SWASH CHANNEL WRECK; 2006 SEASON REPORT

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Paola Palma & Dave Parham
Centre for Marine and Coastal Archaeology

Prepared for Poole Harbour Commissioners

Summary
This report represents the work undertaken by Bournemouth University and Poole Harbour Commissioners on the Protected Wreck site of the Swash Channel Wreck located in the approached to Poole Harbour, Dorset.

It details that the articulated ship structure on the site is potentially much larger that was first though, extending for as long as 40m in a SW-NE axis and in area up to 14m in SE-NW axis, much of this is completed unrecorded. This document also suggests that in some area, as yet unquantified, the site may contain buried stratigraphy up to 2.5m deep.

The report also details the results of the environmental monitoring that have occurred on the site. This work is at an early stage but to date has produced results that indicate that the site is at threat from both physical and biological degradation that is causing loss of archaeological material and subsequently information in a very short period of time.

Acknowledgements

The first monitoring period has benefited from the diving, technical and scientific expertise of the authors of this report and other members of staff at Bournemouth University, namely Nigel Bryant, Olivia Merritt and Elizabeth Rundle

A key role has been played by some of the students of the BSc Marine Archaeology program, to whom training in diving and environmental strategies has been given. In particular is valued the work of Kevin Stratford, Paul Rees and Stuart Churchley for their help, in particular the latter who took on board the proposition of making of the metal monitoring the topic for his dissertation. In addition the help of Brandon Mason, James Winter, Emily Loughton and Jenna Williams is acknowledged.

The help of John Rennardson (Hythe Marine Services), Paul Farrell and Bob Fletcher (Portsmouth University) and especially Frank Eliston (Dorset Work Boats) is also acknowledged

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Contents

Introduction

Discovery
The Swash Channel Wreck (the 'site') lies in approximately 7m of water on a flat sand and shingle immediately adjacent to the eastern edge of the dredged section of the Swash Channel in the approaches to Poole Harbour in Dorset. The site was discovered as a sidescan sonar anomaly as a result of a geophysical survey conducted by Wessex Archaeology (WA) on behalf of Poole Harbour Commissioners (PHC) and Poole Borough Council as part of the Poole Harbour Channel Deepening and Beneficial Use Scheme (Wessex Archaeology 2006).

Designation
The site was designated as a Historic Wreck under the Protection of Wrecks Act 1973 on Friday 10 December 2004 under order 2004 No.3243. The protected site lies within a polygon measuring 100m by 200m whose corners lie at four points Northwest (50°39.8971'N, 001°55.5905'W), Northeast (50°39.9201'N, 001°55.5137'W), Southeast (50°39.8225'N, 001°55.4414W) and Southwest (50°39.7994'N, 001°55.5182'W).

Since the sites designated the archaeological licence has been held by Mr Richard Appleton, Harbour Engineer for Poole Harbour Commissioners. For 2005 the sites archeologically advisors were WA and for 2006 Bournemouth University.

2004/2005 Work Summary
WA undertook initial diving operations on the site in October 2004 (for identification), for 26 days between 23rd May and 27th June 2005 (to undertake a Designated Site Assessment) and for nine days between 17th October and 15th November 2005 (to undertake mitigation works) During this works a total of 300 sandbags were laid on the site. The distribution of these is shown in previous reports (Wessex Archaeology 2005).

WA concluded that the site consist of wooden structure and other debris within an area measuring approximately 40m x 12m with a least two cannons lying to the north of this area. Within this area lie two large wooden fragments of hull structure, one 20-24m long (Area 1) and one 10m x 4m (Area 2). Within Area 1 lie two 2 cast iron cannons and outlying to this area are at least a further 2 cast iron cannons. All measure between 2.5 and 2.75m in overall length.

The two wooden structures are two sections of the articulated side of a vessel hull from the turn of the bilge upwards to the top timbers lying outer side down. The upper works are pieced for circular ports and have at least one small decorative carving present. There is evidence of at least two decks. A number of other isolated timbers lie on the perimeter of the site, one of which WA have suggested may be a rudder.

WA suggested that there was limited evidence of stratigraphy with little evidence of remaining artefacts, with the exception perhaps of small buried pockets within the structure itself. Finds located included rope fragments, a sheave block, 17th century Rhensish stoneware sherds and an articulated brick and tile structure. The pottery sherds, a tile fragment and 44 iron concretions have been raised for analysis.

Of the concretions recovered 35 objects were X-rayed and only two of these showed any items of interest. One of these is a modern bolt and the other a broken iron bolt 0.3m in length. The other nine were too large to fit into the X-ray machine. A number of the X-rays had shadows that suggested that they may have been too thick to X-ray (WA 2006).

The Rhenish stoneware sherds consist of part of a jar or jug that is unlikely to have been made before 1630 because of the presence of a rosette and the use of cobalt. It is unlikely to have been later than 1700 when the vessel shape changed. Dendrochronological work undertaken by Nigel Naying of Lampeter University has provided a felling date for a single timber of post 1585 from a tree that grew in Germany or Holland. The brick and tile fragments are post medieval. A broad date suggested for the site therefore is between 1585 and 1700, tending towards the first half of the 17th century.

The 2006 Season

With the completion of the mitigation work and the Designated Site Assessment there was a need for a long term monitoring of the site. With limited funds with which this could be undertaken, EH arranged a meeting between PHC and the Centre for Marine and Coastal Archaeology (CMCA) at Bournemouth University to discuss a proposal that would allow for this monitoring to take place as part of a research/teaching project connected with the university BSc Marine Archaeology program.

Subsequent to this meeting the CMCA prepared a Project Design designed to undertake this work in accordance to specifications supplied by and under a licence issued by English Heritage.

This work is funded jointly by Poole Harbour Commissioners and Bournemouth University.

Diving

In accordance with regulation 7(1) of The United Kingdom's *Diving at Work Regulations 1997* (S.I. 2776) Bournemouth University is registered to act as a diving contractor. All diving operations undertaken on the Swash Channel Wreck were in line with the Poole Harbour Control – *Operating Procedures & Guidance (Diving Operations)* and *Scientific Diving: Code of Conduct* (Parham, 2006), which has been agreed by the Health and Safety Executive (HSE). The document is designed specifically for the inclusion of university students within scientific diving research. The dates and number of dives conducted on the site during 2006 is listed below.

