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The Alum Bay Wrecks Hampshire

Tree-ring Analysis of Ship Timbers

Nigel Nayling

Discovery, Innovation and Science in the Historic Environment

Research Report Series no. 35-2015

Front Cover: HMS Pomone, the vessel Alum Bay 1 has been identified as. Color lithograph by T. G. Dutton after painting by G.F. St. John. Original source Macpherson collection in, Alan Moore, Sir, Bt. (1926) Sailing Ships of War, 1800-1860 (London: Halton & Truscott Smith). Commons File:HMS Pomone.jpg, retouched.

Research Report Series 35-2015

THE ALUM BAY WRECKS HAMPSHIRE

TREE-RING ANALYSIS OF SHIP TIMBERS

Nigel Nayling

NGR: SZ 30294 85301 / SZ 30231 85277

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SUMMARY

Dendrochronological analysis was undertaken on timbers from two wreck sites known as the Alum Bay Wrecks 1 and 2, lying underwater in the approaches to the coast of the Isle of Wight. The work was undertaken to assist with the characterisation and identification of the wrecks.

Two broadly coeval samples from Alum Bay Wreck 1 were dated, with one providing a felling date range of AD 1797–1833. Two samples from Alum Bay Wreck 2 were also dated, these both retaining possible bark edge, and hence having possible felling dates of AD 1795 and AD 1799, and certainly felled in the very late eighteenth or early nineteenth centuries. The two wreck sites could therefore have some association given the similarity of the dating evidence obtained.

CONTRIBUTORS

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ACKNOWLEDGEMENTS

I am most grateful to the Hampshire and Wight Trust for Maritime Archaeology for arranging access to the sites and providing logistical support. Julian Whitewright provided a range of drawings, copies of original dive logs, and a summary description for each wreck site to assist in compilation of this report. Cathy Tyers (Historic England Scientific Dating Team), Martin Bridge (Oxford Dendrochronology Laboratory) and Alison Arnold (Nottingham Tree-Ring Dating Laboratory) kindly assisted with access to relevant reference data. Cathy Tyers also provided useful comments on early drafts of this report. This report was commissioned and funded by English Heritage (now Historic England).

ARCHIVE LOCATION

Isle of Wight Historic Environment Record
Isle of Wight County Archaeology and Historic Environment Service
Westridge Centre
Brading Road
Ryde
Isle of Wight PO33 1QS

DATE OF INVESTIGATIONS

2001, 2002, and 2009

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CONTENTS

INTRODUCTION

This document is a technical archive report on the tree-ring analysis of samples recovered from two wreck sites located in Alum Bay on the coast of the Isle of Wight (Fig 1). The sites have been the subject of a sustained programme of monitoring and recording led by the Hampshire and Wight Trust for Maritime Archaeology (HWTMA).

This dendrochronological study was commissioned and funded by English Heritage (now Historic England) to further assist in the characterisation and possible identification of the wrecks through the recovery and analysis of a number of samples from oak (*Quercus* sp.) timbers. As well as refining the available dating evidence, it was hoped that tree-ring analysis might potentially identify the origin(s) of the parent trees.

The following summary of the Alum Bay wreck sites was kindly provided by Julian Whitewright of HWTMA.

Alum Bay Wreck 1

The site of Alum Bay Wreck 1 is located at SZ 30294 85301(50°39.996'N, 1°34.362'W (Datum: WGS84)). Archaeological survey and excavation has been conducted on the site since the early 1990s, and the last period of concerted fieldwork was in 2010. Meanwhile the site has been visited by recreational divers for a slightly longer period of time. The latter has resulted in the non-archaeological recovery of a number of artefacts, mainly copper bolts, from the site. A significant number of such artefacts were declared to the Receiver of Wreck during a find's amnesty in 2000, and these remain with their declarers.

The site comprises the wooden, iron, copper, and lead remains of a large structural section from a wooden ship lying in 7–8m of water. At their maximum extent these remains measure *c* 18.5m in length with a width of 8m and lie in a generally north–south alignment. The majority of the structural remains are wooden elements that formerly comprised the framing and planking of the vessel. Iron hull reinforcement elements, primarily in the form of iron knees are also present across the structure. Two types of identifiable fastening material survive *in situ*, wooden treenails and copper bolts. Several examples of the latter carry the broad arrow marking that is synonymous with production for the British Navy. Additionally, some iron concretions may be the remains of iron fastenings, rather than the iron reinforcements just described. Outer hull sheathing in the form of fragmentary thin sheets of copper has also been recorded and recovered from the site. Evidence for the provision of gunports on the vessel also survive, indicating an armed vessel. Finally, at the northern end of the site the remains of a pair of lead anchor hawse-holes are preserved. These indicate that the bow of the original vessel was towards the north and that the section of hull preserved on the site represents one of the forward sides of a vessel, rather than the bottom or stern. The remaining features indicate that the inside of the vessel is uppermost, with the outer-planking the lowest level of material, lying directly upon the seafloor.

