[SUPPLEMENTARY MATERIAL]

TRACING THE LINES: SCOTTISH GROOVED WARE TRAJECTORIES BEYOND ORKNEY

Mike Copper[1*], Derek Hamilton[2] & Alex Gibson[3]

[1] School of Archaeological and Forensic Sciences, Faculty of Life Sciences, University of Bradford, Richmond Road, Bradford BD7 1DP, UK

[2] Scottish Universities Environmental Research Centre, Rankine Avenue, Scottish, Enterprise Technology Park, East Kilbride G75 0QF, UK

[3] alexgibsonarchaeol@outlook.com

* Author for correspondence (Email: m.copper1@bradford.ac.uk)

RADIOCARBON AND BAYESIAN MODELLING

During the course of *Tracing the Lines* a total of 131 radiocarbon dates associated with Scottish Grooved Ware outside of Orkney were identified. These included 28 new dates commissioned as part of the project on previously undated material or to address specific questions (Copper et al 2018; 2019). The new dates are all single entities (Ashmore 1999) and have been made directly on the charred encrustations on the interior of the pot, or just over the rim, which is thought to represent the burnt remains of the food that was cooked in the pot. However, while there are legacy radiocarbon dates from similar food encrustations, many are from other materials, such as wood charcoal, seeds and human and animal bone, that were more or less reliably associated with Grooved Ware. Because of the inherent differences in taphonomic processes from context to context, these samples could not always be

considered to provide a reliable date for the use of the associated Grooved Ware—the primary focus of the project—and needed to be evaluated individually.

The main criterion for inclusion in the Bayesian models was the degree to which a particular radiocarbon date could inform us about the likely date when the associated Grooved Ware vessel(s) had been in use. The date of deposition was of lesser importance as our focus was not so much on the events with which the pots were associated as with dating the vessels themselves, some of which could theoretically have been curated for some time before deposition (c.f. Edwards 2012). Unless there were good reasons for supposing otherwise, a presumption has been made that the time of deposition will not have been significantly later than the time when the pots were last used. Details of all samples reviewed are given in Table 1, and reasons for exclusions given in the text below.

METHODS

The majority of dated samples were processed by one of the various incarnations of the radiocarbon laboratory at the Scottish Universities Environmental Research Centre (SUERC). Samples with GU- codes were submitted to the laboratory when it was still undertaking conventional radiocarbon dating. These samples would have been pretreated following the methods of Stenhouse and Baxter (1983) and measured by liquid scintillation counting as described by Noakes et al (1965). Similarly, the samples numbers prefixed SRR- were pretreated and measured following the same methods at the NERC facility at SUERC (then known as SURRC). Those samples with AA- codes were submitted to the SUERC laboratory where they were pretreated following the methods of Stenhouse and Baxter (1983) before being graphitised as described in Slota et al (1987) and sent to the University of Arizona radiocarbon

laboratory for measurement by accelerator mass spectrometry (AMS) as described by Donahue et al (1997). Since 2001, samples submitted to SUERC have been pretreated and measured following the procedures outlined in Dunbar et al (2016). A number of samples were submitted to the Oxford Radiocarbon Accelerator Unit (OxA-) and these were processed following Hedges et al (1989) and measured by AMS as described in Bronk Ramsey et al. (2004). Finally, there are five results on samples submitted to the now defunct radiocarbon laboratory at University College Cardiff (CAR), which measured samples conventionally through gas proportional counting, and whose laboratory procedures are reported in Dresser (1985).

CHRONOLOGICAL MODELLING

The radiocarbon results were further investigated through the use of Bayesian statistical modelling of the calibrated probabilities to develop refined chronological frameworks for the individual sites and for the use of Grooved Ware in Scotland outside of Orkney as a whole. The chronological modelling process is well documented and regularly used in UK archaeology, with a fast-growing implementation by archaeologists in other countries. The methods are discussed in detail in Buck et al. (1996), Bronk Ramsey (2009), Bayliss (2015) and Hamilton and Krus (2018). The methodology has been implemented here using the OxCal v. 4.3 computer program and the IntCal13 terrestrial calibration curve (Reimer et al 2013). The site-based modelling follows the simple bounded-phase approach described in Hamilton and Kenney (2015).

Based on the evaluation of each context and sample, some samples were immediately excluded from further analysis. These results remain visible in the final model figures, with the result including a question mark (?) after the label and the calibrated

probability shown only in outline. Only sites with three or more non-excluded radiocarbon results were subjected to formal chronological modelling. Within these there are other samples that were considered to provide only a *terminus post quem* result for the formation of the context from which they were derived. These are included in the modelling using the After command for each radiocarbon result. All of the site-based models and further individual dates from sites with less than three results were further modelled to estimate the start and end date for Grooved Ware in Scotland outside of Orkney.

As a general rule, nesting the Boundaries within OxCal is discouraged; however in this instance it is preferred. When looking at the data on a site-by-site basis, some sites have only one or two results whereas others can have as many as nine radiocarbon dates. The nesting in this instance ensures that each site is providing only one or two data points—either the one or two radiocarbon dates or the two modelled boundaries—to the estimation of the overall use of Grooved Ware.

The modelling includes a series of indices for evaluating the agreement of both the individual calibrated radiocarbon probabilities (A) and the agreement between the dates and the model (Amodel). For both of these, if the value is greater than 60 the date or model are considered to be in good agreement. When an agreement index value drops below the acceptable threshold then the result and the taphonomy of the context are re-evaluated, with the sample quality assurance indicators also checked, where possible, with the radiocarbon laboratory.

The model has good agreement (Amodel=120). The sites and samples are discussed in further detail below, with the extracted element of the overall model provided (Illus S40). These figures present all of the available dates from a site, and show them in relation to the overall start and end date probabilities for Grooved Ware in mainland

Scotland. In the figures, the radiocarbon dates that have been included as *TPQs* are noted by the After command and those that are fully excluded have a "?" at the end of their label and the basic calibrated probability is shown in outline. This form of presentation is intended to make the decision-making process much more transparent as it becomes readily clear that results are not simply excluded because it was felt *a priori* that they were "too early" or "too late" for Grooved Ware in these contexts.

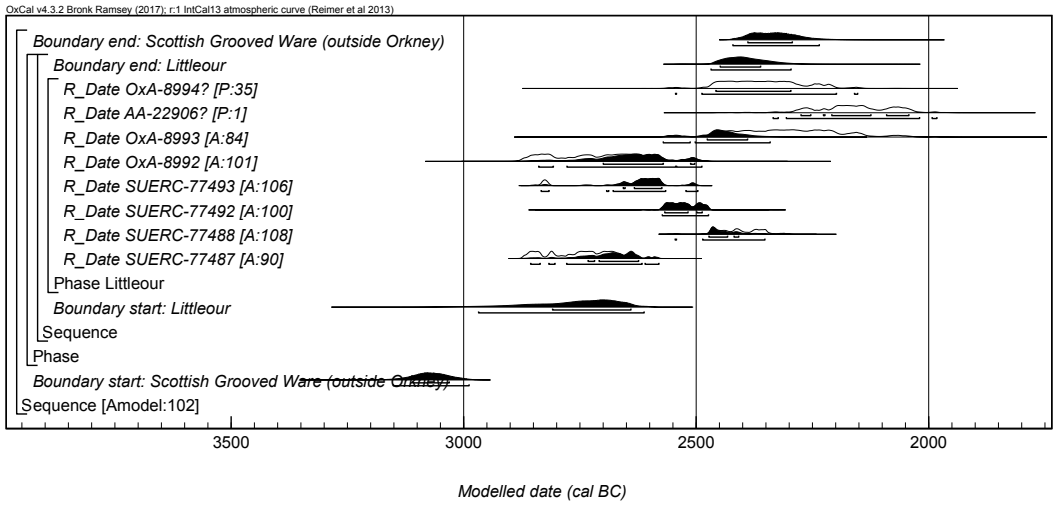
A full list of radiocarbon dates used in this study is provided in Table S1 below. The extracted model element is given in Illus S40 after Table S1.

THE SITES

LITTLEOUR (Barclay and Maxwell 1998)

Perthshire. Canmore ID: 71337. Pit L23 within a timber enclosure

Of the eight available radiocarbon dates from Littleour, two were excluded from the modelling [AA-22906 due to possible residuality and OxA-8994 as this was compromised by coming from two separate vessels]. The chronological model for the remaining six dates (Illus S1) estimates that use of the Grooved Ware assemblage deposited at this site began in *2970–2610 cal BC* (*95% probability*; *start: Littleour*), and probably *2810–2640 cal BC* (*68% probability*), and ceased in *2470–2295 cal BC* (*95% probability*; *end: Littleour*), and probably *2450–2360 cal BC* (*68% probability*).

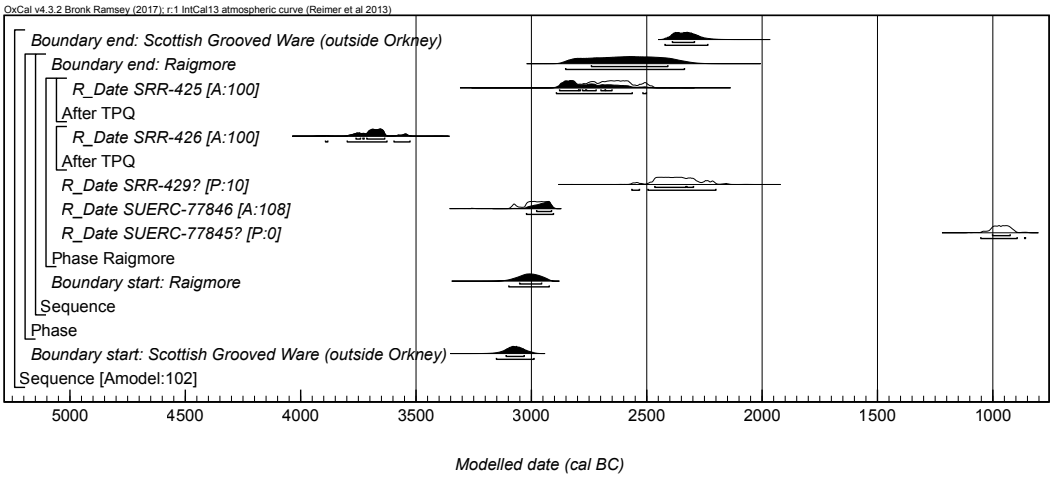


ILLUS S1 Littleour

RAIGMORE (Simpson 1996)

Inverness-shire. Canmore ID: 13414. Pits associated with a timber structure

There are five radiocarbon dates from Grooved Ware contexts at Raigmore. SUERC-77845 (Pit 50) dates to the 1st millennium cal BC and has been excluded as a probably erroneous result. SRR-429 (Pit 21) lies in the 3rd millennium cal BC but has been excluded as the pottery from this feature could be domestic Beaker rather than Grooved Ware. The other two SRR dates have been included in the modelling as *tpq*s: SRR-426 probably comes from intrusive material while SRR-425 is from charcoal of unidentified species. The resulting model (Illus S2) suggests that Grooved Ware at Raigmore began being used in *3100–2920 cal BC* (*95% probability*; *start: Raigmore*), and probably *3055–2955 cal BC* (*68% probability*), its use ceasing in *2855–2335 cal BC* (*95% probability*; *end: Raigmore*), and probably *2740–2405 cal BC* (*68% probability*).

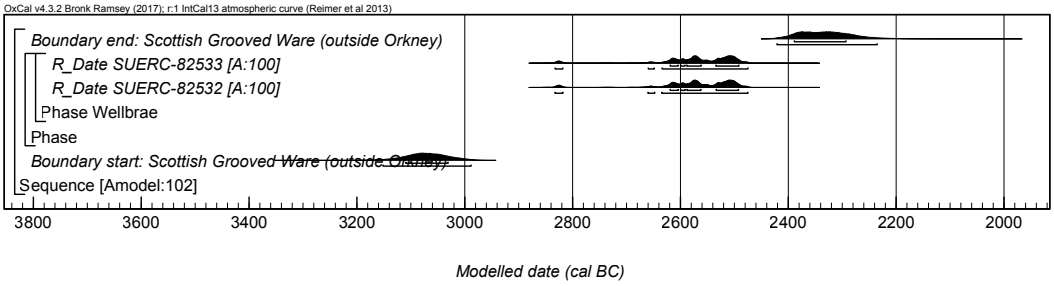


ILLUS S2 Raigmore

WELLBRAE (Alexander, D and Armit 1992)

South Lanarkshire. Canmore ID: 72819. Pits

There are two radiocarbon results on Grooved Ware from Wellbrae: SUERC-82532 and SUERC-82533, from vessels 34 and 36 respectively. These results (Illus S3) suggest that Grooved Ware was most probably in use at the site during the second quarter of the 3rd millennium cal BC.



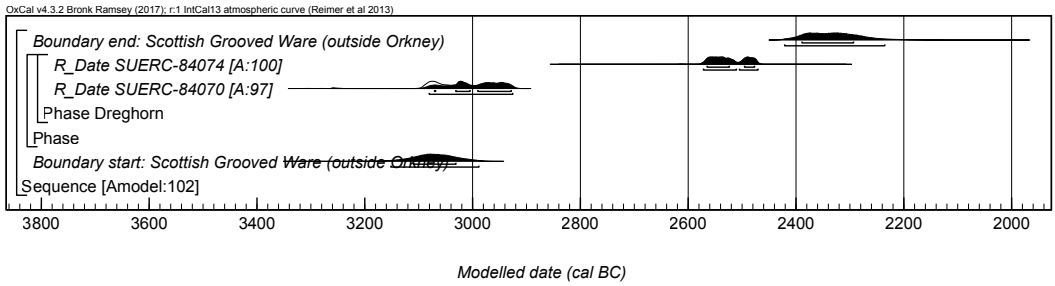
ILLUS S3 Wellbrae

STATION BRAE, DREGHORN (Addyman 2004)

Ayrshire. Canmore ID: 273864. Settlement.

Two results (SUERC-84070 and SUERC-84074: Illus S4) suggest a longevity to Grooved Ware use at the site, and so for the chronology of the site as well. The first

date on S.F. 747 is a century or so either side of 3000 cal BC, while S.F. 1382 dates to a century or so either side of 2500 cal BC.

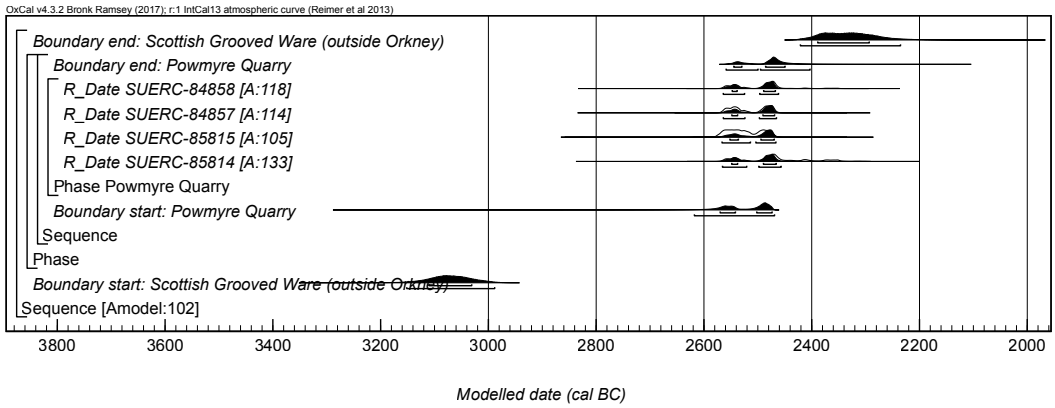


ILLUS S4 Station Brae, Dreghorn

POWMYRE QUARRY, GLAMIS (Robertson 2009)

Angus. Canmore ID: 298415. Pits

Four radiocarbon results are available from four different sherds of Grooved Ware excavated at Powmyre Quarry. The chronological modelling (Illus S5) estimates that Grooved Ware started to be used here in *2620–2470 cal BC* (*95% probability*; *start: Powmyre Quarry*), and probably either *2570–2540 cal BC* (*28% probability*) or *2505–2470 cal BC* (*40% probability*), and fell out of use in *2560–2400 cal BC* (*95% probability*; *end: Powmyre Quarry*), and probably either *2545–2530 cal BC* (*12% probability*) or *2490–2450 cal BC* (*56% probability*).

