannon and are interpreted as being the gun's breeching line.

Theoretical complete carriage

The gun carriage elements are of similar size and although not from the same carriage, they would have been used to mount one of the large 12-pounder guns such as **SCW25.** If this gun were mounted on the carriage its base ring would rest on the last step (Figure 6.13).

The Swash Channel Wreck gun carriage fits the style of a typical 17th-century European carriage such as those seen on *Vasa* (Cederlund 2006), *Edesö* (Eriksson 2014) and *Enigheden* (Moody 1952), as well as those inferred in Carpenter (1993), Caruna (1994) and Moody (1952), but there is no evidence of a wooden transom as seen on these carriages.

In addition, 17th-century carriages of a similar construction but with differing rears can be compared to give a general idea of guns at sea, such as the chock-based carriage on the *Swan* (Martin 2004), the three-wheeled carriage from the late 16th-century shipwreck *Scheurrak SO 1* near the Texel (Puype 2000) and the Windsor Castle cannon (Smith 2001).

Figure 6.12. SCW696 breaching line recovered from alongside SCW25

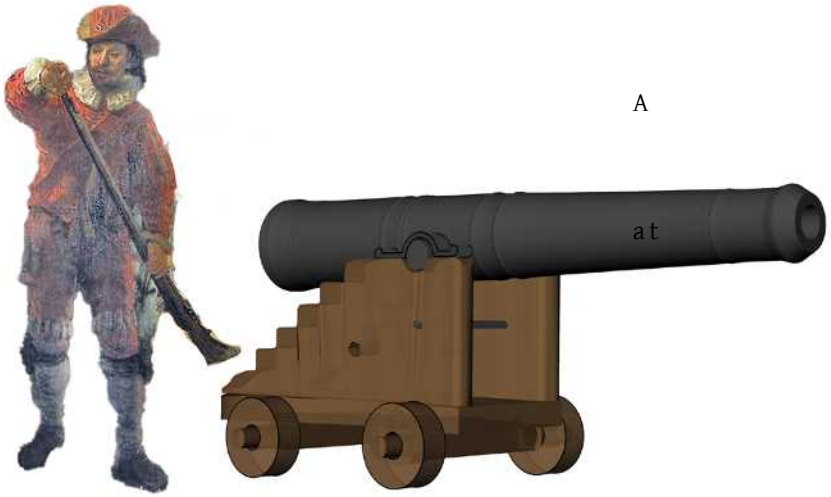


Figure 6.13. Reconstructed gun carriage next to a model of human 1.8m tall

Shot

Round shot

The Swash Channel Wreck has produced six cast-iron round shot of two different calibres.

SCW905–909 were found in association with **SCW25** and were heavily concreted, with diameters taken post-conservation. The shots were all *c* 112–114mm range and match **SCW25**'s bore of *c* 120mm (Figure 6.14). When recovered these weighed approximately 2–4kg, but due to their length of time underwater most of the iron will have leached out into the concretion, graphitising the shot and making the weight unreliable. By taking the original volume of the shot and multiplying this by the density of cast iron (6800 to 7800kg/m^3), an original weight of around 5–6kg (11–13lb) or 10–12 Amsterdam ponds can be calculated for these shot.

Two smaller calibre shot, **SCW904** and **1366,** were found in concretions in the post-excavation phase of the project. **SCW904** has a diameter of 89mm and **SCW1366** has a diameter of 92mm but had slightly expanded due to corrosion. As with the other cast-iron shot these have lost mass to graphitisation but would have had an original weight of *c* 3kg (6.6lb) or 6 Amsterdam ponds.

Figure 6.14. 120mm round shot

Canister or case shot

A canister **SCW740** (Figure 6.15) was discovered in the stern, complete with shot. The post-conservation diameter of 82mm the base suggests this was fired from a 4-pounder gun. Given the anti-personnel properties of this ammunition, the guns that fired such shot would have been mounted higher up in the ship , such as the Group Two gun on the quarterdeck.

The canister consists of a single hollowed-out round wooden tube made from horse chestnut (*Aesculus hippocasteneum*), measuring 251mm in length with a 21mm-thick base; the other end of the canister has been narrowed to create a lip 10mm tall with a diameter of 77mm which would allow a cap to be fitted to contain the shot.

Figure 6.15. SCW740 canister for case shot

Similar-sized case shot were recovered from *Batavia* (1627) (**BAT4435** and **6384)** but rather than a single hollowed-out tube, these consisted of four wooden sections held together by iron bands and filled with scrap iron rather than lead shot (Green 1989). A similar four-sectioned canister was recovered from the *Swan* (1641) (Martin 2004). Several hollowed-out tubes were also recovered from *Vasa* and were provisionally identified as canister shot; these have now been re-interpreted as cartridge tubes (Vasa Museum 2022).

The canister contained 109 ordinary lead shot (**SCW758**) of varying calibres (Figure 6.16) but mainly in the 16mm range, as well as one link shot (**SCW759**) consisting of two 16mm balls and a single strand of wire. This mix of calibres is generally consistent with that seen in the other shot assemblages (**SCW40 and 42**).

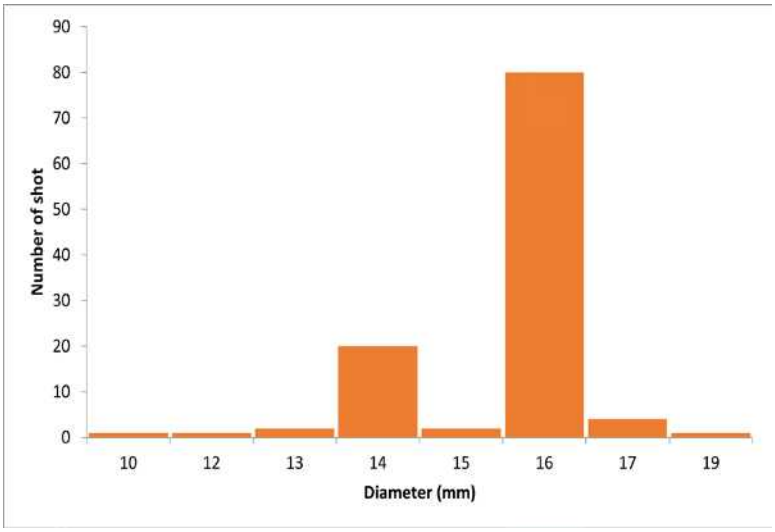


Figure 6.16. Diameters of shot found within canister SCW740

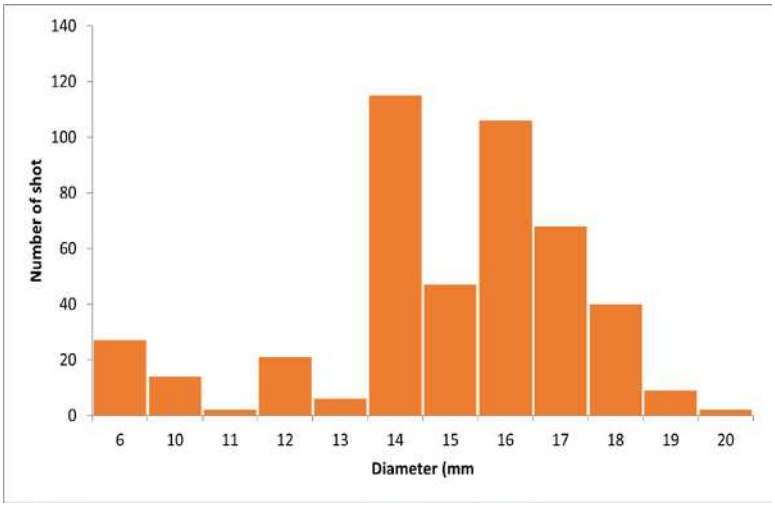


Figure 6.17. Diameters of ordinary lead shot from the SCW

Ordinary lead shot

A large assemblage of lead shot (**SCW40 and 41**) was recovered from an area 30m to the west of the main site, alongside a large concretion adjacent to cannon **SCW2**. The size, condition and similarity to the canister shot (**SCW758**) assemblage suggests that it formed part of a magazine rather than ammunition for an individual weapon.

The calibres of these shot range from 6–20mm (Figure 6.17), with two clear peaks at 14mm and 16mm. The smaller shot matches the bore (14.5mm) of flintlock pistols dating to 1635 and the larger could be from a carbine, which had a regulated diameter of 16.6mm in 1639 (Green 1989). The shot >16mm may relate to muskets, for example *c* 1630 muskets are known to have a bore diameter of 17.7mm (Kist *et al* 1974). Contemporary regulations state that the bore diameter of muskets should be 19mm, but they were fired with 17–18mm shot (van Dam 1701; Green 1989).

Link shot

Three basic types of link shot are classified by Peterson (1966, 84–6):

1. Expanding – two balls joined by a coil of brass wire
2. Sliding – two balls joined by two loops of brass wire sliding over each other
3. Articulated – two balls joined with straight lengths of brass wire terminated by interlocking small rings.

Examples of types 1 and 2 were recovered during the excavation.

SCW759 (Figure 6.18), the only example of expanding shot (Type 1) recovered from the site, was found inside the canister (**SCW740**). It consists of two 16mm lead balls connected with a single coiled copper alloy wire. Parallels of this type of shot have been observed on other wrecks of the period such as *Batavia* (**BAT3673**) where large quantities of the same calibre shot were found on the site (Green 1989); *Lastdrager* (Sténuit 1974); *Kennemerland* (Price and Muckleroy 1974); and the *Santo Christo de Castello* (McBride *et al* 1975).

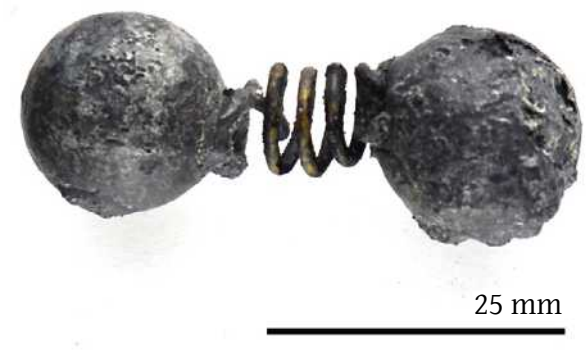


Figure 6.18. Expanding shot SCW759

Two complete and one incomplete examples of sliding shot (Type 2) were recovered from the site; these consisted of two balls connected by two loops of twisted copper alloy wire sliding over one another. Several other shot in the assemblage may have been of this type but the wire has since corroded (Figure 6.19).

These were nicknamed 'Scorpions' or 'Staffordshire knot shots' and were encountered by British forces at Lucknow during the Indian Mutiny in 1858 (*Illustrated London News* 1858). Similar shot that was reportedly recovered from the *Loosdrecht,* a Dutch East Indiaman wrecked on the Needles in 1719, is on display at the Isle of Wight Shipwreck Centre and Maritime Museum (Martin Woodward, pers comm).

Figure 6.19. Sliding shot from SCW740

Other objects

Hand spikes

Hand spikes are wooden levers used to manoeuvre a gun and/or carriage into position (Blackmore 1976). These are made from alder wood (*Alnus* spp.) with a square head and a tapering round wood shaft like a capstan arm. It is possible that the transom of the carriage contained a socket into which the square head would have fitted to allow the gunners to traverse the cannon.

Several hand spikes were located on the site (Figure 6.20), with two definite spikes, **SCW572** and **757,** and one possible, **SCW2052** being recovered. All the hand spikes located on the site were found crossing a gunport, some with heavy concretions suggesting that they were mounted on iron brackets. **SCW2052,** which was also found crossing a gunport, is heavily eroded and appears to be made of a different wood type to the others; it is square in profile with small hole at one end. A fourth hand spike was found crossing a port in the stern but left *in situ*.

Possible linstock

Smith (1627) describes a linstock as a carved stick around half a yard long with a spike in one end, allowing the staff to be stuck into the deck, and a fork in the other holding the match. They would have been used to fire the cannons, allowing the gunner to bring the lit match to the touchhole from a safer distance.

SCW820 (Figure 6.21) is the end section of an ash (*Fraxinus excelsior* L.) handle carved in such a way as to give it a pommel and a grip. There is no evidence of a tang, suggesting that this artefact would have been much longer and of solid wood. A square fragment of iron is present in the pommel end which may be the remains of the spike mentioned by Smith (1627).

Possible powder measure

A large copper alloy tankard (**SCW16)** (Figure 6.22) was recovered which has an internal diameter of 159mm and height of 205mm, giving a volume of *c* 4 litres. The vessel is made from a highly unstable alloy of copper/lead (95/5%) which while it would have aided machinability at the time, has not survived well underwater and is very fragmentary. The main side of the vessel survives but the base and handle were

Figure 6.20. Hand spikes SCW572, 757 & 2052

Figure 6.21. SCW820 possible linstock

Figure 6.22. SCW16 Powder measure

both detached and in fragments before conservation. Due to the surface corrosion, no marks have been observed on the vessel to confirm its identity as a powder measure.

Two vessels of similar dimensions and made from brass with a copper handle were discovered on the *Batavia* (**BAT589** and **3306**) (Green 1989) where they were identified as powder measures; their handles are, however, riveted rather than welded on. Two other vessels (**BAT688 and 3005**) were of similar construction and thought to be powder measures but their identity was 'not absolutely certain' (Green 1989, 62).

Possible match tub

A conical container (**SCW60**), identified as a possible match tub, was found in the bow of the wreck and lay in a pool of concretion at approximately half its depth (Figure 6.23).

Figure 6.23. Conical container *in situ*

The vessel measures approximately 330mm in height, with an external diameter at the base (including concretion) of *c* 350mm, tapering to *c* 150mm at the top. The lower 210mm of the staves, but not the head, are covered in concretion suggesting that it was shod in iron. The remaining 120mm is exposed and had at least four sets of wooden barrel hooping binding it along its length. The internal diameter of the base was *c* 300mm. A rough calculation using these measurements puts the volume at *c* 13.6 litres.

The top of the barrel was almost completely sealed by concretion which contained a round wooden object perpendicular to the staves but owing to the concretion it was not possible to clarify if the two objects were related.

The wide base and narrow neck would provide a low centre of gravity making a more stable open container on the deck in rough seas. The iron sheathing around the bottom of the staves would also add weight and lower the centre of gravity. The most likely interpretation for this vessel is a match tub, used for holding the linstocks and slow match for the guns. Its position on the wreck in between guns **SCW25** and **SCW26** supports this interpretation. The bottom of a match tub would be lined with sheet-iron and filled with sand, which could explain the large amounts of concretion covering the lower half of the container.

Chapter 7

The finds and their significance

Duncan Brown, Thomas Cousins, Peter Davey, David Gaimster,
Ellen Hambleton, and Quita Mould

The wreck produced a small assemblage of general equipment for the maintenance of the ship and other duties.

Maintaining the ship

Carpenter's tools are often found on post-medieval shipwrecks, the assemblage or 'toolkit' from the *Mary Rose* being the most extensive (McKewan 2005). The acceleration in long-distance trade from the early 15th century necessitated the presence of professional shipwrights or carpenters on voyages. Carpenters had to be capable of maintaining and repairing the ship mid-voyage. The carpenter would have brought his own set of tools, probably packed into a personal wooden chest or chests. The basic toolkit would have included hand axes; an adze; one or two mallets of differing sizes; a range of chisels and gouges; one or two augers; hand or chest braces with a range of bit sizes; a metal-headed hammer or two; a range of planes; a chalk line with block of chalk; a handsaw; a hook knife; a file or two; and a wooden rule (McKewan 2005, 294). A grindstone or whetstone would also have been part of the kit, and indeed five were found on *Mary Rose* (ibid).

Tanged tool handles

The Swash Channel Wreck carpentry assemblage is dominated by handles for chisels, files or similar tools. Most have the hollow section for the metal tang visible and have rounded ends indicating use by holding with the hand, as with files and some chisels. Many of the handles are faceted and octagonal in cross-section, and some taper, while others are straight from end to end. This common octagonal and faceted feature suggests that the tools were possibly made as part of a set. These tools also feature a stepped-down section for the fitting of a ferrule. Moxton (1683, 69) shows several different variations of chisels using this type of handle.

Tools of this kind include **SCW14, 420, 444, 891** and **730**; they vary in length from 80mm to 172mm and diameter from 20mm to 40mm (Figure 7.1).

SCW444 is a faceted tool handle made of water elder or cotton tree (*Vibernum opulus/Vibernum lantana* L.).

Figure 7.1. Tool handles recovered from the Swash Channel Wreck

The tang extends 40mm into the handle with a square iron ferrule. The tool handle is in two separate sections which appear to have been deliberately cut rather than broken, one 65mm long and the other 83mm. It is possible that this tool was shortened for a particular purpose.

SCW891 still had part of the concretion attached showing that it was the handle for a cross-cut file (Figure 7.2).

A wide variety of wood was used for these handles (Table 7.1); as with those from *Mary Rose*, there appears to be no correlation between the form of handle and wood species (McKewan 2005, 307).

Mallet

The mallet (**SCW358/623**) was an essential element in the toolkit and would have been used to strike chisels and other wooden tools, and also for driving in wooden pins, wedges and treenails. The mallet consisted of a

Table 7.1: Tanged tool handles

Find No.	Length	Diameter	Species
420	120	30	Untested
444	90	20	*Vibernum* spp.
725	950	460	*Quercus* spp.
730	172	40	*Quercus* spp.
892	90	15	*Juglans regia* L.

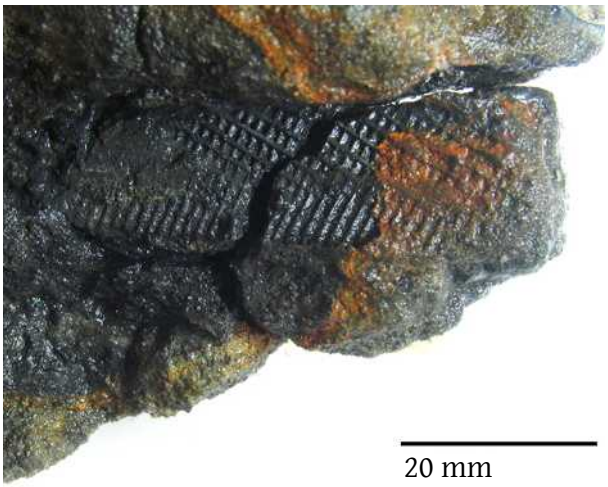


Figure 7.2. Impression of the cross-cut file

Figure 7.3. SCW358 mallet

70mm diameter turned beech wood (*Fagus sylvatica* L.) head and a 30mm diameter alder wood (*Alnus* spp.) handle. The overall length of the mallet was 300mm (Figure 7.3).

Handsaw handle

SCW789 is a walnut (*Juglans regia* L.) handsaw pistol grip (**SCW789**). It is particularly finely manufactured and corresponds closely in form to the same feature shared by contemporaneous firearms. The handle has a small rectangular-section tang extending into the head as well as a step for a socket or ferrule and part of the concretion showing the start of the blade (Figure 7.4).

