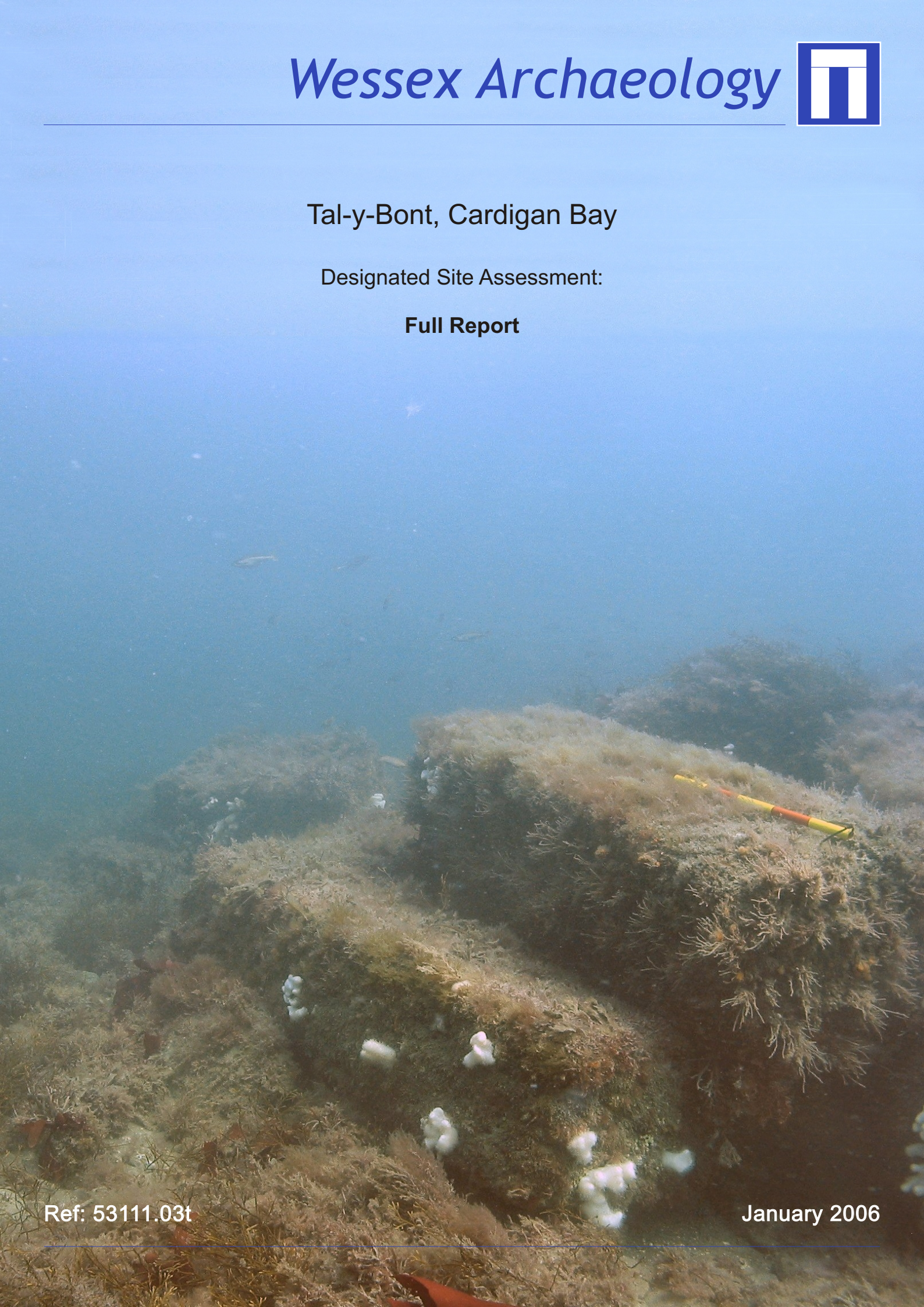
Wessex Archaeology

Tal-y-Bont, Cardigan Bay

Designated Site Assessment:

Full Report



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January 2006

ARCHAEOLOGICAL SERVICES IN RELATION TO THE PROTECTION OF WRECKS ACT (1973)

TAL-Y-BONT, CARDIGAN BAY, WALES

DESIGNATED SITE ASSESSMENT: FULL REPORT

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Summary

'Numbers of vessels have been lost here owing, in great measure, to Captain Collins' chart which makes 10 and 17 fathoms in the very middle of it, when it is correctly ascertained to become dry the last ebb quarter ebb; and he is too closely followed by all our mercenary chart contrivers, few of whom ever saw the places they pretend to describe' (William Morris 1801: commenting on the failure of Captain Collins to chart Sarn Badrig in the late 17th century).

Wessex Archaeology was commissioned by CADW to undertake a designated site assessment of the Tal-y-Bont wreck: a designated wreck site located within Cardigan Bay, Wales. The work was undertaken as part of the contract for Archaeological Services in Relation to the Protection of Wrecks Act (1973).

The site is probably the remains of a Genoese merchant vessel lost in 1709 whilst carrying a cargo including a substantial quantity of marble blocks, although it is possible that artefacts from an earlier vessel are also present on the site. The site currently comprises a low mound of marble blocks surrounded by a scatter of cast and wrought iron guns and anchors, although a debris field is reported to exist between the site and the shore. The site was discovered in 1978 and has since been the subject of both survey and excavation. Although a large number of finds from the site are currently displayed in Barmouth, it has not yet been comprehensively published, and the archive remains in private hands.

The overall objective for site operations as defined by CADW was for recording to Level 3a, with emphasis upon producing a full photographic record of archaeological features in the vicinity of the cargo mound.

Diving operations were conducted in May 2004. Total bottom time was 1317 minutes was achieved during 19 dives. Almost all of the artefacts shown on the existing site plan were located and surveyed. Geo-referenced site positions were acquired for all features and each was also recorded using still and video photography, hand tape measurements and text descriptions. Extensive use was made of panoramic and mosaic photography.

Although the results achieved are unlikely to radically change the archaeological interpretation of the site, they do represent a comprehensive and accessible record, and are therefore capable of forming the basis of a future monitoring program. The site requires the development of a formal management plan involving all interested parties, and post-excavation work leading to full publication of existing fieldwork results should be a priority.

TAL-Y-BONT, CARDIGAN BAY, WALES

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Acknowledgements

This investigation was commissioned by CADW as part of the contract for Archaeological Services in Relation to the Protection of Wrecks Act (1973). The assistance provided by Sian Rees of CADW is gratefully acknowledged.

Wessex Archaeology would also like to thank the following people:

- Antony Iles for background information concerning the recording, archive, publication history and condition of the site;
- Ian Cundy and Sue Barker of Malvern Archaeological Diving Unit for general background information, sketch plans of the cargo mound and a site plan;
- Michael Bowyer, 2004 site Licensee, for information and advice concerning diving conditions, and a copy of a site plan;
- Haven Pwllheli;
- Holyhead MRSC.

The fieldwork was carried out by Graham Scott, Simon Adey-Davies, Jenny Black and Frank Mallon, with assistance from vessel master David Burden. Graham Scott supervised the fieldwork and Graham Scott and Simon Adey-Davies supervised the diving operations. The report was compiled by Graham Scott and edited by Steve Webster. Kitty Brandon prepared the illustrations and the project was managed for Wessex Archaeology by Steve Webster.

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- Digital use of Chart No. 1971

A copy of the report will be sent to UKHO.

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1. INTRODUCTION

1.1.1. This document constitutes a Designated Site Assessment: Full Report for a programme of archaeological work undertaken as part of the contract for Archaeological Services in Relation to the Protection of Wrecks Act (1973). The document has been prepared by Wessex Archaeology (WA) for CADW. It constitutes an assessment of the designated wreck site usually referred to as the 'Bronze Bell site' or Tal-y-Bont, located near Sarn Badrig (St Patrick's Causeway), Cardigan Bay, Wales (**Figure 1**).

1.1.2. The work was conducted in accordance with a verbal brief provided by CADW. Surface supplied diving operations, conducted in accordance with the Inland/Inshore ACOP, took place between 16th and 23rd May 2004 from the diving support vessel *Xplorer*.

2. OBJECTIVES

2.1.1. The overall objective for site operations as defined by CADW was for recording to Level 3a, with emphasis upon producing a full photographic record of archaeological features in the vicinity of the cargo mound.

2.1.2. This was further defined, specifying the following tasks:

- preparation of a geo-referenced site plan showing the location of the main exposed archaeological features;
- validation of the site plan received from the Licensee to determine its accuracy and completeness and to determine which archaeological features remained on the seabed;
- photographic and measured survey of all exposed features located;
- preparation of mosaic photographs for the purposes of survey and monitoring of the site;
- preparation of monitoring photographs.

3. EXISTING SITE DATA

3.1.1. The position of the site as given in the brief was as follows:

Lat.	**52º 46.73" N**
Long.	**04º 07.53" W**
WGS 84	

3.1.2. The following data was available prior to commencement of fieldwork:

- the UK Hydrographic Office (UKHO) record;
- data received from RCAHMW: consisting of a newspaper cutting, a copy of a Mariner's Mirror article (on the marble cargo of the site) and an RDF Media Ltd report dated November 2003;
- data received from NMR: comprising fieldwork reports dated 1979 (Sydney Wignall and others) and October 1987 (Angus Konstam), together with various other miscellaneous documents including various application documents and ADU reports;
- a site plan that appears to be dated 1981 received from Mr Bowyer (**Figure 2**), together with verbal information concerning the current archaeological status of the site;
- advice from Mr Bowyer and Mr Ian Cundy (2004 licensee of the nearby *Diamond* designated site) concerning diving conditions.

3.1.3. Immediately prior to the commencement of fieldwork, photocopies of a chart of the site area published in 1748 (Morris 1748) were obtained during a visit to Gwynedd Archives.

3.1.4. Some documents were given to WA by Mr Cundy and Ms Sue Barker of MADU shortly after the completion of fieldwork. This included a site plan apparently dated 1986, a sketch plan of the cargo mound dated 1999, and a number of survey sheets concerning individual marble blocks. Significant differences between the site plans provided by Mr Bowyer and Mr Cundy can be observed.

3.1.5. WA gained access to ADU video and still photography whilst it was temporarily deposited at the NMR Swindon in late 2004. None of this material was catalogued and the video footage has not been examined in detail. The 35 still slides appear to have been taken during an ADU site visit in 1997, and were largely unlabelled and unsorted. Although visibility appears to have been moderate, image quality is generally low and no use was made of camera scales. In very few could the subject feature be identified. The still photographic archive appears to have only partially survived. In one surface shot an ADU member of staff can be seen taking a photograph of the bronze bell from the site. However, the photograph of the bell does not appear in the archive.

3.1.6. WA also received the ADU hard copy archive late in 2004, following its release to CADW. This consists of:

- ADU reports to ACHWS;
- various correspondence;
- various maps and plans, including a poorly annotated site plan that appears to be dated 1999;
- dive logs (this may be a partial record only);
- various printed artefact lists;
- a site report (Wignall 1979).

4. HISTORY OF SITE INVESTIGATIONS PRIOR TO MAY 2004

4.1.1. A comprehensive history of site investigations does not appear to have been published. This appears to have led to some confusion as to what work has and has not been undertaken. Nevertheless review of the available documentary evidence suggests the following outline history.

4.1.2. **Pre-1978:** An isolated report exists which claims that the site was found as a result of a magnetometer survey in 1966 (e-mail from Phil Mycock 2003). The claimant stated that four bronze guns, many iron guns and a bronze bell were found, and that three of the bronze guns were salvaged and sold. The report does not state why the fourth bronze gun and the bell were not recovered. The fact that no subsequent reporter has mentioned the presence of bronze gun(s) may suggest that this report is unreliable.

4.1.3. **1978:** The site was found in 1978 by a group of local avocational divers, that subsequently became the Cae Nest Group. The site was designated in 1979.

4.1.4. **1979:** Led by Sidney Wignall (an independent wreck investigator), John Illsley and Robin Livens of University College of North Wales Bangor, the group undertook a program of survey and investigation in 1979. This culminated in the limited circulation publication of a report dated the same year (ADU reports appear to state that it was actually published in 1981). Note: the application submitted in respect of designation in 1978 includes a site plan, which suggests that some survey work must have been undertaken in that year.

4.1.5. **1980-86:** The precise history of the fieldwork investigations that then took place on the site between 1980 and 1987 is unclear. However, it appears that the Cae Nest Group investigations continued and that various phases of survey and excavation work may have taken place.

4.1.6. In 1982 an investigation by John Illsley into the source and likely destination of the marble blocks present on the site was published in The Mariner's Mirror.

4.1.7. **1987:** Although the main phase of site investigations appears to have been over by 1982, another season of excavation took place in 1987 under the direction of Angus Konstam of the Royal Armouries. An unpublished interim report on this work was produced and circulated in the same year (Konstam 1987). It appears that some detailed survey and post-excavation work was undertaken in relation to the sites guns but this does not appear to have been published in detail.

4.1.8. **Post-1987:** It appears that little post-1987 fieldwork has been undertaken on the site, and in recent years work has been limited to the occasional monitoring visit (M Bowyer pers. comm.). It appears from a letter written in 1998 to CADW by Mr Bowyer that further survey work took place but that this was limited to checking measurements of the marble mound, and remains unpublished.

4.1.9. In 2003 a TV documentary was produced on the site, and this was subsequently shown as part of a series entitled 'Wreck Detectives' on Channel 4. Limited fieldwork was undertaken on the site for the purposes of filming and some historical

research was undertaken into the source of the marble. This does not appear to have been published, other than in a televised format.

4.1.10. The 2004 Licensee ventured the opinion to WA prior to WA fieldwork that survey work on the site was effectively complete (M Bowyer, pers. comm.).

5. STATUS OF ARCHAEOLOGICAL RECORD IN MAY 2004

5.1.1. Prior to the commencement of fieldwork in 2004, Mr Bowyer gave the following verbal briefing to WA (M Bowyer, pers. comm.):

- The site plan was not geo-referenced but the area shown was believed to lie entirely within the designated area.
- The site consisted of the area shown in **Figure 2** and a debris trail to the north and north-east which was believed to extend at least as far as the low water mark.
- The site had been surveyed using simple triangulation techniques. The plan needed updating to reflect changes in the disposition of artefacts and possible inaccuracies. This revision had not been undertaken. The debris trail had not been surveyed. Although limited surveys of the marble blocks had been undertaken, no detailed plan existed. The blocks had not been resurveyed recently.
- Mr Bowyer stated that significant areas of the area covered by **Figure 2** had been excavated, but he was unable to provide positions for the trenches. He was also unable to explain the numbering and lettering sequences on this site plan.
- Mr Bowyer stated that no distribution plan existed for the finds recovered from the site, as the site was 'dynamic', i.e. presumably the distribution of artefacts was not recorded because they were thought to be mobile and therefore not *in situ*. Mr Bowyer was unable to furnish WA with a list of excavated finds.
- There was no monitoring regime in place and no current plans for further survey work. Archaeological features remaining on the seabed were largely unrecorded. No features had been photographed or otherwise recorded recently (Mr Bowyer was unable to confirm the extent of the site photographic archive). Mr Bowyer did not know which site datums remained in place. He believed that some were missing.
- Excavation and survey records were currently in the hands of the 'Cae Nest Group', a group of four persons who had been involved in the fieldwork, included Mr Bowyer. There was no central repository. There was currently no facility for public access, although requests for information by third parties would be considered.
- Mr Bowyer stated that he wished to publish the site in the journal 'Maritime Wales' but that the paper had not yet been written. It did not appear from his comments that this article would amount to a full report.

5.1.2. Prior to fieldwork, WA was unable to establish whether any of the artefacts shown in **Figure 2** had been recovered since the plan was compiled.

5.1.3. Much of the fieldwork that has taken place on the site has not been published. WA has examined an unpublished limited circulation interim report compiled in 1979 (Wignall 1979) and a short excavation report compiled by Angus Konstam in 1987 for ACHWS. Otherwise reports have been limited to summaries presumably included in annual Licensee Reports, to which WA has only had very limited access.

5.1.4. Shortly after the completion of WA fieldwork in 2004, a collection of finds from the site were put on display in a purpose designed exhibition in Barmouth. Mr Iles has confirmed that all of the finds recovered up to 1982 are currently displayed (A Iles, pers. comm.). A sculpted memorial has been created from a marble block raised under licence from the site, and this is currently on public display in Barmouth.

6. METHODOLOGY

6.1.1. Fieldwork was undertaken by tracked diver survey, diver survey (still photography), diver survey (video), diver survey (photo-mosaic), and diver survey (feature measurement and description) (WA 2003). Task-specific details are as follows:

- The site was searched and a geo-referenced site plan of all archaeological features located using a Sonardyne Prospector LBL acoustic tracking system. The positions and orientations of archaeological features recorded by WA were then compared with the existing site plan.
- All archaeological features located were tagged and photographed. In addition selected dimensions of archaeological features were recorded using hand tapes, and feature orientations were obtained by compass bearings.
- Photo-mosaics were prepared of the areas of the site that contained archaeological features, including the ‘marble mound’.
- Monitoring photographs, including panoramic photographs of the ‘marble mound’, were also taken using a digital stills camera.

6.1.2. A total of four divers were available with, in accordance with normal surface supplied diving practice, one diver in the water at any one time. Diving was rotated between all four divers. The work of the diver was directed from the surface by the diving supervisor, usually with the assistance of an archaeological recorder who was responsible for entering information related to the surface by the diver into a database and operating the diver tracking system.

6.1.3. An array of Prospector beacons was deployed of sufficient size to enclose the area shown in **Figure 2**. The array was calibrated using a Fugro dGPS system with a manufacturer quoted accuracy at the time of 0.75m. The transceiver beacon was attached to and floated over the shoulder of the diver. The diver was then tracked around the array and the positions of archaeological features were obtained by positioning the beacon above it. The system relies on line of ‘sight’ and therefore some difficulties were experienced close to the marble mound, as it was sufficiently high to interfere with the passage of the acoustic energy. This resulted in some cases in the diver having to stand over a feature in order for the system to range properly. Thus creating an inherent inaccuracy in the positioning of the beacon. This inaccuracy is subjectively estimated to be in the range 0.1-0.5m.