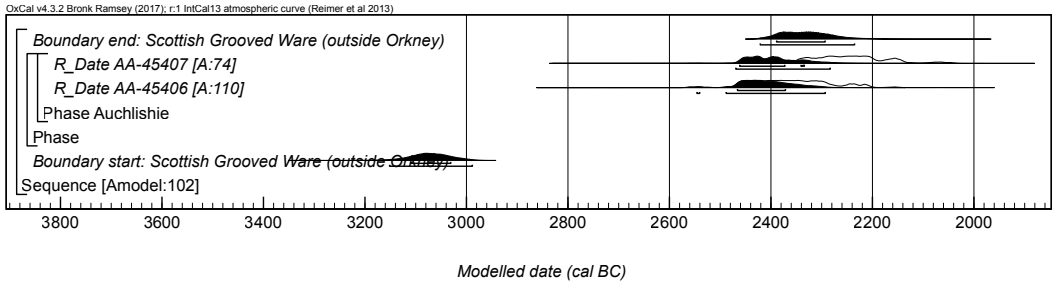


ILLUS S5 Powmyre Quarry, Glamis

AUCHLISHIE (Dick 2000; 2001)

Angus. Canmore ID: 32218. Pits

The two results from Auchlishie (AA-45406 and AA-45407: Illus S6) calibrate to the third-quarter/latter-half of the 3rd millennium cal BC.

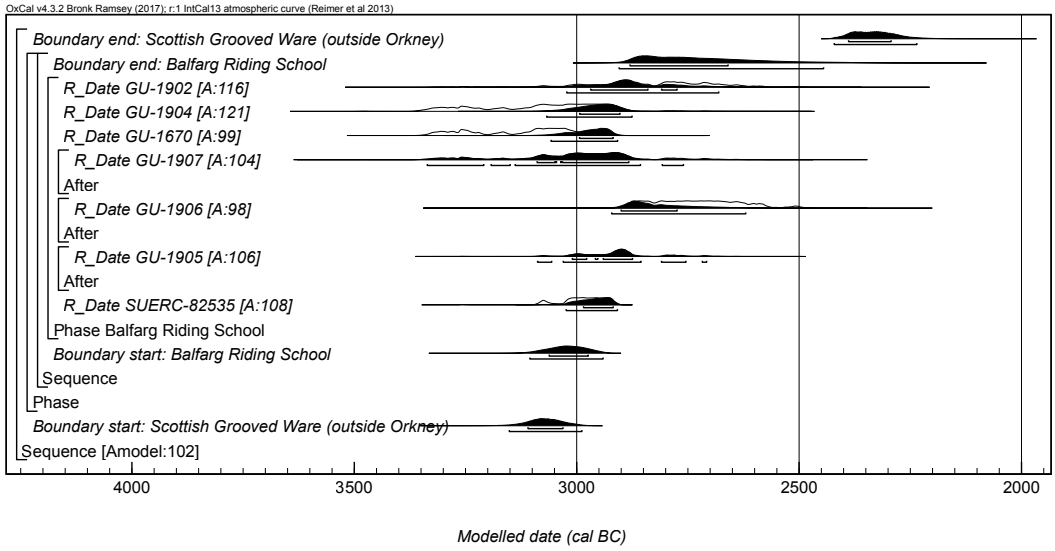


ILLUS S6 Auchlishie

BALFARG RIDING SCHOOL (Barclay and Russell-White 1993)

Fife. Canmore ID: 29959. Ceremonial complex

None of the seven radiocarbon results from Balfarg Riding School has been excluded from the chronological modelling, though GU-1905–7 have been included as only providing *tpq*s for the associated Grooved Ware. The model (Illus S7) estimates Grooved Ware use at this site started in *3110–2940 cal BC* (*95% probability*; *start: Balfarg Riding School*), and probably *3065–2975 cal BC* (*68% probability*), and ended in *2905–2445 cal BC* (*95% probability*; *end: Balfarg Riding School*), and probably *2885–2660 cal BC* (*68% probability*).

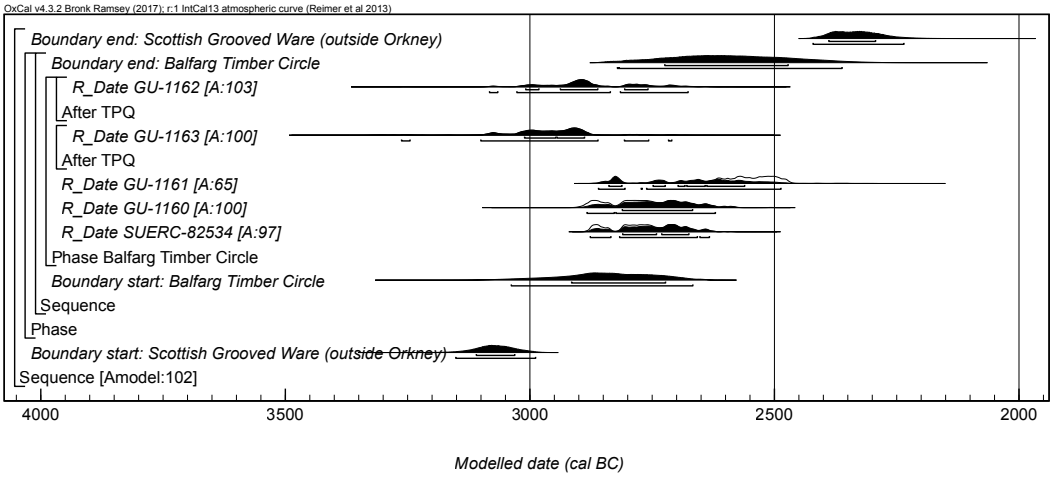


ILLUS S7 Balfarg Riding School

BALFARG TIMBER CIRCLE (Mercer et al 1981)

Fife. Canmore ID: 29990. Timber circle

All five of the available radiocarbon dates from Balfarg Timber Circle have been included in the chronological model, though GU-1162 and GU-1163 are included as *tpq*s. The model (Illus S8) estimates that Grooved Ware use began here in *3040–2665 cal BC* (*95% probability*; *start: Balfarg Timber Circle*), and probably *2915–2720 cal BC* (*68% probability*), and that it ended in *2825–2360 cal BC* (*95% probability*; *end: Balfarg Timber Circle*), and probably *2725–2470 cal BC* (*68% probability*).



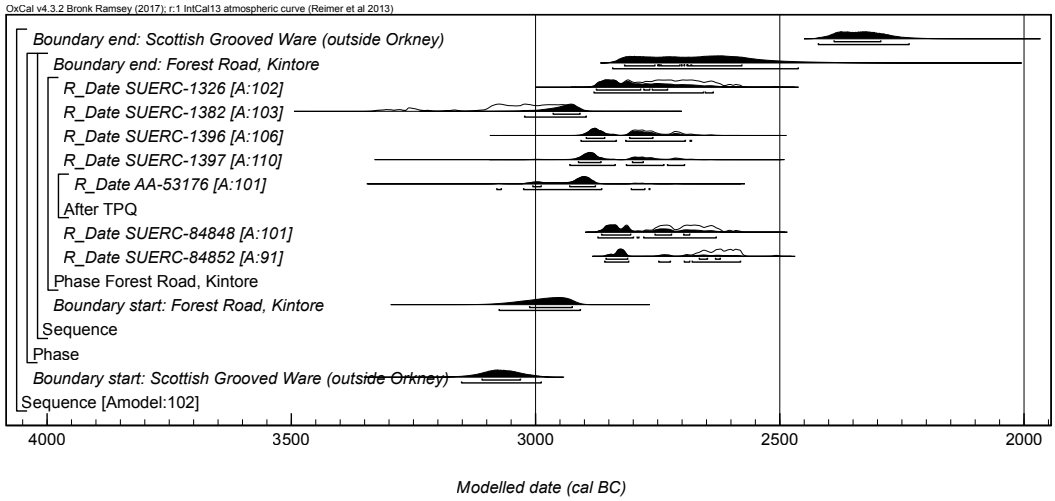
ILLUS S8 Balfarg Timber Circle

FOREST ROAD, KINTORE (Cook and Dunbar 2008)

Aberdeenshire. Canmore ID: 18584. Pits and ring-groove structures

Of the seven radiocarbon results from Forest Road, only one (AA-53176) has been included as a *tpq* as it is possible that the Grooved Ware sherds may have entered the trench in which the dated material was found at a later date. The model (Illus S9) estimates the that start of Grooved Ware use at the site occurred in *3075–2905 cal BC* (*95% probability*; *start: Forest Road, Kintore*), and probably *3015–2925 cal BC* (*68% probability*), and that the use of Grooved Ware ceased in *2845–2460 cal BC* (*95%*

probability; *end: Forest Road, Kintore*), and probably in *2820–2575 cal BC* (*68% probability*).

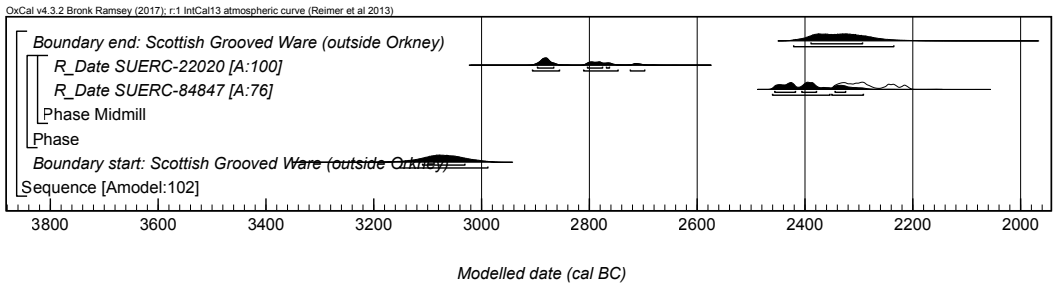


ILLUS S9 Forest Road, Kintore

MIDMILL (Lochrie 2010; Murray, H & Murray, J 2013a; 2013b)

Aberdeenshire. Canmore ID: 289751. Pits

The two results from Midmill are very different and suggest some longevity to the use of Grooved Ware at this site (initially of the Woodlands sub-style and later of the Durrington Walls style), with the dates spanning most of the first three-quarters of the 3rd millennium cal BC (Illus S10).

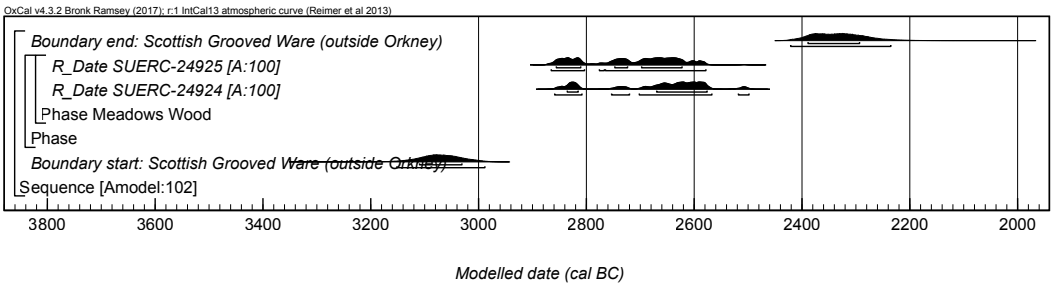


ILLUS S10 Midmill

MEADOWS WOOD (Gray 2010)

Angus. Canmore ID: 34498. Pit

The two radiocarbon dates (SUERC-24924 and SUERC-24925) from Meadows Wood indicate Grooved Ware use in the middle of the first half of the 3rd millennium cal BC (Illus S11).

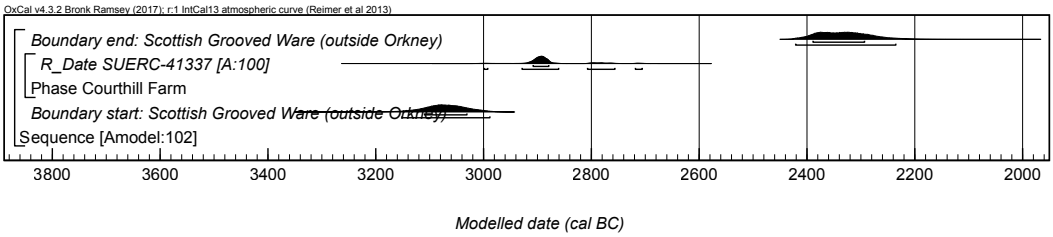


ILLUS S11 Meadows Wood

COURTHILL FARM (Recorded on Canmore as 'Hawkhill') (Hawthorne et al 2016)

Angus. Canmore ID: 355165. Pit

The single Grooved Ware date from Courthill Farm (SUERC-41337: Illus S12) calibrates to 3000–2700 cal BC (95% probability).

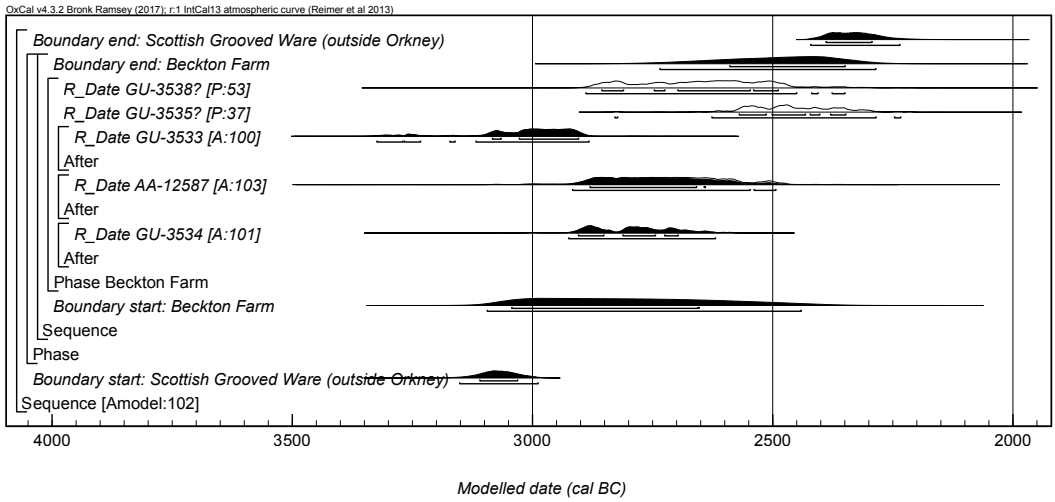


ILLUS S12 Courthill Farm

BECKTON FARM (Pollard 1997)

Dumfriesshire. Canmore ID: 72681. Pits

Of the five third millennium BC radiocarbon dates from Beckton Farm (Illus S13), two (GU-3535 and GU-3538) have been excluded as they are from features that did not produce Grooved Ware pottery and the other three (GU-3533, GU-3534, and AA-2587) can only be considered to provide *tpq*s for the date of Grooved Ware as they are on mixed species charcoal, including charcoal from unidentified species.

