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Excavation and Analysis

Conservation of surface recovered artefacts from the *Invincible*, protected shipwreck site

Angela Middleton, Dan Pascoe, Sarah Paynter

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HMS Invincible
Horse Tail Sand
Hampshire

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SUMMARY
This report summarises the conservation and analysis of surface recovered artefacts from the *HMS Invincible* protected wreck site.

CONTRIBUTORS
Angela Middleton oversaw the production of this report and provided the following sections: Introduction, Conservation, Conclusion, Appendix 1. Dan Pascoe wrote the following sections: The Ship, Site History, Surface Recovery and Description of artefacts. Sarah Paynter wrote: Material Analysis.

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ARCHIVE LOCATION
Historic Dockyard Trust,
The Sail & Colour Loft,
The Historic Dockyard,
Chatham,
Kent ME4 4TE

DATE OF CONSERVATION AND ANALYSIS
The conservation and analysis took place between August 2015 and October 2016.

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INTRODUCTION

The wreck of the *Invincible* has been protected under the Protection of Wrecks Act 1973 since 1980. Much of the early work was carried out by the then licensee holder John Bingeman and his work has contributed to research into life on-board and naval warfare of the 18th century (Bingeman 2010).

At the end of 2009 John Bingeman retired as Licensee and passed his research on to Dan Pascoe who subsequently became the site Licensee. Various aspects of his work have been funded by Historic England; mainly focusing on recording newly exposed sections of the wreck, monitoring sediment levels and enhancing access to the site by increasing interpretation.

THE SHIP

L'Invincible was launched in 1744 at Rochefort in France. She was among the first of three '74 gunships' designed and built by the French (Bingeman 2010, 5). She was captured in 1747 while fighting a superior British force commanded by Admiral Anson off the Cape of Finisterre. The *Invincible*[1] was so impressive that she influenced the design of British warships and the 74-gunship went onto become the backbone of the Royal Navy. Her influence can be gauged by the fact that over fifty years later more than half of the ships fighting at the battle of Trafalgar were 74's.

She was the Royal Navy's first *Invincible*, the ship to change the design of British warships. This is why the remains on the seabed are so important and need to be recorded and preserved.

The *Invincible* wrecked on Horse Tail Sand in the Eastern Solent in February 1758. The wreck is designated under the Protection of Wrecks Act 1973. The Statutory Instrument is Order 1980 No. 1307. The restricted area is a circle with a radius of 100 meters from the point, 50º44.34'N 001º02.23'W.

[1] Since the **HMS Invincible** sank in 1758, the name has been given to subsequent ships. To distinguish her from later ships, this one is referred to as the first *HMS Invincible*.

SITE HISTORY

The wreck was discovered by local fisherman, Arthur Mack, in 1979. Understanding the significance of the site, Arthur enlisted Commander John Bingeman to investigate the wreck archaeologically. J. Bingeman had previous experience of coordinating archaeological investigations on the sites of the *Pomone* and *Assurance*, wrecked off the Needles. The site was designated in 1980 and J. Bingeman became the Licensee.

Surveys revealed the remains of the starboard side had broken off and lay scattered to the north and east of the portside. A sub-bottom profile survey by the University of Southampton in the late 1990's revealed that substantial remains associated with the starboard side lay buried just beneath the surface (Quinn et al. 1998). Some of the exposed remains were surveyed but have never been excavated. The most recent investigations on the site by the present Licensee have discovered exposed areas that have not been previously recorded.

J. Bingeman led numerous surveys and excavations on the site between 1980 and 2010. The results of this work revealed the portside was intact from bow to stern and from parts of the gundeck down to the floor timbers, with numerous artefacts preserved within. These relate to all aspects of shipboard life, and their recovery and subsequent study has offered unique insights into life on-board a ship of the mid-eighteenth century.

The archive repository is Chatham Historic Dockyard, where some artefacts have recently gone back on public view in the Command of the Oceans exhibition.

SURFACE RECOVERY

Since 2012 the site has been experiencing a loss of sediment cover. This has resulted in further exposure of ship's structure and artefacts. This exposure of the site led to it being issued with a surface recovery license in 2012, which was in place until 2016. The artefacts, particularly the organic ones are vulnerable to physical and biological decay. It is therefore necessary to recover them before they deteriorate any further.

Exposure of the main site (port side) extends from the stern to the bow. In some areas sections representing all three surviving decks have become exposed. This is most evident in the bow, where the entire remains of the gundeck are visible, along with increasing structures of the orlop and hold. A proportion of the bow had never been excavated and this area yielded the majority of the artefacts in this report. The images below show the exposed areas of the bow where many of the artefacts have been recovered from (Fig 1-5).