The Dutch developed a pattern of handsaw featuring a 'wide blade, with a convex cutting edge fixed to the handle with a tang forged on the upper edge' with a pistol-style grip (Goodman 1964, 146). The first known example is seen on a token from 1627, while a later 17th-century saw of a similar design can be seen in the State Hermitage Museum in St. Petersburg (Hermitage Museum 2017).

Fid

A fid is a wooden spike made from hardwood or bone and would have been used to open the strands of rope to aid in splicing. **SCW892** is the tapering end of a walnut (*Juglans regia* L.) spike 90mm long. The tapering is not even and appears to have been done by a draw knife rather than lathe (Figure 7.5).

Wooden tool handle

SCW725 is a bulbous tool handle which appears to feature an iron rod broken in two pieces running through the object. A small square hole is present just below the main bulb acting like a grub screw; its purpose is unknown. The fully tanged nature of the object and the small hole suggest it may have been struck by a mallet or used in a twisting motion similar to a small gimlet (Figure 7.6).

Figure 7.4. SCW789 handsaw handle

Figure 7.5. SCW892 possible fid

Figure 7.6. SCW725 bulbous tool handle

Horn handles

Two horn handles were recovered from the wreck: **SCW890** and **SCW1367** (Figure 7.7). These are both oval in cross-section with a length of *c* 80mm; the concretion from **SCW890** revealed a cavity for a flat-bladed tool suggesting that these are knife handles.

Grinding wheel

A grinding wheel broken into two fragments, **SCW547** and **548** (Figure 7.8), comprised the final essential element of the carpenter's toolkit, given the need to maintain so many bladed tools. The grinding wheel

Figure 7.7. SCW890 horn tool handle

Figure 7.8. SCW547 and 548 grinding wheel

would also have been employed to maintain the edges of domestic knives, razors and edged weapons, such as swords and daggers. The wheel is 75mm thick and of a coarse sandstone with an overall diameter of 610mm. It has a square hole in the centre 85mm across which appeared to have held the wooden axle.

General equipment

The high level of organic preservation on this wreck is further illustrated by the recovery of two brushes, one a soft rope brush within a timber sleeve, possibly for applying paint or tar (**SCW755)** (Figure 7.9), and a broom-end, complete with basketry hoop around the bristles (**SCW426**) (Figure 7.10). Similar utensils for the maintenance and cleaning of the ship are known from VOC wrecks (Gawronski *et al* 1992, 109–11).

Hooks

Several concretions could relate to boat hooks or similar items. A mould taken from a lump of concretion produced an impression of the spike from an iron boat hook (**SCW895**). X-rays of additional samples of concretion have revealed the voids of further spikes.

Several hook-shaped concretions were recovered from across the site. These consisted of a wrought-iron hook bound to a wrought-iron bar, both 20mm square in profile; the longest of these (**SCW756**, Figure 7.11) had a surviving length of 250mm. The bar would probably have been bound to a wooden shaft and although

Figure 7.9. SCW755 possible brush

Figure 7.10. SCW426 besom brush

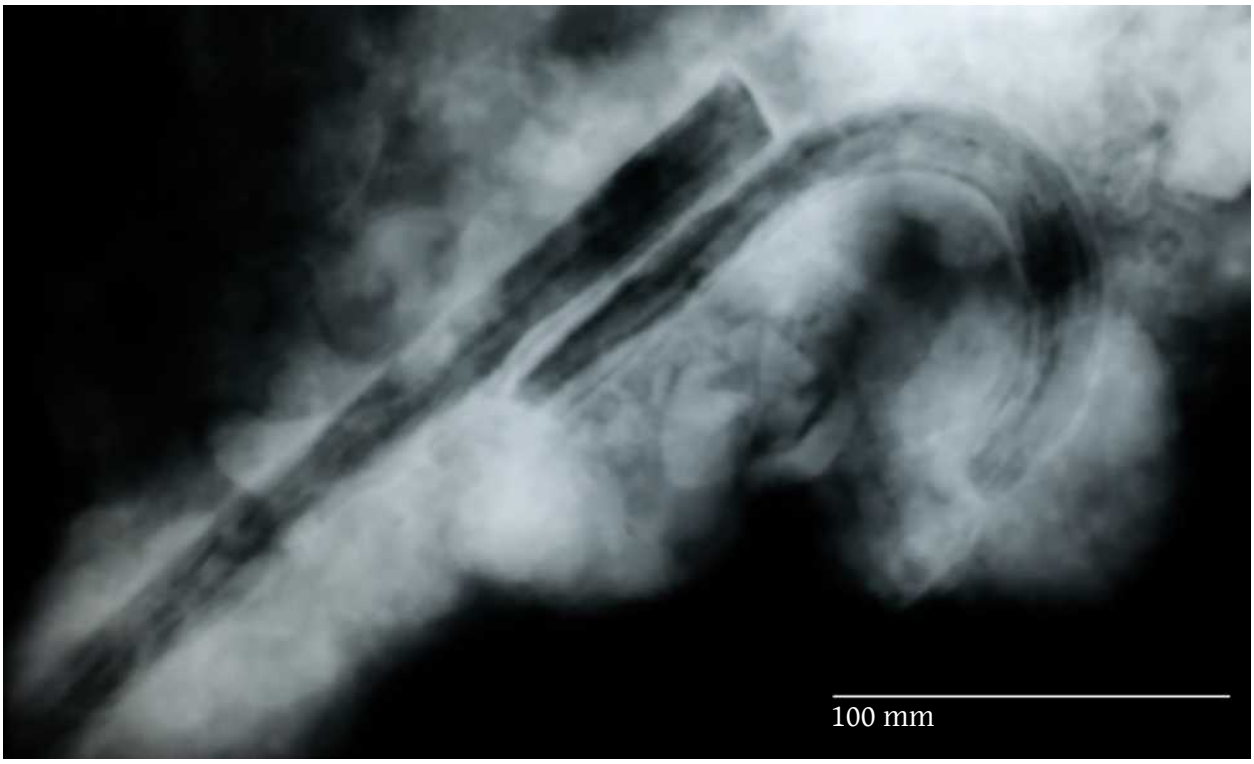


Figure 7.11. X-ray of SCW756

the exact purpose of these artefacts is unknown, it is thought that they may be boat hooks or part of salvage equipment.

Buckets

Two leather buckets were recovered from the wreck. **SCW578** consisted of a body panel which was deliberately removed from its parent bucket. The component parts of the second bucket (**SCW863**) (Figure 7.12) including a body panel, base and pieces broken from the handle, handle mount and various covering strips were found scattered over the length of the wreck, but when brought together they formed a near-complete bucket.

The two buckets were made of cattle hide and were of similar height (*c* 285mm) but differed slightly in their construction.

Like all leather buckets, the near-complete example (**SCW863**) comprised two principal components: a body panel joined with a single, vertical, edge/grain butted seam, and a separate circular base. The base was attached by a double row of stitching, the seam protected by a covering strip. The mouth was supported around the exterior of the rim by a ring of thick, plied and twisted rope, protected by a leather covering strip. The handle, which was of narrower, twisted and plied rope with a leather cover, was attached to the bucket by a stout suspension loop sewn in place to a vertical supporting strip with the ends protected from wear by the mouth (rim) band. All that remained of the attachment loop on the opposite side were the ends of a simple looped strip sewn directly to the mouth area of the bucket panel with no corresponding strengthening strip. This would suggest that the single, vertical strip had been intended solely to protect and waterproof the seam and not provide additional strength to the handle attachment as might first be supposed, perhaps indicating that the intended contents of the bucket had been lightweight. When recovered, the bucket had concretions on the outside of the body panel and large lumps of concretion within. Hemispherical and linear shapes were revealed in X-rays and, along with the impression of wood grain, might tentatively be interpreted as suggesting the former presence of a wooden powder ladle or shot gauge and measure inside the bucket. No pitch or resin was detected on the inside of either bucket panel.

Part of the body panel of a second bucket, **SCW578**, was also found, cut away down one side to remove the seam and along the lower edge to remove the base. This bucket differed in having two vertical supporting strips, one covering the seam like **SCW863** and a second located on the opposite side of the panel, each wider at the base and tapering toward the mouth, as seen on buckets from *Mary Rose* (Mould and Cameron 2005).

As the cut-down bucket panel is incomplete little more can be said. However, while the near-complete example

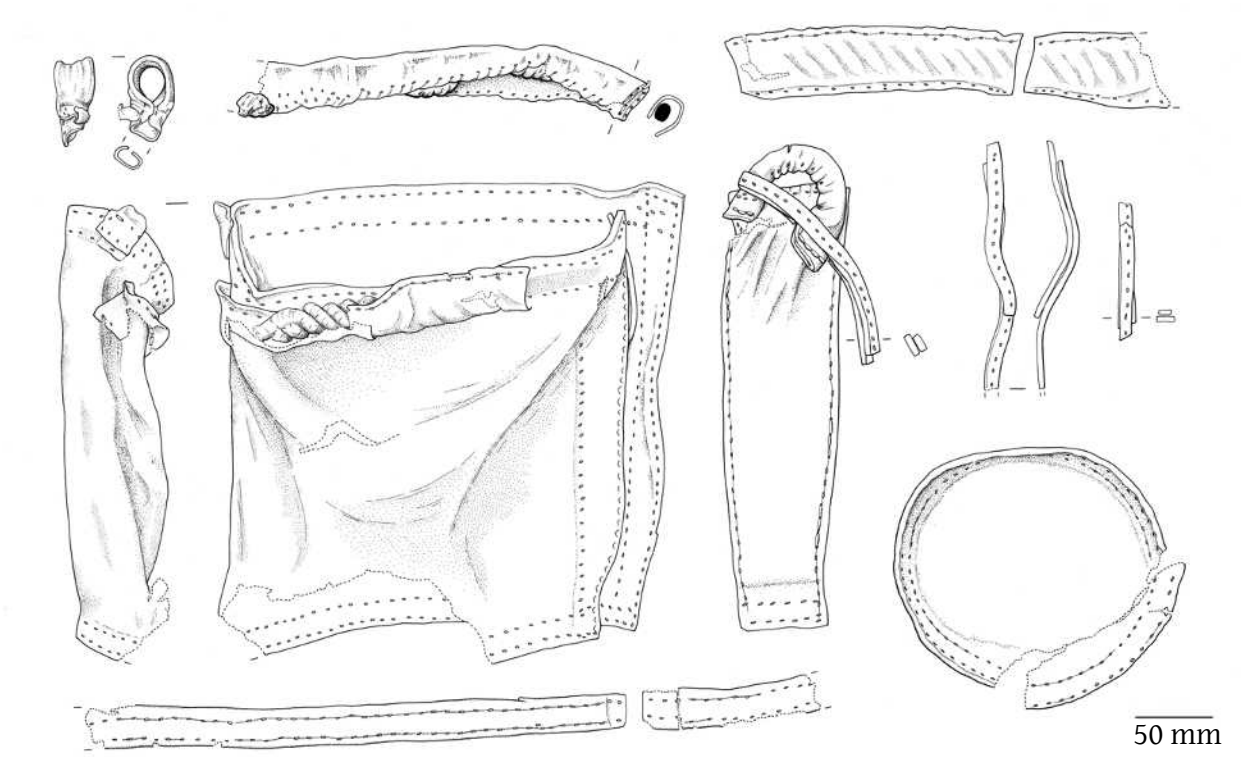


Figure 7.12. SCW863 leather bucket (illustration by Sue Winterbottom)

also bears comparison with those recovered from *Mary Rose*, it can be seen to differ in several aspects of its construction. The bases of the earlier buckets were supported by crossing bands of leather beneath and joined to the body panels with three rows of stitching, while multiple vertical strips were used to support the body panels. The use of only a single strip covering the vertical seam joining the body panel, and two rather than three rows of stitching to attach the base of the **SCW863,** are features also seen on a bucket found in a 17th-century well at Moor House in the City of London (Mould 2006, 124–6, fig 103). The near-complete bucket appears to be unusual in having the mouth supported by rope rather than a wooden withy. Without examining leather buckets of known provenance, it is difficult to know which differences might reflect local constructional traditions rather than simply the later date of the bucket recovered from the wreck site.

Ship's navigation and communication

The site has produced a varied assemblage of ship's navigational and internal communication equipment. Navigation in the early modern period required considerable pilotage skills, especially in inshore waters. In addition to knowledge of coastal features such as headlands, bays, cliffs, and other landmarks, as well as patterns of currents and tides, safe passage depended on knowing or testing the position of deep-water channels and the presence of hazards, such as rocks, shoals and sand banks.

Sounding leads

The two sounding leads (Figure 7.13), or plummets, belong to one of the most ancient classes of maritime technology. Such leads were used to determine the depth of water beneath the keel and the nature of the seabed. The leads were cast with a 'dimple' in the bottom that could be 'armed' with tallow, grease or a similar substance so that when the lead was recovered after sounding, it would bear an impression and carry traces of the seabed beneath. Combined with visual features along the coastline, this information would assist the pilot to establish the ship's position. The depth of water and trend of the logline when the weight was on the sea floor could also inform the pilot of the direction of the tide or current (Stimson 2005).

Vessels usually carried a minimum of two types of leads aboard: a hand-lead and a deep-sea lead. Mainwaring (1644) states that the deep-sea lead would weigh 14lb (6.3kg) with 120 fathoms of line and the hand-lead 7lb (3.2kg) with 20 fathoms of line. Witsen (1690) mentions Dutch vessels of the time carrying a variety of leads including a 'Peil-loot', rarely exceeding 36 Amsterdam ponds.

The larger of the two leads, **SCW796**, weighs 8.4kg or 17 Amsterdam ponds, which is heavier than the 14 Amsterdam ponds deep-sea leads recovered from either *Batavia* or the *Vurgulde Draeck* (Green 1973) and lighter than those mentioned in Witsen (1690, 496).

Figure 7.13. Sounding weights recovered from the wreck (SCW45, left and SCW796, right)

The smaller weight, **SCW45,** fits within the hand-lead size at 3.5kg or 7 Amsterdam ponds. It still retained the 46mm-wide leather strap which had been used to secure the lead to a rope. This passed through the 'eye' (suspension hole) of the lead, each of the slotted ends having the impression of a cord or thin rope *c* 5mm wide clearly visible. The Ashley Book of Knotts (1944, 318) states that hand-leads were normally fitted with a leather strop of this type, allowing different leads to be attached to the lines and to prevent chafing on the measured lead lines. This weight also appears to be marked with a VII, indicating its weight, and an unknown symbol (Figure 7.14).

Dividers

Navigation dividers or compasses were used for a variety of purposes aboard ship including picking off a course on a chart (Swanick 2005); two types of dividers were recovered from the wreck site (Figure 7.15).

The first type are described by Aubin (1702, 248) as straight compasses used by carpenters and pilots. Three fragments of this type were found on the wreck, although **SCW186** and **SCW903** may be parts of the same dividers. The dividers are all cast in brass (pXRF: 78% copper, *c* 20% zinc, 2% lead) and two retain their ball-hinge mechanism and punched rim-and-dot decoration – common features of such objects found on Dutch East India Company (VOC) wrecks. A large collection of this type was found on the *Lastdrager* (1653) where they were thought to have been packed onboard as trade goods (Sténuit 1974). **SCW186** and **366** both feature a maker's stamp in the form of a shield topped with the initials OVS (Figure 7.16).

SCW186 comprised the arm of a brass divider with its scarfed (overlapping) unleaded brass point containing

Figure 7.14. Possible VII ♎ markings on SCW45

Figure 7.15. Three sets of dividers from the Swash Channel Wreck: (left) SCW366; (centre) SCW903 and SCW186; (right) SCW1380

Figure 7.16. Maker's stamp on SCW366

a higher percentage of zinc (pXRF: 30%). The base of the maker's stamp can be seen on this artefact.

The second type of divider – **SCW1380** – is described by Aubin (1702, 249) as chart compasses. It has bifid ringed hinges on both legs which interlock at the top allowing for one-handed operations. Similar types have been found on the *Lastdrager* 1653 (Sténuit 1974) and the *Kennemerland* 1664 (Price and Muckelroy 1974).

Bell

A small bell (**SCW13**) (Figure 7.17) cast in a high-leaded tin bronze was recovered. It has a rim diameter of 97mm and a high of 115mm including the suspension loop. It would have formed part of the ship's internal communication system. The dimensions of the bell and its rigid integral cast clapper shaft suggest it may have been a handbell rather than suspended on a chain or rope. The bell would have been used to indicate time on board the ship and hence to regulate the duty watches. A similar bell (**BAT3201**) was recovered from *Batavia* (Stanbury 1974).

Horn panels

A roughly square-shaped piece of horn (keratin sheet), 32mm 30mm 1.22mm, was noted adhering to fragments of base band from the bucket **SCW863** and the remains of a panel of horn (**SCW1520,** Figure 7.18), 100mm 70mm 0.64mm, with a single cut edge surviving, was found associated with the quarters of shoe **SCW341**.

These items are likely to be horn 'lights' from wooden lanterns, although lanterns made principally of leather

Figure 7.17. SCW13 handbell

Figure 7.18. SCW1520 horn panel

are known, and a small number of later examples survive (Waterer 1950, pl XXIIA) so it is possible that they may come from a lantern of this type. Two types of wooden lantern were recovered from *Mary Rose* and 'tiny slivers of what appeared to be horn were noted in some (wooden) stave grooves at the time of excavation' (Richards 2005b, 343). The ship's manifest of *La Trinidad Valencera* (1588), a wreck closer in date to the Swash Channel Wreck, records that 'eight wooden lanterns of which four are provided with lights of waxed linen, and the other four with lights of horn' (Martin 1997, 10, fig 13) had been on board.

Food preparation

Three items of copper alloy kitchenware were recovered from the wreck and represent key items of equipment from the ship's galley. The first is a square handle or 'ear' from a copper alloy (leaded bronze) cauldron (**SCW676**), probably used for the boiling of meat. Such cauldrons, with their bulbous body and tripod legs, date from the High Middle Ages to the 19th century and are well known in museum and archaeological collections on land (Ruempol and van Dongen 1991, 176). The vertical casting line on the handle is typical of this artefact type.

An extremely fragmentary circular copper-lead (pXrf: 95/5) alloy sheet (**SCW679,** Figure 7.19) with a diameter of *c* 380mm was also recovered; this may be the lining from a cauldron or a lid for one of the cooking pots.

The wreck also produced a near-complete leaded bronze tripod skillet or frying pan with its hollow rod intended for a long wooden handle (**SCW23**). This is a large example, with its rim diameter measuring 310mm (Figure 7.20).

The tripod metal cooking vessels are indicative that the galley of the Swash Channel Wreck would have housed a brick-built oven or furnace on which these vessels would have rested for the duration of their use.

Figure 7.19. Fragments of the copper alloy sheet SCW679

Figure 7.20. SCW23 leaded bronze skillet

It is not clear if the alloy sheet **SCW679** is the remains of another tripod cooking vessel or a cauldron such as those recovered from *Mary Rose* (Weinstein 2005, 429–31).

