Society of Antiquaries of Scotland

Anatomy of an Iron Age Roundhouse

The Cnip Wheelhouse Excavations, Lewis

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Chapter 6

Chronology

6.1 INTRODUCTION

6.1.1 SAMPLE SELECTION

A total of 19 radiocarbon dates were obtained from Cnip (Table 6.1). 18 derive from mammal bone samples, submitted soon after the excavation in 1990, and one from the oxidized wooden handle of an iron spade-shoe (wood species unidentifiable), which was submitted during post-excavation in 1998. The samples cover all three phases identified during excavation.

The selection of samples was carried out with extreme care in order to avoid contexts where older, residual material was judged likely to be present. In the absence of suitable charcoal fragments (the charred plant remains were not an option at the time of submission), the most suitable samples were judged to be substantial mammal bones, with no signs of weathering, which appeared to have been fresh at the time of deposition. The great majority of the dated samples, therefore, derive from deposits which had accumulated within occupied buildings, wall-packing associated with building construction, or special 'ritual' deposits. All but one of the samples (the wood from the iron spade-shoe handle, Block 11) were from the 'key sequence' of blocks as defined in the pottery analysis (Chapter 4). Aside from the four samples from deposits from within the abandoned Wheelhouse 2 (which will be discussed separately below, Section 6.3.2), none of the samples were from outdoor or midden contexts which would potentially have been prone to the incorporation of older material through re-working of midden heaps, trampling by domestic animals, or natural processes such as sand deflation.

Had the dating programme been carried out now, rather than in 1990, samples would undoubtedly have been obtained from single entities (ie in this case, single bones) and submitted for AMS dating, to avoid any possibility of conflating non-contemporary material within single samples. However, with the exception of three dates from Phase 1, where this may well have happened (see Section 6.3.2), the remarkable consistency of the remaining dates suggests that this has not been a problem.

It is particularly helpful that the wood-derived date from the spade-shoe proved virtually identical to bone-derived dates from the same phase (Ill 6.1, AA–29767), thus effectively discounting any suspicion of distortion of the bone-derived dates caused by the marine residue effect (in the unlikely event, for example, that the cattle and deer from which the samples were derived had had seaweed as a major component of their diet).

6.1.2 PROBLEMS

Two dates appear to be at variance with the general sequence. GU-2753 (1570 ± 140 BP) relates to a context (C129, Block 6, fragmentary *bos*, see Section 2.3.1.1) which appears to have been contaminated in the mid-first millennium AD. The context was interpreted on site as the upper part of the wall-packing of Wheelhouse 1, but it lay close to the modern

TABLE 6.1
Cnip radiocarbon dates.

Sample	Context	BP
GU-2754	116	2370 ± 130 BP
GU-2756	276	2600 ± 150 BP
GU-2758	131	2280 ± 140 BP
GU-2755	276	1990 ± 50 BP
GU-2757	131	1960 ± 90 BP
GU-2749	265	1920 ± 60 BP
GU-2746	266	1930 ± 90 BP
AA-29767	72	1910 ± 45 BP
GU-2752	204	1900 ± 50 BP
GU-2748	266	1890 ± 50 BP
GU-2747	223	1890 ± 50 BP
GU-2751	204	1850 ± 50 BP
GU-2742	113	1940 ± 70 BP
GU-2743	109	1930 ± 50 BP
GU-2745	83	1870 ± 70 BP
GU-2741	42	1810 ± 190 BP
GU-2744	83	1770 ± 80 BP
GU-2753	129	1570 ± 140 BP
GU-2750	265	6800 ± 80 BP

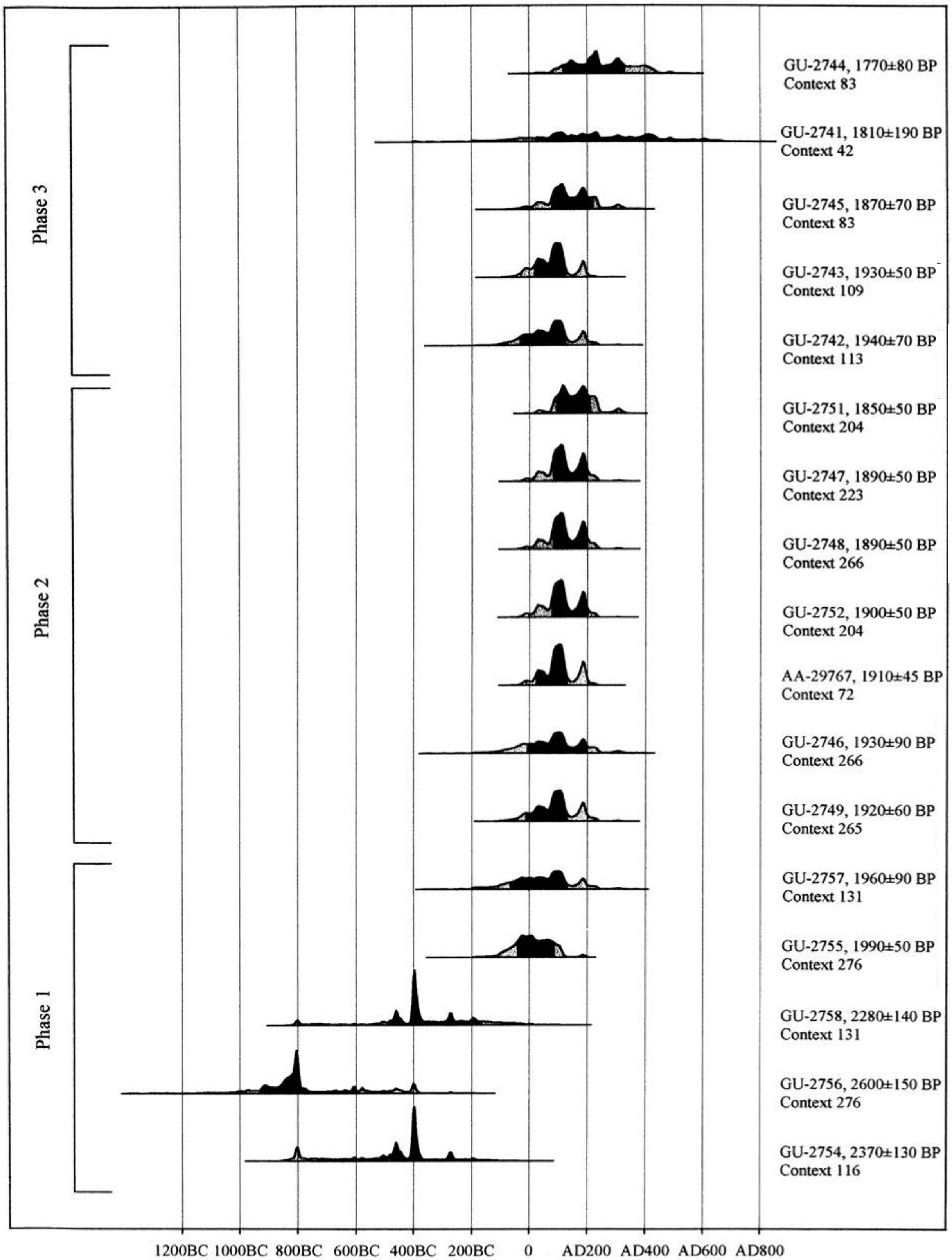

ILLUSTRATION 6.1
Probability distribution of the radiocarbon dates from Phases 1, 2 and 3.

