

ARCHAEOLOGICAL ASSESSMENT OF THE DESIGNATED WRECK OF THE *NORTHUMBERLAND* ON THE GOODWIN SANDS

PROJECT REPORT 2018



An orthophotomosaic of a group of three guns.



PASCOE ARCHAEOLOGY

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OF THE *NORTHUMBERLAND* ON THE GOODWIN SANDS**

PROJECT REPORT

Prepared by:

Pascoe Archaeology
56 Newton Road
Southampton
SO18 1NL

Prepared for:

Historic England
Fort Cumberland
Fort Cumberland Road
Eastney
Portsmouth
PO4 9LD

December 2018

Ref: 7700

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Summary

The *Northumberland*, a third-rate man-of-war, was lost on the Goodwin Sands during the Great Storm of 26-27 November 1703. The wreck was discovered in 1980 and shortly after designated under the protection of Wrecks Act 1973. In 2018 Pascoe Archaeology was commissioned by Historic England to conduct an underwater archaeological assessment of the wreck. This was necessary as the results of two consecutive multi-beam echo-sounder (MBES) surveys (2017 and 2018) had demonstrated the site was uncovering. Comparisons between the two multi-beam bathymetry data sets identified that the local bedforms surrounding the site were moving in a NNE direction. This is migrating seabed sediments away from the site, placing it in a region of seabed erosion. As a result, significant archaeological features are now exposed.

The fieldwork was conducted between the 18-24 August 2018, by a collaborative team led by Pascoe Archaeology. MSDS Marine acted as the diving contractor and diving operations were conducted from the Dive Support Vessel (DSV), *Neptune*. The dive team consisted of members of MSDS Marine, Bournemouth University and Sea Dive Organisation.

The current fieldwork has led to new archaeological features being identified, as well as an increased understanding of the archaeological remains in general. Many exposed archaeological features were recorded photogrammetrically and the results have been scaled and georeferenced with the current multi-beam bathymetry. This has led to the creation of the most accurate and substantial plan of the site to-date.

There have been several exciting new discoveries including a large assemblage of concreted swords, a group of pulley sheaves and one of the ship's Culverin chase guns. The latter still has the parts of the carriage cheeks attached. All of these finds are at the top of the site's stratigraphy, which demonstrates its high archaeological potential.

All is not good news, however. The site is covered with all types of fishing gear ranging from heavy duty trawl net, lobster pots and floating gill net. The gill net is very hazardous as it is made from an extremely fine nylon mesh, suspended from small polystyrene floats. Much of this is floating about 0.5m above the seabed and therefore an entanglement hazard to divers. The net is also a risk to the archaeology as it has damaged more vulnerable artefacts exposed on the site.

The progress of the fieldwork was documented on film by cameraman and producer Michael Pitts. Each day a new episode of the [Northumberland Diaries](#) was uploaded to [YouTube](#) and links put out via twitter, the *Northumberland* wreck [Facebook page](#) and the [Pascoe Archaeology website](#). This was a really successful way of engaging with those interested in the current work on the site.

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Acknowledgements

The author gratefully acknowledges the funding received from Historic England, without it this project would not have been possible. The assistance provided by Mark Dunkley was most gratefully received. The author would also like to thank Robert Peacock for sharing his knowledge of the site.

The fieldwork was carried out by Mark James and Tom Harrison of MSDS Marine, Tom Cousins and Kim Knight of Bournemouth University, Keith Clark and Douglas McElvogue of Sea Dive and Michael Pitts. The survey vessel, *Neptune* was skippered by Dave Bachelor and crewed by Brian Robinson. The project was led by Dan Pascoe and the results of the assessment and the report have been produced by Dan Pascoe.

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1. INTRODUCTION

- 1.1.1. This report has been prepared by Pascoe Archaeology (PA) for Historic England (HE). It comprises an Archaeological Assessment Report for the designated wreck of the *Northumberland* on the Goodwin Sands.
- 1.1.2. The programme of work was conducted in accordance with the Project Design agreed by HE. The archaeological assessment took place through underwater diving investigations over one week from the 18-24 August 2018. PA directed the fieldwork and MSDS Marine acted as the dive contractor. The current 2018 multi-beam bathymetry data was used to target exposed archaeological features on the seabed.
- 1.1.3. Following the fieldwork PA has analysed the results gathered and interpreted the archaeological remains currently exposed on the seabed that form the basis of this report. Exposed archaeological features were recorded photogrammetrically and have been scaled and georeferenced onto the current multi-beam bathymetry. The results have produced an accurate and up-to-date plan of the site.

2. PROJECT AIMS AND OBJECTIVES

2.1. PROJECT AIM

- 2.1.1. The aim of the project is to identify and record exposed and vulnerable areas of the Designated Site of the *Northumberland*, a site on the HAR as High Risk.

2.2. PROJECT OBJECTIVES

- 2.2.1. The objectives of the project are as follows:
 - Assess the site by establishing the condition, extent and type of exposed archaeological material;
 - Identify areas most vulnerable and at risk and in need of detailed recording;
 - Record exposed archaeological material using the most appropriate recording techniques depending on underwater conditions;
 - Record timber sizes, dimensions and types to help identify which parts of the ship are surviving on the seabed;
 - Record the number of guns (cannons) exposed and their sizes;
 - Identify any exposed artefacts, ships fittings and fixtures that may help to determine the identification of areas of the ship;
 - Collecting PH readings from the seabed;
 - Biological trial: the current research is aimed towards a larger project which focuses on understanding the risk and rate of biodegradation to wooden underwater cultural heritage in different marine environments.

3. METHODOLOGY

3.1. DIVING

- 3.1.1. MSDS Marine acted as the diving contractor during the fieldwork. All diving works were undertaken in adherence to the Diving at Work Regulations 1997 (DWR97) and following the guidance laid out in the Scientific and Archaeological Diving Projects Approved Code of Practice (ACoP). The Scientific and Archaeological Diving Projects ACoP allows for the use of professional divers, volunteers and students and has been used successfully on a wide range of projects undertaken by the diving contractor.
- 3.1.2. All diving was undertaken using SCUBA diving equipment with Full Face Masks (FFM) fitted with through-water communications to allow two-way communication with the divers. All divers were suitably qualified and experienced to undertake the proposed tasks.
- 3.1.3. Alongside the professional core dive team were volunteer divers. The volunteers dived according to the rules and regulations of their certifying organisations but under the supervision of the diving supervisor.
- 3.1.4. Diving operations were conducted from the MCA accredited diving support vessel (DSV) *Neptune*, a 15m catamaran and licensed to carry 12 divers.
- 3.1.5. At the beginning of each day the project team were briefed on the dive plan, survey and recording methods, and health and safety. The team members were then divided into buddy pairs for diving and given survey tasks to carry out underwater.
- 3.1.6. A buoyed shot was deployed on the site, which the divers descended. When at the bottom divers clipped onto the bottom of the shot and reeled-out to their chosen areas to survey. This method ensured that divers never got lost from the shot and could always return safely to the surface to be picked up by the dive vessel.

3.2. SURVEY AND RECORDING METHODS

- 3.2.1. The methodological approach to carrying out archaeological work underwater followed the procedures and guidelines set out in 'Underwater Archaeology: The NAS Guide to Principles and Practice' (Bowen 2008).
- 3.2.2. The recording of the site was carried out following procedures and guidelines set out in the 'Institute for Archaeologists Standards and Guidance for Nautical Recording and Reconstruction' (CIFA 2014).
- 3.2.3. Initial site assessment and recording involved observational survey and sketch plans of potential areas of recently exposed material. These were supplemented by digital photographs and HD video. The observations were recorded by the diver onto survey boards using digital cameras and GoPro HD cameras.
- 3.2.4. Photographic and video surveys were taken to record key constructional features and exposed artefacts.

3.3. PHOTOGRAMMETRY

- 3.3.1. Exposed archaeological features were identified and several 1m scales were placed around the feature prior to survey. The scales ensure the results of the surveys can be scaled accurately during the processing phase.
- 3.3.2. A Gopro Hero 6 with an Inon UFL-G140 semi-fisheye dome port was used to conduct the surveys.
- 3.3.3. During diving operations, teams of two were sent down onto the wreck and tasked to survey specific areas. Areas were assigned during the dive briefings at the beginning of each day and teams were shown on a site plan the area to be covered. Divers were equipped with the available cameras: typically dive teams were either assigned the Nikon with the attached GoPro with flat lens, or the standalone GoPro with the dome port. Divers covered their designated areas in a 'lawnmower' pattern with the intent to ensure overlap between photo rows and columns.
- 3.3.4. During dives, the cameras were set to automatic white balance settings and set to automatic capture at one image per second. This workflow was designed to eliminate user error and the need for a comprehensive understanding of camera theory among the team.
- 3.3.5. The images were collected as JPEGs and brought into Adobe Lightroom for colour correcting. Following image correcting the images were loaded into Agisoft Photoscan for processing.
- 3.3.6. Images were then aligned using PhotoScan's medium accuracy setting. Medium was chosen due to both high processing times observed when attempting alignment of larger datasets on the 'high' and 'highest' settings, as well as occasional highly confused models generated due to the high sensitivity of the setting attempting to highlight water particles as features of interest.
- 3.3.7. After chunks of photos were aligned, dense point clouds were generated using high or medium settings. If successful, interpolative meshes and textures were generated from the dense cloud. Once full models were created, the models were scaled in Photoscan. Textures were rendered as orthophotos and Depth Elevation Models (DEM) were also produced. Once scaled the orthophotos and DEMs were georeferenced onto the current 2018 MB.

