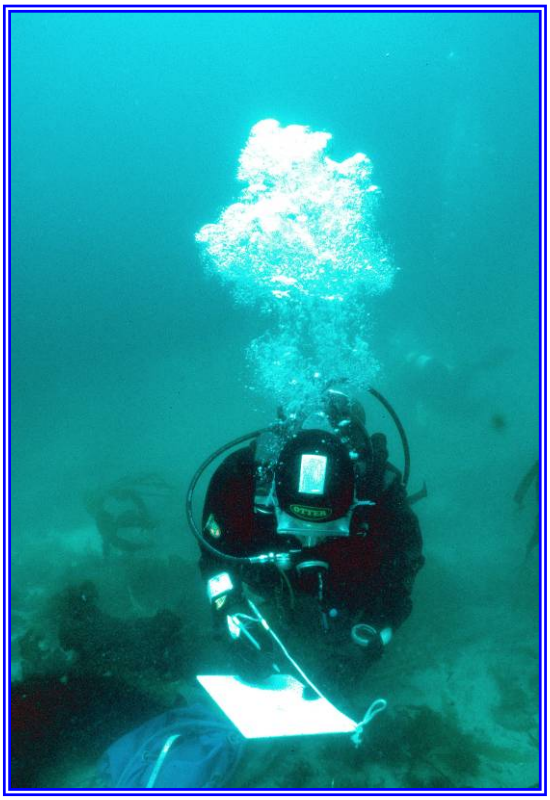
HMS Colossus



Survey Report 2006

Kevin Camidge

CONTENTS

Site Name	HMS Colossus
Licence	Survey
Date issued	9th December 2005
Designation	2001/2403

All positions in this report are UTM zone 30 WGS84

Summary

Monitoring of the condition of the wreck continued this year with three separate inspections undertaken. The exposed timbers on the stern site continue to deteriorate; in the most severe cases parts of the timber have become detached and have been dispersed by the tide. The sediment level monitoring which began in August 2003 was continued. This shows that the sediment levels on the site continue to fluctuate – but the overall trend is towards a diminution of the sediment levels compared to those extant in 2003. This has resulted in the exposure and subsequent deterioration of further elements of the wreck.

Kevin Camidge
14 X 2006

Fieldwork Activities

There were two main survey objectives this year. Firstly, to monitor the deterioration of the exposed stern timbers on the seabed. Secondly, to record the sediment levels on and around the exposed stern timbers to determine whether more timbers are likely to be exposed.

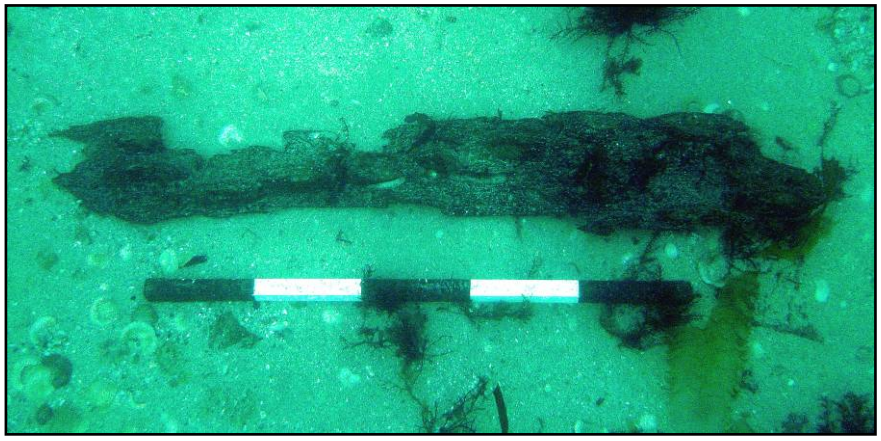
Diving was undertaken on three separate occasions

Date	Number of divers	Diver hours
8 June 2006	8	8.5
6 Aug 2006	12	10.5
20 Aug 2006	2	2.2
TOTAL		21.2

In addition the diving contractor, Wessex Archaeology, visited the site in July. They also took sediment level measurements using the monitoring points already established on the site.

Condition of the exposed timbers

The exposed timbers on the stern site continue to deteriorate. The most obvious evidence of deterioration is due to the action of wood boring organisms *toredo* and *limnoria*[1]. The exposed timber now exhibits clear signs of gribble tunnels and in the most severe cases parts of the timber have become detached and have been dispersed by the tidal flow over the site.



Detached timber, found on the seabed 3m to the north of control point C. (260149.5E, 5535593N) Scale 0.5m

This decay is evidenced by the loss of four of the six sediment level monitoring points (M10, M11, M13 & M14) by July of this year. These were attached to sound exposed timbers of the wreck, which have now decayed so badly that the monitoring points themselves are no longer extant. The monitor points consisted of 100mm galvanised nails driven into sound timber in August 2003 – a clear indication of the ongoing deterioration of the exposed structure of the ship.

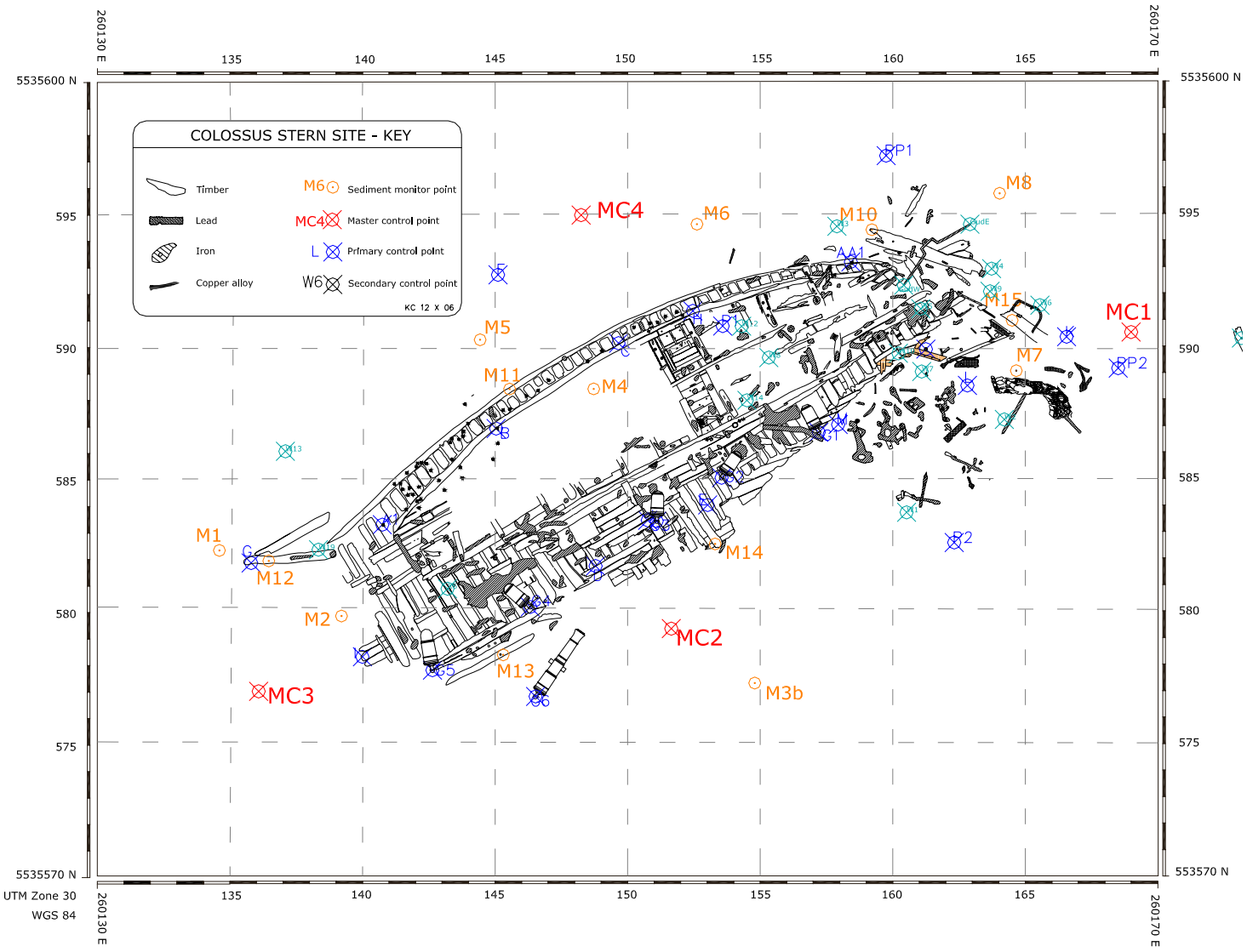
[1] Camidge, K et al *HMS Colossus Stabilisation Trial Final Report* – 2005 p 47

