# Radiocarbon dating archaeobotanical remains from Mildenhall

Mark McKerracher

In 2010, development-led excavations by Cotswold Archaeology in Mildenhall, Suffolk, discovered a long occupation sequence on high ground overlooking the floodplain of the River Lark (Havard *et al.* 2019). The settlement chronology, established on the basis of a combination of artefactual evidence and radiocarbon dating, included both Anglo-Saxon (Period 6) and medieval (Period 7) phases. For the Anglo-Saxon phase, spanning the sixth to eleventh centuries, evidence included boundary ditches, drying ovens, pits and postholes (Havard *et al.* 2019, 29). The 'more intensive and organised activity' of the medieval phase was represented by land reclamation on the floodplain, boundary ditches, a kiln, agricultural enclosures, and many pits. Although this medieval phase is broadly dated to between the later eleventh and sixteenth centuries, a large proportion of the ceramic assemblage was dated to between the later eleventh and thirteenth centuries, with an apparent decline in settlement activity identified from the fourteenth century onwards (Havard *et al.* 2019, 35–6).

The site produced a rich assemblage of charred plant remains, including several samples from Periods 6 and 7 (Cobain in Havard *et al.* 2019, 130–40). These were of interest to the Feeding Anglo-Saxon England project (FeedSax), which sought to use charred plant remains as a proxy for early medieval crop husbandry practices and environments. A key aim of FeedSax was to track agricultural developments over time, a goal which required that archaeobotanical samples were closely and securely dated. FeedSax therefore submitted charred grains from eleven of the most archaeobotanically rich samples to the Oxford Radiocarbon Accelerator Unit for radiocarbon dating. The grains – including those of barley (*Hordeum* L.), free-threshing wheat (*Triticum* L. free-threshing type), oats (*Avena* L.) and rye (*Secale cereale* L.) – were selected from the archive and photographed at the University of Oxford by the author; the photographs are included in the project's photographic archive (McKerracher *et al.* in prep.).

The radiocarbon determinations obtained for these samples have been calibrated using IntCal20 (Reimer *et al.* 2020) and OxCal 4.4.2 (Bronk Ramsey 2009) as shown in the table below and figures at the end of this report.

## Results

| sample | feature | grains | laboratory no. | original period | age BP | calibrated dates AD (confidence) |
|---|---|---|---|---|---|---|
| 2005 | Pit 2028 | 3 x barley | OxA-40314<br>OxA-40315 | 6 (Saxon) | 1176 ± 18<br>1196 ± 18 | 801–895 (71.8%)<br>774–885 (95.4%) |
| 2008 | Pit 2028 | 3 x barley | OxA-40408 | 6 (Saxon) | 1191 ± 19 | 773–888 (95.4%) |
| 2009 | Pit 2065 | 2 x barley | OxA-40409 | 6 (Saxon) | 1134 ± 19 | 880–990 (94.0%) |
| 2011 | Pit 2074 | 3 x rye | OxA-40410 | 6 (Saxon) | 1223 ± 18 | 772–881 (87.4%) |
| 2013 | Pit 2085 | 3 x oats | OxA-40411 | 6 (Saxon) | 1226 ± 18 | 784–880 (79.7%) |
| 2016 | Pit 2095 | 3 x rye | OxA-40592 | 6 (Saxon) | 1242 ± 22 | 680–878 (95.4%) |
| 2017 | Pit 2095 | 2 x barley | OxA-40484 | 6 (Saxon) | 1211 ± 18 | 772–885 (95.4%) |
| 2026 | Layer 2050 | 2 x oats | OxA-40316 | 7 (Medieval) | 1156 ± 18 | 773–974 (95.4%) |
| 2025 | Layer 2055 | 3 x wheat | OxA-40317 | 7 (Medieval) | 1073 ± 18 | 955–1023 (74.6%) |
| 2045 | Layer 2115 | 3 x rye | OxA-40956 | 7 (Medieval) | 1199 ± 17 | 775–884 (95.4%) |
| 3044 | Ditch 24 | 3 x oats | OxA-40318 | 7 (Medieval) | 1132 ± 19 | 881–989 (95.4%) |

Seven of these eleven samples were originally phased to Period 6 (sixth to eleventh centuries). Of these seven, two (samples 2016 and 2017) come from the same pit (F.2095); two radiocarbon dates had already been obtained from sample 2016's parent context within the pit (2091), which both indicated a seventh/eighth- to ninth-century date.

| lab. code | material | age BP | calibrated dates AD (confidence) |
|---|---|---|---|
| SUERC-48050 | rye grain | 1245 ± 30 | 677–878 (95.4%) |
| SUERC-48054 | charcoal | 1193 ± 30 | 771–896 (88.5%) |

Two further radiocarbon dates were sought from this pit, in order (1) to determine if any greater precision were possible for the dating of sample 2016, and (2) to verify whether sample 2017 genuinely belonged to the same phase as 2016. The new date for sample 2016 has afforded slightly greater precision, at 68.3% confidence (cal. AD 703–825, rather than cal. AD 687–826), but the overall conclusion remains the same: that the grain and charcoal dates together suggest a date between the late eighth and late ninth centuries for the context 2091.

The remaining five samples from Period 6 all come from pits which have not otherwise been radiocarbon-dated. The new dates place these samples – 2005, 2008, 2011 and 2013 – between the late eighth and late ninth centuries, with the former two (representing two contexts in pit 2028) perhaps coming slightly later than the latter two (from two different pits). It appears, therefore, that nearly all of the radiocarbon-dated Period 6 samples in fact date specifically from between the late eighth and late ninth centuries.

The exception is sample 2009, which dates from between the late ninth and late tenth centuries – most probably from the tenth century (cal. AD 880–990 with 94.0% confidence, or 918–973 with 56.3% confidence). A near-identical result (cal. AD 881–989 with 95.4% confidence, or 918–973 with 57.6% confidence) was obtained from sample 3044, which comes from the first fill of a ditch originally assigned to Period 7 because of the thirteenth-century pottery in its fill.

The final three dates come from different contexts within the 'medieval peat layer' in Area 2: 'a dark, grey-black, fine-grained humic silt' which sealed a sandy floodplain alluvium containing a single potsherd of eleventh- to twelfth-century date (Havard *et al.* 2019, 41). The charred plant remains from these accumulated layers have returned radiocarbon date ranges spanning the late eighth to early

eleventh centuries. This chronological discrepancy suggests that the underlying eleventh- or twelfth-century potsherd could be intrusive – perhaps introduced via Ditch 25, which cut the alluvial deposits – and that at least part of this 'peat layer' accumulated through the Anglo-Saxon occupation phase, not Period 7. The calibrated date ranges of these three samples would be compatible with at least two or three successive episodes of waste disposal between the late eighth and early eleventh centuries (i.e. the discarding of cereal processing waste 'in the marginal wetland area', as described by Havard *et al.* 2019, 41), ceasing before the cutting of Ditch 25 in the eleventh or twelfth century.