3.4. BIOLOGICAL TRIAL – TEST PANEL DEPLOYMENT

- 3.4.1. Three sets of test panels containing elm, oak and pine were placed on the site. Each set had 5 x elm, 5 x oak and 5 x pine panels. The individual panels are 200x75x25mm in accordance with EN275 (1992) standards.
- 3.4.2. The test panels consist of timed sets, in which the first set will remain on the site for 12 months, the second for 18 months and the third for 24 months. When the panels are retrieved, they will be analysed to determine the type of wood boring species living, breeding and eating the wood.
- 3.4.3. The test panels were arranged in rows of three in accordance to their species and secured using polypropylene rope threaded through a 10mm hole in the middle of

each test panel. An additional 1m of rope was left at each end of the row to secure the panels directly to the wreck. A different colour and number of cable tie combinations were secured to the rope to help identify the test panel groups on retrieval.

4. PROJECT RESULTS

4.1. INTRODUCTION

- 4.1.1. Four days of diving were conducted over the wreck of the *Northumberland* on the Goodwin Sands between 18-24 August, during a period of neap tides. Three days were lost due to adverse weather conditions, which made it unsafe for diving operations to be conducted. A total of 21 individual dives were undertaken by 8 divers, with a total bottom time of 922 minutes.
- 4.1.2. Underwater visibility on site was generally good for the Goodwin Sands. It ranged from 1.5-3m without the use of a torch. Torches were used to look at the detail of archaeological features but overall were not needed to navigate around the site.
- 4.1.3. These conditions were sufficient for the method of photogrammetry to be used as the primary recording method of the exposed archaeological features.

4.2. THE *NORTHUMBERLAND*

- 4.2.1. The *Northumberland* was a third-rate man-of-war of 70 guns built in 1679 in Bristol. She was lost on the 27th November 1703 during the Great Storm. The wreck lies at a chartered depth of 14m 9.5km southeast of Ramsgate on the Goodwin Sands between North Sands and South Sands Head. The exact position is 51°15.4802'N 001°30.0161'E WGS 84 with a designated area with a 300m radius (Figure 1).
- 4.2.2. The current 2018 multi-beam bathymetry identified exposed features within a main wreck mound 37m long by 20m wide. The mound is orientated northwest-southeast, and it lies directly on bedforms that are migrating in a northeast direction (PA 2018, 7) (Figure 1).
- 4.2.3. The interpretation of the exposed remains will start at the southeast end of the site and work systematically backwards to the extent of exposed features at the northwest end (Figure 2).

Wall of concretion

- 4.2.4. The highest point of the wreck mound is located at the southeast end and this can be clearly seen on the multi-beam bathymetry (Figure 1 and 2). Previous investigations had identified this as a concretion of iron shot (Pascoe *et al* 2015, 134), however, the current inspections have revealed a more complex feature.
- 4.2.5. The south face of the feature forms a vertical wall rising to 2m above the level of the seabed. The northern extent of the feature is less pronounced and it gently slopes back down into the wreck mound. The current extent of this feature is approximately 8m across from southwest-northeast and 9m northwest-southeast (Figure 1 and 2). The feature is a large conglomerate of concreted objects, some of which are clearly identifiable and others are not.

- 4.2.6. Beginning at the bottom of the west side of the feature there is a large riveted copper vessel lying on its side. It is in poor condition with part separation between the sides and base of the vessel. The diameter of the vessel measured from its base is 600mm. It is entangled with fishing net, which has probably contributed to its poor condition (Figures 4 and 5). This has been exposed previously and recorded on past site plans and reports (Pascoe *et al* 2015, 135 & WA 2010, 8). These previous site plans and reports have described it as a twin copper cauldron. This suggests there has been significant deterioration or even loss of one of the vessels previously seen.
- 4.2.7. Immediately to the right of the copper vessel, and looking east, are large framing timbers, which emerge from beneath the concretion mass. The side dimensions of the timbers are 340mm (13 ½ inches). This is consistent with the size of the lower hull structure (Pascoe *et al* 2015, 136). These timbers are only exposed for approximately 0.5m before they become buried in the sand, but they demonstrate the survival of wooden structures beneath the concretion and the surrounding seabed.
- 4.2.8. Above the timbers the concretion rises vertically by 2m. The face of the feature is heavily entangled with fishing gear, including a lobster pot, trawl and gill nets (Figure 4). On this section of the concretion it is possible to identify several objects. Near the top is a lead scupper 700mm long. It has a flange at one end on the outward side of the concretion. The external diameter of the scupper is 90mm (Figures 4 and 6). To the right of the scupper is a concreted barrel or a staved bucket. It is partially obscured by trawl netting. The diameter of the base is 330mm (Figures 4, 7 and 8). Below and to the left of the scupper is a small vessel, possibly ceramic (Figure 4). It has an external diameter of 150mm. These objects are surrounded by a mess of ferrous objects including shot, possible bar shot, iron rings and a mass of unidentifiable concretions of all shapes and sizes.
- 4.2.9. Moving round the concretion wall to the south face looking north, a large pulley sheave can be seen. It has a diameter of 300mm (just under 12 inches) and the hole for the pin has a diameter of 60mm (Figure 9). Above the sheave the face of the concretion is obscured by trawl netting. Just under two metres to the east, at seabed level, is at least one other pulley sheave. It is partially buried but looks equally as large as the previous. Once again there is a lot of trawl net covering this area of the concretion.
- 4.2.10. Continuing around the base of the concretion, approximately 3m to the northeast, is a concreted group of at least three pulley sheaves. The top two sheaves are clearly visible and have a diameter of 300mm, and a thickness of 60mm. The holes at their centres have a diameter of 60mm. Below these two sheaves, the edge of a third sheave can be made out. Tangled around the sheaves and surrounding concretion is gill netting with small floats attached. Further netting with floats can be seen coming out of the sand and floating up to 300mm above the surrounding seabed (Figures 10 and 11).
- 4.2.11. Within one metre of the group of sheaves there are several large iron shot and some possible bar shot scattered around the adjacent seabed. From the size of the shot they are likely to be for the larger caliber guns.

Central area of concretions

- 4.2.12. Moving towards the centre of the wreck mound is another area of concretions. This was partly recorded photogrammetrically. There was nothing visibly obvious to help with its identification. Although, on the western side, impressions of planking were visible in the surface of the concretion. From the impression left behind the planking was 450mm wide and 150mm thick (Figure 12).

Area of guns

- 4.2.13. Moving 15m to the northwest from the previous area of concretions is an area consisting of three iron guns and a section of structure. This area was recorded photogrammetrically (Figure 13 and 15). The guns are all heavily concreted, so their measurements will be used only as a guide to help identification of their possible type. The guns have been labelled 1 to 3 for this assessment but attempts will be made to match them to guns recorded on previous site plans (Figure 14).
- 4.2.14. Gun 1 is the most northerly within the group and is orientated ENE/WSW. The muzzle end is slightly higher than the breech end. The total length from the end of the button to the end of the muzzle is 3.35m. The approximate length from muzzle to base ring is 2.95m. Its location and dimension match a gun labelled R15 from a 1993 sketch plan. From these rough sizes Gun 1 (R15) is likely to be a main gundeck demi-cannon (Figures 13-15).
- 4.2.15. Gun 2 lies next to Gun 1 just to the south, with its muzzle roughly level with the middle of Gun 1. Gun 2 is orientated east to west with the muzzle facing up the slope to the east. The breech end of the gun is buried, so it was not possible to get a total length of the gun. The position of Gun 2 next to Gun 1 (R15) suggest it is R24 from the 1993 sketch plan. The recorded length of R24 from muzzle to base ring was 2.9m (Pascoe *et al* 2015, 139). This size is likely to make this another main gun deck demi-cannon (Figures 13-15).
- 4.2.16. Gun 3 is orientated ESE/WNW with the muzzle end pointing ESE. The breech end is 1.3m from the muzzle of Gun 2 (Figure 13). The gun is heavily concreted with other concreted objects stuck to it. This is especially the case around the breech end, which makes identifying the exact location of the base ring almost impossible. It is, therefore, only possible to record the overall length. The length of the gun from the end of the muzzle to the end of the button is 3.6m (11ft 8 inches). The longest guns carried by the *Northumberland* were the culverins, and they were 11 feet long from muzzle to base ring. The Culverins are likely to have been the ship's stern chasers.
- 4.2.17. Gun 3 also has the remains of its associated carriage attached. The gun lies on its side, and the upper side has a small section of the carriage cheek surviving from around the trunnion recess. This extends back to the first step of the cheek. Below the trunnion recess are the remains of the iron side bolt, which extends down under the belly of the gun and into the other cheek. The bottom edge of this cheek can just be seen protruding from the sand and it extends a little further back than the upper cheek (Figures 16 and 17). The bed of the carriage is missing. The surviving parts are consistent with a truck carriage. This type of carriage has two stepped cheeks, fastened to a wooden bed, with two wooden axles and four trucks (wheels). Similar examples have been recovered from the wrecks of the *Stirling Castle* (1703) and the *London* (1665) (Pascoe 2018, 46 and McElvogue 2008, 42).

