HMS Colossus

Investigation 2015

Project Report

Kevin Camidge

With contributions by

Polydora Baker

Gill Campbell

Jezz Davies

Mags Felter

Damien Sanders

Title	Colossus Investigation 2015 Project Report
Reference	Colossus INV15 EH 7157
Authors	Kevin Camidge Polydora Baker, Gill Campbell, Jezz Davies, Mags Felter and Damien Sanders
Derivation	Colossus site stabilisation trial : EH 3593 Colossus stabilisation & recording: 5235 PD Colossus Dive Trail: EH5682 Colossus Monitoring EH5943 Colossus Monitoring & Investigation: EH6114 Colossus Sediment Level Monitoring EH6935 Colossus Investigation 2015 project design
Origination date	10.VIII.2015
Revisers	KC, BR, SA, JZD & DS
Date of last revision	20.XI.2015
Version	1.3
Status	Final
Summary of Changes	Add section *The Next Steps* (p61).
Circulation	Alison James (including DVD) CISMAS dive team
Required action	
File Name Location	D:/Colossus/Investigation2015/ Colossus INV15 REP.docx
Approval	

Acknowledgements

This project was commissioned by Historic England, without whose support it would not have been possible. I would like to thank Alison James of Historic England for her assistance throughout the project. Thanks are also due to Ian Panter and Mags Felter of York Archaeological Trust for their assistance and advice with the conservation of the finds from this project. Damien Sanders gave much useful advice on the considerable quantities of rope recovered. Thanks also to Polydora Baker and Gill Campbell who undertook the appraisal of the sediment samples.

I would like to acknowledge the contribution made to the project by CISMAS members. They worked tirelessly for no pay, giving up their valuable annual leave in order to take part – often working long days and always to the highest standards. Without them this project would not have been possible. I would also like to thank Dave Williams, the excellent skipper of the dive charter boat *Moonshadow*, who was always cheerful and very helpful.

The chair and treasurer of CISMAS, Sharon Austin and Brendon Rowe, have given enormous support to this project. They both participated in the re-examination of the wrecking of *Colossus* which took place as part of the post-processing – this resulted in the new hypothesis of how the present distribution of material came about.

A number of organisations have given valuable assistance to the project. Ambient Pressure Diving donated consumables for use in the AP rebreathers used by some members of the team. Movevirgo of Portreath provided the new 'C.Tag' underwater sign for the site. Otter Watersports provided discounted drysuits for several team members; a dry diver is a happy diver.

Historic England

3H Consulting

3H Consulting

Ambient Pressure Diving

C.TAG

C.Tag
Anti-fouling markers

OTTER WATERSPORTS

Otter Watersports

The Team

Sharon Austin
Photography

Kevin Camidge
Project Manager

Jezz Davies
Finds Recording

Jeff Dicker
Engineering

Andrew Earle
Site Assistant

Mags Felter
Conservator

Andy Grant
Site Assistant

Peter Menear
Finds Photography

Bren Rowe
Dive Supervisor

Jo Sodergren
Finds Assistant

Nick Sodergren
Site Assistant

Dave Williams
Boat Skipper

Contents

Cover Photograph: Lower deadeye 1220 and associated rope 1216 found in trench one.

Project Name

HMS Colossus Investigation 2015.

EH 7157

Project Summary

In 2014 the Cornwall and Isles of Scilly Maritime Archaeology Society (CISMAS) undertook maintenance work of the sediment monitoring points on the wreck of *HMS Colossus* in the Isles of Scilly. During this work an area of newly exposed wreck material was found, partly buried in the seabed some 25m to the east of the stern of the vessel. This previously unsuspected material consisted of parts of the ship's rigging including rope, and a collection of personal items. The objective of this project was to determine the nature and extent of this new material and to rescue any artefacts in imminent danger of dispersal due to the falling sediment levels on the site.

Three small trenches were excavated in the area where newly-exposed material had been discovered in 2014. A number of important objects were recovered for conservation, including several pieces of a 9lb gun carriage - one of which was inscribed with the ship's name. An upper deadeye, complete with attached rope shrouds and lanyard, was also recovered. This was most probably one of the mainmast deadeyes/shrouds. A corresponding lower deadeye, complete with attached iron chains, was also recorded but left *in situ*. A significant quantity of rope was found, especially in trench two. These ropes were recorded and samples taken for further study. A small, localised collection of personal items was also found in 2014. This included 56 pewter uniform buttons, a bone brush and a small area of fabric. Sadly, this area had been disturbed by the time we came to excavate it in 2015. Nevertheless, three further pewter uniform buttons, parts of a leather shoe and a remarkable miniature bronze cannon were recovered in 2015. This collection of items was confined to a very small area (less than 0.3m diameter) and as such was probably originally contained within a small bag.

A number of questions were raised by the material found this year; this has led to a reappraisal of the wrecking process of *Colossus*. A new theory of how the current disposition of remains came about has been suggested – along with suggestions as to how this new theory can be tested.

Background

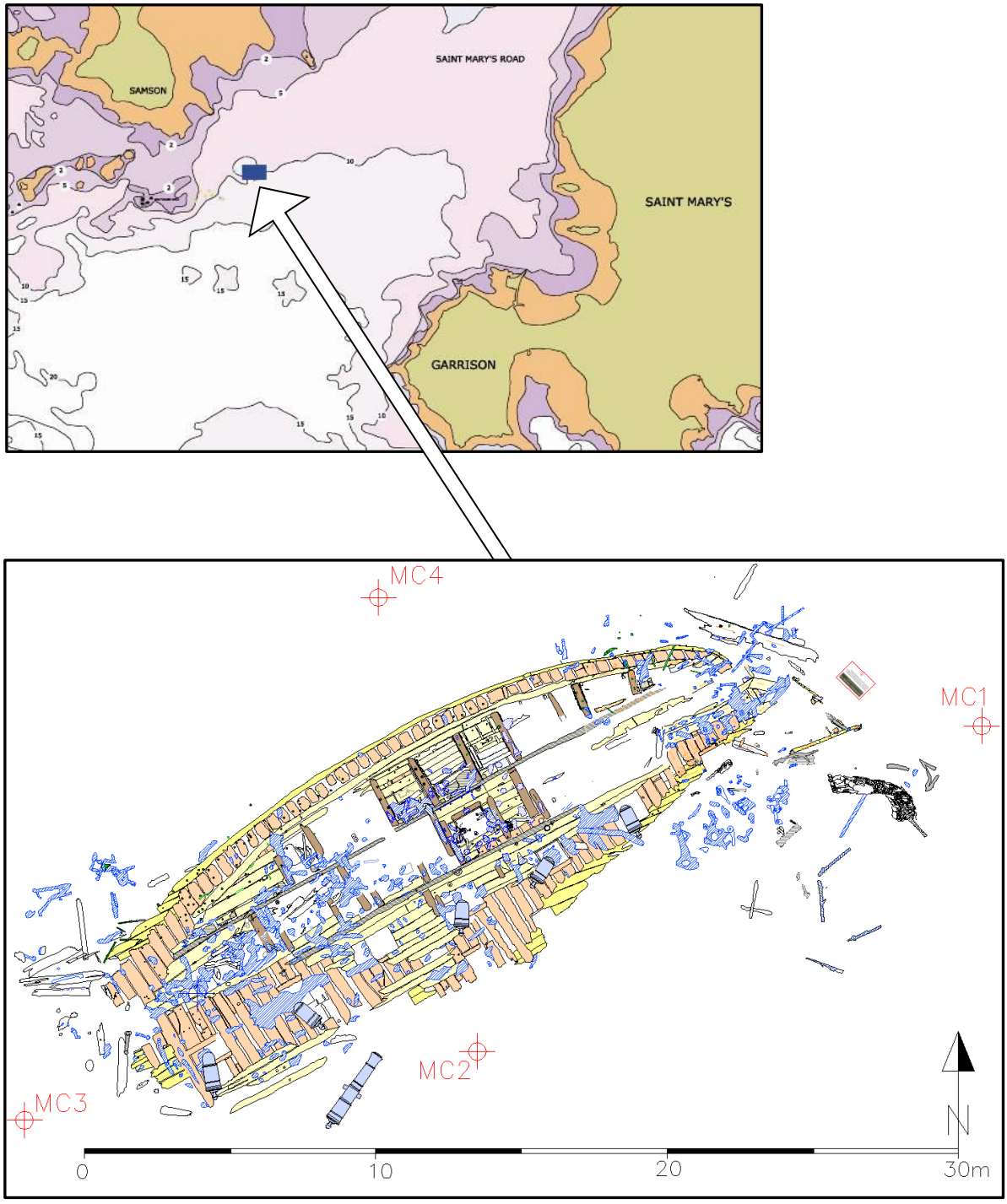


Fig 1
The stern of Colossus. The inset shows the location of the wreck in St Mary's Roads, Scilly.

The Ship

HMS Colossus was a 74 gun warship built in 1787 at Gravesend and wrecked off Samson in the Scillies in 1798. These 74 gun ships were one of the most successful types of the period. They were typically about 51m (170 feet) in length and had a crew of over 600. During her relatively short working life (eleven years) *Colossus* saw action at Toulon, Groix, Cape St Vincent and Cadiz. She also took part in the capture of two enemy ships in 1793: *Le Vanneau*, a French 6-gun ship; and *Vrai Patriot*. She had no less than nine different captains during her relatively short career. She had a complete refit, which took six months, in 1796.

In December 1798 *Colossus* was on her way home to England with wounded from the Battle of the Nile and with cargo, including part of Sir William Hamilton's second collection of Greek pottery. She was sheltering from a gale in St Mary's Roads when the anchor cable parted and she was driven aground to the south of Samson. All but one member of the crew were taken off safely before *Colossus* turned onto her beam ends and proceeded to break up.

Vital Statistics

Length (MGD)	172' 3" (52.5m)
Breadth	47' 9" (14.6m)
Tonnage	1703 tons
Draught (hold)	20' 9½" (6.3m)
Standard armament	28 x 32lb main gun deck
	28 x 18lb upper gun deck
	14 x 9lb quarter deck
	4 x 9lb forecastle
Ballast	110 tons of iron ballast and
	250 tons of shingle
Ordered	13th December 1781
Laid down	October 1782
Launched	4th April 1787

The Site

The wreck of HMS *Colossus* lies to the south of Samson in the Isles of Scilly. To date two main areas of wreckage have been identified, the bow and the stern. In 1975 part of the wreck (probably the bow) was designated under the Protection of Wrecks Act. This designation was revoked in 1984. The current site, the stern, was designated in 2001, and is located at Latitude 49˚ 55'.471N, Longitude 006˚ 20'.505W (260154.906E 5535593.077N UTM zone 30, WGS84).

Previous work

Salvage work took place on *Colossus* from the time of her loss until the early part of last century. Work included Braithwaite and Tonkin 1803-1806, the Dean Brothers in the 1830s and possibly Western Marine Salvage in the early part of last century.

Roland Morris, a marine salver and proprietor of the Penzance Maritime Museum, began searching for the wreck of *Colossus* in 1967 using a small team of divers. In August 1974 they located material relating to *Colossus*. The site was designated in 1975 under the Protection of Wrecks Act 1973. A large quantity of pottery, remains of Hamilton's second collection of pottery, was recovered and deposited in the British Museum – where at least one of these reconstructed pots is now on public display. Once Morris' team had finished their work, the site was de-designated in 1984. The current whereabouts of the other material removed from the site by Morris is for the most part unknown.

Areas of exposed timber and iron guns were discovered by local divers in 2001. This material was some distance to the east of the area worked by Morris and turned out to be part of the stern of *Colossus*. This was designated in July 2001. Late in 2001 the Archaeological Diving Unit (ADU) excavated at the stern of *Colossus* as well as around a piece of carved timber, which turned out to be one of the stern quarter-pieces of the vessel.

In 2002 the quarter-piece, part of the stern decoration of the vessel, was recovered from the site. This was conserved at the Mary Rose Trust, and has now been returned to Scilly for display on Tresco. Later that year a small, limited excavation was undertaken on the site to establish the nature and extent of the structural remains.

In 2003, a two-year site stabilisation trial was commissioned by English Heritage, to determine the most effective method of slowing down the deterioration of the exposed timbers on the seabed. This determined that on this site the most effective form of stabilization is a layer of Terram 4000 (Camidge, 2009).

In 2004 and 2005 the Cornwall and Isles of Scilly Maritime Archaeology Society (CISMAS) carried out a survey of the debris field surrounding the wreck of *Colossus*. This demonstrated the presence of large quantities of material from *Colossus* extending beyond the area covered by the current designation.

Between 2002 and 2012 the author carried out monitoring of the sediment levels on the site. This work has demonstrated that the sediment levels around the stern section of *Colossus* have continued to fall throughout this period.

In 2008 a small area at the stern of the wreck was protected with a geotextile covering of Terram 4000. The efficacy of this type of protection on this site was established in the stabilisation trials commissioned by English Heritage (Camidge, 2009). Timber sample blocks were installed beneath the Terram mat and on the seabed. A small seabed sign was also installed to inform visiting divers of the function of the Terram protection. Before the Terram was installed, the area to be covered was recorded in detail along with a control area, so that the long term effects of the stabilisation could be determined. The same year a diver trail was installed on the site and an underwater guide book produced, copies of which are held by the local dive charter boats for the use of visiting divers. This work was commissioned by English Heritage.

In 2010, a monitoring survey of the small objects exposed on the seabed around the exposed timbers of the wreck was undertaken. The aim of this survey was to allow the amount of object mobility, loss and deterioration to be determined in subsequent monitoring surveys.

2012 saw a small excavation undertaken on the stern section of the site. There were a number of reasons for this undertaking: investigation of the main gun deck ordnance, recording of a main gun-deck port, and detailed recording of the post-wrecking stratigraphy present on the wreck. Recording of newly-exposed wreck material was also undertaken in phase two of the project, along with monitoring of mobile surface artefacts. The on-going recording of the sediment levels on the site was continued. In addition to these site specific enquiries, a number of more general aims were achieved. These included investigation and appraisal of different excavation methods and recording regimes, and the initiation of a long-term reburial trial on the site using real archaeological objects rather than modern tokens. Finally, an opportunity to gain experience in underwater excavation was offered to two separate 'trainees', who were able to use their experience towards their NAS part II and III qualifications.

In July 2014 the sediment level monitoring points were renewed. The sediment levels on the site have been monitored since 2003, and have been found to be steadily diminishing since then. The monitoring points had deteriorated so renewal was necessary to enable the monitoring to continue. At the same time maintenance work on the dive trail was undertaken and the dive trail was extended. During this work it was noticed that new wreck material had become exposed to the east of the stern of the wreck which instigated the investigation undertaken this year.

All reports relating to the work undertaken by CISMAS on *Colossus* can be downloaded at www.cismas.org.uk

A You Tube video of the diver trail can be viewed at http://youtu.be/wS5KURop104

Project Background

In July 2014, while undertaking renewal of the sediment level monitoring points, CISMAS divers discovered newly exposed wreck material some 25m to the east of the stern of *Colossus*. This material included a number of muskets, bringing the total visible on the seabed to ten. There were also a number of items originating from the rigging of the ship, which included several sections of rope (both cable and hawser laid), numerous iron deadeye chains, a large wooden deadeye (with attached rope) and several pieces of timber. A small collection of personal items was also located. The items were all tightly grouped, suggesting that they may have originally been contained within a bag. The items consisted of a leather shoe, a combined bone brush/shoe horn, the remains of fabric (possibly a jacket) and 53 pewter uniform buttons. The buttons, brush and a small fabric sample were recovered and have been conserved by Angela Middleton at Historic England. More details of these items can be found in the Sediment Level Monitoring report (Camidge, 2014). These items are now in the Isles of Scilly Museum on St Mary's and will be the subject of a forthcoming publication by Angela Middleton.

These items were all newly exposed by falling sediment levels. The items were found during the last two days of the project, and only limited investigation was possible. We did not know the extent of this material nor the depth to which it extended as we did not have the time, facilities or suitable licence to investigate further.

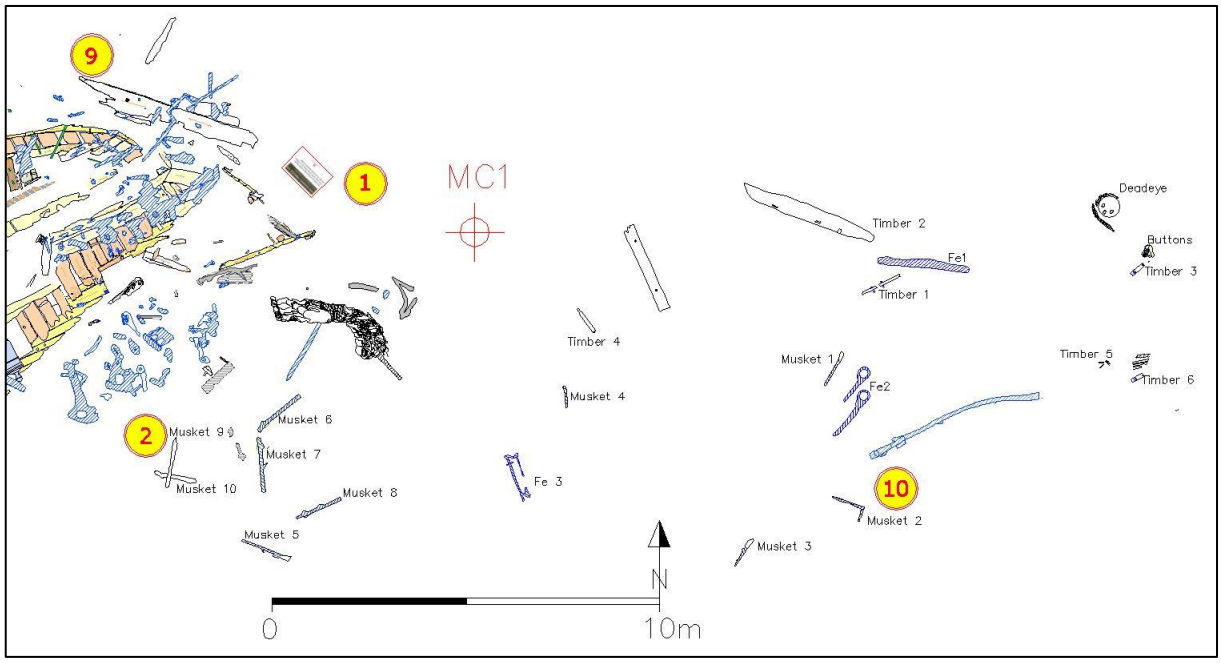


Fig 2
Location of the newly exposed material to the east of the stern of the wreck.

We know from the sediment monitoring undertaken in 2014 that the sediment levels had fallen significantly. The readings taken in July 2014 showed the second lowest levels since monitoring began (a mean fall of 62.2mm relative to the levels in 2003). This is almost certainly why this new material had been exposed. It was therefore important to determine the nature, extent and preservation of this material before it was further exposed and began to deteriorate.

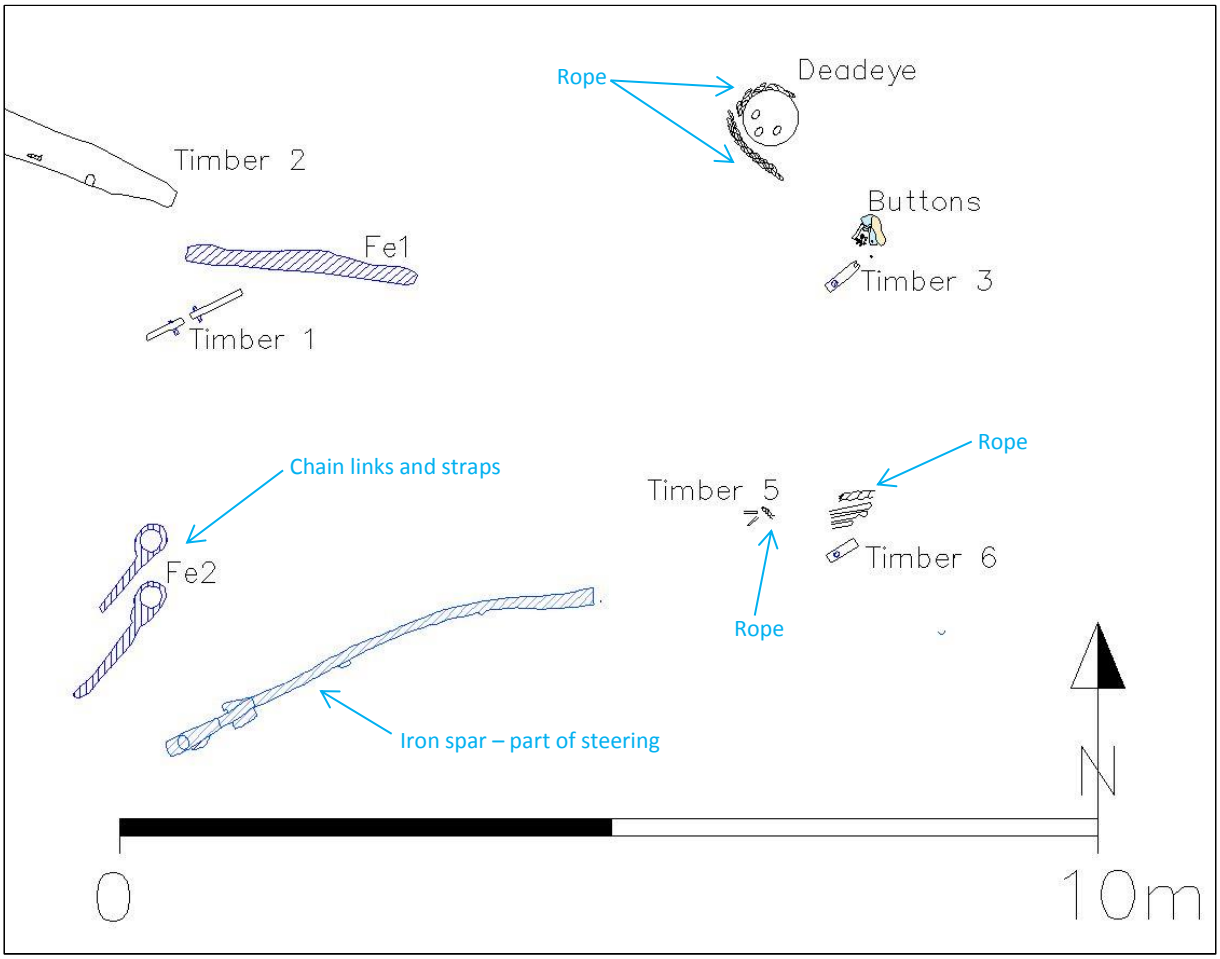


Fig 3. The material to the east of the wreck in 2014

Fig 4. Collection of personal items found in 2014: leather shoe sole (next to scale), area of fabric (below the shoe), bone brush/shoe horn and a group of 53 pewter buttons.

Fig 5. Bone brush / shoehorn F1100. Note the copper alloy wire used to secure the bristle bundles

Fig 6
One of the 53 Pewter uniform buttons [F1150] marked '25 SUSSEX REG^{T}.'

Methods

Excavation

Within each trench the sediment was removed one layer at a time, each layer being recorded on a CISMAS context record form. Excavation was accomplished using a small pointing trowel; the spoil was removed to an area adjacent to the trench by means of a reaction dredge powered by a water pump. Finds were only recovered after their position, depth and context had been recorded; this was facilitated by the use of offset measurements taken from the trench datum line.

Sediment Sampling

Every layer encountered was sampled to detect any paleobotanical remains or other very small items such as bones. Each sample consisted of approximately 10 litres of sediment and was collected from a recorded location.

