ISLAND VISITS: NEOLITHIC AND BRONZE AGE ACTIVITY ON THE TRENT VALLEY FLOOR. EXCAVATIONS AT EGGINTON AND WILLINGTON, DERBYSHIRE, 1998–1999

By MATTHEW G. BEAMISH
(University of Leicester Archaeological Services, LE1 7RH)

With contributions from
ROBERT BERSTAN, CHRISTOPHER BRONK RAMSEY, JENNIFER BROWNING, SIMON CHAPMAN, GORDON COOK, LYNDEN COOPER, RANDALL DONAHUE, ADRIAN EVANS, RICHARD EVERSHED, ROWENA GALE, TOMAS GOLSAR, NADIA GRAHAM, JAMES GRIEG, DEREK HAMILTON, ELIZABETH JOHNSON, PATRICK MARSDEN, PETER MARSHALL, ANGELA MONCKTON, GRAHAM MORGAN, FIONA ROE, DAVID SMITH, ADAM TINSLEY, JOHANNES VAN DER PLICHT, IAN WHITBREAD and ANN WOODWARD

SUMMARY

Excavations in Willington sand and gravel quarry between 1998 and 1999 have produced important evidence of prehistoric activity on the floodplain within the Middle Trent Valley. Areas of low wooded islands surrounded by active streams were a focus of Early to Middle Neolithic activity in the fourth millennium cal BC until around 3000 cal BC. Peterborough Wares were the predominant pottery used on the site and non-animal foodstuffs appear to be dominated by wild resources, although evidence of dairying has also been identified. Radiocarbon dating of the pottery has supported the notion that Peterborough Ware belongs mostly to the second half of the fourth millennium cal BC and was not a Late Neolithic tradition.

In the later half of the third millennium cal BC there is evidence of systematic fire clearance of the area which was to be repeated over several centuries into the second millennium cal BC. In the late third millennium cal BC a burnt mound was probably used seasonally as a cooking site within a clearing for a number of years. The area appears to be subsequently abandoned but is used for burial — a small ring ditch, with possible external bank but no mound encircled a grave cut into alluvial silts probably in the later Early Bronze Age. Several hundred years later, in the late second millennium cal BC, a stream was the site of renewed seasonal burnt mound activity in a partly wooded landscape with surviving waterlogged remains of outstanding quality, including a substantial rectangular roundwood-lined trough; this burnt mound was also used for a short period before abandonment and further woodland regeneration.

INTRODUCTION

Archaeological background

The variety of material evidence from the Middle Trent includes large groups of Palaeolithic hand-axes (Posnansky 1963), a cursus (Wheeler 1972) a possible henge monument at Twyford (Harding with Lee, 1987, 117), numerous ring ditches, and other elements of Neolithic, Beaker and Bronze Age occupation (Derbyshire and Staffordshire HERs), all within a few kilometres of Willington (Fig. 1). The mound of a probable round barrow has recently been identified on a terrace-edge bank some 600m to the south (Guilbert and Garton 2007). The wider view of the Middle Trent Valley (between the Dove and the Derwent) appears as a backdrop for important complexes of ceremonial and funerary monuments of Neolithic and Bronze Age date (Knight and Howard 1994, 14; Loveday 2004; Cooper 2006, 6). This includes another cursus monument at Aston-on-Trent (SK432/295: Gibson and Loveday 1989) (Fig. 59) and a remarkable group of Early Bronze Age metalwork from a round barrow at Lockington (Hughes 2000).

Between 1970 and 1972, excavations at Willington Quarry were undertaken by the Trent Valley Archaeological Research Committee, on an area of first terrace cropmarks to the north-east (SK 285 277 centre) (Fig. 1). Evidence of intermittent occupation from Neolithic to the Saxon period was recovered. The main features were Late Neolithic settlements dated by Grooved Ware and some Beaker pottery, with possible trapezoidal buildings, together with Iron Age settlement and field systems with at least three separate foci (prehistoric ritual monuments, Romano-British farmsteads, and a Saxon settlement (Wheeler 1979, 58)). A watching brief, undertaken by the University of Leicester Archaeological Services, during the construction of a haul road immediately to the north identified the continuation of many of the later prehistoric and Roman enclosures and field systems, along with further evidence of terrace edge occupation of probable Neolithic date (Beamish 1997). The evidence included a pit at 48m OD containing a reworked fragment of a polished stone axe (probable Group XX, Charnwood).

Three kilometres to the east of the current extraction area the ditches of a cursus have been recorded by aerial photography and partly investigated by excavation (Wheeler 1972; Guilbert 1994; Guilbert 1996; Loveday 2004). To the north of the cursus, excavations at Hill Farm (SK 299 295) investigated a number of cropmarks which appeared to relate, in part, to a ritual or mortuary monument dating to the late third or early second millennium cal BC (Hughes 1995). Pottery groups of Early Neolithic, Late Neolithic, Early Bronze Age and Late Bronze Age/Early Iron Age date were found (Ann Woodward *pers. comm.*). At Swarkestone Lowes, Beaker-dated features were excavated beneath the mound of a round barrow (Greenfield 1960).

The work described below is an example of the systematic investigation of sub-alluvial areas, a topography noted for its under-representation when compared to, for example, gravel terraces (Knight and Howard 1994, 14).

The full report including all specialist contributions can be viewed at http://ads.ahds.ac.uk/catalogue/resources.html?willington_eh_2008

Development background

In 1991 planning permission to extract gravel extending the earlier Willington Quarry works into the parish of Egginton to the east was given. Initial non-intrusive evaluative work in 1997 failed to identify archaeological activity (Johnson 1997). Trench evaluation following the start of soil stripping and identification of sub-alluvial deposits enabled the delimiting of zones of variable archaeological potential (Clay and Beamish 1998).

Excavation history

Excavations funded by RMC Aggregates and English Heritage took place between July 1998 and October 1999, while further watching briefs continued until 2001.

The very clayey and, without pumping, waterlogged nature of the substrata resulted in either extremely soft and sticky conditions when wet, or extremely difficult conditions when dried, with a short optimal period between when hoeing or shovel scraping might yield useful results. When exposed, the alluvial clays baked hard and rapidly cracked. Prior to archaeological control, machinery caused compression and damage to some sub-alluvial deposits.

SITE HISTORY, TOPOGRAPHY, PALAEOCHANNELS AND ALLUVIUM

The extraction area is on low lying ground, bounded to the north by the now partly canalised Eggington Brook, which flows west-east on its way to meet the Trent 500m to the south (Fig. 1). This low ground has been periodically flooded, in contrast with the area of terrace edge to the north of the brook which has only been affected by localised flooding (Wheeler 1979, 60). Earlier pre-canalised forms of this watercourse still existed as landscape features in the fields to the south of the railway prior to quarrying.

A series of post-alluvial parallel gullies was recorded in the west of the area; anecdotal evidence from local farmers indicated that these had drained into a pond (itself in-filled by 1998) surviving as landscape features until the 1960's when they had been ploughed out along with most of the field boundaries, converting six pasture fields to one of poor arable.

Zone	History & Method	Area (ha)	Mitigation	Dates of work
6	Contractors strip	1.16	Watching brief and area excavation	4/1998–6/1998
1	Trenched: contractors strip	1.6	Watching brief	7/1998
3	Trenched: contractors strip	1.25	Watching brief	7/1998
5	Trenched: contractors strip	0.8	Watching brief	7/1998
2	Trenched: archaeological strip	0.78	Area excavation	7–10/1998
4	Trenched: archaeological strip	0.16	Area excavation	7/1998 & 3/1999
7	Archaeological strip	0.13	Watching brief	4/ 1999
8	Archaeological strip	1.4	Watching brief and excavation	6–10/1999
9	Test pit evaluation	3.75	Watching brief	4–8/2001
Total	Area total	11.5		

Table 1: Zone areas and history in date order.

Some 14 palaeochannels ranging from the early Post Glacial period through until at least the Roman period were recorded (Fig. 2). These channels became more aggressive and more deeply incised through time. Where prehistoric features had been damaged by prehistoric alluviation, the damage appeared more a washing and seeping change rather than scouring erosion which was apparent for later channels (*cf.* context C2077 p. 33).

The pre-alluvial topography was one of stream channels and gravel islands; a landscape of low gravel rises, separated by troughs, some of which carried active streams (Fig. 2, Channels A and B). Alluviation has occurred between the fourth and the second millennium cal BC. The ring ditch was cut through alluvial clays which sealed some features, and was itself sealed by alluvium.

The substrata of the gravel areas was distinctly mixed, with clay and gravel in varying proportions capping less mixed deposits of gravel and clay. The protection offered by alluviation had protected many natural periglacial features and the Post Glacial products of bioturbation, in addition to the archaeological ones, leading to a confusing picture. It is now apparent that the surface of Neolithic activity was not buried by flood silts for up to a millennium, with resultant weathering. The upper fills of some features were alluvially derived, whilst others appeared filled and consolidated prior to alluviation.

Feature preservation and recognition

Due to the alluvial cover and lack of modern plough damage, feature preservation was in general very good although every undulation in the pre-alluvial surface was also preserved (40% of all recorded deposits were less than 0.10m deep). Most of the tree related deposits recorded were not understood sufficiently when excavated, making retrospective differentiation difficult. It is critical that site excavators fully understand the mechanics of deposit formation below fallen trees so that excavation answers the specific questions that can be asked of this evidence.

Group numbers

Group numbers were used to associate feature, finds and environmental deposits spatially. Radiocarbon dating has confirmed that there were clear areas of palimpsest. The broad groups contain material of mixed dates, and the deposits therefore need to be understood on an individual basis.

Context numbers are quoted where appropriate. The cuts of negative features are prefixed by 'C' whilst deposits are not.

Radiocarbon dates

The radiocarbon measurements have been calibrated using the calibration curve of Reimer *et al.* (2004) and the computer program OxCal (v3.10) (Bronk Ramsey 1995; 1998, 2001). 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 if the error term is greater than or equal to 25 radiocarbon years, or to 5 years if it is less. The ranges quoted in italics are *posterior density*

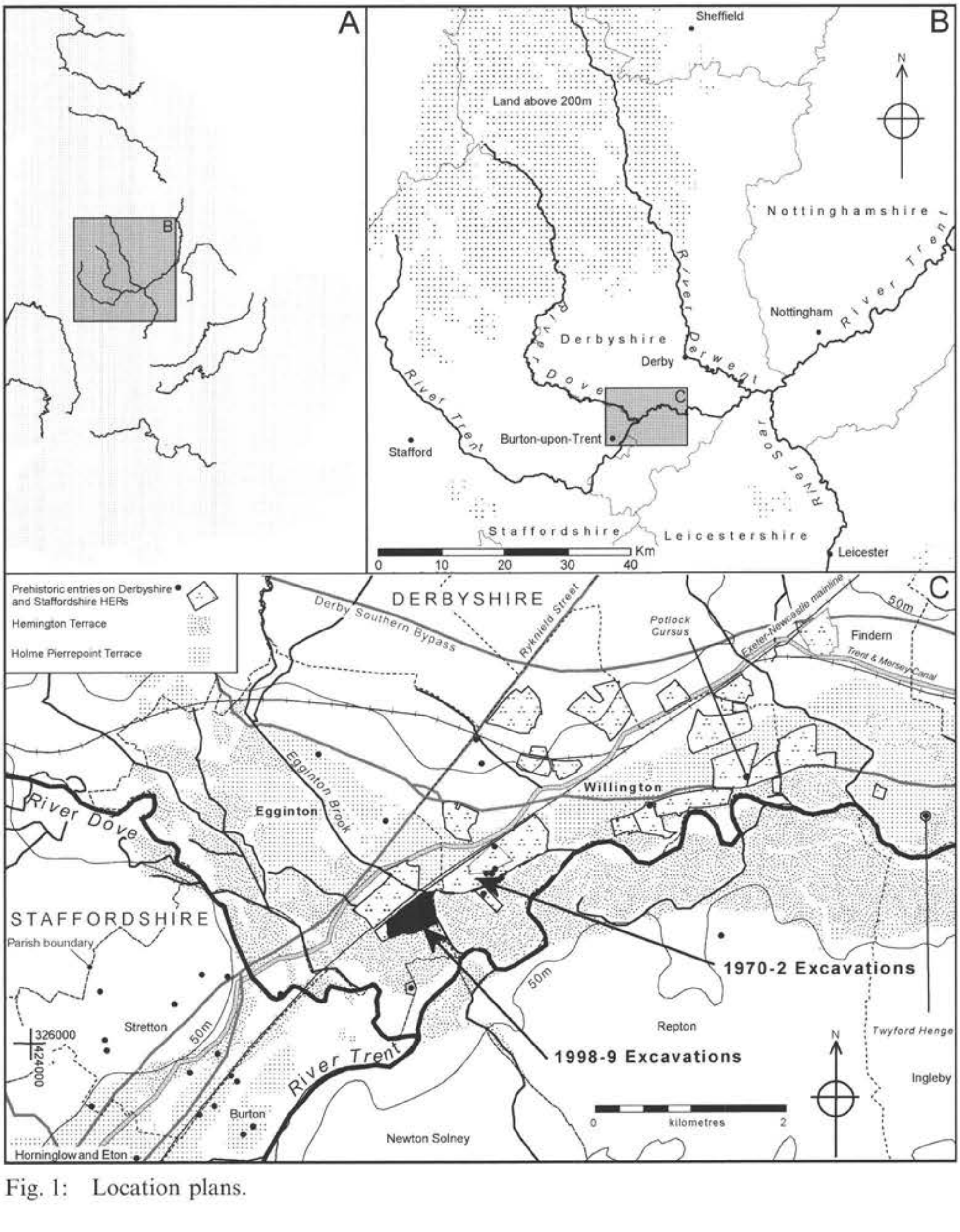


Fig. 1: Location plans.

estimates derived from mathematical modelling of archaeological problems (*radiocarbon results section*). The ranges in plain type in have been calculated according to the maximum intercept method (Stuiver and Reimer 1986). All other ranges are derived from the probability method (Stuiver and Reimer 1993).

Zone	Group Nos.
6	801–814
1,2,3,5	2500–2551
4	4500–4505
7	4550–4552
8–9	4560–4569

Table 2: Group numbers by zone.

THE EXCAVATIONS

The Early to Middle Neolithic activity

Zone 6 (Fig. 2)

This area, the first to be excavated, was characterised by small areas of variably preserved features, including some with fills containing abundant finds. These comprised burnt surface deposits, hearths, shallow and substantial pits, and some suggestion of structures. There was little variation in the topography of the area in comparison to Zone 2, and the mean section datum of 42.68m OD is 0.10m lower than that for Zone 2 indicating that in the event of flood, this area would have become unsuitable for domestic activity before Zone 2. However, based on the radiocarbon dating, alluvium does not appear to have started to inundate either area until near the end of the third millennium cal BC (below p. 68).

Groups 802, 808 and 812 (Figs 3 and 4)

A number of shallow spreads, post-holes, pits and tree-throw holes were found below the alluvium and cutting clayey gravels within an area 21m by 10m, some of the features containing clearly burnt material. Damage had been caused by machine buckets and tracks.

Structure A: On the eastern side a group of similar post-holes all filled with pale grey clays between 0.10 and 0.20m deep (C496, C498, C500 and C504), formed an arrangement with a radius of 2.35m. A worn scraper was recovered from the eastern end. A 0.05m deep spread of similar pale grey clay 2m to the north-west contained Earlier Neolithic Plain Bowl pottery (C492).

A further 1m to the north-west Peterborough Ware sherds were excavated from a silted root-void (C365) with the adjacent gravel upcast ridge of a tree that had fallen to the north-east (364). Earlier Neolithic Bowl pottery was recovered from cleaning layers.

Within the tree hole area of the fallen tree were two small and shallow adjacent deposits (C279 and C292); each was filled with single deposits of greyish orange sandy clays up to 0.08m deep that both contained sherds of Neolithic bowl (some of which were abraded) and also Peterborough Ware, flint and charred material. Radiocarbon determinations of material from C279 (291) of 3515–3360 cal BC (weighted mean of OxA-15127; 4790 $\pm$ 32 BP and OxA-15128; 4709 $\pm$ 31 BP) and 3710–3630 cal BC (SUERC-7607; 4875 $\pm$ 35 BP) were of different ages (below p.51). To the west and south-west of these features was a spread (C298) interpreted as an irregular root-void

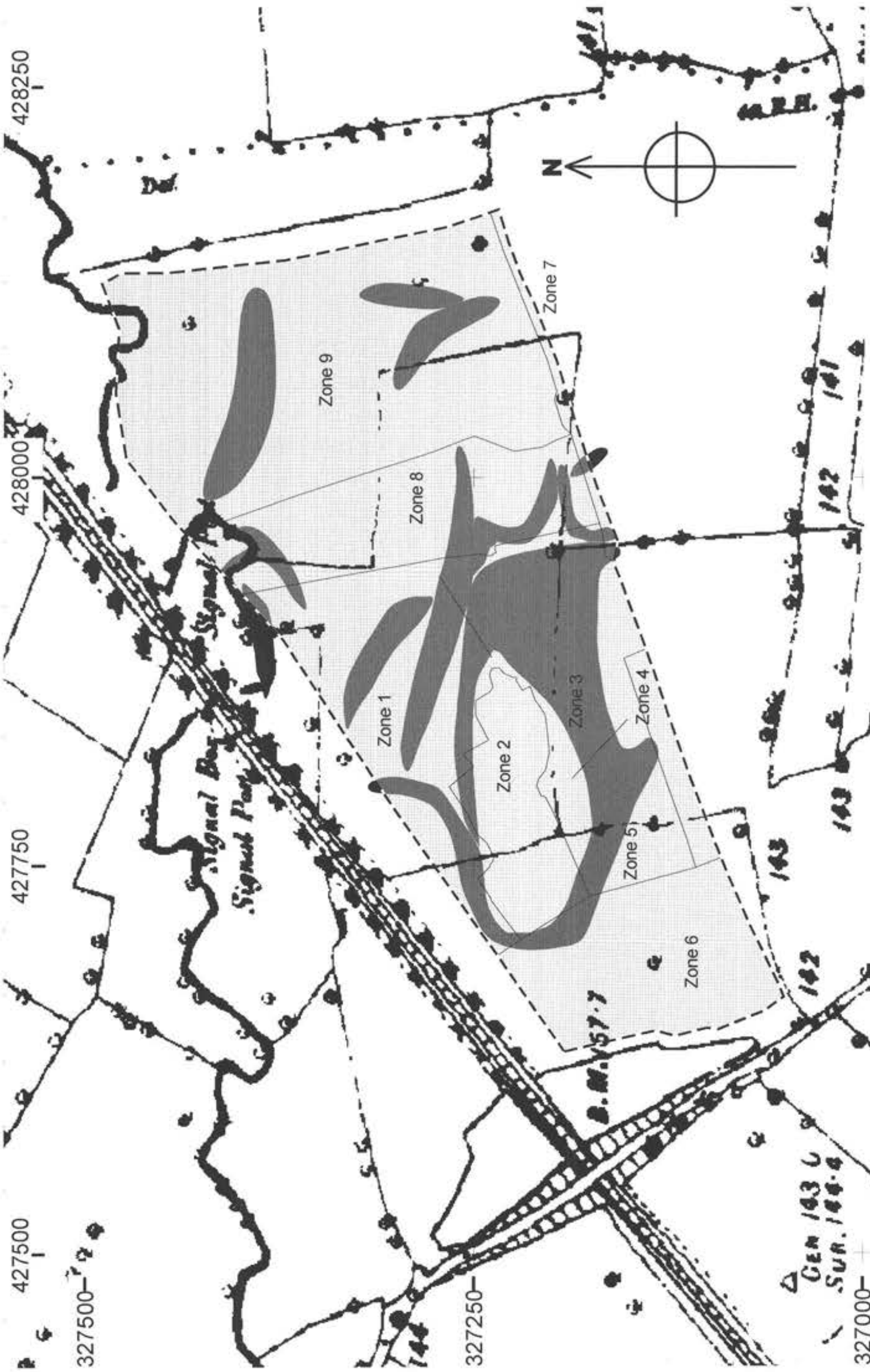


Fig. 2: Area of site, zones and palaeochannels with first edition Ordnance Survey.

silting within which were fragments of Neolithic pottery and a lens of *in situ* burnt material (299) which also provided a radiocarbon date (below p. 74).

To the south a 5m length of machine damaged linear feature C342, up to 0.10m deep and filled with a pale grey clay, was recorded. A sherd of Peterborough Ware was recovered during cleaning (358).

A metre to the south-west, the silted root-void of a tree that had fallen to the north-east was recorded. The fill contained flecks of burnt clay.

On the basis of the distribution of Neolithic pottery sherds and the paleness of recorded fills, all the deposits could be interpreted as contemporary. Clearly from the model of deposit formation below a fallen tree (below p. 138 and Fig. 58), the shallow deposits internal (and at a higher relative level) to the fallen tree in the north-east could not predate the tree and have survived. Therefore the tree must have fallen before the deposits were made. Furthermore, pottery has entered the root-void silting at depth either as part of the initial topsoil deformation or during subsequent silting. This must have occurred before the roots had been substantially replaced with silts. It is therefore quite possible that the occupation is contemporary with, and adjacent to, the fallen tree.

Pottery from the initial cleaning of spread C298 contained fresh and unabraded sherds. Sherds from the small deposits within the putative root area (C292 and C279) were not freshly broken, but were less abraded than those from the root-void silting.

To the west two similar substantial adjacent pits C366 and C368 were quarter sectioned; one contained a tertiary bladelet (367), but the fills appeared sterile. Further shallow deposits that yielded no diagnostic material were recorded on the western edge of the group.

Groups 803 and 809 (Figs 3 and 4)

In an area of truncated and archaeologically contaminated deposits and later gullies, evidence of a probable clearance burn was recorded (C420).

In the north a crescentic spread overlying an irregular hollow (C487), 4.5m long by 1.5m wide and up to 0.20m deep, was investigated. Decorated pottery and flints were recovered. One sherd of Peterborough Ware Mortlake/Fengate style vessel from a cleaning layer (390) submitted for residue dating produced a determination of 3510–3340 cal BC (OxA-15047; 4615 $\pm$ 36 BP) (below p. 80).

Six metres to the south-west another ill-defined and damaged spread of orangey grey clay, that may also represent root-void silting (C523), contained fragments of Peterborough Ware.

Four metres to the south-east two small pits rich in finds and burnt material were recorded (C459 and C480). C459 was 0.75m wide and 0.10m deep, filled with a dark sandy clay rich with Peterborough Ware fragments and charred remains. Two metres to the south, C480, 0.50 in diameter and 0.11m deep, also contained a fill rich in charred material including a fragment of possible sheep pelvis (p. 116) and hazel-nut shell (p. 117), but no ceramics. An immediately adjacent irregular and machine damaged feature 0.24m deep (C478) probably represents root-void siltings that incorporated pottery and flint. Peterborough Ware was recovered from cleaning (28).

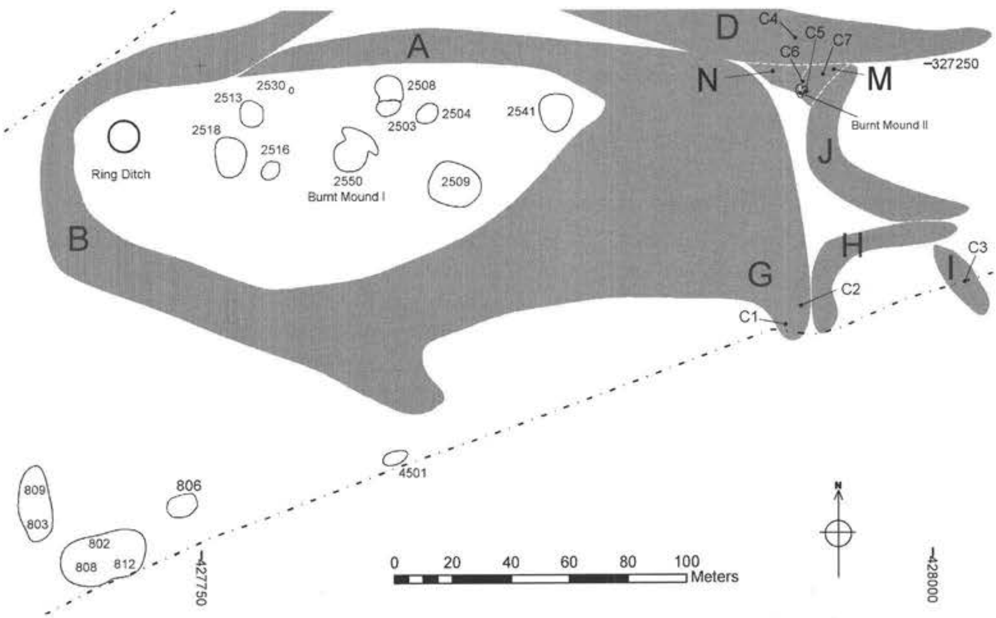


Fig. 3: Location of key groups, pollen columns (C prefix), palaeochannels and zones.

The poor quality of the survival of these deposits limits the scope of their interpretation, although occupation deposits are juxtaposed with probable root-void siltings that also contain occupation debris.

Most of the pottery is abraded, although that from the pit C459, which included Mortlake Ware, shows the least heavy abrasion and it seems very unlikely that this small pit deposit would have survived beneath the putative tree-fall (below p. 138). Material from C459 (458) produced statistically consistent radiocarbon determinations (T' = 1.3; ν = 1; T'(5%) = 3.8; Ward and Wilson 1978) of 3640–3370 cal BC (GrA-31799; 4750 ± 40 BP) and 3660–3520 cal BC (OxA-15899; 4814 ± 38 BP).

Group 806 (Fig. 3)

A small ovoid pit, 0.90 by 0.60m (C326 0.17m deep), contained a layer of dense fire-cracked pebbles up to 0.10m across in a very charcoal rich matrix (340), above a layer of charcoal rich silty clay (325). The stones were either whole or only partly cracked, and were possibly heated *in situ.* Charred remains included sloe stone and nut shell (below p. 117). C326 was isolated but for two small and shallow pits (C321 and C336) 0.45m apart, 6m to the north-east, each 0.60m × 0.40m and less than 0.11m deep. C321 contained sherds of Peterborough Ware.

Zone 2 (Fig. 6)

An elongated island of clayey gravels contemporary with the stream channel to north (A, Fig. 27), and possibly south (B, Fig. 6). The apex of the island is at 42.80m (Fig. 6) whilst the mean section datum of 42.77m is the highest of all zones. In contrast, the ancient surface of the ceremonial ring ditch (Group 3100) cut through the alluvium sealing other deposits and varied between 42.92m and 42.99m.

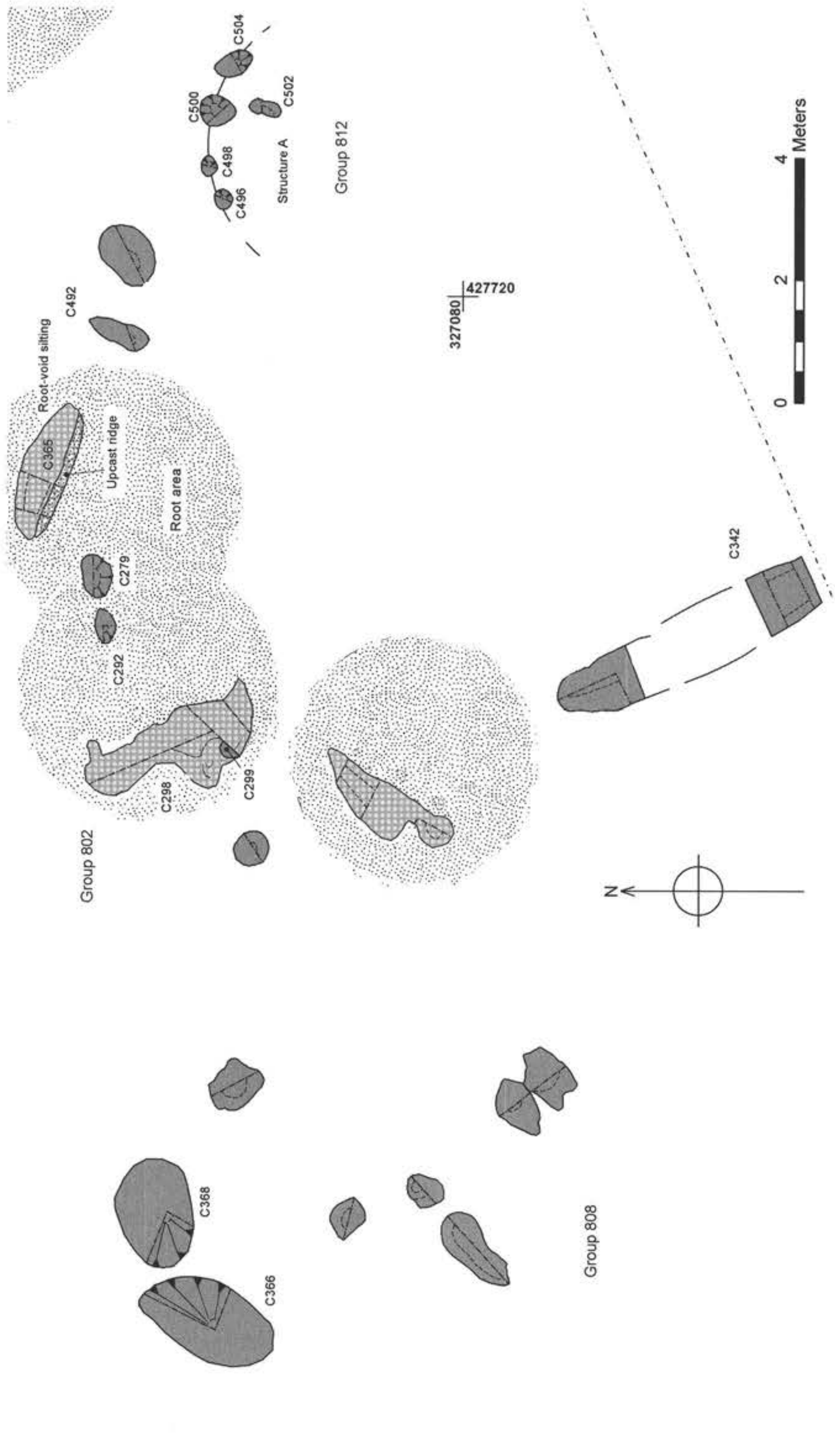


Fig. 4: Groups 802, 808 and 812.

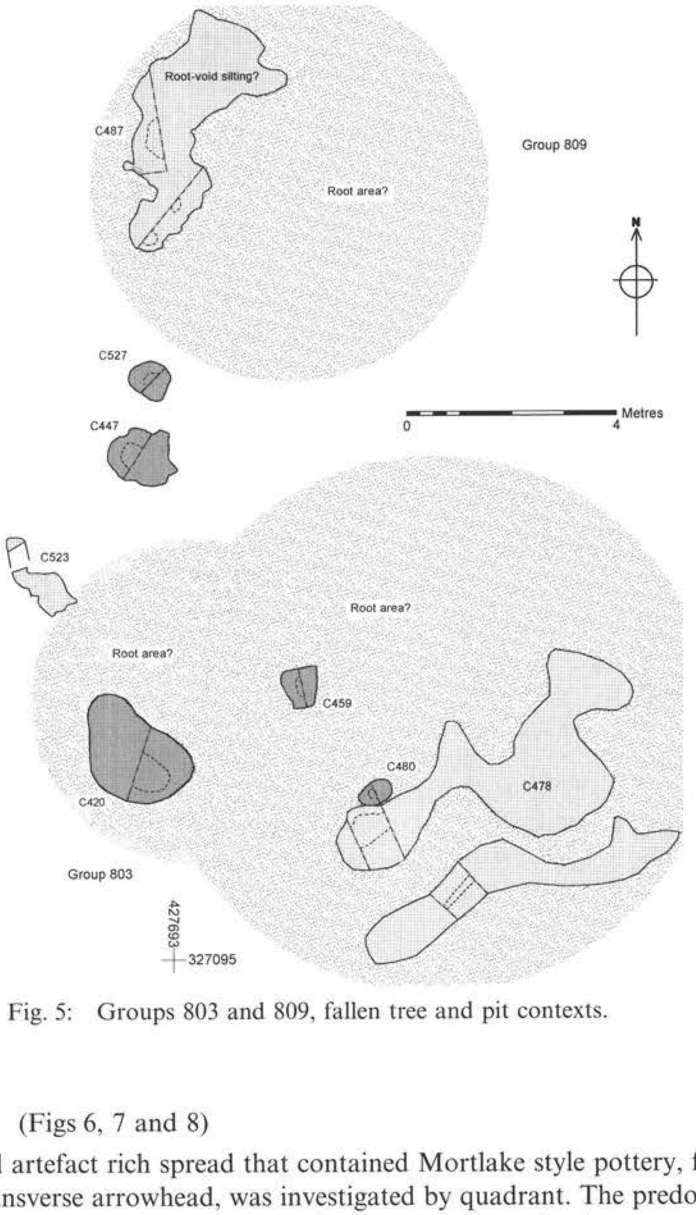


Fig. 5: Groups 803 and 809, fallen tree and pit contexts.

Groups 2504 (Figs 6, 7 and 8)

A substantial artefact rich spread that contained Mortlake style pottery, flakes, bladelets and a transverse arrowhead, was investigated by quadrant. The predominant layer (1416), some 3m across and covering $8m^2$, was a brown sandy clay, up to 0.10m deep. The base of the layer above the natural substratum was irregular with small curvilinear depressions recorded. On its northern edges the spread thinned and became discontinuous. In the more southerly quadrant, 1416 overlay 1598, a light orangey grey sandy clay of a similar thickness to 1416 which also sealed a pocket of soft grey silty clay, 1722.

To the north-east of the centre of 1416, and sealed by it, was a small sharply defined pit (C1485 0.24m deep). The pit contained a predominant and primary fill of fire

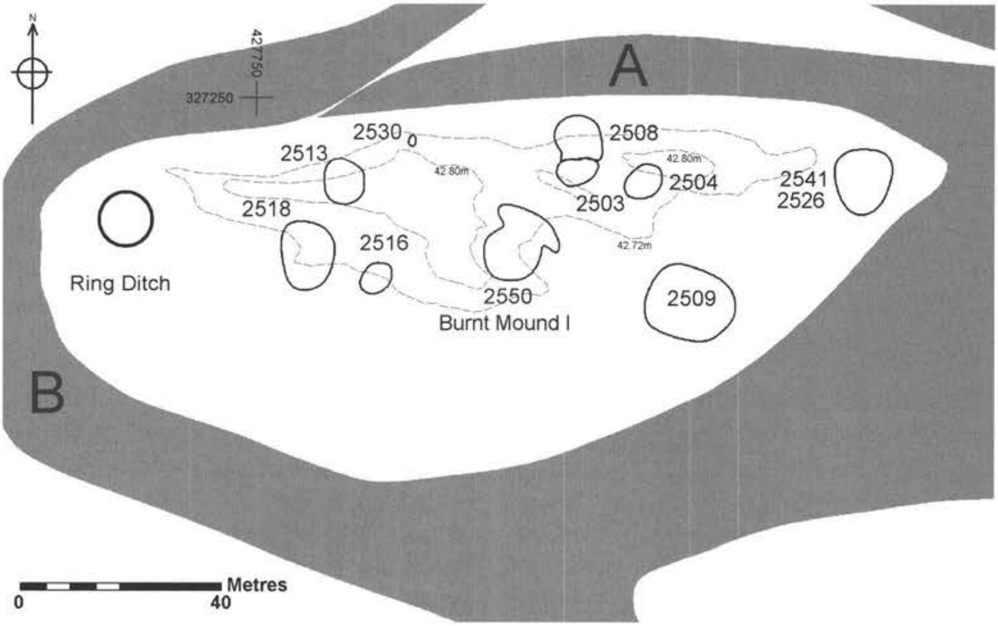


Fig. 6: Key groups of Zone 2 and contours showing slight relief.

cracked stones (1486), sealed by dark grey sandy clay (1477) with a concentration of charcoal at the base. A single fragment of charcoal from 1477 was dated to 3370–3020 cal BC (GrA-31801; 4515 ± 45 BP) (below p. 75).

The spread has been interpreted as a midden that had accumulated around a cooking pit. The irregularity of the base of the spread could indicate that a former tree-hole was utilised for this purpose. Some larger and fresher sherds were noted from the spread (1416).

Groups 2508 (Figs 6, 9 and 10)

Another artefact rich spread, was investigated 14m to the north-west. Comprising greyish brown clays it was less homogeneous than (1416), and in general more irregular (more notably on its west side), with a broad horse-shoe shape around a central ridge of gravel. Concentrations of charcoal were apparent. The deeper western areas (up to 0.18m thick) were investigated with trenches, while the thinner eastern area was removed to the substratum.

Within a broad depression sealed by the spread on the west side and cutting a pale lower layer, (probably a soil remnant (1501)) was a small ovoid pit, 0.70 × 0.55 × 0.25m deep (C1500). The pit contained a dark blue-black clay with up to 30% charcoal (1499), which also contained some Peterborough Ware. The spread (1000/1001/1040) contained Neolithic Peterborough (Fengate) pottery, a sherd of Beaker ware (below p. 88) and lithics which included chips, flakes and a transverse arrowhead.

The overall shape of the spread is clearly reminiscent of an area of tree fall. Most of the pottery from the group was very abraded, and none was fresh. One sherd of Peterborough Ware from 1040 was submitted for residue dating; 3330–2910 cal BC

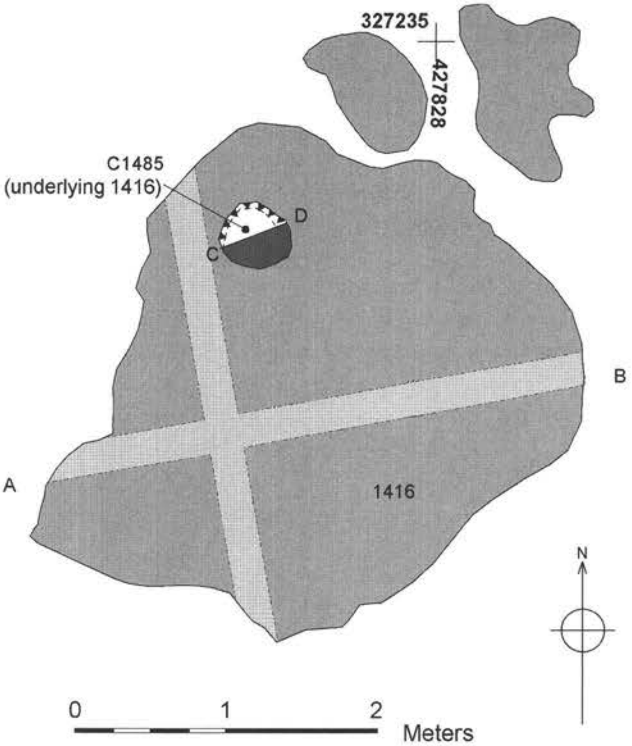


Fig. 7: Plan of Spread 1416, Group 2504.

