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Wreck Site GAD 58 Goodwin and Downs Kent

Tree-ring Analysis of Oak Timbers

Roderick Bale, Nigel Nayling, and Cathy Tyers

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Front Cover: Typical view of GAD timber (4001) *in situ*. Photograph supplied by Wessex Archaeology.

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WRECK SITE GAD 58
GOODWIN AND DOWNS
KENT

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SUMMARY
Four sections of timber from Goodwin and Downs wreck site 58 (Site name: GAD 58; Site code: 1083), located in the English Channel off the Kent coast, were retrieved by Wessex Archaeology with a view to obtaining independent dating evidence through dendrochronology. The timber sections were all oak but only two, from the same timber element, contained sufficient rings to warrant analysis. The resultant combined series could not be conclusively dated despite comparison with an extensive range of British, European, and American reference chronologies.

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ACKNOWLEDGEMENTS
This study was requested by Alison James (Historic England Marine Archaeologist) and commissioned by Shahina Farid (Historic England Scientific Dating Coordinator). We would like to thank both Peta Knott and Paolo Croce (Wessex Archaeology) for their assistance and provision of information.

ARCHIVE LOCATION
Historic England Archive,
The Engine House,
Fire Fly Avenue,
Swindon SN2 2EH

HISTORIC ENVIRONMENT RECORD OFFICE
Kent Historic Environment Record,
Heritage Conservation,
Kent County Council,
Invicta House,
County Hall,
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2015–17

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INTRODUCTION

This document is a technical archive report on the dendrochronological analysis of four timber samples from Goodwin and Downs site 58 (GAD 58). These come from a single wreck, or possibly from multiple wooden wrecks, from the Goodwin and Downs sites, off the Kent coast (Fig 1). The wrecks have evidence of iron smooth bore muzzle loading guns on-board. It is possible that these timbers are part of a debris trail connected to the sinking of the designated wreck of the *Rooswijk* (LEN 1000085, here) which lies 600m away.

Alison James (Historic England Maritime Designation Team) requested tree-ring dating in an attempt to obtain independent evidence of the date and provenance of these timbers. It was hoped that this would assist in characterising the wreck, thus potentially aiding identification and informing a designation assessment.

METHODOLOGY

The four timbers retrieved by Wessex Archaeology were assessed at the Lampeter Dendrochronology Laboratory and subsequently cross-sectional samples were removed by handsaw for analysis.

Methods employed at the Lampeter Dendrochronology Laboratory in general follow those described in Historic England guidance (English Heritage 1998). The samples were waterlogged, and a clean surface was produced by hand using razor blades. The complete sequence of growth rings in the two samples that have more than 40 rings 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.

Dating is dependent on trees over large geographical areas showing a similar relative pattern of wide and narrow annual rings as a result of climatic influences during the growing season. Of course, tree growth is not only affected by climate, and individual tree growth, or that of trees in one cohort or area, can be affected by a whole host of other environmental variables. For example, a tree growing on a flat area close to a stream with abundant water is less likely to exhibit a narrow ring in a dry year than a tree on a steep slope with thin soils which is likely to exhibit a more sensitive tree-ring series. Competition, age trends, injury, and human/animal interference (such as pollarding or foliage defoliation by insects) can result in ring-width patterns that are dominated by non-climatic influences and hence hamper successful analysis. In order to reduce the effects of the background non-climatic 'noise' in individual tree/timber data, multiple radii may be measured and then combined into a single tree/timber series. This 'noise' is further reduced when these individual tree/timber series can be cross-matched within the site or phase to form a well-replicated site master chronology, the production of which enhances the chances of successful dating. The likelihood of a sample or site master chronology being dated is also dependent on the availability of well-replicated reference chronologies from the relevant time period and geographical source.

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. A *t*-value of over 10 between individual samples is potentially indicative of the timbers represented originating from the same parent tree, though *t*-values of far less than 10 are often observed from measuring different radii across a single oak tree cross-section, thus this is only a guide to potential same-tree derivation. Correlated positions are checked visually using computerised ring-width plots.

RESULTS AND DISCUSSION

Details of the four oak (*Quercus* spp) samples are provided in Table 1. The sample locations, and samples themselves are illustrated in Figures 2–9. Two of the timber sections (6004, 6007) contained two few rings and were thus excluded from further analysis. The two remaining timber sections (6001, 6002) represented a single timber element. A single series was measured on 6001, whilst three separate series were measured on 6002. The raw ring-width measurements are provided in the Appendix. These four series were successfully cross-matched (Fig 10; Table 2) and combined to form a single timber series, 6001_6002, of 63 rings. This was then compared with a wide range of reference chronologies from Britain, elsewhere in Europe, and America but without success.

