



**SWASH CHANNEL WRECK: 2007 ANNUAL  
REPORT**

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**Paola Palma & Dave Parham**



**Prepared for Poole Harbour Commissioners**

## **Acknowledgements**

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## **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 side-scan 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°55.4414'W) 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.

## **Previous Work**

### 2004/2005 Work Summary

WA undertook initial diving operations on the site in October 2004 (for identification), for 26 days between 23<sup>rd</sup> May and 27<sup>th</sup> June 2005 (to undertake a Designated Site Assessment) and for nine days between 17<sup>th</sup> October and 15<sup>th</sup> 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, 17<sup>th</sup> 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 Nayling 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 17<sup>th</sup> century.

### 2006 Work Summary

With the completion of the mitigation work and the Designated Site Assessment there was a need for a long term monitoring of the site, work funded jointly by Poole Harbour Commissioners and Bournemouth University.

#### 1. Assessment of the extent of the site

The site was assessed in consisting of an almost 40m long by 17m articulated section of hull structure considered at the time 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. It is thought that the buried areas of the site extend beyond what is immediately visible and this may be extensive.

#### 2. Establish stratigraphy of the site

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 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).

#### 3. 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 showed clear signs of active degradation and erosion, despite the fact that results were 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 caused by a combination of natural tidal and wind generated currents and vessel movements. These conditions are not generally conducive to the stable *in situ* stabilisation of archaeological sites. Over the 2006 season, the exposure of individual structural timbers was 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.

The sacrificial samples showed 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.

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 species of shipworms attacking the timbers and sacrificial samples deployed on site, were not identified during the season 2006, given the young age of the organisms

## **2007 Season**

### **Diving Operations**

Monitoring dives on the site occurred during May, June, July, August (very end of the month) and November 2007. The majority of other work on the site was initially programmed to occur over two discrete 7 day periods in June and July. However the severe weather conditions that the UK experienced during these months heavily disrupted this work which occurred over a much greater extended period stretching from mid June to late August 2008.

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 2007 is listed below.

<b>Diving Times</b>			
<b>Days Cancelled (Weather)</b>	<b>Days Diving</b>	<b>Dives</b>	<b>Minutes</b>
25	15	116	6380

### **Project Aims and objectives**

The overall aims and objectives of the projects remained the same as before, being part of the ongoing project 2006-2011, with the addition of a recently commissioned by English Heritage Scoping Study project which will be summarised later on in this document. The Aims and Objectives of the project are 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.

#### Overall Project Aims

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

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.

In addition in 2007 a further objective was added:

8. Initiate a Scoping Study, commissioned in July 2007 by English Heritage, to investigate the appropriate methodology of *in situ* protection of the site.

### **Methodology for 2007 Season**

1. Contacts were made with Wessex Archaeology to collect the Project Archive.
2. The assessment of the extent of the site was continued by a swim-over and video survey and the annotation of new features, if any were to be found.
3. The establishment of a stratigraphy for the site was continued by an augering survey undertaken around the shipwreck.
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: work this year has concentrated on the deployment of the scientific work for the scoping study. This work has therefore been programmed for 2008.
  - 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  $E_{\text{corr}}$  versus Ag/AgCl electrode cell attached to a stainless steel probe connected to a high impedance multi-meter 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.
8. A Environmental Scoping Study

## **Results**

### **1. Collating the current archive held on the site**

Bournemouth University have now received the complete archive of the Swash Channel Wreck, previously held by Wessex Archaeology. An agreement has been reached with Poole Museum for them to receive both paper and artifactual archive of the site once Bournemouth University is completed on the site.

### **2. Extent of the site**

A drawn survey of the entire exposed section of the site was planned to occur in July. However this was severely hindered by the weather conditions and this work was limited to a video survey to record the condition of the site. Observations undertaken during this survey indicated the broad layout of the hull remains present on the site. It would appear that the wrecks consists of the lower portion of a ships hull running from the stern of the vessel forward for approximately two thirds of the vessels length when the lower portion of the ships hull gradually disappears and the surviving remains roll into the port bow and forecastle upperworks. The results of the video survey are currently unprocessed; this will be undertaken by a placement student during 2008.

During the season a number of small finds were observed within scoured areas of the site. As previously agreed with English Heritage these items were recovered and are currently in passive storage at Bournemouth University and specialists finds and conservation advice is currently being sought.

- 1) Two pieces of butchered cattle bone
- 2) A pewter spoon
- 3) A copper pan
- 4) A small copper alloy hand bell
- 5) A pewter vessel
- 6) A section of rope (much rope has been seen eroding from the site an this section was recovered as representative sample)
- 7) A small timber frame

### **3. Establishing a stratigraphy for the site**

This work is due to be undertaken in November 2007.