Sediment level monitoring

The sediment level monitoring began in August 2003 as part of the Colossus site stabilisation trials commissioned by English Heritage (project # 3593). The relevant section of that report is reproduced in appendix I below. A copy of the full report can be downloaded at www.cismas.org.uk.

Sediment level measurements were taken in June and August of this year. Wessex archaeology also took measurements (at my request) during their visit to the site in July this year.

The sediment monitor pins M1 to M8 are 600mm long x 12mm diameter stainless reinforcing bars. These were fixed into the seabed around the outside of the wreck so that exactly 100mm of the bar was exposed above the seabed when they were installed in May 2003. In August 2003 six additional monitoring points M10 to M15 were installed on the timber of the wreck itself. These consisted of 100mm galvanised nails driven into the timber. Measurements from these points were taken by placing a spirit level on the top of the nail and measuring the height above the adjacent seabed. The location of all the sediment monitoring points can be seen on the plan below.

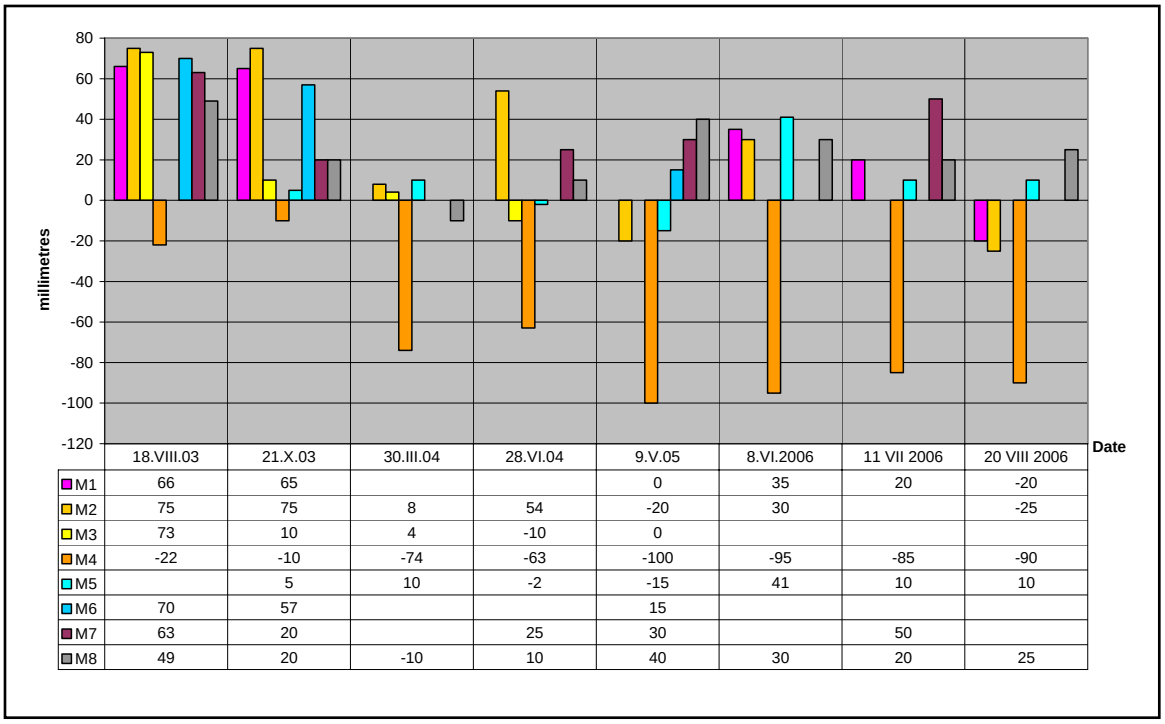


The sediment level measurements shown in blue were taken this year. For the sake of completeness the measurements taken between 2003 and 2005 as part of the Colossus site stabilisation trials have also been included.

DATE	18.VIII.03	21.X.03	30.III.04	28.VI.04	9.V.05	8.VI.2006	11 VII 06	20 VIII 06
MONITOR								
M1	66	65			0	35	20	-20
M2	75	75	8	54	-20	30		-25
M3	73	10	4	-10	0			
M4	-22	-10	-74	-63	-100	-95	-85	-90
M5		5	10	-2	-15	41	10	10
M6	70	57			15			
M7	63	20		25	30		50	
M8	49	20	-10	10	40	30	20	25
Mean M1-M8	53.4	30.3	-12.4	2.3	-6.3	8.2	3.0	-20.0
M10		10	-15	-30	-35	-100		
M11		12	-21	-13	-9	-14		
M12		-31	-61	-54	-39	-124	-109	
M13		5	-38	24	-21			
M14		9	-18	-18	-28	-123		
M15		15	-17	5	35	35	-30	
Mean M10-M15		3.3	-28.3	-14.3	-16.2	-65.2	-69.5	
Mean ALL	53.4	19.5	-20.4	-5.4	-10.2	-25.2	-15.1	-20.0

