CHAPTER TEN

Beside the Ocean of Time: a chronology of Neolithic burial monuments and houses in Orkney

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> The provision of stone built late Neolithic settlements is perhaps the most important characteristic which separates Orkney from other areas of Britain
>
> (Richards 1993a, 206)

10.1 Introduction

This chapter provides an assessment of radiocarbon chronological data from early Neolithic houses and cairns on the Orkney Isles. The available evidence from sites within the Bay of Firth study area is examined in detail (see Figs 1.6 and 10.1). The model also calculats chronologies estimates associated with the use of Neolithic burial monuments, and early Neolithic houses, which from the basis for some observations about the timing of the early Neolithic in Orkney.

The 'Neolithic' first appears in Orkney in the 4th millennium cal BC, with sites including chambered cairns and houses, the 3rd millennium cal BC sees the addition of henge monuments, stone circles and standing stones. In 2005, the chronological currency of the Neolithic in Orkney was defined as spanning the mid-4th millennium to *c.*2000 cal BC. This very broad chronology is traditionally divided into an 'early' Neolithic and 'late' Neolithic, and the two phases are regarded as overlapping, with a transition period generally considered to have occurred around 3000 cal BC (*e.g.* Card 2005, 47). The earlier Neolithic in Orkney is associated with round-based bowl pottery (including 'Unstan' ware; Hunter and MacSween 1991) and Orkney-Cromarty cairns, while the later Neolithic is notable for the presence of Grooved ware and 'Maes Howe type' passage graves. This very broad material culture phasing drew upon studies including Henshall's (1963) framework for chambered cairn types, and Renfrew's (1979) model of social evolution from territory based, 'Unstan' bowl-using, segmentary societies, to centralised, Grooved ware-using chiefdoms (see Chapter 1). The scientific chronological evidence includes the then ground-breaking results from the use of radiocarbon dates to examine Neolithic sites in Orkney during the 1970s (Renfrew *et al.* 1976; Renfrew 1979).

Several 'tipping points' or disjunctures in the interpretation of Neolithic material culture on the islands can be suggested. In all these developments, chronological understandings – including the recognition that different types of evidence represented Neolithic activity – have been key to challenging our perceptions of the nature of society on Orkney at this time. Integral to these changes in interpretation have been shifts in what archaeologists have 'expected' for Neolithic settlements on Orkney (Downes and Richards 2000). These disjunctures included V. G. Childe's (1931b) work at Skara Brae, with the recognition of the site as Neolithic demonstrating the potential scale of Neolithic settlement sites on the islands and prompting a series of influential excavations. The eventual realization that the stone-built stalled houses at the Knap of Howar were of early Neolithic date (Ritchie 1983) contributed to a model of isolated, early Neolithic Orkney settlement (Richards 1993a; Barclay 1996). Equally important was the excavation of the Barnhouse structures (Richards 2005c), which led to a fundamental reassessment of the relationships between monuments and occupation (*e.g.* Richards 2000), a theme of enquiry that very much

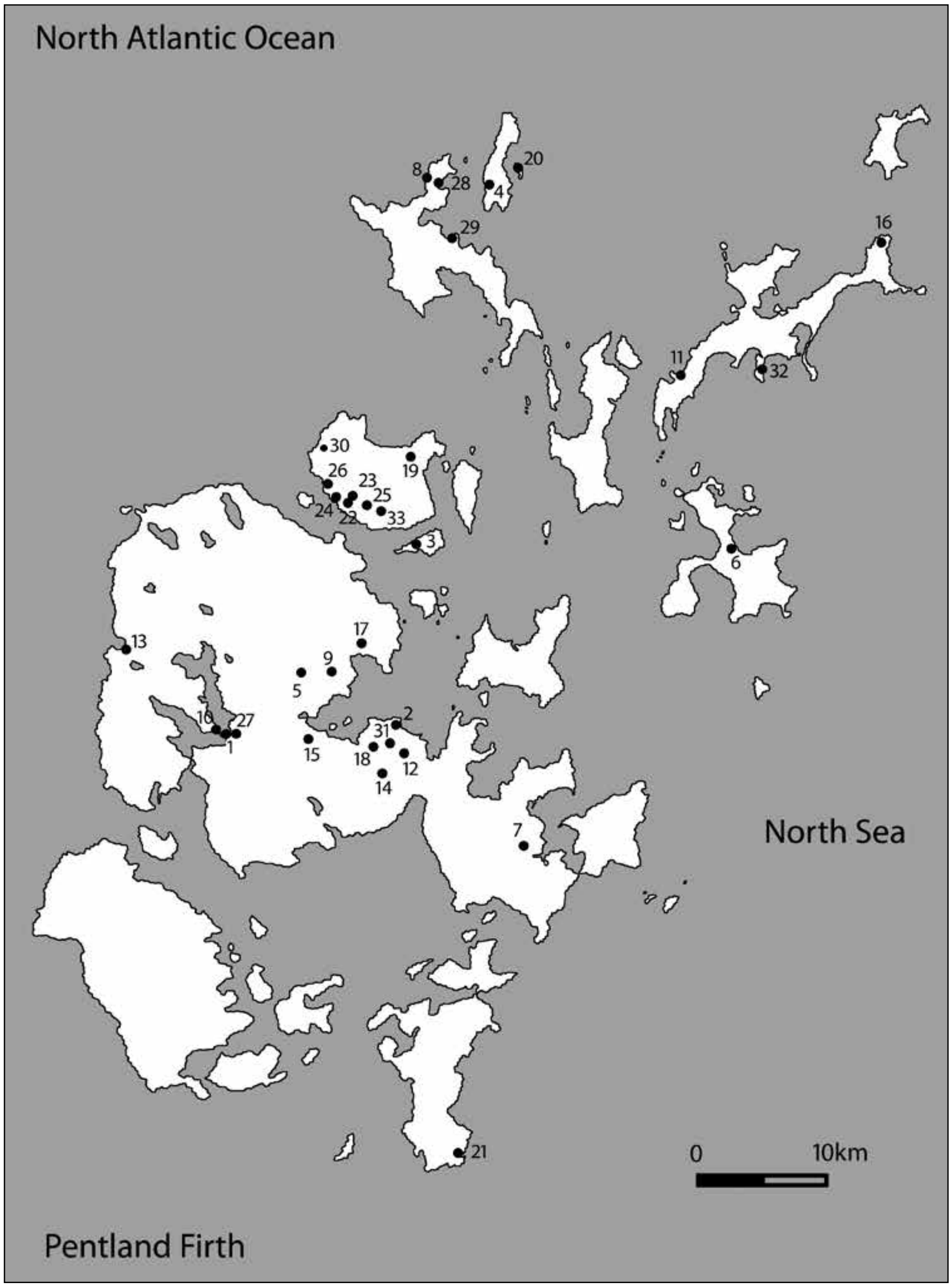

Figure 10.1 Map of Neolithic sites in Orkney with radiocarbon dates mentioned in the text, or shown in the model in Fig. 10.2.1. Barnhouse; 2. Crossiecrown; 3. Ha'Breck; 4. Knap of Howar; 5. Knowes of Trotty; 6. Links House; 7. Long Howe; 8. Links of Noltland; 9. Muckquoy; 10. Ness of Brodgar; 11. Pool; 12. Saverock; 13. Skara Brae; 14. Smerquoy; 15. Stonehall; 16. Tofts Ness; 17. Varme Dale; 18. Wideford Hill; 19. Rinyo; 20. Holm of Papa Westray North; 21. Isbister; 22. Knowe of Lairo; 23. Knowe of Ramsay; 24. Knowe of Rowiegar; 25. Knowe of Yarso; 26. Midhowe; 27. Maeshowe; 28. Pierowall Quarry; 29. Point of Cott; 30. Quandale; 31. Quanterness; 32. Quoyness; 33. Taversoe Tuick.

continues with fieldwork at the Ness of Brodgar. In recent years another important theme concerning early Neolithic habitation has emerged in the recognition of 4th millennium cal BC wooden post-built structures, initially at Wideford Hill (Chapter 2), and in the last few years at Smerquoy (Chapter 4; see below) on Mainland, Ha'Breck, on Wyre (Lee and Thomas 2011; Farrell *et al.* 2014; see below), and Green on Eday (Coles and Miles 2013).

The importance of non-stone built evidence in the early Neolithic of Orkney is relevant to recent work at two other sites. At Varme Dale (see Chapter 9), Evie, Mainland, a series of burnt deposits underlying a Bronze Age mound containing charred cereal remains were dated to the earlier 4th millennium cal BC (see discussion below). At Links House on Stronsay, 4th millennium cal BC radiocarbon dates have been produced from a pit on the site of much earlier Mesolithic activity.

With the exception of these two sites, which are discussed in detail below, the majority of 4th millennium cal BC radiocarbon dates from archaeological sites from Orkney derive from Neolithic chambered cairns and houses. An analysis of the chronological evidence associated with stone circles from Orkney is given in Griffiths and Richards (2013). A mid-5th millennium radiocarbon result has been produced on an oak timber from Cummi Ness, Bay of Ireland, Mainland. The timber may have been anthropogenically modified (Timpany 2014), but cannot be associated with occupation activity and is not discussed further here.

The majority of the non-chambered cairn structures discussed here are termed 'houses', reflecting the theme of this volume, however it is noted that the range of activity associated with these structures might have included domestic as well as other functions, and a formal distinction between domestic and other contexts is probably inappropriate (Brück 2008; Sharples 2000). As part of the discussion below, architectural forms of Neolithic Orkney houses are defined here as:

- Stalled early Neolithic houses such as the Knap of Howar and Smerquoy (see Chapter 4),
- Apparently early Neolithic timber structures including rectilinear structures as at Ha'Breck and circular structures as at Wideford Hill (see Chapter 2).
- Compartmentalized houses with 'pinched' walls, and without substantial orthostatic division, as at Stonehall Knoll (see Chapter 5),
- Sub-square houses as at Skara Brae, and Structure 8 at Barnhouse, a structure at Crossiecown and at Stonehall Farm (see Chapter 5 and Chapter 7),
- Small circular houses as found at Barnhouse,
- Double cruciform houses as found at Barnhouse,
- 'Atypical' constructions.

Results from a number of chambered cairns are discussed here, which include Henshall's 'Orkney-Cromarty' group. This group of chambered cairns has been further sub-divided into 'tripartite' chambers (where orthostats are employed to create three compartments accessed from a passage; see the Knowe of Lairo below), 'stalled' chambers which comprise the majority of the 'Orkney-Cromarty' chambered cairns discussed here (with more compartments than tripartite cairns), and 'Bookan' chambers (with two to five compartments arranged around a central space and roofed at a low level). Other variants include horned cairns, where drystone walling 'horns' are projected from the 'front' of cairns (such as at the Point of Cott discussed below). The majority of chambered cairns known from Orkney comprise 'Orkney-Cromarty-type' structures, with Davidson and Henshall (1989) able to list 59 examples.

Radiocarbon measurements have been produced from a number of passage graves ('Maes Howe-type' structures). These monuments comprise high roofed, rectangular chambers accessed by a passage, and covered by a round mound. Within passage graves, cells radiate off the main chamber, with six present at Quanterness and Quoyness, and four at Wideford Hill and Cuween (all discussed below). While these passage graves are referred to here as 'Maes Howe types', Maes Howe itself is in many ways unusual – in its scale, execution, and the use of orthostats within the central chamber (Richards 1996b, 196; 2000; Renfrew *et al.* 1976, 198; Davidson and Henshall 1989, 46–51). Davidson and Henshall (1989) list twelve passage graves, to which can be added a recent discovery at Swangro on Rousay (Steve Dockrill pers. comm.).

A synthetic discussion and catalogue of the chambered cairns of Orkney is provided by Davidson and Henshall (1989), with a more recent review of many of the sites discussed here provided by Schulting *et al.* (2010). Davidson and Henshall (1989, 87) emphasised the early presence of Orkney-Cromarty cairns and their similarities to chambered cairns of Caithness. Renfrew *et al.* (1976; Renfrew 1979) proposed that Maes Howe-type passage graves post-dated Orkney-Cromarty structures, but that activity at several Orkney-Cromarty sites, such as the Knowe of Yarso, went on for some period of time. Renfrew *et al.* (1976, 200) suggested a period of overlap between 'Unstan' ware (cf. Hunter and MacSween 1991) and Grooved ware occurred on Orkney between 3300 cal BC and 3000 cal BC, with the first Maes Howe-type passage graves – including Cuween and Wideford Hill – constructed in this period. Within the Maes Howe-type group, Renfrew (1979, 210) developed a model informed by radiocarbon results, which placed Quanterness and Quoyness as earlier monuments, with Maes Howe itself being a later development.

This chapter builds on the recent analysis of Schulting *et al.* (2010), and includes results from the Cuween-

Wideford landscape project, and other recently available data to review the chronology of Neolithic house and chambered cairn sites from Orkney.

10.2 Method

The approach taken here applies a Bayesian statistical model to the available data associated with early Neolithic stalled and timber houses, and chambered cairns from Orkney. Data selection and modelling techniques are detailed below and in Table 10.1. Bayesian modelling provides a means of counteracting the statistical scatter that is inherent in an assemblage of radiocarbon (or other scientific dating) measurements. It provides a means of incorporating archaeological information about the relative ordering of dated events, or relationships between dated samples, to constrain scientific chronological data. Bayesian chronological modelling has been applied in archaeology for over 20 years (*e.g.* Buck *et al.* 1991; 1992; 1996; Bronk Ramsey 1995; 1998; 2001; 2009). Bayesian modelling can make use of 'informative' understandings about the relationships between dated samples, for example from stratigraphy, and can include less 'informative' archaeological understandings, for example using the concept of an archaeological site phase to relate activity (Bayliss *et al.* 2007). Recent applications to Neolithic studies in Britain and Ireland have included Bayliss and Whittle (2007), Whittle *et al.* (2011), and Schulting *et al.* (2010; 2012). Several of the models presented here are adapted or derive from the analysis presented by Schulting *et al.* (2010).

Results have been calibrated and Bayesian modelling applied using OxCal v4.2 (Bronk Ramsey 1995; 1998; 2001; 2009). Results have been calibrated using the original error terms, rather than those recommended by Ashmore *et al.* (2000; cf. Schulting *et al.* 2010; Bayliss *et al.* 2011).

The majority of the results in Table 10.1 have been calibrated with the internationally agreed IntCal13 atmospheric calibration curve (Reimer *et al.* 2013), though several of measurements on marine species have been calibrated with the internationally agreed marine calibration curve (Reimer *et al.* 2013). A revised, local radiocarbon reservoir offset **has been applied.** This reservoir offset reflects new approaches to calculating uncertainty (Russell *et al.* 2011; Russell *et al.* in prep.) and the error term means that previous local radiocarbon reservoir effects calculated from measurements at Skara Brae (Ascough *et al.* 2007) are statistically indistinguishable. A few measurements on samples from Holm of Papa Westray North have been calibrated with a mix of terrestrial and marine calibration curves, reflecting differences in diet of these organisms. These cases are discussed in further detail below.

Many of the radiocarbon results presented here only have stable carbon values produced to correct for fractionation as part of radiocarbon measurement. In the case of accelerator mass spectrometry measurement these values tend not to be suitable for dietary reconstruction. Other indicative stable isotopes, such as nitrogen and sulphur are not available. Any appropriate offsets are consequentially difficult to reconstruct robustly, and the picture is further complicated by the evidence for enrichment in stable carbon values, perhaps as a result of terrestrial plant signals (Jones *et al.* 2012). Additional difficulty in interpreting the importance of marine reservoirs in the northen Isles are emphasised by the evidence from Neolithic Shetland for the strategic consumption over short periods of marine resources (Montgomery *et al.* 2013, 1070), which in turn dovetails with archaeological evidence from Orkney (for example from the Knap of Howar; Ritchie 1983) for the use of marine resources at least as part of the subsistence repertoire.

Date ranges in the table have been quoted using the intercept method (Stuiver and Reimer 1986), with end points rounded out by 10 years where the error terms are 25 years or greater, and by 5 years when they are less than 25 years (Millard 2014). The probability distributions shown in the figures were calibrated using the probability method of calibration (Stuiver and Reimer 1993). Output from the Bayesian chronological modelling is by convention given in the text in italics. Commands from the OxCal v4 program are cited in `Inconsolata` font to differentiate them from archaeological terms. The overall model structure is shown in Fig. 10.2. The OxCal v4 commands and brackets define the model structure.

Model sub-sections for house sites in the Bay of Firth are shown in Fig. 10.3–10.4, other early Neolithic house sites from Orkney in Fig. 10.5–10.6, and stalled (Orkney-Cromarty) cairns in Fig. 10.7–10.9. Passage graves (Maes Howe-type) sites are shown in model sub-sections in Fig. 10.10–10.11. A model for the Orcadian passage graves (Maes Howe-type) results is shown in Fig. 10.12.

10.2.1 Data selection and treatment

The analysis presented here uses published radiocarbon dates from Neolithic timber and stone-built stalled houses and chambered cairns from Orkney, and results

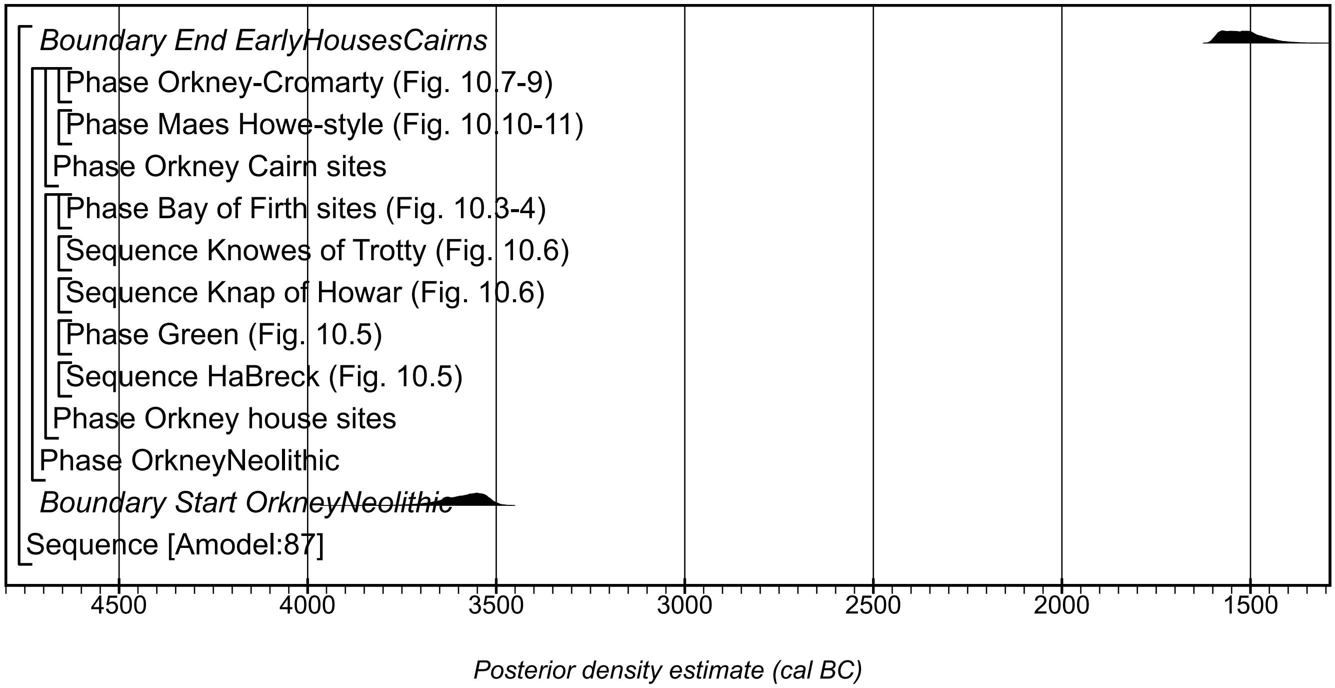

Figure 10.2 The model structure for the analysis of radiocarbon dates from Neolithic houses from the Bay of Firth landscape project, early Neolithic houses from across Orkney, and Neolithic cairns from Orkney (see main text for data selection). Subsections of the model are shown in the following figures as indicated. The large square brackets down the left hand side along with the OxCal keywords define the model, which is described in the text. An estimate for the start of Neolithic activity associated with these sites has been produced (Start OrkneyNeolithic), this and other posterior density estimates calculated in the model are described in Table 10.2.

from sites in the Bay of Firth project area (see chapters in this volume), the Knowes of Trotty (Chapter 3), Mainland, and from Green, Eday and Ha'Breck, Wyre (D. Garrow pers. comm. 2014). This analysis is intended to provide an estimate for the start of the earliest Neolithic activity on Orkney from house and chambered cairn sites. The later Neolithic house sites at Skara Brae, Pool, Barnhouse, Links of Noltland, and Ness of Brodgar are about to be massively updated as part of the *Times of Their Lives* project by Alasdair Whittle and Alex Bayliss, so these, and the later Neolithic evidence from Tofts Ness, are not included in the modelling here. Sites were included in the model presented here if they produced results with calibrated ranges in part in the 4th millennium cal BC, thus for example the results from chambered graves on Rousay at Quandale (GrA-19988 3600±50 BP 2140–1780 cal BC 95% confidence; GrA-19989 3660±50 BP 2200–1890 cal BC 95% confidence), Taversoe Tuick (GrA-21734 3580±60 BP 2140–1750 cal BC 95% confidence), and Blackhammer (UB-6419 3520±34 BP 1950–1740 cal BC 95% confidence) were not included in the model. The results from the chambered cairn at Crantit (Ballin-Smith 1999), and Cuween Hill are also too late, though the latter site is discussed below with reference to house sites in the Bay of Firth below.

10.2.2 The sites

While many of the burial monuments have been known and investigated at least since the 19th century, the evidence for domestic structures has changed significantly in recent years. In the mid-1980s Kinnes (1985; see also Barclay 1996) was able to note only one early Neolithic house site at the Knap of Howar. The change in the pattern of evidence for Neolithic houses on Orkney has in part derived from research within the Bay of Firth landscape (this volume), which has resulted in an archaeological sample of settlement evidence from Crossiecrown, Knowes of Trotty, Wideford Hill, the Stonehall sites, and Smerquoy, all of which have produced radiocarbon results. The less visible nature of house structures in contrast to burial monuments may have contributed to their omission from

Laboratory Number	Dated sample	Parent context	Radiocarbon result (BP)	δ¹³C δ¹⁵N C:N	Calibrated date range (cal BC; 95% confidence unless otherwise stated)
***Knap of Howar**, HY48305180, Bay of Firth, Orkney Mainland: Stalled house – house 2; Stalled house – house 1*					
OxA-16475	Sheep bone	A sheep bone from layer 9/14, primary midden redeposited within the wall-core of house 1, stalled house. *Termini post quos* for the construction of house 1	4603±39	-21.7 7.5 3.2	3510–3130
OxA-16476	Sheep/goat bone	A sheep/goat scapula from layer 16, primary midden sealed below the wall of house 1, stalled house. *Termini post quos* for the construction of house 1	4458±39	-20.1 7.6 3.2	3350–2930
OxA-16477	Sheep/goat bone	A sheep or goat humerus from, passage B, layer 4, a secondary floor deposit in house 2, stalled house, at the entrance to the passage linking the two houses, sealed by blocking material and thus providing a *terminus post quem* for the blocking material and end of use of house 2.	4420±39	-21.2 6.3 3.2	3330–2910
OxA-16478	Cattle bone	A cattle metatarsal from layer 7, a secondary floor deposit of house 2. Dates activity associated with house 2	4510±39	-21.7 6.4 3.2	3370–3030
OxA-16479	Sheep/goat bone	A sheep or goat second phalanx from layer 12, a primary floor deposit of house 2. Dates activity associated with house 2	4552±39	-20.8 4.2 3.2	3490–3100
OxA-16480	Sheep bone	A sheep foetus metatarsal from trench III, layer 3, secondary midden some 20 m south of house 1. Dates Neolithic activity on the site	4633±41	-20.0 8.0 3.2	3520–3340
OxA-16481	Sheep/goat bone	A sheep or goat left calacaneum from trench V, layer 2, secondary midden outside house 2. Dates Neolithic activity on the site	4443±39	-21.5 6.1 3.2	3340–2920
OxA-17778	Pig bone	A pig humerus distal fragment from trench III, layer 4, primary midden some 20 m south of house 1. Replaces OxA-9760 (Sheridan and Higham 2007, 225). Dates Neolithic activity on the site	4673±31	-19.7 7.3 3.2	3630–3360
SRR-344	Mixed animal bone	Animal bone from a secondary midden A/III/3 of period II in Trench III outside the south wall of a house. Not included in the model because of the uncertainty the dated sample could include material of a range of ages	4451±70	–21.1	3370–2900
SRR-345	Mixed animal bone	Animal bone from house 1 refuse in floor deposit B/I/2 of period II. Not included in the model because of the uncertainty the dated sample could include material of a range of ages	4348±75	–20.7	3330–2870
SRR-346	Mixed animal bone	Animal bone from refuse in secondary floor C/I/4 in the passage of House 1a. Not included in the model because of the uncertainty the dated sample could include material of a range of ages	4532±70	–21.2	3500–3010
SRR-347	Mixed animal bone	Animal bone from primary midden D/I/9 in the wall core of house 1, period 1; from same context as a fresh sample dated as SRR-452 (4080±70 BP). The two measurements are very different, and it is unclear if this measurement represents some kind of offset, a measurement outlier, or evidence of much earlier activity on the site. Not included in the model because of the uncertainty the dated sample could include material of a range of ages	5706±85	–22.2	4730–4350
SRR-348	Mixed animal bone	Animal bone from E/II/3, secondary midden of Period II in trench II outside south wall of house. Not included in the model because of the uncertainty the dated sample could include material of a range of ages	4765±70	–21.9	3700–3360
SRR-349	Mixed animal bone	Animal bone from the primary midden F/II/11 in trench II period 1. Not included in the model because of the uncertainty the dated sample could include material of a range of ages	4422±70	–22	3360–2890

Table 10.1 Results from sites from the Bay of Firth landscape study area, early Neolithic stone-built stalled houses and timber structures from across Orkney, and from cairns across Orkney included in the model shown in Fig. 10.2. Details of the 'types' of structure and burial monument are included along with details of the individual samples. Continued pp. 260–271.