- 4.2.18. The nearest gun to Gun 3 on the 1993 sketch plan is labelled as R23. R23, however, was recorded as having a length of only 2.7m, which makes it too short to be a culverin. This length would more likely make it a demi-culverin; twenty-five years have passed since those guns were recorded onto the 1993 sketch plan and guns could have potentially moved. It is also possible that, in 1993, the gun may have been partially buried and therefore its true length was not possible to record.
- 4.2.19. Immediately to the south of Gun 1 and Gun 3 is the edge of a section of structure. It looks like a section of the hull consisting of frames and ceiling planking. This structure disappears into the sand and beneath the guns and is obviously a section of a much larger area of structure (Figure 13).
- 4.2.20. The condition of the exposed timbers is poor with considerable deterioration from marine boring organisms. The exposed section is approximately 2.5m long by 1.5m wide, with up to seven frames and two ceiling planks exposed (Figure 13). Due to the poor condition of the timber, reliable measurements were not possible. However, the identification of possible demi-cannon and culverins would suggest it is highly possible that this section of hull relates to the level of the gundeck, probably close to the stern end.

Concreted assemblage of swords

- 4.2.21. Six metres northwest of the breech end of Gun 1 was a concreted feature with lots of linear features within it (Figure 2). These linear features were situated both horizontally and sticking up almost vertically from the seabed. The whole mass was entangled with trawl and potting line (Figures 18-20).
- 4.2.22. The fishing gear had damaged a small section of the feature. The damaged piece was at risk and vulnerable to loss and was therefore recovered. On closer inspection, following recovery, it was possible to see the shapes of three blades. Also, at the cross section, where it had broken away, it was possible to make out the remains of wood and leather scabbards (Figure 21 and 22).
- 4.2.23. The recovery of this small piece had helped identify that the concreted feature on the seabed was a large assemblage of swords. The whole feature is 2m long by 1.3m wide and up to 1m above the seabed. From the size of the concretion and the number of linear shapes within it, there could be dozens of swords contained within this concretion.
- 4.2.24. The concretion was taken to Angela Middleton at Fort Cumberland for conservation. Angela has since X-rayed the concretion, which has also identified five metallic buttons, hidden within the actual concretion (Figures 23 and 24). The buttons were all in a line suggesting they were once attached to a piece of clothing. The concretion is now with a conservation student at Cardiff University, where it is being carefully de-concreted and analysed.

Biological trial

- 4.2.25. The three sets of test panels were successfully deployed on site and secured to the large concretion at the southeast end of the site. This area of the wreck was chosen as it is robust and above the current level of the seabed. Therefore, the movement of mobile bedforms will not displace or bury the test panels (Figure 25).

Hazards encountered on the site

- 4.2.26. Considering the *Northumberland* is a designated site it was extremely alarming to find that all exposed features of the wreck were covered in fishing gear. The gear consisted of a variety of different types including: heavy robust trawl netting; lobster pots and their accompanying ropes; and, most alarming, a large amount of gill netting. The gill netting is particularly hazardous as it is made of an extremely fine nylon mesh with small floats attached. The floats enable it to float above the seabed making it a real entanglement hazard. On many areas of the site the net was floating up to 0.5m above the seabed (Figures 26-31).
- 4.2.27. We were extremely fortunate when we were diving that the visibility was reasonably good, which enabled us to see the net. The site and the Goodwin Sands, however, are renowned for poor visibility. In poor conditions divers generally crawl on hands and knees, rather than swim. With a lot of the gill net up to 0.5m above the seabed, it is therefore at just the right height for a diver to crawl into. This means diving the site in poor visibility is potentially extremely dangerous with risk of entanglement (Figures 26-31).
- 4.2.28. The entangled fishing gear is also a hazard to the archaeology. This is apparent from the poor condition of the copper vessel and the broken piece from the sword assemblage. Given that, in 2009, WA removed fishing net from this vessel to prevent further damage (WA 2010, 8), this net has come into the site since that time. The fishing gear is moving around the site with the movement of the mobile seabed, strong tides and currents, and during high energy storm events. This is clearly damaging the more fragile objects, but the sheer volume of netting is also obscuring the archaeology. While the net is there, many archaeological features are not easily recognisable and remain undetected.

Social media engagement

- 4.2.29. Each day work on the site was documented by cameraman and producer Michael Pitts. At the end of each day a short video diary was produced showing the highlights of the day's investigation and discoveries. The clips were uploaded onto YouTube and shared via Twitter and Facebook. A total of four 3-5minute episodes, titled the '[Northumberland Diaries](#)' were aired.
- 4.2.30. During and after the fieldwork there have been regular posts on the [Northumberland wreck Facebook page](#) showing the results of the underwater investigations. This has led to the engagement with hundreds and sometimes thousands of the public.

4.3. DISCUSSION

- 4.3.1. With any diving investigation one hopes to achieve a better understanding of the site and to make new discoveries, which may enhance its significance and importance. In four days, the team managed to achieve this by producing an accurate, scaled and georeferenced site plan of several key features. None of these features had been accurately recorded before and some had not even been observed. All features that were surveyed photogrammetrically were scaled and georeferenced in relation to the current multi-beam bathymetry to make the site plan. The stand-out observations were the assemblage of concreted swords, pulley sheaves and the potential culverin stern chaser with carriage parts surviving. These groupings of finds, which are at the

top of the wreck's stratigraphy, demonstrate the high archaeological potential of the site.

- 4.3.2. The *Northumberland* is a complex site and a challenge to interpret but from the information collected from the current archaeological assessment, it is possible to make some credible working hypotheses. From previous investigations the southeast end of the site was believed to be the forward end due to the type of artefacts found there (Pascoe *et al* 2015, 134). The finding of a group of pulley sheaves, and several others nearby, would suggest the location of a possible store: spare blocks would be either stored in the Boatswains store or a separate block room next to the Boatswain store. An illustration by Richard Endsor of the internal layout of the third-rate *Lennox*, a sister ship of the *Northumberland*, shows the Boatswain store in the forward end of the orlop (Endsor 2009, 167). This evidence would appear to support previous interpretations that the southeast end represents the forward end of the ship.
- 4.3.3. The pulley sheaves are just one feature of the much larger mass of concretion at the southeast end, which, due to its complexity, is very difficult to interpret. There are some identifiable artefacts within it but most of it is, at present, unrecognisable. What can be said with some certainty is that it is not just a concretion of iron shot as previously interpreted. There is some evidence of shot, but most of the concreted features are very linear and angular. To gain any real understanding it needs to be investigated more closely. Strategic de-concretion of parts of the feature should be a serious consideration to aid the identification and interpretation.
- 4.3.4. As mentioned above, a lead scupper was identified near the top of the concretion. Scuppers were found on the sides of the hull at the level of the main gundeck. This was the first deck above the waterline and allowed unwanted water to drain out of the ship. The location of the scupper could suggest that the side of the vessel was, at some point, present here, but has since eroded away.
- 4.3.5. Below the concretion is evidence of surviving structure and previous investigations recorded a significant section of the lower hull extending out to the east (Pascoe *et al* 135-137). Should seabed sediments continue to reduce then more structure will become exposed in this area.
- 4.3.6. There is a distance of 20m between the large concretion at the southeast end and the group of three guns. A small section roughly in the middle of this area was recorded photogrammetrically but it was heavily concreted, making it difficult to interpret. Emerging from the sand within this area were edges of timber structures. They were not properly inspected due to time spent on other areas of the site and due to days being lost to weather. However, should the seabed sediments continue to reduce then there is a potential for these wooden structures to become exposed.
- 4.3.7. From the size of the guns at least two are from the main gundeck and there is a good chance Gun 2 is in fact R24, which was interpreted as demi-cannon in 1993. Due to its length, Gun 3 could be one of the ship's four culverin chasers (TNA WO55/1736). These were likely to be stationed at the stern end of the main gundeck at the last two-gun stations on each broadside. They would have been moved to the stern ports when needed. This area of the gundeck was known as the gunroom (Endsor 2009, 156).

- 4.3.8. The survival of parts of the cheeks of the carriage for Gun 3 is quite extraordinary considering it is at the top of the stratigraphy of the site. This highlights the potential for the survival of complete carriages on the site. The *Northumberland* was probably carrying 60 guns for Foreign Service during war time, as opposed to her full armament of 70. Only a maximum of 17 guns have been recorded on the main wreck mound. This reiterates the point of the potential for complete and well-preserved carriages to survive along with their guns lower down in the stratigraphy.
- 4.3.9. The discovery of the assemblage of swords was an unexpected find. The photogrammetric model clearly shows that there is the potential for many swords to be among this feature. According to the gunner's stores of the *Lennox*, the sister ship to the *Northumberland*, there should be 40 swords and 40 hangers (Endsor 2009, 164). Hangers had a slightly curved blade, which appears to fit with the shape of the concretion recovered; this could be a very significant find. This assemblage needs all the fishing gear to be removed, so it does not cause any more damage and so it can be recorded properly.
- 4.3.10. This large group of concreted swords suggests they have come from a store and their grouping also suggests they have not moved far from their original location on the ship. These types of weapons are listed in the gunner's stores. The Gunner's store, like the Boatswain store, was found at the forward end of the ship (Endsor 2009, 167). However, these are 33m from the area of the site believed to be part of the forward end. An alternative is that weapons such as swords were also stored elsewhere onboard, possibly nearer the stern as this feature is near one of the ship's culverin stern chasers. Further research is needed to understand the storage and organisation of hand weapons onboard a naval vessel of this size and from this period.
- 4.3.11. The production of four video diaries documenting the progress of the investigations was a spontaneous idea at the beginning of the fieldwork. The result was at no extra cost to the project but merely down to the enthusiasm of the team to demonstrate the archaeological potential of the site. The diaries were a fantastic way to engage with a wider audience as the archaeological investigations were happening. The feedback via social media was always positive and it showed the public that Historic England was funding an important and worthwhile project. The diaries were a great way to promote and raise awareness of the site.