Dating and Identification

The remains of Alum Bay Wreck 1 fall into the period of wooden shipbuilding when the structural framework of the vessel was fastened with copper, reinforced with ironwork, and the exterior of the hull was sheathed in copper. There is no evidence for the presence of diagonal iron bracing. The presence of pure copper fastenings on Alum Bay Wreck 1 is significant and correlates with other, identified vessels from after AD 1780 when copper fastenings became standardised. Although the Navy continued to use copper sheathing on the majority of its wooden vessels throughout the nineteenth century, copper fastenings were generally replaced by yellow-metal fastenings in merchant and Naval vessels in the years following Muntz's patenting of that material in AD 1832. The ironwork reinforcement recorded on Alum Bay Wreck 1 seem to be the remains of iron knees, which appear to take relatively simple forms of right-angled hanging or lodging knees. As such, they may be provisionally dated prior to the evolution in form that occurs under Robert Seppings, Surveyor of the Navy 1813–32, such as those seen in HMS *Unicorn* (built 1824). The use of lead to line the hawse holes indicates a wreck date prior to AD 1817 when such material was widely replaced with cast iron. A provisional date may therefore be assigned to the remains of Alum Bay Wreck 1 of between the AD 1780s, when copper sheathing and fastening was widely introduced, and AD 1817 when iron replaced lead as a material for lining hawse holes. The remains have been associated for a number of years with the wrecking of HMS *Pomone* on the Needles in AD 1811.

Alum Bay Wreck 2

The site of Alum Bay Wreck 2 is located at SZ 30231 85277 (50°39.983'N, 1°34.416'W (Datum: WGS84)). Archaeological survey has been conducted on the site by HWTMA, primarily during 2000–3. No excavation has been carried out on the site and no material has been raised from the site, with the exception of three samples of wood for the purpose of dendrochronological analysis. The wreck remains lie to the south of a rocky reef on a bed of fine, sandy sediment, which trends to gravel, to the south of the wreck itself. Diver observations over the last ten years indicate that the wreck is usually covered by a thin layer of sandy sediment, which sometimes obscures it, but affords a degree of protection.

The remains of Alum Bay Wreck 2 measure *c* 9m in length by *c* 2.5m wide, and are oriented northwest–southeast. It is unclear which end of the remains represents the bow or stern of the vessel. The wreck is deposited upside down on the seabed and is characterised in its southern half by a substantial area of surviving external planking and a section of timber described as a keel-plank. The planking is carvel laid and the disposition of the visible frames in the northwestern area of the site suggests that construction is based on floors and half frames. There are limited areas of iron concretion in the southern half of the wreck, mostly in the vicinity of the keel. The northern half of the wreck is characterised by a predominance of surviving frame elements, with only limited hull planking. The remains of limber holes can be seen cut into the two floor timbers to

the north of the keel. The vessel is fastened throughout with treenails. Based on the visible remains, it seems likely that the remains represent a significant proportion of a wooden sailing vessel, albeit one of relatively small size in comparison to Alum Bay Wreck 1.

Dating and Identification

At the present time the dating of Alum Bay Wreck 2 remains unknown. The construction of the vessel indicates that it may be placed broadly into the post-medieval period, and it is hoped that further analysis of constructional features will allow this general period to be refined to a more specific one. Clearly, the results of the dendrochronology have the potential to be hugely important in this regard. Finally, although the type of vessel represented by Alum Bay Wreck 2 is still unknown, the suggestion has been made that the vessel represents the remains of a ship's boat. As such, Alum Bay Wreck 2 may possibly be associated with the loss of HMS *Pomone* in AD 1811, but could equally have derived from the myriad of other vessels lost in the vicinity of Alum Bay during the post-medieval period, or it could be the remains of a local fishing vessel.

METHODOLOGY

On 16th July 2001, Alum Bay Wreck 2 was dived using SCUBA by the author with Garry Momber, the present Director of HWTMA (dive log 10), and the exposed outer hull timbers assessed for wood species and tree-ring dating potential. On 1st August 2001, the wreck was dived again and two cross-section samples were taken using a hand saw from the northern ends of the two garboard planks (ie outer hull planks adjacent to the keel) (dive log 31). These samples were provisionally labelled AB201/S01 and AB201/S02 and subsequently relabelled for the dendrochronological analysis: AB2_S01 and AB2_S02.

