

Mesolithic and Early Neolithic activity along the Dee: excavations at Garthdee Road, Aberdeen

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ABSTRACT

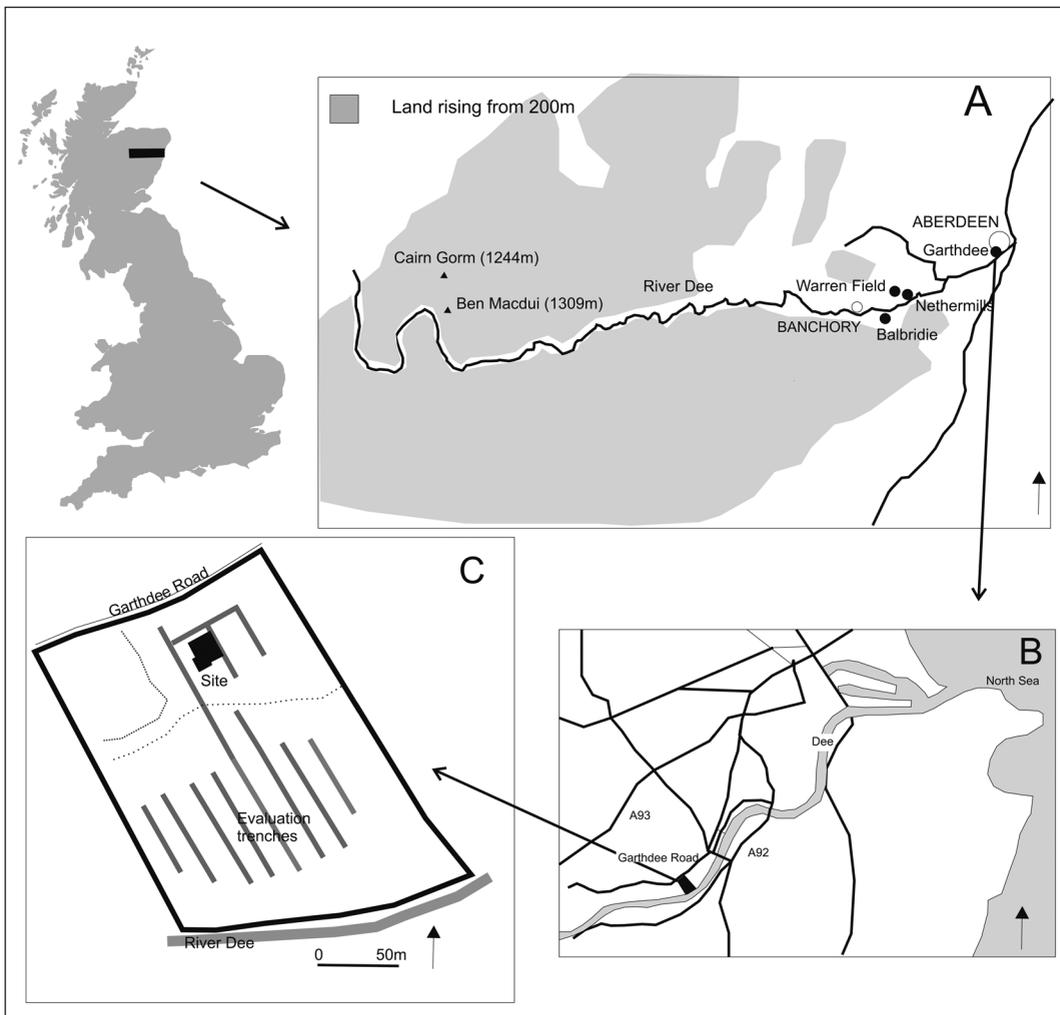
Excavation on a gravel ridge beside the River Dee in Aberdeen revealed a small ovoid building of early Neolithic date. Not only does this add to the very small corpus of early Neolithic buildings yet excavated in Scotland, but the survival of floors and hearths also allows some analysis of functions within the building. The structural, artefactual and radiocarbon evidence suggest that this was a permanent building in use over at least a generation, in contrast to some interpretations of such buildings as temporary shelters. The artefactual and environmental data demonstrate considerable cultural and economic similarities between the occupants of this small building and of the two massive early Neolithic timber halls only a few kilometers away at Balbridie and Warren Field, Crathes. Radiocarbon analysis shows that, although the two halls were built earlier, the Garthdee building may have coexisted with them – emphasizing the varied and complex development of the early Neolithic of eastern Scotland. There is also some evidence to suggest that, although their re-use of an earlier site may have been coincidental, the Neolithic occupants may have been aware of some features of the earlier, Mesolithic, use of the site.

BACKGROUND

The excavation (NGR: NJ 923 032. NMRS No: NJ90SW 268) lay at around 14m OD on the top of a gravel ridge about 150m from the present line of the north bank of the River Dee, near the Bridge of Dee, Aberdeen, some 4.5km from the river mouth (illus 1). A gravel ridge formed a dry south-facing platform above the river, sheltered by another ridge of higher ground further to the north, and would have been very suitable for prehistoric settlement. The Dee valley has been used as a routeway and for settlement since the Mesolithic period; its importance continuing through the Neolithic with two of the rare early Neolithic halls, Balbridie and Warren Field, on either side of the river near Banchory, only some 20km up river from the present site.

In 2004, an archaeological evaluation (Murray 2005; Murray & Murray 2005) had been placed as a condition on a planning application by David Lloyd Leisure Ltd to develop a new sports centre on a green field site beside the River Dee, on the edge of the city of Aberdeen. The development site, which was some 1,600 square metres, extended from low, wet ground beside the Dee, up a gravel ridge to Garthdee Road. The lower area of the development site appeared to have been a series of river-deposited gravel banks with at least one palaeochannel suggesting that there had been periods of change in the course of the river in this area. During both the Mesolithic and Neolithic occupations of the site, the sea level was higher than its present level, with a highest relative sea level of up to 4m OD (Smith et al 1999), which would indicate that the prehistoric activity described below would have been nearer

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ILLUS 1 Site location. A: in relation to other sites mentioned in the text; B: in relation to Aberdeen and the river mouth; C: showing the excavation and evaluation trenches

the water than it is today. This part of the river, just beyond the Bridge of Dee, is still within the tidal zone and is likely to have been tidal during the prehistoric use of the site. Subsequently, the lower ground had been drained and cultivated.

The higher ground at the top of the slope had been considerably disturbed by modern cultivation and dumping. However, a small group of features associated with a sherd of early Neolithic pottery were found cut into the natural, indicating some survival of prehistoric activity. Further evaluation

trenches showed that this survival was restricted to a fairly small saucer-shaped hollow, with no prehistoric finds or features found elsewhere on the ridge.

As a result of this discovery, a further planning condition was imposed and the present site was excavated between 21 March and 17 April 2005. Initially an area 13×17m was excavated alongside the evaluation trench that had yielded the evidence of prehistoric activity. At the end of the excavation, this was extended c4m to the



ILLUS 2 View of the site looking south-east down to the River Dee, with the south bank in the background

south and west to establish the full ground plan of the apparent structure. The excavation was funded by David Lloyd Leisure Ltd.

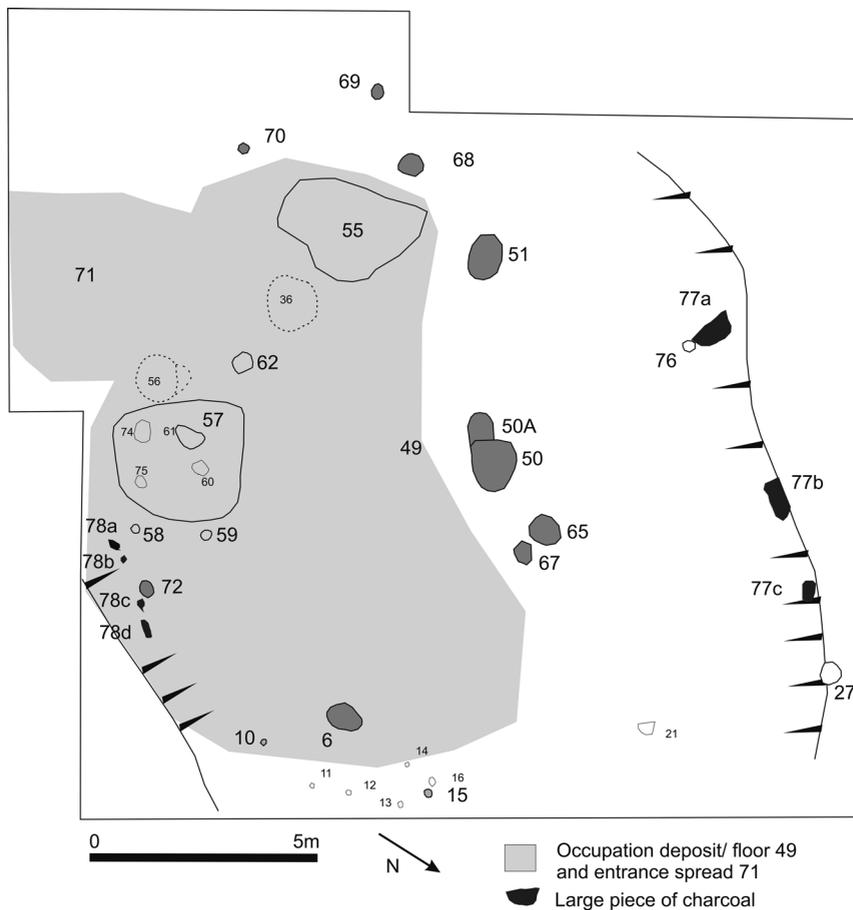
The site archive is deposited in the Sites and Monuments Record of Scotland. The finds have been disposed by the Scottish Archaeological Finds Allocation Panel to the University of Aberdeen Museums.

THE EXCAVATION

Removal of the topsoil and subsoil exposed a step *c*0.50m high in the natural gravel along the north side of the site. The ground sloped gently to the south, forming a shallow saucer-shaped hollow *c* 18m north/south and *c* 16m along the ridge. At the south-east this was limited by another slight step of gravel *c*0.30m high, but to the south-west the ground sloped fairly steeply down towards the river (illus 2). The hollow did not appear to have been cut but may have been a natural feature

enhanced by activity causing erosion on the softer sand, the stepped ground being bands of harder, compacted gravel.

Two phases of prehistoric activity were found: a pit (56) with a structured fill of charcoal, dated by radiocarbon to the later Mesolithic, and a roughly oval building dated by radiocarbon samples, associated pottery and lithics to the early Neolithic (illus 3). A small pit (illus 3: 36), containing a tiny deposit of burnt bone and considerably enlarged and disturbed by animal burrowing, cut through the layers overlying the Neolithic building; this may have been a later prehistoric feature but as the bone could not be identified as human or animal and as there were no related artefacts, it is not described further. A small number of the lithic finds may be of Bronze Age date (Ballin, below) but were not related to any features. A series of later cultivation features have been described elsewhere (Murray 2005); these had not significantly disturbed the underlying archaeology.



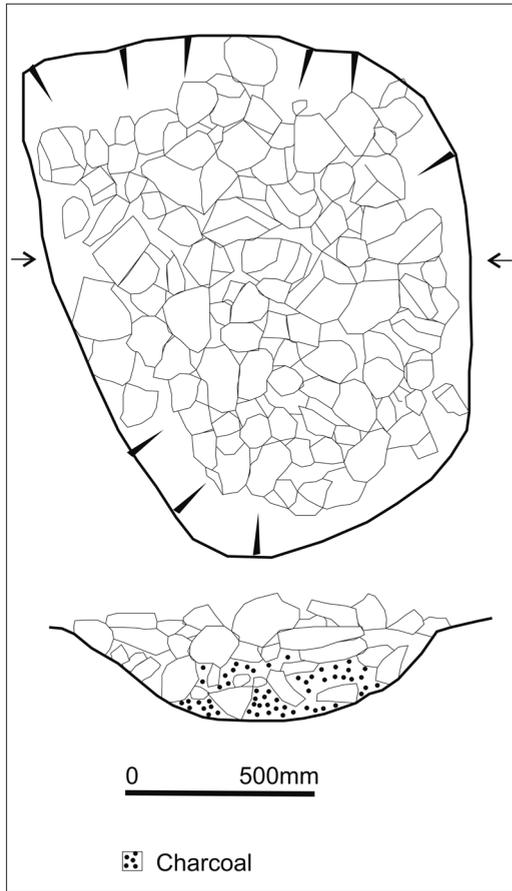
ILLUS 3 Plan of the excavated area. The earlier pit (56) and later pit/burrow (36) are indicated with dotted outlines

MESOLITHIC OCCUPATION

A pit (56) between 0.86m and 1.04m in diameter and 0.39m deep was cut near the south side of the hollow (illus 4, 5). The lower fill comprised a small deposit of burnt material; this was 100% sampled and proved to comprise of only wood charcoal, which was identified as oak and hazel (Timpany, below). There were no other macrofossils, burnt bone or artefacts in this deposit. It had been extremely carefully sealed by a layer up to 0.20m thick of interlocking stones, which filled the pit and then spread to form a covering 1.10×1.30m, the top of which extended slightly beyond the edge of the pit. The stones

were so tightly packed that none of the overlying floor deposits had penetrated into the pit. A small number of the stones appeared to have been heat-fractured and there were several areas of possible heat-reddening of the north and north-west edges of the pit; this may simply indicate that some of the charcoal was hot when placed in the pit or it could suggest that the wood had been burnt in situ and that this had been a hearth.

Two radiocarbon dates from the exceptionally well-sealed lower fill yielded later Mesolithic dates in the mid-sixth millennium cal BC, with an estimated date for the filling of the pit within the period 5630–5480 cal BC (Marshall & Cook below and Table 1). No other features



ILLUS 4 Plan and section of Mesolithic pit (56)

flints may have been accidentally moved around by the Neolithic occupation of the site, they do show that there had been some, albeit perhaps very transitory, Mesolithic use of the ridge.

THE NEOLITHIC BUILDING

A series of post-pits, a floor deposit with hearths and a concentrated distribution of artefacts indicated the outline of a roughly oval building, 11–12m long × 8m wide, orientated with the long axis north-east/south-west and extending along the southern part of the hollow, parallel with the ridge above the river (illus 3). Radiocarbon dates, pottery in the Carinated Bowl tradition, the technology of the flint assemblage and the identification of grain samples all indicate an early Neolithic date.

There was some evidence to suggest that the ground may have been de-turfed as there was a large number of fairly small, mostly shallow, scoops cut into the natural; they were 30–50mm in maximum depth, the majority being around 120 × 170mm, with a few up to 250 × 300mm, one side was generally slightly steeper and the other sides had very gradual slopes. The size and shape of cut could easily have been made with scapula shovels or hoes. This possible de-turfing was restricted to the area of the Neolithic structure and the de-turfing cuts were filled by the floor

on the site could be clearly identified as Mesolithic. However, Ballin (below) identified three microliths of Mesolithic technology; one being c 1m south of pit 56, a second 4m to the east and the third 10m to the north-east, which Ballin suggests may be part of a small cluster (illus 20: concentration 10) of otherwise non-diagnostic flints cut by the suggested wall line of the Neolithic building. While there is a strong probability that these

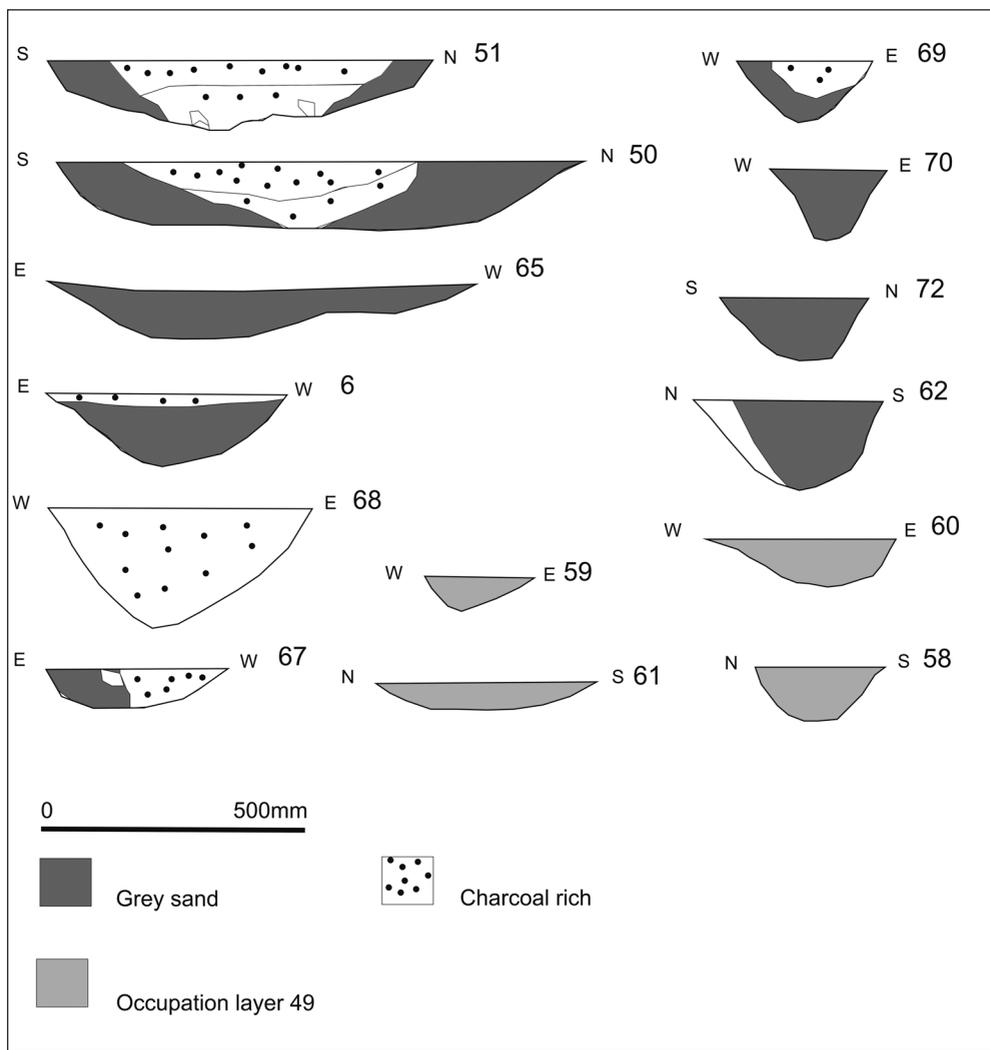


ILLUS 5 Mesolithic pit (56) from south

deposit associated with it and it is considered that they were, therefore, cut directly before the floor build-up began to be deposited and are unlikely to be earlier features. Such de-turfing could be regarded both as creating a floor and as providing turves as possible walling or roofing materials.

The outline of the structure was delimited by a few fairly irregular posts-pits (illus 3 and 6: contexts 70, 69, 68, 51, 50, 50A, 65, 67, 6, 72; possibly 10 and 15). The larger pits around the north side ranged in size between 1.40×0.95m and

0.50×0.47m; all were shallow, between 100mm and 230mm in depth. Pit 50 was a re-cut of an earlier pit (50A) and pit 67 may have replaced or supplemented pit 65. The post-pits towards the south side (69, 70 and 72) and possibly features 10 and 15 (which were planned but not sectioned during the evaluation) were between 200mm and 450mm in diameter. With the exception of 68, the primary fill of these post-pits was undifferentiated grey sand, but the fill of 68 and the secondary fills of 69, 50, 51 and 67 were of looser, charcoal-rich



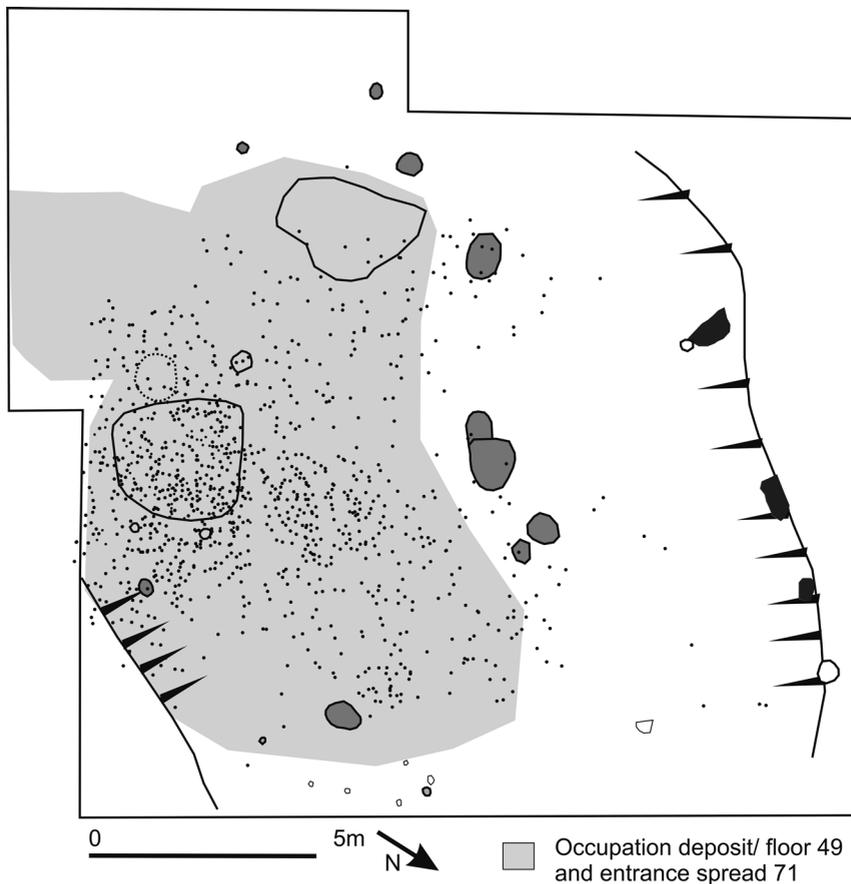
ILLUS 6 Sections of early Neolithic features

silt, possibly accumulating after the removal of timbers. A number of possibly related smaller features (11–14, 16, 21), which had been observed but not sectioned in the evaluation trench, were destroyed during the backfilling and uncovering before the main excavation took place.

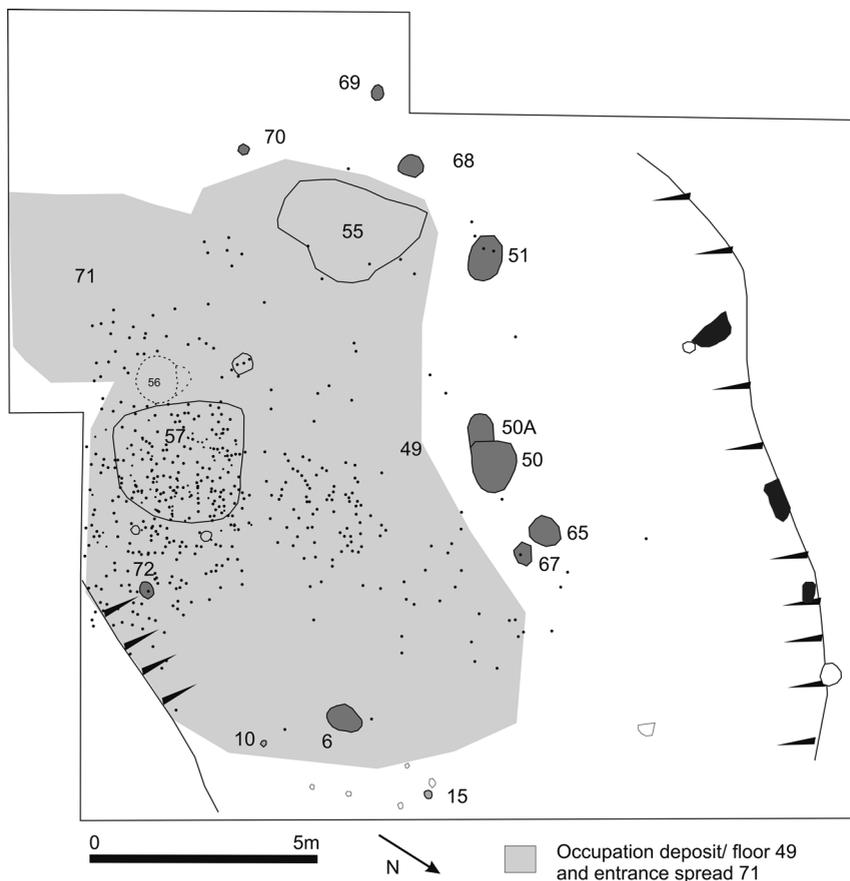
Within the enclosed area there was a very hard ‘trodden’ deposit (49) which incorporated large numbers of finds. This was a single unlensed build-up, 100–200mm in depth, of hard gritty silt with frequent charcoal fragments <10mm in diameter. It is interpreted as a floor or occupation surface, with the very compact consistency suggesting that there was continuous occupation in a roofed structure; it is unlikely that such a hard deposit could have survived without a roof on these sandy soils. An area of blackened sand

(71), similar to and merging into the occupation floor, extended from the west end of the south side of the enclosed area and was suggestive of an entrance facing south-east towards the river. One post-pit (62) in the interior of the structure was in line with this possible entrance, but appears to have been too far into the interior to have been a door post.