After collection the samples were placed into a clean container of water, swirled around and the suspended material put through a 250 micron sieve. The remaining sample was then sieved through a 500 micron sieve, and the remainder of the sample passed through 2mm and 4mm sieves. The result (for each sample) was material sorted into the following particle sizes:

1. 250 micron (wash over)
2. 0.5-2mm
3. 2-4mm
4. >4mm

Flotation samples were double-bagged and stored wet in sealed plastic boxes and sent for appraisal to Gill Campbell at Historic England. The sieved samples were then desalinated, dried and bagged before being sent to Polydora Baker and Gill Campbell at Historic England for appraisal. This appraisal appears in the results section below.

Finds Handling by Jezz Davies

Each object was allocated a unique number when found. The position, context, material and brief description were recorded on the seabed. The object was then bagged inside a pre-numbered minigrip bag and recovered to the seabed finds box and subsequently to the support vessel. Underwater sketches were drawn where they were likely to assist further interpretation. Wherever possible, and visibility permitting, finds were photographed *in situ* prior to recovery; ideally once from directly above and once from a 45° angle. All photographs included a scale and a photograph of the empty finds bag was always taken first to aid indexing.

Detailed recording of the object was undertaken 'out of water' in 'Finds HQ' by the finds supervisor and the conservator. Finds were washed and assessed at the start of the finds processing system. All objects were photographed using a Nikon D800E digital SLR on a copy stand using a Nikkor 60mm micro lens. All photographs were illuminated using both natural light and ring-flash, and objects were photographed from all possible angles (i.e top, bottom and side where possible). A small number of items of particular interest were the subject of either a scale engineering drawing or a sketch.

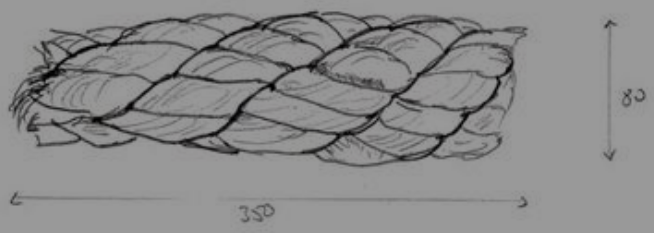
CISMAS Rope Recording Form Colossus 2015

Project name	*Colossus*	**Artefact No**	F1206	**Photo No**	F1206
Project Ref	2015	**Recorder**	JZD	**Date**	9 July 2015
Description	S twist cable closed with 3 strand hawser laid rope				
Rope type (cable, hawser)	Cable	**Material** (hemp, tar)	Hemp	***Note: All dimensions in mm***	

Cordage				Hawser					Strand					Yarns			
S/Z	Circ	Diam	Cant °	S/Z	No	Circ	Diam	Cant °	S/Z	No	Circ	Diam	Cant °	S/Z	No	Circ	Diam
S	263	90	40	Z	3		50	-	S	3			-	Z			

Length of sample	350	**Smell**	Sulphur/Tar
Colour(s)	Light brown	**Texture/consistency**	Reasonably hard
Preservation (good, fair, poor)	Fair	**Sheathing** (present? Type?)	No

Sketch



Photograph

Interpretation

Part of the cable-laid shrouds (1216) attached to upper-deadeye (1220). From the diameter this would have been part of the main or foremast shrouds (which were 11 inch circumference) – the mizzen and topmast shrouds were smaller (6.5 inch circumference).

Notes

Cut from 1216 on seabed (south of deadeye 1220). Hawsers staying together, good artefact for conservation. Retained in Penzance (KC) for further study.

Fig 7

An example of the rope recording form used for this project. This was developed from the rope recording form designed by Damien Sanders. The rope record forms are all contained on the DVD ROM which accompanies this report

Rope recovery and recording

The expectation for the 2015 project was that a significant quantity of rope could present. Project team experience was limited to two members having undertaken the NAS ropes and cordage part III course, so a significant amount of research, reading and preparatory work was undertake by the Project Director and Finds Co-ordinator. This included analysis, dissection, interpretation and recording of a sample of rope (F923) from the 2012 project. Damien Sanders was consulted and offered much useful advice on rope recovery and handling. A rope recording form was developed, based on that designed by Damien Sanders although this was further refined both during and subsequent to the project. Each individual rope sample had its own unique recording form that included a simple sketch.

After over two hundred years on the seabed, all the rope was soft, friable and easily swept away in the current if unattended after exposure. Recovery from the seabed therefore required careful handling. Only short samples of rope (up to 30cms) were required for further analysis, given the difficulties of conserving and storing large quantities of fibre. Each section was placed into weighted, half-section plastic guttering, locally manufactured specifically for this task, before being cut away from its parent rope, wrapped in crepe bandage and placed in a finds bags.

In Finds HQ, rope samples were unwrapped, carefully rinsed of sediment using a fresh water spray bottle, taking care not to damage surface fibres, before photographing, recording and sketching on the unique rope recording form. After processing, rope samples were wrapped in cling film and returned to their finds bag.

A small number of rope samples were identified for dissection to understand the manufacturing process

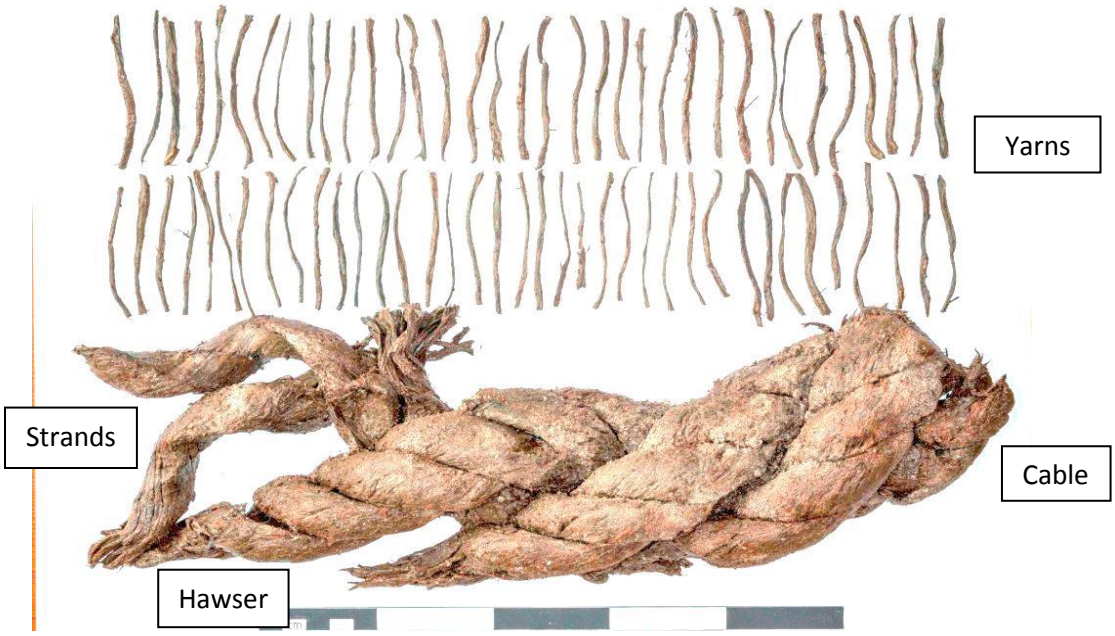


Fig 8
An example of a dissected rope sample – 1204 – a 90mm cable laid rope, part of the shrouds found attached to the lower deadeye 1220. Scale = 0.25m

It should be noted that in the eighteenth century rope thickness was designated by its circumference in inches, though diameter is easier to visualise (Sanders, 2010). However, modern convention dictates that mm diameter is used to record rope in the archaeological context. For example a 90mm diameter rope was probably manufactured as an 11 inch circumference rope.

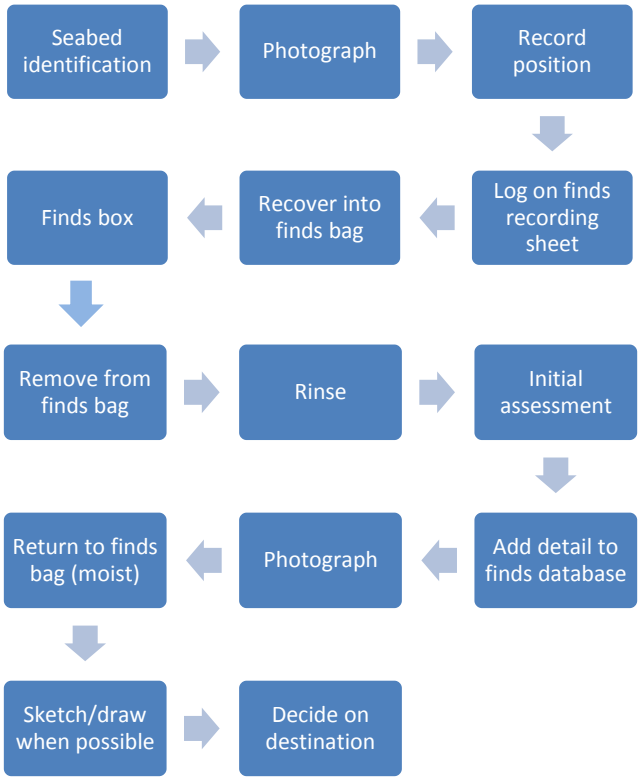


Fig 9
Schematic representation of the finds workflow.
The tasks shown in the top two rows were performed underwater, the bottom three rows on land.

Permissions

A licence from the Marine Management Organisation (MMO) was obtained for this project. Obtaining this licence was costly, time consuming and very frustrating. In excess of four man-days were spent applying for the licence and interacting with the MMO. The fee charged by the MMO for this licence changed three times during the process, the final amount charged being £700.

A licence was also required from the Crown Estate. This was obtained from Knight Frank (agents to the Crown Estate). The process was relatively straightforward and cost £180.

An excavation licence under the Protection of Wrecks Act was obtained from Historic England, no fee was charged for this license.

Results

Sediment Level Monitoring

The sediment levels on the site have been monitored since 2003. This has been accomplished by means of 14 fixed survey pins driven into the seabed at various locations around the site. The results of the sediment monitoring have been reported every year in the annual licensees' report submitted to English Heritage (and now to Historic England). The sediment monitoring points were renewed in July 2014. It was while this work was in progress that the newly exposed material to the east of the wreck was noticed (Camidge, 2014).

The mean of the sediment levels (relative to the sediment levels measured in 2003) was 62.19mm lower in July 2014. When the sediment levels were again measured this year (on July 7th), the mean of all 14 points showed a fall of 3.92mm since July of last year. This is 66.19mm lower than the levels recorded in 2003 (representing an average annual fall of the sediment levels of 5.51mm).

We do not know why the sediment levels on this site have continued to fall since monitoring began in 2003. The excellent preservation of the timber on this site when first recorded in 2001 suggests that it was newly exposed in 2001. By 2003 these timbers were exhibiting considerable areas of attack by wood boring organisms. This exposure and degradation continues to occur – the situation will only change when the sediment levels stop falling.

As the sediment levels are still falling we can expect further new wreck material to be exposed on the seabed. Efforts should be made to record this material before it begins to degrade or is dispersed.

Investigation

The three trenches were positioned such that they encompassed the newly exposed material located in 2014. Trench one was approximately 25m to the east of the stern of the wreck (see fig 10 below).

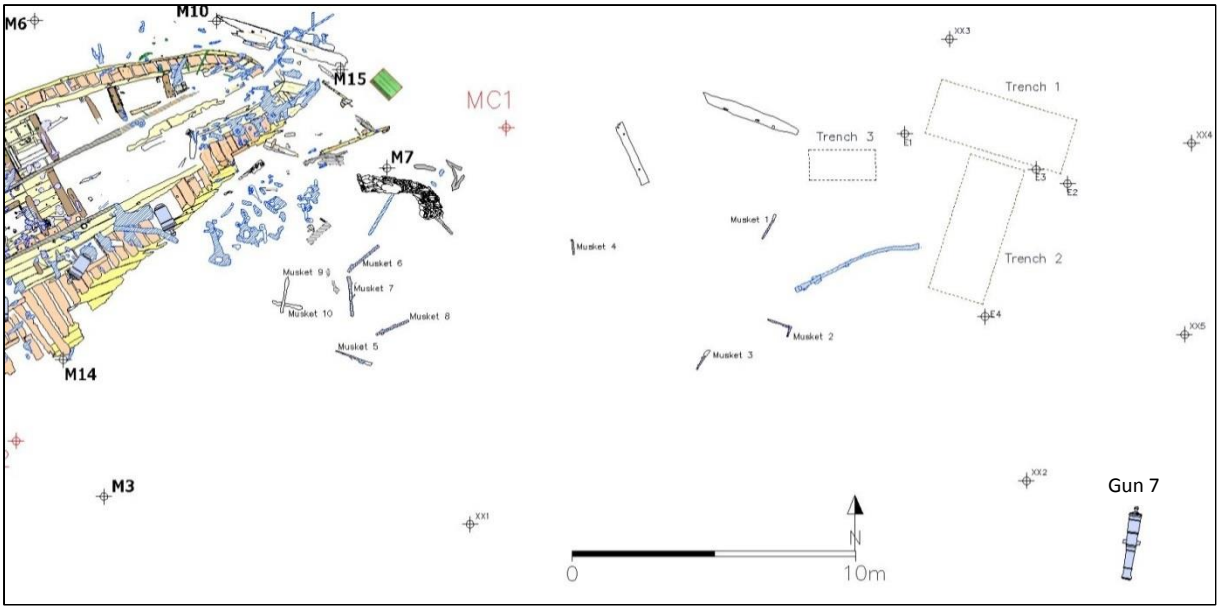


Fig 10
Plan showing the location of the 2015 trenches to the east of the wreck (trenches 1, 2 and 3). Note the position of gun 7, a 9lb iron cannon.

Survey Control

To facilitate recording and survey within the new trenches it was necessary to install new survey control points around the new trenches. These are points XX1 to XX5 shown in fig 10. The new survey points were 0.6m long stainless steel rods of 10mm diameter. These were driven into the seabed in the locations listed in the table below. The position of these new survey points was then determined using direct survey measurements in Site Recorder 4. These survey points have been left in place on the seabed. These survey points were then used to fix the positions of trench datum points along the edge of the trenches (E1 and E2 for trench 1; E3 and E4 for trench 2).

Colossus 2015 Survey Points (UTM zone 30)			
Survey Point	**Easting**	**Northing**	**Depth (m)**
XX1	260167.71	5535576.34	11.3
XX2	260187.37	5535577.96	11.2
XX3	260184.65	5535593.68	11.2
XX4	260193.21	5535589.96	11.3
XX5	260192.97	5535583.13	11.3
E1	260183.08	5535590.29	11.6
E2	260188.83	5535588.51	11.6
E3	260187.72	5535589.03	11.5
E4	260185.92	5535583.77	11.5

Fig 11
Positions of the new survey control points installed. The depths are in metres and are relative to the site benchmark – the button of Gun 1 - which has been assigned a site TBM value of 10m.

Excavation

Excavation took place between 4th July and 16th July 2015. A total of twelve days of excavation were planned. However, due to adverse weather conditions it was only possible to excavate on eleven of these days. The dive team consisted of six divers, operating in two teams of three. Each team undertook two, one-hour dives per day, each dive separated out by a two-hour surface interval. Each dive team consisted of an excavator, a recorder and a photographer. Two further team members spent some of the days ashore recording the recovered finds. On days when all finds had already been recorded they joined the dive team on site.

Trench 1

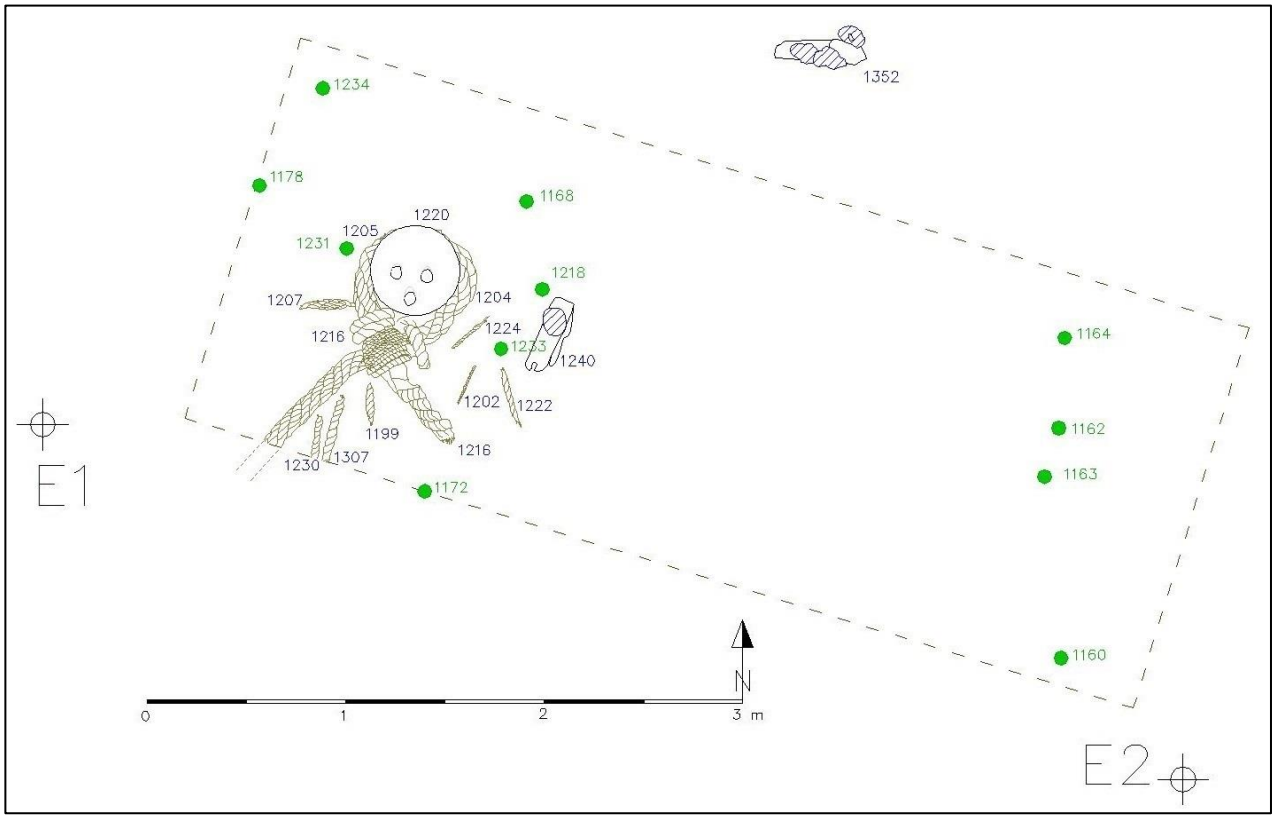


Fig 12

Trench 1 showing the deadeye 1220, the associated rope 1216 and the gun carriage fragments 1240 and 1252. The green circles show the positions of copper sheathing and nails. E1 and E2 are the trench datum points.

Trench 1 was located so that it encompassed the large deadeye 1220 and the timber 1240 discovered in 2014. The trench was 5m long and 2m wide (fig 12 above). It was immediately clear that there had been recent disturbance of the seabed in this area. Sandbags and very large rocks placed over the deadeye and other exposed material in 2014 had all been moved. There were also a number of recently dug holes in the seabed – these would have been filled in by the action of the sea within a very short time. These disturbances appeared to have been caused by divers. Hopefully they were undertaken out of curiosity (what's under here?) rather than through malice. Happily, although the large deadeye was now completely exposed much of the attached rope was still largely buried.

The upper layer in Trench 1 [L1] consisted of light yellowish-brown coarse silty sand with broken shell and small fragments of granite. This layer extended over the whole of the trench and was approximately 100mm thick. It is probably mobile and subject to disturbance, especially in storms. Layer 1 has also, as noted above, been the subject of recent disturbance, probably by divers. Layer 1 overlay Layer 2 [L2], which was light yellowish-grey sand with silt and broken shell. This was more compact than [L1] and was formed from finer particles of sand and shell. [L2] varied in thickness between 0.10 and 0.25m. The final layer encountered was [L5], a very light grey fine sand and silt with small fragments of broken shell. This layer was much more compact than [L2]. The layers encountered in trench one are summarised in fig 13 below.

Colossus 2015 Trench 1 Layers							
Layer	**Trench**	**Sample**	**Description**	**Compaction**	**Thickness(m)**	**Finds**	**SS**
L1	1	F1201	Light yellowish brown silty sand with shell and granite chips	Loose	0.10	21	1
L2	1	F1210	Light yellowish grey sand with silt and broken shell	Medium	0.10 –> 0.25	50	1
L5	1 & 2	F1339	Very light grey fine sand and silt with broken shell	Compact	> 0.25	0	1

Fig 13
Table of the layers encountered in Trench 1. SS denotes number of sediment samples

Deadeye and Associated Rope

One of the newly exposed items discovered in 2014 was the large wooden deadeye 1220 and associated rope 1216. The deadeye was 430mm (c.17 inches) in diameter and 250mm thick, and contained three holes, each of 56mm diameter. One of these holes (arrowed on fig 16) has no leading groove for the lanyard. This hole is where the lanyard stopper knot would have sat, and was located on the inboard side of the deadeye. The holes contained fragments of rope. The deadeye had a semi-circular groove around the outside edge; this groove was 117mm wide and still had parts of the shroud cables within it. The deadeye appeared to be elm (to be confirmed). The shrouds consisted of cable-laid (S twist) rope of 90mm diameter, composed of three hawser-laid (Z twist) ropes each of which was 50mm in diameter. The cable was 'turned in' right handed or anti clockwise (when viewed from inboard), the conventional manner for cable laid shrouds (see fig 17).

Fig 14
The deadeye 1220 and associated rope 1216 on the seabed in trench one. The timber in the upper right hand corner is 1240.
Scale = 0.5m

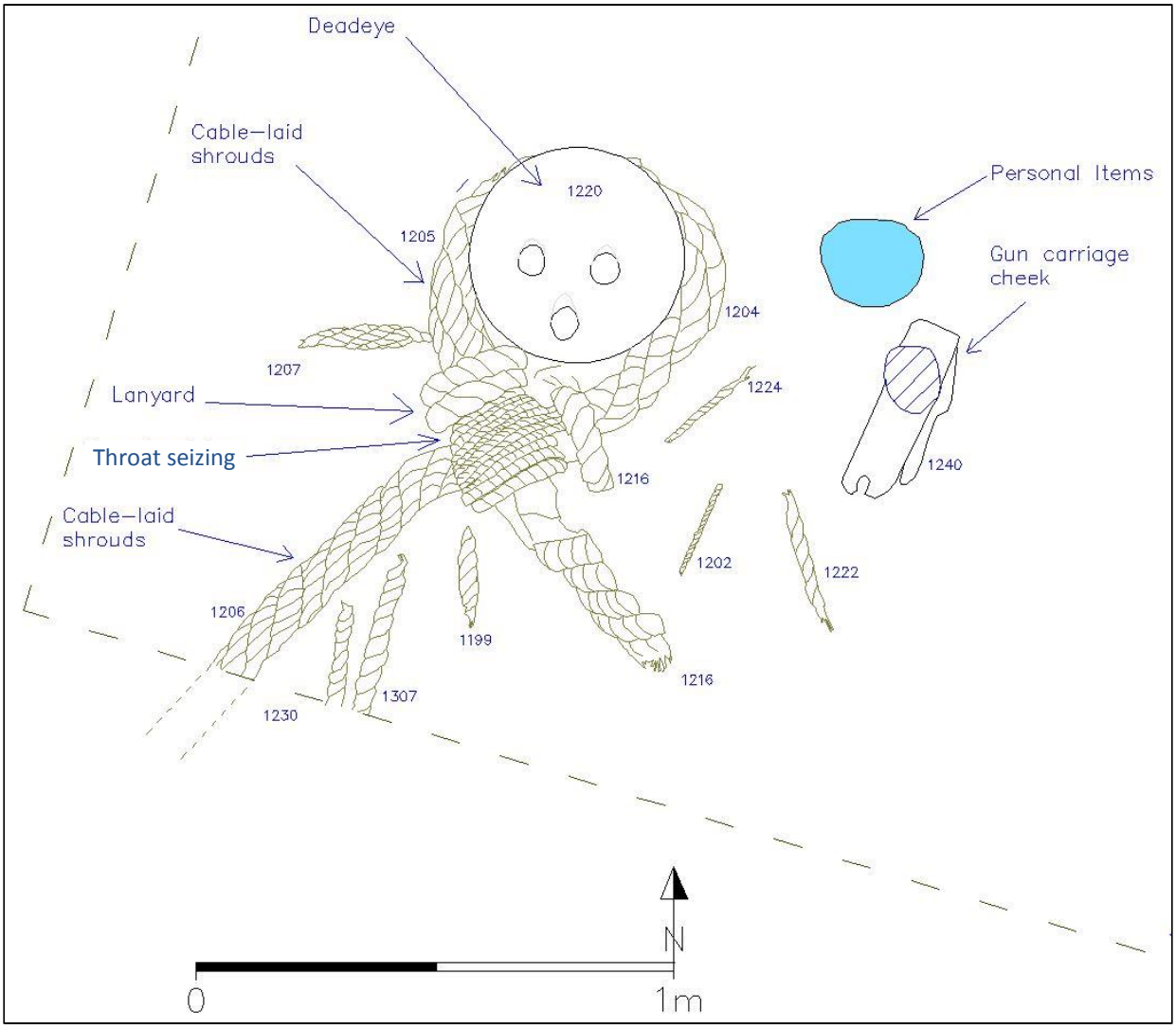


Fig 15
Wooden deadeye 1220 and associated rope 1216 located at the eastern end of Trench 1

The shrouds were wrapped around the score of the deadeye and secured using seizing (or whipping) consisting of hawser laid (Z twist) three strand rope of 14mm diameter. Traces of the lanyard 1216c were found within the deadeye holes and secured through the throat of the shrouds - figs 14 and 15. The lanyard would have passed through the 'eyes' of the upper and lower deadeyes, by which means the tension of the shrouds could be adjusted. Several detached pieces of rope 1199, 1222, 1230 and 1307 found near the block were all hawser laid (Z twist) ropes of 40-50mm diameter and were probably parts of the lanyard. A further piece of the lanyard 1203 (hawser-laid Z twist three strand rope of 50mm diameter) was found under the deadeye when it was recovered.