On 24th June 2002, Alum Bay Wreck 1 was dived twice following controlled excavation, which had exposed well-preserved timbers with surviving sapwood. Samples were recovered from an outer hull plank (AB102/S01), an adjacent framing timber (ABI02/S02A and B), and the lower end of another frame (ABI02/S03A) (dive logs 5b and 8). On 25th June, the wreck was again dived and a sample recovered by hand saw from an outer hull plank (ABI02/S04). Additional sub-samples of sapwood from the previously sampled framing timber ABI02/S03B were also collected at this time (dive log 11). Samples were again subsequently relabelled for the dendrochronological analysis: AB1_S01, AB1_S02A and AB1_S02B, AB1_S03A and AB1_S03B, and AB1_S04.

On 18th May 2005, Alum Bay Wreck 2 was again dived on, and a single sample (AB2/S03) taken from the eastern exposed end of one framing timber using a hand saw and subsequently relabelled AB2_S03. The location of this sample was shown on a sketch plan on the dive log produced in 2009.

On 3rd July 2009, the Alum Bay Wreck 2 was again dived on and two samples recovered from the eastern exposed ends of two framing timbers using a hand saw. These samples were labelled AB209/S01 and AB209/S02 (dive log 1) but were subsequently relabelled AB2_S04 and AB2_S05.

The location of individual samples from the Alum Bay Wreck 1 are shown in Figure 2, and those from the Alum Bay Wreck 2 shown in Figure 3.

Methods employed at the Lampeter Dendrochronology Laboratory in general follow those described in English Heritage guidance documents (English Heritage 2004).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 2004a). 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.

Interpretation of any tree-ring date is limited by whether sapwood or bark edge is present in a sample. Sapwood is distinguishable as lighter coloured band around the outer annual rings of a tree and represents the part of the tree that is alive. For British oaks the number of sapwood rings is estimated to be between 10 and 46 (Bayliss and Tyers 2004), an estimate based on observations of many thousands of samples from living trees and archaeological wood. At a microscopic level, sapwood in oak is recognisable by the open earlywood vessels used for water and mineral transport. Heartwood earlywood vessels appear filled when viewed microscopically as the cell walls have collapsed (tyloses) and no longer form the living part of the tree. Should a sample contain sapwood and bark edge, the year and even season of felling can be inferred from a dated sample. Should partial sapwood be present the estimate of between 10 and 46 rings is used to infer a date range for the sample. In samples where there is no sapwood or microscopic sign of the heartwood/sapwood boundary a date will represent a *terminus post quem* (date after which) the parent timber must have been felled. The date in this case will refer to the date of the last complete annual ring and the felling of the timber will be at least ten years after the date of that final ring.

RESULTS

Details of individual samples from timbers are given in Table 1. Samples from six of the nine timbers had sufficient rings to merit measurement. The ring-width data of all

measured series are provided in the Appendix. The 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.

Alum Bay Wreck 1

The ring-width sequences from the two fragments from the same timber (AB1_S02a and AB1_S02b; see Fig 2) correlated with a high *t*-value of 6.93 and good visual matching. From this, a single mean ring-width sequence of 70 years was calculated for the timber. The three measured ring-width series did not, however, provide consistent cross-matching and so all three ring-width series were compared individually with relevant oak reference chronologies. Consistent correlations were obtained for two individual timber ring sequences, AB1_S02 and AB1_S03, against a range of site reference chronologies (Tables 2 and 3).

Alum Bay Wreck 2

The ring sequences of two of the three measured samples (AB2_S03 and AB2_S05), correlated with a *t*-value of 5.45 and show good visual matching. From this, a mean sequence of 69 years (AB2_T2) was calculated. This mean chronology, and the other measured ring-width series (AB2_S01) individually, were compared with relevant oak reference chronologies. Consistent correlations were obtained for the mean sequence, AB2_T2, against a range of site reference chronologies (Table 4).

INTERPRETATION AND DISCUSSION

The four dated individual ring-width sequences are illustrated graphically showing their relative positions of overlap in Figure 4.