Laboratory Number	Dated sample	Parent context	Radiocarbon result (BP)	$\delta^{13}C$ $\delta^{15}N$ C:N	Calibrated date range (cal BC; 95% confidence unless otherwise stated)
SRR-352	Mixed animal bone	Animal bone from primary midden D/I/9 in the wall core of House 1, period 1; from same context as a sample dated as SRR-347 (5706±85 BP), see note above	4081±65	–23.1	2880–2470
Birm-813	Mixed animal bone	Midden filling wall of house 2 (lower midden). Not included in the model because of the uncertainty the dated sample could include material of a range of ages	4270±100	-23.1	3270–2580
Birm-814	Mixed animal bone	House 2, floor deposit, in the secondary floor of period II. Not included in the model because of the uncertainty the dated sample could include material of a range of ages	4690±130	-19.1	3710–3030
Birm-815	Mixed animal bone	Animal bone from the lower midden in trench IV of period I. Not included in the model because of the uncertainty the dated sample could include material of a range of ages	4250±130	-19.1	3340–2480
Birm-816	Mixed animal bone	Animal bone from the lower midden of period I in trench V. Not included in the model because of the uncertainty the dated sample could include material of a range of ages	4770±180	-19.4	3970–3020
Birm-817	Soil	Organic soil buried at the base of test-pit 16. Not included in the model because of the uncertainty of the association of the sample with any archaeological 'event'	4830±100	–25.2	3900–3370
***Knowes of Trotty**, HY342174*, Bay of Firth, Orkney Mainland: Stalled house					
SUERC-18233	*Betula* sp. charcoal	Hearth 082. This hearth has been attributed to phase 3, associated with fragments of walling overlying the apparently ruinous original building. Stone-built hearth 215 is sealed over by the time of the use of this hearth. Dates the firing of hearth 082	4495±35	-27.2	3360–3020
SUERC-18234	Unidentified charred rhizome	Phase 2 lower layer of stone-built hearth 215. Dates the firing of stone-built hearth 215. Stratigraphically post-dates fire pit 220	4405±35	-26.5	3270–2910
SUERC-18235	*Betula* sp. charcoal	Phase 1 pit 282, underlying walling	4570±35	-26.5	3500–3110
SUERC-18239	*Betula* sp. charcoal	Phase 2 from a scoop, 302, indicating *in situ* burning on south side of stone-built hearth, underlies small scoop 294 subsequently dug	4490±35	-26.2	3360–3020
SUERC-18240	*Calluna* sp. charcoal	Phase 2 deposit 220, within scoop 294, later than scoop 302 south of hearth 215. This measurement is too early for its stratigraphic position in the model, and has not been included as an active element in the model presented here	4405±35	-27.3	3270–2910
SUERC-18241	*Betula* sp. charcoal	Phase 2 fill of fire scoop 302, underlies small scoop 294 subsequently dug	4485±35	-25.8	3360–3020
SUERC-18242	*Betula* sp. charcoal	Phase 2 debris spread 311 in east entranceway/porch	4475±35	-27.3	3350–3020
SUERC-18243	Unidentified wood charcoal	Phase 2 hearth rake out 331, overlies hearth deposit 340. Unidentified nature of sample could mean that there is an inbuilt 'old wood' offset, which would make this a *terminus post quem* for the firing of the hearth. However, this result is not notably older than others from phase 2. It has been included in the model as a *terminus post quem*	4490±35	-25.4	3360–3020
SUERC-18244	*Calluna* sp. charcoal	Phase 2 hearth rake out 340. Deposit 340 is overlain by 331	4525±30	-26.4	3370–3090
Stonehall Knoll, HY366126, Bay of Firth, Orkney Mainland: Compartmentalized house – house 3					
AA-51370	*Salix* sp. charcoal	Occupation (4041) of secondary floor in house 3. Sample found in a thin layer of burnt material and ash tramped into a secondary layer of clay floor. The pottery from this house was round-based bowl. The sample potentially represents material from earlier activity redeposited in the secondary occupation deposit. Not included as an active parameter in the model	4510±40	-26.3	3370–3020
AA-51380	*Betula* sp. charcoal	Occupation (4041) of secondary floor in house 3. Sample found in a thin layer of burnt material and ash tramped into a secondary layer of clay floor. The pottery from this house was round-based bowl. The sample potentially represents material from earlier activity redeposited in the secondary occupation deposit. Not included as an active parameter in the model	4250±40	-26.5	2920–2710

Laboratory Number	Dated sample	Parent context	Radiocarbon result (BP)	δ13C δ15N C:N	Calibrated date range (cal BC; 95% confidence unless otherwise stated)
AA-51379	*Betula* sp. charcoal	Occupation (4041) of secondary floor in house 3. Sample found in a thin layer of burnt material and ash tramped into a secondary layer of clay floor. The pottery from this house was round-based bowl. The sample is the latest of three radiocarbon measurements in the secondary occupation deposit. It may therefore provide an estimate for the timing of this secondary occupation	4010±40	-25.4	2630–2460
AA-51385	*Salix* sp. charcoal	Charcoal fill (1028) of pit in east area of trench. This result is not included in the model.	1610±35	-25.3	Cal AD 380–550
***Stonehall Meadow**, HY366126*, Bay of Firth, Orkney Mainland: Stalled house – house 3					
AA-51386	*Hordeum vulgare* var *nudum* charred grain	Lower fill 3075 of pit in outer compartment of house 3	4475±45	-25.7	3360–3010
AA-51382	*Betula* sp. charcoal	Occupation deposit 3050 around hearth in inner compartment of house 3	4485±40	-25.6	3360–3020
AA-51383	*Salix* sp. charcoal	Upper ash fill 3068 of hearth 3070 house 3	4455±40	-25.6	3360–2930
AA-51375	*Hordeum vulgare* charred grain	Lower ash fill 3069 of hearth 3070 house 3	4435±40	-24.1	3340–2920
AA-51384	*Hordeum vulgare* var *nudum* charred grain	Ash spread 029 from hearth, trench A. Occupation activity not stratigraphically related with the stalled house, or associated with diagnostic material culture	4500±40	-22.4	3370–3020
AA-51374	*Hordeum vulgare* charred grain	Hearth fill 019 trench A. Occupation activity not stratigraphically related with the stalled house, or associated with diagnostic material culture	4550±40	-22.6	3490–3090
***Stonehall Farm**, HY366126*, Bay of Firth, Orkney Mainland: Sub-square house (late Barnhouse-style house) – house 1; 'Atypical' structure – structure 1					
SUERC-5790	*Hordeum vulgare* var *nudum* charred grain	Lower midden deposit (809)	4500±40	-24	3370–3020
AA-51376	*Betula* sp. charcoal	Lower midden deposit (809)	4395±40	-24.9	3270–2900
SUERC-5789	*Hordeum vulgare* charred grain	Upper midden deposit (800)	4170±35	-24.1	2890–2620
AA-51371	*Betula* sp. charcoal	Fill (816) of clay bowl [815] in structure 1	4495±40	-25.4	3360–3020
AA-51387	*Betula* sp. charcoal	Lower cist fill (631) structure 1	4485±55	-24.5	3370–2930
SUERC-5792	Indeterminate charred cereal grain	Upper ash fill (2051) of house 1	4480±40	-21.8	3360–3020
SUERC-5791	*Hordeum vulgare* var *nudum* charred grain	Midden deposit (2015) adjacent to house 1	4340±40	-22.5	3090–2890
***Wideford Hill**, HY40901211*, Bay of Firth, Orkney Mainland: Timber structures – structure 1 (circular) and structure 3 (probably circular with a central scoop hearth, subsequently modified into rectangular timber structure); Compartmentalized house – house 1					
SUERC-4868	*Corylus avellana* charcoal	Primary ash fill of hearth scoop (115) from timber structure 1	4495±35	-25.5	3360–3020
SUERC-4867	*Betula* sp. charcoal	Intermediate ash fill of hearth scoop (89) from timber structure 1	4455±35	-26.5	3340–2940
SUERC-4863	*Corylus avellana* charcoal	Upper mixed fill of hearth scoop (68) from timber structure 1	4530±35	-25.5	3370–3090
SUERC-4862	*Hordeum vulgare* var *nudum* charred grain	Basal fill (054) of posthole [053] from timber structure 3	4645±40	-24.7	3630–3350

Table 10.1 Results from sites from the Bay of Firth landscape study area, early Neolithic stone-built stalled houses and timber structures from across Orkney, and from cairns across Orkney included in the model shown in Fig. 10.2. Details of the 'types' of structure and burial monument are included along with details of the individual samples. Continued pp. 262–271.

Laboratory Number	Dated sample	Parent context	Radiocarbon result (BP)	$\delta^{13}C$ $\delta^{15}N$ C:N	Calibrated date range (cal BC; 95% confidence unless otherwise stated)
SUERC-4869	*Hordeum vulgare* var *nudum* charred grain	Old land surface (128) beneath rammed surface (002)	4545±40	-22.8	3490–3090
SUERC-4860	*Hordeum vulgare* var *nudum* charred grain	Old land surface (128) beneath rammed surface (002)	4525±35	-23.9	3370–3090
SUERC-4859	*Hordeum* charred grain	Spread of ashy material 003 on rammed stone surface 002	4580±40	-22.4	3500–3120
SUERC-4870	*Hordeum vulgare* var *nudum* charred grain	Spread of ash (148) in centre of house 1	4450±35	-22.4	3340–2930
SUERC-4861	*Hordeum vulgare* var *nudum* charred grain	Rammed stone surface (002)	4555±35	-24.9	3490–3100
Crossiecrown, *HY423137*, Bay of Firth, Orkney Mainland: Sub-square house (late Barnhouse-style house) – house 1					
AA-51373 (GU-10319)	*Salix* sp. charcoal	Ash deposit (315) surrounding hearth [018]	3830±40	-26.9	2470–2140
AA-51372 (GU-10318)	*Prunus* cf *padus* charcoal	Ash deposit (012) surrounding hearth [018]	3895±40	-26.6	2480–2210
AA-51381 (GU-10319)	*Hordeum vulgare* var *nudum* charred grain	Clay and ash deposit (480) associated with collapse deposit (003) of house 1, stratigraphically later than hearth [018]	3535±40	-22.2	1980–1740
SUERC-4857	*Hordeum vulgare* charred grain	Lower midden deposit. Uncertain association with structures	4315±35	-22.8	3020–2880
SUERC-4858	*Betula* sp. charcoal	Lower midden deposit. Uncertain association with structures	4405±35	-26.5	3270–2910
SUERC-4853	*Conopodium majus* charcoal	Intermediate midden deposit. Uncertain association with structures	4155±40	-27.1	2890–2580
SUERC-4852	*Conopodium majus* charcoal	Upper midden deposit. Uncertain association with structures	4100±35	-26.7	2870–2500
Smerquoy, *HY40501109*, Bay of Firth, Orkney Mainland: Stalled house					
SUERC-49682	Salicaceae charcoal	Lower occupation deposit (22)	4518±29	-26.5	3360–3090
SUERC-49938	*Hordeum* sp. grain	Fill (45) of small pit at rear of house	3637±32	-23.2	2140–1910
SUERC-49687	Ericaceae charcoal		3533±29	-27	1950–1760
SUERC-49684	*Betula* sp. charcoal	Foundation deposit (15) beneath outer skin of wall	4527±29	-26.2	3370–3090
SUERC-49683	Cereal grain x1, Poaceae grain x1		4546±29	-21.7	3370–3100
SUERC-49685	Hulled *Hordeum* sp. grain x1, Cereal grain x1	Upper occupation deposit (27) in house	3651±29	-23.8	2140–1940
SUERC-49686	Ericaceae charcoal		3689±27	-26.1	2200–1980
Ha'Breck, *HY4374025933*, Wyre: Linear timber house – house 1, house 4; Stalled house – house 2, house 3, house 5					
SUERC-34506	*Hordeum* sp. charred grain	Deposit (436) from stalled stone house 2, material used to pack around the outside of the hearthstones	4550±30	-22.7	3370–3100
SUERC-34503	*Crataegus* sp. charcoal	Deposit (676) from timber house 4	4530±30	-24.5	3370–3090
SUERC-34505	*Corylus avellana* nutshel	Midden deposit (139) in trench A, overlying house 3	4510±30	-28.4	3360–3090
SUERC-34504	*Hordeum* sp. charred grain	Blocking deposit (197) in house 3	4470±30	-22.3	3350–3020
SUERC-35990	*Hordeum* sp. charred grain	Pit fill (528) in centre of timber house 1, sealed by hearth of house 2	4425±30	-25 (assumed)	3320–2920

Laboratory Number	Dated sample	Parent context	Radiocarbon result (BP)	$\delta^{13}C$ $\delta^{15}N$ C:N	Calibrated date range (cal BC; 95% confidence unless otherwise stated)
SUERC-37959	*Betula* sp. roundwood charcoal	Primary fill stone quarry	4690±35	-24.8	3630–3360
SUERC-37960	*Hordeum* sp. (hulled) charred grain	Midden deposit associated with Grooved ware	3780±35	-22	2300–2050
OxA-29154	Salicaceae roundwood charcoal	Preconstruction landsurface, under stalled stone house 3	4662±33	-26.1	3630–3360
OxA-28983	Salicaceae roundwood charcoal		4640±32	-26.8	3520–3350
OxA-28861	*Hordeum* (naked) sp. charred grains	Burned deposit associated with the end of primary occupation in stalled stone house 3	4474±30	-22.7	3350–3020
OxA-28862	*Hordeum* (naked) sp. charred grains	South hearth from secondary occupation in stalled stone house 3	4444±30	-23.4	3340–2940
OxA-28863	*Hordeum* (naked) sp. charred grains	Blocking deposit in stalled stone house 3	4448±30	-22.7	3340–3010
Green, *HY569289*, Eday: Stalled house, with possible later portable material culture (Grooved ware and maceheads) maybe similar to Barnhouse circular structure (though site not published at time of writing) – house 1					
OxA-28984	*Calluna* sp. charred twig	Posthole fill in ?timber structure	4676±32	-26.3	3630–3360
OxA-29155	*Hordeum* sp. (naked) charred grains	Lower hearth fill (290) in stalled stone house 1	4489±32	-22.8	3360–3020
OxA-28454	*Hordeum* sp. grains	Upper hearth fill (116) in stalled stone house1	4472±31	-21.3	3350–3020
OxA-28864	*Hordeum*/*Triticum* charred cereal grains	Midden context (214) post-dating stalled stone house 1	4463±30	-23.5	3340–3020
Quanterness, *HY41771292*, Bay of Firth, Orkney Mainland: Passage grave (****showing the original error terms and the revised error terms from Ashmore *et al.* (2000))					
Q-1294****	Organic soil	Area ZB, III, stratigraphic. layer 1 from the chamber. Described as immediately on bedrock, cut in places by pits/cists. Grid square N3 (from plan Renfrew 1976, 51, fig. 19).	4590±75 (original) 4590±110 (revised)	–	3630–3090
SRR-754****	Human right and left tibia	Pit A, stratigraphic layer 2. Cut into bedrock pre-dates main bone-spread. Crouched inhumation. Area ZB, II, layer 26, small finds no. 308-01, -02, -03 and 307-01.	4360±50 (original) 4360±110 (revised)	–	Weighted mean (original error terms): 4291±25 (T'=4.6; T'5%=7.8; df=3) 2920–2880
Pta-1626****	Human humerus	Pit A, stratigraphic layer 2. Same individual as SRR-754, small finds no. 316.	4300±60 (original) 4300±110 (revised)	–	
Q-1479****	Human right and left femur	Pit A, stratigraphic layer 2. Same individual as SRR-754, small finds no. 311-10, 310-01.	4170±75 (original) 4170±110 (revised)	–	
SUERC-24001 (GU-18421)	Human cranium	Layer 26, pit A, stratigraphic layer 2. Same as SRR-754, Pta-1626, Q-1476.	4280±35	–21.3 12.4 3.6	

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Laboratory Number	Dated sample	Parent context	Radiocarbon result (BP)	$\delta^{13}C$ $\delta^{15}N$ C:N	Calibrated date range (cal BC; 95% confidence unless otherwise stated)
Q-1363****	Human left femur	Main chamber, stratigraphic layer 3 Main bone spread. Described by Renfrew (1976, 70) as ZB, area II, layer 22, small find no. 156-01.	4540±110 (original) 4540±155 (revised)	–	3630–2910
Q-1451****	Human left femur	Main chamber, stratigraphic layer 3. Main bone spread. Described by Renfrew (1976, 70) as ZB, area III, layer 62, small find no. 1321-02, 03 and -04.	4110±100 (original) 4110±140 (revised)	–	2910–2460
Pta-1606****	Human left radius	Pit C, stratigraphic layer 5. Inhumation in shallow pit dug into main burial layer. Area ZB, V, layer 158, small find no. 4590-02.	4130±60 (original) 4130±110 (revised)	–	2890–2490
Q-1480****	Human left tibia	Pit C, stratigraphic layer 5. Same individual as Pta-1606, small find no. 4606-01 and -02.	3905±70 (original) 3905±110 (revised	–	df=1 T=0.2(5% 3.8) (3883±44) 2480–2200
SRR-755****	Human right femur	Pit C, stratigraphic layer 5. Same individual as Pta-1606, small find no. 4602.	3870±55 (original) 3870±110 (revised)	-19.9 –	
SUERC-24000 (GU-18420)	Human phalanx, hand	Layer 23, zone II, stratigraphic layer 1. Cat. ID. 3023.04, lay directly on bedrock	4440±35	–20.4 11.4 3.3	3340–2920
SUERC-24012 (GU-18429)	Human cranium (0-6 months)	Layer 71, zone III, stratigraphic layer. Cat. ID. 1393.06, lay directly on bedrock	4610±35	–21.5 10.5 3.2	3500–3340
SUERC-24002 (GU-18422)	Human femur	Layer 26, pit A, stratigraphic layer. Cat. ID. 311.02, crouched inhumation in pit, same as SRR-754, Pta-1626, Q-1476	4510±35	–20.2 11.5 3.4	3370–3090
SUERC-23998 (GU-18418)	Human right clavicle (14-19 years)	Layer 22, zone II, stratigraphic layer 3. Cat. ID. 164.09, from main bone spread	4585±35	–20.3 9.7 3.3	3500–3130
SUERC-23999 (GU-18419)	Human right clavicle	Layer 22, zone II, stratigraphic layer 3. Cat ID. 221.04, from main bone spread	4555±35	–20.5 10.6 3.3	3490–3100
SUERC-24009 (GU-18426)	Human right clavicle	Layer 61, zone III, stratigraphic layer 3. Cat. ID. 1121.02, from main bone spread	4430±35	–20.3 11.5 3.4	3330–2920
SUERC-23993 (GU-18416)	Human right clavicle	Layer 21, zone II, stratigraphic layer 4. Cat. ID. 189.13, from main bone spread	4490±35	–20.5 11.2 3.4	3360–3020
SUERC-23997 (GU-18417)	Human right clavicle	Layer 21, zone II, stratigraphic layer 4. Cat. ID. 199.17, from main bone spread	4395±35	–20.5 10.7 3.4	3270–2910
SUERC-24003 (GU-18423)	Human left clavicle	Layer 57, zone III, stratigraphic layer 4. Cat. ID. 1084.02, from main bone spread	4570±35	–20.6 10.3 3.2	3500–3110

Laboratory Number	Dated sample	Parent context	Radiocarbon result (BP)	$\delta^{13}C$ $\delta^{15}N$ C:N	Calibrated date range (cal BC; 95% confidence unless otherwise stated)
SUERC-24007 (GU-18424)	Human right ulna	Layer 60, zone III, stratigraphic layer 4. Cat. ID. 1264, from main bone spread	4255±35	−20.8 11.3 3.2	2920–2770
SUERC-24008 (GU-18425)	Human sacrum (3-6 years)	Layer 60A, zone III, stratigraphic layer 4. Cat. ID. 1263.03, from main bone spread	4095±35	−21.0 11.4 3.2	2870–2490
SUERC-24010 (GU-18427)	Human left ulna (9-12 years)	Layer 63, zone III, stratigraphic layer 4. Cat. ID. 1175.01, from main bone spread	4415±35	−20.7 10.9 3.3	3320–2910
SUERC-24011 (GU-18428)	Human right clavicle	Layer 64, zone III, stratigraphic layer 4. Cat. ID. 4009.19, from main bone spread	4510±35	−20.6 10.2 3.3	3370–3090
SUERC-24013 (GU-18430)	Human metacarpal	Layer 102, zone IV, stratigraphic layer 4. Cat. ID. 1579.2, from main bone spread	4500±35	-20.2 12.1 3.2	3360–3020
SUERC-24017 (GU-18431)	Human calcaneous	Layer 102, zone IV, stratigraphic layer 4. Cat. ID. 1587.01, from main bone spread	4480±35	−20.2 10.9 3.2	3360–3020
SUERC-24018 (GU-18432)	Human right fibula	Layer 150, zone V, stratigraphic layer 5a. Cat. ID. 4513.04, stonefall from chamber decay and latest burials; after deposition of main bone spread	4360±35	−21.3 11.4 3.3	3090–2900
SUERC-24019 (GU-18433)	Human left tibia (9-12 years)	Layer 151, zone V, stratigraphic layer 5a. Cat. ID. 4542, stonefall from chamber decay and latest burials; after deposition of main bone spread	4580±35	−19.8 10.7 3.2	3500–3120
SUERC-24020 (GU-18434)	Human sacrum	Layer 155, pit C stratigraphic layer 5b. Cat. ID. 4574.04, inhumation in shallow pit dug into main bone spread	4375±35	−20.1 11 3.2	3100-2900
SUERC-24021 (GU-18435)	Human femur (14–19 years)	Layer 158, pit C, stratigraphic layer 5b. Cat. ID. 4580.08, inhumation in shallow pit dug into main bone spread	4465±35	−20.1 11.3 3.3	3350–3010
Holm of Papa Westray North, *HY50445228*, Papa Westray: Stalled cairn					
GrA-25636	Human phalange	Human sub-adult phalange (HPWN 1) from cell 3(W), context 1; calibrated with a mixed terrestrial/marine curve and local offset (see main text). Slightly elevated $\delta^{13}C$ (possible small input marine protein, maximum c15% Schulting and Richards (2009, 69), they use 16% (2009, 70).	4715±40	-19.6 11.3 3.2	3620–3320
GrA-25638	Human right femur	Human adult right femur (HPWN 1158) from cell 5, context 4; calibrated with a mixed terrestrial/marine curve and local offset (see main text). Slightly elevated $\delta^{13}C$ (possible small input marine protein, maximum c15% Schulting and Richards (2009, 69), they use 13% (2009, 70).	4690±40	-19.9 10.4 2.9	3610–3190
GrA-25637	Human phalange	Human adult right femur HPWN 664, from cell 3(E), context 1; calibrated with a mixed terrestrial/marine curve and local offset (see main text). Probably terrestrial (but Schulting and Richards (2009, 70) apply a 2% marine contribution).	4640±40	-20.8 10 3.0	3520–3130
GU-2068	Human bone	Human bone from a primary burial in the innermost compartment 4	4430±60	-19.4 –	3360–2900

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Laboratory Number	Dated sample	Parent context	Radiocarbon result (BP)	$\delta^{13}C$ $\delta^{15}N$ C:N	Calibrated date range (cal BC; 95% confidence unless otherwise stated)
GU-2067	Human bone	Human bone from the deliberate filling of the end-cell 5	4395±60	-19 –	3340–2890
OxA-17780	Otter bone	An otter bone from trench I, compartment 5 layer 2 the second highest of four levels of filling of the end-cell 5. Replaces OxA-9871 (Sheridan and Higham 2007, 225); calibrated with marine curve and local offset (see main text)	4331±32	-10.5 16.8 3.2	2670–2280
OxA-16472	Sheep metatarsal	A young sheep metatarsal from trench IV layer 1(2), midden adjacent to the kerb of the back of the cairn containing Grooved ware and Beaker. Cold season marine component. Replaces OxA-9834 (Sheridan 2006, 202-3); calibrated with a mixed terrestrial/marine curve and local offset (see main text)	4352±39	-15.3 10.6 3.3	3000–2480
OxA-17779	Sheep vertebra	A sheep bone from trench I, compartment 5 layer 3, the second lowest of four levels of filling of the end-cell 5 (Sheridan and Higham 2007, 225). ?Cold season marine component; calibrated with a mixed terrestrial/marine curve and local offset (see main text)	4167±31	-19.8 7.1 3.3	2860–2250
OxA-16473	Deer antler	A single piece of red deer antler from a secondary deposit (trench V, layer 1) associated with demolition of the tomb facade in the forecourt of the chambered tomb. Replaces OxA-9752 (Sheridan 2006, 202-3)	4127±39	-21.7 5.9 3.2	2880–2570
OxA-16474	Sheep metatarsal	A single sheep metatarsal from a primary floor deposit (trench V, layer 2) in the forecourt of the chambered tomb and contemporary with its use. Replaces OxA-9753 (Sheridan 2006, 202-3). ?Cold season marine component; calibrated with a mixed terrestrial/marine curve and local offset (see main text)	4113±40	-20.1 7.0 3.2	2830–2160
OxA-17782	Deer astralagus	A red deer astralagus from trench IV layer 1(1), midden adjacent to the kerb of the back of the cairn containing Grooved ware and beaker. Replaces OxA-9872 (Sheridan and Higham 2007, 225)	4111±32	-21.8 7.1 3.2	2870–2570
OxA-17781	Deer astralagus	A red deer astralagus from trench IV layer 1(1), midden adjacent to the kerb of the back of the cairn containing Grooved ware and Beaker. Replaces OxA-9872 (Sheridan and Higham 2007, 225)	4075±30	-21.6 7.1 3.3	2860–2490
GU-2069	Sheep bone	Sheep bone from the deliberate filling of the entrance passage of the cairn. ?Cold season marine component; calibrated with a mixed terrestrial/marine curve and local offset (see main text)	4070±60	-19.3 –	2790–2070
OxA-16471	Deer bone	A red deer bone from trench I, compartment 5, layer 1, the uppermost filling of the end-cell 5. Replaces OxA-9832 (Sheridan 2006, 202-3).	4046±38	-21.8 7.4 3.3	2840–2470
Point of Cott, *HY46544746*, Westray: Stalled cairn – later transformed into horned cairn					
UtC-1658	Human bone	Skeleton B, from Compartment 3	4680±50	-20.8 –	3640–3350
UtC-1660	Human bone	Skeleton E, compartment 2 of floor deposit	4680±50	-20.9 –	3640–3350
GU-2936	Human bone	Skeleton C, from compartment 3	4390±60	-21.2 –	3340–2890
UtC-1663	Bulk faunal bone	Sheep, vole and bird bone in the lower level of the chamber (54)	4380±90	-22.6 –	3360–2870
GU-2940	Human bone	Skeleton I, from compartments 1 and 2, in the floor deposit	4360±50	-22.3 –	3270–2890
UtC-1661	Human bone	Skeleton F, compartment 3 floor deposit	4300±50	-20.7 –	3030–2870
AA-11697	Human bone	Infant burial (54) in compartment 1	4505±60	-20.1 –	3490–3010