Wooden shovel

A near-complete wooden shovel (**SCW669**, Figure 7.21), carved from a single block of wood, may have been used for a variety of purposes on board ship in the early modern period, such as stirring the cooking cauldrons, moving cargo, or for shifting ashes from the ovens in the galley (McKewan 2005, 348–9). The blade retains the horizontal shadow-line for its shod-iron edge, now corroded.

Low Countries redware cooking pots

Seven redware cooking jars/pots and one colander were recovered from the wreck. **SCW1538** (Figure 7.22) is the rim of a colander with pre-firing pierced holes extending right up to the rim. It is glazed both inside and out and has a rim diameter of 340mm. **SCW1539** and **SCW866** are rims from cooking pots, probably in the classic style of handled, three-footed *grapen*. **SCW715** is a handle in that form, while the rilled finish on **SCW717** and **SCW869** also suggest the same type of pot. **SCW859** is a rim in the typical collared cooking pot form, while **SCW1385** has a scar that suggests the presence of a foot.

Food and drink

The small assemblage of turned wooden vessels and pewter tableware are the only artefacts that can be attributed with some confidence to the officers' mess. Such a combination of tableware items is symptomatic of 'messing' in early modern maritime society (Weinstein 2005).

Flagons

The most spectacular finds of all the domestic objects found on the wreck are two near-complete pewter wine flagons of baluster form, with domed lid and everted footring that is typical of a 16th to early 17th-century date range (**SCW889** and **897**) (Figure 7.23). The pewter the flagons were made from contained a very high percentage of lead (pXrf: 40%), pointing to a lower quality of manufacture (Weinstein 2005, 438). The flagons have an approximate volume of two litres or three and a half imperial pints, but as with all Dutch measures there are many regional variations. No marks were observed on either flagon to give an indication of place of manufacture, but the thumb piece and style suggest an Amsterdam manufacture from around 1600 (Jan Beekhuizen, pers comm).

Copper alloy tap

A copper alloy tap (**SCW965**, Figure 7.24) was recovered from the concretion (**SCW791**) alongside the pewter

Figure 7.21. SCW669 shovel; note the nail holes where an iron shod would have been attached

Figure 7.22. SCW1538 colander (illustration by Jon Milward)

Figure 7.23. Pewter wine flagons SCW889 (left) and SCW897 (right)

flagons and eyeglass (**SCW888**). It is typical of a 17th-century tap with parallels found in several contexts including *Batavia* (**BAT3260**) and *Vergulde-Draeck* (Green 1973). The tap would have had a flat openwork trefoil head to the handle, of which only the lower two perforations survive; it is unclear if the key is removable. To one side of the stem the spigot or pipe which brought liquid into the tap is 115m long; the curved spout is rectangular in cross-section (9mm wide, 13mm high) with a trapezoidal aperture and a projection at the top of the curve.

Figure 7.24. SCW965 copper alloy tap

Spoon

One pewter spoon (**SCW7**, Figure 7.25) with a large saucer-shaped bowl was recovered; it is typical of the early 17th-century period in the Low Countries (Ruempol and van Dongen 1991, 201). Spoons of very similar form found on the wreck of *Batavia* (Stanbury 1974) and *Vergulde-Draeck* (Green 1973) feature a variety of maker's marks, but no marks could be observed on this example.

Wooden bowls

Fragments of two turned wooden bowls were recovered from the wreck (**SCW619** and **627**). **SCW619** survives in half profile with a shallow footring (47mm diameter), a rim diameter of 115mm and a height of 35mm (Figure 7.26).

Figure 7.25. SCW7 pewter spoon

Figure 7.26. Wooden bowl SCW619

SCW627 is more fragmentary with only a small section of the 44mm diameter foot ring surviving.

The narrow diameter of these bowls indicates that they were intended for drinking rather than for the consumption of food. The light bodies, fine turning and narrow lip of these vessels are consistent with the consumption of wine or spirits, probably by officers. As in the case of *Mary Rose* (1545), larger bowls would have been better for consuming wet foods (Wood and Hather 2005). Such fine 'treen' drinking bowls are extremely rare survivals for the period, in either terrestrial or maritime contexts.

Jugs

All the stoneware is in the form of Bartmann or bearded man jugs, this being a classic Frechen form widely exported and very common on shipwreck sites. There are nine fragments of **SCW1537** (Figure 7.27) which has a well-defined medallion that bears splashes of blue in the glaze. **SCW320** also has a blue splash, although it is clearly a different vessel as the interior surface is grey as opposed to the pink of **SCW1537**. **SCW1387** is represented by a single, small, plain body sherd. These jugs would have been used to decant wine or beer.

SCW574 is a fragment of Low Countries redware in the form of a splayed base that is probably from a jug or similar closed vessel

Ceramic dishes

SCW769, **SCW868** (Figure 7.28) and **SCW883** are tin-glazed dishes with dark-blue painted floral motifs. The

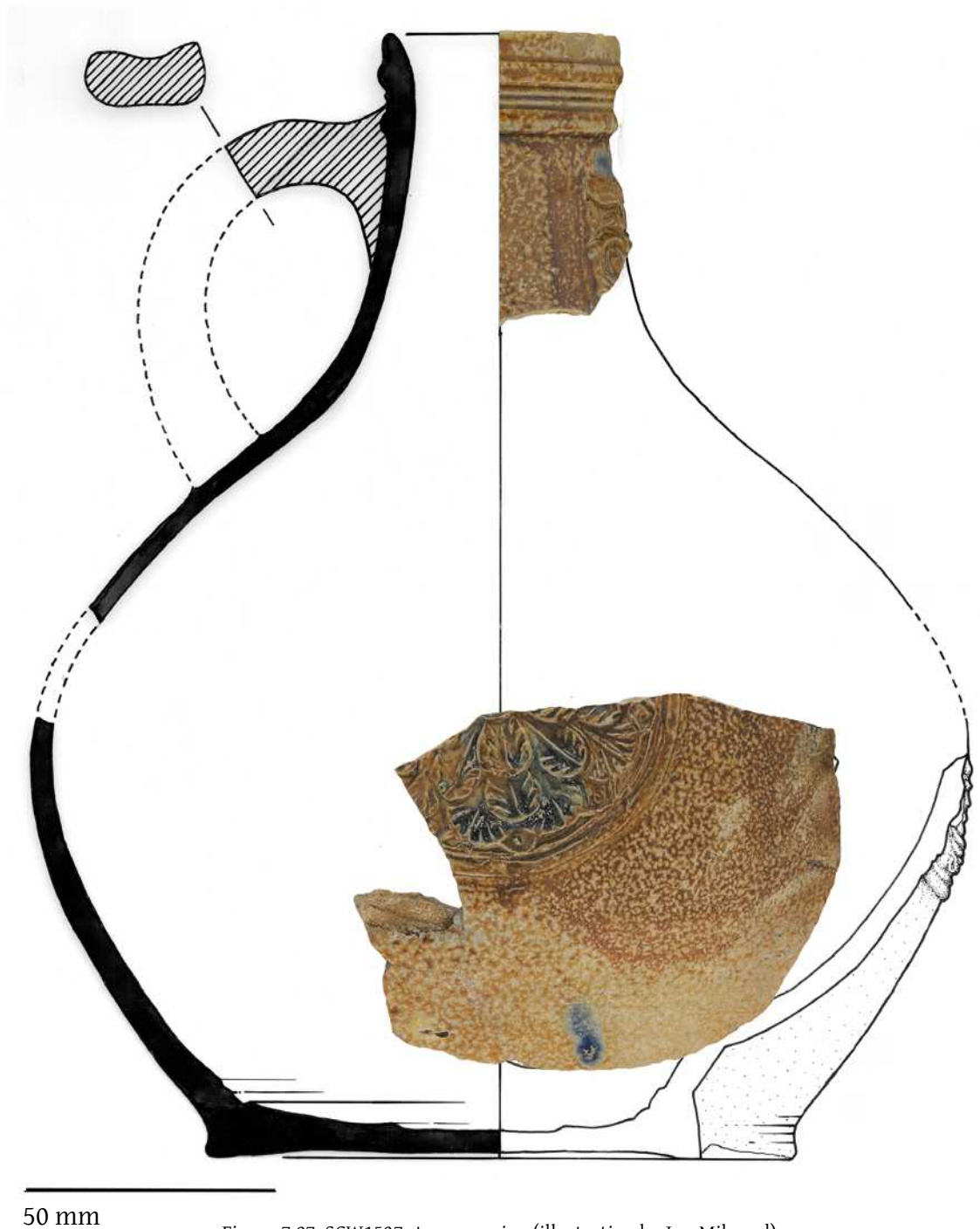


Figure 7.27. SCW1537 stoneware jug (illustration by Jon Milward)

rim diameter is difficult to establish from these small fragments, but they are large vessels. It is possible that these pots were made in England, although it is highly likely, based on the character of the wreck assemblage overall, that all the tin-glazed ware originated in the Low Countries.

SCW396 is a redware body sherd from an open form, probably a dish, that has glaze on both inner and outer surfaces.

Provisions

Two staved containers were recovered from the wreck, both of which have shown themselves to be parts of the ship's stores, with one staved container carrying salt beef and the other preserved fruit.

SCW36 (Figure 7.29) consists of thirteen staves, two hoops, a lower head and one stave of the upper head. The walls of the barrels were lined with black sediment

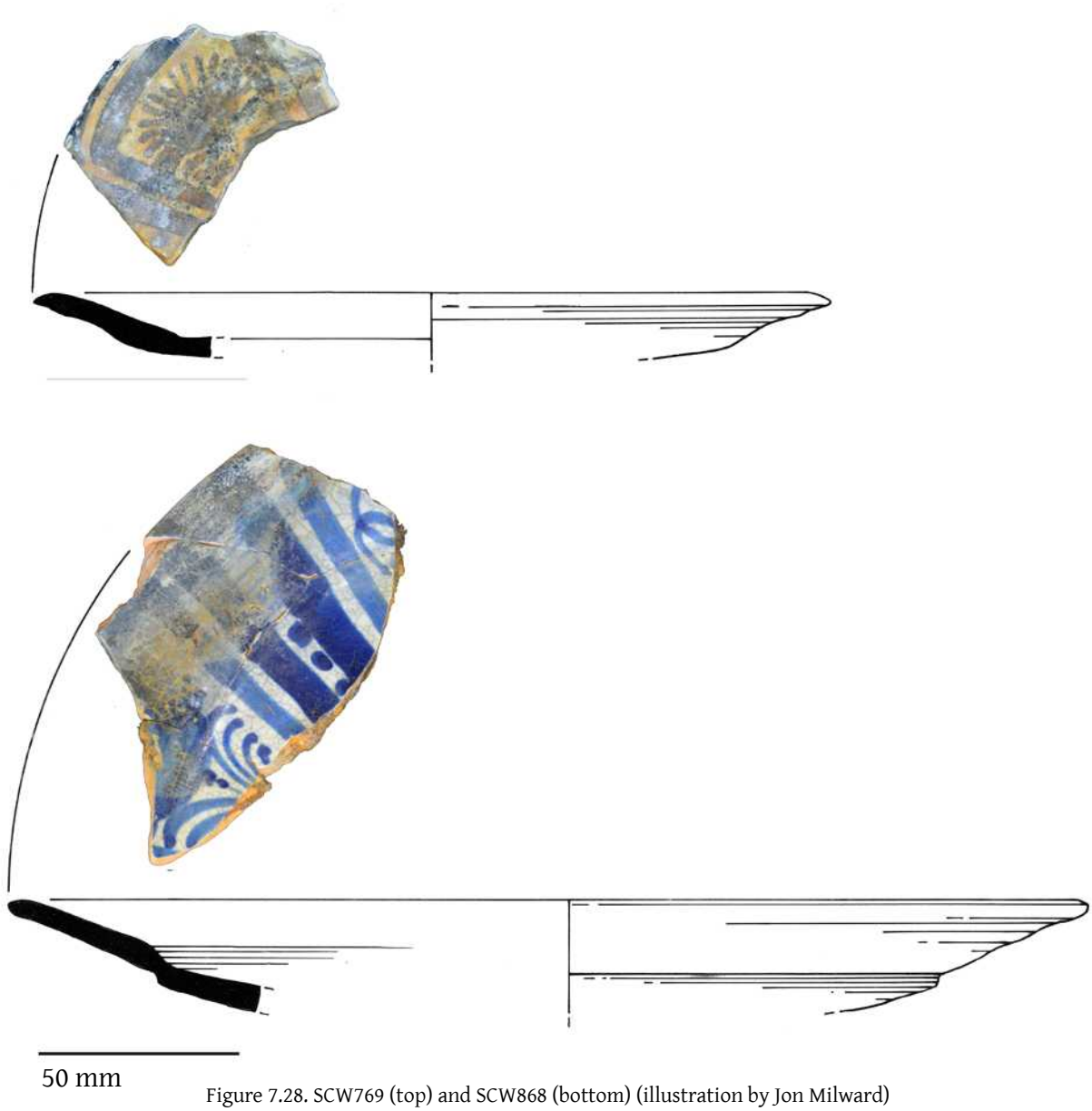


Figure 7.28. SCW769 (top) and SCW868 (bottom) (illustration by Jon Milward)

Figure 7.29. SCW36 staved container, partially excavated (scale: 200mm)

which contained the remains of plums (*Prunus domestica)*. This, in combination with the lack of a bung stave, suggests that the staved container may have been used to contain preserved fruit for the crew.

Due to the bulge in the midsection of a barrel, a precise estimation of volume is difficult. The experience of the cask collection from the *San Juan* in Red Bay, Labrador, Canada indicated that there is on average a 6.5% increase in volume beyond that of a simple cylinder (Grenier *et al* 2007, ii–32). The diameter of **SCW36**'s head is 367mm, with a height between the heads of *c* 500mm, giving an approximate capacity of56.33 litres using the formula above.

Applying modern measurements to 17th-century Dutch measurements can be misleading as they were not standardised across the country, but this would give a total volume of approximately two 'Kinnetje'

Figure 7.30. SCW861 staved container

(27.9 litres) (Gawronski *et al* 1992) – approximately one quarter of an 'okshoofd' (hogshead) (227 litres) (New Netherlands Institute 2013).

The second staved container, **SCW861** (Figure 7.30), consisted of the lower half of a container, although one stave was near complete. The head of **SCW861** measured 468mm in diameter with the largest stave surviving to *c* 500mm, giving a surviving volume of *c* 66 litres. This is almost half the volume of the beef casks from *Mary Rose* (Coy *et al* 2005, 570). **SCW861** contained 33 butchered animal bones, all of which were of a uniform size of approximately 150mm in length. It is therefore likely that **SCW861** is the remains of a cask of preserved beef. The presence of a bung stave suggests that a liquid would have been used to preserve the meat.

Faunal remains from SCW861

The bones recovered from barrel **SCW861** were exclusively from cattle or large unidentified mammals consistent with cattle. The Number of Identified Specimens (NISP) of different elements is presented in Table 7.2. Elements from the trunk are most common in the assemblage, with nine rib fragments and ten vertebral specimens present, mainly from the middle to caudal end of the spine (thoracic and lumbar). This is unsurprising as the ribs and vertebrae are the most commonly occurring elements within the skeleton and this is not, therefore, indicative of atypical element representation. The relatively uniform segmented specimens of ribs and vertebrae are consistent with salted portions that may have been barrelled for the voyage. The scapula is the only fore-limb element represented. The two scapula specimens are left-sided and comprise repeating zones. These therefore provide evidence for a Minimum Number of Individuals (MNI) of two cattle for the assemblage. However, in an assemblage of butchered portions taken aboard a ship it is not meaningful to assess the assemblage in terms of whole individuals (Table 7.2). Hind-limb specimens (comprising five fragments) were more common than those of the fore-limb. Overall meat-bearing elements were dominant, with elements from the skull and extremities (which have a much lower meat yield) entirely absent from the assemblage. This skewed element representation suggests that selected butchered portions were present on the ship rather than whole carcasses or live animals.

Table 7.2: Number of identified specimens of cattle skeletal elements in the assemblage

Element	NISP
Rib	9
Thoracic vert.	5
Lumbar vert.	4
Pelvis	2
Scapula	2
Femur	2
Tibia	1
Cervical vert.	1

A total of 18 of the 27 identifiable fragments showed evidence of butchery. This almost exclusively took the form of heavy chops or saw marks; no knife cuts were observed. The only exception was a blade mark on the distal surface of a rib, where the bone had been 'scraped' for meat removal. Due to the very thin sections of cortical bone on vertebrae, it was often not possible to distinguish whether the remains were sawn or chopped. However, the presence of characteristic diagonal striations of saw-marks on all butchered long bones suggests this was likely to have been the principal mode of butchery, although cleavers may have been used for chopping less-substantial bones such as ribs and vertebrae. Butchery marks were typical for the period. Modifications were generally characteristic of the segmentation of elements into convenient portions. The most common modification was the division of the vertebrae on the sagittal midline, or parallel to that midline. All vertebrae that comprised part of the centrum displayed this modification, with one specimen also having been divided on the opposite plain near the ventral surface of the centrum. Ribs frequently displayed transverse chop marks near the sternal end (around zone 6 following Serjeantson (1996)). The two femoral fragments were sawn diagonally on a transverse

plain, again creating more conveniently sized portions, perhaps for salting. The proximal femur specimen had a distinctive percussion mark and fresh fracture pattern at the proximal mid-shaft, providing clear evidence for bone smashing for marrow extraction. The tibia was not chopped or sawn but displayed a midshaft fresh fracture also suggestive of smashing for marrow extraction. Neither pelvis fragment displayed butchery evidence. Element representation suggests that primary and secondary butchery occurred on shore, with perhaps further segmentation occurring on board.

Other than butchery evidence, few taphonomic modifications were observed in the assemblage. Given the context it is unsurprising that gnawing, weathering, and trampling were entirely absent. Some discolouration was evident on several specimens, certainly as a result of their deposition in an aqueous context. Post-depositional breakage was infrequent, although some splintering of ribs and transverse processes of vertebrae was observed. None of the specimens suffered from severe erosion, likely due to them having some degree of protection inside the cask.

Fusion evidence was sparse and dental remains absent, but brief remarks can still be made regarding the age of the cattle. The proximal tibia and distal femur were both in the process of fusing, with fusion lines clearly evident, indicating an age of 3½ to 4 years. The unfused vertebral centra (two cranial centra epiphyses had begun to fuse) and the unfused scapula blade are in accordance with this age. The evidence thus suggests that recovered cattle were slaughtered at a prime meat age of around 3½ to 4 years old.

Such a small assemblage has very limited interpretative potential and patterns in element representation should not be over-emphasised. However, the most striking pattern to come to light during analysis is that all sizeable specimens were left-sided. In addition, all vertebral fragments (which never comprised more than half of the total element) also derived from the left side of the body. Given the small assemblage size this pattern may result from chance sampling. An alternative explanation is that the recovered bones principally derived from one butchered half cow, with one of the scapula fragments coming from another individual and happening to be from the left side.