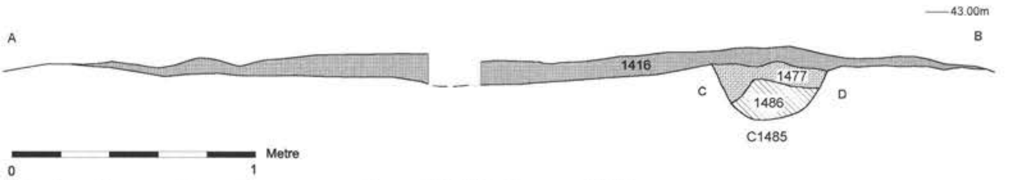


Fig. 8: Composite section across Spread 1416, Group 2504.

(OxA-14482; 4416±36 BP) (below p. 80). Two statistically consistent dates (T' = 1.7; ν = 1; T'(5%) = 3.8; Ward and Wilson 1978) of 3330–2920 cal BC (OxA-15084; 4434±30 BP) and 3370–3020 cal BC (SUERC-8156; 4500±40 BP) were obtained on single fragments of charcoal from 1499, C1500.

On the southern side of the eastern spread were five post-holes (C1556, C1594, C1596, C1600 and C1602) with some evidence of them having held posts; all were revealed on removal of spread material. These features varied from 0.06 to 0.15m in depth.

Group 2503 (Figs 6, 9 and 11)

Immediately to the south of the Group 2508 post-holes, but contrasting strongly with them in character, were four relatively deep sub-circular pits (C1455, 0.30m, C103,

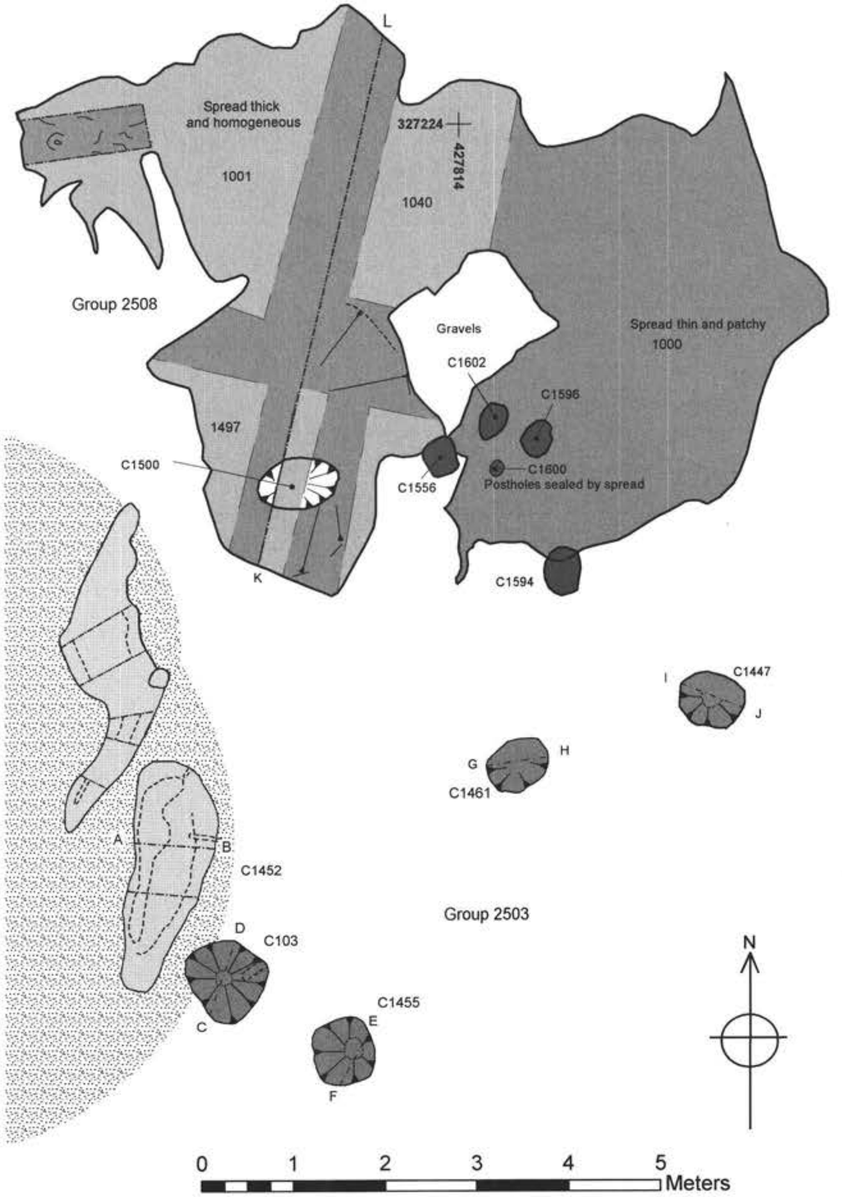


Fig. 9: Plan of Groups 2508 and 2503, spread, pits and post-holes.

Fig. 10: Section across Spread 1001/1497, Group 2508.

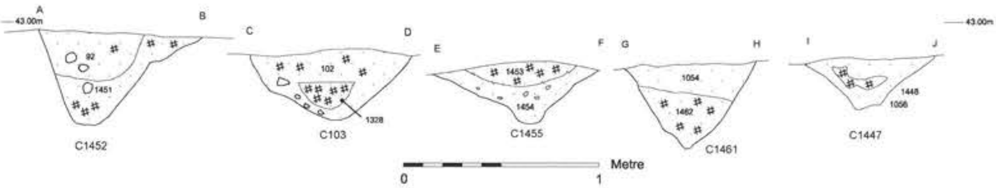


Fig. 11: Sections of Group 2503 features.

0.40m, C1461, 0.37m and C1447, 0.36m deep). An elongated irregular pit (C1452, 0.40m deep) to the west is interpreted as a root-void silting from a tree having fallen to the east.

All the features lay within the projected root system of another tree which must have fallen prior to their digging. Most of these features had notable charred material and also contained some pottery.

Central charcoal lenses and/or basal sockets in three features (C103, C1455 and C1447) was possible evidence of the pits having held posts. Charcoal (1328) near the base of C103 appeared to be a placed layer, rather than the result of *in situ* burning, as the grains of the charcoal pieces were not aligned. The deposit may nonetheless be filling the base of a post-pipe.

C1452 and C103 had sharply defined narrow linear deposits of grey clay on their eastern and northern edges respectively, interpreted as remnants of leverage scars. Thirteen flints were recovered from C1447.

The root-void silting (C1452) was predominantly filled by a dark brownish grey, compact grey clay (1451) containing some charcoal which undercut a cleaner orangey brown sandy clay (92). The charred remains within 1451 were not homogenous and were consistent with a slow accumulation of deposit. There was no indication that the fallen tree was burned *in situ*, and the evidence suggests the roots remained *in situ*, to be replaced by the silt of C1451 as they rotted.

Radiocarbon measurements were used to evaluate whether charcoal from the post-holes and that of the root-void silting could be of the same age (below p. 74), to assess whether a temporal relationship existed between the tree rotting on the ground to west, and the post-holes of a probable structure. However single measurements from C1447, 3360–3020 cal BC (GrA-31770; 4490 $\pm$ 40 BP), and from C1455, 2200–1930 cal BC (GrA-31786; 3665 $\pm$ 40 BP) were of different ages and the root void silting (C1452) also contained material of different ages 3370–3080 cal BC (SUERC-7597; 4510 $\pm$ 35 BP), 2430–2130 cal BC (GrA-31785;3800 $\pm$ 40 BP), and 2200–2020 cal BC (OxA-15110; 3714 $\pm$ 29 BP). (T' = 344.5; v = 2; T'(5%) = 6.0; Ward and Wilson 1978).

Group 2509 (Figs 6 and 12)

On the southern edge of the island were numerous silt filled root voids (mostly unexcavated), further spreads with surface fragments of pottery, and a number of pits and post-holes. The post-holes were all similar in the combination of their lack of depth and homogenous fills of grey-brown silty clays. Most of the pottery from the group was very abraded, and none was fresh.

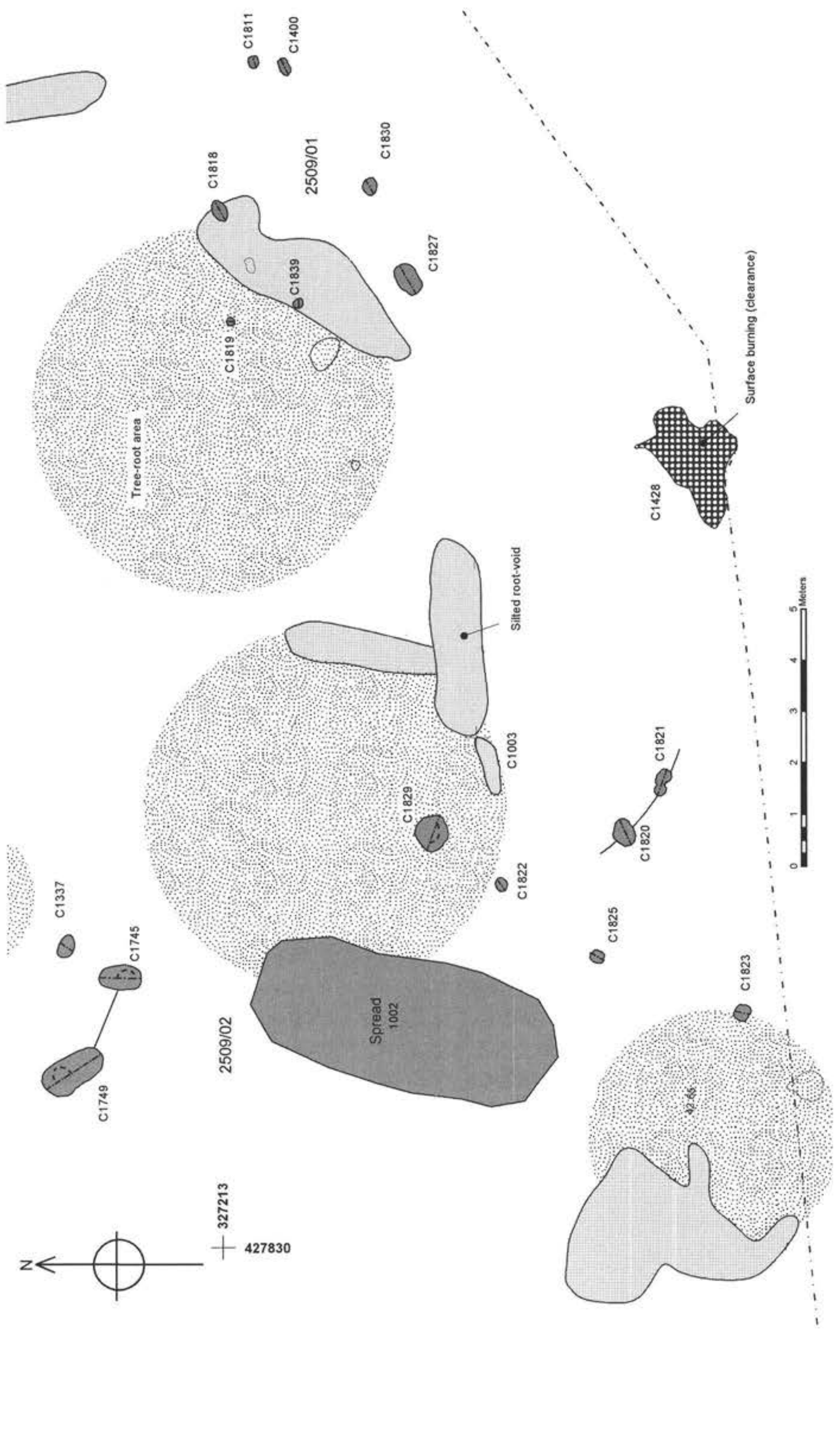


Fig. 12: Group 2509 pits, postholes and spreads.

2509/01

On the eastern side of this area was a cluster of seven such features; four (C1811, C1400, C1830 and C1827) can be fitted to an arc of 5m diameter, however, these features varied from 40 -100mm in depth and it is unlikely that they supported the posts of a roofed structure. The features post-dated a silted root-void.

2509/02

To the west was another cluster of deposits. Spread 1002, and pits C1829, and C1745 and C1749 to the north, all produced some Neolithic pottery. The later two pits were both oblong, well-defined and relatively deep (0.30 and 0.22m respectively). Both contained sealed fills with distinct charred components.

C1829 was round and shallow (0.11m deep) with a grey brown silty clay fill and contained Neolithic pottery, one sherd of which was submitted for residue dating (1004, OxA-14481; 3489 ± 35; 3500–3020 cal BC). 1002 was a thin spread of charcoal rich soil. Pottery was also recovered from the surface of a probable root-void silting 1003.

Five more post-holes up to 0.10m deep lay to the south. A number of different arcs may be used to associate these features, but the patterning is not particularly persuasive.

On the southern edge of the excavations, an area of distinctive *in situ* surface burning was probably from the Late Neolithic/Early Bronze Age fire clearance phases (C1428).

Groups 2513 and 2530 (Figs 6, 13 and 14)

On the northern side of Zone 2 further structural features were recorded. A pair of identical well formed post-holes, C1756 0.35m deep and C1758 0.24m deep, both contained packing cobbles, but no post-pipes. Thirteen sherds of decorated and plain pottery were recovered from both features.

A further five discrete pits, some showing signs of re-cutting were recorded to the west of the post-holes, although none were as well formed. Worked flakes, bladelets, a bladelet core and a scraper were recovered from pits C1785 on the northern side and C1807 in the south of the group.

All these features fell within the probable root area of a tree that had fallen to the north-west and been subsequently burnt (C1933). It is unlikely that the post-holes, particularly those directly below the root diameter of the tree, would have survived without at least some visible disturbance. It therefore seems likely that these features post-date the tree burning episode and are therefore of Late Neolithic or Early Bronze Age date, but contained residual Peterborough Ware pottery.

Some 14m to the north-east was a crudely stone-lined pit that had clear evidence of *in situ burning*, and was probably used as an oven (C2077 0.21m deep) (Fig. 13). A flood event had caused some localised reworking, with burnt clays from the feature visible as distinct trails of rubified material down slope to the north, toward the nearby in-filled stream.

The remnants of a decayed animal jaw were recorded in the primary and predominant fill (a dark grey brown silt (2076)). Fired clay, interpreted as parts of a superstructure were found in the top of the feature (2068); the failure of archaeomagnetic

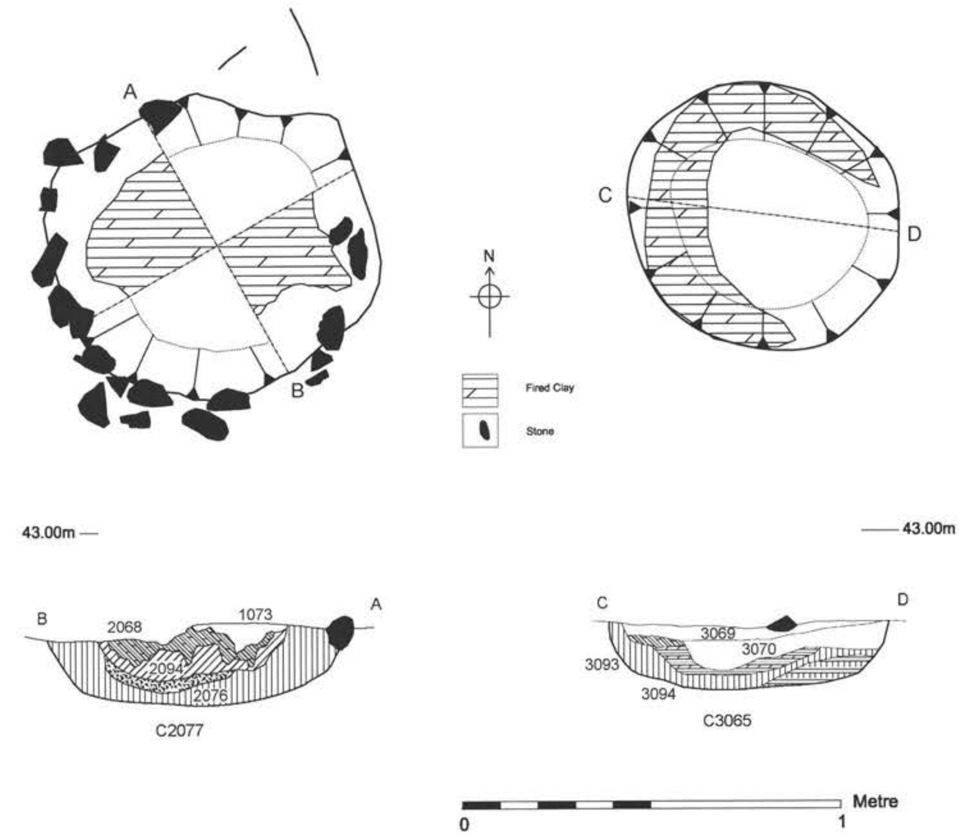


Fig. 13: Sections through Ovens: 2077, Group 2530 and 3065, Group 2516 (see Fig. 15 and Fig. 16 for locations).

sampling to date the fired clay concorded with the on-site interpretation that the material had slumped and was no longer *in situ*. (Paul Linford *pers. comm.*).

Charcoal from the feature was submitted for radiocarbon dating to help date the flood event that had reworked the feature's fill. The reworking must have occurred before the feature had become integrated into any soil that would have formed over it following its abandonment. The date for the charcoal would therefore give a *terminus post quem* for the flood event, and may also be an indication of the start of alluviation. Two dates were determined of 3640–3370 cal BC (SUERC-7595; 4740 ± 35 BP) and 3490–3100 cal BC (OxA-15044; 4556 ± 34 BP). These dates are not statistically consistent (T' = 14.2; ν = 1; T'(5%) = 3.8; Ward and Wilson, 1978), and the latest date 3490–3100 cal BC (OxA-15044) therefore provides a *terminus post quem* for the flood event (Marshall, below p. 80).

Group 2516 (Figs 6, 13 and 15)

To the south of Group 2513, a well formed pit C3065 (0.15m deep) was located that had been used as an oven and contained fired clay lining material, 40 sherds of

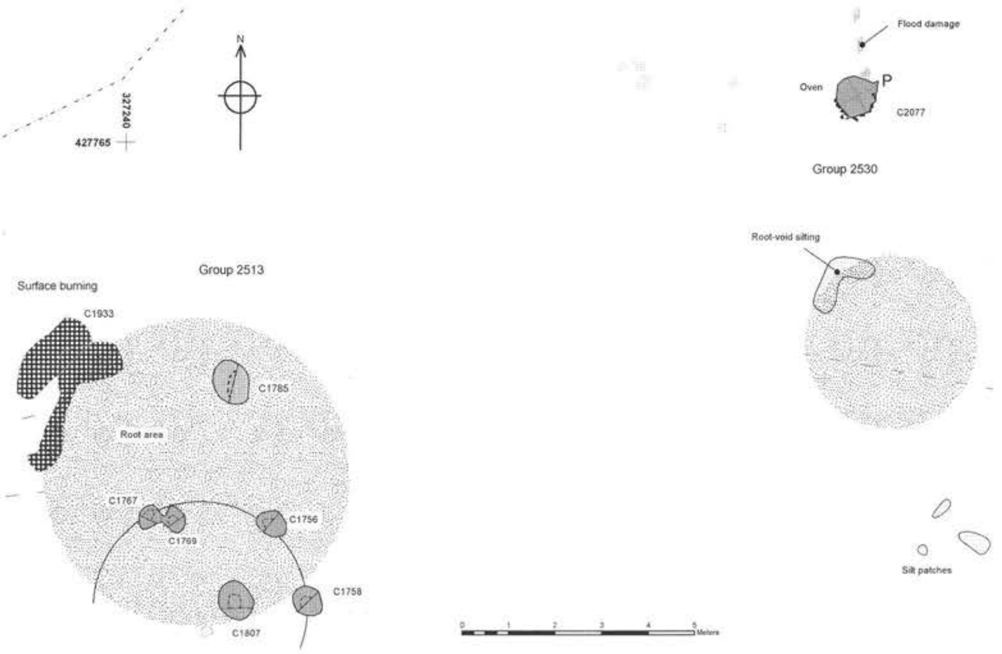


Fig. 14: Group 2513, and Group 2530 (Oven 2077) to north-east.

Peterborough Ware, flints, charred plant remains and unidentifiable calcined bone. Several fills were recorded, including an upper clay layer with lumps of fired clay (possibly derived from a collapsed lid or superstructure (3069) above a mixed clay layer (rich in pottery and charcoal (3070)), above yellow and red burnt clay linings (3093, 3094, 3095).

To the south of this feature were a number of silted root-voids and upcast ridges, from at least one substantial tree-fall. Fifty-five sherds of Peterborough Ware and Beaker pottery were excavated from these layers, all of which showed some abrasion. The Beaker pottery came from a likely area of natural redeposition rather than an area of root-void silting. This indicates that a tree had fallen-over within an area of Middle and later Neolithic occupation, with resulting disturbance and burial of the pottery.

The abrasion study shows quite clearly that the only unabraded sherds were recovered from the only *in situ* feature — the oven, C3065, and that the other deposits had incorporated material that had been lying on the ground surface for some time prior to burial.

Group 2518 (Figs 6 and 15)

A substantial spread of orangey grey brown silty clay (80, 1778) up to 0.20m deep was found to have filled a slight hollow, and overlie a number of features. These included gravel upcast ridges, several silt filled root-voids (e.g. C1780) and a number of ambiguous silty patches that might represent either features or further root-voids.

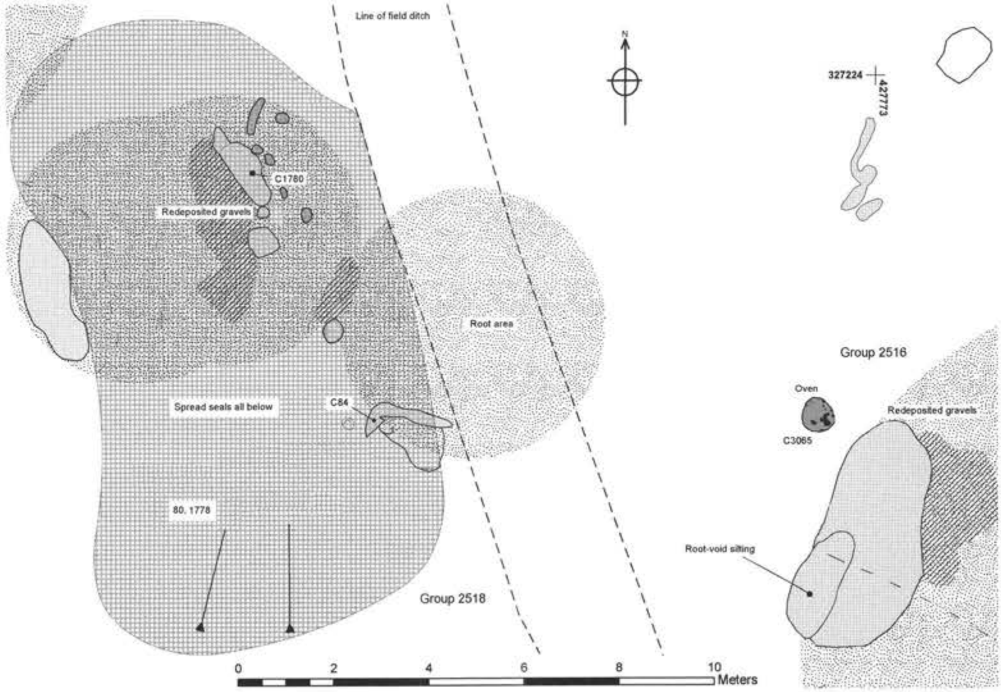


Fig. 15: Plan of Groups 2516 and 2518, fallen tree groups, and Oven 3065.

Neolithic pottery was recovered from 15 contexts in this area, which included the spread. Sherds with fresh breaks were recovered only from an initial cleaning of the spread (80); the pottery from all other contexts including the silt filled root-voids showed degrees of abrasion. Mildenhall Ware and all Peterborough Ware sub-styles were present indicating a longevity of build up. The origin of the fresher unabraded sherds was not identified — it is possible that this was destroyed by the field ditch which truncated the group on its eastern flank.

The shallow features immediately to the east of the northern root-void are not sustainable as features of occupation *per se.* However, the quantity of pottery (98 sherds) and lithics from this area is evidence of some activity focus. Given the degree of abrasion it seems most plausible that this activity occurred before the tree-falls within which the abraded material became incorporated. No unequivocal cut features were identified within the putative root areas belonging to the recorded root-voids and, on this evidence, the trees may well have post-dated the occupation.

Group 2526 and 2541 (Figs 6 and 16)

Groups 2526 and 2541 were recorded on the eastern end of zone 2. Deposits comprised a mix of tree-fall and archaeological features with surface spreads of varying depths incorporating archaeological material, the majority of which was abraded.

Two relatively deep elongated pits delineated an eastern boundary to the complex (C1942 and C1955). Both were asymmetrical in profile. C1942 showed undercutting edges to the east up to 0.50m deep indicating that it was a silt filled root-void from a

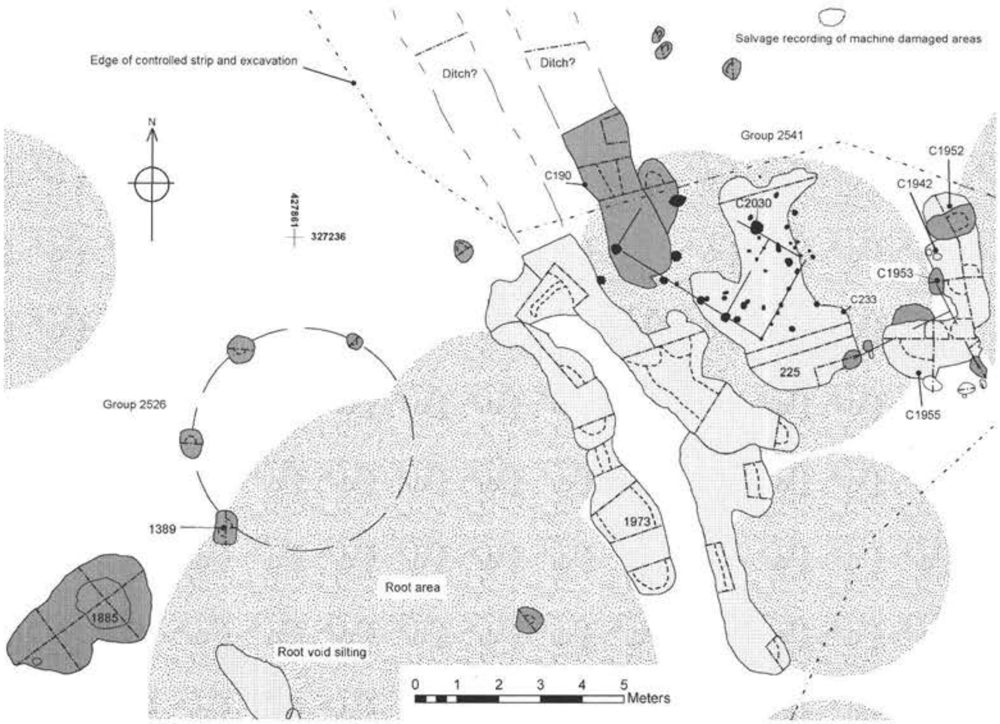


Fig. 16: Plan of Group 2541 and 2526 deposits.

tree that had stood further to the east and fallen to the west. C1955 had steep edges to the north indicating that a tree had stood to the north and fallen to the south.

The roots had been replaced by a series of grey to orangey-brown silts and clay silts, which contained abraded Peterborough Ware (Mortlake/Fengate; C1942, fills 1939, 1938, 1934 and 1935). Cutting the last of these silts and thus post-dating the fallen tree was a sharply defined small pit or post-hole C1953, which contained large unabraded Peterborough (Fengate) Ware sherds (1870). Two further post-hole bases to the south-west (one cutting the spread that sealed the stake-hole features below) may be related.

On the western side was a spread (225) filling a slight hollow (C233) up to 0.08m deep of dark grey-brown silty clays. Sherds of abraded Neolithic pottery, including Earlier Neolithic bowl, Ebbsfleet and Peterborough Wares, and fragments of fired clay, one with a possible wattle impression, were recovered. One sherd of Peterborough Ware was submitted for residue dating (below p. 80). Below the spread were numerous small stake-hole bases (between 20 and 70mm in depth) and one small pit or post-hole (C2030). These structural features had a regularity and coherence and probably represent a small structure 1m wide and between 2m and 4m long. The lightness of the construction suggests that it was unlikely to be roofed, and it may have been an animal pen rather than a building *per se*. On the basis of the post-hole group to the east being of a *bona fide* Fengate date these features, sealed by the spread, must be a little earlier.

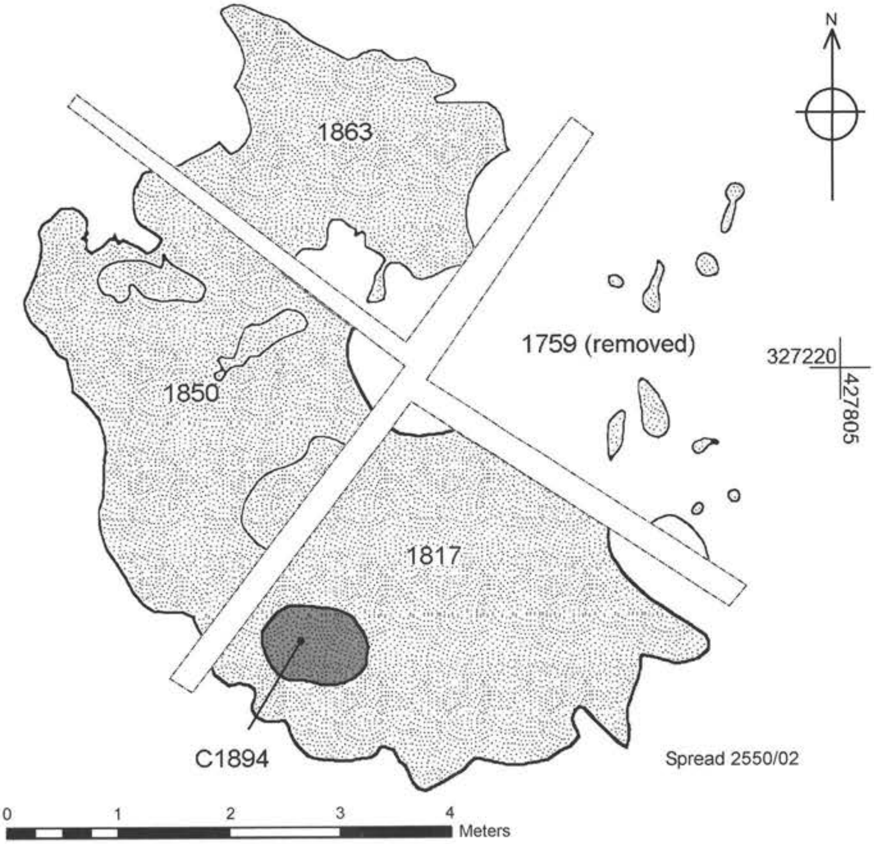


Fig. 17: Spread and pit underlying Burnt Mound I (2550-01/02).

The butt-end of a shallow linear feature up to 0.21m deep, was recorded cutting an earlier pit on the northern edge (C190). Pottery from the upper filling included Early Bronze Age sherds. A possible northern continuation of this feature and a parallel ditch 1m to the west had been badly damaged by dumper truck ruts.

To the south of the ditch terminal were a number of shallow curving elongated spreads, many containing abraded Peterborough Ware sherds, which varied from less than 0.05 to 0.30m in depth. The plan of all these features suggests that they may be root-voids, although this cannot be confirmed from their profiles which were in general shallow but symmetrical.

Although the juxtaposition of the ditch end, the putative pen and the curving spreads could suggest evidence of association, within the context of the palimpsest revealed on the site as a whole, this is uncertain.

Between the root-voids in the east and the spread in the west is a clear absence of features, perhaps due to tree-fall root damage.

Sherds from the silting layers were mainly very abraded while sherds from the probable post-hole (C1953) were the only unabraded pieces. This small area has clearly seen repeated activity in the earlier Neolithic period and the Early Bronze Age. The extent of residuality is impossible to gauge.

Seven metres to the west of the western spreads were four possible post-holes, Group 2526. Ranging from 0.14 to 0.20m in depth all were filled with yellowish to greyish-brown sandy clay. The four features may form an arc of some 2.5m radius. One small sherd of Peterborough Ware was recovered from the fill (1389) of the southernmost feature.

Two metres south-west of the westernmost pit was a spread of light yellowish-brown clayey sand filling a shallow hollow. The northern end of the hollow deepened, and contained a layer of yellowish to greyish-brown clay with 15% fire-cracked stone, four flint flakes and some charcoal (1885) covering an area of around 1m^2. Despite the presence of the heated stone, no evidence was found of *in situ* burning.

Group 4501 (Fig. 3)

The butt-end of a wide curvilinear feature, C4121 0.25m deep was excavated and appeared to cut alluvium and also be partly sealed by it. A quantity of decorated pottery and three flints were recovered.

A number of other small pit-like features in the vicinity were probably naturally filled, clay plugged hollows. The common occurrence of fired clearance-deposits in these areas frequently led to the alluvial redeposition of charcoal in the tops of features, giving an archaeological appearance to features of natural origin.

Burnt Mound I: interior and exterior features

Groups 2550/01, 2550/02, 2550/3, 2529 and 2551

Peterborough Ware and flints were recovered in some abundance from, and to the south of, a low mound located near the apex of the gravel islands (Zone 2). The mound and all underlying deposits were fully excavated by quadrant.

Group 2550-01 Middle Neolithic (Figs 6, 17 and 20)

The earliest deposits found were the discontinuous remnants of a spread of dirty grey gravelly clay (1978, 1980, 2063 and 2065) up to 0.20m deep that lay above the natural substratum, filling various subsoil hollows and containing sherds of an Early Neolithic bowl, some Mildenhall and Peterborough Wares, with some of the latter showing abrasion. A radiocarbon measurement was obtained from a residue adhering to the interior of a sherd of Neolithic Plain Bowl of 3700–3530 cal BC (OxA-14481; 4849 ± 35 BP, see below p. 80).

Cutting the spread was a well defined pit, C1894, 1m × 0.70m × 0.40m deep on the south side of the area. Three fills comprised a primary slump (1930) and a predominant secondary orangey-grey sandy clay (1896), which was capped by a thin darker gravelly clay layer that contained some burnt gravel (1895). Peterborough Ware was recovered from 1896 and an Earlier Neolithic bowl sherd from 1895.

Group 2550-02 Middle Neolithic (Fig. 20)

A layer (1759, 1817, 1850 and 1863) of mid/light orangey-grey sandy clay with discrete patches of intense charcoal, and occasional fragments of fire-cracked stone sealed pit

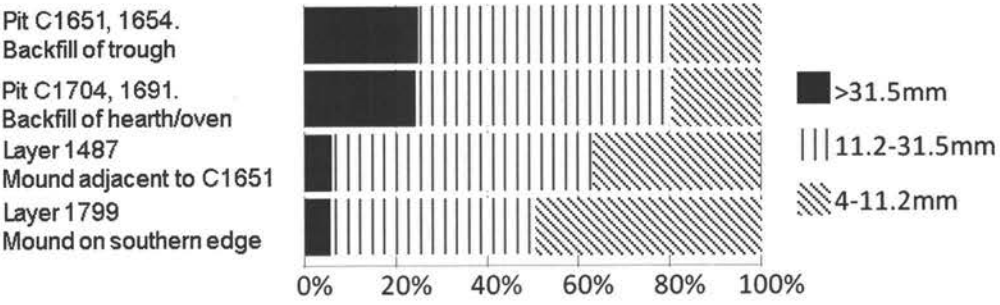


Fig. 18: Proportion (by weight) of stone from Burnt Mound.

1894. This continuous layer, up to 0.10m thick, was substantially thicker than the darker layer of burnt stone and charcoal above it. Peterborough Ware was recovered from all four excavated quadrants.

Statistically consistent radiocarbon determinations (T' = 3.2; ν = 1; T'(5%) = 6.0; Ward and Wilson 1978) (OxA-15046; 4607 ± 35 BP; 3500–3340 cal BC; SUERC-7605; 4695 ± 35 BP; 3630–3360 cal BC) were obtained from two single fragments of charcoal from a sample taken from the south-east quadrant (see below p. 77).

Group 2550-03 Late Neolithic/Early Bronze Age (Figs 18, 19, and 20; Plates 1, 2 and 3)

The burnt mound comprised a kidney-shaped layer (1487, 1773 and 1799) of charcoal and fire-cracked stone and rich dark orangey-grey clay up to 0.04m thick. One metre square areas of material were fully sampled to provide environmental and burnt stone information. Statistically inconsistent radiocarbon determinations (T' = 13.2; ν = 1; T'(5%) = 3.8; Ward and Wilson 1978) from the layer of 2300–2040 cal BC (SUERC-7598; 3775 ± 35 BP) and 2040–1880 cal BC (OxA-15111; 3610 ± 29 BP) indicate that it contained material of different ages.

Central to the layer were three large pit features. The first pit (C1704) was 1.30m in diameter, 0.45m deep and contained three fills capped by alluvium. The upper fill (1691) appeared continuous with the uppermost burnt mound layer (1487) but was made distinct by the increased density and size of fire cracked stones that appeared to have been burnt *in situ*. C1691 was interpreted as representing a final use of the burnt mound, and material was submitted for radiocarbon dating and produced statistically consistent measurements (T' = 0.2; ν = 1; T'(5%) = 3.8; Ward and Wilson 1978) of 2280–2040 cal BC (OxA-15113; 3754 ± 28 BP) and 2400–2030 cal BC (SUERC-7909; 3780 ± 50 BP) (below p. 77). The middle fills were predominantly clay with some burnt gravels that had been backfilled into the feature while the primary layer, 1712, contained more burnt material. C1704, interpreted as a *hearth* or *oven*, did not penetrate the water-table when excavated. Few signs of waterborne fills (other than sealing alluvium) were recorded, and it seems likely that this feature remained essentially dry. When the excavations were hampered by high levels of rainfall, this pit remained dry where its neighbours filled with, and retained, water (Plate 1).

