RESEARCH DEPARTMENT REPORT SERIES no. 106-2010 ISSN 1749-8775

THE SWASH CHANNEL WRECK, DORSET
TREE-RING ANALYSIS OF SHIP TIMBERS

SCIENTIFIC DATING REPORT

Nigel Nayling

ARCHAEOLOGICAL SCIENCE

ENGLISH HERITAGE

This report has been prepared for use on the internet and the images within it have been down-sampled to optimise downloading and printing speeds.

Please note that as a result of this down-sampling the images are not of the highest quality and some of the fine detail may be lost. Any person wishing to obtain a high resolution copy of this report should refer to the ordering information on the following page.

Research Department Report Series 106-2010

THE SWASH CHANNEL WRECK, DORSET

TREE-RING ANALYSIS OF SHIP TIMBERS

Nigel Nayling

Latitude 50º42.244 North, Longitude 02º46.708 West (WGS84)

ISSN 1749-8775

SUMMARY
This report summarises work undertaken to assess and sample *in situ* timbers of a wreck known as the Swash Channel Wreck, lying underwater in the approaches to Poole Harbour, Dorset, with a view to providing precise dating evidence and a likely provenance for the timbers, to assist in characterising, and possibly identifying the wreck. Samples were taken from framing timbers exposed on the seabed to complement a single tree-ring date from one of two timbers sampled in 2005, soon after the wreck's designation under the Protection of Wrecks Act 1973. Tree-ring series from two of the newly sampled framing timbers have been correlated with mean sequences from Germany, the Netherlands, and a previously sampled wreck off the south coast of England. The dating suggests that the parent timbers were felled during AD 1628, and appears to confirm a German or Dutch origin for the framing timbers employed in the ship's construction.

CONTRIBUTORS
Nigel Nayling

ACKNOWLEDGEMENTS
I am most grateful to Wessex Archaeology for arranging access to the site and providing logistical support. David Parham as lead archaeologist provided essential insight into the vessel's construction and disposition. Marta Dominguez-Delmás and Ian Tyers kindly provided assistance with access to unpublished data. I am also thankful for discussions with Esther Jansma and Martijn Manders on the subject of Dutch timber trade. This study was commissioned and funded by English Heritage. Peter Marshall and Cathy Tyers provided useful comments on early drafts.

ARCHIVE LOCATION
Dorset Historic Environment Record
Environmental Services
Dorset County Council
County Hall, Colliton Park
Dorchester DT1 1XJ

DATE OF INVESTIGATION
2009–10

CONTACT DETAILS
Lampeter Dendrochronology Laboratory
School of Archaeology, History and Anthropology
University of Wales Trinity Saint David
Lampeter
Ceredigion SA48 7ED
Telephone 01570 424904
Email n.nayling@tsd.ac.uk

CONTENTS

INTRODUCTION

This document is a technical archive report on the tree-ring analysis of samples recovered from the Designated Historic Wreck known as the Swash Channel Wreck, located in the approaches to Poole Harbour in Dorset (Fig 1). The site has been the subject of a sustained programme of monitoring and recording led by David Parham of Bournemouth University (Palma and Parham 2006; 2007; Parham and Palma 2008) and has been identified as a large armed merchantman of the seventeenth century, based on recovered artefacts and structural details. A previous dendrochronological study produced a terminus post quem for felling for a single framing–timber of AD 1585 (Nayling 2006).

This dendrochronological study was commissioned and funded by English Heritage to further assist in the dating and possible identification of the wreck through the recovery and analysis of an appropriate number of samples from oak (*Quercus* spp) timbers to refine the dating evidence, and potentially identify the origin(s) of the parent trees.

METHODOLOGY

In Autumn 2009, the site was examined by the author with support from the Wessex Archaeology dive team operating on surface supplied diving equipment. Surface detail of many timbers had significantly deteriorated since the first dendrochronological assessment of the site in 2005. Scouring along some of the edges of the wreck had exposed more extensive areas of framing timbers, providing additional opportunities for sampling, although many of these frames had been heavily eroded in these areas. Whilst the sampling strategy sought to improve replication of the single date previously achieved (Nayling 2006) and to verify the use of Dutch or German timber, a key objective was, if possible, to locate samples with surviving bark-edge which had the potential to produce felling dates to the year or even the season. This could assist attempts to identify the wreck, given historical accounts of shipping losses in the area in the early seventeenth century. Samples were recovered from framing timbers, and the staves of a partially exposed barrel, using a combination of hand saws and an hydraulic chainsaw, on dives undertaken on 30 September and 1 October 2009. The relative location of the individual samples is illustrated in Fig 2. Photographs of each sample location are provided in Figs 3–12.