Taken together, the new radiocarbon dates from both settlement features and floodplain layers suggest that crop processing activities at the site were most prolific between the eighth and tenth (or early eleventh) centuries, despite the excavators' general observation that 'Period 7 saw more intensive and organised activity than was seen during the preceding Saxon period' (Havard *et al.* 2019, 35). It could be, therefore, that the function of the excavated area changed over time, with a shift away from crop processing from the eleventh century onwards.

## Acknowledgements

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## References

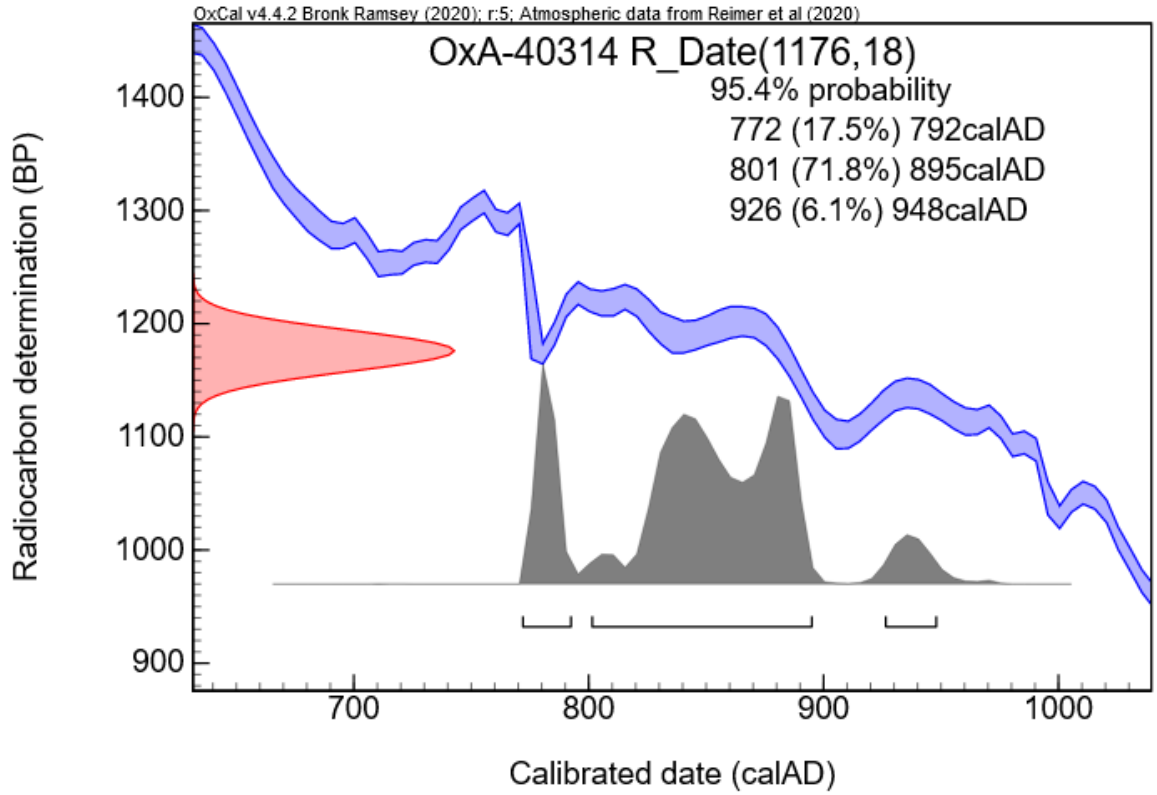
Bronk Ramsey, C. (2009). 'Bayesian analysis of radiocarbon dates', *Radiocarbon* 51(1), pp.337–360.

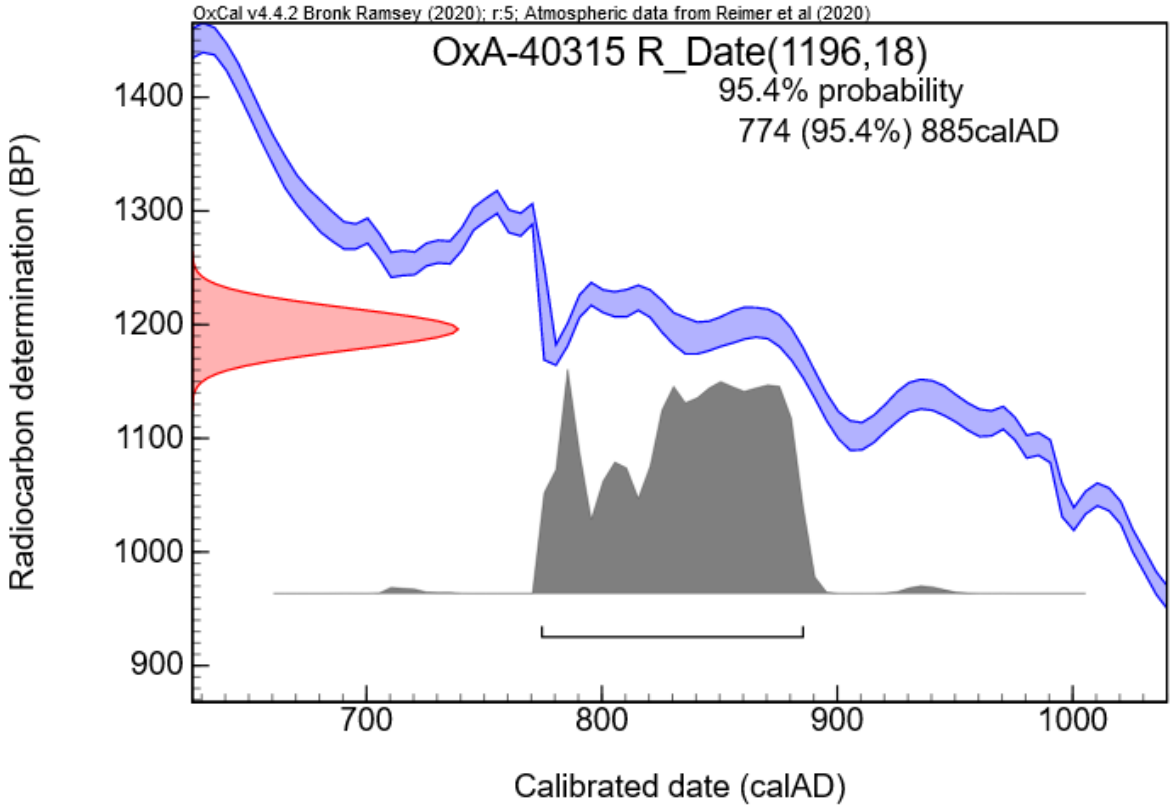
Havard, T., Alexander, M. and Holt, R. (2019). *Iron Age Fortification Beside the River Lark: Excavations at Mildenhall, Suffolk*. East Anglian Archaeology Report No. 169 (Cirencester: Cotswold Archaeology).