6.1.4. Full digital colour video footage of the diving operations was recorded using a diver hat-mounted Colourwatch 306 single chip digital inspection camera, recording onto digital video tape. The image produced by this system was displayed in real time on a surface monitor for the use of the diving supervisor and archaeological recorder.

6.1.5. Archaeological features were measured using hand tapes and photographed using either a Canon G2 digital camera with 0.56 wide-angle adapter lens and using natural light or strobe flash, or by 'snatching' still images from the Colourwatch system during post-fieldwork analysis. Photographs were processed using Paint Shop Pro 7 software to remove colour casting and improve contrast. Photo-mosaics were prepared using a simple diver fly-over technique, with hand tapes and 0.5m scales placed on the seabed for reference. Orientations were established using a diver-held compass.

6.1.6. Data gathered by the diver was recorded in real time using hard wire surface communications and entered into an MS Access database. This database was linked to a GIS that also displayed the diver track generated by the tracking system.

6.1.7. The existing licensee numbering system was not followed because the reliability of the supplied plan was unknown, and insufficient information was available to reliably relocate archaeological features on the basis of the existing numbering system. Furthermore significant time could have been wasted in locating them. Most features seen by WA were tagged using circular yellow plastic survey tags incised with the unique feature number (**WA01-WA34**). Features were tagged in the order that they were located, the list of features is presented in **Appendix III**. The tags were not secured to the features but were weighted with a small lead sheet and placed next to or on them. At the end of diving operations most of the tags were recovered.

6.1.8. Because of time constraints no attempt was made to survey the disposition and dimensions of individual blocks of marble in the cargo mound (**WA33**). However, considerable relevant information is contained in the photo-mosaics and monitoring photographs.

6.1.9. The methodologies used during the 2004 PWA survey are detailed in a separate document (WA 2003).

7. RESULTS

7.1. SITE POSITION

Lat.	**52º 46.7479" N**
Long.	**04º 07.6480" W**
WGS 84	

7.1.1. The site position given is for the centre of the cargo mound. It was obtained by tracked diver survey, and is probably accurate to within less than one metre. All the archaeological features surveyed lie within a radius of 40m of this position.

7.2. DIVING CONDITIONS

7.2.1. A total bottom time of 1317 minutes was achieved during 19 dives.

7.2.2. Information received prior to fieldwork suggested that variable visibility was likely to be experienced, and shortly before operations commenced the current Licensee advised that the visibility was likely to be poor because of a plankton bloom. However, no plankton bloom was experienced and the visibility reported by the divers varied from four to over 10 metres. Conditions were generally excellent for photography.

7.2.3. Strong currents were experienced at times and there was some restriction of bottom time as a result. However, this did not significantly affect either the quality or quantity of data.

7.2.4. Weather conditions had no significant impact upon the results achieved and only 0.5 days were lost due to adverse conditions. It would appear from anecdotal information received from Mr Bowyer and others that the incidence of non-operational weather and sea conditions may have been unusually low for this site, although this information is of unknown reliability.

7.3. GEOLOGY, TOPOGRAPHY AND FLORA

7.3.1. The site is situated approximately two kilometres south-east of the East Passage at the shoreward end of Sarn Badrig (St Patrick's Causeway), and approximately 0.75 kilometres south-west of the present shoreline.

7.3.2. Sarn Badrig is one of three low, smooth topped submerged ridges within Cardigan Bay, which project seaward for up to 15 kilometres. These ridges/reefs are covered by gravel, cobbles and boulders and are formed of clast-supported, clayey diamictons (Tappin *et al.* 1994). Garrard and Dobson (1974) inferred that these ridges were the remnants of late glacial median moraines of piedmont glaciers that extended out from valleys in the adjacent Cambrian Mountains. However, this interpretation has been questioned and an alternative explanation, that the ridges are remnants of late-glacial sandur (outwash plain) has been suggested (Tappin *et al.* 1994).

7.3.3. Sarn Badrig itself extends for approximately 15 kilometres south-west of Mochras Point, and forms the boundary between the largely flat-bottomed Tremadoc Bay and Barmouth Bay. Parts of the ridge dry at spring low water. The reef is separated from the present shoreline by the East Passage, a narrow natural channel.

7.3.4. Until the 1740s and the publication of the first accurate charts of the coast of Wales by Morris, Sarn Badrig does not appear to have been charted. Jones (2001: 19) quotes William Morris, who produced a revised edition of his father's charts in 1801, as saying: 'Numbers of vessels have been lost here owing, in great measure, to Captain Collins' chart which makes 10 and 17 fathoms in the very middle of it, when it is correctly ascertained to become dry the last ebb quarter ebb; and he is too closely followed by all our mercenary chart contrivers, few of whom ever saw the places they pretend to describe. '

7.3.5. The seabed in the vicinity of the site appears to be part of a small reef running parallel to the shore (**Figure 1**). The site appears to be fairly flat, although Konstam

records a slight slope towards inshore, 'especially to the north-west of the site' (Konstam 1987: 2). Wignall (1979: 7) states that the site environment consists of a 'boulder slope'. WA did not undertake a depth survey due to time constraints but visual observation suggests that there is little depth variation within the area shown in **Figure 3**.

7.3.6. The seabed surface consists of a surface scatter of poorly sorted cobbles and boulders of various sizes over a poorly sorted layer of sand, shell fragments and gravel (**all Plates**). Excavation in 1987 (Konstam 1987: 3.7) recorded that below this was a layer consisting of 'grey silty clay of varying depth…[that was] very compact…[and had the] consistency of thick mud…[there was an] intrusion of small stones and shells…[and the surface had a] rippled texture'. Below this surface layer the excavation recorded a 'sand and silt layer [forming a] firm, light grey deposit'. Konstam considered this to be the 'natural seabed level' and immobile, which suggests that he considered this layer to be representative of the pre-wrecking event seabed surface. Unfortunately although Konstam states that the depth of this layer was variable, he gives no measurements, this may be because the context boundaries were hard to distinguish.

7.3.7. Wignall (1979: 7) states that immediately to the north and south of the wreck site, the seabed consists 'entirely of sand'. In a letter to CADW in 2000, Michael Bowyer reported that 'a sandbank has now built up on the eastern end of the site'. This sandbank was not observed by WA.

7.3.8. Analysis of flora and fauna was not incorporated in the scope of work. However, a general cover of low growth flora of various species on most hard surfaces was noted. This did not cause any difficulties for general visual inspection and artefact location but was sufficiently thick to require rough cutting for the purposes of detailed archaeological feature photography. Various faunal species were also noted, in particular a number of species of crustacea and chordata, including hyas araneus (spider crab) and scyliohinus canicula (dogfish). Generally WA operations appeared to have minimal impact upon the site environment.

7.4. ARCHAEOLOGICAL FEATURES – GENERAL

7.4.1. The site is approximately centred upon a low mound of large marble blocks covering an area of approximately 10 x 11m. All of the features located by WA lie within 25m of the nominal centre of this mound. The total area encompassed by the features described below is approximately 920m^2. Most of the iron guns are concentrated to the south-west of the mound, although there are a scatter of others to the north, south-east and west. The anchors are located at the approximate south-west and eastern extremities of the site.

7.4.2. The archaeological assemblage consists of three main groups of artefacts: iron guns, anchors or fragments thereof and marble blocks. The only variation form this list was the discovery of a small potsherd.

7.4.3. Further archaeological material has been located to the north and north-east, between the site and the present shoreline (M Bowyer pers. comm.). This area could not be surveyed due to time constraints. Wignall (1979: 7 and 30-32) states that 'Small patches of accretions of oxide extend shore-wards in a North Easterly direction'. This

area of the site has not been fully surveyed or recorded (M Bowyer pers. comm.) and its extent and character appears to be uncertain. A significant number of 17th century coin finds have been made on the shore above the mean low water mark, and these may be associated with the site (Wignall 1979: 30-32).

7.4.4. Some debris from previous fieldwork, including an old planning frame, were observed. Due to time constraints no attempt was made to survey or otherwise record this material. None of the former excavation trenches were observed.

7.5. ARCHAEOLOGICAL FEATURES –TRACKED DIVER SURVEY

7.5.1. The results of the tracked diver survey are shown graphically in **Figure 3**. All of the archaeological features were positioned by tracked diver survey, with an accuracy of +/- 0.5m. In addition the area of seabed covered by the marble mound was calculated approximately by tracking a diver around the edge of the mound.

7.6. ARCHAEOLOGICAL FEATURES – DESCRIPTION AND MEASUREMENTS

7.6.1. Summary descriptions and hand tape measurements, together with feature orientations are given in **Appendices III** and **IV**. Due to time constraints only selected measurements could be taken. Distances from the marble block mound are the closest points and have been calculated using the diver tracking results. Where available, average positions have been used for this purpose.

7.6.2. All of the iron features were moderately or heavily concreted and covered with low growing flora of various types. Although the flora was coarse cut, concretion was not removed. Therefore measurements should only be treated as approximate. This is particularly so in the case of the iron guns. Features such as base rings were difficult to discern and therefore base ring to muzzle face measurements should be treated with particular caution. Furthermore the bore diameter was in all cases obscured by a variable depth of concretion. As a result it did not prove possible to determine the size of shot that could have been fired from them with any reliability. On occasion two sets of measurements were taken which could not be reconciled suggesting that the divers encountered difficulties in identifying the appropriate measurement points.

Ordnance

7.6.3. A total of 26 iron guns were observed and recorded. The longest (**WA10**) had an overall length of 2.93m and the shortest (**WA32**) was 1.65m long. A wide variety of lengths were noted, although they fit broadly into two groups, a group with an overall length of 2.50-2.93m and a smaller group with lengths ranging between 1.65 and 2.00m. All were moderately or heavily concreted and few details of their form could be distinguished. All of the guns, with the possible exception of **WA23**, appear from their form to be cast iron. It is likely that **WA23** is a wrought iron gun.

7.6.4. **WA01** is a heavily concreted iron gun that lies to the east of the marble block mound. Its overall length is approximately 2.38m. The muzzle, cascabel and button could be clearly distinguished, in particular no base ring or reinforces could be clearly seen, and there was no visible tampion. Although concreted, the muzzle did appear to have a slight flare. The gun lies partly on its side with one trunnion visible, which was offset and straight. The form of the gun indicates that it is of cast iron

construction. The orientation, cascabel to muzzle, was not recorded but can be estimated as 315 degrees.

7.6.5. **WA04** is a heavily concreted iron gun lying partly under the shank of anchor **WA03** on the eastern edge of the site (**Figure 3** and **Plate 4b**). Its overall length is approximately 2.75m, with a base ring to muzzle face measurement of 2.57m. The muzzle, cascabel, button and the approximate position of the base ring could be distinguished. No protruding tampion could be seen in the bore (**Plate 3f**). The gun was partly on its side and the visible trunnion appeared to be offset. The form of the gun indicated that it is of cast iron construction. The orientation, muzzle to cascabel, is 295 degrees.

7.6.6. **WA05** is a moderately concreted iron gun that lay to the north of **WA04** and **WA03** on the eastern edge of the site (**Figure 3**). Overall length is approximately 2.72m with a base ring to muzzle face measurement of 2.47m. The muzzle, cascabel (**Plate 3a**), button and the approximate position of the base ring, together with the first reinforce ring could be distinguished. No protruding tampion could be seen in the bore. The gun was on its side and a trunnion was visible. The trunnion appeared to be straight and appears from photographic evidence to be either central or slightly offset. The form of the gun indicated that it is of cast iron construction. Orientation was not recorded but on the basis of the photographs, cascabel to muzzle, it appears to be orientated west - east.

7.6.7. **WA07** is a heavily concreted iron gun lying approximately 7m to the north of **WA02** and approximately 7.5m east-north-east of the mound (**Figure 3**). Its overall length is approximately 2.73m with a base ring to muzzle face measurement of 2.52m. The muzzle, cascabel, button and the approximate position of the base ring could be distinguished. The bore did not appear to be open, although the outline of a tampion could not be seen. The gun was on its side and a trunnion, that appeared to be offset, was visible. The form of the gun indicated that it is of cast iron construction. Its orientation, cascabel to muzzle, is 320 degrees.

7.6.8. **WA08** is another heavily concreted iron gun lying approximately 8m south-east of the mound (**Figure 3**). Its overall length is approximately 2.55m with a base ring to muzzle face measurement of 2.30m. The muzzle, cascabel, button and the approximate position of the base ring could be distinguished. No protruding tampion could be seen in the bore. The gun lies partly on its side and a trunnion, that appeared to be offset, was visible. The form of the gun indicated that it is of cast iron construction. Its orientation, cascabel to muzzle, is 145 degrees.

7.6.9. **WA09** is another heavily concreted iron gun lying approximately 6m south-east of the mound, and to the north west of **WA08** (**Figure 3**). The overall length of the gun is approximately 2.74m, with a base ring to muzzle face measurement of 2.50m. The muzzle cascabel, button and the approximate position of the base ring could be distinguished. No protruding tampion could be seen in the bore. The gun lies partly on its side and a trunnion, that appeared to be offset, was visible. The gun lies on a local high point in the seabed, with the result that a significant part of its length is in freespan. The form of the gun indicated that it is of cast iron construction. Its orientation, cascabel to muzzle, is 220 degrees.

7.6.10. **WA10** is a heavily concreted iron gun lying approximately 3.6m south-east of the mound and very close to WA09 (**Plate 16a-b**). Overall length is approximately 2.93m with a base ring to muzzle face measurement of 2.70m. The muzzle, cascabel, button and the approximate position of the base ring could be distinguished. No protruding tampion could be seen in the bore. The gun lies partly on its side and a trunnion that appeared to be offset was visible, together with what may be a separate small object concreted to it. The form of the gun indicated that it is of cast iron construction. Its orientation, cascabel to muzzle, is 320 degrees.

7.6.11. **WA12** is a heavily concreted iron gun lying between 2m and 3m north of the mound, and very close to **WA13** (**Figure 3**). Its overall length is approximately 2.70m, with a base ring to muzzle face measurement of approximately 2.56m. Muzzle, cascabel, button and the approximate position of the base ring could be distinguished. No protruding tampion could be seen in the bore. The gun lies partly on its side and a trunnion was visible, together with what may be a separate small object concreted to it. The form of the gun indicated that it is of cast iron construction. Its orientation, cascabel to muzzle, is 100 degrees.

7.6.12. **WA13** is a moderately concreted iron gun that lies approximately 3.5m north of the mound, and close to **WA12** (**Figure 3** and **Plate 2b**). Its overall length is approximately 2.65/2.56m with a base ring to muzzle face measurement of 2.57/2.40m. The muzzle, cascabel, button and the approximate position of the base ring could be distinguished. No protruding tampion could be seen in the bore. Two straight trunnions were visible and these appear from the photographic record to be offset (**Plate 3d**). The form of the gun indicated that it is of cast iron construction. Its orientation, cascabel to muzzle, is 45 degrees.

7.6.13. **WA14** is a moderately concreted iron gun that lies approximately 5.17m north of the mound and close to **WA13** (**Figure 3**). Its overall length is approximately 1.88m with a base ring to muzzle face measurement of 1.76m. Muzzle (**Plate 3e**), cascabel, button and the approximate position of the base ring could be distinguished No protruding tampion could be seen in the bore. The gun lies on its side and a straight trunnion (**Plate 3c**) that appeared to be offset was visible. The form of the gun indicated that it is of cast iron construction. Its orientation, cascabel to muzzle, is 5 degrees.

7.6.14. **WA15** is a moderately concreted iron gun that lies approximately 8.25m north-north-west of the mound (**Figure 3**). Its overall length is approximately 2.75/2.70m with a base ring to muzzle face measurement of 2.55/2.40m. The muzzle, cascabel, button and the approximate position of the base ring could be distinguished. No protruding tampion could be seen in the bore. The gun lies partly on its side and a straight trunnion, which may have been central, was visible. The form of the gun indicated that it is of cast iron construction. Its orientation, cascabel to muzzle, is 195 degrees.

7.6.15. **WA16** is a heavily concreted iron gun that lies approximately 2.8m south-west of the mound, and close to **WA17** (**Figure 3**). Its overall length is approximately 2.70m with a base ring to muzzle face measurement of 2.50m. The muzzle, cascabel, button and the approximate position of the base ring could be distinguished. No protruding tampion could be seen in the bore. The gun lies on its side and a straight trunnion, which appears from the photographic evidence to be central, was visible. The form of

the gun indicated that it is of cast iron construction. Its orientation, cascabel to muzzle, is 305 degrees.

7.6.16. **WA17** is a heavily concreted iron gun that lies approximately 2.5m south-west of the mound and close to **WA16** (**Figure 3**). Its overall length is approximately 2.62m, with a base ring to muzzle face measurement of 2.45m. The muzzle, cascabel, button and the approximate position of the base ring could be distinguished. No protruding tampion could be seen in the bore. The gun lies on its side and a trunnion was visible. The form of the gun indicated that it is of cast iron construction. Its orientation, cascabel to muzzle, is 260 degrees.

7.6.17. **WA19** is a very heavily concreted iron gun that lies approximately 7.5m west-south-west of the mound, almost touching **WA20** and very close to **WA21** (**Figure 3** and **Plate 2c**). Its overall length is approximately 2.75m with a base ring to muzzle face measurement of 2.60m. The muzzle, cascabel, button and the approximate position of the base ring could be distinguished. No protruding tampion could be seen in the bore. A concretion 'fin' was recorded, this is almost certainly a result of the corrosion process and has probably been caused by the leakage of semi-liquid corrosion product from between the outer hard concretion layer and the corroding surface of the gun. It is likely to have occurred as a result of a pressure differential and to have taken a considerable period of time to form. The form of the gun indicated that it is of cast iron construction. Its orientation, cascabel to muzzle, is 030 degrees.

7.6.18. **WA20** is a very heavily concreted iron gun that lies approximately 7.5m west-south-west of the mound, almost touching **WA19** and very close to **WA21** (**Figure 3** and **Plate 2c**). Its overall length is approximately 2.80m with a base ring to muzzle face measurement of 2.60m. The muzzle, cascabel, button and the approximate position of the base ring could be distinguished. No protruding tampion could be seen in the bore. A concretion 'fin' was noted. The form of the gun indicated that it is of cast iron construction. Its orientation, cascabel to muzzle, is 030 degrees.