Personal possessions

Magnifier glass

Within the concretion **SCW791,** a Nuremberg-style magnifier glass was recovered (**SCW888**) (Figure 7.31). This consisted of a single strip of copper wire looped around the glass lens and tied with a wire thread. While this is typical of the later 17th-century Nuremburg

Figure 7.31. SCW888 magnifying glass

design, the simplicity of the design means it would hardly be surprising if local optical manufacturers had not independently come up with similar techniques (Neil Handly, pers comm, January 2018). Similar designs can be seen in contemporary spectacles (Science Museum 2017). These would have been mass-produced with dozens of pairs turned out daily (Rosenthal 1996, 39).

Personal hygiene

SCW626 is an example of a fine-toothed double-sided ivory comb (Figure 7.32). This type of comb is commonly

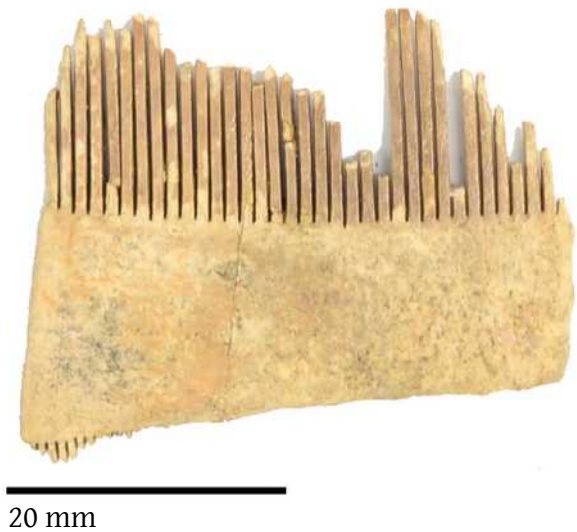


Figure 7.32. SCW626 bone or ivory comb

found in archaeological assemblages from prehistory to the present day and would have been used for personal grooming (Richards 2005a, 156).

Shoes

Construction

All the shoes were of welted construction. The shoe bottoms comprised insoles, midsoles and soles (outer or tread soles) with oval toes, 'natural'-shaped treads, distinct waists and medium seats, the waists of the insoles being rather narrow. The seat areas of the shoe bottoms were slightly raised by the insertion of a separate lift or lifts between the midsole and sole, in the manner of a very low 'wedge'; they did not have separate heels. The shoes were not made 'straight' but shaped for the left or the right foot. Thread was often preserved within the stitch holes and a thick plied thread used to join the shoe bottom components to the shoe welt was particularly well-preserved. The construction of the majority included a rolled welt and the impression of cross bracing was visible on the shoe bottom components (Goubitz *et al* 2001, 88, fig 33d).

Only one shoe, (**SCW768**, Figure 7.33) had a narrower, 'flat' welt suggesting the shoe was of a slightly differing welted construction (Goubitz *et al* 2001, 88, fig 29). These welted constructions are commonly found but some small differences were noted. While the majority of the shoe bottom parts were made of cattle hide as is usually the case, a small number of components had been made of other leathers – sheep/goatskin (midsole **SCW1536**) and possibly deerskin (insole **SCW47**).

The insoles of at least four shoes, **SCW47, 768, 1534, 343** were placed flesh side upward to the foot, rather than the more usual grain side upward.

Four shoes **SCW1536**, **47**, **1503 and 1534** had repair patches to the sole, known as clumps, present at the tread and the seat, attached by small wooden pegs. Others had peg holes in the bottom components (eg **SCW768, 345, 1427**) marking where repairs had been.

One shoe, **SCW46** (Figure 7.34), however, had an additional half-sole attached to its sole at the tread and at the seat which were seamed and had clearly been part of the original construction and not added later as separate repairs. A second shoe, **SCW261** (Figure 7.35), had an additional sole covering the waist and seat area, similarly stitched to the rest of the shoe bottom and with a row of wooden pegs running down the centre; peg holes present at the tread indicated that area had also been further reinforced originally. The provision of additional pieces to the sole during the shoe's construction would produce a very hard-wearing shoe intended for heavy wear. This use of additional patches, termed by Goubitz 'protective patches', attached during the original construction of the shoe can be seen on a shoe sole recovered from Shipwreck SO1 from the Wadden Sea of late 16th-century date (Goubitz *et al* 2001, 89, fig 38b).

The shoe uppers comprised a vamp, with a high tongue and open sides with low side seams, and a pair of quarters with narrow latchets fastening with a lace tie through a pair of lace holes in the tongue. All were all made of bovine leathers. The edges were plain cut, often with strengthening cord stitched along the edge on the inside of the shoe to reinforce potential points of weakness. The quarters of one shoe, **SCW1534,** were lined with calfskin, but most lacked heel stiffeners or other linings. **SCW343** (Figure 7.36) appeared to be of higher quality, and presumably greater expense, to the rest, having low (internal) linings, strengthening cord along the inside edges of the tongue, and decoration.

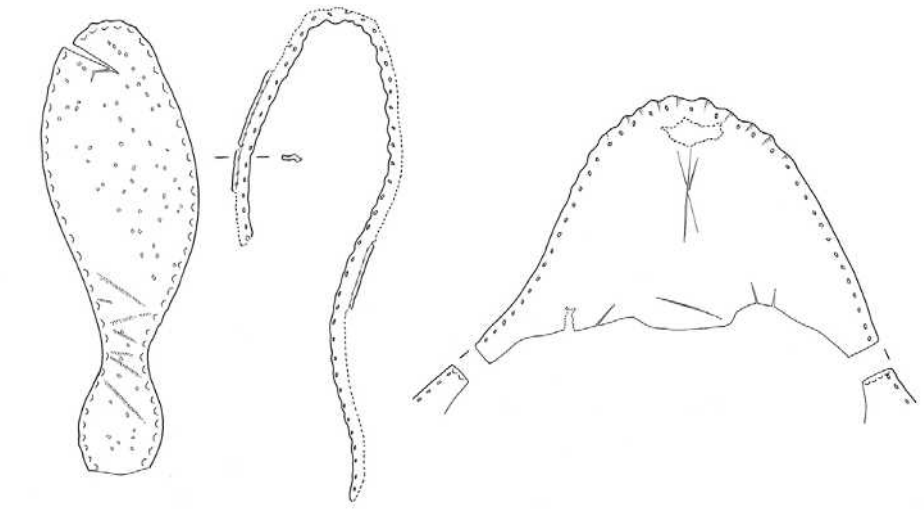


Figure 7.33. SCW768 shoe (illustration by Sue Winterbottom)

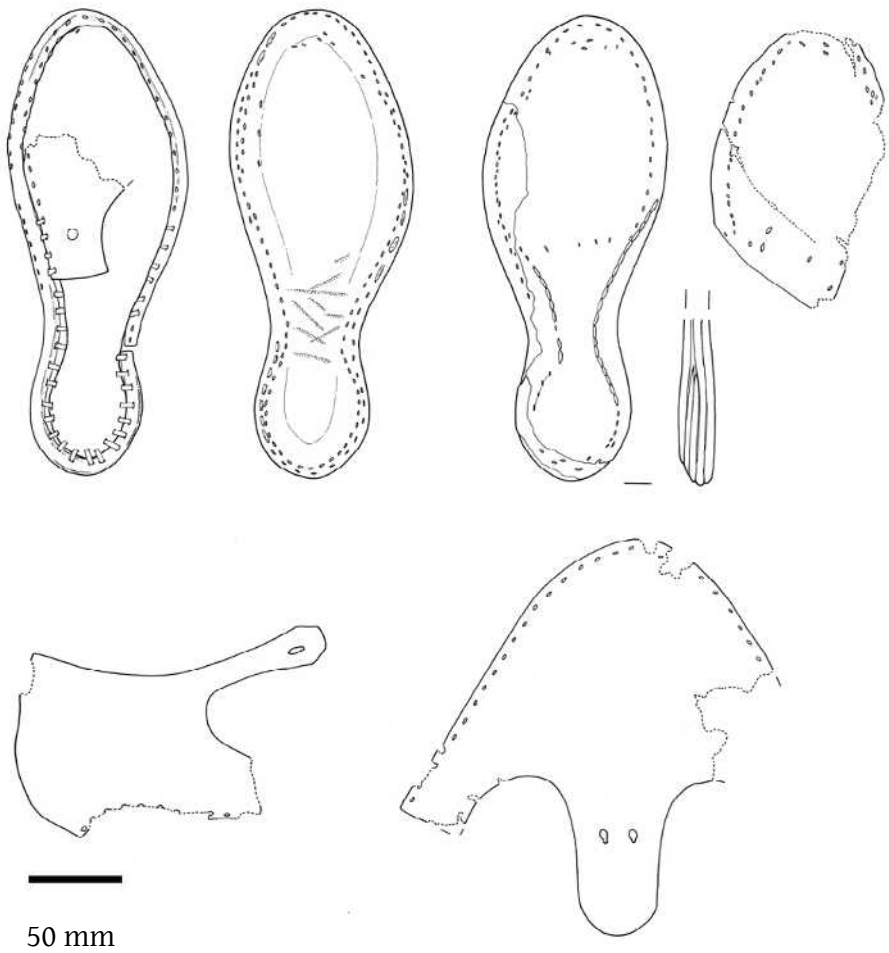


Figure 7.34. SCW46 shoe (illustration by Sue Winterbottom)

Four shoes had vamps made with a separate tongue extension, only one, **SCW47,** having an integral tongue; others were broken and this aspect of the original cutting pattern is uncertain. While the side seams were butted with edge/flesh seams, the back seams were edge/grain-seamed so that the seam was visible on the outside of the shoe, perhaps a minor decorative feature.

Decoration

While seven of the shoes were plain, **SCW1503** and **343** had their vamps and quarters decorated with a series of small vertical slits cut through the leather, a decorative technique popular on both footwear and clothing at this time. The very small slits used on the two shoes, some as small as 2mm in length and none longer than 6mm, fall at the finer end of the term 'pinking', as defined in the description of the decorated jerkins from *Mary Rose,* small cuts up to about 20mm (Foster 2005, 41), or 'stabbing' as described by Goubitz (Goubitz *et al* 2001, 43). Pinking was fashionable from the 1580s, with fine pinking such as this continuing to about 1620 (Swann 2001, 99 and 119).

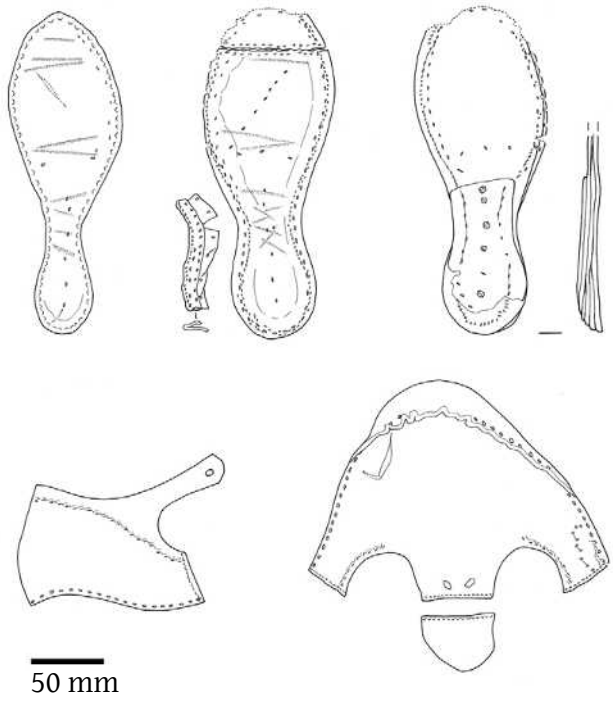


Figure 7.35. SCW261 shoe (illustration by Sue Winterbottom)

Repair

Where discernible, all the shoes had sole repair patches (clumps) at the tread and seat attached with wooden pegs, those put on when the shoes were first made also being sewn onto the welt, as described above. On one shoe (**SCW1536**) these repair patches had been made from leather salvaged from old shoe parts. Three shoes (**SCW261, 1536, 1534**) had stitching from the attachment of a small patch to the upper close to the side seam to repair an area where the lasting margin stitching, attaching the upper to the welt, had torn away; there appears to have been a distinct point of weakness in the design of this style of shoe at the outer (lateral) side seam.

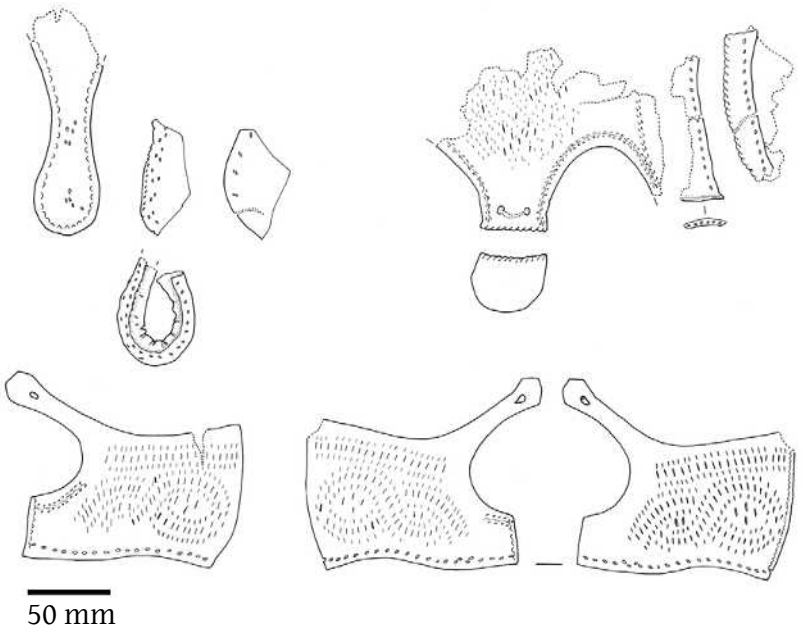


Figure 7.36. SCW343 decorated shoe (Illustration by Sue Winterbottom)

Style and dating

The general style of shoe found on the Swash Channel Wreck is shown in Figure 7.37 though individual cutting patterns may vary slightly in certain particulars. The construction and style of the shoes suggest they date to the first quarter of the 17th century. All are tie-lace latchet fastening shoes of welted construction of a style identified as 'Weesp-Vq style' (Volken 2014, 309, cat no. 15.14) and dated to the last quarter of the 16th-century and first quarter of the 17th century. Shoes of this style from six sites have provided evidence for this dating, the majority from The Netherlands, with a single German example from Munich (ibid). Of particular interest here are those from two shipwrecks: a shoe found on Shipwreck SO1-2406 from the Waddenzee, Texel that can be dated to AD1593, and three examples coming from Shipwreck B71-25/08/192 in Flevoland that is dated to the first quarter of the 17th century (Volken 2014, 201–309). It is possible that the shoes from the Swash Channel Wreck may date slightly later due to the following considerations. Some shoes without heels continued to be made as lefts and rights into the 1620s (Swann 1982, 7), shoes with oval-toed shoes for lefts and rights being found on the wreck of *Vasa* (1628) for example (Swann 2001, 105 and 108), while shoes with open sides continued in popularity into the 1660s (Swann 2001, 110). The shoes are heavily worn, some repaired and patched, and so may have been in use for several years. This being said, they are certainly more likely to date to the very beginning of the suggested date range for the wreck of the Swash Channel Wreck rather than the end, although differences in the suggested date range between the various categories of material culture recovered from a wreck is well attested (Martin 1997, 11).

Shoe sizes

All the shoes were of adult size. Those shoes that could provide an estimate of modern shoe size from measurement of their complete insoles are given in Table 7.3. All fall within the size range worn by men as, though they may appear small to the modern eye, it should be remembered that at the end of the 19th and beginning of the 20th century, adult sizes 2–7 were those mostly frequently worn by men. While their use by women cannot be entirely ruled out (sizes 1–4 were most frequently worn by women), it is perhaps more likely that the smaller shoes were worn by adolescent boys.

Figure 7.37. Shoe style represented by the Swash Channel Wreck finds (not to scale) (illustration by Sue Winterbottom)

Table 7.3: List of shoes and their modern equivalent European sizes

SCW No.	Size
46	Adult 1–2 (33–34)
261	Adult 2 (34)
47	Adult 3 (35)
1534	Adult 3 (35)
1503	Adult 3 (35)
768	Adult 4 (37)
1536	Adult 6 (39)

Secondary adaptations

SCW768 appears to have been adapted from a shoe, presumably of similar style to the others recovered, into a mule (a slip-on shoe with no quarters). Much of the side seams have been cut away so that only their lower parts remain, and the tongue has been cut off. This was a common occurrence, extending the life of an old shoe and making a smaller shoe wearable by a larger foot, perhaps when an old pair of shoes was handed-down to another (Goubitz *et al* 2001, 243). While such an alteration may have been undertaken as a renovation of a shoe for resale (a 'translation'), the irregularity of the removal of the tongue and the secondary slashes present on the vamp of this example suggest it may have been done by the wearer themselves.

When first examined, **SCW768** was found to have chopped straw or grass lying on the insole, apparently protected by the vamp from being washed away. Organic material, such as straw, grass and reed, has been noted inside shoes from other wrecks and marine situations and it is believed that sailors put the material in their footwear for insulation. A pair of thigh boots recovered from *Mary Rose*, with the foot of the wearer's hose still inside, were found to have a layer of straw within, and straw was also noted in sediment within a shoe of similar date from a wreck of a Spanish merchant vessel in Studland Bay, Dorset (Evans and Mould 2005, 88).

Two of the shoe vamps (**SCW261**, **1536**) had a vertical cut made to relieve pressure on the great (big) toe (*hallux*) joint, suggesting that the wearers had suffered with a bunion (*hallux valgus*). A third, **SCW46,** had a secondary cut at the little toe, perhaps to ease excessive rubbing on this part which commonly causes a hard corn. **SCW1427** had two parallel, horizontal cuts in the vamp directly above the position of the toenail on the great toe suggesting that it had been painful for the wearer, possibly due to injury.

Clay tobacco pipes

At least 67 fragments of clay tobacco pipe were recovered from the wreck site. They include fifteen bowls, bowl/heel junctions and at least 52 stems. Of these, four are 18th- or 19th-century in date and regarded as intrusive (**SCW 13, 59, 166, 673).** The pipes have been recorded and studied according to nationally agreed guidelines (Davey 1981; Davey and Higgins 1984; White 2004, 487–90). All the major fabric types have been studied using a 30 binocular microscope. The individual stamps have been recorded and impressions submitted to the National Stamp Catalogue held at the University of Liverpool.

With the exception of the four intrusive fragments, all identifiable fragments are Dutch in type. Eight of the fifteen (Figure 7.38, Nos 1 to 5) belong to a transitional group lying at the end of Duco's 'first generation' pipes dating from *c* 1610 to 1620 and his fully fledged 'double-conical' forms which begin around 1620 and are in production until 1675 (**SCW 267, 611, 617, 871, 873, 887, 894, 1375**). Looking closely at the forms present in the wreck group, they have more developed heels, are rather more precisely finished than the 'first generation' pipes, but are generally narrower than the later series. This is likely to place them in the period 1620 to 1630 rather than before 1620 (Duco 1987, 28–31). The remaining five identifiable bowls are fully developed double-conical pipes (Figure 7.38, Nos 6 to 8) but are fairly early in the series (**SCW 714, 793, 870, 872, 1378**). Duco dates three similar forms to between 1625 and 1635, 1625 and 1640, and 1620 and 1630 respectively (Duco 1981, 248, 276–7, nos 110–112). As there is likely to have been a decade of overlap in the production of these two types, the most likely dating for the Swash Channel Wreck group on formal grounds is somewhere between 1620 and 1635.