Table 1Diving Time

Date	Dives	Minutes
4th May 2006	6	272
31st May 2006	9	301
19th July 2006	8	474
20th July 2006	8	442
17th August 2006	10	552
18th August 2006	10	509

19th August 2006	11	412
19th September 2006	6	306
Total (over 8 days)	**68**	**3,268**

Project Aims and objectives

The overall aim of the project is to complete the survey of and establish a strategy for the future management of the Swash Channel wreck, which may be implemented by the staff and students of Bournemouth University as an ongoing project to be run over the period 2006-2011.
This approach combines the application of the staff's archaeological, scientific and diving expertise with the education of students in archaeological skills through the undertaking of research and monitoring on the site.

The above aim is achieved by:

1. Collating the current archive held on the site
2. Undertaking an assessment of the extent of the site
3. Establishing a stratigraphy for the site
4. Undertaking a monitoring strategy, which includes: a) an assessment of sediment dynamics; b) wood preservation; c) the burial environment and d) the stability of metal on the site.
5. Developing a long term strategy for the management of the site based on the results of the monitoring process, proposing mitigating measures to manage the site's stability where necessary

The following objectives will be addressed at a later stage of this project:

6. As far as is possible setting the site in its local and regional archaeological context.
7. Providing a plan detailing how the archaeological research and management of the site should proceed in the long term.

Methodology

1. The collection of the current archive from the site will be gained by contacting Wessex Archaeology, who holds it.

2. The assessment of the extent of the site is gained by a swim-over survey and the annotation of new features, if any were to be found.

3. The establishment of a stratigraphy for the site is gained by an augering survey undertaken around the shipwreck. This is achieved by using a 1 m long auger and by augering every 4m along the baseline and every 2m out to the west and east of the baseline.

4. The monitoring strategy undertaken is based on the approach developed during the MoSS project and includes an assessment of sediment dynamics, analysis of the biological threat to the wooden structure, the burial

environment (Palma, 2005a, Palma, 2005b) and the stability of metal and wood on the site.

a. Sediment dynamics: To investigate the characteristics of the seabed sediment dynamics, 28 mild steel 1m long rods have been inserted across the site. They are protruding out of the seabed for 500mm. At each dive the sediment level is recorded and the variations plotted into a graph, to establish the trend of sediment movements across the site.
b. Wood preservation in aerobic conditions on the site by analysing the threats to exposed timbers. This is achieved by 1) a visual survey and annotation of the characteristics of the wooden structure belonging to the wreck and 2) the deployment of sacrificial wooden samples to be analysed at regular intervals.
c. The burial environment: Sacrificial samples have been prepared to be deployed in anaerobic conditions. By doing this, it is hoped to obtain data concerning the environment encapsulating part of the wreck. The analyses will reveal how and if the sacrificial samples have degraded by *fungi* and bacteria or if the sediment has been conducive to a natural preservation.
d. Stability of metal on site is achieved by drilling through the concretion encrusting the cast iron cannons. The corrosion potential can be calculated, following the published methodology (Gregory, 1999, Macleod, 1981 & 1995, McCarthy, 2000, North, 1976 & 1982) by using an Ecorr verses Ag/AgCl electrode cell attached to a stainless steal probe connected to a high impedance multimeter encased in underwater housing.

5. Developing a long term strategy for the management of the site based on the results of the monitoring process, proposing mitigating measures to manage the site's stability where necessary

6. As far as is possible setting the site in its local and regional archaeological context.

7. Providing a plan detailing how the archaeological research and management of the site should proceed in the long term.

Results

1. Collating the current archive held on the site

The project archive has been requested from Wessex Archaeology, who have agreed to pass it on to Bournemouth University. To date it as only been received in part. Work on this aspect of the project will be completed once the archive in its entirety has been received.

Figure 1 Lead pipe

2. Undertaking an assessment of the extent of the site.

A swim-over survey conducted during the beginning of the 2006 season revealed that the articulated structure present on the site extends for approximately 40m on a SW-NE axis and approximately 15m in a NW-SE direction, with isolated finds outside this area.
This revealed an archaeological area double the size of the one reported in 2005. This area includes a number of newly revealed timber structures, two cannons and possibly a third one partially buried, and fragments of rope (120mm diameter and approx 560mm in length). Given the tight time monitoring programme, it was not possible to survey this new archaeological area during the 2006.

Figure 2 Recently broken handled vessel

During the swim-over survey, two data were laid on the site with which to position the baseline: datum XY was laid at the SW extremity of the site, and datum ZA at the NE extremity of the site.

Table 2 Datum Points position

Datum	Notes	Easting	Northing	Height
ZA	Benchmark	405260.00	85075.91	0
XY	WA - MBL(S)	405236.50	85042.53	-0.2

During the investigation of the site, new finds were also seen within the original archaeological site. These, of possibly quite extensive importance, are: approximately 2m length of lead pipe bent around the timber structure (Fig.1), a broken but beautifully manufactured ceramic handled vessel (Fig. 2) a leather shoe sole, part of a wooden stave built barrel, bricks, and a fragment of rope (Fig.3). Most of the artefacts appeared to be in very precarious conditions as partially or nearly totally exposed – the rope, for example seemed to be in very unstable state of preservation. This instigated the decision, under English Heritage (EH) approval, to excavate and recover these loose finds for conservation by EH at Fort Cumberland. This task was planned to happen during the diving operations in August 2006 but was not

Figure 3 Exposed fragment of rope

undertaken as these finds were not visible at the time. This is thought to be a result of the dynamic nature of the site: in the case of small objects it is considered that they have been lost and in the case of big objects may either have been lost or possibly naturally reburied. During the dives in August a possible second wooden barrel close to baseline was observed.

During the 2006 season a single fragment of pottery as potential dating evidence was recovered. This proved to be North-Eastern English white-slipped, black-glazed redware, 19th century in date, probably after 1850. This type of pottery usually took the form of large basins or bowls, or chamber pots. It was carried, presumably as a secondary cargo, on coal-carrying ships from Northumberland and North-East Yorkshire. Sunderland was one manufacturing site for this material, It is a common find among seabed assemblages around the east and southern coasts of Britain. This piece is badly abraded though, as the black external glaze is usually much glossier than what we see on this example. The condition of this sherd suggests that it has been exposed on the seabed for quite a while, and may therefore not be associated with that particular vessel (Brown pers com). This is in the process of being declared to the Receiver of Wreck.