ground surface and was exposed by initial removal of the upper sands by machine. With hindsight, it seems probable that the context relates to some otherwise unrecognized post-abandonment activity, although its wide standard deviation could place it in the latter part of the site's occupation. It cannot, however, relate to the construction of the wheelhouse, as had been hoped, and does not provide a useful chronological indicator. GU-2750 (6800 ± 80 BP), by contrast, cannot be explained in this way, since the bones from which it derives (*bos* and *cervus*) cannot possibly relate to the radiocarbon date as received.

6.2 CALIBRATION AND ANALYSIS OF RADIOCARBON DATES

Magnar Dalland

6.2.1 INTRODUCTION

The dates were calibrated using data from Pearson et al (1986), to produce a calibrated probability distribution (PD) for each date (Ill 6.1). Each PD has a dark middle segment sandwiched between two lighter grey segments. The dark and grey segments represent the short (SCR) and long continuous range (LCR). These are the shortest continuous ranges for which the probability that the date lies within the stated range is greater than or equal to, respectively, 68.26 per cent (SCR) and 95.45 per cent (LCR). These values are equal to the probabilities of the one and two sigma ranges of a normal distribution (Table 6.2).

The two anomalous dates (GU-2750 and GU-2753), discussed above, are listed in Table 6.1 but have not been included in the statistical analysis. The remaining 17 dates derive from 12 different contexts, associated with each of the three phases identified during excavation.

The data which constitute the PD curves are summarized, at 100 years resolution, in Table 6.3. The data for each date are displayed in three columns. The left column shows the probability of the date to lie within a 100-year-interval. The second and third columns present the probability for the date to be younger than, or older than, the lower limit of the 100-year-period defined.

6.2.2 STATISTICAL ANALYSIS

Three types of statistical analyses were undertaken to determine the duration, contemporaneity and formation period of Phases 2 and 3. The statistical evaluations are based on the calibrated probability distributions (PDs) of the radiocarbon dates that have been calculated on the basis of the Belfast calibration curve (Pearson

TABLE 6.2
Cnip calibrated radiocarbon dates.

SAMPLE	BP	SCR RANGE	PROB	LCR RANGE	PROB	Context	Phase
GU-2754	2370 ± 130 BP	BC 615 – BC 255	68.30	BC 840 – BC 170	95.61	116	1
GU-2756	2600 ± 150 BP	BC 925 – BC 600	68.52	BC 1050 – BC 375	95.47	276	1
GU-2758	2280 ± 140 BP	BC 480 – BC 165	68.31	BC 810 – BC 30	95.66	131	1
GU-2755	1990 ± 50 BP	BC 40 – AD 85	68.54	BC 105 – AD 120	95.54	276	1
GU-2757	1960 ± 90 BP	BC 65 – AD 130	68.65	BC 170 – AD 240	95.53	131	1
GU-2749	1920 ± 60 BP	BC 10 – AD 130	68.62	BC 40 – AD 225	95.56	265	2
GU-2746	1930 ± 90 BP	BC 5 – AD 200	69.05	BC 175 – AD 245	95.52	266	2
AA-29767	1910 ± 45 BP	AD 25 – AD 130	68.98	BC 10 – AD 205	95.79	72	2
GU-2752	1900 ± 50 BP	AD 80 – AD 195	68.60	AD 0 – AD 230	95.70	204	2
GU-2748	1890 ± 50 BP	AD 85 – AD 195	68.57	AD 15 – AD 235	95.73	266	2
GU-2747	1890 ± 50 BP	AD 85 – AD 195	68.57	AD 15 – AD 235	95.73	223	2
GU-2751	1850 ± 50 BP	AD 95 – AD 210	70.69	AD 75 – AD 325	95.53	204	2
GU-2742	1940 ± 70 BP	BC 30 – AD 125	69.58	BC 85 – AD 225	95.51	113	3
GU-2743	1930 ± 50 BP	AD 20 – AD 125	68.50	BC 30 – AD 205	95.93	109	3
GU-2745	1870 ± 70 BP	AD 80 – AD 220	68.45	BC 15 – AD 320	95.83	83	3
GU-2741	1810 ± 190 BP	AD 25 – AD 445	68.42	BC 195 – AD 650	95.53	42	3
GU-2744	1770 ± 80 BP	AD 120 – AD 330	69.08	AD 85 – AD 435	95.63	83	3

TABLE 6.3
Probabilities of dates to fall within centuries.

	GU-2756 2600 ± 150 BP			GU-2754 2370 ± 130 BP			GU-2758 2280 ± 140 BP			GU-2755 1990 ± 50 BP		
	Bin	**Later**	**Before**	**Bin**	**Later**	**Before**	**Bin**	**Later**	**Before**	**Bin**	**Later**	**Before**
AD 1000–1100												
AD 900–1000												
AD 800–900												
AD 700–800												
AD 600–700												
AD 500–600												
AD 400–500												
AD 300–400										0.0	0.0	100.0
AD 200–300							0.0	0.0	100.0	0.1	0.1	99.9
AD 100–200				0.0	0.0	100.0	0.3	0.3	99.7	7.5	7.6	92.4
AD 0–100				0.1	0.1	99.9	2.0	2.4	97.6	50.9	58.5	41.5
100–0 BC				1.3	1.4	98.6	6.1	8.4	91.6	38.6	97.1	2.9
200–100 BC	0.0	0.0	100.0	4.1	5.5	94.5	11.6	20.0	80.0	2.9	100.0	0.0
300–200 BC	0.7	0.7	99.3	9.1	14.5	85.5	15.0	35.0	65.0			
400–300 BC	3.8	4.5	95.5	28.2	42.8	57.2	33.1	68.1	31.9			
500–400 BC	8.0	12.5	87.5	23.6	66.4	33.6	16.7	84.8	15.2			
600–500 BC	7.4	20.0	80.0	9.2	75.5	24.5	4.9	89.7	10.3			
700–600 BC	8.2	28.1	71.9	7.4	83.0	17.0	3.4	93.1	6.9			
800–700 BC	15.2	43.3	56.7	11.2	94.2	5.8	5.2	98.3	1.7			
900–800 BC	39.9	83.3	16.7	5.7	99.9	0.1	1.7	100.0	0.0			
1000–900 BC	11.3	94.5	5.5	0.1	100.0	0.0						
1100–1000 BC	3.1	97.6	2.4									
1200–1100 BC	1.6	99.2	0.8									
1300–1200 BC	0.7	99.9	0.1									
1400–1300 BC	0.1	100.0	0.0									
1500–1400 BC												