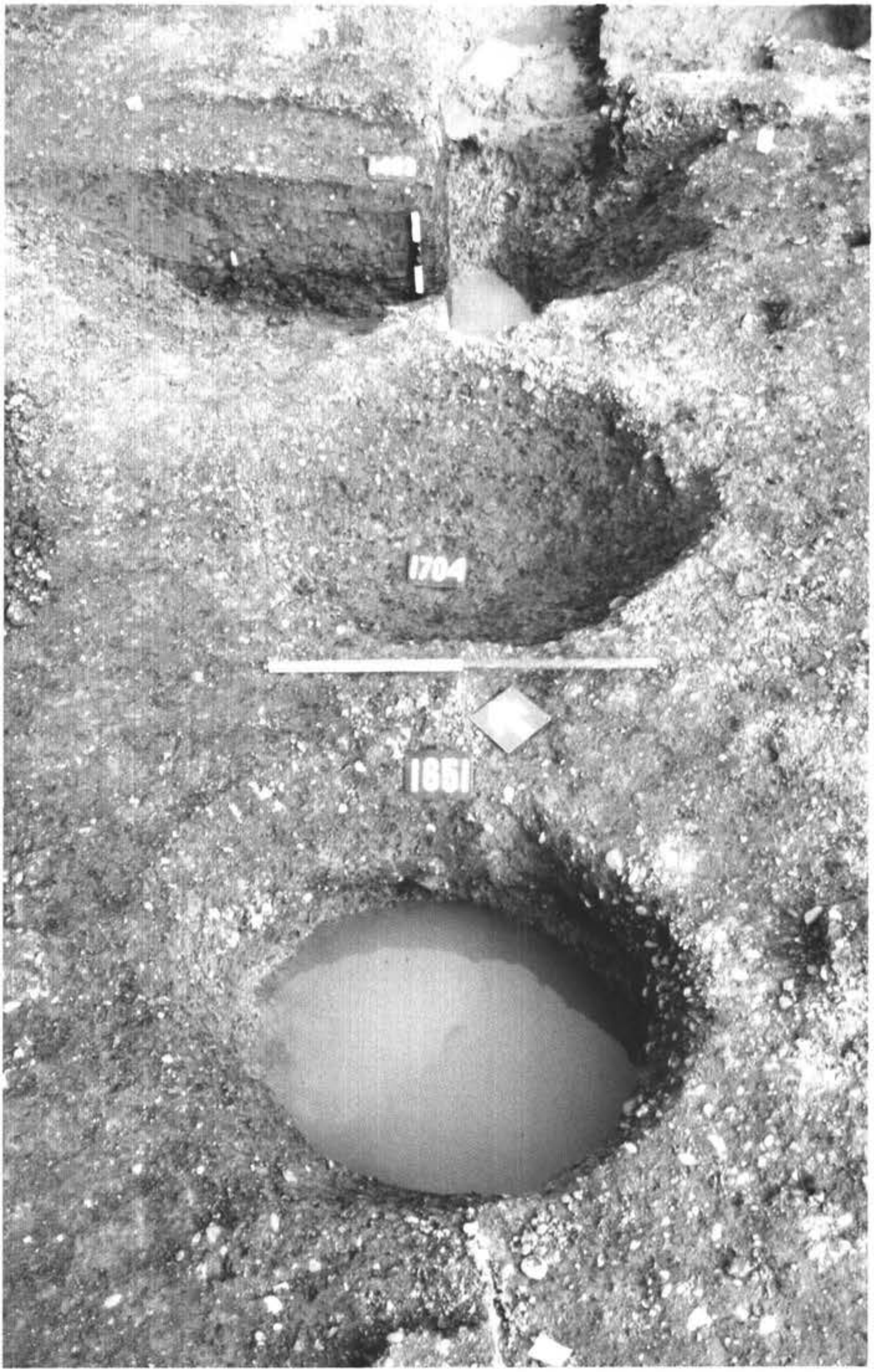


Plate 1: Water-bearing central trough C1651, free-draining hearth/oven pit C1704, and C1483 tank beyond.

Pit 1704 was central to two deeper pits; C1651 to the south and C1483 to the north. C1651, the second large pit, was approximately 1.15m in diameter, 0.50m deep, had round and steep sides giving way to undercut lower edges and either a decayed clay lining (1741) or thick interface with the natural clayey gravels — both indicators that the pit was probably water bearing during its life. Fills included a 0.10m thick layer of probable slump, a dark grey, loose clayey gravel evenly spread across the pit's base (1652) and sealed by a 0.30m deep layer of dark grey sandy clays with frequent gravels (1653). A thin layer of stone free, charcoal rich silty clay (3008) accumulated above 1653, and was itself sealed by alluvially derived tertiary fills (1654 and 1638). Layer 1653 contained fragments of calcined cattle teeth, and was interpreted as a backfill deposit into the feature following the last usage of the burnt mound. It was, therefore, also selected for radiocarbon dating and produced statistically consistent measurements (T' = 1.0; $\nu = 1$; T'(5%) = 3.8; Ward and Wilson 1978) of 2200–1970 cal BC (OxA-15114; 3695 ± 29 BP) and 2280–2030 cal BC (SUERC-7604; 3740 ± 35 BP) (below p. 77).

C1483, the third large pit, had a steep southern edge (0.70m deep), but more gradual northern sides. It contained a similar fill pattern to C1651, with organic primary fills rich in charred remains, sealed by less rich upper fills, capped with sterile alluvium. Layer 1582, above the primary fill, comprised mostly charcoal (up to 60mm),with some clay and occasional burnt gravels, and from the excavation of the layer to the south (as 1688) several fragments of possible oven plate (below p. 107). The deposit is interpreted as a dump of spent fuel from the adjacent hearth or oven. It was selected for radiocarbon dating, to help clarify the chronology of the last use of the feature, and produced statistically consistent measurements (T' = 0.5; $\nu = 1$; T'(5%) = 3.8; Ward and Wilson 1978) of 2210–2020 cal BC (OxA-15112; 3721 ± 30 BP) and 2200–1960 cal BC (SUERC-7602; 3690 ± 35 BP see below p. 77). The feature is described as a 'tank' differentiated from C1651, the 'trough', as although both pits shared similar characteristics, their profiles were different. C1483 cut through another substantial pit, C1676 (0.45m deep), which lay further to the south. This pit contained several layers of gravelly clays and, on its southern edge, a layer of charcoal rich soil up to 0.06m thick. The edges of this pit, where surviving, were gradual.

To the south-east of C1651, was a small bowl-shaped feature (C1892), up to 0.20m deep and filled with a dark sandy clay, rich in charcoal and fire cracked stone. It was sealed by a thin covering of the burnt mound layer, but clearly cut the earlier spread (1980). This feature had possibly been used as a hearth, although equally may represent a secondary deposit of burnt material. Radiocarbon determinations of 2140–1920 cal BC (OxA-15115; 3649 ± 33 BP) and 3630–3360 cal BC (SUERC-7606; 4695 ± 35 BP) are not statistically consistent (T' = 473.1; $\nu = 1$; T'(5%) = 3.8; Ward and Wilson 1978) and indicated the deposit contained material of different ages.

On the north-east side of the mound was a linear hollow (C1460) filled with silty alluvial clay. The feature was investigated in several segments. This was wide and well-defined to the north (2m wide by 0.15m deep) but narrower, shallower and more irregular in the south. Below 0.10m of alluvium, remains of a dense surface of packed pebbles and cobbles up to 0.08m in size were found (1750) which, to the north of C1676 (where it was up to 0.07m thick), sealed an earlier pit deposit C1784.

A number of small pits were also found cutting the surface in the area of the 'tank' features C1800 (0.15m deep) and C2005 (0.21m deep). Cutting the south-eastern edge of the earlier 'tank' (C1676) was a further small pit C1874 (0.10m deep), and cutting the later 'tank' (C1483) was another, C1876, a tapering pit or post-hole (0.25m deep), filled by a grey clay with a thick charcoal lens on the northern side.

Group 2529 (Fig. 19)

Several metres to the south of the mound area were a number of pits/post-holes. From west to east these comprised C1869, a 1.30m diameter pit, with a single fill of grey brown sandy clay (1862) 0.18m deep, that contained some Peterborough Ware, a blade and a flake. The pit was cut by an ovoid post-hole C1868 (0.15m deep) which was similar to another four that extended at around 2.30m spacings on an arc to the north-east: C1803 (0.10m deep), C1809 (0.22m deep), and C1833 (0.37m deep). C1833 contained a deposit of charcoal at the base. The arc of probable post-holes appears to limit the broad spread of pottery and lithics that were recorded on the ground surface. This tentative relationship suggests that the arc represents a discontinuous boundary or fence contemporary with the Middle Neolithic activity.

2550-04 (Fig. 19)

The mound layer was disturbed by a number of small discrete but irregular anomalies (both centrally and to the north-east), filled with either alluvial clays or burnt mound material. These are interpreted as tree-root damage.

Burnt Mound II (Middle Bronze Age) (Figs 3, 21 and 24)

Three distinct phases of palaeochannel activity (N, M, and J) were identified within which the Burnt Mound activity was stratigraphically sandwiched. The site had clearly suffered varying degrees of post-depositional slumping. Organic components within peat layers and silty peat channel fills had become compressed over time, leading to vertical slumping of some 0.40m. This had also resulted in the obliteration of some physical stratigraphic relationships at the edge of the channel over which the wood-lined trough had been sited.

The activity is described in phase order.

Phase 1 *(early Post Glacial palaeochannel)*

Group 4565 Channel N (Figs 3 and 21)

Channel N (C4397) broadly ran west-east, but its profile was mostly obliterated, bar its southern bank, with little recordable form. It contained deep organic fills comprising distinct dark brownish black friable peats (interspersed with lenses of creamy white coloured silts) which deepened significantly from south to north. A column (Column 7) and bulk samples were taken. Channel M (C4610) had cut a course through these peats (Fig. 24).

The distinctive dark and organically rich peats of this phase extended, on the channel's southern margins, below the trough of the Burnt Mound II. The loose and open structure of these peats were the probable cause of the structure's demise, with the

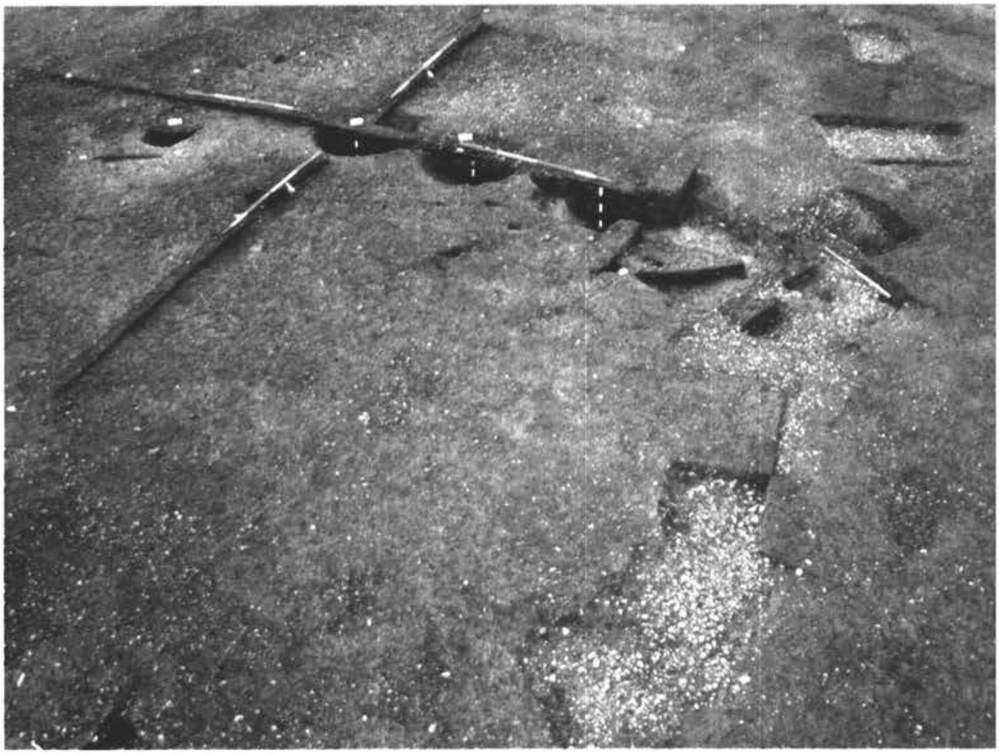


Plate 2: Burnt Mound I, Group 2550, part-excavated from the east. The ranging rods sit on narrow baulks of the burnt mound layer and converge on trough feature, C1651.

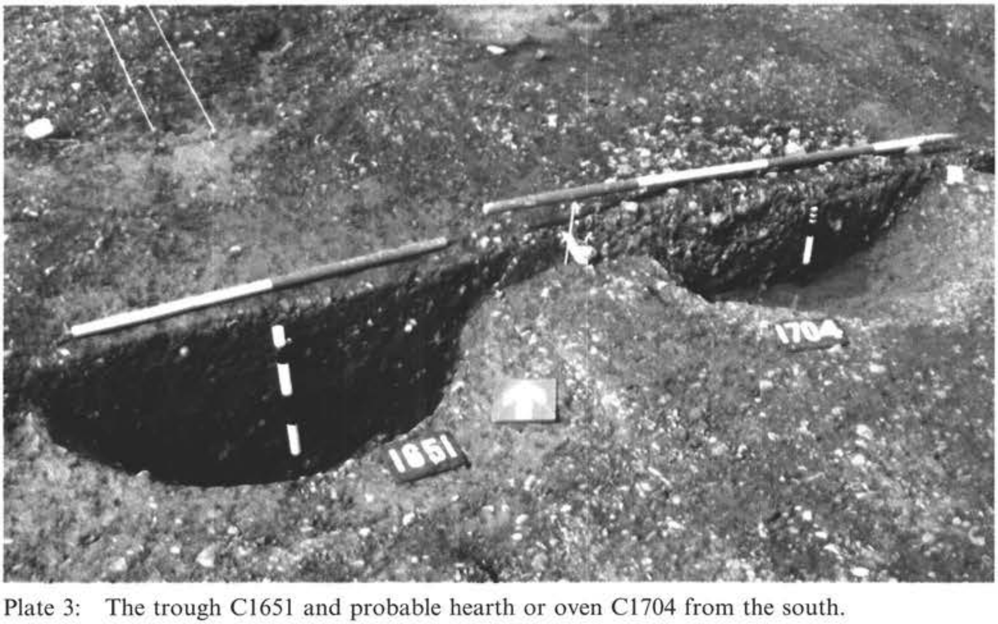


Plate 3: The trough C1651 and probable hearth or oven C1704 from the south.

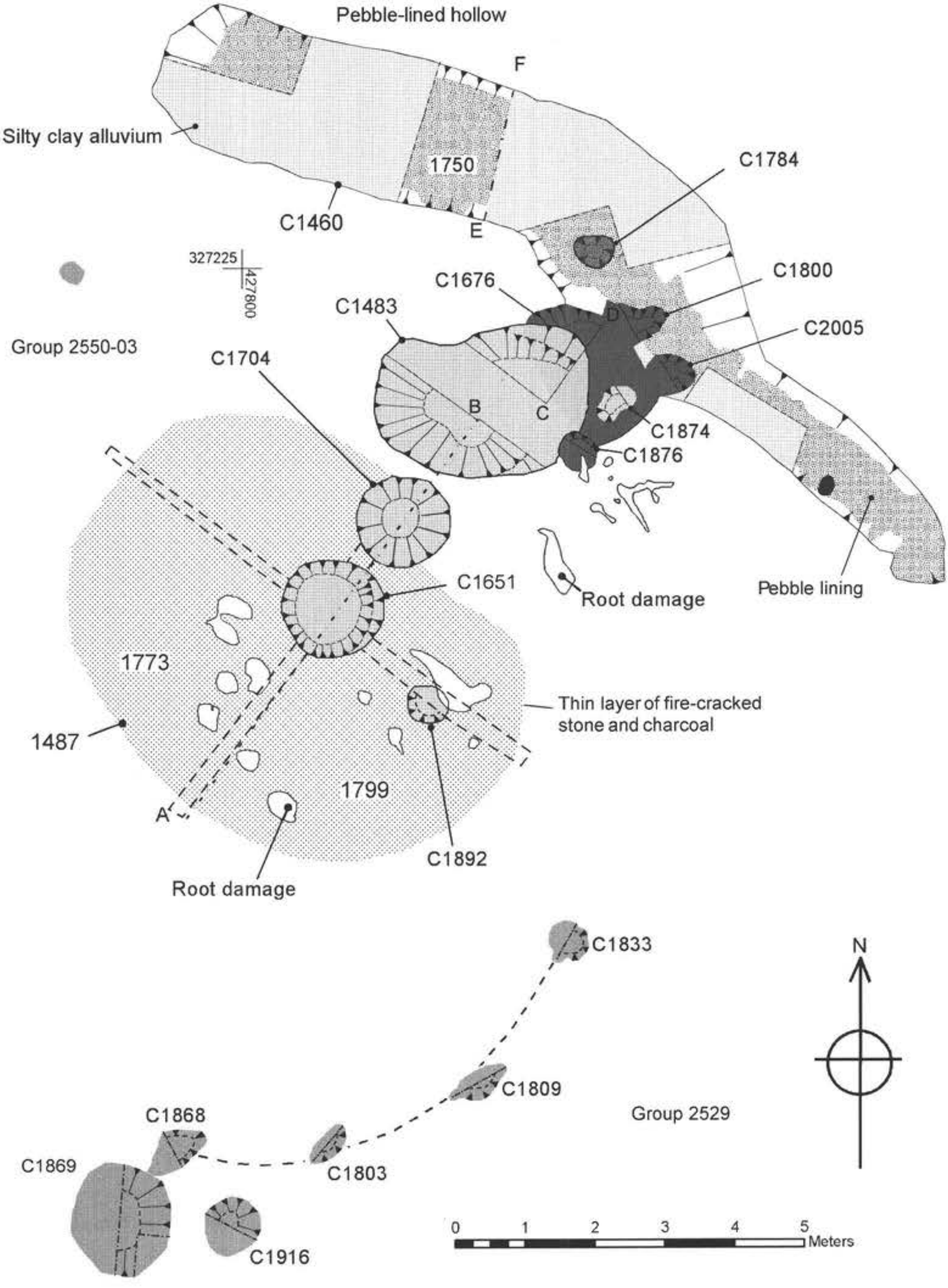


Fig. 19: Burnt Mound I and adjacent features.

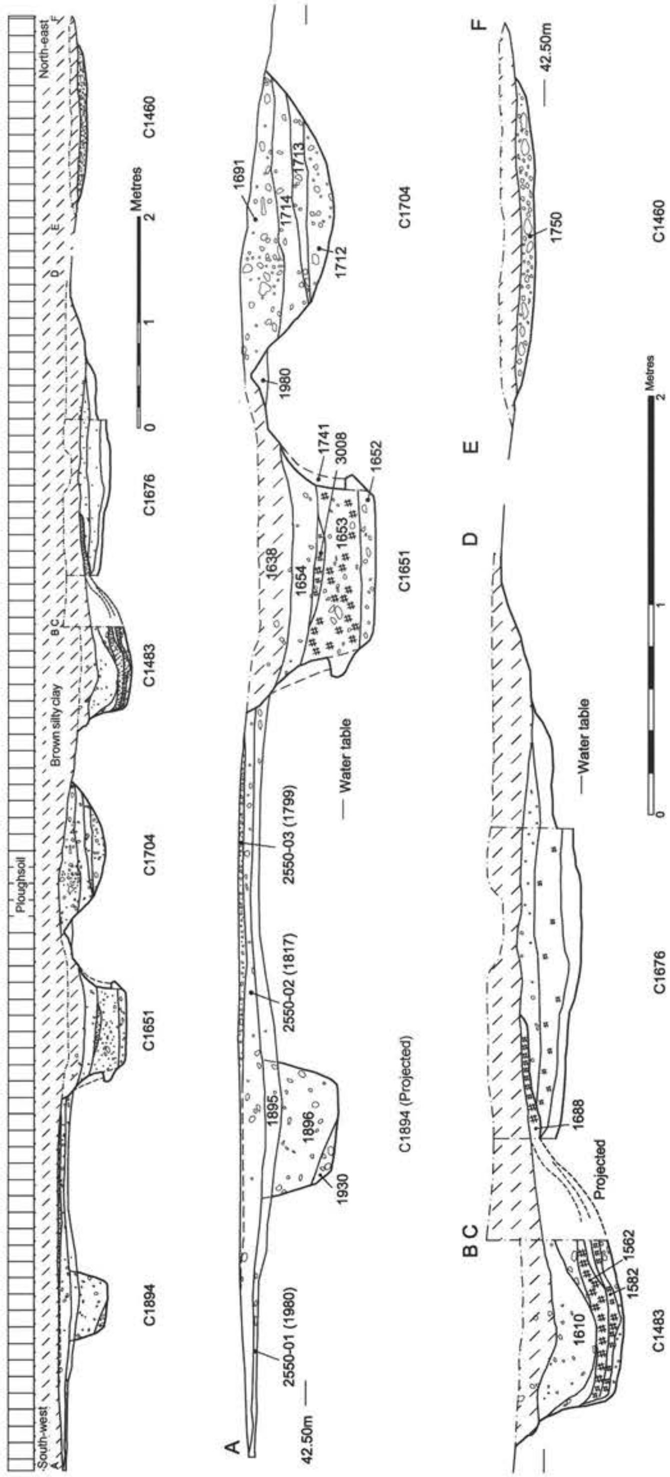


Fig. 20: Composite section through Burnt Mound I and earlier deposits.

predominant lines of fracture and slumping in the timber-lined trough corresponding well with the southern bank of Channel N.

These deposits were similar to palaeochannel deposits recorded and sampled (Channel G and Channel I) on the southern edge of the site, 70m to the south, although no physical links between them can be made. Greig has noted a similarity between the archaeobotanical remains from Channels G and N (below p. 134). Radiocarbon dates from the base and middle of Column 1 indicate an early Post Glacial date 11410–11230 cal BC (SUERC-7351;11405 $\pm$ 45 BP) and 11820–11510 cal BC (SUERC-7350; 11780 $\pm$ 45 BP), making it the earliest chronological deposit sampled on site.

A single inverted timber (T22), was found embedded in the upper levels of this channel. It had clearly not been driven into the peats, or placed in a hole and may represent a branch fall from this or a later period.

Phase II

Group 4564 Channel M (Figs 3, 21 and 24)

Channel M (C4610) was a shallow, 6m wide palaeochannel which turned sharply from the north to the east within 6m. Post-prehistoric channels D (C4607) (Fig. 3) in the north and J (C4395) in the east (Figs 3 and 21) truncated it. The disturbance from Channel J may have also included some re-working of Channel M infill material, as well as its truncation, as the alignment of the timber cluster that lay below the line of the later channel (and was truncated by it on its eastern edge) suggests that these timbers may have been disturbed (Fig. 21).

Channel M was part hand excavated as part of the Burnt Mound excavations, providing a transverse section running from the edge of the timber trough, through the channel deposits. The post-depositional slumping of the trough over the early phase channel peat resulted in the destruction of stratigraphic relationships in this area.

The channel profile was in-filled on its internal bend with heterogeneous alternating lenses of blackish brown peat and dark yellowish brown sands. The base of the channel was defined by a gravel layer overlain by light greyish brown peaty silt (4453) which contrasted sharply with the dark and fibrous peats of the earlier Channel N, with some sand and gravel lenses apparent. The peaty silt contained numerous small branches and twigs and archaeological timbers; 42 were recorded of which 24 showed chop marks (Fig. 54).

Two broad clusters of timbers were identified (Fig. 21); one to the immediate east of the trough, and one 4m south-east. Of 37 pieces selected for detailed recording, 24 had evidence of chopping in the form of well-preserved cut faces, mostly single blows on the timber ends (below p. 124).

The cluster to the immediate east of the trough appeared to converge at a small single upright (T20 0.23×0.04m diameter) without being joined (Fig. 54). One timber pole (T13) was notable for its length of 4.85m, running across the channel. On the basis of the density of timbers adjacent to T13, and their absence to the immediate south of the cluster, it can be inferred that the channel was flowing from north to south. The timbers may have been introduced to consolidate the silting channel; a not dissimilar phenomenon was suggested at Waycar Pasture, Nottinghamshire (Garton

1993a, 149), or alternatively they may simply represent debris caught in a log-jam formed by the pole (T13) and small upright (T20).

Other distinct layers included a twiggy, woody layer (4456) and a thin lens of dense leaf litter (4466) up to 10mm deep, the only clearly defined layer of leaf horizon found. The leaf litter lens contained leaves and buds of birch, alder, hawthorn and nettle (below p. 133), and was radiocarbon dated to 1200–920 cal BC (Poz-18010; 2875 ± 35 BP). A weathered and possibly gnawed Ox calcaneum was recovered from 4453.

Within the timbers at the base of the channel, adjacent to the trough, were a small number of fire-cracked stones and charcoal which became more dense at higher levels. These were not found in distinct sorted horizons and it is probable that they were *in situ*, although there had clearly been extensive slumping of all the deposits as indicated by the deformation of the later trough structure.

The second cluster included two tree stumps, and some larger timbers. The later Channel J crossed and truncated the south-eastern corner of this group (Figs 21 and 24), and some re-working is likely. One timber from the group, had been burnt and also bore tool marks. It was the only sizeable piece of oak from the channel but unfortunately could not be dated by dendrochronological analysis. Two timbers within the second cluster were probably *in situ* of which only the preserved bases survived (all were less than 0.27m long). They had clearly been eroded before being sealed by silts and are probably related to activity unconnected with the burnt mound (*for example*, revetment of the later channel J).

Five metres to the south-east of the trough two horse/ox ribs were recovered during the initial cleaning of the area, (4415). Parallel scrapes on the surface may have resulted from butchery. These may have derived from either the top of Channel M or the base of Channel J. Part of a human, adult male (23+) femur (below p. 116) was also recovered from the interface of the same two channels and also may have derived from either channel. A piece of horse femur also showing cut marks was recovered from a later palaeochannel immediately to the east.

Group 4563; Trough C4468 and Burnt Stone Spreads (Figs 21, 22, 23 and 24; Plates 4 and 5)

Thin layers of fire-cracked stone and charcoal were recorded to the west of Channel M. The main spread of fire cracked stone (4458) was 'U' or sharply crescent shaped and skirted the central pit, with a concave face open to either the channel or marshy ground to the east. The spread covered an area somewhat less than $2m^2$ in total (3.5m by 1.30m) and was up to 0.07m in depth. It comprised mostly whole and unshattered, but nonetheless, burnt stones up to 0.10m long. The spread was widest on the western and southern sides of the central pit and relatively thin on the pit's corners. Little charcoal was visible within this layer.

The rectangular pit (C4468) was interpreted as a trough, designed to hold water. The pit cut measured approximately 2.2m by 1.3m, surviving to 0.30m deep. It had been lined with roundwood timbers and four uprights (below p. 126) reducing the surviving internal dimensions to 2.0m × 1m × 0.17m. Radiocarbon determinations from two separate timbers of ash and alder produced statistically consistent measurements

Fig. 21: Burnt Mound II.

(T' = 0.2; ν = 1; T'(5%) = 3.8; Ward and Wilson, 1978) of 1260–1000 cal BC (GrN-30408; 2920 ± 30 BP) and 1270–1020 cal BC (GrN-30409; 2940 ± 30 BP).

The trough was located on the lip of the steep western bank of the now silting stream Channel M. It lay over the organically rich peats of Channel N dating from the early Post Glacial period and later silty peats (Column 6; Greig, below p. 132). Consequent post-depositional slumping (Fig. 24), and the loss of the immediate stratigraphic relationships between trough and channel, make it difficult to be certain of the relative chronologies of trough and channel, although the trough post-dated peaty silt layers containing fire-cracked stone and charcoal, suggesting the location had seen burnt stone activity for some period. A sample of these layers was taken as Column 6 (Fig. 23), and radiocarbon measurements from these layers included the bottom and top of Column 6, 2150–1940 cal BC (Poz-18029; 3665 ± 35BP) and 1320–1050 cal BC (Poz-18009; 2965 ± 35BP) respectively.

On the north-eastern corner of the trough, a thin lens of dark brown and black charcoal and fire-cracked stone was cut by the trough construction (4483, Fig. 23); this radiocarbon dated to 1390–1040 cal BC (GrN-30412; 2980 ± 50 BP).

Three layers of fire-cracked stone also filled the western half of the trough (4479, 4480 and 4459, Fig. 23), and were visibly different to the surrounding spread (4458), containing more grits and charcoal, and notably voids. The general lack of compaction displayed suggests they were backfill layers that entered the trough with little evidence of weathering or silting between episodes. It is possible that these layers were introduced into the trough in the last usage. A flint blade fragment showing some signs of heating, but not to a high temperature (SF1038), was found in stoney fill 4459. The layers sealed several primary fills of dark grey anaerobic silty clays with significant charcoal components, and loose yellowish white sands which were also found between and clinging to the undersides of the timbers. The sands might either indicate the use of channel water or represent the remains of degraded fire-cracked sandstone pebbles. A central area of the trough base lining appeared blackened and lightly charred on its upper face (Fig. 60; Plate 5).

In two places a dense charcoal rich silty clay layer, up to 0.06m wide and 0.09m deep, was found infilling the area between the outer wooden lining of the trough and the cut (4497). This may either represent discarded spent fuel (although fire cracked stone was not apparent), or could represent an intentional filter. The cutting of the trough pit into the soft margins of the stream would have led to its infilling from the water-table. A similar range of species was identified within the charcoal from this deposit to that of the trough fills (below p. 123).

Two layers of organic silty clay (4463 and 4462, Fig. 23), much penetrated by roots, filled the eastern half of the trough and were sampled for environmental evidence (Column 5). The upper of these layers sealed the lowest layer of fire-cracked stone. Material from the lower layer was dated to 1130–910 cal BC (Poz-18007; 2910 ± 35 BP), and material from the upper to 1260–1000 cal BC (Poz-18006; 2845 ± 35 BP).

To the south of spread 4458 (upslope), two further distinct layers were recorded. 4477 and 4447 (Fig. 21) were dense and well-mixed deposits of fragmented and powdery fire-cracked stone and charcoal. Each was up to 0.05m deep with some increase in charcoal to the base. Although neither deposit sat in a cut, nor showed clear signs of scorching or burning *in situ*, both or either might represent hearth bases appropriately located on higher, dryer ground; however they may equally be re-deposited burnt material. Both deposits were sampled; material from 4477 produced statistically consistent radiocarbon measurements (T' = 1.3; ν = 1; T'(5%) = 3.8; Ward and Wilson, 1978) of 1380–1010 cal BC (GrN-30411; 2960 ± 50 BP) and 1390–1040 cal BC (GrN-30412; 2980 ± 50 BP).

4449 and 4450 were adjacent discrete layers of charcoal rich fire-cracked stone, 4m north of the trough (Fig. 21). Sloping down from west to east the layers lay above channel infill and were probably dumps of spent fuel and stone accumulating on the western edge of the now choking Channel M (Fig. 24).

All the above deposits could have been contemporary with the trough at some, possibly the last, stage of usage. Alluvially *reworked* layers of scorched and reddened clay (4417) were recorded filling the upper levels of channel 4610, and sealing 4477 indicating that other areas of burning existed in the close vicinity (Figs 21 and 24).

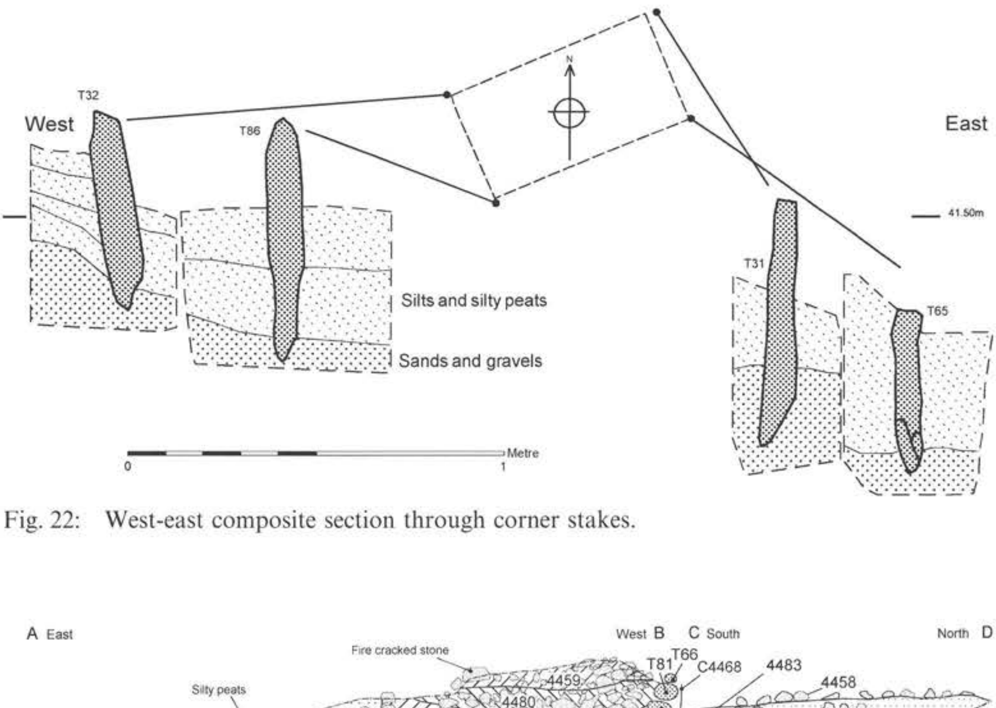


Fig. 22: West-east composite section through corner stakes.

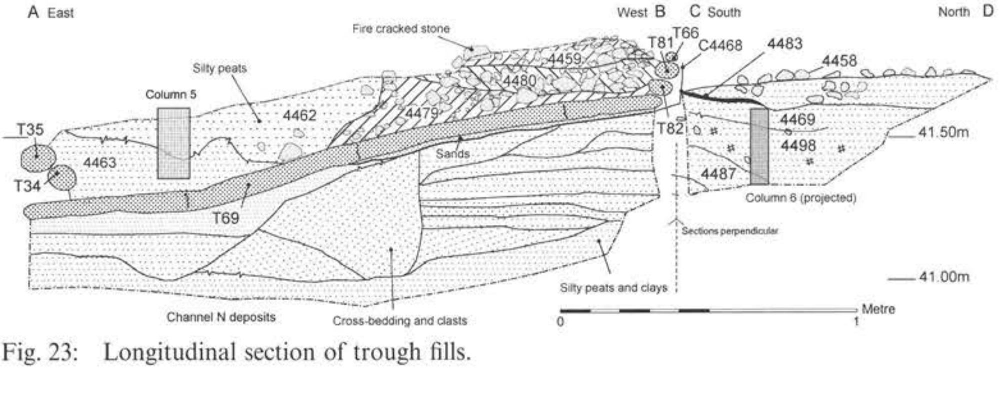


Fig. 23: Longitudinal section of trough fills.

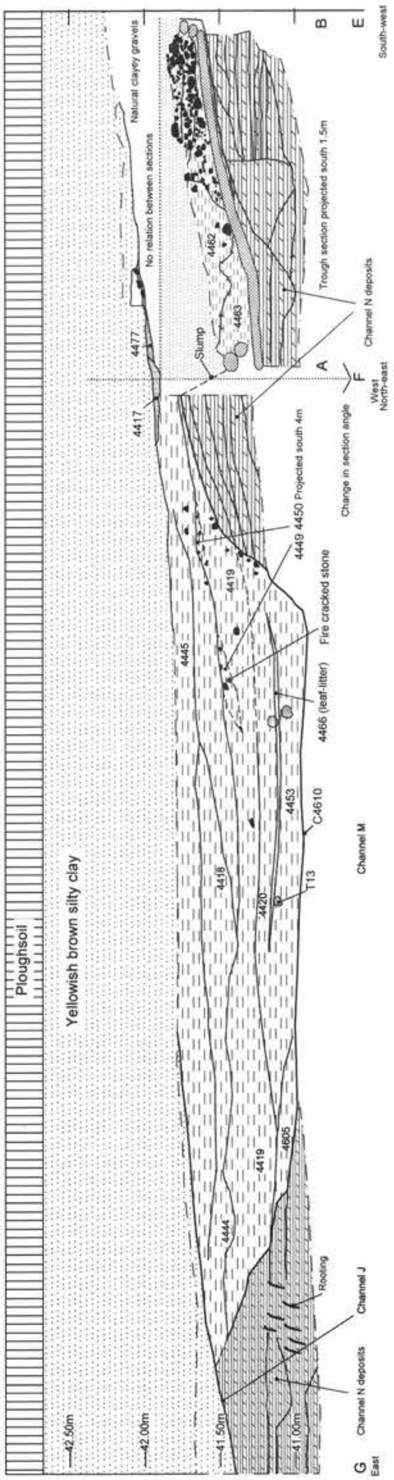


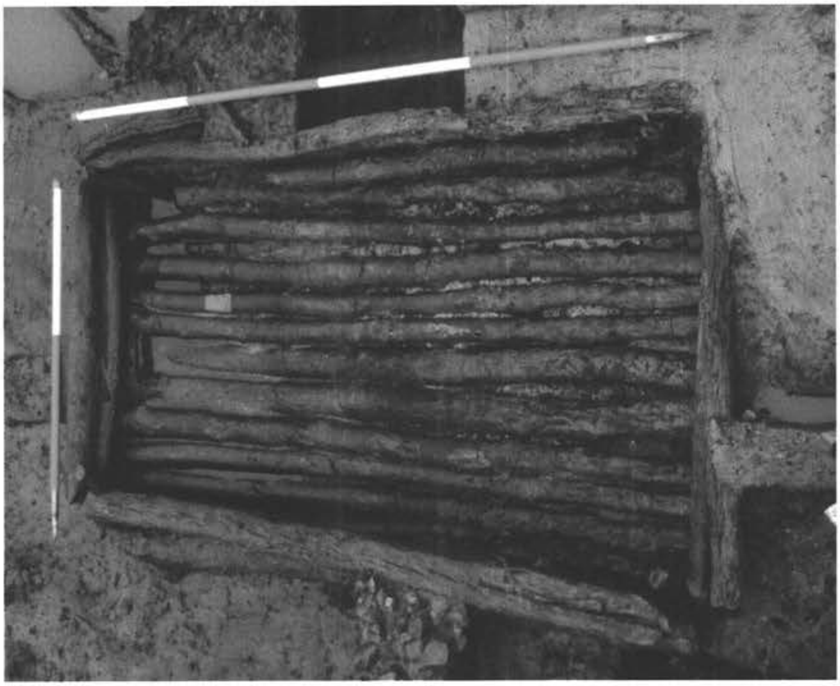
Fig. 24: Composite section of Burnt Mound II trough, channel, and related layers.