3. Establishing a stratigraphy for the site

Work undertaken to date for this objective in the programme includes an auger survey to establish the extent to the mobile sand deposit above what is believed undisturbed archaeological stratrigraphy that has been briefly glimpsed during erosion episodes witnessed in July. Results of the survey are detailed below:

Table 3 Depths of the augering

Baseline (from XY)	East Side					Centre	West Side				
offset	**-10**	**-8**	**-6**	**-4**	**-2**	**0**	**2**	**4**	**6**	**8**	**10**
0	-0.3	-0.3	-0.35	-0.45	0	-0.55	-0.15	-0.5	-0.15	-0.25	-0.15
4	-0.23	-0.11	-0.41	-0.05	0	0	-0.21	-0.36	-0.24	-0.33	-0.2
8	-0.29	-0.27	-0.45	-0.05	0	0	-0.21	-0.36	-0.24	-0.33	-0.2
12	-0.33	-0.3	-0.42	0	-0.1	0	-0.22	-0.22	0	-0.2	-0.15
16	-0.29	-0.34	-0.26	-0.06	-0.25	0	-0.05	-0.07	-0.07	-0.05	-0.04
20	-0.23	-0.22	-0.1	-0.15	0	0	-0.1	-0.09	-0.03	-0.14	-0.1

The results of the auger survey have presented a situation of very thin and mobile overburden, which create difficult conditions for the burial of the sacrificial samples in anaerobic environment as these have to be inserted through this layer. The relative thin layer of mobile sand overburden is not conducive to the natural protection of the site.

4. Monitoring strategy:

a. Sediment dynamics:

The monitoring rods were deployed in the sediment in August and the measurement taken from them is displayed in the graphs below: blue coded are the measurements of the depth of the rods in August and the data collected from them in September is pink coded.

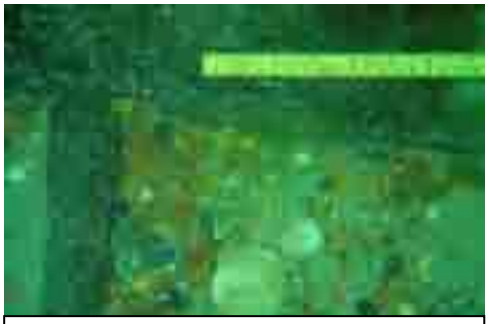
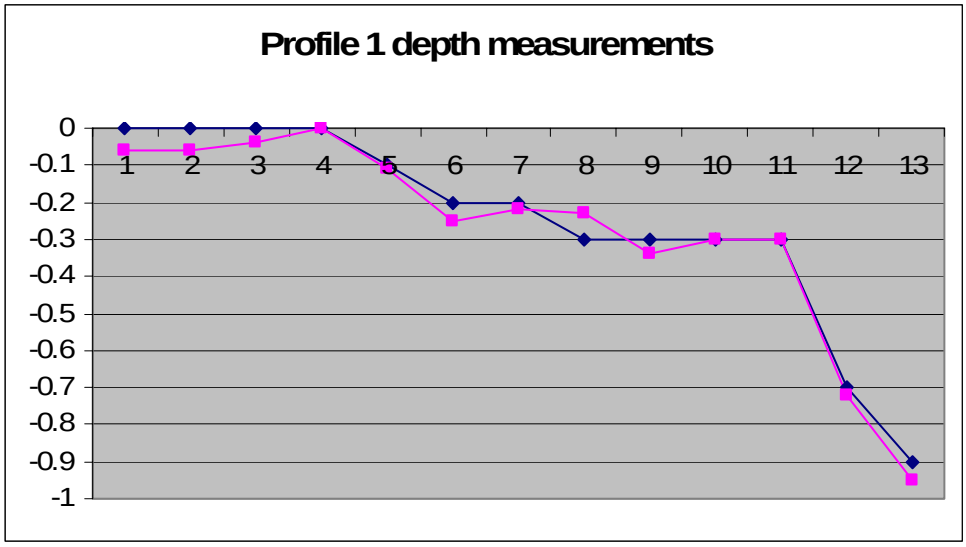