Laboratory Number	Dated sample	Parent context	Radiocarbon result (BP)	δ13C δ15N C:N	Calibrated date range (cal BC; 95% confidence unless otherwise stated)
AA-11698	Human bone	Infant burial in the north end of the collapsed cairn matrix	4585±85	-19.6 –	3630–3020
GU-2934	Human bone	Skeleton A, from compartment 3	4250±90	-21.8 –	3090–2580
GU-2941	Sheep bone	Sheep bone, lower level of passage blocking (157)	4110±50	-22.2 –	2880–2490
GU-2942	Bulk faunal bone sample	Cattle, sheep and bird bone from the chamber roof collapse (54)	3670±70	-20.3 –	2280–1880
GU-2945	Bird bone	Bird bone (106) in compartment 4	3610±100	-20.7 –	2280–1690
UtC-1659	Human bone	Skeleton D from compartment 1	4600±50	-20.8 –	3520–3120
UtC-1664	Bulk faunal bone sample	Dog and cattle bone from the passage fill (sample 4770)	3870±80	-20.2 –	2570–2060
UtC-1665	Otter bones	Otter bones behind the wall face at the passage north end (66); calibrated with marine curve and local offset (see main text)	4040±50	-12.7 –	2320–1870
***Pierowall**, HY43894905*, Westray: Passage grave					
GU-1582	Cattle bone	A single cattle bone in a wall supporting platform (layer 21) over a demolished chambered cairn (Sharples 1984)	4140±60	–20 –	2900–2490
GU-1583	Cattle bone	Cattle bone in a secondary occupation (layer 10) of a small structure built over demolished cairn	4140±60	–20 –	2900–2490
GU-1584	Cattle bone	Cattle bone in secondary occupation (layer 10) of a small structure over demolished cairn (Sharples 1984)	4030±65	–20 –	2870–2400
GU-1585	Ovicaprid bone	Sheep/ goat bone in a translocated shillet layer (layer 7I) used to construct a platform against the round cairn (Sharples 1984)	4045±140	–20.8 –	2920–2150
GU-1586	Ovicaprid bone	Sheep/ goat bone in the collapse (layer 22) of the revetment of the chambered cairn (Sharples 1984)	4330±110	–20 –	3360–2630
GU-1587	Cattle bone	Cattle bone in the collapse (layer 22) of the revetment of the chambered cairn (Sharples 1984)	4065±90	–21.8 –	2890–2340
GU-1588	Ovicaprid bone	Sheep/ goat bone in the collapse (layer 20) of the revetment of the chambered cairn (Sharples 1984)	4105±120	–21.5 –	2920–2310
***Isbister**, ND47048449*, South Ronaldsay: Stalled cairn					
GU-1178	Human bone	Human bone from a foundation deposit (IS76SF72) (Renfrew *et al.* 1983)	4240±100	-20.2 –	3100–2500
GU-1179	Human bone	Human bone from a foundation deposit (IS76SF73) (Renfrew *et al.* 1983)	4435±55	-19.6 –	3350–2910
GU-1180	Human bone	Human bone from a floor deposit (IS76SF74) in stall 4 (Renfrew *et al.* 1983)	4410±90	-20.5 –	3370–2880
GU-1181	Human bone	Human bone from a floor deposit (IS76SF75) in stall 4 (Renfrew *et al.* 1983)	4420±130	-19.5 –	3500–2700

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Laboratory Number	Dated sample	Parent context	Radiocarbon result (BP)	δ¹³C δ¹⁵N C:N	Calibrated date range (cal BC; 95% confidence unless otherwise stated)
GU-1182	Human bone	Human bone from a deposit below shelf in tomb (Renfrew *et al.* 1983)	4475±80	-20.2 –	df=1, T=1.1; T'5%=3.8 4403±43 3330–2900
Q-3013	Human bone		4375±50	–	
Q-3016	Human bone	Human bone from a deposit in cell 3 (Renfrew *et al.* 1983) (IS76SF79)	4360±55	–	df=1; T'5=0.2; T'5%=3.8 4371±48 3270–2890
GU-1185	Human bone		4405±95	-20.8 –	
GU-1187	Human bone	Intrusive burial (IS76SF82) in fill behind hornwork	3250±55	-20 –	1650–1410
GU-1183	Human bone	Human bone from a deposit (IS76SF77) under shelf in stall 5	3920±80	-19.4 –	3856±43 df=1 T=0.9(5% 3.8) 2470–2150
Q-3014	Human bone		3830±50	–	
GU-1184	Human bone	Human bone from a deposit (IS76SF78) in cell 3	4375±90	-19.5 –	4292±47 T=1.2(5% 3.8) 3020–2870
Q-3015	Human bone		4260±55	–	
Q-3017	Human bone	Human bone from a stone infill (IS76SF80) of chamber	4030±50	–	4033±45 df=1 T=0.0(5% 3.8) 2840–2460
GU-1186	Human bone		4045±100	-19.8 –	
Q-3018	Animal bone	Animal bone from back-fill (IS76SF83) behind hornwork	4285±45	–	4275±35 df=1 T=0.1(5% 3.8) 2920–2870
GU-1190	Animal bone		4260±55	-20.7 –	
UB-6552	Left ulna from white-tailed sea eagle	Fragment of left ulna from white-tailed sea eagle reportedly found in a 'foundation deposit' (L12) sealed under the floor of stall 5	4017±38	-14.1 –	2630–2460
UB-6553	Long bone from white-tailed sea eagle	Long bone from white-tailed sea eagle reportedly found in a 'foundation deposit' (L12) sealed under the floor of stall 5	4072±39	-15.6 –	2860–2480
MAMS-14922 (S-EVA 24028)	Human rib ISB 1		4517±18	-19.2	3355–3100
MAMS-14923 (S-EVA 24029)	Human long bone ISB 2		4427±19	-20.2	3265–2970
MAMS-14924 (S-EVA-24030)	Human femur ISB 3		4483±19	-19.7	3340–3090
MAMS-14925	Human tarsal or carpal ISB 4		4490±18	-20.2	3340–3090
OxA-25626	Human cranium IS(7210)	ST3, juvenile c2–4 years (Lawrence and Lee-Thrope 2012).	4507±39	-20.7 12.0 3.3	4463±27 (T'=2.4; T'5%=3.8; df=1) 3340–3020
OxA-25627			4425±36		
OxA-25623	Human cranium IS(2783)	ST4, adult male, perimotem penetrating cranial trauma.	4516±37	-19.7 11.9 3.2	3370–3090

Laboratory Number	Dated sample	Parent context	Radiocarbon result (BP)	$\delta^{13}C$ $\delta^{15}N$ C:N	Calibrated date range (cal BC; 95% confidence unless otherwise stated)
OxA-25624	Human cranium IS(7015)	ST4, adult, sex not identified.	4420±36	-20.5 11.9 3.3	3330–2910
OxA-25578	Human cranium IS(1958)	SC3, adult male with clear case of multiple myeloma.	4416±32	-20.8 12.3 3.3	3320–2920
OxA-25625	Human cranium IS(7209)	SC3, juvenile c2 years. Lawrence and Lee-Thorpe (2012) suggest pathology indicates possible scurvy	4467±36	-20.9 12.4 3.3	3350–3010
OxA-25622	Human cranium IS(2642)	SC1-2/ST1-2. Highest nitrogen values for the skulls analysed in (Lawrence 2006) from this site, suggested as indication of dietary stress (Lawrence and Lee-Thorpe 2012).	3915±34	-20.2 3.0 3.3	2490–2290
OxA-25628	Human cranium IS(7284)	SC1–2/ST1–2, young adult female, with perimortem cranial trauma.	4456±36	-21.2 11.2 2.4	3350–2940
OxA-25579	Human cranium IS(1972)	North horn cist, adult female, with perimortem blunt force cranial trauma.	3255±29	-19.2 12.8 3.2	1620–1450
***Knowe of Rowiegar**, HY37332978, Rousay:Stalled cairn*					
Q-1221	*Bos* sp. tibia and radius	Cattle bone from stalled cairn	4305±50	–	3080–2870
Q-1227	Red deer demur, tibia, and humerus	Deer bone from stalled cairn	4005±60	–	2840–2340
UB-6420	Ovicaprid cranium	Sheep skull fragment from 'level above human bones', in same level as human skull fragment dated by UB-6421	4435±36	-22.4 –	3340–2920
UB-6421	Human cranium	Human skull fragment from 'level above human bones'; in same level as sheep skull fragment dated by UB-6420	4515±37	-21.5 –	3370–3090
SUERC-39631 (GU-26856)	Human right humerus (90047H1)	Adult ?female human skeletal remains from cairn	4605±35	-20.5 10.4	3500–3340
SUERC-39632 (GU-26857)	Human right humerus (90029H2)	Adult male human skeletal remains from cairn	4355±35	-20.2 10.8	3090–2890
SUERC-39636 (GU-26858)	Human right humerus (15084H3)	Adult ?female human skeletal remains from cairn	4540±35	-19.5 10.3	3370–3090
SUERC-39637 (GU-26859)	Human right humerus (90072H4)	Juvenile c 2 years human skeletal remains from cairn	4555±35	-20.9 11.2	3490–3100
SUERC-30638 (GU-26860)	Human right humerus (90075H5)	Adult ?female human skeletal remains from cairn	4470±35	-20.8 10.8	3350–3020
SUERC-39639 (GU-26861)	Human right humerus (90075H6)	Adult ?female human skeletal remains from cairn	4455±35	-20.3 11.1	3340–2940
SUERC-39640 (GU-26862)	Human right humerus (16319H7)	Juvenile c 7 years human skeletal remains from cairn	4545±35	-19.9 9.8	3370–3100

Table 10.1 Results from sites from the Bay of Firth landscape study area, early Neolithic stone-built stalled houses and timber structures from across Orkney, and from cairns across Orkney included in the model shown in Fig. 10.2. Details of the 'types' of structure and burial monument are included along with details of the individual samples. Continued pp. 270–271.

Laboratory Number	Dated sample	Parent context	Radiocarbon result (BP)	$\delta^{13}C$ $\delta^{15}N$ C:N	Calibrated date range (cal BC; 95% confidence unless otherwise stated)
SUERC-39641 (GU-26863)	Human skull (90085S1)	Juvenile c 5 years human skeletal remains from cairn	4510±35	-20.8 10.8	3370–3090
SUERC-39642 (GU-26864)	Human skull (90060S2)	Juvenile c 2–3 years human skeletal remains from cairn	4555±35	-20.8 11.5	3490–3100
SUERC-39646 (GU-26865)	Human skull (90070S3)	Adult ?male human skeletal remains from cairn	4525±35	-20.9 10.8	3370–3090
SUERC-30647 (GU-26866)	Human skull (90066S4)	Adult ?male human skeletal remains from cairn	4545±35	-20.5 11.2	3370–3100
SUERC-39648 (GU-26867)	Human skull (90068S5)	Adult male human skeletal remains from cairn	4575±35	-20.6 10.8	3500–3120
SUERC-39649 (GU-26868)	Human skull (90071S6)	Adult male human skeletal remains from cairn	4475±35	-19.9 10.5	3350–3020
SUERC- 39650(GU-26869)	Human skull (90057S8)	Adult ?male human skeletal remains from cairn	4560±35	-20.4 11.6	3490–3100
SUERC-39651 (GU-26870)	Human skull (90058S9)	Adult ?female human skeletal remains from cairn	4475±35	-20.3 10.2	3350–3020
SUERC-39652 (GU-26971)	Human skull (90035S10)	Adult male human skeletal remains from cairn	4570±35	-20.4 11.1	3500–3110
SUERC-39656 (GU-26872)	Human skull (90063S11)	Adult male human skeletal remains from cairn	4290±35	-19.5 10.5	2930–2870
SUERC-39657 (GU-26873)	Human skull (90064S12)	Adult male human skeletal remains from cairn	4500±35	-20.5 11.1	3360–3020
SUERC-39658 (GU-26874)	Human skull (90065S13)	Adult ?male human skeletal remains from cairn	4515±35	-19.7 10.6	3370–3090
SUERC-39659 (GU-26875)	Human skull (14981S14)	Young adult male human skeletal remains from cairn	4665±35	-20.3 10.5	3630–3360
SUERC-39660 (GU-26876)	Human skull (000x1S15)	Adult male human skeletal remains from cairn	4495±35	-20.7 11.2	3360–3020
SUERC-39661 (GU-26877)	Human skull (90057aS15)	Juvenile c 8–9 years human skeletal remains from cairn	4320±35	20.5 10.1	3020–2880
Knowes of Ramsay, *HY40042800*, Rousay: Stalled cairn					
Q-1222	*Bos* sp. metacarpal, tibia, ulna, and tibia	Animal bone from stalled cairn	4010±60	–	2840–2340
Q-1223	Animal ribs, including cattle	Animal bone from stalled cairn	4340±65	–	3270–2870
Q-1224	Humerus, metacarpal, and radius of red deer	Deer bone from stalled cairn	4300±60	–	3090–2770
Knowe of Yarso, *HY40482795*, Rousay: Stalled cairn					
Q-1225	Three tibia, probably of red deer	Deer bone from chambered tomb	4225±60	–	2920–2630
SUERC-45838 (GU-30088)	Human adult male skull 14662	Human skeletal remains from cairn	4500±35	-20.2 10.2	3360–3020

Laboratory Number	Dated sample	Parent context	Radiocarbon result (BP)	$\delta^{13}C$ $\delta^{15}N$ C:N	Calibrated date range (cal BC; 95% confidence unless otherwise stated)
***Knowe of Lairo**, HY39882796*, Rousay:Stalled cairn					
SUERC-45833 (GU-30086)	Human adult male skull 24761	Human skeletal remains from cairn	4537±34	-20.8 11.2	3370–3090
***Midhowe**, HY37223048*, Rousay: Stalled cairn					
SUERC-46400 (GU-30636)	Human adult male skull 25898	Human skeletal remains from cairn	4700±30	-20.5 10.3	3630–3370
SUERC-46401 (GU-30637)	Human late teens male skull 25899	Human skeletal remains from cairn	4531±28	-20.6 10.3	3370–3100
***Quoyness**, HY67663779*, Sanday: Passage grave					
SRR-752	Human tibia	Human tibia from the chamber	4190±50	-20.5 –	2910–2620
SRR-753	Human bone	A single human bone from the chamber	4270±50	-19.1 –	3010–2710
MAMS-14921 (S-EVAA-24027)	Human rib QUO1	Human skeletal remains from cairn	4487±18	-19.9	3340–3090
***Maes Howe**, HY31821277*, Stenness, Orkney Mainland: Passage grave					
Q-1482	Silty peat	North trench, basal organic material above bedrock, duplicate with SRR-505	3970±70	–	Weighted mean= 4060±48 BP (T'=3.0; T'5%=3.8; df=1)
SRR-505	Silty peat	North trench, basal organic material above bedrock, duplicate with Q-1482	4135±65	-29.9	2860–2480
SRR-504	Silty peat	North trench, lower organic layer of two on inner slope of ditch, 0.85 m below ground level	3660±45	-28.8	2200–1920
SRR-791	Peat	North trench, from layer beneath bank	5090±60	-27.8	4040–3710
Q-1481	Silty peat	South trench, layer 9K, basal organic material, duplicate with SRR-524	3765±70	–	Statistically inconsistent (T'=14.0; T'5%=3.8; df=1)
SRR-524	Silty peat	Sample 8A. South trench, layer 9K, basal organic material, duplicate with Q-1481	3445±50	-29.8	
SRR-523	Silty peat	Sample 7A. South trench, layer 9f/h, above sample 8A	1020±45	–	Cal AD 900–1150
SRR-522	Silty peat	Sample 6A. South trench, layer 9d, above sample 7A	1685±45	-29.8	Cal AD 240–430
SRR-521	Silty peat	Sample 5A. South trench, layer 9a, above sample 6A	1235±45	-29.7	Cal AD 660–900

Table 10.1 Results from sites from the Bay of Firth landscape study area, early Neolithic stone-built stalled houses and timber structures from across Orkney, and from cairns across Orkney included in the model shown in Fig. 10.2. Details of the 'types' of structure and burial monument are included along with details of the individual samples, continued.

Parameter name	**Estimates**	**Figure showing model**	**Posterior density estimate** (95% probability unless otherwise stated)
Start OrkneyNeolithic	Boundary parameter estimating the start of Neolithic activity associated with the use of stalled and timber houses across the islands, all house sites from the Bay of Firth, and cairns from across the islands	10.2	*3730–3480*
End EarlyHousesCairns	Boundary parameter estimating the end of activity from sites shown in the model	10.2	*1610–1400*
Start Stonehall Meadow	Boundary parameter estimating the start of activity associated with Stonehall Meadow stalled house	10.3	*3490–3040*
End Stonehall Meadow	Boundary parameter estimating the end of activity associated with Stonehall Meadow stalled house	10.3	*3330–2750*
SUERC-5792	Radiocarbon date associated with occupation in Stonehall Farm late Neolithic Barnhouse sub-square style house 1	10.3	*3340–3020*
FirstCrossiecrownHouse	First parameter estimating the first dated event associated with Crossiecrown House late Neolithic Barnhouse sub-square style house 1	10.3	*2480–2270*
LastCrossiecrownHouse	Boundary parameter estimating the last dated event associated with Crossiecrown House late Neolithic Barnhouse sub-square style house 1	10.3	*2430–2140*
FirstTimberStructure1	First parameter estimating the first dated event associated with Wideford timber structure 1	10.4	*3360–3140*
LastTimberStructure1	Last parameter estimating the first dated event associated with Wideford timber structure 1	10.4	*3350–3130*
SUERC-4862	Radiocarbon date from the posthole of Wideford timber structure 3	10.4	*3500–3130*
SUERC-4859	Radiocarbon dates associated with the occupation within Wideford compartmentalized house 1	10.4	*3340–3090*
SUERC-4870			*3340–3020*
Start SM13	Boundary parameter estimating the start of the early activity from midden deposits under the Smerquoy stalled house	10.4	*3460–3120*
Construct SM13	Date parameter estimating the construction of Smerquoy stalled house and erection of pecked rock art panel	10.4	*3360–3100*
Start SM13 Late	Boundary parameter estimating the start of the later phase of activity in Smerquoy stalled house	10.4	*2470–1970*
End SM13	Boundary parameter estimating the end of the later phase of activity in Smerquoy stalled house	10.4	*1970–1600*
FirstBayOfFirthHouse	First parameter estimating the first dated event associated with activity from Neolithic houses in the Cuween-Wideford landscape project	10.4	*3600–3310*
LastBayOfFirthHouse	Last parameter estimating the last dated event associated with activity from Neolithic houses in the Cuween-Wideford landscape project	10.4	*1920–1530*
FirstHouse3	First parameter estimating the first dated event associated occupation from stalled Ha'Breck house 3	10.5	*3350–3250*
LastHouse3	Last parameter estimating the last dated event associated with stalled Ha'Breck house 3	10.5	*3240–3020*
SUERC-34503	Radiocarbon date associated with occupation of timber Ha'Breck house 4	10.5	*3360–3100*
SUERC-35990	Radiocarbon date associated with occupation of timber Ha'Breck house 1	10.5	*3330–2920*
OxA-28984	Radiocarbon date associated with occupation of timber ?structure at Green	10.5	*3530–3360*
FirstGreenStalledHouse	First parameter estimating the first dated event associated with occupation from stalled house at Green	10.5	*3360–3150*
LastGreenStalledHouse	Last parameter estimating the last dated event associated with occupation from stalled house at Green	10.5	*3330–3050*
ConstuctHouse1	Date parameter estimating the construction of stalled house 1, Knap of Howar	10.6	*3350–2950*
FirstHouse2_KH	First parameter estimating the first dated event associated with occupation from stalled house 2, Knap of Howar	10.6	*3490–3140*
LastHouse2_KH	Last parameter estimating the last dated event associated with occupation from stalled house 2, Knap of Howar	10.6	*3340–2970*
Start Knowes of Trotty	Boundary parameter estimating the start of activity associated with the Knowes of Trotty stalled house	10.6	*3340–3120*
End Knowes of Trotty	Boundary parameter estimating the end of activity associated with the Knowes of Trotty stalled house	10.6	*3270–2860*
Start Phase2	Boundary parameter estimating the start of occupation associated with the use Knowes of Trotty stalled house	10.6	*3280–3110*

Parameter name	Estimates	Figure showing model	Posterior density estimate (95% probability unless otherwise stated)
Start Holm of Papa Westray North	Boundary parameter estimating the start of activity associated with the primary use of Papa Westray North	10.7	*3610–3370*
End Holm of Papa Westray North	Boundary parameter estimating the end of activity associated with the primary use of Papa Westray North	10.7	*2580–2080*
Start Point of Cott human burial	Boundary parameter estimating the start of activity associated with the use of Point of Cott for burial	10.8	*3620–3390*
End Point of Cott human burial	Boundary parameter estimating the end of activity associated with the use of Point of Cott for burial	10.8	*3010–2670*
Start Isbister	Boundary parameter estimating the start of activity associated with the use of Isbister for burial	10.8	*3490–3230*
End Isbister	Boundary parameter estimating the end of activity associated with the use of Isbister for burial	10.8	*2460–2190*
Start Knowe of Rowiegar	Boundary parameter estimating the start of activity associated with the use of Knowe of Rowiegar for burial	10.9	*3500–3360*
End Knowe of Rowiegar	Boundary parameter estimating the end of activity associated with the use of Knowe of Rowiegar for burial	10.9	*3010–2840*
First Knowes of Ramsey	First parameter estimating the first dated event associated the use of the Knowes of Ramsey	10.9	*3100–2690*
Last Knowes of Ramsey	Last parameter estimating the last dated event associated the use of the Knowes of Ramsey	10.9	*2860–22340*
SUERC-45838_GU-30088	Radiocarbon date associated with the use of the Knowe of Yarso	10.9	*3360–3090*
Q-1225	Radiocarbon date associated with the use of the Knowe of Yarso	10.9	*2930–2580*
SUERC-45833_GU-30086	Radiocarbon date associated with the use of the Knowe of Lairo	10.9	*3370–3100*
SUERC-46400_GU-30636	Radiocarbon date associated with the use of Midhowe	10.9	*3630–3370*
SUERC-46401_GU-30637	Radiocarbon date associated with the use of Midhowe	10.9	*3370–3100*
Start main use Quanterness	Boundary parameter estimating the start of activity associated with the use of Quanterness for burial	10.10	*3560–3340*
End main use Quanterness	Boundary parameter estimating the end of activity associated with the use of Quanterness for burial	10.10	*2570–2280*
Start Pierowall Quarry	Boundary parameter estimating the start of later activity associated with Pierowall *Terminus ante quem* for construction passage grave	10.11	*3120–2600*
FirstQuoyness	First parameter estimating the first dated event associated with the use of the Quoyness	10.11	*3340–3090*
LastQuoyness	Last parameter estimating the last dated event associated with the use of the Quoyness	10.11	*2900–2620*
ConstructMaesHoweEarthwork	Date parameter estimating the construction of Maes Howe earthwork	10.12	*3870–2600*
FirstStalledHouse	First parameter estimating the first dated event associated with the stone-built stalled houses on Orkney	10.13	*3520–3290*
FirstTimberStructure	First parameter estimating the first dated event associated with a Neolithic timber structure on Orkney	10.13	*3520–3360*
FirstHouseSite	First parameter estimating the first dated event associated with a timber or stone-built stalled early Neolithic house on Orkney	10.5–6	*3640–3440*
FirstOrkney Cromarty	First parameter estimating the first dated event associated with an Orkney-Cromarty cairn on Orkney (calculated with the Phase Orkney-Cromarty; shown in Fig. 10.16)	10.7–9	*3640–3440*
FirstMaesHoweStyle	First parameter estimating the first dated event associated with a Maes Howe-style cairn on Orkney (calculated with the Phase MAes Howe-style; shown in Fig. 10.16)	10.10–11	*3590–3340*

Table 10.2 Key posterior density estimates from the model shown in Fig. 10.2 and its subsections, the model shown in Fig. 10.12, and the calculations shown in Fig. 10.13.