Only one of the two dated samples from Alum Bay Wreck 1 (AB1_S03) retained its heartwood/sapwood transition, thereby allowing a felling date range of AD 1797 –1833 to be estimated for this timber, whilst the other clearly broadly coeval timber has a *terminus post quem* for felling of AD 1772. This dating evidence refines that indicated by copper sheathing on the wreck and is consistent with interpretation of the site as the remains of HMS *Pomone* which was launched in AD 1805. However, the dating evidence obtained is based on only two timbers and thus, bearing in mind the complexities in relation to construction and subsequent repairs to vessels, should be viewed with caution.

Two samples from the Alum Bay Wreck 2 provide possible precise felling dates of AD 1795 and AD 1799. It is difficult to be certain that the outermost surface is the bark edge due to the degradation and erosion the timbers have suffered, but regardless, both timbers are clearly very late-eighteenth or early nineteenth century and probably both very late-eighteenth century. A degree of uncertainty is inevitable when bark edges are

indefinite, and stockpiling of timber for shipbuilding at this time was common. The results demonstrate that these two timbers are clearly broadly coeval with the two dated from Alum Bay Wreck 1and hence, do not exclude the possibility that this vessel was associated with Alum Bay Wreck 1.

Given correlations against the reference chronologies (Tables 2 – 4) it appears that all four of the dated timbers are from English sources. Timber AB1_S02 matches most strongly with reference chronologies from sites of more central/eastern origin, whilst AB1_S03 matches most strongly with reference chronologies from a more southern/central origin. The timbers from Alum Bay Wreck 2 show a tendancy to match most strongly with reference chronologies from the south west. Thus, it appears, not unexpectedly as far as vessels are concerned, that the timbers were derived from multiple sources.

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FIGURES

Figure 1a: Location of Alum Bay marked in red. Scale: 1:40000 © Crown Copyright and database right 2020. All rights reserved. Ordnance Survey Licence number 100024900. © British Crown and SeaZone Solutions Ltd 2020. All rights reserved. Licence number 102006.006. © Historic England.

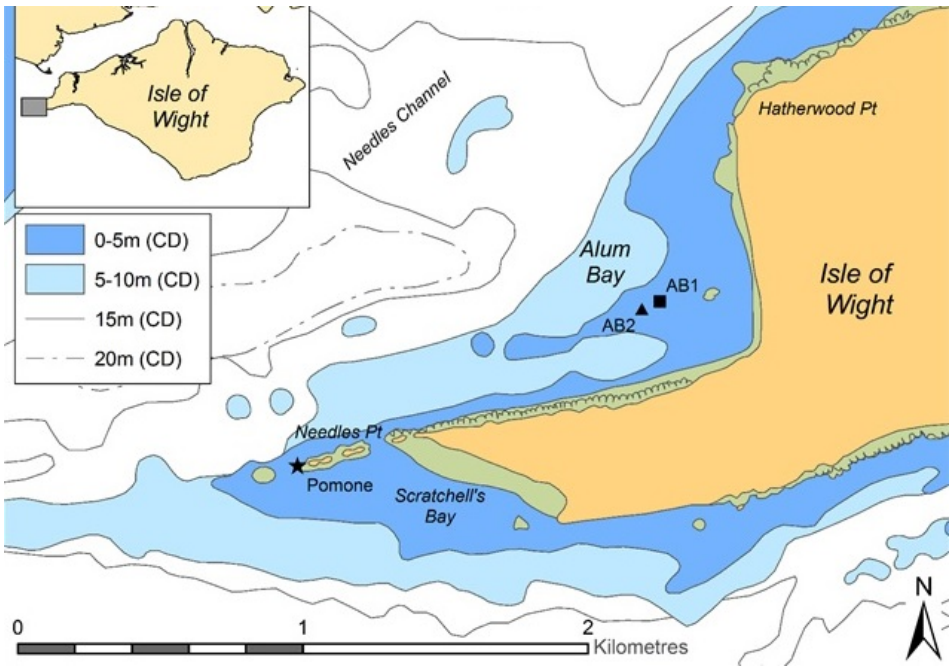

Figure 1b: Location of Alum Bay 1 and 2, the location of the potentially related wrecking site of HMS Pomone is also indicated (HWTMA: spatial and hydrographic data after UKHO Chart 2035, Western Approaches to the Solent)