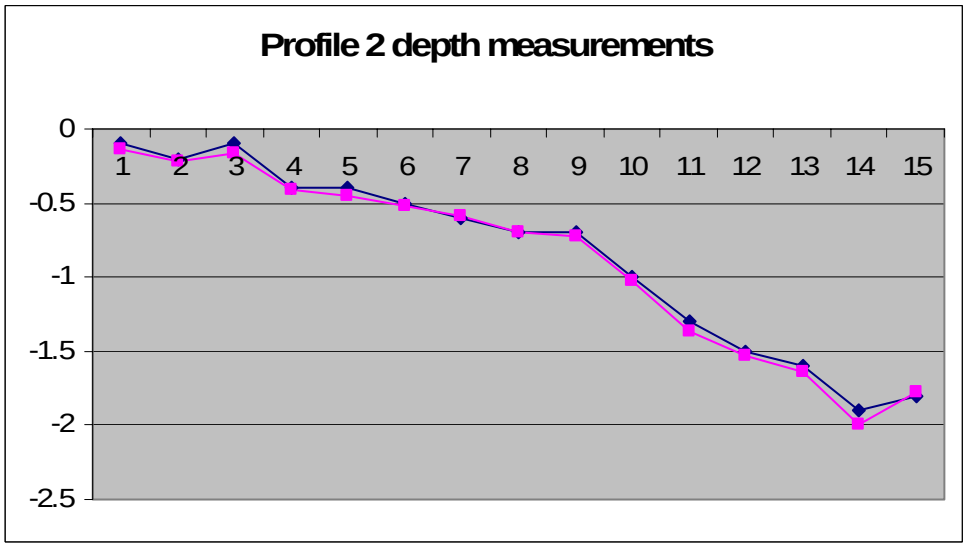
Figure 2 Mixed type of seabed

Table 4 Rods measurement in the Western Area



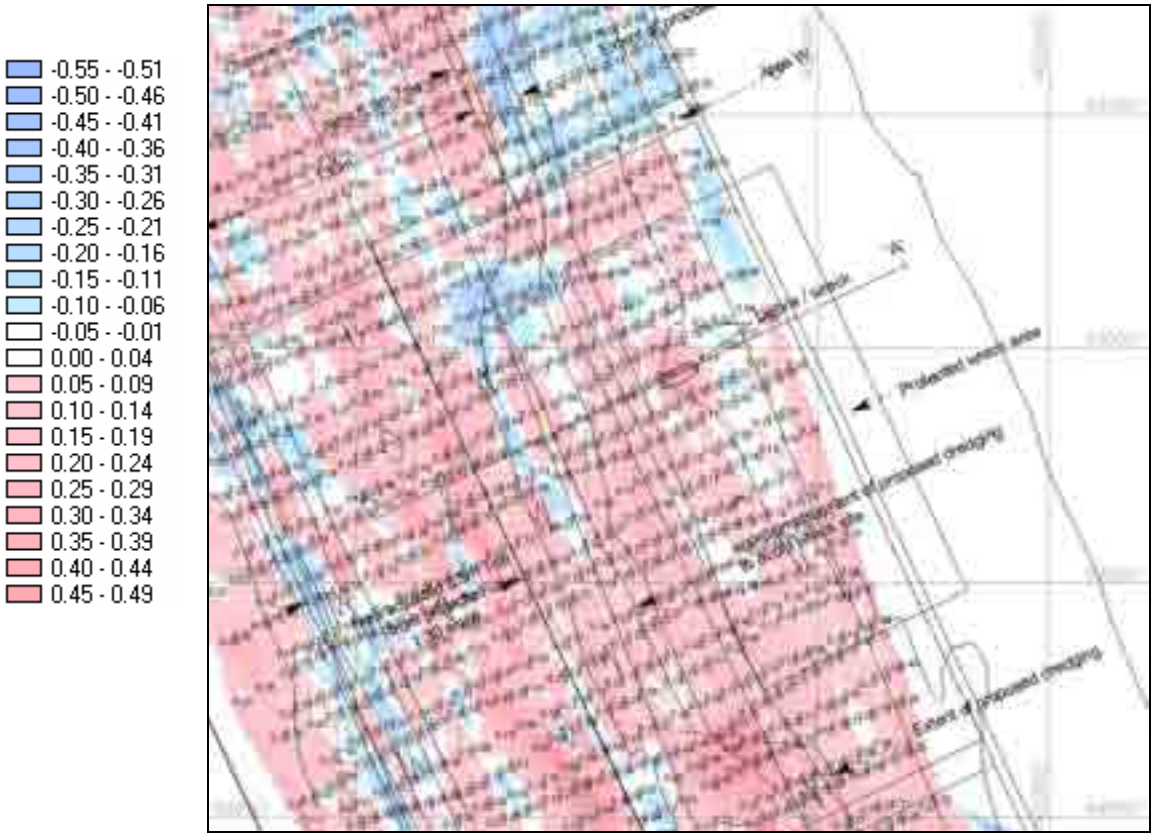
In Western Area "Profile 1" the data collected after 1 month deployment of the rods into the SCW site is shown.

Table 5 Rods measurements in the Eastern area



In Eastern Area “Profile 1” the data collected after 1 month deployment of the rods into the SCW site is shown. With only one data collection period there’s little conclusion that can be drawn for this process, to date.

In accordance with the requirements of the English Heritage conditions of mitigation for the site PHC undertook soundings across the site on two occasions in 2006. In March 2006 (directly after dredging of the Swash channel had been completed) and September 2006. The plan below shows changes in depth/elevation of the seabed between 2 surveys. The soundings were obtained by single beam echo sounding and cover the protected area. Red indicates the deposit of material and blue indicates a loss of material and white indicates no change. Measurement to less than +/-0.05m is outside of the accuracy tolerance of this method of survey. The soundings and comparison will be carried out twice a year as required under the conditions of mitigation, and in future two comparisons will be provided: one with the original post-dredge survey and one with the immediately preceding survey.



Soundings across the site

b. 1. Visual assessment of the wreck wooden structure and its environment.

The substrate around the wreck is mainly sand and shingle, with a few shells and cobbles (Fig.4). This layer appears to be fairly mobile, as shown by a lack of attached marine organisms, except on the larger stones or cobbles and the wreck itself. The mobility of the substrate is also suggested by the presence of particular algae that are associated with sand scoured habitats and mobile pebbles and shell. The wreck itself supports a rich community of flora and fauna, many of them are perennial species,

this fact together with the apparent level of development and succession of fouling organisms present, indicates that the portions of the wreck examined had been exposed for at least a second year in succession. The shallow nature of the site and reasonably clear waters allowed the algae to dominate the wreck surface, whereas deeper wrecks or those in very turbid waters would be dominated by animal growth. There were few green algae present, as they are the first group to disappear as the light is reduced sublittorally. Also, as would be expected the Animals were found to be much more abundant on the under hanging or shaded parts of the wreck. The