#### 4. Monitoring strategy:

##### a. Sediment dynamics:

The sediment rods were installed of the summer of 2006 and consist of mild steel rods one metre in length. These were hammered into the seabed to a depth of 500mm, leaving 500mm projecting from the seabed. Each rod was then levelled with a diving computer against a primary site datum to provide comparative depth records between each rod. The rods were deployed in 2 rows parallel to and 12m distant from the centre line of the site, Profile 1 consisting of 13 rods positioned to the landward, northwest side of the site and Profile 2, consisting of 15 rods positioned to the seaward, southeast side of the site. In both cases the first two and last two rods project beyond the known longitudinal extremities of the site. For Profile 2 two further rods



were placed in error and the data from these continues to be recorded and presented. During each month that diving has been possible on the site the distance between the upper point of each rod and the seabed has been recorded to provide data on fluctuations in seabed levels.

Profile 1 (Table 1) is located to the landward, northwest side of the site. Here major changes appear to be seen in the level of the seabed. The outer extremities Rods 1, 2,

**Figure 1 Sediment rod measurements being taken**

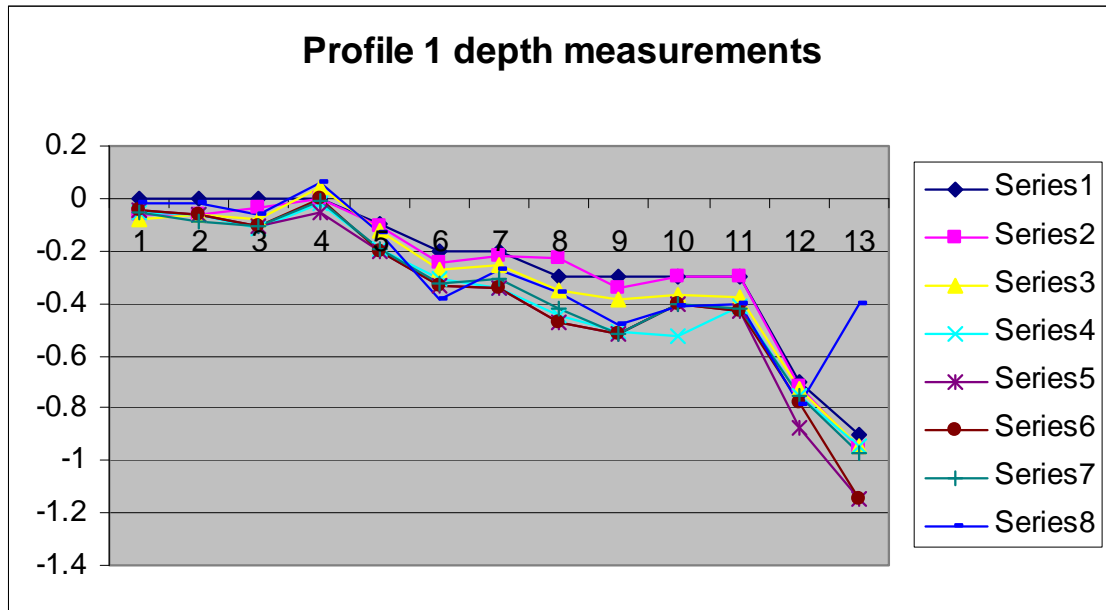
11, 12 & 13 appear relatively stable; these rods either lie on or outside the transverse extremities of the site. Those rods that lie directly parallel to the body of the site show a constant lower of seabed levels to a maximum of 250mm. This has revealed much new archaeology in the form of scattered shipwreck material, mainly timbers.

Profile 2 (Table 2) is located to seaward, southeast side of the site. This profile would appear to show a stable seabed with minor fluctuations in seabed level of around 70mm.

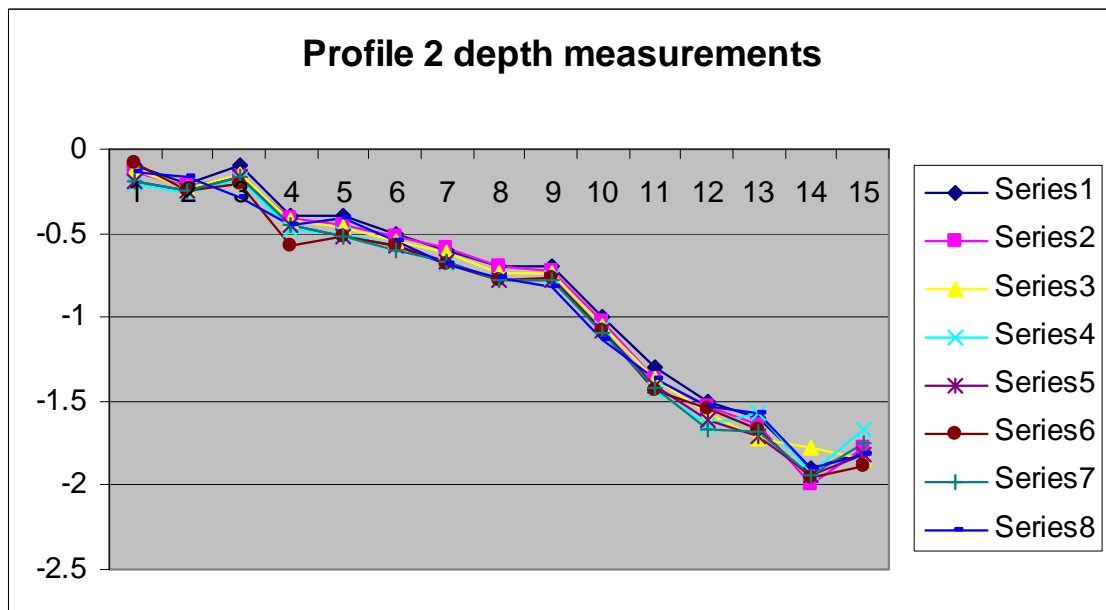
No research work has been undertaken on this data to date. However it is suggested that the sediment movement in the area of the site moves from the east to the west and that the wreck is acting like a groyne, stopping sediment movement and thus denuding the west areas of the site of sediment.