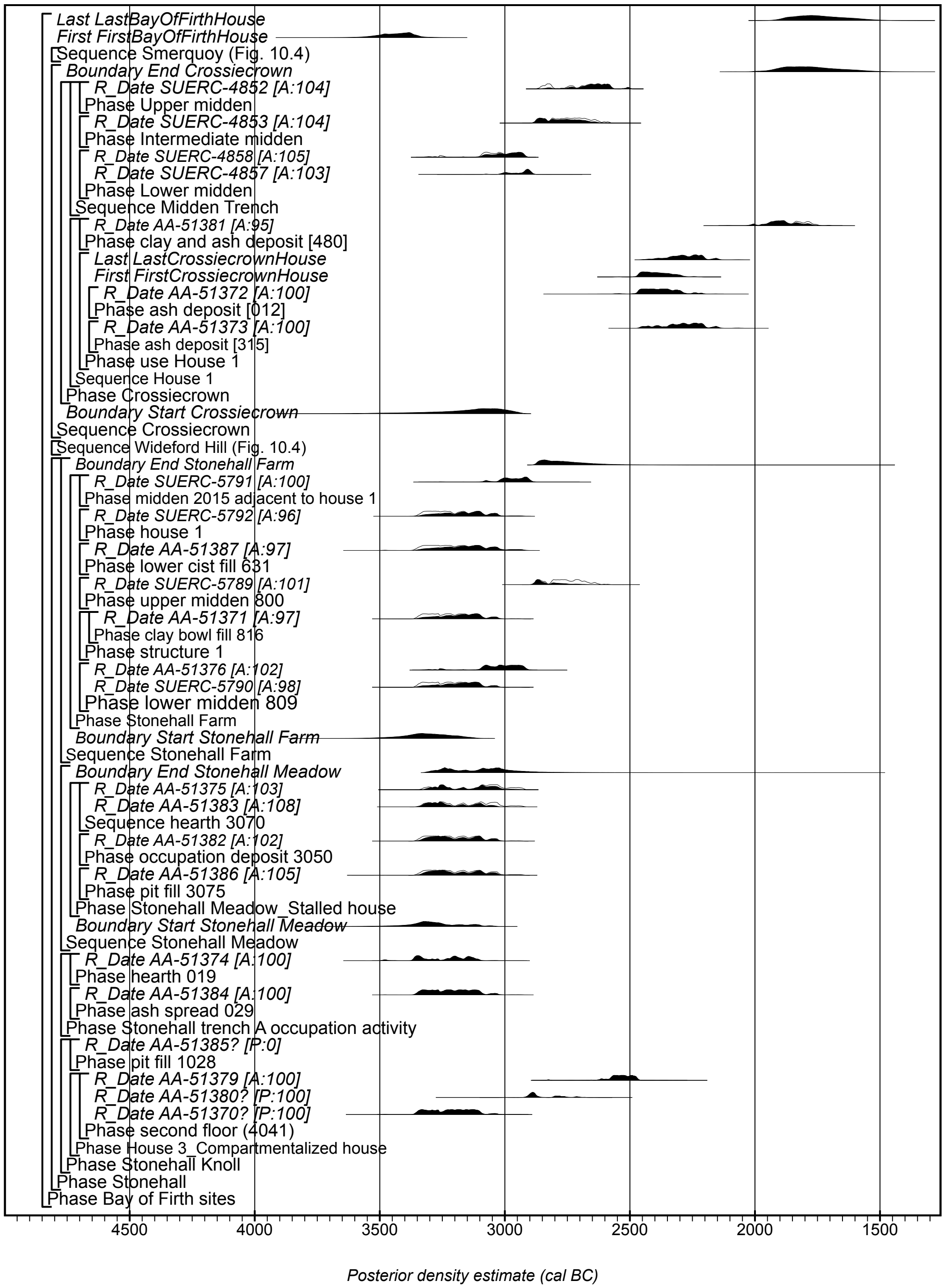

Figure 10.3 The first part of the Bay of Firth component of the model (see also Fig. 10.4). The overall model structure is shown in Fig.10.2. For each radiocarbon result included in the model as an active likelihood two ranges have been plotted. The ranges in outline represent the calibrated radiocarbon results, the solid distributions represent the posterior density estimates – the outputs from the Bayesian statistical model illustrated in the figure. Results not included in the model as active likelihoods are indicated in the figures with a '?' after the laboratory code; for example for the result AA-51380 shown here is not included in the model for reasons described in the text.

antiquarian work. It has also meant that the interpretation and chronological evidence for these sites has changed rapidly over the last 40 years.

For each site included in the model, a brief introduction is provided to the archaeology, the radiocarbon data selected for inclusion, and the modelling approach.

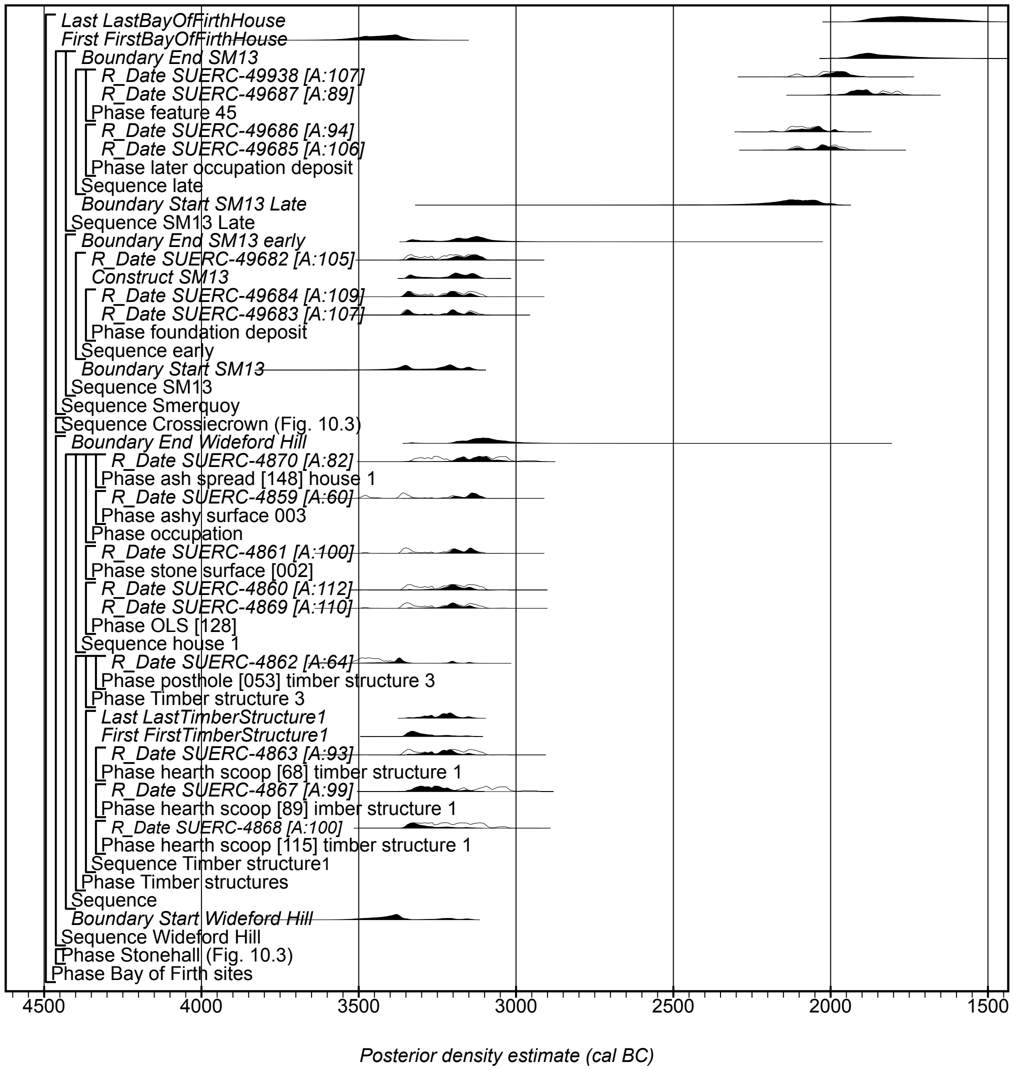

Figure 10.4 The second part of the Bay of Firth component of the model (see also Fig. 10.3).

Consideration of the model outputs and the wider context is made in section 10.3.

10.2.3 Radiocarbon dates from the Bay of Firth sites

The density and diversity of Neolithic structures and occupation evidence from Stonehall, and at nearby Wideford Hill and Smerquoy has significant implications for understandings of Neolithic Orkney (see Chapters 2, 4 and 5). The Bay of Firth component of the model is shown in Fig. 10.3–10.2. The density of occupation in this area has its own implications for producing robust chronologies of sites. Evidence for re-use of stone-built structures – as demonstrated at Smerquoy – means that sites with limited radiocarbon measurements may not sample the full duration of activity. The density of occupation also emphasises the importance of the associations of dated samples with archaeological events of interest. For several sites around the Bay of Firth, dated samples came from contexts – for example secondary floor deposits from House 3 from Stonehall Knoll – which might have included material redeposited from earlier activity.

Stonehall Knoll, Mainland (see Chapter 5)

Radiocarbon dates were produced on samples associated with 'compartmentalized' House 3, from Stonehall Knoll. Three radiocarbon measurements were produced on samples from a thin layer of burnt material and ash tramped into a secondary clay floor from House 3. The floor had seen several episodes of patching, mending and re-levelling. The radiocarbon samples from this horizon

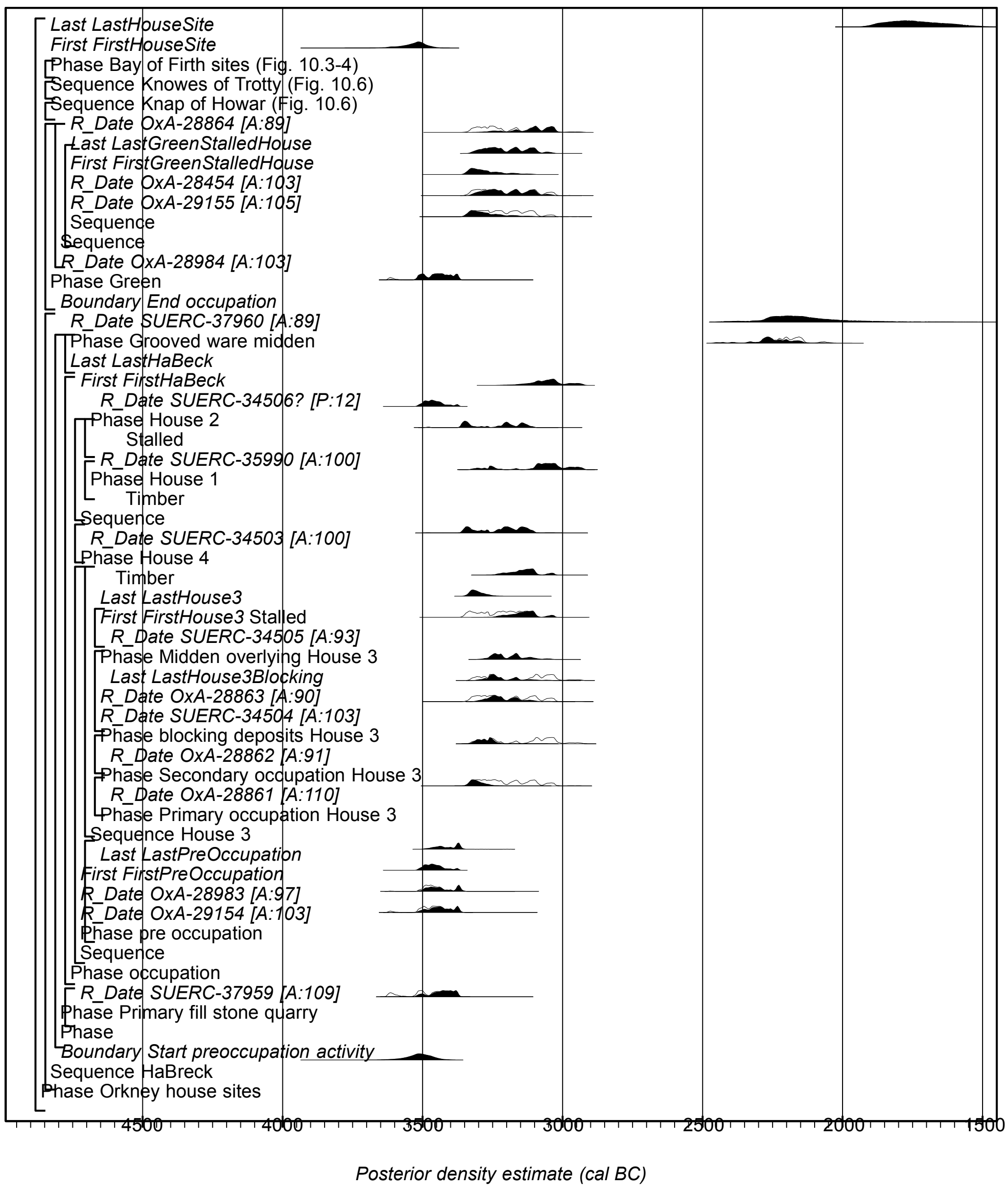

Figure 10.5 The first part of the early Neolithic Orkney house component of the model (see also Fig. 10.6). The overall model structures is shown in Fig. 10.2.

are of very different ages, suggesting at least some of this material could have been redeposited. The two earlier results (AA-51370 and AA-51380) have not been included as active likelihoods in the model presented here; the latest result from this deposit (AA-51379) may provide an estimate for the timing of secondary occupation within House 3, but could equally represent redeposited material. Another result from this trench (AA-51385) derives from a sample from pit fill [1028], which represents much later activity again, and has not been included as an active likelihood in the model.

Stonehall Meadow, Mainland (see Chapter 5)

Four results were produced from House 3, a stone-built stalled early Neolithic structure, at Stonehall Meadow. The results were all produced on samples associated with the occupation of House 3, from a pit in the outer compartment of the house (AA-51386), from two stratified hearth deposits (AA-51383 from an upper deposit, AA-51375 from the lower deposit), and from an occupation deposit from around the hearth in the house inner compartment (AA-51382). Results from the hearth deposit [3070] are modelled reflecting the stratigraphic

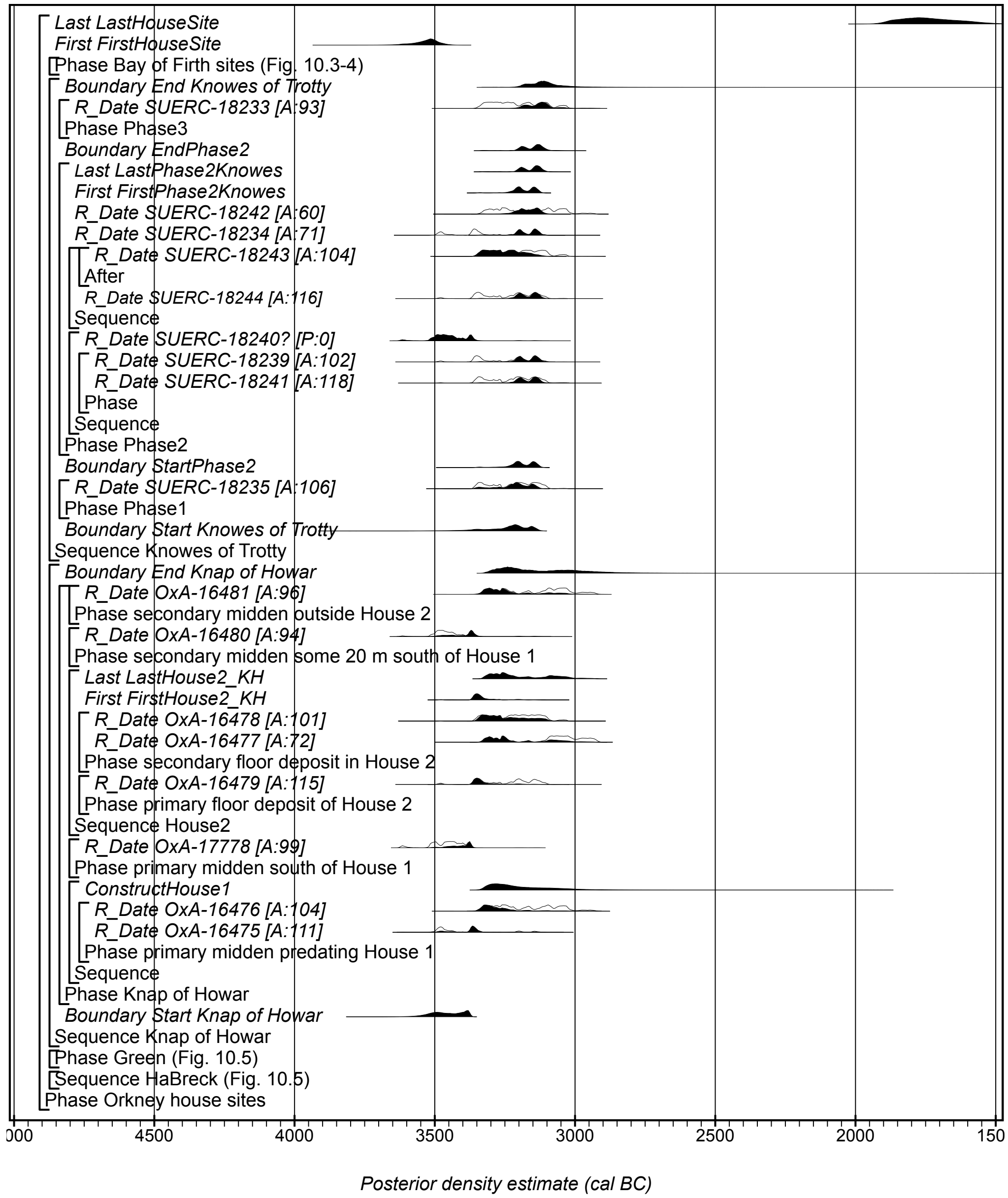

Figure 10.6 The second part of the early Neolithic house component of the model (see Fig. 10.5 and its caption).

sequential relationship between the parent contexts. These and the other results from Stonehall Meadow stalled house are presented as representing a phase of archaeological activity.

From trench A at Stonehall Meadow, two radiocarbon measurements (AA-51374 and AA-51384) were produced on samples from a hearth and an ash spread, these were statistically consistent and could therefore be of the same actual age (T'=0.8; T'5%=3.8; df=1; Ward and Wilson 1978). It is not clear if the hearth was associated with the occupation of House 3, or any of the other Neolithic occupation activity in the vicinity. These results have been included in a phase of Neolithic activity, but have not been associated with any particular structure.

Stonehall Farm, Mainland (see Chapter 5)

Several styles of Neolithic structure were excavated at Stonehall Farm, some of which were superimposed on midden deposits. Radiocarbon dates were produced in association with 'atypical' Structure 1 and sub-square House 1. Two statistically consistent measurements (AA-51376 and SUERC-5790; T'=3.4; T'5%=3.8;

df=1) were produced on samples from a lower part of a midden deposit that underlay Structure 1. From an upper midden deposit a sample was recovered for measurement SUERC-5789. Stratigraphically later than the lower midden deposits, a result was produced on a charcoal sample from a clay bowl which was associated with the use of Structure 1 (AA-51371). A radiocarbon date (AA-51387) on birch charcoal from a cist dug into the floor of the structure was also produced.

A sequential model reflecting the stratigraphic relationships between the parent deposits from the midden underlying Structure 1, the clay bowl associated with the use of Structure 1, and the later cist has poor overall agreement (model not shown). The nature of the deposits means that some of these results could have been produced on redeposited material. The results have been included in a less informative `Phase` model for Neolithic activity on the site.

A single result (SUERC-5792) from an ash-rich fill of sub-square House 1 might have a more robust association with occupation activity of this house, and this result is statistically consistent with a result (SUERC-5791) from a midden adjacent to House 1 (T'=0.8; T'5%=3.8; df=1). These results have been included in the model as representing a phase of Neolithic activity at Stonehouse Farm.

Wideford Hill, Mainland (see Chapter 2)

At Wideford Hill, radiocarbon dates were produced from circular Timber structures 1 and 2, and an apparently rectilinear Timber structure 3, which were stratigraphically earlier than Stonehouse 1 (which stratigraphically overlay Timber structure 2). Results from circular Timber structures 1 and 2 are statistically consistent (SUERC-4868, SUERC-4867, SUERC-4863; T'=2.3; T'5%=6.0; df=2). Three radiocarbon measurements were produced on samples from a sequence of superimposed hearth deposits from Timber structure 1. These results have been modelled to reflect this stratigraphic sequence of these samples. A single result (SUERC-4862) from Timber structure 3 is older than the results from Timber structures 1 and 2.

Stonehouse 1 is here classified as a 'compartmentalized' type house, and is associated with a stratigraphic sequence of radiocarbon samples. These derived from the old land surface [128] underlying the structure, a rammed surface deposited over this old land surface [002], and deposits [148] and [003] associated with occupation activity within the structure. The results from Stonehouse 1 have been modelled to reflect the stratigraphic sequence between the radiocarbon samples' parent deposits. In the model shown here, the results from the timber structures are all presented as belonging to a phase of activity that pre-dates Stonehouse 1, which reflects site phasing, and is based upon the stratigraphic relationship between Timber structure 2 and Stonehouse 1.

Crossiecrown, Mainland (see Chapter 7)

At Crossiecrown, radiocarbon samples were recovered in association with occupation of the Red House (House 1 – a later Neolithic sub-square structure), from a clay and ash deposit [480] associated with the collapse of the Red House, and from midden deposits. Results associated with its occupation (AA-51373 and AA-51372) are statistically consistent (T'=1.3; T'5%=3.8; df=1). The interval between the sample of radiocarbon dates associated with the use of the structure, and the date from the deposit associated with the structure's collapse (AA-51381) indicates that this structure could have had a long and punctuated use-life history, which is poorly understood. Samples (SUERC-4857, SUERC-4858, SUERC-4853, SUERC-4852) from a sequence of deposits from the south midden excavated in Trench 3 were also radiocarbon dated. Two results from a lower midden deposit (SUERC-4857 and SUERC-4858) are statistically consistent (T'=3.3; T'5%=3.8; df=1), and the midden results have been modelled to reflect the `Sequence` of stratigraphic relationships of the radiocarbon samples parent deposits. These results cannot be directly associated with the use of the Red House, or other occupation evidence on the site.

The results from the midden deposits are considerably earlier than those associated with the Red House, and could be taken to suggest that other, earlier occupation activity or structures are located on the site. All these results have been included in a `Phase` model.

Smerquoy, Mainland (see Chapter 4)

Radiocarbon samples were submitted from two phases of activity associated with the use of the Smerquoy Hoose. Following production of radiocarbon dates it became apparent that the later occupation activity was significantly younger than the construction and initial use of the structure. Additional evidence for the complex history of occupation at Smerquoy was apparent from the repositioning of the central stone-built hearth. Extensive sampling for plant macrofossils for radiocarbon measurements did not produce any suitable material from the central hearth, so the timing of this reorientation cannot be established with any certainty.

However, from the radiocarbon chronology associated with the occupation horizons alone, it is clear that the structure was the focus of activity – though probably intermittently – for a considerable period of time.

Importantly, while the Smerquoy Hoose has earlier Neolithic stalled architecture, a panel set into the walling near the entrance has rock art decoration showing a pecked horned spiral motif previously associated with later Neolithic sites. The position of this panel low in the wall-coursing indicates that it must have been executed prior to the construction of the stalled stone house (see Chapter 4).

Two statistically consistent results (SUERC-49683 and SUERC-49684; T'=0.2; T'5%=3.8; df=1) from foundation deposits predating the stone walling at Smerquoy provide *termini post quos* for the construction of the Smerquoy Hoose (which is estimated by the parameter *ConstructionSM13*), and the erection of the rock art panel in the walling. Initial occupation is sampled only by one result (SUERC-49682; another measurement failed due to a yield of insufficient carbon). The chronology of the stratigraphically later occupation is measured by results from an occupation horizon (SUERC-49685 and SUERC-49686) and a stratigraphically later pit (SUERC-49687 and SUERC-49938). The results on the later occupation horizon are statistically consistent (T'=0.9; T'5%=3.8; df=1), though the two results from the later pit are statistically inconsistent (T'=5.8; T'5%=3.8; df=1), and indicate that the later activity was of some duration. The results are presented in the model reflecting the stratigraphic sequence – pre-stone house foundation deposits, early occupation, later occupation and stratigraphically later negative features – from the site.

10.2.4 Radiocarbon dates from other early Neolithic stalled house and timber sites

Knowes of Trotty, Mainland (see Chapter 3)

Radiocarbon samples from the Knowes of Trotty stone-built stalled house were related to a sequence of deposits associated with phases of activity in the early Neolithic structure. From phase 1, SUERC-18235 was produced on shortlife charcoal recovered from a pit underlying the house walling. This result provides a stratigraphic *terminus post quem* for the construction of the house. From phase 2, deposits associated with the use of hearths (SUERC-18242, SUERC-18243, SUERC-18244, SUERC-18241 SUERC-18239) including stone-built hearth 215 (SUERC-18234), and floor/occupation deposits (SUERC-18240), within the stalled house produced radiocarbon samples. Of the radiocarbon results, SUERC-18240 is too early for its stratigraphic position within the model presented here, and this result has not been included as an active likelihood. Later, phase 3 activity within the stalled structure is represented by SUERC-18233, which was produced on a sample from a hearth (082) that had a raised location within the northern part of the house. This result is interpreted as representing the latest use of the structure, with the stratigraphically-earlier stone-built hearth 215 sealed over by this time. One of the results (SUERC-18243) was produced on unidentified charcoal, which therefore could include an 'old wood' offset, is included in the model as a *terminus post quem*.

The model for the Knowes of Trotty stalled house uses the sequential phases of activity pre-dating the stone structure, and associated with use of the structure as its basis. Estimates for the start of different archaeological phases of activity associated with the stalled house (*Start Knowes of Trotty*, *StartPhase2*, *EndPhase2*, *End Knowes of Trotty*) are produced from the model.

