

FINAL REPORT ON DATING QAR OAK TIMBERS

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Three oak samples were removed from the QAR. The maximum number of growth rings was 62 (+1 incomplete) on sample QAR437.000

The other two samples were
QAR434.000 (58 rings) and
QAR435.000 (43 rings); see data at end.

Obviously the discovery that the large oak planks contained few and very wide growth rings was disappointing. Looking at the issue from a dendrochronological perspective, the samples are at the very limit of dating viability i.e. they will not provide definitive tree-ring dates for two reasons. First, the short patterns are extremely unlikely to date definitively simply because of their length and relative complacency i.e. the wide rings vary very little from year to year. Second, we do not know the source of these oak timbers to better than 'probably Europe rather than America'. This fact coupled with the short ring patterns means that we can search for correlations against a range of Irish, English, French, Netherlandish, Danish, German, Polish, Baltic chronologies. The more chronologies we compare with the more likelihood there is of finding spurious correlations in any window of time. This means that there could be very little confidence in any 'matching' position found. Moreover, we do not have oak chronologies for Spain or the western Mediterranean, so there are potential source areas for which we cannot even attempt cross-dating.

Overall, given these several considerations, namely short complacent ring patterns and unknown source it was deemed that the samples could not usefully be dated by dendrochronology. Searches were made against a range of European oak chronologies bracketing the seventeenth century but no matches were found that could be regarded as reliable.

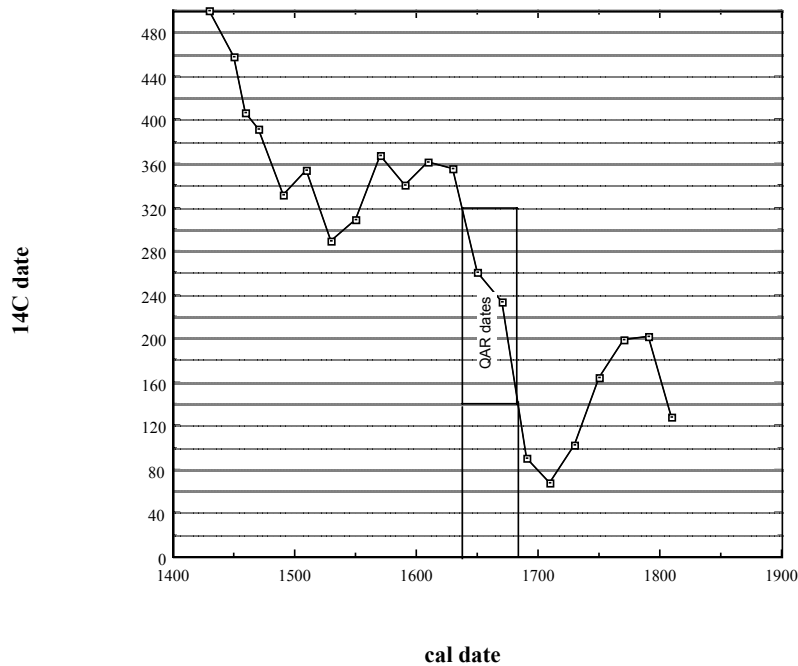
There is one other aspect of dendrochronology that needs to be understood with respect to the QAR project timbers. Complete oak samples have heartwood (the hard wood at the centre of the tree) and sapwood (the friable living wood between the heartwood and the bark). Often the sapwood does not survive, or it was physically removed to avoid rot and insect attack. This is the case with the QAR oak timbers; no sapwood remains, and thus, even if the samples had been datable (which they were not), a sapwood allowance would have to have been made to add to the date of the last heartwood ring. In principle it is possible to estimate the number of sapwood rings in a population, but this requires knowledge of the area where the timbers originated. For example it was found that the sapwood estimate for the Finland/Baltic region is 14 ± 3 (total range 7 to 24) while in Ireland they had on average 32 ± 9 (range 12-50). These estimates are one standard deviation estimates and the full range used in, say, England is 10-50 sapwood rings. So, even if we could have dated the ring patterns of the QAR oak timbers, the addition of a

highly variable sapwood allowance (made difficult by not knowing the origin area) would have rendered the resultant estimated felling range wide i.e. the date would have been vague. In addition, it is possible that with the QAR oaks being relatively young (as indicated by their short ring patterns) the sapwood allowances may be misleading as most estimates have been produced on long lived specimens from the various areas. In other words, under no circumstances could the QAR oak timbers ever give an exact felling date. Probably the best possible date that could ever have been produced by dendrochronology would be a range of a couple of decades.

QAR oak timbers and radiocarbon dates.