The pipes all appear to have been smoked and ten are stamped (Figure 7.39). Five have a variety of stamps featuring roses including two with a six-petalled rose and central dot in relief (**SCW 267, 894**), two with crowned roses with the initials E and L either side of the crown on one (**SCW 617**) and the other with possibly G and V in the same position, though very difficult to make out (**SCW 1375**). **SCW894** is crudely finished over the mould seams in a manner typical of makers in Hoorn/Enkhuizen (van der Lingen, pers comm). Neither set of initials corresponds to those of any known maker. In general such varieties of rose stamp date from the first half of the 17th century (van Oostveen and Stam 2011, 78; Krommenhoek and Vrij 1986, 43; Duco 1981, 247).

The five pipes with *fleur-de-lys* heel stamps are all from the same mould and stamped using the same die. Although well burnished and much higher in quality than the other bowls, they too exhibit typical Hoorn/Enkhuizen finishing techniques.

The *fleur-de-lys* was widely used as a heel stamp but also to decorate stems for much of the 17th century. Examples of such heel stamps from Holland range from 1625 to 1650 in date (Duco 1981, 248–58, 276–95).

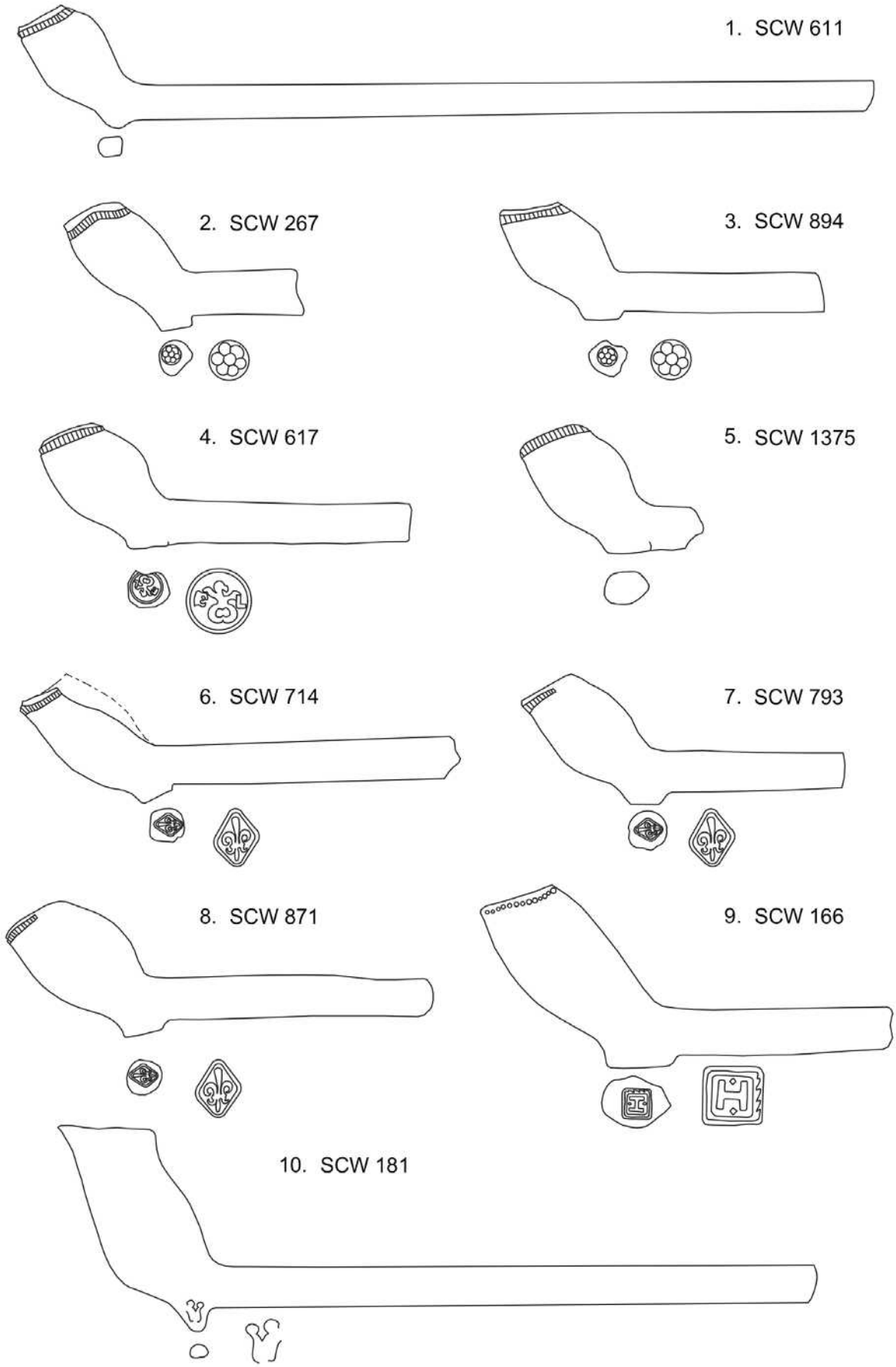


Figure 7.38. Clay pipe assemblage from the wreck (illustrations by Fenella Logan)

Figure 7.39. Stamps on the non-intrusive pipes

These pipes are very well made, highly burnished and of a much higher quality than the first-generation pipes. Burnishing is mentioned in the 1641 Gouda Guild charter and was being carried out before 1635 (Duco 1981, 374), 35 stripes being typical on 17th-century pipes (Duco 1980, 189). The additional work involved added up to 25% to the cost of production and would have been reflected in the selling price (Duco 1980, 182, 188–9).

Although the *fleur-de-lys* pipes and one of the rose-stamped forms were almost certainly made in North Holland, the others are varied in detail and finish and may have been produced in other centres such as Gorichem, Gouda, Haarlem and Hoorn (van Oostveen and Stam 2011, 78, 84, 96, 101). At least one is probably from Amsterdam (**SCW617**).

It would seem likely that the first-generation/double-conical transition pipes were the personal possessions of the crew rather than traded goods as they are made from different moulds, are of varying qualities and show evidence of being smoked. The *fleur-de-lys* pipes on the other hand were all located in the stern of the vessel, with the majority being found inside concretion **SCW791** along with several stem fragments. Given their higher quality and uniformity, these may represent either small private trade goods or the personal supply of one of the officers or passengers. Similar *fleur-de-lys* stamped pipes were found at the Dutch campsites in La Tortuga which were occupied between 1624 and 1638 (Antczac *et al* 2015, 203–6). The fourteen years of occupation there produced a wider range of pipe types than was on board the Swash Channel Wreck, but both assemblages are completely compatible.

Commerce

Weights and measured were not standardised in the Dutch Republics until the introduction of the metric system by Napoleon in the 19th century, with each region having its own measurements system but using the same names. For example, the pond could weigh anything between 404g and 494g, with the Hoorn Pond fitting in the middle at 467.6g (Loden Blokgewichten 2023). This could make trade difficult and therefore any weights would have to feature a hallmark to denote which town the weight was from.

The complete circular lead weight (**SCW44**) recovered from the site is trapezoidal in section with a base diameter of 67mm and a top diameter of 56mm. The top of the weight features three incised lines indicating the item's weight and a crowned mark (Figure 7.40). This weighs 1406g, making each pond 468.67g – close to the Hoorn Pond. The mark features a horn topped by a crown with the letter I on the top left and the numbers 2 and 7 on either side (Loden Blokgewichten 2023). This marks the weight as being proofed in Hoorn in 1627 and would have been in use up until 1632 (Appel 2002).

A set of one to three pound weights of a similar style were recovered from the Salcombe Cannon Site stamped with the letter B; the three-pound weight also features a stamp in the form of the letter A (BM Number 1999,1207.572).

Figure 7.40. SCW966 and SCW44 showing a close-up of the crowned mark on SCW44 and the hallmark of the city of Hoorn

A second possible weight, **SCW966**, was recovered from within concretion **SCW791**. It is approximately the same size as **SCW44** but heavily corroded and weighs only 340g; its identity as a trade weight could not be confirmed.

Medicine

A single item relating to health and medicine was recovered from the site: **SCW17** (Figure 7.41) is a complete profile of a drug jar. It is 154mm in height

Figure 7.41. SCW17 majolica jar (illustration by Jon Milward)

with a rim diameter of 87mm. It has a white overall glaze with a blue-painted central panel that includes the lettering 'V. ALBUM.CAM' supported by an 'Indian Head'. This would be the name of the medicinal compound contained within the vessel, *Unguentum Album Camphoratum*, or camphorated white ointment. The recipe in the Amsterdam Pharmacopoeia of 1636 (Wittop Koning 1961) states that it was made from rose oil, white wax, lead carbonate and ground camphor. This would have been made into a fine, cooling, drying ointment for easing pains and itching within wounds and ulcers (Culpeper 1653). 'Camphor is a naturally occurring compound with a long history of medicinal use' (Green 1990, 662) which is readily absorbed through the skin, where it selectively stimulates nerve endings sensitive to cold, producing a warm sensation when vigorously applied, or a cool sensation when applied gently. This effect also induces a slight local anaesthesia and has an anti-microbial secondary effect.

Majolica jars of similar form and decoration exist in several historical apothecary collections: unmarked majolica jars have been recovered from the Alderney Elizabethan Wreck (Bound and Monaghan 2001), Salcombe Cannon Site (BM Number: 1999,1207.532), and the *Batavia* (Green 1989, 100

Chapter 8

Historical background

Ian Friel

Introduction

In 1658, a judge in the English High Court of Admiralty made a passing reference to what goods the 'mercy of the sea' might leave after a shipwreck. He was reflecting on issues of chance because the sea has no mercy.

The judge was not entirely right. Chance does play a huge role in shipwrecks, both in terms of the wrecking itself and in what survives afterwards, but human agency also has a role.

The Swash Channel Wreck is one of the major archaeological discoveries of recent years in British waters. What remains of the ship is in part a product of the happenstance of wreck and the seabed conditions that preserved much of one side of the hull. However, the evidence for the ship's identity also strongly suggests that 17th-century people had a direct influence on what remained to be found by 21st-century archaeologists.

Identifying the Swash Channel Wreck has been a fascinating process and involved a search through an estimated 15,000 pages or more of 17th-century manuscripts and many printed primary sources. However, even when one finds identification evidence that appears definite, it has to be tested rigorously and placed in a firm historical context. When dealing with a ship from nearly 400 years ago, you must ensure that the apparently 'golden' nugget of information that you have found is not just fool's gold.

Methodology and sources

The period covered by this study, from the 1620s to 1660, predates newspapers and the systematic recording of shipwrecks by government. Trying to identify a specific shipwreck in the archives can be akin to a hunt for the proverbial needle in a haystack, without being sure which *particular* haystack you need to search.

The methodology of this study is as follows:

- a review of printed primary sources for shipwrecks;
- the sampling of a large range of manuscript sources, both local and national;
- an exploration of the nature of the written evidence for shipwrecks in this period;
- the creation of a shortlist of possible documented 'candidates' for the Swash Channel Wreck – ships lost in the vicinity of Poole Harbour and the Isle of Purbeck at this time;
- a detailed analysis of the evidence for the wrecks on the shortlist;
- a proposed identification for the Swash Channel Wreck, tested against the evidence for other wrecks on the shortlist.

Despite the lack of systematised shipwreck recording at this period, there are numerous useful sources that include references to wrecks. The starting-point for this study was the well-indexed *Calendars of State Papers*, Domestic and Colonial (CSPD and CSPC), which were searched using British History Online (http://www.british-history.ac.uk; other BHO sources of the period were also searched). Over one thousand references were checked. Instances of shipwrecks were noted, in addition to any information about shipping activity in Studland Bay or around the Isle of Purbeck.

The catalogues of The National Archives, Kew (TNA) and the British Library (Manuscripts) (BL) were also searched, using terms such as 'wreck', 'Studland' and 'Purbeck', but also the names of some individuals connected to ships lost in the area between Portland and Poole. No relevant BL material was located, but information was found at TNA. The manuscript sources used at TNA included the voluminous records of the English High Court of Admiralty (HCA – sampled for the period 1625–60), and the State Papers Foreign (Holland). The latter were thoroughly checked for the years 1628–60, as diplomatic correspondence can be a valuable source of information about shipping and shipwrecks (http://www.nationalarchives.gov.uk; http://www.bl.uk).

The Poole Borough records, along with other local sources, were accessed at the Dorset History Centre in Dorchester. These included the important, but relatively little-known Poole Admiralty Book, a crucial document for Poole's maritime history in the 16th and 17th centuries.

One of the problems in exploring the history of this period is that for a decade and more, Britain was in total upheaval due to civil wars. To use a contemporary phrase, it was a 'world turned upside down'. This

meant that the routine systems of government often broke down, something reflected in the quality of both national and local record-keeping (Aylmer and Morrill 1979, 37). If the Swash Channel Wreck had taken place in the 1640s, the process of identifying it might have been made impossible, due to a dearth of surviving records. The area round Poole and the Isle of Purbeck was a war zone for several years during this decade. Fortunately, there are good grounds for identifying the wreck as a ship lost eleven years before the Civil War.

The Swash Channel Wreck and historical evidence of 17th-century Dutch shipping

The Swash Channel Wreck was a large, armed merchantman. It was built in north-western Europe, most probably in the Netherlands, in 1628 or later. On archaeological grounds, the ship is thought to have been lost between 1630 and 1650. The vessel could carry at least 26 carriage-mounted guns, and this suggests that it was one of the larger Dutch ships, designed for long-distance operations. One of the odd features of the Swash Channel Wreck is that although it had ample space for cargo, there is no real evidence of any merchandise aboard.

As the ship could carry so many guns, one might suggest that it was a warship, but large ocean-going ships of the period commonly carried armament, both for defence and offence, and the 17th-century Dutch war fleet included armed merchant vessels. The fleet was not a single state navy, but rather a coalition of forces supplied by the admiralties of the five Dutch maritime provinces. A Dutch fleet list of 1631 gives a rough order of magnitude for the tonnage of the Swash Channel Wreck because it suggests that ships with between 24 and 30 guns normally ranged in size from around 300 to 600 tons.

The wider context: the 1625–1642 shipwreck study

We will never know just how many shipwrecks there were around Britain in the 17th century. Many wreck accounts do survive, but they cannot be approached as if they were a simple statistical source. Given the incomplete nature of the records, merely turning up a few 'possibles' for the Swash is not enough. It is also important to understand the reasons why wrecks were recorded and the nature of the evidence that does survive.

In order to provide a context for this study, a survey was undertaken of national sources for shipwrecks in England and Wales for the years 1625–42. The principal source used here was the *Calendar of State Papers Domestic* (CSPD) for first seventeen years of the reign of Charles I (CSPD 1625–43, *passim)*. This survey covers the first part of the 1630–50 period attributed to the wreck and ends in 1642 because of the onset of the English Civil War. The survey cast its net wide and used numerous search terms. These were:

> wreck, wrecked, 'cast away', sank, sunk, foundered, driven ashore, ran ashore, run ashore, aground, capsize, capsized, overset, shipwreck, 'ship was lost', 'lost his ship', 'ship lost', variations on 'burnt ship', 'burned the ship', 'burned his ship', 'fired ship', 'blew up', 'blown up', bilged, bulged, Studland, Purbeck, Poole and Corfe.

The survey was needed in order to explore a number of issues, including:

- how common were wreck records?
- why were the records made?
- can they be regarded as in any way representative of the total number of shipping casualties, even if they are very unlikely to be comprehensive?
- what normally happened after a ship was wrecked?

The CSPDs were supplemented by information from the calendared Acts of the Privy Council (APC, which run to 1632) and manuscript sources such as the State Papers Holland and the records of the High Court of Admiralty (HCA). Selected years of some of the HCA Classes were checked to provide additional references and supplementary information for the CSPD, but a full check of all the HCA documents was not possible in the time available for this project.

CSPD supplied about 83% of the total of shipwreck records in this research, although undoubtedly more would emerge from a thorough study of HCA and other archives for the period. The overall results of the study suggest that many of the wrecks of the larger and more valuable ships in these years can be found recorded in the State Papers. There are some important omissions, however, including the vessel identified as the Swash Channel Wreck, which perhaps failed to 'surface' in CSPD for reasons other than mere chance.

The research found references to 141 shipwreck incidents for the years 1625–42. In some cases, the incident reports related to more than one ship, and the total number of identifiable individual losses in this group came to at least 191 vessels. There are also some much more general statements about losses of large numbers of ships, often due to storms, war, or piracy. In terms of date, the references break down as follows:

Table 8.1: Incidents involving vessels lost in naval warfare or piratical attacks

Period of wreck	Losses of specific ships*	General references to major ship losses	Totals**
1625–29	54	4	58 (20)
1630–34	45	1	46 (9)
1635–39	34	2	36 (7)
1640–42	7	2	9 (2)
1625–42	1	0	1
Total	**141**	**9**	**150 (38)**

* includes incidents in which more than one ship was lost;
** Losses in combat or to piracy in brackets

Most of these incidents occurred on or in the vicinity of the English coast, although some took place in Wales, Scotland and Ireland. The first period takes in most of the years of conflict with France and Spain, and this explains the large number of combat losses (Rodger 1997, 361–2). If one factors out the war casualties in the first period, the rate of reported wreck occurrences looks fairly even up to about 1640.

These reports reflected both the incidence of wrecks and the possibility that the government might record them in some way. Even if the figures are unlikely to be comprehensive, the lack of major variations suggests that they may be at least representative of trends. This is supported by evidence for the times of the year in which ships were lost. With representative sources, one would expect to find more wreck incidents in the stormier autumn and winter months, and this is what the data show. The month of wrecking is known in 79 cases and of these, 50 (63.3%) took place between October and March. However, as will be suggested below, the evidence is probably only representative for a certain *category* of vessel.

Of the 141 specific incidents, the reports of 74 (52.5%) of them were prompted by property or money issues. These included:

- complaints from shipmasters and merchants about their financial losses;
- claims to recover wrecked goods;
- disputes over the right to shipwrecked cargo found on or off the coast;
- protests by owners over the theft of such goods.

Straightforward reports of wrecks accounted for the remainder, though the records in the survey only mentioned the fate of the crew or passengers in just under one-quarter of the instances (35, 24.8%). Human casualties were often a lesser priority when it came to notifying someone of a wreck: it is clear that the single most important reason why wrecks were recorded was because they led to disputes over lost property.