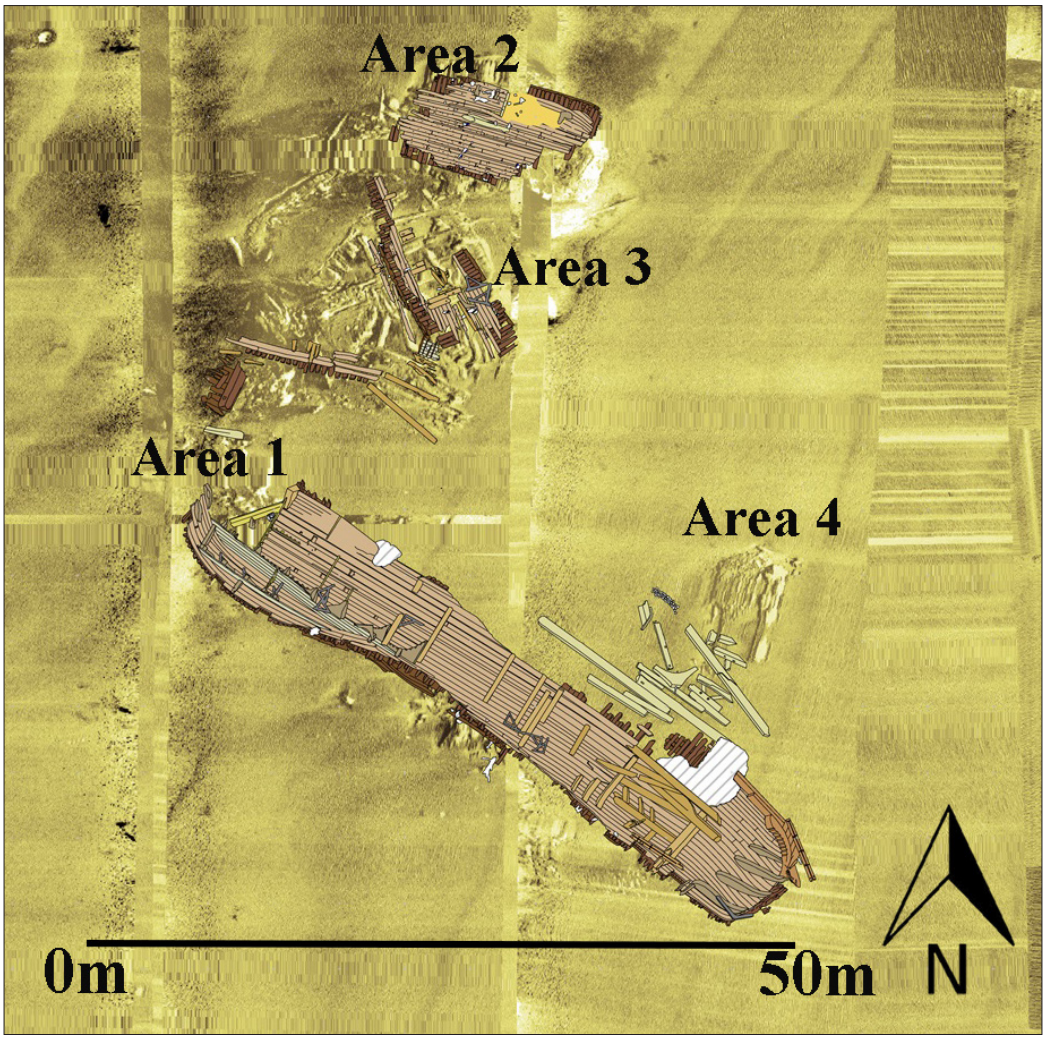

Fig 1: Composite site plans of portside and starboard side remains overlayed on 2014 sidescan sonar image © Bingeman and PAS, SSS © Wessex Archaeology. The portside bow is circled.

Fig 2: View looking NW between the gundeck and orlop (Areal 1) © PAS.

Fig 3: View looking North at cable lying over a pine clad orlop deck (Area 1) © PAS.

In addition to increased exposure of the main site (Area 1 and the whole of the coherent portside), extensive areas to the North consisting of large sections of the starboard side have become increasingly exposed (Areas 2 and 3). Within these areas artefacts have also been found and recovered. Artefacts include a single wooden block, barrel lids and staves.

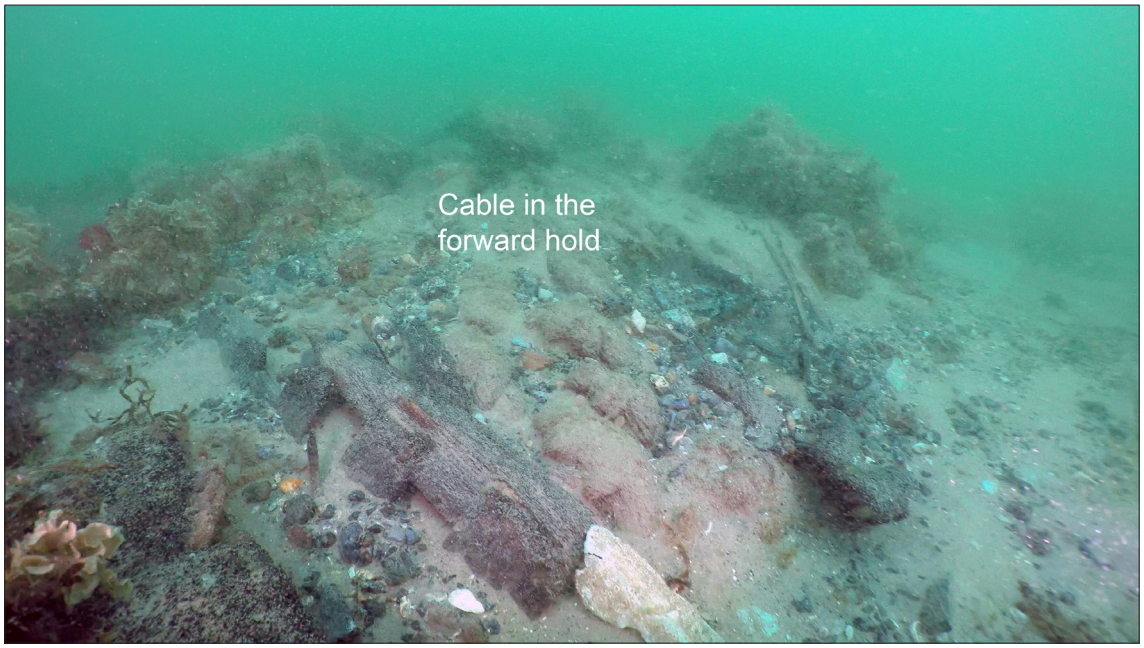

Fig 4: View looking North into the forward hold. Internal structures and artefacts are exposed. The rammer head and copper alloy artefacts have come from this location (Area 1) © PAS.