	AA-29767 1910 ± 45 BP			GU-2752 1900 ± 50 BP			GU-2748 1890 ± 50 BP			GU-2747 1890 ± 50 BP		
	Bin	**Later**	**Before**	**Bin**	**Later**	**Before**	**Bin**	**Later**	**Before**	**Bin**	**Later**	**Before**
AD 1000–1100												
AD 900–1000												
AD 800–900												
AD 700–800												
AD 600–700												
AD 500–600												
AD 400–500				0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0
AD 300–400	0.0	0.0	100.0	0.3	0.3	99.7	0.5	0.5	99.5	0.5	0.5	99.5
AD 200–300	3.1	3.1	96.9	5.8	6.1	93.9	8.0	8.5	91.5	8.0	8.5	91.5
AD 100–200	49.2	52.3	47.7	53.3	59.4	40.6	57.9	66.4	33.6	57.9	66.4	33.6
AD 0–100	44.3	96.6	3.4	37.4	96.8	3.2	31.6	98.0	2.0	31.6	98.0	2.0
100–0 BC	3.4	100.0	0.0	3.2	100.0	0.0	2.0	100.0	0.0	2.0	100.0	0.0
200–100 BC												
300–200 BC												
400–300 BC												
500–400 BC												
600–500 BC												
700–600 BC												
800–700 BC												
900–800 BC												
1000–900 BC												
1100–1000 BC												
1200–1100 BC												
1300–1200 BC												
1400–1300 BC												
1500–1400 BC												

TABLE 6.3
Probabilities of dates to fall within centuries

GU-2757			GU-2742			GU-2746			GU-2743			GU-2749		
1960 ± 90 BP			**1940 ± 70 BP**			**1930 ± 90 BP**			**1930 ± 50 BP**			**1920 ± 60 BP**		
Bin	**Later**	**Before**	**Bin**	**Later**	**Before**	**Bin**	**Later**	**Before**	**Bin**	**Later**	**Before**	**Bin**	**Later**	**Before**
0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0				0.0	0.0	100.0
0.9	0.9	99.1	0.4	0.4	99.6	2.1	2.1	97.9	0.0	0.0	100.0	0.3	0.3	99.7
4.7	5.7	94.3	3.9	4.3	95.7	8.2	10.4	89.6	1.8	1.9	98.1	4.6	5/0	95.0
24.8	30.4	69.6	31.1	35.5	64.5	32.3	42.6	57.4	35.7	37.6	62.4	40.5	45.5	54.5
36.9	67.4	32.6	44.5	79.9	20.1	35.4	78.1	21.9	52.9	90.4	9.6	44.4	89.9	10.1
24.7	92.0	8.0	18.2	98.2	1.8	17.9	95.9	4.1	9.5	100.0	0.0	9.9	99.8	0.2
6.8	98.8	1.2	1.8	100.0	0.0	3.6	99.6	0.4	0.0	100.0	0.0	0.2	100.0	0.0
0.8	99.6	0.4				0.3	99.9	0.1						

GU-2745			GU-2751			GU-2741			GU-2744			GU-2753		
1870 ± 70 BP			**1850 ± 50 BP**			**1810 ± 190 BP**			**1770 ± 80 BP**			**1570 ± 140 BP**		
Bin	**Later**	**Before**	**Bin**	**Later**	**Before**	**Bin**	**Later**	**Before**	**Bin**	**Later**	**Before**	**Bin**	**Later**	**Before**
												0.0	0.0	100.0
						0.0	0.0	100.0				0.6	0.6	99.4
						0.2	0.2	99.8				1.7	2.4	97.6
						3.7	3.9	96.1	0.0	0.0	100.0	22.8	25.1	74.9
0.0	0.0	100.0				5.3	9.2	90.8	0.4	0.4	99.6	21.1	46.3	53.7
0.1	0.1	99.9	0.0	0.0	100.0	12.1	21.2	78.8	8.0	8.4	91.6	27.3	73.5	26.5
4.3	4.4	95.6	3.2	3.2	96.8	13.2	34.4	65.6	25.5	33.9	66.1	13.3	86.8	13.2
17.5	21.9	78.1	21.8	25.0	75.0	16.0	50.4	49.6	35.3	69.1	30.9	8.9	95.7	4.3
50.3	72.2	27.8	62.8	87.8	12.2	20.1	70.5	29.5	26.8	95.9	4.1	3.7	99.3	0.7
24.2	96.4	3.6	12.0	99.8	0.2	13.7	84.3	15.7	3.9	99.8	0.2	0.6	100.0	0.0
3.6	100.0	0.0	0.2	100.0	0.0	8.6	92.8	7.2	0.2	100.0	0.0			
						4.0	96.9	3.1						
						1.4	98.3	1.7						
						1.6	99.9	0.1						
						0.1	100.0	0.0						

et al 1986). To evaluate the contemporaneity of the dates from Phase 2, the dates were tested using the Student's t-test. Using the stratigraphical relationships between samples (Ill 6.2), it was possible to improve the precision of 11 dates from Phases 2 and 3. The duration of Phases 2 and 3 were evaluated using PDs of the age difference between dates. In both cases the stratigraphical relationship between samples was used to limit the range within which the age difference could lie (Dalland 1993).

6.2.2.1 Contemporaneity of the dates from Phase 2

Seven dates are available from five different contexts ascribed to Phase 2. To evaluate the field interpretation that these contexts were contemporary, the seven dates were tested using the Student's t-test to see if the dates could belong to the same population, as if they were results of multiple dates from the same sample. The seven dates produced a test figure of 1.3, well within the test limits of 12.6. This indicates that the variation in dates between these seven samples could be ascribed to statistical variations, and the test does not contradict the field interpretation.

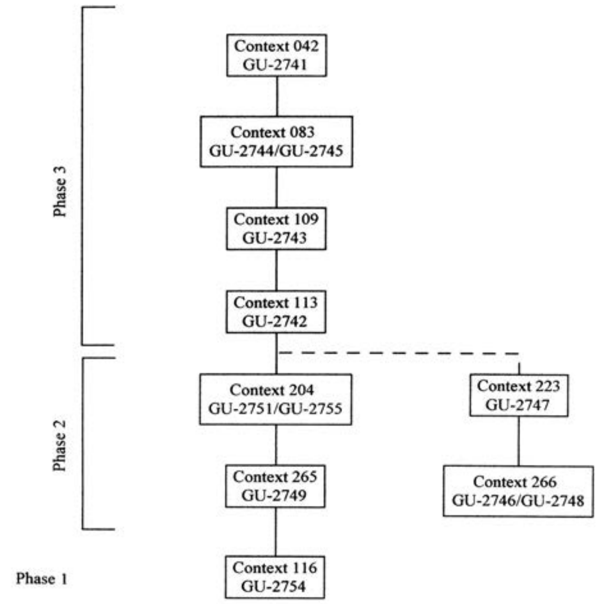

ILLUSTRATION 6.2
C14 samples linked by a direct stratigraphic chain.