Methods employed at the Lampeter Dendrochronology Laboratory in general follow those described in English Heritage guidance documents (English Heritage 1998). The samples were cleaned using razor blades so that the ring sequence could be clearly discerned and measured. The complete sequence of growth rings in each sample was measured to an accuracy of 0.01mm using a micro-computer based travelling stage (Tyers 2004). Cross-correlation algorithms (Baillie and Pilcher 1973; Munro 1984) are employed to search for positions where the ring sequences are highly correlated against each other. The ring sequences were also tested against a range of reference chronologies from Britain and Northern Europe. The *t*-values reported below are derived from the original

CROS algorithm (Baillie and Pilcher 1973). A *t*-value of 3.5 or over is usually indicative of a good match, although this is with the proviso that high *t*-values at the same relative or absolute position must be obtained from a range of independent sequences, and that satisfactory visual matching supports these positions. Correlated positions were checked visually using computerised ring-width plots.

RESULTS

Details of individual samples from timbers are given in Table 1, whilst Table 2 links the sample numbers used in this report to subsequent renumbering of samples. A total of 13 samples was taken, of which seven had sufficient rings to merit measurement. The relatively high number of samples with an insufficient number of rings reflects the difficulty in assessing ring counts on timbers which have been subjected to degradation by gribble and erosion by physical forces.

The tree ring series from two samples taken from the same framing timber (SCW100 and SCW101) were correlated with each other (Table 3a), and a combined raw ring-width series calculated (SCW100_1).Two series (SCW100_1 and SCW105) cross-matched against each other with a borderline significant correlation of *t*=3.5, and the latter of these also correlated with the previously analysed sample Swash2014 (Table 3b).

The tree-ring series from the individual timbers were compared with tree-ring chronologies from Britain and Northern Europe. Two samples correlated with chronologies from the Netherlands and Germany and also ring-width series from samples from the Norman's Bay Wreck (Nayling 2008) and a possible floor timber found washed up on the shore in Studland Bay (Nayling 2009) (Table 4). This dating evidence confirmed the borderline significant correlation identified between these two timbers. The data for these two dated series is given in Table 5.

Both of the dated timbers had complete surviving sapwood and bark edge. One sample (SCW101) had bark edge with the last ring only partially formed, and hence not measured, comprising just early wood in the form of spring vessels , implying felling in the spring or early summer of AD 1628. The season of felling of the second sample with bark edge (SCW105) could not be determined due to the narrowness of the outermost rings, but the year of felling is the same at AD 1628.

DISCUSSION

The dating of two samples to the year AD 1628 is consistent with, and also refines the dating provided by a previous sampling exercise on this designated historic wreck (Nayling 2006). This precise dating should assist historical research directed at identifying the wreck from documentary evidence. Correlations with German and Dutch chronologies strengthen the case for the vessel having a non-British origin, although the pattern of timber trade between Britain and northern Germany at this time is not fully understood. The most likely source region for the timber is North West Germany (Lower

Saxony/Westphalia) with it being transported by the river Ems to the wood market in Emden or by the Weser to Bremen (Dominguez-Delmás *et al* in press).

Correlation with the tree-ring series from a disarticulated timber found washed up on the shore of Studland Bay (Nayling 2009) is intriguing. It is possible that another section of the same wreck as the Swash Channel hull remains lies in an as yet unidentified location in Studland Bay, from which occasional timbers are detached and beached during storms. Using the sapwood estimate employed by Wrobel and Eckstein for timber from northern Germany (10–30 sapwood rings, Haneca *et al* 2008, table 1), the dated Studland timber has been given a felling date range of AD 1619–39, which would be consistent with the precise felling dates now available for the Swash Channel assemblage.

REFERENCES

Baillie, M G L and Pilcher, J R, 1973 A simple crossdating program for tree-ring research, *Tree Ring Bull*, **33**, 7–14

Delorme, A, 1972 *Dendrochronologische Untersuchungen an Eichen des Südlichen Weser- und Leineberglandes*, unpubl PhD thesis, Göttingen Univ

Dominguez-Delmás, M, Benders, J F, and Kortekaas G L G A, in press Timber supply in Groningen (north-east Netherlands) during the early Modern period (16th-17th centuries), in Tree-Rings, Art and Archaeology proceedings, Royal Institute for Cultural Heritage Collection Scientia Artis (P Fraiture), 235-57

English Heritage, 1998 *Dendrochronology: guidelines on producing and interpreting dendrochronological dates*, London

Haneca, K, Cufar, K, and Beeckman, H, 2008 Oaks, tree-rings and wooden cultural heritage. A review of the main characteristics and applications of oak dendrochronology in Europe, *J Archaeol Sci,* **36:1**, 1–11