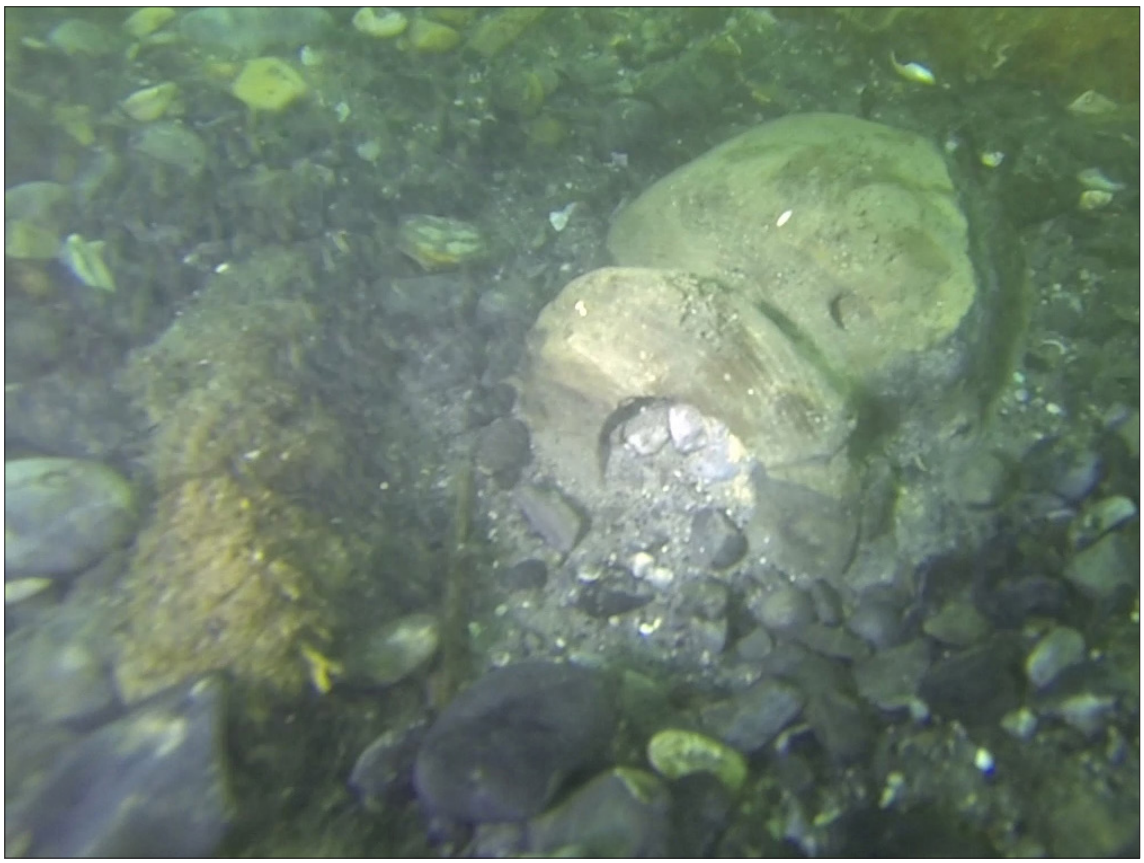

Fig 5: Rammer head found in Area 1 © PAS.

A total of 16 artefacts were lifted as part of surface recovery during 2012-2015 (Table 1).

Table 1: Surface recovered artefacts from Invincible.

SF Number	Area	Object	Material
INV12 A 001	Area 1	Head Pieces (2x)	Wood
INV12 A 002	Area 1	Gunflint	Stone/ Flint
INV12 A 003	Area 1	Lead Shot (1x)	Lead
INV12 A 004 - 006	Area 1	Lead Shot (3x)	Lead
INV13 A 001	Area 1	Small Handle	CuA
INV13 A 002	Area 1	Button	CuA
INV13 A 003	Area 1	Padlock fragment	CuA
INV14 A 001	Area 3	Sheave	Wood
INV14 A 002	Area 3	Head Piece	Wood
INV14 A 003	Area 3	Barrel Stave	Wood
INV14 A 004	Area 2	Pulley and Sheave	Wood
INV14 A 005 - 010	Area 1	Lead Shot (6x)	Lead
INV15 A 001	Area 1	Barrel Key?	CuA
INV15 A 002	Area 1	Button	CuA
INV15 A 003	Area 1	Mount/Screw top?	CuA
INV15 A 004	Area 1	Rammer Head	Wood

CONSERVATION

Assessment

Apart from the lead shot all artefacts were received wet/waterlogged and well packed on 18. 08. 2015. All artefacts were classed as unstable due to being wet/waterlogged. Two wooden artefacts (INV14 A 004 and INV15 A 004) showed signs of marine wood borer damage.

In order to stabilise these artefacts for archive deposition, desalination is required. In the case of the wooden objects this is followed by impregnation with polyethylene glycol (PEG) and subsequent vacuum freeze-drying.

Conservation

Desalination was carried out using distilled water and by checking the conductivity of the storage water. Due to the prolonged wet storage and water changes carried out by Dan Pascoe before the artefacts reached the conservation lab, this stage was completed after 2 weeks for the inorganic and 8 weeks for the organic artefacts.