6.2.2.2 Stratigraphical adjustment

The precision of a radiocarbon date can only be improved by adding data to the system, directly by counting the decays for longer periods, or indirectly by combining the dates of several samples. By using the stratigraphical information new data is added and the precision of the dates can be improved.

The calibrated probability distributions are based on the evaluation of the radiocarbon content of the sample against the calibration data. By using information that is independent of the data on which the distributions are based, the probability distributions could be modified.

If there is stratigraphical evidence that sample A is older than sample B and it is safe to assume that the true relative age of the samples reflects their stratigraphical positions, the condition A > B could be imposed on the probability distributions of the dates of those two samples:

If A) The probability for the age of sample A to lie within AD 100 to AD 105 is 0.05

and B) The cumulative probability of the age of sample B to be younger than AD 105 is 0.6

then The probability that the age of A lies within AD 100–105 while A > B equals 0.05 * 0.6 = 0.03 or 3 per cent.

By recalculating the PD of A using the corresponding values of the cumulative curve of B, a modified PD is produced that takes into account that A > B. Since the normalized values in the unmodified distribution have been multiplied with values less than 1, the modified distribution has to be re-normalized. Returning to the two unmodified distributions, the distribution of B could be modified in the same way using the same condition A > B. The same process could not be repeated using the modified distributions and the same condition, since they are no longer independent of the condition A > B. However, stratigraphical relationships to other samples could be used to further modify the probability distributions.

The effect of this adjustment varies with the relative age of the two dates. If the calibrated distributions of A and B are not overlapping with A being older than B, the adjustment will have no effect as the cumulative values for B and A are 1, for all values of A and B. However, with increased overlapping, the changes become more marked.

When using data that have been modified by stratigraphical information, it is important to be aware of the fundamental assumption that the relative true age of all samples is the same as their relative stratigraphical positions.

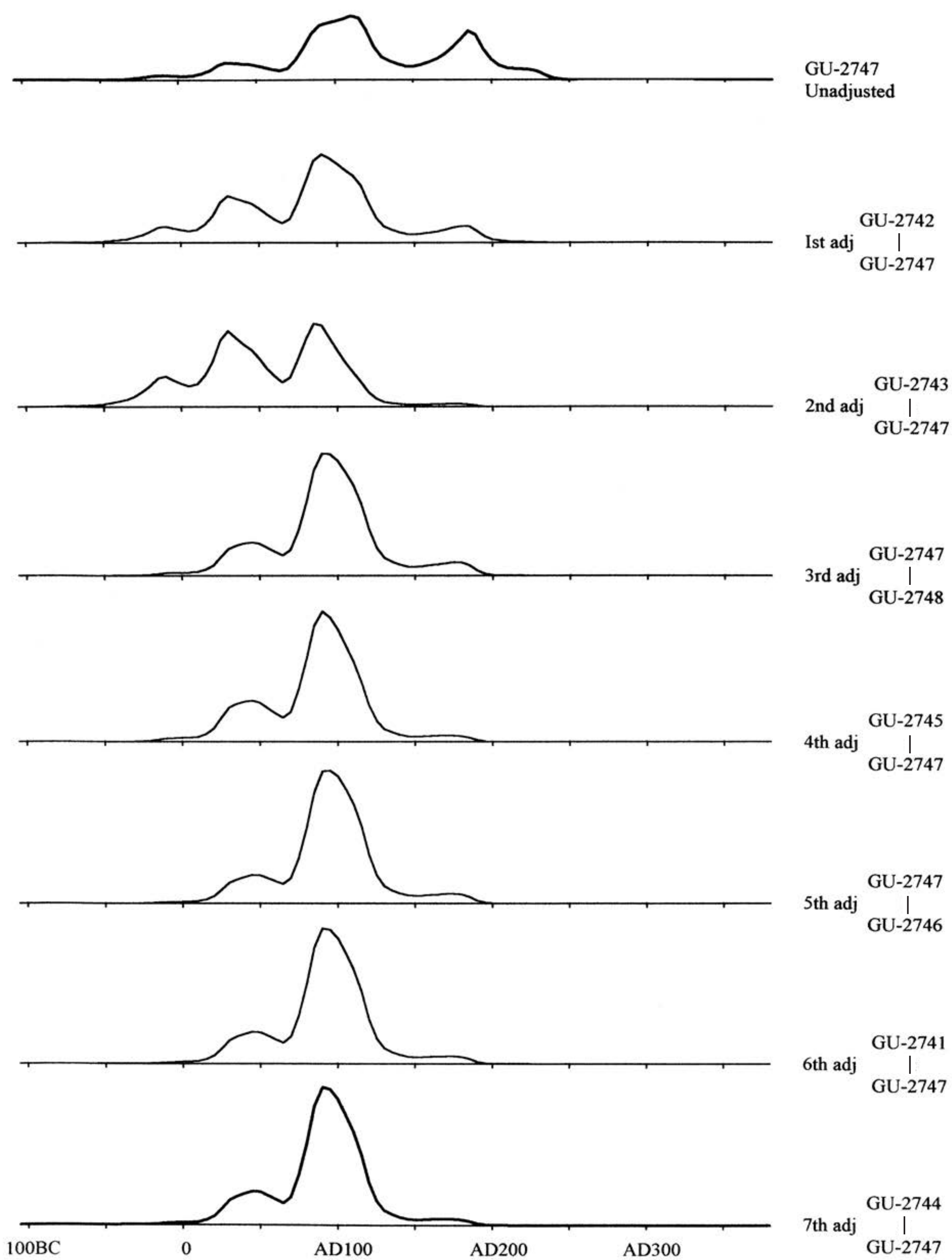

ILLUSTRATION 6.3
Cumulative effect on probability distribution by stratigraphical adjustments.