This distribution of finds suggested that the enclosed area, which lay in the southern half of the site, had been separated from the northern area by a physical barrier that precluded even incidental movement of more than a very few finds. Of the 1014 finds from all layers, only about 50 were outside the enclosed area – even though about half the site lay outside it to the north (illus 7). Of the finds from the contexts contemporary with



ILLUS 7 Simplified plan of the Neolithic building with finds from all contexts



ILLUS 8 Simplified plan of the Neolithic building with finds from its occupation contexts. Earlier pit (56) indicated with dotted outline

the occupation (illus 8), only five were outside the enclosed area. A wall on or just outside the line of post-pits appears a probable explanation, although it is perhaps surprising that there does not appear to have been activity – or activity leaving visible traces of any sort – in the northern part of the hollow ‘behind’ the building.

There were two hearths within the enclosed area. The western hearth (55) had been built directly on the natural surface and had been in use long enough and intensely enough to heat-redden the sand to a depth of 90mm. It appears to have been primary and to have gone out of use during the life of the structure as it was sealed by the upper part of the occupation deposit 49. The other hearth (57), which was more central,

had been in use when there had been some build-up of layer 49. Ballin (below) suggests that the distribution of burnt flints may indicate that this central hearth moved slightly during the use of the building. Several very shallow hollows below the ash spread of this hearth (illus 3: 60, 74 and 75) were interpreted as part of the de-turfing of the site, but one feature (61) may have been a post-pit that pre-dated the hearth or even, during its early use, a hollow to hold a pot. Two other small features (58, 59) may also have been associated with the hearth. This central hearth was a focus of both pottery and flints but the earlier hearth (55) had far fewer finds around it. However, environmental sampling (Timpany, below) shows that burnt grain was present around both hearths,

suggesting that both may have been used for food preparation and cooking.

A fairly extensive system of sampling, both from the floor and from the overlying layer (45) (illus 14), shows a concentration of grain and nuts within some 3m of the hearths, with very little food debris – other than occasional hazelnut shells from samples at the northern and eastern ends of the building. The distribution of all finds also shows a bias to the southern part of the building. This may indicate that the lighter and warmer side of the building was used for cooking, eating etc and the darker northern part of the building for sleeping. Ballin (below) has undertaken detailed spatial analysis of the flints, which suggests that the production and use of flint tools was concentrated in the southern part of the building, broadly focused around the central hearth. A cache of flints below a stone and a deposit of two axe fragments – both at the eastern side of the building – may indicate some different significance of that area. During the initial use of the building there appears to have been a consciousness and avoidance of the far earlier

pit 56, with no artefacts over this area in the lower levels of the floor. However, as occupation continued and the floor built up, this awareness appears to have been lost and normal artefact distribution covered the area.

The floor was sealed by a very loose and friable, but still finds-rich, layer 45. This may be the combination of fallen roof and wall material and the weathering of the upper part of the floor when it was no longer protected by a roof. Beside both the northern and south-eastern gravel ridges that enclosed the hollow, there were linear patches of charcoal which may have been the remains of burnt out timbers lying on the contemporary ground surface (77a–c, 78a–d), the largest fragment being *c* 350mm wide and 900mm long. To the north these were directly on the natural gravel, to the south-east they were on layer 45. Two small post-holes (27, 76) on the northern ridge are difficult to date as, in this higher area, cultivation had truncated all features. Layer 45 had been sealed by mid-brown light sand with occasional patches of small charcoal fragments (25, 5). This was thicker over the southern part of



ILLUS 9 The Neolithic building looking north-east with ranging rods indicating main features

the site and gave the appearance of sand eroded into the hollow, after the building was long gone. Several large animal burrows are probably responsible for the scatter of prehistoric artefacts in this horizon.

Interpretation

It is not possible to reconstruct the building on the surviving evidence (illus 9) but a few possibilities may be indicated. The line of post-pits can reasonably be interpreted as a hypothetical wall line as this would explain the distinct dividing line between the finds-rich internal occupation floor and the finds-poor area north of the post ring. Even the largest of the timbers suggested by the post-pits do not appear to have been more than 350mm in maximum diameter and were not deeply cut into the natural; it cannot be argued that they had been deeper as the floor levels survive. It is possible that a construction was used that incorporated large horizontal timbers in a log type construction – if the vertical posts were incorporated into such a structure they might not have needed to be deeply set into the ground. However, the nature of the overlying layer 45 and the apparent signs of de-turfing prior to construction also allow the possibility that turf was used in the wall and/or the roof covering. The paucity of the finds to the north of the wall line appears odd as, even if the wall had been fairly wide, there is no obvious reason why there was no activity or even dumping behind the outside of the structure; one possibility may be that part of the roof structure rested on the gravel ridge shielding the ground in this area; the traces of burnt timbers along both gravel ridges might be interpreted in this light – although with extreme caution.

The radiocarbon dates do not allow precision regarding the possible duration of the structure (Marshall & Cook below) but the depth of the occupation build-up, the concentration of artefacts, the movement of successive hearths and the evidence of at least two posts having been replaced or augmented, all suggest that this structure had been a roofed building in use for a number of years, possibly up to a generation.

There is little evidence to indicate how or why the building went out of use. Some of the post-pits (68, 69, 51, 50 and 67) appear to have had

posts removed and it is possible that some timber was salvaged for re-use. The only indicators of fire were the traces of charred timber beside the gravel ridges and the charcoal-rich silt filling the post-pits; these are not enough to suggest that the building burnt or was burnt – it may simply have begun to decay and been abandoned with salvage of usable timber for firewood.

RADIOCARBON DATING

P D Marshall and G Cook

INTRODUCTION

Eight radiocarbon age determinations have been obtained on samples of carbonised wood and charred plant remains from Garthdee Road, Aberdeen.

METHODS

The samples were submitted to the Scottish Universities Environmental Research Centre (SUERC), East Kilbride, and pre-treated following standard procedures (Stenhouse & Baxter (1983)), graphitised following the methods outlined in Slota et al (1987), and measured by Accelerator Mass Spectrometry (AMS) according to Xu et al (2004).

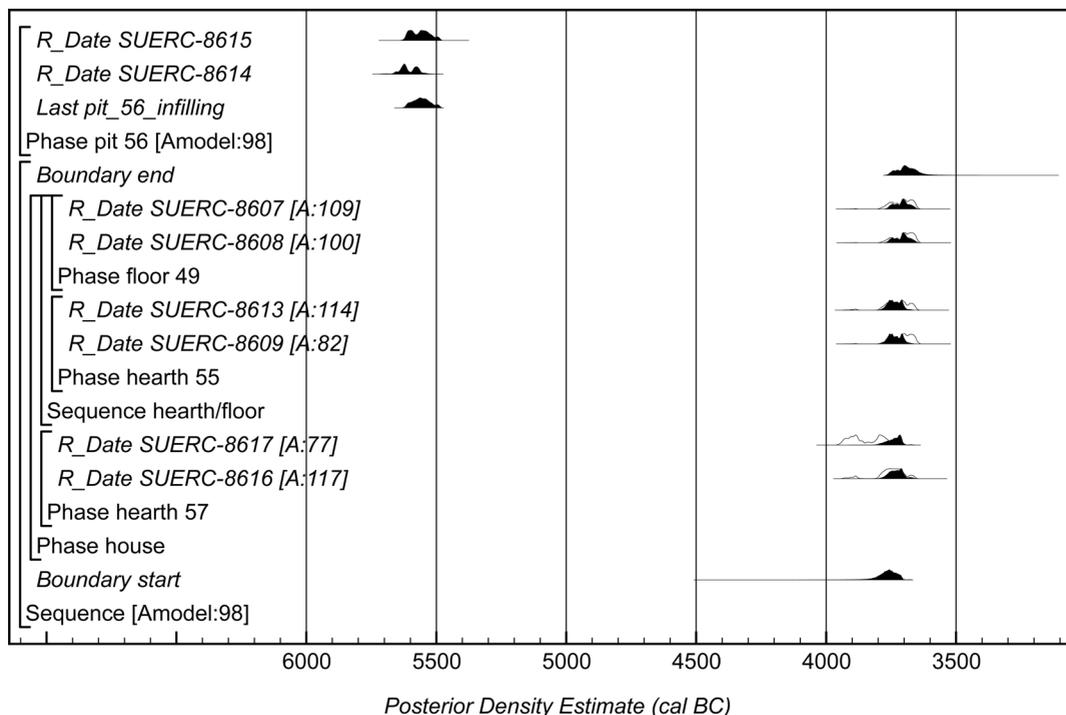
The laboratory maintains a continual programme of quality assurance procedures, in addition to participation in international inter-comparisons (Scott 2003), which indicate no laboratory offsets and demonstrate the validity of the precision quoted.

RESULTS

The radiocarbon results are given in Table 1, and are quoted in accordance with the international standard known as the Trondheim convention (Stuiver & Kra 1986). They are conventional radiocarbon ages (Stuiver & Polach 1977).

CALIBRATION

The calibrations of the results, relating the radiocarbon measurements directly to calendar



ILLUS 10 Probability distributions of dates from Garthdee Road, Aberdeen

dates, are given in Table 1, and in outline in illus 10. All have been calculated using the calibration curve of Reimer et al (2013) and the computer program OxCal (v4.2) (Bronk Ramsey 1995; 1998; 2001; 2009). The calibrated date ranges cited in the text are those for 95% confidence. They are quoted in the form recommended by Mook (1986), with the end points rounded outwards to 10 years. The ranges quoted in italics are *posterior density estimates* derived from mathematical modelling of archaeological problems (see below). The ranges in roman type have been calculated according to the maximum intercept method (Stuiver & Reimer 1986). All other ranges are derived from the probability method (Stuiver & Reimer 1993).

METHODOLOGICAL APPROACH

A Bayesian approach has been adopted for the interpretation of the chronology from this site (Buck et al 1996). Although the simple calibrated

dates are accurate estimates of the dates of the samples, this is usually not what archaeologists really wish to know. It is the dates of the archaeological events, which are represented by those samples, which are of interest. In the case of Garthdee Road, it is the chronology of the use of the building that is under consideration, not the calibrated dates of the individual samples (Bayliss et al 2007). The dates of this activity can be estimated, not only using the absolute dating information from the radiocarbon measurements on the samples, but also by using the stratigraphic relationships between samples.

Fortunately, methodology is now available which allows the combination of these different types of information explicitly, to produce realistic estimates of the dates of archaeological interest. It should be emphasised that the *posterior density estimates* produced by this modelling are not absolute. They are interpretative estimates, which can and will change as further data become available, and as other researchers choose to

TABLE 1
Radiocarbon dates from Garthdee Road

Laboratory number	Sample ref	Context	Sample type	Radio-carbon age (BP)	$\delta^{13}\text{C}$ (‰)	Calibrated date (95% confidence)	Posterior density estimate (95% probability)
SUERC-8616	DLIC 17/1	Central hearth (57)	Charred grain, <i>Hordeum vulgare</i>	4970 ± 35	-27.5	3910–3650 cal BC	3785–3670 cal BC
SUERC-8617	DLIC 17/1	As SUERC-8616	Charred nutshell, <i>Corylus avellana</i>	5020 ± 35	-25.1	3950–3700 cal BC	3800–3695 cal BC
SUERC-8607	DLIC10	Floor occupation build-up (49)	Charred grain, <i>Hordeum vulgare</i>	4925 ± 35	-25.9	3790–3640 cal BC	3670–3655 cal BC
SUERC-8608	DLIC 11	As SUERC-8607	Charred grain, <i>Hordeum vulgare</i>	4925 ± 35	-26.7	3780–3640 cal BC	3670–3650 cal BC
SUERC-8609	DLIC 13/1	Hearth (55), set directly on natural and sealed by the upper part of (49)	Charred nutshell, <i>Corylus avellana</i>	4930 ± 35	-26.5	3790–3640 cal BC	3780–3685 cal BC
SUERC-8613	DLIC 13/1	As SUERC-8609	Charred grain, <i>Hordeum vulgare</i>	4950 ± 35	-27.0	3800–3650 cal BC	3785–3690 cal BC
SUERC-8614	DLIC 15/1	Fill of pit (56)	Charcoal, <i>Corylus avellana</i>	6690 ± 35	-23.9	5670–5550 cal BC	–
SUERC-8615	DLIC 15/2	As SUERC-8614	Charcoal, <i>Corylus/Alnus</i> sp	6620 ± 35	-26.4	5630–5480 cal BC	–

model the existing data from different perspectives.

The technique used is a form of Markov Chain Monte Carlo sampling, and has been applied using the program OxCal v4.2 (<http://c14.arch.ox.ac.uk/>). Details of the algorithms employed by this program are available from the on-line manual or in Bronk Ramsey (1995; 1998; 2001; 2009). The algorithm used in the model described below can be derived from the structure shown in illus 10.

THE SAMPLES

The first stage in sample selection was to identify short-lived material, which was demonstrably not residual in the context from which it was recovered. The taphonomic relationship between a sample and its context is the most hazardous link in this process, since the mechanisms by which a sample came to be in its context are a matter of interpretative decision rather than certain knowledge. All samples consisted of single entities (Ashmore 1999). Material was initially selected only where there was evidence that a sample had a functional relationship to its context. The main category of material that met this taphonomic was carbonised material from hearths, and can reasonably be assumed to represent fuel, or material that was accidental charred during activities associated with the hearth.

Other samples with a less certain taphonomic origin that were submitted came from a floor/occupation deposit and the fill of a pit. Duplicate samples

from these contexts were submitted to test the assumption that the material was of the same actual age.

The two measurements (SUERC-8614 and SUERC-8615) from pit (56) are statistically consistent ($T' = 2.0$; $v = 1$; $T'(5\%) = 3.8$; Ward & Wilson 1978) and could therefore be of the same actual age. The best estimate for the infilling of pit (56) is 5630–5480 cal BC (95% confidence; SUERC-8615).

All six measurements from the floor/occupation build up (49) (SUERC-8607 and SUERC-8608), hearth (55) (SUERC-8609 and SUERC-8613), and hearth (57) (SUERC-8616 and SUERC-8617) are statistically consistent ($T' = 5.2$; $v = 5$; $T'(5\%) = 11.1$; Ward & Wilson 1978) and could therefore be of the same actual age, or more probably very close in age, as stratigraphically hearth (55) is sealed by the upper part of floor/occupation build up (49).

The χ^2 test results for the pairs of measurements from the building are as follows:

- (i) floor/occupation build up (49) ($T' = 0.0$; $v = 1$; $T'(5\%) = 3.8$; Ward & Wilson 1978),
- (ii) hearth (55) ($T' = 0.2$; $v = 1$; $T'(5\%) = 3.8$; Ward & Wilson 1978),
- (iii) hearth (57) ($T' = 1.0$; $v = 1$; $T'(5\%) = 3.8$; Ward & Wilson 1978).

RESULTS

The model shown in illus 10, based on the assumption that the building was in continuous use for a period of time (Buck et al 1996), shows good agreement ($A_{\text{model}} = 96.4\%$) between the radiocarbon dates and stratigraphy. An overall

agreement index of 60% is recommended as the threshold for showing consistency between the prior information and the radiocarbon dates (Bronk Ramsey 1995; Bayliss et al 2007).

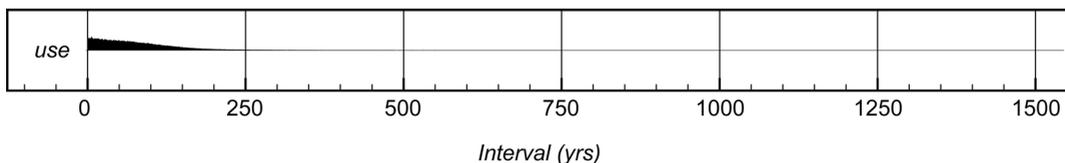
The model provides an estimate for the start of the use of the building of 3850–3700 cal BC (95% probability; *Boundary start*; illus 10) and probably 3790–3715 cal BC (68% probability) and the end of use of 3765–3610 cal BC (95% probability; *Boundary end*; illus 10) and probably 3730–3650 cal BC (68% probability). The span of use of the building is estimated at 1–205 years (95% probability; (illus 11) or 1–100 years (68% probability). The small number of dates available is, however, likely to mean that the estimate tends to suggest that activity continues for longer than it really did.

Given the shape of the probability distributions for the start and use of the building (see illus 10 and 11), they both have pronounced tails, we, as stated above, believe the 68% probabilities given are probably the best estimates for the date of construction and duration of use of the building.

The length of time between the infilling of pit (56) and the start of use of the building is estimated to be 1690–1895 years (95% probability) and probably 1750–1850 years (68% probability).

THE CHRONOLOGY OF SCOTTISH TIMBER BUILDINGS

Illus 12 and Table 2 summarise estimates for the start, end and span of use of the Neolithic buildings from Garthdee Road, Warren Field, Crathes (Murray et al 2009), Balbridie (Fairweather & Ralston 1993), Lockerbie Academy (Kirby 2011)



ILLUS 11 Probability distribution of the number of calendar years during which the building at Garthdee Road, Aberdeen, was in use

TABLE 2
Posterior density estimates of archaeological events and spans of use for Neolithic buildings

Site	Estimated start (95% probability)	Estimated start (68% probability)	Estimated end (95% probability)	Estimated end (68% probability)	Estimated end (68% probability)	Estimated span (95% probability)	Estimated span (68% probability)
Garthdee Road	3850–3700 cal BC	3790–3720 cal BC	3770–3610 cal BC	3750–3650 cal BC	3750–3650 cal BC	1–210 years	1–100 years
Warren Field, Crathes	3810–3720 cal BC	3800–3760 cal BC	3800–3660 cal BC	3780–3750 (50%) or 3730–3710 (18%) cal BC	3780–3750 (50%) or 3730–3710 (18%) cal BC	1–100 years	1–50 years
Balbridie	4950–3690 cal BC	4130–3690 cal BC	3650–2330 cal BC	3570–3040 cal BC	3570–3040 cal BC	1–440 years	60–310 years
Lockerbie Academy	3815–3700 cal BC	3775–3710 cal BC	3710–3625 cal BC	3695–3645 cal BC	3695–3645 cal BC	1–125	25–100
Claish	3750–3650 cal BC	3720–3670 cal BC	3700–3630 cal BC	3690–3640 cal BC	3690–3640 cal BC	1–80 years	1–40 years

and Claish (Barclay et al 2002) obtained by mathematical modelling.

Further analysis of the data (Tables 3 and 4) allows us to make an assessment of the relationship between events (ie the estimates for the start and end dates of the use of the five Neolithic buildings). For example, the probability that the building at Warren Field, Crathes, was in use before that at Garthdee Road is 59.1%, and that the building at Garthdee Road pre-dates that at Balbridie is 12.3%. The building at Warren Field, Crathes, is also very likely to have gone out of use before that at Garthdee Road, 90.7% probability.

But submission of a more reliable suite of short-lived, single entity (Ashmore 1999) samples for radiocarbon dating are required to confirm the date of the building at Balbridie, while the submission of further samples from Garthdee Road would undoubtedly confirm the impression that it was in use for a relatively short period of time (ie <50 years).

THE CHRONOLOGY OF NEOLITHIC TIMBER STRUCTURES

Illus 13 summarises the available estimates for the beginning of use of Neolithic structures in Britain and Ireland. The British buildings are of varying dates, with the earliest being the large timber hall at White Horse Hill (Allen et al 2005) in Kent, which was probably built in the 41st or 40th centuries cal BC, followed by Horton (Chafney et al 2012) and Yarnton (Hey & Barclay 2007) in the Thames valley. The building at Garthdee seems to belong to the first half of the 38th century cal BC when Neolithic things and practices first appeared over large parts of western and northern Britain and, probably, Ireland (Bayliss et al 2011).

The Mesolithic activity on the site has very clear parallels with other early Neolithic sites such as Warren Field, Crathes (Murray et al 2009), and Lismore Fields, Derbyshire, where small-scale Mesolithic activity over a number of millennia occurred in close vicinity to the later Neolithic buildings (Meadows pers comm) and Waterswallows, Derbyshire (Davies pers comm).