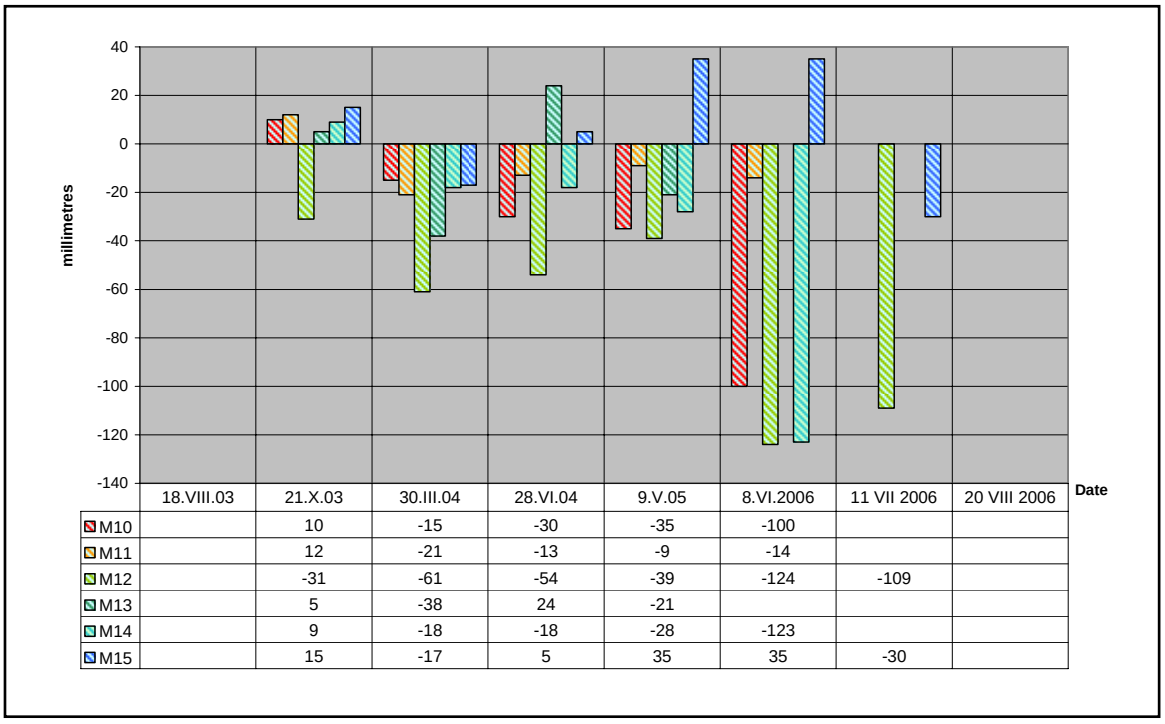
Fig 1 Sediment level changes relative to May 2003 for M1 to M8; August 2003 for M10 to M15. Values shown are in millimetre; positive values denote a rise in seabed level (relative to 2003) while negative values denote a fall in seabed levels (relative to 2003). Measurements made in 2006 are shown in blue.

A blank entry in the table indicates that the diver was unable to locate the monitor point. Often the points are very difficult to find due to the large amount of weed which covers the site over much of the summer period. That said, the fact that points M3 and M6 have not been located on any of the dives this year may indicate that they are no longer in position. An extensive search for the points M10 to M15 in August this year demonstrated that they have now disappeared, or are about to, due to the deterioration of the timber to which they were fastened.



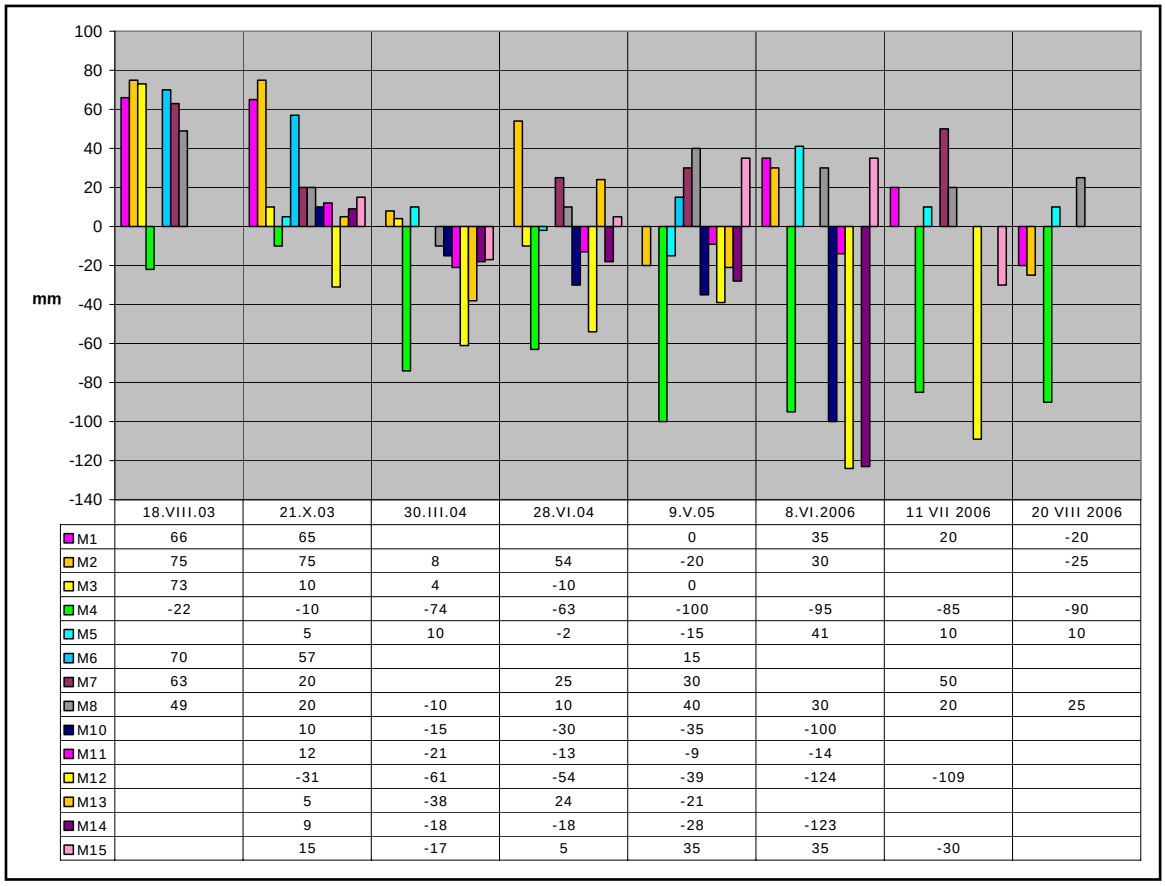
	18.VIII.03	21.X.03	30.III.04	28.VI.04	9.V.05	8.VI.2006	11 VII 2006	20 VIII 2006
M1	66	65			0	35	20	-20
M2	75	75	8	54	-20	30		-25
M3	73	10	4	-10	0			
M4	-22	-10	-74	-63	-100	-95	-85	-90
M5		5	10	-2	-15	41	10	10
M6	70	57			15			
M7	63	20		25	30		50	
M8	49	20	-10	10	40	30	20	25

Fig 2 Chart showing the change in seabed sediment level (relative to the level in 2003) for monitor points M1 to M8. These points are located around the outside of the exposed timber – see location plan above



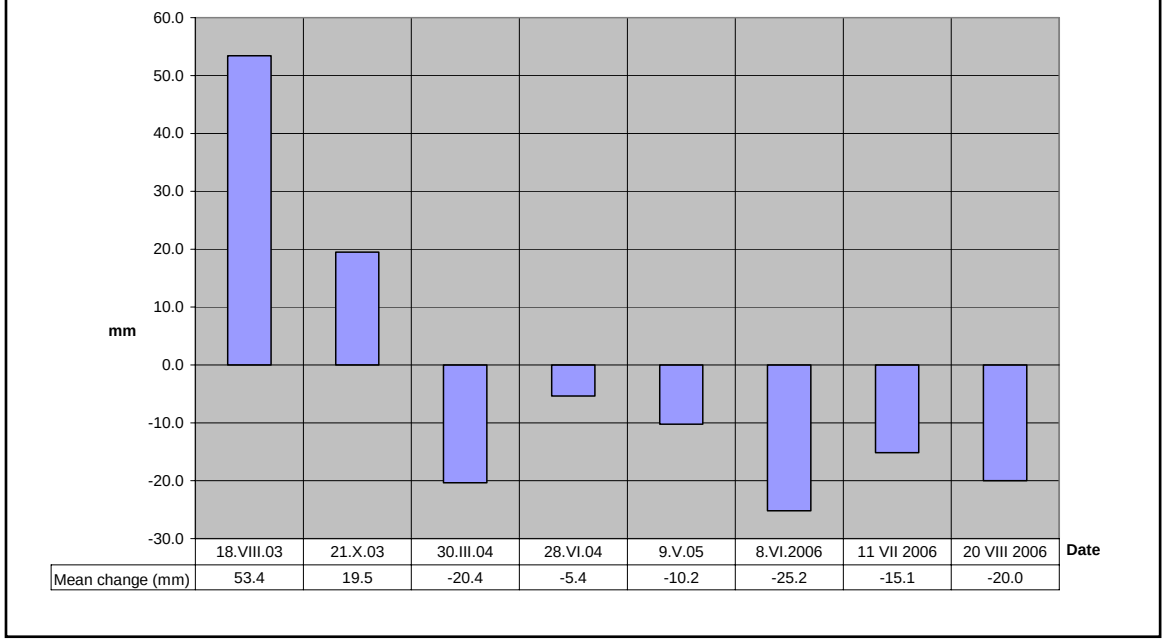
	18.VIII.03	21.X.03	30.III.04	28.VI.04	9.V.05	8.VI.2006	11 VII 2006	20 VIII 2006
M10		10	-15	-30	-35	-100		
M11		12	-21	-13	-9	-14		
M12		-31	-61	-54	-39	-124	-109	
M13		5	-38	24	-21			
M14		9	-18	-18	-28	-123		
M15		15	-17	5	35	35	-30	