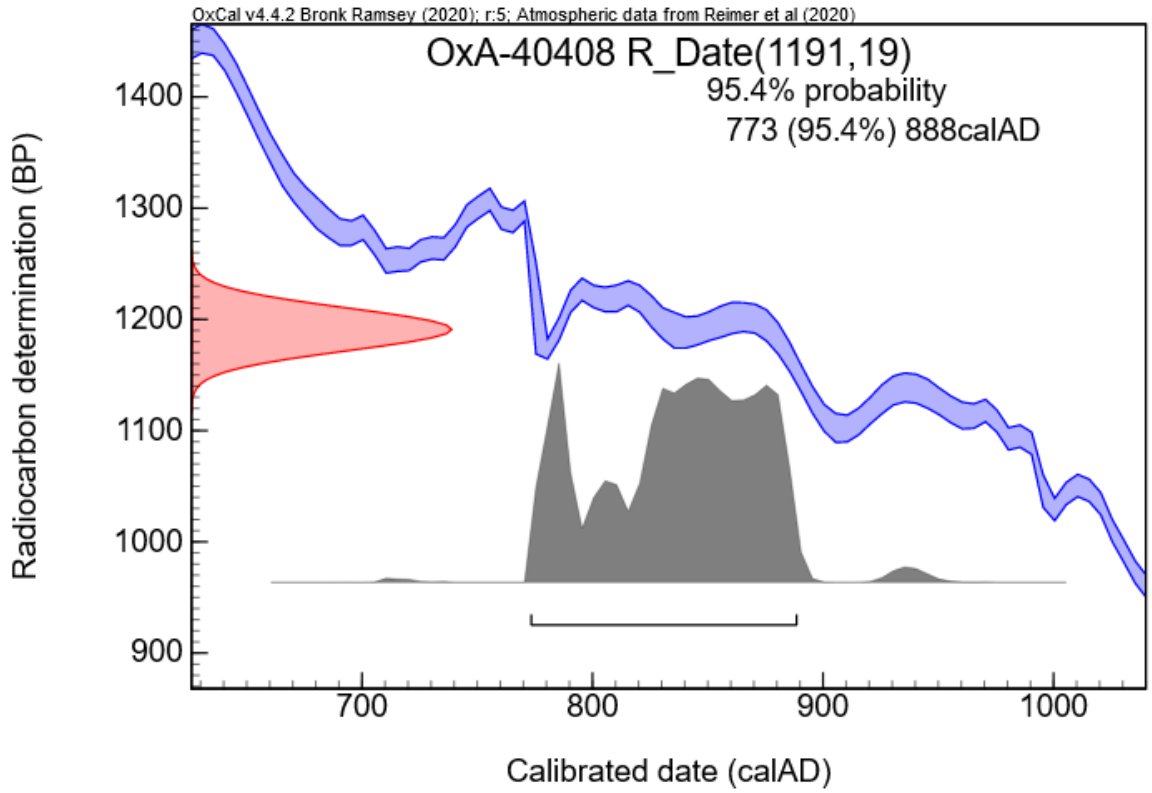
McKerracher, M., Bogaard, A., Bronk Ramsey, C., Charles, M., Forster, E., Hamerow, H., Holmes, M., Hodgson, J., Neil, S., Roushannafas, T., Stroud, E. and Thomas, R. (in prep.). 'Feeding Anglo-Saxon England (FeedSax): the Haystack bioarchaeological database and digital archives', *Internet Archaeology*.

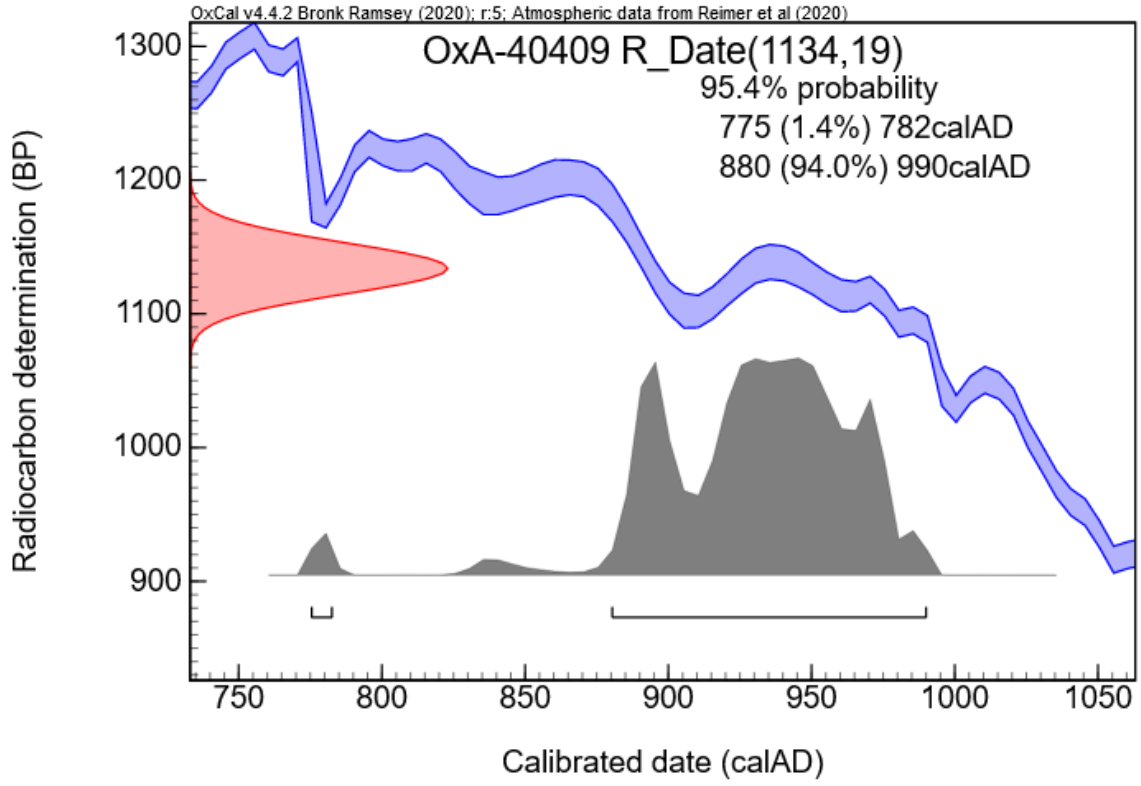
Reimer, P., Austin, W., Bard, E., Bayliss, A., Blackwell, P., Bronk Ramsey, C., ... Talamo, S. (2020). 'The IntCal20 Northern Hemisphere Radiocarbon Age Calibration Curve (0–55 cal kBP)', *Radiocarbon* 62(4), pp.725–757. doi:10.1017/RDC.2020.41