Inorganic materials such as lead, copper alloys and flint were slowly air dried at ambient conditions.

The wooden artefacts were impregnated with 30% PEG 400 for 3 months followed by 30% PEG 4000 for another 3 months. Artefacts were then pre-frozen for 1 week in a domestic chest freezer at roughly -30°C (Fig 6), before vacuum-freeze drying commenced (Fig 7).

Fig 6: Wooden artefacts during pre-freezing.

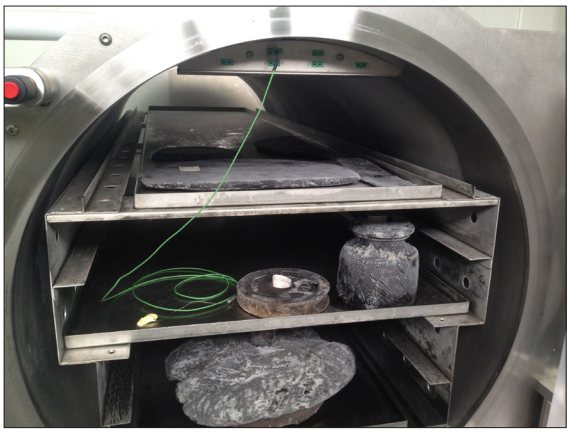

Fig 7: Wooden artefacts inside the vacuum-freeze-drier.

During the vacuum freeze-drying cycle artefacts were weighed. Once the weight loss plateaued off and the wood felt and looked dry, the drying process was considered finished (Appendix 1).

Artefacts were left to acclimatise in ambient conditions. Any excess PEG was removed mechanically using brushes, wooden skewers and dental picks.

MATERIAL ANALYSIS

Two buttons recovered from the *Invincible* were examined. INV13 A 002 is a flat button with a pronounced cone on the back, holding a thin metal strip for attaching the button. INV15 A 002 is a domed button with an integral thick metal loop on the reverse. Both buttons are heavily corroded and INV15 A 002 in particular has a substantial layer of sandy particles adhering to the surface. No trademarks or decoration were discernible by eye.

Buttons are common finds on contemporary sites, and the detailed study of well-dated assemblages can potentially contribute a great deal to the archaeological interpretation, such as the date, the movement of personnel, button production technology and dress regulations. A number of developments in button style and technology have been attributed to the 18th century, and previous studies of finds from the Invincible have already refined this chronology (Bingeman 2010).

Results

The buttons were analysed using portable X-ray fluorescence spectrometry (pXRF) because this is a rapid and non-destructive technique. However the analyses (Table 2) are of the surface, including any corrosion and concretions, and are only a guide to the composition of the original metal (for example, adhering material accounts for the potassium, iron and calcium detected). The reverse of the buttons could not be analysed because of the protrusions.

Table 1: Surface composition of the front of the buttons (element %) using pXRF, bd = below detection limit, normalised.

Button	Sn	Bi	As	Fe	Ti	Ca	K	Pb	Zn	Cu
INV13 A 002	19.4	0.1	0.6	1.1	0.1	1.3	bd	2.1	16.4	58.9
INV15 A 002	bd	bd	0.6	9.7	0.2	0.6	0.9	0.3	5.9	81.9

Button INV13 A 002 appears to be made from a grey metal with an applied copper-rich surface layer. Lead and tin were detected so this button is probably pewter (a lead/tin alloy) with a copper alloy coating, possibly brass (an alloy of copper and zinc), to give it a golden appearance. Similar buttons make up a large proportion of previous button finds from the *Invincible* (Bingeman and Mack 2002). Button INV15 A 002 is probably brass because mainly copper and some zinc were detected. Some dome-shaped buttons had wood or bone backs but this one appears to have a metallic back as well.

Buttons from the *Invincible* are well-dated and warrant typological and technological study, to add to the data for the previously recovered assemblage. XRF analysis can provide an indication of the materials and technologies used in their production, without destructive sampling. However sampling and analysis of one example from each button type using a technique such as SEM-EDS (scanning electron microscopy) would provide confirmation of the XRF results and establish with certainty the method of construction, as well as exposing uncorroded metal for analysis.

Description of artefacts

INV12 A 001 Barrel head pieces (Appendix I, Fig 1-2)

The barrel lid was found and recovered in two parts. It was initially thought that the two parts fitted together to form one complete lid. However, following a closer inspection the two did not match up.

The stamped marking of 'PGC' was recorded at the top of the larger piece, which identified it as a lid of a gun powder barrel (Fig 8). Numerous powder barrels were recovered during the past excavations which had these markings. The smaller fragment was stamped with a broad arrow (Fig 9).

Fig 8: Detail of barrel head piece, with mark 'PGC'.

Fig 9: Detail of barrel head piece with broad arrow.

INV12 A 002 Gunflint (Appendix I, Fig 3-4)

A single wedged shape gunflint was recovered from Area 1. It measured 36mm across the striking edge. Gunflints were fitted to the flint locks of pistols, muskets and on board *Invincible* cannon locks for her 9-pounder guns. *Invincible* was one of thirteen ships selected to trial these new cannon locks (Bingeman 2010:117).There have been five different sizes of gunflints recovered from the site – 42, 38, 36, 32 and 26mm. The two larger sizes are thought to be for the cannon locks so it is likely that this gunflint was for use with a musket.