4.4. RECOMMENDATIONS

- 4.4.1. The current assessment of the site has identified new and significant archaeology on the surface and demonstrates the potential for a lot more beneath the sand. Should the seabed sediments continue to reduce then further material will be exposed and at risk. To monitor the site and record any changes PA recommends conducting a MBES survey in the spring of 2019. Consecutive MBES surveys in 2017 and 2018 have demonstrated the site is within an area of seabed erosion and this has been occurring naturally. With the dredging of the Goodwin Sands for Dover Port potentially going ahead in 2019, the site needs to be regularly surveyed to see if the dredging will or (if it happens) is having an effect on the site.
- 4.4.2. It is clear that there is the potential for a lot more archaeology to be under the sand than is currently showing. However, the actual depth and the extent of archaeological

remains is poorly understood. PA recommends a sub-bottom geophysical survey to establish the depth and extent of the stratigraphy on the site. Identifying the extent and depth of the archaeology beneath the current seabed will also help predict which areas might expose next and to what extent. This will help inform future management strategies and focus diver monitoring on the site.

4.4.3. Due to the loss of diving days because of adverse weather, certain objectives were not completed, and PA recommends returning to fulfil these objectives. These objectives were as follows;

- Collect PH readings from the seabed;
- Ground-truth anomalies to the north of the main wreck mound. The anomalies are potential guns relating to either the *Northumberland* or the *Restoration and Mary* site. Measuring the size of the guns may help determine which sites the guns belong to;
- Complete the photogrammetry survey of exposed features and add to the current site plan.

4.4.4. Considerable amounts of fishing gear were found entangled on areas of exposed wreckage and much of it was floating above the seabed. This is a serious entanglement hazard to divers, especially when the underwater visibility is poor. The author was contacted by HE regarding issuing a visitor's license to a dive club. At present it would be irresponsible to have divers who are unfamiliar with the site and potential hazards. The net is also a hazard to the archaeology and has already damaged the assemblage of concreted swords and the large copper vessel. The net is also obscuring the archaeology and hindering further recording and identification. The net is, therefore, both a risk to divers and the archaeology. PA strongly recommends returning to the site next year to remove the netting and therefore the danger to divers and the archaeology.

4.4.5. As mentioned above three sets of wooden test panels were placed on the site. The first set needs to be recovered after 12 months. This could be done at the same time as the other proposed objectives mentioned above. PA therefore recommends returning to the site next summer.

5. REFERENCES

Endsor, R., 2009. *The Restoration Warship, The Design, Construction and Career of a Third Rate of Charles II's Navy*. Conway Maritime Press. London.

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- Pascoe, D., 2018. *Forensic Archaeology, Gun Carriages and Bronze guns from the Wreck of the London (1665)*. Journal of the Ordnance Society: 24. 43-61
- Pascoe, D. and Peacock, B. 2015. The wreck of the warship *Northumberland* on the Goodwin Sands, 1703: an interim report. *International Journal of Nautical Archaeology*, 44.1,132-144.
- The National Archives (TNA) WO55/1736 *folio* 119-120 – Survey of stores and army.
- Wessex Archaeology. 2010. *Northumberland, Goodwin Sands*. Archaeological Report. Unpublished report. Ref: 53111.03ccc

6. APPENDIX II: THE *NORTHUMBERLAND*

Wreck/Site Name	Northumberland														
NHLE Entry No.	EH Region					Restricted Area					Principal Land Use				
1000058	Southeast					300m					Coastland 1				
Latitude (WGS84)	51°15.4802’N														
Longitude	001°30.0161’E														
Class Listing	Period										Status				
Third-rate Man of War	Post Medieval										Protection of Wrecks Act 1973				
Licensee	Nominated Archaeologist										Principal Ownership Category				
Yes	Yes										MOD				
Seabed Owner	Navigational Administrative Responsibility														
The Crown Estate	Nil														
Environmental Designations															
Nil															
Seabed Sediment										Energy					
Slightly gravelly sand										High					
Survival															
Good															
Overall Condition					Condition Trend					Principal Vulnerability					
Generally unsatisfactory					Declining					Mechanical degradation Seabed erosion Biological decay					
Amenity Value: visibility															
Substantial above-bed structural remains which are highly visible and ‘legible’ without further information.															
Amenity Value: physical accessibility										Amenity Value: intellectual accessibility					
Restricted (C)										Developed interpretative scheme at the Ramsgate Maritime Museum.					
Management Action		Action to be identified/agreed													
Management Prescription		A	B	C	D	E	F	G	H	I	J	K	L	M	N
			X						X			X	X		
Notes:															
The <i>Northumberland</i> was a third-rate Man of war of 70 guns built in 1679 in Bristol. She was lost on the 27 th November 1703 during the Great Storm. The wreck lies at a chartered depth of 14m 9.5km southeast of Ramsgate on the Goodwin Sands between North Sands and South Sands Head.															
The 2018 MBES survey recorded metre to decametre migration of bedforms away from the site. The current survey data shows that the sand bank to the north of the wreck has migrated 120m northeast. The result has been the deepening of the seabed revealing a scatter of anomalies north of the site within the designated area. Several of these features are linear in shape and are highly likely to be guns from the site.															
The extent of exposed archaeological material within the main wreck-mound has also increased to 37m by 20m. The current diving investigations have identified and recorded															

several of the sites exposed archaeological features from the main wreck mound. Much of these features are covered in a variety of fishing gear including, lobster pots, trawl and gill net. This fishing gear is both a hazard to the archaeology but also divers.

The gill net is suspended via floats up to 0.5m above the wreck. The particularly fine nylon mesh makes it extremely difficult to see and therefore an entrapment hazard for divers. The nets in general have also damaged fragile artefacts such as a large copper vessel and a group of concreted swords. The nets are also obscuring significant areas of the wreck hindering the identification of archaeological features.

Diving investigations have identified that vulnerable artefacts such as swords, pulley sheaves and carriage parts are at the top of the site's stratigraphy. This demonstrates the high potential of well-preserved material below the current surface. Should the current trend continue and local bedforms migrate away from the site then further vulnerable archaeological remains will become exposed.

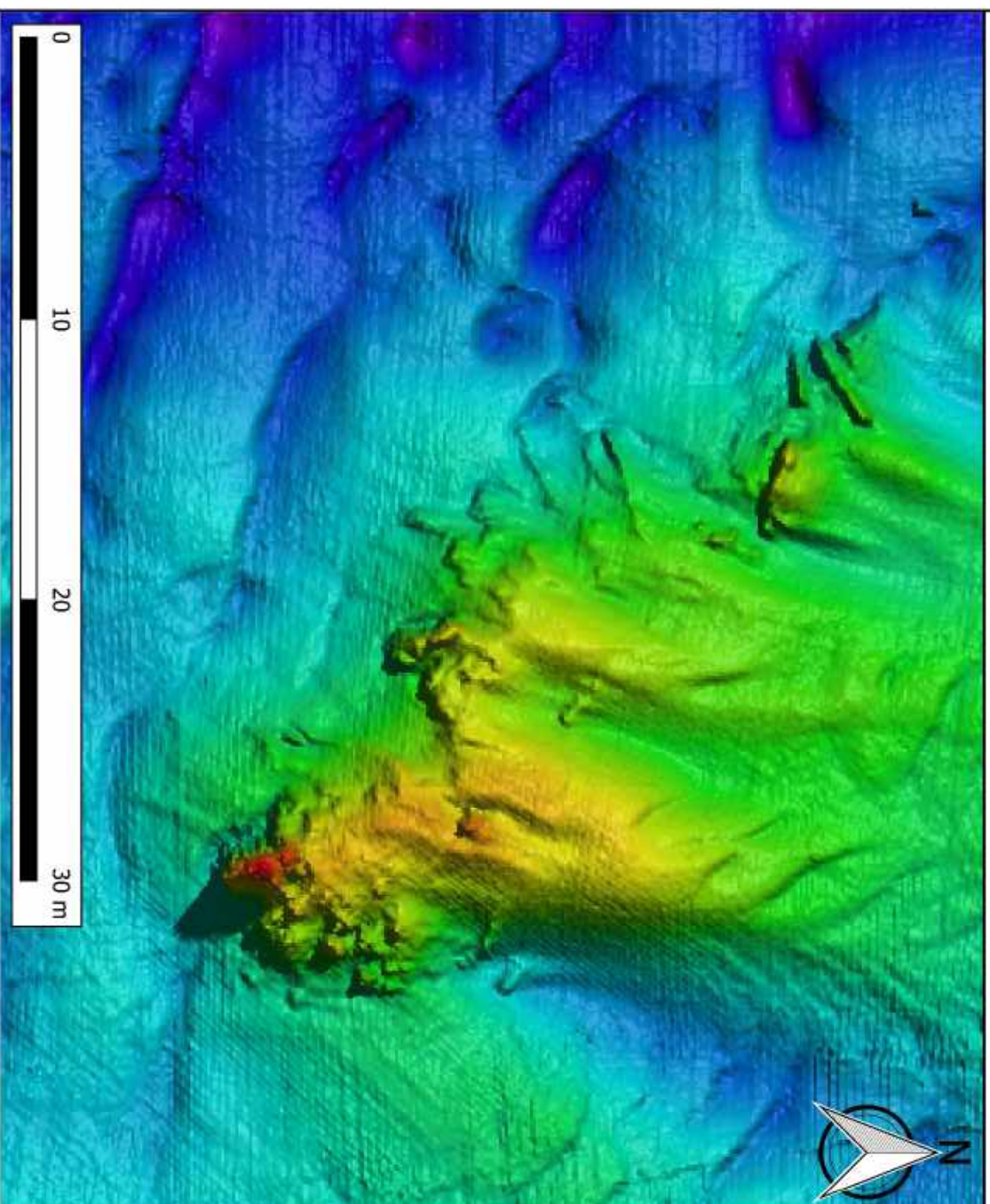
The seabed contour to the west of the site, which is orientated north/south, is now 35m from the most northwest extent of the site. The seabed immediately to the west of the contour is deeper. The boundary of that deeper seabed has advanced 5m east towards the site and therefore poses a threat to the site if the boundary continues to migrate east.