## Calibration of radiocarbon determinations




OxCal v4.4.2 Bronk Ramsey (2020); r:5; Atmospheric data from Reimer et al (2020)
OxA-40408 R_Date(1191,19)
95.4% probability
773 (95.4%) 888calAD
Radiocarbon determination (BP)
1400
1300
1200
1100
1000
900
700
800
900
1000
Calibrated date (calAD)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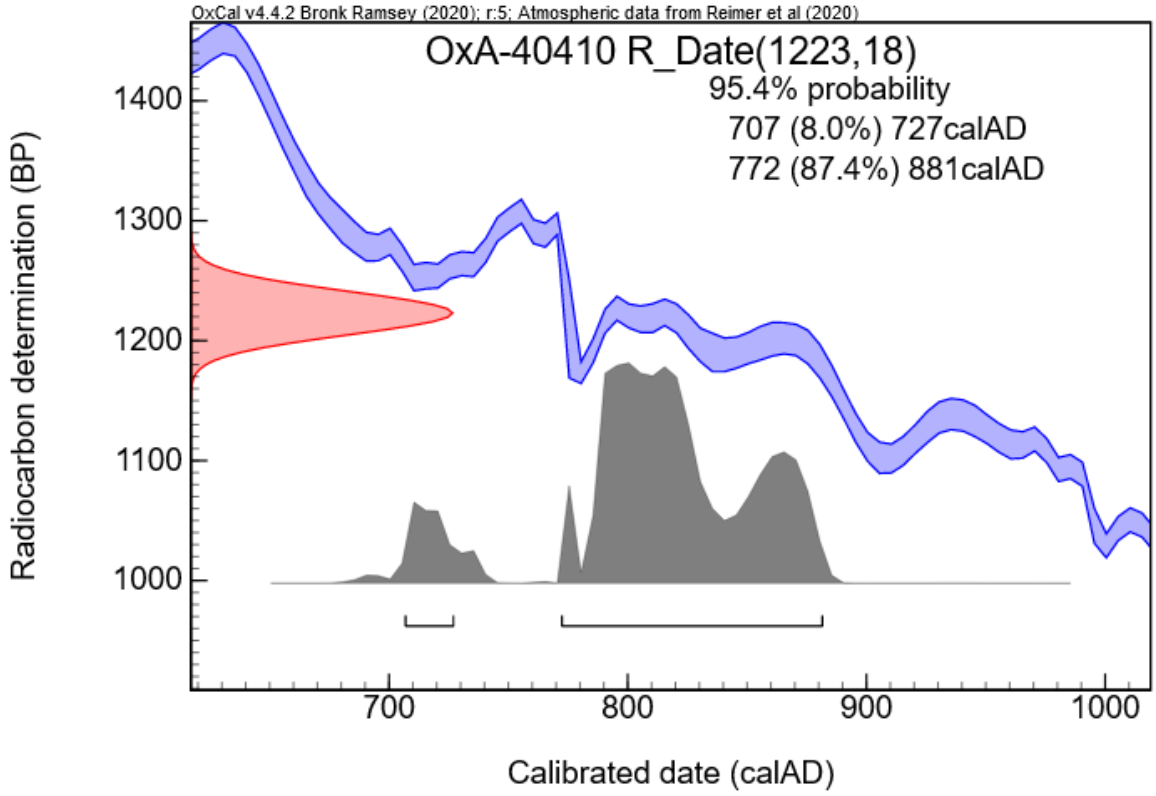
OxA-40409 R_Date(1134,19)
95.4% probability
775 (1.4%) 782calAD
880 (94.0%) 990calAD
Radiocarbon determination (BP)
1300
1200
1100
1000
900
750
800
850
900
950
1000
1050