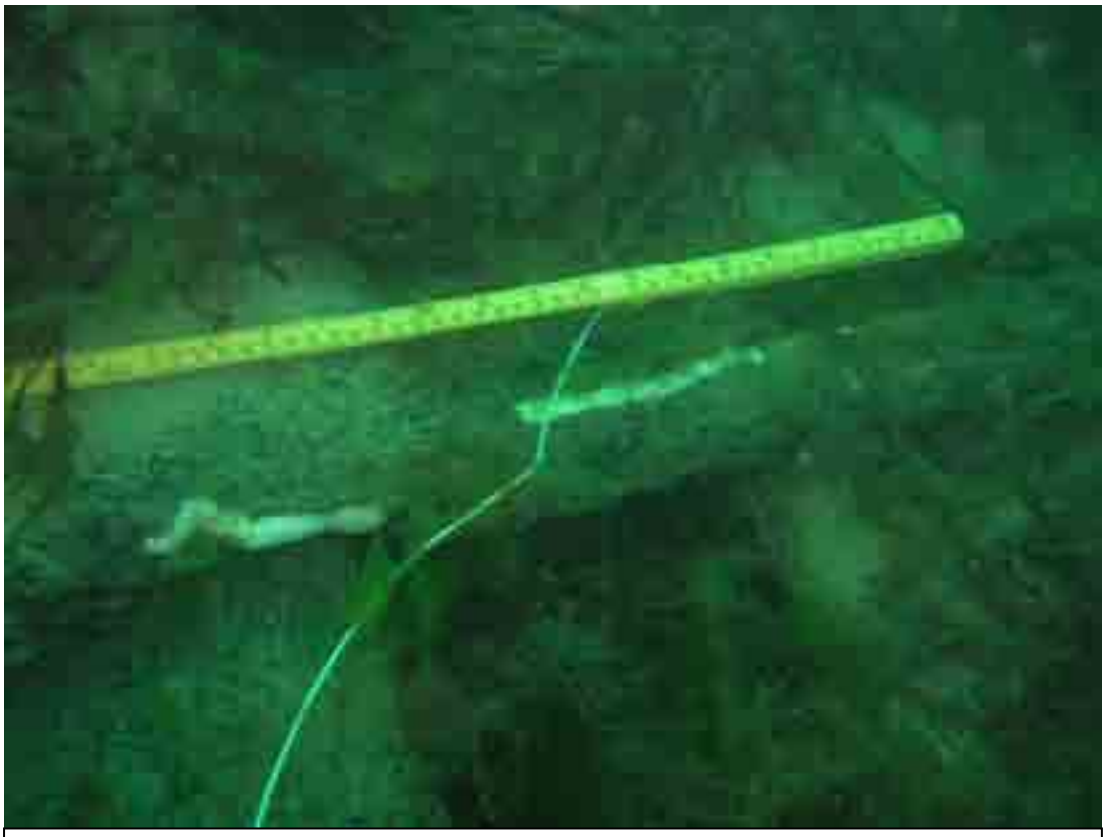


Figure 3 Shipworm tunnel 500mm long on shipwreck timbers

wreck also provides a habit for many highly mobile species of crustacean and fish, which are listed in Appendix 1. Two unusual observations were made in two occasions during the diving season: in the July visit a seahorse on the wreck site and in the August visit a pipefish were noticed. These events were reported to the Dorset Environmental Record Centre.

Early May's Visit: Site was located. A brief visual assessment was made of the site that suggested that no apparent active erosion was taken place. As this was our first visit to the site no real data was collected and this was only a passing view.

End of May's Visit: The site has been found in very exposed conditions compared to the Early May visit. A visual survey has resulted in noticing wide uncovered areas of the shipwreck where at least 400 - 500 mm of wood was found proud of the seabed. The conditions of the wood seemed to be in a general degraded state of preservation. Shipworm attack has been recorded being at a very advance state of attack. The borers have been able to dig into the wood in some instances for up to 500 mm long tunnels.

July visit: an assessment was made on the WA sandbagging as detailed in Fig.3 of WA Report May 2006 Ref 61340.03. A visual survey suggests that the sandbags laid in Area 2 appear to have consolidated well and this area has the appearance of natural seabed with the occasionally badly abraded sandbags being visible. We however concerned that in their currant state the sandbags will last no more than a season or two at which point Area 2 will revert back to unconsolidated sand that will easily erode. Those sandbags laid around MBL(S) have almost completely disappeared with little or no evidence of their presence. The occasional badly abraded sandbag was visible on SE edge of Area 1. A number of freshly eroded depressions in the seabed were seen in which previously unexposed fresh timbers were visible as well as a number of finds referred above.

August visit: the site was again assessed for erosion. The eroded depressions seen in July had filled in and the site was covered in a layer of marine growth. It gave the appearance of being stable and if the dive undertaken in July had not occurred, there would be no immediate evidence of erosion. In addition the site was assessed for biodiversity and a report is included in Appendix .1Whilst marine plant life the wreck had increased noticeably, it was evident that there was substantial less marine fauna in quantity and diversity.

September visit: activity on the site was limited due to adverse weather but there was very little noticeable difference between the conditions of the site in August and those in September.

Figure 4 Sacrificial samples underwater

b. 2. Deployment of sacrificial samples

A stainless steel metal framework has been designed and manufactured for the deployment of the organic samples in aerobic environment. By monitoring the state of the samples, visually at every dive, and analytically at regular intervals, a scientific picture of the progress in degradation can be achieved (Palma, 2005).

Figure 5 Biofilm on sacrificial sample

The framework was deployed on the seabed at the end of May visit, in the SW area in the proximity of the wreck close to XY datum.
During the July visit, the sacrificial samples were extensively covered with algae and barnacles and already a thin biofilm layer was covering their surface. The wood showed signs of initial physical erosion and

initial biological degradation.

Figure 6 Sacrificial sample before deployment

Figure 7 Same sacrificial sample as before after 3 months deployment

During the August visit the framework was found sitting in an eroded hollow and subsided and now lay approximately 350mm below to the original position. The sample surface was thoroughly covered with biological organisms and the samples seemed to have gained an excessive weight – although not fully waterlogged – as a

depression in the row they formed, was noticed. Many fishing hooks and lines and other polluting material was found present on the framework. The samples now showed clear sign of woodborer's activity, and although at a quite superficial level, it shows evidence of extensive damage unexpected after such a short period of time.
When finally the 1st set of samples was recovered and investigate in the lab; the analyses, still on going, has showed to date the presence of two types of woodborers: crustacean (gribble) and shipworm. The gribble is *Limnoria*sp, which causes damage on the wood surface in very short period of time; the shipworm, belongs to the family of *Teredinidae*, and causes a structural damaged to any wooden structure exposed in aerobic conditions. Also the crustacean *Chelura t.* has very recently been recorded on one sacrificial sample. Whereas gribble's damage is more easy to detect as can be visible to an attentive and expert eye, the shipworm degradation is very difficult to detect as the larvae enter the wood by digging a hole much smaller than a pin head and grows extensively in size in the tunnel the organism excavates inside the wooden structure. (They can equally cause extensive damage to any sort of wooden structures from piers to ships – see for example the *Weaverley* paddle steamer published on Daily Echo 6th September 2006).
Only when the degradation is very advanced and the wood starts collapsing, the damage is noticeable – as in the case of the shipworm tunnels mentioned above to be found on the SCW's timbers. The x-rays conducted on the sacrificial samples confirmed the extensive presence of woodborers on the Swash Channel Wreck site.

c. The burial environment

The sacrificial samples for the investigation of the biological threats in anaerobic conditions have been prepared but not deployed as yet due to adverse weather conditions which have prevented their deployment to date. It is planned that these will be laid during the next recovery of the aerobic samples to insure that their deployment and recovery fits in with the recovery strategy.