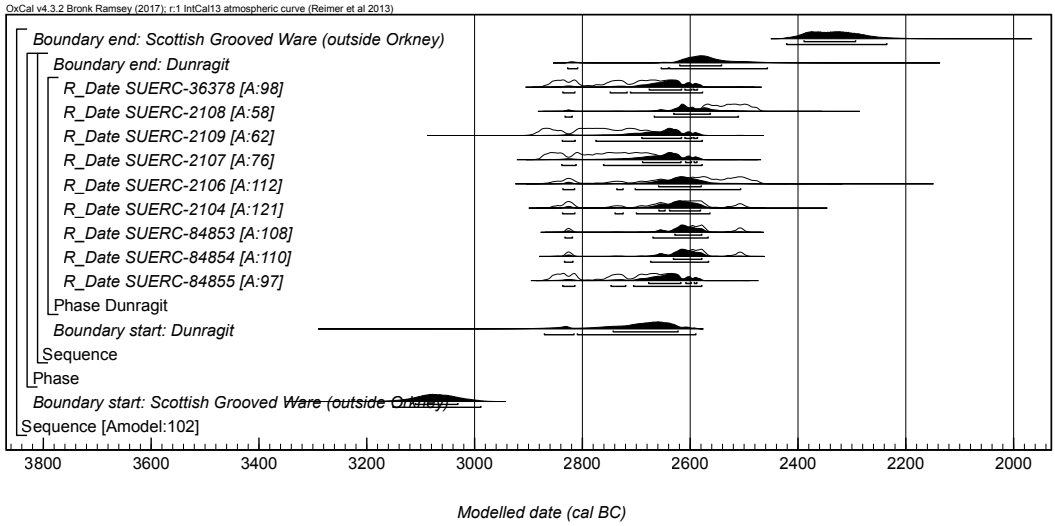


ILLUS S13 Beckton Farm

DUNRAGIT (Thomas 2015)

Dumfriesshire. Canmore IDs: 78918, 78922 and 78923. Palisaded enclosure

The nine Grooved Ware-associated dates from Dunragit form a very coherent group centred on middle of the first half of the 3rd millennium cal BC. The modelling of the dates (Illus S14) estimates Grooved Ware use here began in *2875–2590 cal BC* (*95% probability*; *start: Dunragit*), and probably *2745–2620 cal BC* (*68% probability*). It ceased in either *2830–2805 cal BC* (*3% probability*; *end: Dunragit*) or *2655–2455 cal BC* (*92% probability*), and probably *2620–2540 cal BC* (*68% probability*).

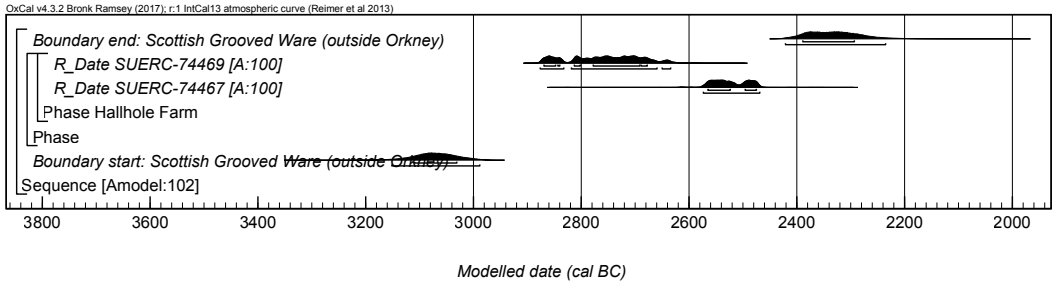


ILLUS S14 Dunragit

HALLHOLE FARM (Ann MacSween and Chris Fyles pers comms)

Perthshire. Canmore ID: 341113. Pits and possible structure

The two radiocarbon results (SUERC-74467 and SUERC-74469) available from Hallhole Farm place Grooved Ware use here in the first half of the 3rd millennium cal BC (Illus S15).

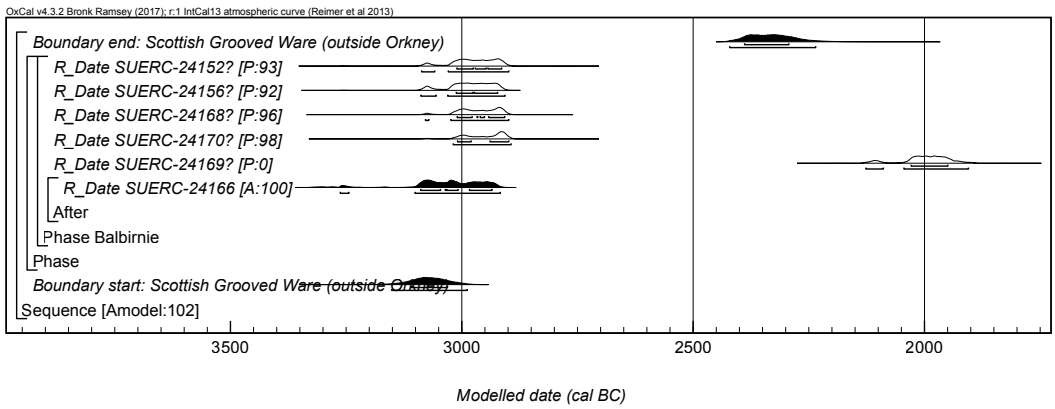


ILLUS S15 Hallhole Farm

BALBIRNIE (Ritchie 1974; Gibson 2010)

Fife. Canmore ID: 29980. Stone circle

Although five of the six radiocarbon dates from Balbirnie calibrate to the beginning of the 3rd millennium cal BC, only SUERC-24166 has not been excluded (Illus S16), and this has only been retained as a *tpq* as the putative Grooved Ware sherd with which it is associated may be intrusive (and may actually be a Bronze Age urn fragment, as noted by Henshall in Mercer et al 1981: 132-3). While SUERC-24169 is clearly too late, dating to the 2nd millennium cal BC, the other four results are excluded as they come from contexts that do not contain Grooved Ware.

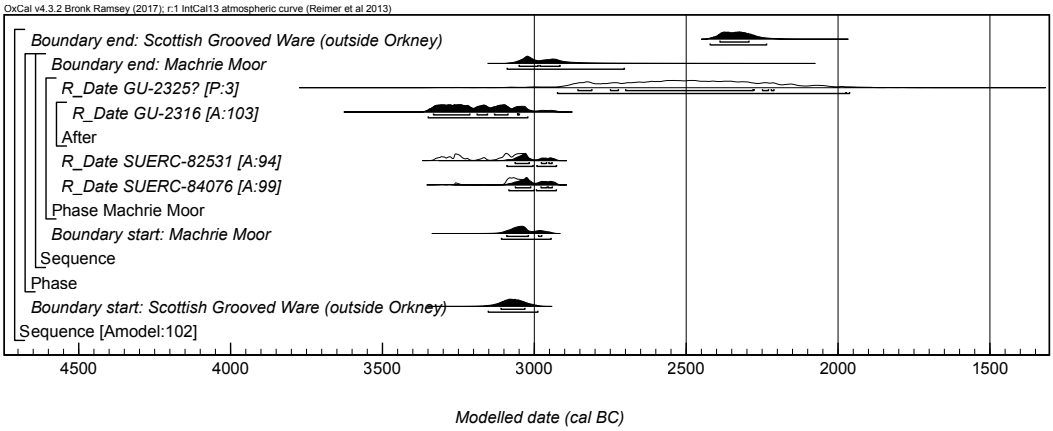


ILLUS S16 Balbirnie

MACHRIE MOOR SITE 1 (Haggarty 1991)

Arran. Canmore ID: 39703. Timber circle

Of the four results from Machrie Moor Site 1, GU-2325 has been excluded as it was derived from oak charcoal, and GU-2316 is included as a *tpq* as it as it is derived from mixed species charcoal. The resulting model (Illus S17) estimates that Grooved Ware was first used at the site in *3110–2945 cal BC* (*95% probability*; *start: Machrie Moor*), and probably either *3095–3020 cal BC* (*63% probability*) or *2990–2975 cal BC* (*5% probability*). Grooved Ware-related activity ended here in *3090–2700 cal BC* (*95% probability*; *end: Machrie Moor*), and probably *3055–2915 cal BC* (*68% probability*).



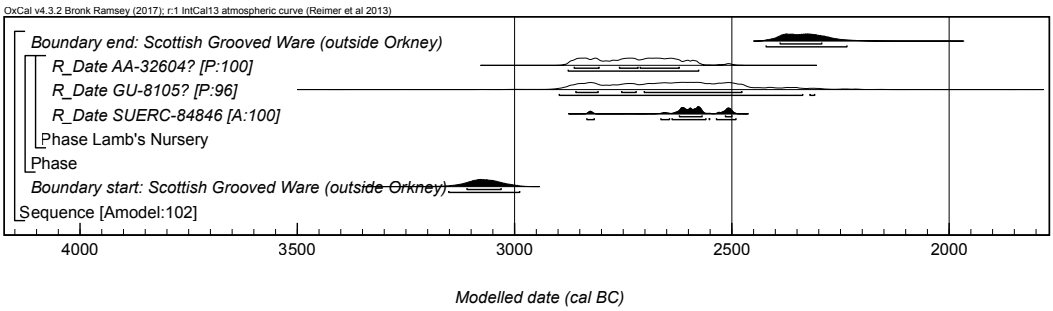
ILLUS S17 Machrie Moor Site 1

LAMB'S NURSERY (Cook 2000)

Midlothian. Canmore ID: 75750. Possible timber structure

Of the three radiocarbon results from Lamb's Nursery, only SUERC-84846 has been retained, placing the Grooved Ware-related activity here in the second quarter of the 3rd millennium cal BC (Illus S18). The other two dates (GU-8105 and AA-32604) have been excluded, the former as its large error margin (110 years) means that it

provides little interpretive value when a more suitable date is available from the site, and the latter as the associated pottery is not unambiguously Grooved Ware.

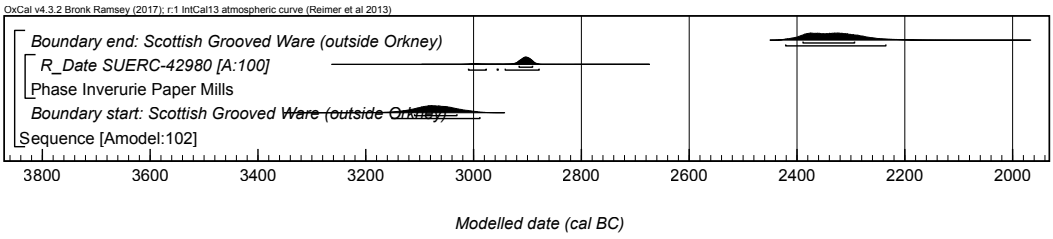


ILLUS S18 Lamb's Nursery

INVERURIE PAPER MILLS (Murray, H and Murray, J 2013c)

Aberdeenshire. Canmore ID: 294518. Pits

There is a single radiocarbon result (SUERC-42980) from this site that calibrates to the first quarter of the 3rd millennium cal BC (Illus S19).

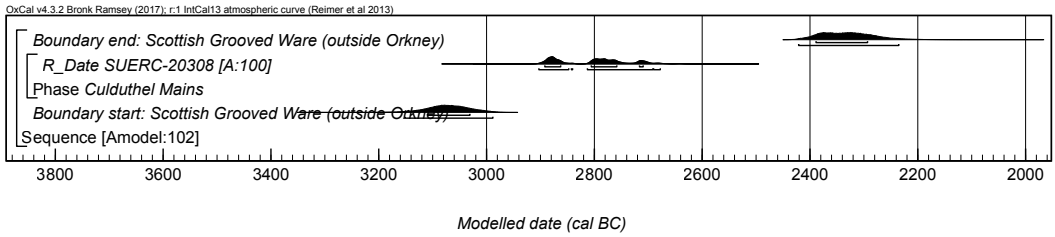


ILLUS S19 Inverurie Paper Mills

CULDUTHEL MAINS (Murray 2008; Peteranna 2011; Sheridan 2010)

Inverness-shire. Canmore ID: 296069. Pits and hillwash

The radiocarbon date from Culduthel Mains (SUERC-20308) places the Grooved Ware-related activity here in the middle of the first half of the 3rd millennium cal BC (Illus S20).

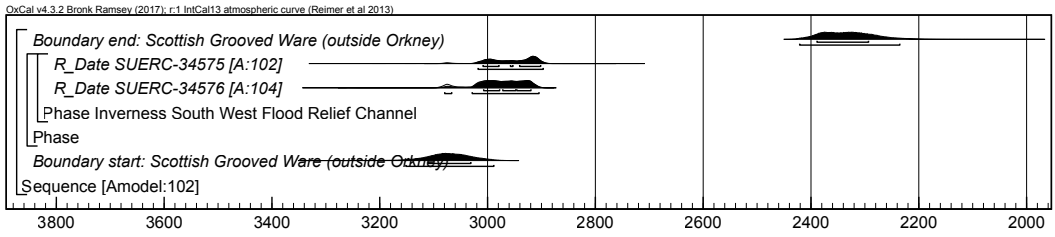


ILLUS S20 Culduthel Mains

INVERNESS SOUTH WEST FLOOD RELIEF CHANNEL (Peteranna 2011; Sheridan 2011)

Inverness-shire. Canmore ID: 320608. Pits

The two radiocarbon results (SUERC-34575 and SUERC-34576) place Grooved Ware-related activity at the site in the opening centuries of the 3rd millennium cal BC (Illus S21).

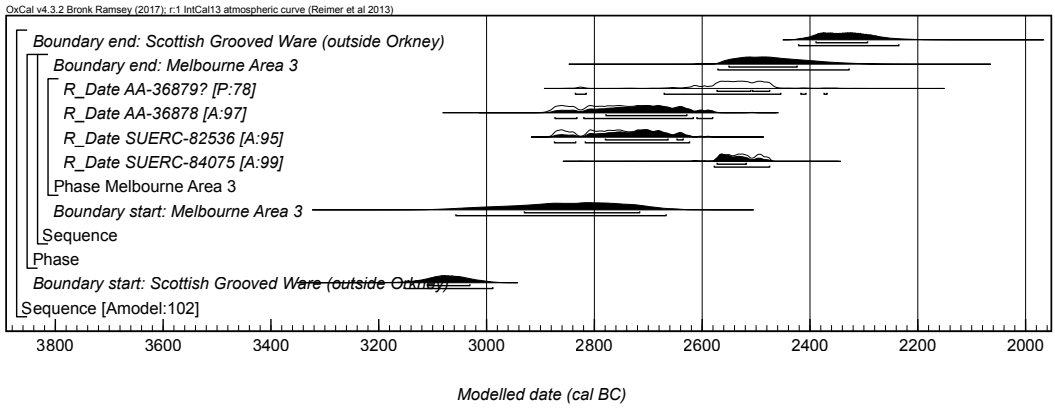


ILLUS S21 Inverness South West Flood Relief Channel

BIGGAR MELBOURNE AREA 3 (Ward 2013)

South Lanarkshire. Canmore ID: 109688. Pits

The four radiocarbon dates from Melbourne Area 3 (Illus S22) mean that it is possible to date Grooved Ware pottery use here from *3060–2665 cal BC* (*95% probability*; *start: Melbourne Area 3*), and probably *2930–2715 cal BC* (*68% probability*). The use of Grooved Ware ended here in *2575–2325 cal BC* (*95% probability*; *end: Melbourne Area 3*), and probably *2555–2420 cal BC* (*68% probability*).