As it turned out, the failure of dendrochronology to date the QAR oak timbers was not fatal to the project, because there is good radiocarbon evidence for the date of the ship. Before a tree-ring specialist, or indeed a radiocarbon specialist had ever looked at the QAR dating question, the excavators had obtained radiocarbon samples, more or less randomly, from a selection of planks, anchors and treenails (we can ignore the hair sample because of the potential tar problem). We know that the spread of radiocarbon dates from the overall QAR wreck site is restricted to something like 320 BP down to 140 BP (BP = before present, i.e. before 1950 radiocarbon years). In order to convert these radiocarbon dates to estimates of real age we have to calibrate the radiocarbon dates against the pre-existing radiocarbon calibration curve (e.g. Pearson et al. 1986). However, as above, we know that none of the timbers seems to be older than about 70 years at most (allowing for limited sapwood on the fast grown/short lived oaks; with the pines not dissimilar). So the potential wood samples available to the people sampling the wreck for radiocarbon samples spanned at most a period of about 70 years in real time. The radiocarbon dates obtained from this random sampling exercise, when applied to the calibration curve, are entirely consistent with samples of wood drawn from a period between 1640 (say 1630 to allow for slop) and 1680 (say 1690 to allow for slop) i.e. the radiocarbon evidence suggests that the fabric of the QAR whether it be planks, anchors or treenails grew between 1630 and 1690. You could not sample any sapwood for dating purposes as there was none present, therefore you can afford to add on about ten years or so, (maybe 20 could be argued for). This means that the radiocarbon evidence can be stretched to suggest a construction date as late as 1690+(10 or 20) i.e. 1700-1710. I checked both Pearson's calibration for European oak and Stuiver's single year calibration and both suggest exactly the same result.

**QAR 14C dates against Pearson
Calibration 1986**



So, we can't dendro-date the timbers or say where they grew, but we can already say that there is every likelihood that your wreck relates to a construction episode between 1690 at the very earliest and about 1710 at the very latest. I think we could argue this case without knowing anything else about the wreck whatsoever.

When you add in the independent evidence of a bell with the date 1709 [Note: The bell date has since been adjusted to 1705* I think there is every likelihood that the bell is actually original to the ship and she was built in 1709. Occam's razor suggests this latter statement, given the dating evidence above.

Some additional thoughts:

We can imagine the best possible set of circumstances and discuss what the outcome might then have been and compare it with the dating proposed above.

Imagine we knew where the ship was built and the forest from which the timbers originally came. Would this have helped significantly? Well probably not. The samples would still be very short and complacent and might not match the most local chronology definitively. Even if they did there is still the problem of missing sapwood giving about a 20 year estimated felling range, i.e. even if you had such information the situation would probably not be any better than it currently is with the radiocarbon evidence.

Final thoughts on QAR dating:

In a “best of all possible worlds” position the likelihood is that 1690-1710 is about the limit that one can achieve given the timbers available. If in subsequent work on the wreck some small quartered oak timbers turned up with more rings than another search for dendro dates might be worthwhile. The bottom line is that without sapwood there is no point in proceeding further with dendrochronology.

One puzzling aspect is the very wide rings of the QAR oaks. We know that in Ireland the average ring width is about 1mm per year across the 17th century AD. This is a period known to be part of the Little Ice Age when winters were particularly cold. I would hazard a guess that the QAR oaks could not possibly have grown in Ireland. Could there be a case for arguing that they might have come from southern latitudes? The simple answer is that I don't know, but it might some day be possible to plot mean ring width values around Europe and see which areas are more likely to be the source of the wide ringed QAR oaks.

Baillie, M.G.L., Hiram, J., Briffa, K. and Brown, D.M. 1985, Re-Dating the English Art-Historical Tree-Ring Chronologies, Nature 315, 317-9

Pearson, G.W., Pilcher, J.R., Baillie, M.G.L., Corbett, D.M. and Qua, F. 1986. High-Precision 14-C Measurement of Irish Oaks to Show the Natural 14-C Variations from AD 1840 to 5210 BC, Radiocarbon, 28, 911-34

Raw tree-ring widths for QAR oak timbers

QUEEN
ANNE'S
REVENG
E
Q10029 QAR437
62
308
372
325
359
337
317
250
295
213
359
276
241
301
279
277
173
101
119
128
152

148
192
210
277
280
306
231
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222
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202
142
108
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167
168
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167
270
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242
169
121
COMME
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No
Sapwood
Problem
rings 8
and 9

QUEEN
ANNE'S
REVENGE
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Q10030 QAR435

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124

175

117

116

224

302

231

230

236

289

323

316

261

167

170

151

98

149

112

132

96

126

113

117

136

126

141

106

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109

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84

101

84

107

116

68

94

87

100

COMME

NT -

No

Problems

No

sapwood

QUEEN

ANNE'S

REVENGE

E

Q10031 QAR434

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COMME

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No

problems

No

sapwood