Calibrated date (calAD)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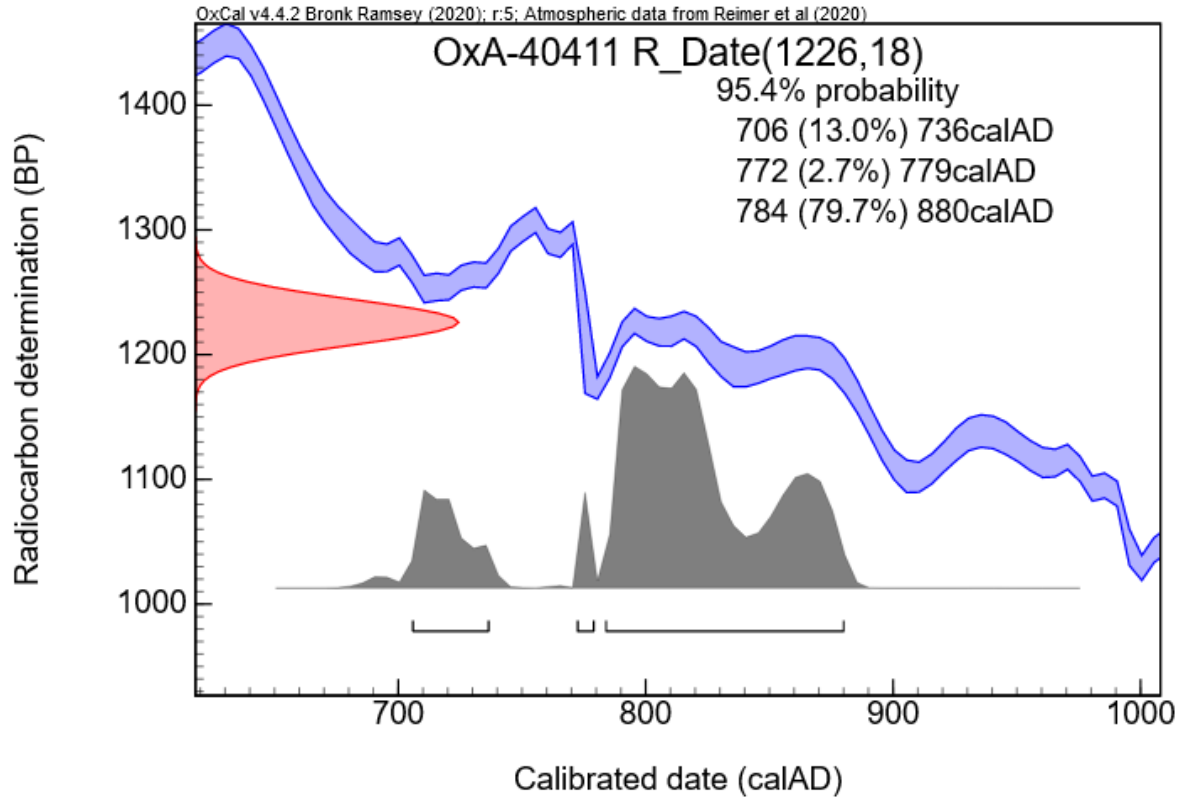
OxA-40410 R_Date(1223,18)
95.4% probability
707 (8.0%) 727calAD
772 (87.4%) 881calAD
Radiocarbon determination (BP)
1400
1300
1200
1100
1000
700
800
900
1000
Calibrated date (calAD)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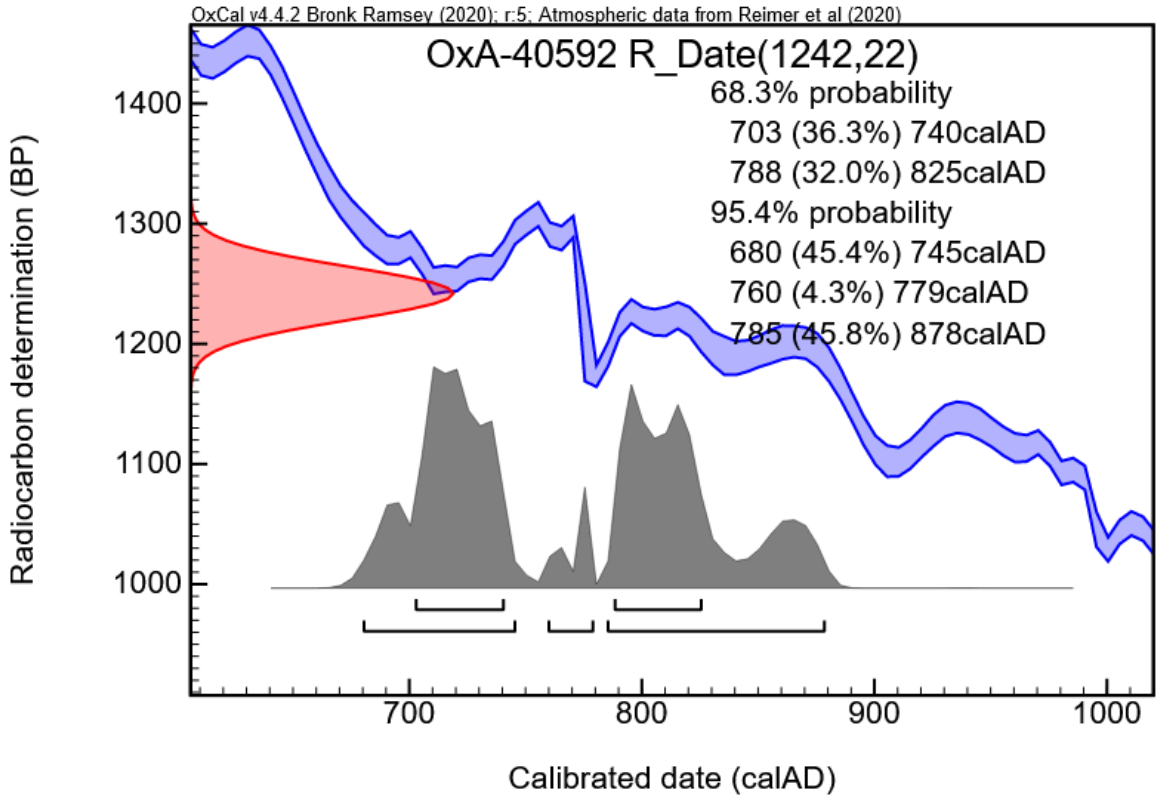
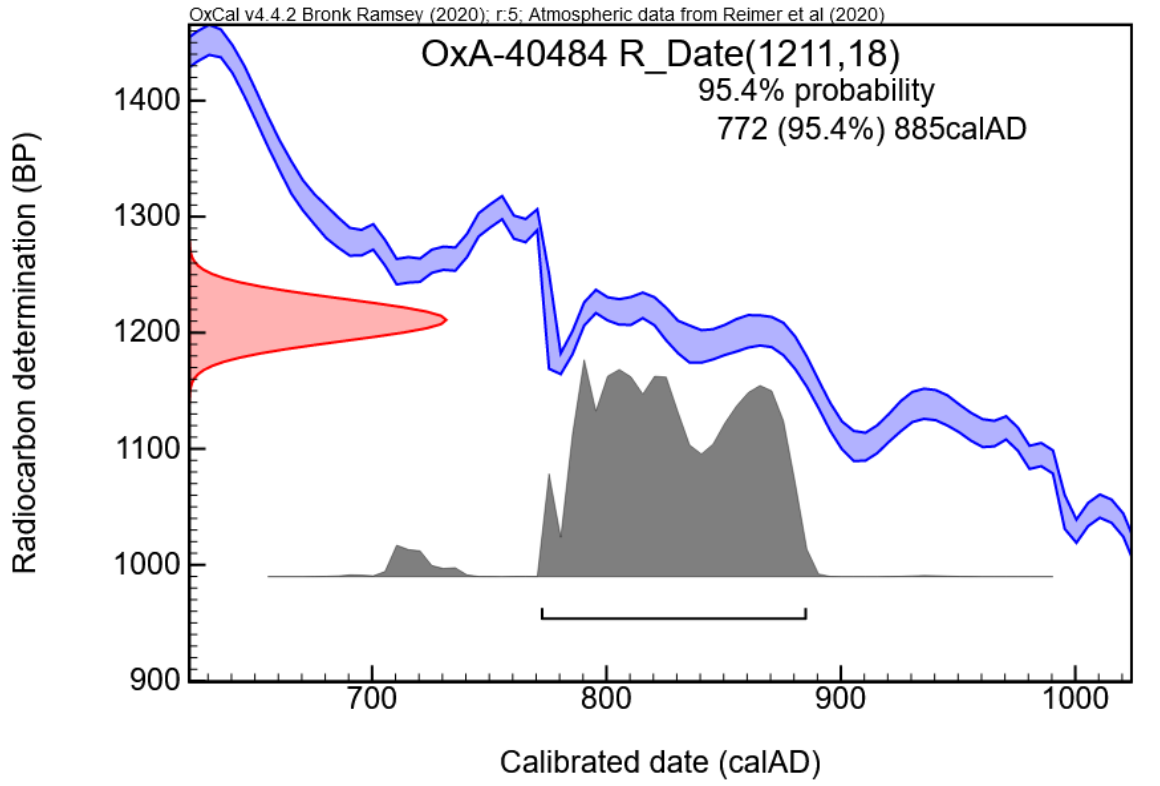
OxA-40411 R_Date(1226,18)
95.4% probability
706 (13.0%) 736calAD
772 (2.7%) 779calAD
784 (79.7%) 880calAD
Radiocarbon determination (BP)
1400
1300
1200
1100
1000
700
800
900
1000
Calibrated date (calAD)