The inability to successfully date this 63-year series is not surprising as it is relatively short and represents only a single timber. It serves to emphasise the importance of obtaining samples from multiple timbers which can be subsequently cross-matched to produce a long well-replicated site chronology which has a significantly higher likelihood of being successfully dated.

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TABLES

Table 1: Details of the samples from the four timber sections retrieved from Goodwin and Downs wreck site 58 (GAD 58)

Timber/Sample number	Function	Cross-section type	Dimensions (mm)	Species	Total number of rings	Sapwood rings	Average ring width (mm)
6001	possible frame	halved	330 x 200	oak	47	-	1.56
6002	ditto	halved	125 x 65	oak	63	13	1.25
6002_1					51	6	1.64
6002_2					60	13	1.12
6002_3					63	13	1.11
6004	plank	tangential	120 x 70	oak	22	-	-
6007	plank with five trenail holes	tangential	60 x 20	oak	13	-	-

Table 2: Correlation (t-values) between the four measured and cross-matched ring-width series from the samples from timber 6001/6002

Series		6001	6002_1	6002_2	6002_3
	Relative date	1–47	4–54	4–63	1–63
6001	1–47	*	4.46	7.90	8.86
6002_1	4–54		*	5.07	5.30
6002_2	4–63			*	12.08
6002_3	1–63				*

FIGURES

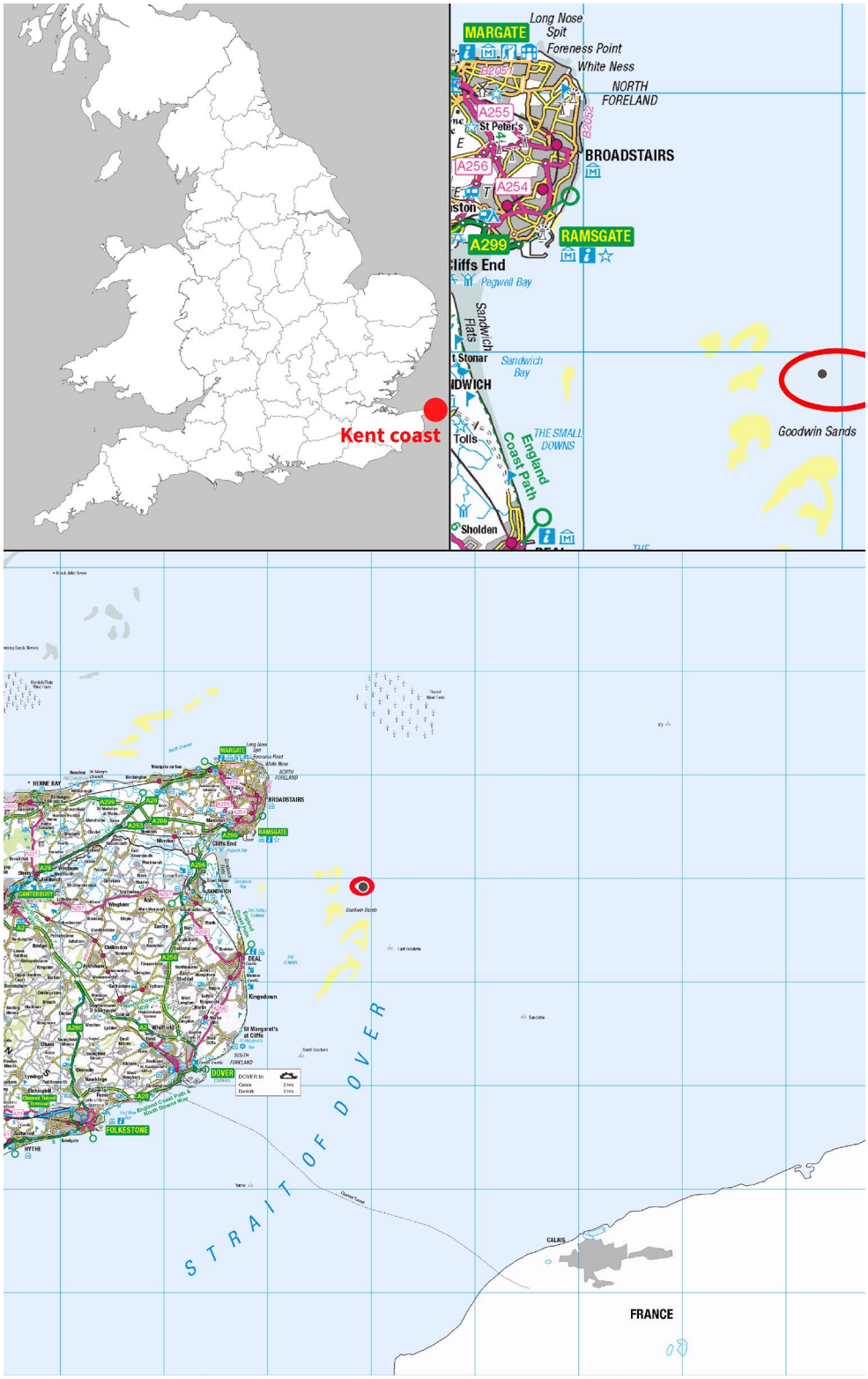

Figure 1: Maps to show the location of the wreck site GAD 58 off the coast of Kent, South East England, marked in red. Scale: top right 1:200,000, bottom 1:500,000