Period	Aug-06	Sep-06	Nov-06	May-07	Jun-07	Jul-07	Aug-07	Sep-07
Key	Series 1	Series 2	Series 3	Series 4	Series 5	Series 6	Series 7	Series 8

**Table 1**



**Table 2**



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

The substrate around the wreck is mainly sand and shingle with shells and cobbles. A new area was found along the longitudinal axis of the wreck where a 10cm clay stratum is covering a large portion close to the position of the rudder. New areas of the hull were noticed been completely exposed yet remained unrecorded as yet.

A new aspect of the assessment of the environment is the deployment of a data logger which English Heritage kindly loaned to Bournemouth University. This is an integral part of a new project English Heritage commissioned to one of the authors of this

report for the *Environmental Scoping Study for in situ stabilization of the Swash Channel Wreck site*. The data logger collects water quality parameters at regular interval depending on the settings given. The data is logged continually for the duration of the battery (around 2 to 3 months, depending on the logging intervals) and ultimately for the duration of the monitoring period. The data logger of EH specification is an EauxSys model and collects readings about pH, Redox Potential, temperature which are the parameters to monitor which influence the presence of fungi, bacteria and marine borers depending on their scale. The presence of these organisms has a major influence of the preservation rate of wood - archaeological or sacrificial, as in the case of this research. Therefore by studying the water parameters we can establish the condition for survival for certain wood degrading organisms and consequently the preservation of the wood itself. The data logger was deployed in July 2007 in proximity of the xy datum point and was secured to the stainless steel framework. It will be collected in November 2007, and will be re-deployed in Spring 2008.



**Figure 2** Deployment of the data logger *in situ*

#### b. 2. Sacrificial samples

A further set of sacrificial samples was recovered in 21<sup>st</sup> May 2007 and analysed in the laboratory at Bournemouth University. At the moment of their collection, the samples had been exposed in the water column for a 12 month period attached to a stainless steel framework on the seabed since May 2006, in the SW area in the proximity of the wreck close to XY datum.

The sacrificial samples were found extensively covered with algae and barnacles and a thick biofilm layer on their surface. The wood surface showed in some cases complete surface destruction and internally the structure presented extensive signs of biological degradation and cell collapse. Under the British Standard Institute the level of attack is graded as 3, in a scale from 0 to 4, (0 correspond to no attack, 1 to slight attack, 2 to moderate attack, 3 to severe attack and 4 correspond to failure), all depending on the condition and appearance of the test wood block and the percentage of shipworms tunnels revealed by x-ray examination.



Figure 3 Sample deployed for 12 months - shows complete surface degradation, grade 3



Figure 4 Sample after 6 months deployment - shows moderate to severe surface degradation, grade 2



Figure 5 Sample after 3 months deployment - shows slight surface degradation, grade 1

During the examination in 2006, the species of shipworm were not identified. These analyses conducted on the samples collected this year have confirmed last year's inclination to believe the specimen being *Lyrodus pedicellatus*. This is now been confirmed and has been found along with the more common one *Teredo navalis*, being present on the same samples. This shipworm called *Lyrodus pedicellatus*, is common in warmer/tropical waters. Pallets – which are considered the main diagnostic features -, shells and specimen were retrieved and evidence of larvae was recorded in the brood pouch of the parent. Whilst the reproduction of *Teredo navalis* happens during the summer months, *Lyrodus* reproduction can occur all year around with peaks in winter time. Also after spawning, *Teredo navalis* is a free swimmer at a larval stage, whereas the *Lyrodus* is ready to settle and therefore can colonise the surrounding wood after only a few hours. Several generations can grow per year. Shipworms are hermaphrodites, so that each individual can produce several thousands of larvae and therefore the potential environmental threats to wooden structures on the seabed is



**Figure 6** *Lyrodus* pallet in situ



**Figure 7** Larvae at different development stages

enormous. Larvae at different stages of their development have been identified up to the spawning phase and oddly enough not just in the brood pouch of the parent but spread in the calcareous tunnel from the shell point to the entrance probably ready to be expelled.