TABLE 6.4
Cnip calibrated radiocarbon dates adjusted for stratigraphy

DATE	SCR RANGE	PROB	LCR RANGE	PROB	PHASE
ADJ2741	AD 230–AD 490	68.39	AD 210–AD 660	95.68	3
ADJ2744	AD 200–AD 330	68.60	AD 155–AD 425	95.89	3
ADJ2745	AD 170–AD 245	69.33	AD 120–AD 330	95.91	3
ADJ2743	AD 165–AD 210	68.98	AD 105–AD 220	96.24	3
ADJ2742	AD 115–AD 190	73.59	AD 95 –AD 200	96.41	3
ADJ2747	AD 75 –AD 125	70.41	AD 20 –AD 155	95.74	2
ADJ2751	AD 70 –AD 135	68.79	AD 20 –AD 165	95.60	2
ADJ2752	AD 30 –AD 105	71.95	BC 10 –AD 125	95.53	2
ADJ2746	BC 85 –AD 50	69.73	BC 180–AD 100	95.66	2
ADJ2748	AD 15 –AD 100	69.77	BC 30 –AD 115	95.58	2
ADJ2749	BC 40 –AD 55	68.96	BC 80 –AD 105	95.69	2

The cumulative effect of the stratigraphical adjustments is demonstrated in Illus 6.3, where stratigraphical links to seven other dates improves the precision of date GU-2747. The first and second correction are based on under-relationships which pushes the distribution towards the older range, while the third correction based on an over-relationship narrows down the distribution towards the younger range. The last four corrections are less significant due to smaller overlaps.

The modified PDs of the 11 stratigraphically linked dates from Phases 2 and 3 are shown in Illus 6.4. The stratigraphical link to GU-2754 from Phase 1 had very little effect on the other dates due to lack of overlap between the distributions and was not included in the adjustments. The dotted line represents the unmodified distribution, while the dark segments represent the short continuous ranges (SCR). Table 6.4 shows the ranges of the SCR and LCR for the modified PDs. A summary of the adjusted PD curves, at 100 years resolution, is shown in Table 6.5.

The adjusted dates indicate that the Phase 2 dates largely fall within the first century AD. The Phase 3 dates lie mainly within the period from the beginning of the second to the middle of the third century AD.

6.2.2.3 The duration of Phases 2 and 3

Based on the tabulated data of the calibrated distributions, it is possible to calculate the probability distribution of the age difference between two dates. The age difference between two dates is calculated using joint probability.

If I) The probability of date A lying between AD 100 and AD 105 is 0.05

and II) The probability of date B lying between AD 200 and 205 is 0.10,

the probability of date A lying within AD 100-105 with B at the same time 100 years younger than A, is 0.05 * 0.10 = 0.005.

By adding all joint probabilities for A and B to fall within ranges separated by +100 years, the probability of B being 100 years younger than A is calculated. By doing this for all possible differences between A and B, a probability distribution of the age difference between the two dates is achieved. Adding up the probabilities over the entire distribution range creates a cumulative curve. This curve makes it easy to read off the probabilities for various differences.

Since the difference evaluations have to be based on two independent PDs the unadjusted PD of the radiocarbon dates were used in the calculations.

In order to estimate the duration of Phase 2, the difference between two dates from Context 204 and one from 265, as well as the difference between one date dates from Context 223 and two from 266 were calculated. In the evaluation of the duration of the phase, an average of the four difference distributions from these dates was used (Ill 6.5 and Table 6.6). The table shows for example that there is a 62.7 per cent probability that the duration is less than 100 years (37.3 per cent probable that it is more than 100 years).

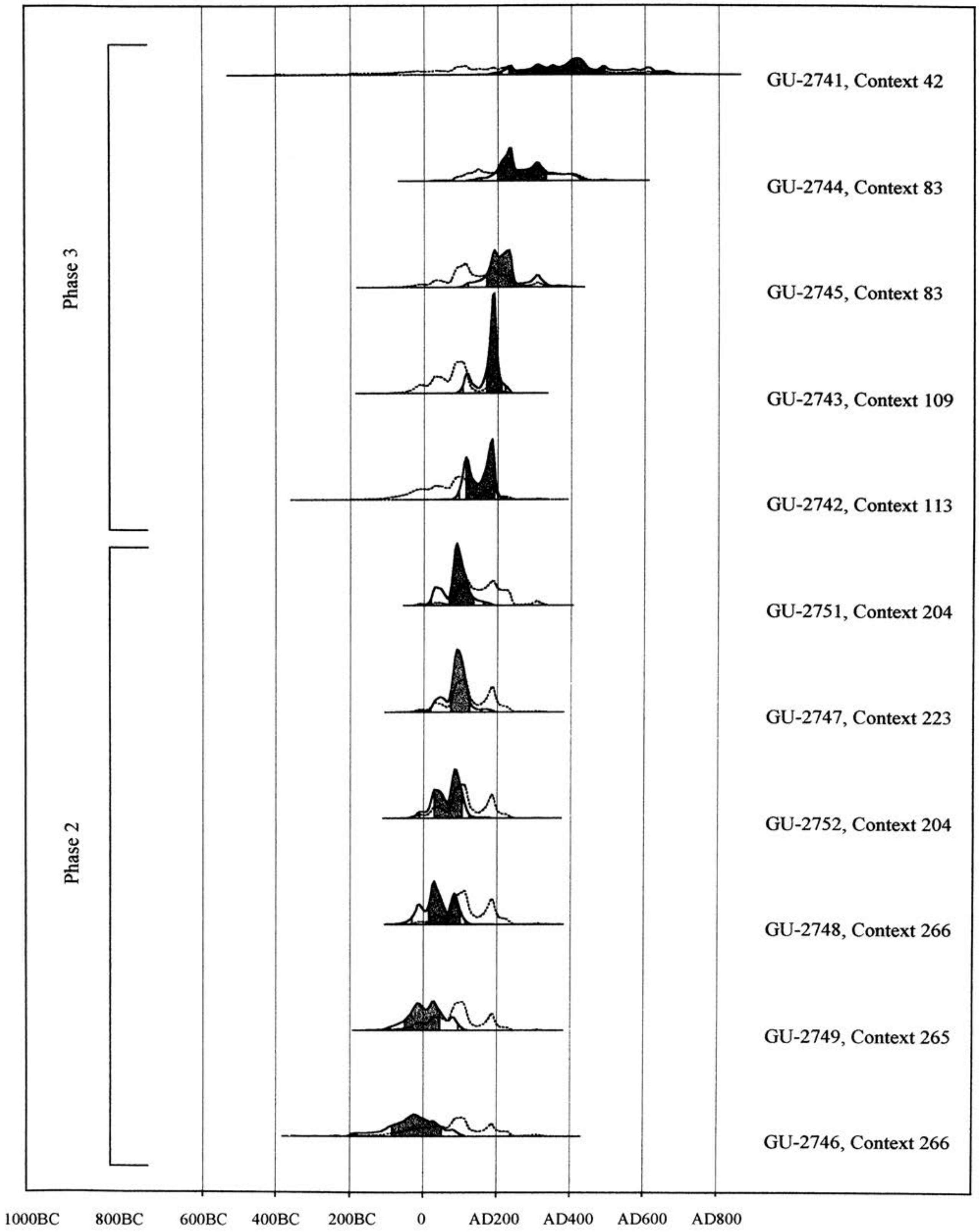

ILLUSTRATION 6.4
Probability distribution of the radiocarbon dates from Phases 2 and 3 adjusted for stratigraphy.