OxCal v4.4.2 Bronk Ramsey (2020); r:5; Atmospheric data from Reimer et al (2020)
OxA-40592 R_Date(1242,22)
68.3% probability
703 (36.3%) 740calAD
788 (32.0%) 825calAD
95.4% probability
680 (45.4%) 745calAD
760 (4.3%) 779calAD
785 (45.8%) 878calAD
Radiocarbon determination (BP)
1400
1300
1200
1100
1000
700
800
900
1000
Calibrated date (calAD)


OxCal v4.4.2 Bronk Ramsey (2020); r:5; Atmospheric data from Reimer et al (2020)
OxA-40484 R_Date(1211,18)
95.4% probability
772 (95.4%) 885calAD
Radiocarbon determination (BP)
1400
1300
1200
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1000
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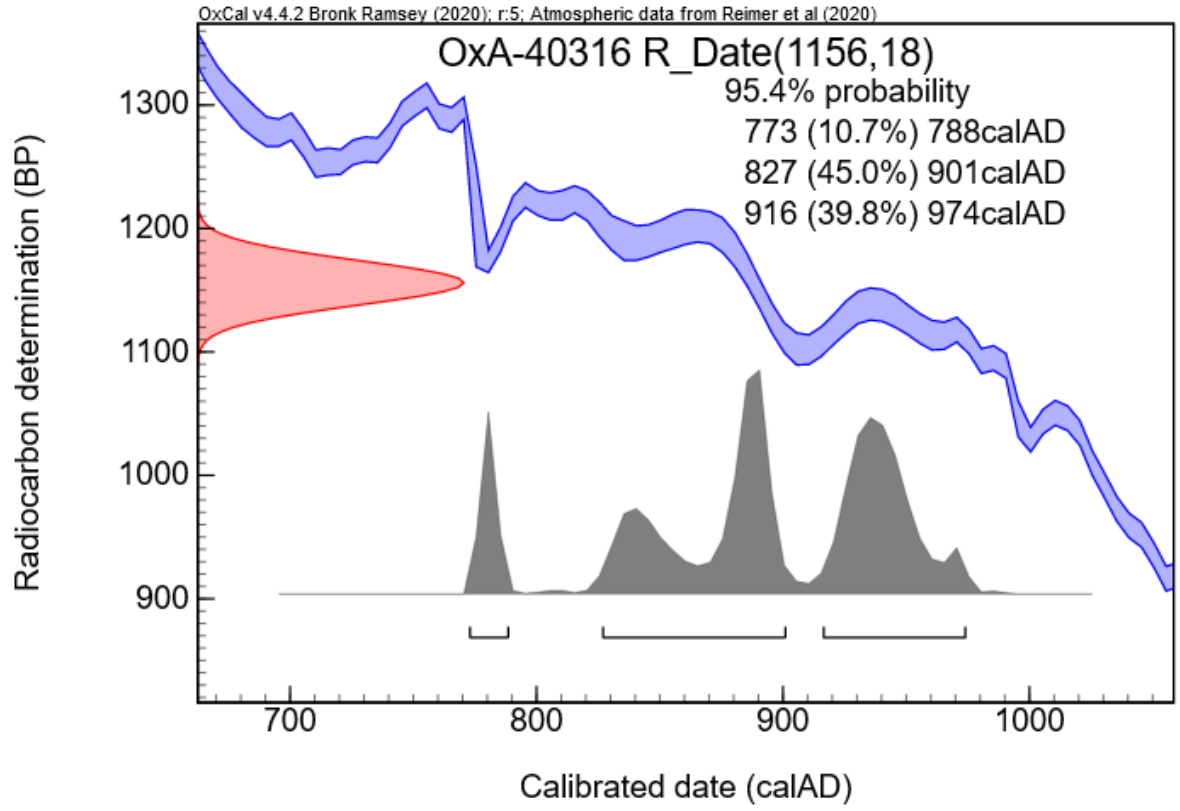
800
900
1000
Calibrated date (calAD)