Huber, B and Giertz-Siebenlist, V, 1969 Unsere tausendjährige Eichen-Jahrringchronologie durchschnittlich 57 (10-150)-fach belegt, *Oesterreichischen Akademie der Wissenschaften, Mathematisch- Naturwissenschaftliche Klasse, Abteilung*, **178**, 37-42

Munro, M A R, 1984 An improved algorithm for crossdating tree-ring series, *Tree Ring Bull*, **44**, 17–27

Nayling, N, 2006 *Tree-ring analysis of ship timbers from the Swash Channel Wreck, Poole Harbour Dorset*, University of Wales Lampeter Archaeological report 2006

Nayling, N, 2008 *The Norman's Bay Wreck, East Sussex: tree-ring analysis of ship timbers.* Engl Heritage Res Dept Rep Ser, **25-2008**

Nayling, N, 2009 *Dendrochronological spot date report: disarticulated framing timber, Studland Bay,* University of Wales Lampeter Archaeological report 2009

Palma, P, and Parham, D, 2006 *Swash Channel Wreck: 2006 Season Report.* Maritime Archaeology Research Group, Bournemouth University

Palma, P, and Parham, D, 2007 *Swash Channel Wreck: 2007 Annual Report.* Maritime Archaeology Research Group, Bournemouth University

Parham, D, and Palma, P, 2008 *Swash Channel Wreck: 2008 Season Report.* Maritime Archaeology Research Group, Bournemouth University