Fig 3 Chart showing the change in seabed sediment level (relative to the level in 2003) for monitor points M10 to M15. These points are located adjacent to the exposed timber – see location plan above



	18.VIII.03	21.X.03	30.III.04	28.VI.04	9.V.05	8.VI.2006	11 VII 2006	20 VIII 2006
M1	66	65			0	35	20	-20
M2	75	75	8	54	-20	30		-25
M3	73	10	4	-10	0			
M4	-22	-10	-74	-63	-100	-95	-85	-90
M5		5	10	-2	-15	41	10	10
M6	70	57			15			
M7	63	20		25	30		50	
M8	49	20	-10	10	40	30	20	25
M10		10	-15	-30	-35	-100		
M11		12	-21	-13	-9	-14		
M12		-31	-61	-54	-39	-124	-109	
M13		5	-38	24	-21			
M14		9	-18	-18	-28	-123		
M15		15	-17	5	35	35	-30	

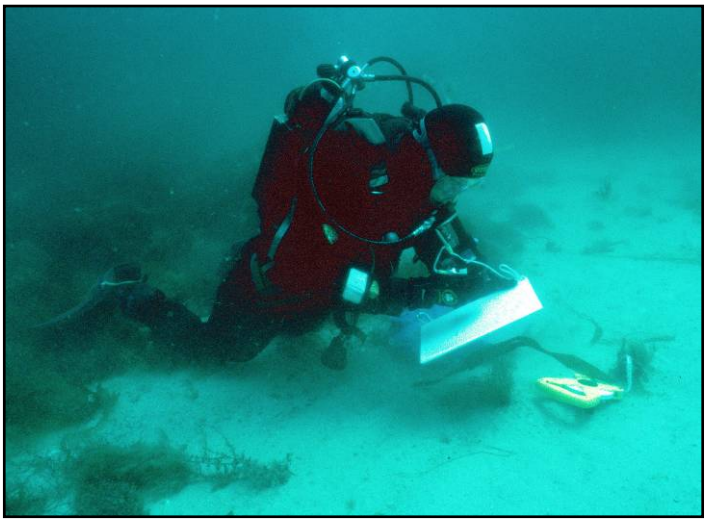
Fig 4 Chart showing the change in seabed sediment level (relative to the level in 2003) for all monitor points. Zero represents the seabed level in 2003, negative values denote a fall in sediment levels, positive values a rise in sediment levels

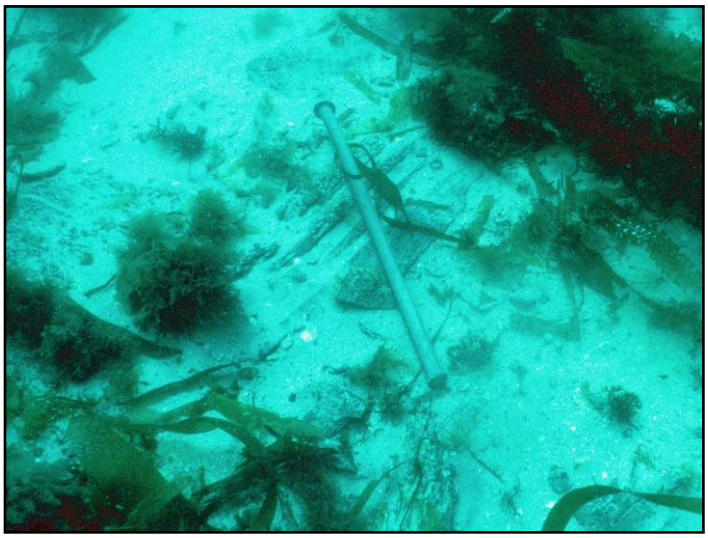


	18.VIII.03	21.X.03	30.III.04	28.VI.04	9.V.05	8.VI.2006	11 VII 2006	20 VIII 2006
Mean change (mm)	53.4	19.5	-20.4	-5.4	-10.2	-25.2	-15.1	-20.0

Fig 5 Chart showing the mean overall change in seabed sediment level (relative to the level in 2003) for all monitor points. Zero represents the seabed level in 2003, negative values denote a mean fall in sediment levels, positive values a mean rise in sediment levels

As can be seen from figures 1-5 above, seabed sediment levels on the site have continued to fluctuate. The overall trend, however, is for sediment levels to be lower than they were when measurements began in 2003 – see particularly fig 5. The theory proposed in the Colossus Stabilisation Trial report that the sediment levels fall during the winter months and slowly rise in the summer months needs to be tested by continuing to monitor the sediment levels on the site.





Above: Gun 3 looking towards the west. Note the exposed ship's frames in the foreground.

Top left: Diver recording sediment level measurements

Centre left: Guns 4 and 5 looking west.

Below left: Copper fastening bolt with rove attached. Western end of the exposed timber, close to control point A1. This was not visible when the site plan was made (2001 to 2003) and has almost certainly been moved.

Potential for further work

The labels on all of the control points and sediment monitoring points need to be replaced as the existing ones are now either missing or difficult to read.

Continued monitoring of the exposed timber is essential, particularly as it is clear from the sediment monitoring that the seabed sediment levels are continuing to fluctuate, but are consistently lower than they were in 2003 when the sediment monitoring was started. In particular the elements exposed and subsequently reburied at the stern of the vessel by the ADU in 2001, which were of outstanding quality and preservation, need to be watched in case they become exposed and thus subject to rapid deterioration. As it is inevitable given the current seabed level trends that this stern area will eventually become exposed, this area should be considered for stabilisation - as proposed in the Colossus Stabilisation Trial report in 2005. Failing this, then the small area at the stern should be excavated and properly recorded before it is too late. Careful consideration of the resources required for such an undertaking would need to be made.