The deadeye and associated rope were recorded and then recovered for conservation. The rope was very fragile so it was decided to recover it separately from the deadeye. To this end it was consolidated by wrapping it with elastic bandages and placing it into a large plastic crate for transport to the surface. At the surface the bandages were carefully removed, the rope was recorded and photographed and then wrapped using heavy-duty cling film and returned to the plastic crate for transport to the conservation labs at York Archaeological Trust. The shrouds 1206 continued beyond the trench to the south (fig 15) and were cut at this point. The remaining section of shroud left in situ was approximately 0.3m below the seabed surface.

Fig 16
Three views of the deadeye 1220: on the left the face, centre the side view and on the right the top view. Note the remains of the lanyard within the deadeye holes. The score (groove around the edge to hold the shrouds) is continuous except for the top where the shrouds were seized together. Scale = 0.25m

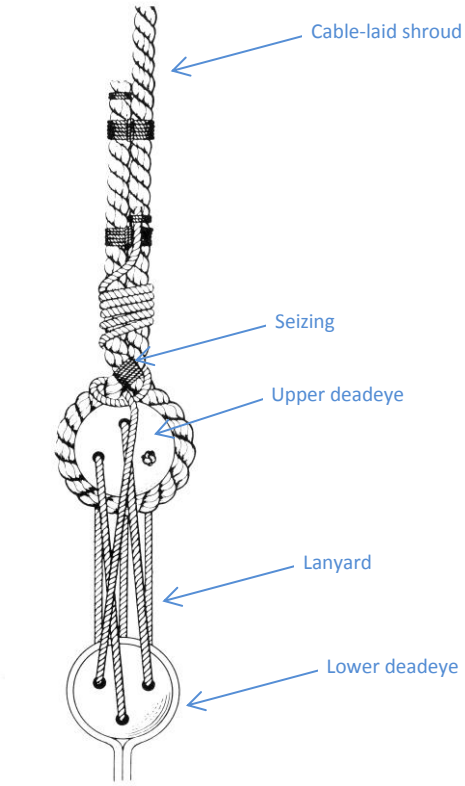


Fig 17
Deadeyes, cable-laid shrouds and lanyard showing the lanyard passed through the 'throat' between the shroud and the upper deadeye. Based on an illustration in (Lees, 1990, p.42)

The lower deadeyes were secured with iron 'chains' which were bolted to the outside of the hull timbers. The upper deadeyes were attached to the shrouds by means of the score around its outer edge. The shrouds supported the lower masts and also carried the ratlines – which allowed the sailors to ascend the rigging.

The diameter of the deadeye (0.43m – 17inches) suggests that this was one of the main or foremast deadeyes. Given its proximity to the stern of the vessel it is probably from the mainmast shrouds. The largest deadeyes found on the wreck of the *Invincible* – a similar vessel - were recorded as 18 inch deadeyes, two of which were found with a recorded diameter of 430mm, exactly the diameter of deadeye 1220 (Bingeman, 2010) . The associated cable-laid shroud rope 1216 has a diameter of 90mm. This accords with the recorded size of the fore and main mast shrouds on the *Bellona* - again a similar ship - at 11 inches. Note that rope was historically measured as the circumference in inches (Lavery, 2003, p.20), and 90mm diameter converts to 11.1 inch circumference – so the correspondence is very good.

One odd feature of the deadeye and associated rope found in Trench 1 was the slope of the deadeye – it was lying at an angle of about 35^{o} to the seabed (sloping down to the south). The associated rope also sloped steeply down to the south, varying from being on the seabed surface to being at a depth of 0.4m below the seabed in the space of about 1m. There was only sand below the rope and deadeye so the conclusion is that these objects were deposited onto a steeply undulating seabed. This is unusual – any holes or slopes in a sandy seabed are usually levelled out by the action of the sea within hours – or at most a few days. We shall address this issue further in the conclusions section below.

Rope Recovered from Trench One				
Type	**Twist**	**No**	**Description**	**Interpretation**
H10	Z	1225	Detached fragment	Whipping of shroud end?
H14	Z	1216b	In situ shroud seizing – recovered attached to shrouds	Seizing around the shrouds
H16	Z	1202	Detached fragment – possibly part of seizing for shrouds	
H16	Z	1224	Detached fragment	
H40	Z	1199	Detached fragment	Lanyard?
H40	Z	1219	Found under deadeye 1220	
H40	Z	1222	Detached fragment	
H40	Z	1223	Found under deadeye 1220	
H50	Z	1203	Found under deadeye 1220 - probably part of the lanyard	Lanyard
H50	Z	1216c	Passed through the throat of the shrouds/deadeye	
H50	Z	1230	Detached fragment – probably part of the lanyard	
H50	Z	1307	Detached fragment – probably part of the lanyard	
C50	S	1207	Fragment attached to shrouds	?
C90	S	1216	Shrouds around deadeye 1220	Main/foremast shrouds
C90	S	1204	Shroud east side of 1220	
C90	S	1205	Shroud west side of 1220	
C90	S	1206	Shroud deadeye to mast	
Key to **Type** entries: H = Hawser-laid 3 strand rope C = Cable-laid from 3 hawser-laid ropes numbers are the rope diameter in millimetres Hence H40 is hawser-laid 3 strand rope of 40mm diameter				

Fig 18
Table showing a summary of the rope recovered from Trench 1

Gun Carriage Parts

A fragment of timber 1240 was found 0.45m to the east of the deadeye 1220 (Figs 9 and 12). This timber was partly exposed on the seabed and moderate gribble on its upper surface suggests that it had been partly exposed for about 18 months. The timber is 0.39m long, 0.33m deep and 0.10m wide. It is broken (fig 20) and has an iron fastening bolt still in place. The timber has incised letters cut into one end reading 'COL US' (the letters are 20mm high). Another small piece of timber 1265 (67x42x32mm) found subsequently some 4.2m to the north east of 1240 was found to be part of 1240, and was also inscribed - in this case with 'SS'. It is clear that this timber originally bore the name of the ship 'COLOSSUS' – only the second 'O' being missing (fig 19 below).

Fig 19
End view of timber 1240 and 1265 showing the incised lettering 'COL SSUS'. Scale = 0.25m

The timber is probably elm (to be confirmed) and was probably originally part of the cheek of a bracket and transom gun carriage – fig 21 shows which part of the gun carriage the fragment represents. The first 'step' of the carriage cheek is visible (fig 20). The timber exhibits several cracks and breaks and has obviously been subjected to considerable trauma. The width of the cheek (0.10m) suggests that this was originally part of a 9lb gun carriage '*The sides consisted of two cheeks or brackets, of the same thickness as the bore of the gun it was designed to support*' (Caruana, 1994, p.359). This is born out in an earlier work '*The thickness of the cheeks are (always supposed to be) the same thickness as the diameter of the gun's bore, to which it belongs*' (Mountainte, 1747, p.66) .The bore of the 9lb Armstrong pattern guns carried by Colossus was 4.2 inches which is approximately 106mm (Caruana, 1994, p.66). There are two holes (15mm diameter) drilled through the thickness of the cheek about 40mm from the end, the holes being 32mm apart (fig 20). The function of these holes is not known and they do not appear on any of the drawings of 18th century gun carriages seen to date.

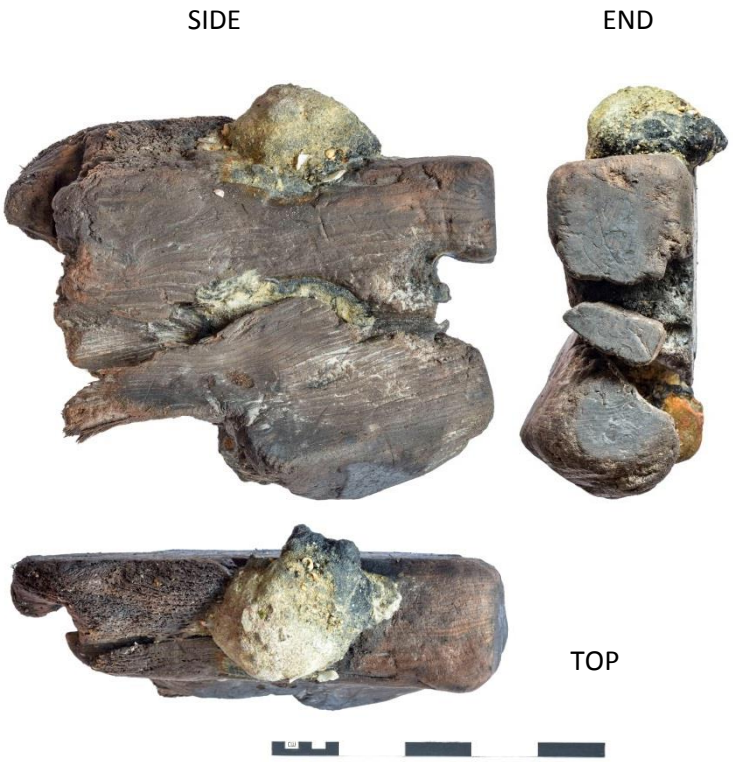


Fig 20
Three views of the timber gun carriage part 1240 with fragment 1265 in place. The side view shows how the timber has been broken and is only held together by the iron fastening.
Scale = 0.25m

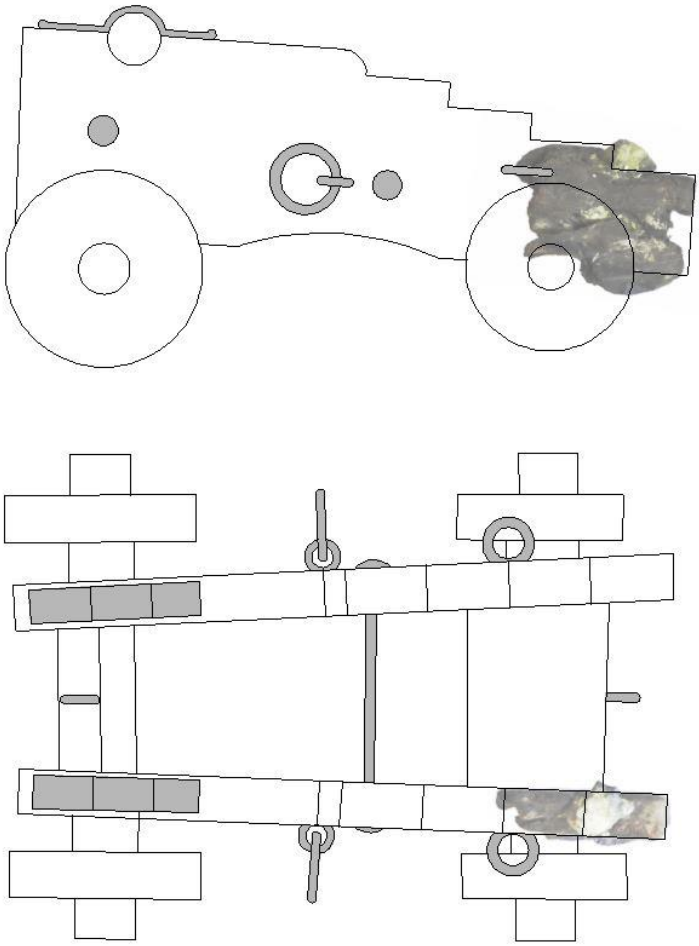


Fig 21
Timber 1240/1265 superimposed onto the outline of a 9lb gun carriage of 1732 (Caruana, 1994, p.371)
Although this is an earlier carriage, it would have been very similar to those on board Colossus.

A second fragment of gun carriage 1352 was found on the seabed to the north of Trench 1 (fig 12). This is very similar in size and appearance to 1240. This timber also has characters incised into the end – in this case the inscription is more enigmatic and probably reads ‘ 9◦◦ l ◦N$^{o'}$ (fig 22). The ‘9’ probably refers to its being a 9lb carriage, and the ‘l’ is probably part of the ‘LB’ marking which follows. The ‘N^{o}’ is probably an abbreviation of number, and the (now missing) number which followed would have denoted the gun number. The characters are approximately 20mm tall. One of the cheek ring bolts is still in place as well as the first ‘step’ of the cheek. The ring bolt allows us to determine that this fragment is part of the right hand (from the gunner’s point of view) cheek of the carriage - figs 22 and 23 below.

Fig 22
Timber fragment 1352 showing the incised characters on the end. The iron concretion top left appears to be the remains of a ring bolt. Scale = 0.25m

As with the other gun-carriage fragment (1240), this piece also has two holes of approximately 15mm diameter drilled through the cheek some 38mm from the end (fig 20 side view). One of these holes is partly worn through but the other is intact. There is no iron staining around these holes so they were probably not for iron fastenings, but may have been designed for a rope to pass through.

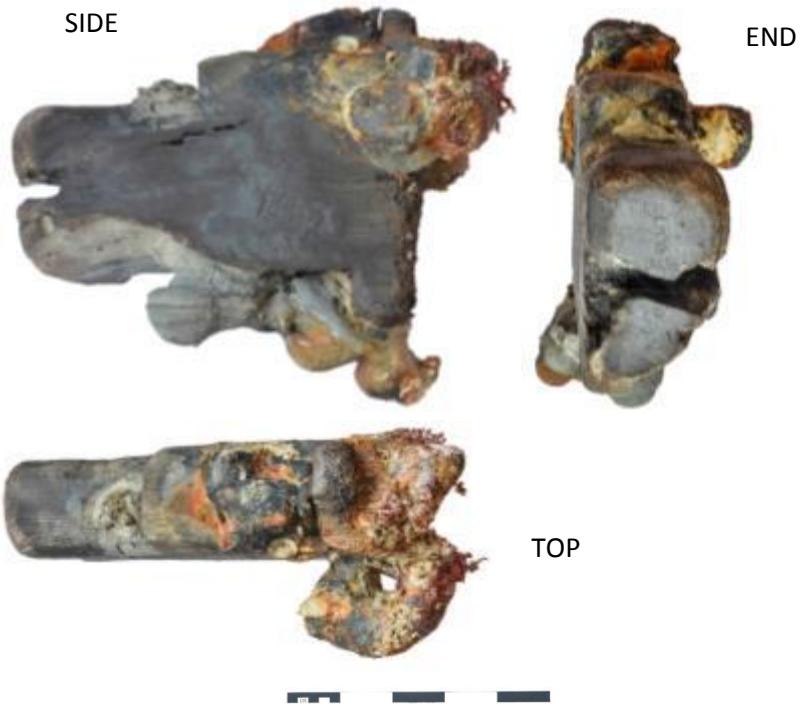


Fig 23
Three views of the timber gun carriage part 1252. Note the remains of the iron ring bolt and the cheek 'step'.
Scale = 0.25m

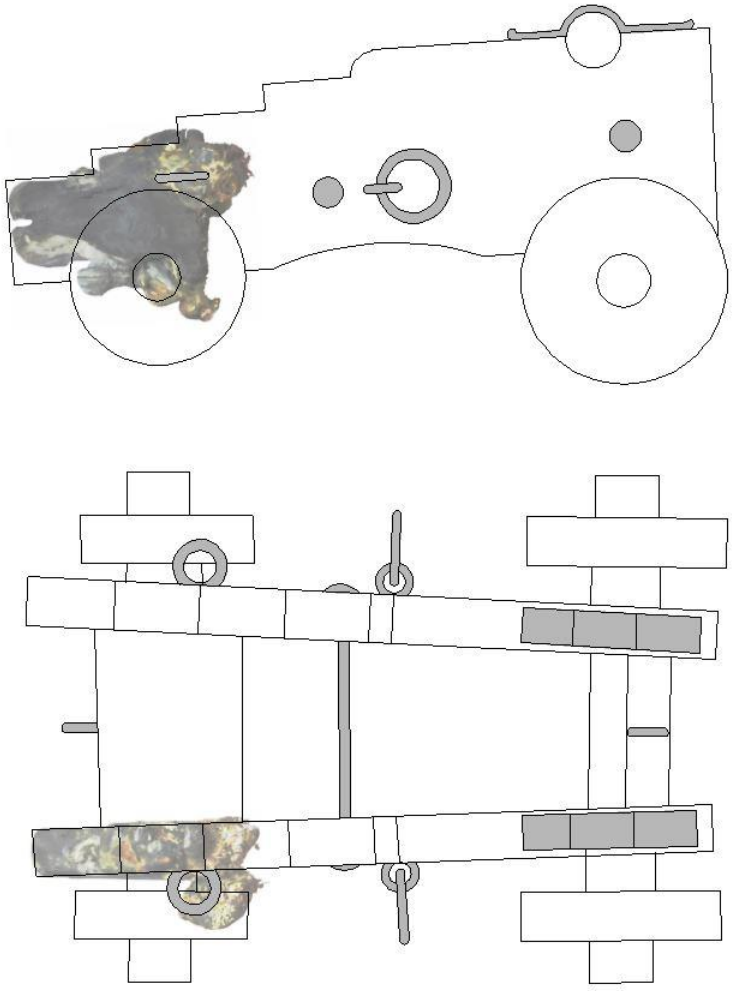


Fig 24
Timber 1252 superimposed onto the outline of a 9lb gun carriage of 1732 (Caruana, 1994, p.371).

Although this is an earlier carriage this carriage would have been very similar to those on board Colossus.

Note how the cheek 'step' and the ring bolt coincide.

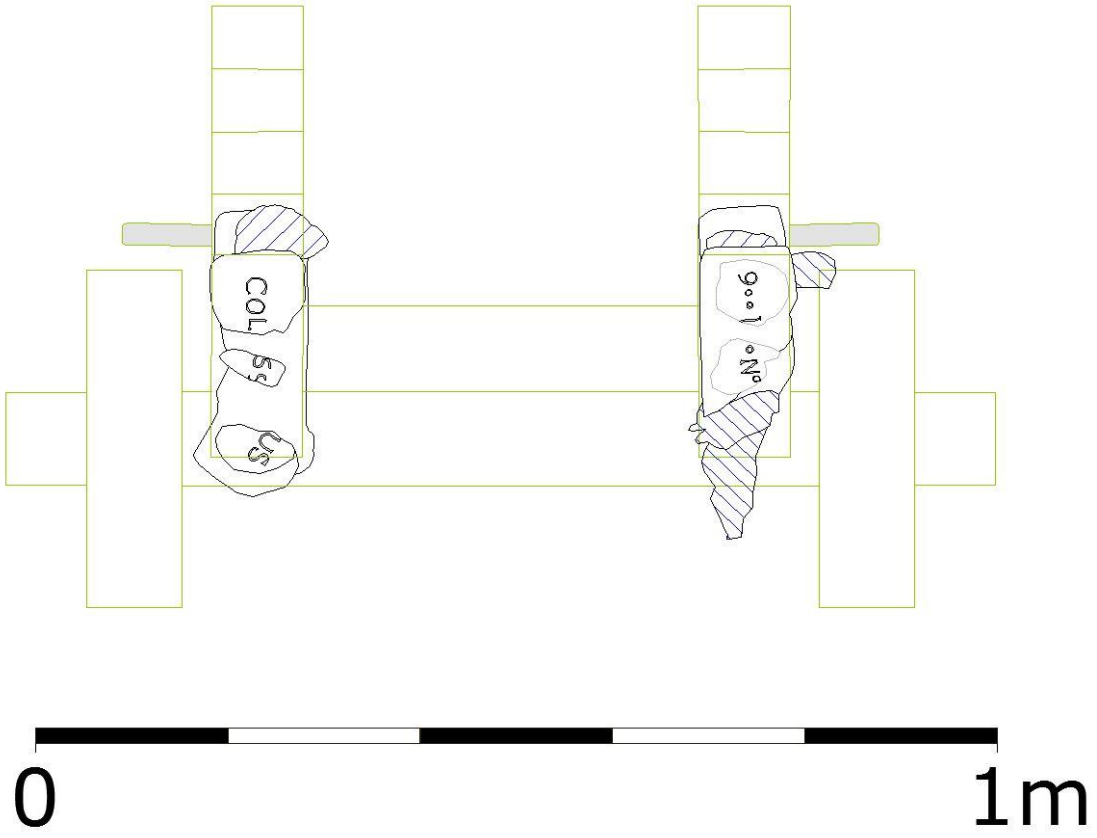


Fig 25
Drawings of timber fragments 1240/1265 and 1252 superimposed onto a drawing of a 9lb gun carriage illustrating how the inscribed characters would have appeared on the rear of the gun carriage.

As both gun carriage fragments seem to be from a 9lb gun-carriage it is tempting to assume that they were from the same gun carriage. The two inscriptions have been superimposed onto a drawing of a 9lb gun carriage in fig 25 – this illustrates how the inscriptions may have appeared on the back of the carriage. It is also tempting to ascribe this gun carriage to the only 9lb gun known on the site (gun 7 see fig 10 above) – especially as this lies only 15m from where the carriage parts 1240 and 1252 were found.

Possibly the most notable feature of these pieces of gun carriage is how they have broken – they both present as shattered pieces of timber. Given that the 9lb guns were situated on the quarter-deck of *Colossus* the gun and carriage combined probably fell into the sea when the ship rolled. However it is hard to imagine this resulting in enough trauma to shatter the carriage to such an extent. We shall return to this in the conclusions section below.

Wood Fragments

In total, 31 small fragments of wood were found in Trench 1. The majority of these were no larger than 60mm on their longest dimension, and many of the fragments exhibited ragged breaks. It would seem likely that many of these fragments were originally part of the shattered gun carriage evidenced by the larger fragments 1240 and 1352 described above. These wood fragments were reburied on site once they had been photographed and recorded. The fragments were: 1171, 1180, 1185, 1186, 1187, 1188, 1190, 1211, 1212, 1215, 1217, 1226 and 1232.