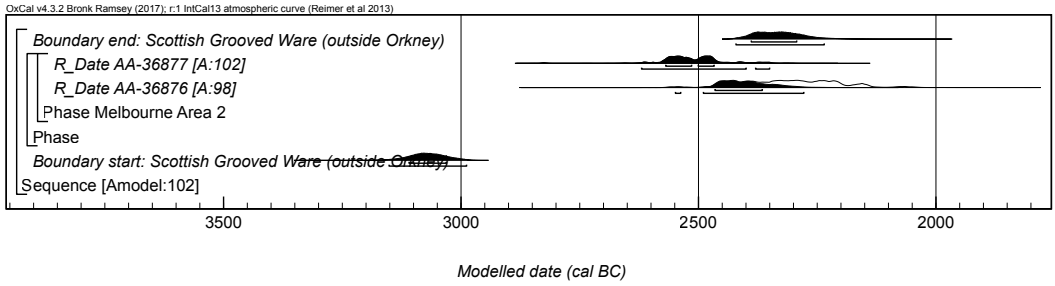


ILLUS S22 Biggar Melbourne Area 3

BIGGAR MELBOURNE AREA 2 (Ward 2013)

South Lanarkshire. Canmore ID: 109688. Pits

The two radiocarbon dates from Biggar Melbourne Area 2 (AA-36876 and AA-36877) place Grooved Ware-related activity in the centuries either side of the middle of the 3rd millennium cal BC (Illus S23).

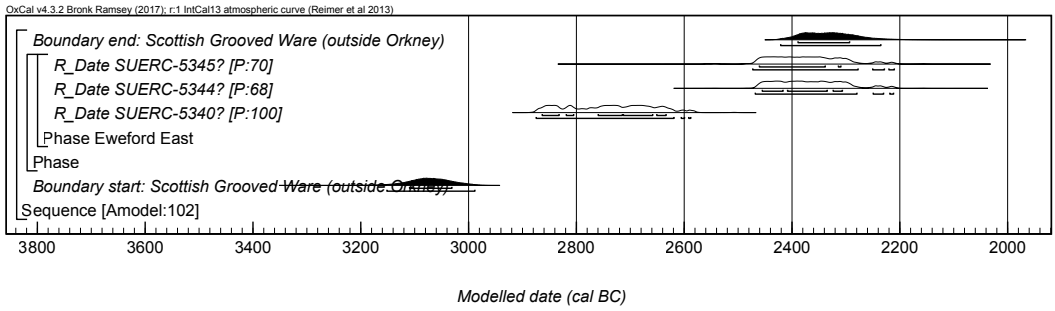


ILLUS S23 Biggar Melbourne Area 2

EWEFORD EAST (Lelong and MacGregor 2008; Sheridan 2008)

East Lothian. Canmore ID: 57600. Post alignment

All four radiocarbon dates from Eweford East have been excluded as they are only circumstantially associated with the Grooved Ware from this site and there is also a possibility that the pottery in question is residual (Illus S24).

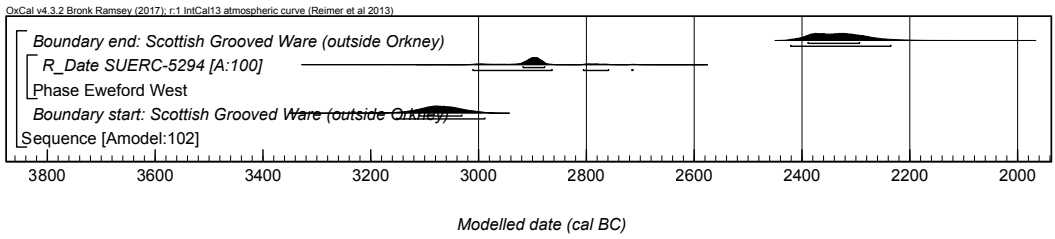


ILLUS S24 Eweford East

EWEFORD WEST (Sheridan 2006a; Lelong and MacGregor 2008)

East Lothian. Canmore ID: 257432. Pits and hollows adjacent to an Early Neolithic rectangular mound

The one accepted date (SUERC-5294) indicates that Grooved Ware was being used at this site in the first quarter of the 3rd millennium cal BC (Illus S25).



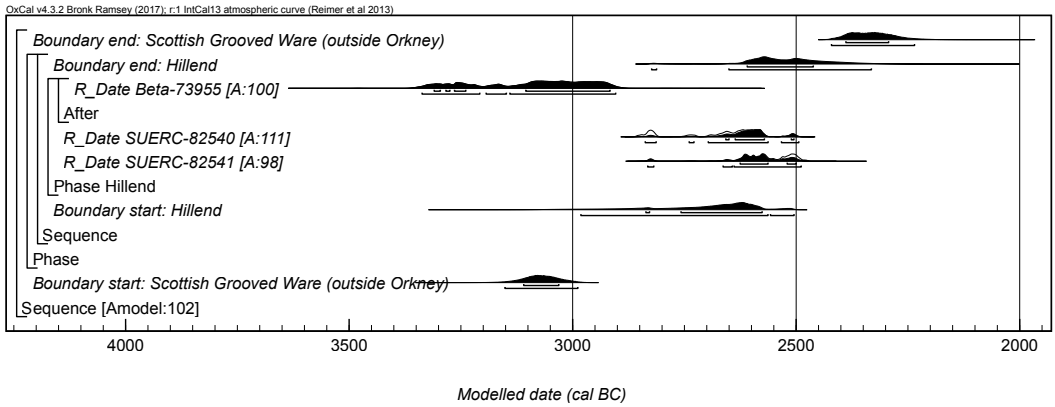
ILLUS S25 Eweford West

HILLEND (Armit et al 1994)

South Lanarkshire. Canmore ID: 47370. Pits close to an undated 'henge-lik'e enclosure

There are two new results (SUERC-82540 and SUERC-82541) from Vessels 5 and 2, respectively, from Hillend. These have been combined with an older date (Beta-73955) that has been included as a *tpq* since the unidentified charred material dated was almost certainly residual. The chronological modelling (Illus S26) estimates that Grooved Ware began to be used here in *2985–2505 cal BC* (*95% probability*; *start: Hillend*), and probably either *2840–2825 cal BC* (*1% probability*) or *2760–2575 cal*

BC (*67% probability*). It ceased being used in either *2825–2810 cal BC* (*1% probability*; *end: Hillend*) or *2655–2330 cal BC* (*94% probability*), and probably *2610–2460 cal BC* (*68% probability*).

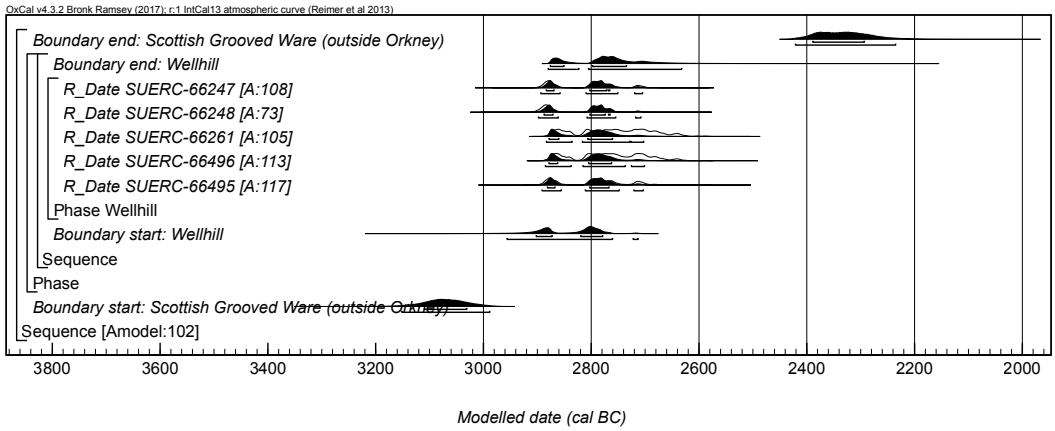


ILLUS S26 Hillend

WELLHILL (Alexander 2016; Wright n.d.)

Perthshire. Canmore ID: 84910. Pits and posthles

The five radiocarbon dates considered from Wellhill form a very coherent group that, when modelled, estimates that the Grooved Ware began being used in either *2960–2760 cal BC* (*94% probability*; *start: Wellhill*) or *2725–2710 cal BC* (*1% probability*), and probably either *2905–2870 cal BC* (*26% probability*) or *2820–2775 cal BC* (*42% probability*) and that this activity ended in either *2880–2820 cal BC* (*22% probability*; *end: Wellhill*) or *2805–2630 cal BC* (*73% probability*), and probably either *2880–2850 cal BC* (*17% probability*) or *2800–2735 cal BC* (*51% probability*) (Illus S27).

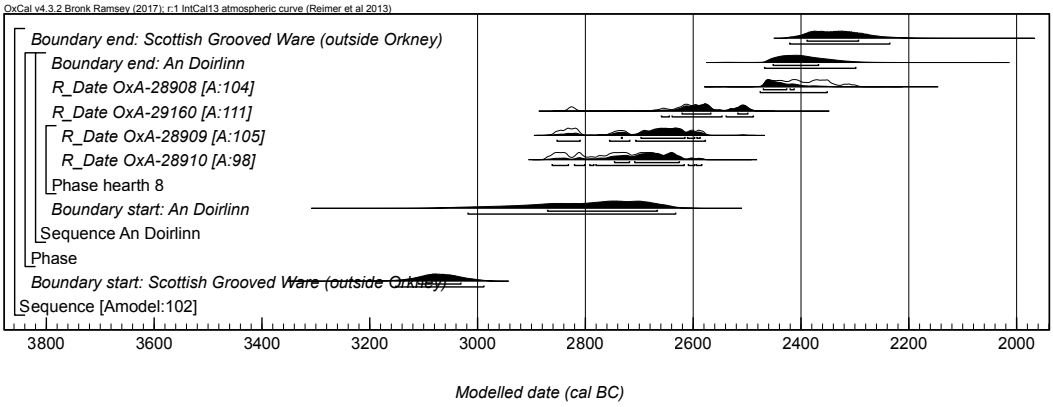


ILLUS S27 Wellhill

AN DOIRLINN (Garrow and Sturt 2017)

Western Isles. Canmore ID: 9797. Settlement

There are four Grooved Ware-related radiocarbon results from An Doirlinn. The modelling of these dates (Illus S28) indicates Grooved Ware began being used in *3020–2630 cal BC* (*95% probability*; *start: An Doirlinn*), and probably *2875–2665 cal BC* (*68% probability*) and ceased being used in *2470–2295 cal BC* (*95% probability*; *end: An Doirlinn*), and probably *2455–2365 cal BC* (*68% probability*).



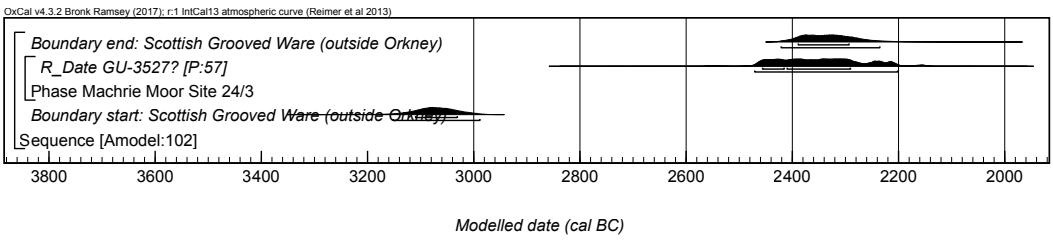
ILLUS S28 An Doirlinn

SITES WHERE ALL THE DATES HAVE BEEN EXCLUDED

MACHRIE MOOR SITE 24/3 (Barber 1997: 84–5 and Fig. 45)

Arran. Canmore ID: 275848

The single date from Site 24/3 on Machrie Moor has been excluded from the modelling as it is not reliably associated with the Grooved Ware from this site, which may well have been redeposited (Illus S29).

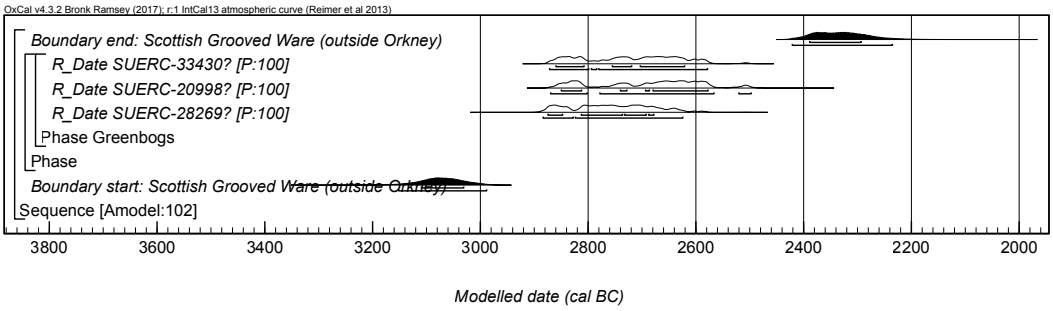


ILLUS S29 Machrie Moor Site 24/3

GREENBOGS (Noble et al 2012)

Aberdeenshire. Canmore ID: 107496. Ditch close to two timber circle

Although the three radiocarbon dates from Greenbogs fall squarely into the middle of the first half of the 3rd millennium cal BC, the results (Illus S30) have been excluded from the modelling as they are not reliably associated with the Grooved Ware from this site.

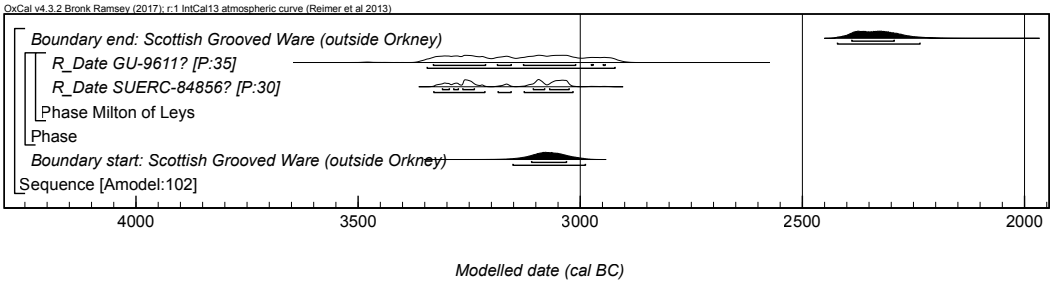


ILLUS S30 Greenbogs

MILTON OF LEYS (Conolly & MacSween 2003)

Inverness-shire. Canmore ID: 184929. Pit cluster

Both radiocarbon dates (GU-9611 and SUERC-84856: Illus S31) have been excluded as it is likely that the vessel in question (Vessel 1) is not actually Grooved Ware (see main article).

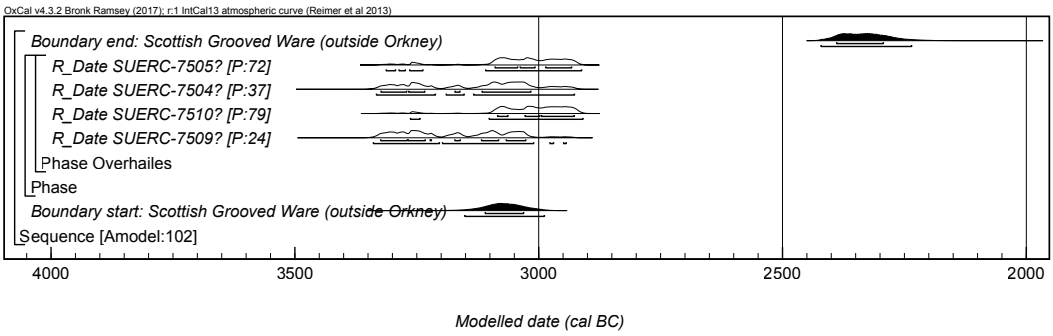


ILLUS S31 Milton of Leys

OVERHAILES (Sheridan 2006b; Lelong and MacGregor 2008)

East Lothian. Canmore ID: 249178. Pits and postholes

All four of the radiocarbon results available from Overhailes (Illus S32) have been excluded from modelling for this project as it is probable that the associated sherds are not from Grooved Ware vessels.