Tyers, I, 2004 *Dendro for Windows programme guide*, 3rd edn

FIGURES

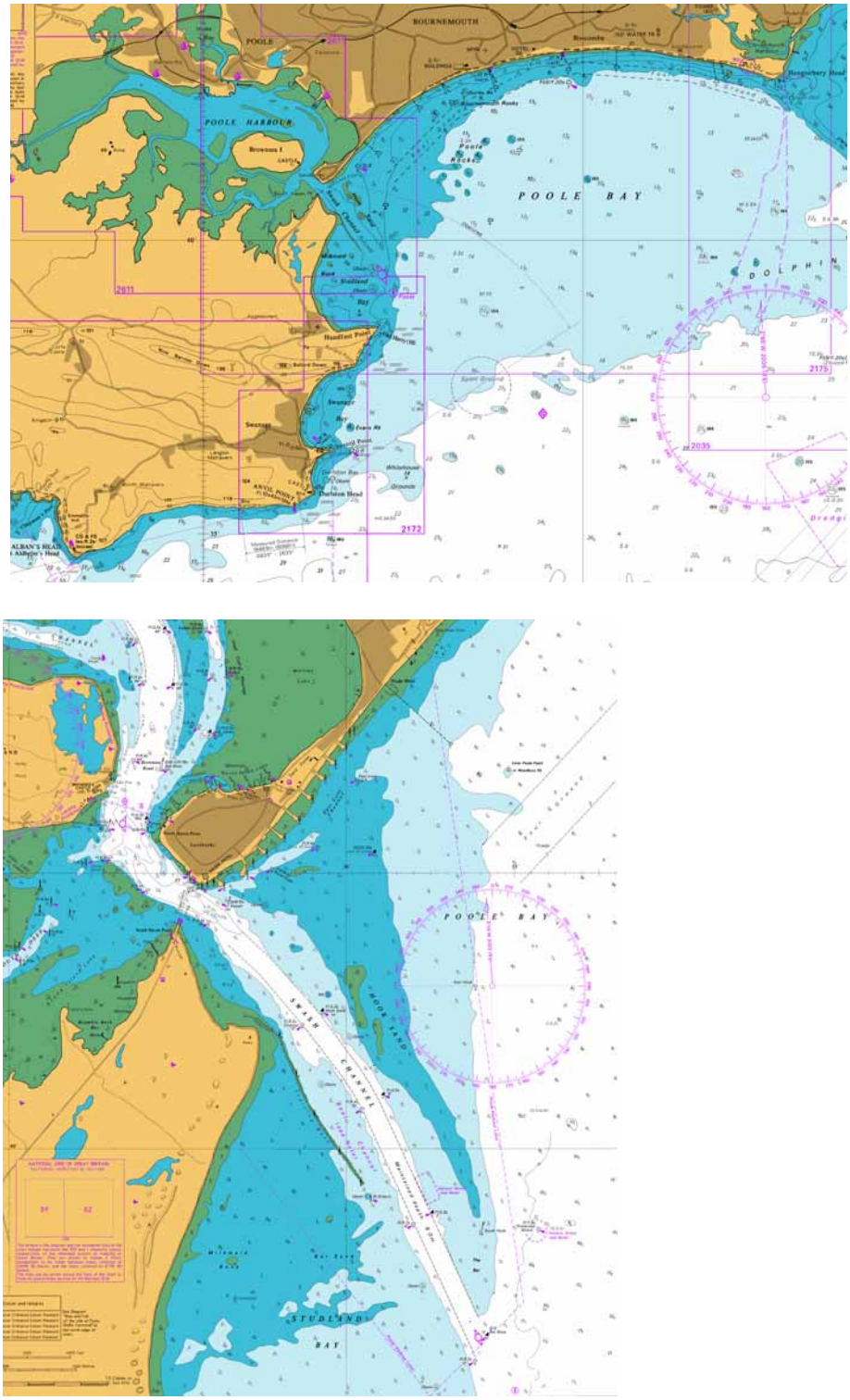

Figure 1 Location of the Designated Area of the Swash Channel Wreck under the Protection of Wrecks Act 1973. Poole Harbour and approaches (above) and detail (below) showing bounding box of designated area. Crown copyright

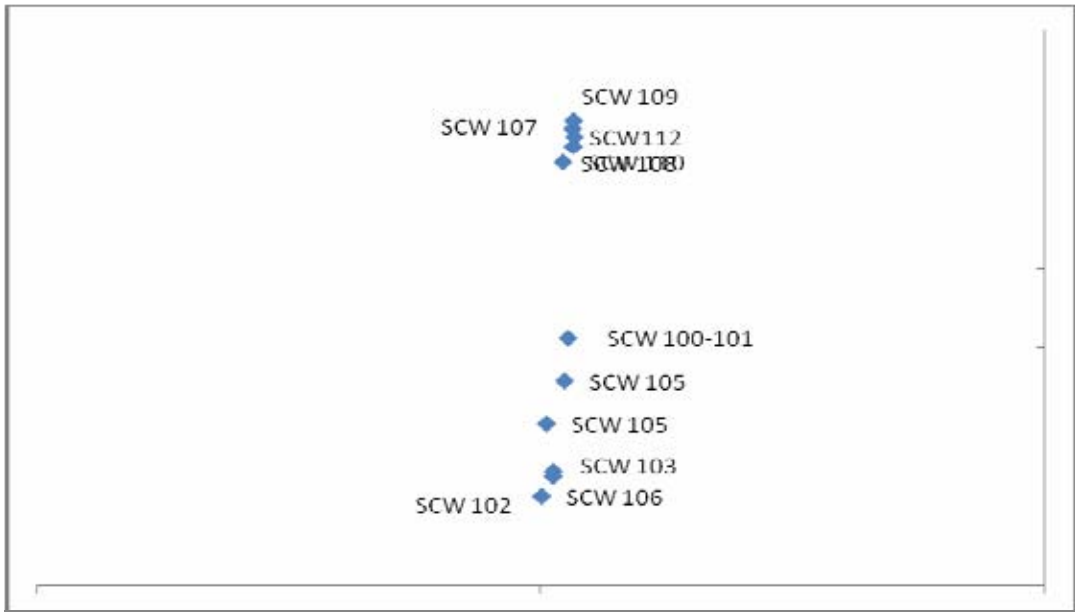

Figure 2 Location of samples taken. Co-ordinates are relative. Full mapping of sample locations will be undertaken during survey and excavation. Data from Wessex Archaeology