There is currently no management plan for the site.

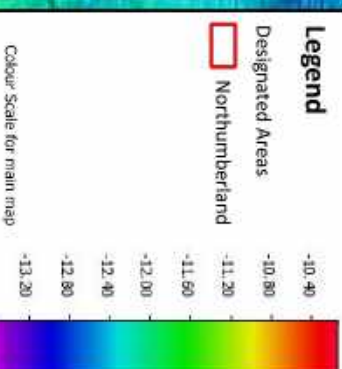
Due to the fact the *Northumberland* is experiencing a period of seabed erosion as a result of the migration of a sand bank away from the site, archaeological material is now exposed and therefore vulnerable to biological and physical decay. The exposed archaeological remains are also covered in fishing gear which has already resulted in damage to artefacts, but it also poses a serious risk to divers. Risk is therefore assessed as: **High**

Data Source	2018 MBES and 2018 diving assessment	Date & Initials	20/12/2018 DP
Date of previous assessment: 03/05/2018		Has an ecological survey been undertaken? No	

Northumberland



- Legend**
- Designated Areas
 - Northumberland



DATE: 29/04/2018

AUTHOR: MARK JAMES

PROJECTION: WGS84 231 N



Figure 1: Site location and 2018 multi-beam bathymetry of the main wreck mound.

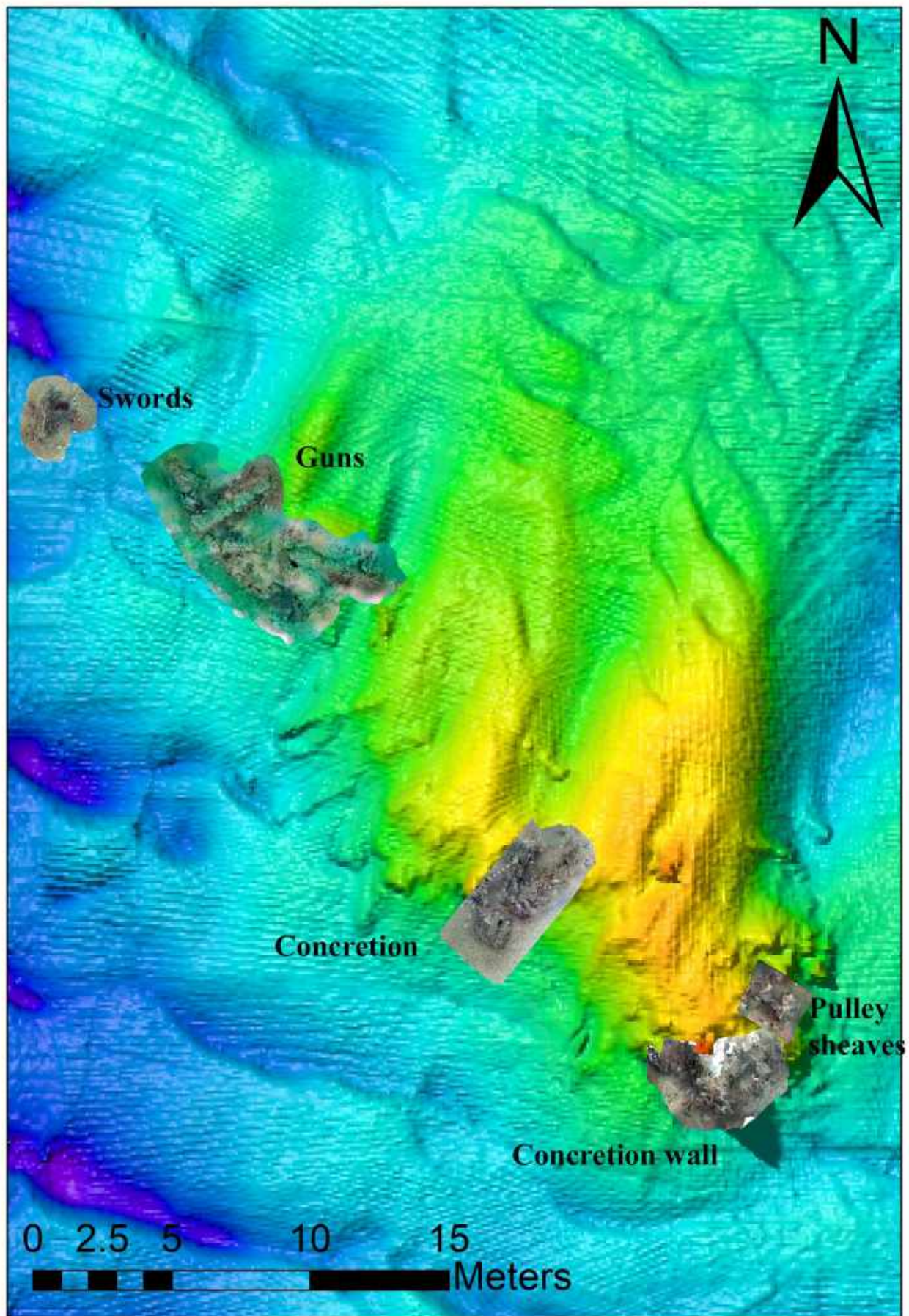


Figure 2: The multi-beam bathymetry with the scaled and geo-referenced orthophotomosaics of areas recorded.

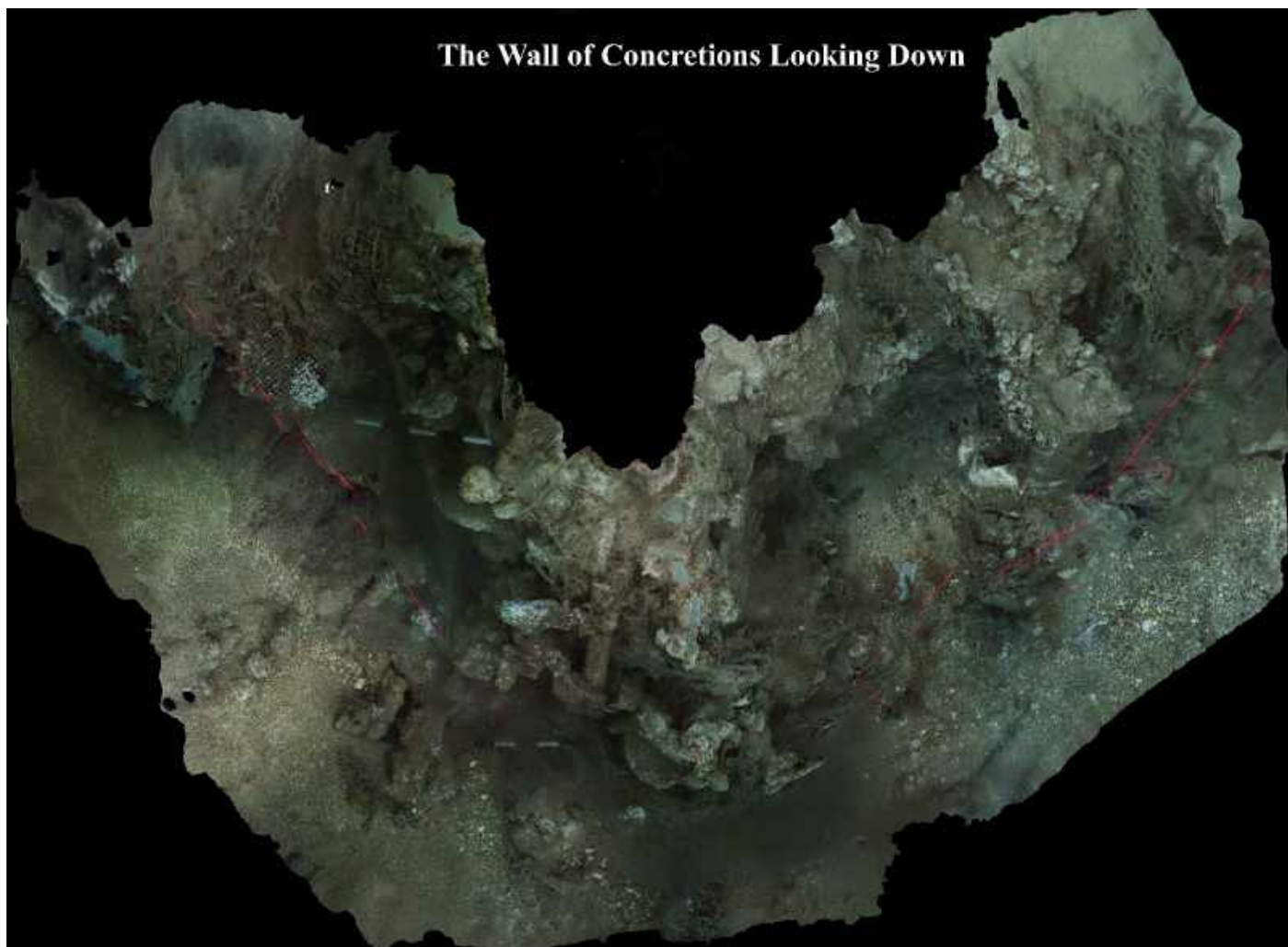


Figure 3: An orthophotomosaic of the plan view of the wall of concretion at the SE of the site. The scales in the image are 1m with 20cm increments.