Trough slumping

All the trough lining corner posts had been driven through peaty silts and clays to sands and gravels (Fig. 22) and showed some resulting compression damage. The builders must have been aware of the lack of firm ground under the western half of the trough as stakes T31 and T65 had to be driven some 0.40m further to find sands and gravels and must have been longer pieces of wood to allow for this. There was no indication that the sands and gravels below the trough had also slumped.

The interfaces and location of the layers of fire-cracked stone in the western half of the trough indicates that they entered the trough prior to any slumping, as they have not tumbled down slope as might be expected. However, the broadly horizontal interface of the naturally accumulated silty clays in the eastern half indicates that the slumping had occurred prior to their deposition. As the corner stakes of the trough were of similar lengths when excavated (i.e. those at the lower eastern end were not

Plate 4: Burnt Mound II part excavated and from the east. The earliest deposits were dark friable peats of probable early Post Glacial date (Channel N), visible to the right. These have been cut by a later Channel (M) in the base of which lies the mass of timber debris to the left. The channel has subsequently silted. The wood-lined pit is cut through similar silts, but has slumped substantially due to being constructed over the open peats of Channel N. Fire-cracked stone is visible on each side of the trough, and within it. In the right foreground thin layers of charcoal and fire-cracked stone sit on the bank of the silted channel.



Plates 5a and 5b: The trough during and after excavation.

significantly longer), it is probable that erosion of the exposed parts of the timbers occurred before the structure was inundated with silt and the timbers subsequently protected. Therefore, it is probable that some period of time elapsed between backfilling of the trough and the slumping of the structure and it's infill with silty clays.

The Fire Clearance evidence

Surface burnings

One hundred and fourteen reddened areas were recorded across 11 hectares of the site (Fig. 25). These deposits were always below a body of alluvial silty clay; a few examples were recorded cutting a thin layer of clay above the gravelly substratum (C136, Fig. 26).

Many interpretations seemed possible for the features when first discovered although fire-clearance seemed the most obvious. Following a positive identification of some burnt tree pit features (with the assistance of Mark Robinson of the Natural History Museum, Oxford in August 1999), recorded stratigraphies were re-assessed. In several instances, the recording of the tree-holes' stratigraphy along the line of symmetry/axis of fall (notwithstanding under digging of the upcast ridge), combined with bulk

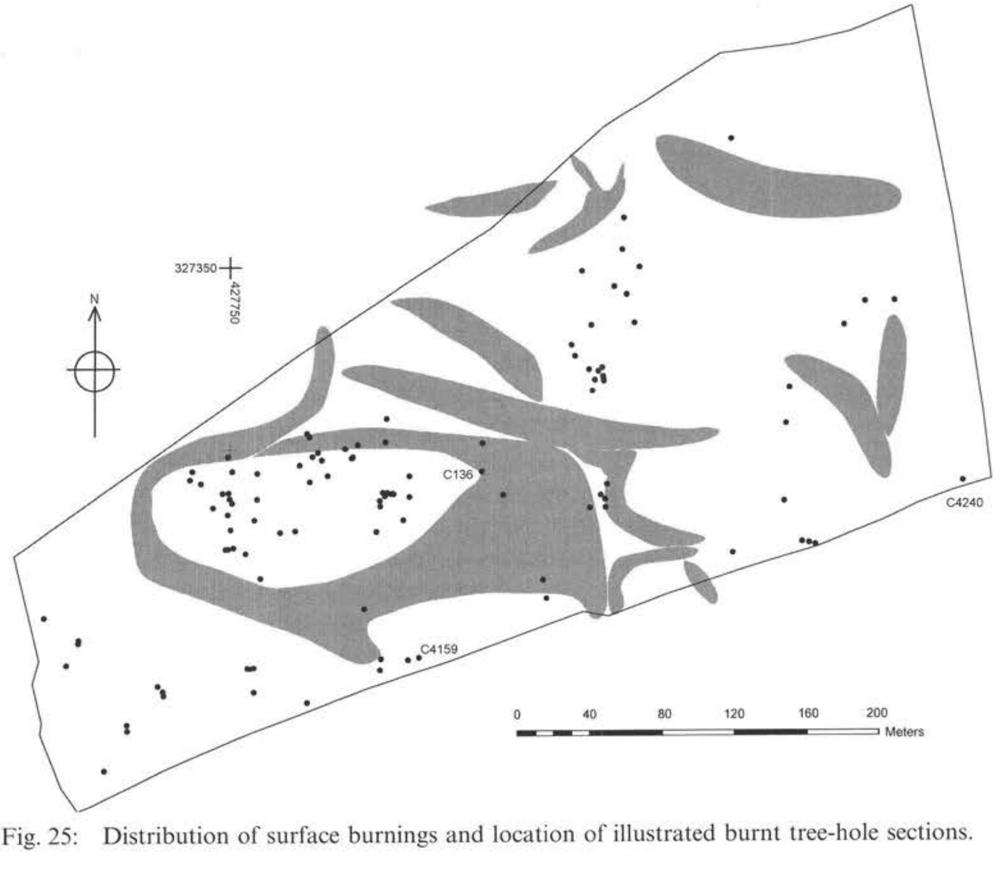


Fig. 25: Distribution of surface burnings and location of illustrated burnt tree-hole sections.

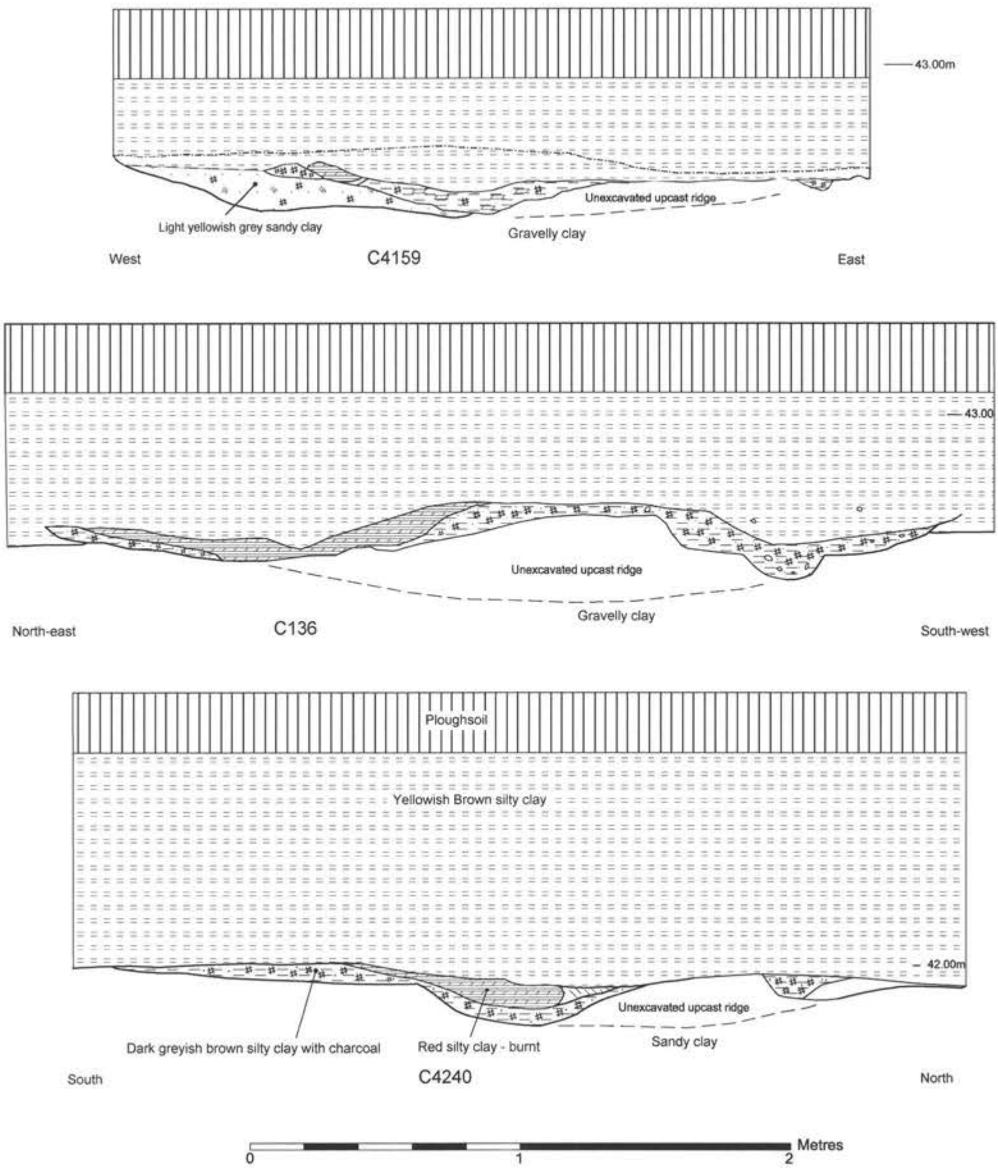


Fig. 26: Sections through burnt tree-pits.

sampling from key contexts has made interpretation of these features and their dating possible.

The majority of these deposits comprised thin layers of friable reddened silty clay with occasional adjacent patches of charcoal rich silty clay. The reddened clay seemed most likely to be natural yellowish brown silty clay that had been reddened with fire. When investigated, the reddened layers almost invariably overlay thin discontinuous patches of the charcoal rich silty clay. This recurrence confirmed that the red clay was burnt with the charcoal rich clay being the remnants of burnt material and that the

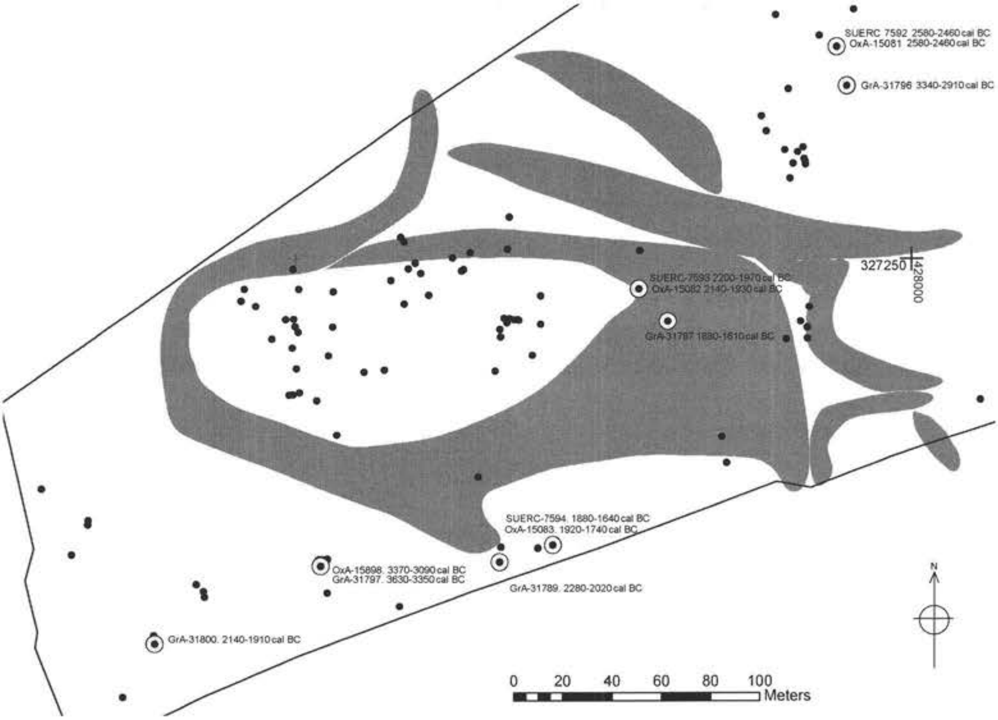


Fig. 27: Dated clearance deposits.

two were directly related and part of the same burning event, the upper part having become oxidised and the lower part reduced (Plates 6 and 7).

Burnt trees

In a few instances these burnt deposits were found filling classic tree-fall features which were located broadly across the examined area (Figs 25 and 26). Within the features, the relationship of reduced charcoal rich and reddened oxidised units remained the same and had not been rotated or inverted. On this basis, it seems quite feasible that the burning was truly *in situ* and post-dated the tree-fall.

Little time delay is suggested between tree-fall, and burning episodes. The roots of the fallen tree were in place when the burning occurred, or the burning would not be the primary deposit, or as deep within the (truncated) profile. It is of course possible that the burning of the woodland passed through trees standing and fallen, live and dead, but a more compelling explanation is that the trees were hauled over and subsequently burnt.

Dating

Twelve radiocarbon measurements, from eight contexts directly related to fire clearance deposits were obtained (below p. 65). Six measurements formed three statistically consistent pairs (Fig. 28A, B and C).

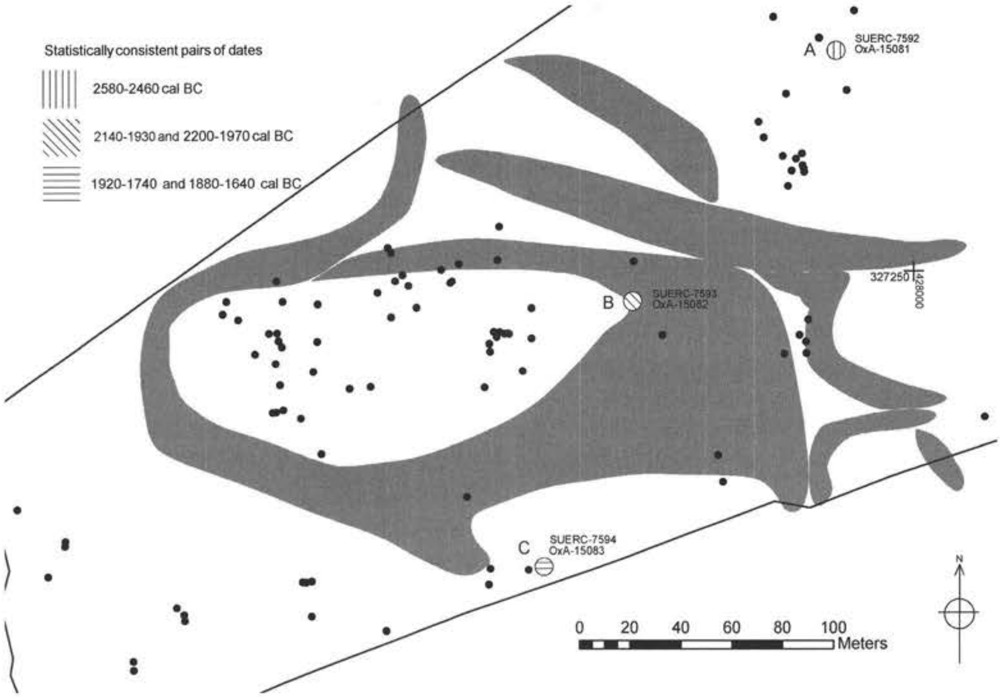


Fig. 28: Distribution of statistically consistent radiocarbon measurements from burnt deposits interpreted as clearance burns.

A, C4490, 95m north of Burnt Mound II: 2580–2460 cal BC (OxA-15081; 3981 ± 27 BP) and 2580–2460 cal BC (SUERC-7592; 3995 ± 35 BP) (T' = 0.1; ν = 1; T'(5%) = 3.8; Ward and Wilson 1978).

B, C136, 62m west of Burnt Mound II: 2140–1930 cal BC (OxA-15082; 3645 ± 28 BP) and 2200–1970 cal BC (SUERC-7593; 3700 ± 35 BP) (T' = 1.5; *v* = 1; T'(5%) = 3.8; Ward and Wilson 1978).

C, C4159, 145m south-west of Burnt Mound II: 1920–1740 cal BC (OxA-15083; 3508 ± 28 BP) and 1880–1640 cal BC (SUERC-7594; 3440 ± 35 BP) (T' = 2.3; *v* = 1; T'(5%) = 3.8; Ward and Wilson 1978).

The Ring Ditch (Figs 6, 29 and 30)

Group 3100

In the north of Zone 2, part of a small ring ditch of *c*.11m diameter was noted during the machine removal of alluvium. No archaeological features had been seen to cut the alluvium during stripping. Stripping was halted and a ditch segment excavated.

Cleaning of the baulk section that lay just to the north of a central feature revealed that the ring was sealed by, and also cut through alluvial clays. Excavation continued with the machine removal of alluvium outside of the ring ditch area, to the level at which the ditch could be seen; this was followed by hand excavation of the interior. Alluvial clays were removed in spits in the two available quadrants. The buried

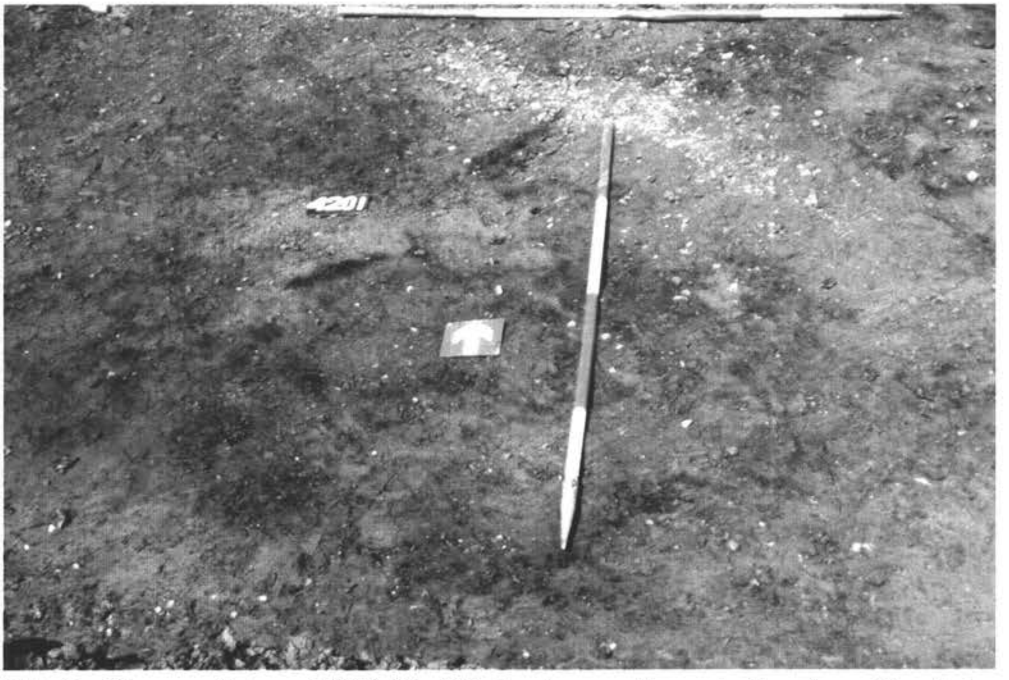


Plate 6: Clearance feature, C4240 (Fig. 26) showing gravel upcast ridge, fire reddened clay (4201) with reduced fuel layer/soil (4239) in foreground.

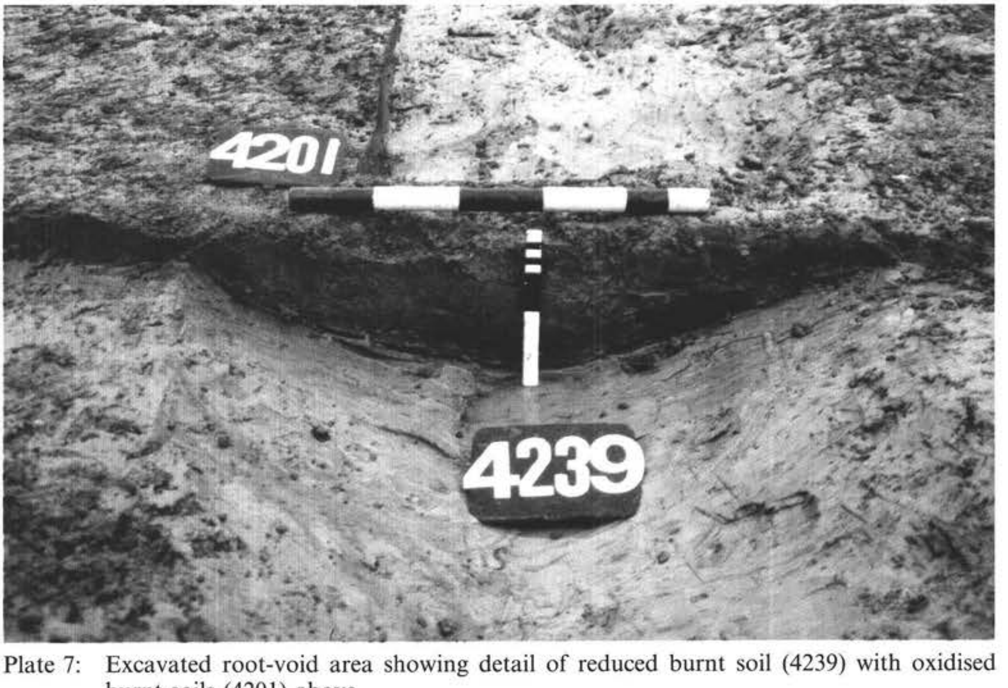


Plate 7: Excavated root-void area showing detail of reduced burnt soil (4239) with oxidised burnt soils (4201) above.

surface of the monument was recognisable by a slightly darker colour and increase in manganese content that had probably replaced the organic components of the soil.

The buried surface lay between 42.93m and 42.99m OD and no evidence existed for an internal mound. Fragments of Peterborough Ware and fire-cracked stone were recorded on the surface on the interior of the ditch. The filling of the ditch and the alluvial burial of the monument appeared continuous. The level from which the ditch and central pit had been cut was clear, although the ditch appeared at a slightly higher level during excavation, due to slumping of layers.

Twenty-two quadrant segments of 0.8–0.9m length were excavated through the ditch. The ditch, which was 2.50m wide and 0.31m deep, had initially filled with a clean light grey clay, up to 0.10 m deep. A secondary fill of yellowish brown alluvial silty clay, which became greyer and less manganese rich with depth, filled the remainder of the profile and was continuous with the alluvial silty clay that buried the monument. No finds were made within any of the excavated ditch segments.

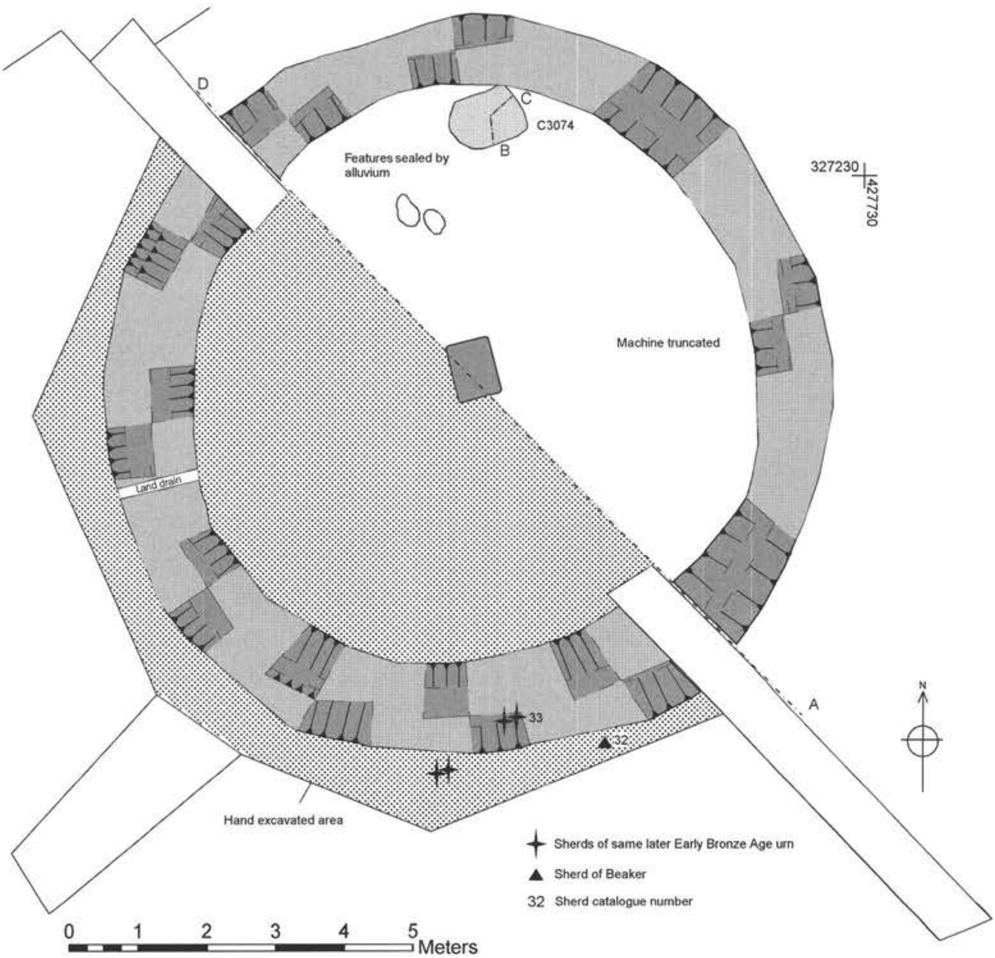


Fig. 29: Plan of excavated Ring Ditch and burial pit.

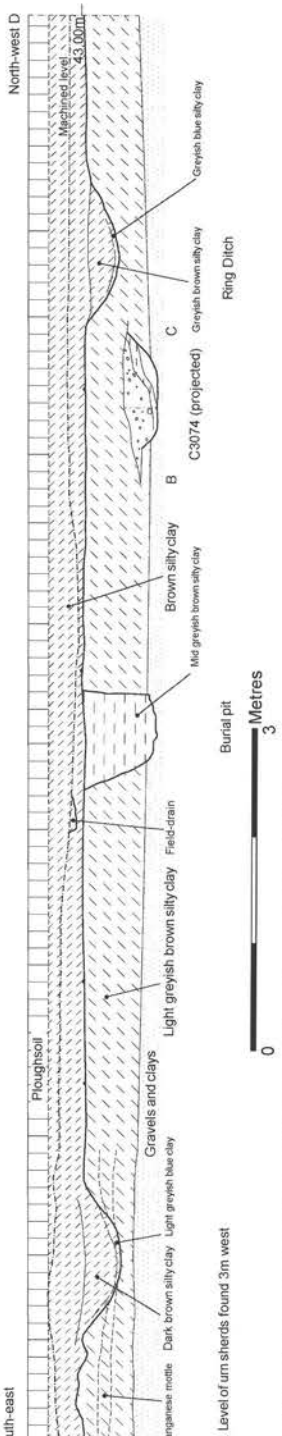


Fig. 30: Composite north-east facing section through Ring Ditch.

The central pit was excavated in 100mm spits. The pit was rectangular (0.80 × 0.70 × 0.65m) with near vertical sides bar in the southern side which was at around 60°. There was little differentiation in silty clay fills until just over the base where there was a distinct thin layer of brown clayey silt. No artefacts were found during excavation or bulk sample processing.

One sherd of Beaker pottery (Fig. 49.32) and five of an later Early Bronze Age biconical or cordoned Urn (Fig. 49.33) came from the first excavated spit immediately above, and to the south of the ditch (Fig. 29) at around 43.06m (i.e. at a level higher than the buried land surface of the monument which was just below 43.00m). The sherds preserved carbonised internal residues. The number of sherds from the same urn suggests that a later burial may have been disturbed in the immediate vicinity.

The absence of a mound may not be explained by homogenising through flooding. A clay mound would have remained extremely resilient to flood damage. This must indicate that the spoil from the ditch was removed from the area, or possibly placed outside the ditch as a bank. The recorded sections clearly show a contrast between the interfaces inside and outside the ring ditch; within the ditch the interface is flat and even (which corresponds with the hand excavated internal surface); without the ditch at the south-eastern end (Fig. 30 'A') the interface was irregular and jagged, with a high point some 0.07m above the surface of the central pit.

Following the excavation of the ring ditch, the remaining alluvium through which it had been cut was removed by machine. Features recorded below comprised a pit C3074, 0.30m deep, which contained a layer of burnt clay (Fig. 30), and two small shallow pits which contained no finds. To the east of the ring ditch, further features became visible following the machine removal of the alluvium demonstrating that the ring ditch was chronologically later.

To the south of the ring ditch a complete saddle quern, SF 185 (below p. 115), was recovered from the base of fine alluvium, just overlying the gravely clay periglacial layers, at a height of 42.64m. It was deposited by the northern edge of Palaeochannel B., but was not associated with any earth-fast features. It is likely to have been placed or intentionally discarded into shallow water.

SCIENTIFIC DATING

By P. Marshall, W. D. Hamilton, J. van der Plicht, C. Bronk Ramsey, G. Cook and T. Goslar

Introduction

Fifty-five radiocarbon age determinations have been obtained on samples of charcoal, waterlogged macrofossils, wood, and charred residues on the interior of pottery sherds. The full report including the methodology can be found on http://ads.ahds.ac.uk/catalogue/resources.html?willington_eh_2008.

The radiocarbon results and their calibrations are given in *Tables 3* to *9*, and are quoted in accordance with the international standard known as the Trondheim convention (Stuiver and Kra 1986). They are conventional radiocarbon ages (Stuiver and Polach 1977).

Methological approach

A Bayesian approach has been adopted for the interpretation of the chronology from the burnt mounds and Neolithic ceramic sequence from this site (Buck *et al.* 1996). Although the simple calibrated dates are accurate estimates of the dates of the samples, it is the dates of the archaeological events, which are represented by those samples, which are of interest. In the case of Willington, it is the chronology of the use of the burnt mounds and the start of the use of various pottery types that is under consideration, not the dates of samples or pottery residues. 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 and the relative dating information provided by ceramic typologies.

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 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 v3.10 (http://www.rlaha.ox.ac.uk/), which uses a mixture of the Metropolis-Hastings algorithm and the more specific Gibbs sampler (Gilks *et al.* 1996; Gelfand and Smith 1990). Details of the algorithms employed by this program are available from the on-line manual or in Bronk Ramsey (1995; 1998; 2001). The algorithm used in the models described below can be derived from the structures shown in Figures 33, 34, 36 and 37.

Objectives and sampling strategy

The radiocarbon programme was designed to achieve the following objectives:

- To provide a chronological framework for interpreting the environmental sequence from the palaeochannel deposits.
- To date and ascertain the significance of human activity in the vicinity of fallen trees.
- To date the fire-clearance of the floodplain.
- To provide overall estimates of the start, end, and duration of the use of the burnt mounds.
- To date alluviation.
- To provide precise dates for the Peterborough Ware (and its sub-styles) ceramic assemblage.

Results

Chronology of the Palaeochannels (Table 3)

Four samples were submitted from Channel G, a palaeochannel with a peaty infill on the southern edge of the excavations. Four samples were submitted from column 1 taken at the following depths; 0–0.1m (two samples), 0.48–0.50m and 0.96–0.98m.

The two samples from 0–0.1m comprising terrestrial seeds and twig fragments are not statistically consistent ($T'=8.9$; $\nu=1$; $T'(5\%)=3.8$; Ward and Wilson 1978) and thus contain material of different ages (4245±35 BP; GrA-31468 and 4395±36 BP;

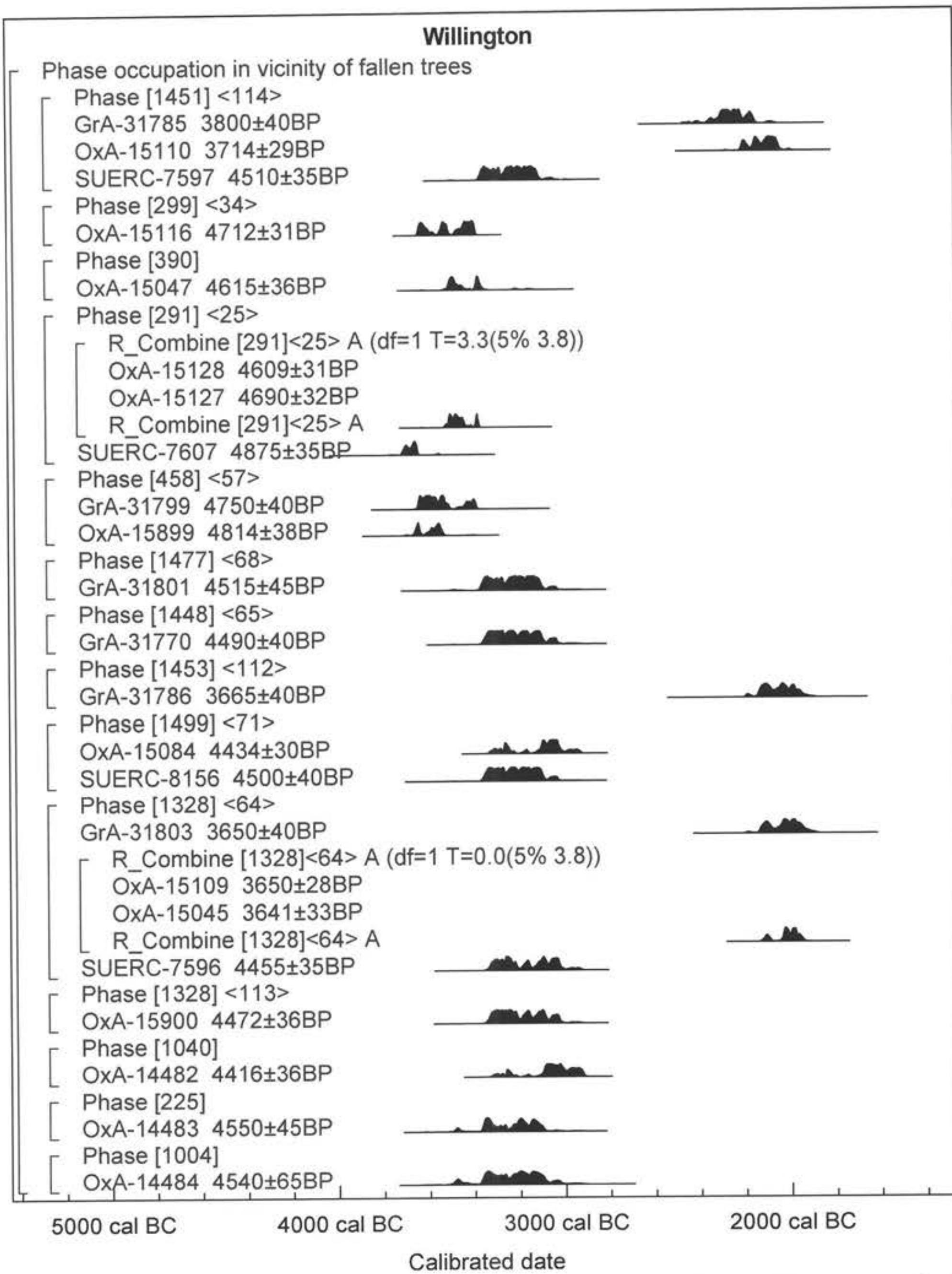


Fig. 31: Probability distributions of dates from occupation in the vicinity of fallen trees. Each distribution represents the relative probability that an event occurred at a particular time. These results are the result of simple radiocarbon calibration (Stuiver and Reimer 1993).

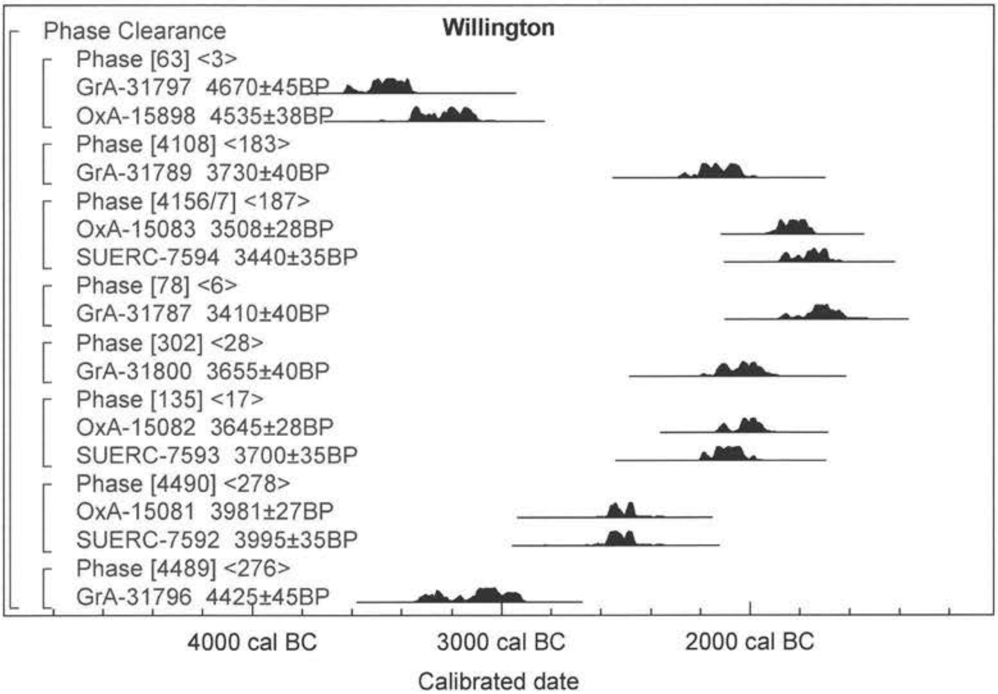


Fig. 32: Probability distributions of dates for fire clearance of the floodplain. Each distribution represents the relative probability that an event occurred at a particular time. These distributions are the result of simple radiocarbon calibration (Stuiver and Reimer 1993).

OxA-15897). This is not surprising given that both samples contain material from within a 0.1m section of the palaeochannel. The measurements at best therefore only provide a *terminus post quem (tpq)* for the top part of the column. The samples from 0.48–0.50m and 0.96–0.98m also comprised terrestrial seeds. The dates (11405 ± 45 BP; SUERC-7350 and 11780 ± 45 BP; SUERC-7351 respectively) indicate an early Post Glacial date for the channel.

A sample from a lens of leaf litter sitting near the base of palaeochannel N, without direct stratigraphic link to the Burnt Mound II trough, provided a radiocarbon date of 1200–920 cal BC (Poz-18010; 2875 ± 35 BP).

Fallen trees and associated features (Table 4)

The radiocarbon dates show a clear phase of occupation in the vicinity of fallen trees lasting from *c.* 3500–3000 cal BC. Those contexts (e.g. 1451 and 1328) containing material dating to *c.* 2000 cal BC are probably intrusive and related to clearance activity (Fig. 31).