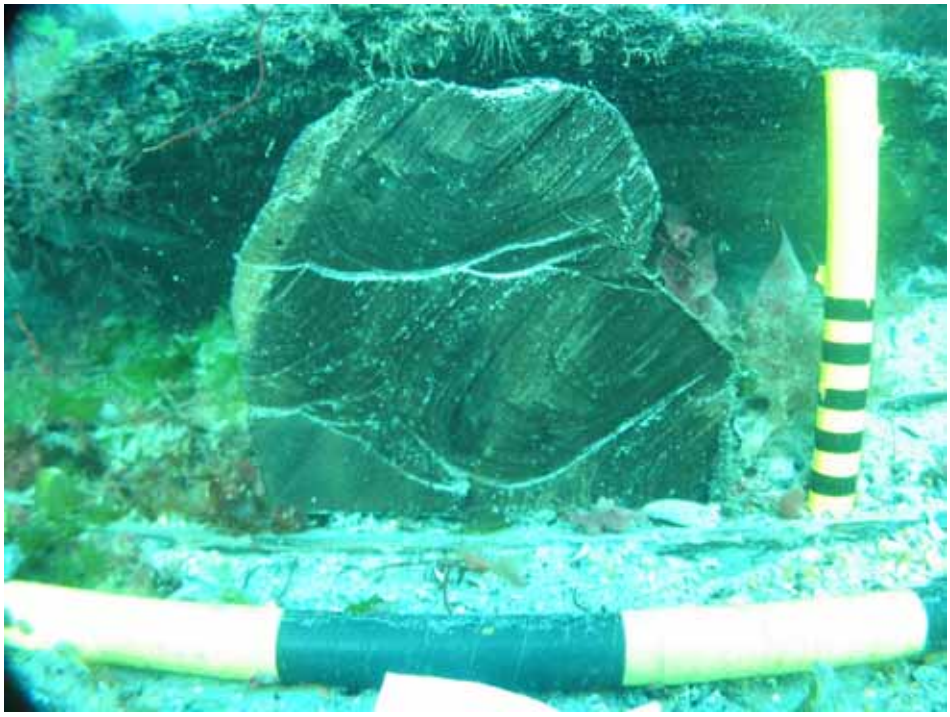

Figure 3 Photograph of sample location for SCW100 and SCW101. Crown copyright © Photo taken by Wessex Archaeology

Figure 4 Photograph of sample location for SCW 102. Crown copyright © Photo taken by Wessex Archaeology

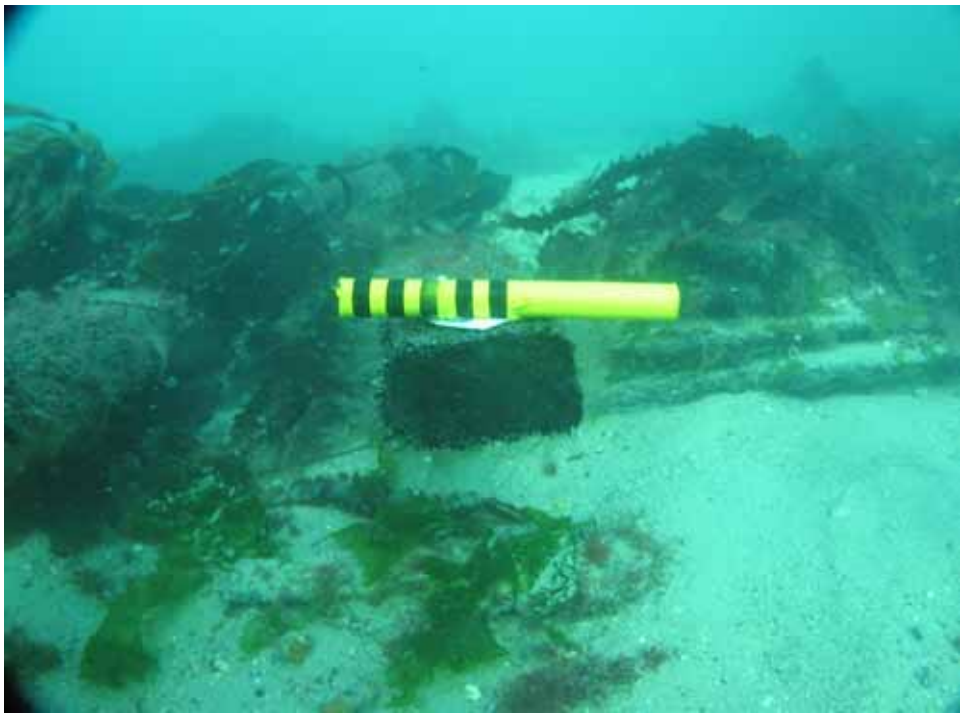

Figure 5 Photograph of sample location for SCW 103. Crown copyright © Photo taken by Wessex Archaeology

Figure 6 Photograph of sample location for SCW 104. Crown copyright © Photo taken by Wessex Archaeology

Figure 7 Photograph of sample location for SCW 105. Crown copyright © Photo taken by Wessex Archaeology

Figure 8 Photograph of sample location for SCW 106. Crown copyright © Photo taken by Wessex Archaeology