The presence of the *Lyrodus* in British waters is potentially an indication of environmental change, due to global warming.

The increase in the air/water temperatures creates the right conditions for non-indigenous species to develop settle in areas like the South of England (P. Palma Monitoring of Shipwreck Sites: the English experience for in situ monitoring of the degradation processes of a marine site with specific attention to woodborer's attack, P.A.R.I.S. Conference Proceeding 2006, forthcoming publication).

Furthermore, it is thought that a possible third species of shipworm may be present. An yet unidentified shape of pallet has been collected. It is potentially thought to belong to the species *Nototeredo norvegica*, species recorded in several Mediterranean sites. Further work is needed to confirm this hypothesis.

Finally, the combination of identifying the presence of *Lyrodus pedicellatus* on site and the hull structure being more thoroughly exposed compared to last year, suggests that there is more provision for a very reproductive wood degrading organism. It is the feeling of the authors that the wreck preservation is greatly at stake at the light of these new data.

#### d. Stability of metal (cannons) on site

The 4 iron cannons found in 2005 on the site are heavily concreted.

A former Bournemouth University student, Stuart Churchly, was trained by the authors for the monitoring methods and site study and he conducted his student placement and dissertation research on the Swash Channel Wreck and metal degradation of the cannons. His work was recently awarded the Keith Muckelroy Price for the greatest effort into the Marine Archaeological Programme at Bournemouth University. His work has now been continued, by a current student James Winter, whose primary objective is to undertake the physical and corrosion potential survey of the six cannons. James Winter dealt with large amounts of research were required to compile the methodology for the work on the cannon to ensure that the tests performed were accurate and conducted in the most efficient and safe manner possible.



**Figure 8 Using a Bathythermograph to monitor metal degradation of the cannons**

Work conducted by the few academics in this field was scrutinised and the methodology used for this project was compiled utilising often modified techniques adapted by comparing other people's methodologies and trying to make improvements where their projects had suffered from equipment failure or the unavailability of specialist tools. The data collected by the monitoring of the metal degradation are currently being processed and will be used for the student's dissertation.

- 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. At the moment, the collection of the data is still an on going process.

**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. Dendrochronological sample have been taken from the site in an attempt to provide a more reliable and accurate date for the site, although the results are not yet available. 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. It is understood that work conducted by Nigel Nayling of Lampeter University on dendrochronological samples recovered from the site suggests a single felling date on or after 1585 from a tree grown in Germany or Holland. A full report detailing this work has yet to be received. 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 has been undertaken as the first student dissertation (the former student graduated 2007) and three more students, graduating in 2008, are undertaking research based topics related to the site. Stuart Churchly undertook a dissertation entitled: "What can be interpreted from the preliminary survey of the Swash Channel Wreck?". This work has now been added to the project archive and is available for use in the compilation of the final publication of Bournemouth work on this site.

**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 project are known. Bournemouth University has provided English Heritage with considerable feed back on their draft management plan of the site.

**8. Initiate a Scoping Study, commissioned in July 2007 by English Heritage, to investigate the appropriate methodology of *in situ* protection of the site.**

The aim of the project is to undertake a fourteen month period environmental scoping study to provide data useful to experiment the best stabilization method aimed to achieve *in situ* preservation of the Protected Wreck Site of the Swash Channel Wreck (SCW), Poole. In the specific, the project set a trial of different strategies for *in situ* stabilisation to be deployed for a twelve month period and will establish the efficacy versus financial viability of each method, compared to all the methods deployed. This project undertakes a scientifically study of the original timber decay and degradation and efficacy of different protective methods, rather than being focussed only on sacrificial samples, which could offer localised and partial results (P.Palma 2007).

## Archaeology

During preliminary relocation works in May it was noticed that over the winter the site had been subject to considerable scour and that a number of small finds and areas of timber structure not seen before were observed. Amongst these was a carving located on the head of a feature considered to be the vessels rudder (see Figure 9). This was first noticed on 21st May 2007 when it was photographed (Figures 10 & 11) and protected by sandbags. This discovery was then notified to both English Heritage and Poole Harbour Commissioners. A further investigatory diving has been undertaken aimed purely at establishing the exact size and context of the feature.

Recording work has established that the feature is exposed for almost all of its length portion of the feature measures 8.4m long, tapers from 1.1m at its base to 0.4m at the upper exposed end of the rudder head. The maximum recorded thickness of the feature is approx 0.26m. It is estimated weight is between 1.3 and 1.8 tons. The carving (See Figure 12) is currently interpreted as being in the form of a male human head.

It consists of carving measuring 400mm x 750mm lying flush with the surrounding seabed. Beneath the carving (i.e. vertically down the rudder) are a pair of iron bands situated approx 600mm apart that extend across the entire width of the feature and match the iron banding seen around the rudder of the *Vasa* strengthening the rudder around the tiller mortise. Investigations in this area indicate that the tiller is not still *in situ*. Along the further length of the rudder are a further six 120mm wide iron bands that extend for nearly all of the entire width of the feature and terminate in large perpendicular concretions that fit within recesses in the forward face of the rudder. These features that are interpreted as pintles.