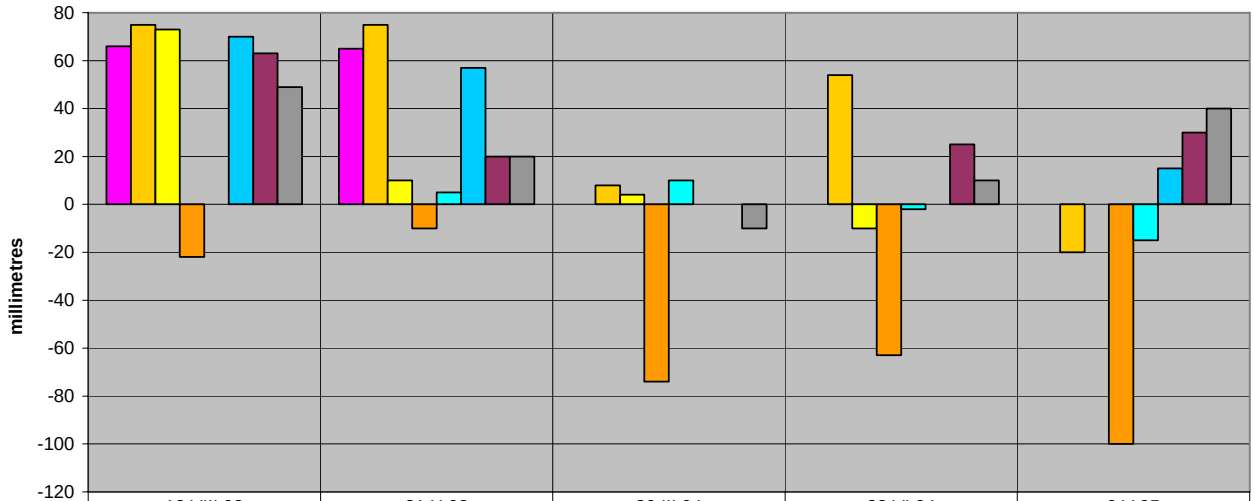
New sediment monitoring points need to be installed next year to replace those which have now disappeared due to the loss of the timber to which they were attached. It is proposed that new points are installed as close as possible to the original positions (M10 to M15) so that measurements will be comparable to those taken from 2003 to 2006. Measurements of seabed sediment levels need to be continued. In particular, it would be very useful if some measurements could be made during the winter months to test the theory that sediment levels tend to fall over the winter months.

Kevin Camidge
14 X 2006

Appendix I – Extract from the Colossus Stabilisation Trial Report

Sediment level monitoring

The chart and table below show the seabed levels recorded at each of the original monitoring points M1 – M8. These points were installed in May 2003, and all measurements are relative to the seabed level at that time. Positive measurements denote a rise in seabed level while negative measurements indicate a fall in seabed level. Where no reading is shown, the monitor point was not located at that inspection. This could be caused by displacement of the pin (in one observed case visiting divers pulled the pin out), or by inability to locate the pin (displaced weed can cover the site to a considerable depth at certain times of the year). The readings were taken at the dates shown, at each of the five monitoring inspections over the two year period of the trial. Ideally, the measurements would have been taken at more frequent, regular intervals. In the event it was only possible to take measurements at the regular, scheduled retrieval intervals for the stabilisation trial sample retrievals. It would have been interesting to see how the sediment levels varied in the winter months.



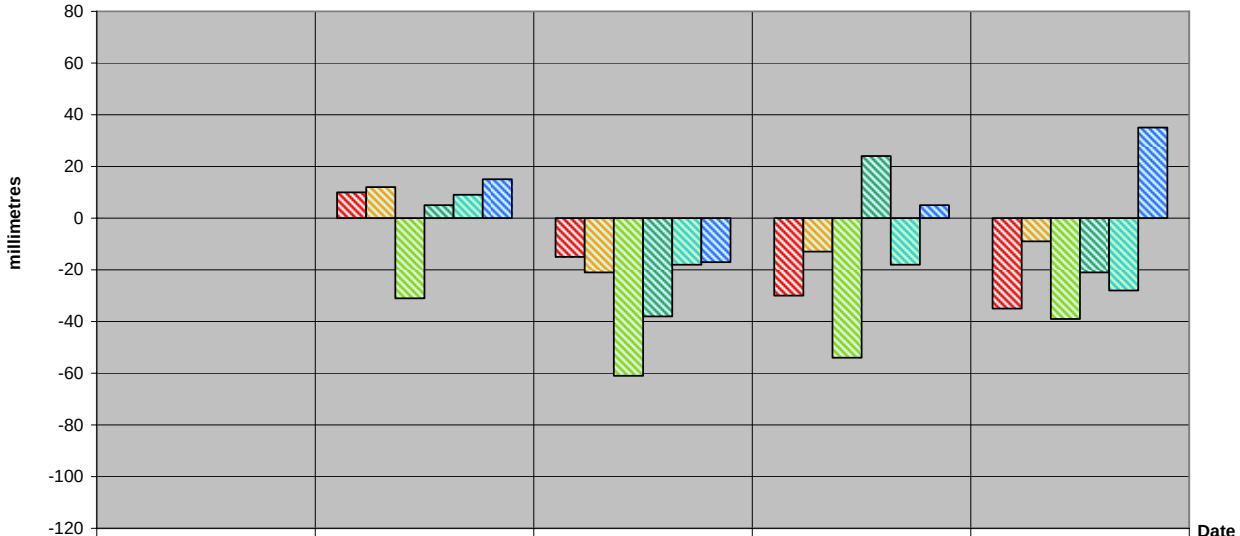
	18.VIII.03	21.X.03	30.III.04	28.VI.04	9.V.05
M1	66	65			0
M2	75	75	8	54	-20
M3	73	10	4	-10	0
M4	-22	-10	-74	-63	-100
M5		5	10	-2	-15
M6	70	57			15
M7	63	20		25	30
M8	49	20	-10	10	40

Fig 10 Seabed levels relative to those in May 2003 at monitor points M1 – M8

All except one of these monitoring points were situated around the outside of the exposed timber of the wreck. The exception was M4 which was placed in the centre of the wreckage (see sediment monitor location plan fig 3). The seabed level at M4 fell fairly consistently throughout the period of the trial.

The other seven points (M1-M3 and M5-M8) all recorded rises in sediment over the first three months of the trial of 49 – 75mm. This accumulation of sediment largely disappeared over the winter (between October 2003 and March 2003); at the March 2004 inspection the levels were roughly comparable with those at installation. The June 2004 inspection revealed a more mixed picture with three of the points (M3, M4 and M5) showing a fall in levels while the other three points (M2, M7 and M8) showed a rise in seabed levels. At the final inspection in May 2005 two points (M1 and M3) were the same level as in May 2003. Three points (M2, M4 and M5) showed decreased seabed levels and three points (M6, M7 and M8) showed a rise in sediment levels. Interestingly, all three of the locations showing a rise in level at this final inspection are all on the eastern side of the wreck. The evidence is not conclusive but it would seem that there is a tendency for sediment to accumulate throughout the summer months and to fall during the winter months. If this is a genuine and ongoing trend then its cause may well be the higher energy conditions generated by winter storms.

After the two years of the trial the mean of the seabed level measurements taken at these eight points (M1- M8) was -6.25mm. This is a relatively small change but can have a major impact on exposing timber which is only just below the surface of the seabed. So although the levels vary, currently the overall trend is one of sediment loss at these original monitor points.