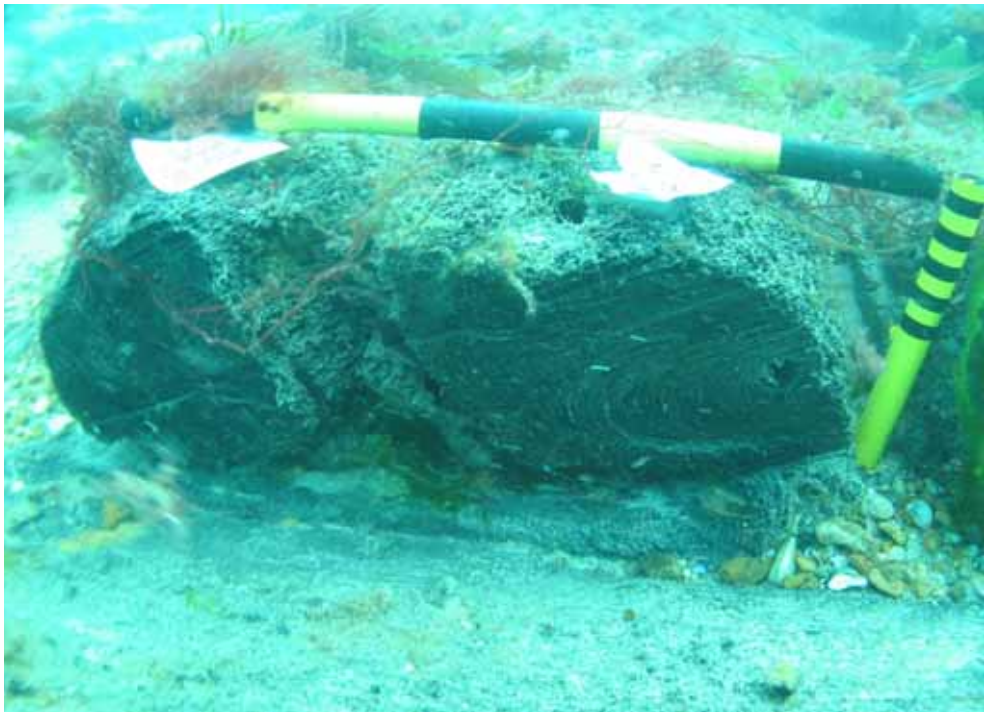

Figure 9 Photograph of sample locations for SCW 107 and SCW108. Crown copyright © Photo taken by Wessex Archaeology

Figure 10 Photograph of sample location for SCW109

Figure 11 Photograph of sample location for SCW110 and SCW111. Crown copyright © Photo taken by Wessex Archaeology

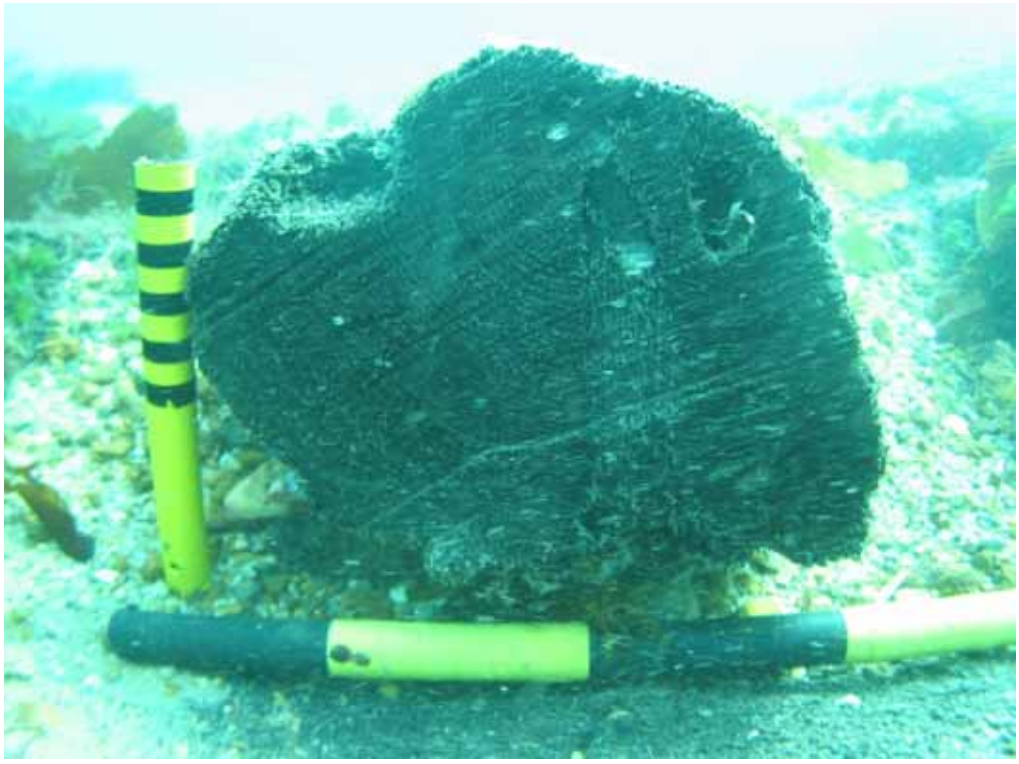

Figure 12 Photograph of sample location for SCW112. Crown copyright © Photo taken by Wessex Archaeology