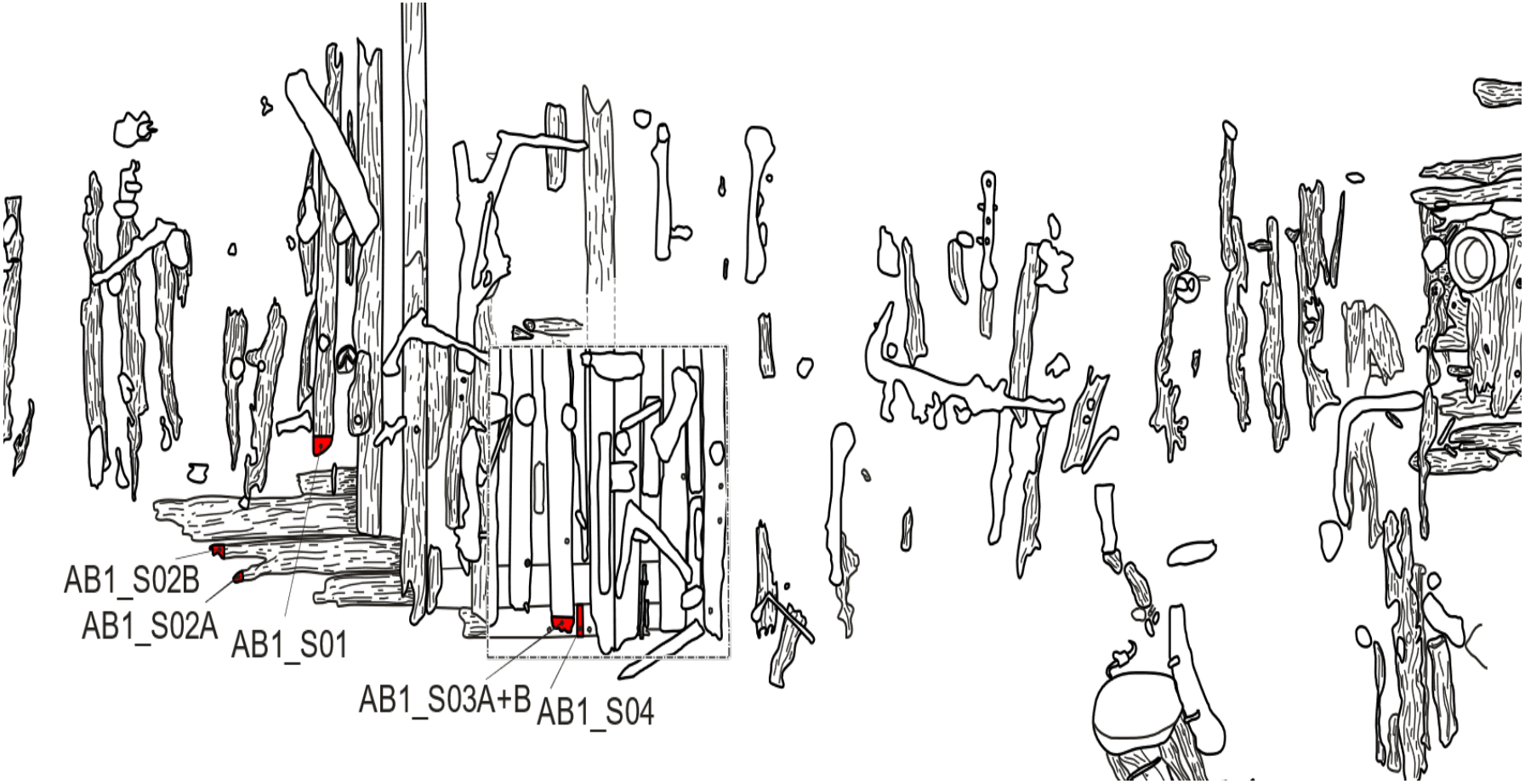

Figure 2: Alum Bay Wreck 1, site plan showing location of samples (HWTMA)