The Fire-Clearance of the floodplain (Table 5)

The clearance of woodland from the floodplain represents an important change in the local landscape development as it was a pre-cursor to providing increased grazing

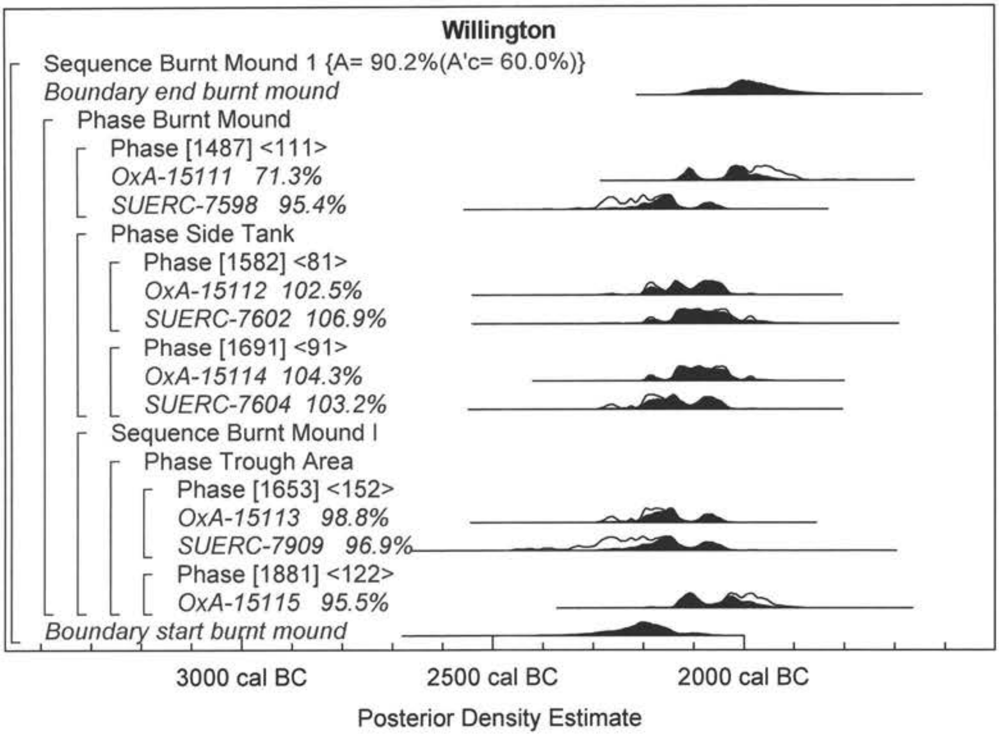


Fig. 33: Probability distributions of dates from Burnt Mound I: each distribution represents the relative probability that an event occurs at a particular time. For each of the radiocarbon dates two distributions have been plotted, one in outline, which is the result of simple radiocarbon calibration, and a solid one, which is based on the chronological model used. The large square brackets down the left hand side along with the OxCal keywords define the model exactly.

or land for cultivation or both. Samples were submitted from eight contexts directly associated with the clearance of trees from the floodplain.

The results suggest clearance of the floodplain was concentrated in the mid third to mid second millennia cal BC.

Burnt Mound I and stratigraphically related contexts (Table 6)

Duplicate samples from six contexts interpreted as forming part of Burnt Mound I and stratigraphically related layers were dated. A measurement from a residue dated sherd (Table 9, 1980) is also included.

The results clearly show that the layer underlying the burnt mound also incorporated residual material from earlier Neolithic activity.

We have chosen to exclude all the Neolithic samples from the model shown in Figure 33 (SUERC-7605–6; OxA-14481 and OxA-15046). SUERC-7607 clearly represents residual material that was incorporated into the basal layer of the burnt mound from the underlying Neolithic contexts. The model shows good agreement between the sequence and radiocarbon measurements ($A_{overall}=90.2\%$) and provides estimates for the start of burnt mound activity of *2340–2060 cal BC (95% probability; start burnt*

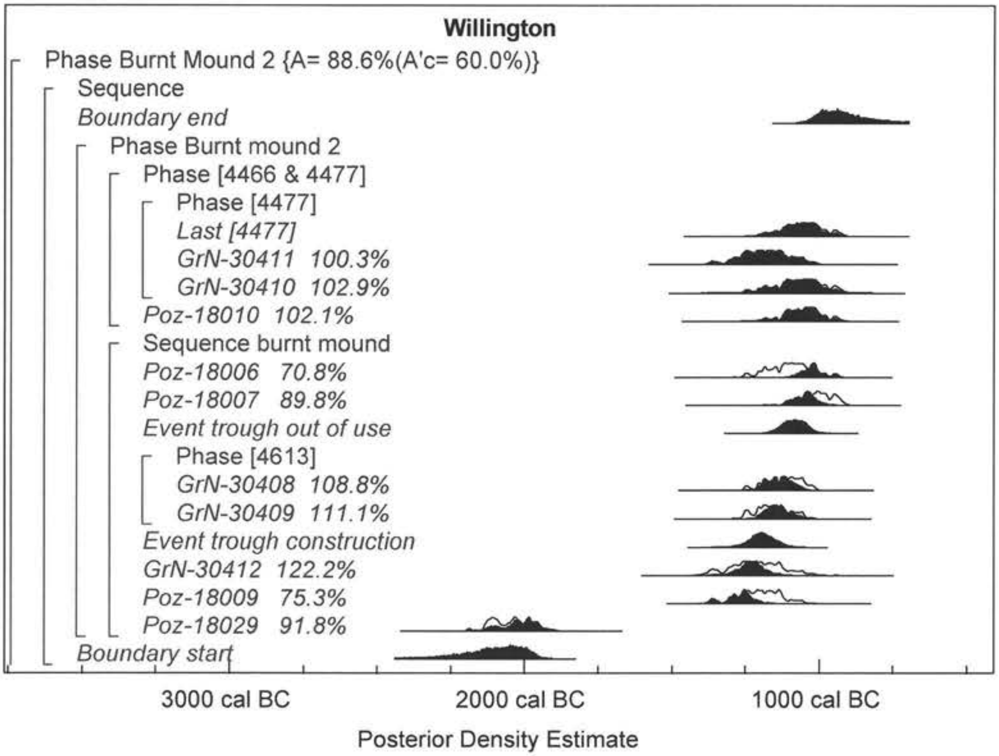


Fig. 34: Probability distributions of dates from Burnt Mound II: each distribution represents the relative probability that an event occurs at a particular time. For each of the radiocarbon dates two distributions have been plotted, one in outline, which is the result of simple radiocarbon calibration, and a solid one, which is based on the chronological model used. The large square brackets down the left hand side along with the OxCal keywords define the model exactly.

mound; Fig. 33) and probably in *2260–2140 cal BC (68% probability)*. The end of use of the burnt mound is estimated at *2120–1840 cal BC (95% probability; end burnt mound*; Fig. 33) and probably in *2040–1920 cal BC (68% probability)*.

The use of Burnt Mound I is estimated to be *20–430 years (95% probability)* and probably *80–320 years (68% probability)*. The relatively small number of radiocarbon measurements are, however, likely, to mean that the estimate is longer than it actually was.

Burnt Mound II (Table 7)

A sequence of three samples came from the silty peat layers below the wood lined trough. Two measurements were taken from the trough timbers while a sequence of three samples came from the silty peat layers below the trough. The two measurements from timbers from the trough are statistically consistent and could be of the same actual age. Two samples came from bottom and top of a column sample of the silty peat infill of the trough.

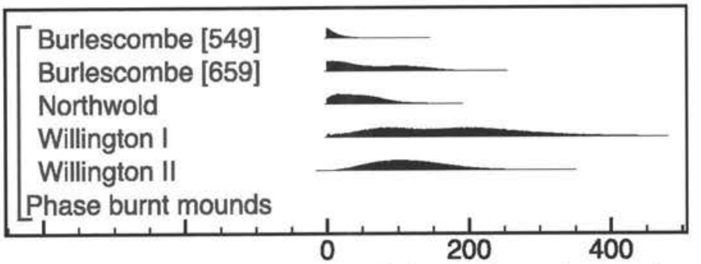


Fig. 35: Probability distribution of the numbers of years during which activities occurred at burnt mounds 1 and 2 (derived from Figs 33 and 34) in comparison with other recently studied burnt mounds at Northwold (Crowson and Bayliss 1999) and Burlescombe (Best & Gent 2007). Note that the tail of Willington I distribution has been truncated to enable detailed examination of the highest areas of probability

One sample was from a lens of leaf litter near the base of the adjacent palaeochannel without direct stratigraphic link to the trough. Two measurements from charcoal from a hearth type feature adjacent to the trough are statistically consistent and could be of the same actual age.

There is good agreement between the sequence and radiocarbon ($A_{overall} = 88.6\%$; Fig. 34) and the model provides estimates for trough construction of *1290–1100 cal BC* (*95% probability; trough construction;* Fig. 34) and probably *1240–1150 cal BC* (*68% confidence*) with an end of use of *1170–1000 cal BC* (*95% probability; trough out of use;* Fig. 34) and probably *1130–1040 cal BC* (*68% confidence*). The trough is estimated to have been in use for between *20–210 years* (*95% probability*) and probably *40–150 years* (*68% probability*).

Both burnt mounds were in use for a relatively short period of time, although the gap between the end of use of Burnt Mound I and construction of the trough of Burnt Mound II is estimated to be *640–960 years (95% probability)* and probably *720–880 years (68% probability*).

The dating of alluviation (Table 8)

In order to try and provide a more precise estimate for the onset of alluviation than the *terminus post quem* of 3490–3100 cal BC achieved (p. 80), attempts were made to model all measurements from the site on the basis of whether samples were either above or below alluvium. Ultimately this proved impossible for a number of reasons. Firstly detailed recording of the natural layers cut by features was not always carried out in the field as at the time the importance of this relationship was not appreciated. Secondly, alluviation was not a simple time-transgressive event. However, modelling of those samples that were from features recorded as having alluvium below them allows a *terminus ante quem* for alluviation to be estimated of *2200–1980 cal BC (95% probability)*.

Peterborough Ware (Tables 9, 10, 11 and 12)

Six ceramic sherds with organic residues adhering to the interiors were submitted for dating from contexts (390) Group 809, (1980) Group 2550–01, (1040) Group 2508,

(225) Group 2541, (1004) Group 2509, and (246) an ungrouped post prehistoric context. Additionally three other sealed contexts were dated that were associated with significant assemblages of Peterborough Ware ceramics; (458) Group 803, (1499) Group 2508, and (1477) Group 2504.

Modelling of the results from Willington together with the available radiocarbon measurements for finds of Peterborough Ware from England and Wales (Marshall *et al.* in prep.) to try and provide more precise estimates for the date of Peterborough Ware was undertaken using three different underlying assumptions.

Model A (Fig. 36; Table 10)

Modelling the data as a single phase takes no account of the fact that the ceramic sherds are in some way related to each other, i.e. it treats them as each is chronologically independent. This model shows good overall agreement ($A_{overall}$ = 84.5%), and provides estimates for the beginning of use of Peterborough Ware of *3600–3350 cal BC (95% probability*), and probably in *3510–3360 cal BC (68% probability)*. The latest deposits of this style occurred in *3010–2860 cal BC (95% probability)*, and probably in *2970–2890 cal BC (68% probability)*.

Model B (Figs 37, 38 and 39; Table 11)

Further analysis, however, allows us to make use of more realistic underlying assumptions. In the first of these we make use of the fact that Peterborough Ware can be differentiated into a number of styles. We do though make no assumptions about the interrelationship between each ceramic style and therefore postulate that each style (e.g. Ebbsfleet, Mortlake, Fengate) started at some definitive date, continued in use at a fairly uniform rate and then stopped (Buck *et al.* 1992). For each phase we can estimate the age of the first and last dated objects and their span. However, taking into account that in all cases we probably only have a sample of the ceramics from that phase and therefore it is almost certain that both earlier and latter examples exist we can estimate the start, end and duration of these phases on the basis of two assumptions. Firstly, the examples we have are representative of the whole group (i.e. style) and secondly the vessels were used (in the case of measurements on residues) or deposited uniformly through the phase.

Model C

The model is based on the purported sequence of Peterborough Styles as defined by Smith (1956; 1974) with a succession from Ebbsfleet through Mortlake to Fengate. This model again assumes that each phase of use of a style is uniform and allows estimates to be calculated for the date of transition between the phases and their duration. This model shows poor agreement ($A_{overall}$ = 38.3%) between the radiocarbon evidence and sequential sequence of Peterborough Ware styles.

Model D (Fig. 40; Table 12)

The final model based on the sequential sequence from Ebbsfleet through Fengate to Mortlake shows good agreement between the radiocarbon evidence and sequence ($A_{overall}$ = 66.0%).

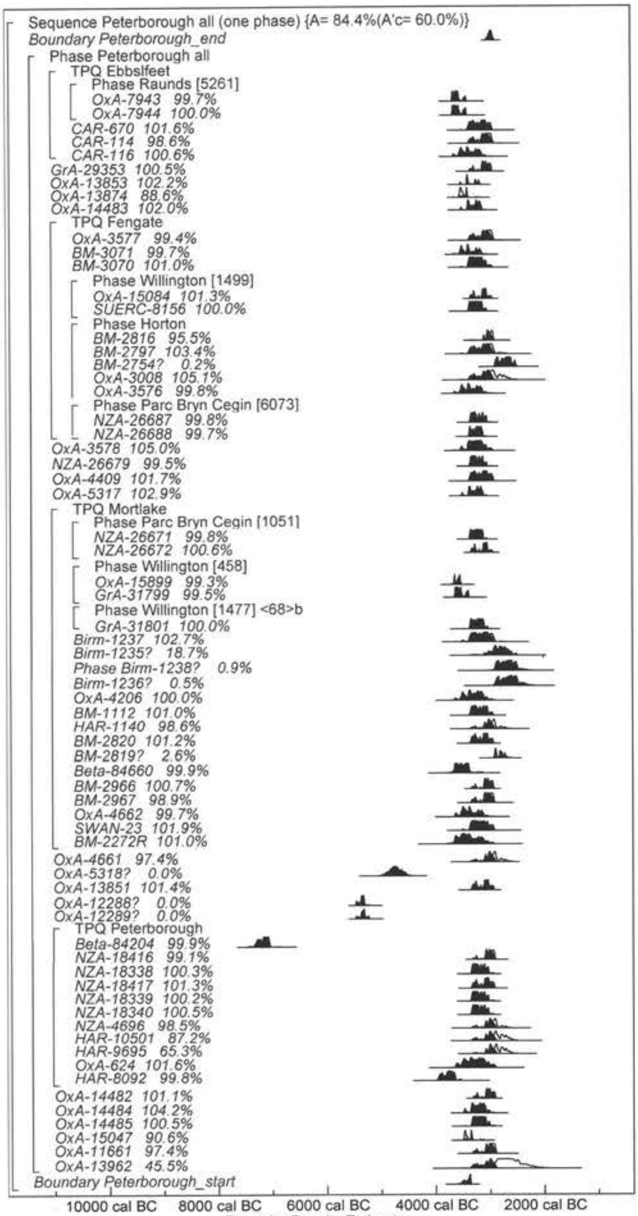


Fig. 36: Probability distributions of dates Peterborough Ware (model A): each distribution represents the relative probability that an event occurs at a particular time. For each of the radiocarbon dates two distributions have been plotted, one in outline, which is the result of simple radiocarbon calibration, and a solid one, which is based on the chronological model used. The other distributions correspond to aspects of the model. For example, the distribution '*Boundary Peterborough_end*' is the estimated date for the end of use of Peterborough Ware. A question mark (?) indicates that the result has been excluded from the model. The large square brackets down the left hand side along with the OxCal keywords define the model exactly.

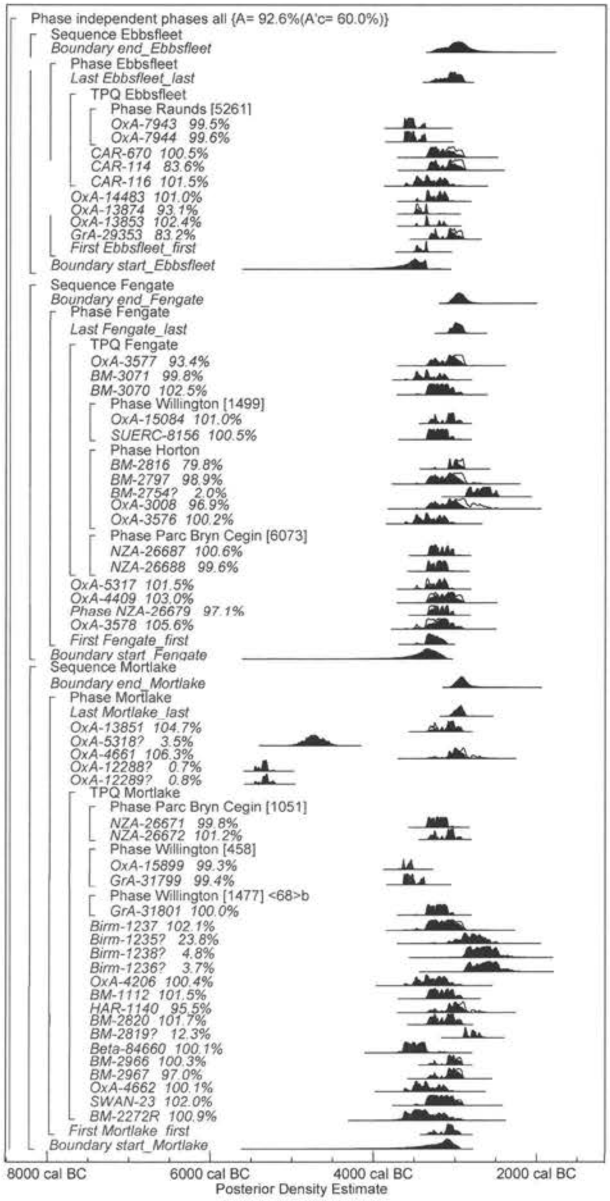


Fig. 37: Probability distributions of dates Peterborough Ware (model B): each distribution represents the relative probability that an event occurs at a particular time. For each of the radiocarbon dates two distributions have been plotted, one in outline, which is the result of simple radiocarbon calibration, and a solid one, which is based on the chronological model used. The other distributions correspond to aspects of the model. For example, the distribution '*Boundary end_Fengate*' is the estimated date for the end of use of the Fengate style of Peterborough Ware. A question mark (?) indicates that the result has been excluded from the model. The large square brackets down the left hand side along with the OxCal keywords define the model exactly.

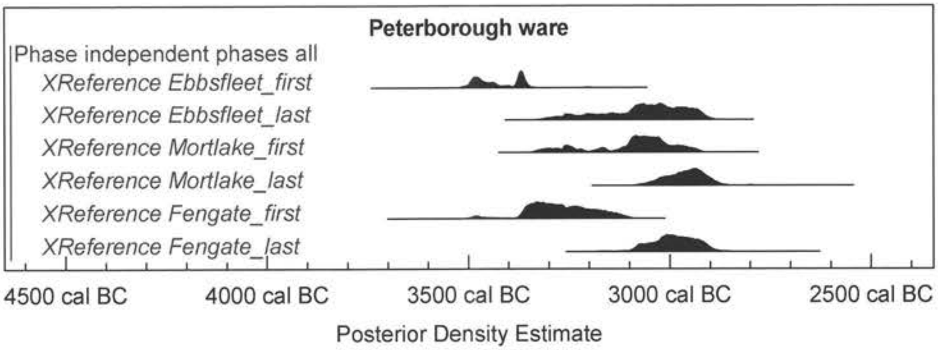


Fig. 38: Probability distributions for estimated first and last dates in each phase derived from model B probability distributions.

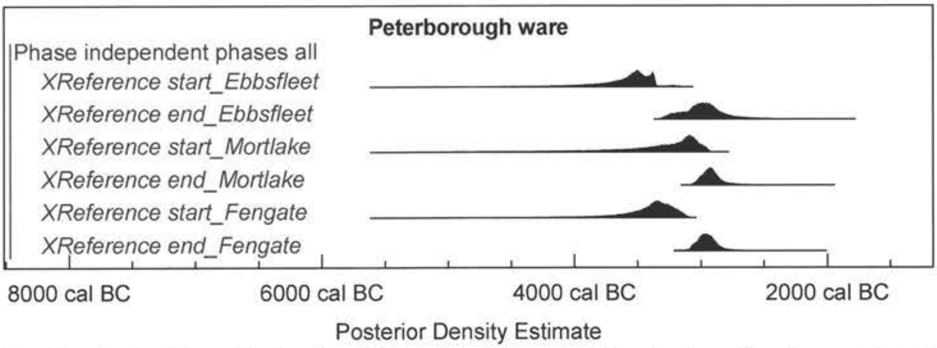


Fig. 39: Probability distributions for estimated start and end dates for the postulated phases during which each style was used assuming that they might overlap, derived from model B probability distributions.

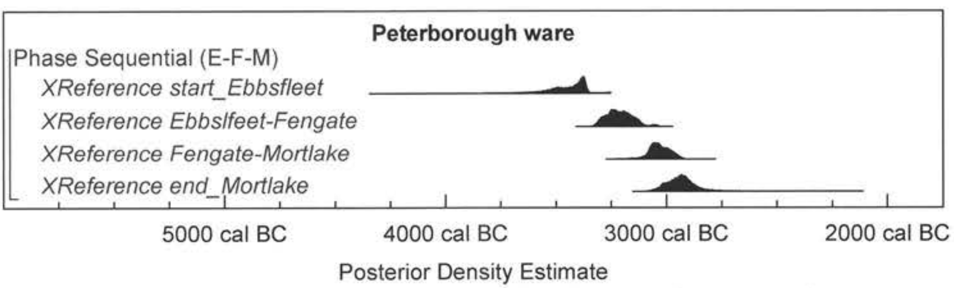


Fig. 40: Probability distributions for the transitions between phases assuming a sequential sequence of Ebbsfleet through Fengate to Mortlake, derived from Model D probability distributions.

Discussion

Model D (Table 12) suggests that the use of Peterborough Ware was considerably shorter that the span of *c.* 3400–2500 cal BC put forward by Gibson and Kinnes (1997). It provides estimates for the beginning of use of Ebbsfleet *3690–3340 cal BC (95% probability)*, and probably in *3500–3530 cal BC (68% probability)*. The latest deposits of Mortlake occurred in *3060–2880 cal BC (95% probability)*, and probably in *3010–2880 cal BC (68% probability)*.

Pollen Column	Context & Sample	Material	$\delta^{13}C$ (‰)	Radiocarbon age BP	Calibrated date range (95% confidence)
GrA-31468	0–0.1m	Waterlogged plant macrofossils: *Rannunculus* sect. *Rannunculus* (3), *Corylus avellana*, *Persicaria lapathifolia* (2), *Rumex* sp., *Prunella vulgaris* (2), *Sambucus nigra*, *Carex* (3)	–28.7	4245 ± 35	2910–2750 cal BC
OxA-15897	0–0.1m	Waterlogged plant macrofossils: twig fragments	–28.7	4395 ± 36	3270–2910 cal BC
SUERC-7350	0.48–0.50m	Waterlogged plant macrofossils: *Rannunculus* sect. *Rannunculus* (3), *Rannunculus flammula*, *Betula* sp., *Alnus glutinosa*, *Filipendula ulmaria*, *Apiaceae*, *Carex*	–26.2	11,405 ± 45	11,410–11230 cal BC
SUERC-7351	0.96–0.98m	Waterlogged plant macrofossils: Betula sp., *Filipendula ulmaria*, *Apiaceae*, *Eleocharis* sp., *Schoenoplectus* sp. *Carex*	–27.4	11,780 ± 45	11,820–11510 cal BC

Table 3: Environmental column radiocarbon results.

Tree-throw/ usage	Context & Sample	Material	Description	$\delta^{13}C$ (‰)	Radiocarbon age BP	Weighted mean	Calibrated date range (95% confidence)
OxA-15116	[299]-<34A>	charcoal, *Prunus spinosa* (R Gale)	From a homogenous burnt deposit filling an irregular spread that may be part of a tree-throw [327].	–25.4	4712 ± 31		3640–3370 cal BC
OxA-15127	[291]-<25A>	charcoal, *Prunus spinosa* (R Gale)	From a deposit representing human activity within the pit of a tree-throw	–26.9	4790 ± 32	4649 ± 22 BP (T' = 3.3; ν = 1; T'(5%) = 3.8;).	3515–3360 cal BC
OxA-15128	[291]-<25A>	*Prunus spinosa* (R Gale)	Replicate of OxA-15127	–26.4	4709 ± 31		
SUERC-7607	[291]-<25B>	charcoal, *Corylus avellana* (R Gale)	As OxA-15127	–27.1	4875 ± 35		3710–3630 cal BC
GrA-31799	[458]-<57A>	Charcoal, *Prunus spinosa* (R Gale)	From the rich fill of a pit that also contained Peterborough Ware (Mortlake) pottery.	–25.0	4750 ± 40		3640–3370 cal BC
OxA-15899	[458]-<57B>	Charcoal, Pomoideae (R Gale)	As GrA-31799	–27.7	4814 ± 38		3660–3520 cal BC
GrA-31800	[302]-<28>	charcoal, *Prunus spinosa* (R Gale)	From the filling of the base of a burnt out small tree/shrub.	–25.6	3655 ± 40		2140–1910 cal BC
GrA-31770	[1448]-<65A>	charcoal, *Corylus avellana* (R Gale)	Charcoal from the fill of a post-pit	–25.5	4490 ± 40		3360–3020 cal BC
GrA-31786	[1453]-<112>	charcoal, *Prunus spinosa* (R Gale)	From an episode of burning redeposited in the base of a pit that held the post of a structure.	–25.8	3665 ± 40		2200–1930 cal BC
OxA-15084	[1499]-<71A>	charcoal, *Prunus spinosa* (R Gale)	From an episode of burning possibly associated with a tree-throw and post pits forming a structure. Contains Peterborough (Fengate) pottery	–26.1	4434 ± 30		3330–2920 cal BC

Tree-throw/ usage	Context & Sample	Material	Description	$\delta^{13}C$ (‰)	Radiocarbon age BP	Weighted mean	Calibrated date range (95% confidence)
SUERC-8156	[1499]-<71B>	charcoal, *Corylus avellana* (R Gale)	As OxA-15084	–25.2	4500 ± 40		3370–3020 cal BC
GrA-31785	[1451]-<114A>	charcoal, *Prunus spinosa* (R Gale)	From a deposit of charcoal deposited in a tree-throw.	–27.1	3800 ± 40		2430–2130 cal BC
OxA-15110	[1451]-<114A>	charcoal, *Prunus spinosa* (R Gale)	From a deposit of charcoal deposited in a tree-throw.	–25.4	3714 ± 29		2200–2020 cal BC
SUERC-7597	[1451]-<114B>	charcoal, *Corylus avellana* (R Gale)	As OxA-15110	–26.5	4510 ± 35		3370–3080 cal BC
GrA-31803	[1328]-<64>	charcoal, *Prunus spinosa* (R Gale)	From an episode of burning re-deposited in the base of a pit that held the post of a structure.	–26.1	3650 ± 40		2140–1900 cal BC
OxA-15045	[1328]-<64A>	charcoal, *Prunus spinosa* (R Gale)	From an episode of burning redeposited in the base of a pit that held the post of a Neolithic structure.	–26.4	3641 ± 33	3646 ± 21 BP (T' = 0.0; ν = 1;	2130–1945 cal BC
OxA-15109	[1328]-<64A>	charcoal, *Prunus spinosa* (R Gale)	Replicate of OxA-15045	–25.3	3650 ± 28		
SUERC-7596	[1328]-<64B>	charcoal, *Prunus spinosa* (R Gale)	As OxA-15044	–25.5	4455 ± 35		3340–2940 cal BC
OxA-15900	[1328]-<113>	charcoal, *Corylus avellana* (R Gale)	From an episode of burning re-deposited in the base of a pit that held the post of a structure.	–26.7	4472 ± 36		3390–3020 cal BC
GrA-31801	[1477]-<68>	charcoal, *Prunus spinosa* (R Gale)	From the rich fill of a ?cooking pit that also contained Peterborough Ware (Mortlake) pottery.	–25.5	4515 ± 45		3370–3020 cal BC

Table 4: Radiocarbon results associated with tree-throws.

Clearance	Context & Sample	Material	Description	$\delta^{13}C$ (‰)	Radiocarbon age BP	Calibrated date range (95% confidence)
GrA-31797	[63]-<3A>	charcoal, *Alnus*/*Corylus* (R Gale)	From a charcoal rich deposit related to an extensive fire reddened clay associated with a tree clearance	–27.1	4670±45	3630–3350 cal BC
OxA-15898	[63]-<3B>	Charcoal, *Betula* (R Gale)	As GrA-31797	–26.9	4535±38	3370–3090 cal BC
GrA-31789	[4108]-<183>	Charcoal, *Alnus* (R Gale)	From a charcoal rich deposit related to an extensive fire reddened clay associated with a tree clearance	–27.3	3730±40	2280–2020 cal BC
OxA-15083	[4156/7]-<187A>	charcoal, *Prunus spinosa* (R Gale)	From a charcoal rich deposit related to an extensive fire reddened clay associated with a tree-throw.	–29.4	3508±28	1920–1740 cal BC
SUERC-7594	[4156/7]-<187B>	charcoal, *Prunus spinosa* (R Gale)	As OxA-15083	–25.8	3440±35	1880–1640 cal BC
GrA-31787	[78]-<6>	Charcoal, possible Rosaceae twig (R Gale)	From a charcoal rich deposit related to an extensive fire reddened clay associated with a tree clearance	–25.7	3410±40	1880–1610 cal BC
OxA-15082	[135]-<17A>	charcoal, *Prunus spinosa*, stems (R Gale)	From a charcoal rich deposit related to an extensive fire reddened clay associated with a tree-throw.	–26.3	3645±28	2140–1930 cal BC
SUERC-7593	[135]-<17B>	charcoal, *Prunus spinosa*, stems (R Gale)	As OxA-15082	–24.6	3700±35	2200–1970 cal BC
OxA-15081	[4490]-<278A>	charcoal, *Fraxinus*, probably root (R Gale)	From a charcoal rich deposit related to an extensive fire reddened clay associated with a tree-throw.	–25.3	3981±27	2580–2460 cal BC
SUERC-7592	[4490]-<278B>	charcoal, *Fraxinus excelsior*	As OxA-15081	–25.3	3995±35	2580–2460 cal BC
GrA-31796	[4489]-<276>	Charcoal, *Corylus avellana* (R Gale)	From a charcoal rich deposit related to an extensive fire reddened clay associated with a tree clearance	–27.9	4425±45	3340–2910 cal BC

Table 5: Clearance radiocarbon results.

Laboratory code	Context & Sample	Material	Description	$\delta^{13}C$ (‰)	Radiocarbon age BP	Calibrated date range (95% confidence)	*Posterior Density Estimate (95% probability)*
OxA-15111	[1487]-<111A>	charcoal, *Prunus spinosa* (R Gale)	From a charcoal rich deposit derived from spent fuel cleaned out of the central features	–26.8	3610±29	2040–1880 cal BC	*2140–2080 (28%) or 2050–1930 (67%) cal BC*
SUERC-7598	[1487]-<111B>	charcoal, *Fraxinus excelsior* (R Gale)	As OxA-15111	–25.9	3775±35	2300–2040 cal BC	*2270–2030 cal BC*
OxA-15112	[1582]-<81A>	charcoal, *Corylus avellana* (R Gale)	From the base of a substantial pit adjacent to the hearth/oven [1704] and derived from an episode of burnt mound activity.	–24.3	372 ±30	2210–2020 cal BC	*2200–2030 cal BC*
SUERC-7602	[1582]-<81B>	charcoal, *Fraxinus excelsior* (R Gale)	As OxA-15112	–26.2	3690±35	2200–1960 cal BC	*2200–1980 cal BC*
OxA-15113	[1653]-<152A>	charcoal, Pomoideae (R Gale)	From a charcoal rich deposit (trough) near the base of the central burnt mound	–24.9	3754±28	2280–2040 cal BC	*2210–2030 cal BC*
SUERC-7909	[1653]-<152B>	charcoal, Pomoideae (R Gale)	As OxA-15113	–25.8	3780±50	2400–2030 cal BC	*2250–2030 cal BC*
OxA-15114	[1691]-<91A>	charcoal, Pomoideae (R Gale)	From a charcoal and fire cracked stone rich deposit (?oven/hearth)	–26.2	3695±29	2200–1970 cal BC	*2200–2010 cal BC*
SUERC-7604	[1691]-<91B>	charcoal, *Fraxinus excelsior* (R Gale)	As OxA-15114	–24.4	3740±35	2280–2030 cal BC	*2210–2010 cal BC*
OxA-15115	[1881]-<122A>	charcoal, *Fraxinus excelsior* (R Gale)	From a charcoal rich deposit post-dating the lower burnt mound activity	–24.7	3649±33	2140–1920 cal BC	*2140–1960 cal BC*
SUERC-7606	[1881]-<122B>	charcoal, *Corylus avellana* (R Gale)	As OxA-15115	–24.6	4695±35	3630–3360 cal BC	-
OxA-15046	[1817]-<123A>	charcoal, *Prunus spinosa* (R Gale)	From a charcoal rich deposit pre-dating the upper burnt mound layer and central trough [1651]	–24.1	4607±35	3500–3340 cal BC	-
SUERC-7605	[1817]-<123B>	charcoal, *Prunus spinosa* (R Gale)	As OxA-15046	–25.1	4695±35	3630–3360 cal BC	-

Table 6: Burnt Mound 1 and associated contexts radiocarbon results.

Burnt Mound 2	Context & Sample	Material	Description	Radiocarbon age BP	Calibrated date range (95% confidence)	Posterior Density Estimate (95% probability)
GrN-30408	[4613] <T31>	Waterlogged wood; *Fraxinus*	Timbers forming trough within pit [4468]	2920 ± 30	1260–1000 cal BC	*1210–1050 cal BC*
GrN-30409	[4613] <T61>	Waterlogged wood; *Alnus*	Timbers forming trough within pit [4468]	2940 ± 30	1270–1020 cal BC	*1220–1050 cal BC*
GrN-30410	[4477] <272A>	Charcoal; 46 (12g) *Alnus/Corylus*, 2r (<1g) *Fraxinus*, 3r (2g) Pomoideae, 1 (<1g) *Prunus*, 1 *Quercus*	Fragmentary fire cracked stones and charcoal	2880 ± 50	1260–910 cal BC	*1260–930 cal BC*
GrN-30411	[4477] <272B>	Charcoal; 4 (4g) *Alnus*, 11 (4g) *Alnus/Corylus*, 5 (4g) *Fraxinus*, 5 (3g) Pomoideae, 1 (<1g) *Prunus*, 1h, 6 (4g) *Rhamnus cathartica*,	Fragmentary fire cracked stones and charcoal	2960 ± 50	1380–1010 cal BC	*1380–1340 cal BC (2%) or 1320–1010 cal BC (93%)*
GrN-30412	[4483] <284>	Charcoal; 12 (2g) *Alnus*, 4 (1g) Pomoideae, -, 9r (1g) *Quercus*, 2 (<1g) *Rhamnus cathartica*, 3r (<1g> *Ulmus*	Silty peat layer	2980 ± 50	1390–1040 cal BC	*1320–1130 cal BC*
Poz-18010	[4466] <S 270>	Waterlogged plant macrofossils: *Ranunculus* sect. *Ranunculus*, (3), *Urtica dioica* L., (20), *Urtica urens* L., (1), *Alnus glutinosa* L. catkin, (2), *Alnus glutinosa* L. seeds, (13), *Chenopodium* sp., (1), *Atriplex* sp., (2), *Stellaria media* (L.) *Villars*, (3)	From leaf litter horizon within channel filling	2875 ± 35	1200–920 cal BC	*1200–930 cal BC*
Poz-18006	[4462]	Waterlogged plant macrofossils: *Rannunculus* sect. *Rannunculus* (2), *Alnus glutinosa* L. seeds (2), *Persicaria hydopiper* (L.) *Spach* (3), *Rumex* sp.(1), *Filipendula ulmaria* (3), *Potentilla anserina* L. (1), *Lycopus europaeus* L.) (1), *Scirpus sylvaticus* L. (4),	Top of shallow column.	2845 ± 35	1260–1000 cal BC	*1100–930 cal BC*

Burnt Mound 2	Context & Sample	Material	Description	Radiocarbon age BP	Calibrated date range (95% confidence)	Posterior Density Estimate (95% probability)
Poz-18007	[4463]	Waterlogged plant macrofossils: *Rannunculus* sect. *Rannunculus* (1), *Urtica dioica* L. (1), *Alnus glutinosa* L. catkin (1),*Alnus glutinosa* L. seeds (1),*Chenopodium* sp. (1), *Stellaria media* (L.) *Villars* (4), *Lychnis flos-cuculi* L. (2), *Filipendula ulmaria* (1),	Base of shallow column.	2910 $\pm$ 35	1130–910 cal BC	*1130–970 cal BC*
Poz-18029	[4498]	Waterlogged plant macrofossils: *Rannunculus* sect. *Rannunculus* (20), *Urtica dioica* L. (1), *Alnus glutinosa* L. seeds (3), *Chenopodium* sp. (2), *Lychnis flos-cuculi* L. (4), *Persicaria* cf. *maculosa* Gray (3),*Persicaria hydropiper* (L.) *Spach* (8), *Rumex acetosell*	From channel deposit (column)	3665 $\pm$ 35	2150–1940 cal BC	*2130–1920 cal BC*
Poz-18009	[4454}	Waterlogged plant macrofossils: *Urtica dioica* L. (1),*Alnus glutinosa* L. seeds (2), *Persicaria* cf.*maculosa* Gray (1),*Persicaria hydropiper* (L.) *Spach* (8), *Bidens* sp.(1) *Eupatorium cannabinum* L. (1) A*lismatacaeae* (7) *Eleocharis* sp. (1), *Scirpus sylvaticus* L.	From channel deposit (column)	2965 $\pm$ 35	1320–1050 cal BC	*1390–1180 cal BC*

Table 7: Burnt Mound II radiocarbon results.

Laboratory code	Context & Sample	Material	Description	$\delta^{13}C$ (‰)	Radiocarbon age BP	Calibrated date range (95% confidence)
OxA-15044	[2076]-<149A>	charcoal, *Prunus spinosa* (R Gale)	From the base of a partly stoned lined oven	−24.3	4556 ± 34	3490–3100 cal BC
SUERC-7595	[2076]-<149B>	charcoal, *Prunus spinosa* (R Gale)	As OxA-15044	−24.2	4740 ± 35	3640–3370 cal BC

Table 8: Alluviation radiocarbon results.