TABLE 3

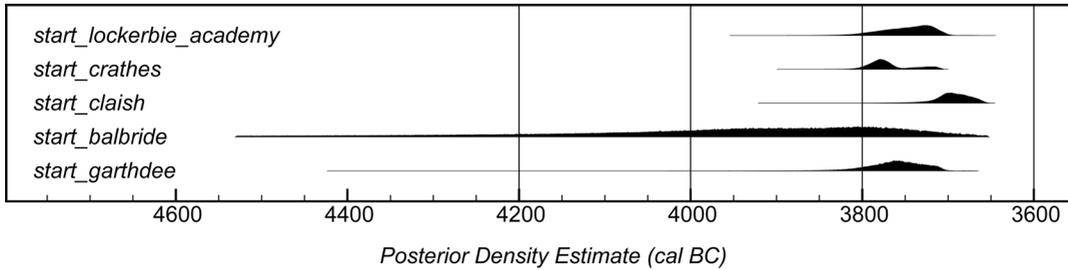
Percentage probabilities of the relative order of the initial use of the four Neolithic buildings (Garthdee, Warren Field, Crathes, Balbridie and Claish). The cells show the probability of the distribution in the left-hand column being earlier than the distribution in the top row. For example, the probability that Garthdee is earlier than Warren Field Crathes is 40.9%

	<i>start_garthdee</i>	<i>start_balbridie</i>	<i>start_claish</i>	<i>start_crathes</i>	<i>start_lockerbie_academy</i>
<i>start_garthdee</i>		12.3	96.0	40.9	61.9
<i>start_balbridie</i>	87.7		97.5	87.1	90.5
<i>start_claish</i>	4.0	2.5		2.6	6.0
<i>start_crathes</i>	59.1	12.9	97.4		70.0
<i>start_lockerbie_academy</i>	38.1	9.5	94.0	30.0	

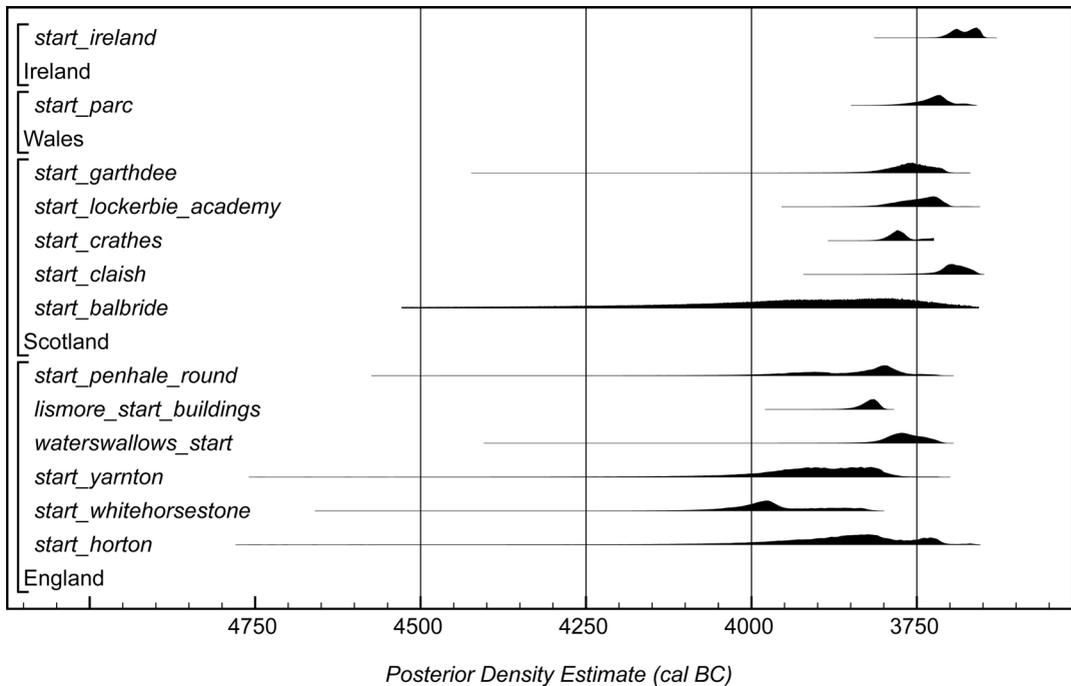
TABLE 4

Percentage probabilities of the relative order of the endings of the four Neolithic buildings (Garthdee, Warren Field, Crathes, Balbridie and Claish). The cells show the probability of the distribution in the left-hand column being earlier than the distribution in the top row. For example, the probability that Garthdee went out of use before Warren Field Crathes is 9.3%

	<i>end_garthdee</i>	<i>end_balbridie</i>	<i>end_claish</i>	<i>end_crathes</i>	<i>end_lockerbie_academy</i>
<i>end_garthdee</i>		99.8	74.9	9.3	71.7
<i>end_balbridie</i>	0.2		0.0	0.0	0.1
<i>end_claish</i>	25.1	100.0		0.2	45.0
<i>end_crathes</i>	90.7	100.0	99.8		99.5
<i>end_lockerbie_academy</i>	28.4	99.9	55.0	0.5	



ILLUS 12 Summary of estimates for the start, end and span of use of the Neolithic buildings from Garthdee Road, Warren Field, Balbridie, Lockerbie Academy and Claish



ILLUS 13 Summary of the estimates for the beginning of use of Neolithic structures in Britain and Ireland

ENVIRONMENTAL EVIDENCE

Scott Timpany

THE MESOLITHIC PIT

The primary fill of pit 56 was 100% sampled; processing revealed that it contained only a small quantity of charcoal fragments (Hastie 2005). Identification analysis of the fragments from the pit shows that oak (*Quercus* sp) and

hazel (*Corylus avellana*) are the only two tree species present. One fragment, which could not be identified due to poor preservation, was also found during the analysis (Table 5). Previous identification of charcoal fragments for radiocarbon dating found possible evidence for the presence of alder (*Alnus glutinosa*) identified as hazel/alder (*Corylus/Alnus*), however, the absence of any alder from the analysis – and the dominance of hazel – indicates

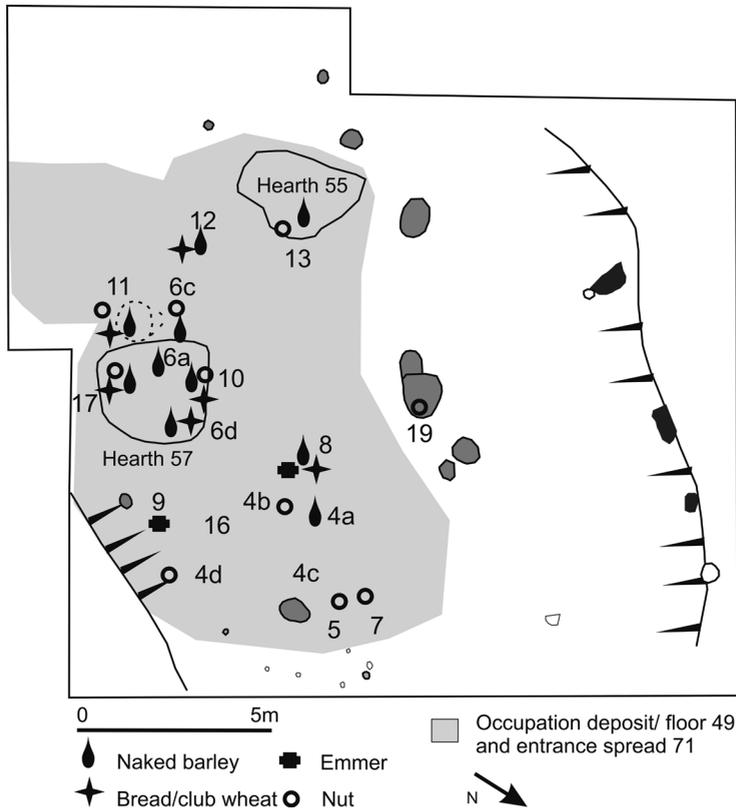
that the dated fragment is more likely to have been hazel.

Subsequent radiocarbon dating of two of the fragments has revealed that this pit reflects activity in the later Mesolithic (Table 1

and Marshall & Cook above). The charcoal identifications from the pit have shown that hazel was mainly used, with a lesser amount of oak, for fuel wood (Table 5). The presence of hazel woodland in the area during the Mesolithic

TABLE 5
Charcoal identification from Mesolithic pit 56, samples 14 and 15

Taxon	Sample:	14	15
	Context:	56/2	56/3
	Feature:	Mesolithic Pit	
<i>Quercus</i> sp fragments		2 (0.1g)	5 (0.5g)
<i>Corylus avellana</i> fragments		18 (2.4g)	14 (1.2g)
Unidentifiable fragments		–	1 (0.2g)



ILLUS 14 Simplified plan of the Neolithic building showing the position of samples (numbered) and the distribution of grains and nuts

TABLE 6
Total counts of charred plant remains from the Neolithic building at Garthdee

	<i>Sample:</i>	4A	4B	4D	5	6A	6C	6D	7
<i>Taxon</i>	<i>Context:</i>	23	23	23	45	45	45	45	45
	<i>Feature:</i>	<i>Possible destruction layer/post floor</i>							
<i>Corylus avellana</i> nutshell		–	1 (0.1g)	14 (0.2g)	3 (0.1g)	–	2 (0.2g)	–	1 (<0.1g)
<i>Spergula arvensis</i> fruit		–	–	–	–	–	–	–	–
<i>Brassica nigra</i> fruit		–	–	–	–	–	1	–	–
<i>Rubus fruticosus</i> fruit		–	–	–	–	–	–	–	–
<i>Hordeum vulgare</i> var <i>nudum</i> grain		1	–	–	–	2	4	1	–
<i>Triticum aestivo-compactum</i> grain		–	–	–	–	–	–	2	–
<i>Triticum dicoccum</i> grain		–	–	–	–	–	–	–	–
Cereal indet. grain		1	–	–	–	1	–	–	–

	<i>Sample:</i>	8	9	10	11	12	16	18	13	17	19
<i>Taxon</i>	<i>Context:</i>	54	49	49	49	49	49	49	55	57	50/01
	<i>Feature:</i>	<i>Floor/occupation layer</i>							<i>Hearth</i>	<i>Post pit</i>	
<i>Corylus avellana</i> nutshell		8 (0.2g)	–	12 (0.2g)	2 (<0.1g)	23 (0.4g)	9 (0.1g)	2 (0.1g)	–	–	5 (0.1g)
<i>Spergula arvensis</i> fruit		–	1	–	–	–	–	–	–	–	–
<i>Brassica nigra</i> fruit		–	–	–	–	–	–	–	–	–	–
<i>Rubus fruticosus</i> fruit		–	–	–	–	–	–	–	–	1	–
<i>Hordeum vulgare</i> var <i>nudum</i> grain		1	–	2	3	6	–	–	34	6	–
<i>Triticum aestivo-compactum</i> grain		1	–	5	1	1	–	–	–	3	–
<i>Triticum dicoccum</i> grain		1	1	–	–	–	–	–	–	–	–
Cereal indet. grain		2	–	4	6	3	–	–	23	3	–

is suggested by recent pollen work undertaken at Warren Field, Crathes (Davies et al 2007; Lancaster 2009). The presence of oak/hazel woodland in the area during this time would be in agreement with pollen isochrone maps for this area (Bennett 1989; Birks 1989). The choice of hazel and oak to use as fuel during the Mesolithic is concurrent with other charcoal identifications of this period (Atkinson et al 2002) and suggests Mesolithic people were using local resources for their choice of fuel wood. The absence of other arboreal taxa may reflect a degree of selectivity in wood gathering, or that other tree types were sparse in the landscape.

THE NEOLITHIC BUILDING

A series of 10 litre bulk samples were taken within the Neolithic building, from the floor (49) hearths (55, 57) and the overlying post-occupation deposit (45) (illus 14).

Charred plant remains recovered from the Neolithic building were principally of cereal grain together with hazelnut shell fragments. Three species of grain were identified: naked barley (*Hordeum vulgare* var *nudum*), bread/club wheat (*Triticum aestivo-compactum*) and emmer wheat (*Triticum dicoccum*). Single finds of charred fruits of bramble (*Rubus fruticosus*), corn spurry (*Spergula arvensis*) and mustard (*Brassica* sp) were also recovered (Table 6).

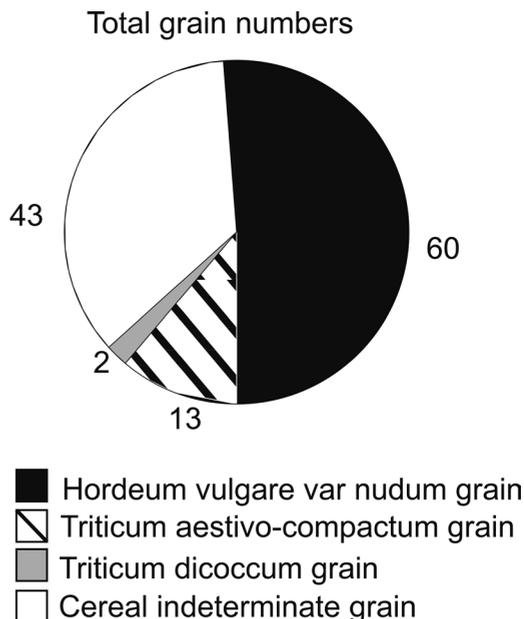
Discussion

The distribution of grain across the site (illus 14 and Table 6) shows that the grain was largely from hearths 55 and 57; this was particularly true for naked barley, with 70% of all the naked barley on the site coming from these two features, 63% of it from hearth 55. Bread/club wheat and emmer wheat were more scattered in their distribution, largely coming from floor/occupation layer 49, although some bread/club wheat was present in hearth 57. However, a large number of grains were of indeterminate nature and retain the possibility of being species other than naked barley. This destruction of grain within hearths is concurrent with the findings of Gustafsson (2000), who found through field

experiments that up to 45% of grain present in multiple firings of a hearth can be lost.

That much of the charred grain is focused around the hearths reinforces the view of these areas being the hub of food preparation activity within the building. The scatter of grain across the floor/occupation layer is likely to represent the general spread of material (eg from raking out hearths) over the period of use of the building. The presence of a small number of grains from the possible destruction layer 45 (Table 6) raises the possibility of this grain representing straw used in roofing materials; Gustafsson (2000), however, notes that it can be extremely difficult to separate grain from occupation layers with that found in destruction layers. The presence of charred hazelnut shell, a frequent find at prehistoric sites, in both the floor and the destruction layer is also suggestive of the two layers having become mixed over time.

The dates from the charred grain at Garthdee Road indicate a fairly narrow age range for the building, between an estimated start date of 3850–3700 *cal BC* (95% probability) and an estimated end of use of 3765–3610 *cal BC* (95%



ILLUS 15 Total grain numbers from Garthdee samples

probability) (Marshall & Cook above) A number of authors have recently argued (eg Darvill 2000; Brown 2007) that comparative studies of early agriculture should be based on radiocarbon dates of grain rather than charcoal fragments, which may have come from long-lived species such as oak (*Quercus* sp), and can skew results. On this basis, these dates indicate that the settlement at Garthdee was occupied just after the nearby timber hall at Crathes, but prior to the timber hall at Claish, Stirling (Barclay et al 2002). The dates from the grain at Garthdee place it amongst the earliest dated [agrarian] sites in Scotland (Marshall, above).

The types of grain recovered are also of interest; the charred cereal assemblage at Garthdee is dominated by naked barley (illus 15 and Table 6). In a recent review of charred cereal grains from Scottish Neolithic sites, Bishop et al (2009) have showed that during the Neolithic, naked barley was the most frequent cultivar, often accompanied by evidence of gathering of wild foodstuffs; such as can be seen in the Garthdee assemblage with the presence of hazelnut shell and bramble fruits. Wheats were found to be generally less frequent in those assemblages dominated by naked barley (eg Burl 1984; Bishop et al 2009). However, at Timber Hall sites, wheats have been found to be generally more dominant in the cereal assemblages, such as at Balbridie and Claish, where emmer wheat has been found to be more prominent (Fairweather & Ralston 1993; Barclay et al 2002) and at Warren Field, where club/bread wheat is dominant (Timpany 2006; Lancaster 2009). These differences in choices of the main cereals being cultivated are interesting and may reflect crops favoured by communities for taste, different uses, ease of cultivation or decisions based on gaining the highest yield eg barley growing better when rainfall is above average; wheat preferring a drier climate (Watson & More, 1956). It is unlikely that differences in cultivation were based on soil type with Garthdee having a similar soil (humus iron podzol) to that at Warren Field and Balbridie (Soil Survey of Scotland Staff, 1981). The increasing work in studying charred grain assemblages from across Scotland reflects this variety in crop production amongst sites in the Neolithic (eg Bishop et al

2009) but further work is needed in order to fully understand it.

FINDS

All the finds for each layer were plotted to 10mm accuracy in the horizontal plane. As some of the layers, such as the floor/occupation build-up 49, were relatively deep, they were excavated in spits of c50mm depth. The distribution of finds from all layers is shown in illus 7; the distribution of finds from the occupation contexts is shown in illus 8. More detailed analyses of the distribution of the lithics (illus 20) and of the pottery (illus 22, 23) are discussed below.

THE LITHIC ASSEMBLAGE

Torben Bjarke Ballin

During the archaeological investigation of the site, a sizeable lithic assemblage (409 pieces; Table 7) was recovered. Neolithic assemblages from eastern Scotland tend to be relatively small, usually numbering between a few tens to a few hundred pieces (Warren 2006). On that background, the collection from Garthdee Road must be classified as an important supplement, adding valuable material to a sparse field of research. Consequently, it was decided to characterize this important early Neolithic assemblage in some detail.

RAW MATERIALS – TYPES, SOURCES AND CONDITION

The lithic assemblage is predominantly flint (94%), supplemented by a small number of quartz and quartzite artefacts and two fragments of a stone axehead. Usually, East of Scotland assemblages include a substantial number of fine-grained orange to honey-brown flints (cf Warren 1999; Suddaby & Ballin 2011), but at Garthdee Road, most flints belong to a fine- to medium-grained light-brown variety, with few impurities and good flaking properties. The massive dominance of this type of flint gives the assemblage a distinct appearance and it is possible

TABLE 7

Lithics: general artefact list. Unless otherwise stated, all artefacts are flint

<i>Context</i>	4	5	23	24	25	29	32	33	35	36	37	39	45	48	49	50	55	57	66	<i>u/s</i>	<i>Total</i>	
<i>Debitage</i>																						
Chips			1		1										4							6
Flakes	2	5	12	1	21		1	1	8	3	6		36		80			5	1			182
Blades	1	2	9		15	1			7		3	1	15		42		1	5				102
Microblades		1							3						8			1		1		14
Indeterminate pieces					1					1			5		10							17
Crested pieces															1	1						2
Platform rejuvenation flakes			1										2		1							4
Quartz/quartzite debitage		1			1				3		1		10	1	8			1				26
<i>Total debitage</i>	3	9	23	1	39	1	1	1	21	4	10	1	68	1	154	1	1	12	1	1		353
<i>Cores</i>																						
Core rough-out			1																1			2
Single-platform cores					1				1				4		6							12
Cores w 2 platforms at an angle													1		1							2
Irregular cores															1							1
Bipolar cores					1																	1
Core fragments															1							1
<i>Total cores</i>			1		2				1				5		9			1				19
<i>Tools</i>																						
Microliths / backed bladelets									1						2							3
Short end-scrappers					1								1		1							3
Blade-scrappers		1																				1
Side-scrappers															3							3
Scraper-edge fragments													1									1
Plano-convex knives																				1		1
Piercers			1		1										1							3
Burins and ?burins													1		2							3
Pieces with oblique truncations															2							2
Pieces with retouched notch(es)														1	1							2
Pieces with edge-retouch					2					1			1	1	8							12
Flakes/frags of stone axeheads, ?hornfels			2																			2
Anvil, quartz													1									1
<i>Total tools</i>		1	3		4				1	1		4	2	20						1		37
TOTAL	3	10	27	1	45	1	1	1	22	5	11	1	77	3	183	1	1	13	1	2		409

TABLE 8

Lithics: burnt pieces ratio by context – only the seven find-richest contexts are included

<i>Context</i>	23	25	35	37	45	49	57	<i>Total, flint</i>
Sub-ensemble total	27	44	19	10	66	176	12	380
Burnt pieces	6	13	3	2	21	67	3	121
Per cent (burnt flint ratio)	26	30	16	20	32	38	25	32

TABLE 9

Lithics: reduction sequence

	<i>Flakes</i>		<i>Blades/microblades</i>		<i>Total</i>	
	<i>Number</i>	<i>Per cent</i>	<i>Number</i>	<i>Per cent</i>	<i>Number</i>	<i>Per cent</i>
Primary	14	7	1	1	15	4
Secondary	84	41	47	35	192	57
Tertiary	106	52	86	64	131	39
TOTAL	204	100	134	100	338	100

TABLE 10

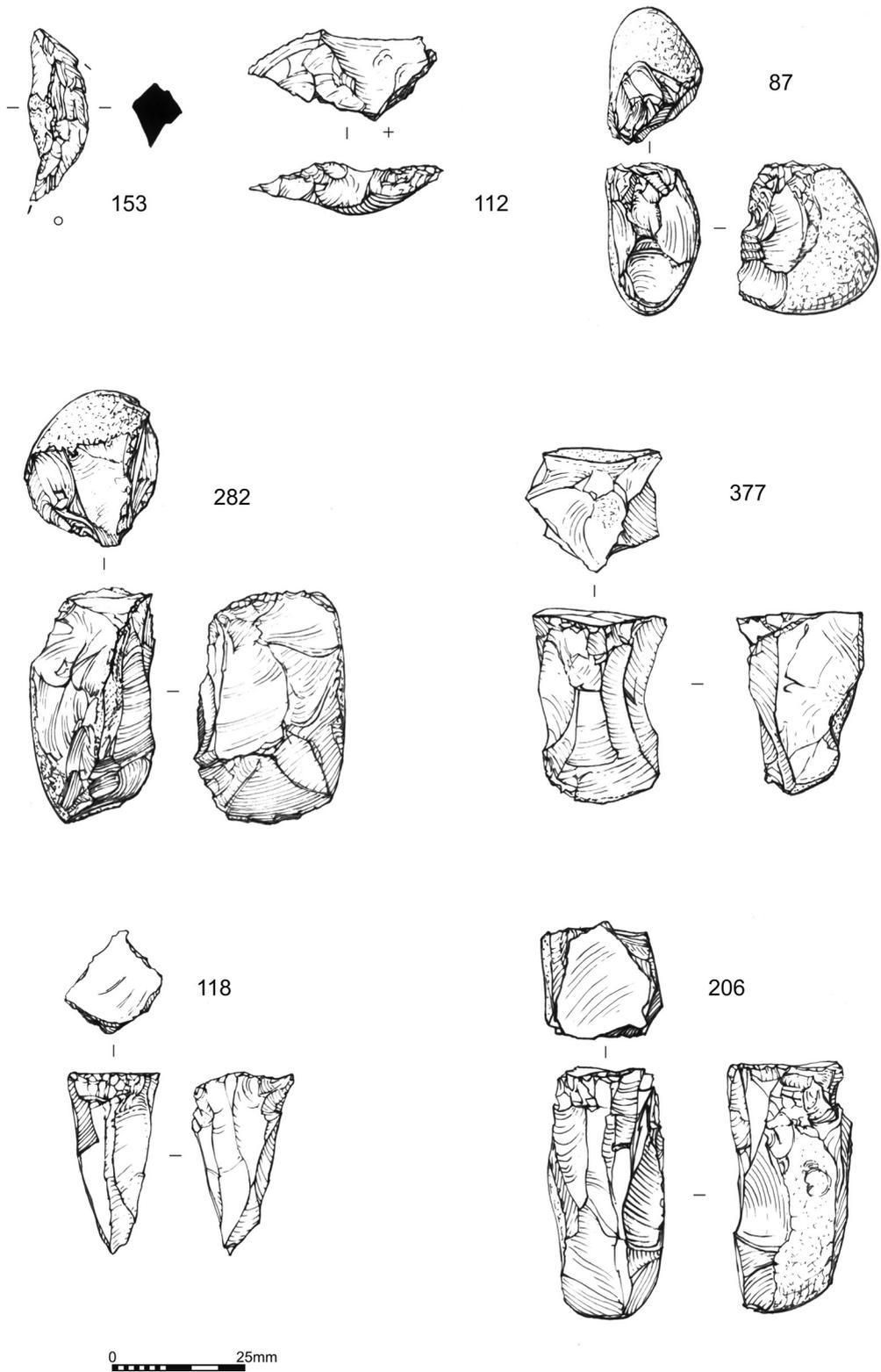
Lithics: applied percussion techniques: definable unmodified and modified flakes and blades

	<i>Flakes</i>		<i>Blades/microblades</i>		<i>Total</i>	
	<i>Number</i>	<i>Per cent</i>	<i>Number</i>	<i>Per cent</i>	<i>Number</i>	<i>Per cent</i>
Soft percussion	33	30	55	62	88	44
Hard percussion	53	48	21	23	74	37
Indeterminate platform technique	8	7	5	6	13	7
Platform collapse	7	7	6	7	13	7
Bipolar technique	9	8	2	2	11	5
TOTAL	110	100	89	100	199	100

that this particular variety of flint is washed ashore locally from restricted off-shore deposits (61% of the flints have abraded cortex; Table 9). The sizes of two core rough-outs (CAT 87, 282: illus 16; GD 30–45mm) are also within the range usually expected from beach pebbles, with pebbles from the Buchan Ridge Gravels generally being substantially larger (Saville 1995: 354).

Approximately one-third of all flint artefacts are burnt (Table 8), but the ‘burnt flint ratio’ differs considerably from context to context (16–38%). The highest concentration of burnt flint was encountered in connection with context 49, the main occupation layer.

The 27 pieces of worked quartz/quartzite include white homogeneous milky quartz, but



ILLUS 16 Lithic finds. Illustration by Jan Dunbar

most is either white saccharoidal quartz or quartzite. The quartz/quartzite may have been procured from a number of sources, such as river banks and beaches, but erratic blocks may also have been collected (Ballin 2012).