Fig 26
Example of the wood fragments found in Trench 1. These seven fragments were recovered together and recorded as 1187. The scale is 10cm long

Copper Sheathing Nails

Nine copper alloy sheathing nails and two fragments of copper sheeting were found within trench one. The nails were all 34mm long with square-sectioned shanks tapering to a point; they have round heads (11mm diameter) with a counter-sunk underside (fig 27). Interestingly, many of the sheathing nails have a broad arrow mark impressed into the underside of the head. The countersink and broad arrows appear to be identical on the different nails and may have been produced by driving the nail into a die. The positions at which these nails were found within Trench 1 have been plotted - see fig 12 above.

Fig 27

Two views of copper alloy sheathing nail 1167 - note the broad arrow impressed into the underside of the head.

Why do we have such a quantity of sheathing nails and sheathing fragments in an area so far (over 25m) from the extant hull remains? One working hypothesis must be that part of the lower hull of *Colossus* has passed over this area of seabed sometime during the wrecking process.

Personal Items

A small collection of personal items were discovered in 2014. This closely spaced group of objects consisted of a leather shoe, an area of fabric, a bone brush and 56 pewter uniform buttons (see Project Background above). These items were all found within a small area no larger than 0.3m diameter, and it is possible that they were originally contained within a fabric container (a small bag?). In 2014 the brush, pewter buttons and a small fabric sample were recovered for conservation (Camidge, 2014) and are now in the Isles of Scilly Museum. The remainder of this material was covered with sand bags in 2014.

At the beginning of work in 2015 it was noticed that the sandbags covering these items had been displaced. The leather shoe sole 1191 was found some distance away from trench one lying on the seabed – this has now been recovered for conservation. It was clear that this collection of items had been recently disturbed and much of the fabric noticed in 2014 was now missing. Three further pewter uniform buttons 1169, 1176 and 1236 were discovered dispersed within trench one. The buttons were all of the fouled anchor design previously found. The only items remaining in the collection of personal items in 2015 were a miniature cannon and two pieces of a leather shoe.

Fig 28
The pewter uniform buttons from Trench 1. Left 1176, centre 1169 and right 1236

Perhaps the most unusual item discovered in this collection of personal items was a miniature copper-alloy cannon only 155mm long. Three similar miniature guns were recovered from the wreck of the *Santo Christo de Castello* which was wrecked near Mullion in Cornwall in 1667. These are now on display in the Charlestown Shipwreck Museum, where they are described as noon guns. Noon guns were small cannon which were designed to be fired by means of the sun's rays focused with a lens on the touch hole – the lens being positioned so that the gun fired at noon. This item is currently undergoing conservation at York. Once conservation is complete further study of this item should be possible.

Fig 29
The copper-alloy model cannon 1213 discovered with the collection of personal items in Trench 1 in 2015. The gun is only 155mm long. Side and top views above, muzzle view bottom left and the breach bottom right.

Fig 30
The heel of a leather shoe sole 1167 found associated with the collection of personal items in Trench 1

Iron
A total of 14 iron objects were found in Trench 1; most of which were iron fastenings. These fastenings were used extensively above the water line in the hull of the ship – they were also used as fastenings in the gun carriages. Some of the iron objects have been x-rayed at York (see conservation below). Those iron objects not sent for x-ray were reburied on site once they had been recorded and photographed.

Of particular interest is 1198, a concreted iron fastening bolt. The x-ray shows that one end of the bolt is clenched while the other exhibits a rectangular slot for a forelock key. Forelock-fastened bolts were often used on gun carriages.

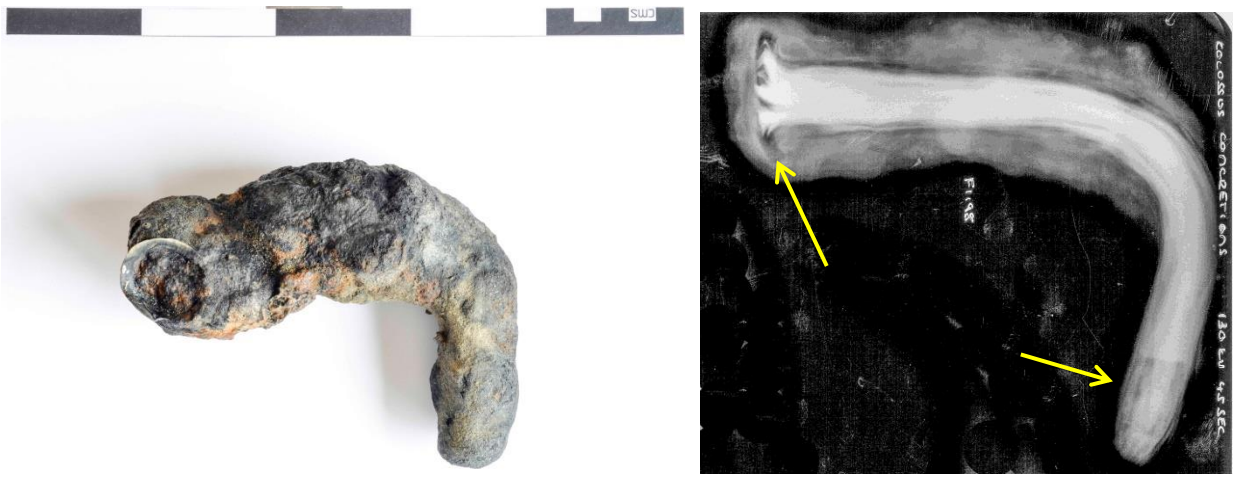


Fig 31
Photograph (left) and x-ray (right) of the iron forelock bolt 1198. The clenched end and forelock slot are arrowed on the x-ray

Also of note were two iron rings. One, a plain iron ring 1193, was probably part of a ring bolt and 1291 an eye bolt. These were both x-rayed (fig 32).

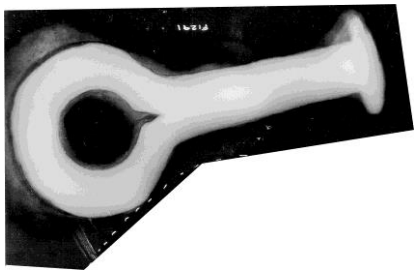


Fig 32
Photographs and x-rays of ring bolt 1193 (left) and eye bolt 1291 (right)

Trench 1 Iron Objects			
ID	**Layer**	**X-ray**	**Description**
1165	L1		Fastening
1174	L1	Yes	Fastening, probably a nail
1177	L1		Amorphous concretion
1192	L1		Possibly a fastening
1193	L1	Yes	Iron ring – possibly from a ring bolt
1194	L1	Yes	Fastening bolt – one end clenched
1175	L2	Yes	Fastening
1182	L2		Amorphous concretion
1195	L2		Fastening bolt
1198	L2	Yes	Fastening bolt. One end is clenched, the other shows a slot (on the x-ray) which would have accommodated a forelock key. Forelocked bolts of this period were common on gun carriages (Caruana, 1994)
1200	L2	Yes	Fastening bolt – x-ray shows lugs or rings at one end
1209	L2	Yes	Fastening bolt
1221	L2	Yes	Fastening bolt – x-ray shows a rectangular feature at one end
1291	L2	Yes	Eyebolt

Fig 33
Summary of the iron objects found in Trench 1

Summary of Finds

Finds Summary – Trench One – [L1]					
Material	**Total**	**Object**	**ID**	**Numbers**	**Destination**
Copper alloy	8	Sheathing nails	1160		D
			1162		D
			1163		D
			1164		D
			1172		D
			1178	6	D
		Sheathing frag	1168	1	D
		Other	1170	1	R
Composite	1		1166		YC
Glass	2		1161		R
			1184		R
Iron	6		1165		R
			1174		YX
			1177		R
			1192		R
			1193		YX
			1194		YX
Leather	1	Shoe part	1167		YC
Pewter	2	Uniform buttons	1169		YC
			1176		YC
Wood	1	Fragments	1171		R
TOTAL	**21**				

Destination Key:
YC = York for conservation YX = York for X-ray R = Reburied on site
D = Desalination in Penzance

Fig 34
Summary of finds from [L1]

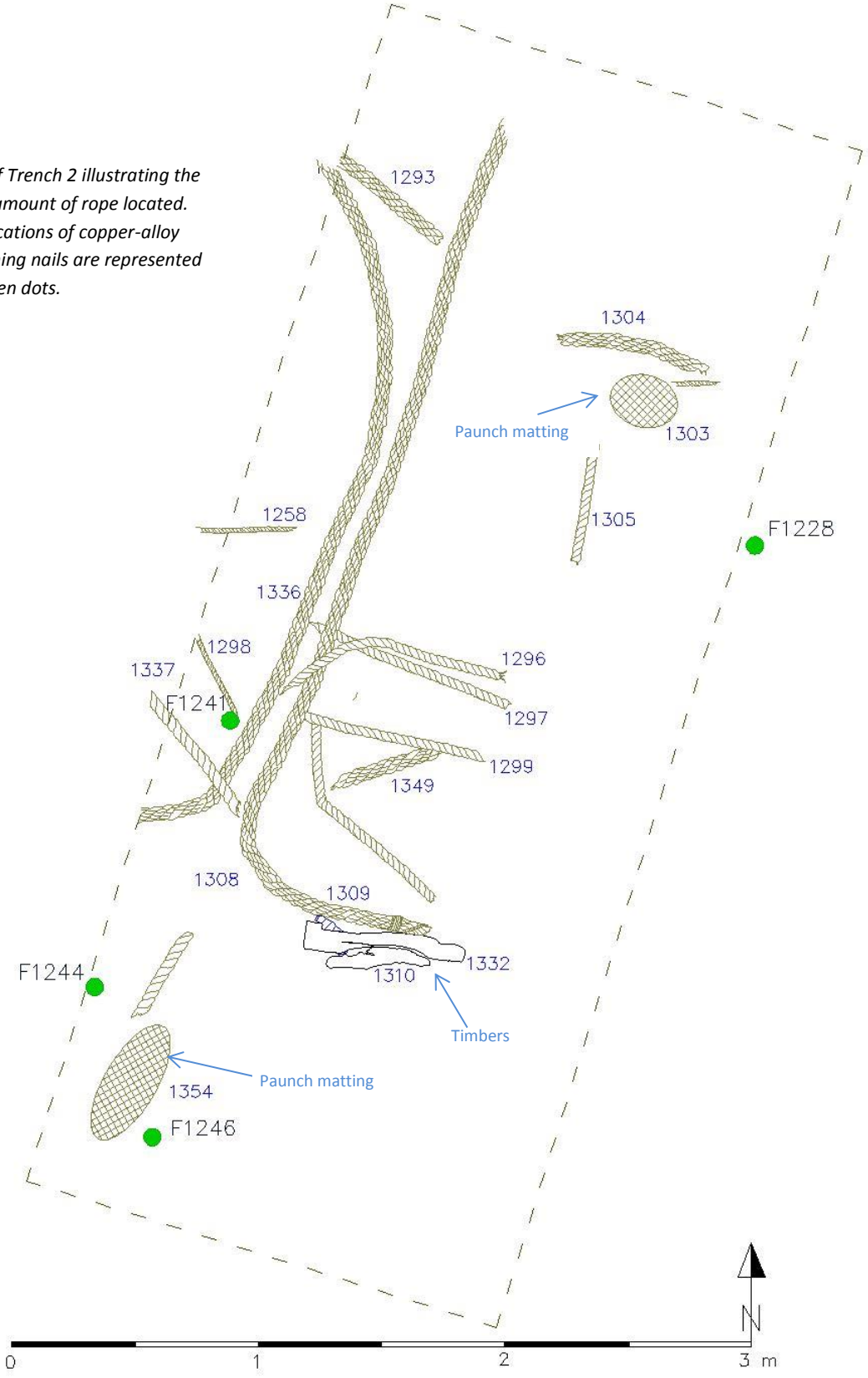
Finds Summary – Trench One – [L2]					
Material	**Total**	**Object**	**ID**	**Numbers**	**Destination**
Copper alloy	7	Sheathing nails	1181		D
			1218		D
			1233	3	D
		Thimble	1189	1	YC
		Model Cannon	1213	1	YC
		Sheet	1231		D
			1234	2	D
Iron	8		1175		YX
			1182		R
			1195		R
			1198		YX
			1200		YX
			1209		YX
			1221		YX
			1291		YX
Lead	2	Musket shot	1179		D
		Sheet	1183		R
Leather	2	Object	1197		R
		Shoe part	1214		YC
Pewter	1	Uniform button	1236		YC
Rope	15	H10	1225	1	R
		H16	1202	2	S
			1224		S
		H40	1219	4	S
			1222		S
			1223		S
			1199		S
		H50	1230	3	S
			1307		S
			1203		S
		C50	1207	1	S
		C90	1204	3	S
			1205		S
			1206		S
		Deadeye seizing	1216	1	YC
Wood	15	Fragments	1180	13	R
			1185		R
			1186		R
			1187		R
			1188		R
			1190		R
			1211		R
			1212		R
			1215		R
			1217		R
			1226		R
			1232		R
			1235		R
		Deadeye	1220		YC
		Gun Carriage part	1240		YC
TOTAL	**50**				

Destination Key:
YC = York for conservation YX = York for X-ray R = Reburied on site
D = Desalination in Penzance S = Storage in Penzance
Rope types key:
H = Hawser-laid 3 strand rope C = Cable-laid from 3 hawser-laid ropes
numbers are the rope diameter in millimetres
Hence H40 is hawser-laid 3 strand rope of 40mm diameter

Fig 35
Summary of all finds from [L2].

Trench 2

Fig 36
Plan of Trench 2 illustrating the large amount of rope located. The locations of copper-alloy sheathing nails are represented by green dots.



Trench 2 was located to the south of Trench 1, as shown in fig 10 above. The trench was 5m long and 2m wide (fig 36). There were no signs of recent disturbance in this trench – possibly because there was nothing obvious visible on the surface.

The upper layer in Trench 2 [L3] consisted of light yellowish-brown coarse silty sand with broken shell and small fragments of granite. This layer extended over the whole of the trench and was 0.10 to 0.15m thick. [L3] is probably mobile and subject to disturbance especially in storms. [L3] is probably the same layer as [L1] in trench one. This layer overlay [L4] which was light yellowish-grey sand with silt and broken shell. This was more compact than [L3] and was formed from finer particles of sand and shell. [L4] varied in thickness between 0.20 and 0.35m. [L4] is probably the same as [L2] in trench one. The final layer encountered was [L5], a very light grey fine sand and silt with small fragments of broken shell. This layer was much more compact than [L4]. The layers encountered in Trench 2 are summarised in fig 37 below.

***Colossus* 2015 Trench 2 Layers**							
Layer	**Trench**	**Sample**	**Description**	**Compaction**	**Thickness(m)**	**Finds**	**SS**
L3	2	F1292 F1335	Light yellowish brown silty sand with shell and granite chips	Loose	0.10 -> 0.15	15	2
L4	2	F1255 F1334	Light grey sand with silt and broken shell	Medium	0.20 -> 0.35	28	2
L5	1 & 2	F1339	Very light grey fine sand and silt with broken shell	Compact	> 0.25	2	1

Fig 37

Table of the layers encountered in trench two. SS denotes sediment samples

Although the distinction between [L4] and [L5] was clear, in places the two seemed to be mixed. It was also evident that the surface of [L5] was not level, but undulated by as much as 0.35m vertically with depressions and gullies evident in its surface. As [L5] was interpreted as the pre-wrecking seabed sediment, these inequalities are difficult to account for – this will be addressed in the wrecking process section below.

Possible Gun Carriage Parts

Two badly damaged pieces of timber 1310 and 1332 were found in [L4] of Trench 2 (fig 36). On recovery it was found that these timbers were in fact part of the same object. The timber appeared to be elm and had a large iron fastening bolt was evident at one end. These timbers were reburied on site after recording and photography.

Fig 38

Two views of possible gun carriage parts 1310/1332. Note the extensive breaks and splits in the timbers. Scale = 0.25m

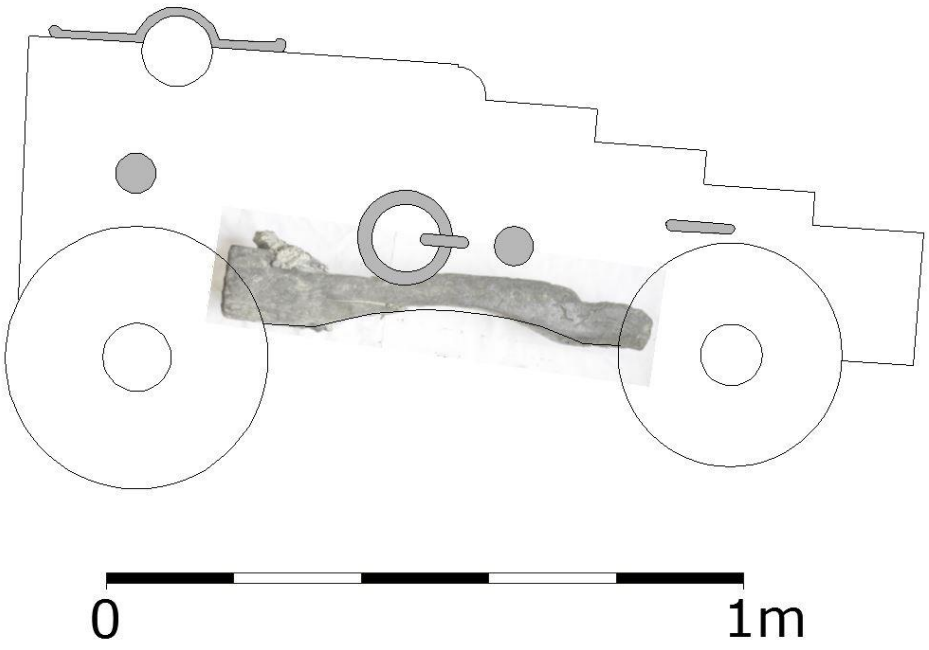


Fig 39

Showing timbers 1310/1332 superimposed onto the drawing of a 9lb gun carriage illustrating how these timbers may have been part of a 9lb gun carriage

These timbers have been subjected to extensive trauma - see fig 38, note how the timber has been split and broken. The timbers are 0.66m long, 0.14m deep and 0.11m wide. This width would accord with the expected width of the cheek of a 9lb gun carriage. The shallow curve evident in the timber is also similar to the curve at the bottom of a gun carriage cheek – see fig 39 above where a photograph of these timbers has been superimposed onto a drawing of a 9lb gun carriage. For these reasons it is possible that these timbers are further parts of the 9lb gun carriage evidenced by the fragments 1240 and 1252 found in trench one. Sadly this connection was not made on site; consequently these timbers were reburied on site.

Wood Fragments

A further 26 fragments of wood were recovered from trench two. These were largely badly broken and eroded. A piece of dowel (1227) of 37mm diameter and some 370mm long could be the remains of a handle – for example from gun handling equipment. All the other pieces encountered from this trench were unidentifiable fragments and were reburied after recording and photography.

Trench Two Wood Objects			
ID	**Layer**	**Size (mm)**	**Description**
1227	L3	370	Dowel – possibly handle (gun equipment?)
1238	L3	166	Fragment
1239	L3	57	4 small fragments
1242	L3	200	Long thin fragment
1252	L3	187	4 fragments – includes a knot hole
1290	L3	205	4 fragments, including part of a drilled hole
1243	L4	93	Fragment
1256	L4	95	Fragment
1257	L4	116	4 fragments – some grooves and other tool marks
1259	L4	288	Fragment
1302	L4	347	2 shattered fragments
1331	L4	430	Fragment

Fig 40
Summary of the wood objects found in Trench 2

Copper Sheathing Nails

Three copper-alloy sheathing nails and one piece of copper sheet were found in Trench 2 – these are plotted on the trench plan – fig 36. The nails 1241, 1244 and 1246 were the same size as those found in the adjacent Trench 1. However, all three nails and the copper sheeting 1228 found in Trench 2 were coated with a layer of corrosion concretion incorporating sand particles. Why there is this difference between the preservation of the nails from the two trenches is not clear. The concretion was removed from one of the nails (1246) to confirm that the nails were of similar size and design to the un-concreted ones found in Trench 1.

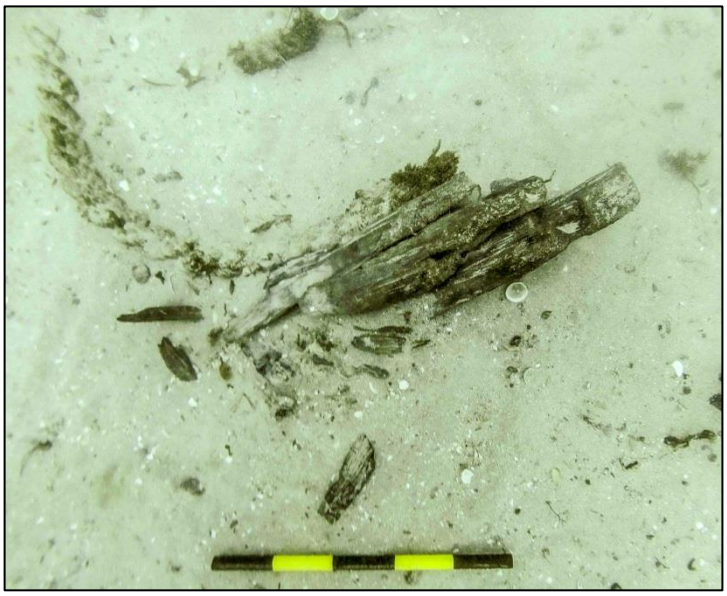
The presence in this trench of sheathing nails and fragments so far from the hull remains is puzzling – but may indicate that part off the hull of the vessel passed over this area at some point in the wrecking process.

Fig 41
Concreted copper-alloy sheathing nail 1241

Rope

A considerable quantity of rope was encountered during the excavation of Trench 2. This is shown in the Trench 2 plan (fig 36). The rope had to be recorded and sampled soon after exposure; if it was left exposed for any time it soon unravelled and disintegrated. The result is that it was not possible to photograph all the rope together – rather it was necessary to photograph small sections at a time. The 14 rope samples which were recovered from this trench have been recorded in detail and are summarised in the table of rope from Trench 2 – fig 44.

The most prominent of these ropes were two lengths of cable-laid rope of 55mm diameter 1308 and 1336. 1308 was 3.8m long and both ends of the rope were within the limits of Trench 2. The other long rope 1336, which was lying roughly parallel to 1308, extended beyond the limits of the trench, but 3.2m of this rope was exposed within the trench. It is not possible to be sure what function these ropes served on board *Colossus* but their size and construction accords with that of the rope used for the mizzen-mast or main/fore topmast shrouds recorded for the 74-gun ship *Bellona* (Lavery, 2003, p.96). However, the absence of ratline half-hitches probably means they are more likely to have been backstays. One of these ropes, 1308, had evidence of worming and serving at its eastern end. This short section (0.25m) was recovered as rope sample 1309 – fig 42. No evidence of worming or serving was observed on any other ropes in trench two, despite several sections being recovered and carefully examined at the surface. Both these ropes undulated vertically, apparently lying over holes and gulleys evident in the surface of [L5]. Two small lengths of slightly smaller diameter cable-laid rope were also recovered from this trench, both 50mm in diameter and shown on fig 36 above (1293 and 1304). The other ropes recovered from Trench 2 were all hawser-laid and varied in diameter from 8mm to 50mm – see fig 44 below. Much of the hawser-laid rope probably formed parts of the running rigging.