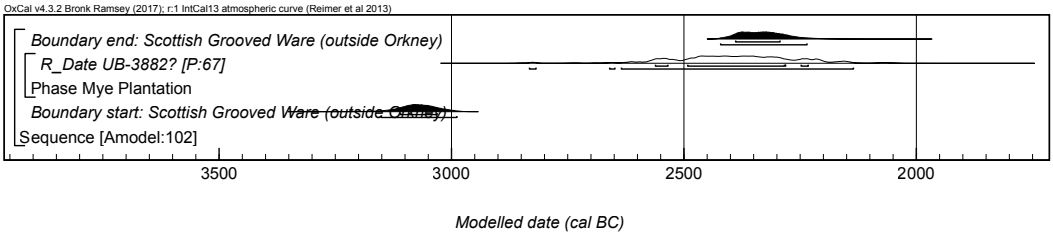


ILLUS S32 Overhailes

MYE PLANTATION (Mann 1903; Sheridan 2002)

Dumfries and Galloway. Canmore ID: 61303. Pitfall trap

The radiocarbon date (UB-882: Illus S33) from Mye Plantation Pit 3 has been excluded as it is not reliably associated with the single Grooved Ware sherd from this site.

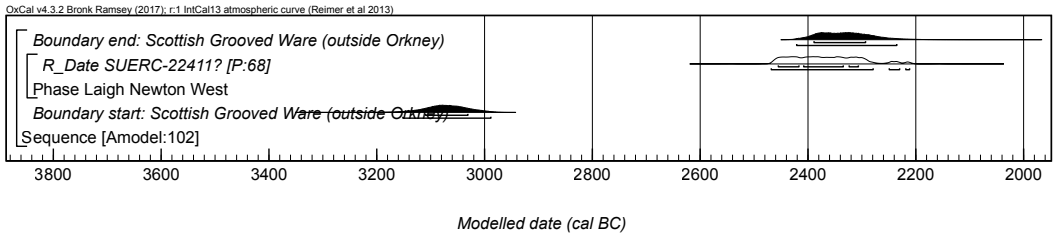


Illus S33 Mye Plantation

LAIGH NEWTON WEST (Toolis 2011)

Ayrshire. Canmore ID: 295646. Pit

A single date (SUERC-22411: Illus S34) was excluded as the associated Grooved Ware sherds are almost certainly redeposited.

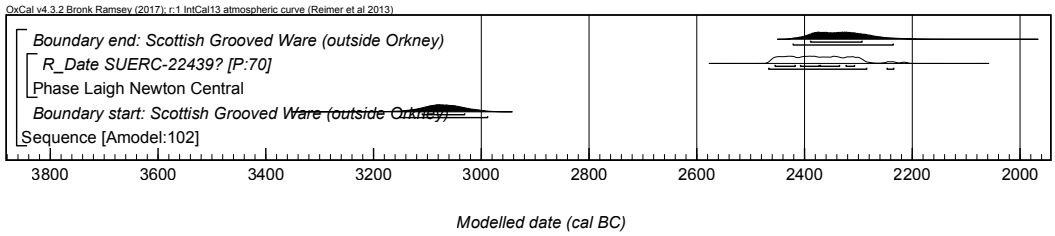


Illus S34 Laigh Newton West

LAIGH NEWTON CENTRAL (Toolis 2011)

Ayrshire. Canmore ID: 295646. Pits

A result (SUERC-22439) from Laigh Newton Central on birch charcoal has been excluded as the single unambiguous Grooved Ware sherd from the dated context is likely to be residual (Illus S35).

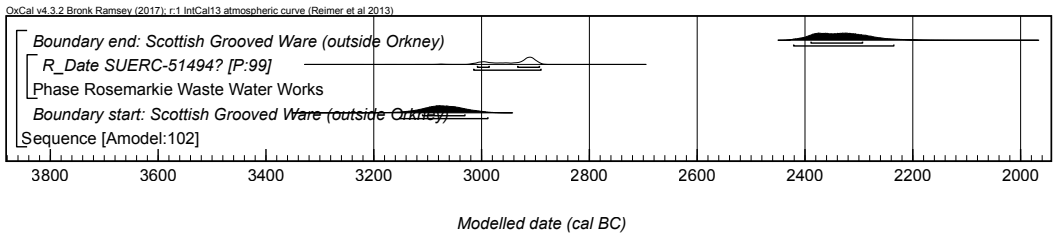


Illus S35 Laigh Newton Central

ROSEMARKIE WASTE WATER WORKS (Fraser 2014)

Ross-shire. Canmore ID: 346630. Pit

The single radiocarbon result (SUERC-51494) from Rosemarkie is excluded because the mixed nature of the pottery in the pit producing the date suggests that the dated material (alder charcoal) is likely to be residual. As such the date cannot be reliably associated with the Grooved Ware pottery (Illus S36).

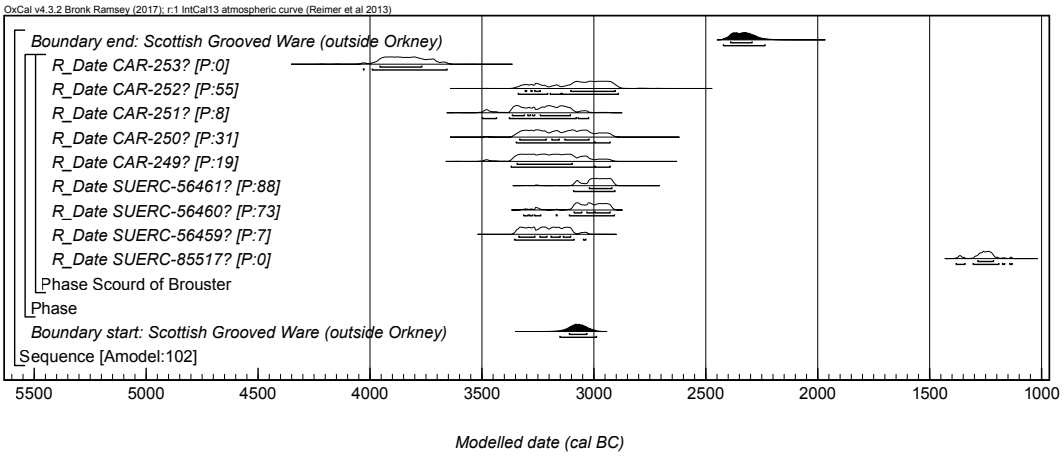


Illus S36 Rosemarkie Waste Water Works

SCORD OF BROUSTER (Whittle 1986)

Shetland. Canmore ID: 405. Settlement

There are nine dates from the Scord of Brouster (Illus S37). Five legacy dates from the Cardiff laboratory (CAR-249–53), which have been excluded because the associated pottery is not Grooved Ware. Three more recently acquired dates (SUERC-56459–61) are also excluded for the same reason. A final date was produced as part of this project (SUERC-85517), but as this falls within the latter half of the 2nd millennium cal BC it has been excluded from further analysis.

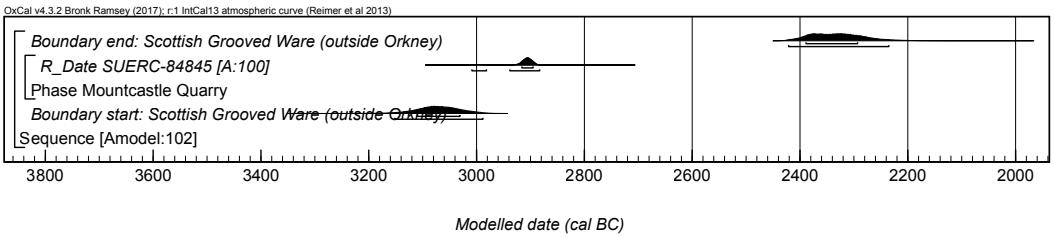


Illus S37 Scord of Brouster

MOUNTCASTLE QUARRY (Kimber 2008)

Fife. Canmore ID: 305245. Pit

The single result from Mountcastle Quarry (SUERC-84845: Illus S38) dates the use of Fengate Ware pottery at this site to 3010–2880 cal BC (95% probability). As the date is not associated with Grooved Ware it has been excluded from our models.



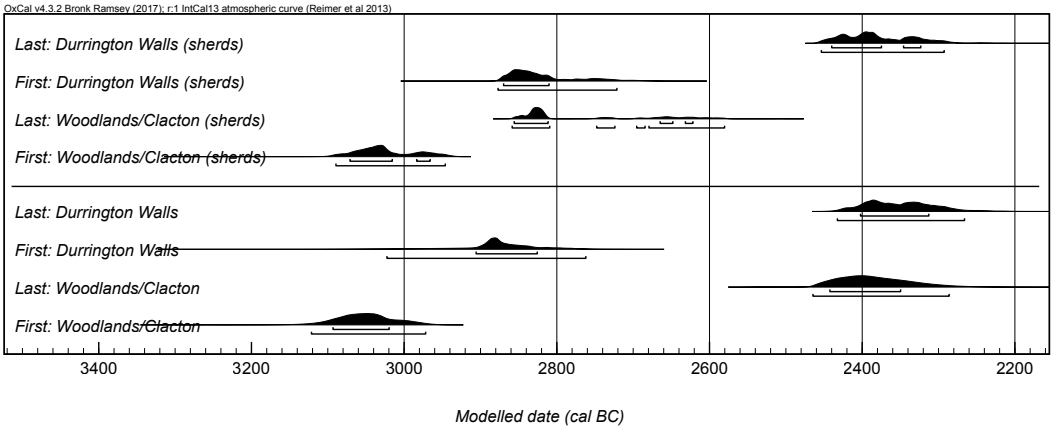
Illus S38 Mountcastle Quarry

FURTHER CHRONOLOGICAL MODELLING

Of interest is not only the overall dating of Grooved Ware pottery at the individual sites, which can be used to investigate the tempo and vector of cultural transmission, but the chronology of the different sub-styles. There is a notable number of sites with Durrington Walls and Woodlands style Grooved Ware, and two reliably radiocarbon-dated sites presenting Clacton style features: An Doirlinn and Pit F2 at Melbourne Farm Area 3, Biggar. The Clacton style sherds at Beckton Farm are indirectly dated, and both here and at Melbourne Farm, Woodlands style sherds are also present. The Clacton style has previously been considered to represent an earlier form of Woodlands Grooved Ware (Garwood 1999) but is proposed here to be a *later* development. However, as the two styles appear to be variants of a single, dynamic tradition they are grouped together here as the 'Woodlands/Clacton' sub-style.

The secondary modelling is actually a method whereby the data are queried to determine the earliest and latest probabilities in a group. There are two ways to approach this query. The first is to cross-reference the probabilities associated with the sites that contain only one sub-style of Grooved Ware, using either the dates from an unmodelled site or the start and end boundaries for modelled sites. Forest Road, Kintore, has a single date from Woodlands-style Grooved Ware (SUERC-84848: V282) with the remainder from—or associated with—Durrington Walls style vessels. In this one instance, the modelled probabilities have been cross-referenced into their respective groups for the query. There is an obvious potential drawback to this query method, and that is the fact that not every date is directly from a sherd of pottery, so post-depositional taphonomic processes (i.e. reworking) may have an effect, large or small, on the final results and interpretation. To examine this possibility, the second

method only cross-references the individual modelled or calibrated probability of a date from a carbonised residue on a specific pot sub-type. While this method is most likely to provide a more accurate assessment of the chronology of the use of the two sub-styles of Grooved Ware, the lower number of dates and the fact that not all will have been subjected to site-based chronological modelling can result in lower precision results (Steier and Rom 2000). The results of both methods are shown in Illus S39.



Illus S39 Secondary modelling of date ranges for Woodlands-Clacton and Durrington Walls Grooved Ware (below: Method 1; above Method 2)

When considering all of the dates on and associated with the two sub-styles (Method 1), the earliest date for Woodlands/Clacton style Grooved Ware in Scotland is in *3125–2970 cal BC* (*95% probability*; *First: Woodlands/Clacton*), and probably in *3095–3020 cal BC* (*68% probability*). The latest date for the use/(re)deposition of this sub-style is in *2465–2285 cal BC* (*95% probability*; *Last: Woodlands/Clacton*), and probably in *2445–2350 cal BC* (*68% probability*). This contrasts with the dating for the Durrington Walls style of Grooved Ware, which starts in *3025–2760 cal BC* (*95% probability*; *First: Durrington Walls*), and probably in *2910–2825 cal BC* (*68% probability*). This sub-style appears to have gone out of use in *2435–2265 cal BC*

(*95% probability*; *Last: Durrington Walls*), and probably in *2405–2310 cal BC* (*68% probability*).

Turning to Method 2, which queries only the results from carbonised food residues adhering directly to the sherds, the earliest date for Woodlands/Clacton style Grooved Ware in Scotland is in *3090–2945 cal BC* (*95% probability*; *First: Woodlands/Clacton (sherds)*), and probably either in *3075–3015 cal BC* (*58% probability*) or *2985–2965 cal BC* (*10% probability*). The latest date for the use of this sub-style is either in *2860–2810 cal BC* (*59% probability*; *Last: Woodlands/Clacton (sherds)*) or *2750–2720 cal BC* (*6% probability*) or *2700–2580 cal BC* (*30% probability*). The Durrington Walls sub-style of Grooved Ware starts in *2880–2720 cal BC* (*95% probability*; *First: Durrington Walls (sherds)*), and probably in *2870–2810 cal BC* (*68% probability*). This sub-style appears to have gone out of use in *2455–2290 cal BC* (*95% probability*; *Last: Durrington Walls*), and probably in either *2440–2375 cal BC* (*54% probability*) or *2350–2320 cal BC* (*14% probability*).

The first method that incorporates all of the potential dating suggests the Durrington Walls sub-style begins to be used in Scotland approximately 200 years after the appearance of the Woodlands/Clacton sub-style outside Orkney. However, the data would suggest that both types overlapped considerably in use and fell out of use at about the same time. This sharply contrasts with the second method that examines the direct dating of pottery sherds. The sherd-only method still has approximately two centuries of separation between the start of the Woodland/Clacton and Durrington Walls sub-styles, but either at around the same time or within a few hundred years, the Woodlands/Clacton sub-style falls out of use though the Durrington Walls style

continues in use until the end of the 25rd or beginning of the 24th century cal BC. The late date for Woodlands/Clacton-style Grooved Ware, following the first method, is driven by the end date for the dated activity at Beckton Farm and An Doirlinn, suggesting that later features with residual pottery may have been dated at both sites. However, at both of these sites the later dates are associated with what would conventionally be considered 'classic' Clacton-style sherds, which is not associated with early 3rd millennium BC dates, suggesting that this is a later form of Woodlands style Grooved Ware that extended its currency into the later 3rd millennium cal BC.

REFERENCES

Addyman, T 2004 'Station Brae, Dreghorn (Dreghorn parish), Neolithic settlement with a ?ritualistic component, medieval village', *Discovery and Excavation in Scotland* 5: 87-90.

Alexander, A 2016 'Neolithic pottery from Dunning, Perthshire', unpublished Masters dissertation: University of Glasgow.

Alexander, D & Armit, I 1992 'Excavations at Wellbrae (parcel 249), Strathclyde Region July-August 1991. NWEP2 Report No 16', unpublished excavation report. Centre for Field Archaeology, University of Edinburgh/UnivEd Technologies.

Armit, I, Cowie, T & Ralston I 1994 'Excavation of pits containing Grooved Ware at Hillend, Clydesdale District, Strathclyde Region', *Proceedings of the Society of Antiquaries of Scotland* 124: 113–27.

Ashmore, P 1999 'Radiocarbon dating: avoiding errors by avoiding mixed samples', *Antiquity* 73: 124-30.

Barber, J (ed) 1997 *The archaeological investigation of a prehistoric landscape: excavations on Arran 1978–81.* Edinburgh: Scottish Trust for Archaeological Research.

Barclay, G & Maxwell, G 1998 *The Cleaven Dyke and Littleour: monuments in the Neolithic of Tayside.* Edinburgh: Society of Antiquaries of Scotland.