The rudder lies upon a sand/gravel matrix that it is thought represents the 'natural' for this site within which lie pockets of soft silt. It is completely exposed on its northern side (its base) with this in freespan for approx 200mm. It is partly exposed on its north-western side (its outer edge) to approx 150-200mm tapering into the sand at the south-eastern edge (the upper end with the carving) where this is flat with the seabed. On its southern western side (the inner ship side) the feature disappears into the mobile sand for what is considered to be a short distance. It is not joined to any other element of structure and it is assumed, as is common in shipwreck, that the rudder has come detached from the ship.

The feature was noted by Wessex Archaeology (WA) during the recording undertaken during the Designated Site Assessment undertaken for EH. The feature does not appear to have been recorded in any detail and is not shown on the site plan. It is however described as follows '*Context 1009 (WA designated context reference) is a long timber with a square section, positioned approximately on the edge of Areas 3 and 4 and originated approximately north to south. It was partly buried and therefore its full extent could not be established. It appears to be in excess of 4.5m long and has a thickness of approximately 0.3m. Width is uncertain but appears to exceed 0.5m at the northern end. It comprised of what appears to be an oak core, consisting of at least two abutting sections along the long axis. Over this are softwood planks arranged across the short axis of the upper face and along each of the edge faces. These small planks do not extend to the southern end of the feature, but end in a*

*deliberate and probably deliberate edge close to the northern end. Above the softwood planking are concreted metal strips these run along the long axis of the upper edge face from the visible edge and are made of iron. Their precise shape is not clear. They appear to be lightweight strapping and appear to be securing the softwood planks to the oak core.*

*Approximately 0.3-0.5m from the end of the softwood planking, the edge of the long axis is stepped in a quarter circle moulding. South of the softwood planking the edge of the feature may be moulded, although this is uncertain.*

*The softwood planking is very probably sacrificial sheathing. The presence of this sheathing indicates that the sheathed faces were external to the vessel and below the waterline. The presence of sheathing on all three faces indicates that the feature represents a leading or trailing edge and extends to the very bottom of the vessel. The presence of moulding and the stepping in of the long axis indicates that the feature cannot be part of the stem or stern post or associated timbers. It is therefore interpreted as being a rudder, with the trailing lower part exposed'. (Wessex Archaeology 2006 para's 6.4.105-6.4.108).*

The circular decoration visible on the feature parallels that moulding (WA Context 1396) observed by WA during the Designated Site Assessment on the forward end of the vessels upper works. WA have suggested that this may be associated with a timber (WA Context 1404) that maybe a carving of a human form, although the exact reason for these thoughts is not clear (Wessex Archaeology 2006 para 6.4.80). The condition of this circular decoration is described as '*very good*' it was uncovered by excavation and has presumably been subsequently reburied. The other carving observed on the site (WA context 1523), an inscribed mark on a ceiling plank resembling a letter 'A' was in good condition when observed in 2004 but was virtually unrecognisable by October 2005 (Wessex Archaeology 2006 para 6.4.38)

### *Threats*

Analyses conducted on the sacrificial samples confirmed the extensive presence of highly aggressive woodborers on the Swash Channel Wreck site (Palma & Parham 2006). This work demonstrated that freshly exposed timber is immediately colonised by woodborers meaning has a life that can now be measured in months. Carving seen by WA during there initial dives were observed to have degraded within a relatively short period of time (Wessex Archaeology 2006).

### *Significance*

A rapid literature search has suggested that rudders are only in place on a small number of historic wrecks in the Great Britain and Eire. These are the incomplete rudder of the *Mary Rose* (1545) which is missing is the upper portion (Marsden 2004) the Alderney Elizabethan Wrecksite (c1590), which is missing its lower portion (M<sup>c</sup>Elvogue 1998, Monaghan & Bound 2001), the site of the Spanish Armada requisitioned merchantman *La Juliana* at Streedagh Strand in Eire (1588) (Birch & M<sup>c</sup>Elvogue & 1999) which has been recorded in sketch plan only and may not have survived *in situ* and the lower portion of the rudder from the 18 gun brig HMS *Primrose* (1809) lost on the Manacles in South Cornwall (Palmer pers com). Carvings are even less usual with there present only being known from the wrecks of HMS *Colossus* (1798) (Camidge 2001) and the Duart Point Wrecksite (1653) (Martin

1995). On none of these sites are these two features (i.e. a carved rudder) combined. The only parallel that has been discovered to date is that of the rudder of the Swedish warship *Vasa* which has a carving attached to the rudderhead (Cederlund & Hocker 2006). At c10m in length this is somewhat longer than that of the Swash Channel wreck but is superficially similar in form.