7.6.19. **WA21** is a very heavily concreted iron gun that lies approximately 8.54m west south west of the mound, almost touching **WA19** and very close to **WA20** (**Figure 3** and **Plate 2c**). Its overall length is approximately 1.90m with a possible base ring to muzzle face measurement of 1.75m. The muzzle, possible cascabel and possible button were observed. No protruding tampion could be seen in the bore and no trunnions were distinguished. The extent of the concretion obscured the form of the gun and it is possible that it is either is of cast or wrought iron construction. Its orientation, cascabel to muzzle, is 355 degrees.

7.6.20. **WA22** is another heavily concreted iron gun that lies approximately 10m west-south-west of the mound, touching and lying on top of **WA23** (**Figure 3**). Its overall length, estimated from photographs, is approximately 1.60m. The muzzle, possible cascabel and possible button were observed. No protruding tampion could be seen in the bore. The gun appears to have trunnions, but their form could not be determined. The form of the gun indicated that it is of cast iron construction. Its orientation, cascabel to muzzle, is approximately 340 degrees.

7.6.21. **WA23** is another very heavily concreted iron gun that lies approximately 10m west-south-west of the mound, touching and lying under **WA22** (**Figure 3**). The overall

length, estimated from photographs, is 1.60m. A possible tiller was observed, suggesting that the gun might be of the swivel type, but it was not possible to determine whether the gun was of wrought or cast construction. Its orientation, from the possible tiller to the probable muzzle, was approximately 25 degrees.

7.6.22. **WA25** is a heavily concreted iron gun that lies approximately 13.5m west of the mound and close to **WA24** and **WA26** (**Figure 3** and **Plates 2a** and **2d**). Its overall length was approximately 1.95m with a base ring to muzzle face measurement of 1.75m. The muzzle, cascabel, button and the approximate position of the base ring could be distinguished. No protruding tampion could be seen in the bore. The gun lies on its side and a trunnion was visible. The form of the gun indicated that it is of cast iron construction. Its orientation, cascabel to muzzle, is 295 degrees.

7.6.23. **WA26** is a heavily concreted iron gun that lies approximately 14.8m west of the mound and close to **WA25** and **WA27** (**Figure 3** and **Plate 2a**). Its overall length is approximately 2.63m with a base ring to muzzle face measurement of 2.40m. The muzzle, cascabel, button and the approximate position of the base ring could be distinguished. No protruding tampion could be seen in the bore. The gun lies on its side and a trunnion was visible. The form of the gun indicated that it is of cast iron construction. Its orientation, cascabel to muzzle, is 20 degrees.

7.6.24. **WA27** is a heavily concreted iron gun that lies approximately 13.0m west of the mound and close to **WA26** and **WA32** (**Figure 3**). Its overall length is approximately 2.68m with an approximate base ring to muzzle face measurement of 2.43/2.50m. The muzzle, cascabel, button and the approximate position of the base ring could be distinguished. No protruding tampion could be seen in the bore. The gun lies partly on its side and a trunnion was visible. The form of the gun indicated that it is of cast iron construction. Its orientation, cascabel to muzzle, is 90 degrees.

7.6.25. **WA28** is a very heavily concreted iron gun that lies approximately 10.25m west of the mound and close to **WA29-31** (**Figure 3** and **Plate 2e**). Its overall length is approximately 2.75m with a base ring to muzzle face measurement of 2.50m. The muzzle, cascabel, button and the very approximate position of the base ring could be distinguished. No protruding tampion could be seen in the bore. The gun lies partly on its side and a trunnion was visible. The form of the gun indicated that it is of cast iron construction. Its orientation, cascabel to muzzle, is 45 degrees.

7.6.26. **WA29** is another very heavily concreted iron gun that lies approximately 9.1m west of the mound, close to **WA28** and **WA30-31** (**Figure 3** and **Plate 2e**). Its overall length is approximately 2.65m with a base ring to muzzle face measurement of 2.47m. The muzzle, cascabel (**Plate 3b**), button, a trunnion and the very approximate position of the base ring could be distinguished. No protruding tampion could be seen in the bore. The form of the gun indicated that it is of cast iron construction. Its orientation, cascabel to muzzle, is 185 degrees.

7.6.27. **WA30** is another very heavily concreted iron gun that lies approximately 8.8m west of the mound, close to **WA28-29** and **WA31** (**Figure 3** and **Plate 2e**). Its overall length is approximately 1.90m with a base ring to muzzle face measurement of 1.75m. The muzzle, cascabel, button and the very approximate position of the base ring could be distinguished. No protruding tampion could be seen in the bore. The

form of the gun indicated that it is of cast iron construction. Its orientation, cascabel to muzzle, is 340 degrees (estimated from photographic evidence).

7.6.28. **WA31** is another very heavily concreted iron gun that lies approximately 9.45m west of the mound, close to **WA28-29** and **WA30** (**Figure 3** and **Plate 2e**). A possible cascabel, button and the very approximate position of the base ring could be distinguished. The cascabel and part of the barrel is unsupported by the seabed, possibly because the muzzle is pinned under **WA29**. Its overall length was approximately 1.85m with a base ring to muzzle face measurement of 1.70m. The muzzle is obscured by **WA29** and therefore the lengths given can only be considered approximate. The form of the gun indicated that it is probably of cast iron construction. Its orientation, cascabel to muzzle, is 140 degrees.

7.6.29. **WA32** is a very heavily concreted iron gun that lies approximately 12.25m west-north-west of the mound and close to **WA27** (**Figure 3** and **Plate 2f**). Its overall length was approximately 1.65m. The muzzle, cascabel and button could be distinguished. No protruding tampion could be seen in the bore. The gun lies partly on its side and a trunnion was visible. The form of the gun indicated that it is of cast iron construction. Its orientation, cascabel to muzzle, is 160 degrees.

7.6.30. Of the 26 guns located during the survey, 25 appear to be cast iron muzzle loading ordnance of various sizes, that would have been carriage mounted if carried as armament. The remaining gun (**WA23**) appears to be a swivel gun and may have been a wrought iron breech-loaded weapon.

7.6.31. Wignall (1979: 13) stated that 'all cannons except three had their wooden tampions in place in the muzzle'. Although the majority of the guns had their bores blocked, WA cannot positively confirm the presence of tampions.

Anchors

7.6.32. A total of three anchors were recorded. All were moderately or heavily concreted and few details of their form could be distinguished.

7.6.33. **WA02** is a large straight-armed anchor that lies approximately 6.2m east of the mound (**Figure 3** and **Plate 4a**). Its overall length, from crown to ring, is approximately 3.15m (10.33 feet). The anchor lacks a stock and ring but otherwise appears to be complete.

7.6.34. **WA03** is a large straight-armed anchor that lies approximately 11.3m east of the mound (**Figure 3** and **Plate 4c**). Its overall length, from crown to ring, is 3.10m (10.17 feet) (3.35m including the ring). The anchor lacks a stock but is otherwise complete.

7.6.35. **WA06** (not shown on Figure 3 as it is too close to **WA02**) is a fragment of an iron ring, situated next to the shank of anchor **WA02** (**Figure 3** and **Plate 4f**). Its internal diameter was approximately 0.31m, and the ring was 0.07m thick. The ring could be a very heavily corroded anchor ring but the apparent discrepancy in size between it and the ring attached to anchor **WA03** may suggest that it is a mast ring rather than an anchor ring. Bowyer has suggested that it may be a 'rigging ring' (M Bowyer pers. comm.), although Wignall appears to have identified it as an anchor ring (Wignall 1979: 24).

7.6.36. **WA11** is a fragment of an anchor, which comprised an anchor fluke and part of an arm. It is situated approximately 2.4m south-south-west of the mound (**Figure 3** and **Plate 4d**). The fluke measures 0.65m wide by 0.70m long along the sides. The overall length from the bill tip to the break in the arm is 1.25m. These measurements may have been affected to some extent by concretion. There is a distinctive bill and the arm appeared to be oval in section.

7.6.37. **WA18** is another fragment of anchor, consisting of part of the shank and the attached anchor ring (**Figure 3** and **Plate 4e**). It is situated approximately 6.5m west of the mound. The internal diameter is 0.4 and the ring is 0.16m thick. The shank had a square section with the width of each face being approximately 0.2m. An unknown depth of concretion affected all of these measurements.

7.6.38. **WA24** is a straight-armed anchor that lies approximately 14.4m west-south-west of the mound (**Figure 3** and **Plate 4b**). Its overall length from crown to the (possibly broken) end of the shank is approximately 2.74m. The anchor lacks a ring.

Marble Blocks

7.6.39. At the apparent centre of the site there is a low mound of marble blocks (**WA33**) (**Figure 3** and **Plates 1a-c**) covering an area of approximately 110m^2. The mound stands up to 2m higher than the surrounding seabed. Wignall (1979: 61-62) surveyed a total of 39 blocks, but noted the presence or the probable presence of several more that were either thought to be buried or inaccessible.

7.6.40. The dimensions of the individual blocks vary between 0.75 x 0.60 x 0.20m and 2.05 x 0.85 x 0.39m, with dimensions in the region of 1.55 x 0.75 x 0.65m being most typical. The blocks are generally closely stacked in up to three layers, although some spreading has occurred, presumably as a result of the wrecking event or a subsequent process. Illsley (Wignall 1979: 46) records ‘a number of blocks of lower grade limestone’, although these are not referred to in the contemporaneous 1979 list of artefacts (Wignall 1979: 58).

7.6.41. Unfortunately, due to the lack of previous data, it has not proved possible to reconcile the WA photo-mosaic and panoramic photographs of the mound (**Plates 1a-c**) with any previous survey.

7.6.42. The marble has been identified as being a type originating from Carrara in Northern Italy (Wignall 1979: 40; Illsley in Wignall 1979: 47 and Illsley 1982: 305). This appears to have been confirmed by the description of the Genoese vessel given by Morris (see Section 8.4). A recent Channel 4 Wreck Detectives television documentary appears to have refined this by identifying the probable quarry at Carrara, although this research does not appear to have been published as yet.

Miscellaneous

7.6.43. In the immediate vicinity of **WA16** a small potsherd was seen lying on the seabed. This was not recovered for surface examination.

7.7. ARCHAEOLOGICAL FEATURES – PHOTO-MOSAIC SURVEY

7.7.1. The results of the photo-mosaic survey add considerable visual interpretative information to the site plan. Whilst they are considered to be moderately accurate in

terms of both absolute and relative positioning, they should not be regarded as being a stand-alone survey in themselves.

7.7.2. The survey of the marble mound probably appears to represent the most accurate positional survey of the marble blocks carried out to date. Analysis of individual photographs, thereby avoiding positional and scaling errors inevitable with the use of a very simple mosaic technique, suggests that the result may be more accurate than the limited previous surveys that have taken place utilising either sketch or triangulation techniques. There is some indication from documentation received from MADU that part of the mound has previously been surveyed using a 3D technique, possibly in 1999, but this does not appear to have been completed or published.

7.8. ARCHAEOLOGICAL FEATURES – MONITORING PHOTOGRAPHS

7.8.1. Panoramic photographs of the marble mound were taken from various positions around the mound. Examples of the results are shown in **Plates 1a-c**. As no previous work of a similar type has previously been undertaken little interpretation is possible, other than that no very recent damage can be observed. However, these photographs may be regarded as providing baseline data of the condition of the marble blocks and mound for comparison with future results.

7.8.2. Various claims have been made for the height of the marble mound above the surrounding seabed. The ADU reported in 1987 that the mound was 4m high and in 2000 that it was 'still standing nearly 3m above the current seabed' (ADU 1987 and 2000). In 1996 Martin Dean (of the ADU but not obviously writing in that capacity) reported that the blocks were 'still stacked on the seabed to a height of almost five metres' (Dean 1996). However, although a depth survey of the site was not undertaken by WA, analysis of **Plates 2-5** suggests that in 2004 the difference in depth between the top and base of the mound was not as great as and probably less than 2m. Furthermore pneumofathometer depth measurements of the top of the mound and the seabed next to the northern edge of the mound taken within approximately one minute showed a depth difference of 1m.

7.8.3. It is conceivable that localised scouring around the mound could account for this discrepancy, although casual observation during 2004 suggested that the seabed surface around the mound was fairly stable. Perhaps a more likely explanation is the possibility of accidental removal of blocks from the top of the mound. Measurement error seems unlikely given the size of the discrepancy.

7.9. COMPARISON OF WA RESULTS WITH PREVIOUS SURVEY DATA

7.9.1. For the purposes of this comparison, discrepancies between artefact measurements taken during the original site survey (Wignall 1979, revised by Bowyer 1981, **Figure 2**) and equivalent WA results not exceeding 0.10m are not treated as being significant. It is not known whether the term 'length' used by Wignall in the context of guns means overall length or base ring to muzzle face, as the term is not explained. Although length is normally taken to mean base ring to muzzle face, a closer correspondence appears to exist between WA overall length measurements and Wignall measurements, than between these and WA base ring to muzzle face measurements. It is therefore assumed for the purposes of the analysis below that for Wignall 'length' means overall length.

7.9.2. **WA01** can be positively identified as Wignall's 66 (**Figure 2**). The position, size and orientation of this gun corresponds approximately with feature 66, which Wignall (1979 60) records as being 2.50m long. There is a discrepancy of 0.12m between the measurements of length, which may be due to the different methods used.

7.9.3. **WA02** can be positively identified as Wignall's 76 (**Figure 2**). The position and orientation correspond approximately with anchor 76, although the length recorded by Wignall (3.50m) is greater than the crown to ring measurement recorded by WA of 3.15m. The reason for this discrepancy is probably measurement error.

7.9.4. **WA03** can be positively identified as Wignall's 75 (**Figure 2**). The position and orientation of this anchor correspond approximately with anchor 75, although the length recorded by Wignall (3.60m) is again greater than the crown to end of shank and crown to end of ring measurements recorded by WA (3.10 / 3.35m respectively). The reason for this discrepancy is probably measurement error.

7.9.5. **WA04** can be positively identified as Wignall's feature 64 (**Figure 2**). The position and size of this gun correspond approximately with 64, which Wignall (1979: 60) records as being 2.65m long. Its current orientation and relative position to 65 are different from that shown in **Figure 2**. This may be the result of a survey error or because the gun has moved since 1979.

7.9.6. **WA05** can be positively identified as Wignall's feature 65 (**Figure 2**). The position and size of this gun correspond approximately with 65, which Wignall (1979: 60) records as being 2.65m long. Its current orientation and relative position to 65 are different from that shown in **Figure 2**. Again, this may be the result of a survey error or because the gun has moved since 1979.

7.9.7. **WA07** can be positively identified as Wignall's feature 70 (**Figure 2**). The position, orientation and size of this gun corresponds approximately with 70, which Wignall (1979: 60) records as being 2.65m long.

7.9.8. **WA08** can be positively identified as Wignall's feature 63 (**Figure 2**). The position, orientation and size of this gun corresponds approximately with 63, which Wignall (1979: 60) records as being 2.50m long.

7.9.9. **WA09** can be positively identified as Wignall's feature 61 (**Figure 2**). The position and size of this gun corresponds approximately with feature 61, which Wignall (1979: 60) records as being 2.71m long. Its current orientation is different from that shown in **Figure 2** (cascabel and muzzle are shown reversed). This may be the result of a survey error or because the gun has moved since. One of the 1997 ADU slides appears to be of this artefact, although the image quality is poor and it is not possible to determine whether any change in the condition of the artefact has occurred.

7.9.10. **WA10** can be positively identified as Wignall's feature 62 (**Figure 2**). The position of this gun and orientation corresponds approximately with 62. However, there is a discrepancy of 0.18m in measured length, with Wignall (1979: 60) recorded it as 2.75m. The reason for this discrepancy is probably measurement error.

7.9.11. **WA11** can be tentatively identified as Wignall's feature 79 (**Figure 2**). However, there are both relative and absolute positional discrepancies, together with

dimensional discrepancies. This may also be the result of a survey error or because the artefact has moved since 1979.

7.9.12. **WA12** can be positively identified as Wignall's feature 67 (**Figure 2**). The position, orientation and size of this gun corresponds approximately with 67, which Wignall (1979: 60) records as being 2.65m long.

7.9.13. **WA13** can be positively identified as Wignall's feature 55 (**Figure 2**). The rough position and size of this gun corresponds approximately with 55, which Wignall (1979: 60) records as being 2.65m long. However, the current orientation and relative position differs from that shown in **Figure 2** (the cascabel is currently positioned much closer to **WA12**). As before this may be the result of a survey error or because the gun has moved since 1979.

7.9.14. **WA14** can be tentatively identified as Wignall's feature 73 (**Figure 2**). The rough position, orientation and size of this gun corresponds approximately with 73, which Wignall (1979: 61) records as being 1.90m long. However, the position of this gun relative to gun **WA13** is incorrectly shown in **Figure 2**. This may be the result of a survey error or because the gun has moved since 1979.

7.9.15. **WA15** can be tentatively identified as Wignall's feature 71 (**Figure 2**). The position and orientation of this gun corresponds approximately with feature 71. However, there is a discrepancy of 0.25m in measured length, which Wignall (1979: 61) records as being 3.00m. This may be as a result of misidentification or the result of survey error.

7.9.16. **WA16** can be positively identified as Wignall's feature 60 (**Figure 2**). The position, size and orientation of this gun corresponds approximately with 60, which Wignall (1979: 60) records as being 2.75m long.

7.9.17. **WA17** can be positively identified as Wignall's feature 53 (**Figure 2**). The position, orientation and length of this gun corresponds approximately with 53, which Wignall (1979: 60) records as being 2.60m long.

7.9.18. The identification of **WA19** is uncertain, but it may be Wignall's 52, 51 or possibly 50 (**Figure 2**). The rough position and orientation of this gun corresponds approximately with feature 51, but Wignall (1979: 60) records 51 as being only 2.00m long, which effectively rules out that identification. A better match is with 52, which is recorded as being 2.65m long, but the orientation has changed if it is that gun. The size and rough position correspond with 50, but in this case orientation and position relative to **WA20** and **WA21** are problematic, and this identification is considered less likely.

7.9.19. The identification of **WA20** is uncertain, but it may also be Wignall's 52 or 51 (**Figure 2**). The rough position, orientation and length of this gun corresponds approximately with 52, which Wignall (1979: 60) records as being 2.65m long. However, **WA19** provides a better match in terms of length.