The Knap of Howar, Papa Westray

The Knap of Howar is located adjacent to the sea shore on the west coast of Papa Westray. The site was first excavated in 1929, but it was not until Anna Ritchie's work (1983) that the two stone-built stalled houses were recognised as being of Neolithic date. The two structures are conjoined by a connected passageway. House 1 was probably constructed prior to House 2 (Ritchie 1990a, 42), see discussion below. House 1 was divided into two areas by a stone stall; within the first compartment was a stone bench, while in the second were a quern, hearth and wall recess. House 2 was divided into three compartments. The inner compartment included several wall recesses, and the middle included a hearth. At least two phases of activity are associated with House 2, as evidenced by the blocking of the door into this structure.

The structures at the Knap of Howar represent the 'classic' early Neolithic Orkney stalled rectilinear house, with walls formed from midden core material and stone facing (see Chapter 1). The walls have rounded corners internally and externally, and the internal space is divided by orthostatic stone slabs. Material culture recovered included flint, animal bones (including fish), pottery and polished stone axes. The pottery was defined as forming four categories, with some 13 'Unstan' ware bowls, simple bowls, bowls with cordons, and miscellaneous sherds represented (Henshall 1983, 70). The assemblage also included sherds with similarities with Grooved ware (*ibid.*, 72).

Two groups of radiocarbon measurements were produced. Results on samples of mixed animal bone (Birm-813–816; SRR3449; SRR-352) and a result on 'soil' (Birm-817) have not been included in the model presented here. More recently, a series of short-life, single entity measurements on samples identified to species level were produced (Sheridan and Higham 2006). Two results (OxA-16475 and OxA-16476) on midden material from under House 1 provide stratigraphic *termini post quos* for the construction of the structure, an estimate for which is provided by the *ConstructHouse1* Date parameter. Radiocarbon results (OxA-16477, OxA-16478 and OxA-16479) from samples from a stratigraphic sequence through the primary and secondary floor deposits from House 2 are interpreted here as dating occupation activity associated with this structure (see discussion below). Other radiocarbon measurements on single entity bone samples from midden deposits from the site are associated with Neolithic occupation (OxA-16480, OxA-16481 and OxA-17778). As well as the stratigraphic relationships described above through the floor deposits of House 2, and a Sequence model to provide an estimate for the construction of House 1, the results from the site are modelled as if they represent a related Phase of activity associated with the Neolithic use of the site.

Ha'Breck, Wyre

Excavations at Ha'Breck, Wyre have revealed a series of early Neolithic stone-built stalled structures, early Neolithic rectilinear timber structures, a domestic stone quarry, and later activity which includes midden deposits associated with Grooved ware. Five structures have been excavated at the site (Lee and Thomas 2011; Farrell *et al.* 2014), linear timber structures are represented by House 1 and House 4. Stone-built earlier Neolithic stalled houses were represented by House 2, House 3 and House 5. Radiocarbon results from the site were produced as part of the recent *Stepping Stones* AHRC-funded project directed by Duncan Garrow and Fraser Sturt, and post-excavation analysis is ongoing.

The Ha'Breck early Neolithic structures show evidence of transition from timber to stone structures, with houses rebuilt on the same footprint, and with stratigraphically later stone structures rebuilt adjacent to timber ones (Farrell *et al.* 2014). The excavators suggest that several of the buildings were used for a relatively limited period of time, with the corner timber posts comprising House 4 removed as the structure was decommissioned. This can be contrasted with the apparent longevity of occupation associated with stone-built stalled House 3 immediately to the west of House 4. Stone-built House 3 included wooden central posts, and occupation went on for long enough to necessitate the replacement of these posts four or five times (Farrell *et al.* 2014).

A single radiocarbon measurement each was produced from a context from timber House 1 (SUERC-35990) and from a context from timber House 4 (SUERC-34503). Samples from a sequence of deposits from House 3 exist, including statistically consistent measurements from a pre-occupation deposit underlying this building (OxA-29154 and OxA-28983; T'=0.2; T'5%=3.8; df=1), and deposits from within House 3. A stratigraphic sequence from the occupation of House 3 comprises 'primary occupation' (from which a sample for OxA-28861 was recovered), 'secondary occupation' (from which a sample for OxA-28862 was recovered), and closure or blocking deposits (from which statistically consistent measurements SUERC-34504 and OxA-28863; T'=0.3; T'5%=3.8; df=1) were produced. Stratigraphically later than this again was a midden deposit overlying House 3, from which a sample for SUERC-34505 was recovered.

Stalled stone House 2 is stratigraphically later than timber House 1. However, the result from House 2 (SUERC-34506) is earlier than that from House 1 (SUERC-35990), and when modelled reflecting this stratigraphic sequence of the results have poor agreement (model not shown). Too few measurements exist from these structures to explore their chronology in any detail; for the purposes of the model shown here, the earlier result (SUERC-34506) from House 2 has not been included as an active likelihood on the grounds that it may represent redeposited material. Neither of these measurements can be demonstrated to represent really robust estimates for the use House 2 or House 1.

In addition to the measurements from these structures, a single result (SUERC-37959) was produced on a charcoal sample from the stone quarry, and a single result was produced on a sample from a 'Grooved ware midden' on the site (SUERC-37960).

The results from the pre-occupation deposit under House 3, the sequence of results through the structure, and the result from the midden over this structure have been modelled to reflect the stratigraphic sequence. The rest of the results from Ha'Breck are presented as representing a phase of archaeological activity on the site. The presence of the much later result (SUERC-37960) associated with Grooved ware activity on the site indicates that occupation at Ha'Breck might have had considerable longevity and complexity.

Green, Eday

Excavation at Green, Eday, revealed Neolithic occupation (Coles and Miles 2013), and post-excavation analysis is ongoing. A stalled stone-built early Neolithic structure is present on the site. Finds from the site included later Neolithic material culture (Grooved ware and maceheads). Radiocarbon results from the site were produced as part of the recent *Stepping Stones* AHRC-funded project.

Four radiocarbon dates exist from Green. OxA-29155 and OxA-28454 were produced on samples from superimposed hearth deposits in stalled stone-built House 1. OxA-28864 was produced on a sample from a midden deposit (214) stratigraphically later than House 1. OxA-28984 was produced on a sample from a posthole that may be associated with the use of a timber structure, The stratigraphic sequence of relationships between the hearth deposits in House 1 and the overlying midden context has been used in the model presented here. OxA-28984 is included in the model as part of the phase of Neolithic activity.

10.2.5 Radiocarbon dates from Orkney-Cromarty cairns

Holm of Papa Westray North, Papa Westray

Holm of Papa Westray North is a stalled early Neolithic chambered cairn, with a long history of work. The site is visible from the coast, on the north of Papa Westray, at *c.*5m OD (Davidson and Henshall 1989). The cairn was rectangular, measuring 11.8m by 6.3m. Interventions at the site were recorded in 1849 and 1854, though prior to this, the site had been robbed (Ritchie 2009). Modern excavation at the site occurred in 1982–83, and revealed a stalled cairn, with a series of phases of activity. The monument comprised a forecourt, an entrance passage, and a chamber that was divided into four compartments by orthostats. At the end of the chamber was a small cell (cell 5). The primary phase of the monument comprised a round cairn and cell 5. In phase 2, the structure was elaborated to form a rectangular cairn and passageway. After some period of use, cell 5 was filled in and the entrance blocked. In phase 4, the chamber and passage appear to have been deliberately infilled.

A range of material culture was recovered from the cairn, including round-based plain bowl pottery (including flanged-rim bowls), Grooved ware (with both incised and applied decoration), as well as human remains from individual stalled compartments. Finds other than human skeletal remains were nearly all recovered from the central area and the east side of compartments 1–3. The skeletal remains were disarticulated, and perhaps moved around as part of the use of the cairn, with elements from different compartments refitting (Ritchie 2009, 30). Sheep, bird, otter, rodent and fish bones, limpet shells, and a deer antler were recovered from within the chamber, and may represent a range of taphonomic processes. Faunal remains in the chamber might indicate that it was open for a period of time after its initial use (Ritchie 2009). Beaker pottery was recovered from contexts outside the cairn.

Radiocarbon measurements were produced on samples of human bones from cell 3 (context 1 – GrA-25636 and GrA-25638), from cell 5 (GrA-25638, and from the stratigraphically later infilling of cell 5 GU-2067, OxA-17779, and OxA-17780), from compartment 4 (GU-2068), and from the midden deposit which contained Grooved ware and Beaker pottery (OxA-16472 and OxA-17781) adjacent to the kerb of the back of the cairn. From a primary floor deposit in the forecourt a sample of red deer bone was dated (OxA-17782).

From the later modification of the monument, OxA-16473 was produced on a sample from the demolition of the grave facade in the forecourt, OxA-16471 was produced on a sample from the final fill of cell 5, and a measurement (GU-2069) was produced on a sample from the deliberate infilling of the entrance passage (Ritchie 2009, 22). Initial modelling of the results from Holm of Papa Westray North making use of the published stratigraphic relationships between samples' parent deposits indicated that human skeletal remains may have been redeposited. Results are modelled here as a `Phase` of activity associated with the use of the site (Schulting *et al.* 2010, 27). Separate estimates for the `First` and `Last` dated events associated with results from within the cairn and from the midden have been calculated.

The model presented here makes use of the estimates for marine contributions to the diets of three humans represented at the cairn (Schulting and Richards 2009, 69; a 16% marine contribution for GrA-25636, a 2% marine contribution for GrA-25637 and a 13% contribution for GrA-25638). The uncertainty associated with this portion of the dietary contribution has been applied as ±10, which in this case is an arbitrary figure. The local radiocarbon marine reservoir has been applied as 24±67, as described above.

Work by Balasse and Tresset (2009) indicated a marine contribution to the diet of some sheep/goat remains from the site, including that the individual dated by OxA-17779 consumed marine fodder in winter seasons (Balasse and Tresset 2009, 81). For measurements OxA-17779, OxA-16474 and GU-2069 a marine diet fraction of 30±50% has been applied to reflect a cold season contribution, or possible cold season contribution, of marine resources with the local marine reservoir offset. This reflects an estimate that one third of the dietary contribution might be derived from marine resources during the winter and early spring. Results on several young sheep metatarsal bones (OxA-16472, OxA-16474 and GU-2069) indicate greater marine contributions. For these young sheep samples, a marine dietary contribution is increased to 50±50% to reflect the greater proportional effect over these individuals' short lifespans, with a five month gestation period (*ibid.*, 77). In light of recent work indicating strategic, small-scale marine contributions to Neolithic diets on Shetland (Montgomery *et al.* 2013), further work examining the nature of these contributions would be welcome.

A measurement on an otter bone (OxA-17780) has been calibrated using the marine curve and the local reservoir value. The radiocarbon results on vole bones from the site (OxA-18665 4054±28 BP 2840–2480 cal BC 95% confidence; OxA-18666 4089±29 BP 2860–2500 cal BC 95% confidence) are not included in the analysis as the radiocarbon ages and nature of the samples mean that they are likely to be intrusive.

Point of Cott, Westray

The Point of Cott, Westray, is a stalled horned cairn, with a chamber divided into four compartments. The site was first excavated in 1935 (Henshall 1963), and was subsequently excavated in 1984–85 in response to coastal erosion (Barber 1997). The monument had been robbed prior to this (Henshall 1963, 226). The monument was initially constructed as a stone-built stalled chamber with surrounding cairn. Drystone walls were then extended at the front of the chamber to give the monument a trapezoidal or horned appearance. The horn on the south west of the monument had been destroyed by coastal erosion prior to investigation by Calder in the 1930s (Henshall 1963). The minimum length of the cairn was estimated to be over 30m, with the southern façade 16m wide. The surviving hornwork was 6m long. In the chamber, the fourth, terminal compartment was subdivided by a slab along the longitudinal cairn axis (Barber 1997). At the north of the monument, two infant inhumations were recovered, representing stratigraphically later burials than activity associated with the cairn construction.

Pre-cairn deposits produced animal bone, and lithics that were identified by Finlay (1997) as later Mesolithic and probably redeposited. The cairn produced human skeletal remains, animal bone and pottery. Whale ivory beads were recovered from compartments 3 and 4 of the chamber. The pottery assemblage comprises 65 sherds, the majority of which derived from five vessels, three of these with flanged rims and round bases, and two with flat rims (MacSween 1997). Sherds from some of these vessels were found distributed between different chambers and the passage. Two sherds from secondary contexts possibly represent incised Grooved ware.

Fifteen radiocarbon dates were produced on human skeletal remains and faunal remains from the stalled cairn compartments. Samples on bulk bone and bird bone are not included in the model shown here. A result on an otter bone has been calibrated with the marine calibration curve and local offset (see above). This otter bone was recovered from behind the wall face of the north of the passage.

Results produced on human bone have been modelled as representing a `Phase` of use of the cairn for burial. These results are constrained to be earlier than the one measurement on single entity animal bone from the passage blocking (GU-2941), and than the result on the otter bone (UtC-1665), which is much later and cannot be associated with the initial activity at the site. Because the bulk faunal samples have been excluded from the model, and the sheep bone (GU-2941) and the otter bone (UtC-1665) have not been included in the main `Phase` of the model, this `Phase` only includes results on human remains. The result (AA-11698) on an infant burial from the collapsed matrix of the cairn at the northern end of the chamber is in keeping with the other results from human remains from the chamber.

Isbister, South Ronaldsay

The stone-built stalled cairn at Isbister, South Ronaldsay, is located on cliffs, with impressive views of the sea, and a commanding position in the contemporary landscape. The monument takes the form of an oval cairn, with a stalled central passage perpendicular to the entrance passage. The longer axis of the mound is currently some 31.5m, though the eastern side of the monument has been damaged by erosion, and the mound was probably originally circular. The central passage is divided into five compartments by four sets of orthostats (Davidson and Henshall 1989, 126). From the central passage, three side cells project and the termini of the main chamber are divided into compartments. These terminal compartments included stone shelves set within them, though any deposits on these had been disturbed prior to excavation in 1958. Isbister has had a complex history of investigation. Published excavations include those in 1958, work by the then landowner in 1976, 1978, 1982–83 (Hedges 1983), and those sponsored by the local council in the late 1980s (Davidson and Henshall 1989). The characteristics of the site have led to it being classed a 'hybrid', including both a stalled chamber and side cells (cf. Schulting *et al.* 2010).

From the central chamber an assemblage of disarticulated human skeletal remains, animal bones and charcoal was recovered, and 'Unstan' bowl was recovered from the site (Schulting *et al.* 2010, 26). Human and animal bones, included bones of the white-tailed sea eagle, were recovered from below the floor slab in the south end compartment. This deposit was interpreted as a foundation deposit associated with the monument construction. From the forecourt on the east side of the entrance passage three stone axes, a mace head, knife and jet button were recovered. After a period of use, the chamber appears to have been deliberately decommissioned and sealed. A much later cist was inserted into the cairn mound, and another later cist into the north horn of the cairn.

Thirty-two radiocarbon measurements have been produced on the human and animal bone assemblage from the site (Renfrew *et al.* 1983; Schulting *et al.* 2010: Lawrence and Lee-Thorp 2012), these results include repeat measurements on the same bone samples (Renfrew *et al.* 1983). The recently published results (MAMS-14922, MAMS-14923, MAMS-14924, MAMS-14925) reported in Sheridan *et al.* (2012, 202) are included in the model, as are the results (OxA-25626, OxA-25627, OxA-25623, OxA-25624, OxA-25578, OxA-25625, OxA-25622, OxA-25628, OxA-25579) reported in Lawrence and Lee-Thorp 2012, 203). Weighted means are taken prior to calibration on statistically consistent repeat measurements on the same individuals (GU1182 and Q-3013; GU-1186 and Q-3017; OxA-25626 and OxA-25627; GU-1183 and Q-3014).

As extensively discussed by Schulting *et al.* (2010), modelling the results from Isbister according to their reported stratigraphic association produces a model which has poor agreement (model not shown). For example, two results from the 'foundation deposit' (UB-6552 and UB-6553) are much later than measurements on samples from deposits in the stalls, and are of similar age to results from the cairn infilling (GU-1186 and Q-3017). This tension between the results and recorded stratigraphy could indicate that material within the grave had been mixed and redeposited. The sea eagle bones clearly do not relate to the site 'foundation deposit' (Schulting *et al.* 2010, 26).

The results from the main chamber are all included in a Phase of activity that is earlier than the results from stratigraphically later cists. The results on the sea eagle bones (UB-6552 and UB-6553) and the repeat measurements on the same unidentified animal bone (Q-3018 and GU-1190) have not been included in the model as active likelihoods. By excluding these results, the earlier Phase from the model estimates the currency of human burial at the site.

Knowe of Rowiegar, Rousay

The Knowe of Rowiegar, Rousay, is a stone-built stalled cairn, located at 6m OD on the south west shore of Rousay. The first recorded excavation of the site was in 1937 by Walter Grant (Davidson and Henshall 1989, 136-8) where it was found that central part of the chamber of the long stalled cairn had been subsequently modified to form a souterrain. In its original form, the main chamber probably comprised 12 stalls (Davidson and Henshall 1989). Unbonded walling was added to the north west and south east ends of the cairn at some point. There is evidence for Iron Age occupation on top of the cairn and to its east.

Material culture included sherds of 'Unstan' ware (Kinnes 1985), scrapers of chert and flint, a flint knife recovered from the fourth compartment, and flint flakes. Human remains were recovered from within the chamber, along with cattle and sheep bones, and the wings of a gannet (Davidson and Henshall 1989).

Radiocarbon dates were produced over a considerable period of time on samples recovered from the site (Renfrew *et al.* 1976; Sheridan 2005b; Curtis and Hutchison 2013). Samples of human bone and faunal remains all appear to derive from the use of the monument (cf. Davidson and Henshall 1989, 87), and results have been modelled in a single Phase. One result (Q-1227) had poor agreement with this model in initial runs. This result is later than others from the site and this has not been included as an active parameter in the model presented here.

Knowes of Ramsay, Rousay

The Knowes of Ramsay, Rousay, is a stone-built stalled cairn (Callander and Grant 1936), at 55m OD, immediately to the west of the Knowe of Yarso, and to the immediate north east and overlooking the Knowe of Lairo. The site was excavated in 1935, though it had been subject to robbing prior to this (Callander and

Grant 1936; Henshall 1963). Prior to excavation the mound survived to 1.5m. It was rectangular in plan, and some 34.4m long by 8.2m wide. The chamber had been divided into 14 compartments by pairs of transverse slabs. A small stone cist was found near the southwest corner of the fifth compartment from the entrance. Finds included six small sherds of pottery, a scraper and five pieces of flint or chert, human bones and numerous animal bones.

Three radiocarbon results on animal bone samples from the site have been produced (Renfrew *et al.* 1976), of these the nature of the animal species used for measurement (Q-1223) is unclear, and this result has not been included as an active parameter in the model. The Knowes of Ramsay results have been presented in a `Phase` model (cf. Davidson and Henshall 1989, 87). As with other sites discussed here, the animal bone may not be associated with the earliest use of the site as a mortuary monument, and an estimate from the site for the `First` dated event might better provide a *terminus ante quem* for its construction and initial use (see discussion below).

Knowe of Yarso, Rousay

The Knowe of Yarso, Rousay, is a stone-built stalled cairn, located on the south coast of Ramsey (100m OD). Prior to excavation, the rectangular mound was c19m by 9.7m. The monument included a central passage divided into three side compartments, and a terminal compartment (Callander and Grant 1935). The site was investigated in 1934, and finds recovered included human remains from the passage and chamber, though most of these were recovered from the inner compartments, where skulls had been arranged along the base of the walls (Richards 1988, 49; Davidson andHenshall 1989). The faunal assemblage included deer, sheep and dog bones. Food Vessel and Beaker pottery, flint arrowheads and other worked flints were also recovered.

Two radiocarbon dates were produced from the site, on a deer sample (Q-1225; Renfrew *et al.* 1976) and a sample of human skeletal remains (SUERC-45838; Curtis and Hutchison 2013). The results are presented as representing a `Phase` of archaeological activity (cf. Davidson and Henshall 1989, 87). As with other sites detailed here, the animal bone is considerably later than the sample of human bone.

Knowe of Lairo, Rousay

The Knowe of Lairo, is an extraordinary stone-built, tripartite, long horned cairn, which was excavated in 1936 (Grant and Wilson 1943). The site had been robbed and disturbed prior to excavation (Henshall 1963; Davidson and Henshall 1989). The cairn is located on the edge of a terrace at 15m OD, below the hillside which is the location of the Knowes of Ramsay and the Knowe of Yarso (Davidson and Henshall 1989, 132).

The monument was roughly trapezoidal, and the cairn survived to a height of 3.2m at the east end above the chamber. It is c17m wide at the east end, 9m at the west, and some 45.7m in length from the start of the passage entrance to the west end of the mound. The inner chamber was divided by orthostats, with a series of recesses. Initially the monument had a tripartite plan, with three compartments dividing the main chamber. However subsequently a line of masonry blocked the third compartment, and ran along the side of the first two compartments (Davidson and Henshall 1989). Within this masonry skin were four recesses at varying heights, two of which were two-storeyed. Material recovered from the cairn includes a ground stone axe and two sherds representing wall or base sherds from round bowl pottery. A single result on human bone from the Knowe of Lario (Curtis and Hutchison 2013) provides and indication of the date of use of the monument.

Midhowe, Rousay

The stone-built stalled cairn at Midhowe, Rousay, was excavated by Callander and Grant in the early 1930s. The site is located on the south west coast of Rousay, at 10m OD. Before excavation the mound survived to *c.*2.7m high. The cairn was of rectangular plan, and measured *c.*32.5m long by *c.*13 m wide (see Callander and Grant 1934). The chamber was divided into 12 compartments, with the terminal compartment subdivided by transverse slabs. Low shelves or benches ran along the north east side of the chamber in compartments five to eleven. Human remains were recovered on these shelves, with more material deposited below the bench, and on the floor of the chamber.

At the north west of the cairn, evidence for subsequent modification took the form of a passage from the end of the cairn to the chamber, while a cist-like tank in the north end of the cairn also indicated remodelling of the site (Davidson and Henshall 1989). The chamber was blocked with collapsed material from the roof. Stratigraphically later than the roof collapse were the remains of two inhumations. Also after the initial cairn construction, two walls were constructed that abutted the north east corner and south east corners of the monument.

Faunal remains recovered from the site included cow, sheep, and fish bones, red deer bones and antler, and limpet shells. Finds included a flint knife, and 'Unstan' bowl pottery (Callander and Grant 1934; Kinnes 1985). Two results (Curtis and Hutchison 2013) were produced on human bone probably from two different individuals from Midhowe, and are presented as part of a Phase of activity associated with the use of the structure.

10.2.6 Radiocarbon dates from passage graves

Quanterness, Mainland

Quanterness was discussed extensively in Chapter 8, it comprises a large circular mound, and survived to *c.*31m diameter and a height of *c.*3.4m (Davidson and Henshall 1989). A stone-built passage led to a rectangular central chamber, from which six side cells radiate. The cells were roughly rectangular, though the three southern cells had concave bowed outer walls. An Iron Age house was built on the east side of the monument. Early 19th century exploration of the site is reported (Barry 1805), but it remained predominantly undisturbed until the systematic excavation by Renfrew (Renfrew *et al.* 1976; Renfrew 1979).

A sequence of five 'strata' was identified in the central chamber, with a similar sequence in the south west cell. The site produced a large Grooved ware pottery assemblage representing at least 34 vessels, a small quantity of flint and stone, and faunal remains. Human remains were recovered from the main chamber (80% of which was excavated), from one cell and from the innermost part of the passage, the majority of which was disarticulated. The nature of the assemblage was interpreted as resulting from excarnation (Chesterman 1979). Schulting *et al.* (2010, 9) reassessed the human skeletal remains, and as well as revising the size of the population represented, emphasised that the assemblage does not show weathering or alteration, and includes small skeletal elements which are not usually present in an assemblage if subject to secondary burial.

Twenty radiocarbon dates were recently reported from the site (Schulting *et al.* 2010) in addition to the nine older results that existed for the site. Dated samples include human remains from a variety of contexts within the cairn – including contexts that are related stratigraphically – and a single sample on 'organic soil'. Several measurements were made on samples that are thought – on archaeological grounds – to represent the same skeletons. Schulting *et al.* (2010, 16) note a tension between the reported stratigraphic association of the parent contexts and the radiocarbon measurements, and suggest that post-depositional disturbance has limited the stratigraphic integrity of the sequence. The model presented here adapts that of Schulting *et al.* (2010) using the original error terms, with results from the site presented within a Phase of activity associated with the use of the cairn for burial. A weighted mean is taken prior to calibration of results from a single articulated inhumation burial in pit C (statistically consistent Q-1480 and SRR-755; T'=0.2; T'5%=3.8; df=1). Another original result (Pta-1606) which was thought to also date the inhumation in pit C, and two more recent results (SUERC-24020 and SUERC-24021) from pit C produced much earlier measurements, and are included in the model as estimates for the dates of death of other individuals. A weighted mean is taken prior to calibration of statistically consistent results (SRR-754; Pta-1626; SUERC-24001; Q-1479; T'=4.6; T'5%=7.8; df=3) on skeletal remains from pit A. The output from the model provides a currency for the use of the site for burial.

Pierowall, Westray

Excavation at Pierowall, Westray, in 1981 occurred when quarrying revealed the remains of a chambered cairn and later activity. The site is located at 20m OD, above the west side of the Bay of Pierowall, Westray. The monument comprised a c18m diameter cairn defined by two circular stone revetments, and a central passage. The two revetments were not bonded, though the excavator suggests that there was no significant interval between the construction of these structures (Sharples 1984, 82). The cairn is notable for producing three large decorated stones, one of which may have served as a lintel from the passage. After the initial construction of the site it was significantly altered, with the cairn levelled and paved over, and a small rectangular structure constructed adjacent to the location of the cairn. This structure was associated with a significant quantity of flint-working debris, and pottery including some sherds of Grooved ware. Subsequently a large early Iron Age roundhouse was constructed at the site.