The geography of the wreck incident reports is interesting, as the map shows (Figure 8.1). It gives the approximate locations of various wrecks found by this study in England and Wales (those for Scotland, Ireland and the Channel Islands have been excluded). There are certain biases apparent:

- wreck reports tended to cluster around big ports, havens or anchorages;
- a wreck was more likely to be reported (as an event) to the central government if it took place in a district overseen by a royal official or naval officer;
- the volume of reports tended to tail off the further the location was from London.

Despite these drawbacks, the information found by the survey covers a wide area, from north-east England to the south coast, and from Cornwall to North Wales.

The red dots on the map mark the known losses of Dutch vessels; these made up around one in seven of the reported 141 wreck incidents. Their number and wide distribution are signs of the ubiquity of Dutch merchant shipping at this date, and probably also a reflection of political and legal factors. Under Article 18 of the 1625 Treaty of Southampton between Britain and the Netherlands, any Dutch ships or goods wrecked on the British coast, or their remains, were supposed to be restored to their original owners.[1]

The sources also have other biases. Given that smaller vessels were likely to be more vulnerable to bad weather, it is reasonable to suppose that boats and ships in this category would have been lost in greater numbers each year than large ships. Also, there were more small vessels than large ones. However, most of

[1] SP 84/147, f 7

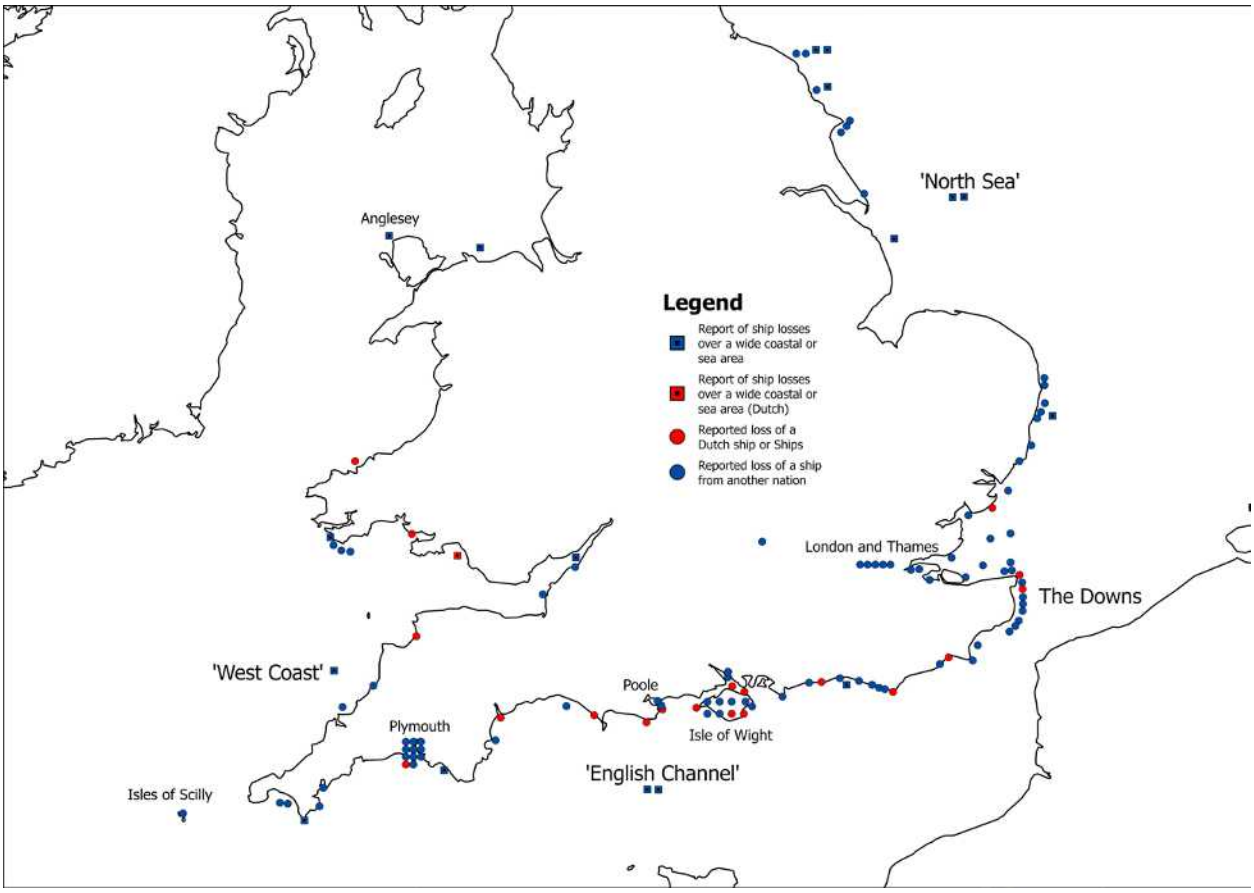


Figure 8.1. Map of shipping casualty references from the 1625–1642 shipwreck survey

the wreck references in the 1625–42 survey relate to larger vessels. This is because such wrecks represented huge concentrations of wealth, and their loss often led to looting and disputes that generated records. For instance, after the *Darling* of London was wrecked on the Sussex coast in 1634, the owners and merchants claimed that looters took at least £500-worth of items out of it, including elephants' tusks and ship's gear.[2]

The sources have a built-in 'deficit' in terms of recorded wreck numbers that will probably never be corrected. This is given credence by references to mass wreckings, for example:

- in 1628 a petition from Dunwich in Suffolk referred to a 'fleet of colliers lately cast away';
- in 1630 the merchants of Newcastle complained that 'most of their best-appointed ships' had been taken and sunk in war;
- in 1637 it was said that eighteen wine ships were wrecked on the Sussex coast;
- a report in December 1641 spoke of 'forty ships' being 'cast away upon the coasts'.[3]

The evidence available for this period appears to be representative of losses of larger ships. This is fortunate from the point of view of identifying the Swash Channel Wreck, because it was a big ship capable of carrying a lot of cargo and many valuable guns. It would be surprising if at least a small amount of paperwork had not followed in its wake.

Wrecking and after: law, looting and salvage

The right of wreck

The legal concept of 'wreck' is key to understanding the records of shipwrecks before the modern era. It was all about property, whether cargo, ship's tackle or the remains of the ship itself. All had some value. Even ships' timbers could be recycled as firewood, or sometimes for use in houses, as happened in the makeshift port of Ravenserod (Yorkshire) in the 13th century (Hoskins 1972).

The 'right of wreck' meant that a person or institution had the right to acquire any shipwrecked materials found on coastline that they owned. The right may have been restricted to local rulers or kings in earlier Anglo-Saxon times, but by the 11th century English monarchs had realised that it could be used as a gift to reward the Church or secular landowners.

[2] HCA 24/94, No 65

[3] CSPD 1628–29, vol 100, no. 38; CSPD 1641–43, vol 486, no. 39; CSPD 1625–49 Addenda, vol 531, no. 113; pp 385–402; CSPD 1627–28, vol 91, no. 82; CSPD 1636–37, vol 345, no. 94

The interests of the owners of a wrecked ship and goods were finally recognised in 1236, when the legal notion of 'wreck' was introduced. It was laid down that if a person or animal escaped alive from a shipwreck, the ship and goods, or what was left of them, were not *legally* wreck – the presence of a survivor meant that divine providence was at work. This law gave the owners a 'window' of three months in which they could reclaim the wrecked items: if they failed to do so, the material became the property of the local owner of the right of wreck. The 1276 Statute of Westminster extended the period of grace to one year, but thereafter the law of wreck remained largely unchanged until the 18th century (Marsden 1897, xxxix–xli). Thanks to the ways in which rights of wreck were conferred as gifts, a complicated patchwork of English wreck jurisdictions evolved during the Middle Ages. Matters were made even more complex by arguments over who owned the right on stretches of coast, and the fact that wrecks were often looted.

Life, death and looting

A wrecked ship and its contents could be a windfall for coast dwellers, poor and wealthy alike, and the circumstances of such an accident could easily be interpreted as an act of God. It is also likely that a 'finders-keepers' mentality lay behind a lot of looting, and the impulse is not yet extinct. When the merchantman *Napoli* ran aground off the Devon coast in 2007, several individuals ransacked some of the containers that floated ashore (BBC News, 23 January 2007).

It is probable that in the past shipwreck survivors were sometimes murdered, for the law could provide an incentive to ensure that no-one survived a wreck (Friel 1983). The 1625–42 survey did not turn up any accusations of homicide, though the dead sometimes received scant regard. When some drowned sailors were washed ashore on the Welsh coast in 1630 or 1631, they were stripped of their clothes and left to rot.[4]

Some coastal communities saw the proceeds from shipwrecks as their traditional right. In 1619, Sir John Killigrew proposed to build a lighthouse on the Lizard in Cornwall, with the double aim of preventing wrecks and profiting from lighthouse tolls. However, a report said that the local people protested: they feared he would 'take away God's Grace from them ... They have been so long used to reap purchase by the calamity of the ruin of shipping as they claim it hereditary' (Roddie 1976).

Out of the 141 incidents in the 1625–42 survey, nineteen (13.5%) offered definite evidence of looting, and the true figure was likely much higher. A 1629 report spoke of the 'inhuman custom' of Sussex people who plundered wrecked ships.[5] A few years later, in 1634, after a ship carrying Malaga wine sank in the Thames Estuary it was said that the local fishermen were getting drunk daily on 'wrack sack'. In the Dorset area, the most notorious case occurred in the Chesil Beach area. The ship *Golden Grape* was wrecked there in 1641, carrying a rich cargo of oil, sherry sack, silk, money, and other items. Some of the crew survived, but the wreck was still pillaged using 'force and violence', and HCA wreck commissioners subsequently interrogated nearly 400 people about the incident[6] (Pope 1918).

Salvage

If looting was common, so were legal attempts to salvage wrecks. The 1625–42 survey found nineteen reports (13.5%) of planned salvage work of some kind, as opposed to mere theft. Much of the activity was probably very basic, such as the hooking of items from the seabed, but some of it was more sophisticated. In 1627, for instance, a sunken warship called the *Rainbow* was brought back to the surface with the aid of slings of some sort (Roddie 1976, 257).

The most celebrated salvor of the time was a Dutchman named John Jacob Janson or Jacob Johnson, known in England as 'Jacob the Diver'. Jacob had diving apparatus and used it for work on submerged wrecks. Between 1620 and the 1630s (perhaps as late as 1636) he undertook a range of salvage projects in England, France and Ireland, often with considerable success, and he may well have worked on the wreck[7] (Roddie 1976).

It is important to understand the prevalence and nature of wreck-looting and salvage in this period because most of the possible 'candidates' for the Swash Channel Wreck were subject to one or the other – or both.

Lawyers and diplomats

The English High Court of Admiralty (HCA) had legal authority over a wide range of marine issues, including wrecks, but it is unlikely it investigated more than a minority of cases. When the Court did become involved, its normal procedure was to appoint commissioners. Their purpose was to determine the circumstances surrounding a wreck and – if possible – to recover wrecked goods. As a result, commissioners' reports can be very informative.

[4] CSPD 1629–31, vol 182, no. 59

[5] CSPD 1629–31, vol 151, no. 32

[6] CSPD 1633–34, vol 263, no. 23

[7] HCA 23/12, nos 23, 31 and 32

Diplomatic records are also a potentially useful source for shipwreck information. The arrest, capture or loss of a foreign ship in British[8] waters often led to diplomatic correspondence, as the ambassadors or other representatives of the ship's home country addressed the British government on behalf of the owners of the vessel and its cargo. The Dutch were generally well-organised and tenacious when it came to retrieving their goods, and they clearly had an effective network of informants in England. In 1629, one English official commented sourly that the Dutch ambassador had 'his diligent intelligencers in every port or haven of this realm', with lawyers in constant attendance at the High Court of Admiralty, and English bureaucrats only too ready to offer help.[9] If the HCA proved to be too slow in dealing with a case, Dutch ambassadors were quite prepared to 'escalate' the matter to a much higher level, such as the King's Privy Council.[10]

However, even successfully prosecuted wreck cases could drag on for months or years, with the plaintiffs getting little or no compensation at the end of it. When a Dutch ship was wrecked off Little Holland in Essex in 1633, three separate salvage operations yielded goods that were sold for just under £2184. Despite this, after the salvors, Admiralty Court officials and others had been paid, a mere £500 went to the Amsterdam merchants who owned the cargo, and that more than two years after the ship had been lost.[11]

The right of wreck, widespread looting and a cumbersome legal system could turn the recovery of lost cargoes and gear could into a nightmare for owners. For all that, without the reams of paper generated by this process, we would know a lot less about past shipwrecks.

The local context: geography, history and the Swash Channel Wreck

The history of the coast around Poole and Studland Bay helps us to understand why the Swash Channel Wreck lies where it does. The shallow Bay has long been known to offer a firm anchorage and good shelter from westerly and south-westerly winds (Admiralty 1863; Norre 1839, 49). These qualities were well understood by mariners in the 17th century, who found it a good place to run ships ashore in safety, or to land troops (Powell and Timings 1963, 86–7). In the 1650s, both English and Dutch pirates and privateers used the Bay as a quiet place to sort out their loot.[12] The vessel identified as the Swash Channel Wreck seems to have ended up in Studland Bay because its master was seeking shelter for his ship (see below).

The Manor of Studland and the right of wreck

Coastal manors often held the right of wreck for their stretch of shoreline. Wreck evidence can be found in some manorial records, because finds had to be declared to the manorial court. The Manor of Studland was owned by the Bankes family of Corfe Castle, and they had the right of wreck in Studland Bay. Unfortunately, the Studland manor court proceedings from the 1620s and 1630s do not offer any help in identifying the Swash Channel Wreck and there are no surviving manorial court records between 1638 and 1653, almost certainly as a result of the Civil War. The extant court proceedings do record the recovery of anchors and other items from unnamed ships, and even the discovery of a boat with two drowned fishermen. However, there is nothing to suggest that people from the manor took anything from the wreck. If they did loot the wreck, they kept quiet about it.[13]

The Port of Poole

The Swash Channel ship was lost during a time of great insecurity and danger in European waters, something reflected in the history of Poole between the 1620s and 1650s. Poole was a significant West Country port in the 17th century, engaged in the Newfoundland fishery and in trades to southern Europe. However, the town's maritime economy was showing signs of decline in the 1620s. In 1626, the local authorities claimed that in the previous two years Poole had lost over 135 seamen, either dead or taken by the navy, and suffered eight ships sunk or captured by enemy navies and Barbary pirates. In all, the financial losses were reckoned to be in the order of £6000.[14] These were heavy blows for a relatively small town.

Poole declared for Parliament during the English Civil Wars (1642–46 and 1648–51). The town received a garrison and contributed at least one ship to the Parliamentarian fleet. It was never attacked, but like other ports in Britain, its shipping was often at risk from privateering and piracy. Even settlements on Purbeck could be threatened in this way, and Royalist privateers still plagued the Dorset coast as late as 1650 (Mayo 1902, 210 and 359; Powell 1962, 63–70 and 202; Powell and Timings 1963, 86–7; Anonymous 1643, 3; Bayley 1910, 89–93, 121–2 and 339).

[8] After the Union of the Scottish and English Crowns in 1603, it was not uncommon for English government documents to use the terms 'Britain' or 'British' in the early 17th century.
[9] SP 84/141, 58
[10] SP 84/138, 29; SP 84/139, 120
[11] HCA 24/89, no. 202; HCA 50/2, ff 37 and 40–41v
[12] SP 84/160, ff 123–132v, 140, 142, 150–150v and 168–169; SP 84/162, ff 287, 289 and 298
[13] DHC D/BKL/CE/2/1, mm 1r and 2r; DHC D/BKL/CA/1/3, p 3; DHC D/BKL/CA/1/4, p 66; DHC D/BKL/CA/1/7, p 70
[14] SP 16/51, f 73

Identifying the Swash Channel Wreck

There are a number of historical 'candidates' for the Swash Channel Wreck, but based on the available evidence, it is suggested that it was a vessel called the *Fame* of Hoorn. However, as has already been said, it is important to test this identification against comparative evidence for other documented wrecks in the vicinity of the Isle of Purbeck between the 1620s and the late 1650s. These will be considered in turn.

Fame *of Hoorn, 1631*

On Tuesday, 2 March 1631, the owners of a Dutch ship called the *Fame* made a complaint to the High Court of Admiralty in London.[15] The English and Latin versions of their submission record the key points, summarised here:[16]

1. In January and February 1631, the *Fame* was owned by Hercules Garretson and Cornelius Vene and their 'company' [which could just mean 'associates' rather than 'company' in the sense of a formally constituted organisation]. It was also noted that they owned 'all, and singular the tackle, furniture, apparel, provision, munition and victual thereunto belonging' [there is no mention of cargo]; the ship was also armed.
2. In January and February 1631, the owners sent the ship on a voyage from Hoorn to the West Indies, with the aim of returning to Hoorn.
3. Whilst on its outward voyage, the *Fame* anchored near Poole.
4. While the ship was at anchor, 'by tempest and stress of weather' the anchor 'did come home' – meaning that it dragged and would not hold (Manwaring and Perrin 1922, 89).
5. The ship 'overset and was overwhelmed in the sea and in some danger of perishing' ['overset' meant 'capsized']. It was driven by the winds on to the *scopules* [banks?] or sands (*arenas*) near the port of Poole and 'broken in pieces and torn up'.
6. After the ship capsized, 'divers and sundry persons, dwelling and inhabiting in or near Poole', took away victuals, tackle, 'furniture' [equipment] and 'other necessaries' from the *Fame.*
6. The ship's master, Jacob Johnson Botemaker and all of the 'company' [crew] of the ship, numbering about 45 people, escaped to shore and all survived.

The petition of Garretson, Vene and their partners to the Court was supported by depositions made by Henry Dirrickson and Maynard Lawrenson. It is probable that these men were also Dutch, but their relationship to the owners is not clear. Garretson and Vene's aim in approaching the HCA was to ask for a commission to be despatched to recover the goods and arrest those who had taken them. As the paper by Swart and Brozelius shows (see below), the Dutch forms of the owners' names were Cornelis Veen and Hercke Gerritsz, and they were indeed merchants and shipowners of Hoorn.

As the crew survived, the *Fame* and its contents were not legally wreck, and should have been restored to their owners. The 1625 Treaty of Southampton also reinforced the wreck law in this case. Despite this, the 1629–31 HCA Act Books do not record any further litigation regarding the *Fame*, and there does not seem to be a record of the appointment of any wreck commissioners to progress the case. Nor does the *Fame* feature in CSPD. The lack of action is nowhere explained, but fortunately there is a local source that tells us more about the wreck and where it lay.

Poole had its own Admiralty Court from the Middle Ages, and records of its proceedings survive from 1550. The Court was meant to meet about once a year, with the Mayor serving as Admiral and '24 honest seafaring men' acting as the jury. The town's water bailiff had responsibility for work on harbour facilities, although it does seem that some other port officials were appointed from time to time.[17] The boundaries of Poole haven extended from Redcliffe Atwell, the border with the port of Wareham, to North Haven Point, and then as far out to sea 'as a man could discern a Humber barrel to float upon the ocean'. This distance has been estimated at about three miles (4.8km) and took in all of Studland Bay and the site of the Swash Channel Wreck (Smith 1928).