INV13 A 003 Pistol shot (Appendix I, Fig 5)

This pistol shot was unusual as it had an additional 'lip' for fixing to a paper cartridge (Bingeman 1985:203). The size of the shot was 14mm(1/2 inch). What was also unusual was that this was the first pistol shot with a 'lip' to be found on the site (Bingeman 1985). So far only musket shot with 'lips' had been recovered, making this a new artefact type with regards to the small arms on board.

INV12 A 004-006 Musket shot (x3) (Appendix I, Fig 6)

There were three lead shot recovered from Area 1, of two different diameter sizes: 18mm (3/4 inch) and 16mm (5/8 inch).

INV13 A 001 Copper alloy handle (Appendix I, Fig 7-8)

A small brass handle was found in Area1 near to an exposed spirit barrel. It is not known exactly what it would have been attached to. Due to its size it is likely to have come from a small box or a small piece of furniture.

INV13 A 002 Button (Appendix I, Fig. 9-10)

This pewter button with copper alloy coating was found in Area 1 near to an exposed spirit barrel. The face of the button is flat and has no markings. On the reverse side is a small brass loop where it would have been sewn onto the garment. Numerous brass buttons were found on the site during the excavations and many of these related to the uniforms of the soldiers and marines on-board (Bingeman 2010).

INV13 A 003 Part of a padlock (Appendix I, Fig. 11-12)

This is the front face of a small copper-alloy padlock which was found in Area 1 near to the spirit barrel. A complete example was recovered from the site during the 1980s which aided the identification of this example.

INV14 A 001 Pulley sheave (Appendix I, Fig. 13-14)

The pulley sheave was recovered from next to a rider in Area 3. It is made from a hardwood and the dimensions of the sheave are as follows: the overall diameter is 168mm; the thickness is 28mm and the internal diameter of the sheave is 35mm.

INV14 A 002 Part of a barrel head piece (Appendix I, Fig. 15-16)

The head piece was found on the eastern edge of Area 3, it is a single piece of a two part lid from a small barrel. The condition of the wood is pristine and it is possible to see the cooper's tool marks. The diameter of the lid is 198mm and it has a thickness of 12mm. The edges are chamfered on the inside of the lid.

INV14 A 003 Barrel stave (Appendix I, Fig. 17-18)

The barrel stave was found with the barrel lid but not attached. It is one single stave and part of a small barrel. The stave is 300mm long and 68mm wide at the centre and 5mm thick. There are two recesses on the inside of each end to accommodate the lids.

INV14 A 004 Single pulley block (Appendix I, Fig. 19-22)

The single pulley block was found near control point 07 (CP07) close to the SW corner of Area 2. It is not complete, one side of the outer shell is missing and the surface of the other side has evidence of biological decay. The hardwood sheave and pin are in a very good condition. The overall length of the shell of the block is 360mm (14 inches) and it has a width of 255mm. The hard wood pin has a diameter of 47mm (1 ¾ inches) and a length of 170mm (6 ¾ inches). The sheave has a

diameter of 245mm and a thickness of 50mm. A complete range of sizes of single blocks have been found on *Invincible*, from 5 to 21 inches (Bingeman 2010: 77), so this 14 inch block fits within this range.

INV14 A 005-010 Musket shot (x6) (Appendix I, Fig. 23)

The shot were found on the orlop of the main site close to the iron knees. They range slightly in size from 17–18mm in diameter.

INV15 A 001 Barrel tap key (Appendix I, Fig. 24-25)

This is a small copper alloy tool used to open taps on barrels. It was found in Area 1 amongst an area of exposed cable.

INV15 A 002 Button (Appendix I, Fig. 26-28)

This copper alloy button, probably brass (see above), was also found in Area 1, close to the barrel tap key.

INV15 A 003 Unidentified copper alloy object (Appendix I, Fig. 29-30)

This object was found in Area 1, it is threaded on the inside, possibly for screwing on to another component.

INV15 A 004 24-pounder rammer head (Appendix I, Fig. 31-32)

This object was found in Area 1, near to the exposed cable. It has a 5 ½ inch diameter at the base. There is a letter 'G' punched into the base. This object was either fitted to a solid wooden shaft, known as a rammer or to a stiffened and served rope known as a flexible rammer. They were used to push and pack the shot and charge down the barrel of the guns.

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Bingeman, J. and Mack, A. T., 2002, Appendix B: The dating of military buttons, in J. Bingeman, *The First HMS Invincible (1747-58): Her excavations (1980-1991).* Oxbow Books.

Quinn, R., Adams, J. R., Dix, J. K. and Bull, J. M., 1998. *The Invincible (1758) Site - An Integrated Geophysical Assessment*, in: International Journal for Nautical Archaeology 27.2, pp. 126-38.