Barclay, G & Russell-White, C 1993 'Excavations in the ceremonial complex of the fourth to second millennium at Balfarg/Balbirnie, Glenrothes, Fife', *Proceedings of the Society of Antiquaries of Scotland* 123: 43–210.

Bayliss, A 2015 'Quality in Bayesian chronological models in archaeology', *World Archaeology* 47: 677-700.

Bronk Ramsey, C 2009 'Bayesian analysis of radiocarbon dates', *Radiocarbon* 51: 337-60.

Bronk Ramsey, C, Higham, T & Leach, P 2004 'Towards high-precision AMS: progress and limitations', *Radiocarbon* 46: 17-24.

Buck, C E, Cavanagh, W G & Litton, C D 1996 *Bayesian approach to interpreting archaeological data.* Chichester: John Wiley and Sons.

Conolly, R & MacSween, A 2003 'A possible Neolithic settlement at Milton of Leys, Inverness', *Proceedings of the Society of Antiquaries of Scotland* 133: 35–45.

Cook, M 2000 'Excavation of Neolithic and Bronze Age settlement features at Lamb's Nursery, Dalkeith, Midlothian', *Proceedings of the Society of Antiquaries of Scotland* 130: 93-113.

Cook, M & Dunbar, L 2008 *Rituals, roundhouses and Romans: excavations at Kintore, Aberdeenshire 2000–2006.* Vol. 1. Edinburgh: Scottish Trust for Archaeological Research.

Copper, M, Sheridan, J A, Gibson, A, Tripney, B, Hamilton, D & Cook, G 2018 'Radiocarbon dates for Grooved Ware pottery from mainland Scotland arising from the project Tracing the Lines: Uncovering Grooved Ware Trajectories in Neolithic Scotland', *Discovery and Excavation in Scotland* 19: 214–7.

Copper, M, Sheridan, J A, Gibson, A, Tripney, B, Hamilton, D & Cook, G 2019', 'Further radiocarbon dates for Grooved Ware pottery from mainland Scotland arising from the project Tracing the Lines: Uncovering Grooved Ware Trajectories in Neolithic Scotland', *Discovery and Excavation in Scotland* 21: 232–4.

Dick, A M 2000 'Auchlishie (Kirriemuir parish): Neolithic activity; Iron Age settlement; souterrains', *Discovery and Excavation in Scotland (New Series)* 1: 12–13.

Dick, A M 2001 'Auchlishie (Kirriemuir parish) Neolithic activity; Iron Age settlement', *Discovery and Excavation in Scotland (New Series)* 2: 17.

Donahue, D J, Beck, J W, Biddulph, D L, Burr, G S, Courtney, C, Damon, P E, Hatheway, A L, Hewitt, L, Jull, A J, Lange, T E, Lifton, N, Maddock, R, McHargue, L R, O'Malley, J M & Toolin, L J 1997 'Status of the NSF-Arizona AMS laboratory', *Nuclear Instruments and Methods in Physics Research B* 123: 51-6.

Dresser, Q 1985 'University College Cardiff radiocarbon dates I', *Radiocarbon* 27 (2B): 383.

Dunbar, E, Cook, G, Naysmith, P, Tripney, B & Xu, S 2016 'AMS 14C dating at the Scottish Universities Environmental Research Centre (SUERC) Radiocarbon Dating Laboratory', *Radiocarbon* 58: 9-23.

Edwards, B 2012 'Social structures: pits and depositional practice in Neolithic Northumberland', *in* Anderson-Whymark, H & Thomas, J (eds) *Regional perspectives on Neolithic pit deposition: beyond the mundane, Neolithic Studies Group Seminar Papers 12,* 77-99. Oxford: Oxbow.

Fraser, L 2014 'Fortrose and Rosemarkie Waste Water Works, Rosemarkie Road, Rosemarkie, archaeological excavation: final report', unpublished excavation report: Ross and Cromarty Archaeological Services. https://her.highland.gov.uk/Source/SHG26699

Garrow, D & Sturt, F 2017 *Neolithic Stepping Stones: excavation and survey within the western seaways of Britain, 2008–2014.* Oxford: Oxbow.

Garwood, P 1999 'Grooved Ware in southern Britain: chronology and interpretation', *in* Cleal, R and Macsween, A (eds) *Grooved Ware in Britain and Ireland: Neolithic Studies Group Seminar Papers 3,* 145–76. Oxford: Oxbow.

Gibson, A 2010 'Dating Balbirnie: recent radiocarbon dates from the stone circle and cairn at Balbirnie, Fife, and a review of its place in the overall Balfarg/Balbirnie site sequence', *Proceedings of the Society of Antiquaries of Scotland* 140: 51–77.

Gray, H 2010 'A92 upgrading: Dundee to Arbroath, Angus', unpublished client report: CFA Archaeology, post-excavation archive report 1718.

Haggarty, A 1991 'Machrie Moor, Arran: recent excavations at two stone circles', *Proceedings of the Society of Antiquaries of Scotland* 121: 51–94.

Hamilton, W D & Kenney, J 2015 'Multiple Bayesian modelling approaches to a suite of radiocarbon dates from ovens excavated at Ysgol yr Hendre, Caernarfon, North Wales', *Quaternary Geochronology* 25: 72-82.

Hamilton, W D & Krus, A M 2018 'The myths and realities of Bayesian chronological modeling revealed', *American Antiquity* 83: 187-203.

Hawthorne, D, Roy, M & Streatfeild-James, J 2016 'Crab apple processing: the contents of an isolated Neolithic pit at Courthill Farm, Inverkeilor, Angus', *Tayside and Fife Archaeological Journal* 21–22: 7–14.

Hedges, R, Law, I, Bronk, C & Housley, R 1989 'The Oxford Accelerator Mass Spectrometry facility: technical developments in routine dating', *Archaeometry* 31: 99-113.

Kimber, M 2008 'Mountcastle Quarry, Letham, Fife: results of an archaeologically monitored topsoil strip', unpublished client report: Headland Archaeology Ltd. https://doi.org/10.5284/1019096

Lelong, O & MacGregor, G 2008 *The lands of ancient Lothian: interpreting the archaeology of the A1.* Edinburgh: Society of Antiquaries of Scotland.

Lochrie, J 2010 'Midmill, Kintore, Aberdeenshire: prehistoric pottery report', unpublished report for Murray Archaeological Services. Edinburgh: Headland Archaeology.

Mann, L M 1903 'Report of the excavation of prehistoric pile-structures in pits in Wigtownshire', *Proceedings of the Society of Antiquaries of Scotland* 37: 370–415.

Mercer, R, Wickham-Jones, C, Henshall, A, Whittington, G, Harman, M, Lunt, D, Brock, J, Williams, D, Dickson, C, Stenhouse, M, Pare, C & Nebelsick, L 1981 'The excavation of a Late Neolithic Henge-type enclosure at Balfarg, Markinch, Fife, Scotland, 1977–78', *Proceedings of the Society of Antiquaries of Scotland* 111: 63–171.

Murray, H & Murray, J 2013a 'Midmill Industrial Estate, Kintore, Aberdeenshire: archaeological evaluations and excavations carried out 2007–2012 by Murray Archaeological Services Ltd. Report number MAS 2013–10 Part 1', unpublished excavation report: Murray Archaeological Services. https://archaeologydataservice.ac.uk/library/browse/issue.xhtml?recordId=1156374&recordType=GreyLitSeries

Murray, H & Murray, J 2013b 'Midmill Industrial Estate, Kintore, Aberdeenshire: archaeological evaluations and excavations carried out 2007–2012 by Murray Archaeological Services Ltd. Report number MAS 2013–10 Part 2: tables and appendices', unpublished excavation report: Murray Archaeological Services. https://archaeologydataservice.ac.uk/library/browse/issue.xhtml?recordId=1156374&recordType=GreyLitSeries

Murray, H & Murray, J 2013c 'Site west of International Paper, Port Elphinstone, Inverurie, Aberdeenshire. Report Number MAS 2012–15', unpublished excavation report: Murray Archaeological Services. http://archaeologydataservice.ac.uk/archives/view/greylit/details.cfm?id=23291

Murray, R 2008 'Data structure report of an archaeological excavation at Culduthel Farm Phases 7 and 8', unpublished report for Tulloch Homes Ltd: Headland Archaeology.

Noakes, J, Kim, S & Stipp, J 1965 'Chemical and counting advances in Liquid Scintillation Age dating', *in* Olsson, E & Chatter, R (eds) *Proceedings of the Sixth International Conference on Radiocarbon and Tritium Dating,* 68-92. Pullman: Washington Sate University Press.

Noble, G, Greig, M, Millican, K, Anderson, S, Clarke, A, Johnson, M, McLaren, D & Sheridan, J A 2012 'Excavations at a multi-period site at Greenbogs, Aberdeenshire, Scotland and the four-post timber architecture tradition of Late Neolithic Britain and Ireland', *Proceedings of the Prehistoric Society* 78: 135–71.

Peteranna, M 2011 'South West Inverness Flood Relief Channel Phase 3: archaeological watching brief and excavation', unpublished client report for Global Construction Ltd: Ross and Cromarty Archaeological Services. https://doi.org/10.5284/1018561

Pollard, T 1997 'Excavation of a Neolithic settlement and ritual complex at Beckton Farm, Lockerbie, Dumfries and Galloway', *Proceedings of the Society of Antiquaries of Scotland* 127: 69–121.

Reimer, P J, Bard, E, Bayliss, A, Beck, J W, Blackwell, P G, Bronk Ramsey, C, Buck, C E, Cheng, H, Edwards, R L, Freidrich, M, Grootes, P M, Guilderson, T P, Haflidason, H, Hajdas, I, Hatté, C, Heaton, T J, Hoffman, D L, Hogg, A G, Hughen, K A, Kaiser, K F, Kromer, B, Manning, S W, Niu, M, Reimer, R W, Richards, D A, Scott, E M, Southon, J R, Staff, R A, Turney, C S & Van Der Plicht, J 2013 'IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP', *Radiocarbon* 55 (4): 1869-87.

Ritchie, J N G 1974 'Excavation of the stone circle and cairn at Balbirnie, Fife', *The Archaeological Journal* 131: 1–32.

Robertson, A 2009 'Data structure report of an archaeological watching brief at Powmyre sand and gravel quarry, Glamis, Angus: Phase 2 works', unpublished client report: Headland Archaeology. https://doi.org/10.5284/1009687

Sheridan, J A 2002 'The radiocarbon dating programmes of The National Museums of Scotland', *Antiquity* 76: 794–6.

Sheridan, J A 2006a '*Grooved Ware from Eweford Area 5, Lower Hollows and beyond',* unpublished archive report associated with Lelong and MacGregor 2008 *The lands of ancient Lothian: interpreting the archaeology of the A1.* Edinburgh: Society of Antiquaries of Scotland.

Sheridan, J A (2006b) *The pottery from Overhailes.* Unpublished report associated with Lelong and MacGregor 2008 *The lands of ancient Lothian: interpreting the archaeology of the A1.* Edinburgh: Society of Antiquaries of Scotland.

Sheridan, J.A. 2008 'The pottery from Area 2, Eweford', unpublished archive report to accompany Lelong, O & Macgregor, G (eds) *The lands of ancient Lothian: interpreting the archaeology of the A1,* 69–98. Edinburgh: Society of Antiquaries of Scotland.

Sheridan, J A 2010 'Pottery report: Culduthel Farm, Phases 7 and 8 (CSE06)', unpublished specialist report for Headland Archaeology.

Sheridan, J A 2011 'Pottery from Culduthel (South-West Inverness Flood Relief Channel Phase 3, IFR10)', unpublished specialist report for Ross and Cromarty Archaeological Services.

Simpson, D 1996 'Excavation of a kerbed funerary monument at Stoneyfield, Raigmore, Inverness, Highland, 1972–3', *Proceedings of the Society of Antiquaries of Scotland* 126: 53–86.

Slota, P, Jull, A J T, Linick, T & Toolin, L J 1987 'Preparation of small samples for 14C accelerator targets by catalytic reduction of CO', *Radiocarbon* 29: 303-6.

Steier, P & Rom, W 2000 'The use of Bayesian statistics for 14C dates of chronologically ordered samples: a critical analysis', *Radiocarbon* 42: 183-98.

Stenhouse, M J & Baxter, M 1983 '14C reproducibility: evidence from routine dating of archaeological samples', *PACT* 8: 147-61.

Thomas, J 2015 '*A Neolithic ceremonial complex in Galloway: excavations at Dunragit and Droughduil, 1999–2002',* Oxford: Oxbow.

Toolis, R 2011 *Neolithic domesticity and other prehistoric anomalies: excavations at Laigh Newton, East Ayrshire. Scottish Archaeological Internet Reports 49.* Edinburgh: Society of Antiquaries of Scotland/Historic Scotland. https://archaeologydataservice.ac.uk/archives/view/sair/volumes.cfm

Ward, T 2013 *Pre-History North of Biggar Project. Excavations at Melbourne Farm 1996.* Biggar: Biggar Archaeology Group. http://biggararchaeology.org.uk/pdf_reports/BAG_MELBOURNE.pdf

Whittle, A (ed) 1986 *Scord of Brouster: an early agricultural settlement on Shetland.* Oxford: Oxford University Committee for Archaeology, Monograph 9.

Wright, D n.d. 'Wellhill 2014', unpublished data structure report: Strathearn Environs Royal Forteviot Project. http://www.gla.ac.uk/media/Media_386736_smxx.pdf

TABLE S1 RADIOCARBON DATES

All dates calibrated using OxCal 4.3.