TABLE 6.5
Stratigraphically adjusted probabilities of dates to fall within centuries.

	GU-2746 adjusted			GU-2748 adjusted			GU-2749 adjusted			GU-2747 adjusted			GU-2751 adjusted		
	Bin	Later	Before	Bin	Later	Before	Bin	Later	Before	Bin	Later	Before	Bin	Later	Before
AD 900–1000															
AD 800– 900															
AD 700– 800															
AD 600– 700															
AD 500– 600															
AD 400– 500															
AD 300– 400															
AD 200– 300	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0
AD 100– 200	1.1	1.1	98.9	6.3	6.3	93.7	1.7	1.7	98.3	40.2	40.2	59.8	37.8	37.8	62.2
AD 0– 100	34.1	35.2	64.8	76.5	82.8	17.2	56.6	58.3	41.7	59.4	99.6	0.4	61.2	99.0	1.0
100– 0 BC	50.5	85.7	14.3	17.2	100.0	0.0	40.5	98.8	1.2	0.4	100.0	0.0	1.0	100.0	0.0
200– 100 BC	12.8	98.5	1.5				1.2	100.0	0.0						
300– 200 BC	1.0	99.5	0.5												
400– 300 BC	0.5	100.0	0.0												

	GU-2752 adjusted			GU-2742 adjusted			GU-2743 adjusted			GU-2745 adjusted			GU-2744 adjusted			GU-2741 adjusted		
	Bin	Later	Before	Bin	Later	Before	Bin	Later	Before	Bin	Later	Before	Bin	Later	Before	Bin	Later	Before
AD 900–1000																		
AD 800– 900																0.0	0.0	100.0
AD 700– 800																0.5	0.5	99.5
AD 600– 700													0.0	0.0	100.0	9.7	10.3	89.7
AD 500– 600										0.0	0.0	100.0	0.1	0.1	99.9	14.0	24.2	75.8
AD 400– 500										0.1	0.1	99.9	5.8	5.9	94.1	30.9	55.1	44.9
AD 300– 400				0.0	0.0	100.0	0.0	0.0	100.0	11.2	11.3	88.7	30.9	36.9	63.1	27.5	82.6	17.4
AD 200– 300	0.0	0.0	100.0	2.2	2.2	97.8	14.1	14.2	85.8	52.5	63.8	36.2	53.9	90.7	9.3	16.1	98.7	1.3
AD 100– 200	18.2	18.2	81.8	95.0	97.2	2.8	85.3	99.5	0.5	36.1	99.9	0.1	9.3	100.0	0.0	1.3	100.0	0.0
AD 0– 100	77.5	95.7	4.3	2.8	100.0	0.0	0.5	100.0	0.0	0.1	100.0	0.0						
100– 0 BC	4.3	100.0	0.0															

To estimate the duration of Phase 3, the differences between the date from the lower Context 113 and the two dates from Context 083 were used. The date from ontext 042 above 083 which also belongs to Phase 3 was very imprecise and was not used. However, the central value of the average of the two dates used was very close to the date from Context 042. By not selecting the date from the upper context of Phase 3, the evaluation of the duration of Phase 3 would be an underestimate. As for Phase 2, the average of the difference distributions was used to estimate the duration of Phase 3 (Ill 6.6 and Table 6.7). The table shows, for example, that there is a 67.5 per cent probability that the duration is less than 200 years (32.5 per cent probable that it is more than 200 years).

6.3 INTERPRETING THE CHRONOLOGICAL EVIDENCE

Ian Armit

The calibration and statistical analysis of the radiocarbon dates provides an unusually tight chronological definition for Phases 2 and 3, but does little to resolve the problems of dating Phase 1.

6.3.1 DATING PHASES 2 AND 3

The seven dates from Phase 2 derive from three different parts of the settlement. GU-2746–8 all relate to samples taken from the secondary occupation of Structure 4 (Contexts 223 and 266, Block 8), in the middle part of Phase 2. GU-2751–2 both derive from an extensive occupation deposit in the later part of the Wheelhouse 1 sequence (Context 204, Block 5b, see Section 2.4.1.1), while GU-2749 derives from an earlier deposit within the same structure (Context 265, Block 5a). The remaining date, AA–29767 derives from the wooden handle of a spade-shoe dumped in the uppermost infill layers of the entrance to Wheelhouse 2, which collectively span Phase 1 and Phase 2.

All five of the Phase 3 samples came from floor deposits of Structure 8 (Block 1). GU-2741 is stratigraphically latest, deriving from the final re-use of the structure, probably following de-roofing. The remainder range stratigraphically from the primary occupation of Structure 8 (GU-2742, Context 113), through a substantial build-up of floor deposits to GU-2744–5 (Context 083) (see Section 2.5.1.2).

The consistency of the dates from Phases 2 and 3 strongly supports the initial hypothesis that the mammal bone samples were deposited in fresh condition as cooking or butchery waste as the various occupation deposits formed. The integrity of these samples, both in terms of potential marine reservoir distortion, and potential for contamination through the mixture of fresh and 'old' bone, is confirmed by the date obtained from the wooden handle of the spade-shoe (AA–29767), which slots perfectly into the Phase 2 sequence. The same cannot be said, as we shall see below (Section 6.3.2), for the samples derived from non-floor deposits in Phase 1.

As Magnar Dalland has indicated, the adjusted radiocarbon dates indicate that Phase 2 falls principally within the first century AD, and has a 62.7 per cent probability of having lasted for 100 years or less. The succeeding Phase 3 lies mainly between the early second century AD and the mid-third century, and has a 60.2 per cent probability of having lasted for 150 years or less. From the preceding stratigraphic description and analysis it is clear that there was no break between Phases 2 and 3 and that their durations are thus directly sequential. The stratigraphic evidence

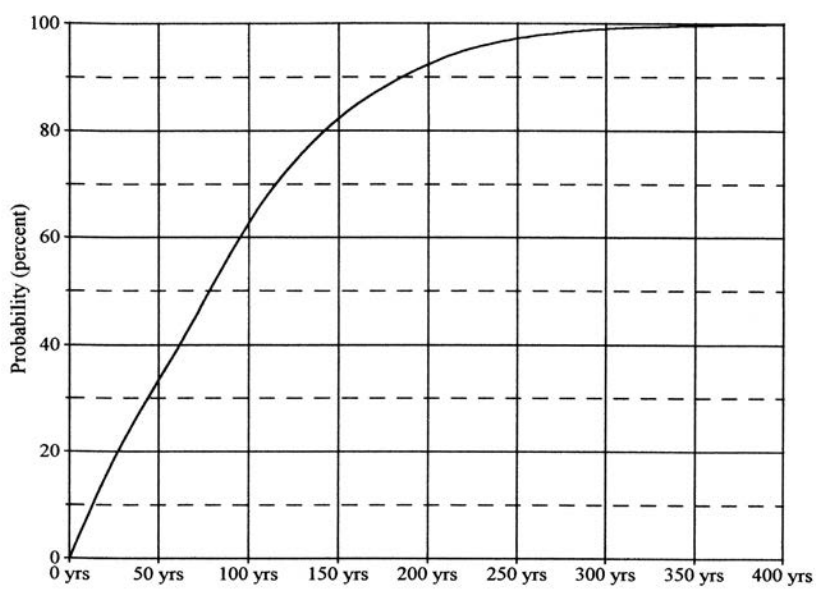

ILLUSTRATION 6.5
Cumulative probability distribution for the duration of Phase 2.