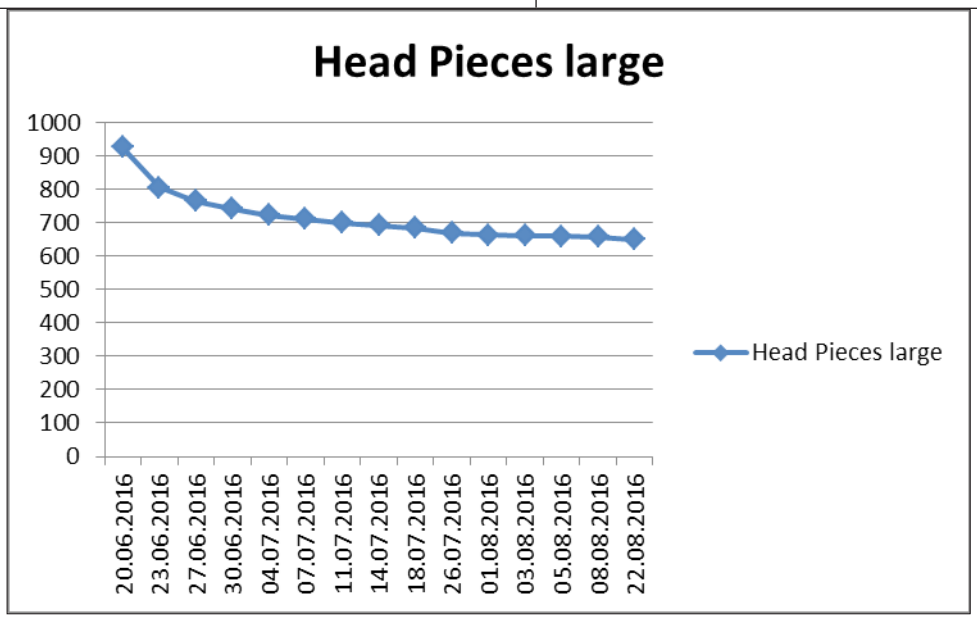
APPENDIX I

Photographic record

Fig 1: INV12 A 001 Barrel head pieces, before conservation.

Fig 2: INV12 A 001 Barrel head pieces, after conservation.

Start Date Drying	20.06.2016
End Date Drying	22.08.2016/ 03.08.2016
Initial Weight	926.2g/ 386.7g
Final Weight	650.9g/ 307.4g



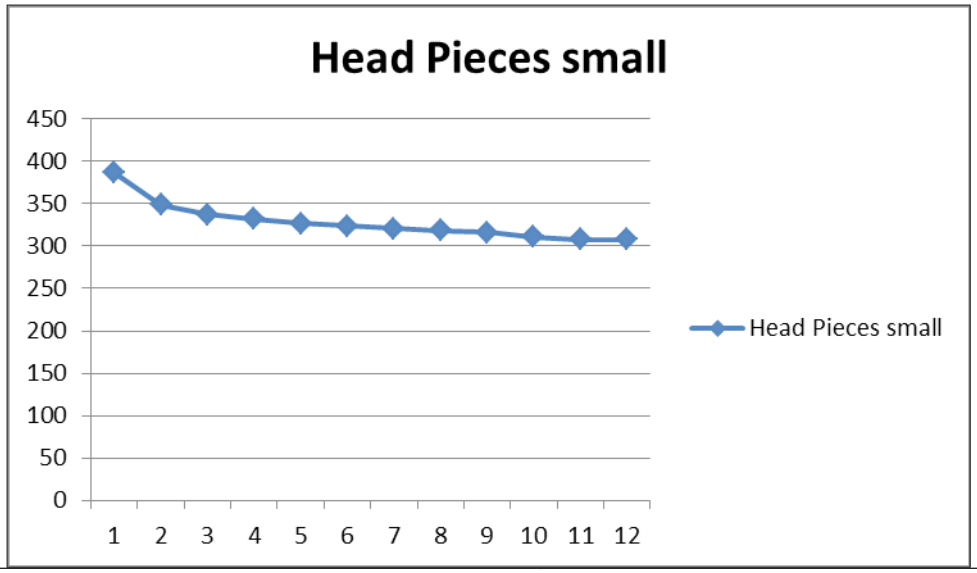


Fig 3: INV12 A 002 Gunflint, before conservation.

Fig 4: INV12 A 002 Gunflint, after conservation.

Fig 5: INV12 A 003 Pistol shot (1x), after conservation.

Fig 6: INV12 A 004-006 Musket shot (3x), after conservation.

Fig 7: INV13 A 001 Copper alloy handle, before conservation.

Fig 8: INV13 A 001 Copper alloy handle, after conservation.

Fig 9: INV13 A 002 Button, before conservation.

Fig 10: INV13 A 002 Button, after conservation.

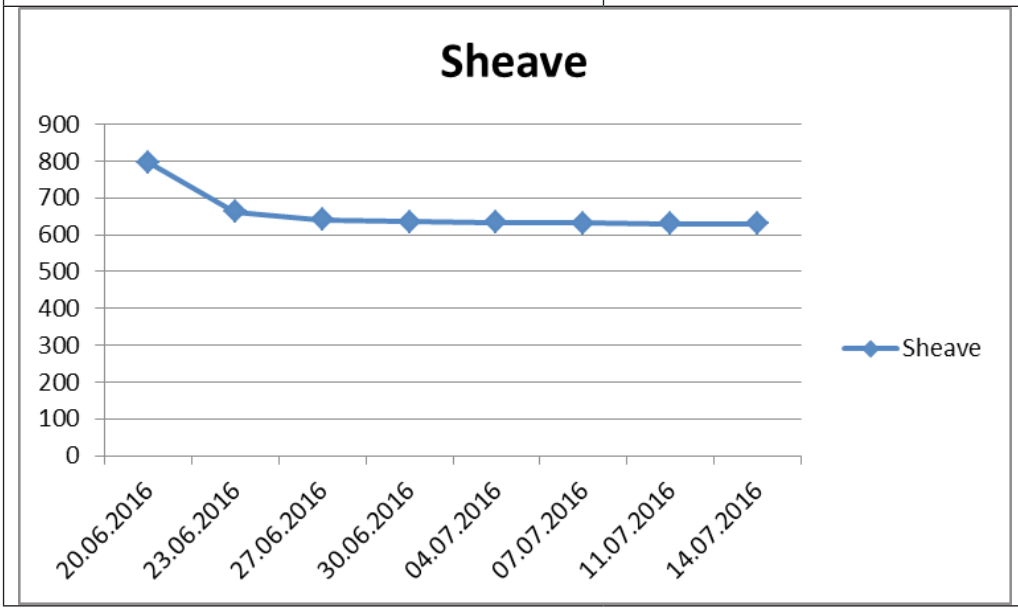
Fig 11: INV13 A 003 Padlock fragment, before conservation.