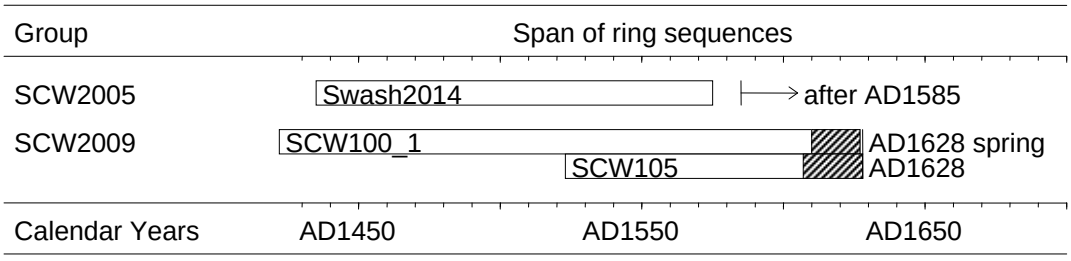

Figure 13 Bar diagram showing the date ranges of absolutely dated tree-ring series and implied dates of felling of the parent trees. White bars are heartwood; hatched bars are sapwood

TABLES

Table 1 Sample details, Swash Channel Wreck

Sample code	Additional information, where known	Cross-section	Dimensions (mm)	Total rings	Sapwood	ARW (mm/year)	Date of sequence	Felling date range
SCW100		Radial	220 x 120	184	-	1.14	AD 1424–1607	after AD1617
SCW101	Repeat sample of SCW100	Quartered	215 x 195	206	17++½Bs	1.15	AD 1422–1627	AD1628 spring
SCW102		Halved	215 x 110	60	-	2.18	undated	-
SCW103		Radial	120 x 70	40	-	2.75	unmeasured	-
SCW104		Radial	180 x 150	45	?H/S		unmeasured	-
SCW105		Quartered	220 x 170	106	21+B	1.93	AD 1523–1628	AD1628
SCW106		Radial	160 x70	40	-	4.00	unmeasured	-
SCW107		Whole	260 x 180	60	-	2.10.	undated	-
SCW108		Quartered	260 x 180	30	-	6.00	unmeasured	-
SCW109		Quartered	140 x 100	36	-	2.78	unmeasured	-
SCW110	Barrel Stave	Radial	90 x 7	69	-	1.24	undated	-
SCW111	Barrel Stave	Radial	50 x 8	35	-	1.40	unmeasured	-
SCW112		Halved	240 x 170	88	+?HS	1.97	undated	-

Total rings = all measured rings ARW = average ring width of the measured rings. Sapwood: ++½Bs = plus unmeasured partial ring before bark edge indicating felling in spring/early summer. +B = bark edge, felling season indeterminate, ?HS = possible heartwood/sapwood boundary. All samples were oak (*Quercus* spp.)

Table 2 Concordance between sample numbers given during sampling (and used in this report), and subsequent re-numberings. Data supplied by Wessex Archaeology

Sample Number	Old sample number v.1	Old sample number v.2	Sampler	WA DIVA observation number	WA photograph numbers
2024	SCW 100-101	SCW 120-121	Nigel Nayling	3305	3077–83
2025	SCW 102	SCW 119	Nigel Nayling	3314	3056–61
2026	SCW 103	SCW 118	Nigel Nayling	3311	3062–7
2027	SCW 104	SCW 122	Nigel Nayling	3292	3084–93
2028	SCW 105	SCW 117	Nigel Nayling	3284	3036–55
2029	SCW 106	SCW 116	Nigel Nayling	3286	3068–76
2030	SCW 107	SCW 113	Nigel Nayling	3318	3103–9
2031	SCW 108	SCW 114	Nigel Nayling	3320	3103–9
2032	SCW 109	SCW 115	Nigel Nayling	3381	3152–5
2033	SCW 110	SCW 123	Nigel Nayling	3329	3094–3102
2034	SCW 112	SCW 112	Nigel Nayling	3326	3110–17

Table 3 Correlations between dated samples from the Swash Channel wreck; - = t-values less than 3.00

a) Correlation between samples SCW100 and SCW101 from the same timber. These tree ring series were combined to form a single series SCW100_1

Sample	SCW101
SCW100	21.17

b) Correlation between samples SCW101 and SCW105, recovered in 2009, and Swash2014, recovered in 2005

Samples	SCW100_1	SCW105
Swash2014	4.36	-
SCW100_1		3.50

Table 4 Correlations between the two dated samples and samples from wrecks in British waters and chronologies from the Netherlands and Germany.