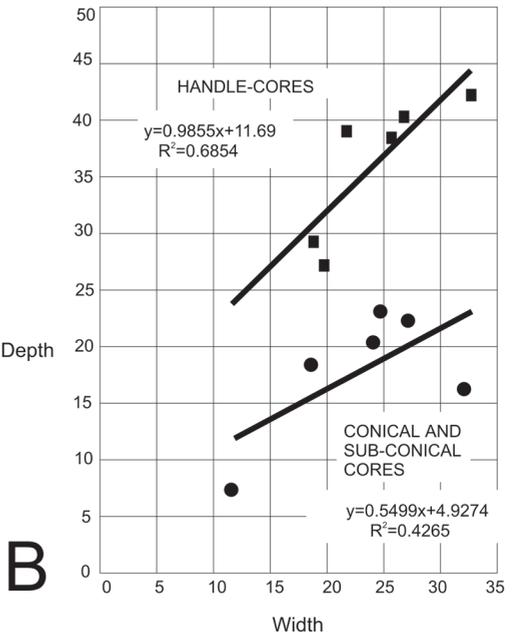
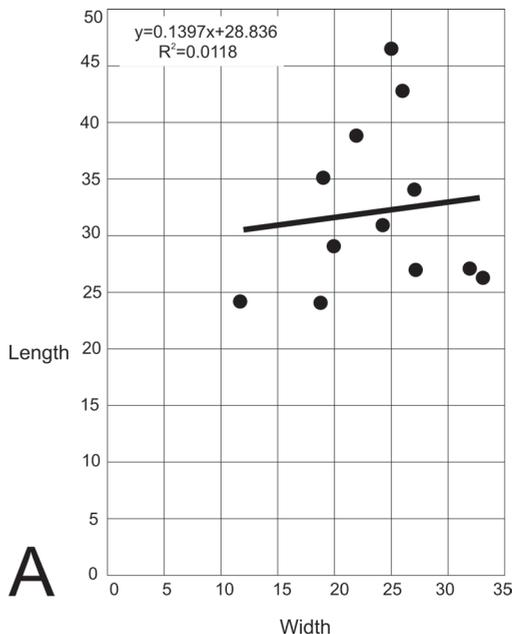
Two flakes (CAT 382: illus 19, 383) are in the same fine-grained, homogeneous, distinctly greenish material. One has a clearly polished dorsal surface, indicating that they were both detached from an abandoned Neolithic stone axe. They are most likely to be fine-grained sandstone (pers comm A Hall, Dept Archaeology, and J Harris, Dept Earth Sciences, Glasgow University).

DEBITAGE

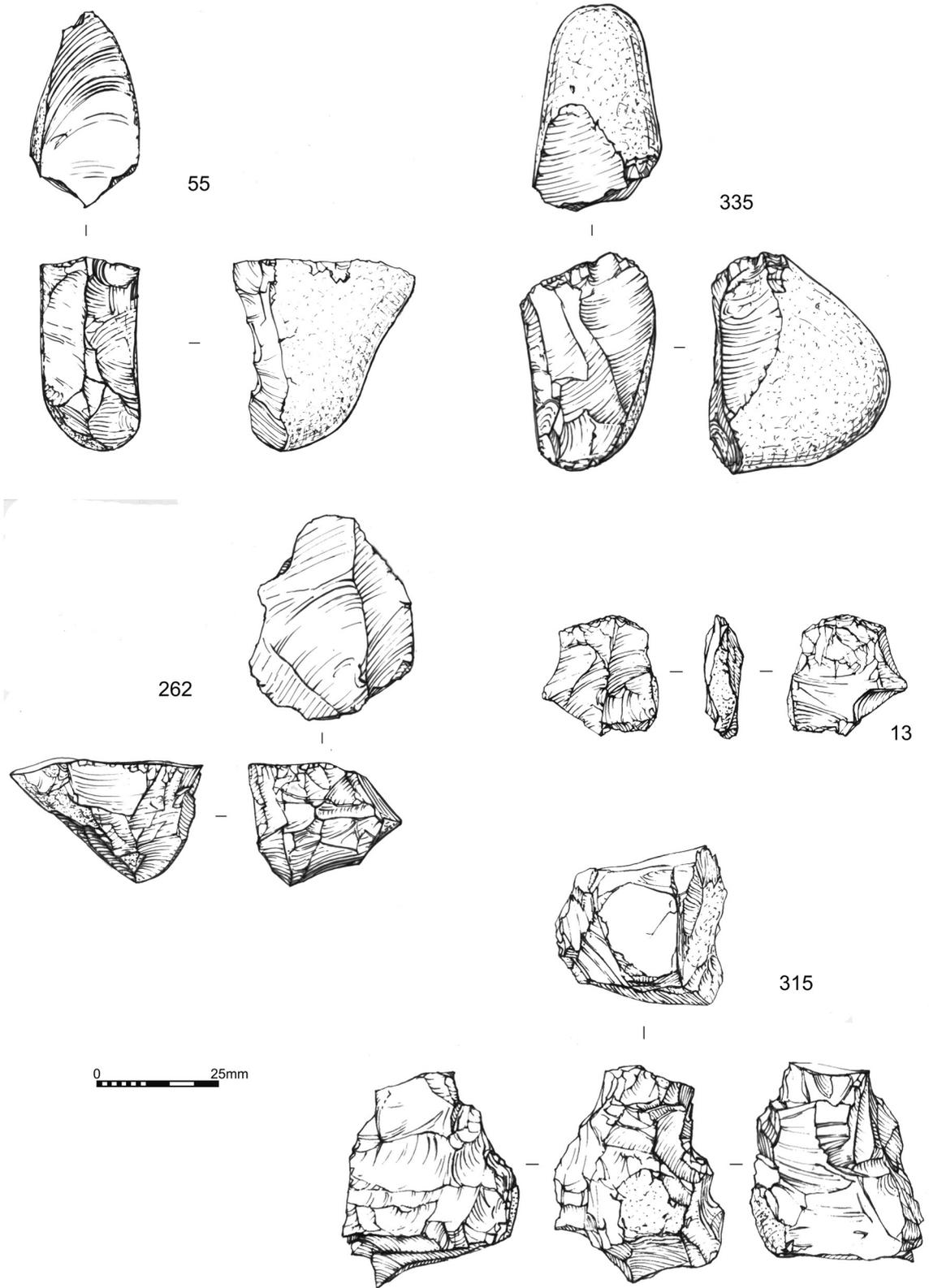
In total, 353 pieces of debitage were recovered from the site. Apart from 26 flakes and indeterminate pieces in quartz/quartzite, all debitage is flint. The flint debitage includes six chips, 182 flakes, 102 blades, 14 microblades, 17 indeterminate pieces, two crested pieces, and four platform rejuvenation flakes. Although the flint debitage is dominated by flakes (56%), blades and microblades make up a substantial minority group (35%). Table 9 shows that the blade group has a ratio of cortical:non-cortical pieces of approximately 1:2, whereas the flake group has a ratio of approximately 1:1. This indicates that the flakes are mostly waste from the decortication of nodules, whereas the blades are the intended products of the reduction process.

The notion of flakes and blades representing two technologically different debitage categories is further supported by Table 10, which demonstrates that almost two-thirds of all blades were detached by the application of soft percussion, whereas only one-third of the flakes were detached in this fashion.

Only six preparation flakes were found, that is, two crested pieces (CAT 153: illus 16, 381) and four platform rejuvenation flakes (CAT 92, 112: illus 16, 133, 290). Only one crested piece (CAT 153: illus 16) is intact (49×15×7mm). The four core tablets differ in size, with the greatest dimension ranging from 17mm to one of 36mm.



ILLUS 17 Single-platform cores. A: length/width of all single-platform cores (no difference between conical cores and handle-cores); B: width/depth of conical cores (black circle) and handle-cores (black square)



ILLUS 18 Lithic finds. Illustration by Jan Dunbar

CORES (ILLUS 16, 17 AND 18)

During the archaeological investigation of the site, 19 cores were retrieved: two core rough-outs, 12 single-platform cores, two cores with two platforms at an angle, one irregular core, one bipolar core, and one core fragment. The single-platform cores were sub-divided into two formal groups, namely five conical cores with approximately circular platforms and seven handle-cores, knapped at the narrow end of an elongated platform. With a platform core: bipolar core ratio of 95:5 (corresponding to a similar platform blank:bipolar blank ratio; Table 10), the aim of the site's flint-knappers was clearly to produce blanks by the application of platform technique.

Core rough-outs

Two core rough-outs were recovered, one large (CAT 282: illus 16; 45×28×24mm) and one small (CAT 87: illus 16; 30×27×18mm). In many lithic industries, core rough-outs were formed by the production of two diagonally positioned guide-ridges, in combination with a plain platform, but in the present case, the pattern was clearly to produce one guide-ridge and leave the cortex of the core's 'back-side' intact. CAT 87 is probably at a slightly earlier stage than CAT 282, still needing to have the platform area shaped by a transverse blow to the core-side, whereas CAT 282 has a complete unfaceted platform and a partially trimmed platform-edge.

Single-platform cores

The two groups of single-platform cores, conical cores and handle-cores, differ in appearance, but they are of roughly the same general size (illus 17), and they were worked and prepared in very much the same manner.

Conical cores

The five conical cores (CAT 118: illus 16, 206: illus 16, 249, 326, 377: illus 16) differ slightly in regularity, with the main difference being size (average dimensions: 34×21×18mm; GD=24–47mm). The depth of the platform of the smallest specimen of the group (CAT 249) is only 7mm.

CAT 326 has a faceted platform, whereas all other cores in this group have plain platforms; all platform-edges are trimmed or abraded.

Handle-cores

The seven handle-cores mainly differ from the above category by having had blades detached from the narrow end of an elongated platform. Two specimens (CAT 55, 335: both illus 18) are slightly larger than the other cores (average dimensions: 41×24×39mm, compared to average: 27×26×31mm), but all pieces in this category have thicknesses approximately equal to or larger than the distance from platform to apex (compared to the conical cores, where the thickness equals, on average, half the distance from platform to apex). The platforms of CAT 129 and 262 (illus 18) are faceted, whereas the remainder in this category have plain platforms and, in three cases, the platform-edge is untrimmed, against four trimmed specimens.

Cores with two platforms at an angle

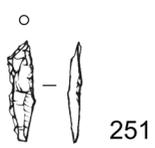
The two cores included in this category (CAT 142, 315: illus 18) are both based on slightly larger nodules than the majority of the single-platform cores (average dimensions: 48×37×27mm). Most likely, it was first attempted to reduce them in traditional single-platform style, but in both cases they disintegrated, partially as a result of internal impurities, forcing the knappers to re-orientate their cores and produce secondary platforms.

Irregular cores

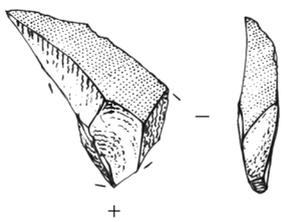
This category only includes one piece (CAT 321), which was reduced from multiple directions. It is relatively small (19×15×10mm) and appears to have been worked in a completely unsystematic fashion.

Bipolar cores

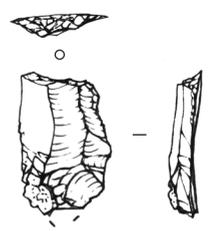
Only one bipolar core was recovered from the site (CAT 13: illus 18). It is comparatively small (27×25×8mm) and cortex only survives along one lateral side. Flakes were detached from both faces, and it has a typical knapping-seam at either terminal.



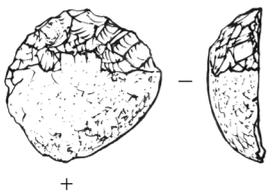
251



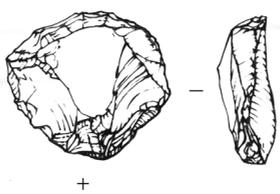
382



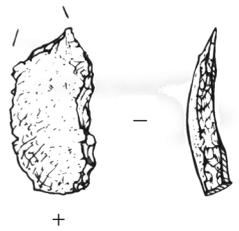
235



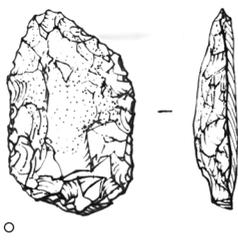
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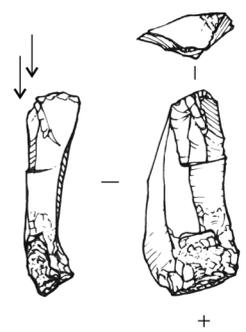
94



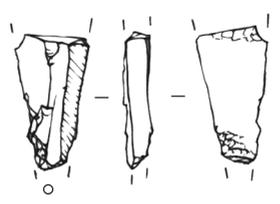
337



302



298



232



300



ILLUS 19 Lithic finds. Illustration by Jan Dunbar

Core fragments

One piece (CAT 316) has been classified as a core fragment (26×14×14mm). It is the plain, trimmed platform of a core, but it is not possible to determine exactly which type of core it derives from.

TOOLS (ILLUS 19)

A total of 37 formal tools were recovered from the site, supplemented by a small number of unmodified pieces with use-wear (discussed in separate section below). With 12 pieces, flakes and blades with edge-retouch dominate the tool category (32%). Eight scrapers dominate the formal tools (23%), supplemented by three microliths or backed bladelets, one plano-convex knife, three piercers, three ?burins, two truncated pieces, two notched pieces, two stone axehead fragments and one anvil. The anvil is quartz, and the two axehead fragments are fine-grained sandstone, whereas all other tools are flint. The 37 tools correspond to a tool ratio of 9%, which is slightly higher than expected. The tool ratio of sieved assemblages rarely exceeds 4%, unless the site is a specialised camp where little or no knapping took place (Ballin 1999). In the present case, the high tool ratio may be explained by the lack of consistent sieving and the resulting lower number of chips.

Microliths and backed bladelets

As a foundation of microlith typology, it is proposed to follow Clark's definition of a microlith as a bladelet which has had its proximal end removed, mostly by microburin technique (Clark 1933: 55). This definition allows the microlith to maintain its diagnostic value as a pre-Neolithic artefact; the definition also separates microliths 'proper' from the less diagnostic backed bladelets with intact bulbar ends.

In the present report, microliths *sensu stricto* and backed bladelets are treated as a group, as these types are thought to have had the same general function. At Garthdee Road, one true microlith and two fragments of microliths or backed bladelets were retrieved. CAT 251 (illus 19) is an elongated scalene triangle (16×4×2mm)

which has had both short sides blunted by retouch. The shortest of its three sides is only partially retouched, revealing a proximal microburin facet. CAT 172 is in the same size category as CAT 251 (14×5×2mm), but the proximal end has broken off. One of its lateral sides is fully blunted. The somewhat broader CAT 369 (13×6×1mm) has also lost its proximal end. This specimen has one slightly uneven, fully retouched lateral side. The fact that the latter two implements are distal fragments of microblades makes it impossible to determine whether they are true microliths or backed bladelets.

Scrapers

The assemblage includes eight scrapers, with short end-scrapers and side-scrapers being the most common types (three pieces each). These sub-categories are supplemented by one blade-scraper and one scraper-edge fragment. The flake-based short end-scrapers embrace two different forms, namely one relatively large elongated piece (CAT 203; 36×26×14mm) and two small thumbnail-scrapers (CAT 41, 185; average: 25×25×8mm: both illus 19). CAT 203 was heavily damaged by exposure to fire. The two squat specimens both have a steep convex scraper-edge at the distal end. These working-edges are highly regular and well-executed, and they were formed by the application of pressure technique.

One solitary blade-scraper (CAT 40) is based on a regular macroblade (29×16×6mm). The outermost part of the distal working-edge is missing, but the curving corners of the modified area clearly define it as a scraper. The three side-scrapers (CAT 299: illus 19, 302: illus 19, 379) are all based on blades, and they are all missing one end (average dimensions: 26×14×6mm). The scraper-edge fragment (CAT 139) is burnt, and it probably broke off a relatively large scraper (14×25×10mm) due to exposure to fire. The working-edge is nosed and steep.

Plano-convex knives

The basic attribute of this tool category is its plano-convex cross-section and its invasively retouched edges and dorsal face (Clark 1932: 158). One piece from the present site (CAT 1:

illus 19) has been classified as a plano-convex knife, as approximately two-thirds of its dorsal face is covered by invasive retouch. The two lateral sides of CAT 1 merge to form a distal point. The implement is based on an elongated bipolar flake.

Piercers

The three piercers (CAT 23, 94; illus 19, 232; illus 19) form a heterogeneous tool group. They are all fragments of larger implements, and the surviving parts are approximately of the same size (average dimensions: 26×16×6mm). CAT 94 and 232 both had a traditional piercer tip, but both tips have broken off. CAT 23 is a highly expedient piece, which had a piercer tip formed on the corner of a distal break. It is based on the proximal fragment of a flake.

?Burins

This category includes three specimens, two of which are based on regular blades (CAT 298, 300; both illus 19), with one being based on a robust flake (CAT 100). None of the three pieces corresponds to traditional edge-burins or dihedral burins. The two blade-based implements (average dimensions: 33×13×7mm) have had a burin spall detached by a blow to the lateral side of the blank. The use as a burin is made likely by macroscopic wear at the corners of the burin-edge and along the lateral sides of the pieces. CAT 100 (40×32×11mm) appears to be a more traditional burin, as it has had a possible burin-edge formed by the detachment of two small flakes along a lateral edge by a series of burin-blows to a proximal break. Faint use-wear at this possible burin-edge supports the interpretation of the implement as an expedient burin.

Truncated pieces

CAT 235 and 337 (both illus 19) form a small homogeneous artefact category of blade fragments with straight oblique truncations. CAT 235 is on a proximal fragment and CAT 337 is on a distal fragment. They are of approximately the same general size (average dimensions: 23×13×2mm), and in both cases, the cutting-edge has flat use-wear, indicating use as a knife.

Notched pieces

This category includes two pieces, CAT 150 and 152. CAT 150 is on an elongated flake (33×17×6mm) and it has a shallow notch in the right lateral side, distal end. CAT 152 is the burnt proximal fragment of a slender blade, and it has a similar notch in the right lateral side, proximal end. The function of the notches may be to facilitate hafting.

Pieces with edge-retouch

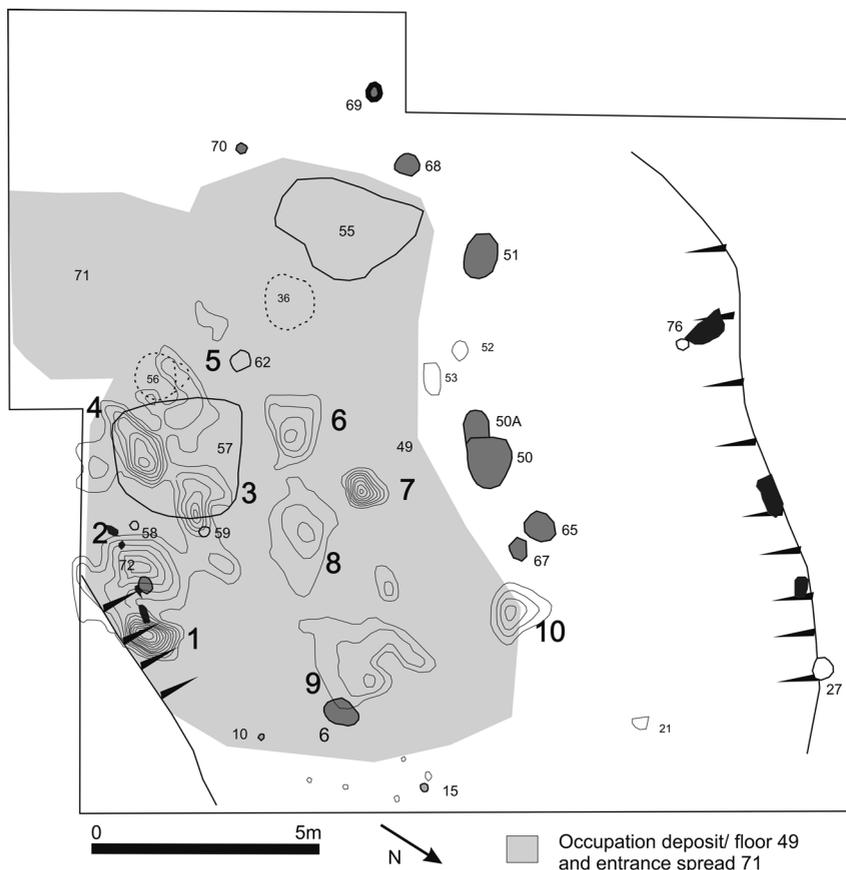
This tool group comprises 12 pieces. They differ considerably in size (GD of intact pieces 16–42mm; average of all pieces: 22×16×5mm) and shape, with three pieces being on blades, and nine on flakes. This tool group probably includes artefacts and fragments of artefacts with different functions.

Unmodified pieces with use-wear

In total, 14 flints were defined as having macroscopic use-wear. Two of these are pieces with oblique truncations (CAT 235, 337), two are pieces with edge-retouch (CAT 14, 177), and one is a burin (CAT 298). The former four pieces have flat use-wear of the kind usually associated with cutting (Juel Jensen 1985; 1988), whereas the burin has more robust use-wear of one corner, supporting the use of this piece as having been used for graving.

In addition, nine unmodified blanks were defined as having use-wear, indicating that they are informal tools. One of these is a flake (CAT 82), whereas the remainder are broad blades (CAT 67, 101, 138, 157, 159, 162, 216, 309, 374). All nine pieces display the same form of use-wear, namely flat lateral retouch, indicating that they are probably informal knives.

As part of the examination of the Garthdee Road lithic assemblage, no focused search for pieces with use-wear was conducted, and the 14 pieces listed above are simply pieces with macroscopic use-wear, which was easily notable in a magnifying glass with 8× magnification. Any detailed discussion of pieces with use-wear would have to involve the application of a microscope, preferably of the high-powered type (Juel Jensen 1988), as one of the most important forms of use-



ILLUS 20 Simplified plan of site showing general distribution of flint artefacts (min. contour: 3; contour intervals: 3). The main concentrations are numbered (1–10). The smaller numbers refer to contexts

cores and tools, however, fit within the assumed boundaries of the house in a logical fashion, with context 57 probably representing the early Neolithic building's (latest) central hearth.

The burnt flints add important chronological information, as well as information on the general spatial structure of the house. As demonstrated in connection with the discussion of the spatial structures of the Early Bronze Age house at Dalmore on Lewis (Ballin 2008), it is quite common for the central hearth of a prehistoric house to be adjusted or re-located over the life-span of a building. The most substantial concentration of burnt pieces was recovered from the area around the latest central hearth

57 (concentrations 3–5). The relatively wide distribution of this scatter of burnt pieces may be due to the kicking around of burnt pieces from hearth 57 (traffic).

The location of possible knapping floors inside the house is indicated by the general flint distribution. Based on the scatters of waste (illus 20), the analyst finds it highly likely that knapping took place in connection with all, or most, of concentrations 1–10, but not necessarily at the same time.

Various activities are indicated by modified tools and blades with use-wear. The distribution of the formal tools coincide approximately with the distribution of production waste and burnt

flints, suggesting that primary production, as well as the production and use of tools, was carried out beside the various hearths. Most of the informal tools were found towards the northern wall of the house and the distribution of these may indicate the location of a specialised activity area in the northern half of the house. However, it is necessary to undertake an actual use-wear analysis of these implements to acquire a more detailed understanding of these activities.

The location of two axehead fragments in concentration 9 (illus 20) indicates that a Neolithic polished stone axehead was 'cannibalised' in this area, and the find of seven flint artefacts, five of which are formal tools, under a stone in concentration 1 (illus 20), defines this concentration as a cache. Two of the tools included in this deliberate deposition are side-scrapers and two are ?burins, possibly forming a tool-kit for the planing, graving, or scraping of hard materials. It is thought that the almost empty areas towards the north of the house may represent sleeping areas (cf the interpretation of the three houses at the Scord of Brouster, Shetland; Ballin 2005).