A large quantity of disarticulated human bone was recovered in the cairn rubble, potentially representing material cleared out of the chamber as the cairn was levelled. These had been dumped in association with a large quantity of limpet shells. Animal bones were recovered from the later structures, and from the fill behind the outer cairn wall face.

Radiocarbon results were produced on samples of cattle and ovicaprid bone from deposits from the collapsed cairn revetment, and two later phases of occupation over the demolished cairn. Results from the site have been modelled to represent a Phase of activity associated with the collapsed cairn revetment, and then two sequential phases of later occupation reflecting the stratigraphic relationships between the radiocarbon samples' parent contexts. The extant radiocarbon data cannot demonstrably be associated with the earliest phases of use of the passage grave. The estimate for the start of the radiocarbon dated activity is probably best understood as a *terminus ante quem* for start of the use of the site for burial activity.

Quoyness, Sanday

The passage grave at Quoyness, Sanday, was investigated by Farrer and Petrie in 1867, and re-excavated by Childe (Childe 1952; Davidson and Henshall 1989). The site is located on the shore on the south side of Sanday. The monument includes a rectangular chamber, passage, cairn and surrounding platform. The mound was defined by two retaining walls, and recorded as *c.*20.5m by *c.*17m in plan, and surviving to 4m high. Six cells radiated from the central chamber. These were irregular in plan, and of variable size. The platform appeared to mask the mouth of the passage and was associated with material culture including Grooved ware, two Skaill knives, limpet shells, animal bone and two deer antler tines. The site is notable for two decorated stone panels in the southern side of the chamber (Bradley 1998a).

From inside the passage, human remains (many of which were removed by Farrer), animal bone, and a few sherds of Grooved ware pottery were recovered (Childe 1952, 135). Three radiocarbon dates have been produced on human remains from Quoyness. The results show differences in ages, with MAMS-14921 (Sheridan *et al.* 2012), representing an individual who died earlier than the other two measurements. The results have been presented as representing a Phase of activity associated with use of the site for burial.

Maes Howe, Mainland

Maes Howe passage grave is located near the south east end of the Loch of Harray at 20m OD, in proximity to Barnhouse, the Ness of Brodgar, and the Stones of Stenness and Ring of Brodgar. The site was excavated in 1861 by Farrer, by Childe in 1954–55 (Childe 1956), and the ditch and bank by Renfrew (Renfrew *et al.* 1976). More recent excavations by Richards in 1991–92 located the drain from an earlier building running out beneath the front platform, and a standing stone socket at the rear of the passage grave (Challands *et al.* 2005). Further investigations of the 'bank' and ditch revealed the former to have actually been a standing wall during the third millennium cal BC (*ibid.*, 234–7). Material culture recovered from the chamber and cells included human remains and animal bones, which are now lost. The site comprises a large earth mound, a stone-built central passage, square chamber, and three cells. A passage leads into a square chamber, which is defined at the corners by orthostats. Prior to excavation in 1861, the mound was between 28 to 30m diameter, and some 11m high (Davidson and Henshall 1989). Initially, the mound was described by a ditch and stone wall, the earliest construction of which was probably contemporary with the mound (see Childe 1956; Challands *et al.* 2005).

Renfrew's investigation of the ditch was explicitly designed to recover radiocarbon samples (Renfrew *et al.* 1976). Nine radiocarbon measurements were produced on samples of 'peat' or 'silty peat' through the ditch fills, and from underlying the passage grave bank (Renfrew *et al.* 1976; Renfrew 1979). The majority of the results come from the southern trench. These measurements were all produced by radiometric dating (rather than accelerator mass spectrometry), so the samples probably represent an 'averaged' radiocarbon content from the peat horizon. If the peat or silty peat sediment predominantly reflects the *in situ* products of plant humus decay, these measurements could provide robust estimates for the age of these horizons. Two results (Q-1482 and SRR-505) from the basal organic fill of the ditch from the north trench are statistically consistent, and probably provide the most robust results for the start of infilling the ditch, and *termini ante quos* for the excavation of the ditch. Renfrew *et al.* (1976) also produced a radiocarbon result (SRR-791) from peat underlying the bank, which was interpreted as the ground surface prior to the construction of the monument.

In the model presented here results from under the bank and ditch fill are included in a Sequence model (Fig. 10.12). An estimate (*ConstructMaesHoweEarthwork*) for the construction of the monument has been calculated to occur sometime after the peat (SRR-791) formed on the old ground surface underlying the bank, and before the ditches began infilling (sampled by Q-1482 and SRR-505 modelled using the R_Combine function), this is a slightly different treatment of the data than presented in Griffiths and Richards (2013).

Two results (Q-1481; SRR-524) from the basal organic deposit from the south trench are statistically inconsistent, and given the nature of the material we cannot present a very robust understanding of when infilling in this area began; these results have not been included in the model. The next result (SRR-523) in the ditch sequence is much younger than those overlying it, and has not been included in the model.The estimate (*ConstructMaesHoweEarthwork*; *3870–2600 cal* BC *95% probability;* or *3730–2840 cal* BC *68% probability;* Fig. 10.12) for the construction of the monument is necessarily imprecise.

10.3 Results and discussion

The overall model presented here includes results from Neolithic sites excavated in the Cuween-Wideford landscape project, early Neolithic timber and stalled houses from across Orkney, and Neolithic burial cairns with results from the 4th millennium. These sites have been analysed using the models outlined above, and as shown in Fig. 10.2. The model has good overall agreement between the prior information and the radiocarbon dates (A_{model}=87%). Using evidence from early Neolithic stalled stone houses and timber structures, and from chambered cairns, the Neolithic in Orkney began in *3730–3480 cal* BC *(95% probability*), most probably in *3630–3510 cal* BC *(68% probability; Start OrkneyNeolithic*; Fig. 10.2; Table 10.3). The end of activity represented at these sites is estimated to have occurred in *1610–1400 cal* BC *(95% probability;* or *1530–1430 cal* BC *68% probability; End EarlyHousesCairns;* Fig. 10.2); the sample presented here includes results from later phases of activity at several sites.

From the different site-specific elements of the models, a series of posterior density estimates for the first dated events associated with different types of site is presented in Table 10.2. Activity associated with the use of Neolithic timber houses in Orkney is estimated to have begun in *3520–3360 cal* BC *(95% probability;* or *3520–3480 cal* BC *16% probability* or *3470–3390 cal* BC *51% probability*; *FirstTimberStructure*; Fig. 10.13). The first estimate for the activity associated with a Neolithic stalled house suggests this occurred in *3520–3290 cal* BC *(95% probable;* or *3390–3310 cal* BC *68% probable; FirstStalledHouse;* Fig. 10.13). The first activity associated with an Orkney-Cromarty chambered cairn is estimated to have occurred in *3640–3440 cal* BC *(95% probability;* or *3570–3470 cal* BC *68% probability; FirstOrkney Cromarty*; Fig. 10.7–10.9). The first estimate for activity associated with a passage grave occurred in *3590–3340 cal* BC *(95% probability*; or *3510–3470 cal* BC *14% probability* or *3450–3360 cal* BC *55% probability; FirstMaesHoweStyle*; Fig. 10.10–10.11). An estimate for the first activity on 'house' sites, though not necessarily directly associated with structures, is *3640–3440 cal* BC *(95% probability*; or *3570–3480 cal* BC *68% probability; FirstHouseSite*; Fig. 10.5–10.6) (see discussion below).

There are a number of limitations associated with the available data presented in the model here. In many cases numbers of radiocarbon dates from individual sites are limited, and often without a good understanding of sample taphonomy or association. In these cases, this model cannot be used to estimate robustly the dates of the archaeological events of interest, such as the construction of a cairn or house. In several cases, due to the excavation techniques applied to a site, the use of the site in prehistory, or because of the preservation conditions at the site, dated samples are only associated with what probably represents later phases of activity, rather than the earliest use of sites. This appears to have been the case with several cairn sites. While in these cases the modelled estimates for the *end* of activity might be accurate, such models may under-estimate the antiquity of the earliest activity at these sites, and fail to sample the full duration of activity at these sites.

10.3.1 Neolithic settlement in the Bay of Firth

The density of occupation around Wideford Hill, and the apparent longevity of activity associated with different forms of house structures in this area is significant. People were repeatedly drawn to dwell on the lower hillsides overlooking the Bay of Firth, and to the eastern slopes of Wideford Hill if recent fieldwalking discoveries at Saverock by Christopher Gee represent settlement sites (see Fig. 1.6). These people also produced a range of styles of 'domestic' architecture. While the vertical stratigraphy of these sites does not appear to be comparable to, for example, that present at Skara Brae, the Ness of Brodgar or Muckquoy (Chapter 9), the density of structures in plan and the associated midden deposits demonstrate that this was a desirable or favoured location, and remained so for many years.

Using posterior density estimates produced from the model shown in Fig. 10.2, it is possible to estimate the duration of activity associated with different house structures from the Bay of Firth (Fig. 10.3–10.4). The first Neolithic house in the Bay of Firth probably dates to *3590–3310 cal* BC *(95% probability;* or *3500–3360 cal* BC *68% probability; FirstBayOfFirthHouse*; Fig. 10.3–10.4), an estimate that derives from the parameter associated with the use of timber structure 3, Wideford Hill. The last dated event associated with houses included in the model here from the Bay of Firth dates to *1920–1530*

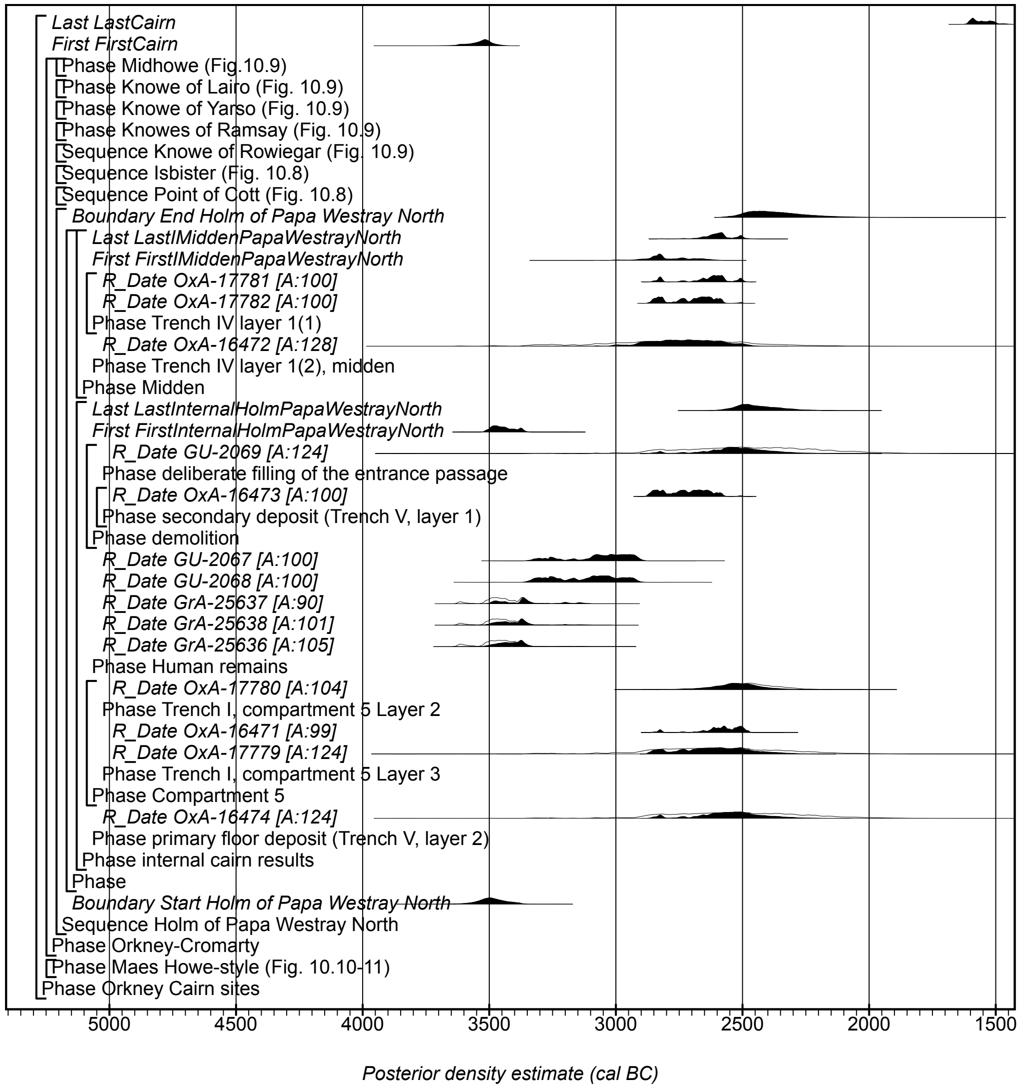

Figure 10.7 The first part of the Orkney-Cromarty cairn component of the model (see also Fig. 10.8 and Fig. 10.9). The overall model structures is shown in Fig. 10.2.

cal BC *(95% probability;* or *1880–1660 cal* BC *68% probability; LastBayOfFirth*; Fig. 10.3–10.4).

Activity at house structures in the Bay of Firth, shown in Fig. 10.3–10.4 went on for *1460–1960 years (95% probability;* or *1550–1800 years 68% probability; DurationBayOfFirthHouse*; no figure). This occupation might be regarded as sampling the whole of the duration of the Orcadian Neolithic, and beyond, and within this range we have a very limited understanding of the timing and tempo of house-lives, a picture that holds true for the rest of Orkney. As Schulting *et al.* (2010) noted, despite the density of Neolithic evidence we still have a relatively impoverished understanding of the development of occupation, both in the earliest regional Neolithic, and into the later regional Neolithic.

Timber Neolithic structures are only known from a few locations on Orkney. Of these, the full extent of some structures has not been uncovered (for example at Wideford), while some sites such as Brae of Smerquoy (Chapter 4) are still being excavated, and at others, such as at Green and Wideford Timber Structure 3, a very limited number of radiocarbon results has been produced. The identification of wooden post-built and discrete 'Neolithic' pit deposits (as might have been sampled at Links House, see below) is an important development in the understanding of different early Neolithic social practices. The impression that a *balanced* sample of the evidence from Neolithic of Orkney is available (Barclay 1996, 61) is not substantiated if it is accepted that a proportion of the earliest evidence is

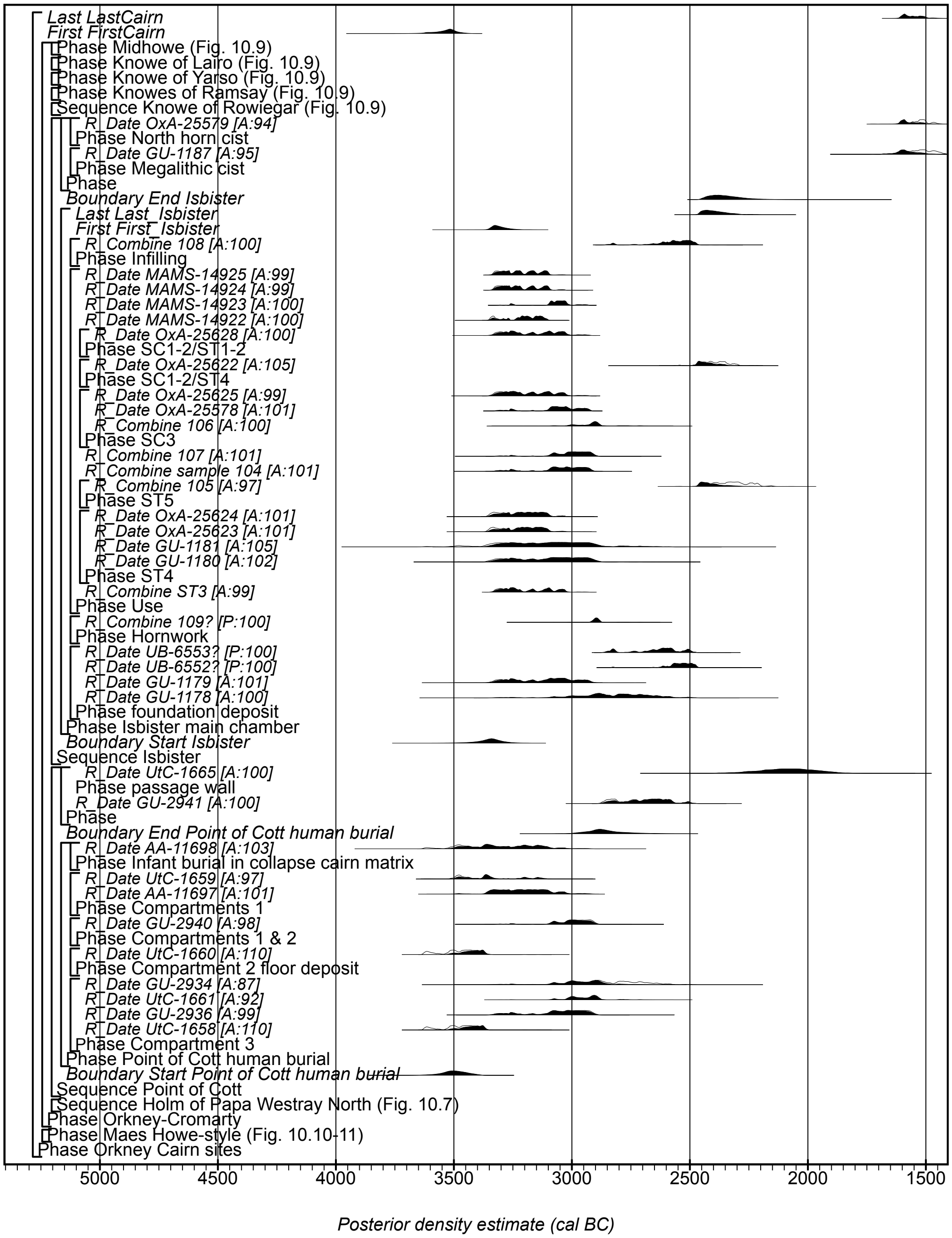

Figure 10.8 The second part of the Orkney-Cromarty cairn component of the model (see also Fig. 10.7 and Fig. 10.9). The overall model structures is shown in Fig. 10.2.

represented not by stone architecture, but by earthfast features.

At Wideford Hill, a result (SUERC-4862) on Timber Structure 3 is significantly earlier than the statistically consistent results on Timber Structure 1 (SUERC-4868, SUERC-4867, SUERC-4863 T'=2.3; T'5%=6.0; df=2). How representative this result is remains to be seen as dating material was not recovered for the full extent of the structure. Moreover, Timber Structure 3 probably represents a palimpsest of post-holes from at least two structures (see Chapter 2). Habitation at Green, Eday, produced an even earlier result (OxA-28984) from a timber structure, however, once again it is poorly understood in terms of its representativeness of activity associated with timber structures on the site. Evidence from two timber structures from Ha'Breck

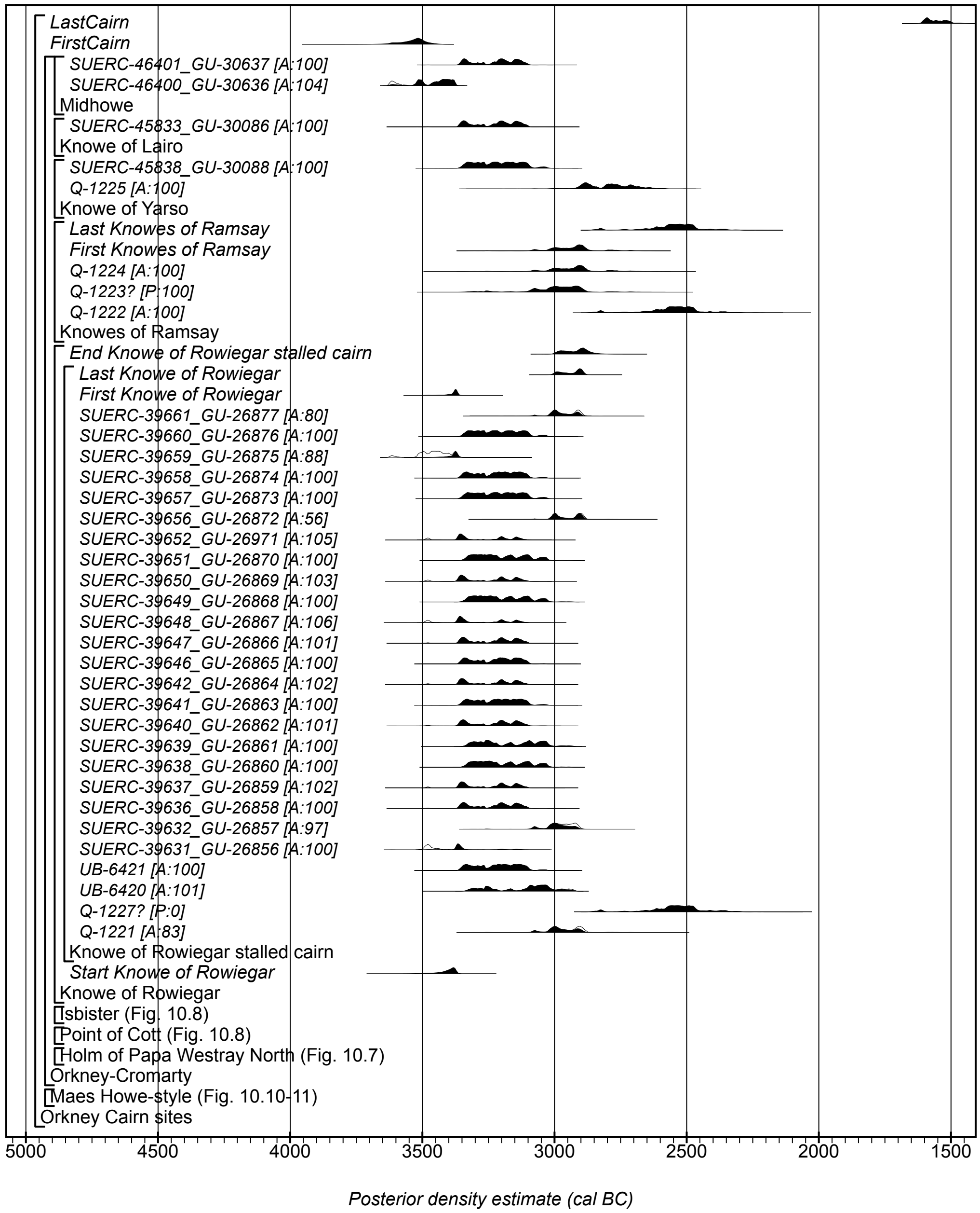

Figure 10.9 The third part of the Orkney-Cromarty cairn component of the model (see also Fig. 10.7 and Fig. 10.9). The overall model structures is shown in Fig. 10.2.

(SUERC-35990 and SUERC-34503) suggests that these could have continued to be used on this site in the 33rd–32nd centuries cal BC, a pattern of later use of wooden architecture in Orkney which might be supported by the estimate for the end of activity associated with Timber Structure 1 on Wideford Hill.

Posterior density estimates from stone-built houses with stalled architecture suggest that the earliest evidence for these structures in Orkney occurs in the second half of the 4th millennium cal BC. At Green, Knap of Howar House 2, and Ha'Breck House 3, it is possible that the structures were constructed before *c.*3300 cal BC. At a number of sites (Smerquoy phase 1, Stonehall Meadow, and the Knowes of Trotty), stone-built stalled houses could also have been constructed around this time, but the posteriors are insufficiently precise to allow a more detailed chronology. Activity associated with Stonehall Meadow stalled house began in *3490–3040 cal BC (95%*

probability; or *3390–3230 cal BC 60% probability*; *Start Stonehall Meadow*; Fig. 10.3). At Smerquoy, the earliest results were produced on midden deposits underlying the stone stalled house, from *3460–3120 cal BC (95% probability;* or *3390–3330 cal BC 24% probability* or *3260–3140 cal BC 44% probability; Start SM13;* Fig. 10.4). At the Knowes of Trotty the earliest activity, again associated with occupation evidence under the stone structure, in this case a pit, is dated to *3340–3120 cal BC (95% probability;* or *3280–3130 cal BC 68% probability; Start Knowes of Trotty;* Fig. 10.6). The phase of the site associated with occupation within the structure is dated to *3280–3110 cal BC (94% probability;* or *3230–3130 cal BC 68% probability; StartPhase2*; Fig. 10.6).

From the model presented here, it is more probable that the posterior density estimate associated with the first use of House 2 at the Knap of Howar occurred before the estimate produced here for the construction of House 1 at the Knap of Howar. The phasing of the Knap of Howar structures suggested that House 1 was built earlier than House 2 (Ritchie 1983, 52), but that the passage linking the two structures was an integral part of the design, and therefore that there could be little chronological gap in the construction. The earlier estimates for the earliest activity associated with House 2 (Fig. 10.6) could derive from earlier midden material redeposited on the floor of House 2 perhaps as part of the occupation. Alternatively it might be that subsequent to the house abandonment primary midden material was redeposited within the houses where walls had collapsed (cf. Ritchie 1983, 53). If we accept that the houses represented a relatively closely timed construction, the later estimate, for the construction of House 1 might be most appropriate for both the structures.

The estimate for the start of phase 2 at the Knowes of Trotty, which is suggested as an estimate for the construction of the stalled stone house, appears later than much of the other estimates from the construction of stone-built stalled houses with the exception perhaps of the Smerquoy Hoose (Fig. 10.13). As noted above, however occupation evidence underlying this structure, indicates that the stone-built phase was not the earliest activity on this site.

The Smerquoy Hoose, with stone-built stalled architecture, has a relatively imprecise estimate for its construction. Within this rather bimodal distribution, it is possible that the construction could be associated either with an earlier 33rd century phase of activity, which would be akin to the timing of the first activity associated with the use of House 2 at the Knap of Howar (though see discussion above). Alternatively, the later part of this estimate could be in keeping with the estimate for the start of phase 2 activity at the Knowes of Trotty associated with the construction of the stone-built stalled structure. We cannot revise the estimate for the Smerquoy Hoose further at the current time, and as discussed here, both the Knowes of Trotty estimate, and the evidence from the Knap of Howar may include caveats in their interpretation.

