APPENDIX 1 - DATING

1.1 Assessment of the Radiocarbon Date

by Chris Hayden

Introduction

1.1.1 A sample of sapwood from a large piece of an oak branch which had been preserved in deposits at the base of the palaeochannel in trench 17 was submitted for radiocarbon dating. The sample was intended to provide a *terminus post quem* for the sequences of environmental samples taken from stratigraphically later contexts.

Method

1.1.2 The sample was analysed using an accelarator mass spectrometer to determine its conventional radiocarbon age, percent modern and $\Delta^{14}C$ based on the NBS-I oxalic acid standard, and the $\delta^{13}C$ was measured using a stable isotope mass spectrometer.

Material and Context

1.1.3 The sample was taken from the sapwood of the branch, this being the youngest part closest in age to the date of the tree's death. The date of death of the tree is assumed to be roughly contemporary with the date of its deposition. It is likely that the branch became deposited in the palaeochannel deposits as a result of a tree falling. Only the portion of the branch embedded in the deposits was preserved, the rest rotting away. The date of death of the tree thus probably post-dates the deposition of context 1731 into which it is embedded (Figure 5). Its relationship with context 1730 is less certain, but its seems likely that its deposition was roughly contemporary with the deposition of this context. Whatever the case, it provides a clear *terminus post quem* for the environmental samples which begin in context 1727 above.

Results

1.1.4 The sample results are tabulated below. A copy of the certificate, issued by the Rafter Radiocarbon Laboratory, and the OxCal calibration graph, is attached.

Lab ref	Context	Sample	Date	1σ	2σ
NZA-12234	ARC STR99 ctx 1730 (base of waterlogged palaeochannel sequence	Oak branch (sapwood)	7968 ±60	95.4% confidence 7050cal BC - 6690 cal BC	68.2% confidence 7040cal BC - 6780 cal BC

1.1.5 The date is considerably earlier than anticipated. Late Iron Age pottery was recovered from the upper part of the sequence and assessment of the pollen cores suggested that the whole sequence was most likely to be of later prehistoric date. The taphonomy of the channel sequence is complex and not particularly well-defined. Initial interpretation of the stratigraphy suggested that the branch might not be contemporary with the deposits in which it was embedded. The preliminary radiocarbon date suggests that the branch does indeed belong with the earliest deposits in the sequence.

1.1.6 If the environmental sequence is to be of any value for environmental reconstruction in fulfilment of the fieldwork event aims and landscape zone priorities, further radiocarbon dating will be required to confirm the mesolithic date suggested for the early part of the sequence, the late Iron Age date suggested by the artefactual evidence for the upper part, and the chronology of the intervening deposits.

Potential for Further Work

1.1.7 The environmental sequence has produced clear results of direct relevance to achieving Landscape Zone Priority 1 and Fieldwork Event Aims 2, 4 and 5 for the site, which are set out in section 2 of the main report, above. It would be desirable to establish more precisely the date of this sequence, in particular to date the major changes observed in the pollen record by radiometric means. There are samples of waterlogged remains from contexts 1726 and 1725 which may allow further radiocarbon dates to be obtained for these contexts. The most significant change in the pollen and insect evidence, between grassland and woodland recolonisation, occurs between these two contexts, which at present are thought most likely to be of late Iron Age or Roman date. Further dates may allow a more precise estimate of the date at which the field system appears to have fallen into disuse to be obtained. Statistical methods are now available which will allow an estimate of the date range chronological boundary between the two contexts to be made (eg Bronk Ramsey 1995).

1.1.8 Unfortunately, the period of time in which the transition is likely to have occurred (the 2nd century AD) corresponds to a very flat area in the calibration curve followed by a marked wiggle which means that material dating in calendar years from *c* AD 125 to 250 and perhaps later will produce very similar radiocarbon dates. The OxCal calibration package will simulate the kinds of radiocarbon dates one could expect for material of a given calendar age and a given error (here taken as ±60 years). It is possible to use these simulated dates to see how accurate an estimate of the date of the transition it may be possible to obtain. Simulations have been run assuming that one, two or three samples of similar or differing dates have been taken from each context (ie two, four and six determinations in total). The results, shown in Table 24-Table 29, suggest that even if two samples were taken from each context the date range would still be likely to be nearly three hundred years. If only two samples are taken the range may be much greater, possibly over 400 years. This level of accuracy is insufficient to address the question at issue which is whether the change in the landscape occurs roughly at the same as the field system goes out of use (in the 2nd century AD), or whether the change occurs nearer the end of the Roman period. Larger numbers of samples could reduce the range: six samples, for example, typically reduce the range more usefully to less than 200 years, and further increases in the number of samples produce smaller ranges.

Bibliography

Bronk Ramsey, C, 1995, Radiocarbon calibration and analysis of stratigraphy, *Radiocarbon* **38**, 425–30

Table 24: simulation of two close dates

Calendar date for which C14 date estimated	**Calibrated date range (95%) incorporating stratigraphic data**	
AD 120	200 BC	AD 90
DATE OF TRANSITION	**130 BC**	**AD 290**
AD 130	AD 70	AD 350

Table 25: simulation of two more distant dates

Calendar date for which C14 date estimated	**Calibrated date range (95%) incorporating stratigraphic data**	
AD 70	0	AD 240
DATE OF TRANSITION	**AD 50**	**AD 330**
AD 160	AD 110	AD 390

Table 26: simulation of four close dates

Calendar date for which C14 date estimated	**Calibrated date range (95%) incorporating stratigraphic data**	
AD 110	40 BC	AD 210
AD 120	40 BC	AD 210
DATE OF TRANSITION	**AD 50**	**AD 290**
AD 130	AD 110	AD 390
AD 140	AD 110	AD 390

Table 27: simulation of four more distant dates

Calendar date for which C14 date estimated	Calibrated date range (95%) incorporating stratigraphic data	
AD 80	210 BC	AD 90
AD 120	0	AD 260
DATE OF TRANSITION	**AD 80**	**AD 350**
AD 140	AD 200	AD 440
AD 180	AD 180	AD 440

Table28: simulation with six dates

Calendar date for which C14 date estimated	Calibrated date range (95%) incorporating stratigraphic data	
AD 70	170 BC	AD 120
AD 100	110 BC	AD 130
AD 120	90 BC	AD 140
DATE OF TRANSITION	**0**	**AD 190**
AD 140	AD 50	AD 320
AD 160	AD 80	AD 380
AD 190	AD 50	AD 320

Table 29: simulation with eight samples

Calendar date for which C14 date estimated	Calibrated date range (95%) incorporating stratigraphic data	
AD 70	60 BC	AD 150
AD 90	40 BC	AD 180
AD 100	110 BC	AD 140
AD 120	50 BC	AD 170
DATE OF TRANSITION	**AD 60**	**AD 220**
AD 140	AD 120	AD 390
AD 160	AD 90	AD 320
AD 170	AD 130	AD 400
AD 190	AD 120	AD 390