CHRONOLOGY

The lithic assemblage from Garthdee Road is dated by a number of elements, namely diagnostic types, technological attributes, distribution patterns, and association with radiocarbon dates (Marshall & Cook above) and diagnostic pottery (Sheridan below).

Diagnostic types

In general, the assemblage includes few core or tool types of relevance to the dating of the site's main occupation. The diagnostic types include three microlithic pieces, three ?burins, two fragments of a polished stone axehead, one plano-convex knife and two regular thumbnail scrapers. One scalene microlith (CAT 251) and two fragments of microliths or backed bladelets (CAT 172, 368) are late Mesolithic (Saville 2004), and their mostly peripheral distribution indicates that they may be residual pieces, associated with the earlier use of the site. Burins are generally thought to be characteristic of the Mesolithic

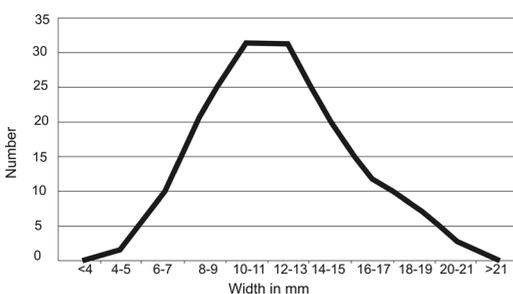
period but do occur in early Neolithic contexts (Butler 2005: 51); the three pieces from Garthdee Road (CAT 100, 298, 300) belong to a relatively uncommon sub-type, and the presence of macroscopic use-wear was an important element in their identification. The fact that they are based on blanks of the same type and execution as the bulk of blanks from the site supports the notion of these pieces as being contemporary with the occupation of the house.

Two fragments of a stone axehead (CAT 382, 383), one of which has dorsal polish, are definitely Neolithic (Smith 1979), but the fragments are small, and it is not possible to determine which axehead type these pieces were detached from. The plano-convex knife (CAT 1: unstratified from the original evaluation trench) is of a type frequently found in Early Bronze Age contexts (Finlayson 1997), and the fact that it is based on a bipolar flake, whereas the bulk of the assemblage appears to have been produced by an industry focusing on platform technology, defines it as an intrusive element. Two thumbnail scrapers (CAT 41, 185: from contexts post-dating the occupation of the building), with edges manufactured by neat pressure-flaking, may also date to the Early Bronze Age. The blank for CAT 41 was also detached by the application of bipolar technique.

Technological attributes

Most of the assemblage seems to form a homogeneous whole, with a small number of bipolar pieces looking 'out of place'. The main bulk of the assemblage was produced by a specialised blade-industry exclusively focusing on the application of platform technique. As demonstrated in Ballin and Lass Jensen (1995), the widths of most chronologically unmixed blade assemblages form an approximately bell-shaped curve. When this is not the case (the curve has more than one peak), the cause is usually that the assemblage is the product of multiple occupations at the site, in most cases creating a trough in the central part of the curve or, occasionally, off-centre. Illus 21 was produced to test whether the flint assemblage from Garthdee Road is likely to have been the product of one or multiple occupations at the site. Illus 21 only includes the site's blades and microblades, that is, the 'target

blanks' of the blade industry responsible for most of the lithic finds. This diagram is a strong indicator that the bulk of the assemblage is the product of one industry. If the late Mesolithic industry responsible for the three microlithic pieces had had a more robust presence at the site, a small secondary peak would have been expected at roughly width 6–8mm. The small Early Bronze Age presence does not have any effect on the curve, as this industry is entirely flake-based, and illus 21 is based exclusively on blade material.



ILLUS 21 The widths of all blades and microblades

The blades are the products of a very tight operational schema, including distinct elements, such as the consistent trimming/abrasion of platform-edges, and the absence of platform preparation (almost all platforms are plain). The cores represent different stages of a logical sequence, including well-defined core rough-outs and core types. The conical cores and the handle-cores probably reflect different approaches (by the same people) to nodules of different shapes. At Garthdee Road, bipolar technique does not form part of the operational schema, although this approach may have formed a more significant part of the early Neolithic industries of eastern Scotland's less flint-rich interior (cf Warren Field: Warren 2009).

As soft percussion blade industries are generally replaced by hard percussion (Levallois-like) blade industries at the early/middle Neolithic transition (Ballin 2011; Suddaby & Ballin 2011), the present assemblage must pre-date this watershed. As illus 21 indicates that the debitage

from Garthdee Road was not produced by a microblade industry, the early Neolithic period is the only likely date for the assemblage.

Distribution pattern

In terms of dating the assemblage, the most important point is probably the way the vast majority of the finds fit within the assumed walls of the dwelling, with the various concentrations generally being located in the immediate vicinity of a central domestic hearth. This suggests that the bulk of the lithic finds (ie the blade industry) are contemporary with the house, radiocarbon dated to the early Neolithic (Marshall & Cook above). As mentioned above, a number of assumed pre- and post-Neolithic objects have deviating distribution patterns, with most of these non-Neolithic pieces having been recovered from peripheral locations (eg microliths and bipolar material).

A number of distributional elements suggest a complex relationship between the various concentrations. The distribution of burnt flints, for example, indicates that several of the small concentrations may have had hearths at some stage, and it is likely that the central hearth of the early Neolithic house was replaced on several occasions, in connection with re-arrangements of the house interior.

Early Neolithic domestic and ritual sites: the lithic evidence

The excavation of Garthdee and Warren Field, both near the River Dee in Aberdeenshire, provide highly interesting, roughly contemporary, lithic assemblages (this report and Warren 2009). These assemblages differ on a number of points, such as numerical size and composition, and they suggest a notable difference in terms of on-site behaviour. Generally, it is thought that Garthdee Road may be a traditional Early Neolithic domestic site, whereas it is suggested that Warren Field may represent a 'different' type of site (Sheridan & Brophy 2012: 43).

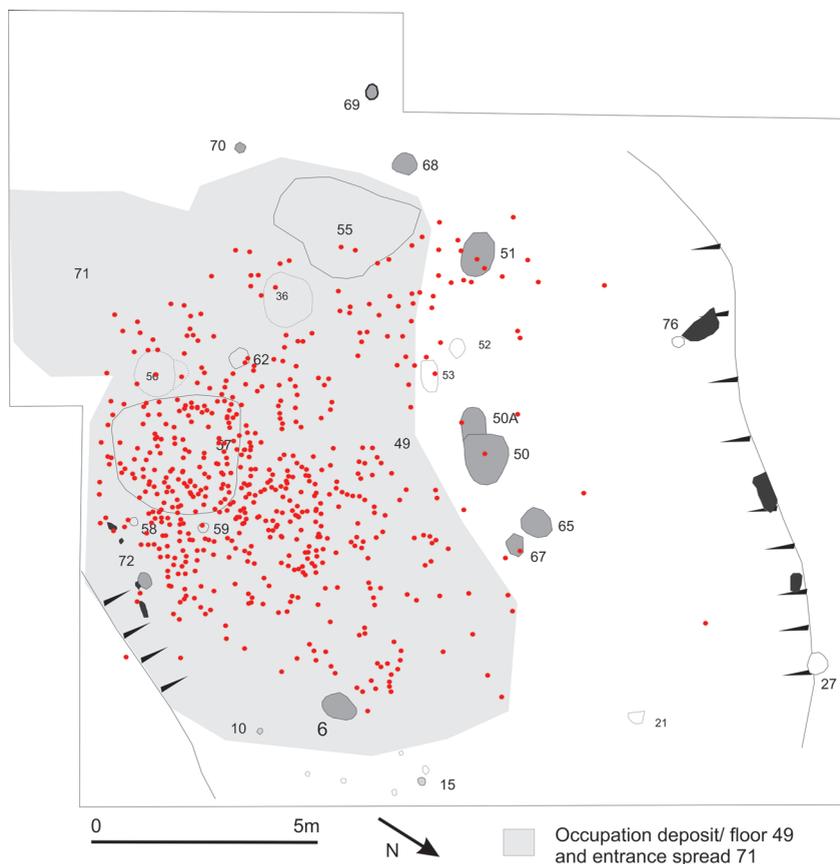
The two assemblages differ notably on the following points:

1. Numerical size – Garthdee Road includes 409 lithics (of which possibly a dozen

- pieces are Late Mesolithic or Early Bronze Age), whereas at Warren Field only 52 lithics were assigned to the hall's pre-destruction levels (Warren 2009: 105);
2. general composition – Garthdee Road includes considerably higher numbers of finds associated with lithic primary production, such as cores (19 pieces), whereas at Warren Field no cores were recovered from pre-destruction levels (ibid. Table 11); and
 3. the ceramic:lithics ratio is different for the two sites, with that of Garthdee Road (100:58) being somewhat smaller than that of Warren Field (100:39; according to Sheridan [2009: 81] all sherds were found inside or near the timber hall).

Although artefacts in Arran pitchstone are generally associated with some non-functional values, they are generally found on Early Neolithic domestic as well as other (eg ritual) sites (Ballin 2009a) and although at Garthdee Road none was found, they occur at Warren Field in pre- as well as post-destruction levels.

However, there are also other differences between the two Aberdeenshire sites, such as depositional practices: The Garthdee Road structure is similar to the structures known from Scottish Mesolithic house sites (eg Howick and East Barns; Waddington 2007; Waddington & Pedersen 2007; Gooder 2007), with few or no unusual depositions, whereas the timber hall from Warren Field corresponds to other Scottish Early Neolithic 'halls', being characterized



ILLUS 22 Overall spatial distribution of ceramic finds at Garthdee Road

by significant in-house depositions of flint, pitchstone and pottery (Sheridan 2009: Fig 36). At Warren Field, artefactual material had been deposited within the house in pits as well as (not least) wall and roof-bearing post-holes, a situation corresponding closely to the situation at another Scottish timber hall, Doon Hill in East Lothian (Ballin 2009b), where seven pieces of pitchstone and one piece of flint were recovered from wall and roof-bearing post-holes. At Warren Field, as well as at Doon Hill, the lithic finds from the pits and post-holes include one leaf-shaped arrowhead as well as worked pitchstone, and most of the lithics are burnt.

Although Sheridan and Brophy (2012) may be right in their interpretation of the relationship between the different Early Neolithic house types, it is the view of this analyst that our present body of evidence does not allow any firm conclusions to be made regarding the relationship between the two house types – given the differences between them in terms of depositional practices – it is just as likely that the main difference between these house types/sites is that one may mainly represent domestic and the other ritual activities.

THE CERAMIC FINDS

Alison Sheridan

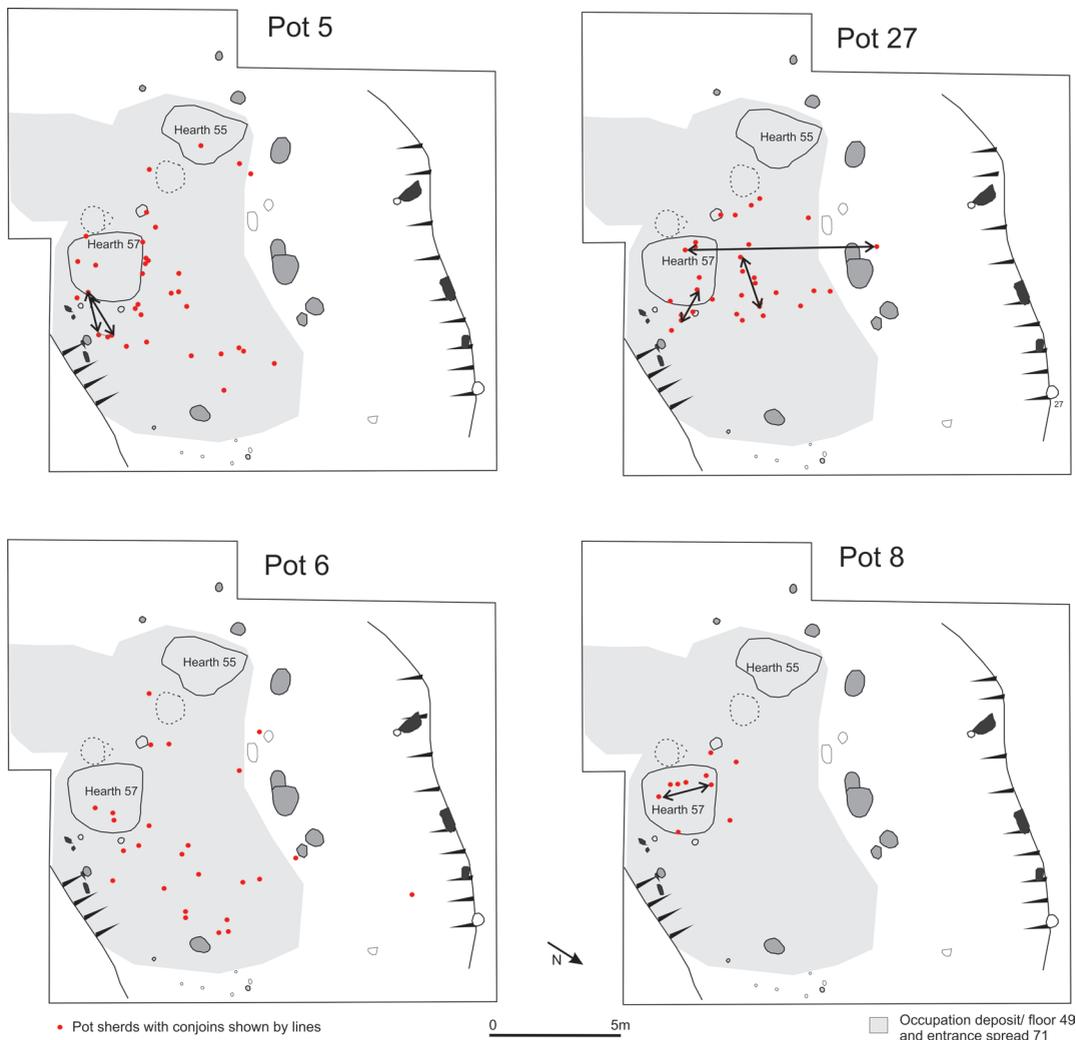
The ceramic assemblage comprises 709 sherds and 19 fragments (ie pieces smaller than 10mm in their largest dimension), together with two small lumps of potter's clay; the overall weight of the pottery is c4.8kg, and of the potter's clay, 23g. The minimum number of identifiable pots is 34, and while around 290 sherds remain unattributed, this does not mean that the overall pot total had significantly exceeded this figure. This is because the similarities in form, fabric and finish between different pots within the assemblage make the attribution of some sherds to a specific pot, from a potential pool of several, impossible. A detailed listing of the sherds, and descriptions of the individual pots, is available in archive form, while Table 12 summarises the key features of the pots. As will be discussed below, the pottery all belongs to the Carinated Bowl tradition, in its earliest form.

SPATIAL AND CONTEXTUAL DISTRIBUTION; CONDITION

Virtually all of the pottery, and both of the potter's clay lumps, came from within the area encompassed by the structure (illus 22). Most of the pottery (c 74% by sherd total and 73% by weight) was found in the floor layer, with its abundant trodden-in artefacts (context 49), and the layer or horizon immediately above it, which is believed to represent the weathered upper part of the floor mixed with material fallen from the wall and roof during the process of demolition and decay (contexts 23, 31–3 and 45). The two lumps of potter's clay, SF200 and 938, were found in context 49. While numerous sherds were found in and near hearth 57, ceramic finds (as with other types of artefact) are sparse in and around hearth 55 at the south-west corner of the structure.

No complete pot was found, although in three cases (Pots 5, 6 and 7) the constituent sherds amount to 50% or more of the vessel, and with Pot 1, a set of six conjoining sherds make up over a third of the pot. These, together with a seventh sherd, were found in the fill of wall post-hole 67 (SF1005); other sherds from the same pot found elsewhere in the structure bring the proportion of the pot present to 40–50%. In most cases, however, less than 10% of any single pot is represented, and even when one factors in the aforementioned unallocated sherds, it is clear that large parts of most of the pots are missing. As regards sherd size, the largest single sherd (SF1070, unstratified, from Pot 14) measures 83×67mm, and there are a further 47 sherds and conjoining sherd-sets that exceed 50mm in their maximum dimension, with Pots 5, 25 and 27 being distinguished by a relatively high incidence of such sherds and sherd-sets. Of the rest of the assemblage, most sherds fall within the 20×20mm to 40×40mm size range.

Examples of the spatial spread of sherds from individual vessels are presented in illus 23 where, for instance, sherds from Pot 5 can be seen to be scattered across much of the floor surface, extending some 9m along the building's long (NE/SW) axis and around 7m along its narrower axis. The pattern of sherd conjoins shows a similar degree of scatter, including a



ILLUS 23 Plots of the spatial distribution of sherds from Pot 5, Pot 27, Pot 6 (excluding body sherds that could equally belong to Pot 6 or Pot 7) and Pot 8. Lines indicate conjoining sherds

linkage extending over 7.5m for rim and neck sherds from Pot 27. A few sherds from Pot 6, like those from the very similar Pot 7, extend still further, to go beyond the presumed limits of the house. Conversely, the heavily burnt sherds of Pot 8 cluster in and around hearth 57, where the pot may well have broken. Conjoins across contexts confirm the close links between contexts 45 and 49 (as illustrated in Pot 5, for example), while the distribution of sherds from Pots 6 and 7, spanning 11 contexts (namely 5, 23, 25, 31, 35,

37, 40, 45, 49, 54 and 57), attests to the migration of sherds from their initial places of deposition during the putative demolition and the decay of the structure, and during later cultivation and trampling of the area. Despite such post-depositional disturbance, the general condition of the Garthdee Road sherds indicates that most had not become heavily abraded after the pots were broken: fracture surfaces are generally fairly fresh or only lightly abraded. The sherds that show any marked degree of abrasion tend to

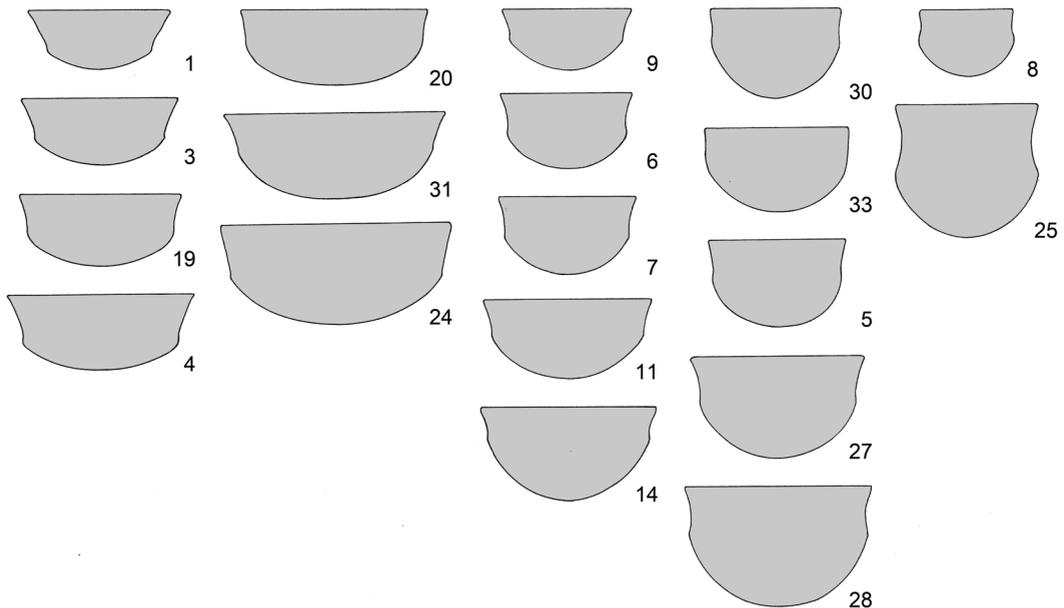
be those that had been burnt, the burning having softened the fabric.

One notable characteristic in the assemblage is a tendency to lamination (spalling), often along coil/strap joint planes. This was noted among sherds from eight pots (Pots 5, 8, 16, 24–6, 33 and 34) and in one sherd from Pot 28, along with 120 unallocated sherds (with an additional 10 ‘possibles’). The cause of this lamination is unclear, although slight dryness of the clay during manufacture may well have been a factor. It does not appear to be a by-product of burning, since there is not a close correlation between spalled and burnt or scorched sherds.