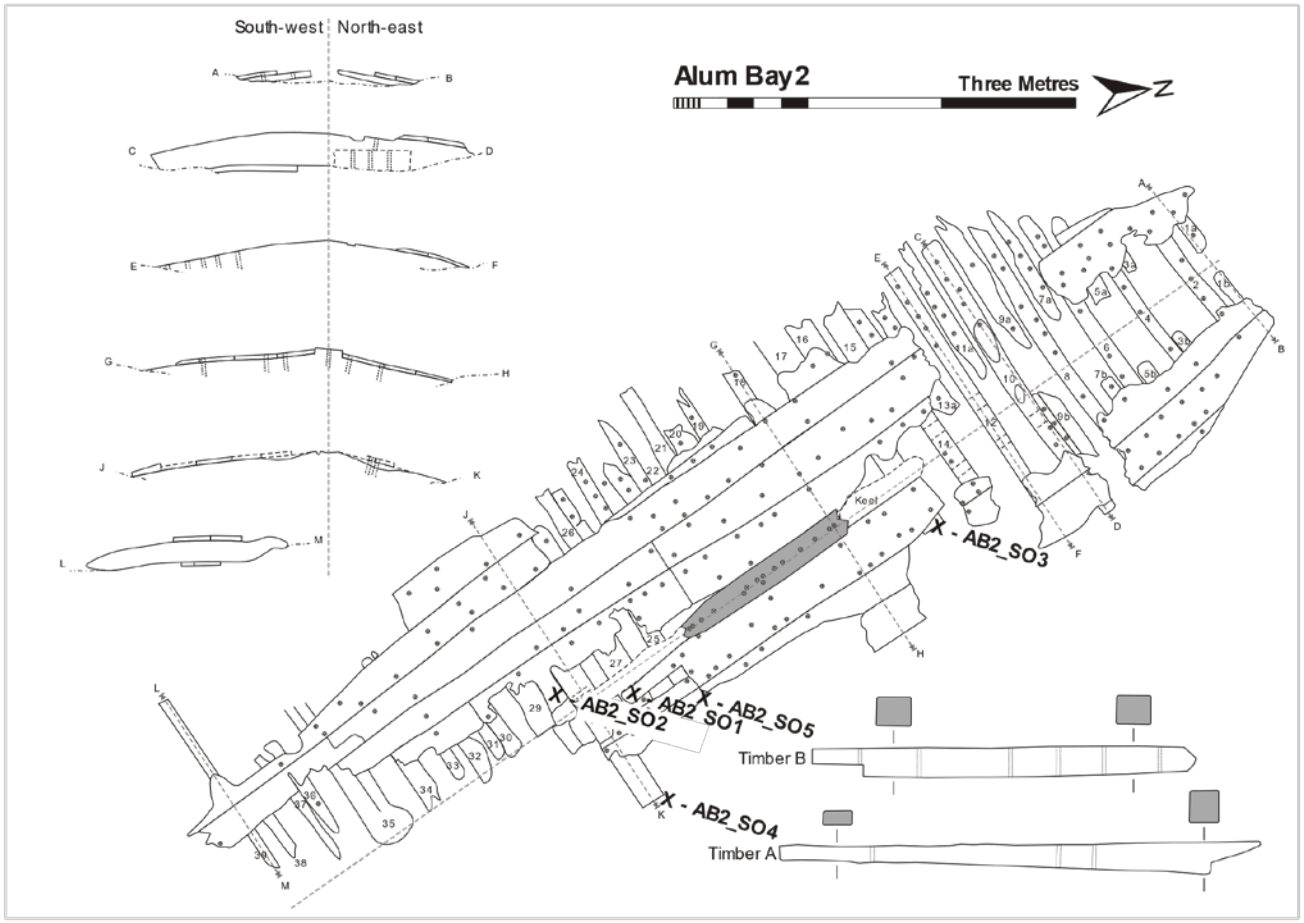

Figure 3: Alum Bay Wreck 2, site plan showing location of samples (HWTMA)

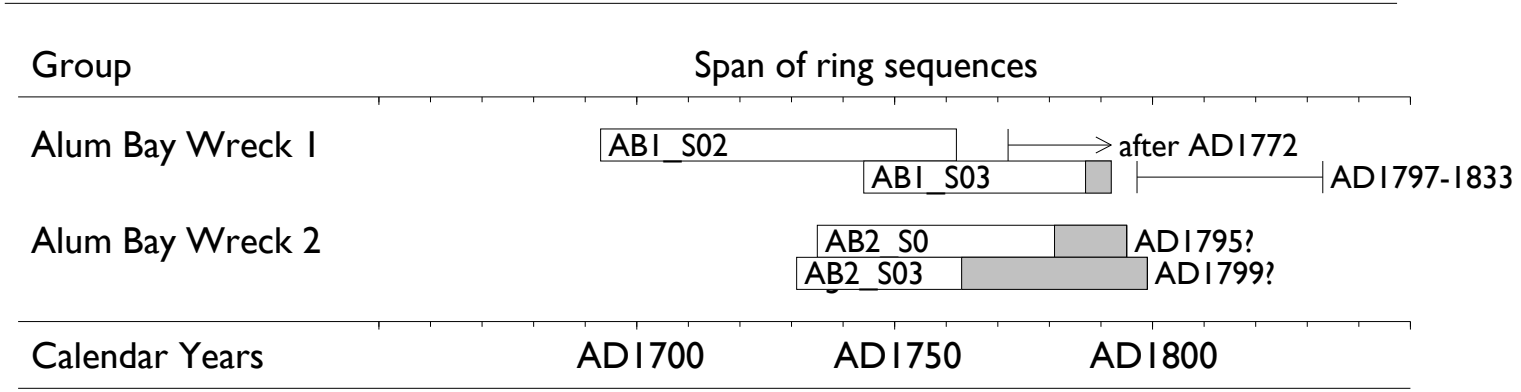

Figure 4: Bar diagram of showing the relative positions of overlap of the dated samples, along with their individual felling date / felling date range. White bar = heartwood; grey bar = sapwood