7.9.20. The identification of **WA21** is also uncertain, but it may be Wignall's 51 or 52 (**Figure 2**). The rough position corresponds with gun 51 and the orientation corresponds with 52. However, neither the length nor the orientation corresponds

with 51, which Wignall (1979: 60) records as 2.0m long. Furthermore the length and position does not correspond with 52, which Wignall (1979: 60) records as being 2.65m long.

7.9.21. **WA22** can be positively identified as Wignall's feature 49 (**Figure 2**). The position, orientation and approximate length of this gun corresponds approximately with 49, which Wignall (1979: 60) records as being 1.90m long.

7.9.22. **WA23** can be positively identified as Wignall's feature 57 (**Figure 2**). The position, orientation and approximate length of this gun corresponds approximately with 57, which Wignall (1979: 60) records as being 1.53m long.

7.9.23. **WA24** can be positively identified as Wignall's anchor 77 (**Figure 2**). The position and orientation correspond approximately with 77, although, as with **WA02** and **WA03**, the length recorded by Wignall (3.30m) is greater than the crown to broken end of shank measurement of 2.74m recorded by WA. The reason for this discrepancy unknown but it is conceivable that it could be due to post-1979 damage. However, three of the 1997 ADU slides appear to be of this artefact, and the condition of the arms and flukes appear to be largely unchanged since that date.

7.9.24. **WA25** can be tentatively identified as Wignall's feature 41 (**Figure 2**). The approximate position and size of this gun corresponds approximately with 73, which Wignall (1979: 61) records as being 1.85m long. However, the orientation of the gun as recorded by WA differs from that shown in **Figure 2**. The gun is now lying approximately east - west, with the cascabel to the east. This may be the result of a survey error or because the gun has moved since.

7.9.25. **WA26** can be tentatively identified as Wignall's feature 42 (**Figure 2**). The rough position and orientation of this gun corresponds with 53. However, Wignall (1979: 60) records it as being 2.60m long, somewhat larger than the WA measurement.

7.9.26. **WA27** can be positively identified as Wignall's feature 43 (**Figure 2**). The position, orientation and approximate length of this gun corresponds approximately with 43, which Wignall (1979: 60) records as being 2.75m long.

7.9.27. The identification of **WA28** is uncertain, but it may be Wignall's 47 or 50 (**Figure 2**). The length corresponds with both guns, which Wignall records as being 2.75 and 2.74m respectively. Its orientation corresponds very roughly with both, although, 47 is a rather closer match. On Wignall's plan neither gun is positioned as **WA28** is in relation to **WA29**, **WA30** and **WA31**. The position of **WA28** roughly corresponds with that of 50, whereas the position shown for 47 is too far away. It is possible that one or more gun has been moved, otherwise a recording error is possible.

7.9.28. The identification of **WA29** is highly uncertain, but it may be Wignall's 44 (**Figure 2**). The position of this gun roughly corresponds with 44, although the relative position of **WA 28** and **WA29** does not correspond well with the relative positions of 44 and 47 or 44 and 50. The length of **WA29** does not correspond with 44, which Wignall records as being 2.25m. Similarly orientation does not correspond with 44, which is shown in **Figure 2** as being orientated with its cascabel to the south-west, rather than to the north.

7.9.29. **WA30** can be tentatively identified as Wignall's feature 46. The approximate position, length and orientation of this gun corresponds with 46. However, the position relative to **WA29** does not match the relative positions of 46 and 44 as shown in **Figure 2**. This may be due to movement, otherwise a recording error is possible.

7.9.30. The identification of **WA31** is uncertain. Although the approximate absolute position, relative position (to Wignall's 44) and orientation of this gun corresponds with Wignall's 46, there is a great disparity between the length of **WA31** and the length of 2.65m recorded by Wignall for 46 (1979: 60). The reason for this disparity is unclear, but it seems unlikely that **WA31** is 46.

7.9.31. The identification of **WA32** is highly uncertain. No guns are shown in **Figure 2** in the position that **WA32** currently occupies. The most likely explanation is that **WA32** has been moved since the site plan was compiled.

7.9.32. It is conceivable that the group of guns comprising Wignall's 47, 41, 42, and 43 shown in **Figure 2** is **WA25**, **WA26**, **WA27** and **WA32** respectively. If the group, as shown in **Figure 2** is rotated clockwise by about 45 degrees, then they would be in approximately the correct position. This would in turn resolve the question of why **WA32** does not appear in **Figure 2**. However, this would result in significant length discrepancies and it would be difficult to explain what could then only have been a gross survey error. Therefore this theory can probably be discounted.

7.9.33. A total of 26 guns were located by WA, 25 cast iron muzzle loading pieces of various sizes and a probable breech loader of the swivel gun type. Wignall (1979: 12) records the presence of 25 cast iron muzzle loading guns across the whole site and 10 wrought iron swivel guns from the centre to the western edge of the site, a total armament of 35 guns. Somewhat confusingly, Konstam refers to 'at least 38 artillery pieces' (1987: 2). He states that three light swivel guns and a cast iron saker had been recovered prior to the 1987 excavations. ADU reports are unhelpful in this respect, either failing to state the number of guns on the site or alternatively referring to 'over 20', suggesting that they never established the true number of guns.

7.9.34. There is an apparent discrepancy between the number of guns observed on the site during the course of fieldwork and the number of guns recorded by various sources as being originally present on the site. Various catalogues of artefacts recovered from the site have been sourced from the ADU hard copy file; including a 'List of Artefacts on Display at Tal-y-Bont' dated 23rd May 1986. This lists three Verso Cannons (Swivel Guns) and one Saker Cannon. Another undated list of recoveries refers to three swivel guns and a saker gun plus, in handwriting, an additional swivel gun 'at the Tower of London'. Furthermore Smith (2004: 25) lists five wrought iron 'slings', four of which he gives museum numbers.

7.9.35. Therefore it appears that at least four swivel guns and one cast iron gun have been recovered from the site prior to 2004. However, this may not be the true total because that added to the total located by WA (plus Wignall's gun 183 in an area not searched by WA) would result in a total number of guns for the site of only 31, whereas all previous estimates are for 35-38. The discrepancy appears top lie with the number of swivel guns. Only one has been positively identified on site and four are known to have been recovered. However, Wignall records there being ten and an

undated, un-attributed document in the ADU file entitled 'B.B.W.3. Surveying Investigation' refers to eight.

7.9.36. The number of guns shown in the 1979 (Wignall 1979: 19) and 1981 site plans (**Figure 2**) are the same, although gun 133 does not appear in the 1979 plan. However, comparison of the 1981 and 1986 plans shows that by 1986 a total of six small (probably swivel) guns (54, 56, 58, 69, 72 and 74) and one larger gun (48) are missing from the plan, presumably recovered. The larger gun may be the saker mentioned above.

7.9.37. During the course of the post-fieldwork assessment, a site plan was discovered attached to the 1978 application for designation. This application appears to have been largely compiled by Sidney Wignall and is based upon the results of initial fieldwork in 1978. The plan is interesting because it shows a very significantly different disposition of guns and anchors from any subsequent plan. Some of the guns are known to have been moved from their original locations to facilitate excavation (M Bowyer pers. comm.) and it is therefore conceivable that the 1978 plan represents the original positions of many of the artefacts. However, it is also possible that the 1978 plan is based on very little actual measured survey.

7.10. ARCHAEOLOGICAL FEATURES – NOT OBSERVED BY WA

7.10.1. WA have not examined any of the recovered artefacts and do not currently have access to finds records from the site, other than those contained in the ADU hard copy file and in the Wignall (1979) and Konstam (1987) reports. Most prominent amongst the finds are probably the small bronze ship's bell after which the site was originally named. The bell is cast with the date 1677 and has relief decoration. It appears from the 1999 site plan to have been recovered from just to the west of the marble mound.

7.10.2. The decorative motifs of the bell are religious and consist of two cherubs, cameos of the Virgin Mary and of Christ with a crown of thorns. The inscription 'I.H.S.' (an abbreviated form of Jesus, Saviour of Man in Greek) and the Latin legend *Laudate Dominum Omnes Gentes*, from Psalm 117, are also present (Illsley in Wignall 1979: 44). The decoration appears to be Catholic rather than Protestant and suggests that, unless it was intended for export, the bell was probably not cast in Britain. Its general size and shape suggests that it is probably a ship's bell rather than a church bell that was being carried as cargo (Illsley in Wignall 1979: 45).

7.10.3. Outlying artefacts 183 and 184, to the north and north-east respectively of the area shown in **Figure 2,** were not located, as insufficient bottom time was available to search for them. They do not appear in the list of artefacts in Wignall (1979) and were therefore presumably located after 1979. Artefact 183 appears to be a gun, whereas 184 appears to be a circular or ring feature. Artefact 183 is described as 'excavated cannon' in the 1999 site plan.

7.10.4. Konstam (1987: 8-9) records the possible presence of a gun carriage, or fragment thereof, under gun 50. Wignall appears to have identified this as being oak planking (1979: 9). This was not seen by WA.

7.10.5. Wignall refers to a 2m long cast iron gun buried on the foreshore to the south of the site, which he believes may be part of the vessels armament. This is apparently based on the proximity of the gun to the site and the odd number of guns found underwater (1979: 12).

8. CONCLUSIONS AND DISCUSSION

8.1. INTERPRETATION – ORDNANCE

8.1.1. Wignall (1979: 12) records the presence of 25 cast iron muzzle loading guns across the whole site and 10 wrought iron swivel guns from the centre to the western edge of the site, a total armament of 35 guns. He distinguishes two groups of cast iron 'main battery pieces' of 2.5-3.0m length, and 'secondary battery pieces' of 1.85-2.25m length. The evidential basis for this categorisation is not explained. Wignall removed concretion from one main battery piece (gun 45) and one secondary battery piece (48).

8.1.2. The larger gun, which he records as having a length of 2.65m, had a nominal bore diameter of four inches when the concretion was removed. On the basis of this measurement Wignall was unable to identify the gun as being a recognisable northern European type and suggested instead that the gun might have been a Spanish or Portuguese type, firing a shot of about seven pounds weight (Wignall, 1979: 13 and 16). Wignall also records that the exterior of one main battery piece was cleaned and that the number 2603 was observed. Wignall identifies this as being the weight in pounds and comments that because this weight was not expressed in hundred weights and pounds it is unlikely to be an English gun (Wignall 1979: 13 and 60). Unfortunately Wignall does not state whether this was gun 45.

8.1.3. Wignall believed that this gun had similar dimensions to a Spanish Passavolante or Zebratana or alternatively a similar Portuguese piece (1979: 13). He dismissed the possibility that it was an English type on the basis that it fell between a demi-culverin and a saker. Despite this the gun appears to have been generally accepted as being a saker. A scale drawing of this gun (not attributed) has been found in the ADU file. The dimensions and form suggest that the saker identification is correct.

8.1.4. The smaller gun, recorded as being 1.85m in length, had a nominal bore of 2.5 inches and was observed to be marked with the number 636 on the top of the barrel between the second and third reinforces (Wignall 1979: 60). The gun also had a raised letter 'P' on the left trunnion, almost certainly the mark of the gun-founder. Wignall identifies this as being a 2 pounder or falconet (Wignall 1979: 13).

8.1.5. Wignall recovered a swivel gun from the site (Wignall 1979: 13). This is given the number 1007 in the artefact list but unfortunately he does not record which of his 10 recorded swivel guns this recovered example was. However, it is shown between two large guns to the north of the mound in a site plan attached to the application submitted by Wignall in 1978 to designate the site. The recovered gun was 1.33m long and with a bore of 0.058m. When cleaned of concretion (the length is presumed to be without concretion) it was identified as being a wrought iron breech-loading gun of the 'verso' or petraros' type (Wignall 1979: 13). The tampion and breech block were in place. A drawing of a wrought iron swivel gun has been found in the

ADU file. The length of the drawn piece matches that of the recovered swivel gun but the drawing does not identify which gun it is. **WA23** is probably of a similar type, although it is apparently larger.

8.1.6. Smith (2004: 21-25) has recently considered the significance of the wrought iron swivel guns found on the site. He describes each piece (presumably the four or more recovered) as being stave built with six iron binding hoops and therefore consistent with Smith's type SW1/6 (Smith 1988: 8). This type of gun, known in England in the 17th century as a 'sling' has been dated to the late 16th to early 18th century (Smith 1995: 107-9).

8.1.7. One of the wrought iron guns recovered from the site was loaded with a leather bag containing fragments of iron (Smith 2004: 23) whilst another was loaded with small lead shot (Konstam 1988: 18). It therefore appears likely that these guns were being carried as anti-personnel weapons, possibly in response to the threat of piracy (Smith 2004: 23). The fact that two of these guns were loaded and that the recovered breach had a tampion (Wignall 1979: 59) suggests that they were either mounted or held in immediate readiness, rather than as cargo or ballast. It is also clear from the commentary of Smith that the guns have some international significance, being five of only 35-38 recovered wrought iron guns of this type world-wide.

8.1.8. The same catalogues suggest that at least nine pieces of cast iron shot and some bar shot have been recovered from the site. Details of size and weight are not recorded, except for reference to one of 30lbs, although the listing suggests that this find was only tentatively identified as shot. None of the weapons found on site could have fired such a large ball. Wignall (1979: 58-9) recovered three cast iron shot and one iron bar shot and records the weight of the ordinary iron shot as being 5-6lbs, roughly equivalent to the weight of shot that may have been fired from a saker. The presence of this shot and the reported presence of tampions suggests, as with the wrought iron guns, that at least some of the cast iron ordnance was in use as armament rather than cargo or ballast.

8.2. INTERPRETATION - ANCHORS

8.2.1. Wignall discusses the anchors at length in his 1979 report (Wignall 1979: 24-27). He points out that none of the three complete or near complete anchors lack flukes and that therefore the presence of an extra fluke suggests the presence of a fourth anchor on site. Wignall speculates that the dimensions of the fluke suggest a very large anchor but the measurements recorded by WA suggest an anchor not significantly larger than **WA02** or **WA03**.

8.2.2. Interpretation of the anchors is difficult because it relies on either a complete set of anchors being present or the size of the vessel being known. In this case we do not appear to have either a complete set of anchors but we do know that the vessel was probably about 700 tons (see 8.4 below). Dimensions relative to size given by the near contemporary English writer Sutherland (1717) suggest that the **WA02** and **WA03** would only have been the largest anchors on vessels of 225 tons or less. Although the size of Genoese anchors is unknown, it is thought unlikely that the sizes of anchors carried by Genoese vessels operating in northern waters would have been very significantly different from similar English vessels. It is therefore likely that the largest anchor carried by the vessel is not present on the site, although it is

possible that **WA11** may represent a fragment of it if Wignall's measurements are accepted.

8.2.3. Wignall interprets **WA02** and **WA03** as being bower anchors and **WA24** as being a stream or kedge anchor (Wignall 1979: 26). The chief difficulty with this interpretation is that **WA02** and **WA03** would appear to be rather small bowers for a vessel of 700 tons. Using the formula put forward by Tinniswood (1945: 90) for calculating shank lengths, the length of the largest shank (3.15m / 10.33 feet) would be equivalent to that of a stream anchor of a 700 ton 1640 vessel. However, a vessel would not have carried three stream anchors. It is therefore possible that at least two of the bowers carried by the vessel were in fact too small for it, or that these two anchors are the vessels sheet and kedge.

8.2.4. Tinniswood (1945: 89) suggests that for a 1620-1640 vessel of 700 tons, a total of seven anchors would be carried, including a sheet, four bowers, a stream and a kedge. Although anchors generally got heavier and fewer in number in time, it is likely that the vessel on this site would have carried at least six, if not seven or more anchors. It is therefore likely that at least two anchors from the vessel are not present on the site, including a sheet anchor, a kedge and at least one large bower. The whereabouts of these anchors are not known. They may be further offshore having been deployed prior to the wrecking, or they may have been salvaged.

8.3. INTERPRETATION – MARBLE BLOCKS

8.3.1. The marble blocks represent cargo, stacked closely together, probably in a roughly triangular shape. As such they represent the transport of a valuable raw material in bulk unfinished form. It is not known whether they were an order for single purpose or to provide a stone merchant with stock, which could then be sold on. However, the high cost of such material suggests that the former explanation is more likely to be correct.

8.3.2. A prestige building project is the most likely destination. However, it is not known where this building project was or where the intended port of entry was. There has been much speculation about whether the marble was intended for the building of St Pauls in London. This issue has been considered in detail by Illsley (1982: 305-315) although he was not aware at the time of the probable 1709 date for the wrecking event (see below). It seems that marble was being purchased for the cathedral until 1709. Although the relevant accounts make no mention specifically of Carrara marble, this does not rule out its purchase.

8.3.3. There were other prestige building projects in the early 18th century and the marble may have been intended for a substantial remodelling rather than a new build structure (Martin in Wignall 1979). It is certainly possible that another British, Scottish or Irish location or even Continental Europe was the ultimate destination of the material.

8.3.4. Wignall (1979: 28-9) discusses the probable use of the marble blocks as ballast in place of the shingle or river washed stone that might otherwise have been used. However, the total weight of the blocks is unlikely to have exceeded 66 tons and, as Wignall rightly points out (1979: 29), this weight of ballast would be inadequate for a vessel of more than 400 tons. Assuming Lewis is correct in recording the Genoese

vessel as being of 700 tons then the marble blocks can only have been part of the ballast.

8.4. INTERPRETATION – THE VESSEL

8.4.1. Until 1999, the probable identity of the wreck was unknown. Although a detailed discussion of the development of various theories on the identity and date of the wrecked vessel are beyond the scope of this report, it is important to outline the main pre-1999 evidence as follows:

- The date on the bronze bell is 1677. This suggested a late 17th or early 18th century date for the vessel and the wrecking event, assuming that the bell was not a later intrusion.
- The presence of a substantial quantity of rough cut Carrara marble suggested that the vessel was a merchant ship and that she had loaded in either Genoa or Leghorn (the main ports used for the export of Carrara marble in the late 17th and early 18th centuries.
- Martin (1979) suggested on the basis of the coin evidence that the vessel might have traded in Italy, France, England, Spain and the Netherlands and that the overall coin and artefact assemblage suggested a vessel engaged in coastal trade in the Western Mediterranean and Atlantic coast of Northern Europe.
- The presence of a large number of guns on the site suggested a large and heavily armed vessel.
- The latest coin found on the site appears to date from 1704 (Konstam 1987: 9). This provided a terminus post quem for the wrecking event.