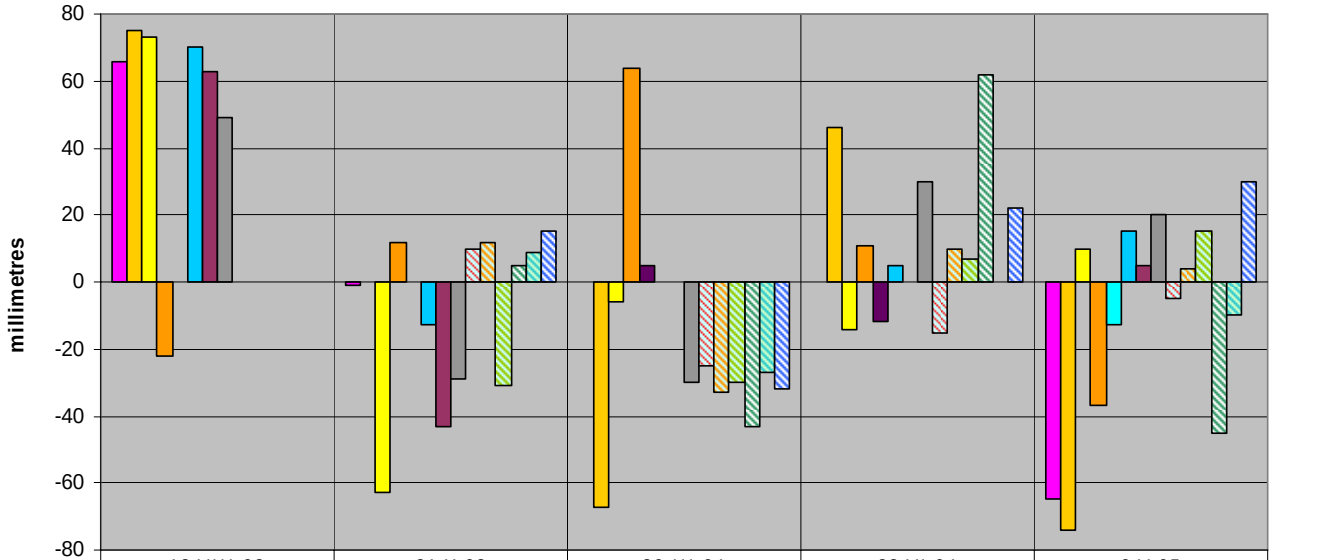
	18.VIII.03	21.X.03	30.III.04	28.VI.04	9.V.05
M10		10	-15	-30	-35
M11		12	-21	-13	-9
M12		-31	-61	-54	-39
M13		5	-38	24	-21
M14		9	-18	-18	-28
M15		15	-17	5	35

Fig 11 Seabed levels relative to those in August 2003 at monitor points M10 –M15

In August 2003 six extra sand monitoring points (M10 – M15) were installed. These were all placed adjacent to the exposed timber on the seabed in an effort to monitor the conditions immediately adjacent to the timber, where continuing seabed level decline had been observed.

After three months (October 2003) all except one of these points showed a small rise in sediment level. The exception, M12, showed a fall of 31mm. At the next inspection in March 2004, sediment levels at all six points had fallen (relative to the levels at installation in August 2003). For the remainder of the trial, the majority of these points showed a fall in the sediment levels since August 2003. This trend is visually more convincing on the sediment level charts (fig 11) for this set of points when compared to those for the original points M1 – M8. After the two years of the trial the mean of the seabed level measurements taken at these six points (M10 - M15) was -16.2mm. So although there is some variation in levels there is a strong overall trend of sediment loss at these six monitor points.

Care should however be taken when comparing these two sets of monitoring points as they were installed at different dates. This means that they are measured relative to different seabed levels: M1 – M8 to that existing in May 2003, while M10 – M15 were recorded relative to the seabed level existing when they were installed in August 2003.



	18.VIII.03	21.X.03	30.III.04	28.VI.04	9.V.05
M1	66	-1			-65
M2	75	0	-67	46	-74
M3	73	-63	-6	-14	10
M4	-22	12	64	11	-37
M5			5	-12	-13
M6	70	-13		5	15
M7	63	-43			5
M8	49	-29	-30	30	20
M10		10	-25	-15	-5
M11		12	-33	10	4
M12		-31	-30	7	15
M13		5	-43	62	-45
M14		9	-27	0	-10
M15		15	-32	22	30

Date

Fig 12 Seabed level changes between inspections recorded at monitor points M1 –M15

In order to compare the two sets of sediment measurements more directly, a chart of the sediment level change since last inspection has been constructed (fig 12). This

shows the change in seabed level since the last inspection rather than the change since installation. This allows a direct comparison of all the sediment monitoring points.

From the chart above it is apparent that there is no overall clear cut rise and fall of the seabed levels over the whole site. Considering all fourteen monitor points together, there was not any inspection where all the observations were sediment rises or falls – but always a mixture of the two. What this does illustrate is that there is measurable sediment mobility over the site. The tendency to sediment level falls at the edges of the exposed timber (monitor points M10 – M15) perhaps demonstrates scouring at the edges of the exposed timber.

Sediment samples

Five samples, SS1 – SS5, were taken from the surface of the seabed; from the locations shown on the plan below. These were taken from the top 60mm of the seabed – approximately 500ml of sediment was taken in each sample. The seabed in each sample location was photographed. The location of each of these samples is shown on the location plan below. The samples were submitted to Matthew Canti at English Heritage for analysis. The sediment sample report is reproduced in full in appendix IV.

Two samples were taken from below the surface of the seabed, SS7 and SS8.
The stratigraphy on the site has been observed in three different places: to the SE when the stern carving was excavated, the NE where the finds were reburied [AB] and in the centre of the site where the exploratory excavation took place. In each case the observed stratigraphic sequence was similar. The top 0.20-0.25m of the seabed [SS6] consists of coarse sand and broken shell. Below this is a layer 0.15-0.35m deep consisting of very fine, white compact sand or silt [SS7]. Under this there is a layer of coarser, light grey sand [SS8]. Each of these was sampled during the excavation of the finds reburial repository [AB].

Reference to the sediment sample report in appendix IV indicates that the two samples not taken from the seabed surface (SS7 and SS8) clearly show a different composition to those taken from the seabed surface (SS1 – SS6). The surface samples seem to consist of medium sand, while the sub-surface samples SS7 and SS8 both exhibit a significant proportion (42% and 29% silt) of finer material when compared to the surface samples. One possible interpretation is that this is due to the seabed surface mobility already demonstrated by the sediment monitoring, the finer material having been dispersed during sediment transport in the surface layer. If this is the case, it would seem to indicate that - in the areas where stratigraphy has been observed - the top 0.20m of the seabed has been subject to sediment transport. It is tempting to speculate that the presence of this finer material in the buried samples may have some bearing on the remarkable preservation of organic material from this site[2].

[2] Smaller particles in the sediment resulting in smaller void spaces and thus reduced porosity and lower permeability.

Sediment transport

Sediment is likely to be subject to movement in a number of ways. It can be transported in suspension or by bottom traction. Particles in suspension settle at different rates depending on their size and density. For example very fine sand settles at a rate of 3.8mm/sec while silt at a rate of about 0.5mm/sec. Thus finer particles will travel further in a tidal stream than coarser particles[3].

From observations of the exposed timbers of Colossus it is also apparent that crabs are digging holes around the timbers and are probably contributing to local scouring around them. This phenomenon has been observed on a number of occasions during the stabilisation trials. Some of the observed holes dug by crabs are of an impressive size.

Edible crab digging a hole between frame timbers east of Gun 1.

When the Terram 4000 mat was being removed from the seabed a copper alloy musket trigger guard [406] was found in the sediment over the mat. This object had been drawn, measured and tagged on the seabed in August 2003. Its original location was over 17m away from where it was found on the Terram mat. This is a relatively heavy object and the distance it has been transported is perhaps illustrative of the forces at work on this site.

In 2001 nine 'soundings' or bore holes were sunk into the sand around the outside of the wreck. This was done to establish the depth of the sand around the area of the newly exposed timber. The soundings were affected by pumping water through a 3m length of 22mm plastic tube. This could then be pushed with ease vertically down through the sand. Once the tube stopped, the depth and position was recorded. These soundings are shown in red on the plan below, along with their recorded depth. What these soundings demonstrate is an appreciable depth of 'soft' sediment underlying the exposed timber of the wreck. As the limited excavation on the site to date has not extended outside the hull of the vessel, it is not at all clear to what depth archaeological material extends within this sediment.