TABLES

Table 1: Sample details from the Alum Bay Wrecks

Sample code	Additional information, where known	Cross-section	Dimensions (mm)	Total rings	Sapwood	ARW (mm/year)	Date of sequence	Felling date range
AB1_S01	Wreck 1, sample from eroded framing timber	Tangential	115 x 70	<40	-	-	Not measured	
AB1_S02A	Wreck 1, sample from hull plank. Piece A	Tangential	120 x 50	50	-	2.12	AD1713–1762	after AD1772
AB1_S02B	Wreck 1, sample from hull plank. Piece B	Tangential	120 x 50	63	-	1.87	AD1693–1755	after AD1765
AB1_S03A	Wreck 1, sample from freshly excavated framing timber. Piece A	Quarter	150 x 100	34	-	2.88	AD1744–1777	after AD1787
AB1_S03B	Wreck 1, sample from freshly excavated framing timber. Piece B	Quarter	150 x 100	36	5	2.60	AD1757–1792	AD1797-1833
AB1_S04	Wreck 1, sample from freshly excavated outer hull plank	Tangential	100 x 40	46	-	2.34	Undated	-
AB2_S01	Wreck 2, sample from garboard strake on east side of keel timber taken in 2001	Tangential	145 x 26	49	-	2.50	Undated	-
AB2_S02	Wreck 2, sample from garboard strake on west side of keel timber taken in 2001	Tangential	140 x 25	<40	-	-	Not measured	-
AB2_S03	Wreck 2, sample from framing timber on east side of wreck (=frame 16) taken in 2005	Quarter	85 x 75	69	36+?B	1.38	AD1731–1799	AD1799?
AB2_S04	Wreck 2, sample from framing timber on east side of wreck (=frame 28) taken in 2009	Whole	140 x 110	35	-	3.5	Not measured	-
AB2_S05	Wreck 2, sample from framing timber on east side of wreck (=frame 25) taken in 2009	Quarter	110 x 100	61	14+?B	1.66	AD1735–1795	AD1795?

Key: +B? = possible bark edge, felling season indeterminate ARW = average ring width of the measured rings. All samples were oak (*Quercus* spp)

Table 2: Correlations between the individual series AB1_S02 (AD 1693–1762) from Alum Bay Wreck 1 and reference chronologies

Reference chronology	Date span (AD)	*t*-value
Kirby Hall, Deene, Corby, Northamptonshire (Arnold *et al* 2forthcoming)	1378–1795	5.93
Lyddington Bede House, Lyddington, Rutland (Arnold *et al* 2015a)	1623–1753	5.93
Magdalen College, Oxford, Oxfordshire (Miles and Bridge 2015)	1612–1716	5.74
Apethorpe Hall, Apethorpe, Northamptonshire (Arnold *et al* 2008)	1574–1749	5.71
Houghton Mill, Cambridgeshire (Loader pers comm)	1683–1764	5.46
Tilbury Fort, Essex (Groves 1993)	1678–1777	5.36
Clothall Bury farmhouse, Wallingford, Hertfordshire (Arnold *et al* 2003)	1636–1753	5.18
Thrigby Post Mill, Norfolk (Fletcher *et al* 1984)	1674–1790	5.12
Great Gransden Windmill, Cambridgeshire (Bridge 2015)	1706–1836	5.09
Stoneleigh Abbey, Stoneleigh, Warwickshire (Howard *et al* 2000)	1682–1753	5.05

Table 3: Correlations between the individual series AB1_S03 (AD 1744–1792) from Alum Bay Wreck 1 and reference chronologies