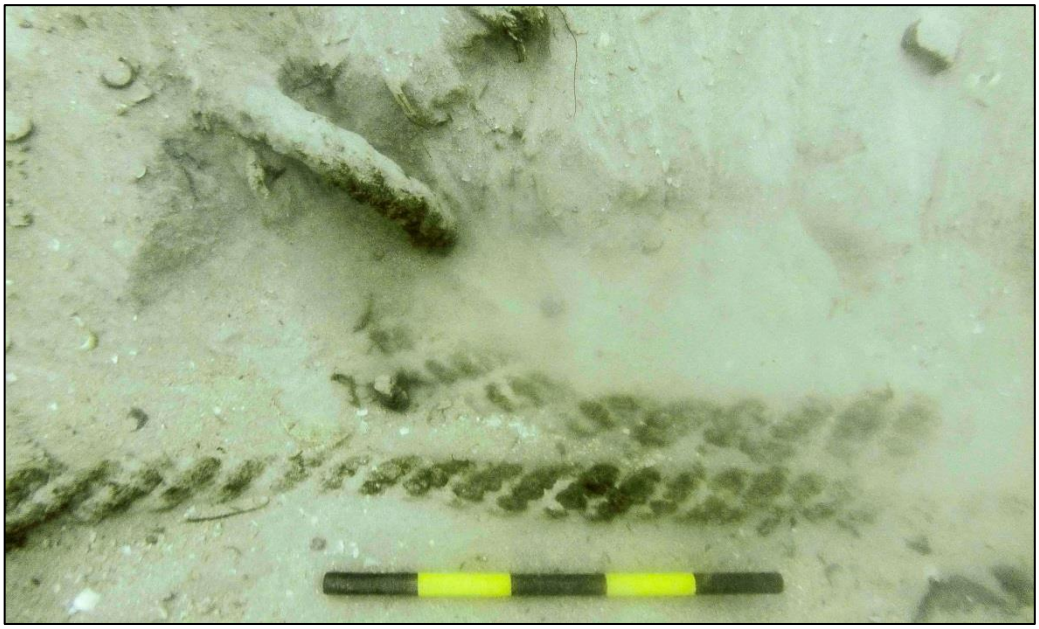


Fig 42
Examples of the rope found in trench 2.

Top: rope 1308/1309 and timber fragments 1310 and 1332.

Centre: Cable-laid ropes 1308 and 1336

Bottom: A section of cable-laid rope 1309 showing evidence of worming and serving. This sample constitutes the eastern end of rope 1308. Scale = 0.25m

Two small areas of rope matting 1303 and 1354 were also observed - see fig 36 and 43. These were very fragile and difficult to excavate. An attempt was made to recover one of them. These are examples of thrummed paunch-matting, woven from rope and used to protect areas of rigging and the sails from abrasion (Sanders, 2010). Thrumbs are short pieces of yarn for tufting chafing gear (Ashley, 1947) .

Fig 43
A small fragment of paunch-matting 1303 located in Trench 2, on the left in situ (scale = 0.2m) and on the right after recovery (scale = 0.25m).

No blocks were found associated with any of this rope. Although an iron rope-thimble was found (see fig 45 below), this was not associated with any rope when excavated. The rope found in this trench is likely to be parts of the rigging of *Colossus* – and the position of Trench 2 some 25m to the east of the surviving hull section probably supports this conclusion.

Rope Recovered from Trench 2				
Type	**Twist**	**No**	**Description**	**Interpretation**
H8	?	1333	Detached fragment of serving from 1309	Serving
H14	Z	1258	Continues beyond western edge of trench.	
H16	Z	1298	Continues beyond western edge of trench – possibly associated with 1258	
H38	Z	1305	Detached fragment	Rigging?
H40	Z	1296	Three parallel hawser laid ropes close together, over and under 1308	
H40	Z	1297		
H40	Z	1299		
H50	Z	1337	Extends beyond western edge of trench. Over 1336	
C50	S	1293	Extends beyond western edge of trench. Close to 1336	Rigging?
C50	S	1304	Detached fragment. Close to paunch matting 1303	
C55	S	1308	Long length of cable (at least 3.8m) Parallel to 1336	Mizzen Shrouds or Fore/Main Topmast Shrouds?
C55	S	1309	Part or 1308 but has worming and serving traces.	
C55	S	1336	Long length of cable (at least 3.2m). Parallel to 1308	
C55	S	1349	Detached fragment. Under 1299	
		1303	Area of woven rope matting – very fragile	Paunch matting
		1354	Area of woven rope matting – very fragile – not recovered	

Key to **Type** entries:
H = Hawser-laid 3 strand rope C = Cable-laid from 3 hawser-laid ropes numbers are the rope diameter in millimetres
Hence H40 is hawser-laid 3 strand rope of 40mm diameter

Fig 44
A summary of the rope recovered from Trench 2.

Iron

12 concreted iron objects were recovered from Trench 2. The majority of these were iron fastenings. Three of the objects 1251, 1254 and 1301 were sent to York Archaeological Trust and x-rayed. Of particular interest is 1301, an iron thimble (for rope). This has a channel around its edge to accommodate the rope which is 40mm across (presumably to hold rope of approximately 40mm diameter) and was 120mm across in total.

Fig 45
Two views of the iron rope thimble 1301.

Scale = 0.1m

Trench Two Iron Objects			
ID	**Layer**	**X-ray**	**Description**
1251	L3	Yes	Fastening bolt
1253	L3		Fastening – nail or bolt
1254	L3	Yes	Fastening bolt – x-ray shows one end clenched, the other end has six 'notches' cut into the bolt
1277	L3		Ring bolt
1245	L4		Amorphous concretion
1260	L4		Fastening bolt
1276	L4		Fastening
1301	L4	Yes	Thimble (for rope) – channel 40mm wide
1278	L5		Fastening bolt fragment
1350	L5		3 fastening bolt fragments

Fig 46
Summary of the iron objects found in Trench 2

Summary of Trench 2 Finds

Finds Summary Trench Two [L3]					
Material	**Total**	**Object**	**ID**	**Numbers**	**Destination**
Copper Alloy	1	Sheet	1228	1	R
Glass	1	Bottle frag	1237	1	R
Iron	4		1251 1253 1254 1277		YX R YX R
Rope	2	H38 C55	1305 1309	1 1	YC S
Wood	7		1227 1238 1239 1242 1248 1252 1290		R R R R R R R
TOTAL	**15**				
Destination Key: YC = York for conservation YX = York for X-ray R = Reburied on site D = Desalination in Penzance S = Storage in Penzance					

Fig 47
Summary of the finds from Trench 2 [L3]

The finds recovered from Trench 2 are all summarised in the tables shown as figs 47, 48 and 49. A full record of each object is contained within the finds database which is included on the DVD ROM which accompanies this report. Similarly, photographs of each object are also contained on the DVD ROM. The two objects recorded in [L5] may have originated in [L4] but apart from these no other artefacts were found in [L5], and it is probable that [L5] represents the pre-wrecking seabed.

Finds Summary Trench Two [L4]					
Material	**Total**	**Object**	**ID**	**Numbers**	**Destination**
Copper Alloy	3	Sheathing nail	1241	3	D
			1244		D
			1246		D
Iron	4	Thimble	1301	1	YX
		Other	1245	3	R
			1260		R
			1276		R
Rope	13	H14	1298	1	S
		H16	1258	1	S
		H40	1296	3	S
			1297		S
			1299		S
		H50	1337	1	S
		C50	1304	2	S
			1293		S
		C55	1308	3	S
			1336		S
			1349		S
		Paunch mat	1303	1	S
		Whipping	1333	1	S
Wood	8		1243		R
			1256		R
			1257		R
			1259		R
			1302		R
			1310		R
			1331		R
			1332		R
TOTAL	**28**				
Destination Key:					
YC = York for conservation YX = York for X-ray R = Reburied on site					
D = Desalination in Penzance S = Storage in Penzance					

Fig 48 Summary of the finds from Trench 2 [L4]

Fig 49 Summary of the finds from Trench 2 [L5]

Finds Summary Trench 2 [L5]					
Material	**Total**	**Object**	**ID**	**Numbers**	**Destination**
Iron	2		1278		R
			1350		R
TOTAL	**2**				
Destination Key:					
YC = York for conservation YX = York for X-ray R = Reburied on site					
D = Desalination in Penzance S = Storage in Penzance					

Trench 3

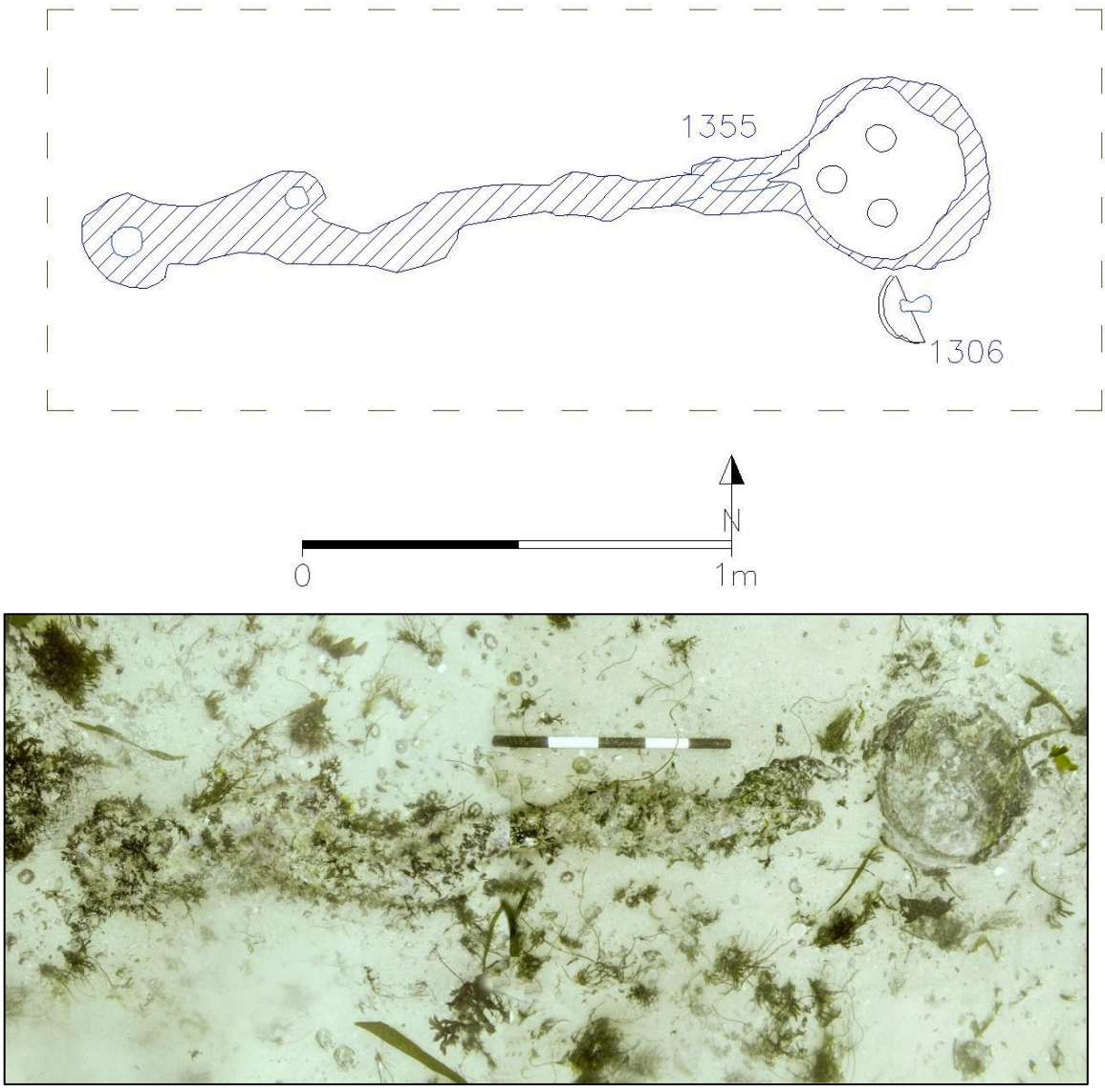


Fig 50
Plan and composite photograph of deadeye and chains 1355 – seabed scale = 0.25m

Trench 3 was entirely occupied by a large iron concretion 1355 which sat on the seabed surface. The iron is 2.12m long, and although heavily concreted some details of its composition from separate pieces can be seen (fig 50). Examination of this iron object revealed that a wooden deadeye was enclosed within the iron. This is the remains of a lower-deadeye, and the iron 'chains' were the means by which this was bolted to the outside of the hull of the vessel – see fig 17. Two bolt holes (65mm diameter) can be seen at the western end of the chains. The size of this deadeye (0.41m diameter) suggests that it supported one of the shrouds for the main or fore masts of the vessel. Given the proximity of 1355 to the remains of the upper-deadeye 1220 located in Trench 1, this could well have been the other half of the deadeye pair for 1220 – see fig 51.

This deadeye was recorded and left in situ. To avoid any unnecessary disturbance of this deadeye no sediment was excavated in Trench 3.

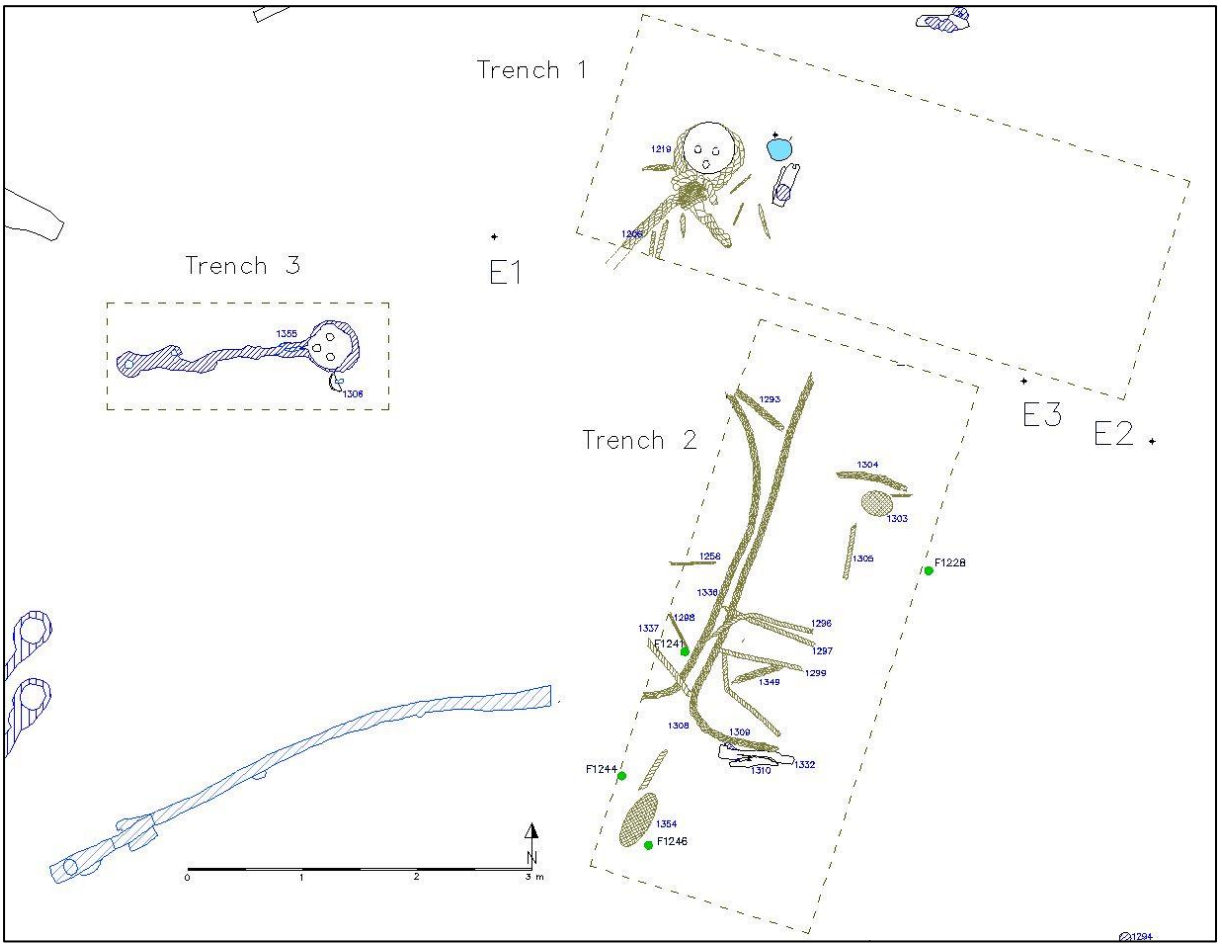


Fig 51
Plan showing how the material in all three trenches relates. Note the proximity of the upper deadeye in Trench 1and the lower deadeye in Trench 3.

The only item recovered from Trench 3 was a wooden sheave 1306 found very close to the western end of the lower deadeye (fig 52). This sheave was 228mm (c. 9 inches) in diameter and 50mm wide. The groove around the edge was 35mm wide and 10mm deep. One unusual feature of this sheave is the concreted iron spindle through its centre. This object was subsequently x-rayed (see x-rays below) the x-ray shows details of the spindle and a possible coak.

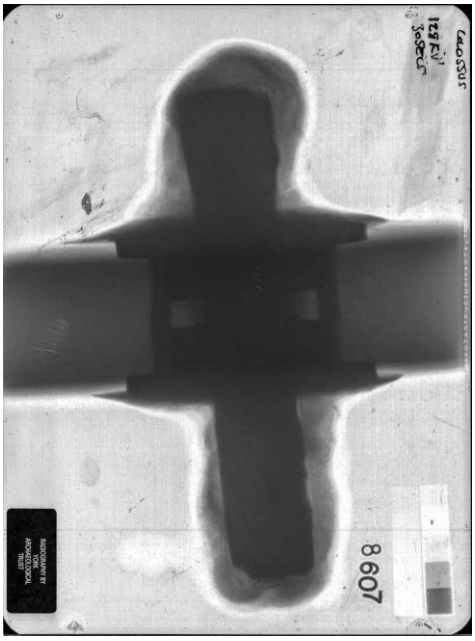


Fig 52
Hardwood sheave with concreted iron spindle – 1306

Photograph (left) and x-ray (below)

Scale = 0.25m

Surface Material

A quick search of the seabed around the trenches demonstrated that there was a significant quantity of newly exposed material visible – in total, 32 objects were noted. Basic recording of this material was undertaken and positions established by taking a measurement and compass bearing to the nearest control point. This method of positioning is not as accurate as direct survey measurements but gives a good approximation of the position in the limited time available. This material was left *in situ* on the seabed and is listed in fig 57 below. A smaller number of items found on the seabed in the immediate vicinity of the trenches were recovered for more detailed recording – they are summarised in fig 58 below.

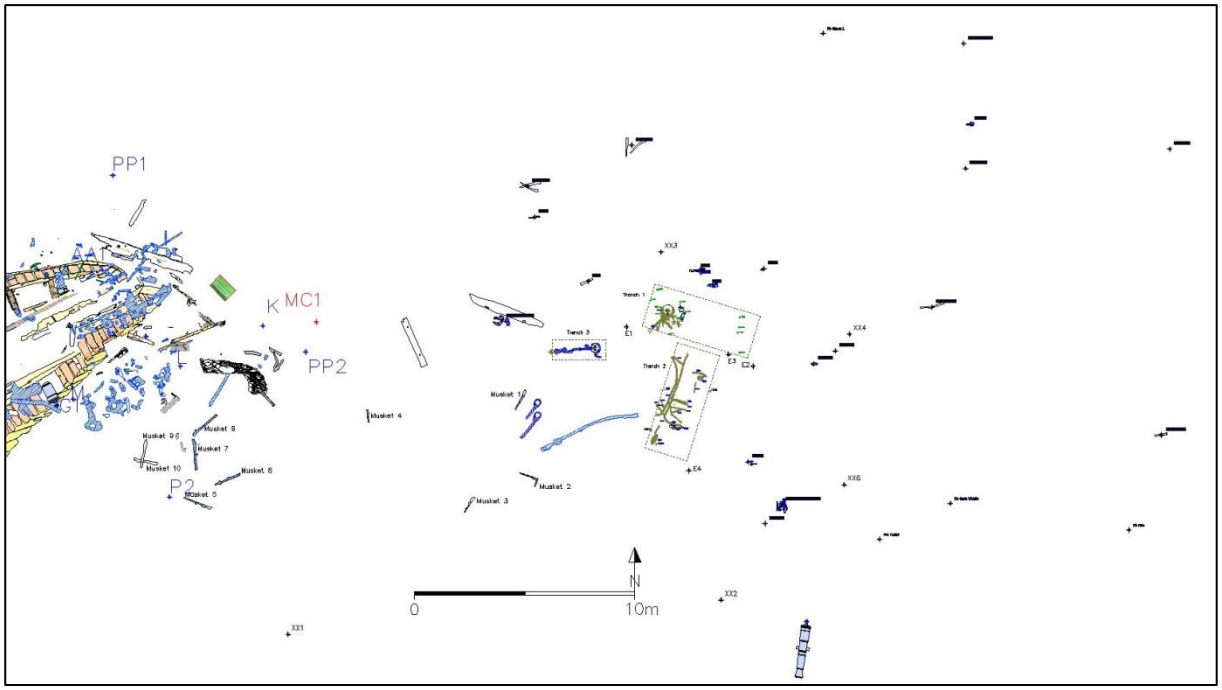


Fig 53
Distribution of objects exposed on the seabed around the 2015 trenches.

The plan above shows the distribution of material exposed on the seabed around the excavated trenches. This spread of material is puzzling, especially when considering the heavier objects such as the three lead scupper pipes – it seems unlikely that these have been dispersed by the action of the sea so their location well to the east of the *Colossus* stern is difficult to explain.

Of particular interest were five lead sash weights, one of which (1351) was recovered. These would have been used as counter-weights for the stern sash windows of *Colossus* (Boudriot, 1986, p.86. II). The sash weights are one of the few objects of whose location on the ship we can be certain - they would only have occurred at the stern of the vessel. The five sash weights were all found along a north-south line 10m to the east of trench one. This is some 40m to the east of the present stern of *Colossus* – what are these sash weights doing so far from the stern?

Four more muskets were located to the north west of the trenches, which in addition to the six found newly exposed in 2014 bring the total exposed on the seabed to 14.

Fig 54
Two views of the square-sectioned lead sash weight 1551- Scale = 0.25m

Two iron shot (cannon balls) were also found on the seabed, located some 3m to the east of Trench 2. The diameter of these shot was 103mm, which makes them 9lb shot (Caruana, 1994, p.66) as originally used for the quarter-deck guns of *Colossus*. It is perhaps not coincidental that these 9lb shot were found only 7m from the only surviving 9lb gun (G7) known on the site. These shot 1294 and 1295 were recovered and are currently undergoing conservation at York.

The only piece of pottery found this year also came from the seabed surface, and was located approximately 10m to the east of Trench 2 (fig 55). This is a fragment of slip-trailed redware which has so far defied positive identification (Duncan Brown personal communication).

Fig 55
The only piece of pottery found this year 1353. Scale = 0.10m

Fig 56
Iron spoon 1196. Scale = 0.25m

The only item of personal equipment found was a heavily concreted iron spoon 1196 – fig 56. This was found on the seabed surface at the centre of Trench 2. It is possible that this was originally part of the collection of personal items (buttons, brush etc) found in 2014 but subsequently disturbed (see Trench 1 above).

Material Exposed on the Seabed – Not Recovered				
Material	**Object**	**Dimensions**	**Easting**	**Northing**
Copper	Fastening bolt (one end clenched)	0.3m long	260178.90	5535595.27
Wood	Small 'L' sectioned timber	0.6m long	260181.34	5535592.36
Composite	Two muskets lying crossed on seabed	1.2m long 0.7m long	260178.60	5535596.68
	Two muskets lying together on seabed	0.85m long 0.90m long	260183.31	5535598.54
Lead	3 sash weights	0.43m long	260198.40	5535603.15
	1 sash weight (+ one recovered 1351)	0.43m long	260197.79	5535582.28
	Sheet 1	0.15 x 0.25m	260192.02	5535603.61
	Sheet 2	0.43 x 0.35m	260207.76	5535598.36
	Scupper pipe 1	1.10 x 0.12m	260196.96	5535591.19
	Scupper pipe 2	0.45m long	260207.39	5535585.39
	Pipe	0.55 x 0.11m	260205.91	5535581.07
Iron	Iron concretion	0.35m long	260198.71	5535599.49
	Iron concretion 1	0.3m long	260192.57	5535589.20
	Iron concretion 2	0.4m long	260189.37	5535581.36
	Iron concretion 3	0.3m long	260191.60	5535588.61
	Complex concretion + Pb	0.6m long	260190.15	5535582.23
	Complex concretion	0.7 x 0.4m	260177.42	5535590.54

Fig 57 Summary of the objects found on the seabed in the vicinity of the trenches.