[3] C Dunbar & J Rodgers *Principles of Startigraphy* London 1957

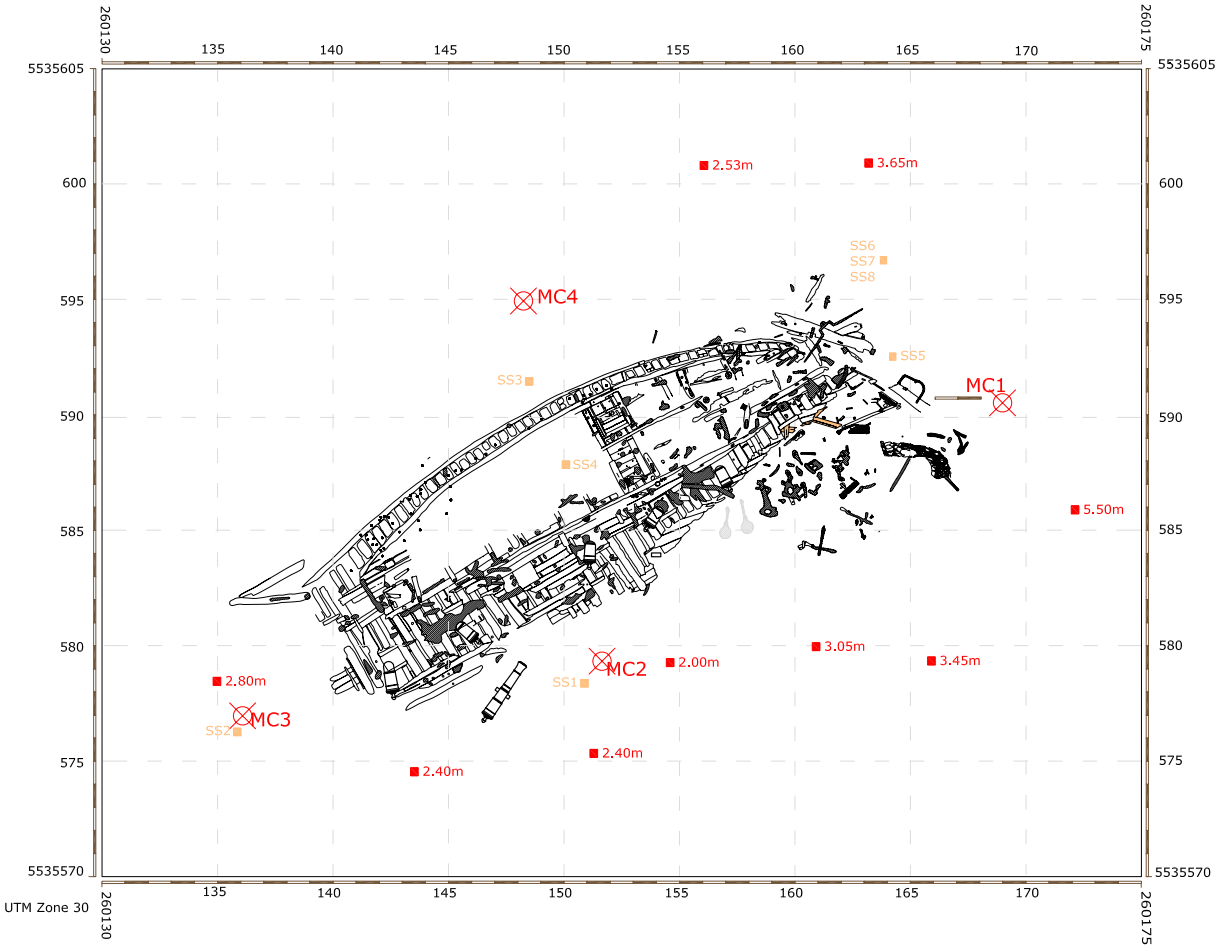


Fig 13 Location plan of sediment samples and soundings. SS1-SS8 are the sediment samples The soundings are shown in red and show the depth to which the probe reached.

Kevin Camidge

Appendix II – Data forwarded by Todd Stevens

The following material is reproduced exactly as supplied by Todd Stevens. This work was designed and executed independently by Todd Stevens. I have no further information concerning this work. KC

TODD STEVENS
'Colossus'
Pilot's Retreat
St Mary's
Isles of Scilly
TR21 0NA

Dear Kev,

After many dives in the area believed to be the bow site of HMS Colossus, I felt confident enough to show Wessex our findings when they arrived for this seasons work on the site. To aid them I ran a long line from the supposed position of gun C6 (scallop found by my team as reported in last years DBA by Wessex) south west across the rocky terrain for about 60 meters, then a further 60 meters west across the sandy area we now know is Emma's gully. The line terminated in the position expected to be where gun C12 should have been. The line was affixed to the seabed at points wherever artefact material had been encountered on the previous dives mentioned.
Wessex, using the line as a datum, proceeded to log the positions of all the above mentioned artefact material. Whilst they were doing this I explained how, after all our dives in the area, we had found Roland Morris's site plan to be extremely accurate. To prove this I requested Wessex perform an exercise that ignored artefact evidence encountered on the seabed, and simply track a diver who was instructed to move where sand terminated against rock in the area. This would in effect, through the diver tracking system, draw the topographical contours of the seabed. I rightly felt that when the track recorded by the diver tracking system was placed alongside the Morris site plan, the two would match. This task was performed to great effect in both Emma's gully and the galley area. Subsequently proving once and for all exactly which area of seabed the Morris site plan was actually taken from. It not only proved that the bow site was much further east than was reported by Morris but just how accurate the site plan was as I previously believed.

Wessex then left after their other tasks had been completed. An underwater metal detector was then handed to our team for the general use of. We then proceeded to use the equipment in Emma's gully around the objects logged by Wessex. (**see diagram 2**) The positions of everything drawn on diagram 2 were taken in relation to the Wessex marker shown by them as number 2058. (accurate GPS numbers will be obtainable in the coming Wessex report).

From there, employing the metal detector, we wanted to go in search of evidence of other gun positions in relation to the Morris site plan. As these guns were primarily those to be found around the G*alley area,* and therefore inside of the protected zone, I sought permission to use the metal detector by being named on your survey licence. Once granted

we performed a sweep for any evidence of gun C9 in the exact position shown on the Morris map. In the kelp in the position given as C9 we found what looks to be another gun scallop which hopefully will be proven to be the original position of gun C9. We also encountered other material all around it such as you would expect like iron shot. We also encountered a lead cannon apron south of the scallop by about 6meters. Further south again by 15 meters metal objects could be detected in amongst the loose rocks.

We then looked at the Morris plan and noted that in the top right hand corner just above the position given for gun C9 the plan terminates over a sandy patch. (**see diagram 1**) We then decided to sweep this sandy area as that is exactly what the seabed was found to be in that position. As a result we found many large readings in the sand and, as you can see, have now extended the Morris site plan towards the north. Since then we have swept an area from N49-55-407 W006-20-722 (**A**) heading West back out of the Protected zone to terminate in position N49-55-398 W006-20-748 (**B**). The survey was north of the Galley area and off the Morris site plan. We encountered many large readings along the way proving that the site of Colossus is spread further North than previously thought by Morris. Nothing of any great consequence has been encountered thus far, only iron work- with the only identifiable pieces being various sizes of shot. As you can well understand this is solely because the sea bed is a very thin sand layer over bedrock so nothing but metal work survives. Glass fragments from bottles and windows, as well as some ceramics were also encountered. I have only supplied the GPS marks of where the survey took place as quite frankly there were too many inconsequential objects encountered to need list them all here. Suffice to say that all were from Colossus.