Reference chronology	Date span (AD)	*t*-value
Skeleton Barn, Oakhouse Farm, Hampstead Norreys, Berkshire (Miles 2001)	1722–1811	6.40
Granary, Old Basing, Hampshire (Bridge 1996)	1691–1790	6.19
Kya House, Ludgershall, Buckinghamshire (Miles *et al* 2003)	1719–1794	6.00
Pitstone Windmill, Buckinghamshire (Miles *et al* 2004)	1729–1823	5.69
Savernake Forest, Wiltshire (Briffa *et al* 1986)	1651–1982	5.56
The Hovel, Ludgershall, Buckinghamshire (Miles and Worthington 1999)	1671–1811	5.54
Real Tennis Court, Hampton Court, London (Bridge and Miles 2016)	1741–1831	5.19
Kiln Farm House, Upper Basildon, Oxfordshire (Miles and Bridge 2011)	1692–1798	5.19
Bayswater Mill, Headington, Oxfordshire (Miles and Bridge 2013)	1744–1833	5.09
Great Gransden, Windmill Cambridgeshire (Bridge 2015)	1706–1836	5.01

Table 4: Correlations between the site master AB2_T2 (AD 1731–1799) and both of its individual component seriess AB2_S03 (AD 1731–1799) and AB2_S05 (AD 1735–1795) with reference chronologies

Reference chronology	Date span (AD)	*t*-value		
		AB2_T2	AB2_S03	AB2_S05
South Coombeshead barn, Stoke Climsland, Cornwall (Tyers and Groves 1999)	1714–1833	8.10	4.91	7.66
Buckland, Yelverton, Devon (Morgan pers comm)	1677–1799	7.41	7.84	4.92
St John the Baptist Chapel, Exeter Cathedral, Devon (Arnold *et al* 2006)	1698–1805	7.39	6.56	6.36
Winchester, Hampshire (Barefoot 1975)	1635–1972	6.62	6.33	4.67
Sydenham House, Marystown, Devon (Arnold *et al* 2015b)	1741–2013	6.46	5.27	6.03
Warleigh House, Tamerton Foliot, Devon (Howard *et al* 2006)	1671–1774	6.39	5.48	6.11
Stoneleigh Abbey, Stoneleigh, Warwickshire (Howard *et al* 2000)	1646–1813	6.10	5.43	3.57
Ely Cathedral, Ely, Cambridgeshire (Arnold *et al* 2005)	15921794	6.08	5.12	4.53
Cotehele House, Calstock, Cornwall (Tyers 2004b)	1752–1872	6.07	3.68	5.13
Stoneleigh Abbey, Stoneleigh, Warwickshire (Howard *et al* 2000)	1701–1998	5.71	4.93	4.35

APPENDIX

AB1_S02A

276	228	310	190	188	157	142	295	324	334
163	224	325	205	255	207	167	175	165	197
183	249	257	164	176	267	279	148	147	137
135	146	195	240	205	192	118	81	114	172
231	282	178	288	258	302	247	219	240	198

AB1_S02B

63	76	97	149	133	187	161	218	235	163
200	227	167	153	92	93	152	111	152	158
270	166	288	203	249	178	143	200	276	306
233	200	285	204	283	311	245	193	203	218
161	233	260	190	178	277	318	208	140	134
150	88	129	192	173	156	80	71	88	123
214	310	280							

AB1_S03A

421	316	442	398	349	252	245	348	269	249
311	343	330	318	334	432	374	318	254	263
314	175	179	189	277	244	266	198	147	253
208	305	275	206						

AB1_S03B

198	365	383	375	322	245	287	308	192	194
195	323	299	295	231	163	256	234	315	313
220	245	193	188	150	261	457	325	208	189
207	270	342	216	209	179				

AB1_S04

189	296	297	368	294	299	300	234	134	130
118	98	108	177	208	200	113	155	206	252
203	261	257	299	312	282	297	241	202	285
335	262	212	239	235	297	288	286	238	237
262	282	197	216	184	201				

AB2_S01

370	360	407	507	450	298	416	265	226	436
442	340	288	405	428	299	334	262	272	456
320	313	372	300	126	119	112	147	153	165
120	141	169	91	72	130	143	181	125	208
100	213	179	173	197	170	146	154	141	

AB2_S03

211	204	116	297	417	441	157	291	339	246
151	168	243	186	201	212	205	150	143	164
273	243	140	169	194	223	164	100	153	139
101	46	70	95	53	120	110	167	130	61
55	70	95	122	80	129	120	58	61	104
94	71	104	115	62	54	68	48	69	58
65	78	58	49	78	47	81	64	54	

AB2_S05

338	314	303	322	341	238	124	151	236	193
95	105	91	76	116	116	192	109	115	71
217	147	109	70	175	154	151	99	223	243
184	189	216	274	222	132	104	96	114	146
150	174	137	188	148	195	154	132	158	164
124	104	192	163	132	135	176	131	138	130
164									

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