TABLE 6.6
Duration of Phase 2.

Duration (years)	**Probability (%) less than**	**more than**
450	100.0	0.0
300	99.0	1.0
250	97.2	2.8
225	95.4	4.6
200	92.4	7.6
175	88.1	11.9
150	82.3	17.7
125	74.0	26.0
100	62.7	37.3
75	48.1	51.9
50	33.5	66.5
25	18.7	81.3
0	0.0	100.0

would, in general, favour a shorter, rather than longer, interpretation of the potential period of occupation, and adds weight to the statistically based suggestion of time-spans of no more than around 100 and 150 years respectively. If we were to suggest, therefore, that Phase 2 ran from around AD 1–AD 100, and the main occupation of Structure 8 in Phase 3 from around AD 100–AD 250, it seems unlikely that we would be too far wrong.

It is statistically possible, however, that sporadic re-use of Structure 8 in Phase 3 persisted as late as around AD 400 (GU-2741) but even this latest dated sample could easily lie within the AD 100–250 period suggested for Phase 3. It is worth noting that the context from which this date derives (042, Block 1) represents the final, apparently small-scale, re-use of Structure 8, possibly soon after it lost its roof and effectively provides a *terminus ante quem* for the disuse of the settlement as a domestic focus (see Section 2.5.1.2). It is also worth noting that the three copper alloy objects (from Phase 1 and late Phase 2) show no sign of influence from Roman metal, while one pin mould (also from late Phase 2) does have signs of such influence (see Sections 3.9 and 3.12). This would be consistent with a date for the later Phase 2 deposits in the second half of the first century AD, and so is fully supportive of the radiocarbon dates.

6.3.2 DATING PHASE 1

The stratigraphically earliest date from Phase 1 comes from cattle vertebrae sealed behind the wall of Wheelhouse 2 (Context 116, Block 16) which has been interpreted as a deliberate foundation deposit. This deposit also included a great auk head and a complete cordoned jar. Its context, therefore, was arguably the most secure of all the dates from the site and was thought to represent the most secure sample for wheelhouse construction to have been processed from any excavated site. Problems, however, lay ahead.

The sample dates to the period from 615–255 cal BC at 1 sigma, and from 840–170 BC at 2 sigma (Table 6.2). At the time of submission it was believed that this sample should date the construction of Wheelhouse 2 fairly precisely, as it was assumed that such a foundation deposit would have been fresh at the time of deposition, perhaps from an animal specially sacrificed, or from a foundation feast. However, there is a generally greater awareness now of the potential for the curation of special deposits, and it is entirely possible that these cattle vertebrae were not fresh at the time when they were placed in the wall. Nonetheless, the condition of the accompanying great auk head, with its beak still attached, from the same context, suggests that this at least was deposited as an intact head, and was thus presumably either fresh or in some way preserved.

Taken at face value, therefore, the date from this sample would suggest that the wheelhouse was built almost certainly before 170 BC, and probably before

TABLE 6.7
Duration of Phase 3.

Duration (years)	**Probability (%) less than**	**more than**
600	100.0	0.0
500	99.7	0.3
400	97.3	2.7
350	94.0	6.0
300	88.3	11.7
275	84.4	15.6
250	79.8	20.2
225	74.2	25.8
200	67.5	32.5
175	60.2	39.8
150	52.4	47.6
125	43.2	56.8
100	33.5	66.5
75	24.4	75.6
50	15.8	84.2
25	7.6	92.4
0	0.0	100.0

255 BC. This possibility should not be discounted out of hand. However, it is also possible, as we shall see below (this section), that this bone derived from an earlier source and may not be representative of the true construction date of the wheelhouse.

The remaining four Phase 1 samples derive from the infill of Wheelhouse 2 (Contexts 131 and 276, Block 15, see Section 2.3.2.2). These contexts were sealed by the construction of Structure 3 and are thus stratigraphically part of Phase 1. One sample from each of these two contexts (GU-2755 and GU-2757) appear to date to the first century BC or early first century AD (Table 6.2), given the restrictions on their SCR and LCR ranges occasioned by the dating of the later Phase 2 deposits to the first century AD. The other two samples (GU-2756 and GU-2758), however, produced much earlier dates, with much wider ranges, dating respectively at LCR to 1050–375 BC and 810–30 BC. Although not conflicting with the dates for Phase 2, in that all could lie comfortably before the first century AD, this range of dates for Phase 1 suggest an improbably early origin for the wheelhouse.

One hypothesis might explain the early dates. If we accept that curated bone from an off-site source was deliberately introduced to the settlement, perhaps to provide foundation deposits, and/or as components of wall-packing material, this material could have found its way into the infill of Wheelhouse 2 at the time when the upper walls of the building were demolished, early in Phase 1. Some additional circumstantial evidence for the importation of off-site material comes from the unusual artefactual composition of the wall-packing material in Wheelhouse 1, which included concentrations of metal-working debris otherwise unrepresented on the site. Thus the later Phase 1 dates could derive from contemporary, non-contaminated sources, while the earlier dates could have been contaminated by inclusion of one or more bones which were old at the time of deposition.

The Phase 1 dating problem clearly highlights the danger both of dating samples from midden-type deposits, where material can derive from multiple sources, and of 'multiple-entity' dating, where mixtures of old and fresh material can produce misleading 'average' dates (Ashmore 1999).

So what, if anything, can we say about the dating of Phase 1? We might suggest that the later Phase 1 dates represent discard from Wheelhouse 1 which accumulated during the first century BC, with construction of the wheelhouses being represented by the foundation deposit date (GU-2754), some time in the third century BC or even earlier (see Section 2.3.2.1). The third century BC is clearly a surprisingly early date for wheelhouse construction, and we will probably have to await the results of future excavations before we can judge how reliable this Cnip construction date really is. All that can be said with confidence is that Phase 1 occupation of the wheelhouse dated in part to the first century BC, and may have begun significantly earlier.

6.3.3 CONCLUSION

In conclusion we can propose the following as a broad dating framework for the site.