8.4.2. A theory was proposed that there were actually two wrecks on this site. This was based upon coins recovered from both the site and the foreshore, and upon the presence of obsolete wrought iron swivel guns amongst late 17th century material. The coins fell into two dateable groups, late 16th century to early 17th and mid 17th to early 18th century and include Spanish coins of Phillip I and French and Dutch coins of 1640-60 (Konstam 1987: 10 and Wignall 1979: 30-31). The two-wreck theory postulated a wreck of late 16th or early 17th century date, and a subsequent wreck of the mid-late 18th century.

8.4.3. However, it appears that in late-1999 those investigating the site became aware of a historic chart, a copy of which had been acquired by Gwynedd Archives, that appeared to contain relevant information. The chart is one of a number prepared by the hydrographer Lewis Morris between 1737 and 1744, and published in 1748. The position of a Genoese vessel of about 700 tons lost in 1709 whilst carrying a cargo of marble and paper, together with other goods, is charted to the south-east of Sarn Badrig and close to the shore. The annotation on the map states: ‘Here the Wreck of a Genoese Ship of ab. 700 tun lies, Lost 1709. Loaden with marble, Paper Etc(?)’.

8.4.4. Given the lapse of time between the hydrographic work carried out by Morris and the date of the loss recorded, it is highly unlikely that any visible sign of the wreck existed when Morris was in the area. Therefore it is likely that Morris received his information from local sources. Indeed the wrecking event may well have still been within living memory. The date of the wrecking event is therefore likely to be

correct, or at least correct to within a few years, and could not of course be any later than 1748.

8.4.5. The chart does not contain the detail and accuracy of later charts and therefore both the relative and absolute positions of the wreck are likely to be approximate. It is nevertheless possible that it could still be very accurate if the location had been pointed out to Mr Morris by a witness, if it had been surveyed at the time, or if Morris had dragged for it to establish its precise position whilst conducting his survey. Regardless of this, the position of the loss shown upon the chart has a very high degree of correlation with the position of the site.

8.4.6. The Genoese vessel is described on the chart as carrying a cargo of marble. The probability of two wrecks carrying the same type of marble both being lost in the same location in the 17th or 18th centuries appears to be remote, particularly so in the absence of evidence of any nearby prestige building scheme. Therefore the site is very probably the wreck of the Genoese merchant vessel noted and charted by Lewis Morris.

8.4.7. In the context of the early 18th century, the tonnage given by Morris indicates a large to very large ocean-going merchant vessel. It is perhaps the unusual size of the vessel and therefore its possible local fame that led to it being included on Morris' chart. To put its size in context, it would have been about the size of one of the largest contemporary British East Indiamen. For example, the *Falmouth*, built in Blackwall in 1752 had a tonnage of 668 (French 1995: 33) and the *Martha*, built in 1693, had a tonnage of 700 (Sutton 2000: 149). The dimensions of the *Falmouth*, 33.15m long by 10.36m maximum beam give an idea of the likely dimensions of the Genoese vessel.

8.4.8. The site is approximately 38m long, west to east (**WA24** to **WA03**). This approximately matches the 35 metre length that might be expected of a 700 ton merchant vessel of the late 17th or early 18th centuries.

8.4.9. If the bell is not an intrusion and was cast for the vessel, then the date of construction may be 1677 or thereabouts. The size and resultant prestige of the vessel possibly increases the likelihood of it having been made for it, but this is speculative. A construction date of 1677 would mean that the vessel was 32 years old when it was lost. Whilst this is not impossible, it would be highly unusual. In the absence of the bell, an estimate for the date of construction of post-1690 would probably be given.

8.4.10. The recovery of late 16th century coins from the site (Konstam 1987: 9-10) means that the possibility of a second, earlier wreck on the site cannot be entirely discounted, even though little artefactual evidence and no documentary evidence for the presence of a second vessel has been found. The wrought iron guns, often taken as an indicator of an early post-medieval date on shipwreck sites, were also carried by early 18th century vessels (Smith 1995: 107-9). Merchant vessels of that period might have been expected to be carrying a mixture of modern and obsolescent guns, in other words whatever was available.

8.4.11. Most of the coins falling into the earlier group appear to have been recovered on the foreshore and may not therefore have come from the site. It is possible that the limited number of earlier finds of all types could simply be survivals. However, the presence of late 16th century coins on board a vessel in 1709 implies unusually long

circulation and is difficult to explain using the single ship theory (one as early as 1577 is recorded in a list titled 'Catalogue Listing – Bronze Bell Wreck' in the ADU file).

8.4.12. The if the presence of finds from an earlier vessel is accepted, then this does not of course mean that the vessel itself was wrecked at the site. This earlier wrecking may have occurred in the vicinity, perhaps further offshore, with the finds from this vessel coming from a debris field.

8.5. INTERPRETATION – THE WRECKING EVENT

8.5.1. Wignall (1979: 42-3) discussed possible scenarios for the wrecking event. He concluded that it was more likely that the vessel had been sailing north by design than by force of weather and that its destination may therefore have been Dublin or Cork. He theorised that the progress of the vessel may have been halted by a north or north-west wind and that as a result it had taken shelter in the lee of St Patrick's Causeway. Wignall then proposed that the wind may then have backed around to the south or south-west, embaying the vessel on a lee shore with no avenue of escape. If the vessel anchors had then failed to hold, the master could have taken the desperate decision to run his ship ashore.

8.5.2. WA are not aware of any major building work was being undertaken in the settlements around Cardigan Bay in the early 18th century that would have required such a large quantity of such a prestigious and expensive material as Italian marble. It is therefore thought most likely that the vessel was embayed in Cardigan Bay, either as a result of the circumstances outlined by Wignall or as a direct result of a south-westerly gale, possibly compounded by navigational error or unfamiliarity. In those circumstances the vessel would have rapidly found itself trapped between Sarn Badrig and the coast and unable to escape.

8.5.3. Force of weather is another plausible explanation, with the vessel being forced north of Lands End and the Bristol Channel and then into Cardigan Bay by a gale. This could have been combined with a navigational error, perhaps due to a crew with little experience of the route. Wignall dismisses the force of weather explanation (1979: 43) but this assumes both competence, familiarity, and, perhaps, the lessons of modern navigation. As Illsley (1982: 313) subsequently pointed out, bad navigation and severe weather could take a ship wildly off course, such as happened with the *St Mary Magdalen* bound for Dublin from St Sebastian in 1692, which was forced into Plymouth. As Illsley states, a three-degree compass error in setting course from Cape Finisterre to Plymouth could put a vessel in St George's Channel and it is by no means impossible that unusual courses were set in an attempt to avoid the attention of privateers or pirates.

8.5.4. Sarn Badrig does not appear to have been accurately charted until the 1740s. The area was originally charted by Captain Grenville Collins in the late 17th century. He notoriously failed to chart or make any reference to the hazard presented by the reef. Both Lewis Morris, and his hydrographer son William, blame Collins, and 'mercenary chart contrivers' who copied him, for the loss of vessels (quoted in Holden 2003: 15 and Jones 2001: 19). As a result any chart carried by the Genoese vessel is unlikely to have included Sarn Badrig. Unless they had local knowledge or had a pilot with local knowledge onboard, both of which seem unlikely, the crew

would probably have been unaware of its existence unless and until they actually saw it.

8.5.5. The marble cargo mound probably represents the location where the vessel sank. The weight and disposition of the mound is such that it is most unlikely that it has been moved a significant distance from that point. However, it is possible that a largely intact vessel, still containing its cargo, could have moved a moderate distance along the seabed from where it actually sank or initially grounded. Wignall (1979: 7) considers it possible that the vessel could have 'successively ground and lift her way towards the shore, breaking as she went'.

8.5.6. The presence of three anchors suggests that the vessel may not have had time to deploy all its anchors before sinking. Alternatively the master may have chosen not to deploy those anchors for some reason, perhaps because he had calculated that it would make no difference and that running the vessel ashore was the only option. It is also possible that they were not deployed because the crew was unaware that the vessel was about to run aground because of navigational error or unfamiliarity. In those circumstances the presence of only three anchors would be perplexing, unless others had subsequently been salvaged.

8.5.7. What we can reliably deduce about the wrecking event can be summarised as follows:

- The evidence is currently capable of supporting a number of different loss mechanisms.
- Given the apparent origin of the vessel and that the wreck location is to the south of the physical barrier of Sarn Badrig, it is highly probable that the vessel reached Cardigan Bay from the south.
- The destination of the vessel is unknown and it is not therefore known whether the vessel found itself in Cardigan Bay by accident or design.
- The exact circumstances of the loss are unknown. The vessel may have been taking shelter at or near the loss location or may have been trapped on a lee shore. It is possible that the master may have been deliberately trying to run the vessel ashore. It is also conceivable that if the vessel was lost and the wrecking occurred at night during heavy weather, then the crew may not have been aware of the proximity of land.
- The role of Sarn Badrig in the loss is uncertain. The site is not on this hazard but it may have effectively trapped the vessel if the wind was blowing from the west, south-west or south. Although the crew is unlikely to have had advance knowledge of it unless they had a local pilot or experience, they may nevertheless have seen it.
- The vessel either went aground and was lost or foundered, possibly after being holed elsewhere.
- The site is highly likely to represent the loss location because of the presence of the marble mound and a large number of guns.

8.6. INTERPRETATION – POST WRECKING EVENT SITE HISTORY

8.6.1. All that appears to be known with certainty about the history of the site between the wrecking event and its rediscovery in 1978 is that it very probably appears on Lewis' chart. The words of Lewis' son and the fact that Lewis appears to have taken the trouble to travel to the areas he charted suggest that the information about the wreck came from local or regional sources. This in turn suggests that the site was reasonably well known, at least among local seafarers or officials, some four decades after the loss of the vessel.

8.6.2. The site is exposed and it is likely that the vessel will have broken up either immediately or within a short period, particularly given the rocky nature of the seabed in the immediate vicinity of the site. Observation of the seabed during WA operations and the excavations carried out by Konstam (1987: 8) suggest that there is little prospect of a significant proportion of the vessel structure surviving, except perhaps under the marble mound. This in turn suggests an almost complete break up of the vessel.

8.6.3. Three large pewter plates were found concreted to the upper surface of one of the guns to the west of the mound (Wignall 1979: 9). Wignall concluded from this discovery that the gun and plates must have been buried whilst the concretion formed as otherwise the plates would have been moved by hydrodynamic action. As a result Wignall developed a sand cover theory, which he believed was supported by the presence of the remains of a breaching rope and of a fragment of timber. This is certainly plausible, although it may also be the case that movement of the larger artefacts resulted in the anomalous position of the plates.

8.6.4. The existence of an extensive debris field extending as far as the foreshore has been reported to the north and north-west of the site. A substantial number of 16th and 17th century finds have been recovered from the foreshore. Wignall (1979: 30-32) summarises these recoveries and also reports that 'small patches of accretions of oxide' were observed to extend shore-wards in a north-easterly direction from the site.

8.6.5. Michael Bowyer (pers. comm.) states that the debris field has not been surveyed. However, it appears to have been searched to some extent (Bowyer 2000: letter to CADW) and reports of its existence are therefore taken at face value. The position of this debris field in relation to the site is exactly as would be expected given that the greatest fetch is to the south and south-west and that the site is particularly exposed in those directions. The possibility that this area contains material from other sites cannot however be discounted.

8.6.6. Notwithstanding reports that the debris field has not been surveyed, it is clear from their annual reports that the ADU undertook a 'detailed' magnetometer survey between the shore (presumably no closer than a navigable depth) and the site in 1996 (ADU 1996). They reported failing to detect any significant anomalies. This suggests that there are no large detectable artefacts within the area of the debris trail examined (although it should be noted that the survey specifications are not known). This led the ADU to suggest that the material found on the shore may have been carried in floating containers in the immediate aftermath of the break-up of the vessel. This

could equally have been due to survey issues such as line spacing and the quality of the equipment used.

8.6.7. It is likely that the debris field, assuming it exists, was created either by material transported directly from the vessel as it broke up or subsequently by erosion and re-deposition. In 1994 Michael Bowyer reported in a letter related to a licence application that 'The movement of artefacts has not stopped – the more resilient pieces are still coming up on the beach'. Mr Bowyer was clearly referring to a perceived continuous migration of material from either the site or the debris trail to the foreshore. WA does not have sufficient data to examine this claim but it is certainly possible that some movement has occurred, either historically or in the recent past.

8.6.8. Given that the site is close inshore and was clearly known about in the mid-18th century, it is possible that it was salvaged at some point prior to its rediscovery in 1979. If anchors and some of the marble had been recovered, this could at least partly explain why the quantity of marble carried falls short of the amount required for ballasting, or what the vessel could carry, and why some of the anchors are missing.

8.6.9. In a letter to CADW dated 25th October 2000, Michael Bowyer stated that fragments of pewter had been located by metal detector search to the north of the site. He went on to say that 'as speculated the ship must have been carrying a great amount of pewter, some of which we know from research was salvaged at the time of the wreck and ended up in Cores y Gedol Hall'. This building overlooks the site and some salvage would be expected. A table in the hall is apparently marked with a letter 'A' which corresponds with a marking found on a pewter plate recovered from the site (Nicholls 1984: 35). It therefore appears that there is some artefactual evidence for material salvaged from the site.

8.6.10. However, the salvage theory would not explain why such a large number of iron guns, some of the anchors and a large quantity of marble was left, unless unknown difficulties were experienced during the operation or the salvaged material was limited to items retrieved from the foreshore. Furthermore no documentary evidence for salvage appears to have been located. It is possible that historical research may further this theory, in the meantime it appears to remain unproven.

8.6.11. Considerable salvage work in the form of the archaeological investigation has taken place since 1979. Before the site was licensed, a marble block was removed and later used to create a sculpture commemorating the wrecking event. It is now on public display in Barmouth.

8.7. STATUS OF THE ARCHAEOLOGICAL RECORD

8.7.1. The overall character of the exposed material on the seabed can be summarised as follows (after Watson and Gale 1990):

Area and distribution of surviving ship structure:	No ship structure known to survive, although fragments may be buried, particularly under the marble mound. The area surveyed by WA in 2004 was 920m^2, but the site may be larger. The west-east distribution of artefacts approximately matches the length predicted for a 700 ton vessel.
Character of ship structure:	No ship structure known to survive.
Depth and character of stratigraphy:	Unknown, but several contexts were recorded in 1987 during limited excavation. Other excavations have not been published.
Volume and quality of artefactual evidence:	Excavation has demonstrated that the site is rich in inorganic late 16th to early 18th century artefacts typical of shipwreck sites. A large volume of finds has been recovered and displayed locally but is largely unpublished. Finds include a bronze bell dated 1677, after which the site is commonly named, and which may or may not be a ship's bell. At least 26 guns remain on the seabed and an uncertain number have been recovered since 1979. Guns fall into two categories, cast iron muzzleloaders, possibly largely sakers or similar, and wrought iron breach loaders of the swivel gun type. A large number of substantial marble blocks also remain on the site, grouped in a mound, together with a number of anchors and anchor fragments. There is an unknown potential for the presence of a significant quantity of buried artefacts and a debris field may exist between the site and the shore.
Apparent date of ship's construction and/or loss:	Vessel very probably lost in 1709. Construction therefore 1709 or earlier. Possibly 1677 if the bell was made for the vessel. Otherwise probably 1690-1709. Identity currently unknown. The possible presence of a second, earlier vessel on or in the vicinity of the site cannot be discounted because of the recovery of late 16th century coins from the site
Apparent function:	Large to very large merchant sailing vessel of about 700 tons, carrying Italian (Carrara) marble and paper, together with other goods.
Apparent origin:	Very probably a Genoese vessel, probably sailing from Genoa or Leghorn or other western Mediterranean port. Destination unknown.

8.8. RECOMMENDATIONS

8.8.1. It is recommended that CADW should liase with all stakeholders to devise a plan for the site, covering such issues as future investigation, conservation, access and publication.

8.8.2. A desk-based assessment of this site would be beneficial, particularly if full publication is unlikely to be achieved in the short to medium term. There may be unexplored potential for documentary research concerning the identity and destination of the vessel, particularly in Italy. There may also be potential for identifying evidence for any earlier vessel loss near the site.

8.8.3. Full publication to current archaeological standards of the field and post-excavation work undertaken since 1979 appears to be long overdue and must be considered a priority. Given the lapse of time and the apparent lack of firm intention, there appears to be a significant risk that publication will either not occur at all or will be

limited. Encouragement and whatever assistance is practicable should therefore be given to the archive holders and/or Michael Bowyer to publish the site fully.

8.8.4. The site currently appears to lack a systematic and objective monitoring regime, making site management by the curator difficult. It is therefore recommended that a consistent program of monitoring should be established. Given that future monitoring is likely to rely upon the licensee and other avocational parties, it is recommended that monitoring techniques should be simple and should not make any undue demands upon either the time or resources of those involved.

9. ASSESSMENT ARCHIVE

9.1.1. The project archive consisting of a hard copy file and computer records, together with miscellaneous hardcopy photographs and plans are currently stored at WA under project code 53111.

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APPENDIX I: GLOSSARY AND ABBREVIATIONS

Glossary

Bottom time – time between diver leaving surface and beginning ascent.

Freespan – not supported by the seabed.

Coarse Component Size Ranges – Fine Sand (0.06-0.2mm); Medium Sand (0.2-0.6mm); Coarse Sand (0.6-2.0mm); Fine Gravel (2.0-6.0mm); Medium Gravel (6.0-20.0mm); Coarse Gravel (20.0-60.0mm); Cobbles (60.0-200.0mm); Boulders (200.0mm+).

Outwash plain – a broad, gently sloping sheet of outwash deposited by meltwater streams flowing in front of or beyond a glacier, and formed by coalescing outwash fans.

Reef – a ridge of rock or coarse material, the top of which lies close to the surface of the sea, and may be exposed at low water.

Sarn (plural 'sarnau') – a Welsh word for 'causeway', used in west Wales for a roughly linear boulder or cobble reef derived from glacial moraine, lying at shallow depth (maximum depth about 10m below chart datum), and completely covered at low tide (May and Hansom 2003). Welsh word meaning 'causeway' (Tappin *et al*. 1994).

Sandur - a synonym for outwash plain, an Icelandic loanword meaning the broad plain formed by the deposition of glacially derived sediments in front of the margin of a glacier.