#### *Wider Significance*

Mainwaring's "*Seaman's Dictionary*" of 1622 mentions 4, 5 or 6 pintles for a rudder, presumably depending on its size. If this is the case then with 6 pintles this feature is from a larger ship. The rudder would have been the height of the sternpost plus some extra to carry it up to the stern counter and allow the tiller to enter the ship. An Admiralty manuscript of 1625 states that the height of the sternpost will be 8/7 the depth in the hold and also states that it will rise at 18' to 22', Bakers *Fragments of Early English Shipwrightry* gives 20' to the vertical (Lavery, 1988). No sources can be found for documentation of the height the rudder raises after the sternpost, but the rudder of the *Vasa* of 1625 suggests a further increase of 22% for a ship of this size. If the angle of rise of the sternpost is taken as 20' and that 36% of the length of the rudder extends past it a simple calculation gives the height of the stern post as 6.88 metres thus allowing the depth of hold to be calculated as 6 metres (19.7 feet).

The number of pintles found on the rudder suggests that the wreck is one of the larger ships of her day. Baker gives the proportions of a ship's length of keel, breadth and depth of hold as 1: 0.4 : 0.2 respectively, with the tonnage being calculated by multiplying these together (in feet) and dividing by 100 (Parham, 1996). We have already calculated her depth of hold as 19.7 feet giving us a breadth of 39.4 feet and a length of keel of 98.5 feet, resulting in a tonnage of 764.54.

It should be stressed that these are very rough calculations but they do suggest a large (The first *Ark Royal*, the English flagship during the Armada campaign of 1588 had a displacement of c690 tons) ship for the late 16<sup>th</sup> /early 17<sup>th</sup> century. To date we have only been able to parallel this feature with the highly decorated and expensively constructed Swedish warship *Vasa*. The suggestion therefore is that the Swash Channel wreck forms the remains of a large high status vessel of its period.

Because of the extreme rarity and significance of this object and the clear and urgent threat to its survival it is recommended that it should be recovered, recorded, suitably conserved and published. This was verbally agreed with English Heritage in June 2007 and preparatory work to undertake this was undertaken with Bournemouth University. Sponsorship was offered by Poole Harbour Commissioners and a number of local organisations for the recovery and initial recording, and a lottery bid is being prepared to fund the conservation and eventual display at Poole Museum, which has agreed to take the feature as a place of final repository. However discussions with English Heritage in August 2007 indicated that they wanted further recording of the feature prior to its recovery and this work is now delayed until at least 2008.

Figure 9- Site Plan Showing Location of Rudder (After Wessex Archaeology Rectified Side Scan Image (not to scale))