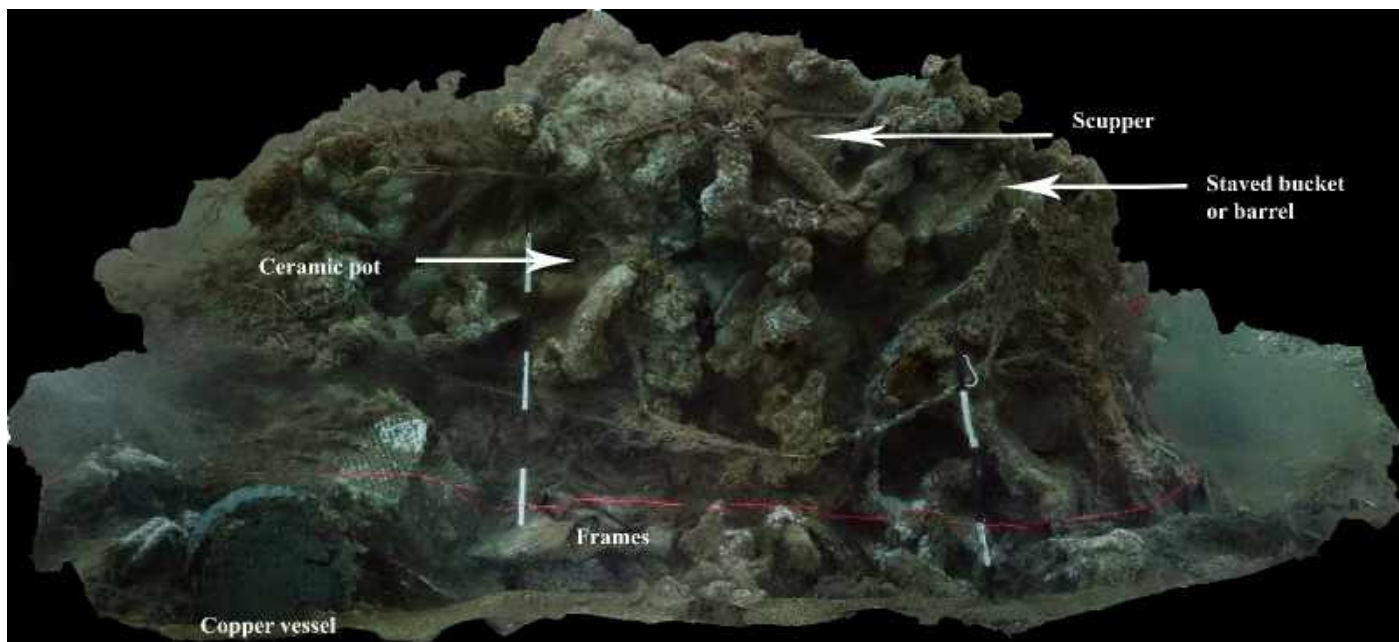


Figure 4: An orthophotomosaic of the west face of the concretion wall with annotations. The scales in the image are 1 metre with 20cm increments.



Figure 5: Diver inspecting the copper vessel. Notice the amount of fishing net entangled with it.



Figure 6: Image of lead scupper near the top of the concretion.



Figure 7: At the centre of the image a concreted staved bucket or barrel.



Figure 8: A side view of the concreted stave bucket or barrel.



Figure 9: An orthophotomosaic of the south face of the wall of concretion. The scales are 1 metre with 20cm increments.



Figure 10: A diver inspecting a group of pulley sheaves at the SE end of the site. Photo by Michael Pitts.



Figure 11: Diver inspecting the group of pulley sheaves. Photo by Michael Pitts.

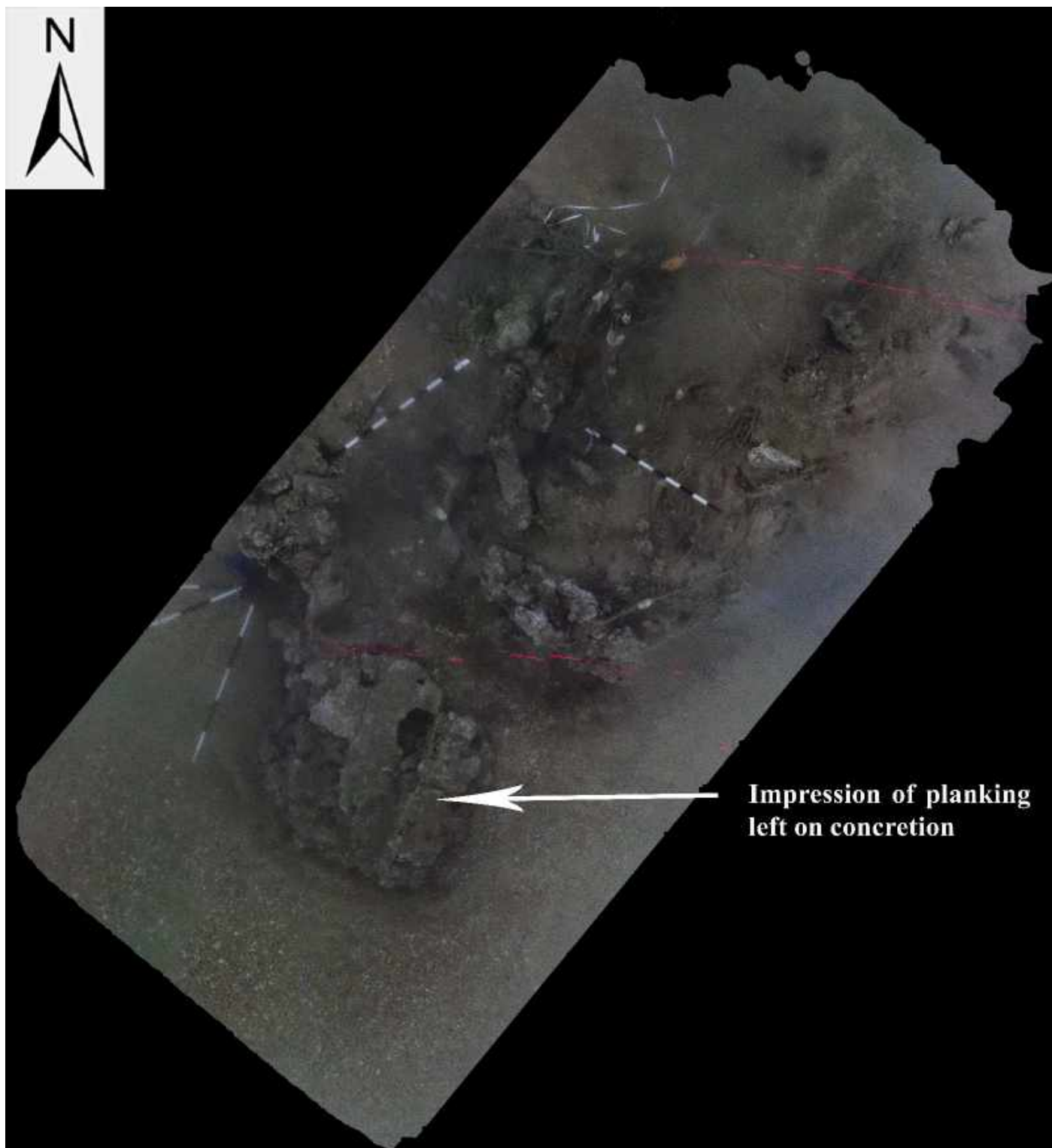


Figure 12: An orthophotomosaic of an area of concretions near the centre of the wreck mound. The scales in the image are 1 metre with 10 and 20cm increments.