Abbreviations

ACHWS – Advisory Committee for Historic Wreck Sites
ACOP – Approved Code of Practice
ADU – Archaeological Diving Unit
BST – British Summer Time
C – cascabel
Cr – crown
Dive Obs. – Diver Observation from DIVA (4.1.7.)
E – east
HW – high water
IJNA – International Journal of Nautical Archaeology
LW – low water
m – metres
M – muzzle
MADU – Malvern Archaeological Diving Unit
N – north
NF – north fluke
NMR – National Monuments Record
RCAHMW – Royal Commission for Ancient & Historic Monuments, Wales
S – south
SF – south fluke
Sh – ring end of shank
SI – Statutory Instrument
T – top
W – west
WA – Wessex Archaeology

APPENDIX II: DIVE DETAILS

Dive	Date	Diver	Start time	Max. / Min. Depth (m)*	Bottom Time (min.)	Estimated Visibility (m)	Current and Swell
135	16/05/04	Mallon	12:40	4.5 / 4.0	47	5+	Strong current
136	16/05/04	Adey-Davies	14:41	4.5 / 4.25	14	4-5	Strong from N, aborted due to current
137	16/05/04	Adey-Davies	16:05	5.0 / 3.75	54	4-5	Moderate, easing
138	17/05/04	Black	10:11	6.5 / 5.5	72	4	Slack, some swell
139	17/05/04	Mallon	11:54	5.5 / 4.5	113	5-7	Moderate
140	17/05/04	Adey-Davies	14:26	4.5 / -	2	6	Very strong, aborted due to current
141	18/05/04	Adey-Davies	09:42	6.5 / 6.25	79	5-6	Slight, swell affected diver on bottom
142	18/05/04	Black	11:37	6.0 / 5.25	53	5	Slack, some swell
143	19/05/04	Scott	12:59	5.5 / -	81	5-6	Moderate, increasing strong
144	19/05/04	Mallon	10:13	6.75 / 6.5	98	7	Slack
145	19/05/04	Adey-Davies	12:55	5.5 / 4.5	53	7	Slight becoming strong, aborted due to current
146	20/05/04	Mallon	10:40	7.5 / 6.0	114	10+	Slack, swell affected diver on bottom
147	20/05/04	Adey-Davies	13:12	5.0 / -	53	-	-
148	21/05/04	Scott	10:20	7.0 / -	24	4-5	Strong from S, dive aborted due to anchor not holding
149	22/05/04	Mallon	10:44	7.75 / 7.5	75	10+	Slight
150 (151)	22/05/04	Scott	12:42	7.0 / 6.75	138	-	-
152	23/05/04	Black	10:43	8.0 / -	69	10+	Slight
153	23/05/04	Mallon	12:16	7.75 / -	128	-	-
154	23/05/04	Scott	14:45	6.0 / -	50	-	-

* Minimum recorded rather than minimum absolute.

APPENDIX III: ARCHAEOLOGICAL FEATURES LOG

WA No.	Licensees No.	Dive Obs. No. (WA database, see 6.1.6)	Dive Obs. No. with position fixes	Summary Description	Additional Description
01	66	1275, 1277, 1287, 1319, 1320, 1338, 1355, 1363, 1394, 1396, 1397, 1398, 1399, 1400, 1401, 1402, 1403, 1404, 1405, 1406, 1407	1319 (muzzle), 1320 (cascabel), 1363/147 (muzzle), 1394/149 (muzzle)	Iron gun	
02	76	1275, 1278, 1280, 1316, 1317, 1318, 1338, 1356, 1357(?), 1369	1316/1317 (crown), 1318 (shank, ring end), 1356/146 (crown), 1369/149 (crown)	Anchor	
03	75	1275, 1279, 1321, 1322, 1323, 1357 (?)	1321 (crown), 1323 (shank, fing end)	Anchor	
04	64	1275, 1283, 1284, 1286, 1324, 1325, 1326	1324 (cascabel), 1325 (muzzle)	Iron gun	
05	65	1275, 1285, 1327, 1328	1327 (muzzle), 1328 (cascabel)	Iron gun	
06	80?	1275		Iron Ring	Next to WA02
07	70	1288, 1329, 1330	1329/146 (muzzle), 1330/146 (cascabel)	Iron gun	
08	63	1290, 1292, 1296, 1333, 1334	1333/146 (cascabel), 1334 (muzzle)	Iron gun	
09	61	1290, 1292, 1295, 1297, 1331, 1332, 1338	1331/146 (cascabel), 1332/146 (muzzle)	Iron gun	
10	62	1290, 1292, 1294, 1298, 1335, 1336, 1338, 1455	1335/146 (cascabel), 1336/146 (muzzle)	Iron gun	Very heavily concreted
11	79	1290, 1292, 1293, 1337, 1338, 1408	1337/146, 1408/151	Anchor Fluke	Anchor fluke and broken arm, concreted
12	67	1301, 1307, 1309, 1312, 1313, 1341, 1342, 1344, 1349, 1350, 1354, 1366	1341/146 (cascabel), 1342/146 (muzzle), 1366/148 (general)	Iron gun	Very heavily concreted
13	55	1301, 1306, 1308, 1312, 1313, 1343, 1344, 1346, 1349	1343/146 (cascabel), 1344/146 (muzzle)	Iron gun	
14	73	1301, 1305, 1312, 1313, 1345, 1346	1345/146 (cascabel), 1346/146 (muzzle)	Iron gun	Gun on its side
15	71	1301, 1302, 1303, 1304, 1312, 1313, 1347, 1348, 1349	1347/146 (muzzle), 1348/146 (cascabel), 1349/146 (cascabel)	Iron gun	Very heavily concreted, possible archaeological material concreted to underside
16	60	1364, 1365, 1370, 1371, 1372, 1379, 1392, 1451, 1464	1364/148 (cascabel), 1365/148 (cascabel), 1371/149 (muzzle), 1372/149 (cascabel), 1464/153 (muzzle)	Iron gun	
17	53	1359, 1360, 1373, 1374, 1375, 1378, 1391	1359/147 (general), 1374/149 (muzzle), 1375/149 (cascabel)	Iron gun	Chain concreted to gun
18	78	1360, 1376, 1377, 1390	1360/147, 1376/149, 1377/149	Anchor Ring	Anchor ring and shank fragment

WA No.	Licensees No.	Dive Obs. No. (WA database, see 6.1.6)	Dive Obs. No. with position fixes	Summary Description	Additional Description
19	51,52,59?	1380, 1381, 1384, 1385, 1410	1381/149 (general), 1384/149 (muzzle), 1385/149 (cascabel)	Iron gun	
20	51, 52, 59	1382, 1386, 1387, 1410, 1426, 1427	1382/149 (general), 1386/149 (cascabel), 1387/149 (muzzle), 1426/151 (muzzle), 1427/151 (cascabel)	Iron gun	
21	51, 52, 59	1383, 1388, 1389, 1410	1388/149 (muzzle), 1389/149 (muzzle)	Iron gun	
22	49	1428(?), 1429(?), 1449	1428/151 (?, muzzle/cascabel?), 1429/151 (?, muzzle/cascabel?), 1449/152 (?, cascabel)	Iron gun	
23	57	1430, 1450	1430/151, 1450/152 (?)	Iron swivel gun	
24	77	1414, 1415, 1421, 1440, 1441, 1442, 1443, 1448, 1456, 1457, 1458, 1459	1414/151 (crown), 1415/151 (shank, ring end, broken), 1440/151 (south bill), 1441/151 (crown), 1442/151 (north bill), 1443/151 (shank, ring end, broken), 1458/153 (crown), 1459/153 (shank, ring end, broken)	Anchor	
25	41?	1416, 1417, 1444, 1445, 1446, 1465, 1466, 1467, 1468	1416/151 (muzzle), 1416/151 (cascabel), 1444/151 (muzzle), 1445/151 (muzzle), 1446/151 (cascabel), 1465/153 (cascabel), 1466/153 (muzzle), 1467/153 (general)	Iron gun	
26	42?	1418, 1419, 1469, 1470, 1473, 1475	1418/151 (cascabel), 1419/151 (muzzle), 1469/153 (cascabel), 1470/153 (muzzle), 1473/153 (general)	Iron gun	
27	43?	1420, 1471, 1472, 1474, 1493	1420/151 (muzzle), 1471/153 (muzzle), 1472/153 (cascabel)	Iron gun	
28	50?	1432, 1433, 1476, 1477, 1486, 1434, 1435, 1494	1432/151 (cascabel), 1433/151 (muzzle), 1476/153 (cascabel), 1477/153 (muzzle), 1494/154 (muzzle)	Iron gun	
29	44?	1478, 1479, 1487, 1495	1434/151 (muzzle), 1435/151 (cascabel), 1478/153 (muzzle), 1479/153 (cascabel), 1487/153 (general), 1495/154 (muzzle)	Iron gun	Under muzzle WA28
30	46?	1438, 1439, 1480, 1481, 1488, 1497	1438/151 (cascabel), 1439/151 (muzzle), 1480/153 (cascabel), 1481/153 (muzzle), 1497/154 (cascabel)	Iron gun	Very heavily concreted

WA No.	Licensees No.	Dive Obs. No. (WA database, see 6.1.6)	Dive Obs. No. with position fixes	Summary Description	Additional Description
31	45?	1436, 1437, 1482, 1483, 1489, 1496	1436/151 (muzzle), 1437/151 (cascabel), 1482/153 (cascabel), 1483/153 (muzzle), 1489/153 (general), 1496/154 (cascabel)	Iron gun	
32	?	1484, 1485, 1490, 1498	1484/153 (muzzle), 1485/153 (cascabel), 1498/154 (muzzle)	Iron gun	Small iron gun? Very heavily concreted
33		1258, 1299, 1314, 1339, 1340, 1350, 1351, 1352, 1353, 1354, 1366, 1367, 1368, 1393, 1422, 1423, 1424, 1425, 1451, 1452, 1453, 1454, 1455, 1460, 1461, 1462, 1463	1339/146 (top), 1340/146 (north side), 1350/146 (north side), 1351/146 (west side), 1352/146 (south side), 1353/146 (east side), 1354/146 (north side), 1393/149 (top), 1396/150 (top)	Marble block mound	
34		1370		Pot sherd	Next to WA16

APPENDIX IV: MEASUREMENTS OF ARCHAEOLOGICAL FEATURES

WA No.	Licensees No.	WA Dimensions (m)	WA Orientation	Length (m) in Wignall (1979) (assumed to be OL)
01	66			2.5
02	76	Crown-ring 3.15		3.5
03	75	Crown-end shank 3.10 / Crown-end ring 3.35	140 (shank-ring)	3.6
04	64	OL 2.75 / MF-BR 2.57	295 (muzzle-cascabel)	2.65
05	65	OL 2.72 / MF-BR 2.47		2.65
06	80?			
07	70	OL 2.73 / MF-BR 2.52	320 (cascabel-muzzle)	2.65
08	63	OL 2.55 / MF-BR 2.30	145 (cascabel-muzzle)	2.5
09	61	OL 2.74 / MF-BR 2.50	220 (cascabel-muzzle)	2.71
10	62	OL 2.93 / MF-BR 2.70	320 (cascabel-muzzle)	2.75
11	79	Width fluke 0.65 / side fluke 0.70 / OL (bill-break in arm) 1.25 / diameter of arm (oval?) 0.20	N/A	1.3 (width 0.85)
12	67	OL 2.78 or 2.70 / MF-BR 2.56 or 2.50	100 (cascabel-muzzle)	2.65
13	55	OL 2.56 or 2.65 / MF-BR 2.57 or 2.40	045 (cascabel-muzzle)	2.65
14	73	OL 1.87 or 1.89 / MF-BR 1.76 or 1.75	005 (cascabel-muzzle)	1.9
15	71	OL 2.75 or 2.70 / MF-BR 2.55 or 2.40	015 (muzzle-cascabel)	3
16	60	OL 2.70 / MF-BR 2.50	125 (muzzle-cascabel)	2.75
17	53	OL 2.62 / MF-BR 2.45	80 (muzzle-cascabel)	2.6
18	78	Length of shank fragment 0.75 / OL 1.35 / ring diameter 0.40 (inner), 0.72 (outer) / width of shank 0.20	50 (shank-ring)	0.30 diameter
19	51,52,59?	OL 2.75 / MF-BR 2.60	030 (cascabel-muzzle)	2.00/2.65/1.45
20	51,52,59?	OL 2.80 / MF-BR 2.60	004 (cascabel-muzzle)	2.00/2.65/1.45
21	51,52,59?	OL 1.90 / MF-BR 1.75	355 (cascabel-muzzle)	2.00/2.65/1.45
22	49			1.9
23	57			1.53
24	77	OL 2.74 / End shank to base crown 2.49*	255	3.3
25	41?	OL 1.90 or 2.00 or 1.91/ MF-BR 1.74 or 1.752	090 or 295 (muzzle-cascabel)	1.85
26	42?	OL 2.63 / BMF-BR 2.40	020 (cascabel-muzzle)	2.75
27	43?	OL 2.66 or 2.70/ MF-BR 2.43 or 2.50	090 (cascabel-muzzle)	2.75
28	50?	OL 2.75 / MF-BR 2.50	045 (cascabel-muzzle)	2.74
29	44?	OL 2.65 / MF-BR 2.47	005 (muzzle-cascabel)	2.25
30	46?	OL 1.90 / MF-BR 1.75	010 (muzzle-cascabel)	1.9
31	45?	OL 1.85 / MF-BR 1.70	140 (muzzle-cascabel)	2.65 (nominal bore 0.10 after removal of concretion)
32	?	OL 1.65	160 (cascabel-muzzle)	

* WA measurement believed to be inaccurate due to diver error.

OL – Overall length; MF – Muzzle face; BR – Base ring

APPENDIX V: PHOTOGRAPHIC LOG

WA No.	Licensees No.	Photographs (Dive No.)
01	66	Mosaic/1012/1270/04/047-072 (137), 1012/1277/04/074-086 (139), 1012/1287/04/166 (141)
02	76	Mosaic/1012/1270/04/047-072 (137), 1012/1278/04/087-099 & 1012/1280/04/128-145 (139)
03	75	Mosaic/1012/1270/04/047-072 (137), 1012/1279/04/100-127 (139)
04	64	1012/1284/04/146-155 (141), 1012/1286/04/165 (141)
05	65	1012/1285/04/156-164 (141)
06	80?	Mosaic/1012/1270/04/047-072 (137), 1012/1278/04/087-099 & 1012/1280/04/128-145 (139)
07	70	1012/1288/04/167-174 (141)
08	63	Mosaic/1012/1292/04/175-203 & 1012/1296/04/236-243 (143)
09	61	Mosaic/1012/1292/04/175-203 & 1012/1295/04/220-235 & 1012/1297/04/244-245 (143)
10	62	Mosaic/1012/1292/04/175-203 & 1012/1294/04/210-219, 1012/1298/04/246-248 (143)
11	79	Mosaic/1012/1292/04/175-203 & 1012/1293/04/204-209(143)
12	67	1012/1307/04/288-302 (144), Photomosaic1012/1312/04/303-331 (145)
13	55	1012/1306/04/278-287 (144), Photomosaic1012/1312/04/303-331 (145)
14	73	1012/1304&1305/04/268-277 (144), Photomosaic1012/1312/04/303-331 (145)
15	71	1012/1302&1304/04/257-267 (144), Photomosaic1012/1312/04/303-331 (145)
16	60	1012/1370/04/382-388 & 1012/1373/04/393-394 (149), Mosaic2783-2733 (150/1)
17	53	1012/1373/04/389-392 & 1012/1373/04/395 (149), 1012/1376/04/396 (149), Mosaic2783-2733 (150/1)
18	78	1012/1376/04/396-398 (149), Mosaic2783-2733 (150/1)
19	51,52,59?	1012/1380&1381/04/399-406 (149), Mosaic2783-2733 (150/1), Mosaic2783-2733 (150/1)
20	51,52,59?	1012/1382/04/407-411 (149), Mosaic2783-2733 (150/1)
21	51,52,59?	1012/1383/04/412-416, Mosaic2783-2733 (150/1)
22	49	Mosaic2783-2733 (150/1)?, 1012/1449/04/2865-2869 (152)
23	57	Mosaic2783-2733 (150/1)?,1012/1450/04/2870-2877 (152)
24	77	Mosaic2783-2733 (150/1), 1012/1448/04/2852-2864 & 1012/1456/04/2898-2905 (152), 1012/1462/04/2907-2909 (153)
25	41?	1012/1467/04/2910-2914 (153)
26	42?	1012/1473/04/2915-2920 (153)
27	43?	1012/1474/04/2921-2929 (153)
28	50?	1012/1486/04/2930-2935 (153)
29	44?	1012/1487/04/2936-2938 (153)
30	46?	1012/1488/04/2939-2940 (153)
31	45?	1012/1489/04/2941-2943 (153)
32	?	1012/1490/04/2944-2947 (153)
33	No number	Panorama1012/1299/04/249-256 (143), Mosaic1012/1366-1368/04/332-381 (148), Mosaic2723-2782 (150/1), Panorama1012/1451-1455/04/2878-2897 (152)
34	N/A	-

APPENDIX VI: FUTURE OPERATIONS PLANNING

The following advice is based upon experience using SSDE techniques only. It is intended as a general guide only and no liability can be accepted for reliance upon it.

General

The location is exposed and can suffer from significant sea swell. WA lost two days out of a total of eleven to adverse weather in June and the experience of others suggests that the significant time is likely to be lost to adverse environmental conditions at all times of year. Therefore future operations should be scheduled in June, July or August if possible to maximise the likelihood of coinciding with a period of settled weather. The site is potentially hazardous in all sea states other than 1-2.

Insufficient bottom time was achieved to determine the best conditions for good visibility. WA understands that periods of planktonic bloom are experienced, mainly in the spring or early summer. During these periods visibility may be seriously affected. Visibility is also likely to be affected after a prolonged period of rain because of run-off.

Pwllheli is the most suitable harbour if a shore base and mooring is required, although it has limited tidal restrictions. All berthing is marina based and requires discretionary permission. Barmouth, although considerably closer is tidally restricted and floating berths are not available. The approaches to Barmouth can also be difficult in adverse conditions. Berthing arrangements should be made as far in advance as possible, particularly during the summer months.