The only other thing of note to report that was performed while under your survey licence, was the placing of a sandbag over an artefact on the stern section of the wreck. The artefact, a lignum vitea sheave, was totally uncovered and in danger of being lost over the winter. After consultation with EH the task was performed just prior to a force eleven gale which could have resulted in the artefact being further dislodged or even lost. We photographed the sheave before placing the sand bag. (see photograph supplied)

Todd Stevens

Diagram 1

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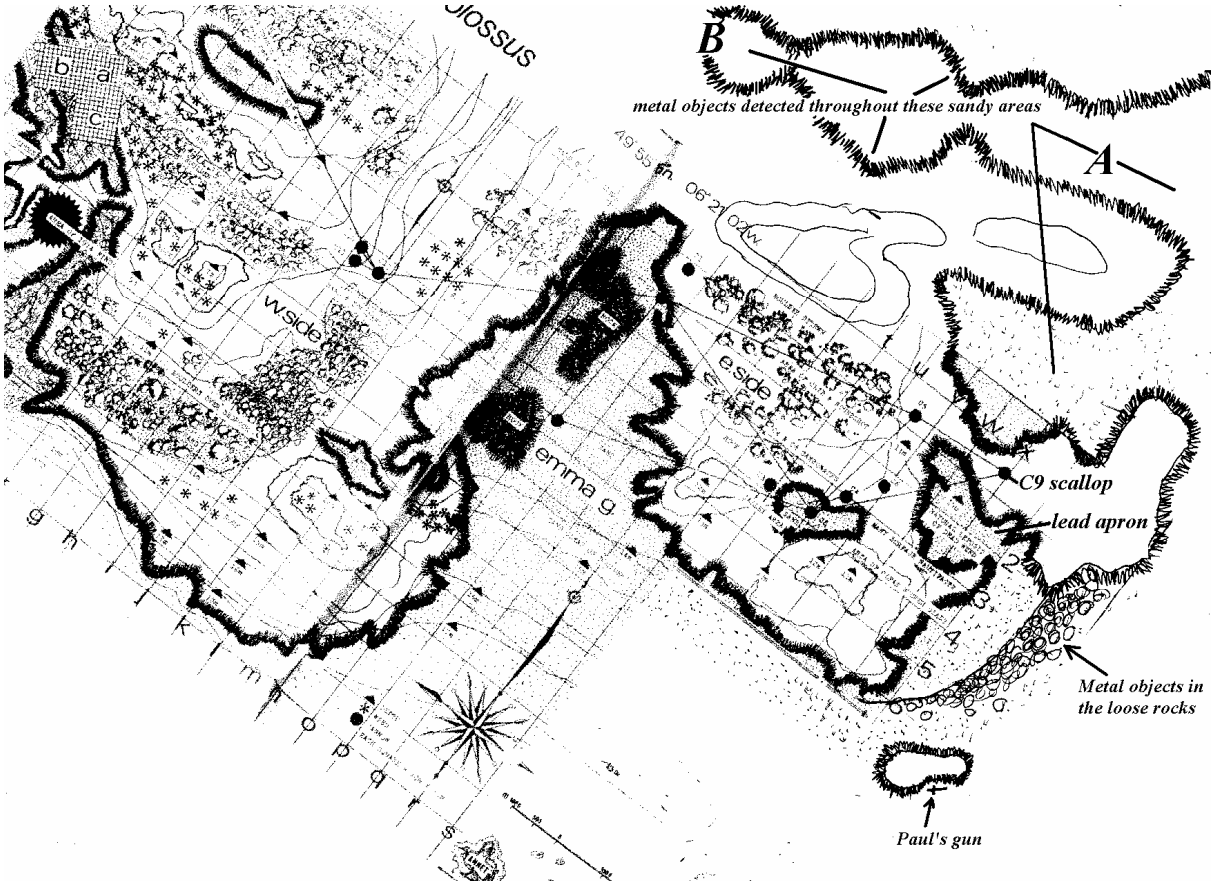
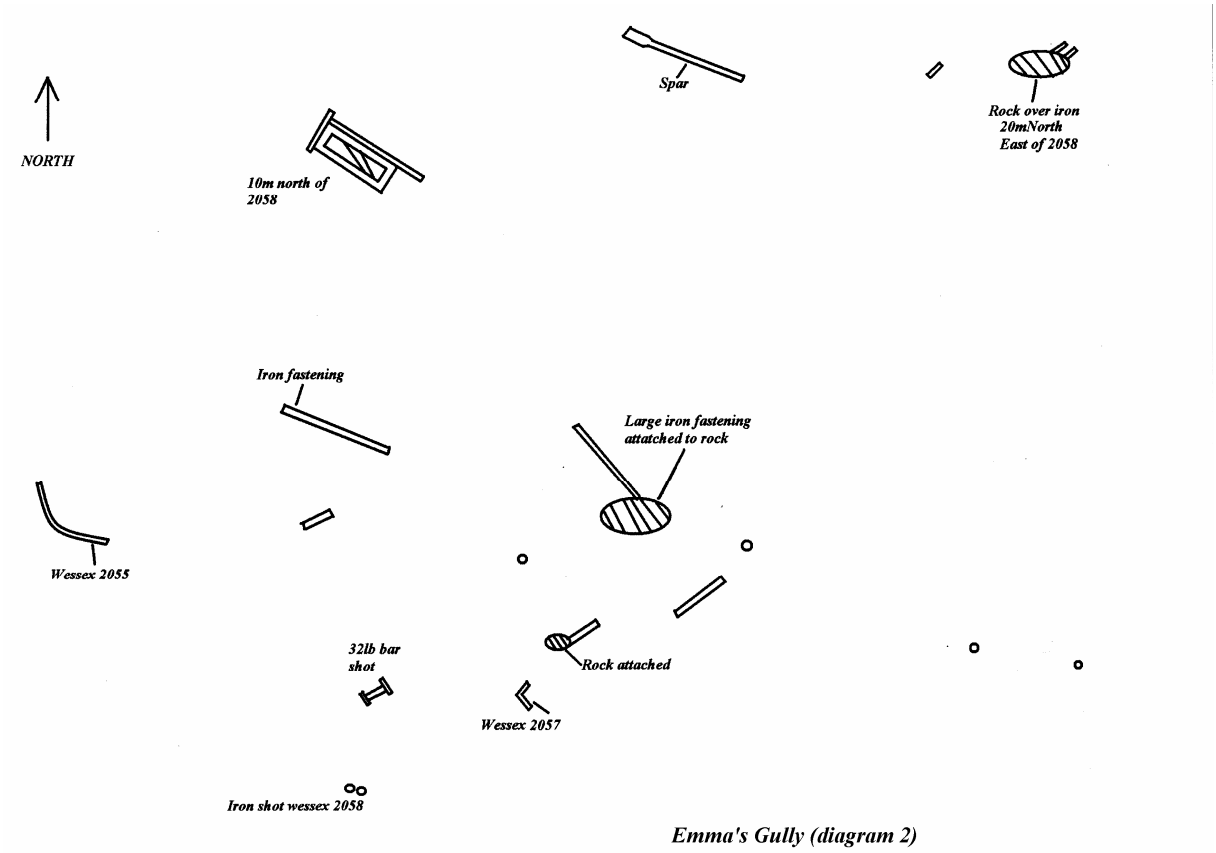


Todd Stevens

Diagram 2



Emma's Gully (diagram 2)

Todd Stevens

Sheave photograph

Todd Stevens