	Material Exposed on the Seabed – Recovered for Recording					
Material	**Total**	**Object**	**ID**	**Easting**	**Northing**	**Destination**
Composite	4	Gun carriage parts	1265	260189.33	5535592.93	YC
			1352	260186.99	5535592.21	YC
		Sheave	1306	260182.13	5535589.04	YC
		Other	1338	260186.51	5535592.91	R
Iron	5	Shot	1294	260188.60	5535584.19	YC
			1295	260188.65	5535584.18	YC
		Spoon	1196	260184.58	5535586.69	YC
		Other	1347	260186.48	5535592.91	R
			1348	260186.43	5535592.88	R
Lead	1	Window sash weight	1351	260198.49	5535597.48	D
Leather	1	Shoe sole	1191	260183.00	5535586.66	YC
Pottery	1	Jug fragment?	1353	260194.97	5535585.23	D
Wood	1		1208	260183.82	5535591.32	YC
TOTAL	**13**					
	Destination Key: YC = York for conservation R = Reburied on site D = Desalination in Penzance					

Fig 58 Summary of the objects found on the seabed in the vicinity of the trenches and recovered for detailed recording/conservation.

Conclusions

The aim of this project was to record the material found newly exposed on the seabed to the east of the main area of the *Colossus* stern. A number of important objects have been recovered for conservation including several pieces of a 9lb gun carriage, one of which was inscribed with the ship's name. A lower deadeye complete with attached rope shrouds and lanyard were also recovered. This was most probably one of the mainmast deadeyes/shrouds. A corresponding lower deadeye complete with attached iron chains was also recorded but left *in situ*. A significant quantity of rope was found, especially in Trench 2. These ropes were recorded and samples taken for further study. A small, localised collection of personal items was also found in 2014. This included 56 pewter uniform buttons, a bone brush and a small area of fabric. Sadly this area had been disturbed by the time we came to excavate it in 2015. Nevertheless, three further pewter uniform buttons, parts of a leather shoe and a remarkable miniature bronze cannon were recovered in 2015. This collection of items was confined to a very small area (less than 0.3m diameter) and as such was probably originally contained within a small bag.

The ropes discovered were to some extent expected. Given that the main section of hull lies on its port side, the area of this investigation would be where the masts and rigging would be expected to lie. The copious quantities of rope discovered in Trench 2 probably originated in the rigging of the ship. However, several of the other discoveries this year are more difficult to explain. Firstly there is the material which originated from the outer hull of the vessel. What was this doing over 25m to the east of the stern of *Colossus*? This includes the copper sheathing fragments and nails found in Trenches 1 and 2. The two mainmast deadeyes and chains were also originally fastened to the outside of the hull. Finally we have the five lead window sash weights (from the stern windows of the vessel) found on the seabed to the east of the trenches. These items may all suggest that the hull of *Colossus* passed over this area at some time during the wrecking process. The other material found this year possibly supports this hypothesis, including the lead scupper pipes and iron concretions – both likely to have originated in the hull of the vessel.

The three outlying iron guns (G7, G8 and G10) situated to the south and east of the wreck have also never been explained. These guns now lie 32m, 52m and 61m respectively from the wreck. How did they get there? The only 'plausible' explanation to date has been that they were dropped there by those salving the guns. But if this were the case why leave them there – when they lie on flat sand and would have been relatively easy to recover?

The fragments of gun carriage recovered all exhibited extraordinary damage. They were broken and split extensively – far more than seemed reasonable to expect from the carriage and gun falling from the deck of *Colossus* into the sea – even if the gun was still attached to the carriage when it landed on the seabed. What could account for this 'crushing' of the gun carriage?

Finally we have the evidence from the excavation. The rope and upper-deadeye was often found to be steeply sloping. If this was deposited on the pre-wrecking seabed (which is sand) this would surely have been level. The undulations and furrows noticed in the surface upon which these items were discovered requires some explanation.

We will therefore turn to a re-examination of the wrecking process of Colossus in the hopes that an explanation can be found for these anomalies.

The Wrecking Process Re-examined.

The wrecking process of *Colossus* was examined in some detail as part of the Debris Field Survey project undertaken by CISMAS in 2005 (Camidge, 2005). We determined the area where Colossus was probably anchored when the cable parted and established what depth of water she finally grounded in. This was based on the draught of the vessel when she finally grounded – we know that the crew were forced to take refuge on the quarter-deck as the water was up to the sills of the upper gun deck – which would mean she was drawing about 10.7m at the time (see fig 59). Interestingly this established that one of the possible locations for the final grounding was exactly where the stern section of *Colossus* now lies. If we assume for the moment that this is indeed roughly where she finally grounded we can examine the final few hours of the vessel and see whether there is any explanation of the anomalies noted above.

We know that the anchor cable parted at 16:00 on 10th December 1798. The Captain's account of the loss says they then let go first the small bower anchor and then the sheet anchor. At 17:30 'the *Small Bower anchor came home, & we were obliged to veer & let her ride between both*'. At 18:00 the ship first struck ground – but not too hard. The wind was recorded at SE to ESE, but at 20:00 the wind '*drew more to the Southward*'. Then '*we continued to heave till we got to near half a Cable on each anchor*'. This means she was riding to the two anchors with half a cable-length of cable on each anchor. A cable-length at that time was 120 fathoms which is 219m (Falconer, 1780) so half a cable would be about 108m. Sadly the end was near: '*she again struck with great violence & shortly after gained on our Chain Pumps'.* The final blow came at midnight when the rudder was '*beat off'.* Before daylight on the 11th December the water was up to the upper gun-deck sills '*I had assembled the people on the Quarter Deck & Poop – the water then being up to the Cills of the Ports of the Upper Deck'.* It now only remained for the crew to make their escape in small boats which came out to the stranded vessel from St Mary's. By the next day the ship had fallen over onto her beam ends.

The proposed position the stricken vessel occupied at this point is depicted in fig 60. With the water up to the upper deck sills she would have a draught of over 10.7m, so at that state of the tide she would have been aground. We know from a bathymetric survey we undertook in 2004 that the ground shoals towards the north – so *Colossus*, stern to the north would be more firmly aground at the stern. The bearing of the vessel would have been determined by the wind. The likely situation is shown in figs 60 and 61. As the anchors dragged, or the cables parted, the vessel bounced along the seabed pivoting on her stern so that she lay roughly east-west in the location the wreckage now occupies today. As the hull broke up part (or all) of the bow was moved by the ebb tide to the west where the remains of the bow section were found by Roland Morris.

The interesting point is whether this hypothesis explains any of the anomalies discussed above. Certainly the external hull material (copper sheathing/nails and deadeyes) would be likely to be shed on the seabed as the vessel bounced across the seabed. The outlying guns (G7, G8 and G10) all lie in the postulated path of the vessel (see fig 61) and could easily have been shed on the way.

Date & time	Wind	Tide	Event
6 Dec 1798	E strong		At sea, returning with convoy to England.
7 Dec			*Colossus* (and convoy) anchored in St Mary's Sound in 11 fathoms of water with the best bower and veered to a whole cable.
8 – 9 Dec	SE to ESE strong		Wind being offshore the water was smooth
10 Dec	Gale increased considerably	SPRINGS LW 0015 1.06m HW 0607 5.57m LW 1240m 1.07m HW 1828 5.21m	Master sent to sound around the ship – found the ground clear and shoaling to each shore. Other two anchors ready to go – spare (bower?) anchor supplied to *Vanguard* at Naples
About 1600		Flood 3.52m	Cable parted (new cable). Small bower let go. Only sheet anchor left. Could not put to sea as not possible to clear the rocks before dark. Yards & topmasts struck. Sheet anchor let go.
1730		Flood 5.05m	Small bower came home. Obliged to veer and ride between both.
1800		Flood 5.14m	Struck ground (but not too hard). Still hopes of getting to sea at daylight with the flood tide. Guns NOT jettisoned but everything else to lighten ship was done.
2000	Veered to southward	Ebb 4.59m	Ship tailed more inshore. Tried with boat and found more water ahead of the ship. *We still kept her free with our pumps.* *Having then 7 fathom water under her stern.* Hove in to half cable on anchors (to pull forward?). As the tide ebbed the ship struck with great force. Water gained, all pumps manned, baled with buckets and tubs.
11 Dec midnight	Continued to blow hard	Ebb 1.49m LW 0056 1.27m	Rudder beaten off. Distress signals (made from the first of the ships driving) were constantly repeated. Water gained fast.
Before daylight		HW 0648 5.36m	Obliged to order people on the quarter deck and poop. Water up to the sills of upper deck. [Ship now drawing 35', 10.66m, 5.8 fathom] As the ship rolled [the sea?] struck with so much violence against the quarter deck broke several of the beams.
0800		Ebb 4.97m	Saw several boats coming to assist.
1500		LW 1321 1.29m HW 1909 4.96m	All saved except one. *Colossus* boats forced to bear away to Bryher – not being able to pull to windward.
Next night			The ship fell over and was on her beam ends.
14 Dec (or later)			*Since writing the above* *Colossus main mast is gone* *Part of her larboard side appears beat in* *& the guns of course fell over*
Compiled from Captain Murray's account (ADM 1/5348) and Murray to Napean from Scilly (ADM1/2136)			

Fig 59 A summary of the conditions and actions of Colossus leading to her loss. Tidal data was calculated using Tidecalc (Hydrographic Office) software.

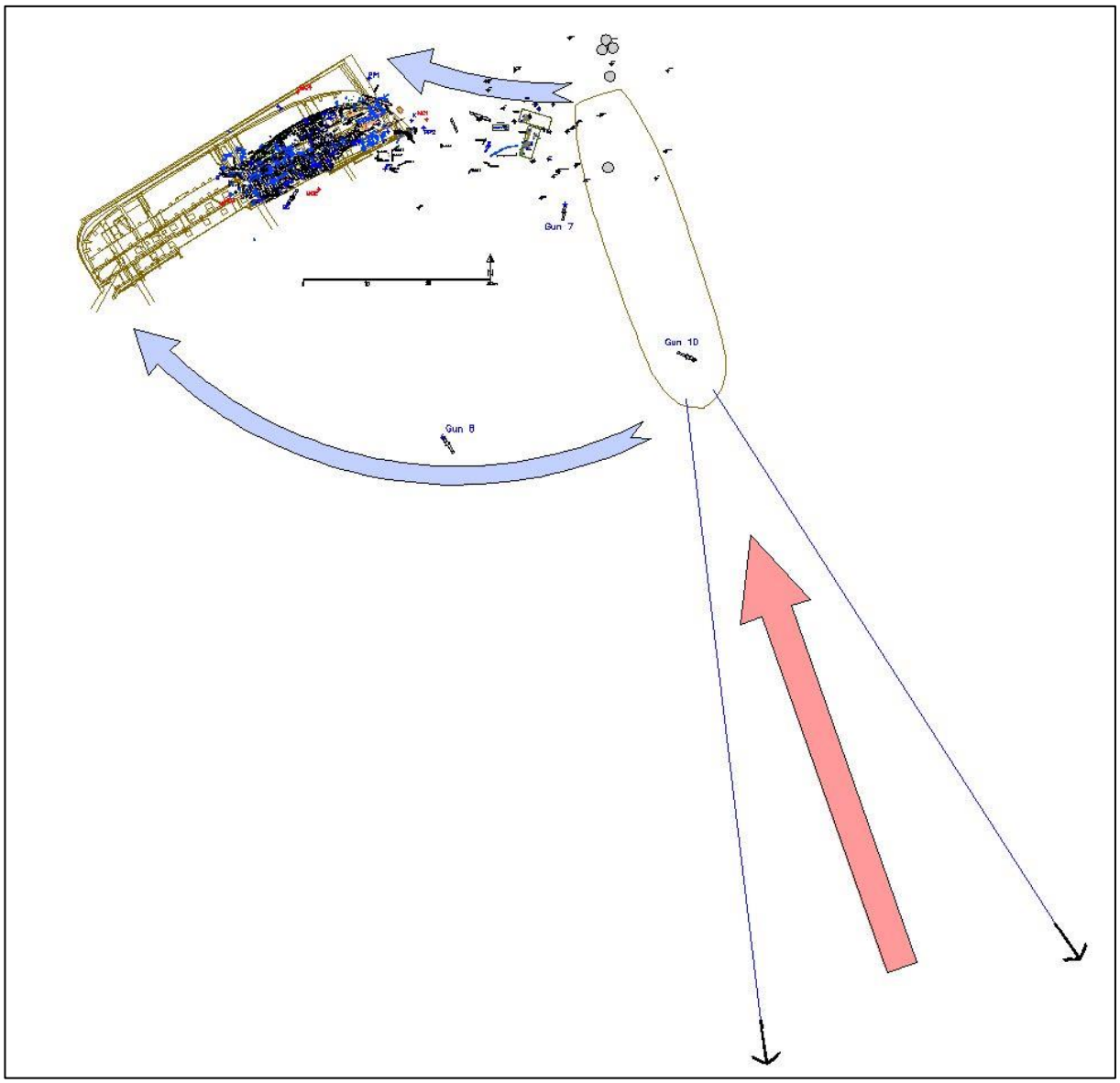


Fig 60

The wrecking of Colossus. The large red arrow shows the wind direction. The Colossus is shown riding to her two anchors head to the wind – cables 100m long (half a cable). To the left is shown the current remains of the stern lying on its port side. The sheer-plan of a 74-gun ship is shown superimposed in green. The blue arrows show the hull pivoting on her stern into the current location of the wreckage. Note how everything forward of the mainmast is now missing.

The positions at which the five stern window sash weights were found are shown on fig 61 below. These all lie in close proximity to the proposed position the stern would have occupied. If the stern windows were breaking up, the sash weights could well have been deposited in this area. The crushed gun carriage parts can also be explained within this scenario – the 9lb carriage would have been on the quarter-deck, from where it fell overboard. Then the hull, as it pivoted, passed over the area where the carriage parts were found, crushing them in the process. Finally, the seabed undulations noted in the excavation were caused by the progress of the hull as it bounced across the seabed.

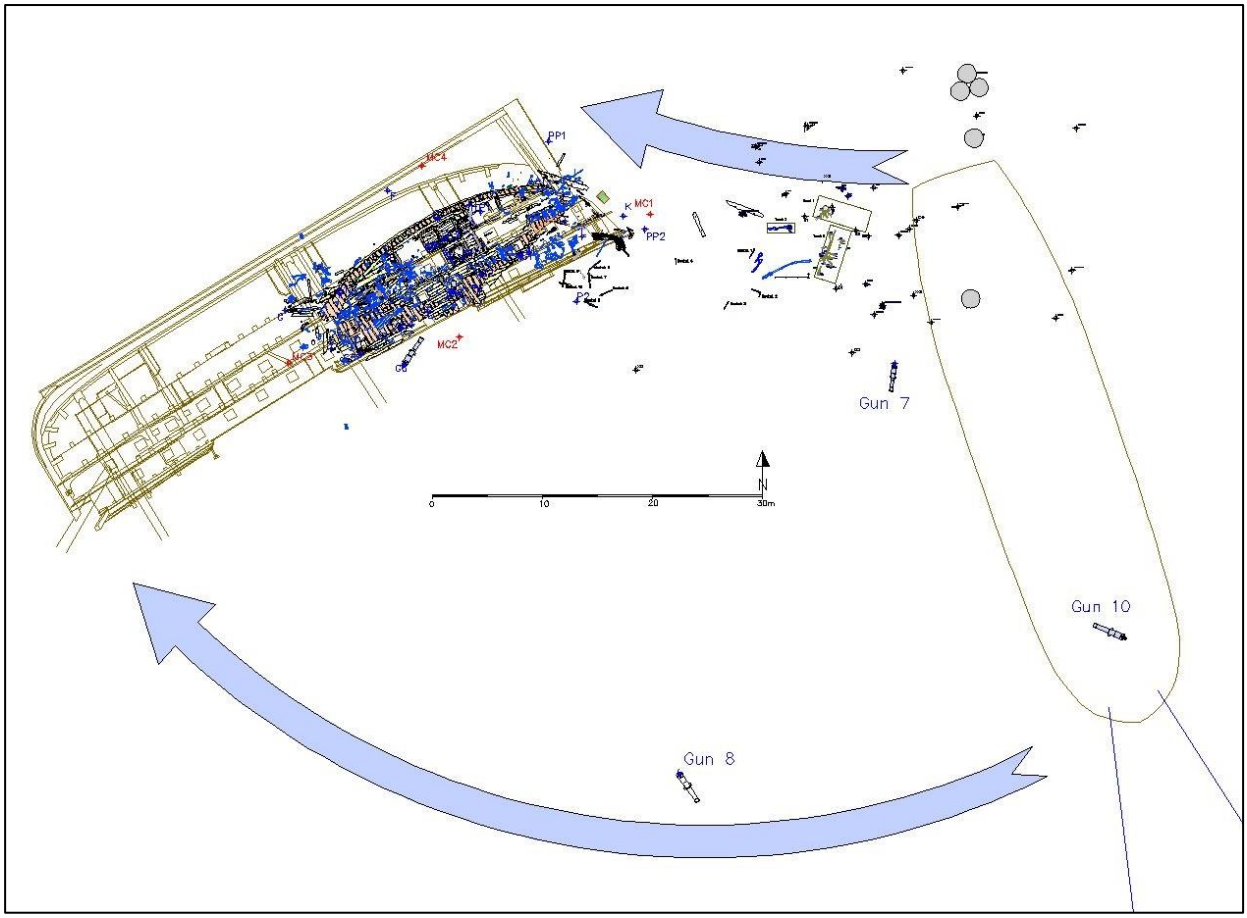


Fig 61
Detail of the wrecking of Colossus. The small grey-filled circles at the top right represent the positions where the five lead window sash weights were found. Note how the projected movement of the hull from final anchored position to wreck 'moves over' the outlying guns (G7, G8 and G10). Note also the position of the 2015 trenches (just below the top blue arrow).

The theory fits well with the evidence. For the first time we have an explanation for some of the puzzling distribution of material around *Colossus*. One final mystery remains to solve – why are the upper gun-deck 18lb guns all in place on the stern while all the 32lb lower-deck guns are missing from the stern section?

The Next Steps

One of the most interesting things to emerge from this project is the formulation of an alternative theory of the wrecking process. The details of this have until now remained unchallenged – they were originally outlined in 1960 by Juliet du Boulay (Boulay, 1960). The conventional view maintains that the ship foundered on Southward Well (an area of rocks to the south of Samson) and the assumption is that the stern broke away and was carried by the flood tide to its current location some 450m east of Southward Well. The re-examination of the wrecking process presented above offers an alternative theory, which explains many of the anomalies of the site as we currently know it. This alternative theory needs to be tested – the following proposals outline how this can be accomplished.

Search the area to the south of the current stern remains.

This is the area of seabed over which the hull would have passed between abandonment and final settling – as shown in fig 61. We now think that the hull was bouncing along the bottom at this stage. The new theory suggests that much material will be found on the seabed to the south of the wreck, an area which has not been thoroughly searched. The falling sediment levels have probably exposed more material. All of this needs to be identified and recorded.

Search for the two bower anchors.

Although the two anchors the vessel rode to at the end may have been salvaged, a search in the location shown in fig 60 should certainly be made. Contemporary accounts record that one anchor was salvaged – but we know that *Colossus* deployed three anchors (best bower, lost when the cable parted, and the sheet and second bower anchors which she was riding to when abandoned). Interestingly, this area was not searched during the debris field survey undertaken in 2004/5 but re-examination of the magnetic survey data shows several anomalies in the area postulated for the anchors.

Search for the rudder.

We know that the rudder was 'beaten off' at midnight (see fig 59). A search should be made to the north of the hull position shown in fig 60 and 61 to see whether any evidence of the rudder remains.

Sediment Level Monitoring.

The sediment level monitoring should be continued so that we know whether more wreck material is likely to be exposed by falling sediment levels. If more material is found to the south of the existing wreckage, extra sediment monitoring points should be installed in this area.

New Underwater Sign

An underwater sign marks the start of the diver trail. This sign is an A3 sized sheet of polycarbonate plastic with applied vinyl lettering. The sign is subject to fouling by marine growth and usually becomes illegible after 12-18 months underwater. The sign has been replaced twice since it was first installed in 2008 as part of the Stabilisation and Recording Project (Camidge, 2008). This year the sign was replaced with a commercially available non-fouling C-Tag sign produced by MoveVirgo limited of Portreath. The sign was provided free of charge by MoveVirgo as they are keen to see whether their product will solve the fouling problem. The sign consists of a yellow soft plastic facing bonded onto a hard plastic sheet. The sign is said to be completely non-toxic. The condition of this sign will be examined as part of the ongoing monitoring of the site.

Fig 62
The underwater sign which marks the start of the diver trail. On the left the old sign and on the right the new sign.

Conservation Assessment by M Felter

HMS *Colossus* 2015 (C2015)

Site Director/Unit: Kevin Camidge, CISMAS
Conservator: M Felter
Date: 3.9.2015

York Archaeological Trust Conservation Report Number 2015/49

Number of artefacts

Material	**Quantity**
Concretions (iron)	12
Copper alloy	7
Leather	3
Wood	5
Rope	1

Aims And Objectives

This report aims to meet the requirements of MAP2 (English Heritage, 2001) and MoRPHE (English Heritage, 2006) to produce a stable site archive. This has involved X-radiography and an assessment of the condition, stability and packaging of the finds.
The condition of the various classes of material is summarised and indicators of unusual preservation noted. The potential of the assemblage for further analysis and research is discussed, and recommendations made for further investigative conservation and long term storage.

Procedures

The iron concretions, copper alloy finds and the sheave (F1306) were X-rayed using standard Y.A.T. procedures and equipment. 8 plates were used, and each plate was given a reference number in the YAT conservation laboratory series (X8592-7, 8606-7). The X-ray number was written on each small find bag. Each image on the radiograph was labelled with its small find number. The plates were packaged in archival paper pockets.

All finds were examined, material identification checked and observations made about their condition and stability and recorded below. The individual assessment of each find is presented in the tables in the Appendix.

Condition Assessment Summary

Metals:
Copper alloy: The copper alloy was in fairly good condition, mostly complete and where concretion is present this is thin and stable. There was no sign of active corrosion at present.

Concretions (iron): The iron objects which were concreted were generally in good stable condition at present with only two (F1174 and F1200) showing signs of the beginning of active corrosion in patches on the surface. F1196 was in two joining fragments. The X-rays showed the metal cores to range from solid through to almost complete mineralisation. This is probably the distinction between cast and wrought iron, the latter being more susceptible to swift corrosion upon immersion in seawater.

Iron (not concreted): The only iron object not currently concreted was a cannon ball (F1294), the concretion having been removed on site. The object is currently in fairly good condition, with only slight damage to the outer surface, however it is unstable and will be prone to flash rusting.

Organics:
Wood: The wooden items consisted of big solid pieces of gun carriage and a large wood deadeye, as well as a composite sheave of wood and concreted iron. The wood is generally in fair condition, with somewhat soft surfaces and gribbled over large areas. The items all have some degree of damage and wear caused during the sinking of the vessel and during burial.

Leather: The three fragments of leather were in poor condition, having suffered much damage during burial. All three items had fragile and damaged edges and evidence of delamination.