OxCal v4.4.2 Bronk Ramsey (2020); r:5; Atmospheric data from Reimer et al (2020)
OxA-40316 R_Date(1156,18)
95.4% probability
773 (10.7%) 788calAD
827 (45.0%) 901calAD
916 (39.8%) 974calAD
Radiocarbon determination (BP)
1300
1200
1100
1000
900
700
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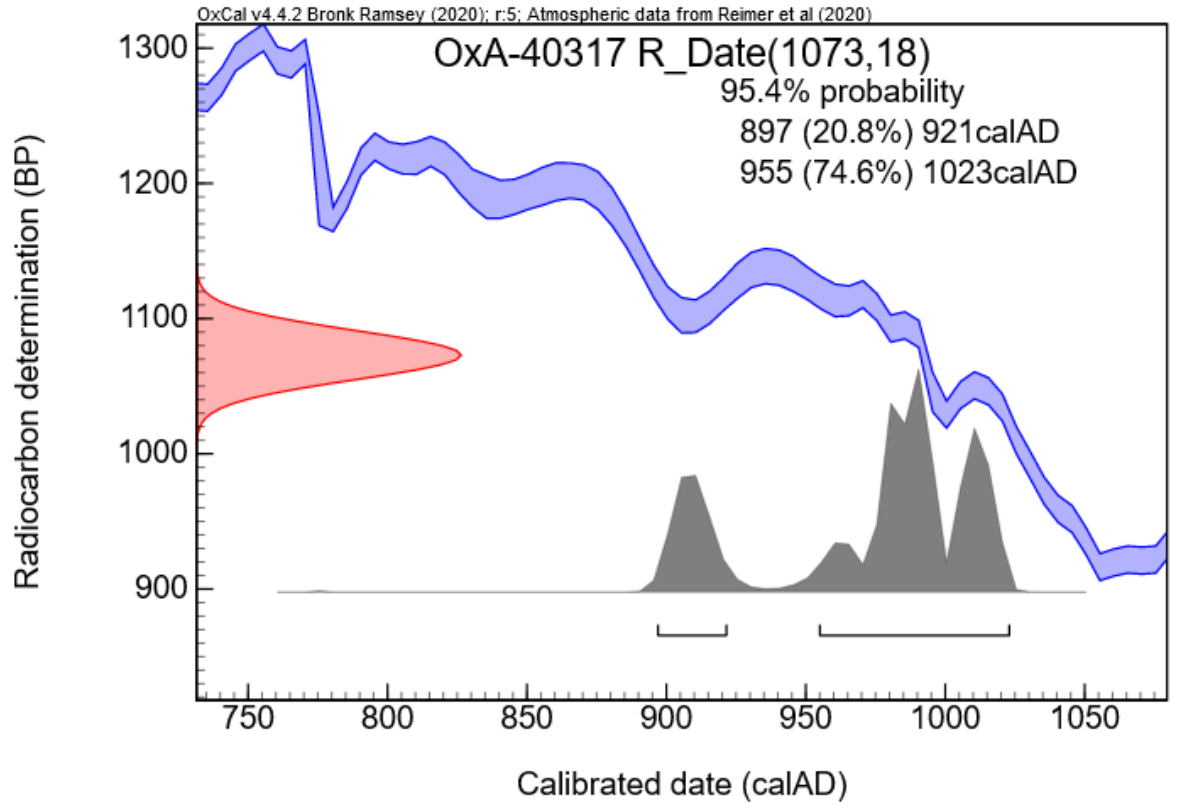
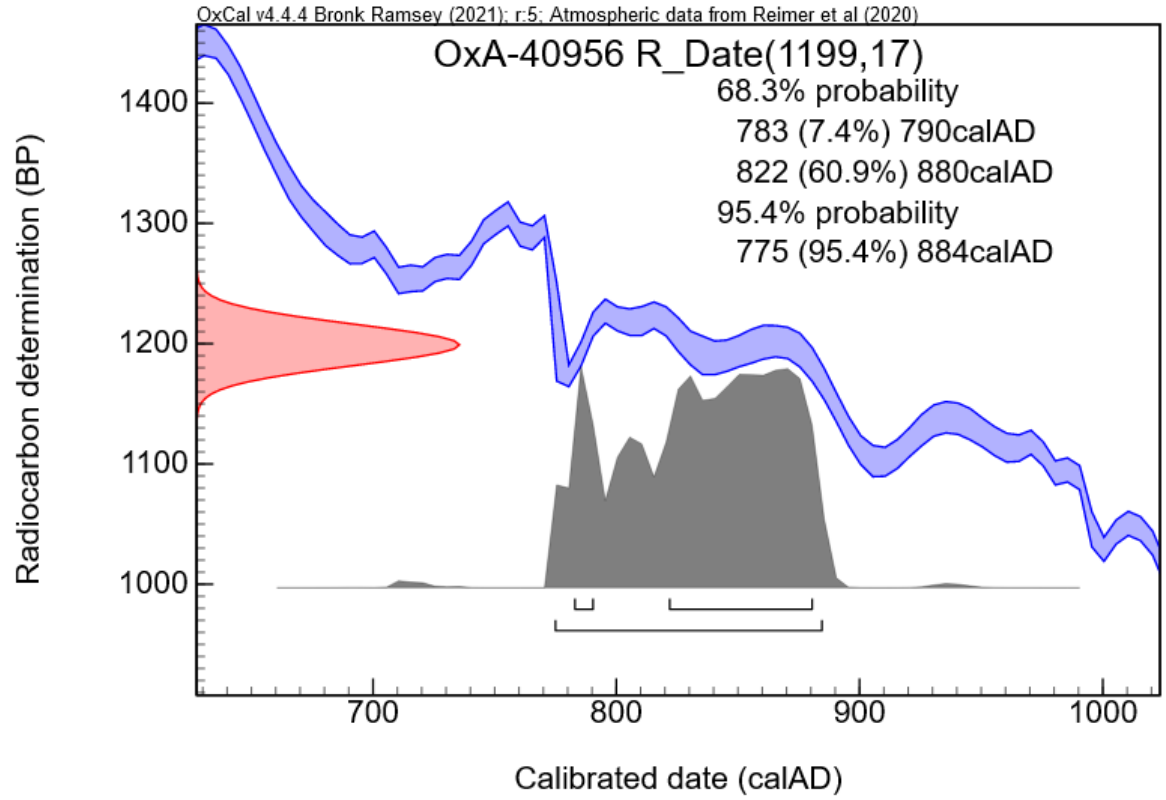
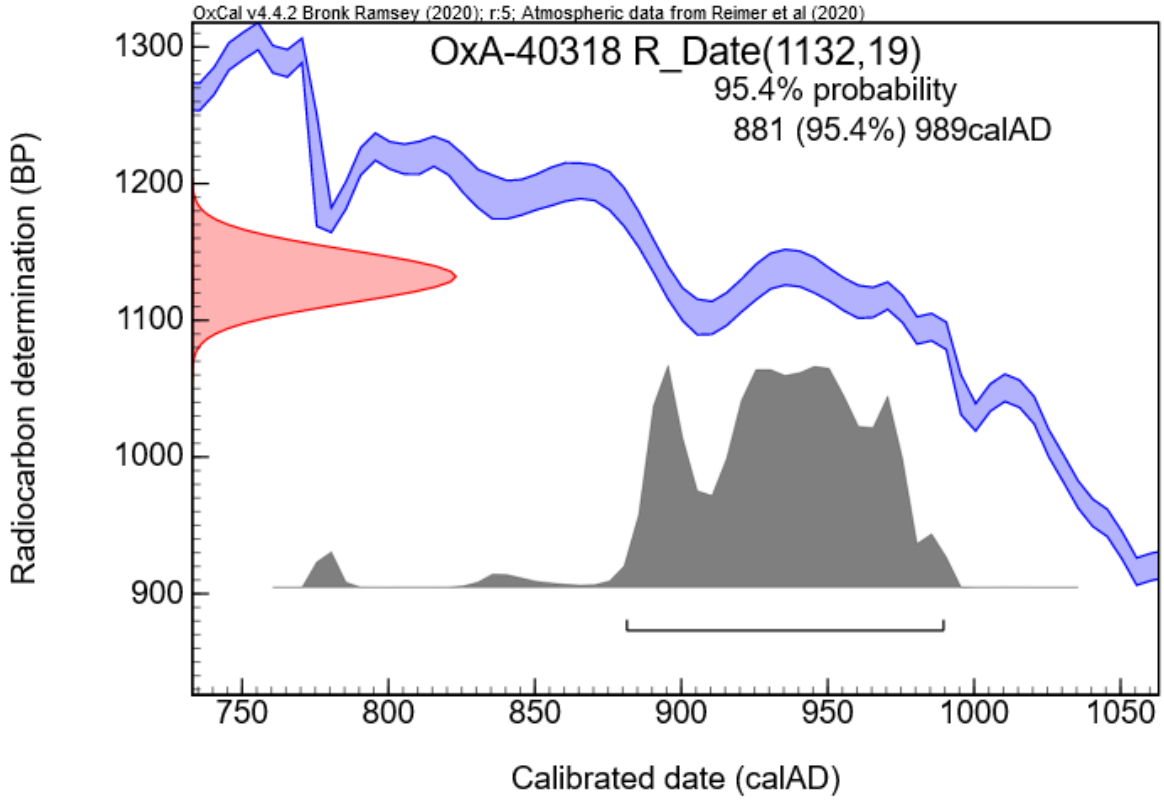
900
1000
Calibrated date (calAD)


OxCal v4.4.2 Bronk Ramsey (2020); r:5; Atmospheric data from Reimer et al (2020)
OxA-40317 R_Date(1073,18)
95.4% probability
897 (20.8%) 921calAD
955 (74.6%) 1023calAD
Radiocarbon determination (BP)
1300
1200
1100
1000
900
750
800
850
900
950
1000
1050
Calibrated date (calAD)


OxCal v4.4.4 Bronk Ramsey (2021); r:5; Atmospheric data from Reimer et al (2020)
OxA-40956 R_Date(1199,17)
68.3% probability
783 (7.4%) 790calAD
822 (60.9%) 880calAD
95.4% probability
775 (95.4%) 884calAD
Radiocarbon determination (BP)
1400
1300
1200
1100
1000
700
800
900
1000
Calibrated date (calAD)