SHAPE AND SIZE, CONSTRUCTION, SURFACE TREATMENT, COLOUR AND FABRIC

The assemblage appears to consist exclusively of gently carinated and S-profiled bowls (illus 24–27, 30); there are no examples of the hemispherical bowls or cups, or of necked jars, that are often found alongside such bowls in other ‘traditional Carinated Bowl’ assemblages

(Sheridan 2007). With but three exceptions (Pots 8, 25 and 33) the bowls are all ‘open’ (ie with rim diameters exceeding that of the carination or inflection), with fairly long, slightly curving necks that range, in their angle of tilt, from the widely splaying form as seen in Pots 1, 3 and 4 and probably also Pot 2 (illus 24 and illus 25, top) to the near-vertical form as seen, for example, in Pot 5 (illus 27). The three exceptions are ‘neutral’ bowls, with upright necks whose diameter matches, or is minimally smaller than, that of the carination or S-inflection (illus 26). Rims are simple and rounded, gently flattened or gently pointed. The junction between the neck and belly is marked by a simple S-shaped inflection or a gentle carination, and belly depth ranges from the very shallow (as in Pots 1, 3 and 4: illus 24 and 25, top) to deep (as in Pots 5 and 25: illus 24, 26 and 27). The same basic shapes occur in a range of sizes (illus 24). The smallest pot, Pot 8 (illus 26, top), has an estimated rim diameter of *c*150mm, while the largest, Pot 24 (illus 25, bottom), has an estimated rim diameter of *c*370mm. The estimated heights of the



ILLUS 24 Synopsis of the size and shape of vessels from Garthdee Road whose profiles could be reconstructed. Illustration: Marion O'Neil

TABLE 12
Summary description of the key characteristics of the 34 identifiable Carinated Bowl pots from Garthdee Road

Pot No	Shape	Est rim diam (mm)	Widest part of pot	Est height (mm)	Wall th. range (mm)	Visible organic residues?	Lipid anal? (see note)	Surface finish	Colour: evidence for scorching or burnings; cereal/grass impressions	Fabric
1	Open shallow carinated bowl, flaring neck; rounded but marked carination	c 230	Rim	c 94	5.0-9.2	Patches, thin, E		Very smooth, slip-like on E; smooth on I; fingertip fluting on E	E blackish & dark brown; C & I reddish-brown	Sl gritty
2	Open, prob shallow carinated bowl, flaring neck	c 240	Rim	?	6.2-9.4	None		E very smooth, slip-like; I smoothed but rougher & not slip-like; incls protruding. Fingertip fluting on E	E light brown; C & I med brown, sl reddish Poss scorched	Sl gritty
3	Open, prob shallow carinated bowl, flaring neck	c 250	Rim	?	5.8-8.1	On E		Very smooth, slip-like E & I; E burnished to low sheen on E & I	E rich blackish-brown; C med brown; I black	Very sl gritty
4	Open, prob shallow carinated bowl, flaring neck	c 300	Rim	?	6.1-8.1	Tiny patches on E		Very smooth, slip-like E & I. Horizontal smoothing striations on I	E black; C dark brown; I blackish-brown	Very sl gritty
5	Open, fairly deep-bellied carinated bowl; very gentle carination	c 220	Rim	140	4.9-9.3	E & I, v thin on I		Very smooth, slip-like E & I	E & C black & dark brown; I black	Non-gritty
6	Open, carinated bowl, medium-depth belly; very gentle carination	c 210	Rim	c 118	3.8-8.3	E & traces on I	Y (GR-1, SF168, from Pot 6 or 7)	Very smooth, slip-like E & I	E & C dark brown; I dark brown & blackish. One pair conjoining Rims sherds burnt, otherwise not	Non-gritty to very sl gritty
7	Open, carinated bowl, medium-depth belly; very gentle carination	c 220	Rim	c 125	4.7-8.8	E & I; quite thick on I in one area		Very smooth, slip-like E & I	E black-brown; C black; I dark brown to blackish	Non-gritty
8	Minimally open, S-profile bowl with near-vertical neck and medium-depth belly	c 150	S-inflection (est diam 154mm)	c 107	4.3-7.3	Patch, v thin, on I		Smooth E & I; prob wet-smoothed but not slip-like finish	E mottled reddish, red, buff, brown, dark grey; C dark to light grey; I buff, light brown, dark grey, black. Burnt; some sherds heavily burnt	Non-gritty

Pot No	Shape	Ext rim diam (mm)	Widest part of pot	Est height (mm)	Wall th. range (mm)	Visible organic residues?	Lipid anal? (see note)	Surface finish	Colour; evidence for scorching or burnings; cereal grass impressions	Fabric
9	Open, carinated bowl, medium-depth belly; very gentle carination	c 206	Rim	c 97	5.8-9.2	I and E, v thin traces	Y (GR-9, SF780, poss Pot 9)	Very smooth, slip-like E & I. Horizontal wipe striations on I	E med brown & blackish, some sherds orange; C med brown to black; I med to dark brown to black. Lower belly sherds scorched	Non-gritty
10	Open, carinated or S-profiled bowl. Repair hole below rim	190	Rim	?	5.5-8.9	E, v thin		Very smooth, slip-like E & I	E black & black-brown; C black-brown; I black	Non-gritty
11	Open, carinated bowl, medium-depth belly; very gentle carination	c 270	Rim	c 125	5.0-7.7	Tiny specks, thin, on E		Very smooth, slip-like E & I	E med brown, sl greyish; C med brown & blackish; I blackish. One sherd (SF941), probably from either Pot 11 or Pot 12, has impression of (probable) emmer grain and grass impression	Non-gritty
12	Open, carinated or S-profiled bowl	c 212	Rim	?	5.8-8.2	Thin patches on E		Very smooth, slip-like E; smooth I	E blackish-brown (one sherd mid-brown); C dark brown (one sherd mid-brown); I dark grey-brown	Non-gritty
13	Open, carinated or S-profiled bowl	c 250	Rim	?	7.0-9.5	Tiny traces E & I		Very smooth, slip-like E & I. Horizontal smoothing striations on I	E dark brown & dark grey-brown; C blackish & dark brown; I blackish	Non-gritty
14	Open, carinated bowl, fairly deep belly; gentle carination	280	Rim	150	6.0-9.7	Small patches on E & I		Very smooth, slip-like E; smooth I. Horizontal smoothing marks on I	E dark brown & black-brown; C dark brown; I dark brown with black patches of encrustation	Non-gritty
15	Open, carinated or S-profiled bowl	240	Rim	?	7.1-9.1	None		Smooth, slip-like E & I; horizontal smoothing hollows on E	E mid brown & dark grey; C dark grey; I mid-brown & grey-brown	Non-gritty
16	Open, carinated or S-profiled bowl	c 310	Rim	?	5.0-11.2	Tiny patch on E of one sherd		Smooth, slip-like E & I; shallow horizontal smoothing marks on E and more pronounced undulations from smoothing with blunt tool on I	E blackish-brown & dark brown; C med brown, greyish in places; I blackish	Non-gritty

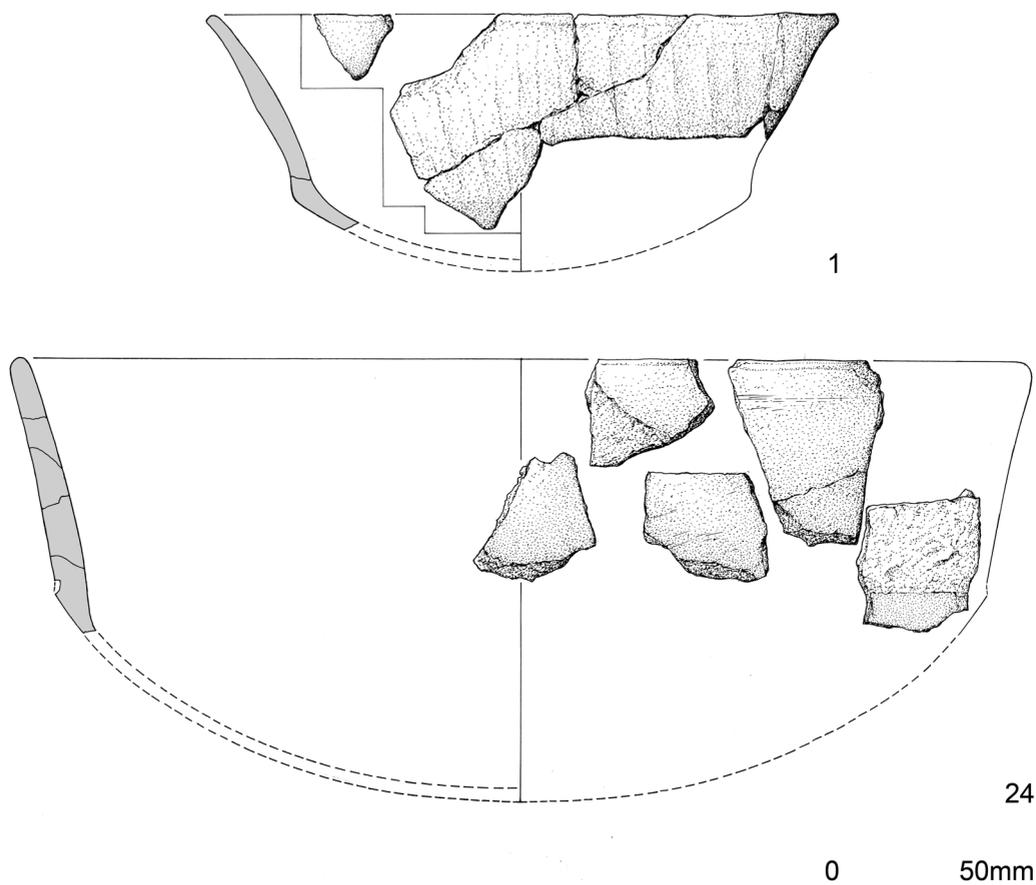
Pot No	Shape	Est rim diam (mm)	Widest part of pot	Est height (mm)	Wall th. range (mm)	Visible organic residues?	Lipid anal? (see note)	Surface finish	Colour; evidence for scorching or burning; cereal grass impressions	Fabric
17	Prob open, carinated or S-profiled bowl	Between 210 and 250	Rim	?	7.0-8.4	Hint of v thin patch on I		Very smooth, slip-like E & I	E dark brown & blackish-brown; I blackish-brown	Non-gritty
18	Prob neutral or open, carinated or S-profiled bowl	Poss 280	Rim	?	7.7-9.0	V thin patches on E		Very smooth, slip-like E & I	E dark brown, greyish tinge; C obscured by sediment; I blackish-brown	Non-gritty
19	Open shallow carinated bowl, flaring neck, gentle carination	c 260	Rim	115	6.2-12.6	I; one sherd has thin patch on E		Very smooth, slip-like E; smooth I. Horizontal smoothing striations on I	E blackish-brown; C blackish; I black	Non-gritty
20	Open S-profile bowl, shallow belly	c 300	Rim	c 120	6.6-10.0	On E and I		Very smooth, slip-like E & I. Horizontal smoothing marks on I	E & I med-brown & black-brown; C blackish-brown	Non-gritty
21	Prob open, carinated or S-profiled bowl	200-250	Rim	?	6.2-7.7	None	Y (GR-5, SF610, prob Pot 21)	Smooth on E & I but some inclusions protrude on E	E mid-brown; C & I mid grey-brown	Very sl gritty
22	Prob open, carinated or S-profiled bowl	200-250	Rim	?	7.0-9.2	Thin, on E		Fairly smooth E; I rougher due to abrasion	E dark brown; C obscured by sediment; I med-brown	Very sl gritty
23	Prob open, carinated or S-profiled bowl	270-310	Rim	?	8.8-9.5	None		Very smooth, slip-like E; smooth I	E blackish-brown; C & I mid-brown	Non-gritty
24	Open shallow carinated bowl, gentle carination	c 370	Rim	c 160	5.1-13.2	On E & I		Very smooth, slip-like E & I; v shallow horizontal marks on E & I from wiping and polishing to low sheen	E blackish & dark brown; C med brown; I black	Non-gritty
25	Open, S-profiled, fairly deep-bellied bowl	230	Rim & inflection	c 214	8.1-14.0	On I		Smooth E & I; thin slip-like surface on E and parts of I. Horizontal smoothing marks on I	E variable: neck light to med brown with grey-brown & buff areas; lower body light brown with reddish tinge; C dark grey; I med grey-brown & blackish-brown. Lower belly sherds sl scorched	Very sl gritty

<i>Pot No</i>	<i>Shape</i>	<i>Est rim diam (mm)</i>	<i>Widest part of pot</i>	<i>Est height (mm)</i>	<i>Wall th. range (mm)</i>	<i>Visible organic residues?</i>	<i>Lipid anal? (see note)</i>	<i>Surface finish</i>	<i>Colour; evidence for scorching or burning; cereal grass impressions</i>	<i>Fabric</i>
26	Probably open, S-profiled or carinated, fairly deep-bellied bowl, similar to 25 but thinner-walled	No rim-sherds; neck diam c 200	Prob rim, poss also inflection	?	9.2–12.9	Small patches on E & I	Y (GR-2, SF812)	Smooth E & I; thin slip-like surface on E. Faint horizontal wipe marks on I; I not as smooth as E	E med to dark grey-brown; part of belly sl yellow-brown from poss scorching; C med grey & med brown; I med grey-brown & blackish. One sherd (SF222) has impression and remains of barley grain; another (SF260) has grass impression	Very sl gritty
27	Open, carinated bowl with gentle carination and medium-depth belly	280	Rim	c 164	7.9–11.7	None	Y (GR-7, SF798)	Uneven E&I, slip-like surface on E & I. Roughly horizontal smoothing striations E & I. Belly corrugated from where coils joined	E med brown with greyish & red-brown areas; lower body scorched to red-brown and bright red; C med-dark grey; I med brown, black-brown & red brown. One sherd heavily burnt. One sherd (SF894) has grass impression	Gritty
28	Open, carinated bowl with (probably) gentle carination and deep belly	c 300	Rim	c 194	7.2–11.3	V thin traces on E		Fairly (but not very) smooth E & I; E poss wet-smoothed. Roughly horizontal smoothing/wipe marks on E	E med brown with med to ark grey patches; one burnt sherd yellow-buff & light grey-brown; C med grey; I med grey-brown. One sherd black throughout. E of neck scorched; several sherds burnt	Sl gritty
29	Prob open, carinated or S-profiled bowl	c 210	Prob rim	?	6.6–9.0	Sm patch on I of one sherd		Smooth E & I but inclusions protrude. One sherd has undulating E from where coils joined	E pink/grey/brown; orange; grey-brown; C buff, orange, med grey-brown; I grey-brown, orange-buff, light grey. All sherds burnt	Gritty
30	Open, S-profiled, deep-bellied bowl	210–250, poss 210	Rim	c 144	9.1–12.9	Hint of poss thin residue on I of one sherd	Y (GR-4, SF324)	Smoothed E & I, probably wet-smoothed, but not slip-like; sl rough, almost sandy texture	E& C grey-brown & mid-brown with orange; orange-buff; yellow-buff; I light orange-brown; grey-brown; orange-buff. All but one sherd burnt	Sl gritty

Pot No	Shape	Est rim diam (mm)	Widest part of pot	Est height (mm)	Wall th. range (mm)	Visible organic residues?	Lipid anal? (see note)	Surface finish	Colour: evidence for scorching or burning; cereal grass impressions	Fabric
31	Open carinated bowl with gentle carination and fairly shallow belly	c 356 (extrapolated from neck; D: rim absent)	Rim	c 135	7.5–9.5	None		Smooth E & I; slip-like over parts of E. Horizontal smoothing striation on I	E light brown & reddish-brown with blackish firing cloud; C med grey; I mid grey-brown & mid-brown.	Sl gritty
32	Prob open carinated bowl	Rim absent	Prob rim	?	7.9–9.1	Poss thin trace on I		Wet-smoothed but sl uneven & I, with inclusions protruding	E med-brown, lighter immediately below surface; C black; I med brown	Sl gritty
33	Neutral or sl open, S-profiled, deep-bellied bowl	c 230	Rim & inflection	c 137	8.9–11.7	Much, thick, mostly E; also I		E obscured by thick organic encrustation but smooth; I sl rough, with smooth, with some inclusions protruding. Horizontal striations from wiping on E	E black & dark brown; C grey-brown; I med to dark grey-brown	Sl gritty
34	Large, thick-walled pot; no rim or carination/S-inflection sherds so can't tell shape	[large]	?	?	10.5–13.0	None		Surfaces sl uneven, with protruding inclusions, esp on I; rough to the touch, although had probably been wet-smoothed	E reddish-orange & buff; C med grey; I med brown & grey-brown. Possibly sl scorched	Gritty

Key: E = exterior; C = core; I = interior; incl. = inclusion. Colour descriptions omit the black patches of encrustation seen on many of the pots. Core colour sometimes obscured by sediment.

Note: the GR-numbers are the sample reference numbers; the SFnumbers are the Small Finds numbers. The lipid-analysed sherds not listed above are as follows: sample GR-3; SF327; from Pot 6, 7 or 10; GR-6; SF932, from any one of Pots 11 and 13–20; GR-8; SF1026, possibly from either Pot 4 or Pot 19; and GR-10; SF665, probably from Pot 6, 7 or 10



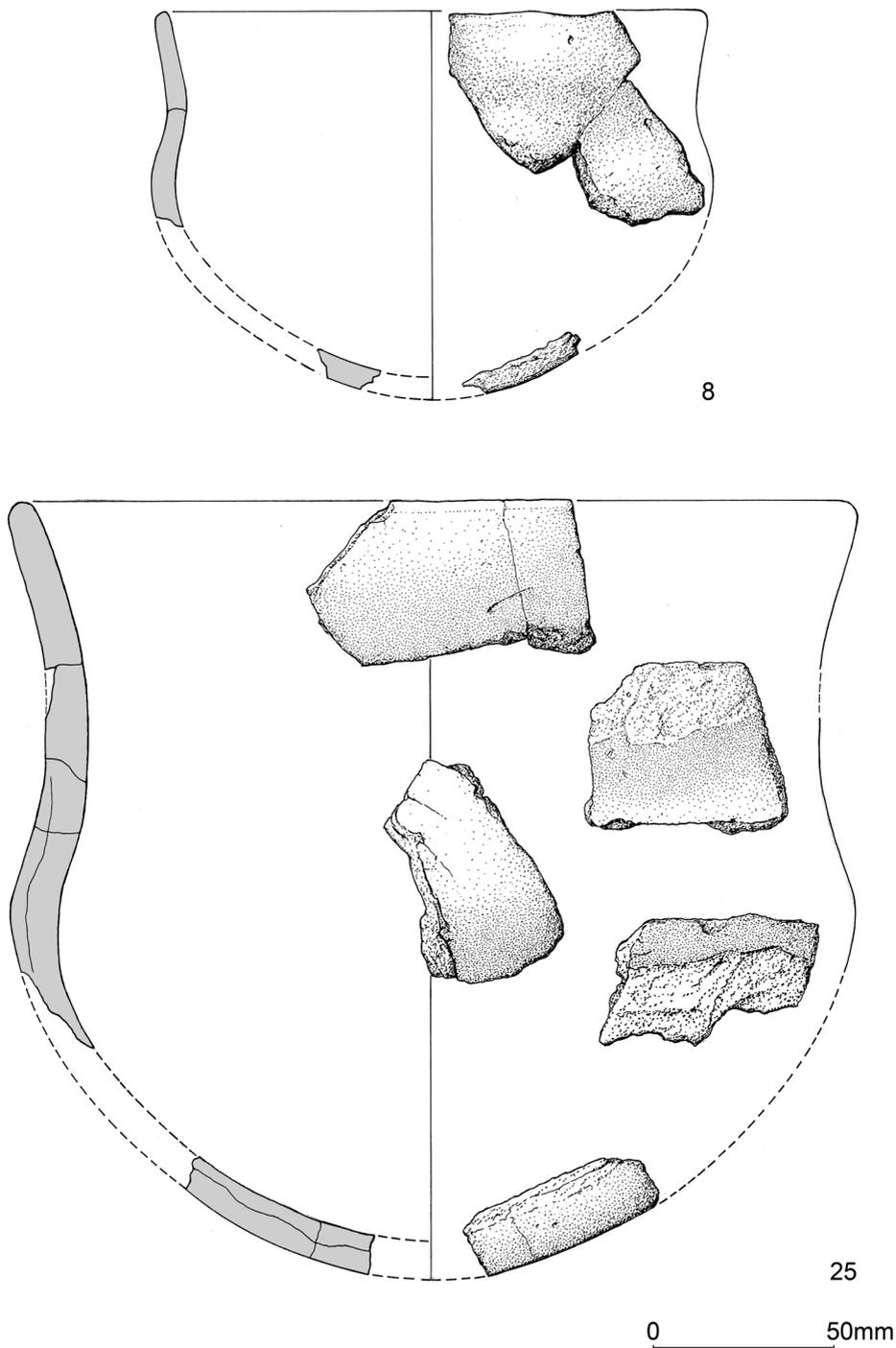
ILLUS 25 Examples of shallow-bellied bowls: Pots 1 and 24. Note that in these, as in all the reconstruction drawings, not all of the pots' constituent sherds are shown, but only those which serve to define the vessels' original profile.
Illustration: Marion O'Neil

shallowest (Pot 1) and deepest (Pot 25) vessels are *c* 94mm and *c* 214mm respectively.

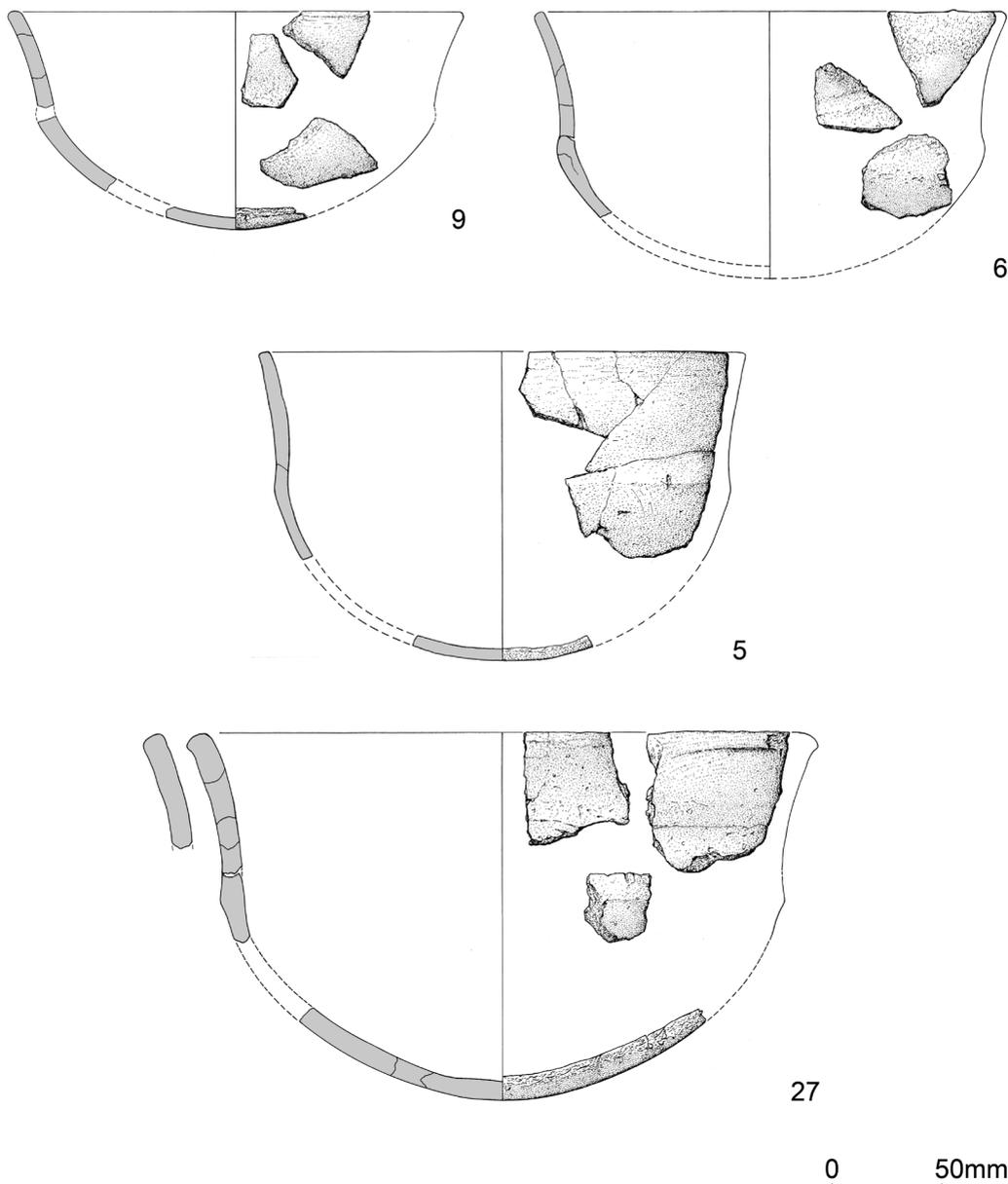
As regards wall thickness, there is variability both within and between vessels, but overall the thinnest sherd in the assemblage is exceptionally thin at a mere 2.6mm (SF879, unallocated to a specific pot), while the thickest measures 14mm (SF796, Pot 25). The vast majority of sherds fall within the 5–10mm thickness range. Within individual vessels, the thickest point lies either at the carination (or S-inflection) or at the mid-to lower part of the neck, with Pots 1, 19 and 24 offering excellent examples of the latter feature (illus 25). These three pots also show how wall

thickness can decrease markedly below the carination (or S-inflection).

There is clear evidence for the methods used to build, shape and finish the pots, with U-, inverted U- and S-shaped coil/strap joints clearly visible in many of the vessels, together with a few diagonal and near-vertical joints that mark the point where the ends of a strap – that is, a flattened coil – had been smoothed together. The horizontal joints include one or two 'false rims' (eg SF337, Pot 26), their smooth, bulbous shape making them resemble actual rims. The width of individual straps appears to range between 17.5cm and 37cm, with *c* 25cm being the commonest width;



ILLUS 26 Examples of deep-bellied bowls: Pots 8 (top and 25 (bottom). Both of these have a 'neutral' profile, where the diameter of the rim does not exceed that of the widest part of the pot (ie the S-inflection).
Illustration: Marion O'Neil



ILLUS 27 Examples of medium-depth to deep-bellied bowls. Illustration: Marion O'Neil

good examples of sherds that have broken along joint lines at top and bottom are to be seen in Pots 25–7, 31 and 33. The fact that joints can even be seen at the bottom of the belly (as is clearly evident in SF937 from Pot 27) indicates that virtually the whole of the pot had been built up

using flattened coils, rather than by moulding the base from a sizeable single piece of clay.

The use of a spatulate tool to shape the rim, leaving slight facets, is evident on a few pots including Pots 14 and 27, and seams and/or bulges formed by the smoothing outwards (or inwards)

of the top of the rim are visible on Pots 19, 24 and 27. Pot 16 has a curious shallow ledge on the exterior of the rim, where the neck has been smoothed up towards the rim.