Approach

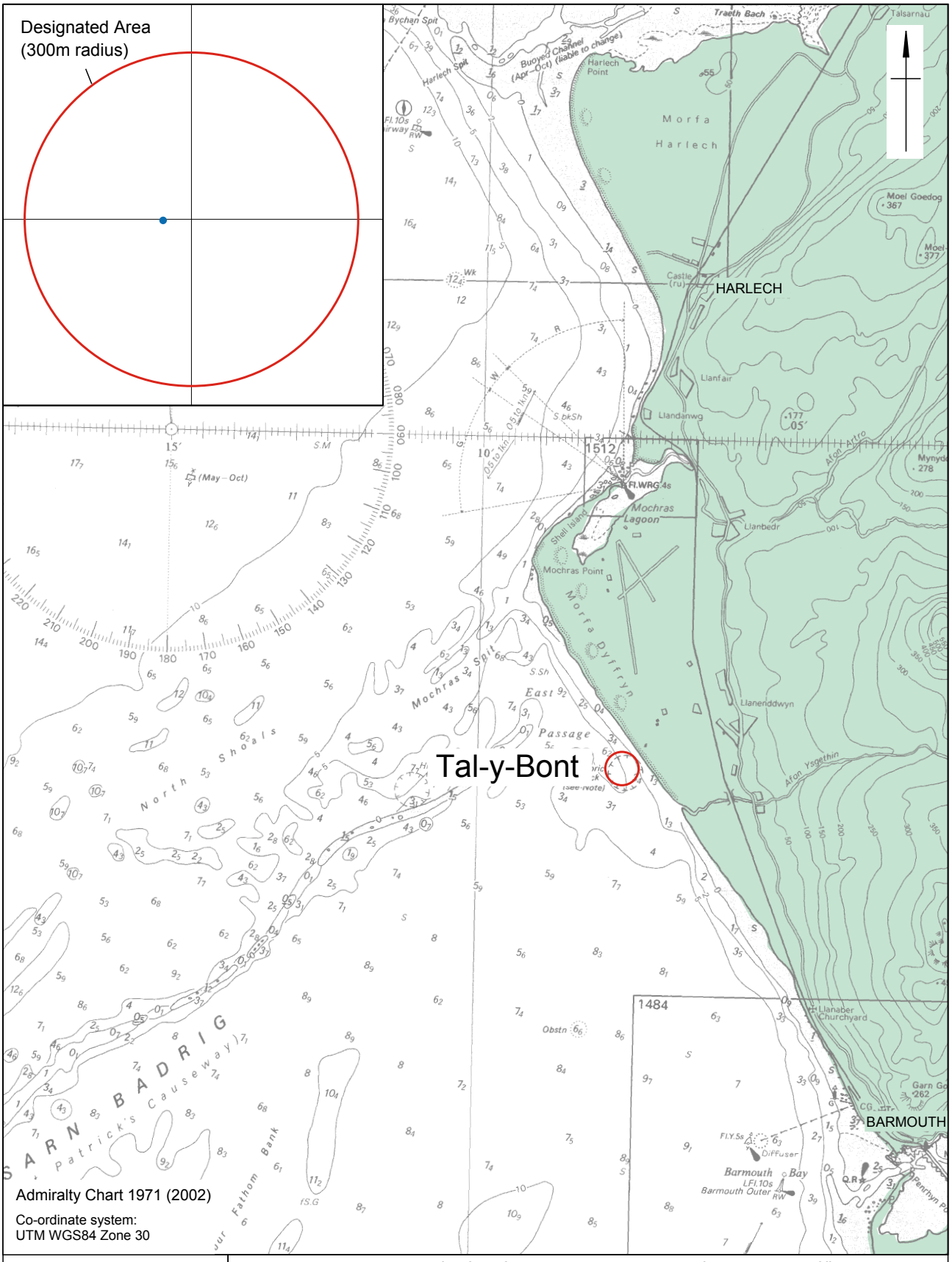
Sarn Badrig remains a significant navigational hazard at low water. Approach from the south should therefore be made with caution.

Anchoring

Anchoring was not found to be especially problematic, although there is a risk of dragging an anchor across the site. Anchoring within 50m of the site should be avoided by all but the lightest craft. None of the archaeological features are suitable for the attachment of a mooring, although it may be possible to use the more substantial features for securing a lightweight shot for use by ascending and descending divers. There is little risk of damage from the deployment of a lightweight shot from the surface.

Dive Windows

Strong tidal currents are experienced at times on Sarn Badrig. These run from south to north on flood tides and from north to south on ebb tides and can reach in excess of one knot, particularly close to the eastern end of the reef, where a narrow passage exists between the reef and the present shoreline. Reliable data concerning the strength of the flow in the vicinity of the site does not appear to exist, but WA followed advice received from Mr Cundy and Mr Bowyer (I Cundy and M Bowyer, pers. comm.) and, were possible, dived mid-tide. As a result diving operations were not significantly affected by tidal currents, although divers did experience some difficulty at times.



- Tracked diver position for top of marble mound (Obs 1396) 52 46.748 N 004 07.648 W (WGS. 84)

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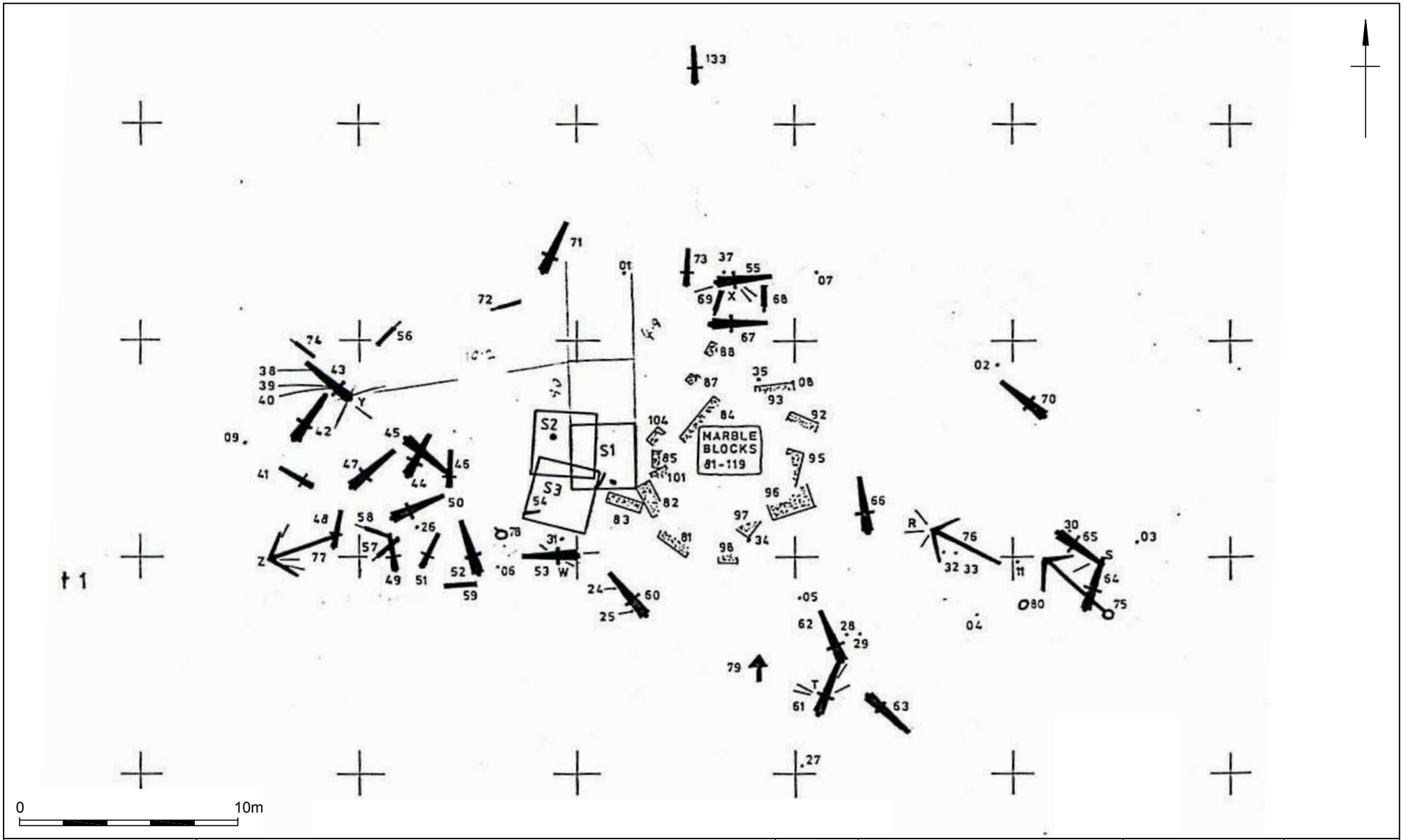
Wessex Archaeology

Tal-y-Bont site location

Figure 1



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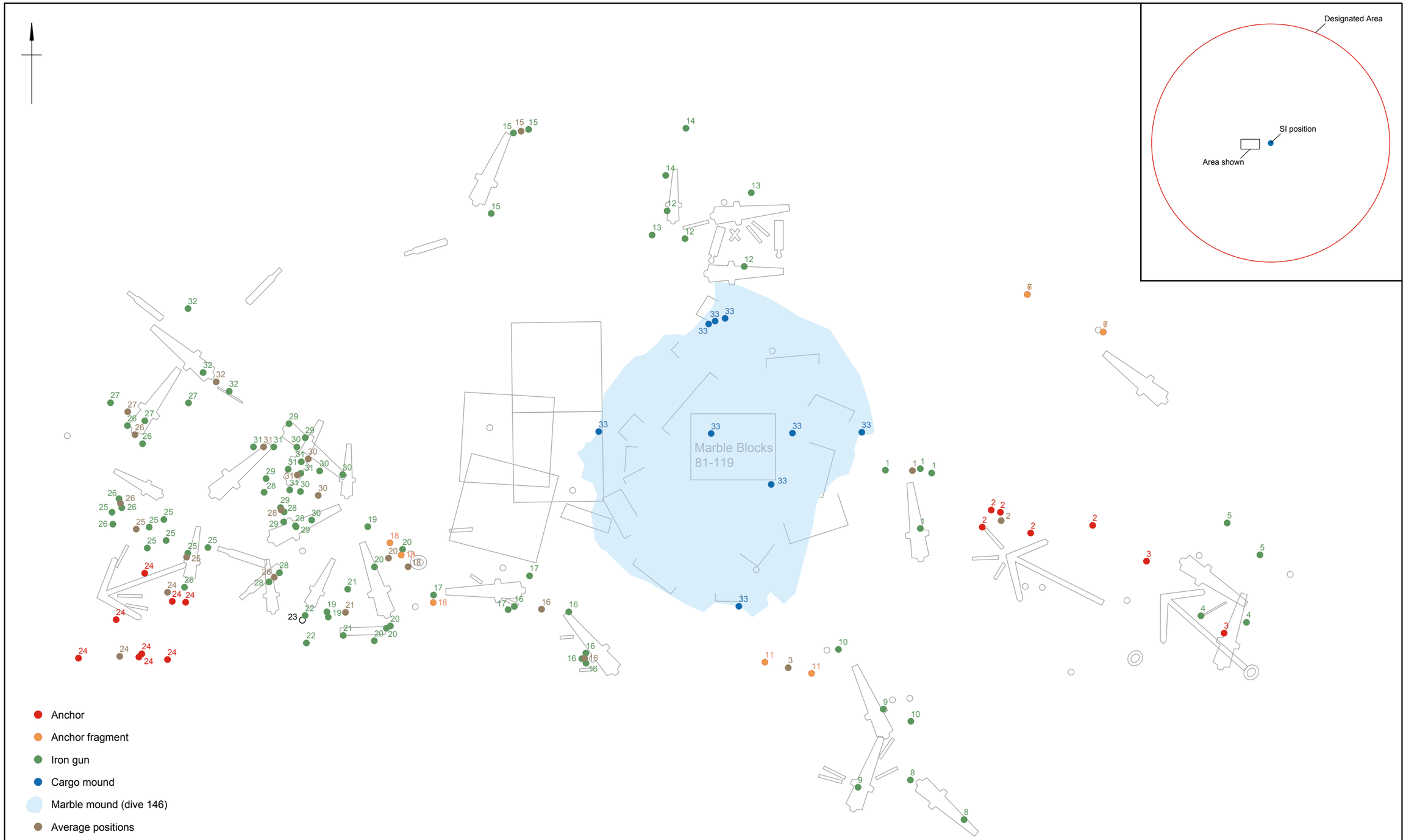
Site plan (c.1981)

Figure 2



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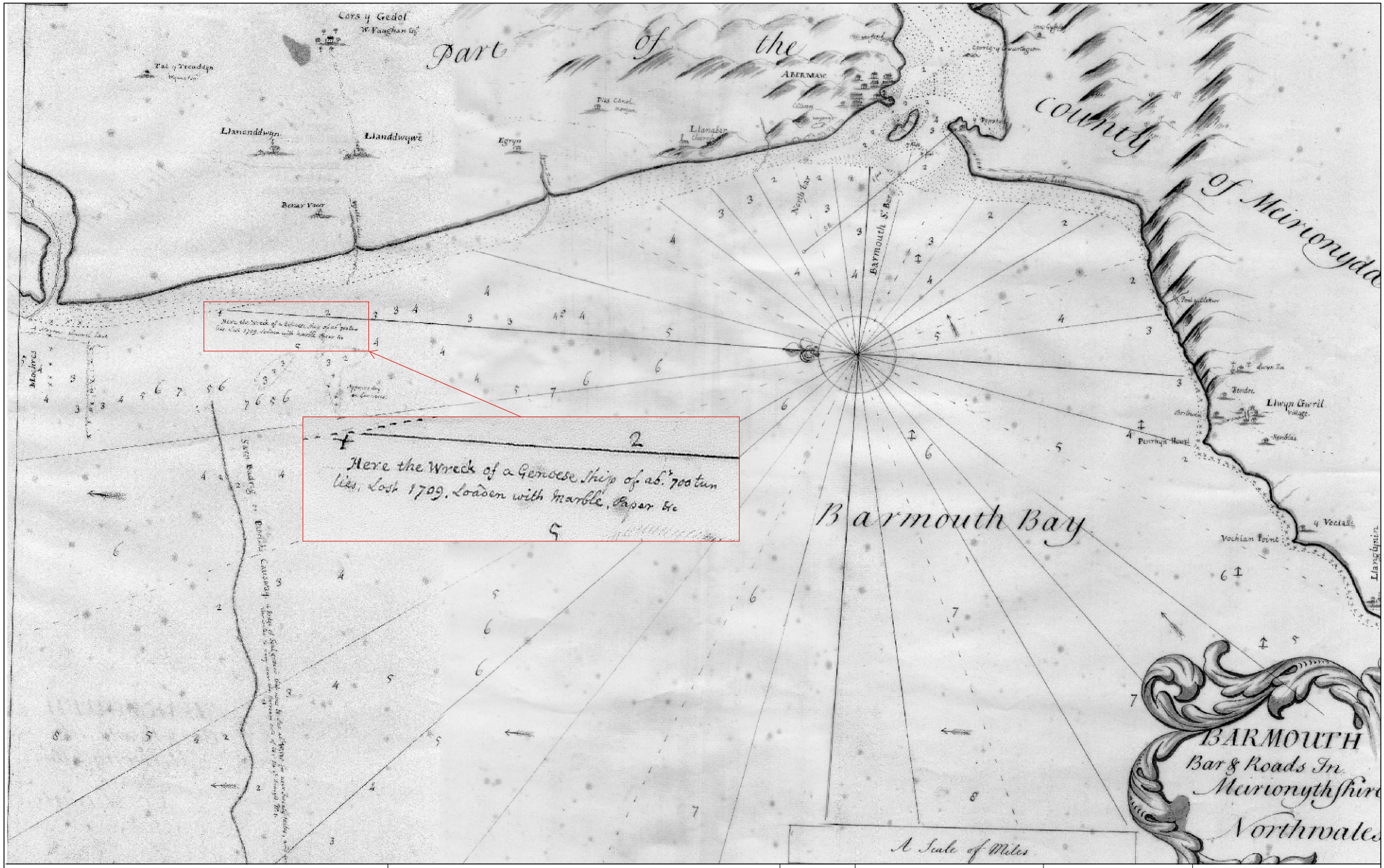
WA diver observations overlain onto the 1981 Site plan

Figure 3



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Admiralty chart

Figure 4

Plate 1a: Panoramic mosaic of the marble mound from Wa16 looking north-east

Plate 1b: Panoramic mosaic of the marble mound looking south-west

Plate 1c: Detail of Plate 1a

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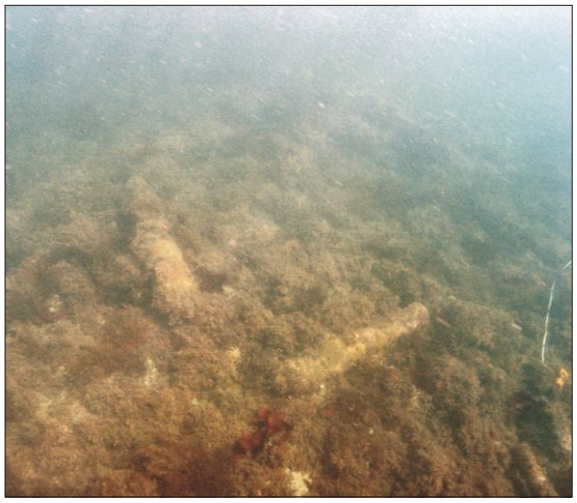