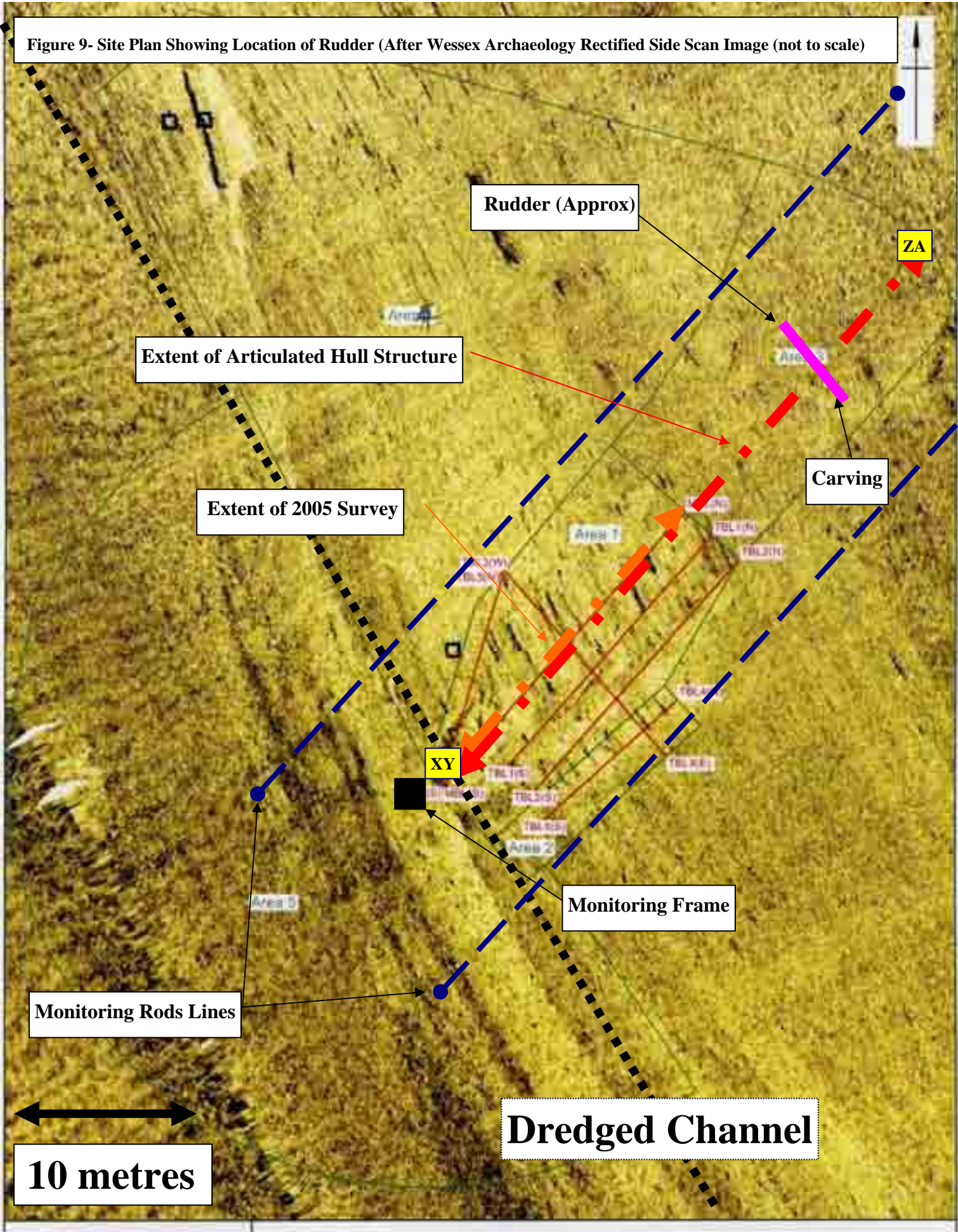




Figure 10 – Carving as Seen 21<sup>st</sup> May 2007

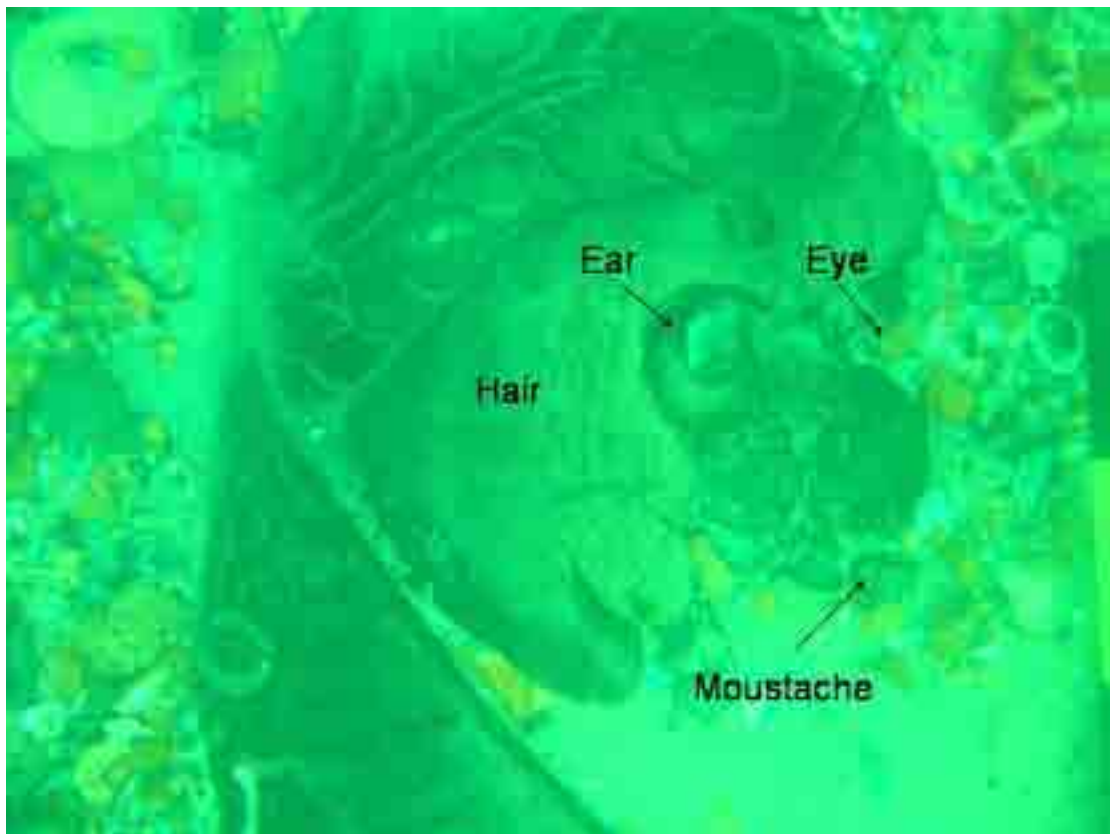


Figure 11 – Carving as Seen 21<sup>st</sup> May 2007 – showing detail of head

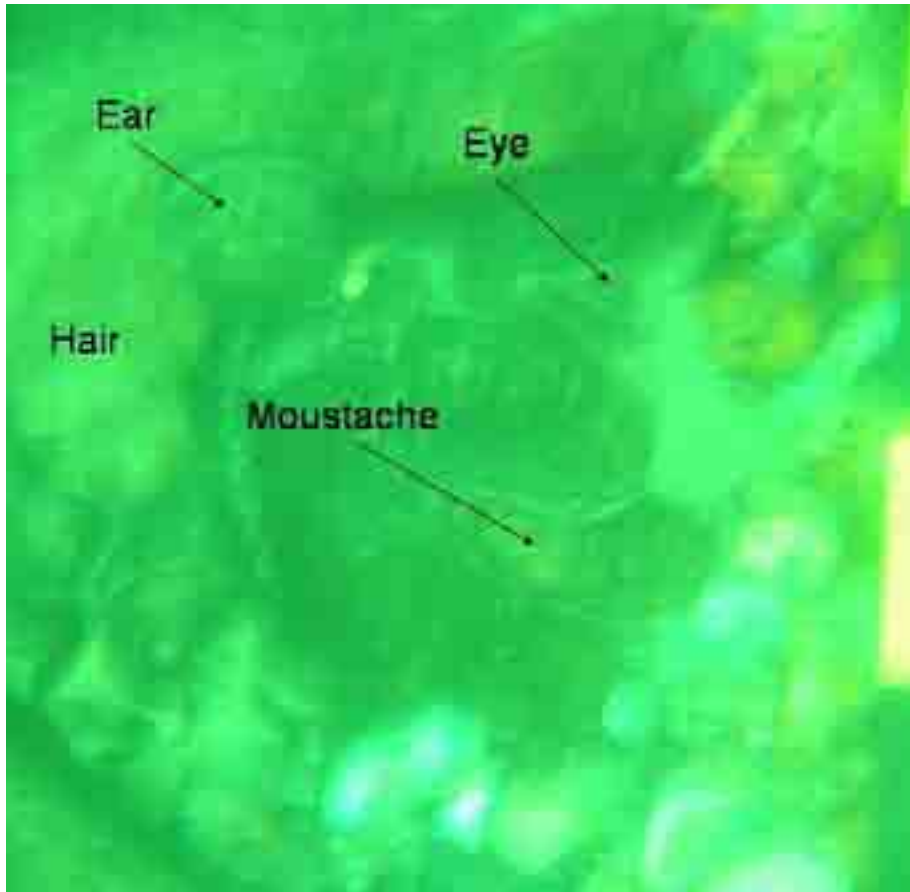


Figure 12 Carving as seen on 4<sup>th</sup> June 2007 – showing detail of head  
(Quantity of image poor due to environmental conditions on site)



Figure 13 Showing hancing as seen 13<sup>th</sup> November 2006



**Plate 5 Showing exposed feature and false piece as seen 13<sup>th</sup> November 2006**



**Figure 14 Showing undercutting at foot of feature as seen 13<sup>th</sup> November 2006**

## **CONCLUSIONS**

### **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 continued to prove to be very active from a sedimentary, biological and water movement point of view. The site is exposed to relatively extreme water movements, often experienced by the team whilst operating underwater, are thought to be caused by a combination of natural tidal and wind generated currents and vessel movements. These conditions are not generally conducive to the stable *in situ* stabilisation of archaeological sites. As already mentioned in the 2006 report, this extreme sediment regime has a dramatic influence to the physical state of the hull structures providing mechanical damage and superficial erosion. Large areas of the hull structure were newly located during the 2007 season; these areas were previously buried under the sediment.

The results of the analyses conducted on the wood sacrificial samples confirmed a trend which was suspected during the 2006 season and showed alarming results, which consist not only in the amount of damage caused by shipworms in only 12 month period, also in the particularly destructive and resistant and highly reproductive nature of the shipworms identified. On this basis, the potential preservation for the wreck is very low and it is unlikely to survive in the long term.