Figure 2: Timber 6001/6002 (photograph Wessex Archaeology)

Figure 3: Timber GAD58 6001 showing sample location, same timber as GAD58 6002 (photograph Roderick Bale)

Figure 4: Timber GAD58 6002 showing sample location, same timber as GAD58 6001 (photograph Roderick Bale)

Figure 5: Cross-sectional slice from GAD58 6002 (photograph Roderick Bale)

Figure 6: Timber GAD58 6004 showing sample location (photograph Rod Bale)

Figure 7: Cross-sectional slice from GAD58 6004 (photograph Roderick Bale)

Figure 8: Timber GAD58 6007 showing sample location (photograph Rod Bale)

Figure 9: Cross-sectional slice from GAD58 6007 (photograph Roderick Bale)

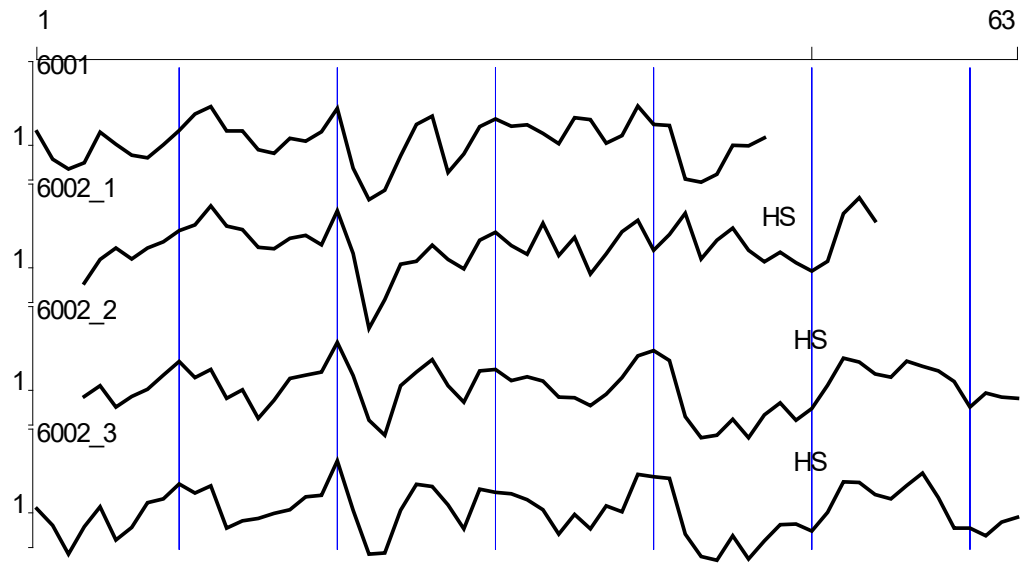

Figure 10: The four cross-matched ring-width series from timber sections 6001 and 6002. Relative years 1–63 are shown on the x-axis and the y-axis is ring-widths in mm on a logarithmic scale

APPENDIX

Ring width values (0.01mm) for the measured series

GAD 58 6001

129	77	64	72	128	102	83	79	101	132
180	207	131	131	92	86	114	108	129	200
65	36	43	82	148	173	60	85	142	164
143	147	125	103	168	162	104	120	209	148
145	53	50	58	100	99	115			

GAD 58 6002_1

75	117	145	118	145	163	201	224	320	219
205	147	143	174	184	154	292	131	32	55
107	113	153	117	98	168	195	152	129	231
126	177	89	130	197	244	139	187	279	118
168	211	139	112	134	110	94	13	277	373
242									

GAD 58 6002_2

89	109	73	89	102	133	172	127	148	86
101	59	83	125	133	141	246	132	57	43
109	141	178	109	80	144	148	120	129	119
88	87	75	93	127	191	211	175	61	41
43	58	41	63	79	57	71	110	183	170
136	128	173	157	144	118	73	95	88	86

GAD 58 6002_3

108	79	46	77	112	60	76	121	130	172
145	166	75	86	90	99	106	135	139	266
105	46	47	105	171	164	116	74	156	147
143	128	106	67	97	74	114	102	206	197
191	67	44	41	65	42	59	80	81	71
101	179	177	141	130	167	211	133	75	75
65	84	92							

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