Phase 1	? BC–AD 1
Phase 2	AD 1–AD 100
Phase 3	AD 100–AD 250

6.4 CNIP AND THE CHRONOLOGY OF WHEELHOUSES

Ian Armit

Until quite recently Hebridean wheelhouses tended to be dated to the middle of the first millennium AD.

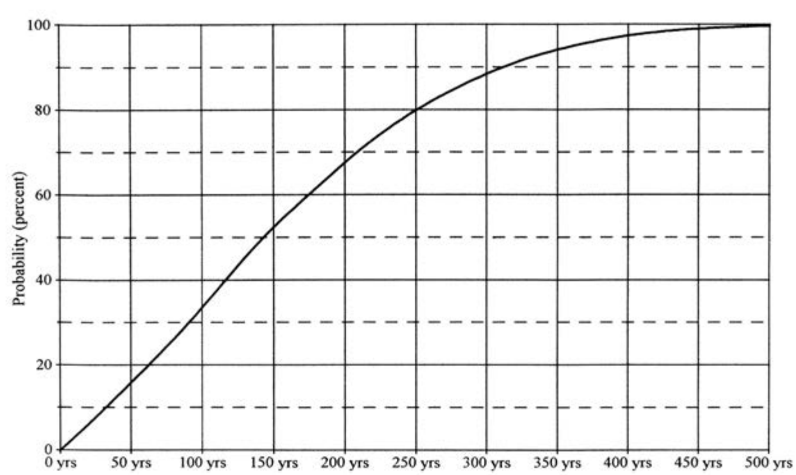

ILLUSTRATION 6.6
Cumulative probability distribution for the duration of Phase 3.

Especially influential was Stevenson's study of the metalwork, particularly pins, from several of these sites, to which he ascribed a broadly mid-first millennium AD date (Stevenson 1955). Many wheelhouse sites, however, were occupied long after the wheelhouses themselves had ceased to be used in their primary form. Much of the artefactual material available to Stevenson, therefore, derived from potentially late occupation within what were often multi-phase and poorly understood sites. This material has little direct bearing on the dating of wheelhouses as a structural type (cf Armit 1992, 69).

Prior to the excavations at Cnip, radiocarbon dates from wheelhouses and related structures were restricted to those from Sollas (Campbell 1991) and the Udal (Crawford nd), both in North Uist, and the radially partitioned structure at Hornish Point, South Uist (Barber 2003). The radiocarbon dates from Structure 5 at Hornish Point suggest that it was built in the fourth or third centuries BC (Barber et al 1989), although the dates are from marine shell and thus pose some problems of interpretation. Two dates from immediately post-wheelhouse occupation at the Udal (Crawford nd, 9) apparently suggest a first century AD date for 'squatter' activity subsequent to the occupation of the wheelhouse.

More problematic, however, are the series of radiocarbon dates from the wheelhouse at Sollas, which range primarily from the late first to early third centuries AD, overlapping with the latter part of Phase 2 and Phase 3 at Cnip. Although it has been suggested that these radiocarbon dates relate to the construction of the Sollas wheelhouse (Campbell 1991), re-examination of the contexts from which the dates derive, particularly in the light of the evidence from Cnip, suggests that they may instead relate to secondary occupation.

The radiocarbon samples from Sollas were obtained from a series of pits cut into the floor of the wheelhouse. In his publication of R J C Atkinson's 1950s excavations, Campbell identified a stratigraphic relationship between two groups of pits; an earlier group comprising a series of large pits from the cells and periphery of the structure, and a later group of more disordered, smaller pits spread across a larger area (Campbell 1991). The radiocarbon dates were obtained exclusively from the later series of pits, which commonly cut through the upper fills of the early series, suggesting some time-depth to the deposits. In the publication of the excavations it was suggested that all of these pits related to one major episode of pit-digging prior to the occupation of the wheelhouse; thus it seemed permissible to relate the radiocarbon dates from the later series of pits to the primary occupation of the building. Yet, assuming that the floor deposits at Sollas, as at Cnip, may have been periodically cleaned down to the primary sand floor, either or both series of pits could have been excavated, and deposits placed within them, at any time during the primary occupation of the wheelhouse. Such cleaning and scouring of deposits is clearly demonstrated at Cnip (especially in Structure 4) and may be expected to be even more marked in the context of a structure like Sollas, which is the largest and most architecturally imposing of all known Hebridean wheelhouses.

None of the radiocarbon dates from Sollas, therefore, need relate either to the construction of the wheelhouse, or to its earliest phase of occupation. Although the wheelhouse at Sollas does indeed appear to have been occupied from the late first to early third centuries AD, overlapping with Phases 2 and 3 at Cnip, it may have been built rather earlier.

Aside from the slim body of radiocarbon evidence, some information on wheelhouse chronology can be gleaned from the evidence of artefactual material, particularly querns, found on various wheelhouse excavations. Although rotary querns are commonly associated with wheelhouses in the Western Isles, the earlier saddle quern form has also been found at three sites. At Foshigarry, North Uist, a saddle quern was recovered from Wheelhouse C, which was probably the earliest wheelhouse on the site (Armit 1992), perhaps suggesting a date for the occupation of this structure prior to *c* 200 BC (Armit 1991). At the nearby site of Bac Mhic Connain a saddle quern was recovered the upper fill of a wheelhouse, but its context is not particularly helpful: it could simply have formed part of the upper walling of the structure which had collapsed at a late stage in the building's structural history (Beveridge 1931). At A' Cheardach Mhor, South Uist (Young & Richardson 1960), a similar situation was recorded, with a broken saddle quern built into one of the wheelhouse piers. The wheelhouse at Kilpheder, South Uist, however, had broken rotary quernstones incorporated in its walling (Armit 1992). This evidence, combined with the saddle quern from Foshigarry C, would seem to suggest that wheelhouses were constructed both before and after *c* 200 BC, the likely period of transition from saddle to rotary querns.

Overall then, the evidence so far available suggests that wheelhouses were being constructed and occupied in the later centuries BC, possibly prior to 200 BC (based primarily on the rather tenuous quern evidence from Foshigarry) and with clear antecedents (represented by Structure 5 at Hornish Point) perhaps as early as *c* 400–500 BC. It is clear, however, that we still lack evidence for the inception of the Hebridean wheelhouse building tradition. The demise of Hebridean wheelhouses, by contrast, is much better dated. Wheelhouse 1 at Cnip was clearly losing its monumental stature during the first century AD. The wheelhouse at Sollas most probably went out of use during the second century AD. Secondary structures also appear to have been built over a wheelhouse at the Udal in the first century AD (Crawford nd, 9), while Kilpheder, South Uist, on the basis of the Romano-British brooch from the final period of occupation, may well have been abandoned around the end of the second century AD (Lethbridge 1952). There appears to be no evidence as yet for the construction of any Hebridean wheelhouse after the first century AD.