d. Stability of metal (cannons) on site

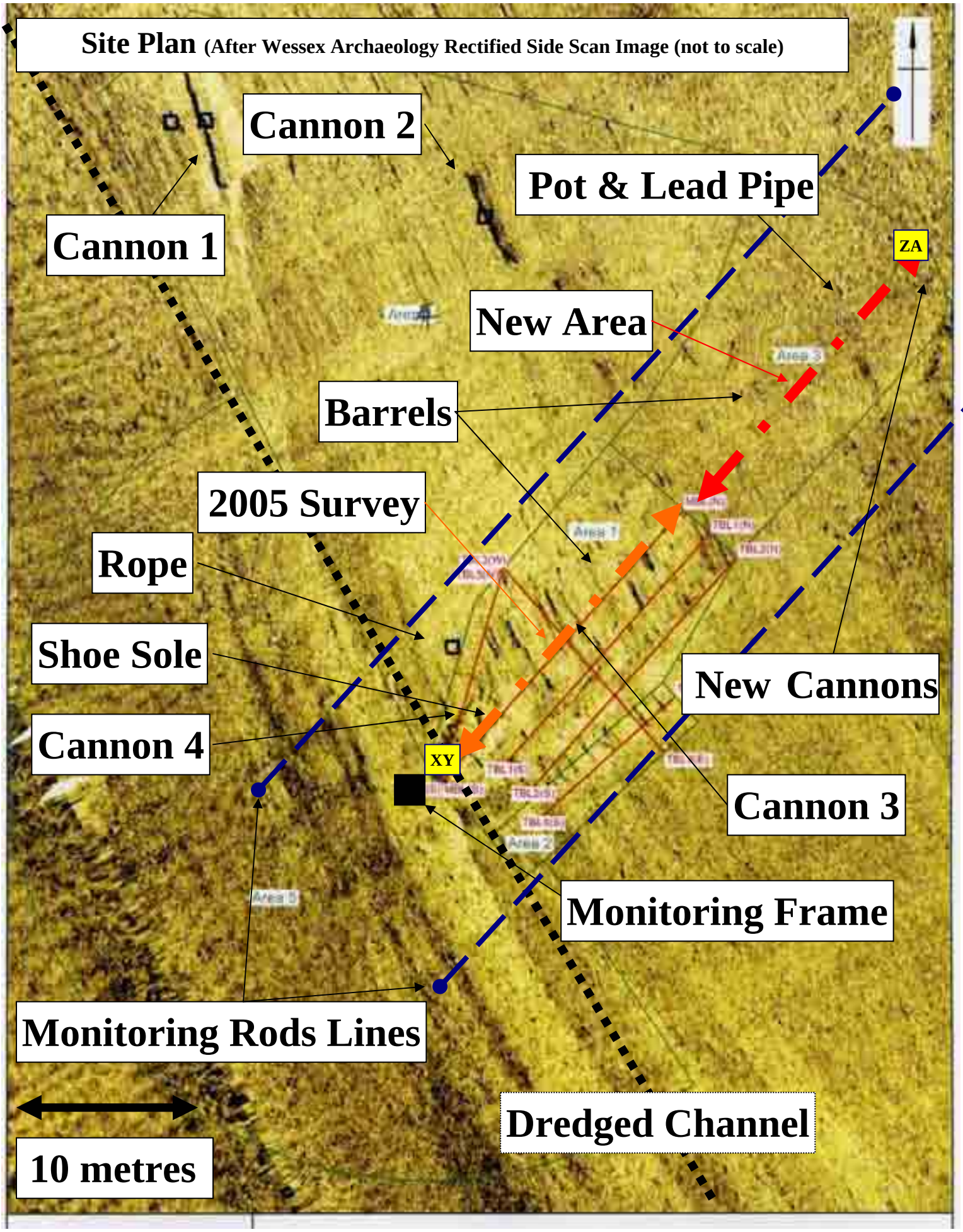
The 4 iron cannons found in 2005 on the site are heavily concreted. The thickness of the concretions needs to be assessed for the stability of the metal within the concretion. Fissures and micro-cracks which could allow the water to reach and further degrade the underlying metal surface.

Before initiating the monitoring the stability of the cannons, it was decide to make a rapid assessment of these.

Table 6 Cannons observations

Cannon	**1**	**2**	**4**	**3**
Length	2.67m	2.85m	2.85m	2.80m
Percentage exposed	10%	95%	60%	70%

Cannon 3 has been drilled and sampled in accordance with the published methodology, three sets of meter readings and water samples were taken but these were destroyed during recovery. This work will be repeated during the November diving schedule.


Site Plan (After Wessex Archaeology Rectified Side Scan Image (not to scale)
Cannon 2
Pot & Lead Pipe
Cannon 1
ZA
New Area
Barrels
2005 Survey
Rope
Shoe Sole
New Cannons
Cannon 4
XY
Cannon 3
Monitoring Frame
Monitoring Rods Lines
Dredged Channel
10 metres

5. **Developing a long term strategy for the management of the site based on the results of the monitoring process, proposing mitigating measures to manage the site's stability where necessary**

This aspect of the project will be undertaken once the results of the monitoring phase are available.

6. **As far as is possible setting the site in its local and regional archaeological context.**

To be able to achieve this objective the history and chronology of the area where the wreck is positioned has to be investigated but before doing so the wreck will have to be chronologically framed in its historical context.
Several attempts have been made to date the wreck. The assessment of the site's stratigraphy will demonstrate whether the pottery taken from the site came from a sealed context. A single dendrochronological sample from the site has produced a felling date on or after 1575 from a tree grown in Germany or Holland. Further investigation of the site and the monitoring of eroding areas may provide further datable evidence to support and potentially refine the current date of post-1630. Finds recovered during the 2006 work all date from the immediate post-medieval or modern periods and are therefore considered to be intrusive to the site and cannot be used for dating purposes. Further work will also be undertaken as a series of student dissertations during the life of the project.