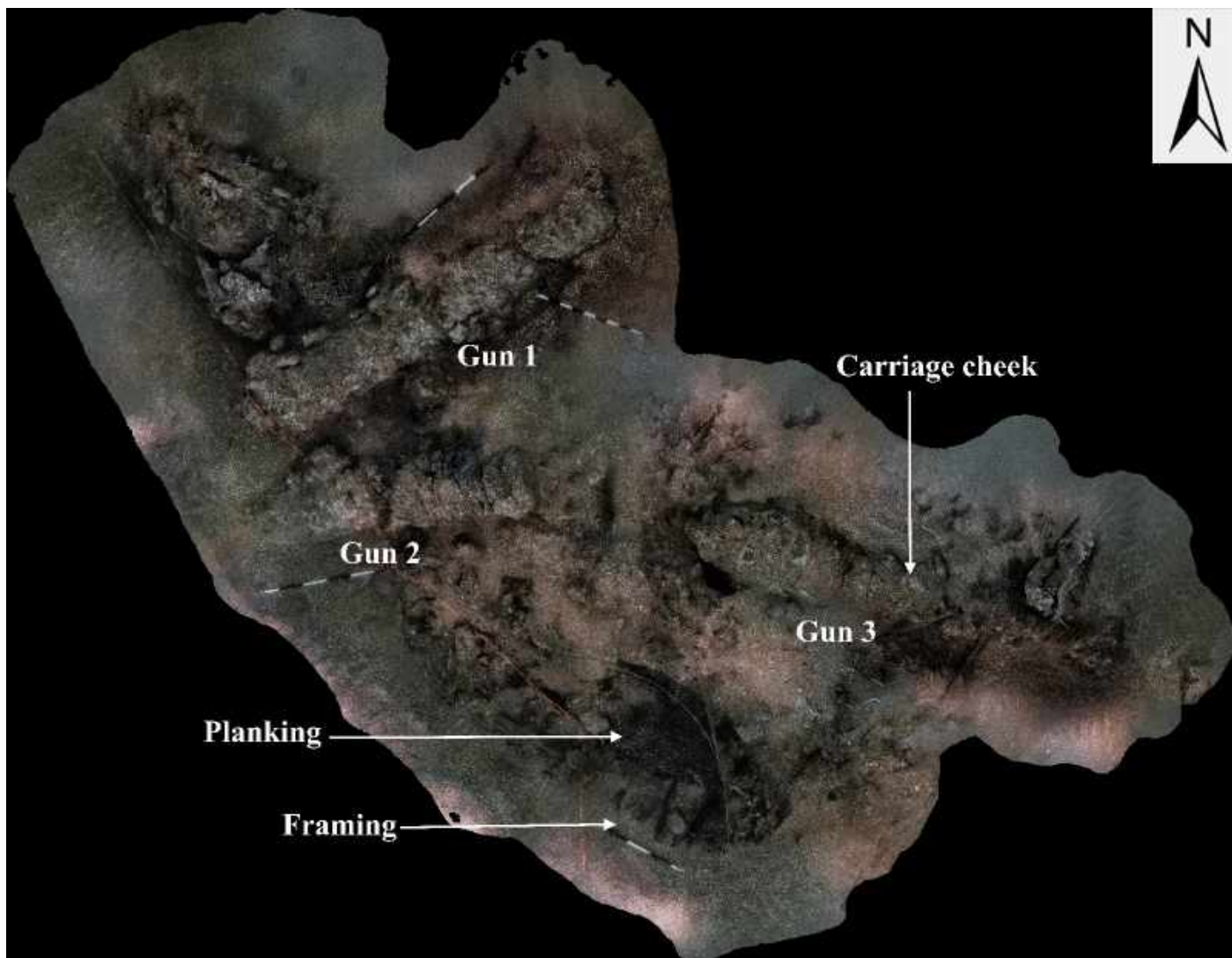


Figure 13: An orthophotomosaic of the group of three guns. The scales in the image are 1 metre with 10 and 20cm increments.



Figure 14: An image taken from the photogrammetry model of the guns. The scales in the image are 1m with 10 and 20cm increments.

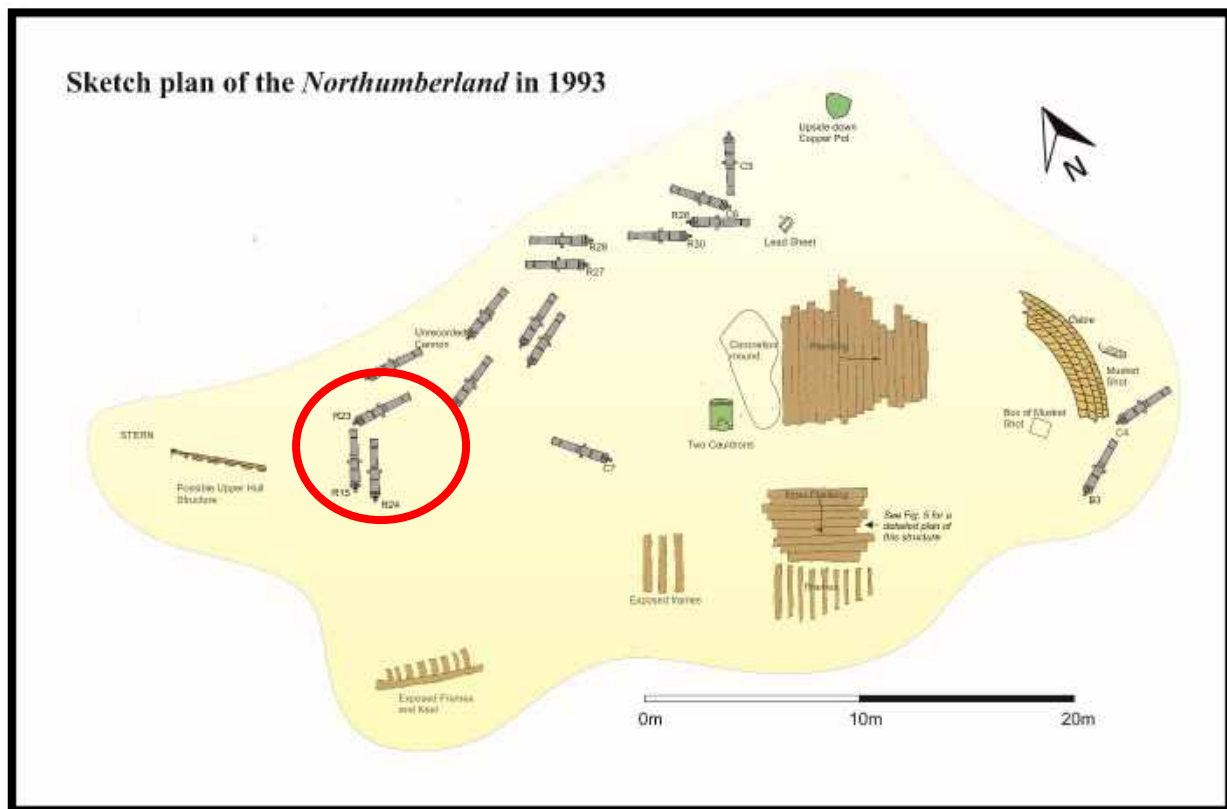


Figure 15: The 1993 sketch plan of the site. The red circle shows the group of guns under the current investigation

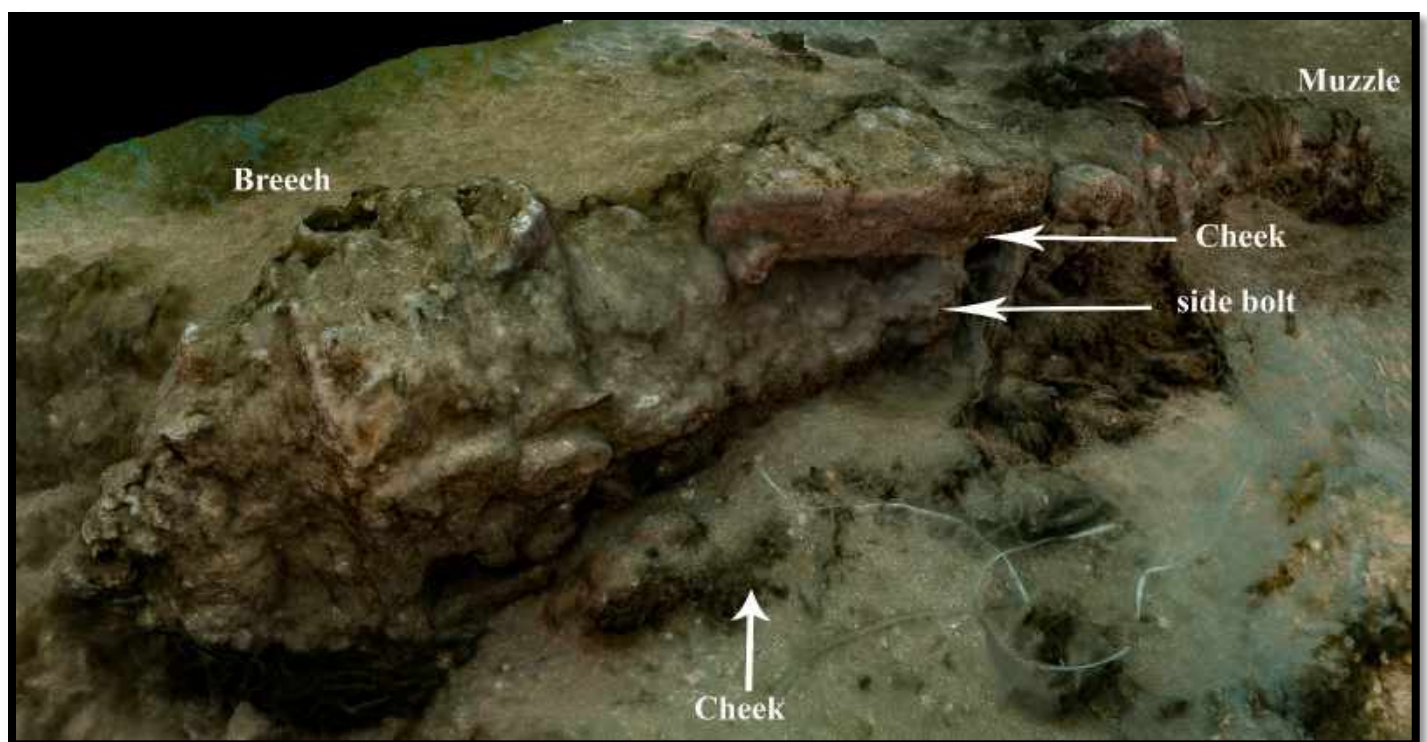


Figure 16: A photogrammetry model of Gun 3 showing the survival of parts of its associated gun carriage. The gun is lying on its side with the remains of parts of both cheeks present.