Rope: The rope 'knot' (F1216, F1216b, F1216c) associated with the deadeye (F1220) was in fairly good condition in its current wet state, but the fibres are fragile and liable to breakage. The whole object has large amounts of sand and silt within the interstices.
Two pieces of rope which would have been reburied (F1293 and F1305) were donated to YAT as test pieces.

Statement of Potential

Indicators of preservation
The finds show the dynamic and aggressive nature of the deposition and the burial environment in the form of rapid corrosion of the wrought iron, old but heavy damage to the thick timbers of the gun carriages and the extensive damage from gribble.

Dating evidence
The form of the shoe sole (F1191) and possibly the decoration on the buttons may be indicators of date.

Evidence of technology, craft or industry or anything else of note
Tools: F1196 appears to be a wrought iron spoon, which could possibly be from smelting.
The rope 'knot' will be an indicator of the types of fastenings and rope fibres which were used onboard the Colossus.

Recommendations

Further Conservation

Further conservation work is proposed for the following artefacts to aid identification and clarification, to stabilise them (for long-term storage) and to bring them to display/publication standard (recommendations for further work are also outlined and highlighted in bold in the tables in the appendix):

Find	Material/Object	Aim
1166	Lead/iron possible musket shot	Display/publication
1167	Leather heel	Display/publication
1169	Cu alloy button	Display/publication, clarify decoration
1169	Cu alloy button	Display/publication, clarify decoration
1189	Cu alloy thimble	Display/publication
1191	Leather shoe sole	Display/publication
1213	Cu alloy noonday gun	Display/publication, clarify features
1214	Leather striated fragments	Display/publication, clarify features
1216	Large knot of rope associated with F1220	Display/publication, clarify features and knot construction
1220	Wood large deadeye	Display/publication
1236	Cu alloy button	Display/publication, clarify decoration
1240	Wood gun carriage fragment	Display/publication
1265	Small wood fragment	Display/publication, rejoin with F1240
1294	Iron cannon ball	Display/publication
1295	Concreted iron cannon ball	Display/publication
1306	Wood and iron sheave	Display/publication, clarify construction
1352	Wood gun carriage fragment	Display/publication

Analysis and specialist Support

As part of the treatment process the following analyses will be carried out:
Wood species identification of F1220, F1265, F1240, F1352 and F1306
Leather identification of F1167, F1191 and F1214

Packaging and Long Term Storage

All finds were recorded and photographed on site, then packaged up in suitable containers and shipped by courier to York for assessment and treatment.

As part of the assessment procedure the objects were unwrapped and placed in containers of tap water to start the desalination process. The de-concreted cannon ball was placed in 2% Sodium hydroxide w/v in tap water.

Objects which are recommended for reburial on the sea-bed (such as the iron concretions) have also been placed in tap-water until the decision to rebury/retain has been taken.

BUDGET

	DETAIL	**COST (Ex VAT)**	**COST (Inc VAT)**
Labour	MF 1 day @ £250/day AN other, 6 days @ £125/day	£250.00 £750.00	£300.00 £900.00
X-radiography	8 plates @ £5/plate	£40.00	£48.00
Consumables	PEG wax, glycerol, adhesives, consolidants	£160.00	£192.00
Freeze- Drier	Part load charge	£280.00	£336.00
Courier	To collect objects from Penzance and return conserved objects to Penzance	£220.00	£264.00
TOTAL		**£1700.00**	**£2040.00**

References

English Heritage, Management of Archaeological Projects, 1991.

English Heritage, Management of Research Projects in the Historic Environment, 2006.

Assessment Tables

1. Concretions (iron)

X-ray	Find	Image	Assessment
8592	1174		Small thin 'concretion' of an iron object in fair condition, with some active corrosion at one end and various nodular protrusions. The X-ray show the object within to be an iron nail, heavily corroded with the iron core mineralised at the edges and tip. **Recommendations: reburial on seabed.**
8592	1175		Small compact 'concretion' of an iron object in good, stable condition. The X-rays shows the object within to be an iron rod or bar with a rounded end, fully mineralised. **Recommendations: reburial on seabed.**
8592	1193		Round and flat 'concretion' of an iron object with various nodular protrusions, in good stable condition. The X-ray shows the object within to be an iron ring, almost fully mineralised. **Recommendations: reburial on seabed.**
8594	1194		Thick oblong 'concretion' of an iron object with a sub-square shape at one end. The concretion is currently stable. The X-ray shows the object within to be a large nail or bolt, with a fairly solid core and mineralised edges. **Recommendations: reburial on seabed.**
8597	1196		Iron concreted 'spoon' (possibly a smelting spoon) in two joining pieces. The break edge shows the handle to have a flat cross-section. The wrought iron has completely corroded away leaving a void inside the concretion which is confirmed by the X-ray. The object is currently stable. **Recommendations: if this object is required for display in its current state it would require desalination.**
8594	1198		'J'-shaped 'concretion' of an iron object in fair condition, active corrosion evident in one area. The X-ray shows the object within to be a large nail or bolt, bent into a 'J'-shape, with a solid core and mineralised edges. **Recommendations: reburial on seabed.**

X-ray	Find	Image	Assessment
8595	1200		Long, thin 'concretion' of an iron object with various nodular protrusions and spots of active corrosion, especially at the thicker end where the concretion is thin. The X-ray shows the object within to be a thick iron rod with two rings attached at one end, the iron core is thick and robust with minimal mineralisation at the edges. **Recommendations: reburial on seabed.**
8593	1209		Large 'concretion' with numerous nodular protrusions and various inclusions including rope fragments. The object is stable and in good condition. The X-ray shows the object within to be an iron rod or bar, with a solid core with mineralisation at the edges. **Recommendations: reburial on seabed.**
8595	1221		Thick, solid and compact 'concretion' of an iron object, flat at one end and rounded at the other, in good stable condition with various nodular protrusions. The X-ray shows the object within to be an iron bar or rod set into an iron socket/washer at one end. The object has a relatively solid core but with heavy mineralisation at the edges. **Recommendations: reburial on seabed.**
8594	1251		'J'-shaped 'concretion' of an iron object with various nodular protrusions. The object is stable with quite compact concretion. The X-ray shows the object within to be a large nail/bolt bent into a 'J'-shape and heavily mineralised. **Recommendations: reburial on seabed.**
8595	1254		'J'-shaped 'concretion' of an iron object with various nodular protrusions (initially thought to contain a pistol). The object is stable with grey/black sandy concretion. The X-ray shows the object within to be a curved iron bar with five rectangular notches in the side at one end, this end also appears broken. The iron core is solid with only slight mineralisation at the eges. **Recommendations: reburial on seabed.**
8596	1291		'Concretion' of an iron object in good stable condition, with various nodular protrusions and inclusions. The X-ray shows the object within to be an iron eye with a flange at the 'foot'. The object is solid with very little mineralisation visible. **Recommendations: reburial on seabed.**

X-ray	Find	Image	Assessment
	1295		Concreted cannon ball, in good stable condition. A 'scar' on the surface suggests another cannon ball may have been concreted onto it. Not X-rayed. **Recommendations: if required, the object can be de-concreted, desalinated and surface treated to make ready for display.**
8596	1301		Concreted iron thimble for rope, with a separate small piece of wood which is probably not related. The concreted thimble is in good stable condition with shell and wood inclusions. The X-ray shows the metal core to be robust and thick with some damage to the edges including a substantial crack to one area of the outer edge. **Recommendations: reburial on seabed.**

2. Iron

X-ray	Find	Image	Assessment
	1294		De-concreted cannon ball, complete and in fairly good condition, with some slight delamination of the surface which probably happened during removal of the concretion. **Recommendations: if required, the object can be desalinated and surface treated to make ready for display.**

3. Copper alloy

X-ray	Find	Image	Assessment
	1166		Possible early musket-shot (*minier)*, lead outer casing with iron core and wood 'nose'. The object is in good condition, although the outer surface of the lead has marks and scratches reminiscent of chewing. The base of the iron core is reddish-brown but not yet actively corroding. **Recommendations: if required for display the item needs desalination and surface treatment.**
8597	1169		Complete copper alloy button with incised anchor decoration on the upper surface. The object is in good stable condition, with thin concretion the surface. The X-ray shows the metal core to be fairly robust with slight damage to the edges and loop attachment present. **Recommendations: if the required for display the item requires concretion removal, desalination and possible surface treatment.**
	1176		Complete copper alloy button with incised anchor/rope decoration on the upper surface. The object is in good stable condition, with thin concretion the surface. The X-ray shows the metal core to be fairly robust and loop attachment present. **Recommendations: if the required for display the item requires concretion removal, desalination and possible surface treatment.**
8597	1189		Copper alloy thimble in good stable condition. The surface has a dark blue patina. The X-ray shows the metal core to be thin but even and intact. **Recommendations: if the required for display the item requires concretion removal, desalination and possible surface treatment.**

X-ray	Find	Image	Assessment
8597	1213		Complete copper alloy object in the shape of a cannon, possibly a 'noonday gun'. The object is in good to fair condition, covered with a thin layer of concretion which is purple/blue in colour with patches of yellow metal. There is a crack to the muzzle where a small piece of the concretion has come away. The X-ray shows the metal core to be robust and even. **Recommendations: if the required for display the item requires concretion removal, desalination and possible surface treatment.**
8597	1236		Complete copper alloy button with incised anchor decoration on the upper surface. The object is in good stable condition, with thin concretion the surface. The X-ray shows the metal core to be fairly robust and loop attachment present. **Recommendations: if the required for display the item requires concretion removal, desalination and possible surface treatment.**

4. Wood

X-ray	Find	Image	Assessment
	1220		Large and solid wood deadeye with three oval/round perforations (which all contain fragments of rope; the object was found in association with F1216, a large knot of rope). The surface is worn and damaged in some areas but retains a smooth surface in other areas, especially near the edge. One surface is heavily gribbled. There is some encrusted sand on the surface of the groove in the side which is otherwise very smooth. The surface does not have any engraved surface markings. **Recommendations: if the object is to be retained it will require desalination, pre-treatment with polyethylene glycol, freeze-drying and post-freeze drying surface treatment as well as bespoke packaging.**

X-ray	Find	Image	Assessment
	1240		Fragment of wooden gun carriage with lettering '*COL___US*' incised into one face and areas of concretion corresponding to iron elements/bolts. The object is broken and misshaped but this is not fresh damage. The surface of the wood is soft and one edge is gribbled. F1265 is probably a fragment from this find. The fragment is currently stable and in fair to good condition. **Recommendations: if the object is to be retained it will require desalination, pre-treatment with polyethylene glycol, freeze-drying and post-freeze drying surface treatment as well as bespoke packaging.**
	1265		Small fragment of wood, probably associated with F1240, with letter '*S*' incised into one face. The object is in good to fair condition, slightly soft and with fragile edges. **Recommendations: if the object is to be retained it will require desalination, pre-treatment with polyethylene glycol, freeze-drying and post-freeze drying surface treatment to rejoin it with F1240.**
8606, 8607	1306		Wooden sheave with iron central shaft which is concreted. The wood is in good condition, smooth and quite solid with only slight wear to the edges. The X-ray shows the metal core of the central shaft to be quite solid with only minimal mineralisation of the edges. There are two square perforations visible. The thin nodular protrusions contain no metal and do not appear to represent cotter pins. **Recommendations: if the object is to be retained it will require removal of the concretion from the iron, desalination, pre-treatment with polyethylene glycol, freeze-drying and post-freeze drying surface treatment as well as bespoke packaging.**

X-ray	Find	Image	Assessment
	1352		Fragment of wooden gun carriage with an incised inscription: '*9000 No*' on one face. There are various nodules of concretion probably corresponding to iron elements/bolts and areas of grabbling. Old damage and wear to the edges and a crack on one face where the wood is very thin and the concretion penetrated into the wood structure. **Recommendations: if the object is to be retained it will require desalination, pre-treatment with polyethylene glycol, freeze-drying and post-freeze drying surface treatment as well as bespoke packaging.**

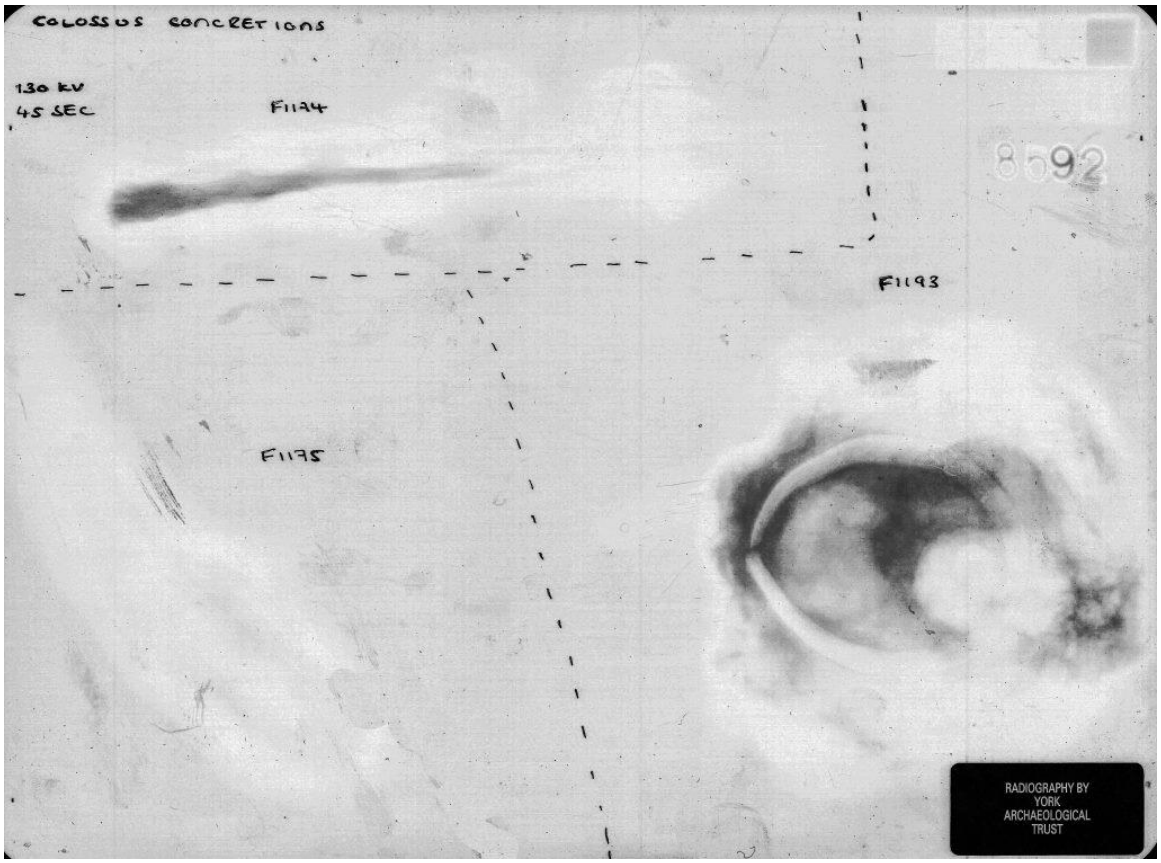
5. Leather

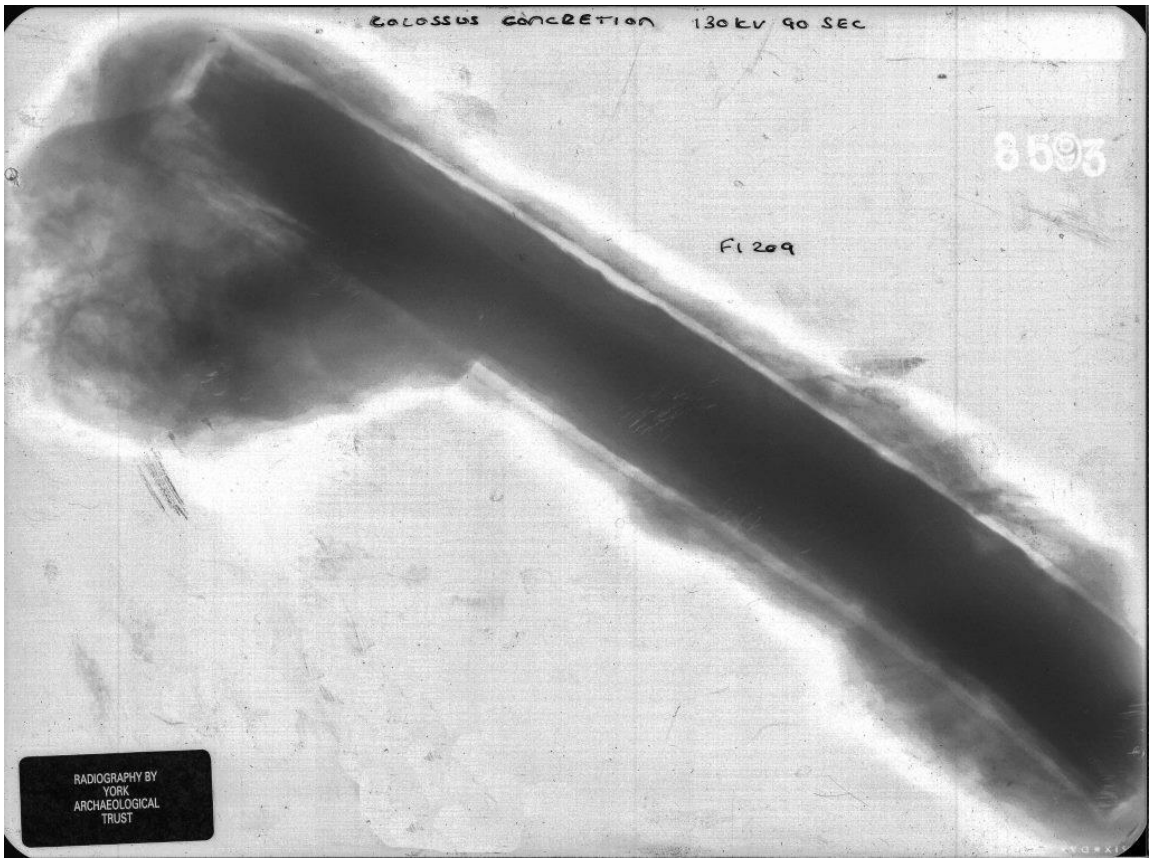
Find	Image	Assessment
1167		Leather shoe sole fragment with small wood pegs holding the leather layers together. The leather is in poor condition, stiff and brittle, with very fragile edges and areas of delamination of the surface. Some of the wood pegs are loose and broken away. **Recommendations: if this object is to be retained it requires desalination, pre-treatment with polyethylene glycol and freeze-drying followed by post-freeze drying treatment.**
1191		Complete leather shoe sole in fair condition. The sole is largely intact structurally and retains some flexibility but the edges are very fragile, in some areas torn and damaged. **Recommendations: if this object is to be retained it requires desalination, pre-treatment with glycerol and freeze-drying followed by post-freeze drying treatment.**
1214		Four fragments of leather in poor condition, very thin and fragile with broken ends and delaminating. The largest piece has horizontal decorative striations. **Recommendations: if this object is to be retained it requires desalination, pre-treatment with glycerol and freeze-drying followed by post-freeze drying treatment.**

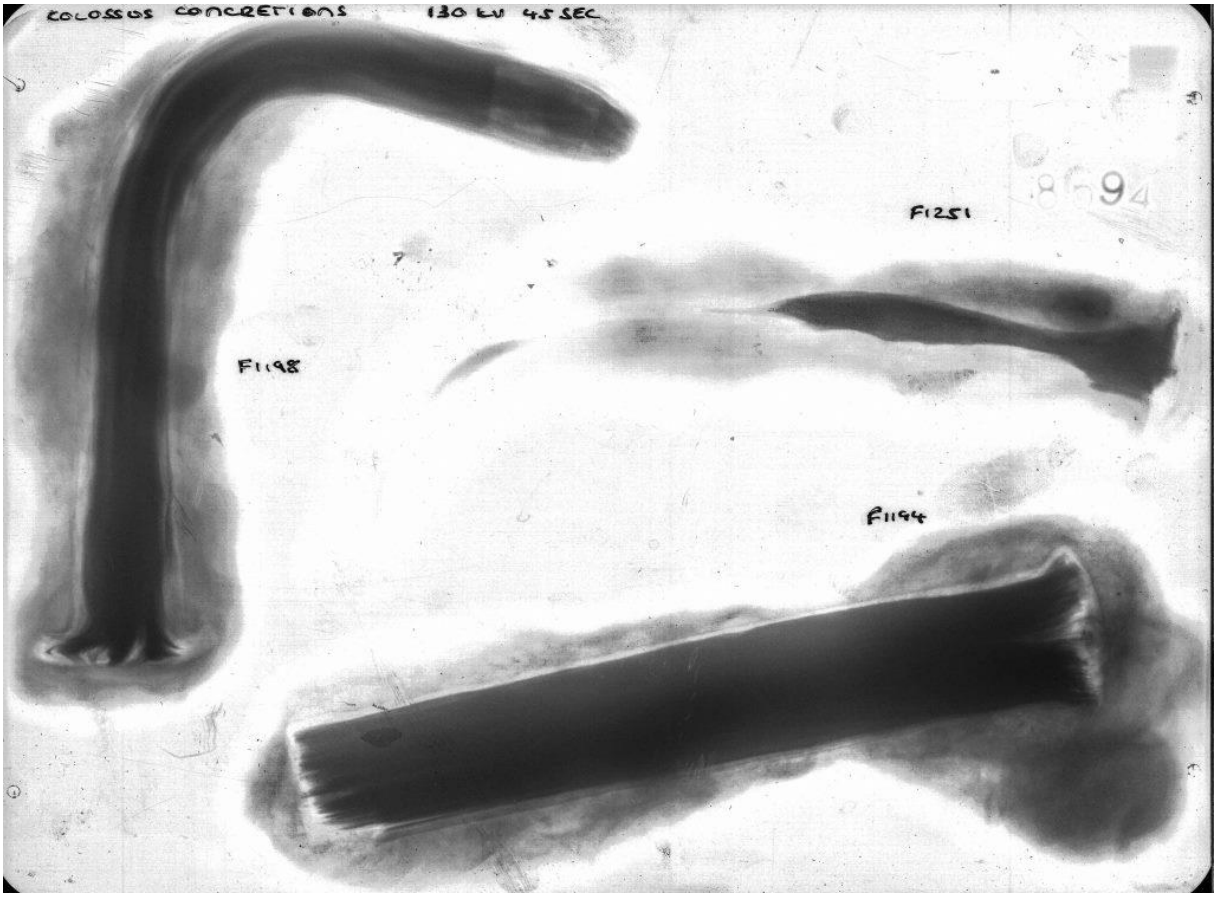
6. Rope

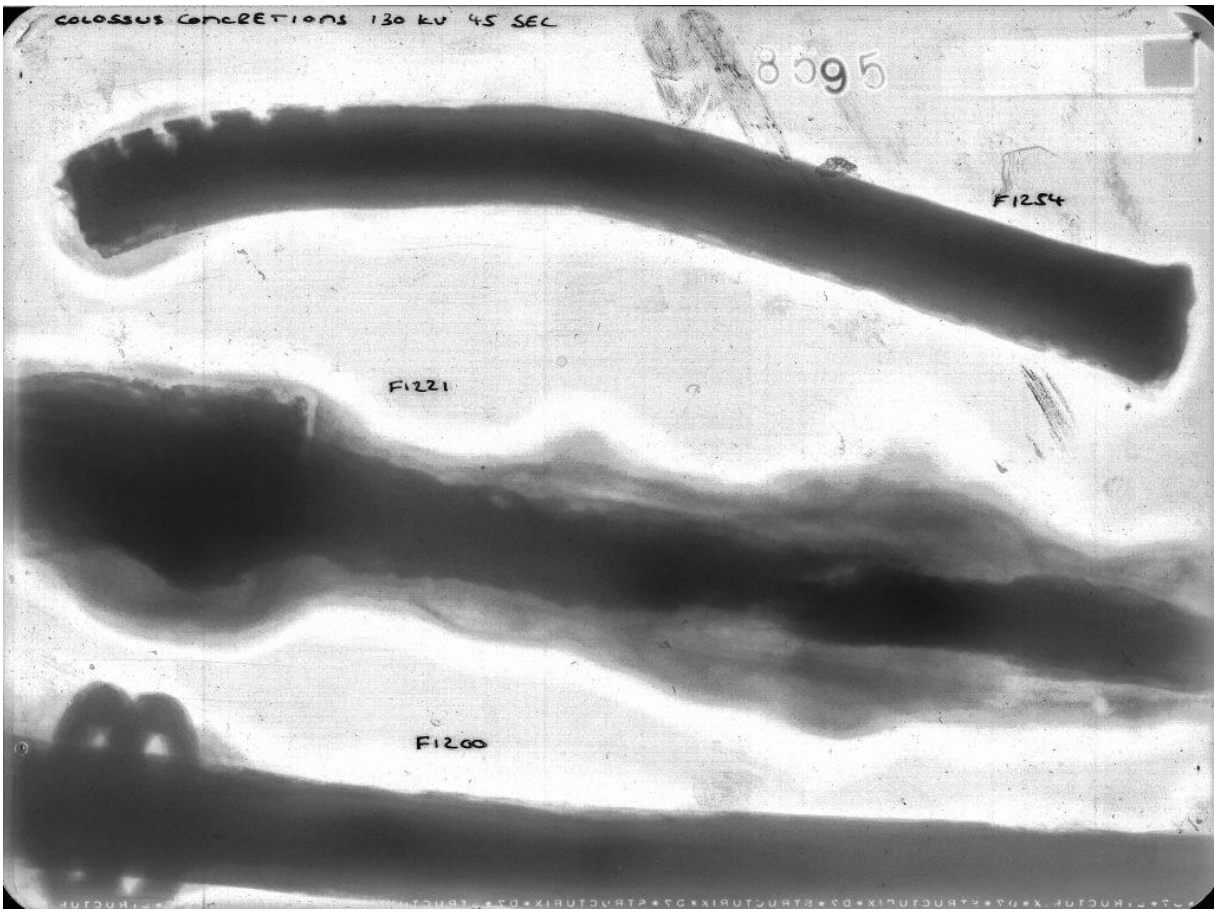
Find	Image	Assessment
1216		In its wet state the rope is fairly robust but the fibres are fragile and liable to breakage. The knot itself has several very weak areas where parts of the rope elements have broken away or have unravelled. The interstices have substantial amounts of sand and silt. **Recommendations: if this fragment is to be retained it requires desalination, cleaning, recording, pre-treatment with polyethylene glycol, freeze drying, post-freeze drying treatment and consolidation and bespoke packaging.**
1293		Rope test pieces.
1305		Rope test pieces.