Laboratory code	Context & Sample	Material	Description	$\delta^{13}C$ (‰)	Radiocarbon age BP	Calibrated date range (95% confidence)
OxA-15047	[390]	carbonised residue	Peterborough Ware, Mortlake/Fengate vessel	−27.4	4615 ± 36	3510–3340 cal BC
OxA-14481	[1980]	carbonised residue	Neolithic bowl	−26.5	3489 ± 35	3700–3530 cal BC
OxA-14482	[1040]	carbonised residue	Peterborough Ware	−27.2	4416 ± 36	3330–2910 cal BC
OxA-14483	[225]	carbonised residue	Peterborough Ware (Ebbsfleet)	−29.0	4550 ± 45	3500–3090 cal BC
OxA-14484	[1004]	carbonised residue	Peterborough Ware	−28.1	4540 ± 65	3500–3020 cal BC
OxA-14485	[246]	carbonised residue	Peterborough Ware	−26.6	4500 ± 50	3370–3020 cal BC

Table 9: Ceramic residue radiocarbon results.

Peterborough style dated	*First (95% probability)*	*Last (95% probability)*	Span
Ebbsfleet	*3520–3340 cal BC*	*3270–2900 cal BC*	60–540 years
Fengate	*3380–3110 cal BC*	*3090–2980 cal BC*	20–370 years
Mortlake	*3330–3210 (17%) or 3190–3150 (3%) or 3130–2920 (75%) cal BC*	*3060–2870 cal BC*	1–310 years

Table 10: Estimates for first and last dates and span of each ceramic style.

Phase includes Peterborough style dated material	*Start (95% probability)*	*End (95% probability)*	Duration
Ebbsfleet	*4290–3340 cal BC*	*3300–2670 cal BC*	50–1400 years
Fengate	*3890–3100 cal BC*	*3090–2780 cal BC*	30–1000 years
Mortlake	*4430–2920 cal BC*	*3070–2740 cal BC*	1–1560 years

Table 11: Estimates for start and end dates and duration of each ceramic style.

Phase includes Peterborough style dated material	*Start (95% probability)*	*End (95% probability)*	Duration
Ebbsfleet	*3690–3340 cal BC*	*3320–3110 cal BC*	40–490 years
Fengate	*3320–3110 cal BC*	*3130–2930 cal BC*	30–320 years
Mortlake	*3130–2930 cal BC*	*3060–2880 cal BC*	1–240 years

Table 12: Estimates for Peterborough Ware styles based on a sequential model in which the end of one style is assumed to be the start of the next.

All three models are extremely 'conservative' in that they treat all samples without a direct functional relationship to the Peterborough Ware in a context (i.e. all non-residue measurements) as only providing *tpqs* for the ceramics. The implications of not treating all non-residue dates results as *tpqs* for the chronology of Peterborough Ware proposed above will be explored more fully in Marshall *et al.* (in prep.).

THE NEOLITHIC AND BRONZE AGE POTTERY

By Patrick Marsden, Adam Tinsley and Ann Woodward

Introduction

A total of 2057 sherds of Neolithic and Bronze Age pottery weighing 9381g was recovered from the excavations. The average sherd weight is 4.6g.

Table *13* shows a breakdown of the pottery by period with Ebbsfleet, Mortlake, Fengate and undiagnostic Peterborough Wares constituting *c.* 92% of the total pottery by weight. Smaller quantities of earlier Neolithic pottery including Mildenhall Ware are also present, together with Beaker, Early Bronze Age ceramics and a sherd of a possible refractory vessel of uncertain period. The full report, including detailed methodology, fabric, form and decoration descriptions can be viewed at http://ads.ahds.ac.uk/catalogue/resources.html?willington_eh_2008.

Ceramic style	Sherd no.	Weight (g)
EARLIER NEOLITHIC BOWL	34	159
MILDENHALL	18	172
EBBSFLEET	11	128
EBBSFLEET/MORTLAKE	70	352
MORTLAKE	46	607
MORTLAKE/FENGATE	67	315
FENGATE	52	583
PETERBOROUGH	1671	6619
BEAKER	77	240
EARLY BRONZE AGE	9	186
REFRACTORY?	2	20
	2057	**9381**

Table 13: Occurrence of pottery (sherd no. and weight) by ceramic style.

Viewing pottery distribution across the site as a whole (Figs 41, 42, and 43), the major selected concentrations appear to occur in two broad locations: a close-knit series in the south-western sector (context groups 802, 803, 809) and a wider spread in the northern sector, both west (2516, 2518) and east (2504, 2508, 2509, 2541) of Burnt Mound I (2550). Finally group 4501 occupies a more isolated location further to the south-east.

There is a clear trend in the distribution of ceramic styles. Mortlake Ware, together with whipped cord decoration which is most typical of Ebbsfleet Ware, tend to be most common in the south-western context groups, while most of the diagnostic Fengate Ware (and Mortlake/Fengate sherds), plus concentrations of incised decoration, are concentrated in the northern site zone. Context group 4501, in the south-east sector, also contains mainly Fengate Ware and sherds with incised decoration.

If one accepts that Fengate Ware was later than Ebbsfleet and Mortlake Ware then these results may indicate that the earliest Middle Neolithic occupation was located in the south-western sector, and that activities later spread to the north and south-east. If, as the radiocarbon dating is indicating at present, Mortlake Ware started later than the Fengate style, or if these two styles were roughly contemporary, then the distribution may suggest that Mortlake and Fengate vessels were being used for different purposes in different areas of the site, or by different sets of people occupying the two different zones of the site. Site levels indicate that the south-western sector was slightly lower lying than the northern island. This may have led to earlier abandonment with a rapid occupation shift caused by a slight rise in the water table.

Key Ceramic Groups

Group 2550 Burnt Mound 1

Dating of the Burnt Mound I sequence on ceramic grounds is very difficult, as no diagnostic sherds were present above the first two layers (old ground surface and features cutting it). The presence of significant numbers of sherds belonging to the Peterborough Ware tradition (determined on fabric; also Ebbsfleet or Mortlake sherd FSN68 Fig. 45.12), along with several pieces belonging to earlier Neolithic traditions (bowl and Mildenhall Ware, the latter FSN64 Fig. 45.7), suggests that the mound was established after and above a phase of Middle Neolithic activity in this specific location. Within these layers the occurrence of large and fresh sherds was relatively high. This activity itself appears to have post-dated Earlier Neolithic activity with the incorporation of abraded Plain Bowl sherds within underlying pit C1894 (FSN59).

However the upper stratigraphic groupings: the hearth/oven and trough, and the burnt spread contained smaller groups of sherds and these were often very abraded. On ceramic grounds it could be argued that the pottery in the burnt layer, along with its associated features, was residual. The pottery in the lower spread is probably contemporary with the formation of the layer although it equally may have derived from the pottery-rich old ground surface upon which it was built. Radiocarbon dating suggests that the spread on which the burnt mound was sited was probably contemporary with the Middle Neolithic pottery that was contained within it (OxA-15046, 3500–3340 cal BC and SUERC-7605, 3630–3360 cal BC), and the Burnt Mound proper is dated to at least one thousand years later (Fig. 33).

Group 802 spreads, stake-holes and tree-throw

The seven feature sherds (none illustrated) included three rims from plain Neolithic bowl, one rim of Mildenhall Ware, two rims of Ebbsfleet style and one Mortlake rim. Context 0005 contained Plain Bowl, Ebbsfleet and Mortlake sherds, while context 0297 included sherds of Mildenhall and Ebbsfleet Wares. This might suggest that some residual pottery of earlier Neolithic date was present, while the presence of two Ebbsfleet vessels might indicate a relatively early date for this context group.

Group 803 spreads, stake-holes and burnt pit.

The feature sherds were all from Peterborough Ware vessels, including one rim of Ebbsfleet style (Fig. 45.11, FSN31) and one belonging to the Mortlake style (Fig. 46.13 FSN28). The Ebbsfleet and Mortlake rims were from different contexts: 0521 and 0458 respectively.

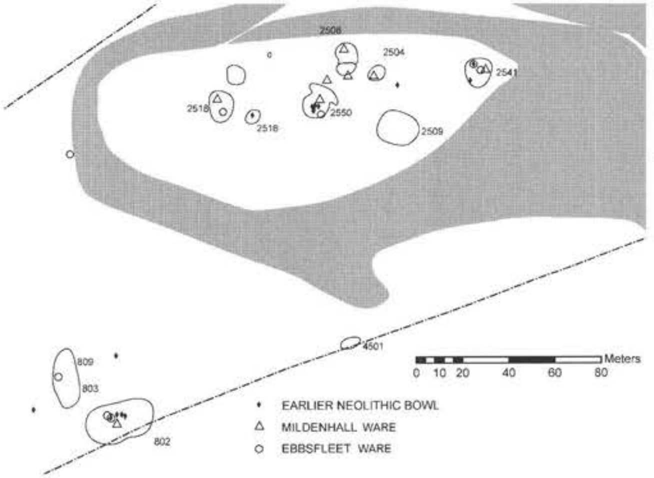


Fig. 41: Distribution of Earlier Neolithic Bowl, Mildenhall Ware and Ebbsfleet Ware pottery.

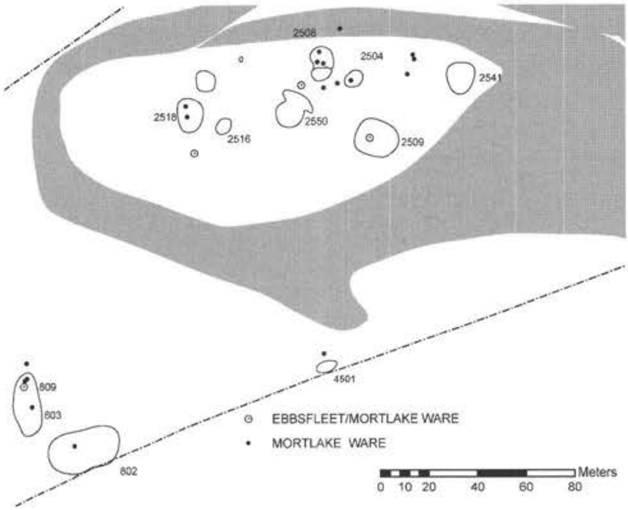


Fig. 42: Ebbsfleet/Mortlake and Ebbsfleet Ware.

Group 809 tree throw with artefact-rich spread.

A published rim sherd is of Mortlake or Fengate style (Fig. 47.22, FSN24 from 0390). The other feature sherds, all from different contexts, included examples of Ebbsfleet or Mortlake Ware and other probably Mortlake sherds.

Group 2504 spread and pit.

The three feature sherds all came from context 1416. The upper portions of two Mortlake vessels are published (Fig. 46.14 and 15, FSN48 and 49) while the third piece was a possibly Mildenhall rim.

Group 2508 spread with burning and pits — cooking pit?

Sherds of Mortlake and Mildenhall Wares (the latter Fig. 45.4, FSN34) came from context 1001, while both Mortlake and Mortlake/Fengate sherds (Fig. 47.21, FSN53) were found in 1463. Other diagnostic pieces all came from different contexts and included variously a Fengate rim (Fig. 48.23, FSN32), a Fengate base fragment (Fig. 48.28, FSN39) and a Mortlake rim (Fig. 47.17, FSN52).

Group 2509 finds-rich spread with some post-holes

No diagnostic sherds were recovered in this group.

Group 2516 oven with ?tree-throws.

A rim from a plain Neolithic bowl (Fig. 45.2, FSN76) came from context 1150, while 3090 contained four Beaker sherds (base angle published: (Fig. 49.31 FSN77) along with eight pieces of undiagnostic Peterborough Ware.

Group 2518 spread sealing occupation

Context 1778 contained diagnostic sherds of Mortlake, Fengate and Mildenhall or possibly Ebbsfleet Wares, and context 80 produced an Ebbsfleet rim and a sherd of Fengate Ware (Fig. 48.25, FSN6).

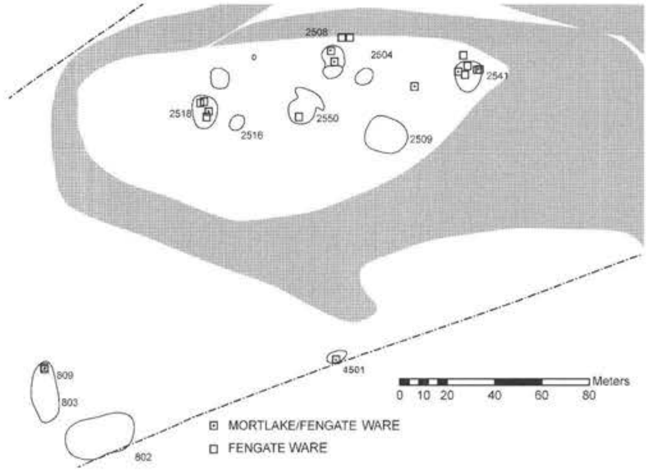


Fig. 43: Mortlake/Fengate and Fengate Ware.

Group 2541 possible post-hole structure interleaved with tree-throws.

Context 1973 contained two Plain Bowl rim sherds (one published: Fig. 45.1, FSN63), and two different rims from Ebbsfleet Ware vessels were found in context 225. Other individual contexts produced a Mildenhall Ware rim, an Ebbsfleet rim (Fig. 45.9, FSN15), two Mortlake/Fengate rims (one is Fig. 47.19, FSN61), two Fengate rims (Fig. 48.26 FSN66, 27 FSN60,), a Fengate base and other Peterborough Ware items.

Group 4501 pit and curving gully

Fengate (Fig. 48.24, FSN10) and Mortlake/ Fengate rims were both found in context 114, and a possibly Mortlake rim in context 212 (Fig. 47.18, FSN14).

Fabrics by Ann Woodward and Adam Tinsley

The fabrics of the Peterborough Ware assemblage from Willington Quarry are mainly characterised by coarse angular inclusions of quartz and quartzite. Thus fabric types Qu1 and Qu2 comprise 91% of the sherd total. Other less common inclusions are flint, hard rock and sandstone, with some of the rock having been identified as igneous. In contrast, the fabrics of the smaller numbers of sherds of Beaker and Bronze Age date contain grog, and a little sand and shell. Petrological analysis confirmed these macroscopic identifications: quartz, quartzite, and igneous rock of at least two kinds (horneblende diorite or gabbro and granodiorite), all of which were sometimes accompanied by sandstone fragments. The same sandstone was found in association with grog in one of the Beaker samples. Chert was also identified in one of the Peterborough Ware samples, and the Bronze Age urn sample contained a denser distribution of smaller quartz inclusions, typical of the pottery of this period. The quartz, quartzite, sandstone and chert could all have been obtained from gravel beds local to the site. Some of the igneous fragments may also have been obtained from the local gravels, but probably originated from outcrops in Charnwood Forest (Groups 6 and 7). However, the igneous inclusions in Group 8 could be horneblende diorite or gabbro, which could have come originally from a small outcrop under Swithland Reservoir (Fig. 59).

In the immediate area, an assemblage of slightly earlier Mildenhall Ware from Hill Farm, Willington also contained large quantities of quartz and quartzite inclusions, although calcite was also present. At Lockington, Derbyshire, one Neolithic sherd contained quartz, and so did Peterborough Ware sherds from Whitemoor Haye, Staffordshire, slightly further up the Trent Valley. Beaker sherds from Lockington and Whitemoor Haye contained grog, similar to the Beaker fabric identified at Willington Quarry (for references see Johnson and Whitbread, this report). Macroscopic examination of material from other Peterborough Ware sites within Derbyshire and the Peak District suggests that the use of quartz and quartzite may reflect a wider regional preference for such inclusions. For example, a uniquely decorated Ebbsfleet vessel from Melbourne (Courtney 1976) and sherds from at least two vessels, one an Ebbsfleet bowl, from Upper House Farm (Hart 1985) are reportedly in a quartz fabric, as are sherds from at least two Mortlake vessels from Kenslow (Garton and Beswick 1983). Sherds recovered from Fox Hole Cave are also reportedly in a composite flint and quartz fabric (Jackson 1949; Bramwell 1971). These assemblages are relatively small but cumulative with the Willington material produce a total that represents 70% of the minimum number of vessels from Derbyshire, for which data related to fabric type was available. For neighbouring East Midlands counties the percentage is rather lower e.g. *c.* 45.5% for Leicestershire, and further south shell inclusions are more common (e.g. 45.5% shell for Cambridgeshire). In the West Midlands, the few finds of Peterborough Ware do tend to include quartz fragments, as at Wasperton (Hughes and Crawford 1999, 27), and this trend is very noticeable in Wales where quartz inclusions predominate, especially in vessels belonging to the Mortlake style of Peterborough Ware (Gibson 1995, fig. 3.8).

Further south, Peterborough Ware assemblages are dominated by fabrics containing crushed flint. Flint accounts for 98% of the inclusions relating to such finds from the Middle and Lower Thames, although 21% of vessels from Yarnton, Oxon (Upper Thames) contained quartz inclusions. In Wessex, flint again was most commonly employed, although there is slightly more shell than flint in the Fengate Ware vessels examined by Cleal (1995, fig. 16.2). Angular quartz and sandstone inclusions were also sometimes present, reaching 6% in the Mortlake style vessels studied by Cleal.

It has been argued that the deliberate selection of quartz as inclusions for Peterborough Ware pottery was related to its symbolic importance. Quartz boulders were often incorporated into early prehistoric monuments, and the bright colour and luminescence of the quartz may have imbued this material with magical and powerful qualities (e.g. Gibson 1995, 29). The contrast between the white inclusions and the dark matrix of the pottery fabrics was undoubtedly intentional. Flint inclusions also stand out strongly from background fabrics, although the magical properties of flint are less obvious.

The major use of quartz and quartzite in the Peterborough Ware fabrics at Willington Quarry may imply that the assemblage belongs to a widespread potting tradition that extends from the Welsh coast to its most easterly expression in Derbyshire and Leicestershire. It is tempting to suggest that such a tradition was maintained within a series of social networks, perhaps even familial ties. The deep roots of such a tradition may be evidenced by the high occurrence of quartz inclusions in the large assemblage of Mildenhall Ware from Hill Farm, Willington, belonging to a slightly earlier stage within the Neolithic period.

The identification of igneous inclusions within some of the Middle Neolithic pottery from Willington Quarry is of particular importance. Inclusions from the sources of granodiorite in Charnwood Forest (Fig. 59) are now well known within assemblages of Iron Age and Late Bronze Age pottery, and have now been identified in some of the Early to Middle Bronze Age urns from Eye Kettleby, Leics. (Knight *et al.* 2003, 117–9). However this is the first instance of granodiorite inclusions having been found in pottery of Neolithic date. But it is not the first recorded occurrence of igneous inclusions in Peterborough Ware pottery. At The Breiddin, granitic inclusions were derived from a non-local North Wales source (Gibson 1995, 29), while at Meole Brace, Shropshire at least two of the Mortlake style vessels contained deliberately added granite and rhyolite as well as quartz. The granite and rhyolite had probably been obtained from erratics in the local Boulder Clays (Williams 1995, 14–15).

Petrological Analysis by Elizabeth Johnson and Ian Whitbread

Introduction

Thirteen sherds of Neolithic and Early Bronze Age pottery were selected for petrographic analysis with an additional two sherds included for hand specimen examination of specific large inclusions. The full report, including detailed methodology and fabric descriptions can be viewed at http://ads.ahds.ac.uk/catalogue/resources.html?willington_eh_2008. The analysis was to answer direct questions including the petrography of the fabrics, the source of material found in the fabrics and whether material had been deliberately added. Additionally, would the worn edges of the large inclusions in the two sherds not included in the petrographic sample reveal information relating to their source?

Results

Analysis of the fabrics reveals quartz/quartz silt, quartzite and sandstone as the most frequently occurring inclusions in the samples which, given the background geology, are likely to derive from local gravel beds. Three fabric classes contained igneous material including gabbroic rock and altered igneous material, possibly a granodiorite. One fabric is characterised by the lack of sedimentary rocks such as quartz and sandstone as much as by the presence of granitoid material, which might suggest a non-local source for the inclusions. Fabric 8 is characterised by a sandy matrix and the presence of amphibole and biotite mica within the rock fragments.

A possible source for the igneous material may be the Mountsorrel complex in Leicestershire, as a variety of igneous rocks including gabbro, granodiorite and diorite are found in this region (Le Bas 1968, 47–48).

A number of the fabric groups in this sample probably have had inclusions deliberately added to the clay during pottery production, though it is not possible to positively determine this in all cases.

Comparison with other sites

Three other sites from which Neolithic and Bronze Age pottery had been recovered and analysed petrographically were selected for comparison with the fabric groups identified in this sample.

Four fabric groups of Mildenhall Ware from Hill Farm, Willington, were identified as containing grog, large quartz grains, smaller quartz and calcite inclusions (Williams forthcoming). While some fabrics were comparable, the most notable difference is that the fabrics analysed above do not match the Hill Farm calcite group. Similar quartz and sandstone inclusions were identified at Lockington (Williams 2000: 60–61) and Whitemoor Haye (Ixer 2002, 94–97; forthcoming)

Form and Decoration

Earlier Neolithic, Beaker and Early Bronze Age by Ann Woodward

Early Neolithic bowl

Two diagnostic rims come from an open bowl and a closed, probably carinated vessel, while a plain wall sherd carries part of a plain raised lug (Fig. 45.1–3). Simple rims from plain open or carinated bowls with out-flaring rims are typical of the Early Neolithic bowl tradition. Similar pottery has been found previously at Willington (Manby 1979, 146 and fig. 58, 1–21). Such pottery is relatively rare in the Trent Valley or the Peak District, the few locations having been listed by Manby (*ibid.*). One substantial profile was recovered from Aston barrow 1, Aston-on-Trent (Reaney 1968, fig. 6) and similar sherds derive from Swarkestone barrow 4 (ApSimon 1960, fig. 9).

Mildenhall Ware

The rims found at Willington Quarry are characterised by relatively simple expanded, and usually everted, rims (Fig. 45.4–7). The vessels represented are mainly plain, but the incised herringbone design on the top of one rim, and the row of small indentations are typical of the tradition. Mildenhall Ware was not represented in the assemblage recovered from the Wheeler excavation programme at Willington, but it was the main style of pottery found in the pit groups at Hill Farm, Willington (Woodward and Hancocks forthcoming). Further afield large assemblages of Mildenhall Ware occur at Briar Hill, Northamptonshire (Bamford 1985), Etton, Cambridgeshire (Pryor 1998) and Hurst Fen, Suffolk (Clark *et al.* 1960).

Beaker

Diagnostic fragments from Willington include a rim and base sherds from one vessel, and pieces of base angle from two further vessels (Fig. 49.29–32). Due to the small size of the sherds, attribution to particular Beaker styles is very difficult. However, the simple decoration, comprising horizontal rows of cord or comb impressions only, may suggest that these vessels belonged to the earlier stages of Beaker development. They may therefore have been similar to the primary Beaker found in Aston barrow 1 (Reaney 1968, fig. 4a). The Beaker sherds with more complex decoration, found previously at Willington (Manby 1979, figs 65–6) and at Swarkestone barrow 4 (ApSimon 1960, fig. 9) may have derived from Beakers belonging to more developed (but not necessarily later) styles.

Urn

The plain rim sherd from an urn-sized vessel (Fig. 49.33) possesses a distinct internal bevel. This feature, together with the fabric containing dense quartz inclusions may indicate that this piece came from a Biconical Urn of the later Early Bronze Age period. However, this rim form does also occur during the Late Bronze Age.

Peterborough Ware by Adam Tinsley

Before discussing the wider affinities of the Willington assemblage it must be stressed that the following comparisons are based upon the author's direct experience of Peterborough Ware material, which while fairly extensive, mainly relate to assemblages from central and eastern England (Fig. 44). This situation does not render such comparisons invalid but it will unfortunately result in suitable comparative material from western England being largely overlooked. This point may carry some significance in the light of the discussion relating to ceramic styles (above p. 88) and may warrant further investigation in order to situate the assemblage more securely and to examine any associated patterning in the distribution and form of the material.

The following discussion will focus upon aspects of form and decoration within the Willington assemblage and will attempt to place the various typological subgroups definable within the assemblage in relation to comparable material locally and on a regional basis. Other salient and distinguishing features of the assemblage such as the fabric composition of the group are discussed (above p. 85). Key diagnostic material will be dealt with on an individual sherd basis within the various subgroup headings.

In general terms the Willington pottery offers one of the largest assemblages recovered from Derbyshire and the surrounding area and differs from normal Peterborough Ware assemblages throughout the country, which for the most part consist of only a small number of sherds. However, it does not approach the larger deposits of sites mainly located in southern and central England such as West Kennet, Wiltshire (Thurnham 1861; Piggott 1962), Caesar's Camp, Surrey (Grimes 1960b) and the as yet unpublished sites of Yarnton, Oxfordshire, the Royal Medical College, Surrey and the Imperial College Sports Ground, Surrey, to name but a few. Nor does it offer the quality of material evident among such assemblages, the Willington group being highly fragmented, with much denuded material, a limited number of diagnostic sherds and a small number of partial vessel profiles. In some cases the fragmentary nature of the material can render it difficult to assign sherds to a subgroup with confidence. However, at Willington it has been possible to identify material belonging to all three subgroups: Ebbsfleet, Mortlake and Fengate Ware. This occurrence is notable as the subgroups more commonly occur in a dual combination, usually though not always either Ebbsfleet and Mortlake or Mortlake and Fengate, or more frequently still in isolation. Willington is therefore part of a select group of sites that present a rare opportunity to examine all three subgroups in close association.

Among the geographically immediate sites of southern Derbyshire only Aston Hill includes material identified from all three subgroups and this relies upon a somewhat equivocal identification of a Fengate rim (May 1971, 33, fig. 2.4). The composition of the Potlock Cursus assemblage and other potentially important sites from the area are unfortunately unknown to the author and must await publication. Outside southern Derbyshire other tripartite assemblages are more numerous and include material from West Kennet long barrow, Wiltshire (Piggott 1962), Windmill Hill, Wiltshire (Smith

Fig. 44: Peterborough Ware sites mentioned in comparative study.

1965), the site of Baston Manor, Kent, (Philp 1973) as well as material recovered from the River Thames at Mortlake, although this may be questionable and the association entirely fortuitous for obvious reasons (Lawrence 1929; Cotton 2004). A further group of sites are currently under analysis and include material recovered by both Wessex Archaeology and Oxford Archaeology from among several sites in Berkshire and Surrey close to the Stanwell Cursus. They include the sites of Beddington, the Imperial College Sports Ground, The Royal Medical College and a group of isolated sites located as part of the Maidenhead flood relief scheme.

Elsewhere the apparent separation of the various subgroups has been taken to indicate distinctions in the ways in which they were used or at least deposited (Thomas 1999). However, these distinctions have not been explained satisfactorily and are not fully understood. Sites such as Willington therefore present a contrast with the established pattern of recovery but also an opportunity to examine the contextual relationship between the various subgroups. This opportunity is enhanced by the suite of radiocarbon dates available at Willington and is made all the more relevant given the possible issues raised by a review of the subject by Gibson and Kinnes (1997).

Ebbsfleet Ware

The examples of Ebbsfleet Ware from Willington, identified in Figure 45, are fairly typical of the subgroup. Illustrated sherds 10 and 11 are particularly diagnostic and bear comparison in form with published material from Ebbsfleet, Kent (Burchell *et al.* 1939), the River Thames at Mortlake and Hammersmith (Lawrence 1929 and unpublished material), Windmill Hill, Wiltshire (Smith 1965), West Kennet, Wiltshire (Piggott 1962) and Mixnam's Pit, Surrey (Grimes 1960a) to name but a few sites. The use of whipped cord on both sherds and in particular the herringbone pattern upon sherd 11, is not uncommon and was noted as a possible characteristic of chronologically late Ebbsfleet Ware by Smith (Smith 1974). Again such features can be seen on Ebbsfleet Ware material from Mortlake (Lawrence 1929, 83) and at sites such as Green Howe, North Yorkshire (Wood 1971, 9 fig. 4), Thornton-le-dale, East Yorkshire (Manby 1956, 4, fig. 1), West Kennet, Wiltshire (Piggott 1962, 37, fig. 11), Windmill Hill, Wiltshire (Smith 1965, 75–6, figs 31 and 32,) and Drayton Cursus, Oxfordshire (Barclay *et al.* 2003, 64, fig. 4.22.8,).

Illustrated sherd 8 lacks somewhat the classic S-shaped profile of Ebbsfleet Ware, as suggested in the profile of illustrated sherds 10 and 11, but can still be easily accommodated within the subgroup. The lack of decoration in this instance is notable, compared to the rest of the assemblage, yet Ebbsfleet vessels do tend to be decorated in a relatively spartan manner and plain examples are not entirely uncommon. Undecorated examples can be found among material from Ebbsfleet, Kent (Burchell *et al.* 1939, 419, fig. 8), Stonea, Cambridgeshire (Cleal 1986) and a site at Browick Road, Wymondham, Norfolk (Percival unpublished).

The small size of illustrated sherd 12 makes it difficult to compare directly with material elsewhere. It is probably from the rim of an Ebbsfleet vessel similar to examples cited above but could also be from the tip of a Fengate collar.

Mortlake Ware

The Mortlake component of the assemblage contains some of the more complete profiles available from Willington. Among them are fairly typical examples of the subgroup as well as one or two examples that are more difficult to place.

Illustrated sherds 13 and 15, Figure 46, are typical of Mortlake Ware, demonstrating a developed shoulder, a relatively deep cavetto neck and a thickened, externally projecting rim with a slight internal lip. Comparisons can be drawn directly with examples from Ecton, Northamptonshire (Moore and Williams 1975) and Craike Hill, East Yorkshire (Manby 1958) as well as unpublished material from Staines Road Farm, Shepperton, Surrey (Jones in prep.), Beddington, Surrey, and other sites. They also bear comparison with sherds from Staines causewayed enclosure, Surrey, although in this instance the material is missing the shoulder profile and has been identified as Ebbsfleet Ware (Robertson-Mackay 1987, 175 and 176, fig. 52).

Illustrated sherd 14 could also equally stand such comparisons. Ebbsfleet vessels tend to be of larger proportions than the diameter suggested for the vessel represented (which is comparable with those diameters developed for illustrated sherds 13 and 15), and a Mortlake assignation would be acceptable for this sherd. However the simplicity of the rim and the greater width of the neck are more indicative of Ebbsfleet Ware. Having said this, the apparent relatively sharp return of the shoulder angle could push the pendulum in the opposite direction. Most Ebbsfleet vessels produce a softer more rounded S-shaped profile with relatively weak shoulders, although an example from the Drayton Cursus, Oxfordshire, can show how futile such generalisations can be (Barclay *et al.* 2003, 57, fig. 4.16.3).

The near vertical profile of illustrated sherd 16 (Fig. 47) is suggestive of a jar or tub-like form and rules out an Ebbsfleet assignation. However, the same vertical profile, with a simple near vertical rim projecting from a weak shoulder, is not easily accommodated within Smith's original typology for Mortlake or Fengate Ware either (Smith 1956). This does not mean that the vessel is unique and several similar examples can be found within assemblages from Sawdon Moor, East Yorkshire (Brewster *et al.* 1995, 160, fig. 53.2,), Maidenhead, Berkshire (unpublished) and Little Cressingham, Norfolk (Lawson *et al.* 1986), although this last sherd has a pointed rather than flattened rim top. Further examples include a large profile from Wollaston, Northamptonshire (Gibson 1996), although in this instance the shoulder is more developed, and a vessel from Skendleby Longbarrow, Lincolnshire (Evans and Simpson 1991, 33, fig. 26.3), although here the flat rim top projects both externally and internally creating a t-shaped rim. In both these last instances, the vessels have been identified as Mortlake Ware and it is in this category that such material may more readily be incorporated. The vertical nature and flat rim top of illustrated sherd 17 may suggest a similar vessel to that above, although in this case, the lack of any further shoulder profile can not rule out an Ebbsfleet assignation when compared with an example from Carnaby Top Site 1, East Yorkshire (Manby 1975, 36, fig. 8.15).

The decoration of incised herringbone patterns evident on the internal surface and flat rim top of illustrated sherd 18 (Fig. 47) is common among the Peterborough Ware tradition. It is slightly more difficult, however, to find any direct parallels for the form of this sherd. While the short, flat topped rim and internal pinched ridge do not find direct comparisons, the sherd appears to come from a relatively small, unelaborate vessel and, as such, may more easily be accommodated within the Mortlake subgroup. Mortlake Ware in this respect tends to show a greater bias towards vessels of lower internal capacities than the other Peterborough Ware forms. Examples of similar small bowls include material from Garton Slack Barrow 112, East Yorkshire, although this lacks the flat rim top and internal ridge and is described by Manby as a Rudston Style vessel (Manby 1988 Appendix C., 81). Other examples include a vessel from Risby Warren, Lincolnshire (Riley 1957, 45, fig. 3.4) and, perhaps more closely, unpublished sherds with flat rim tops from Garrowby Wold Barrow 68, East Yokshire, as well as Maidenhead, Berkshire, and Imperial College Sports Ground, Surrey.

Mortlake/Fengate Ware

Other material featured in Figure 47 is slightly more problematic when assigning subgroup categories, but for the most part can find numerous parallels elsewhere. Illustrated sherd 19 appears to be relatively straightforward, in that the hammer-shaped rim profile is highly indicative of Mortlake Ware with numerous parallels at Caesar's Camp, Surrey (Grimes 1960b), West Kennet, Wiltshire (Piggott 1962) and Maidenhead, Berkshire (unpublished). It also finds further comparisons in terms of the hammer profile combined with pinched internal ridges with specific examples, P6 and P7, from West Kennet, Wiltshire, and an example of a Mortlake bowl inverted within a pit at Cippenham, Berkshire (Ford and Pine 2003). Alternatively the absence of a shoulder angle, while probably the result of breakage patterns and not an entirely unknown feature within the Mortlake subgroup, may rather be indicative of a Fengate vessel comparable to, for example, one from Briar Hill, Northamptonshire (Bamford 1985, 117, fig. 56 NP85). Grey areas do exist between stereotypical examples of any subgroup, for example, the Cippenham vessel appears to combine a Mortlake rim with a possible conical body, typically a feature of Fengate Ware, and one could not rule out such a combination in this case.

Illustrated sherds 20 and 21 also enter a grey area between Mortlake Ware and Fengate Ware. The projected profile of illustrated sherd 20 is most probably indicative of a Mortlake vessel similar to an example from Ampleforth, Yorkshire (Wilmot 1938) as well as similar, as yet unpublished, examples from the Imperial College Sports Ground, Surrey, among other sites (Wessex Archaeology). However, the incompleteness of this profile warns against making such assumptions and the sherd may easily have come from a Fengate collar. The decoration, which appears to be in the form of incised infilled triangles, is certainly more in keeping with a Fengate assignation. Examples of such a motif include material from Astrop, Northamptonshire (Leeds 1912), Briar Hill, Northamptonshire (Bamford 1985), Fornham St Genevieve, Suffolk, Creeting St Mary, also Suffolk, Baston Manor, Kent (Philp 1973) as well as the Wiltshire sites of Windmill Hill (Smith 1965) and West Kennet (Piggott 1962). I am only aware of a single instance where such a motif occurs on a Mortlake vessel and this is from Yarnton, Oxfordshire (unpublished), where the motif is executed in short lengths of twisted cord.

The profile of illustrated sherd 21 is more complete and with the triangular shape, external lip and internal ridging can find several parallels. Unfortunately, such parallels are indicative of both Mortlake and Fengate Wares. One comparison is with the restored vessel from Stanton Harcourt, Oxfordshire (Leeds 1940, 7, fig. 2), which, while not a classic Fengate form, could easily fall into this category. A similar sherd from Craike Hill, East Yorkshire (Manby 1958, 228, fig. 4.5), on the other hand, demonstrates a much more substantial and heavily angled shoulder and is indicative of a Mortlake vessel. While a Mortlake vessel is more likely, the decoration of this sherd is in keeping with illustrated sherd 20 and a Fengate motif. A greater profile in both cases would be necessary to substantiate either case.

Illustrated sherd 22 appears to be from near the base of conical or tub-like vessel and consequently could easily derive from a Fengate vessel or possibly from the lower portion of a vessel similar to that indicated by illustrated sherd 16. As such, it could be classed as Mortlake or Fengate, the decoration of whipped cord maggots at home with either.

Fengate Ware

Figure 48 contains some of the more unusual sherds in the Willington assemblage, although most seem at home in the Fengate Ware sub-category. While the profile of illustrated sherd 23 is somewhat equivocal due to the speculative reconstruction of the neck and shoulder, it does find a close parallel with an unpublished reconstructed profile developed by Isobel Smith from material recovered at Lion Point, Essex (Smith 1956). With the Essex example, the t-shaped rim prompted identification as Mortlake Ware, although the profile also indicates a long, conical body with a flat base and more suggestive of Fengate Ware or, in this instance, perhaps a Mortlake/Fengate composite vessel.

The decorative scheme visible across the external rim or collar of curving arcs or 'swags' is highly interesting on a number of levels. The motif is relatively uncommon among Peterborough Wares but does occur on a number of examples covering the length and breadth of the tradition's distribution. Similar motifs in twisted cord are evident at a number of sites including Ford in Northumbria (Longworth 1969; Kinnes and Longworth 1985), Arreton Down, Isle of Wight (Alexander *et al.* 1960, fig. 7), King's Stanley, Gloucestershire (Gibson 2005; Evans 2006) and possibly Baston Manor, Kent (Philp 1973, fig. 6.9), although the latter may more easily be described as infilled triangles. Crudely incised swags occur on a vessel interior from Caesar's Camp, Surrey (Grimes 1960b, fig. 75), and sherds from Etton Causewayed Enclosure, Cambridgeshire (Pryor 1998, fig. 204). Swags and swag-like motifs executed in end-on-end finger nail decoration occur on two unusual vessels from Carnaby Top site 19, East Yorkshire (Manby 1975, fig. 13.4 and 5, illustrated as two vessels but probably one and the same, and fig. 13.10), a sherd from the Springfield Cursus, Essex (Buckley *et al.* 2001, fig. 21.72), and possibly on material from Fengate, Cambridgeshire, although the quality of the illustrations in this last instance is somewhat poor and the material has since been lost (Leeds 1922, fig. 8 and 9). Swags executed in bird bone have also been reported from a vessel in the Bagshot long barrow ditch, Surrey (Keiller and Piggott 1939), and Piggott noted similar examples from Barnham, Suffolk, and Cassington, Oxfordshire. In the case of the latter two examples the relevant material could not be found during examination of the assemblages and it may be that the various sherds have been lost. A final example has been described by Gibson in relation to a uniquely decorated vessel soon to be published as part of an assemblage from Salford, Bedfordshire (Dawson forthcoming, noted in Gibson 2005). Of all the examples quoted above, about half represent Mortlake Ware, the remaining Fengate Ware. As such, the decoration can offer little help in assigning a subgroup definition to the Willington material. However, what may be more interesting is that, as Gibson notes (*ibid.*), swag motifs are a feature of Grooved Ware decoration and as such may be indicative of the transference of traits from one tradition to the other. This need not pre-suppose the presence of Grooved Ware in the area during the time of occupation at Willington but rather reflect a more general chronological overlap at a national scale.