Fig 12: INV13 A 003 Padlock fragment, after conservation.

Fig 13: INV14 A 001 Pulley Sheave, before conservation.

Fig 14: INV14 A 001 Pulley Sheave, after conservation.

Start Date Drying	20.06.2016
End Date Drying	14.07.2016
Initial Weight	796.7g
Final Weight	629.6g



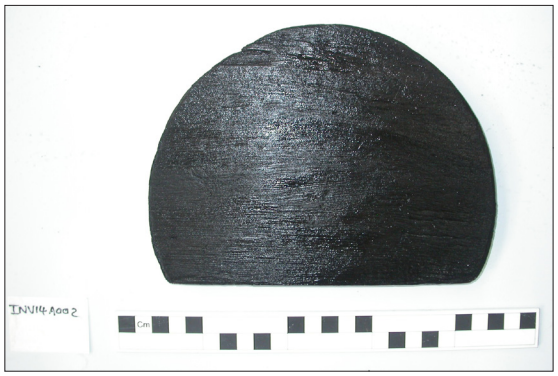


Fig 15: INV14 A 002 Barrel head piece, before conservation.

Fig 16: INV14 A 002 Barrel head piece, after conservation.

Start Date Drying	20.06.2016
End Date Drying	03.08.2016
Initial Weight	266.4g
Final Weight	190.1g

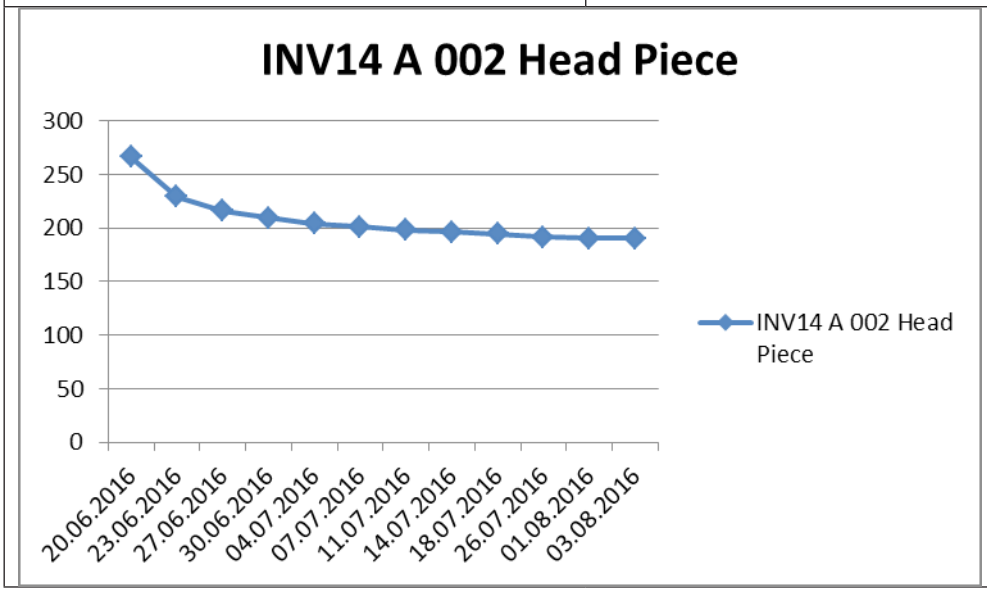


Fig 17: INV14 A 003 Barrel stave, before conservation.

Fig 18: INV14 A 003 Barrel stave, after conservation.

Start Date Drying	20.06.2016
End Date Drying	14.07.2016
Initial Weight	128.5g
Final Weight	73.4g

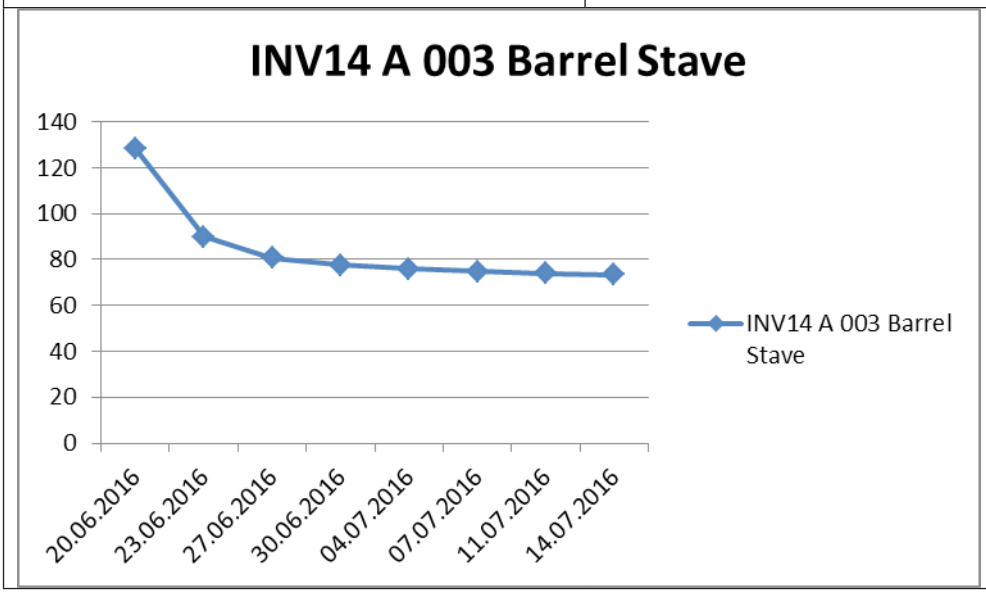


Fig 19: INV14 A 004 Single pulley block, before conservation.