7. **Providing a plan detailing how the archaeological research and management of the site should proceed in the long term.**

This will be undertaken when the results of the monitoring phase of the projects are known

Conclusions

Archaeology

The site consists of an almost 40m long by 17m articulated section of hull structure considered at the moment to be an almost complete side of a vessel in areas from the turn of the bilge to the top timbers. Outlying this, are several individual structural timbers. There are at least six cast iron cannons present on the site, four of these lie within or adjacent to the hull section whilst the other two lie to the NW area. The recording that has been taken place of these suggests that they may all be of similar size. No detailed recording of the hull structure was undertaken during 2006. It is thought that the buried areas of the site extend beyond what is immediately visible and this may be extensive. Further work should be able to establish this.
Observations taken during the 2006 season suggest that areas of the site may have up to 2.5m of stratigraphy surviving within the articulated structure. Outside of this, buried artefacts have also been noted, but on evidence to date we cannot conclude the depth of stratigraphy present in these areas.
Nigel Nayling has now confirmed that the single dateable dendrochronological sample recovered from the site has an outer ring dating at 1575AD (not 1585 as previously reported) and matches the German/Dutch Chronology. As the sample contains no sapwood a felling date for this tree can only be given as post 1575 (Nayling, 2005).

There has been some speculation as to the identity or otherwise of the originating ship but to date we have insufficient evidence of a precise date for the site and little artifactual evidence to suggest any specific interpretation. It is hoped that now the site has been set up further archaeological work in 2007 may enhance this picture.

Monitoring

The combination of visual observations and scientific methodology applied on the site showed a picture of an extremely dynamic environment. Overall the site has proved to be very active from a sedimentary, biological and water movement point of view.
The different monitoring methodologies applied on the Swash Channel Wreck already show clear signs of active degradation and erosion, despite the fact that results are available only for a single 3 month period.
The site is exposed to relatively extreme water movements, often experienced by the team whilst operating underwater, are thought to be a combination of natural tidal currents, ground swells and vessel movements. These conditions are not generally conducive to the stable *in situ* stabilisation of archaeological sites. Over the season, the exposure of individual structural timbers has been found to vary from either fully or partially buried to completely exposed. This extreme sediment regime has a dramatic influence to the physical state of the hull structures providing mechanical damage and superficial erosion. At one stage during the summer, the site was intensively populated by elongated up to 1m long brown algae. Ideally these would have provided sediment traps which could have provided a protective layer of sediment for the timber structure to build up, however these were only present on the site for a relatively short period of time and their loss prevented this from occurring. The mitigation strategy applied on the site in 2005 involved the placement of occasional sandbags on few scattered areas of the site. This mitigation has been found inconclusive as whilst those bags placed in Area 2 have appeared to work, those laid in other areas appear to have been ineffectual.
The sacrificial samples have shown biological damage not just at a surface level but at a cell structure level as well. Larvae and adult of woodborer's species have been recorded on the sacrificial samples placed in the aerobic environment, whereas in addition to this, the original wreck timbers showed evidence of extensive damage happened possibly in a recent past.

The analyses conducted on the sacrificial samples confirmed the extensive presence of woodborers on the Swash Channel Wreck site.
It is in the nature of these organisms to spread if the environmental characteristics are suitable to their survival and reproduction cycles and it would seem that the SCW site offer the right characteristics.
The presence of woodborers on any site has to be carefully investigated for different reasons: firstly depending on the species of shipworm – this can either be free swimmer at a larval stage – which means that if a site is polluted with this organism, its larvae (in a number of millions) will spread easily and fast by means of water movements or drift wood, colonising other sites; or it can be of a veliger type whose larvae not being free swimmers, settle on the same site provided wood availability or that the environmental characteristics don't change (Palma, 2005a, Palma, 2005b). Secondly on a dynamic site, if or when the wooden wreck is exposed to aerobic conditions, a source of wood is right away available for new species to colonise. The

amount of damage that can be caused in a relatively short period of time is often neglected and underestimated but very often is the cause of the loss of important archaeological information, in not the poor preservation of the site.

The metal monitoring is again at its very initial stage; being part of the student training the phase has not provided scientific results as yet. It is hoped to deploy further tests in the diving operations to follow.

Education

The monitoring program was initiated in 2006 as part of a research/teaching project connected with the university's BSc Marine Archaeology program. During the course of the project seven students have been involved in its management and execution. During their time on site they have been supported by a full HSE scuba team who have managed their safety and diving practises.
Specific scientific and monitoring training phases have been designed and put in place for the students to learn best practice for *in situ* site management as well as more general archaeological and project management techniques.
This has provided the students involved with an unusual opportunity for involvement in a maritime archaeological and environmental project in which they can play an active part in the planning, execution and post excavation stages of the project.
The transferable skills learnt by the students can be applied to the monitoring of the aerobic environment and to the metal degradation. It is hoped that the study of the burial environment can also be achieved when that phase is initiated.
This exceptional opportunity is highly unusual and provides an opportunity to train future generations of archaeologists in the understanding and management of archaeological sites and their environmental threats. There are only a very small number of specialists in this field, actively operating on an international scale. By training students in this direction – as well as by giving them themed researches in this sector – new specialists will develop in this field where lack of research and possibly interest are present. In particular it has to be mentioned the involvement of one second year student who has started his dissertation on the metal monitoring of the cannons on the site. Although this is a steep learning curve, and longer is needed before reliable data is collected, the level of understanding of the corrosion processes are at the moment fully understood and the student is developing his skills on this subject, following published methodology.
All the other students, without been so deeply involved, have received a constant appreciation of the environmental characteristics and their influence on archaeological sites.

Archive Location

The project archive from 2006 onwards and part of the 2004/05 archive is currently stored at Bournemouth University. The remainder of the 2004/05 is awaited.

Bibliography

Department of Culture Media & Sport 2004 *Statutory Instrument 2004 No. 3243 Protection of Wrecks (Designation) (England) (No.3) Order 2004*

Gregory. D 1999 Monitoring the effect of sacrificial anodes on the large iron artefacts on the Duart Point wreck 1997 *The International Journal of Nautical Archaeology* 28.2: 164-173

Macleod, I. D 1981. Identification of Corrosion Products on Non- Ferrous Metal Artefacts Recovered from Shipwrecks *Studies in Conservation* 1991, 36.4: 222-234

MacLeod. I. D 1995 In situ corrosion studies on the Duart Point wreck, 1994 *The International Journal of Nautical Archaeology* 24.1: 53-59

McCarthy, M 2000 *Iron and Steamship Archaeology Success and Failure on the SS Xantho. The Plenum Series in Underwater Archaeology.* Kluwer/Phenum, New York

Nayling, N. 2006 *Tree-ring Analysis of Ship Timbers from the Swash Channel Wreck, Poole Harbour Dorset*, University of Wales Archaeological report 2006

North, N. A, 1976 The formation of coral concentrations on marine iron *The International Journal of Nautical Archaeology* 5: 253-258

North, N. A, 1982 Corrosion products on marine iron *Studies in Conservation* 27: 75-83

Palma P, 2005a, *Monitoring of Shipwreck Sites,* International Journal of Nautical Archaeology, Vol. 34 Number 2, pp 323-331

Palma, P, 2005b, Monitoring the effect of Shipworm Attack on Shipwreck Sites in *Nautical Archaeology* 2005.3: 5-6

Parham, D., 2006, *Scientific Diving: Code of Conduct* Bournemouth University.