OxCal v4.4.2 Bronk Ramsey (2020); r:5; Atmospheric data from Reimer et al (2020)
OxA-40318 R_Date(1132,19)
95.4% probability
881 (95.4%) 989calAD
Radiocarbon determination (BP)
1300
1200
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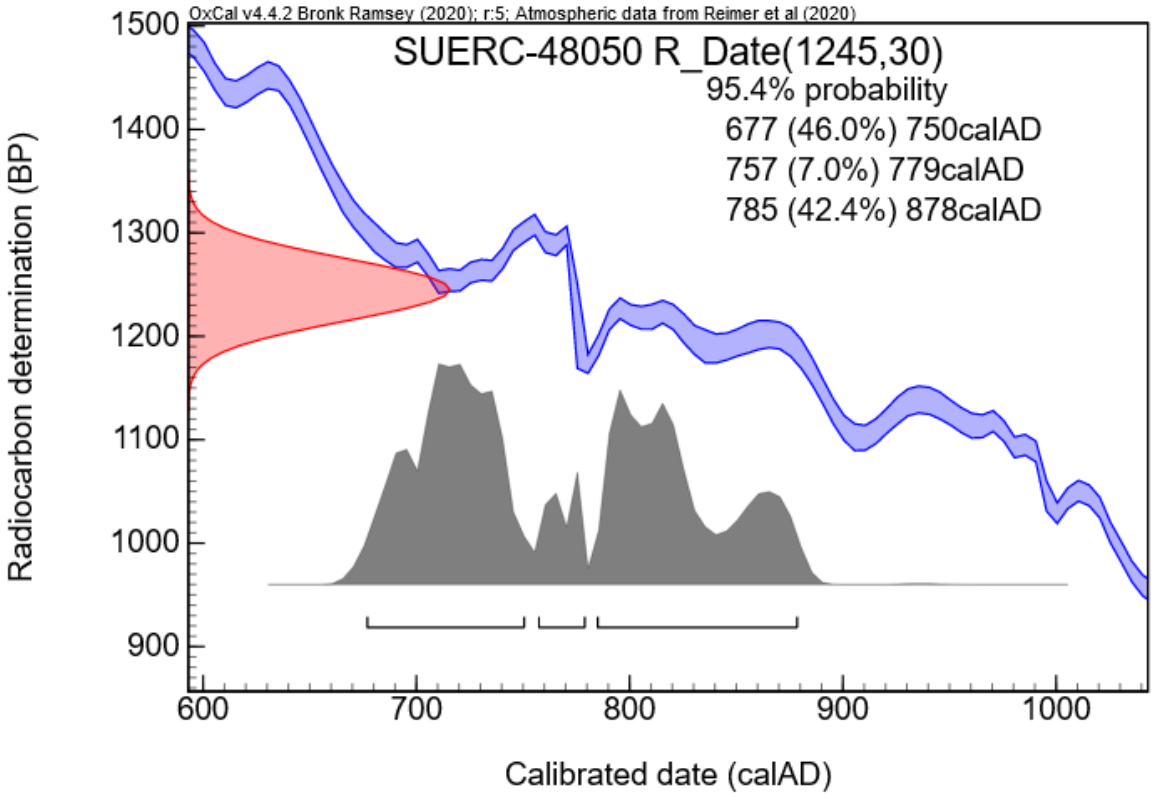
900
950
1000
1050
Calibrated date (calAD)


OxCal v4.4.2 Bronk Ramsey (2020); r:5; Atmospheric data from Reimer et al (2020)
SUERC-48050 R_Date(1245,30)
95.4% probability
677 (46.0%) 750calAD
757 (7.0%) 779calAD
785 (42.4%) 878calAD
Radiocarbon determination (BP)
1500
1400
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700
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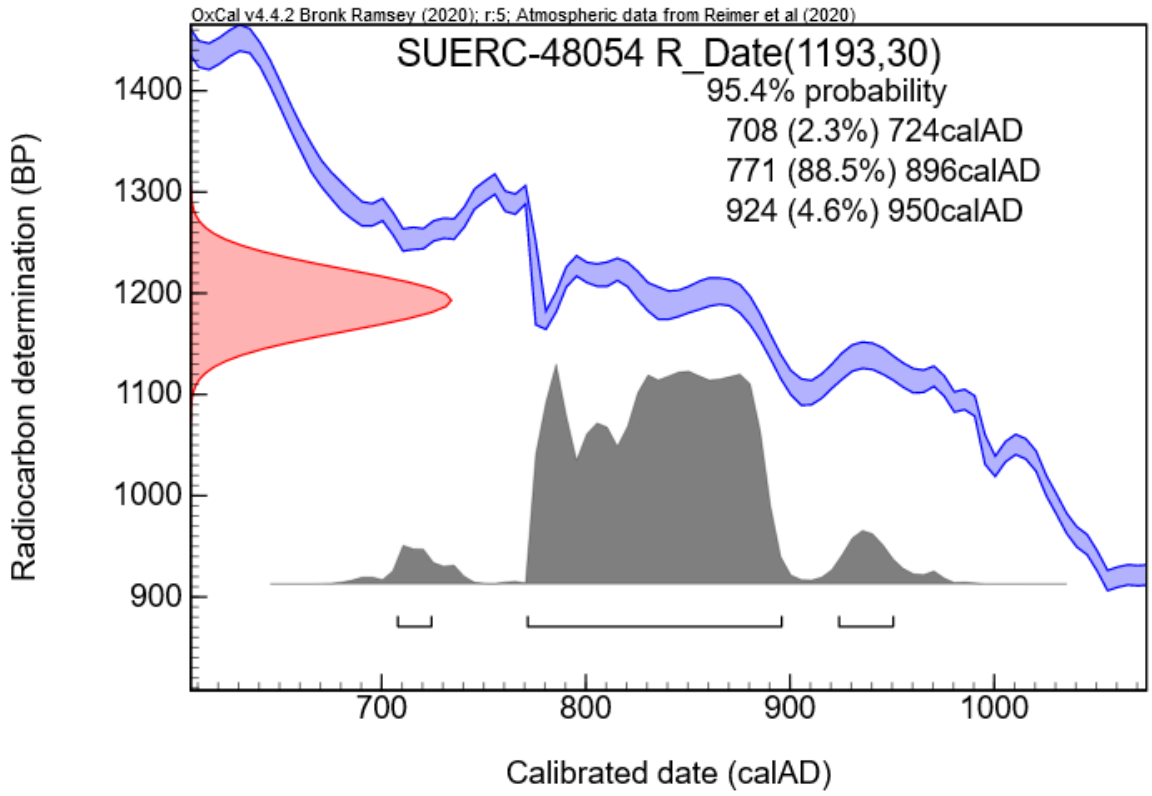
900
1000
Calibrated date (calAD)


OxCal v4.4.2 Bronk Ramsey (2020); r:5; Atmospheric data from Reimer et al (2020)
SUERC-48054 R_Date(1193,30)
95.4% probability
708 (2.3%) 724calAD
771 (88.5%) 896calAD
924 (4.6%) 950calAD
Radiocarbon determination (BP)
1400
1300
1200
1100
1000
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900
1000
Calibrated date (calAD)