The monitoring of the metal degradation has been very successful and developed quite steeply during the season 2007. A Bathycorrometer, a new high specialised tool was purchased to allow more specific and scientific work to be undertaken. The data collected at the moment is being processed and will be part of a student dissertation, which will constitute part of the final archive of the site.

### **Archaeology**

Work on the site in 2007 was limited due to poor weather conditions. However the discovery of the ship's rudder has allowed some conclusions to be drawn as to the nature and original character of the site and scouring of sediment within the wrecksite itself, revealing additional material that has allowed a better understanding of the remains lying within the seabed.

### **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 the 2007 operations the number of students involved has increased to 11 students, four of which are undertaking dissertations that are relevant to this project. Many of these students are improving their transferable skills, with three students who have chosen to undertake their five week placement with the project. Furthermore, one student took on board the analysis of the concretions coming from the site, and was kindly trained by the authors and Ms Karla Graham at English Heritage on X-radiography, development and analyses. This skill is now being passed onto two other students who agreed to take over these duties. During their time on site, students 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. Together with environmental monitoring, one student is specialising in monitoring metal degradation underwater, a very much needed skill which lacks of expertise on the national professional landscape.

This project 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 archive is stored at Bournemouth University. It has been agreed with Poole Museum that both paper and material archive will be passed onto them at completion of the project.

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