In every case, the surfaces of the vessels had been carefully smoothed (even though some lithic inclusions protrude from some pots, particularly the 'gritty' examples as described below). Horizontal wipe marks, including shallow striations from where a piece of grit had been dragged across the surface, were noted on the interior surface of Pots 1, 4, 9, 13, 14, 19, 25, 26, 27, 30, 31 and 33 and on the outside of Pots 13, 27, 28 and 34. Horizontal corrugations that probably resulted from the use of a pebble or similar blunt-ended tool to smooth the surface (as opposed to a wiper made from soft material such as hide or a bunch of vegetation, which is likely to have been the case with the previous examples) were noted on the exterior of Pot 15 and the interior of Pots 16 and 20. Horizontal marks on the interior of the markedly thin-walled Pot 8 may have resulted from scraping the surface

to achieve the desired wall thickness, rather than from simply smoothing.

Additional surface treatment in the form of wet-smoothing at the leather-hard stage to create a slip-like effect (or else the actual application of a thin slip) was noted on the exterior surface of Pots 1–7, 9–28 and 31 and on the interior as well on Pots 3, 9–11, 13, 15–21, 24, 25 and 31. With Pots 30 and 32–4, there may have been a cursory external wet-smoothing; here, there is a less obvious slip-like appearance. On Pot 24, horizontal wipe marks on both surfaces must relate to wiping subsequent to (or during) this process. While this wet-smoothing has left many pots with a low sheen on their surface, the only example in the assemblage where deliberate burnishing to a slightly higher sheen has taken place is Pot 3, where a blunt tool has been rubbed over both surfaces at the neck.

The only evidence for deliberate decoration in the entire assemblage consists of faint vertical fingertip fluting on the exterior of Pots 1 and 2 (illus 28). This would have been effected by



ILLUS 28 Fingertip fluting on Pot 1. Photograph: Alison Sheridan

pulling a fingertip down the exterior of the pot, prior to the addition of a slip. It is present on the neck of these two pots (which are both shallow-bellied, with splaying necks) and hints of possible fluting on belly sherd SF1065 in Pot 1 suggest that it may have extended below the carination. These are the only two pots to have produced unequivocal evidence for fingertip fluting (although the burnishing on Pot 3 has produced a similar effect on the outside of that pot's neck). Other 'candidates' are unconvincing: one unattributed sherd (SF1065) has a slightly undulating exterior suggestive of possible fluting (as well as horizontal smoothing marks from a blunt tool) on its exterior, but the sherd is too small for the identification to be more than tentative. Two sherds from Pot 29 with markedly corrugated surfaces can be ruled out as candidates for this type of decoration, since here the corrugations probably relate to the smoothing-over of coil joints.

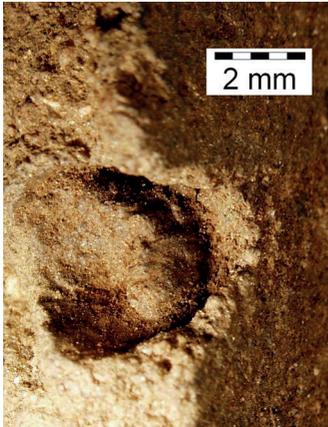
In terms of colour, where sherds have not been scorched or burnt, the surfaces are various shades of brown (sometimes a rich, slightly reddish-brown), grey-brown and blackish, and there is generally an evenness of colour through the wall that indicates that the pots had been fired for long enough, and in the right conditions, for organic materials in the clay to have been burnt out completely. (Some sherds do, however, have the 'sandwich' appearance with a dark core that indicates that the organic materials had not burnt out completely.) Sherds from at least four pots (Pots 9, 27, 34 and one sherd from either Pot 6 or 7), along with 11 unallocated sherds, show unequivocal signs of scorching; on Pot 27 this feature occurs on the exterior of the belly sherds, which would have been closest to the source of the heat when the pot was used in cooking. Other sherds – all the sherds belonging to Pot 29, most of the sherds from Pots 8 and 30, plus 29 unallocated sherds – are more heavily burnt, and these may have lain around in a hearth after the pots broke. This is supported by the distribution patterns: the sherds from Pots 29 and 30 cluster in the vicinity of hearth 57, while those from Pot 8 (illus 23) are mostly within hearth 57.

As regards fabric, there is consistency across the assemblage in the nature of the lithic

inclusions present, although a distinction can be drawn between those vessels which contain very few and generally small inclusions (at a density of 3% or less, and mostly under 2mm×2mm in size), and others where the inclusions are more abundant and generally slightly larger (up to 7–10% density). Most of the assemblage (22 out of the 34 identifiable vessels) falls into the former category; the remaining dozen pots (Pots 1, 2, 25–34) fall along a spectrum from 'slightly gritty' to 'gritty'. While the thickest-walled vessels (Pots 25, 30 and 34) – and those with a slightly coarse texture – fall within this latter category, there is no neat correlation between fineness or wall thickness and fabric: the carefully finished fineware bowl Pot 1 is slightly gritty, for example, and there is a large degree of overlap between 'gritty' and 'non-gritty' pots in terms of wall thickness. Some of the slightly gritty pots (eg Pot 30) have a surface texture that feels slightly sandy.

The inclusions consist of tiny platelets of mica, which impart a slightly glittery texture to many pots; angular and sub-angular white and clear quartz; and sub-angular fragments of a matte, creamy mineral (probably feldspar), some speckled with inclusions of a black mineral (possibly hornblende or biotite mica). These minerals (although not the speckled variant) are also present in the two fragments of potter's clay, and while it is unclear whether they had been deliberately added to that clay in preparation for potting, it seems likely that some had been naturally present in the clay, while some – particularly those in the 'gritty' pots – had been added as a filler, to prevent shrinkage and cracking. An origin of all the minerals in the granitic rocks of Aberdeenshire seems highly likely, and it is probable that the raw materials for pottery manufacture had been obtained within a few kilometres of the site. It is unclear whether the clay had been levigated prior to its use, to refine it and improve its working properties, but this is possible.

Two examples of cereal grain impressions were noted in the assemblage, and were kindly identified as to probable species by Scott Timpany. One, on sherd SF222 from Pot 26, is likely to be of naked barley, with some of



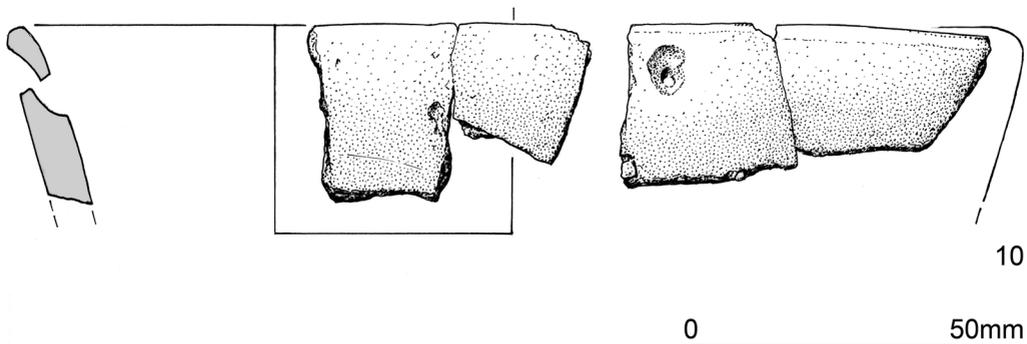
ILLUS 29 Cereal grain impression (of naked barley) on sherd SF222 from Pot 26. The charred remains of the actual grain are visible in the hollow.
Photograph: Alison Sheridan

the charred grain still surviving in situ (illus 29), while the other, on SF941 (probably from either Pot 11 or Pot 12), may well be of emmer wheat. Both species are represented in the plant macrofossil assemblage from Garthdee Road (Timpany, above), although only a few charred emmer grains are present. Impressions of burnt-out grass were noted on a few sherds, including SF941. While these impressions could be taken to indicate that the pots in question had been made during the late summer, the fact that cereal grains could be stored, and that grass has a long growing season, mean that the pots could have been made at any time between spring and autumn.

USE AND CURATION

Evidence indicating that some of the pots had been used for cooking is provided by visible burnt-on black organic residues (as distinct from charcoal smears from contact with extraneous burnt material, as was noted on sherds SF643 and 896) and also by the results of Cramp's analysis of 10 sherds to check for absorbed lipids, which are invisible to the naked eye (see Cramp, below). The distribution of burnt sherds in and around hearth 57, as described above, is also suggestive of the use of pots for cooking. Visible organic residues were noted on the outer surfaces of 19 of the pots (Pots 1, 3–7, 10–14, 16, 18, 20, 22, 24, 26, 28 and 33), and on the inner surfaces of 15 pots (Pots 5–9, 13, 14, 17–19, 24–6, 29 and 33, and possibly also Pots 30 and 32). These pots span the full range of bowl forms. Numerous unallocated sherds also have encrusted organic residues on one or both surfaces. The amount of visible residue is often small, being limited to small patches of thin encrustation, although on Pot 33, it is particularly thick and extensive. The results of Cramp's analysis, as detailed in her report below, show that seven of the analysed sherds produced abundant evidence for the presence of degraded animal fats, while an eighth showed signs of an 'unresolved complex mixture' of lipids; the remaining two sherds produced no lipid traces.

That some pots had been used for long enough to become cracked and repaired is clear from the presence of two post-firing repair holes, one from



ILLUS 30 Post-firing repair hole in Pot 10. Illustration: Marion O'Neil

Pot 10 (illus 30) and the other from unallocated sherd SF953.

DISCUSSION

Despite the variation in form, fabric, surface finish and size as detailed above, the Garthdee Road assemblage shows a marked consistency in its makers' approach to pottery design and manufacture, and in raw material procurement and use. There are no obvious vessel groupings that might correspond to the different phases in the structure's life. The distribution and condition of the sherds strongly suggests that we are dealing with the remains of a domestic assemblage, in which sherds from freshly broken pots lay on the floor or in the hearth, and were distributed around the interior of the house through the normal habitation processes; some were subsequently shifted around during the house's demolition or decay and during later activity, including cultivation. The incompleteness of the pots may be due, at least in part, to the removal of some sherds for disposal elsewhere, although clearly substantial parts of several pots remained in the house. The relatively light degree of abrasion noted in most of the sherds is consistent with their having lain around in a structure that was roofed for some time: while they may have been shifted around as people moved around the house, they had clearly not been exposed to the elements.

All phases in the life history of pots are represented, from their manufacture – as attested by the lumps of potter's clay – to their use, curation (as attested by the two repair holes), breakage, deposition and subsequent disturbance.

This assemblage is immediately recognisable as belonging to the earliest manifestation of the Carinated Bowl (CB) Neolithic pottery tradition in Scotland, and this is supported by the radiocarbon dates which indicate a use-life for the structure between 3790–3720 *cal BC* and 3750–3650 *cal BC* (Bayesian-modelled estimate, 68% probability: see Marshall & Cook above). Several features are wholly typical of this tradition, namely:

- (i) the form of the pots, with gentle carinations or S-inflexions, relatively simple rim forms, and shapes that range from shallow

bowls with flaring necks to deeper-bellied pots;

- (ii) their style of manufacture, which includes not only the methods used to build the pot and finish the surface but also the distinctive feature on Pot 1 where the mid-point of the neck is thicker than the thickness of the carination and belly below (illus 25);
- (iii) the rarity of any decoration, and decoration limited to fingertip fluting;
- (iv) the presence of a range of fabrics and wall thicknesses, including extremely thin and fine;
- (v) evident skill and care in the manufacture of the vessels.

A further recurrent feature appears to be the presence of inclusions relating to granitic rocks (ie mica platelets and fragments of quartz, feldspar and a black mineral, possibly hornblende): this suggests that the ceramic tradition represented here included following a 'recipe' with regard to raw material selection.

The closest *comparanda* are to be found among the earliest assemblages of Carinated Bowl (CB) pottery in Scotland (and indeed elsewhere), as discussed previously by this author (eg Sheridan 1997; 2007; 2009). A cluster of these 'traditional CB' finds is known from Aberdeenshire, which appears to have been one of the areas where the putative immigrant farming groups who introduced this tradition to Scotland settled (Sheridan 2007: fig 1); such finds tend to follow the major river systems. The Garthdee Road assemblage finds a particularly close parallel to that found at the large house at Warren Field, Crathes, around 20km up the River Dee as the crow flies (Sheridan 2009), with similarities in all of the features detailed above. These two assemblages are chronologically statistically indistinguishable and, as argued elsewhere (eg Sheridan 2013), the evidence fits the idea that the Garthdee Road house represents the place where the second- or third-generation descendants of the initial settlers established a settlement, having 'budded off' from the initial communal settlement in the large house. Another find along the Dee, between Crathes and Garthdee Road, is known

from Park Quarry, Durriss, where a pit containing burnt lithics and a pine cone also produced large parts of a thin-walled traditional CB vessel, along with other sherds belonging to the same tradition (Shepherd & Greig 1991; Sheridan 2007: 481). It is not intended to list all the *comparanda* for the Garthdee pottery here, since previous discussions (eg that of the Crathes assemblage (Sheridan 2009)), have already gone into the question of the distribution of traditional CB pottery in Scotland in some detail. Suffice it to note that detailed *comparanda* for each of the characteristics listed above can be found not only in north-east Scotland but also in central Scotland (eg at Claish, Stirling: Sheridan 2002); southern Scotland (eg Biggar Common, South Lanarkshire: Sheridan 1997, and Larkhall Academy, South Lanarkshire: Sheridan, unpublished report); south-east Scotland (eg Eweford West and Penraig Hill, East Lothian: Sheridan 2008); and south-west Scotland (eg Lockerbie Academy, Dumfries and Galloway: Sheridan 2011).

The Garthdee Road assemblage therefore offers a particularly clear insight into the ceramic possessions of an Early Neolithic household, revealing the cultural tradition within which the pottery is situated.

INVESTIGATION OF ABSORBED RESIDUES FROM POTTERY

Lucy Cramp

INTRODUCTION

Ten sherds of Early Neolithic Carinated Bowl pottery from Garthdee Road were sampled in order to investigate absorbed organic residues arising from prehistoric usage of the vessel. The distributions of preserved lipid components in pottery can be utilized to distinguish fats of various origins, including animal fats, plant waxes, oils and resins. Further classification of animal fats can be reached using the stable carbon isotope composition of individual fatty acids (Dudd et al 1999). Sherds were lipid extracted (see below, Methodology) and screened using high temperature gas chromatography (GC) in order to quantify and initially characterise residues and subsequently to select residues for

further mass spectrometric and isotopic analysis. Well-preserved residues were then selected for further preparation and analysis using gas chromatography-isotope ratio-mass spectrometry (GC/C/IRMS).

METHODOLOGY

Sherds were photographed, followed by the cleaning of a small area of the external surfaces of the potsherd using a modelling drill. These pieces were removed with a chisel, and crushed in a solvent-washed mortar and pestle. After the addition of an internal standard (20 μ g *n*-tetratriacontane) sherds were solvent-extracted using 2 \times 10ml CHCl₃/MeOH 2:1 v/v via sonication (20min). Solvent was removed using a gentle stream of N₂ and aliquots of the total lipid extract (TLE) were filtered through a silica column and treated with 40 μ l *N,O*-bis(trimethylsilyl)trifluoroacetamide with 1% TMCS (BSTFA, 70 $^{\circ}$, 1h) prior to screening using high temperature gas chromatography (HTGC). Aliquots of five lipid extracts were then hydrolysed (2ml 0.5M NaOH/MeOH, 70 $^{\circ}$, 1h) and methylated (100 μ l boron trifluoride in methanol, 75 $^{\circ}$, 1h), then analysed using gas chromatography/mass spectrometry (GC/MS) and stable carbon isotope ratio mass spectrometry (GC/C/IRMS) at the NERC Life Sciences Mass Spectrometry facility, Bristol node. Values were corrected for the methyl group added during methylation using a mass balance equation (Rieley 1994).

RESULTS

Lipid preservation

Lipids were very well preserved in most of the residues from Garthdee Road, with significant concentrations of lipid recovered from 70% of sherds (Table 13). The mean lipid concentration of the sherds yielding degraded residues was 91 μ g/g, with lipid concentrations reaching a maximum of 245 μ g/g.

Lipid composition

The major components comprised saturated fatty acids, dominated by the C_{16:0} and C_{18:0} homologues in distributions characteristic of degraded animal

TABLE 13

List of sherds investigated and initial quantitative and qualitative findings. Residues highlighted in grey indicate those containing significant concentrations of lipids which were selected for stable carbon isotope analysis.

FFA – free fatty acid, MAGs – monoacylglycerols, DAGs – diacylglycerols, TAGs – triacylglycerols

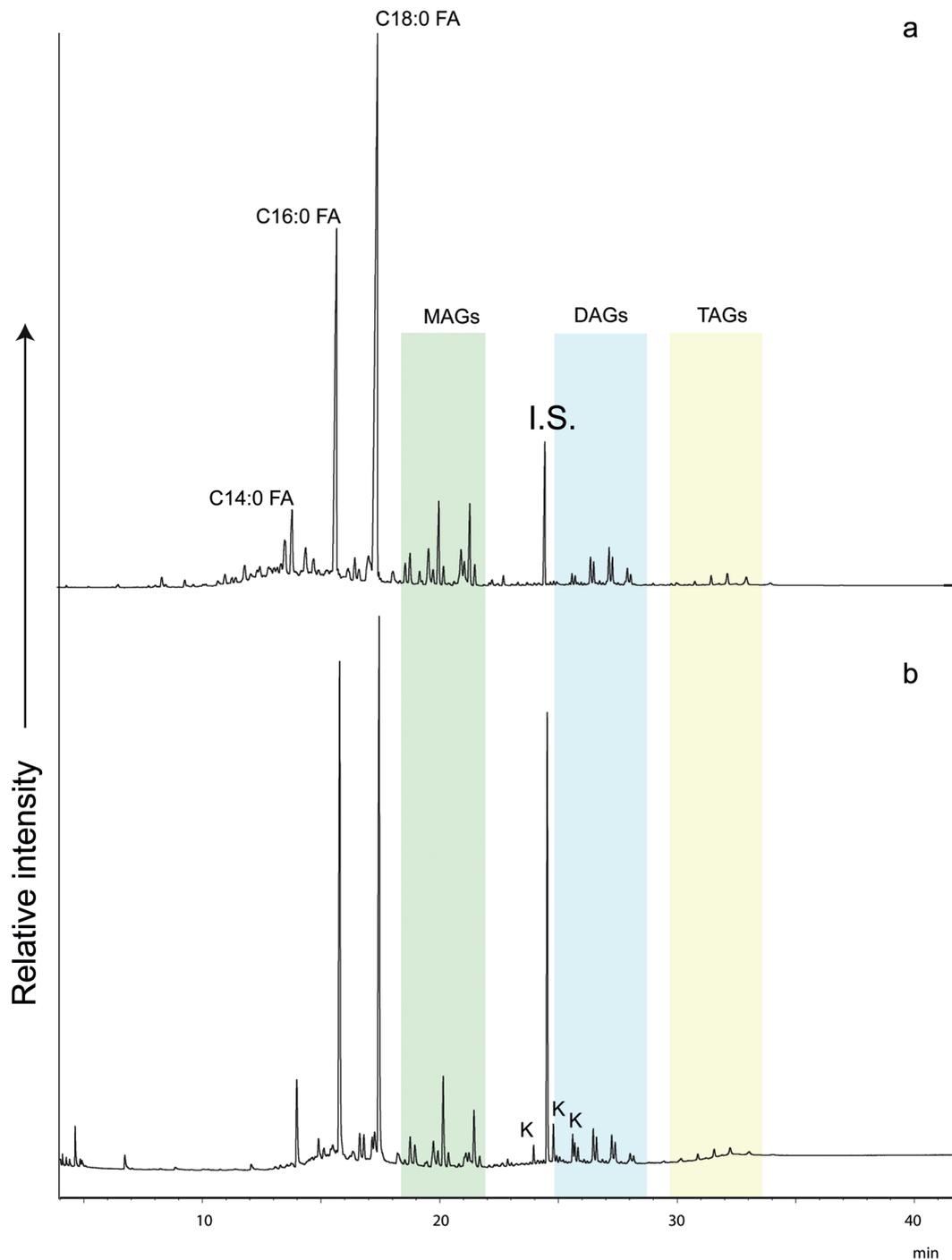
<i>Sherd sample no</i>	<i>Small Find no</i>	<i>Pot no</i>	<i>Lipid concentration ($\mu\text{g g}^{-1}$)</i>	<i>Lipid distribution</i>	<i>Initial classification</i>
GR-1	168	6 or 7	244.6	FFAs (C_{14} – C_{20}); MAGs, DAGs, TAGs	Degraded animal fat
GR-2	812	26	17.6	FFAs (C_{14} – C_{20}); MAGs, DAGs, TAGs	Degraded animal fat
GR-3	327	6, 7 or 10	18.4	FFAs (C_{14} – C_{24}); mid-chain ketones (C_{31} – C_{35})	Degraded animal fat
GR-4	324	30	30.7	Unresolved complex mixture	
GR-5	610	Prob 21	160.2	FFAs (C_{12} – C_{20}); MAGs, DAGs, TAGs	Degraded animal fat
GR-6	932	Unallocated	26.6	FFAs (C_{14} – C_{18}); MAGs, DAGs, TAGs	Degraded animal fat
GR-7	798	27	0.0	-	-
GR-8	1026	4 or 19	38.0	FFAs (C_{14} – C_{18}); MAGs, DAGs, TAGs; mid-chain ketones (C_{31} – C_{35})	Degraded animal fat
GR-9	780	Poss 9	0.0	-	-
GR-10	665	6, 7 or 10	134.6	FFAs (C_{14} – C_{24}); mid-chain ketones (C_{31} – C_{35})	Degraded animal fat

fats (Table 13; illus 31: a). In addition, a distinctive range of ketones (C_{31} – C_{35}) was observed in three sherds (illus 31: b). This characteristic distribution is known to arise via heating of animal fats in a ceramic matrix (Evershed et al 1995; Raven et al 1997).

Compound-specific stable carbon isotope analysis

Five residues contained sufficient concentrations of fatty acids for the determination of the

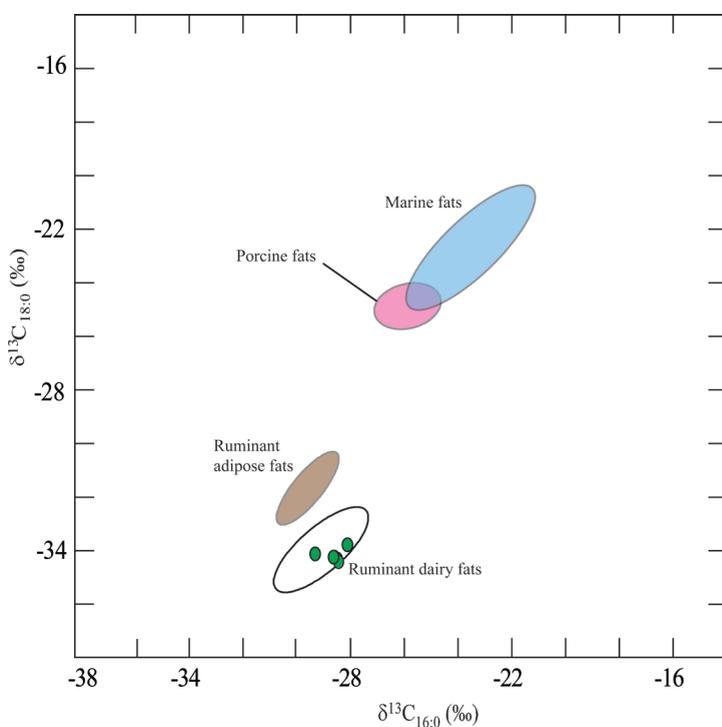
stable carbon isotope values, which allows the discrimination of fats of different origins, namely separating marine and non-ruminant (eg porcine) fats from ruminants and, within the latter, dairy from carcass fats (Dudd & Evershed 1998; Dudd et al 1999; Evershed et al 2002a, 2002b; Cramp & Evershed 2014). The values reveal that all of the fats investigated can be assigned to a dairy fat origin (Table 14; illus 32). This association of early Neolithic Carinated Bowl from Britain



ILLUS 31 Partial high temperature gas chromatograms from two trimethylsilylated residues from Garthdee Road (GR-1 and GR-8), exhibiting lipid distributions that are typical of degraded animal fats. CX:Y FA – free fatty acid with carbon chain length X and degree of unsaturation y; K – mid-chain ketone; MAGs – monoacylglycerols, DAGs – diacylglycerols, TAGs – triacylglycerols; I.S. – internal standard (*n*-tetratriacontane)

TABLE 14
Compound-specific stable carbon isotope values of fatty acids from selected residues, analysed as fatty acid methyl esters

<i>Sherd</i>	$\delta^{13}\text{C}_{16:0}$	$\delta^{13}\text{C}_{18:0}$	$\Delta^{13}\text{C} (\delta^{13}\text{C}_{18:0} - \delta^{13}\text{C}_{16:0})$	<i>Classification</i>
GR-1	-28.0	-33.8	-5.8	Dairy fat
GR-3	-29.2	-34.1	-4.9	Dairy fat
GR-5	-28.5	-34.2	-5.8	Dairy fat
GR-8	-28.4	-34.3	-5.9	Dairy fat
GR-10	-28.5	-34.2	-5.7	Dairy fat



ILLUS 32 Scatter plot of $\delta^{13}\text{C}_{16:0}$ fatty acid values plotted against $\delta^{13}\text{C}_{18:0}$ fatty acids from residues extracted from five sherds from Garthdee Road. The reference ellipses derive from modern UK terrestrial and North Atlantic aquatic fats (Copley et al 2003; Cramp & Evershed 2014)

and Ireland has been reported previously (Cramp et al 2014) and is particularly strong in Scotland, as reflected in the findings here.