Site chronology/sample	SCW100_1	SCW105
Norman's Bay Wreck (Nayling 2008), sample NORM1055	4.36	5.88
Norman's Bay Wreck (Nayling 2008) , sample NORM1059	5.85	4.32
Norman's Bay Wreck (Nayling 2008) , sample NORM1061	3.17	4.00
Norman's Bay Wreck (Nayling 2008) , sample NORM1065	3.45	5.77
Studland Bay (Nayling 2009), sample STUD2009	4.34	5.21
Weserbergland (Delorme 1972)	4.06	5.92
Hamburg, Germany (Huber and Giertz-Siebenlist 1969)	4.74	5.43
Niedersachsisches Kustenraum (Leuschner pers comm)	7.67	6.47
Ostfriesland, Germany (Leuschner pers comm)	7.97	6.33
Westphalia region, Germany (Tisje pers comm)	11.34	5.95
Twente region, Netherlands (Tisje pers comm)	7.33	3.84

Table 5 Tree-ring widths for dated samples.

a) SCW100_1, dated to AD 1523 to 1628 inclusive

Date	Ring Widths (hundredths of mm)									
AD1422		155	226	227	265	192	188	174	108	143
-	134	206	196	154	156	189	145	102	112	123
-	80	87	153	146	126	117	112	107	172	118
AD1451	171	157	141	133	92	123	104	137	128	112
-	111	80	98	71	66	102	119	113	101	87
-	97	108	110	102	99	95	62	88	67	130
-	127	114	119	193	129	144	127	109	121	85
-	96	111	126	214	236	188	160	105	100	148
AD1501	117	118	154	98	121	139	76	98	90	85
-	107	121	100	108	116	114	89	105	102	67
-	91	98	99	140	83	142	94	158	124	141
-	131	76	95	99	54	60	90	86	135	122
-	129	99	138	106	150	98	112	105	91	83
AD1551	100	100	80	66	75	92	128	85	103	110
-	98	76	92	91	90	95	111	96	74	79
-	103	109	86	91	83	65	106	141	93	65
-	82	121	143	139	98	132	91	78	136	105
-	126	111	111	120	78	90	115	89	94	86
AD1601	71	72	81	113	144	187	180	100	99	97
-	82	113	110	128	90	95	102	112	81	107
-	81	77	71	90	99	88	101			

b) SCW105, dated to AD 1523 to 1628 inclusive

Date	Ring Widths (hundredths of mm)									
AD1523			145	205	151	233	188	209	182	205
-	194	149	204	179	213	144	186	132	228	281
-	294	271	312	233	307	368	411	439	394	262
AD1551	256	343	315	236	224	255	285	280	214	177
-	345	335	232	201	232	201	162	200	164	147
-	148	189	155	140	120	126	192	210	146	174
-	140	138	215	156	166	239	179	169	223	187
-	152	155	220	161	154	169	210	208	183	155
AD1601	146	179	173	152	192	181	203	197	120	130
-	108	124	170	167	98	108	141	143	109	109
-	89	126	128	134	99	85	86	87		






ENGLISH HERITAGE RESEARCH DEPARTMENT

English Heritage undertakes and commissions research into the historic environment, and the issues that affect its condition and survival, in order to provide the understanding necessary for informed policy and decision making, for sustainable management, and to promote the widest access, appreciation and enjoyment of our heritage.

The Research Department provides English Heritage with this capacity in the fields of buildings history, archaeology, and landscape history. It brings together seven teams with complementary investigative and analytical skills to provide integrated research expertise across the range of the historic environment. These are:

* *Aerial Survey and Investigation*
* *Archaeological Projects (excavation)*
* *Archaeological Science*
* *Archaeological Survey and Investigation (landscape analysis)*
* *Architectural Investigation*
* *Imaging, Graphics and Survey (including measured and metric survey, and photography)*
* *Survey of London*

The Research Department undertakes a wide range of investigative and analytical projects, and provides quality assurance and management support for externally-commissioned research. We aim for innovative work of the highest quality which will set agendas and standards for the historic environment sector. In support of this, and to build capacity and promote best practice in the sector, we also publish guidance and provide advice and training. We support outreach and education activities and build these in to our projects and programmes wherever possible.

We make the results of our work available through the Research Department Report Series, and through journal publications and monographs. Our publication Research News, which appears three times a year, aims to keep our partners within and outside English Heritage up-to-date with our projects and activities. A full list of Research Department Reports, with abstracts and information on how to obtain copies, may be found on www.english-heritage.org.uk/researchreports

For further information visit www.english-heritage.org.uk

ENGLISH HERITAGE