The Court had jurisdiction over a wide range of issues within its small realm. These included theft, piracy, derelicts, flotsam, valuables found on dead bodies, accidental death, conscription for royal service, the regulation of fishing and the fish market.[18] In practice, most meetings of the Court were taken up with discussions of harbour management, pilotage and fishing infringements. Wrecks were seldom mentioned in the 17th-century Court proceedings. However, in the Court held on 24 June 1631, there is the following statement (spelling modernised):

[15] HCA 24/87, No 171, ff 1-2v

[16] The original documents give the date as 2 March '1630': this is because under the Julian calendar then in use in England, Lady Day, 25 March, was taken as the start of the year. Any dates between 1 January and 24 March that would count as 1631 in the modern calendar were assigned at the time to 1630 and would be rendered in some modern historical writing as 1630/31.

[17] DHC DC/PL/CLA 24 Poole Admiralty Book 1550–1834

[18] DHC DC/PL/CLA 24, unnumbered folios at the beginning of the volume

Margin	Main Text
Mr Newland to place a couple of buoys on the wreck by the first of August under the penalty of a £200 fine	Item we present that Mr Newland does undertake for the Fleming to clear the harbour of the wreck of the *Fame* of Hoorn cast away before Studland, we do therefore enjoin him to place a couple of buoys on that wreck by the first of August next on pain of forfeiting of two hundred pounds.
the pains and amerciaments [fine] affirmed per John Cartridg and William Nurreys	'Memorandum that the pains and amerciaments above-written were affirmed by the oaths of John Cartridg and William Nurreys two of the jury aforesaid the day and year first above written:'[19]

This is followed, almost a year later, at the Admiralty Court of 21 May 1632 (Figure 8.2) by this entry:

Margin	Main Text
The channel to be cleared of the wreck, and 2 buoys placed thereon	Item we present that Mr Robert Newland the younger of the Isle of Wight hath not cleared the channel of the Flemish wreck and not placing two buoys thereon, and therefore he is enjoined il [*sic*, for it?], *vizd* to clear the channel thereof and to place two buoys thereon by 25th of July next on pain of forfeiting two hundred pounds:'[20]

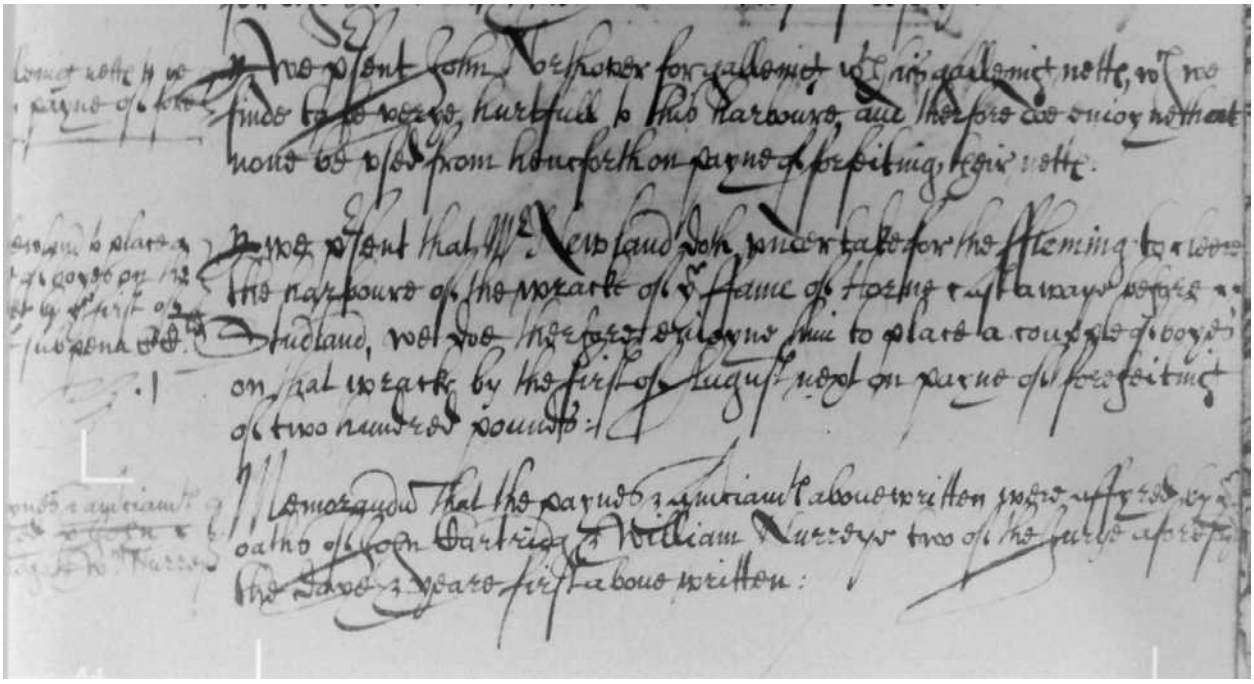


Figure 8.2. The Poole Court Admiralty records relating to the *Fame* of Hoorn

These two entries place the wreck of the *Fame* 'before Studland' and clearly lying in a 'channel'. Two hundred pounds was a huge sum – the highest single fine that the Court normally levied was £2. It is an indication of just how worried the port authorities were about where the wreck lay. As the channel was 'before Studland', it must have been the main channel into Poole Harbour. This matches the location of the Swash Channel Wreck very well; the HCA reference complements this evidence, as it says that the *Fame* turned over on a sandbank. The Swash Channel Wreck lies on the edge of Hook Sand.

There is no further mention of the *Fame* in the Poole Admiralty Court records, no record of the fines actually being levied, and no evidence of any ship colliding with the wreck. It appears that Newland finally managed to clear it. Mr Newland must have been one of the sons of Robert Newland senior, a wealthy merchant and shipowner (d 1637) who had wharves and warehouses at Newport and East Cowes on the Isle of Wight.[21] Robert Newland senior was involved with Jacob the Diver in the salvage of cargo, gear and weapons from the Dutch East Indiamen *Kampen* and *Vergulde Draeck*, both of which sank off the Needles in 1627 (Roddie 1976, 259–60).

[19] DHC DC/PL/CLA 24, f 60. A full transcription can be found at: http://www.poolehistory.org.uk/node/328328

[20] DHC DC/PL/CLA 24, f 61

[21] TNA PROB/11/174, will of Robert Newland

The 1631 reference to the requirement for 'the Fleming' to clear the wreck is interesting, for it was catch-all term used by the English to describe people from both Flanders and the Netherlands. Therefore the Dutch *Fame* was called 'the Flemish wreck'. Given the Newland family's involvement with the Diver, it seems very likely that Robert Newland junior proposed to use Jacob's services in salvaging the *Fame*.

The looting of the *Fame* by local people suggests that it remained above water for a while after it capsized. However, by June 1631 the ship must have sunk so far that buoys were needed to mark its location. What happened after May 1632 is not known; the next Court, held in August 1633, does not refer to it. Either Newland had solved the problem, or it had solved itself in some way, perhaps by the collapse of the hull.

The small number of surviving cannon in the ship, with only six present out of a possible 40 or more, may be evidence of professional salvage work rather than opportunist looting. One could imagine that looters might take guns from the above-water side of the capsized *Fame* but accessing the guns on the submerged port side would have been infinitely more difficult without heavy salvage gear or diving equipment. The relative dearth of guns in the Swash Channel Wreck, including those on the port side, could be the result of Jacob the Diver's activities, for he had considerable experience in removing ordnance from sunken hulls.

Research by Peter Swart and John Brozelius in the Dutch archives did not find any information about the *Fame* itself, but it did uncover a lot of material about Veen and Gerritsz. These two ship-owning merchants were involved in the Caribbean salt trade, amongst other enterprises, and Swart and Brozelius think it probable that the *Fame* was a private ship used to carry salt. This would help to explain the lack of cargo in the wreck of the *Fame*, suggesting that the ship was sailing out in ballast, ready to be loaded in the West Indies.

Though Swart and Brozelius suggest that it is conceivable that the *Fame* was working for the Dutch West India Company (WIC) on this voyage, they also raise the possibility that it was trading on Veen and Gerritsz' private account. There was much conflict between Hoorn merchants and the WIC over the latter's attempts to enforce its monopoly of West Indies' commerce. If the *Fame* was on a private-enterprise voyage, as an 'interloper', it could also explain why the English HCA took no effective action over Veen and Gerritsz' complaint. The cases of the *Salmon* of Amsterdam (1632) and the *St Adrian* of Middelburg (1658) got serious attention from the English government because the Dutch owners and merchants involved were able to complain to the highest levels (see below). A couple of private traders from Hoorn might have lacked the influence to involve the Dutch ambassador or other important people in their situation, especially if they were sailing in defiance of the WIC. The West India Company might even have taken steps in London to derail the Hoorn merchants' case, as a way of punishing interlopers.

The English documentary material for the *Fame* contains crucial evidence regarding the nature of the ship, the circumstances of its loss and the location of the wreck. This evidence supports the discoveries made by archaeologists and complements the findings of Dutch scholars. Taken together they indicate that the Swash Channel Wreck and the *Fame* of Hoorn are one and the same.

Historical study of merchant ship *De Faam* from Hoorn

Peter Swart and John Brozius

Summary of the study and conclusion

No records were found in the West Frisian Archives or the Dutch National Archives of the ship, the *Fame* from Hoorn, which stranded off the south coast of England in 1631. Nor were there any records of this specific voyage or of any earlier voyages. However, information was found about the ship's owners and their involvement in the salt trade with the West Indies.

Cornelis Veen and Hercke Gerritsz

Cornelis Veen and Hercke Gerritsz, owners of *De Faam* (*Fame*), were merchants from Hoorn. Hercke was baptised in 1587, Cornelis Veen in 1591. Their lives show striking parallels: both were members of the Dutch Reformed church and both were married in 1612. Hercke Gerritsz marries Lysbeth Jans, Cornelis Veen's first cousin. When the men each have a child baptised in January 1616, they are both residing at the Oost (an upmarket street in Hoorn). However, there are also some differences: for example, while Cornelis Veen holds various governing positions in Hoorn, the name of Hercke Gerritsz does not feature on any of the lists of (city) aldermen.

From 1623 Cornelis Veen was governor of The *Noordsche Compagnie* (the Northern Company). When this company was founded in 1614, Hercke Gerritsz was also asked to become a shareholder, but it is not known whether he invested in the Northern Company. The merchants were not on the governing board of the Dutch West India Company (WIC).

Hercke Gerritsz and Cornelis Veen were also the owners of the ship *Neptunus* (*Neptune*), and in that capacity they began a lawsuit before the High Court of Holland in 1624 against Adriaan Cornelisz Schagen, salt maker and

former Burgomaster in Alkmaar. The lawsuit concerned a delivery of salt to Adriaan Cornelisz Schagen in August of 1622 for which no payment was received. The delivery and payment took place through the broker Gerrit Jansz of Hoorn. The money was said to have been given to the ferryman who plied to and from Hoorn by Adriaan Cornelisz Schagen's housekeeper, but it was never received by the broker. Gerritsz and Veen lost the case and had to pay the legal costs.

The Captain of the *Neptune* was the well-known Dirck Albertsz Raven. His ship ran aground near Spitsbergen in 1639 and he committed this adventure to paper; a street in Hoorn is named after him – Commander Ravenstreet. In October 1623, Captain Jan Albertsz Raven, Dirck Albertsz' brother, is in Hoorn ready to sail to the West Indies. The WIC is not pleased and wants to detain the ship because Jan Albertsz had violated the patent of the WIC with a load of salt and wood from the West Indies on an earlier occasion. However, the city governors of Hoorn do not cooperate to prevent the ship from sailing.

There is further proof of Cornelis Veen's involvement in the salt trade and trade with the West Indies. In 1622, he takes Amsterdam merchant Leendert Leendertsz to court regarding the delivery of 50,000 pounds of '*stockvisch sout*' (stockfish salt), and as ship owner he rents out the ship the *Son* (*Sun*) to the WIC to sail to Brazil and from there on to the West Indies to get salt (1632).

West Frisian salt trade and the WIC

The West Frisian cities wished to keep the salt trade excluded from the patent of the WIC, which lead to many years of tension between the cities and the WIC. As a result of the ongoing private salt trade, the WIC chamber of the *Noorderkwartier* (Northern Quarter) does not get a proportionate share in the total of WIC operations. In 1627, a compromise is reached whereby the private salt traders will pay revenue recognition to the WIC. At Hoorn's request the agreement is temporary in nature and will be evaluated after four years.

In 1627, an incident takes place near the Cape Verdian island of Ilha de Maio. Five Hoorn salt traders are obstructed by the WIC, after which the ship owners try to claim damages from the Company. This case is not yet settled at the end of 1629 and two Hoorn salt traders, ready to sail from the island of Texel, were unable to set sail. The *Staten Generaal* (States General: assembly of all the provincial states) exerts pressure on the WIC to reach a solution.

In 1629, a West Frisian salt ship anchors at the island of *Sint Christoffel* (Saint Christopher, currently known as St Kitts). This island falls under the English flag and the captain pays a toll for the load of salt. Sometime during the first six months of 1631, Hoorn salt traders call at the uninhabited island of *Sint Maarten* (Saint Martin), an island located close to Saint Christopher that is being claimed by England. The English are not pleased with the visit of the salt ships.

In 1631, a Hoorn notary translates a letter written in English which proved that Governor Thomas Warner of Saint Christopher granted permission to the Dutch and Zeeland salt traders to get salt. In the same year, the *Staten-Generaal* (States General) establishes rules for armed ships that are allowed to sail within the patent area of the WIC, the idea being that these ships will harm the Spaniards; they are also allowed to load salt. Africa, Brazil and North America are off-limits.

In January 1634, Otto Reijnersz, the biggest and most important ship owner in Hoorn, asks for permission to have five well-armed ships (including eight soldiers per ship) fitted out to get salt from the West Indies. The five ships also serve to provide a convoy for less well-armed ships that must pay Reijnersz for this service.

Other Studland Bay and Purbeck wrecks of the period

There are records of other wrecks in the Studland Bay/Purbeck area between the 1620s and 1650s. None of these can be convincingly identified as the Swash Channel Wreck, but the evidence for each of them needs to be explored to explain why this is so.

The 200-ton ship of 1650

It appears that there was at least one major shipwreck in the vicinity of Poole during the years immediately following the Civil War, but the evidence for this relies on a single source. The story comes from the writings of Sir Bulstrode Whitelocke (1605–75), who was a lawyer and parliamentarian. He wrote an account of his life and times that ran to over 30 volumes, an important source for the period. Though his modern biographer and editor states that Whitelocke made mistakes over details, he also says his statements have generally proved to be accurate in substance when they could be tested (Spalding 1975, 9–14; Whitelocke 1853).

On 18 April 1650, Whitelocke heard that a warship of 200 tons had run aground 'upon that coast' at Poole and could not be got off. It soon broke in two, drowning about fifty passengers – men, women and children – and taking with them 'goods, gold, silver, pearl, and rich jewels, to a great value'. Another sixty or so passengers were saved by local boats (Whitelocke 1853, 179; Bayley 1910, 339–40).

It is possible that Whitelocke was giving a garbled account of the loss of the 600-ton Dutch West Indiaman *Princess Amelia* on the Welsh coast in 1647.[22] The ship was en route to America carrying a large number of men and women as passengers, and broke apart when it was wrecked, with heavy loss of life. However, not only did this take place several years before the alleged Poole wreck, the *Princess Amelia* was much larger than the one in the Poole account, and Whitelocke surely knew Poole well enough not to confuse it with somewhere in Wales (he had once been involved in some failed business dealings in the town) (Spalding 1975, 72 and 113).

Although Whitelocke described the Poole wreck as a man-of-war, everything in his description indicates that it was an armed merchantman with passengers. It was probably an emigrant ship, on its way to America, and most likely English, as Whitelocke makes no mention of its nationality.

The HCA Act Book, for the period January to June 1650, which records the day-to-day business of the Court, lists six wreck cases, but none of these relates to ships lost on the Dorset coast, or anywhere near it. Likewise, the evidence presented to the HCA Instance and Prize Courts in the years 1649–52 does not seem to include any material relating to a major shipping casualty off Dorset.[23]

Aside from its general date and the presence of cannon aboard, the main potential link between the 1650 wreck and the Swash Channel Wreck is that the former broke in two. The Swash Channel Wreck, of course, lies in two large pieces. The 1650 wreck was the only ship lost off Purbeck in this period that was said to have broken apart in this fashion.

The exact date of the 1650 wreck is unclear. Whitelocke's entry implies that his source (presumably a letter) was describing a recent event. Unfortunately, this cannot be confirmed from the Poole Admiralty Court records because the only Court held in these years made no reference to any wrecks.[24]

The strongest arguments against identifying the 1650 wreck as the Swash Channel ship are:

- there is no evidence that the Swash Channel Wreck was fitted with multiple cabins for passengers, which seems to have been a normal practice with emigrant ships;[25]
- passengers normally travelled with household goods packed in bags and chests. There was no unequivocal evidence of household items in the Swash Channel Wreck, and crucially, no sign of items closely associated with women or children, and no evidence of the jewellery mentioned by Whitelocke;
- most tellingly of all, no human remains were found in the Swash Channel Wreck, whereas the 1650 account suggests that some fifty people perished. Inevitably, some of their bodies would have been trapped in the sunken hull.

The remnants of this disaster may still lie somewhere in Studland Bay or off the Purbeck coast, but there is no good reason to think that it was the Swash Channel Wreck.

The Salmon *of Amsterdam, 1632*

In contrast to the story of the *Fame*, the events following the wreck of the *Salmon* show very clearly what could happen when a ship's owners and merchants were powerful enough to get real action from the English government.

The *Salmon* was a Dutch merchant ship of 250 tons 'cast ashore ... in or near the Isle of Purbeck' in November 1632 and then looted. The owners were able to get the Dutch ambassador in London to act on their behalf, and in January 1633 he wrote a detailed complaint about the incident to the Privy Council, the king's advisory body.

The *Salmon* was loaded at 'Saphy' or 'Saffia' in Barbary (presumably Safi on the Atlantic coast of Morocco) with various goods, including goatskins, wax, almonds and gums, and the cargo belonged to seven merchants of Amsterdam. In November 1632 ('English Style' – it was December according to the New Style Gregorian Calendar dating used by the Dutch), while on its return journey to Holland, the ship was chased into the English coastal waters by a Dunkirker, a privateer acting for the Spanish government. The ship got lost one foggy night and ran aground on the Isle of Purbeck.

The following day, the master and crew took their longboat and went ashore to look for assistance. The Bailiff of Purbeck helped the survivors, but in the meantime a resident of the Isle stole the Dutchmen's boat. He was William Chaldecott, the son of a wealthy local farmer, Francis Chaldecott, and he used the boat to take some items from the wreck. He claimed 'that all belonged to him because the ship was on the rocks near the land of his father'. He also persuaded several mariners to board the ship and remove anything they could, on the basis that they would keep half of it. The Bailiff tried to intervene, but the ship was pillaged and its hull was cut up.