DISCUSSION: THE SITE IN CONTEXT

H K Murray and J C Murray

MESOLITHIC ACTIVITY

While the fill of pit 56 is dated as later Mesolithic, it is of course possible to argue that the charcoal derived from elsewhere and had been selected for curation in the pit. However, the statistical consistency of the dates suggest this was not the case and allow an estimate for the date of infilling as 5630–5480 cal BC (Marshall & Cook above). Moreover, the lack of any silting or erosion from the sandy sides of the pit is strong evidence to suggest that no time had elapsed between the digging of the pit, the placing or burning of the charcoal and the covering with stones. There

was only slight evidence to suggest that a fire had been lit in the pit itself, although the charcoal and possibly some or all of the stones had been part of a fire. There is none of the silting from

the sides that might be expected if it had been a long-term hearth or if, for example, the pit had been used for heating water with hot stones within an animal skin (the sand and gravel would in themselves have been too porous).

The careful structuring of the fill does not appear to have been the product of a simple backfilling of rubbish into a convenient pit. The burying of the fire residues may have been a normal practice of site clearance after use – or may have been the careful curation of charcoal from a fire that had a more than mundane significance. There was some evidence that a few of the stones had been heat cracked, but the careful interlocking of the stones could not have been done while they were hot; this might suggest, for example, that the stones had originally been part of a sheltering kerb around the pit or a separate hearth. The angular nature of the stones was unlike the water-rounded pebbles in the surrounding natural, suggesting deliberate selection rather than the filling of the pit with the nearest available materials.

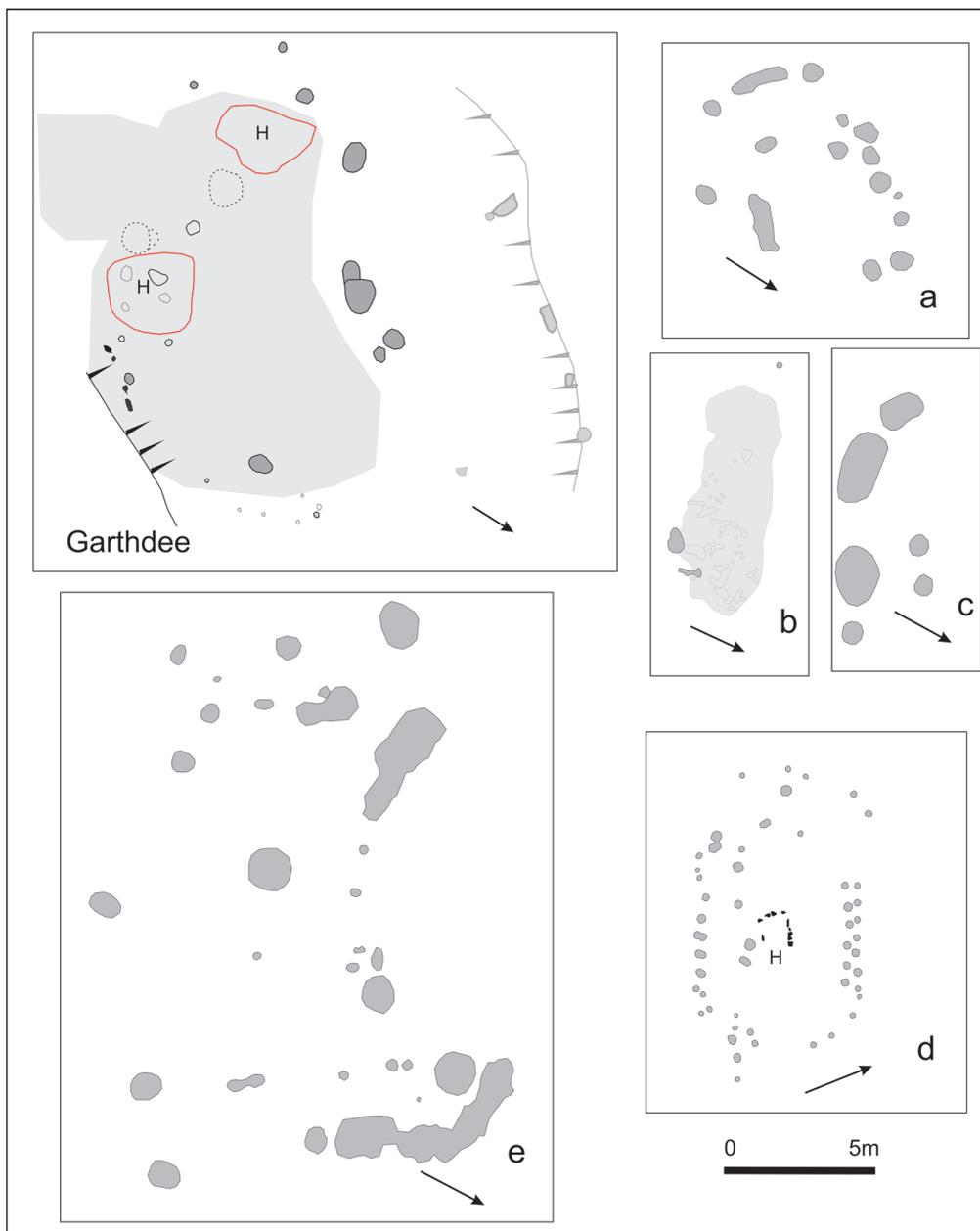
The function of the fire that produced the charcoal cannot be proven. The lack of bone or plant remains superficially mitigate against a cooking fire, but this is simplistic as some foods and cooking would leave no traces and the association on the site of a small number of contemporary flints suggest that a domestic fire – for heating, cooking and scaring away animals etc – cannot be ruled out. Consideration of function is made difficult by our limited understanding of the daily intricacies of Mesolithic life; there may be a mundane explanation that we have not considered or there may be a fusion of mundane and ritual that we cannot conceive (cf Warren 2005: 126–7; Brophy 2006: 23).

The ephemeral nature of many Mesolithic structures means that, in many cases, pits may be the only surviving features; where these occur without diagnostic or indeed any artefactual evidence, they will only be identified as Mesolithic by the vagaries of sampling for radiocarbon dating (Tulloch Wood: Carter 1993; Broom Lodge: Murray & Murray 2007; Warren Field: Murray et al 2009) and it is inevitable that many such features that have not been radiocarbon dated will not be recognised as Mesolithic. The relatively small number of recognised Mesolithic pits may

therefore be reasonably supposed to cover a huge range of original functions. At one end of the spectrum there is the monumental character of the alignment of pits dug over a long period, from perhaps the late ninth through to the mid-sixth millennium cal BC, at Warren Field, Crathes, some 20km upstream along the River Dee from Garthdee (Murray et al 2009). Although some of the alignment pits were much larger, several were of a size comparable to the Garthdee Road pit and all had charcoal deposits at or near the base. However, they did not appear to have been deliberately sealed, the charcoal having been gradually covered by the slippage from the pit sides and the upcast material around them. Pits at Cowie Road, Bannockburn, Stirling, may be similar, although the primary fills have not been dated (Rideout 1997: 36–7, 54–6). The one late Mesolithic radiocarbon date from that site is from what is described as a fire-pit (F59), a designation which appears to be based on charcoal in the fill, although no evidence for burning in situ is described (Rideout 1997: 42).

Closer parallels can be found on occupation sites where hearths and pits have been found associated with wind-breaks or other relatively ephemeral structures. Newton, Islay (McCullagh 1989), Rhum (Wickham-Jones 1990) and Barsalloch (Cormack 1970) are of particular relevance as they were all sites with Mesolithic occupation set in natural hollows – at Newton, for example, in a hollow on a ridge above a loch. At Craighead, Fife Ness, another site overlooking water, an arc of post-pits may be interpreted as a wind-break of some sort sheltering a possible hearth, with a large pit opposite the arc (Wickham-Jones & Dalland 1998). This raises the possibility that a comparable sheltering structure had existed at Garthdee Road but was obliterated by the later Neolithic occupation.

Parallels for the careful sealing of the Garthdee Road pit are more difficult, although the section through the central pit in the Mesolithic dwelling at Newton (McCullagh 1989: 25–6 and fig 3) appears to show a layer of stones over the main fill; burning around the pit is perhaps suggestive of a hearth. A pit at Kinloch, Rhum (Wickham-Jones 1990: ill 83), had a fill of charcoal-rich soil sealed by a deposit of coarse stone tools and



ILLUS 33 The Early Neolithic building at Garthdee and possible parallels; (a) Kinbeachie (after Barclay et al 2001); (b) Forest Road, Kintore ST12 (after Cook & Dunbar 2008); (c) Forest Road, Kintore ST07 (after Cook & Dunbar 2008); (d) Raigmore (after Simpson 1996); (e) Deer's Den (after Alexander 2000). Arrows point north; H = hearth

pebbles, which may have a conceptual similarity to the stone sealing at Garthdee Road.

The Mesolithic activity at Garthdee Road can therefore be interpreted as a probably very short-lived occupation of a sheltered hollow on the ridge above the River Dee; an occupation at the end of which there appears to have been a deliberate sealing of a pit or hearth. It can be regarded as part of the ebb and flow of Mesolithic activity along the Dee, from the coast at Aberdeen (Kenworthy 1982), past the extensive occupation at Nethermills, near Banchory (Kenworthy 1981), and up into the hills at Chest of Dee and Caochanan Ruadha (Fraser 2003; 2005).

NEOLITHIC AWARENESS OF THE MESOLITHIC PIT?

During excavation, the Mesolithic pit had been regarded as associated with the Neolithic building, as this area appeared to have been avoided or respected with no finds in the lower levels of the building's floor deposit (49) over the area of the filled pit – in stark contrast to the surrounding area and the neighbouring hearth (illus 8). The reason for this avoidance may have been practical – although unlikely, it could have been a bumpy area that was simply not comfortable to sit on – or it may reflect some knowledge of the pit. For, it is probable that, when the site was cleared and possibly de-turfed for constructing the Neolithic building, the patch of stones was recognised as different from the natural water-worn stones of the ridge. It could be argued that such recognition of difference may have been of no significance to the Neolithic inhabitants – but this does not explain the finds distribution. It can also be argued, possibly more convincingly, that such recognition resulted in the sealed pit being regarded with awe or respect and therefore either avoided or even possibly marked out by some covering that has resulted in the finds distribution observed on site. What is indisputable – and confirmed by the lithic evidence – is that there had been Mesolithic activity in the hollow on the ridge and that the site was reused for a Neolithic building between c 1,750 and 1,850 years later (Marshall & Cook above).

The Neolithic re-use of sites originating in the Mesolithic has been recognised elsewhere in Scotland. There is a need to distinguish between deliberate continuity and the re-use of a favourable location. Where there has been re-use of a location, it is possible in some cases to suggest that the signs – or even potentially a memory or tradition – of earlier activity may have prompted the later use of the site; the Neolithic re-visiting of the Mesolithic pit alignment at Warren Field can perhaps be interpreted in this light. In a similarly monumental setting, at Cowie Road, Bannockburn, a pit (P59) with a Mesolithic date from the lower fill had early Neolithic carinated pottery in the upper fill (Rideout 1997: 42). This evidence implies a degree of recognition – at the very least there was a hollow into which Neolithic material had been either deliberately or incidentally deposited. At Chapelfield, Cowie, three pits (I, II, V) yielded Mesolithic dates from their lower fills with two of them having early Neolithic artefacts in recuts in their upper fills – again perhaps indicating recognition of visible hollows (Atkinson et al 2002: 147–9, 182–3).

In many cases, however, the choice of the re-used location may have been coincidental, followed by either recognition or non-recognition of the earlier use of the site. At Spurryhillock, Aberdeenshire, one pit yielded early Neolithic pottery and another had charcoal with a Mesolithic date – the site is beside a series of cropmarks (NMRS NO88NE 39 Farrochie) with oval features perhaps suggestive of early prehistoric settlement (Alexander 1997: 26). Like Garthdee Road, this site is in a location, on a ridge above water, that would have been attractive to early prehistoric occupation and the re-use here could be coincidental, with the Neolithic evidence not indicating any awareness of the earlier usage. In contrast, it has been argued above that at Garthdee Road, while the re-use of the site is likely to have been chance, there was an apparent element of recognition or avoidance of the Mesolithic pit by the Neolithic occupants of the site.

THE NEOLITHIC BUILDING IN CONTEXT

The Garthdee building may be set against a number of small, equally amorphous Neolithic buildings

found in lowland Scotland; its importance lies in the rare survival of hearths and occupation levels with the possibility of defining some elements of the social use of space within the building. These often small irregular structures are in sharp contrast to the handful of large rectangular early Neolithic timber halls, two of which, Balbridie and Warren Field, lie only 20km up the Dee from Garthdee; the similarities and contrasts of material culture between the halls and small buildings such as Garthdee may be fundamental to understanding the processes of change in early Neolithic society.

The Neolithic buildings of lowland Scotland have been summarised by Barclay (1996, 2003) and recently discussed by Brophy (2006) and Noble (2006). The apparently ephemeral nature and small artefact assemblages of many of these buildings has caused them often to be interpreted as temporary structures, and they have been used to support suggestions of mobility within parts of the population; other sites, such as Biggar Common or Deer's Den, with larger artefact assemblages have been interpreted as possibly more settled/permanent in nature (Noble 2006: 58–68). Brophy (2006: 18–25) suggests a division between roughly rectangular structures and oval or sub-circular buildings, suggesting the possibility that the small oval or round buildings – such as those at Chapelfield, Cowie (Atkinson et al 2002) – may indicate a tradition in central and south-west Scotland – although small round houses of late Neolithic date are among the Neolithic buildings at Kintore, Aberdeenshire, and would suggest that these were more widely spread (RH13, RH27: Cook & Dunbar 2008: 80–3). All the recent commentators have also stressed the increasing number of sites where there are pits and other occupation evidence of possible domestic character, but an apparent lack of buildings; had the Garthdee Road site not been in a hollow that preserved floor deposits and hearths, it would have presented a similar absence of structure. Therefore, the lack of surviving structural evidence may not preclude the former presence of buildings.

It is with the larger 'rectangular' buildings that Garthdee Road has closest parallels, although

the present authors would argue that few in this group are strictly rectangular. Geographically and structurally the closest parallels to Garthdee Road are Raigmore and Kinbeachie in Highland and ST07 Forest Road, ST12 Forest Road and Deer's Den, all around Kintore, Aberdeenshire. The structure at Raigmore, which was sealed below a cairn, had post-holes outlining an area of 10×5m (maximum 14×6m) with a central hearth; the plan appears to have had straight long sides and curved end(s). It was orientated roughly east/west on a gravel terrace (20m OD) above the Moray Firth. Grooved Ware pottery and radiocarbon dates from associated and later pits (2468–2298 cal BC and 2873–2509 cal BC) suggest the building may have been in use in the early third millennium BC (Simpson 1996: 62–4). Some 20km away at Kinbeachie, a smaller, roughly rectangular structure 7×4m was outlined by shallow pits. It was orientated north-east/south-west on a ridge above the Cromarty Firth. Radiocarbon determinations date it to within the period 3500–2920 cal BC. No occupation floors survived, but there were concentrations of pottery and grain from some of the post-pits (Barclay et al 2001: 60–2, 80–3). All three of the Kintore sites lay on slightly elevated ground on the west side of the flood plain of the River Don. The Deer's Den structure comprised a series of fairly shallow pits around a roughly rectangular area 17×11–12m, with the long axis north-east/south-west. No occupation floors survived, but there was a high concentration of early Neolithic pottery and lithics in the pits' fills and some carbonized grain. Three radiocarbon samples from the pits were dated to between 3820–3640 cal BC and 3790–3630 cal BC (Alexander 2000: 15–17, 65–7). ST07 Forest Road consisted of a group of six shallow hollows and pits framing an area of c3.5×7.5m, orientated north-east/south-west; a concentration of pottery from the fills of these features suggests an early Neolithic date (Cook & Dunbar 2008: 67–8). ST12 Forest Road was an elongated hollow, orientated north-east/south-west with rounded ends c3.1×7.6m, having two post-pits at one side. The fill of the hollow, less than 0.1m in depth, described as 'a dark brown silt with occasional small rounded stones and charcoal inclusions', incorporated

a small concentration of Neolithic pottery and lithics. Radiocarbon dates of 3130–2920 cal BC and 3030–2880 cal BC were obtained from charcoal in the fill (Cook & Dunbar 2008: 79–80).

These structures range in date over several hundred years and close structural parallels should not be expected; but all these possible buildings appear to have had elongated plans ranging between ovoid and roughly rectilinear and to be generally considerably larger than the oval/circular buildings. It has been suggested elsewhere that these structures were ‘timber-framed’ (Brophy 2006: 19) or used ‘non-earthfast timbers’ (Cook & Dunbar 2008: 80). While the term ‘timber-framed’ perhaps suggests an overly sophisticated carpentry, early Neolithic split timbers or planks have been found at Durriss (Russell-White 1995), Balbridie (Fairweather & Ralston 1993) and Warren Field (Murray et al 2009), and it is possible that some of the smaller early Neolithic buildings may also have used some form of mass timber construction as part of a timber clearance stage of settlement (Brunskill 1999: 24–5). However, as has been tentatively suggested for the Garthdee building, turf construction is another possibility that would equally result in the often fairly ephemeral structural evidence. A few other trends are worth emphasising; like Garthdee Road, all the structures described above had been built on higher ground overlooking a river or the sea; with the exception of Raigmore, all are orientated with the long axis either north-east/south-west – although only at Garthdee Road is there evidence of the orientation of the entrance (south-east); most were associated with some concentration of early Neolithic artefacts. Apart from Garthdee Road, the only interior features to survive were the hearth at Raigmore and the possible occupation layer (although not described as such) at ST12, Forest Road, Kintore. Kinbeachie, Deer’s Den and Forest Road ST07 yielded evidence of carbonized grain – all predominantly barley, with emmer also present at Kinbeachie and Deer’s Den. Garthdee Road is unusual in also having had bread/club wheat, demonstrating that its use, if not cultivation, was not confined to the large

timber halls, although, as discussed by Timpany (above), this may relate to changes over time in the choice of crops grown.

It was by pure chance that the Garthdee Road site was excavated just prior to the main 2005 season of excavation at the early Neolithic timber hall at Warren Field, Crathes (Murray et al 2009); it did however focus comparison between the two sites. In the Dee valley, the available radiocarbon evidence (Marshall & Cook, above) suggests that the large timber hall at Warren Field appears to have been built before the smaller building at Garthdee Road, and possibly coexisted with it before the destruction of the Warren Field hall. The Balbridie hall may have been in use later, but the nature of the samples from which the radiocarbon dates were obtained from that site do not allow the same precision. (However, the phenomena of timber halls continued after this in other parts of lowland Scotland, with Claish being built after both Garthdee Road and Warren Field had fallen out of use.) Brophy and Sheridan (2012: 45–6) interpret the halls such as Warren Field (and Balbridie) as communal buildings, with smaller houses such as Garthdee built by individual families as they spread out within the region. Certainly, in terms of the effort and material used in their construction, the halls must have been built as a group effort. Conclusions regarding the differences in function of the buildings are more complex; it has been argued (Murray, Murray & Fraser et al 2009: 62–3; Brophy & Sheridan 2012: 46) that the Warren Field hall had a significant symbolic presence in the landscape, while sharing many indicators of domestic life with the smaller building at Garthdee.

Situated 20km apart, and both lying on higher ground on the northern bank of the River Dee, the communities at both Garthdee Road and Warren Field appear to have used the river to access resources such as flint from beach deposits at the river mouth. Both appear to have used grain; bread/club wheat, naked barley and emmer wheat were found on both sites. The concentrations of grain around the hearths at Garthdee Road strongly suggest food consumption, making it hard to accept earlier ideas that grain from the timber halls indicated ‘special’ functions such as storage, feasting or consumption of alcohol

(eg Cross 2003: 199). The pollen evidence at Warren Field indicated cereal cultivation directly around the hall, sadly conditions were not suitable for comparable sampling at Garthdee Road so we do not know if it too was surrounded by cultivated land – corn spurry may be regarded as a cultivation indicator, but it does not tell us where the cultivation took place. On both sites there was evidence of a continuing use of wild foods; hazelnuts were ubiquitous; bramble and mustard were also found at Garthdee Road, chickweed, sorrel and buds of hawthorn and birch at Warren Field – all edible wild foods.

The acidic soils did not allow survival of animal bone and the very small fragments of burnt bone from both sites were not identifiable to species – with the possible exception of a single fragment of either sheep or roe deer from Warren Field – however, lipid analysis of pottery from that site has demonstrated the use of milk products from either cattle or sheep/goats indicating animal husbandry. Lipid analysis from 10 sherds of pottery from Garthdee Road (Cramp above) also indicates the presence of dairy fats, suggesting that livestock husbandry was a widespread feature of early Neolithic life in the Dee valley.

One of the most striking differences between the two sites was the far greater assemblage of finds from the small building at Garthdee Road as opposed to the assemblage from the Warren Field hall (or indeed the halls at Balbridie and Claish). Even arguing that the loss of internal floors due to plough truncation has reduced the number of artefacts is not the full answer; it would certainly reduce the more vulnerable pottery but does not explain the difference in the quantity or type of lithics found, as discussed by Ballin (above). Is the paucity of finds from the halls an indicator of a difference in function or in the ‘cleanliness’ of the building in use, or does it reflect a very thorough clearance before destruction? Certainly the quality and range of finds, particularly the pottery from Garthdee Road, does not suggest that the smaller building housed people with an inferior or impoverished material culture.

Cook and Dunbar (2008) have recently stressed a belief in the transitory nature of early

Neolithic settlement in north-east Scotland, but at Garthdee Road the depth of the floor deposit, the quantity of finds, the movement of hearths and the apparent replacement of some timbers suggest a less temporary structure, possibly one that may have lasted for as much as a generation – or up to 50 years (Marshall & Cook, above). Perhaps the picture given from both Garthdee Road and Warren Field suggests that, although some temporary settlements may have existed, there may also have been a diversity of settled agricultural communities along the river valleys of lowland Scotland.

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