Site	Lab ID	Context ID	Context description	Material	Calibrated 1-sigma	Calibrated 2-sigma	$\delta^{13}C$ (‰)	^{14}C Age (BP)
Greenbogs	SUERC-33430	A26	Fill of posthole from outer ring of four-post Structure A	Alder charcoal	2867–2581 cal BC	2858–2626 cal BC	–23.6	4125±30
	SUERC-20998	A4	Fill of posthole within the central setting of four-post Structure A	Alder charcoal	2871–2497 cal BC	2851–2578 cal BC	–27.3	4100±40
	SUERC-28269	B4	Fill of posthole of the four-post setting within Structure B	Alder charcoal	2885–2625 cal BC	2875–2679 cal BC	–24.1	4165±40
Balfarg Riding School	SUERC-82535	F8133	Fill of pit to southeast of Structure 1	Organic residue from Vessel P60b	3090–2909	3013–2926	–27.4	4373±30
	GU-1905	7023B	Upper fill of posthole in interior of Structure 2 (probably redeposited from overlying layer)	Alder charcoal	3086–2696	3011–2874	–26.5	4285±55
	GU-1906	7044B	Upper fill of post pipe of boundary post of Structure 2 (probably redeposited from overlying layer)	Oak and alder charcoal	2897–2503	2875–2636	–27.3	4115±70
	GU-1907	7041B	Upper fill of posthole (probably redeposited from overlying layer)	Oak and alder charcoal	3338–2696	3092–2881	–24.7	4330±85

Balfarg Riding School (cont.)	GU-1670	013/012	Charcoal-rich layer in enclosure ditch	Hazel charcoal	3335–2917	3309–2929	–26.5	4425±50
	GU-1904	013/102	Middle fill of enclosure ditch	Mixed species charcoal	3327–2896	3089–2917	–26.7	4385±55
	GU-1902	1002	Fill of pit	Mixed species charcoal	3090–2580	3007–2674	–26.7	4250±85
Balfarg Henge (timber circle)	SUERC-82534	Un-specified	Uncertain: sherds from Vessel P8 were shared between Area U2 and various features in the timber circle	Organic residue from Vessel P8	2882–2636	2876–2696	–27.3	4170±30
	GU-1160	A13 (base)	Fill of posthole	Alder charcoal	2896–2621	2882–2679	–25.5	4180±50
	GU-1161	A11 (backfill)	Fill of posthole	Alder charcoal	2855–2465	2620–2480	–25.8	4035±50
	GU-1162	A11 (backfill)	Fill of posthole	Oak charcoal	3084–2669	3009–2708	–24.3	4270±60
	GU-1163	A11 (base)	Fill of posthole	Oak charcoal	3264–2706	3012–2889	–24.8	4315±60
Forest Road, Kintore	SUERC-84852	7014	Fill of Pit 53	Organic residue from Vessel V190	2855–2573	2834–2580	–27.3	4093±22
	SUERC-1396	11563	Primary fill of Pit P46	Birch charcoal	2907–2671	2895–2705	–27.1	4215±40
	SUERC-1397	11563	Primary fill of Pit P46	Hazel charcoal	3007–2674	2914–2763	–26.4	4250±45
	SUERC-1382	11354	Secondary fill of Pit 52	Alder charcoal	3325–2907	3086–2928	–25.6	4400±45
	SUERC-84848	11355	Primary fill of Pit 52	Organic residue from Vessel 282	2871–2586	2859–2633	–26.9	4131±24

Forest Road Kintore (cont.)	SUERC-1326	7013	Secondary fill of Pit 53, a putative cremation deposit	Bone or hazel charcoal (the excavation report and Scottish Radiocarbon Dating Index disagree)	2878–2589	2867–2637	–28.5	4145±40
	AA-53176	7462	Bedding slot of ring-groove house 27 (RH27)	Willow charcoal	3079–2761	3008–2877	–25.6	4290±45
Midmill, Kintore	SUERC-84847	Pit 28/1	Fill of shallow pit	Organic residue from Vessel 109	2457–2206	2400–2211	–28.4	3848±24
	SUERC-22020	7/5	Fill of pit	Human bone	2907–2697	2897–2764	–25	4225±30
Powmyre Quarry, Glamis	SUERC-84857	305	Fill of Pit 306	Organic residue from Vessel L	2569–2464	2559–2470	–27.3	3977±22
	SUERC-84858	305	Fill of Pit 306	Organic residue from Vessel P	2570–2351	2559–2464	–27	3964±24
	SUERC-85814	305	Fill of Pit 306	Organic residue from Vessel G	2570–2346	2565–2356	–27.2	3955±30
	SUERC-85815	305	Fill of Pit 306	Organic residue from Vessel H	2577–2468	2566–2476	–27	3999±30
Station Brae, Dreghorn	SUERC-84070	581	Fill of posthole	Organic residue from Vessel SF747	3093–2927	3089–2935	–27.6	4404±22
	SUERC-84074	1591	Fill of posthole	Organic residue from vessel SF1382	2573–2471	2565–2478	–27.4	3999±24
Meadows Wood, Nether Kelly	SUERC-24924	41/5	Secondary or tertiary fill of Pit 41	Alder charcoal	2860–2499	2836–2577	–26	4090±30

Meadows Wood, Nether Kelly (cont.)	SUERC-24925	41/5	Secondary or tertiary fill of Pit 41	Hazel charcoal	2866–2579	2856–2624	–27.7	4120±30
Courthill Farm, Inverkeilor	SUERC-41337	N/A	Fill of rapidly backfilled isolated pit	Crab apple seed	3001–2706	2909–2879	–24.4	4265±35
Beckton Farm	GU-3533	F149	Lower fill of pit 150	Hazel, oak and *pomoideae* charcoal	3324–2883	3038–2905	–25.4	4360±60
	GU-3534	F005	Central fill of pit 80	Hazel, *pomoideae* and unidentified charcoal	2924–2620	2905–2696	–25.7	4220±60
	GU-3535	F197	Upper fill of 'Fire pit' 194	Hazel, bird cherry and oak charcoal	2828–2235	2572–2348	–25.7	3960±60
	GU-3538	F052	Upper fill of 'Fire pit' 090	Hazel, oak and bird cherry charcoal	2890–2350	2856–2489	–25.9	4070±90
	AA-12587	F069	Single fill of pit 159	Hazel, *pomoideae* and unidentified charcoal	2911–2478	2877–2627	–27.3	4250±95
Dunragit	SUERC-84853	685	Fill of recut of posthole 792	Organic residue from vessel FG7 V1	2836–2495	2828–2504	–27.4	4068±22
	SUERC-84854	030	Upper fill of 'miscellaneous feature' 032	Organic residue from vessel FG1 V1	2847–2492	2831–2503	–28.4	4070±24

Dunragit (cont.)	SUERC-84855	003	Upper fill of posthole 084	Organic residue from vessel FG3 V1	2865–2581	2855–2629	–28.8	4123±24
	SUERC-2104	048	Secondary fill of pit 050	Hazel charcoal	2865–2493	2838–2506	–26.3	4080±35
	SUERC-2106	004	Uppermost fill of pit 050	Hazel charcoal	2848–2474	2831–2492	–24.8	4055±55
	SUERC-2107	049	Primary fill of pit 050	Hazel nutshell	2878–2623	2869–2668	–29.3	4150±35
	SUERC-2108	244	Primary fill of posthole 063	Hazel charcoal	2831–2468	2577–2489	–25.3	4025±35
	SUERC-2109	048	Secondary fill of pit 050	Oak charcoal	2890–2625	2879–2680	–27.3	4175±45
	SUERC-36378	2025	Cremation burial within grave cut 2042	Cremated bone	2867–2518	2858–2626	–24.4	4125±30
Hallhole Farm, Meikleour	SUERC-74467	1604	Middle fill of pit/large posthole 16	Hazel nutshell	2575–2469	2565–2476	–22.6	3997±29
	SUERC-74469	6501	Upper fill of posthole 65	Hazel nutshell	2877–2635	2870–2678	–25.5	4157±25
Balbirnie	SUERC-24166	Stonehole 10	Cremation VIII below Stone 10	Human bone (radius)	3264–2917	3089–2935	–26.9	4405±30
	SUERC-24152	Beneath Stone 1	Individual 1, Cremation III	Human bone (adult cranium)	3088–2899	3011–2914	–26.8	4355±35
	SUERC-24156	Beneath Stone 1	Individual 2, Cremation III	Human bone (adult cranium)	3089–2907	3012–2924	–25.9	4370±30
	SUERC-24168	Stonehole 7	Cremation V	Human bone (femur or tibia)	3080–2898	3011–2908	–19.7	4345±30
	SUERC-24169	?Beneath Stone 2	Cremation IV	Human bone (fibula or distal ulna)	2127–1905	2030–1948	–25.1	3630±30

Balbirnie (cont.)	SUERC-24170	Filling of Stonehole 9	Femur or tibia, Cremation VI	Human bone	3019–2894	3010–2899	–20.7	4330±30
Mountcastle Quarry	SUERC-84845	004	Fill of shallow pit 005	Organic residue from Vessel 1b	3010–2883	2916–2896	–28.1	4304±24
Machrie Moor Site 24/3	GU-3527	30	Lower fill of pit 19	Mixed hazel and alder charcoal	2472–2202	2457–2291	–28.1	3870±50
Machrie Moor Site 1	SUERC-82531	Uncertain, but either 235 or 1279	Sherds from vessel 24b came from two adjacent postholes of the inner post circle, the context producing the dated sherd is uncertain	Organic residue from vessel 24b	3331–2936	3314–3020	–26.7	4443±30
	SUERC-84076	Soil overlying F235 and F1279	Soil overlying two postholes of the inner post circle	Organic residue from vessel 20c	3263–2925	3094–2944	–29.3	4414±26
	GU-2316	F1271	Posthole of main post ring	Mixed oak, hazel and alder charcoal	3354–2943	3331–3031	–26	4470±50
	GU-2325	1280	Posthole of main post ring	Oak charcoal	2925–1963	2857–2212	–26.1	2030±180
Milton of Leys	SUERC-84856	36	Pit 21	Organic residue from Vessel 1	3331–3016	3311–3026	–28.2	4448±24
	GU-9611	36	Fill of Pit 21	Hazel nutshell	3346–2922	3332–3012	–24.3	4445±75
Stoneyfield, Raigmore	SUERC-77846	Pit 20	Fill of pit	Bone (unidentified species)	3090–2907	3016–2923	–28.5	4271±33
	SUERC-77845	Pit 50	Fill of pit	Human bone	1053–895	1002–926	–22.1	2813±31
	SRR-425	Pit 49	Fill of pit	Charcoal (unidentified species)	2877–2490	2861–2505	–24.8	4099±70

Stoneyfield, Raigmore (cont.)	SRR-426	Pit 41	Fill of pit	Pine charcoal	3898–3526	3761–3636	–26.1	4890±60
	SRR-429	Pit 21	Fill of pit	Charcoal (unidentified species)	2565–2201	2465–2299	–26.1	3894±60
Lamb's Nursery	SUERC-84846	236	Fill of isolated pit	Organic residue from sherd 236	2835–2491	2622–2501	–28	4060±22
	AA-32604	186	Possible stake hole slot forming part of Structure A	Oak charcoal	2877–2577	2864–2622	–23.9	4130±50
	GU-8105	92	Lower fill of Pit 90	Mixed oak, hazel and alder charcoal	2898–2310	2859–2481	–25.9	4070±110
Inverurie Paper Mills, Port Elphinstone	SUERC-42980	49/5	Base of Pit 49	Charred wheat and barley grains	3011–2878	2916–2891	–24.5	4296±29
Culduthel Mains	SUERC-20308	811	Lower fill of cremation pit 808	Cremated human bone	2904–2678	2893–2712	–27.2	4215±35
Inverness South West Flood Relief Channel	SUERC-34575	Pit 23	Pit fill	Birch and hazel charcoal	3021–2895	3011–2902	–25.8	4335±30
	SUERC-34576	Pit 20	Pit fill	Birch and hazel charcoal	3087–2906	3011–2921	–24.5	4365±30
Melbourne Farm, Biggar, Area 3	SUERC-82536	F15	Pit fill	Organic residue from pot SF372	2880–2632	2873–2681	–28.2	4162±30
	AA-36878	F2	Lower northern part of fill of pit F2	Hazel charcoal	2885–2620	2872–2678	–26.5	4160±45
	AA-36879	F19	Eastern part of fill of pit F19	Hazel charcoal	2836–2353	2573–2476	–25.3	4010±45
Melbourne Farm, Biggar, Area 2	SUERC-84075	F1	Single fill of pit	Organic residue from pot SF341	2574–2476	2568–2489	–26.7	4011±22

Melbourne Farm, Biggar Area 2 (cont.)	AA-36876	F1	Single fill of pit	Hazel charcoal	2620–2209	2566–2344	–25.3	3945±65
	AA-36877	F5	Single fill of pit	Hazel charcoal	2622–2345	2571–2466	–22.2	3985±45
Eweford East	SUERC-5340	1114	Fill of posthole 1115	Willow charcoal	2875–2610	2864–2634	–25.8	4140±35
	SUERC-5344	1166	Fill of posthole 1167	Hazel charcoal	2469–2212	2456–2307	–25	3880±35
	SUERC-5345	1166	Fill of posthole 1167	Willow charcoal	2474–2211	2461–2310	–23.6	3890±40
Eweford West	SUERC-5294	103	Fill of pit 101	Hazel nutshell	3013–2759	2921–2876	–25	4274±40
Overhailes	SUERC-7504	246	Fill of pit 247	Hazel charcoal	3335–2927	3323–3017	–25.7	4440±40
	SUERC-7505	246	Fill of pit 247	Hazel nutshell	3314–2912	3090–2933	–23.7	4405±35
	SUERC-7509	017	Fill of pit 024	Hazel charcoal	3340–2945	3323–3027	–25.2	4455±35
	SUERC-7510	017	Fill of pit 024	Apple/pear charcoal from southern pit	3264–2911	3085–2928	–26.2	4395±35
Littleour	SUERC-77487	L23	Single fill of pit L23	Organic residue from Pot 1	2872–2631	2864–2666	–27.5	4144±24
	SUERC-77488	L23	Single fill of pit L23	Organic residue from Pot 2	2477–2309	2471–2349	–26.7	3923±24
	SUERC-77492	L23	Single fill of pit L23	Organic residue from Pot 5	2574–2474	2569–2486	–28.6	4008±24
	SUERC-77493	L23	Single fill of pit L23	Organic residue from Pot6	2850–2497	2832–2575	–27.5	4079±23
	OxA-8992	L23	Single fill of pit L23	Organic residue from Pot 3	2877–2497	2858–2580	–27.861	4110±55

Littleour (cont.)	OxA-8993	L23	Single fill of pit L23	Organic residue from Pot 6	2549–2044	2455–2205	–26.585	3845±75
	OxA-8994	L23	Single fill of pit L23	Organic residue from Pots 2 (SF28) and 8c (SF10)	2489–2153	2459–2296	–26.05	3880±55
	AA-22906	L23	Single fill of pit L23	Birch charcoal	2335–1983	2275–2044	–26.3	3750±50
Wellbrae	SUERC-82532	077	Lower fill of pit 077	Organic residue from Vessel 34	2834–2475	2620–2493	–27	4046±30
	SUERC-82533	077	Lower fill of pit 077	Organic residue from Vessel 36	2834–2475	2620–2492	–27.3	4045±30
Hillend	SUERC-82540	Uncertain, but sherds from dated vessel found in Pits 1, 2 and 3	Pit fill	Organic residue from Vessel 5	2859–2496	2836–2574	–25	4084±30
	SUERC-82541	Uncertain, but sherds from dated vessel found in Pits 1, 2 and 3	Pit fill	Organic residue from Vessel 2	2834–2476	2620–2494	–27.5	4048±30
	Beta-73955	012	Lower fill of Pit 1	Unidentified charred organic material	3337–2905	3311–2917	–25	4410±70
Wellhill	SUERC-66247	F0016	Single fill of Pit 16	Birch roundwood charcoal	2903–2695	2892–2762	–26.8	4216±29
	SUERC-66248	F0016	Single fill of Pit 16	Hazel roundwood charcoal	2909–2704	2901–2779	–25.3	4234±29

Wellhill (cont.)	SUERC-66261	F0016	Single fill of Pit 16	Organic residue from Grooved Ware pot	2880–2633	2873–2681	–27.3	4162±29
	SUERC-66496	F0016	Single fill of Pit 16	Organic residue from Grooved Ware pot	2883–2638	2877–2697	–27.4	4172±29
	SUERC-66495	F0016	Single fill of Pit 16	Organic residue from Grooved Ware pot	2898–2679	2888–2713	–28.6	4206±29
An Doirlinn	OxA-28908	44	Hearth F10	Heather twig charcoal	2471–2301	2466–2348	–27.6	3908±26
	OxA-28909	37	Hearth F8	Alder roundwood charcooal	2864–2576	2850–2586	–25.9	4110±27
	OxA-28910	37	Hearth F8	Alder roundwood charcoal	2873–2625	2864–2636	–26	4141±27
	OxA-29160	39	Hearth F9	Alder charcoal	2849–2487	2831–2498	–25.2	4063±30
Mye Plantation	UB-3882	The ‘north end’ of Pit 3	Fill of Pit (‘Site’) 3	Alder charcoal	2558–2286	2469–2346	–28.14	3913±89
Laigh Newton West	SUERC-22411	258	Fill of Pit 250	Hazel charcoal	2469–2212	2456–2307	–28.1	3880±35
Laigh Newton Central	SUERC-22439	263	Fill of Pit 229	Birch charcoal	2467–2236	2455–2308	–25.1	3880±30
Rosemarkie Waste Water Works	SUERC-51494	F37	Pit containing Grooved Ware and a possible Early Bronze Age vessel	Alder charcoal	3015–2890	3009–2893	–25.3	4320±31