Perhaps one of the most interesting aspects of the chronology of stone-built stalled houses is the evidence for later occupation at Smerquoy (Chapter 4). Here, radiocarbon dates revealed a much later phase of activity within the stone structure (at a higher level, and associated with discrete negative features) which began in *2470–1970 cal BC (95% probability;* or *2200–2020 cal BC 68% probability; Start SM13 Late;* Fig. 10.4), and ended in *1970–1600 cal BC (95% probability;* or *1940–1770 cal BC 68% probability; End SM13*; Fig. 10.4). These results emphasise that the Smerquoy Hoose would probably have been evident as a stone structure, or ruined feature, for a significant time after its first construction in the early Neolithic.

From the evidence presented here, it appears that both timber structures and stone-built stalled houses were constructed in Orkney in the second half of the 4th millennium cal BC. The radiocarbon date from Green is notable in potentially being earlier than the other timber structures, though there are insufficient results from this site to be able to assess whether this result is representative of the chronology of the earliest structures. At Ha'Breck, the available chronological evidence appears to suggest that timber structures could have been in use at the same time as stalled houses, though again here the small numbers of radiocarbon dates from timber structures introduces a degree of uncertainty.

Sub-square structures have been identified at Crossiecrown (Chapter 7) and Stonehall Farm house 1 (Chapter 6). Similar forms of structure may also represented by some of the activity at the Ness of Brodgar, Structure 1 at Tofts Ness, and possibly Structure 8 at the Links of Noltland. Evidence from Stonehall Farm House 1 (SUERC-5792) could be consistent with the start of this activity in the second half of the 4th millennium cal BC. However, the statistically consistent results from the Red House (House 1) at Crossiecrown (AA=51373; AA-51372; T'=1.3; T'5%=3.8; df=1) are much later, associated with activity in the middle of the 3rd millennium cal BC.

The very limited evidence associated with compartmentalized stone houses from the Bay of Firth (Stonehall Knoll House 3 and Wideford Hill Stonehouse 1), again cannot reveal chronological patterns in the use of such structures. It is of note that the structures at Stonehall Knoll and Wideford Hill, while in close geographical proximity, appear to represent activity of significantly different ages, though the association of samples from Stonehall Knoll may suggest that the chronology of this structure at least is not robustly understood. Equally, this is the third structure erected on the knoll and stratigraphically earlier post-holes are present (see Chapter 5). Though the results from Wideford Hill appear to be more internally consistent, the small numbers of well-associated samples limit our understanding of the development of the site.

More convincing parallels with the use of Structure 1 at Stonehall Farm (AA-51371) may be found with the use of the atypical Structure 8 at Barnhouse. The result from Stonehall Farm (AA-51371) is statistically consistent with the three results from Structure 8 at Barnhouse (OxA-3763 4360±60 BP 3310–2880 cal BC 95% confidence; OxA-3764 4400±65 BP 3350–2890 cal BC 95% confidence; OxA-3765 4475±65 BP 3370–2910 cal BC 95% confidence; T'=4.2; T'5%=7.8; df=3). Later architectural changes witnessed in the Bay of Firth therefore appear to have been part of a series of developments across Mainland, Orkney. The 'atypical' 'Grobust' structure at the Links of Noltland appears to have been in use much later (GU-1692 3850±65 BP 2480–2130 cal BC 95% confidence; GU-1695 3750±100 BP 2470–1890 cal BC 95% confidence).

The discussion here emphasises one of the issues in assessing very limited data associated with types of houses, meaning that it is impossible to differentiate whether site types change over time and space – or both – or whether evidence from some areas is regionally atypical or more common. Arguably, tendencies to produce typologies risk abstracting narratives of change that might have represented hyper-local regional stories, as part of variable traditions across the Orkney Isles (Barclay 1996).

What is apparent from this discussion is that while the spectacular evidence from the Ness of Brodgar and Skara Brae demonstrates a very specific type of later Neolithic occupation, the Bay of Firth includes evidence for diverse and enduring occupation in a relatively circumscribed area. This exercise emphasises that while there has been considerable research dedicated to producing relative and scientific chronologies for Neolithic sites (*e.g.* Renfrew 1979; Ritchie 1990a, 51–52), the number of structures with sufficient, well-associated radiocarbon dates to estimate key archaeological events are few. The evidence for significantly later activity within the Smerquoy Hoose indicates that at least some of the stone-built structures in this area were returned to. Re-use of structures, together with a limited radiocarbon sample, could account for the apparent variability in age of activity associated with different forms of house architecture. As noted in a different context by Richards (2005c, 2), we are still in the situation where the 'type' of site provides the dominant archaeological narrative, rather than having achieved a chronological framework that is sufficiently robust to allow emphasis on local trajectories of change, traditions or practices.

The reuse of Smerquoy, and the density of occupation activity in the Bay of Firth over a considerable period of time suggest that while the deep vertical deposits of midden apparent from other Neolithic sites on Mainland, for example at Skara Brae and the Ness of Brodgar, are not apparent here, space – or perhaps better *place* – was at a premium. Over a very long period people returned here, constructed and perhaps reused a range of house types.

10.3.2 Chambered cairns

From the model developed here, a number of interesting aspects of the data for chambered cairns are apparent. An overall estimate for the first dated event associated with Orkney-Cromarty cairns is *3640–3440 cal BC (95%* probability; or *3570–3470 cal BC 68% probability; FirstOrkney Cromarty*; Fig. 10.16). Though the overall sample size is limited, the estimates for the start of activity associated with stalled cairns from the Point of Cott (*3620–3390 cal BC 95% probability;* or *3550–3440 cal BC 68% probability; Start Point of Cott Human burial;* Fig. 10.14) and the Holm of Papa Westray North (*3610–3370 cal BC 95% probability*; or *3550–3430 cal BC 68% probability; Start Holm of Papa Westray North*; Fig. 10.14) are similar. This might indicate that these two sites provide the best currently available estimates for activity associated with Orkney-Cromarty cairns across the archipelago. Alternatively, the proximity of these sites could indicate a highly-local tradition and timing associated with cairn building on Papa Westray and Westray. The current evidence for the main phases of these sites (see Table 10.2), indicates that each one, and most probably both, came into use in the second half of the 36th–first three quarters of the 35th centuries cal BC.

The evidence we have indicates that activity at the Knowe of Rowiegar began in *3500–3360 cal BC (95%*

probability), most probably in *3420–3360 cal BC (68% probability; Start Knowe of Rowiegar*; Fig. 10.14). It is highly probable (*92%*) that the start estimated for activity at the Knowe of Rowiegar (*Start Knowe of Rowiegar*; Fig. 10.14) occurred after the start of activity at the Point of Cott (*Start Point of Cott Human burial;* Fig. 10.14), and highly probable (*88%*) that activity at Rowiegar also occurred after activity began at the Holm of Papa Westray North (*Start Holm of Papa Westray North;* Fig. 10.14). The temporal and spatial similarities between the estimates for the start of the human bone assemblage of the Point of Cott and the Holm of Papa Westray suggest that these could have been related processes.

The rest of the data associated with the use of Orkney-Cromarty chambered cairns shows marked variability in the timing of activity. It is notable, that at many of the chambered cairns, as at the Knowe of Ramsay and Knowe of Yarso, Rousay, results produced on animal bone indicate much later activity, which might be indicative of reuse, or that the monuments were open for some time, rather than providing estimates for the primary construction and use of the monuments (cf. Schulting *et al.* 2010). At the Holm of Papa Westray North, where more radiocarbon dates exist than for the Knowe of Ramsay, Knowe of Yarso, Knowe of Lairo and Midhowe, animal bone samples represent activity later than the oldest human remains at the site. The duration of the primary phase of use of these sites, or their subsequent reuse, cannot be established because of the relatively limited numbers of samples from these structures. Recent results produced from Rowiegar suggest that at least some stalled cairns might have been the focus of considerable later activity; at Rowiegar activity appears to have gone on for *360–560 years (95% probability; 370–500 years 68% probability; DurationRowiegar*; no figure). Unfortunately, considerable disturbance at the site prior to its excavation means that a more precise chronology of the site cannot be achieved (Curtis and Hutchison 2013). Of the different forms of Orkney-Cromarty cairns, no 'Bookan'-type sites (a very nebulous category) have produced radiocarbon dates for this sample, and only one 'tripartite' cairn; the Knowe of Lairo, is represented. From the available data, this small sample means that we cannot identify evidence for chronological development in these supposed 'types' of structure.

Of the chronological samples from passage graves, Quanterness is interesting in providing a posterior density estimate that is precise, and importantly earlier than any other estimate for the start of activity at such a site on Orkney, with the possible exception of Maes Howe. The start of activity at Quanterness is here estimated as occurring in *3560–3340 cal BC (95% probability;* or *3450–3350 cal BC 61% probability; Start main use Quanterness;* Fig. 10.10). The estimate for the first dated event associated with the main phase of use of the Quanterness passage grave is significantly earlier than the next reasonably precisely dated estimates for activity associated with passage graves from the islands, at Quoyness (*3340–3090 cal BC 95% probability* or *3330–3210 cal BC 48% probability,* or *3180–3150 10% probability,* or *3130–3100 10% probability; First Quoyness;* Fig. 10.11), and Pierowall Quarry (*3120–2600 cal BC 95% probability;* or *2940–2680 cal BC 68% probability; Start Pierowall Quarry*; Fig. 10.11). The results from Pierowall are best understood as *termini ante quos* for construction of the use of the first monument, and it is unclear how representative of the duration of use the available data from Quoyness are. The chronology of Maes Howe could be consistent with the early range from Quanterness, but this estimate is so imprecise as to make comparison with other passage graves of limited use.

For Quanterness, Schulting *et al.* (2010, 18; Table 10.2) noted the inconsistency of the recorded stratigraphy of parent units with the age of radiocarbon samples from these units. They note the potential for considerable longevity of practice at Quanterness, which they suggest makes the site one of the longer-lived funerary monuments in Neolithic Britain (Schulting *et al.* 2010, 29). Cooney *et al.* (2011, 657) have noted the limited evidence from passage grave sites that can be presented as associated with the *use* of these structures.

For Ireland, as well as the Mound of the Hostages at Tara, Knowth (Cooney *et al.* 2011), and the recent results commissioned from Carrowmore (Berg and Hensey 2013), Cooney *et al.* (2011, 657) suggest that results from Newgrange (GrN-5462-C 4425±45 BP 3340–2910 cal BC 95% confidence; GrN-5463 4415±40 BP 3330–2910 cal BC 95% confidence), from Carrowmore 51 (Ua-11581 4625±60 BP 3630–3120 cal BC 95% confidence) and from Carrowmore 56 (Ua-10735 4495±80 BP 3500–2910 cal BC 95% confidence; Ua-10736 4525±80 BP 3510–2920 cal BC 95% confidence; Ua-10737 4620±70 BP 3630–3100 cal BC 95% confidence; Ua-4487 4395±65 BP 3340–2890 cal BC 95% confidence; Ua-4488 4480±75 BP 3490–2910 cal BC 95% confidence) may date the use of Irish passage grave examples. In addition, Schulting *et al.* (2012) present recent results produced on skeletal remains from Millin Bay and Ballynattay, sites which they define as having passage-grave affiliations. These results are not discussed here.

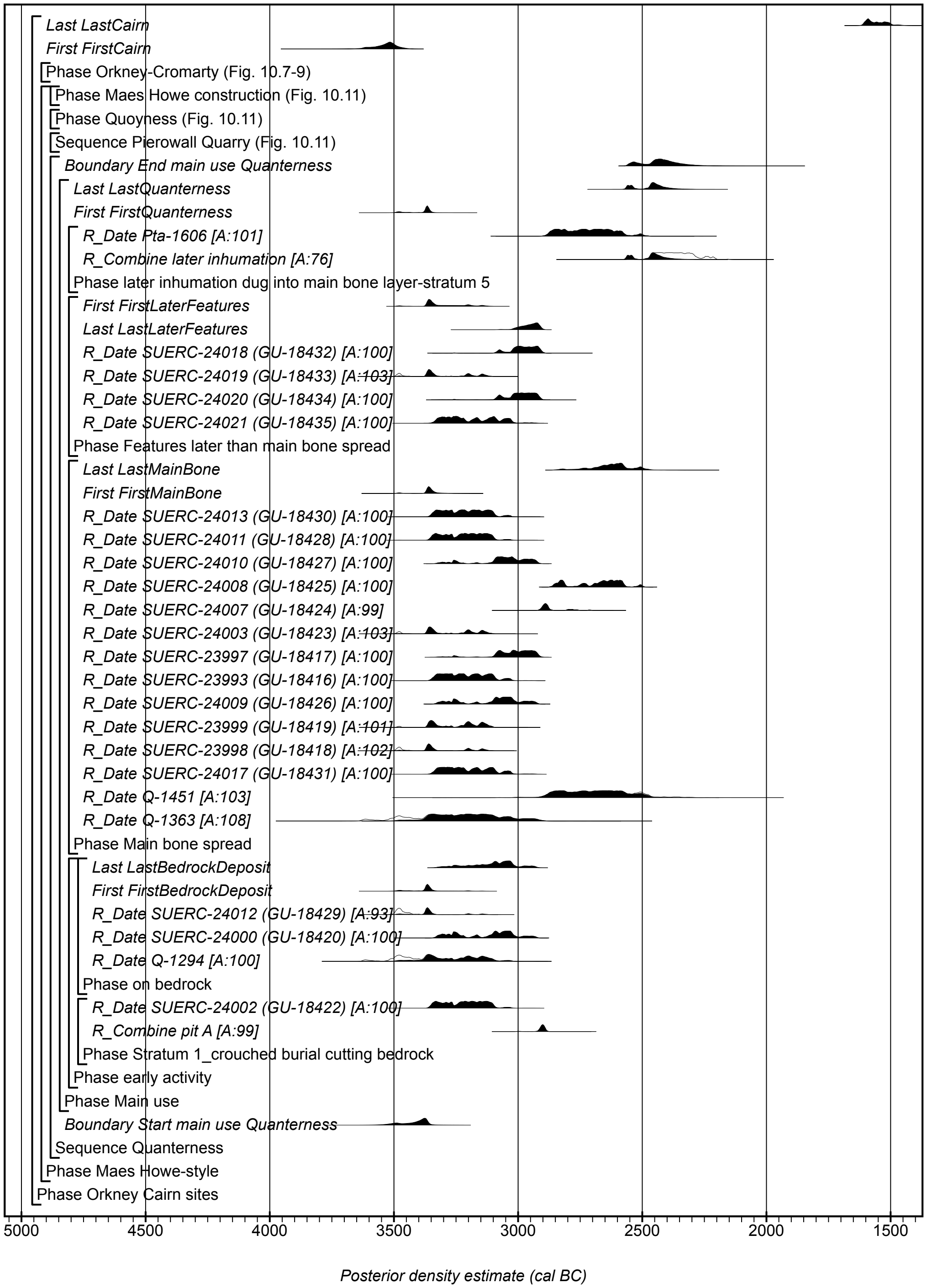

Figure 10.10 The first part of the passage grave (Maes Howe-type) component of the model (see also Fig. 10.11). The overall model structures is shown in Fig. 10.2.

The models for the Mound of the Hostages at Tara (Cooney *et al.* 2011, 651, Fig. 12.47), the Carrowmore recent results (Berg and Hensey 2013), and the model for the construction of Bryn Celli Ddu (Burrow 2010) have been reprogrammed in OxCal v4.2, and calculated using IntCal13 (Reimer *et al.* 2013), and key posterior density estimates from these models are shown in Fig. 10.15. The shortlife results from Carrowmore 56, which may be associated with the use of the structure (Cooney *et al.* 2011, 657) have been analysed using a Phase model

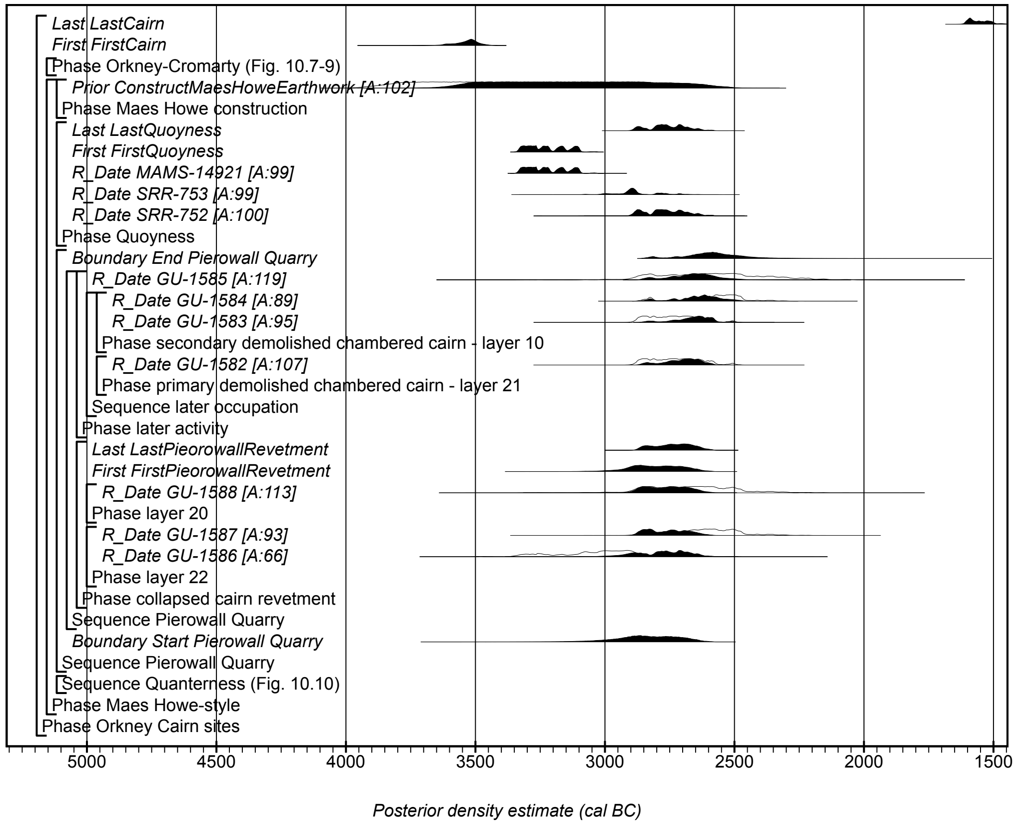

Figure 10.11 The second part of the passage grave (Maes Howe-type) component of the model (see also Fig. 10.10). The overall model structures is shown in Fig. 10.2.

defined by `Boundary` parameters shown in Fig. 10.15 (model not shown). A result from Bryn yr Hen Bobl on human bone (OxA-12742 4441±34 BP 3340–2920 cal BC 95% confidence) produced by Rick Schulting and cited in Burrow (2010) may date the use of this monument.

Comparison of the Quanterness posteriors with the recently published Carrowmore results (Berg and Hensey 2013), demonstrates that Quanterness is not out of keeping with these County Sligo sites. It is highly probable (*98% probable*) that the estimate for the start of activity at Carrowmore 3 (*Start Carrowmore3*; Fig. 10.15) occurred before the estimate for the start of activity from Quanterness (*Start main use Quanterness*; Fig. 10.15). These results could be consistent with a suggestion (*e.g.* Sheridan 2014; Schulting *et al.* 2010, 39–41) that the design of the Orcadian passage graves had been influenced by, or even copied from, passage graves in Ireland, as part of a strategy of competitive conspicuous consumption by their builders (see also Richards 2013c). Importantly for the discussion here, results shown in Fig. 10.15 emphasise, as the stratigraphy suggests, that the estimate from Pierowall probably under-samples early activity associated with the passage grave. The evidence from Quoyness is less clear, the estimate for the first dated activity at this site (*FirstQuoyness*) could be in keeping with other evidence for passage grave use. This estimate is earlier than estimate for the construction of the monument at Bryn Celli Ddu (*construction of grave*; Fig. 10.15).

Later again are the results produced on animal bones from Cuween Hill, a passage grave overlooking the Bay of Firth (Chapter 8). The excavation of this site in 1888 (Charleson 1902) recovered numerous animal bones from the main chamber, and human and animal bones from the side cells. A lower fill in the main chamber contained human and dog bones, including 24 dog skulls. Three statistically consistent radiocarbon dates (SUERC-4847 4010±35 BP 2620–2460 cal BC 95% confidence; SUERC-4848 3965±40 BP 2580–2340 cal BC 95% confidence; SUERC-4849 4025±40 BP 2840–2460 cal BC; T'=1.2; T'5%=6.0; df=2; Fig. 10.15) on dog bones recovered from the lower fill of the chamber are probably *termini ante quos* for the construction of the monument.

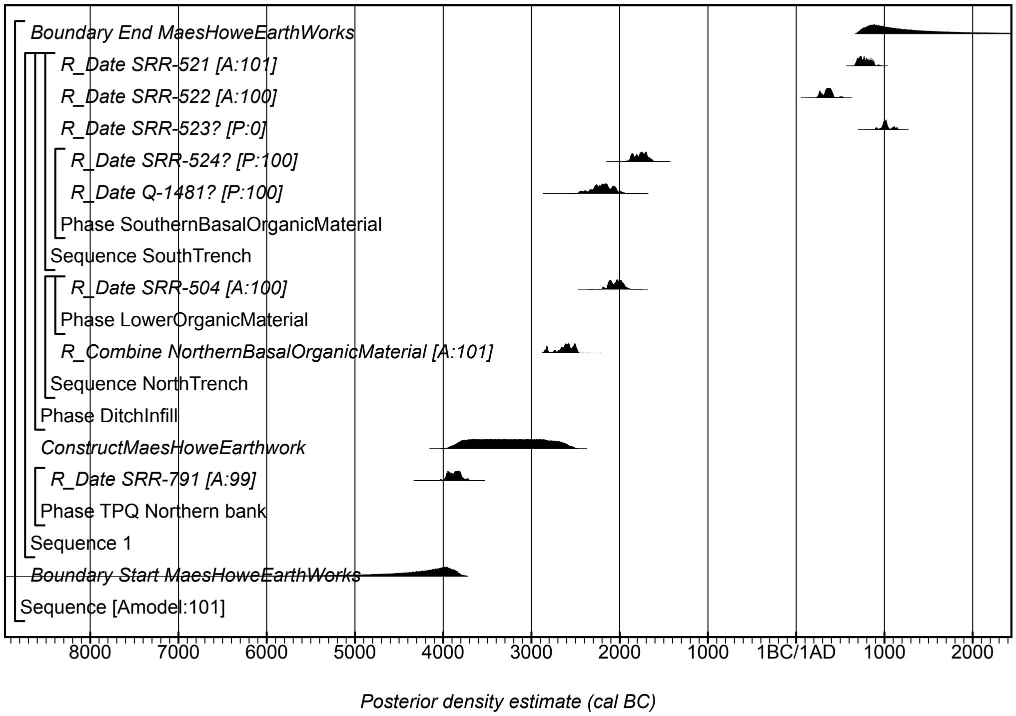

Figure 10.12 A model for radiocarbon results from Maes Howe sampled by Renfrew (et al. 1976). For each radiocarbon result included in the model as an active likelihood two ranges have been plotted. The ranges in outline represent the calibrated radiocarbon results, the solid distributions represent the posterior density estimates – the outputs from the Bayesian statistical model illustrated in the figure. Results not included in the model as active likelihoods are indicated in the figures with a '?' after the laboratory code. An estimate for the construction of the earthwork has been produced from the model.

A human femur (UB-6422 3668±36 BP 2200–1940 cal BC 95% confidence) from the entrance passage post-dates the use of the chamber stratigraphically, and is chronologically significantly later again. These results have not been included in the analysis here, because of the data selection criteria outlined above.

Comparison of the calibrated radiocarbon results from Cuween Hill with the results for the *end* of activity at Quanterness demonstrate that the activity represented by the Cuween samples probably pre-dated the last evidence from Quanterness (Fig. 10.15). Indeed, the end of activity at Quanterness (*2570–2280 cal BC 95% probability;* or *2550–2510 cal BC 11% probability* or *2470–2280 cal BC 57% probability; End main use Quanterness;* Fig. 10.10) could well be part of the same traditions sampled by the available radiocarbon results from Cuween. It could therefore be that rather than the activity at Quanterness representing very long, continuous rites, the later evidence from the site represents subsequent revisitation as part of a different series of traditions, which was related to the deposition of the dog-rich lower fill of the main chamber at Cuween as part of allied secondary activity at passage graves in the Bay of Firth. Given the evidence for much earlier activity at Quanterness it seems that the activity at represented by the radiocarbon samples from Cuween are not associated with its primary use.

10.4.1 Other evidence for early Neolithic activity: Varme Dale early cereals

Two Bronze Age barrows, which form part of the cemetery at Varme Dale (see Chapter 9), Evie, Mainland (Fig. 1.6), were excavated as part of *Orkney Barrows Project* directed by Jane Downes. Mound 2 had been constructed over a series of burnt deposits (Downes pers. comm. 2014). *Salix* sp. charcoal samples from two of these deposits (contexts [2041 and 2027]) produced statistically consistent radiocarbon results (AA-53158 4875±45 BP 3750–3530 cal BC 95% confidence; AA-53157 4890±40 BP 3760–3630 cal BC 95% confidence; T'=0.1; T'5%=3.8; df=1; Fig. 10.13). A weighted mean taken prior to calibration using the intercept method produces the calibrated range of 3710–3630 cal BC (95% confidence) or 3700–3640 (68% confidence;

Fig. 10.13). Both these contexts produced significant quantities and ranges of species of charred cereals for early Neolithic Orkney (cf. Bishop *et al.* 2009, 63–65). Context [2027], (AA-53157) produced around 100 grains, including wheat and barley identified to various levels, and individual grains of rye, oat, and three grains of flax. Similar quantities and species were recovered from context [2041].