Illustrated sherd 24 is perhaps more strongly indicative of the Fengate Ware subgroup than illustrated sherd 23 above. However, the knife like profile of the wide collar is quite difficult to parallel elsewhere. Collars of a similar size and shape, but demonstrating a greater curvature of the internal surface, occur at Cassington, Oxfordshire (Leeds 1940, Plate 1.A), Carnaby Top Site 19, East Yorkshire (Manby 1975 fig. 13.3, 49) and the rather curious reconstructed vessel from Icklingham, Suffolk (Piggott 1954, Plate X, 311). The flat internal surface of the Willington vessel is suggestive of a vertical-sided cylindrical form rather than the typical Fengate truncated cone. It is perhaps within examples of such cylindrical jar forms that we may draw a better comparison for this sherd. In this respect, the Icklingham vessel as well as other unpublished material from the same site offer some indication of the potential form of illustrated sherd 23, as do perhaps sherds from the Thames at Mortlake (see Cotton 2004, 130, fig. 15.2).

The form of illustrated sherd 25 is rather curious and, unfortunately, too little of the vessel is represented to provide any clear cut parallels. The sharp external angle of the rim and the flat internal rim edge do find a match with an unpublished sherd from Normanby Park, Lincolnshire (Riley 1973). Here the sherd has fractured just below the external rim angle and is therefore missing any internal ridges as is evident in the Willington example, should they have ever existed. The sharp angle of the external rim edge and the shallow width of the external surface are perhaps more indicative of a Mortlake rim rather than a Fengate collar but it would be difficult to say more without further sections of the vessel.

The final sherd to warrant comment is illustrated sherd 27 (Fig. 48). Here, only the upper portions of the vessel rim are present and comparisons with both Mortlake and Fengate vessels are possible. However, the possible presence of an infilled triangle motif on the rim exterior together with the sharp angle of the body or neck are perhaps more indicative of the latter. In this respect, the sherd may be compared to a simple, conical profile from Sawdon Moor, East Yorkshire (Brewster *et al.* 1995, 159, fig. 52.3) and several almost identical vessels from Yarnton, Oxfordshire (unpublished). While these vessels do not conform to the scheme of large developed collars more typical of Fengate vessels (Smith 1956), they do appear to represent a more simplistic, perhaps more utilitarian facet of the subgroup.

Conclusion

While the Willington assemblage is highly fragmented and contains much denuded material it has been possible to pick out a range of diagnostic sherds that indicate the presence of all three subgroups of the Peterborough Ware tradition. In terms of composition the Willington assemblage is therefore distinguished in local as well as inter-regional terms, the various subgroups tending to occur in pairs or more often in isolation. In this respect it is unusual to recover Ebbsfleet Ware and Fengate Ware together unless accompanied by Mortlake Ware also. This separation was previously explained in partly chronological terms as a consequence of a sequence of evolution from Ebbsfleet through Mortlake to Fengate (Smith 1956). However, the review of radiocarbon dates associated with Peterborough Ware by Gibson and Kinnes (1997) and the dating programme of this project (Marshall *et al.* this volume) has cast some doubt upon this sequence and may indicate that the separation of the subgroups is rather conditional upon different spheres of use and deposition. The assemblage at Willington therefore offers a contrast with perceived patterns of deposition and the opportunity to study the contextual as well as possible chronological relationships of the various subgroups. The various subgroups appear to be equally well represented at the site, although sherds belonging to the Mortlake subgroup offer a better and more complete indication of the original vessel profiles. This may relate to possible differences in the nature or position of deposition but may equally simply reflect a greater robustness of Mortlake vessels along the rim and shoulder compared to their subgroup counterparts. In all cases examples of each subgroup include a range of fairly typical forms for which parallels are relatively easy to pinpoint and can be drawn from a wide geographical area. The same may be said of the range of decorative elements displayed by the assemblage. Collectively the range of forms and decoration at Willington testify to the consistent nature of Peterborough Ware adoption across the range of its distribution. However, it has been difficult to find direct parallels for a number of individual vessels, for example, illustrated sherds 18, 24 and 25. In these instances a more general set of attributes have been highlighted linking the sherds to comparative material elsewhere. This may indicate a degree of localised or even regional diversification in form although any such suggestion must be extremely tentative, due in large part to the fact that much of the immediate comparable material from Derbyshire has been unavailable for examination as a result of the temporary closure of the main repository, in this case Sheffield City Museum. Elsewhere, a degree of diversification can be witnessed on a site by site and regional basis and has prompted the identification of regional groups either in purely stylistic terms, for example, Wales (Gibson 1995), or in relation to apparent differences in form, for example, East Yorkshire (Manby 1975). Whether or not the Willington material is indicative of such patterns must await further examination of comparative material and for the time being cannot be advocated.

A connection with Grooved Ware stylistic elements is suggested by the presence of swag motifs upon several rim sherds tentatively identified as Fengate Ware. It is suggested that the direct chronological and geographical overlap of stylistic elements is not necessary in order for there to have been a degree of influence established between the two traditions. Alternatively, the presence of certain stylistic elements within two distinct ceramic forms may instead be entirely fortuitous.

Dating by Ann Woodward

Peterborough Ware

The results of the radiocarbon dating programme undertaken at Willington, and comparisons with other reliable dates for Peterborough Ware from around the country, suggest that the tradition was current for about five or six hundred years, between *3510–3360 cal BC (68% probability)* and *2970–2890 cal BC (68% probability*; see p. 47). This is a considerably shorter span than that indicated by Gibson and Kinnes in 1997 (*c.* 3400–2500 cal BC), although it started at roughly the same time.

The new programme has confirmed the primacy of the Ebbsfleet style. Previous discussions and analyses of the tradition, starting with the seminal analysis of morphological and decorative changes provided by Smith (1956) have suggested that the Fengate style started later than Mortlake. Although based on only a few radiocarbon determinations, Gibson and Kinnes were able to point out that the Fengate style appeared to start just as early as Mortlake (Gibson and Kinnes 1997, 70). This pattern has been confirmed by the new radiocarbon programme (Marshall *et al.*, this report), while the current available suite of dates indicates that the Fengate style may indeed have started before the Mortlake style.

The group of radiocarbon dates from Willington provide an important contribution to the corpus of such dates nationwide. Previous dates for Peterborough Ware from the East Midlands are few; the most important examples being those for Ebbsfleet style vessels from Etton, Cambridgeshire (3330–2910 cal BC; GrA-29353; 4410 ± 40 BP; Pryor 1998) and Raunds, Northamptonshire (3650–3370 cal BC; OxA-7944; 4750 ± 45 BP; Harding and Healy 2007). At Willington the span of occupation associated with Peterborough Ware is considerably shorter than the span of Peterborough Ware nationwide. Also the Willington span appears to occupy the earlier part of the nationwide occurrence. The relative abundance of diagnostic Fengate and Mortlake-Fengate sherds at Willington may strengthen the ideas that the Fengate style appeared early, and it may be that a later 'Mortlake only' phase is not discernible at Willington, as occupation had ceased before that typological stage was reached.

Gibson and Kinnes concluded that the 'internal stylistic sequence (of Peterborough Ware) is a matter of typological perception and cannot be supported by associations, stratigraphy or C14' (Gibson and Kinnes 1997, 70). After a further decade of excavation and radiocarbon dates, this conclusion still stands. Indeed, it may be that the perceived development from Mortlake to Fengate styles will need to be reversed. However it is desirable that this process should be checked by a larger number of relevant dates in the future.

Mildenhall Ware

Available radiocarbon dates from sites such as Briar Hill (Northamptonshire), Broome Heath (Norfolk) and Etton (Cambridgeshire) indicate that the Mildenhall tradition was current during the middle quarters of the fourth millennium cal BC (Pryor 1998, 352). Unfortunately a series of thermoluminescence dates from sherds of Mildenhall Ware at Hill Farm, Willington (Barnett in prep.) were anomalous, falling between 2500 and 1500 cal BC, i.e. within the Late Neolithic and Early Bronze Age periods.

Beaker

Although the Beaker fragments could not be assigned to specific Beaker types, the incidence of very simple motifs may suggest that the vessels represented derived from early within the Beaker sequence, probably between *c.* 2500 and 2000 cal BC.

EBA Biconical Urn

The rim sherd from an urn, which probably belonged to the Biconical or Cordoned series of later Early Bronze Age urns. Such urns occur between *c.*1500 and 1300 cal BC., and the Willington sherd may have been contemporary with the decorated Cordoned Urn from Willington (Manby 1979, fig. 64) and with the later plain Cordoned Urns at cemeteries like Eye Kettleby, Leicestershire (Marsden and

Woodward forthcoming) or Eaglestone Flat, Derbyshire (Barnatt 1994, fig. 1 and Table 2).

Lipid analysis and vessel function by Ann Woodward

A total of 50 pottery samples from Peterborough Ware, taken from the upper portions of diagnostic vessels, were submitted for lipid analysis (see below p. 101). They were also selected in order that all areas of the site were represented. The aim was to investigate the incidence of lipids relating to dairy products and adipose fats from different groups of domestic animal, and traces of plant and insect waxes. Interpretable chemical signatures were derived from 14 (28%) of the sherds. This frequency was rather lower than that obtained for six other Neolithic assemblages recently studied, where lipids were found in 43% of the 438 sherds analysed (Copley *et al.* 2005).

Appreciable lipid residues were found in 16 sherds, two of which were of Mortlake style, one of Fengate style and the rest could only be identified generally as Peterborough Ware. Fourteen sherds were analysed in detail, of which eleven indicated the former presence of dairy products, one the presence of ruminant adipose fat (i.e. from meat) and two contained traces from mixed ruminant and porcine adipose fat. These results indicate that the consumption of dairy products was common and that the meat from ruminants (cattle, sheep or goat) and pigs was also being processed in the vessels concerned. One Mortlake sherd and one of Fengate style both contained evidence from dairy products, and a second Fengate sherd was shown to contain ruminant adipose fat. In addition, two of the sherds, one of Fengate style and one generalised Peterborough Ware sherd, contained traces of plant wax or of insect wax, such as beeswax. Samples producing positive results were located in all areas of the site, and evidence of dairy products and animal fats were found in both the southern and the northern sectors of the site.

Analysis also showed that 13 of the sherds had been exposed to extreme heating (>300°C). Whether this heating had occurred during or after use however could not be ascertained, although the combination of the general shallowness of deposition and repeated burning of the area in the later third and early second millennia cal. BC may account for this (p. 145)

A study of 438 sherds from six Neolithic sites in southern England produced some interesting comparative results (Copley *et al.* 2005). Of the sites studied, five had produced assemblages belonging to the earlier Neolithic bowl traditions and only one of the sites included assemblages of Middle and Late Neolithic date. From this site, Yarnton Flood Plain (Oxfordshire), sherds belonging to the Peterborough Ware (Middle Neolithic) and Grooved Ware (Late Neolithic) traditions were analysed, and also some sherds from Beaker vessels dating from the Late Neolithic to Early Bronze Age periods. The results for Peterborough Ware sherds from Yarnton can be compared with those from Willington. At Yarnton, eight of the 21 sherds of Peterborough Ware contained lipids (Copley *et al.* 2005, Appendix and fig. 3, right). These were shown to represent dairy fats (four instances), mixed ruminant and porcine adipose fats (three instances), plant lipids (two instances) and ruminant adipose fat (one instance). These results compare well with those from Willington which have been summarised above.

A previous analysis of lipids from sherds of Peterborough Ware and Grooved Ware from the site of Upper Ninepence, Walton (Powys) had shown that Grooved Ware contained porcine fats and the Peterborough Ware mainly ruminant fats (Dudd *et al.*, 1999). However, for Yarnton it could be shown that there was no direct association between vessel tradition and broad ruminant or porcine groupings (Copley *et al.*, 2005, fig. 4, lower right and fig. 5). Both Peterborough Ware and Grooved Ware contained evidence from dairying, ruminant animal fats and porcine fats, and the Peterborough Ware results from Willington also fit well into this more generalised picture.

Fragmentation and Abrasion by Ann Woodward

In order to assess the integrity of the various assemblages from different types of features, clusters of features and spreads, the nature of fragmentation and degree of abrasion of sherds was studied within a series of key context groups.

The results of these studies demonstrate that the various pottery assemblages recovered from the various context groups were remarkably similar in their content. The spread of sherd sizes was fairly even, but with a slight predominance of large sherds. However the overall occurrence of medium and small sherds typifies all the group assemblages which gave a general impression of having been very broken up in antiquity. It is therefore possible to suggest that all the larger ceramic assemblages had been deposited in similar ways. They appear to have been the result of *in situ* activity, but sherds probably became broken up during occupation. If such occupation lasted a long time, or was seasonal or episodic in nature at each location, then the sherds may have been deposited over an unknown length of time.

Catalogue of Illustrated Sherds

Figure 45

1 Rim with rounded lip. Fabric Qu2. Earlier Neolithic Bowl. Context 1973, group 2541. (FSN63).

2 Rim and neck of bowl with rounded rim. Decoration: diagonal lines of uncertain origin (possibly incised?) below rim and on neck. Very abraded outer surface. Fabric Qu3. Earlier Neolithic Bowl. Context 1150, group 2516. (FSN76).

3 Part of simple applied solid, probably circular, lug. Fabric Qu2. Earlier Neolithic Bowl. Small Find no. 270. (FSN12).

4 Rim, thickened and slightly rolled. Decoration: opposed diagonal impressed lines (outermost row made by fingernail) on the rim top forming herringbone design; horizontal row of impressions on the internal surface of the rim. Fabric Qu2. Mildenhall Ware. Context 1001, group 2508. (FSN34).

5 Rim, rounded and rolled externally. Decoration: incised lines on the rim top and horizontal row of deep impressions made with a bone implement or stick on the inside of the rim. Fabric Qu2. Mildenhall Ware. Context 297, group 802. (FSN22).

6 Rim, everted and rolled. Fabric Qu2. Mildenhall Ware. Context 1257, group 2521. (FSN42).

7 Rim, thickened and everted. Fabric Qu2. Mildenhall Ware. Context 1978, group 2550. (FSN64).

8 Upper portion of round-shouldered bowl with slightly everted rounded rim. Fabric Qu2. Peterborough Ware, Ebbsfleet sub-style. Context 36, ungrouped. (FSN5).

9 Neck and shoulder of rounded-shouldered bowl. One perforation and another deep impression or incomplete perforation on the neck. These were probably made before firing. Fabric Qu1. Peterborough Ware, Ebbsfleet sub-style. Context 221, group 2541. (FSN15).

10 Rim and neck of vessel with slightly thickened everted rim. Angle uncertain. Decoration: opposed diagonal whipped cord maggot impressions on the internal surface of the rim and neck probably forming herringbone design; some whipped cord maggot impressions also visible on abraded top of the rim. Fabric Qu1. Peterborough Ware, Ebbsfleet sub-style. Small find no. 462, group 2550. (FSN74).

11 Rim and part neck of vessel with expanded and slightly thickened rim. Decoration: opposed diagonal whipped cord maggot impressions on the internal surface of the rim and neck forming herringbone design; diagonal whipped cord maggot impressions in horizontal rows on the rim top and external surface. Fabric Qu2. Peterborough Ware, Ebbsfleet sub-style. Context 521, group 803. (FSN31).

12 Rim, everted and flat. Decoration: incised diagonal lines on inside of rim. Fabric Qu1. Peterborough Ware, Ebbsfleet or Fengate sub-style. Context 2063, group 2550. (FSN68).

Figure 46

13 Upper portion of bowl with very sharp shoulder, deep neck and expanded everted rim. Decoration: opposed diagonal whipped cord maggot impressions on the flat rim surface, immediately below the rim, and above the shoulder; vertical maggot impressions arranged in tightly spaced rows below the shoulder; further opposed diagonal maggot impressions inside the rim. Fabric Qu2. Peterborough Ware, Mortlake sub-style. Context 458, group 803. (FSN28).

14 Upper portion of bowl with sharp shoulder, long deep neck and expanded everted rim. Decoration: opposed diagonal whipped cord maggot impressions on the flat rim surface, inside the rim and neck area and immediately above and below the shoulder. Fabric Qu2. Peterborough Ware, Ebbsfleet or Mortlake sub-style. Context 1416, group 2504. (FSN48).

15 Upper portion of bowl with sharp shoulder, deep neck and expanded everted rim. Decoration: opposed diagonal whipped cord maggot impressions on the flat rim surface, inside the rim and neck area as well as on, immediately above and below the shoulder. Fabric Qu2. Peterborough Ware, Mortlake sub-style. Context 1416, group 2504. (FSN49).

Figure 47

16 Rim and shoulder fragments from a bowl with sharp shoulder and flattened, slightly everted, thickened rim. Decoration: horizontal rows of oval impressions below the rim lip, at the shoulder and below. Fabric Qu2. Peterborough Ware, Mortlake sub-style. Context 1002, group 2509. (FSN36).

17 Rim, thickened. Decoration: incised diagonal lines on rim lip and intersecting incised diagonal lines on the outside of the rim and below. Fabric Qu1. Peterborough Ware, Ebbsfleet or Mortlake sub-style. Context 1497, Small find no. 404, group 2508. (FSN52).

18 Upper portion of small round-shouldered bowl with flat rim and internal moulding. Decoration: opposed diagonal lines on the rim top; incised cross-hatching on the internal moulding and incised diagonal lines on the upper body wall in abraded area. Fabric Qu2. Peterborough Ware, probably Mortlake sub-style. Context 212, group 4501. (FSN14).

19 Rim with internal and external expansion and an internal moulding. Decoration: incised filled triangle design on the rim: incised diagonal lines on the internal moulding. Fabric Qu1. Peterborough Ware, Mortlake or Fengate sub-style. Context 1934, group 2541. (FSN61).

20 Rim, strongly expanded forming distinct collar. Decoration: incised diagonal lines in ? motif on collar and rim lip?. Fabric Qu1. Peterborough Ware, Mortlake or Fengate sub-style. Context 1001, group 2508. (FSN33).

21 Rim, strongly expanded, inturned. Decoration: incised diagonal lines in a ?motif on the rim lip and diagonal lines of probable whipped cord maggot impressions in a horizontal row below the rim. Fabric Qu2. Peterborough Ware, Mortlake or Fengate sub-style. Context 1463, Small find no.492, group 2508. (FSN53).

22 Portion of lower body. Decoration: whipped cord maggot impressions. Fabric Qu2. Peterborough Ware, Mortlake or Fengate sub-style. Context 390, group 809. (FSN24).

Figure 48

23 Rim and lower wall fragments from a necked vessel with strongly expanded triangular-sectioned collared rim. Decoration: incised irregular multiple curvilinear decoration on the collar, irregularly placed fingernail impressions on the lower wall. Fabric Qu2. Peterborough Ware, Mortlake or Fengate sub-style. Context 1000, group 2508. (FSN32). Lipid Analysis WiQ 14.

24 Collar fragments with pointed almost upright rim. Decoration: on the collar, opposed diagonal incised lines forming a horizontal herringbone design. Fabric Qu2. Peterborough Ware, Fengate sub-style. Context 114, group 4501. (FSN10).

25 Rim and upper wall fragments of conical vessel with expanded, inturned rim with two internal mouldings. Decoration: opposing incised diagonal lines forming a herringbone motif on the internal mouldings and inside of the rim; diagonal lines on the rim lip; more lightly executed intersecting incised diagonal lines below the rim on the outer vessel surface. Fabric Qu2. Peterborough Ware, Mortlake or Fengate sub-style. Context 80, group 2518. (FSN6).

26 Rim, inturned and tapered. Decoration: 'stab and drag' diagonal lines on external surface. Fabric Qu1. Peterborough Ware, Fengate sub-style. Context 2004, group 2541. (FSN66).

27 Rim, strongly expanded and inturned. Decoration: incised filled triangle design on the rim lip and ?incised horizontal lines below the rim. Fabric Qu2. Peterborough Ware, probably Fengate sub-style. Context 1870, group 2541. (FSN60).

28 Base, flat. Fabric Qu2. Peterborough Ware, probably Fengate sub-style. Context 1055, group 2508. (FSN39).

Figure 49

29 Rim and neck fragments, rim everted and rounded form. Decoration: encircling lines of twisted cord impressions on outside of rim and neck. Fabric Gr2. Beaker. Context 151, group 2531. (FSN75).

30 Rim and neck fragments, rim everted and rounded form. Decoration: encircling lines of twisted cord impressions on outside of rim and neck. Fabric Gr2. Beaker. Context 151, group 2531. (FSN75).

31 Base, flat. Decoration: encircling line of comb impressions on outside of the base. Fabric Sh1. Beaker. Context 3090, group 2516. (FSN77).

32 Base and part of lower body, flat base pinched out at the circumference. Fabric Sa3. Beaker. Small find no. 584, group 3100. (FSN81)

33 Rim, inturned with internal rim bevel. Fabric Sa2. Early Bronze Age, Biconical Urn. Small find no.581, group 3100. (FSN78).

Organic Residue Analyses of Pottery Vessels by N. Graham, R. Berstan and R. P. Evershed

Introduction

Fifty pottery sherds were submitted to lipid analysis using established protocols, which are described in more detail in earlier publications (Evershed *et al.*, 1990; Charters

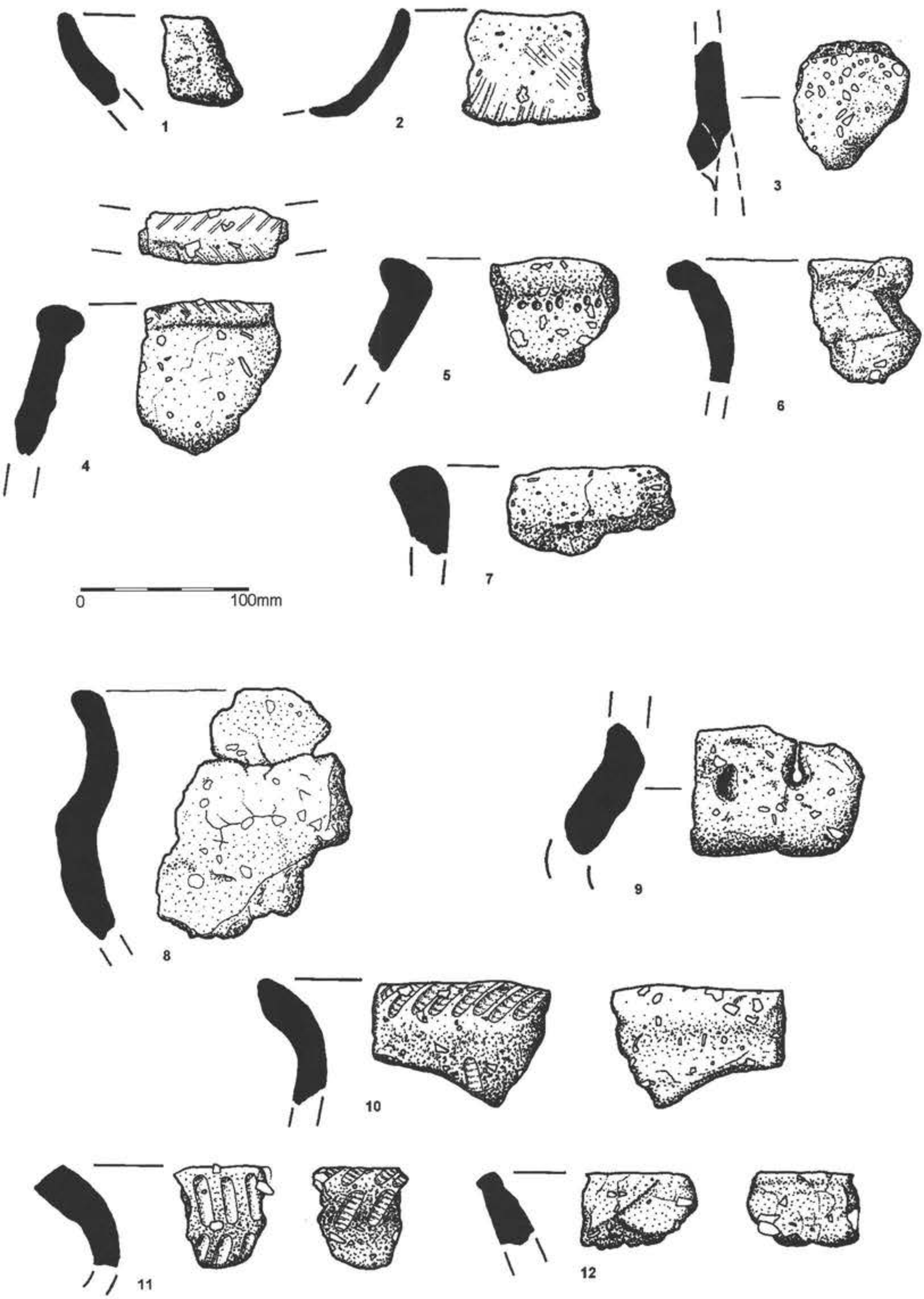


Fig. 45: Earlier Neolithic Bowl (1–3), Mildenhall Ware (4–7), Peterborough Ware, Ebbsfleet (8–11), Ebbsfleet or Fengate sub-style (12).

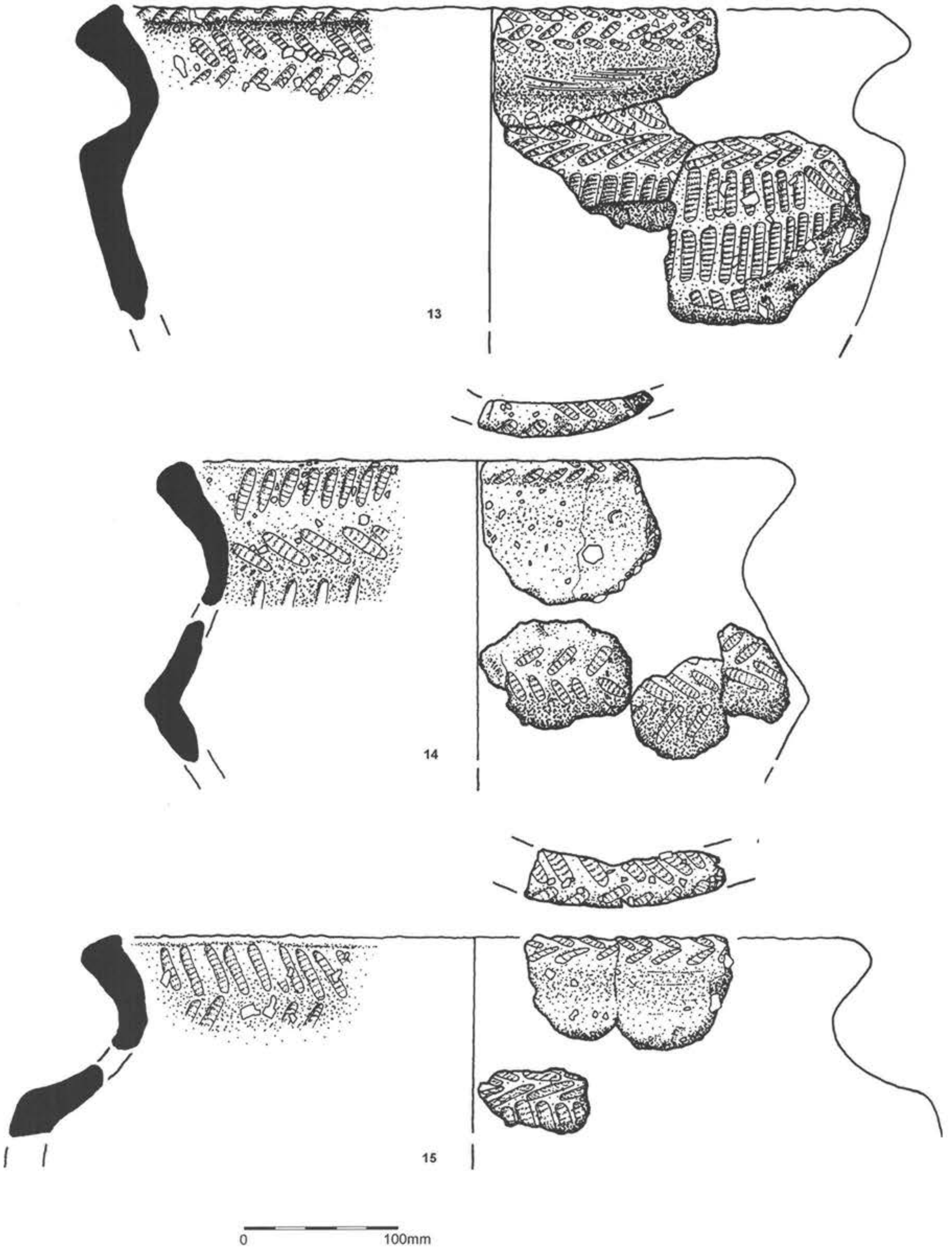


Fig. 46: Peterborough Ware, Mortlake sub-style (13 & 15) and Ebbsfleet or Mortlake sub-style (14).

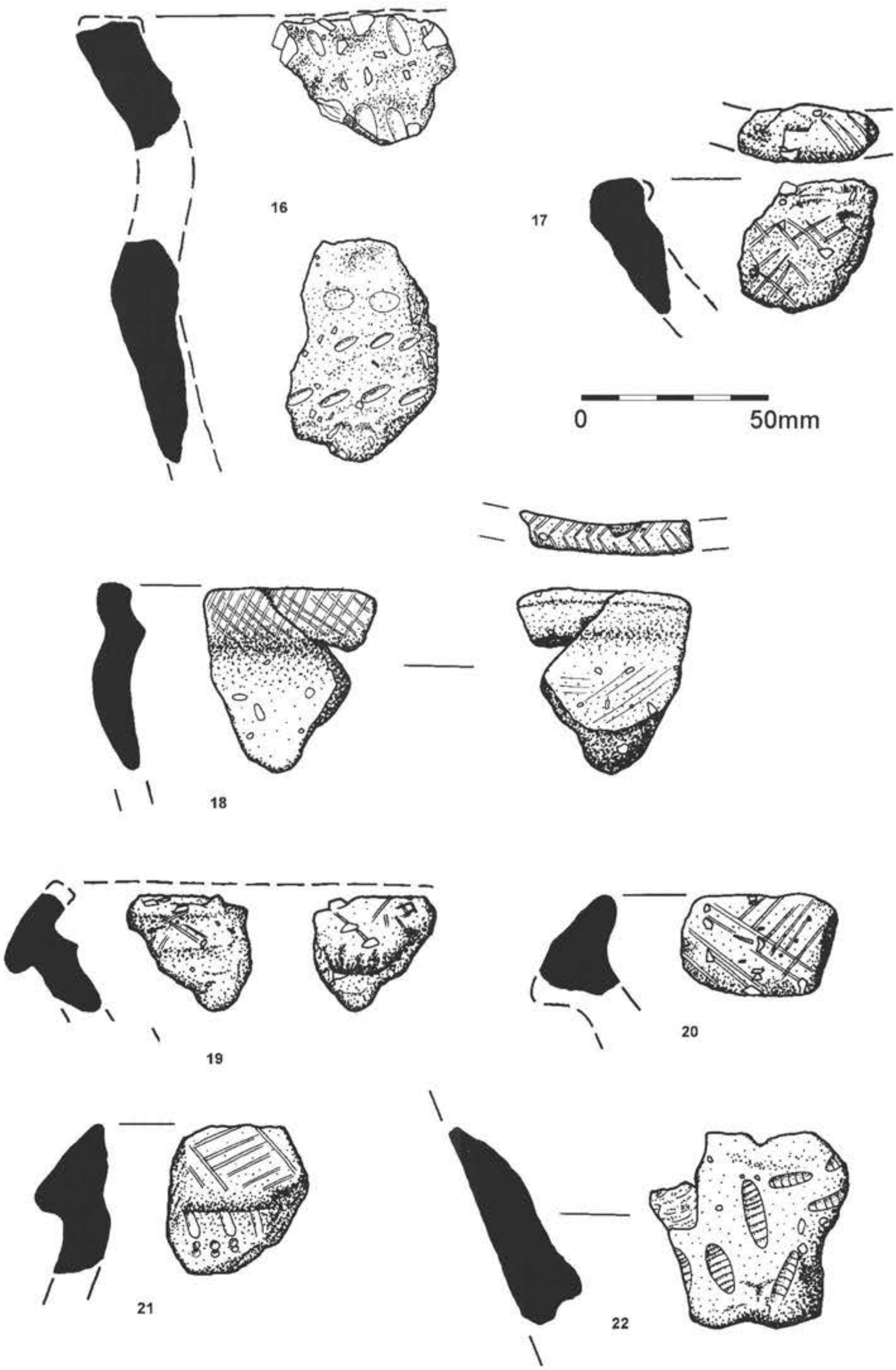


Fig. 47: Peterborough Ware, Mortlake sub-style (16), Ebbsfleet or Mortlake sub-style (17), probably Mortlake sub-style (18) and Mortlake or Fengate sub-style (19–22).

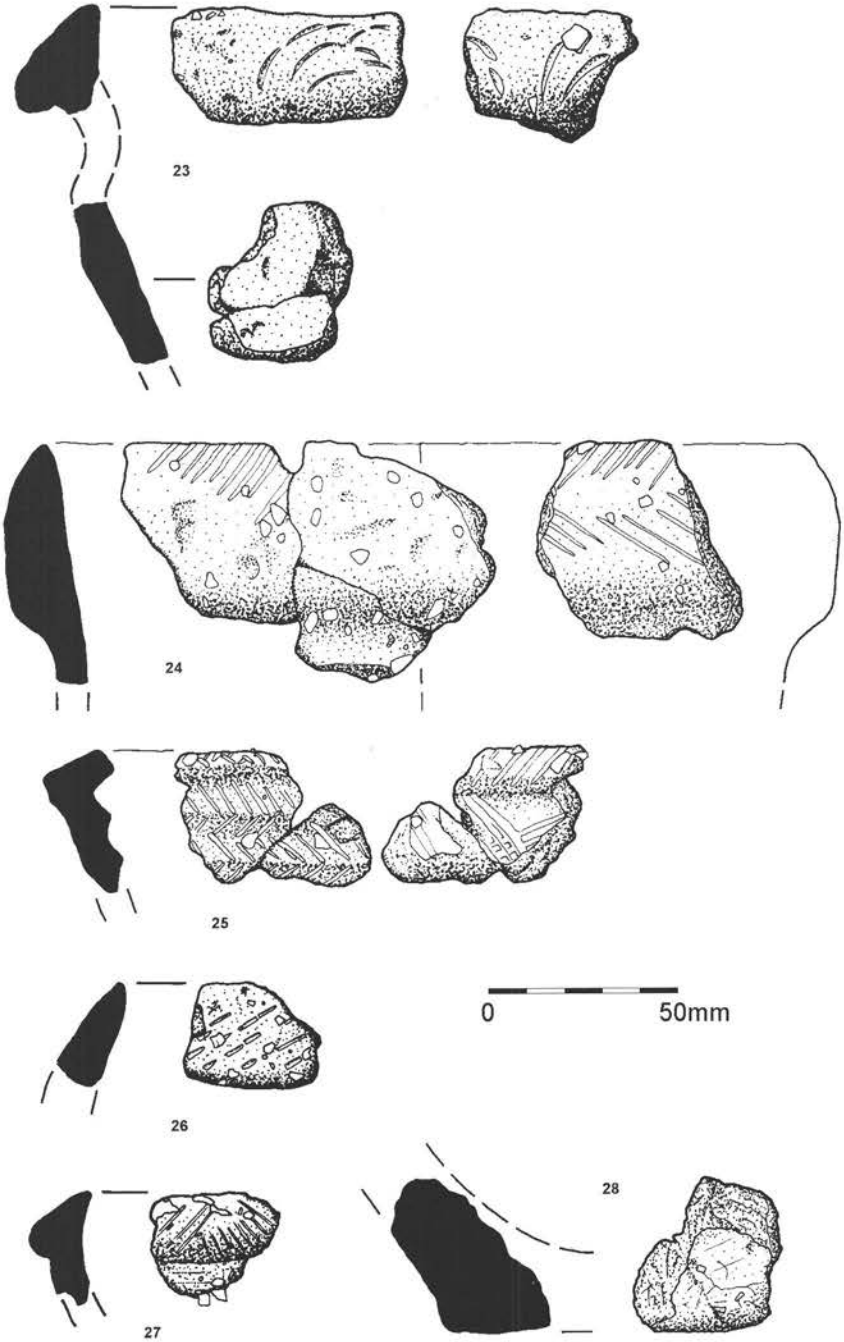


Fig. 48: Peterborough Ware Mortlake or Fengate sub-style (23 & 25), and Fengate sub-style (24, 26 and probably 27–28).

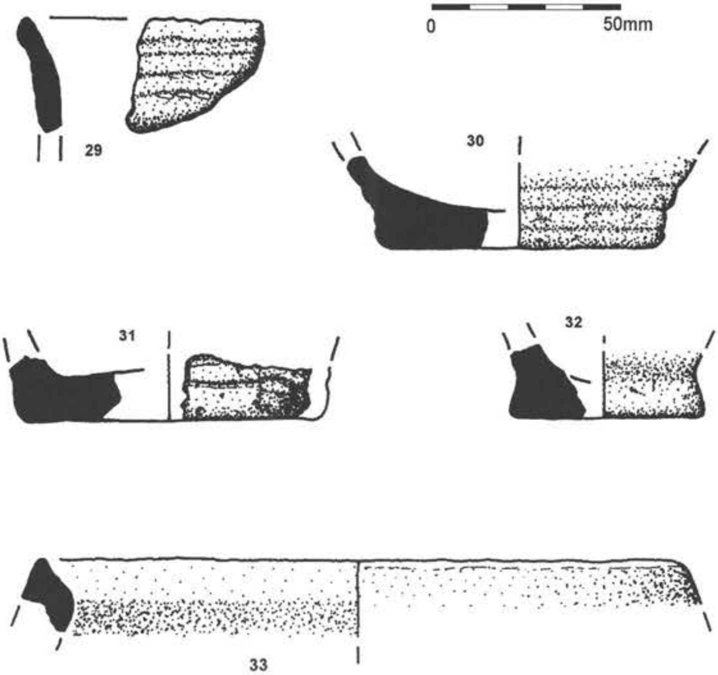


Fig. 49: Beaker and Early Bronze Age.

et al., 1993; Copley *et al.* 2003). The full report, including detailed methodology and analyses can be viewed at http://ads.ahds.ac.uk/catalogue/resources.html?willington_eh_2008.