PHC 2003 Poole Harbour Control – *Operating Procedures & Guidance (Diving Operations)* (07/04/03)

Wessex Archaeology 2005 *Swash Channel, Poole Harbour Approach, Dorset Designated Site Assessment* (Ref: 53111.02ff) July 2005

Wessex Archaeology 2006 *Swash Channel, Poole Harbour Approach, Dorset Designated Site Assessment Archaeological Report* (Ref: 53111.03gg) April 2006

Wessex Archaeology 2006 Poole Harbour Channel Deepening and Beneficial Use Scheme *Swash Channel, Designated Wreck: Mitigation Works* (Ref: 61340.02) May 2006

Centre for Marine and Coastal Archaeology
Bournemouth University
30 October 2006

Appendix 1

Observations on the Flora and fauna associated with the Swash Channel Wreck, Poole Dorset. Paul Farrell and Bob Fletcher (Portsmouth University)

The Wreck was dived at slack water on the 17th August 2006; notes were taken of habitat type and the more obvious flora and fauna. Some algal samples were also taken for later identification, with the kind assistance of Dr. Bob Fletcher (University of Portsmouth)

The substrate around the wreck was mainly sand and shingle, with a few shells and cobbles. The shells noted were those of; *Ensis* sp. (razor clam), *Ostrea edulis* (native oyster) and *Crepidula fornicata* (slipper limpet), *Buccinum undatum* (Common Whelk) and *Hinia reticulata* (Netted dog whelk). The substrate appeared to be fairly mobile, as shown by a lack of attached organisms, except on the larger stones or cobbles and the wreck itself. The mobility of the substrate was also suggested by the presence of particular algae that are associated with sand scoured habitats and mobile pebbles and shell; e.g., the brown algae *Taonia atomaria* and Cladostephus *spongiosus* and the red alga *Chondria dasyphylla.*

The wreck itself supported a rich community of flora and fauna, many of them perennial species, this fact together with the apparent level of development and succession of fouling organisms present, indicated that the portions of the wreck examined had been exposed for at least a second year in succession.

The shallow nature of the site (7m?) and reasonably clear waters allowed the algae to dominate the wreck surface, whereas deeper wrecks or those in very turbid waters would be dominated by animal growth. The plants and Animals noted are listed below. There were few green algae present, as they are the first group to disappear as the light is reduced sublittorally. There where large numbers of brown and red algae, as these are better at tolerating the lower light conditions, reds generally being the algal group that can tolerate the lowest light conditions, and hence reach greater depths. Also, as would be expected the Animals were found to be much more abundant on the under hanging or shaded parts of the wreck. The Animals are mainly identified to groups rather than species level, and consisted largely of Hydroids, Bryozoans, Sponges and Ascidians (Sea squirts). The wreck also provided a habit for many highly mobile species of crustacean and fish, which are also listed below.

Species list associated with wreck

Brown Algae

Chorda filum (Linnaeus) Stackhouse Le Jolis (chord weed)
Cladostephus spongiosus (Hudson) C. Agardh.
Dictyopteris polypodioides (A.P. de Candolle) J.V. Lamouroux (unusual)
Dictyota dichotoma (Hudson) J.V. Lamouroux
Hincksia mitchelliae (Harvey) P.C. Silva
Laminaria saccharina (Linnaeus) J.V. Lamouroux
Sargassum muticum (Yendo) Fensholt
Taonia atomaria (Woodward) J. Agardh
Feldmannia sp.
Ectocarpus siliculosus (Dillwyn) Lyngbye

Red Algae

Antithamnion plumula (J. Ellis) Thuret

Bonnemaisonia hamifera Hariot
Brongniartella byssoides (Goodenough & Woodward) F. Schmitz
Calliblepharis ciliata (Hudson) Kützing
Callithamnion tetragonum (Withering) S.F. Gray
Ceramium rubrum C. Agardh
Chondria dasyphylla (Woodward) C. Agardh
Cryptopleura ramosa (Hudson) L. Newton
Dilsea carnosa (Schmidel) Kuntze (red rags)
Falkenbergia rufolanosa (Harvey) F. Schmitz
Gracilaria sp.
Polysiphonia elongata (Hudson) Harvey
Rhodomela virgata Kjellman
Scinaia furcellata (Turner) J. Agardh
Green algae
Ulva lactuca Linnaeus
Bryopsis plumosa (Hudson) C Agardh Le Jolis
Ulva intestinalis Linnaeus
Animals
Sea scorpion – either; *Myoxocephalus scorpius* (Linnaeus) or *Taurulus bubalis* (Euphrasen)
Labrus bergylta Ascanius (Ballan Wrasse)
Crenilabrus melops (Linnaeus) Corkwing Wrasse
Parablennius gattorugine (Linnaeus) (Tompot Blenny)
Trisopterus luscus (Linnaeus) Pout
Gobiidae (various Goby species)
Maja squinado (Herbst) Spider-Crab of commerce
Balanus balanus (Barnacle)
Carcinus maenas (Shore Crab)
Homarus gammarus (European lobster)
*Necora puber (*velvet swimming crab)
Pagurus bernhardus (Hermit Crab)

Buccinum undatum (Linnaeus) Common Whelk

Hinia reticulata (Linnaeus) Netted Dog Whelk
Spirobidae and Serpulidae (Tubeworms, various species)
Hydroids, e.g. *Bugula sp*. and *Tubularia* sp.
Bryozoa, e.g., *Electra pilosa* (Linnaeus)
Porifera (Sponges, several species)
Ascideiella adspersa (Sea squirt)
Styela Clava (Sea squirt)
Botryllus spp. Various species of encrusting, colonial sea squirts.