These burnt deposits may reflect a single archaeological burning 'event', which occurred before a topsoil formed, and subsequently was sealed by the barrow. While the grains themselves were not used for the radiocarbon measurements, the nature of the deposits, and the consistency of the measurements suggest these results might be robust estimates for the age of the cereal assemblage.

10.4.2 Late Mesolithic presence?; Links House, Stronsay

There is a paucity of evidence for Mesolithic activity in Orkney, and the region has been regarded as having little potential for Mesolithic archaeology (Ritchie and Ritchie 1981). Largely because of the perceived limited evidence for such activity, Mesolithic material culture has been suggested to have been present on 'Neolithic sites' as 'the survival of old-fashioned ideas' (Ritchie 1995, 20). Surface collection in the last 15 years has located Mesolithic material (Wickham-Jones and Firth 2000; Cantley 2005; Richards 2005a, 11–14), and a review of the available Orkney evidence occurred (Saville 2000), while microliths were recovered from the body of a Bronze Age mound at Long Howe, Tankerness (Wickham Jones and Downes 2007). A charred hazel nutshell from the mound at Long Howe produced a radiocarbon date (SUERC-15587 7900±35 BP 7030–6640 cal BC 95% confidence), but this cannot be robustly associated with diagnostic Mesolithic activity.

The limited evidence from across the islands can be contrasted with the recent work at Links House, Stronsay. The site is located on the east side of Stronsay, a couple of hundred meters west of the coast at Mill Bay. Work at the site was targeted on a discrete lithic scatter, and excavation occurred in response to ongoing threat from ploughing. A series of test pits and trenches excavated over several seasons recovered a large Mesolithic lithic assemblage in association with groups of negative features, including timber structures (Lee and Woodman 2009a). The lithic assemblage is blade based, utilising small beach and till flint nodules. A range of lithics – points, obliquely blunted points, awls, microliths, blades, backed blades, and tanged points – has been recovered, which led the excavators to suggest that the site was the focus of activity from the early Mesolithic (indicated by the presence of tanged points) to the Mesolithic-Neolithic transition (Lee and Woodward 2009a, 32). However, the excavators are at pains to note that this activity was probably not continuous (Lee pers. comm. 2014) and post-excavation activity is on-going. A series of early radiocarbon results from the site are in keeping with that from Long Howe, while three others represent much later activity.

The later results from the site comprise three statistically consistent (T'=0.9; T'5%=6.0; df=2) radiocarbon dates (SUERC-24023 5080±35 BP 3970–3780 cal BC 95% confidence; SUERC-24027 5110±35 BP 3980–3790 cal BC 95% confidence; SUERC-24028 5065±35 BP 3970–3770 cal BC 95% confidence; Fig. 10.13), which were produced on *Salix* sp. charcoal from a pit associated with group 1 features. A weighted mean taken prior to calibration using the intercept method produces the calibrated range of 3970–3790 cal BC (95% confidence) or 3960–3800 (68% confidence; Fig. 10.13).

Links House represents an important development in Orcadian prehistoric studies, as it demonstrates the survival of discrete negative features associated with extensive early prehistoric activity. The nature of this early 4th millennium cal BC activity is far from clear, diagnostic Mesolithic or Neolithic material culture has not been identified from the feature. The chronology of the earlier results from the site also raises an interesting set of implications for the start of the Neolithic in Orkney.

10.4.3 The evidence for the earliest Neolithic in Orkney

The dates from Varme Dale probably represent the earliest diagnostic Neolithic evidence that is currently available from Orkney (Fig. 10.16). It is *100% probable* that the weighted mean on the two Varme Dale results occurred before the estimate for the first event associated with other first Neolithic settlement evidence (*FirstHouseSite*). It is *100% probable* that the first event associated with the use of chambered cairns (*FirstOrkney Cromarty*) occurred after the first event associated with the Varme Dale results. The earliest evidence from structures (*FirstTimberStructure* and *FirstStalledHouse*) occur later than the first occupation at these sites (*FirstHouseSite*; Fig. 10.16); it is *90% probable* the *FirstHouseSite* occurred before *FirstTimberStructure*. It is *96% probable* that *FirstHouseSite* occurred before *FirstStalledHouse*.

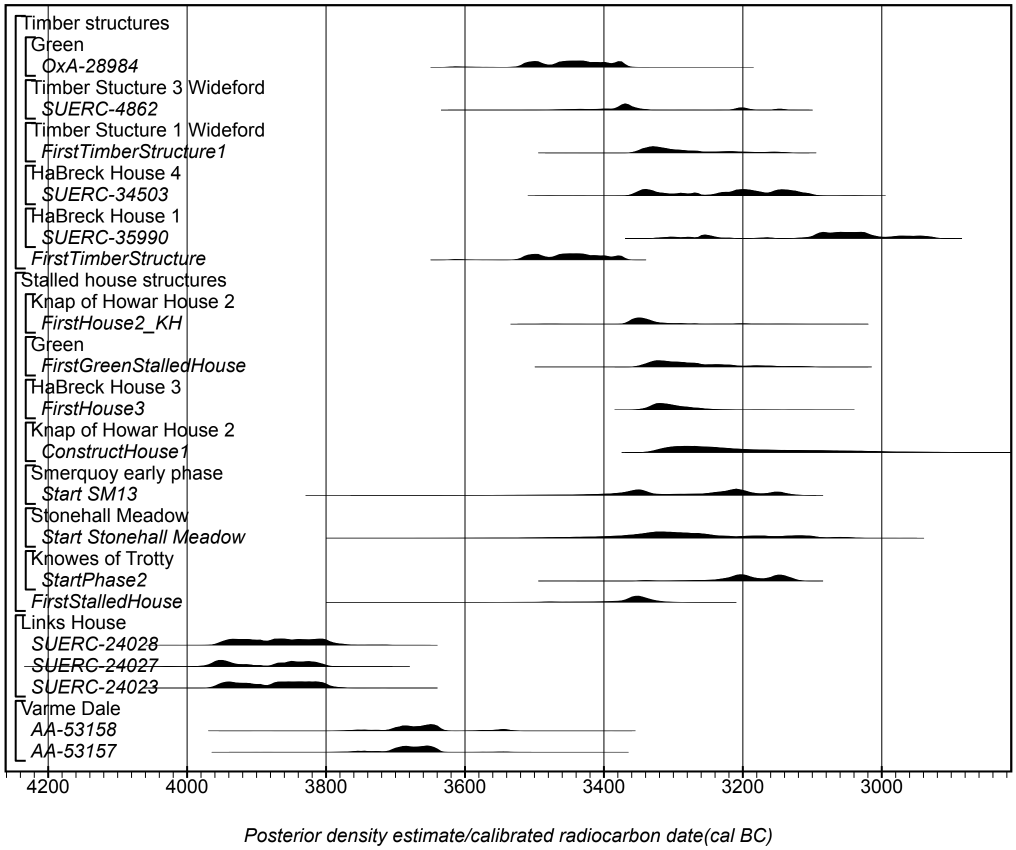

Figure 10.13 Posterior density estimates associated with early Neolithic timber structures and stone-built stalled houses from Wideford Hill, Ha'Breck, the Knap of Howar, Smerquoy, Stonehall Meadow and the Knowes of Trotty calculated in the model sub-sections shown in Fig. 10.3–6. Calibrated radiocarbon dates from the later activity from Links House, and the results from Varme Dale are also shown; these results are given in the text.

At the same time, we are unable probabilistically to order the first estimates for the use of Orkney-Cromarty cairns and the first evidence of any form of activity from settlement sites; it is *51% probable* that *FirstHouseSite* occurred before *FirstOrkney Cromarty* (Fig. 10.16). The evidence from all the activity at settlement sites and from Orkney-Cromarty cairns suggest that this activity could have occurred over a closely related timeframe.

In several cases detailed here, as at Green and Ha'Breck, the earliest radiocarbon dates from the site do not derive from the structures. At other sites, such as the Knowes of Trotty, and at the Knap of Howar House 1, evidence for early Neolithic structures built on top of midden deposits indicates that these did not represent the earliest occupation activity on the sites. At these sites therefore the nature of the earliest occupation activity is poorly understood, and the earliest Neolithic occupation evidence on such sites might pre-date activity indicated from radiocarbon dates from these structures.

The differences between the current estimate for the start of the Orkney Neolithic derived from the analysis presented here (parameter *Start OrkneyNeolithic*; Fig. 10.2) and the weighted mean of the three later results from Links House is estimated as *80–380 years (95% probability*) or *180–320 years (68% probability; LinksHouse_Neolithic*; Fig. 10.17). The estimate for the difference between the weighted mean associated with the Varme Dale cereals and the first evidence for timber structures (*FirstTimberStructure;* Fig. 10.13) is *120–330 years (95% probability;* or *170–280 years 68% probability; VarmeDale_Structure;* Fig. 10.17). The difference between the earliest evidence from house sites with evidence of structures (*FirstHouseSite*; Fig. 10.3–10.6) and the Varme Dale weighted mean is *20–240 years* (*95% probability*) most probably or *100–200 years (68% probability; VarmeDale_Settlement;* Fig. 10.17). These estimates may suggest how much the model presented here for early Neolithic houses and cairns under-estimates the antiquity of the earliest Orkney Neolithic.

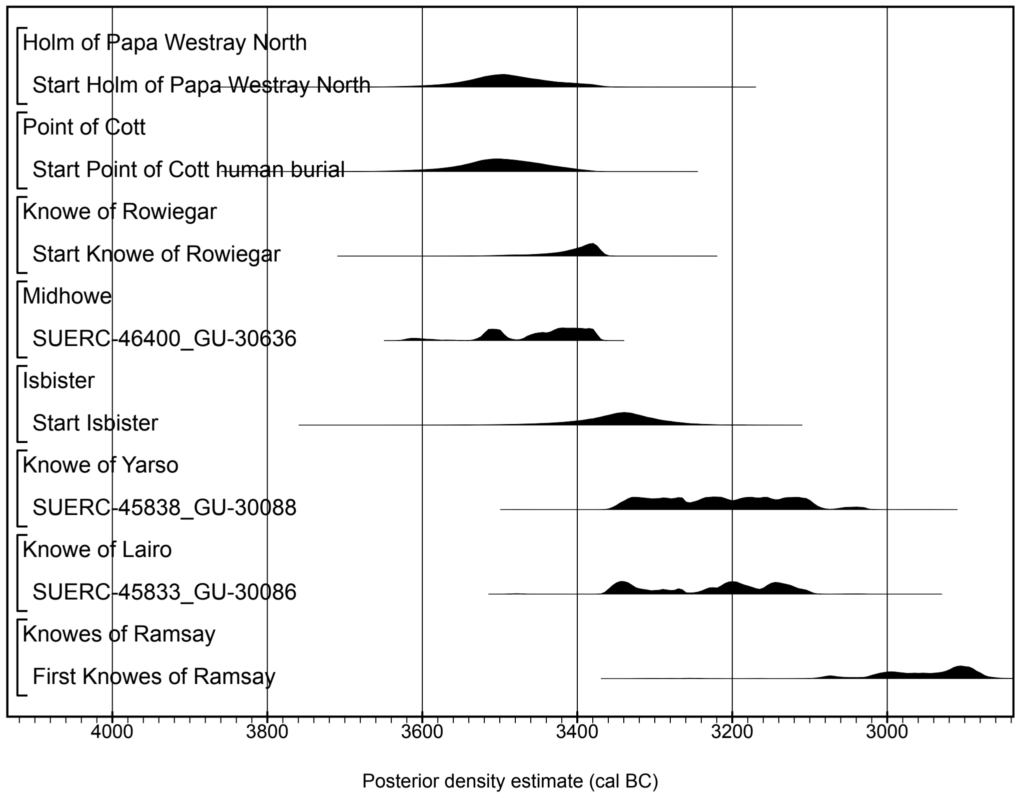

Figure 10.14 Posterior density estimates associated with start of activity from early Neolithic Orkney-Cromarty cairns at Holm of Papa Westray North, Point of Cott, Knowe of Rowiegar, Midhowe, Isbister, the Knowe of Yarso, the Knowe of Lairo and the Knowes of Ramsay. These posterior density estimates have been calculated in the model sub-sections shown in Fig. 10.7–9.

In early Neolithic Orkney, domesticated plant (and possibly animal) resources therefore may have predated the current evidence for the first appearance of timber structures and stone-built stalled houses. Such a scenario would have implications for the nature of the role of early domesticates in the first appearance of Neolithic lifeways in Orkney (cf. Cooney *et al.* 2011). It is possible that in Orkney cereals were part of the introduction of domesticates as a component of the transportation of portable Neolithic material culture and lifeways (see for example, Sheridan 2014), as well as perhaps timber structures and practices which involved digging earthfast features. This would have included the introduction of domesticated animals, and resurrects arguments about the introduction of animal resources to Orkney and the movement of human populations (Sharples 2000, 112).

The late dates from the pit feature at Links House could also support such a scenario. The late dates from Links House appear to represent people living much later on at a 'Mesolithic' site, and engaged in activities including the digging of small pits. In other parts of the country, such activity would be more in keeping with early 'Neolithic' traditions. In this scenario the presence of late dates at Links House might actually represent activity associated with novel Neolithic lifeways, but without, in this context, diagnostic early Neolithic material culture. The tantalising evidence from Links House might therefore support the view that emphasis on both stone-built 'early' and 'late' Neolithic structures may not quite acknowledge the full range of 4th millennium practices in Orkney. Excluding the uncertain nature of the Links Howe activity, the presence of late 5th or 4th millennium Mesolithic populations on Orkney does not currently appear substantiated by the available chronological evidence. While evidence from Links House (Lee pers. comm. 2014), and suggestions from Long Howe, indicate the presence of much earlier Mesolithic groups, this leaves open the possibility that if the early 4th millennium presence at Links House represents Neolithic activity, the Orkney Isles represented a landscape 'empty at least of human settlement' (Ritchie 1990a, 37).

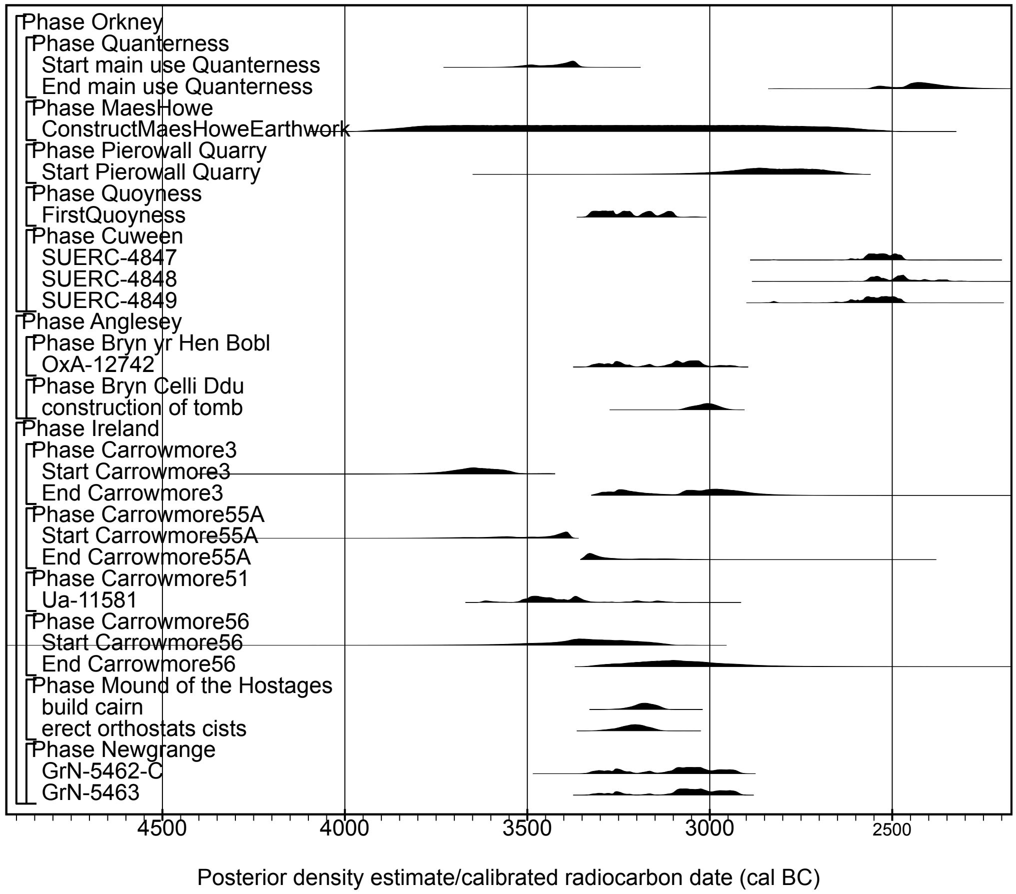

Figure 10.15. Posterior density estimates associated with passage graves from Quanterness, Maes Howe, Pierowall and Quoyness calculated in the model subsections shown in Fig. 10.9–10. Posterior density estimates from Carrowmore 3 (Berg and Hensey 2013, Carrowmore 55A (Berg and Hensey 2013), the Mound of the Hostages (Cooney et al. 2011), Bryn Celli Ddu (Burrow 2010) have been recalculated from models cited in the text. Boundary parameter estimates for the start and end of activity associated with the use of Carrowmore 56 have been calculated from results described in the text (Ua-10735; Ua-10736; Ua-10737; Ua-4487; Ua-4488), modelled in a Phase (model not shown).

The wider context of the early Neolithic in Scotland has been most recently outlined by Whittle *et al.* (2011, 808–33). As with the current case in Orkney, this sample is necessarily contingent on the history of research and practice in the study region, defined by the authors as a 'grab' sample of data from Scotland south of the Great Glen. In this sample, an estimate for the start of Neolithic activity is provided by the modelling of radiocarbon dates associated with northern Carinated bowl, cereals, and ground stone axes, and results from Neolithic monuments (long barrows, rectilinear mortuary enclosures, chambered cairns, non-megalithic round mounds and linear constructions) and rectilinear timber halls (Whittle *et al.* 2011, 822).

This analysis suggests that the Neolithic in southern Scotland began in *3835–3760 cal* BC *(95% probability; 3815–3535 cal* BC *68% probability; start S Scotland;* Whittle *et al.* 2011, 822), while the early Neolithic of north-east Scotland is estimated to have begun in *3950–3765 cal* BC *(95% probability; 3865–3780 cal* BC *68% probability; start NE Scotland;* Whittle *et al.* 2011, 824; Fig. 10.16). The distributions in Fig. 10.16 emphasise a potential connection between the timing of the activity at Links House and the start of the Neolithic on mainland Scotland. The Links House results could be closely chronologically related to the timing of the start of Neolithic practices on mainland Scotland, but are earlier than the available evidence for Neolithic activity in Orkney.

Importantly for the Orkney discussion presented here,

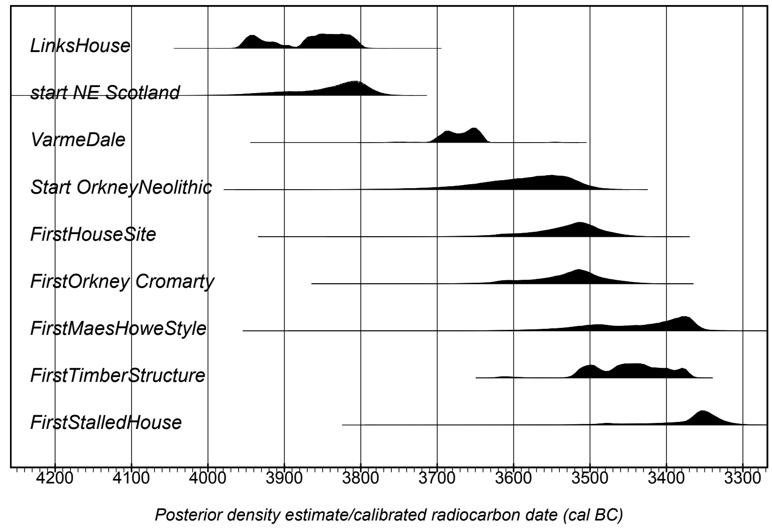

Figure 10.16 A comparison of posterior density estimates calculated in the model shown in Fig. 10.2 (FirstMaesHoweStyle; FirstOrkney Cromarty; Start OrkneyNeolithic). Estimates for the first dated event associated with timber structures (FirstTimberStructure) and a stone-built stalled houses (FirstStalledHouse) from Neolithic Orkney calculated in Fig. 10.13 are also shown. The distributions shown for Varme Dale (VarmeDale) and Links House (LinksHouse) are weighted means of the radiocarbon dates from these sites taken prior to calibration; these results are described in the text. A posterior density estimate for the start of Neolithic activity in the north east Mainland Scotland from Whittle et al. (2011, 824; Start NE Scotland) is also shown.

long barrows and timber halls in Scotland appear to have been relatively short-lived, ending in the first half of the 37th century cal BC (Whittle *et al.* 2011, 833). If the earliest Neolithic activity in Orkney included relatively short-lived sites such as timber structures, pits and early midden or burnt deposits, the currently available evidence might well under sample and underestimate the timing of this activity. The similarities of the estimates for the start of the Neolithic in northeast Scotland and the latest activity at Links House, leaves open the possibility that the timing of the earliest Orcadian Neolithic might be much more in keeping with changes and processes happening, most probably in the 39th or 38th centuries cal BC, on the nearby Scottish mainland.

10.5 Conclusion

Limited evidence for Mesolithic presence (though see Wickham-Jones 1994, Fig. 47, 74; Lee and Woodward 2009a) has arguably meant that for Orkney, one of the 'great leaps forward', 'revolutions', or 'climaxes' (Renfrew 1990, 248) in prehistory has been shifted from the Mesolithic-Neolithic transition to the 'revolution' from early Neolithic activity to later Neolithic activity. Arguably, the imposition of dramatic revolutions in the archaeological record, which might not be demonstrated by chronological evidence, promotes the quest for 'moments' of transition (cf. Schulting 2000; Brophy 2004), which might not usefully add to the discourse. The sequential development from groups with relatively limited early Neolithic things, to groups with lots of conspicuous later Neolithic things, has been glossed in terms of developments in 'complexity' (Richards 2005c, 37), with evidence for superimposition of Grooved ware over round-based early Neolithic pottery at Pool, on Sanday (MacSween 1992; Hunter *et al.* 2007), and Rinyo, on Rousay (Childe 1952, 136), perhaps appearing to underline a directional change (*e.g.* Renfrew 1979, 206).

Discussions emphasising other parts of Britain (Sheridan 2010; Thomas 2008; 2013; Whittle *et al.* 2011), have centred on the role of robust chronologies as means to readdress what otherwise had appeared as 'synchronous' changes in material culture and types of site, and contribute more nuanced, regionally-specific narratives. Currently the available chronological evidence from Orkney does not allow this kind of precision. A degree of restraint should perhaps be encouraged (cf. Richards 1998; Card 2005), both because the scientific chronology outlined here is necessarily provisional, and because simplistic linear models of change across a highly

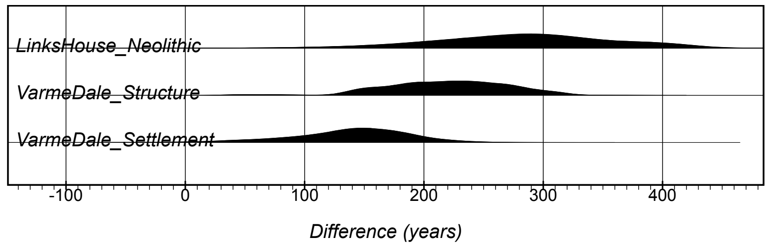

Figure 10.17 A comparison of posterior density estimates calculated in the model shown in Fig. 10.2 (FirstMaesHoweStyle; FirstOrkney Cromarty; Start OrkneyNeolithic). Estimates for the first dated event associated with timber structures (FirstTimberStructure) and a stone-built stalled houses (FirstStalledHouse) from Neolithic Orkney calculated in Fig. 10.13 are also shown. The distributions shown for Varme Dale (VarmeDale) and Links House (LinksHouse) are weighted means of the radiocarbon dates from these sites taken prior to calibration; these results are described in the text. A posterior density estimate for the start of Neolithic activity in the north east Mainland Scotland from Whittle et al. (2011, 824; Start NE Scotland) is also shown.

divergent island archipelago may be inappropriate (cf. Richards 1998).

The nature of the Orkney material record (Parker Pearson and Richards 1994; Cummings and Pannett 2005) offers a continual challenge to differentiate between exceptional processes, people, places and times, and the exceptional preservation of these remains. This said, the spatial scale and concentration of evidence for Neolithic activity over relatively small areas, for example, in the Bay of Firth, mean that it is appealing to argue that quite distinct processes and emphases were being played out. Taken together, we are presented with a record, which while perhaps not quite distinctly different from other parts of Britain, for example in the emphasis on the manipulation and use of midden deposits (for example Beamish 2009; Allen 2005), is markedly regional. This is not to argue for insularity or distinction from mainland Scotland, as evidenced from similarities in stalled cairns in Caithness (Davidson and Henshall 1989), but could suggest a unique set of processes (see Richards 2013c) which still require contextualizing with reference to wider changes occurring in mainland Britain and Ireland, and in terms of different rates of timing and tempo across Orkney in the Neolithic.

Inherent in the early–late Neolithic chrono-typological schemes which until recently have been employed might also contribute to a latent emphasis on disjuncture in the types of lifeways that are envisaged. Within the 'early' Neolithic complex of round-based ceramics, Orkney-Cromarty cairns and stalled houses, and the 'later' Neolithic Grooved ware and passage graves, it might be increasingly more appropriate to recognise '…some tombs [and houses] exhibiting features from both styles of architecture' (Card 2005, 47), not least for example in the recently identified inscribed 'horned spiral' stone from the Smerquoy Hoose. The evidence presented here might not be sufficient to present a simple chronological pattern for development and change in Neolithic Orkney, but it might also indicate a distinct set of traditions which are not well served by frameworks of 'late' or 'early' 'Neolithics'.