A local commission was appointed to recover stolen goods, followed later by an HCA commission, but the

[22] HCA 24/109, no. 185
[23] HCA 3/43, ff 337–516; HCA 24/109 and HCA 24/110, passim
[24] DC/PL/CLA 24, ff 69–70
[25] HCA 23/12, nos 112–13 and 116–17

commissioners only retrieved about one-eighth of the goods. William and Francis Chaldecott, along with five or more local boatmen, refused to give up their loot or any money they had made from selling it. The Dutch ambassador called for Privy Council action, and the arrest of the Chaldecotts 'and all others who refuse to submit to reason'.[26]

On 6 February, the HCA ordered the commissioners to seize those involved in taking the goods.[27] This was followed by a similar order from the Lords of the Admiralty, which confirmed that the wreck was near the Chaldecotts' lands and that the men were demanding half of the recovered goods. This was seen as unreasonable. Francis Chaldecott and any others refusing 'reasonable recompense' for salvage work were to be bound over to appear before the Lords of the Admiralty in London in March, to explain their defiance of authority.[28]

This was a very serious and frightening prospect and in the end, the Chaldecotts relented. It was reported in March 1633 that they had come to an agreement with a representative of the Dutch owners over recompense for the stolen ship remains and goods. The other people who had stolen wreck material were also said to have returned it. The father and son made a petition to the authorities, claiming that they had never made any money from the wreck because of the costs of salvage. They also said that their land had been damaged by crowds of people tramping to and from the wreck site. Sensibly, they ended with a grovelling apology, and seem to have got away without any penalties.[29]

Although Francis Chaldecott rather conventionally confessed in his 1636 will to being 'a great and grievous sinner' he was a wealthy man when he died soon after, and owning land in both Dorset and Wiltshire. He lived at East Whiteway Farm, between Church Knowle and Steeple, and was buried in Steeple church, his life celebrated on a monument set up there by William in 1641. The Chaldecotts' involvement with the *Salmon* is a reminder that both the rich and the poor got involved in theft from wrecks.[30]

Although the *Salmon* was a vessel of the right date and origin to be the Swash Channel Wreck, a number of things rule it out:

- at 250 tons, it was rather too small to be the Swash Channel Wreck;
- there was no sign of cargo in the Swash Channel Wreck, and certainly no fragments of exotic items like goatskins, wax, almonds and gums;
- the *Salmon* lay off the Chaldecotts' Purbeck lands, which seem to have been around East Whiteway Farm. This farm lies two miles (*c* 3km) north of Kimmeridge Bay – the possible site of the *Salmon's* loss, which itself is a good eight miles (*c* 13km) from the Swash Channel Wreck.[31]

The St Adrian *of Middelburg, 1658*

The wreck of the *St Adrian* came a few years after the *c* 1630–50 dating of the Swash Channel Wreck, and this means it is not a strong contender to be the wreck. However, as a Dutch merchantman engaged in long-distance trade, salvaged by Poole people, it needs to be considered. As with the *Salmon*, the events surrounding the loss of the *St Adrian* also demonstrate just how much wrangling could ensue once the Dutch government got involved in a wreck dispute.

The *St Adrian* was loaded at Alicante in Spain with a cargo of wool, aniseed, almonds, rice, gums, drugs and other cargo. The ship was bound for Middelburg when it was lost on the Dorset coast in late March 1658. All of the crew survived, including the master, Adrian Bomeler, and cargo was therefore not wreck in the legal sense. The owners of the cargo were all Dutchmen, including 'his Excellency Van Wrede Rinswordy who is a minister of state and Ambassador for the States General beyond the seas'.

There was some confusion over the location of the wreck site, as two documents derived from Dutch evidence describe it as 'Portland'. However, George Skutt of Poole, who oversaw the salvage of the cargo along with his brother William (the town's mayor), said explicitly in a letter of 12 June 1658 that the ship 'was by extremity of weather put on shore in the Isle of Purbeck'. An earlier document of 7 May, signed by William Skutt and other Poole men, refers to the wreck location as being 'about six leagues distant from the nearest port'.

Local people would not have confused Portland with Purbeck, and there is no reason to doubt their claim as to the wreck's general location. Six leagues were equal to 18 miles (28.8 km), although one should perhaps take the actual figure with a pinch of salt. It featured in a document in which the Poole men

[26] SP 84/146, ff 13r–14v; HCA 14/47, f 19 (no. 361)
[27] HCA 14/47, f 19 (no. 361); HCA 23/11
[28] SP 16/228, ff 17–18v
[29] SP 16/233, 69 and 77
[30] TNA PROB 11/172
[31] DHC D/BKL/CE/2/1, mm 3r–4r; DHC D/BKL/CE/2/1, mm 5 and verso

were emphasising the difficulties and expenses of the salvage work. Assuming that the 'any port' referred to meant Poole, however, the general effect of these statements is to place the *St Adrian* at the western end of the Isle of Purbeck and would therefore mean that it could not be the Swash Channel Wreck (it should also be noted that, as with the *Salmon*, the *St Adrian* had an exotic cargo that was entirely absent from the Swash Channel Wreck).

There is not space to tell the full story of the fate of the *St Adrian*'s cargo, but the tale involved duplicity, intense legal bickering, and a 'turf war' between the HCA and a higher court. Even the dying Lord Protector, Oliver Cromwell, was asked to intervene. One of the most memorable things to emerge from the case is a poetic phrase used by an HCA judge, who described shipwrecked goods as 'what the mercy of the Sea hath left'.

The Mermaid, *1628 or earlier*

There is a brief reference in a letter of February 1634 to a ship called the *Mermaid*, wrecked 'near Poole', 'in the lifetime of the late Duke of Buckingham'.[32]

George Villiers was made Duke of Buckingham in 1623 and was assassinated on 23 August 1628; he was Lord High Admiral from 1619 until his death. The remains of the *Mermaid* were valued between £40 and £50 and were said to have come into the possession of various men in Poole. It appears that Buckingham had not been paid the share of the wreck's value due to him as Lord High Admiral. The 1634 letter asked the HCA to enquire into the circumstances and recover any money due to the Duke's estate.

The latest felling date for timber from the Swash Channel Wreck is 1628, so on the grounds of date – 1628 at the latest – and location, the *Mermaid* qualifies for attention in this study. The wreck seems to have been looted or salvaged by Poole people, but there is no other information about it and there is no indication that it was Dutch. Taken with the marginal nature of the dating evidence, it is unlikely to have been the Swash Channel Wreck.

The Frances *of Dunkirk, 1630*

The *Frances* of Dunkirk was a 'Dunkirker', one of a large fleet of privateers based in Flanders, operating under the auspices of the Spanish Crown. Dutch shipping was the principal target of the Dunkirkers, but they were also a menace to other countries. The *Frances* was a ship of around 100 tons, deliberately run aground in Studland Bay by its crew in order to escape three pursuing Dutch warships.[33] The fate of the ship is unknown, but, at 100 tons, it was too small to have been the Swash Channel Wreck.

The Janakin *of Amsterdam, 1631*

The *Janakin* of Amsterdam was a Dutch merchantman 'driven by wind upon rocks and sands and there bruised and broken' near Portland, in late 1630 or early 1631. The wreck was included in this study in case there had been some confusion between Portland and Purbeck, as happened with the *St Adrian*. However, the documents relating to the case consistently refer to Portland as the site of the wreck, and there is no reason to doubt this.[34]

The Battle of Portland, 1653

The Battle of Portland was one of the major engagements of the First Dutch War, fought between 18 and 20 February 1653. The British fleet of General-at-Sea Robert Blake intercepted a large force commanded by the famous Dutch admiral Maarten Tromp. Tromp was escorting a convoy of 150 merchant ships en route for Holland and the initial fighting took place off Portland Bill. Although the Dutch warships at first lay between the Bill and the British fleet, the wind was blowing from the north-west. This drove them south towards the French coast, and the Dutch then turned eastwards up the English Channel, in what became a running fight.

Give the direction of the wind, blowing away from the English coast, and the later course of the battle, it is unlikely that any Dutch warships or merchantmen would have sailed in the direction of the Isle of Purbeck. This means that it is not probable that the Swash Channel Wreck was a casualty of the battle (Sanderson 1975, 140–2; Rodger 2004).

[32] CSPD 1633–34, p 461

[33] TNA SP 16/165, 32 and 32i; CSPD 1629–31, vol 165, nos 32 and 32i

[34] HCA 3/33 ff 469v and 471v; HCA 14/47, no. 149; APC 1630–31, no. 742

Chapter 9

Conclusions

Lessons learnt

As the first large-scale maritime archaeology excavation in England since the raising of the Mary Rose in October 1982, almost three decades earlier, the Swash Channel Wreck offered a number of lessons to maritime archaeology in the 21st century.

Management and publicity

Placing responsibility for the ongoing management of the site into the hands of two suitable organisations (Poole Harbour Commissioners and Bournemouth University) provided a long-term solution to the site's management which is ongoing today (2023). Between them the two organisations had the capability to undertake work on the site and the contacts and experience to source funding to facilitate this work. This acted as a force multiplier for Historic England Funds, with £1.56 being spent for every £1 granted by HE. The on-going large project also allowed several smaller ones to occur, as facilities put in place for the major project were used to support others.

The involvement of the university meant that multiple cohorts of students were able to work on the various phases of the project, which allowed the experience and expertise gained project to be rapidly disseminated to other organisations in both the UK and abroad. While students formed only a relatively small part of the team, the majority being professional archaeologists, many of those professionals were introduced to the project when they were students. As well as the archaeologists, a range of other professionals brought specific skills to the project during the fieldwork stage.

The raising of the rudder from the site in July 2013 marked the end of the excavation phase of the project and received considerable publicity, appearing in news items as far away as Australia. Its importance was acknowledged by a visit in September 2013 from Ed Vaizey, the then Minister of State for Culture and the Digital Economy, during its conservation at York Archaeological Trust.

The high profile that this event received was just reward for the project partners and Historic England's determination that the project would not be the *Stirling Castle* of the 21st century.

The project paved the way for much larger projects on the protected wrecks of the 74-gun ship *HMS Invincible* (1744) and the Dutch East Indiaman *Rooswijk* (1737), setting a precedent for how to deal with significant high-risk sites that cannot be managed *in situ*. The project allowed the sector to re-learn the lessons it had forgotten in the three decades since the *Mary Rose* and for those lessons to then be used to help support maritime archaeology in the Middle East and Australia.

Monitoring

Bournemouth University's role when it first became involved with the project was to monitor the site, collect data on the marine threats, and to record any material as the wreck was uncovered. For this work the use of sediment monitoring rods provided clear monthly data on the changes in the levels of sediment covering the site; although later largely replaced in accuracy and breadth by the use of swath bathymetry, the rods provided cheap and accurate data over time. More convincing evidence of the changes in sediment levels was the constant revealing of fresh archaeological material as the area of the site increased. This proved too much to record with traditional drawn archaeological methods, leading to the development of a methodology for photographing the site; at 720m² this was the largest photograph of a protected wreck site at that time.

Biological monitoring provided a view of the site's gradual destruction as timber subject to prolonged exposure degraded and new material was uncovered and started the process of decay. The monitoring of marine life provided a convincing picture of the primary agent of archaeological destruction, namely gribble (*Limnoria*), rather than the shipworm which had been seen as the main threat at the beginning of the monitoring process. Gribble had caused extensive damage to the surface of the submerged wood before any serious damage was caused by shipworm, bacteria, or any other agent of decay. By the time monitoring had provided the evidence to demonstrate the threat that these organisms posed, the damage was already complete. The conclusion drawn from this is that as soon as timber has been exposed it is under threat and immediate action is needed to avoid the loss of archaeological data.

Infrastructure

Projects of this nature require considerable infrastructure to undertake and complete. It was fortunate that the project was located close to a substantial port that had the commercial infrastructure available as well as a supportive port authority and local industry which enabled lifting and *in-situ* preservation work to be undertaken. Recording and conserving archaeological objects weighing several tons requires specialist handling equipment, facilities and expertise: this work was undertaken at the Newport Ship facility in Newport, South Wales and York Archaeological Trust in York. This involved moving many relatively heavy and delicate items between locations with round trips of over 600 miles on occasion. Over the length of the project the team became very efficient at this, but it was a considerable drain on the project's resources and time. Some of these facilities no longer exist in the form they were at the time of the project and this approach would not be viable today. A more efficient approach would have been to record and conserve the objects in a suitable local facility and bring the expertise to them, which has occurred with other, more recent projects.

The nature of the ship

The remains of the Swash Channel Wreck consist of almost the entire port side of the ship, from the turn of the bilge up to the top timbers. Research on the vessel suggest that it was around 37m long with a beam of 9.3m and depth of hold of 3.7m and was capable of mounting over 40 large guns split across two main decks with a half, quarter, and poop deck at the stern. The dendrochronological work shows the vessel was built post-1628, while the small finds on board, in particular the clay pipes, point to a loss within the second quarter of the 17th century.

All the archaeological evidence gathered in the study of the Swash Channel Wreck suggests that the vessel originated in the Netherlands and was likely built in the bottom-based, shell-first style as described by Witsen in the 1670s (Hoving 2012). This type of shipbuilding is most closely associated with the VOC (van Duivenvoorde 2015), with multiple archaeological examples known including the *Batavia* and the Christianshavn *B&W 2*. In addition to the VOC wrecks, the *Vasa* was built in this tradition and therefore has many parallels with the Swash Channel Wreck (Cederlund 2006).

The key identifier for this building tradition is the presence of *spijkerpennen*, a type of clamp used to hold the lower planking in place before the insertion of the floor timbers. However, as the Swash Channel Wreck only survives from the turn of the bilge up, this key evidence was missing from the wreck. Other key features, such as the non-uniform framing pattern, the layout of the external and internal planking, and similarities between the other surviving vessels such as *Batavia* and *Vasa*, make it clear that they are of the same construction family. Recent work by McCarthy (2023) also shows a close match with the size and sheer of the Swash Channel Wreck and contemporary Dutch ship models. The layout of the decks and cabins is also very similar to historic records, the closest parallel being the *Batavia* reconstruction (Vos 1990).

The wreck has produced a relatively small finds assemblage, mainly dominated by carpentry tools, navigation instruments, and items used in the preparation and consumption of food and drink. The site has excellent preservation for organics, including wood and leather, but only copper and pewter alloy objects have survived amongst the metal wares; all the iron tool bits have been lost. In addition, and in contrast to most early modern wreck sites, it is worth commenting that no small articles of clothing or personal adornment have been recovered, or the masses of bulk goods, or supplies traditionally associated with East Indiamen on outbound vessels.

The character of the wreck, the unusual survival of hull structure, the very limited number of small finds, the relative paucity of cannon (seven from a vessel that was capable of mounting up to 40), the lack of an apparent cargo, and the presence beneath the wreck of a large rope cable all suggest that it was subject to contemporary salvage. Typical salvage techniques of the period included pulling the deck off a wrecked vessel with a raft (Rowe 1730) which then allowed any buoyant material to float to the surface. This also had the effect of hastening the break-up of the hull, with the sides falling outwards onto the seabed; the seabed could then be dragged for heavier material. The unusual survival of the hull of the wreck and the distinct lack of finds accords well with activity of this kind.

The wreck did not produce the huge range of finds seen on other wrecks of the period such as *Batavia*, although those recovered have provided a picture of life on board the ship prior to its loss, its armament and rigging. The site did, however, produce a significant amount of hull structure which adds to the general archaeological corpus of Dutch shipbuilding at a key moment in the development of oceanic seafaring. More importantly, it contains features such as the ship's upperworks and rudder that are not seen on most sites and provides the only archaeological example of these features where it has been it is possible to disassemble parts of the structure in order to understand its construction.

Identity of the wreck

The identification of a shipwreck is a matter of probability unless the site contains definitive evidence of the vessel's original identity or there is unequivocal documentary, pictorial or other evidence relating to the lost ship. Such evidence is not common in 16th- and 17th-century sources: only a handful of the wreck records in the 1625–42 wreck survey offer any precise details of a wreck site.

The four best 'candidates' for the Swash Channel Wreck are the *Fame* of Hoorn, the *Salmon* of Amsterdam, the ship of 1650, and the *St Adrian* of Middelburg (see Table 8.1).

By itself, locational information is not enough to permit the positive identification of a historic shipwreck. As the 1625–42 shipwreck study makes clear, shipping casualties were appallingly frequent at this period; it is quite possible that the *Fame* was not the only 17th-century vessel wrecked in the approaches to Poole. However, the documentary evidence for this ship fits very well with both the archaeological discoveries about the Swash Channel Wreck and what the Dutch archives have to say about the activities of Veen and Gerritsz. None of the other 'possible' wrecks comes close to this. The overwhelming weight of the evidence, including a pan weight (**SCW44**) stamped with the hallmark for Hoorn between the dates of 1627–32, indicates that the Swash Channel Wreck was once known as the *Fame* of Hoorn.

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The Swash Channel Wreck is an account of the discovery, excavation and analysis of an early 17th-century Dutch shipwreck. The wreck is most likely the Dutch West Indiaman *Fame* of Hoorn, lost in the Swash Channel in the approaches to Poole Harbour in February 1631. The site was initially found during dredging operations in the channel in 1990. In 2006, it was re-discovered by Wessex Archaeology, and Poole Harbour Commissioners partnered with Bournemouth University to undertake the monitoring and recording of the site. The remains are of a large *c*. 40m structure consisting of the port side of the ship from the turn of the bilge to the top of the upperworks, with associated wreckage which includes the ship's rudder, a multitude of rigging items, and a small collection of finds that consist mainly of domestic and provisioning items and the ship's armament.

By 2009, it was clear that the site was rapidly eroding and English Heritage commissioned Bournemouth University to conduct one of the largest underwater excavations in the UK since the excavation of the *Mary Rose* in the 1980s. This occurred between 2010 and 2013 and involved the excavation and recording of the first 18m of the bow and the last 12m of the stern, leaving the 12m midship section unexcavated. In addition, a large section of the upperworks and the first 6m of the bow were deemed to be too exposed to protect in situ and therefore were raised and recorded in high detail between 2014 and 2015.

The wreck proved to be the largest survival of the hull of any 17th-century ship in UK waters and one of the most complete 17th-century Dutch shipwrecks outside of the Baltic. The ship's construction and material culture confirm its origin as a Dutch vessel lost in the early part of the 17th century. The hull has immediate parallels with the wreck of the Swedish warship *Vasa*, lost in Sweden in 1628, and the Dutch East Indiaman *Batavia*, lost in Western Australia in 1629, and exhibits characteristics of both. The circumstances of the Swash wreck provided the opportunity to dismantle the structure and study in greater detail the timbers from which it was constructed.

Contemporary clearance work and probably salvage meant that with the site did not yield a large number of finds but those that remained provide an insight into life on board, the makeup of the crew, and the ship's armament, as well as allowing the reconstruction of sections of the ship's rigging.

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