Scord of Brouster	SUERC-85517	2	Layer 2, north wall of House 2, Phase 2	Carbonised organic residue on sherd 297 from House 2	1383–1132	1286–1215	–26.2	3013±24
	SUERC-56459	L3	Dark soil layer pre-dating construction of House 2	Calcined mammal bone	3355–3036	3336–3105	–27.7	4499±38
	SUERC-56460	L3	Dark soil layer pre-dating construction of House 2	Calcined mammal bone	3316–2909	3089–2929	–28.4	4400±38
	SUERC-56461	L3	Dark soil layer pre-dating construction of House 2	Calcined mammal bone	3092–2906	3020–2920	–31.2	4372±38
	CAR-249	3f (lens within L3)	Base of layer beneath wall on northwest side of House 2, Phase 1 (pre-house occupation)	Birch and hazel charcoal	3370–2928	3343–3097	–25.2	4495±75
	CAR-250	3f (lens within L3)	From layer beneath wall, above Sample SB11, House 2, Phase 1	Birch and hazel charcoal	3348–2928	3332–3022	–25.7	4455±70
	CAR-251	3d (lens within L3)	From concentration in Layer 3d in interior of House 2, Phase 1	Birch and hazel charcoal with some barley	3499–3025	3364–3106	–24.6	4540±64

Scord of Brouster (cont.)	CAR-252	Wall matrix	From within wall on northwest side of House 2, Phase 2 (construction of house)	Heather charcoal with grass stems and cereal grains	3339–2891	3308–2905	–25.6	4390±80
	CAR-253	L2, House 2, interior	From Layer 2 within House 2, Phase 2 (use of house)	Birch and hazel charcoal	3990–3656	3956–3769	–26.3	5050±85

Illus S40 Extracted Element

```
Plot()
 {
  Sequence()
  {
   Boundary("start: Scottish Grooved Ware (outside Orkney)");
   Phase()
   {
    Sequence()
    {
     Boundary("start: Littleour");
     Phase("Littleour")
     {
      R_Date("SUERC-77487", 4144, 24);
      R_Date("SUERC-77488", 3923, 24);
      R_Date("SUERC-77492", 4008, 24);
      R_Date("SUERC-77493", 4079, 23);
      R_Date("OxA-8992", 4110, 55);
      R_Date("OxA-8993", 3845, 75);
      R_Date("AA-22906", 3750, 50)
      {
       Outlier();
      };
      R_Date("OxA-8994", 3880, 55)
      {
       Outlier();
      };
     };
     Boundary("end: Littleour");
    };
    Sequence()
    {
     Boundary("start: Raigmore");
     Phase("Raigmore")
     {
      R_Date("SUERC-77845", 2813, 31)
      {
       Outlier();
      };
      R_Date("SUERC-77846", 4371, 33);
      R_Date("SRR-429", 3894, 60)
      {
       Outlier();
      };
      After()
      {
       R_Date("SRR-426", 4890, 60);
      };
      After()
      {
       R_Date("SRR-425", 4099, 70);
      };
```

```
 };
 Boundary("end: Raigmore");
};
Phase("Wellbrae")
{
 R_Date("SUERC-82532", 4046, 30);
 R_Date("SUERC-82533", 4045, 30);
};
Phase("Dreghorn")
{
 R_Date("SUERC-84070", 4404, 22);
 R_Date("SUERC-84074", 3999, 24);
};
Sequence()
{
 Boundary("start: Powmyre Quarry");
 Phase("Powmyre Quarry")
 {
  R_Date("SUERC-85814", 3955, 30);
  R_Date("SUERC-85815", 3999, 30);
  R_Date("SUERC-84857", 3977, 22);
  R_Date("SUERC-84858", 3964, 24);
 };
 Boundary("end: Powmyre Quarry");
};
Phase("Greenbogs")
{
 R_Date("SUERC-28269", 4165, 40)
 {
  Outlier();
 };
 R_Date("SUERC-20998", 4100, 40)
 {
  Outlier();
 };
 R_Date("SUERC-33430", 4125, 40)
 {
  Outlier();
 };
};
Phase("Auchlishie")
{
 R_Date("AA-45406", 3885, 50);
 R_Date("AA-45407", 3820, 55);
};
Sequence()
{
 Boundary("start: Balfarg Riding School");
 Phase("Balfarg Riding School")
 {
  R_Date("SUERC-82535", 4373, 30);
```

```
 After()
 {
  R_Date("GU-1905", 4285, 55);
 };
 After()
 {
  R_Date("GU-1906", 4155, 70);
 };
 After()
 {
  R_Date("GU-1907", 4330, 85);
 };
 R_Date("GU-1670", 4425, 50);
 R_Date("GU-1904", 4385, 85);
 R_Date("GU-1902”, 4250, 85);
};
Boundary("end: Balfarg Riding School");
};
Sequence()
{
 Boundary("start: Balfarg Timber Circle");
 Phase("Balfarg Timber Circle")
 {
  R_Date("SUERC-82534", 4170, 30);
  R_Date("GU-1160", 4180, 50);
  R_Date("GU-1161", 4035, 50);
  After()
  {
   R_Date("GU-1163", 4315, 60);
  };
  After()
  {
   R_Date("GU-1162", 4270, 60);
  };
 };
 Boundary("end: Balfarg Timber Circle");
};
Sequence()
{
 Boundary("start: Forest Road, Kintore");
 Phase("Forest Road, Kintore")
 {
  R_Date("SUERC-84852", 4093, 22);
  R_Date("SUERC-84848", 4131, 24);
  After()
  {
   R_Date("AA-53176", 4290, 45);
  };
  R_Date("SUERC-1397", 4250, 45);
  R_Date("SUERC-1396", 4215, 40);
  R_Date("SUERC-1382", 4400, 45);
```

```
 R_Date("SUERC-1326", 4145, 40);
 };
 Boundary("end: Forest Road, Kintore");
};
Phase("Midmill")
{
 R_Date("SUERC-84847", 3848, 24);
 R_Date("SUERC-22020", 4225, 30);
};
Phase("Meadows Wood")
{
 R_Date("SUERC-24924", 4090, 30);
 R_Date("SUERC-24925", 4120, 30);
};
R_Date("SUERC-41337: Courthill Farm", 4265, 35);
Sequence()
{
 Boundary("start: Beckton Farm");
 Phase("Beckton Farm")
 {
  After()
  {
   R_Date("GU-3534", 4220, 60);
  };
  After()
  {
   R_Date("AA-12587", 4150, 95);
  };
  After()
  {
   R_Date("GU-3533", 4360, 60);
  };
  R_Date("GU-3535", 3960, 60)
  {
   Outlier();
  };
  R_Date("GU-3538", 4070, 90)
  {
   Outlier();
  };
 };
 Boundary("end: Beckton Farm");
};
Sequence()
{
 Boundary("start: Dunragit");
 Phase("Dunragit")
 {
  R_Date("SUERC-84855", 4123, 24);
  R_Date("SUERC-84854", 4070, 24);
  R_Date("SUERC-84853", 4068, 22);
```

```
 R_Date("SUERC-2104", 4080, 35);
 R_Date("SUERC-2106", 4055, 55);
 R_Date("SUERC-2107", 4150, 35);
 R_Date("SUERC-2109", 4175, 45);
 R_Date("SUERC-2108", 4025, 35);
 R_Date("SUERC-36378", 4125, 30);
 };
 Boundary("end: Dunragit");
};
Phase("Hallhole Farm")
{
 R_Date("SUERC-74467", 3997, 29);
 R_Date("SUERC-74469", 4157, 25);
};
Phase("Balbirnie")
{
 After()
 {
  R_Date("SUERC-24166", 4405, 30);
 };
 R_Date("SUERC-24169", 3630, 30)
 {
  Outlier();
 };
 R_Date("SUERC-24170", 4330, 30)
 {
  Outlier();
 };
 R_Date("SUERC-24168", 4345, 30)
 {
  Outlier();
 };
 R_Date("SUERC-24156", 4370, 30)
 {
  Outlier();
 };
 R_Date("SUERC-24152", 4355, 35)
 {
  Outlier();
 };
};
Sequence()
{
 Boundary("start: Machrie Moor");
 Phase("Machrie Moor")
 {
  R_Date("SUERC-84076", 4414, 24);
  R_Date("SUERC-82531", 4443, 30);
  After()
  {
   R_Date("GU-2316", 4470, 50);
```

```
 };
 R_Date("GU-2325", 3980, 180)
 {
  Outlier();
 };
};
 Boundary("end: Machrie Moor");
};
R_Date("GU-3527: Machrie Moor Site 24/3", 3870, 50)
{
 Outlier();
};
Phase("Milton of Leys")
{
 R_Date("SUERC-84856", 4448, 24)
 {
  Outlier();
 };
 R_Date("GU-9611", 4445, 75)
 {
  Outlier();
 };
};
Phase("Lamb's Nursery")
{
 R_Date("SUERC-84846", 4060, 22);
 R_Date("GU-8105", 4070, 110)
 {
  Outlier();
 };
 R_Date("AA-32604", 4130, 50)
 {
  Outlier();
 };
};
R_Date("SUERC-42980: Inverurie Paper Mills", 4296, 29);
R_Date("SUERC-20308: Culduthel Mains", 4215, 35);
Phase("Inverness South West Flood Relief Channel")
{
 R_Date("SUERC-34576", 4365, 30);
 R_Date("SUERC-34575", 4335, 30);
};
Sequence()
{
 Boundary("start: Melbourne Area 3");
 Phase("Melbourne Area 3")
 {
  R_Date("SUERC-84075", 4011, 22);
  R_Date("SUERC-82536", 4162, 30);
  R_Date("AA-36878", 4160, 45);
  R_Date("AA-36879", 4010, 45)
```

```
 {
  Outlier();
 };
};
Boundary("end: Melbourne Area 3");
};
Phase("Melbourne Area 2")
{
R_Date("AA-36876", 3845, 65);
R_Date("AA-36877", 3985, 45);
};
Phase("Eweford East")
{
R_Date("SUERC-5340", 4140, 35)
{
 Outlier();
};
R_Date("SUERC-5344", 3880, 35)
{
 Outlier();
};
R_Date("SUERC-5345", 3890, 40)
{
 Outlier();
};
};
R_Date("SUERC-5294: Eweford West", 4275, 40)
{
};
Phase("Overhailes")
{
R_Date("SUERC-7509", 4455, 35)
{
 Outlier();
};
R_Date("SUERC-7510", 4395, 35)
{
 Outlier();
};
R_Date("SUERC-7504", 4440, 40)
{
 Outlier();
};
R_Date("SUERC-7505", 4405, 35)
{
 Outlier();
};
};
Sequence()
{
Boundary("start: Hillend");
```

```
 Phase("Hillend")
 {
  R_Date("SUERC-82541", 4048, 30);
  R_Date("SUERC-82540", 4084, 30);
  After()
  {
   R_Date("Beta-73955", 4410, 70);
  };
 };
 Boundary("end: Hillend");
};
Sequence()
{
 Boundary("start: Wellhill");
 Phase("Wellhill")
 {
  R_Date("SUERC-66495", 4206, 29);
  R_Date("SUERC-66496", 4172, 29);
  R_Date("SUERC-66261", 4162, 29);
  R_Date("SUERC-66248", 4234, 29);
  R_Date("SUERC-66247", 4216, 29);
 };
 Boundary("end: Wellhill");
};
Sequence("An Doirlinn")
{
 Boundary("start: An Doirlinn");
 Phase("hearth 8")
 {
  R_Date("OxA-28910", 4141, 27);
  R_Date("OxA-28909", 4110, 27);
 };
 R_Date("OxA-29160", 4063, 30);
 R_Date("OxA-28908", 3908, 26);
 Boundary("end: An Doirlinn");
};
R_Date("UB-3882: Mye Plantation", 3913, 89)
{
 Outlier();
};
R_Date("SUERC-22411: Laigh Newton West", 3880, 35)
{
 Outlier();
};
R_Date("SUERC-22439: Laigh Newton Central", 3880, 30)
{
 Outlier();
};
R_Date("SUERC-51494: Rosemarkie", 4320, 31)
{
 Outlier();
```

```
 };
 Phase("Scord of Brouster")
 {
  R_Date("SUERC-85517", 3013, 24)
  {
   Outlier();
  };
  R_Date("SUERC-56459", 4499, 38)
  {
   Outlier();
  };
  R_Date("SUERC-56460", 4400, 38)
  {
   Outlier();
  };
  R_Date("SUERC-56461", 4372, 38)
  {
   Outlier();
  };
  R_Date("CAR-249", 4495, 75)
  {
   Outlier();
  };
  R_Date("CAR-250", 4455, 70)
  {
   Outlier();
  };
  R_Date("CAR-251", 4540, 65)
  {
   Outlier();
  };
  R_Date("CAR-252", 4390, 80)
  {
   Outlier();
  };
  R_Date("CAR-253", 5050, 85)
  {
   Outlier();
  };
 };
};
Boundary("end: Scottish Grooved Ware (outside Orkney)");
Span("span: Scottish Grooved Ware (outside Orkney)");
};
Phase("Sub-styles")
{
 Phase("Durrington Walls (Method 1)")
 {
  First("First: Durrington Walls");
  Last("Last: Durrington Walls");
  Date("=start: Littleour");
```

```
 Date("=end: Littleour");
 Date("=AA-45406");
 Date("=AA-45407");
 Date("=SUERC-84848");
 Date("=SUERC-84847");
 Date("=SUERC-22020)");
 Date("=SUERC-82532");
 Date("=SUERC-82533");
 Date("=start: Powmyre Quarry");
 Date("=end: Powmyre Quarry");
 Date("=start: Dunragit");
 Date("=end: Dunragit");
 Date("=SUERC-74467");
 Date("=SUERC-74469");
 Date("=AA-36876");
 Date("=AA-36877");
 Date("=start: Hillend");
 Date("=end: Hillend");
};
Phase("Woodlands/Clacton (Method 1)")
{
 First("First: Woodlands/Clacton");
 Last("Last: Woodlands/Clacton");
 Date("=start: An Doirlinn");
 Date("=end: An Doirlinn");
 Date("=start: Beckton Farm");
 Date("=end: Beckton Farm");
 Date("=start: Balfarg Riding School");
 Date("=end: Balfarg Riding School");
 Date("=SUERC-84852");
 Date("=AA-53176");
 Date("=SUERC-1397");
 Date("=SUERC-1396");
 Date("=SUERC-1382");
 Date("=SUERC-1326");
 Date("=start: Machrie Moor");
 Date("=end: Machrie Moor");
 Date("=SUERC-42980: Inverurie Paper Mills");
 Date("=AA-36878");
};
Phase("Durrington Walls (Method 2)")
{
 First("First: Durrington Walls (sherds)");
 Last("Last: Durrington Walls (sherds)");
 Date("=OxA-8992");
 Date("=OxA-8993");
 Date("=SUERC-77487");
 Date("=SUERC-77488");
 Date("=SUERC-77492");
 Date("=SUERC-77493");
 Date("=SUERC-84848");
```

```
  Date("=SUERC-84847");
  Date("=SUERC-82532");
  Date("=SUERC-82533");
  Date("=SUERC-85814");
  Date("=SUERC-85815");
  Date("=SUERC-84857");
  Date("=SUERC-84858");
  Date("=SUERC-84855");
  Date("=SUERC-84854");
  Date("=SUERC-84853");
  Date("=SUERC-74467");
  Date("=SUERC-74469");
  Date("=SUERC-82541");
  Date("=SUERC-82540");
 };
 Phase("Woodlands/Clacton (Method 2)")
 {
  First("First: Woodlands/Clacton (sherds)");
  Last("Last: Woodlands/Clacton (sherds)");
  Date("=SUERC-82535");
  Date("=SUERC-84852");
  Date("=SUERC-84076");
  Date("=SUERC-82531");
 };
};
};
```