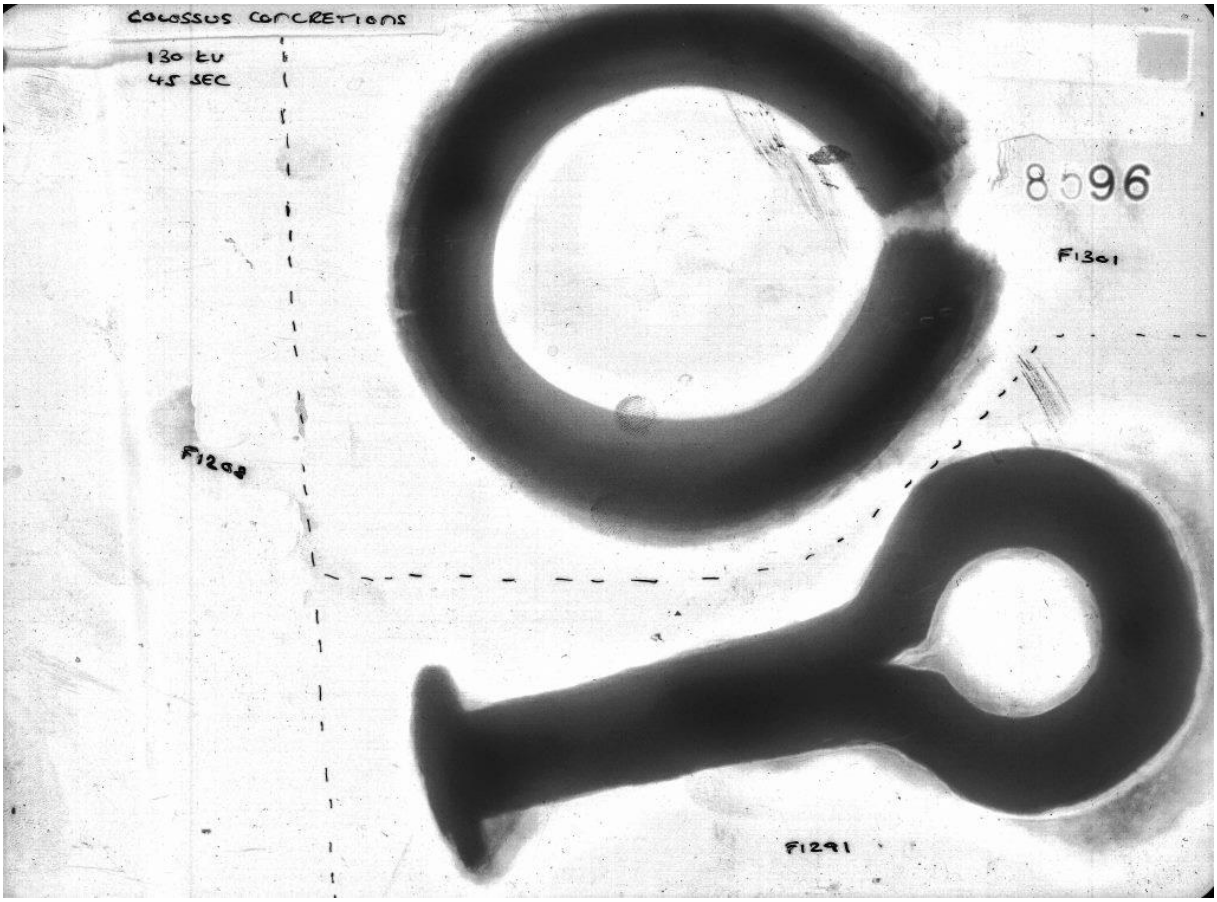
X-Rays

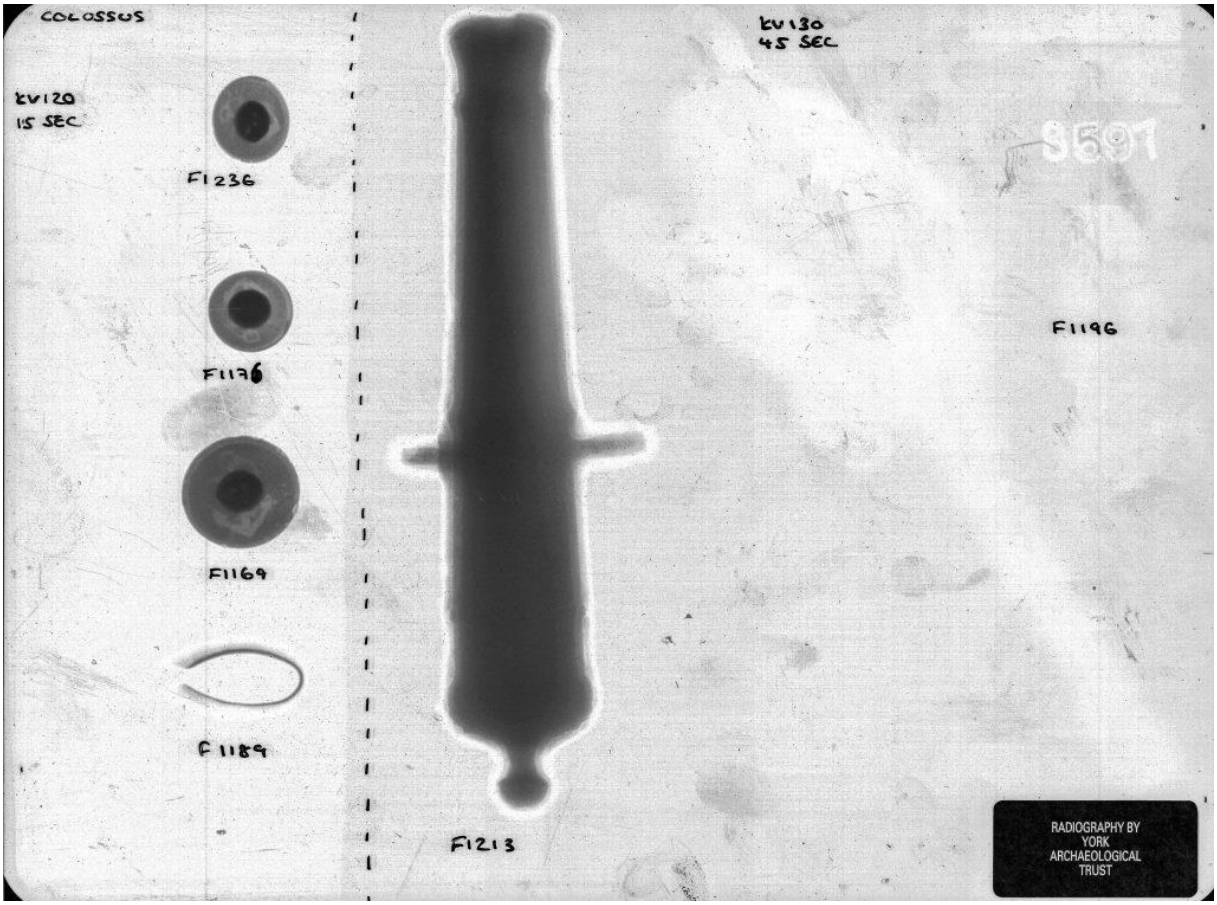

COLOSSUS CONCRETIONS
130 KV
45 SEC
F1194
8592
F1193
F1195
RADIOGRAPHY BY
YORK
ARCHAEOLOGICAL
TRUST

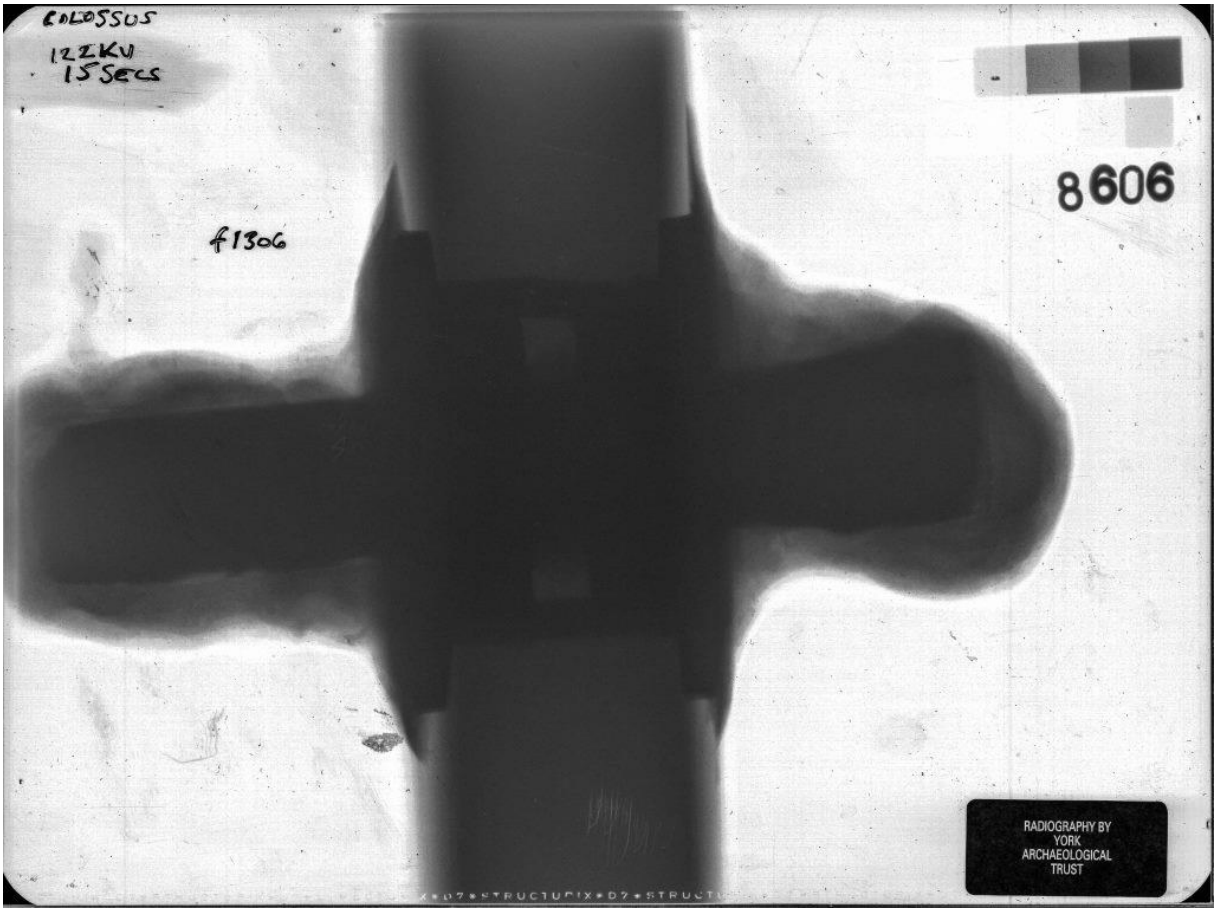

COLOSSUS CONCRETION 130 KV 90 SEC
8593
F1209
RADIOGRAPHY BY
YORK
ARCHAEOLOGICAL
TRUST

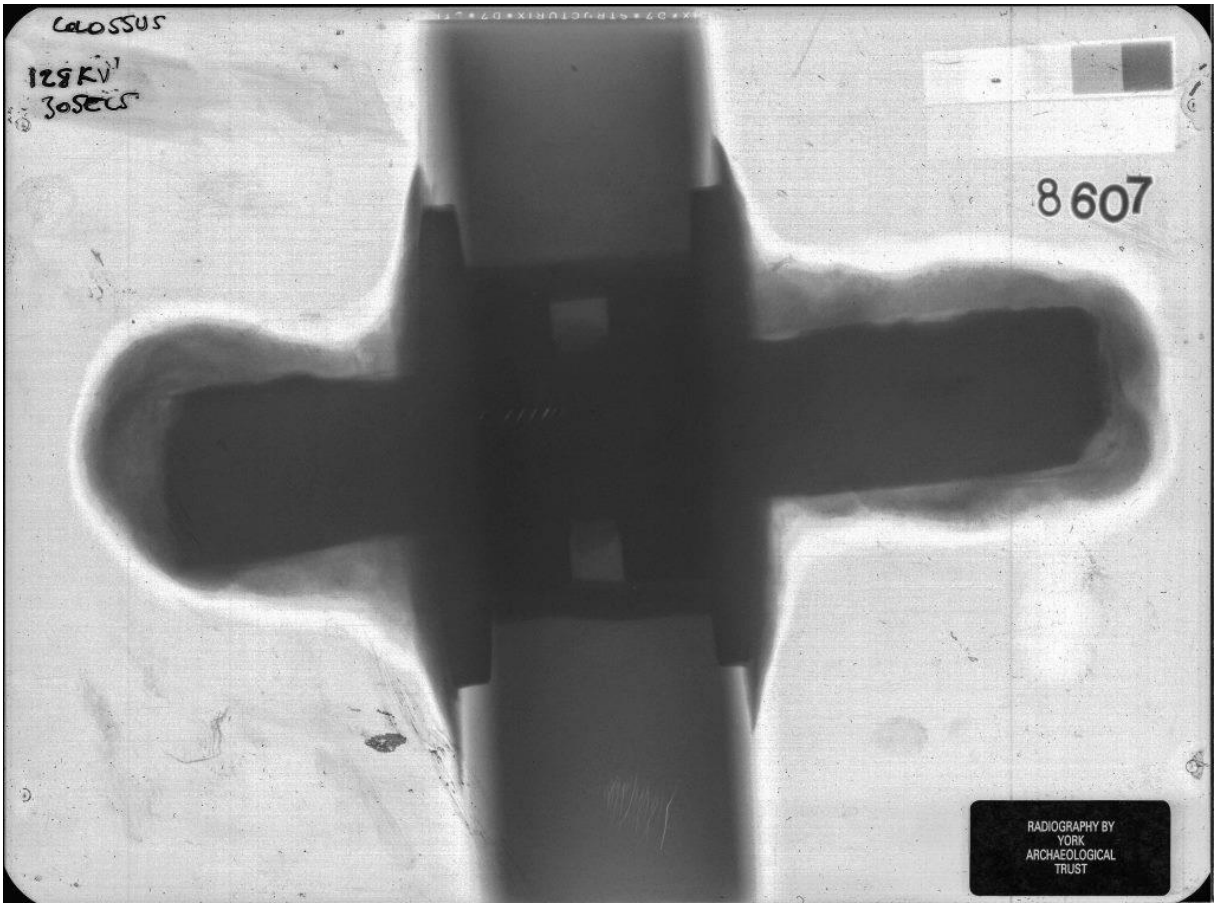

COLOSSUS CONCRETIONS 130 KV 45 SEC
8094
F1251
F1198
F1194


COLOSSUS CONCRETIONS 130 KV 45 SEC
8095
F1254
F1221
F1200


COLOSSUS CONCRETIONS
130 kV
45 SEC
8096
F1301
F1208
F1291


COLOSSUS
kV 120
15 SEC
F1236
F1196
F1169
F1189
kV 130
45 SEC
8591
F1196
F1213
RADIOGRAPHY BY
YORK
ARCHAEOLOGICAL
TRUST


COLOSSUS
122KV
15 SECS
f1306
8606
RADIOGRAPHY BY
YORK
ARCHAEOLOGICAL
TRUST


COLOSSUS
128KV
30SECS
8607
RADIOGRAPHY BY
YORK
ARCHAEOLOGICAL
TRUST

Sediment Samples by Gill Campbell and Polydora Baker

Seven sediment samples of between 6 and 8 kg were taken from the layers encountered during the excavation, 2 from trench 1 and 5 from trench 2. The aim of the sampling exercise was to determine if any organic remains such as bone or plant food stuffs, which could have come from the ship, were present in these sediments.

Methods

Each sample was wet-sieved by the excavator using a simple-wash-over technique. The wash-over material was collected on a 250micron mesh and kept wet. The material that did not wash over was sieved down to 500microms and dried before being spilt into >4mm, 4-2mm, and 2mm-0.5mm fractions.

All seven samples were assessed as to their content. The >4mm and 4-2mm dried residues were sorted in their entirety and any remains picked out. Each wash-over was examined under a binocular dissecting at up to x50 magnification and notes made on the material present. As very little material other than sand and the remains of marine organisms were present in wash-overs or the >4mm and 4-2mm residues, the 2mm-0.5mm residue fraction of the samples was not examined.

Results

The results of the assessment are presented in Table 1. Very little material other than the remains of marine organisms was observed. No finds were recovered from any of the >4mm residue fractions. The 4-2mm residue fraction of sample F1201 contained four metal fragments, including a possible fragment of a spring. The 4-2mm residue fraction of F1210 included a single small fragment of iron stained wood, while the 4-2mm residue fraction of F1292 contained 5 possible fragments of iron or iron concretion.

Several of the wash-overs produced small fragments of wood, generally too small to identify. The wash-over from sample F1292 from layer 3 in trench 2 was the exception. It produced one large fragment of mature hardwood (probably ash [*Fraxinus* sp.]), and several smaller fragments which may have been derived from this piece, as well as a single small fragment of conifer wood. This sample also contained occasional fragments of coal and insect remains.

Fragment of possible rope and fibres were observed in wash-overs from samples F1334 and F1334, with F1339 also containing rare fragments of insect. Both wash-over F1339 and F1210 also contained single fragments of *Rubus* sp. (blackberry, raspberry etc.) seeds. In addition a single Asteraceae (daisy family) achene was present in wash-over F1210.

No bones or charred plant remains or charcoal were observed in any of the samples.

Discussion

The results are of limited interpretative value but suggest that very little organic material from the wreck other than rope and timber have survived or were deposited in this area of the seabed. The remains of insects and the occasional seed could all have been washed or blown into the sediment. The large fragments of wood in the wash-over from sample F1292 could relate to the wreck. The identifications require confirmation using high-power microscopy but the presence of these fragments does not greatly increase our knowledge of the ship. The fragments of rope and fibre almost certainly derive from the rope finds recovered as part of the excavation.

No further work on these samples is recommended other than the confirmation of the wood identifications.

Sample	Wash-over	4-2mm residue
F1201	4 metal fragments	Coal +, very small wood fragments ++.
F1210	Iron-stained wood fragment - too small to identify	Very small wood fragments ++, coal +, *Rubus* sp. seed fragment, Asteracae indet. achene.
F1255	-	-
F1292	5 Iron fragments/ concretion fragments	One fragment, circa 10mm wood fragment, possibly *Fraxinus* sp. (ash), fragment of conifer wood, small wood fragments ++, coal +, insect +.
F1334	-	Fragment of rope and detached fibres. Modern grass fragment, Very small wood fragments +.
F1335	-	Very small wood fragments +, coal +
F1339	-	Possible rope fibres, insect +, *Rubus* sp. seed fragment

Fig 63: Results of assessment of sediment samples from the 2015 excavations of 'The Colossus'. Remains other than those of marine organisms were absent in the >4mm residue fractions. Key : + = 1 to 5 items, ++ = 6-25 items.

DVD ROM Contents

Data Collection Forms
- Context Sheets
- Site Drawings
- Survey
- Underwater Finds Sheets

Finds
- Finds Database
- Rope Record Sheets
- Finds Drawings
- X-rays

Site Plans
- Whole Site
- Trench 1
- Trench 2
- Trench 3

Photographs
- Underwater Photos
- Finds Photos
- Movie Clips

Report

Bibliography

Ashley, W.A., 1947. *The Ashley Book of Knots*. London: Faber and Faber.

Bingeman, J., 2010. *The First Invincible (1747-58). Her Excavations (1980 - 1991)*. Oxford: Oxbow.

Boudriot, J., 1986. *The Seventy-four Gun Ship*. Paris: Jean Boudriot Publications.

Boulay, J.d., 1960. Wrecks in the Isles of Scilly. *The Mariner's Mirror*, 46(2), pp.88-112.

Camidge, K., 2005. *HMS Colossus Debris Field Survey*. Unpublished survey report - available at www.cismas.org.uk. CISMAS.

Camidge, K., 2008. *HMS Colossus Stabilisation & Recording*. Unpublished report for English Heritage.

Camidge, K., 2009. HMS Colossus, an Experimental Site Stabilization. *Conservation and Management of Archaeological Sites*, 11(2), pp.161-88.

Camidge, K., 2014. *HMS Colossus Sediment Level Monitoring 2014 (EH6935)*. Unpublished report for English Heritage. CISMAS.

Caruana, A., 1994. *The History of English Sea Ordnance 1523-1875*. Rotherfield, East Sussex: Jean Boudriot Publications.

Falconer, W., 1780. *An Universal Dictionary of the Marine*. London: T Cadell.

Lavery, B., 2003. *The 74-Gun Ship Bellona*. London: Conway Maritime Press.

Lees, J., 1990. *The Masting and Rigging of English Ships of War 1625-1860*. London: Conway Maritime Press.

Mountainte, W., 1747. *The Practical Sea-Gunner's Companion: or an Introduction to the Art of Gunnery*. London: Mount & Page.

Sanders, D., 2010. Knowing the Ropes: The Need to Record Ropes and Rigging on Wreck-Sites and Some Techniques for Doing So. *IJNA*, 39(1), pp.2-26.