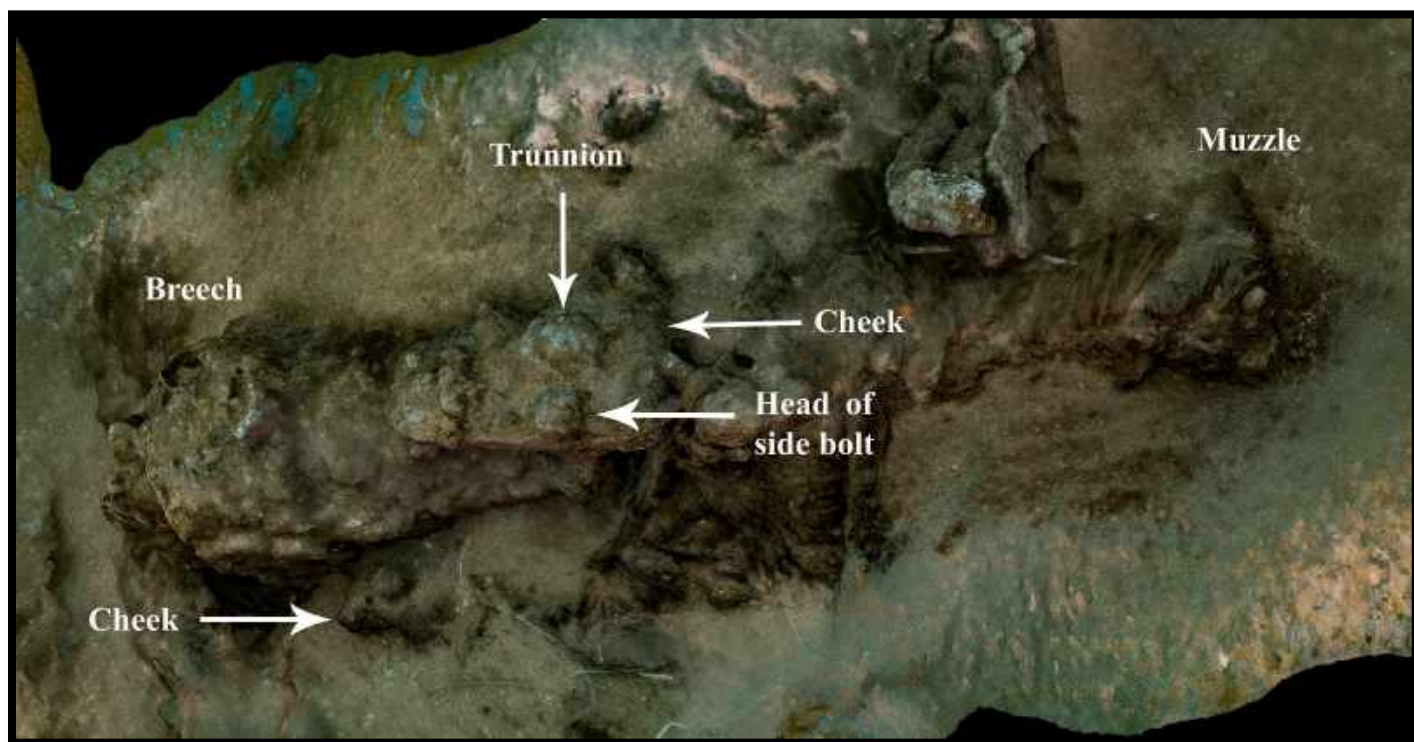


Figure 17: A photogrammetry model of Gun 3 from the view looking down. It shows the survival of parts of its associated carriage. The trunnion of the gun is slotted into the trunnion recess of the cheek. Below the trunnion recess is the head of the side bolt supports the two cheeks together. The bottom edge of the opposite cheek can just be seen protruding through the sand.



Figure 18: An orthophotomosaic of the assemblage of swords looking down. The scales are 1m with 10 and 20 cm increments. There is a lot of net entangled around the swords sticking up.



Figure 19: An orthophotomosaic from the side view. It shows how the swords are distributed in horizontally and vertically. The scales are 1 metre with 20cm increments.



Figure 20: A photo showing the amount of fishing gear entangled around the assemblage. Photo by Michael Pitts.



Figure 21: Photo of the concretion recovered.



Figure 22: At the break wood and leather can be seen.



Figure 23: An X-ray identifying the ends of blades plus five metallic buttons in a row.



Figure 24: An X-ray image from the side show the row of five buttons.

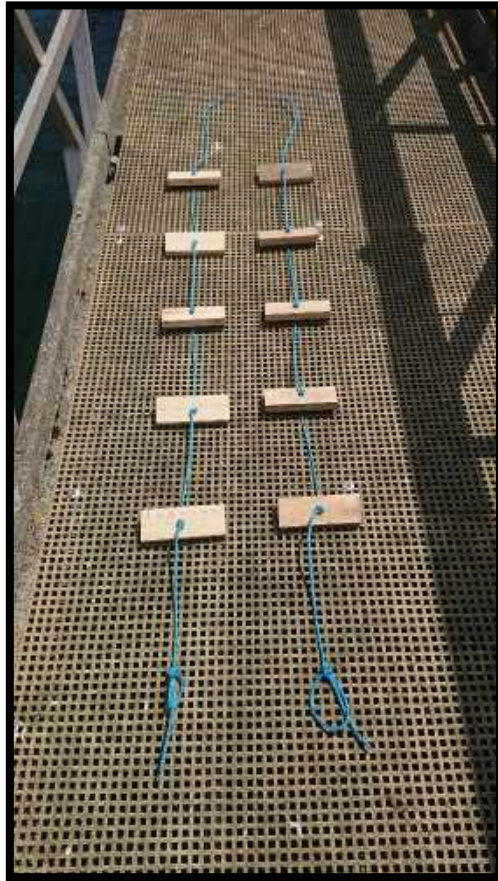


Figure 25: An example of the test pallets placed on site.



Figure 26: An example of the gill net floating above the seabed due to the small floats.

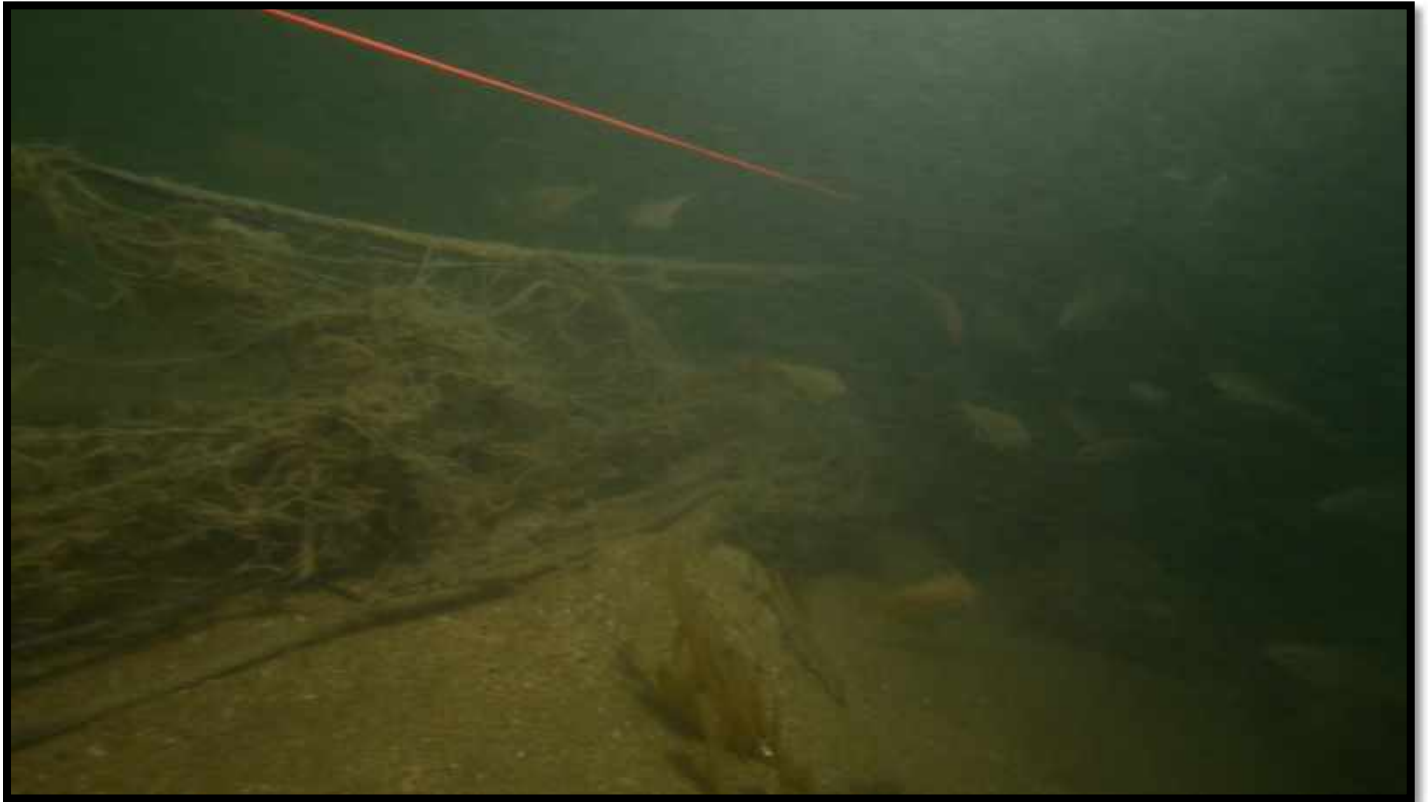


Figure 27: Gill net floating above the seabed.



Figure 28: Diver holding a large bundle of gill net entangled on the wreck.



Figure 29: An example of the floats suspending the gill net above the seabed.



Figure 30: Gill net and floats entangled on exposed features. This totally obscures the archaeology.



Figure 31: Trawl and gill net covering the exposed feature.