Plate 2a: WA24, 25 and 26

Plate 2b: WA13

Plate 2c: WA19

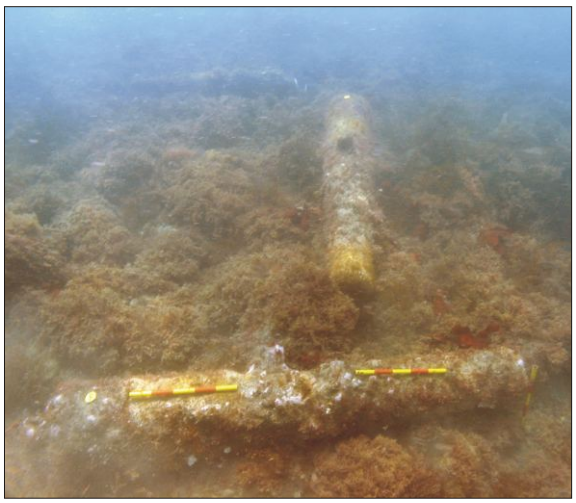

Plate 2d: WA25

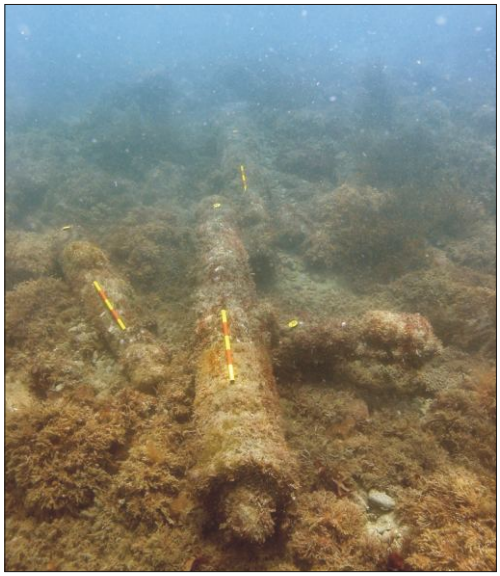

Plate 2e: WA28, 29, 30 and 31

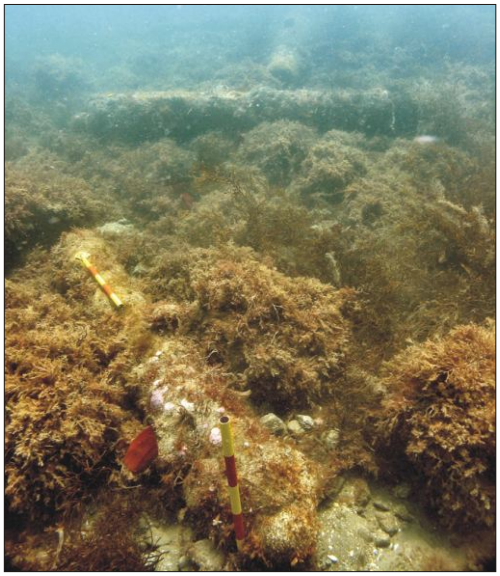

Plate 2f: WA32

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Plate 3a: WA05: Iron gun cascabel

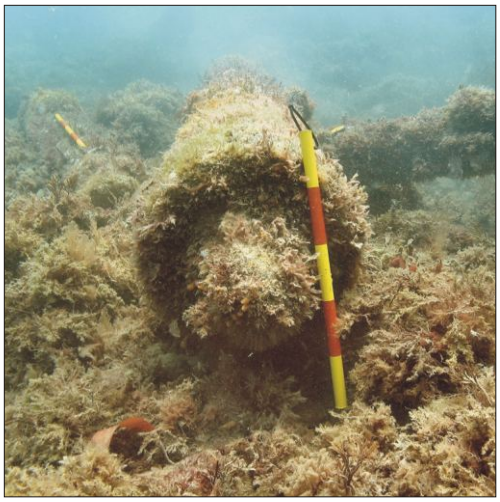

Plate 3b: WA29: Iron gun cascabel

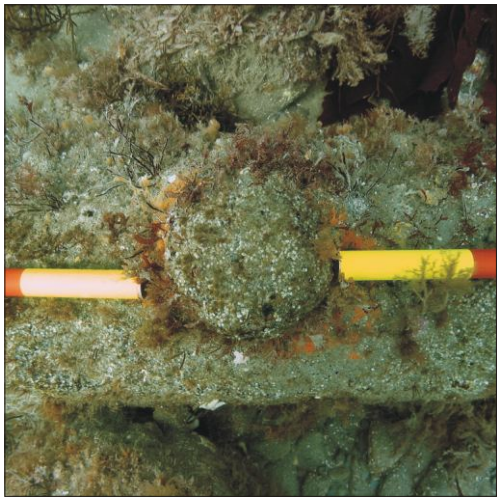

Plate 3c: WA14: Iron gun trunnion

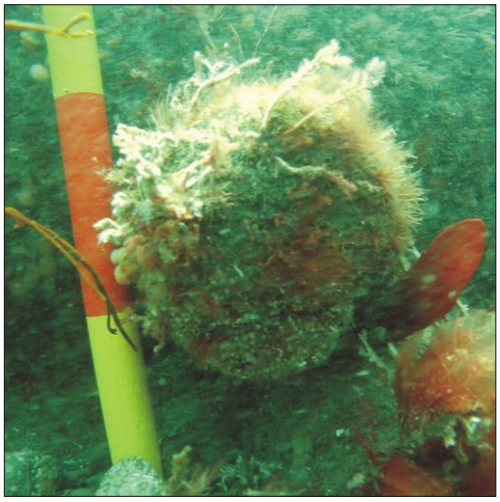

Plate 3d: WA13: Iron gun trunnion

Plate 3e: WA14: Iron gun muzzle

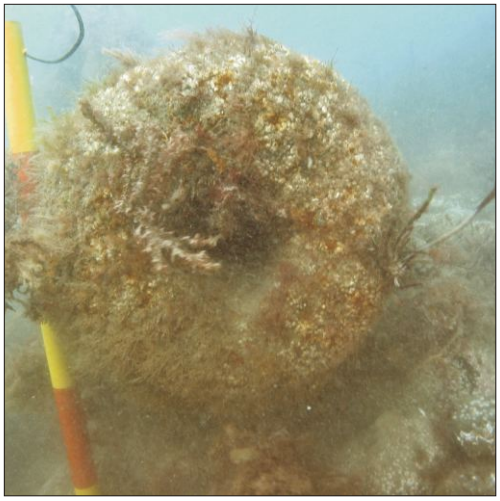

Plate 3f: WA04: Iron gun muzzle

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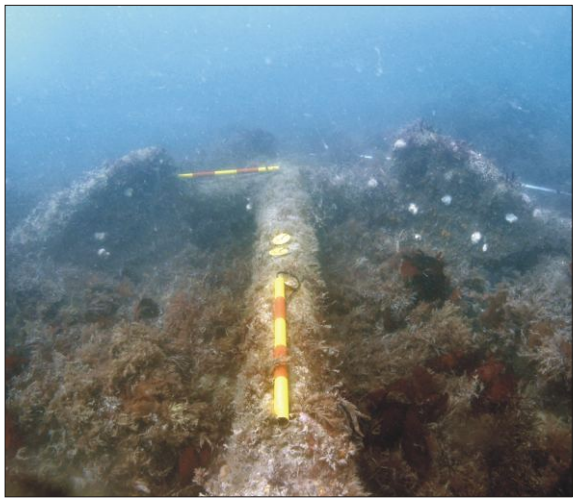

Plate 4a: WA02: Anchor

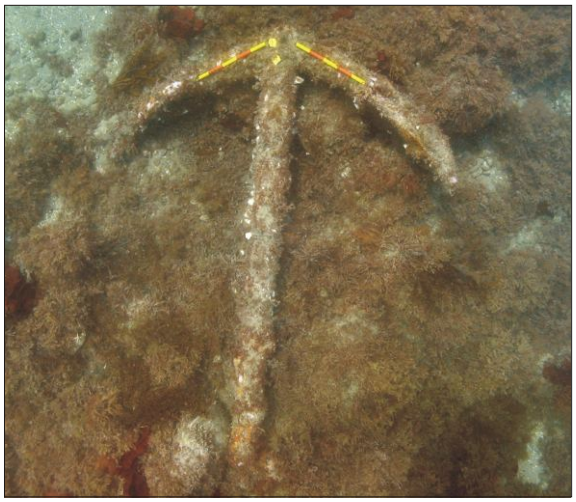

Plate 4b: WA24: Anchor

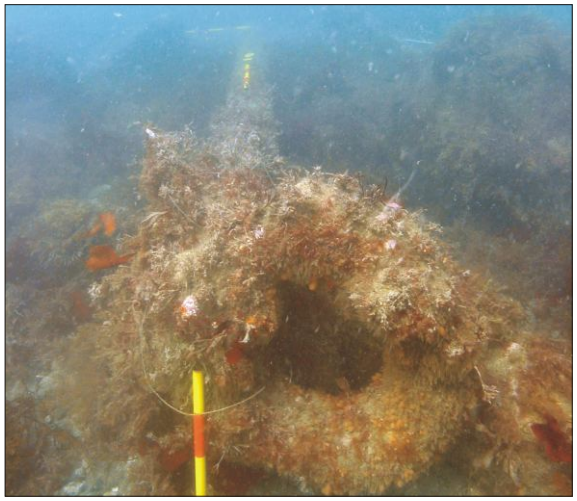

Plate 4c: WA03: Anchor

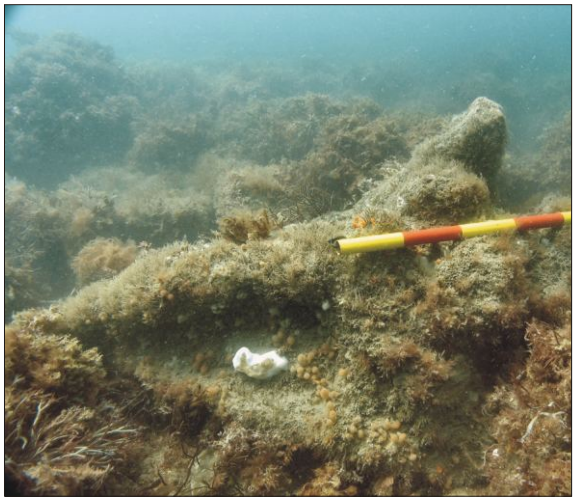

Plate 4d: WA11: Anchor fluke and broken arm

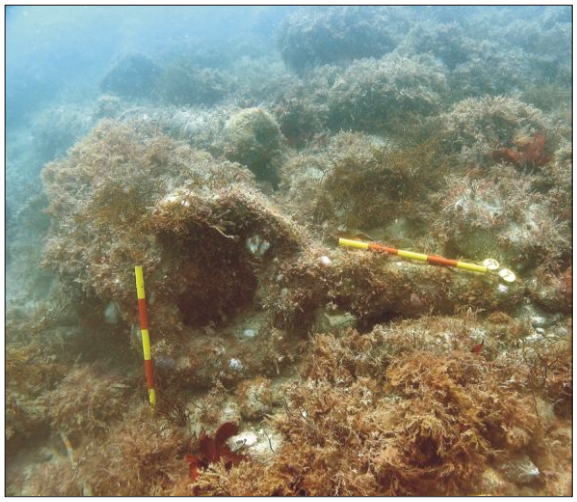

Plate 4e: WA18: Anchor ring and shank fragment

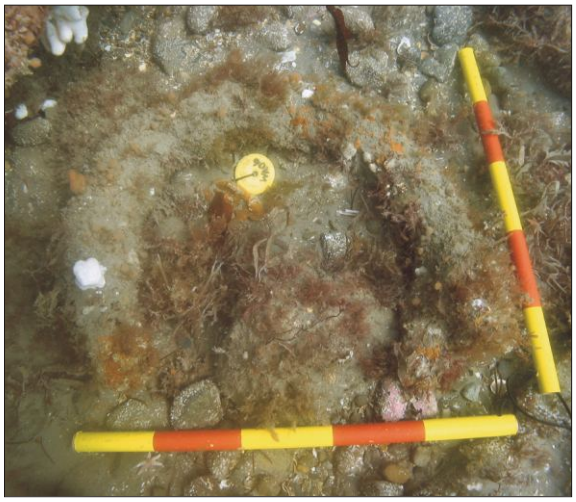

Plate 4f: WA06: Iron ring found next to anchor WA02

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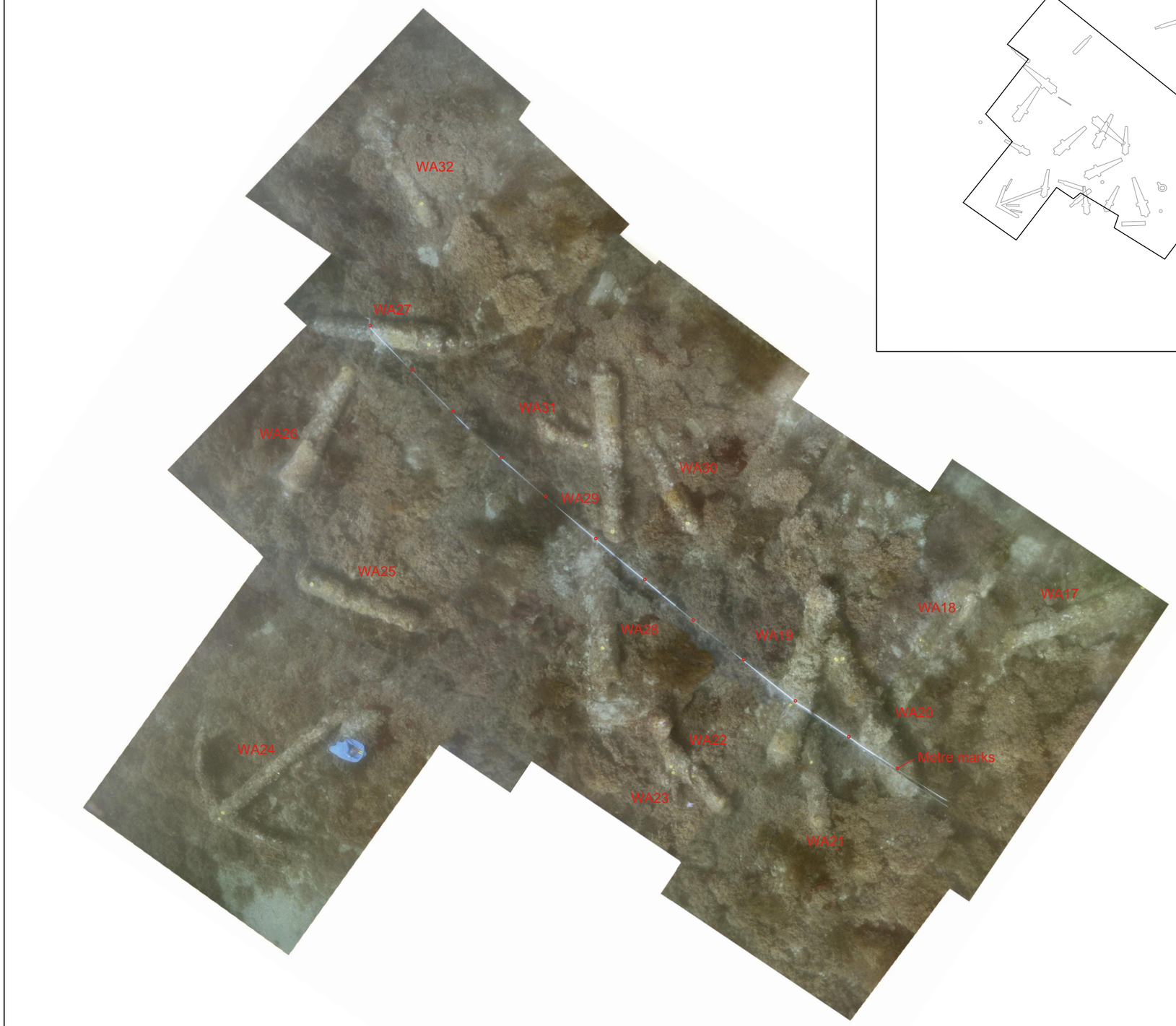

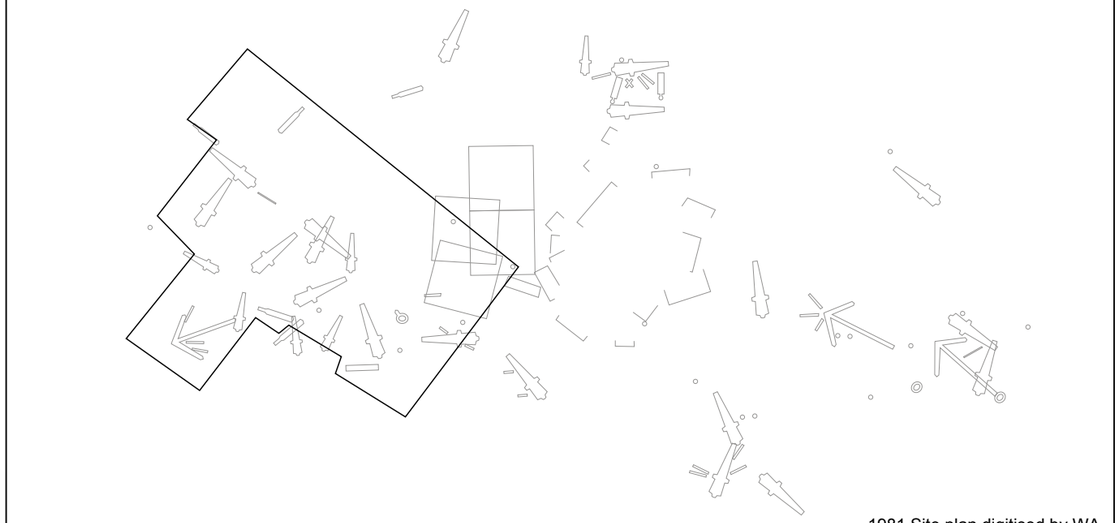

1981 Site plan digitised by WA

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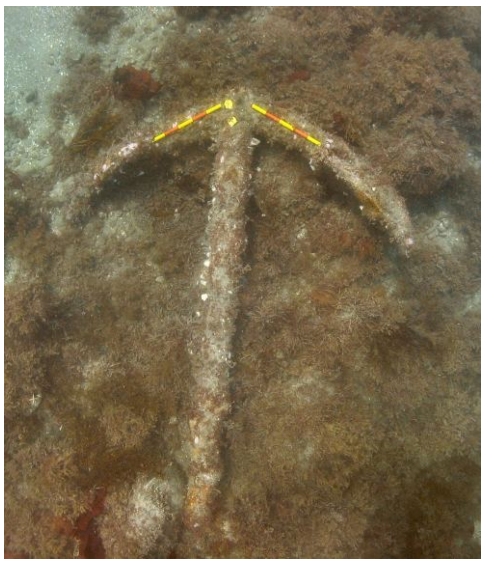
Figs\2004\z30 Tal-Y-Bont\Full report\Plate 5.dwg	

Photomosaic of south-west area of Site



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