Fig 20: INV14 A 004 Single pulley block, after conservation.

Fig 21: INV14 A 004 Single pulley block, before conservation.

Fig 22: INV14 A 004 Single pulley block, after conservation.

Start Date Drying	20.06.2016
End Date Drying	22.08.2016
Initial Weight	5897.1g
Final Weight	3913.3g

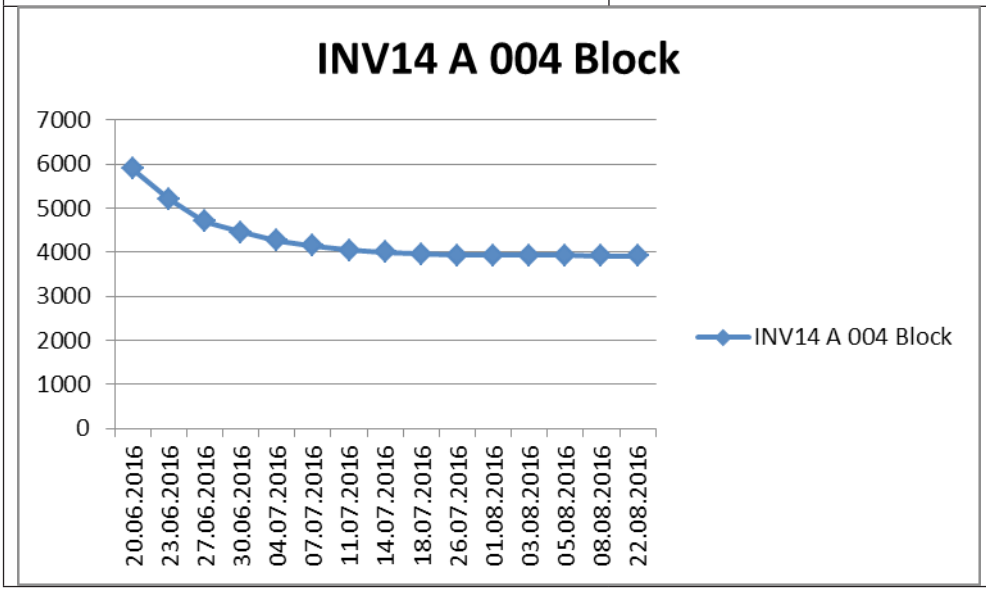


Fig 23: INV14 A 005-010 Musket shot (x6), after conservation.

Fig 24: INV15 A 001 Barrel tap key, before conservation.

Fig 25: INV15 A 001 Barrel tap key, after conservation.

Fig 26: INV15 A 002 Button, before conservation.

Fig 27: INV15 A 002 Button, after conservation.

Fig 28: INV15 A 002 Button, before conservation.

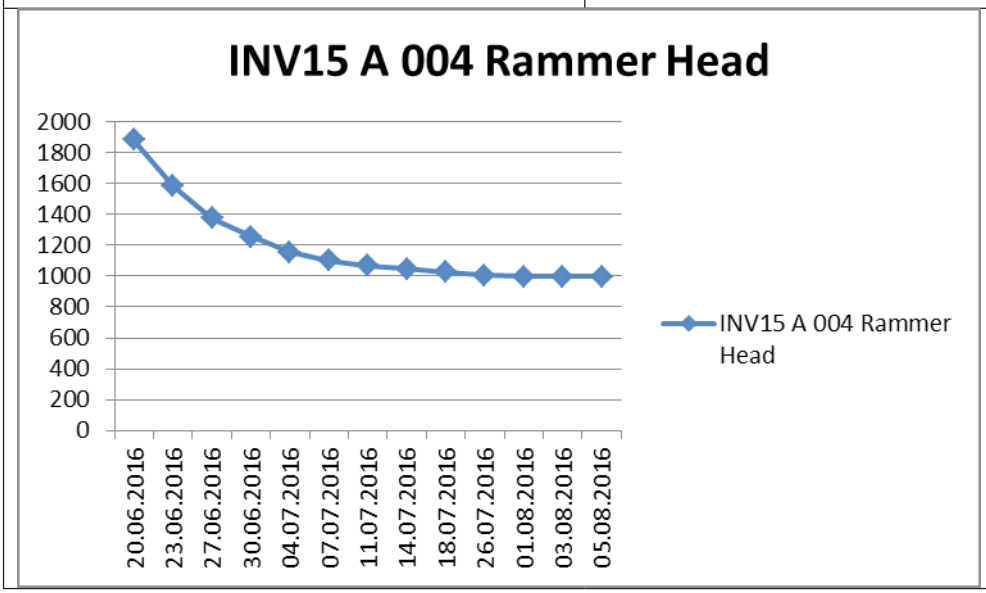
Fig 29: INV15 A 003 Unidentified copper alloy object, before conservation.

Fig 30: Unidentified copper alloy object, after conservation.

Fig 31: INV15 A 004 24-pounder rammer head, before conservation.

Fig 32: INV15 A 004 24-pounder rammer head, after conservation.

Start Date Drying	20.06.2016
End Date Drying	05.08.2016
Initial Weight	1883.6g
Final Weight	995.7g



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