Results

Analyses of the solvent extracts obtained from the Willington Quarry pottery revealed 16 of the 50 (32%) sherds examined to contain appreciable lipid concentrations. Twelve out of the sixteen extracts with significant lipid concentrations contained acylglycerols (mono-, di- and tri-) and free fatty acids with distributions consistent with an animal fat origin. Although containing just free fatty acids, four other residues also likely derive from animal fats, as indicated by their dominant fatty acids. Two of the extracts also contained traces of wax esters, which indicates a small contribution from a plant or insect wax (e.g. beeswax) source.

Seven of the degraded animal fat residues corresponded directly with a ruminant dairy fat origin while one residue was found to be derived from a ruminant adipose origin. Two residues are more likely to derive from the mixing of ruminant and porcine fats.

Thirteen of the potsherds also showed evidence of extreme heating (>300°C), as indicated by the presence of mid-chain ketones.

Fired Clay by Patrick Marsden

Introduction

A total 4639g of fired clay was recovered from the excavations. This was mainly in a fragmentary and abraded state and most pieces were undiagnostic. The full report,

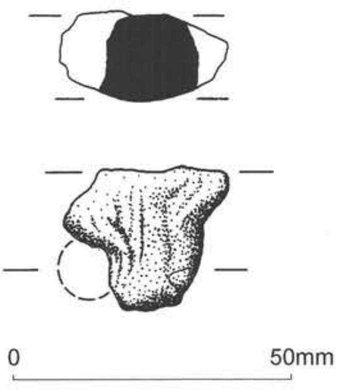


Fig. 50: Fragment of possible oven plate from (1688, C1483) Burnt Mound I (Group 2550/3).

including detailed methodology, fabric and form descriptions can be viewed at http://ads.ahds.ac.uk/catalogue/resources.html?willington_eh_2008. Two features were interpreted as 'ovens' and produced significant amounts of fired clay (Group 2516 1514g and Group 2530 1343g), which may have been part of clay structures. Group 2516 produced five fragments with surfaces and Group 2530 20 fragments, which may be the outer or inner faces of the 'oven' walls. Burnt Mound I *tank* C1483, 1688, contained five fragments of fired clay with surfaces possibly from an oven plate, as one fragment displays parts of two perforations (Fig. 50). A few holes and possible wattle impressions were present on fired clay in other contexts, which otherwise was fragmentary and undiagnostic.

THE LITHICS

By Lynden Cooper

The excavation and watching brief produced an assemblage of 640 worked lithics and 50 natural pieces (discarded). The general provenance of the group was sub-alluvial providing a *terminus post quem* in the Early Bronze Age. The assessment suggested that the material may represent a palimpsest from Upper Palaeolithic, Mesolithic and Neolithic activities. A coarse measure of the relative input from these periods can be seen by the chronologically distinctive tool types and technological breakdown of the debitage products. The assessment suggested that most of the material was Neolithic. Early Neolithic material is very sparse. It is assumed that the Neolithic flint reflects the pattern seen with the ceramics and is mostly of Middle Neolithic date.

The material has been grouped into 58 of the stratigraphic groups. Most of the material was spread thinly across 57 of these groups such that detailed reporting by group is not useful. An apparent exception is the 101 pieces from the earlier Burnt Mound I, group 2550. However, that group is a palimpsest evident from the parallel studies of lithic wear analysis, ceramics and scientific dating (respectively p. 113, p. 81 and p. 62). The full report, including detailed methodology, tables and analysis can be viewed at http://ads.ahds.ac.uk/catalogue/resources.html?willington_eh_2008.

Raw material

The vast majority of pieces were of semi-translucent flint typical of local till sources (Henson 1985). There were a very few pieces of opaque flint derived from the limestones of Lincolnshire and Yorkshire, although these may also occur occasionally in till deposits in the Midlands (*ibid* and A. Myers *pers. comm.*) In addition to the flint artefacts there were also five fragments of polished axe, one of a likely Group VI source and four of a creamy-white chalky flint, possibly from the Louth area, Lincolnshire (J. Humble *pers. comm.*). A likely Charnian axe fragment was found in earlier evaluation works at the site (see below).

Debitage

The debitage offers some broad measure of the levels of admixture of the Upper Palaeolithic, Mesolithic and Neolithic material. There is a small Upper Palaeolithic component comprising a blade-core (Fig. 51.1) and a few associated blades. The core has clear platform preparation in the form of partial edge faceting. The Mesolithic component, as indicated by pieces from true bladelet technology (Holgate 1988; Ford 1987), is appreciable at *c.* 12.8%. It has been suggested that in much of the Midlands the degree of patination on flints can give a coarse measure of chronology (Cooper 2004, 26; Cooper forthcoming). This argument is supported at many sites in the region where diagnostic Mesolithic tools are often patinated but Neolithic and later tools are not. If patinated flakes and blades are assumed also to be earlier the potential Mesolithic component is slightly higher at 15.4%. Similar proportions were reported for the palimpsest of lithics at Eye Kettleby, Leicestershire (Cooper forthcoming).

The Neolithic flint debitage is of flake technology with no evidence for platform preparation but with some attempts to strengthen the core front by overhang removal. The cores were quite small on the whole and most were unclassifiable, displaying multiple platforms. Many were exhausted and presumably were discarded where found.

Tools

Microliths

The four examples included two obliquely truncated points (Fig. 51.2–3), a crescent and a rod form. Two other bladelets were retouched but lacked the typical backing retouch of microliths; they may represent unfinished forms. The crescent and rod forms can be regarded as Late Mesolithic whereas the obliquely truncated points can occur from the terminal Late Upper Palaeolithic to the Late Mesolithic. One of the points had a deep white patina, suggesting it was possibly older than the other microliths.

Scrapers

The 21 scrapers were mostly of short end type, although one was circular and another was a double end type. A scraper with an additional spur had a prepared base, a feature sometimes seen on Late Neolithic pieces.

Serrated pieces

There were 16 serrated pieces or micro-denticulates (Figs 51.6,7 and 52.8,9,10) identified macroscopically with another two possible examples identified in microwear analysis (see 'utilised pieces'). These occured on five bladelets, five blades and six flakes. Seven display a thin band of lustre or gloss along the serrated edge, a feature often associated with this type of tool (Clark *et al.*, 1960, 217). This tool type has a long

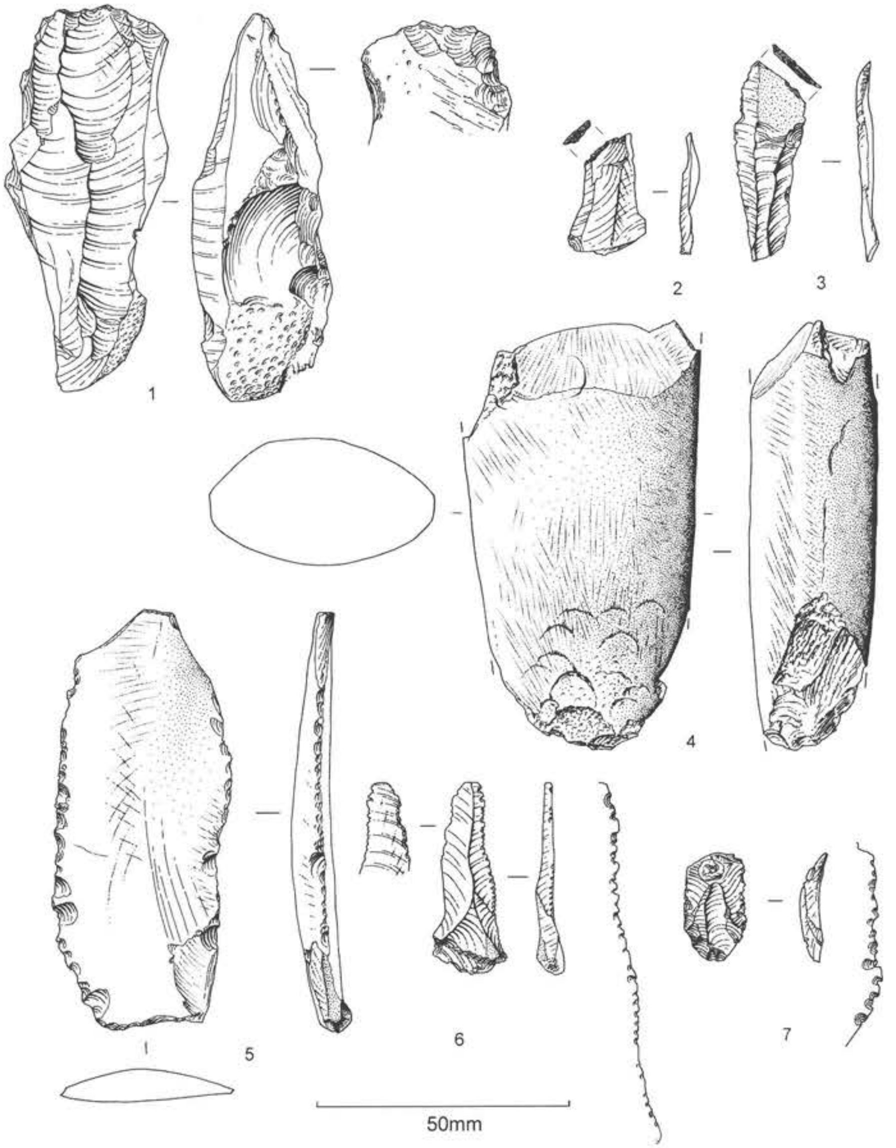


Fig. 51: Lithics 1–7.

currency from the Early Mesolithic (Barton 1992) to the Early Bronze Age (Bradley 1970), but are highly prolific in the Early and Middle Neolithic (Smith 1965; Middleton 1998, 230; Robertson-Mackay 1987, 111).

Utilised pieces

Four pieces displayed signs of utilisation in having continuous small retouch nicks along their edges (*cf.* Smith 1965). Two of these had thin bands of lustre along their

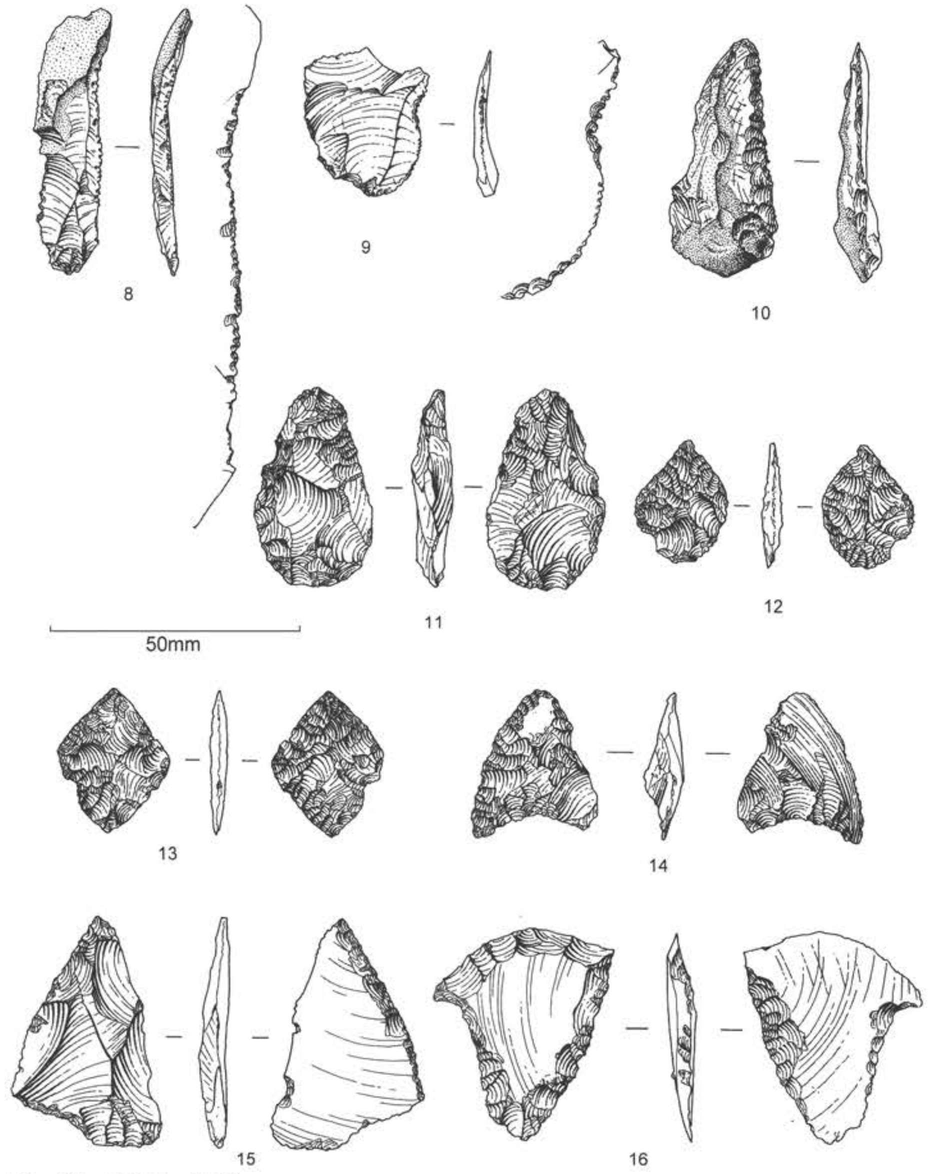


Fig. 52: Lithics 8–16.

edges and the microwear analysis has indicated that they are worn examples of serrated pieces.

Axes

Five fragments of polished axe were recovered including a fragment of a suspected Group XX source and four pieces in a creamy white flint. The similarity in raw material and the proximity of the four pieces would suggest that they may have derived from a single axe (Fig. 51.4).

In addition another polished axe fragment was located during earlier works at the site (1997–89, SF 1): a blade from an axe of fine-grained tuff, also likely to be of Charnian origin i.e. Group XX (T. Clough *pers. comm.*; Implement Petrology No. DB 290).

Knives

There were five knives with four being flint examples and one on a flake from a polished axe (Fig. 51.5).

Arrowheads

Two leaf-shaped arrowheads included a Green type 4a (Fig. 52.12–13) made with translucent flint and a fine lozenge-shaped example made on a greyish-brown opaque flint (Fig. 52.14–16). Five transverse arrowheads included two of chisel type (one broken), two of British oblique type and a further unclassifiable example. One of the chisel types is noteworthy (Fig. 52.16) as being exotic in that it was made with an opaque, mottled orange-brown and beige coloured flint while the remaining four were of local till flint.

Laurel leaves

Three examples of this class were found, one complete and two fragments. The latter have transverse breaks characteristic of knapping accidents on bifaces.

Catalogue of illustrated pieces (Figs 51 and 52)

1	Blade core (898)
2	Obliquely truncated point (901)
3	Obliquely truncated point (372)
4	Polished axe fragment (1)
5	Knife (134) on a blade struck from a polished axe
6–10	Serrated pieces (861, 1015, 321, 727 and 125)
11	Laurel leaf point (218)
12	Leaf-shaped arrowhead (1000)
13	Lozenge-shaped arrowhead
14	Transverse arrowhead, British Oblique type
15	Transverse arrowhead, British Oblique type
16	Transverse arrowhead, Chisel type

Discussion

The assemblage included material ranging from possibly the Late Upper Palaeolithic to the Late Neolithic. The potential Upper Palaeolithic material comprised a blade core with platform edge preparation (partial edge faceting) and some blades in proximity, all of the material exhibiting a deep white patina in contrast to the diagnostically younger pieces. An obliquely truncated point displayed similar patination but typologically this can span from the terminal Palaeolithic to the Early Mesolithic. Mesolithic material included microliths and related forms, and debitage displaying true bladelet technology. The earlier prehistoric material is relatively sparse and must indicate sporadic activities within the floodplain zone.

While the Upper Palaeolithic component is not culturally diagnostic it is very likely to be of a general Late Upper Palaeolithic date. The Trent Basin boasts a relative

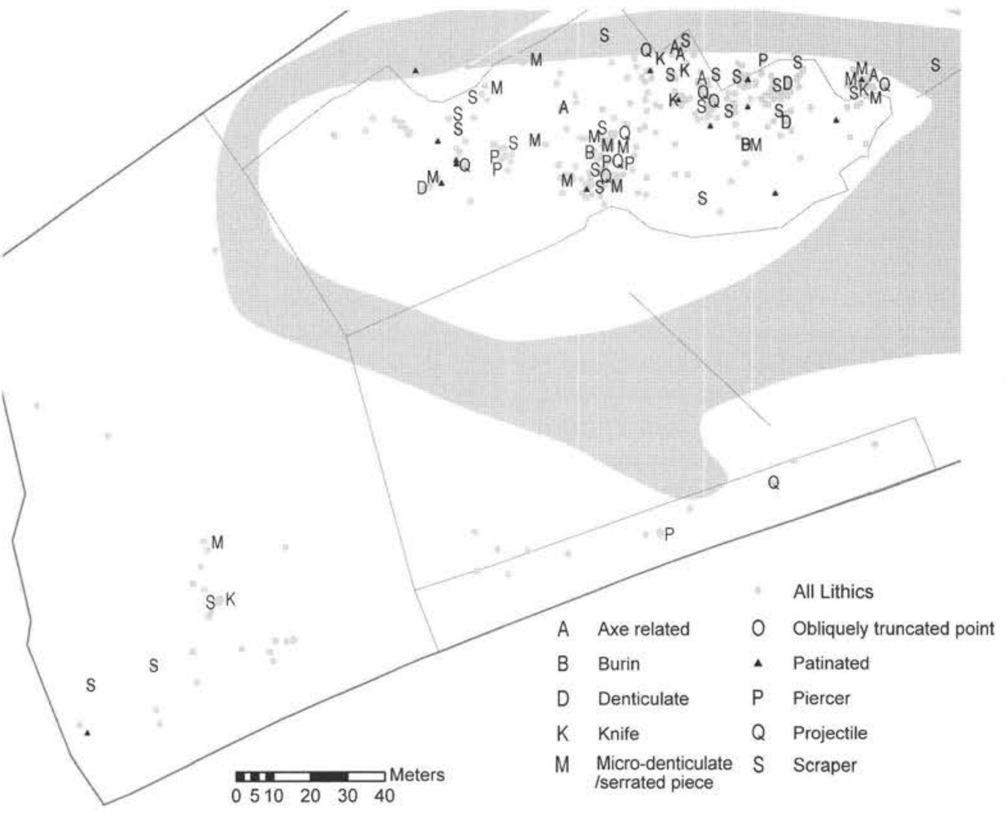


Fig. 53: Distribution of lithics including tools with zone areas.

wealth of Late Upper Palaeolithic sites and findspots, including the eponymous Creswell Crags cave sites, open air sites such as Bradgate Park (Cooper 2002) and Farndon Fields (Garton 1993b) and single findspots of diagnostic projectile points (Jacobi *et al.* 2001; Cooper and Jacobi 2001). A clear majority of the archaeological remains can be placed within the British Late Magdalenian (Creswellian) and it has been speculated that the Trent, together with the Severn, provide a SW-NE axis corridor used as a Late Upper Palaeolithic annual round in the north-west European peninsula (Pettitt 2008).

It would seem that the vast majority of the assemblage could be assigned to the Middle-Late Neolithic. The only diagnostic tool forms within this time period are the transverse arrowheads. However, Laurel leaves and leaf-shaped arrowheads can occur in the Middle Neolithic while polished axes extend throughout the Neolithic period. The remaining tools including scrapers, knives and piercers can all sit comfortably within the Peterborough Ware occupation of the site. It is of interest that the Neolithic lithic scatter is from the same areas that Mesolithic activity is recorded.

The flint was rarely deposited in pits, the majority being recovered from the old land surface. While the range of activities undertaken at the site appears domestic in character (butchery, plant harvesting, hide scraping etc) the small size of the assemblage would appear to suggest limited, task specific occupation. Donahue points to the limited evidence for seasonality from the microwear study i.e. late summer or early autumn (below p. 115).

Assessment of the distribution of tooltypes (Fig. 53) suggests that some clustering is evident. Axe fragments appear on the northern edge of the island, as do projectiles, and there are densities of micro-denticulate/serrated pieces below and to the south of Burnt Mound I.

Comparison with the lithic assemblage from the adjacent Neolithic site to the north-east (Saville 1979) shows some similarities including the presence of Mesolithic material and the proportions of tools and cores. Saville notes, with some surprise, the high incidence of retouched and utilised material (20.5%), the low incidence of cores (6.9%) and the very small size and exhausted condition of the cores. At face value such proportions might indicate that knapping took place off site — however, Saville regards this as unlikely, and suggests that collection bias and the technological restraints imposed by use of a pebble flint resource may account for this 'peculiarity of its internal composition'. The current assemblage has 15% retouched/utilised pieces and 7% cores, all extremely small examples.

The small collection from Willington is a significant addition to the East Midlands lithics database. Many past workers have commented upon the difficulties of comparing assemblages from the region with the widely published material from southern England (Moore and Williams 1975; Garton and Beswick 1983; Saville 1979). Although there have been recent claims that this situation prevails (Head and Young 2000) this is not apparent to the author (Cooper and Humphrey 1998; Cooper forthcoming). The Willington assemblage thus helps to further challenge the notion that lithic assemblages from the Midlands cannot be compared to the well-researched areas of southern Britain. While size may be a difference the technological methods and abilities and the tool typology are very comparable to the contemporary southern assemblages (Humble 2006; Cooper forthcoming).

Microwear Analysis of Lithic Artefacts by Randolph E. Donahue and Adrian A. Evans

Introduction

Lithic microwear analysis was undertaken to identify the uses of lithic artefacts contained within and below Burnt Mound I. One hundred and one lithic artefacts were among finds recovered from layers preceding and contemporary with the burnt mound, and sealed by alluvium from above, of which 18 were selected for this study.

The objectives of the lithic microwear analysis included: identification of the kinds of uses performed by the artefacts; assessment of whether there are any differences across the contexts; determination if the artefacts had been re-deposited from one or more contexts; assessment of whether the lithic assemblage may relate to domestic economic activities, crafting and steam bathing (Barfield and Hodder 1987), or if they are associated with ritual behaviour or ceremonial food preparation (Ladle and Woodward 2003); and investigation of the site formation processes. The full report, including detailed methodology and analysis can be viewed at http://ads.ahds.ac.uk/catalogue/resources.html?willington_eh_2008.

The microwear samples were chosen and analysed before the chronological gap between the underlying Middle Neolithic and the Late Neolithic/Early Bronze Age burnt mound was established.

Results

Of the 18 artefacts examined for use, five have microscopic wear and fracture scars on their edges that can be attributed to some category of use, three appear to have been unused and 10 had undergone post-depositional modification such that it could not be determined if the artefact had been used.

Although a variety of technological types were included in the study, only two tool categories showed evidence of use-wear. These include serrated pieces and miscellaneous retouched pieces. The serrated pieces consist of one flake and two blades (one blade was previously identified as an 'utilised' blade, but the serrations are quite distinct microscopically). These displayed evidence for probable use as sickle blades. The serrated flake was used for a short period of time for cutting cereal or equivalent grass-like material. Miscellaneous retouched flakes showed evidence for butchering (1) and hide scraping (1). The effects of post-depositional processes will have altered the frequency distribution of uses. Wear produced by herbaceous plants is both extensive and robust, thus it is identifiable even after severe post-depositional modification (Donahue 1994). Thus it will survive when other forms of wear have been obliterated.

Comparison with other sites

Lithic microwear analyses of artefacts from British Neolithic sites are no longer rare. Donahue has examined artefacts from the settlement site of Lismore Fields, Buxton, Derbyshire (Donahue 1991), pit features at Dragonby, Lincolnshire (Donahue 1994, May *et al.*, 1996), Upper Ninepence, Walton Basin, Wales (Donahue 1999), and Eye Kettleby (Donahue 2002). These studies of unmodified and modified flakes and formal stone tools from very different kinds of sites and features indicate that a diverse range and frequency of tasks were being performed with stone tools during the Neolithic. These include: scraping, cutting and piercing of hides; butchering of animals; whittling, cutting, wedging, of wood; the scraping and chiselling of bone; the cutting (sickling) of cereals; and use of weapons such as arrows. The variety of activities indicated by microwear analyses conforms to the residential setting of these sites and the expected domestic activities to be found there. Specialist economic localities are exemplified by the results of a microwear study of the Bronze Age Royal Dock School site which consisted of a predominance of hide working tools in association with pits dug into peat (Donahue 2000). The pits associated with Grooved Ware ceramics at Upper Ninepence were also predominantly associated with hide working artefacts (Donahue 1999). This is in contrast to the pits associated with Peterborough Ware ceramics which had a much more balanced distribution of activities represented. A recent microwear study by Donahue (n.d.) of the lithic artefacts from the Whitwell Neolithic Long Cairn site, Derbyshire, produced some important implications regarding Neolithic funerary contexts. Firstly, there is a distinct assemblage associated with mortuary structures comprising finely worked tool forms, which may or may not have been used. Secondly, the distribution of used tool forms would support the hypothesis that boundary markers do seem to delimit areas of ritual significance from areas of secular activity.

Finally, it was observed that those artefacts with use-wear indicative of economic activities which were recovered within the ritual area were all in secondary contexts.

These studies provide a framework for comparing the microwear results of the Willington Quarry assemblage, although it must be done cautiously because of the small sample sizes and the effects of post-depositional modification. It suggests that Willington Quarry contains an assemblage of artefacts indicative of various economic activities. Combined with the technological variability of the assemblage, it would tend to indicate that quite a varied set of activities are represented. The prevalence of sickle blades, indicative of the reaping of cereals (or other herbaceous plants) could result from loss in agricultural fields, but in conjunction with other tool uses and artefacts indicative of tool production, it is likely that sickle blades were being discarded and replaced at this location. These kinds of maintenance activities could be done within a domestic context, but could be done within the context of social gathering place where members of a sodality or brotherhood might meet.

Seasonality

It is worth briefly commenting on the presence of sickling activities in terms of seasonality. Harvesting is an activity that takes place during the late summer or early autumn. Whilst the evidence indicates that activities were being carried out during this period, it does not exclude the possibility of use of the site at other times of the year.

Conclusion

The microwear analysis of the lithic artefacts from below, and residually within Burnt Mound I at Willington Quarry provides evidence regarding tool use on a small sample of artefacts. There is evidence for cutting soft plant material, butchery and hide working. If representative of the kinds and intensity of activities performed at the site, then it is possible to suggest that this was an area of economic tool maintenance activities. There is evidence for occupation during late summer through early autumn, but it may extend for a much longer duration. Interpretation of tool use by means of microwear analysis is confounded by the high, albeit typical, percentage of artefacts that have undergone post-depositional modification.

THE WORKED STONE

By Patrick Marsden and Fiona Roe

A saddle quern of brown medium grained feldspathic, probably Coal Measures sandstone was located from C2535 (SF185). The grinding surface had been worn shiny in places while the edges show wear. The underside comprised a weathered natural surface. Two possible whetstones were present in Group 1642, Group 2522 and context 2529.

ANIMAL BONE

By Jennifer Browning

A very small assemblage of animal bone was recovered, comprising 97 fragments of bone from archaeological contexts; the great majority were calcined with a clear bias towards preservation within burnt deposits. Unburnt bone is rare, due to the high pH of the substrate (5.9 where measured).

The full report, including detailed methodology and tabulation can be viewed at http://ads.ahds.ac.uk/catalogue/resources.html?willington_eh_2008.

Most of the bone fragments are mammalian but it was only possible to identify a few with greater precision. From Middle Neolithic deposits one possible sheep pelvis fragment was recovered within Group 803, C480. From Late Neolithic/Early Bronze Age deposits, it was determined that Ox was present from fragmentary tooth enamel (Burnt Mound I *trough* C1651), and also in fire-clearance deposits. The evidence is tentative but does suggest the keeping of domestic mammals.

Larger pieces of unburnt bone were recovered from palaeochannels J and M in Zone 8 and adjacent to the Burnt Mound II. Ox and cattle-size bones were identified adjacent to Burnt Mound II, whilst fragments of horse, ox and pig are present in other palaeochannels. These included an incomplete horse femur, which had numerous fine parallel cut marks on the third trochanter, the attachment point of the tendon of the gluteus superficialis muscle (Getty 1975, 305).

HUMAN BONE

By Simon Chapman

One fragment of adult human femur was recovered from the interface between channels J and M to the east of Burnt Mound II. The fragment may have derived from the infilling of either channel.

CHARRED PLANT REMAINS

By Angela Monckton

Introduction

Samples were taken for the recovery of charred plant remains which can give evidence of food, activities and the surrounding environment of the site over time. The full report, including detailed methodology and tabulation can be viewed at http://ads.ahds.ac.uk/catalogue/resources.html?willington_eh_2008.

Results

The charred plant remains recovered were mainly charred hazel nutshell (*Corylus avellana*) and fruit stones of sloe (*Prunus spinosa*) with occasional hawthorn pips (*Crataegus* sp). These plant remains probably represent gathered food and suggest nearby wood margin or scrub vegetation. No cereal grains were present.

A few single charred seeds were recovered of wild plants including grasses (Poaceae), sedge (*Carex* sp), clover type (*Trifolium* type), vetch type (*Vicia/Lathyrus*), fat-hen (*Chenopodium album*), thistle (*Carduus/Cirsium*), knotweed (*Polygonum* sp), cornsalad (*Valerianella* sp) and scentless mayweed (*Tripleurospermum inodorum*). Charred seeds were most numerous in Burnt Mound II which included cone fragments of alder (*Alnus glutinosa*) with seeds still attached. These deposits also contained numerous waterlogged seeds particularly of water plants, but also included fruit pips of hawthorn, bramble (*Rubus fruticosus* agg.) and elder (*Sambucus niger*) which were available as foods, although it is not possible to prove that these represent food remains. The charred seeds included buttercups (*Ranunculus acris, repens* or *bulbosus*), sedges (*Carex* spp.), spike-rush (*Eleocharis* sp.), bedstraw (*Galium* sp.) and grasses. The seeds probably represent the plants growing on and around the site and suggest grassy vegetation, disturbed ground and scrub or woodland margin in the vicinity, with water plants and water-side vegetation nearby.

The features which contained the most charred remains, mainly of hazel nutshell and sloe stones were from Groups 803, 805, 806, 2503, 2504, 2529, 2543, 2550 (Burnt Mound I), and Group 4563 (Burnt Mound II). Most remains were found in Group 803 (Neolithic pits) and Group 2550 (pit or trough of Burnt Mound I). A few charred seeds were found in other groups described below.

Middle Neolithic and Late Neolithic/Early Bronze Age

Two groups produced samples with both sloe stones and hazel nutshell; Groups 803, and 806. These were from two Neolithic pits of Group 803 pit C458 which contained 17 nutshell fragments and six sloe stones, and pit C480 with 48 nutshell fragments and a grass seed. An undated hearth Group 806, hearth C326, contained a single sloe stone, nutshell fragment and charred seeds. Fire clearance deposits (Group 805, C56), contained two sloe stones and a hawthorn pip, and (Group 2543, C78) contained two sloe stones. There was nutshell alone in Group 2503, post-hole C1447, and Group 2504, C1485 cooking pit.

Single charred seeds were found in 11 contexts with no other plant remains. These were from a hearth (Group 2516, C3065), tree-throw hole in-fills (Group 807, 338, 352), (Group 2512, 1449, 1557), (Group 2520, C2016), burnt deposits probably resulting from fire clearance (Group 2509, C1428), (Group 2519, 3058), (Group 2543, 134), post-hole (Group 2509, C1821), and a pit (Group 4502, Pit C443). These contexts were either Middle Neolithic or Late Neolithic/Early Bronze Age. Charred seeds included grasses, clover and vetch type, thistle, cornsalad, scentless mayweed and fat-hen, which are all plants of grassy vegetation. The seeds probably represent the vegetation of parts of the site which incidentally became included in feature fills.

Burnt Mound I

Charred plant remains were found in the features rather than in the burnt spread of Group 2550. The later tank C1483 contained only nutshell in a final dump of charred material (sample 79), whereas earlier dumps (samples 80, 81 and 92), contained five sloe stones and fifteen nutshell fragments respectively. A few charred grass seeds were the only other charred seeds recovered. Hearth/Oven 1704, sample 91, contained a couple of sloe stone fragments. Abundant charcoal was recovered from all the samples from this group. No charred plant remains were recovered from the earlier Neolithic spread below the mound and these remains are interpreted as contemporary with the use of burnt mound.

A sample from Group 2529, post-hole C1833, relating to probably either Burnt Mound I or the Middle Neolithic spread below, contained three sloe stones.

Middle Bronze Age

Burnt Mound II

In Burnt Mound II (Group 4563), as in Burnt Mound I, all the remains recovered were from the features not the burnt spread. The primary backfill of the trough 4479 (samples 273 and 314) contained the most charred seeds with fragments of alder cone present with seeds still attached, together with 18 charred seeds of buttercup, sedges, vetch type and bedstraw together with a few waterlogged seeds, mostly of the same plants with some uncharred stem and root fragments. There was also a single charred hazel nutshell fragment in this sample. The only other remains from this group were a charred sloe stone with 12 charred seeds including spike-rush, sedges and bedstraw. There was also a charred alder catkin fragment, and a few waterlogged seeds including buttercup and club-rush. C4477 a possible hearth base (sample 272) contained a possible fruit stone fragment.

Samples from a secondary charred deposit (4449 and 4450) contained alder cone fragments and a charred buttercup seed both with more waterlogged seeds including water-plants. The latter also contained charcoal and was very rich in seeds of water and waterside plants, similar to samples from Palaeochannel M.

Alder flowers are pollinated in February and March and then set seed which is released in the summer, after which the cones become woody before the leaves fall for winter. Therefore the charring of the cones has occurred before the seeds became detached. Additionally buttercups flower and set seed in the early summer.

Discussion

The remains from the Middle Neolithic pits, and the Late Neolithic/Early Bronze Age and Middle Bronze Age burnt mounds all have some similarity, with the presence of hazel nutshell and fruit stones as evidence of food waste probably from gathering in the late summer and early autumn. Burnt Mound II, although with least numbers of remains, has more specific evidence of activity in the early to mid summer in the form of charred alder cones with seeds still attached, and charred buttercup seeds. Tree ring evidence indicates that the Burnt Mound II trough was constructed in the late spring (Morgan, below p. 125).

Other burnt mound sites in the region have also produced mainly wild food remains. Samples from the Late Neolithic burnt mound at Watermead Park, Birstall, contained only sparse amounts of sloe and hazel nutshell remains, while at the Middle Bronze Age burnt mound at Willow Farm, Castle Donington, samples also contained sloe stones and hazel nutshell with very sparse evidence of cereals including the chaff of glume wheat (Monckton forthcoming a and b). However, Neolithic and Bronze Age cereals are known from the region (Monckton 2006), but these and plant remains in general are sparse on the burnt mound sites. Although cereals have been established as a usual part of the Neolithic economy they are not found on all sites and it is likely that different parts of the landscape were exploited in different ways, as they are today. Hence cereals are much less likely to be present in wetland habitats.

Burnt Mound II has evidence of grassland from associated pollen and beetles in the nearby palaeochannel (Greig, below p. 128; Smith, below p. 134), and this may suggest use during the period of summer pasturing of animals on the floodplain.

The river valleys not only provided communications by water and land but the floodplains were also rich in resources. Animal resources would have included food from hunting wild birds and water-fowl, fish and eels; animals which would have used the streams for water, and meadows when cleared as seasonal pasture, water-meadows too were a valuable resource; and possibly animal products, such as meat and hides, even feathers, were processed using streams at the end of the season. Plants available for foods included fruits and nuts from scrub or woodland margins, either natural or man-made clearings, and perhaps later from hedgerows used to divide the land. Young leaves of nettle, hawthorn and fat-hen are known to be edible and these would have been available. In addition water plants can provide food as some sedge seeds, water-lily seeds, and reed-mace rhizomes are edible with appropriate processing (Hillman and Mears 2007). Other plant products such as reeds and fibres would also have been used. Unfortunately, although these plants were present on the site there is little evidence of their use except for the disposal of nutshell and fruit stones in fires, as food waste from probably temporary occupation

Conclusions

The remains were mainly of the gathered foods, hazel nuts and sloes which were found in 18 samples. This would appear to indicate a reliance on gathered rather than cultivated food. The lack of any even low concentration of grains and grain fragments is noteworthy and, although the results should be treated with caution, it appears that there were no cultivated foods used on this site at Willington. The site is very much less productive than the similar floodplain site Yarnton in the Thames Valley where 2728 nutshell fragments and 201 cereal grains were found in 7 tonnes of samples (over 400 items of food remains per tonne) and Yarnton was not thought, on this evidence, to be a fully agricultural economy (Robinson 2000). Here 170 items of plant remains including charred seeds were found from just over one tonne of samples suggesting that only gathered plant foods were utilised and sparsely. Seasonal use in the late summer to autumn is suggested from the remains of gathered food found in Middle and Late Neolithic/Early Bronze Age deposits, whilst charred seeds also indicate that Burnt Mound II was used in the early to mid summer.

THE CHARCOAL

By Rowena Gale

Introduction

Forty seven samples of charcoal were selected for analysis, several of which were used for radiocarbon dating. These samples represented residues from a) suspected tree clearance by burning and felling, b) from domestic hearths and c) deposits of fuel debris associated with activity at the two burnt mounds. It was anticipated that charcoal analysis would illustrate the character of local woodland (for comparative purposes with the pollen record) and evidence of species selection related to economic function. The full report, including detailed methodology can be viewed at http://ads.ahds.ac.uk/catalogue/resources.html?willington_eh_2008.

Results

The anatomical structure of the charcoal present was consistent with the following taxa or groups of taxa:

Betulaceae. *Alnus glutinosa* (L.) Gaertner, European alder; *Betula* sp., birch
Cornaceae. *Cornus sanguinea* L., dogwood
Corylaceae. *Corylus avellana* L., hazel

Fagaceae. *Quercus* sp., oak
Oleaceae. *Fraxinus excelsior* L., ash
Rhamnaceae. *Rhamnus cathartica* L., buckthorn
Rosaceae. Subfamilies:
Pomoideae, which includes *Crataegus* sp., hawthorn; *Malus* sp., apple;
Pyrus sp., pear; *Sorbus* spp., rowan, service tree and whitebeam. These taxa are anatomically similar; one or more taxa may be represented in the charcoal.
Prunoideae. *Prunus spinosa* L., blackthorn.
Salicaceae. *Salix* sp., willow, and *Populus* sp., poplar. In most respects these taxa are anatomically similar.
Ulmaceae. Ulmus sp., elm

Neolithic c. 3600–3000 cal BC

The general paucity of cereal remains in Neolithic deposits suggests that occupation during the early Neolithic occurred in a wooded landscape with little or no cultivation of crops (below p. 141). Domestic occupation was recorded in Zone 2, the highest part of the site. Features in Group 2503 (above p. 29) included pits/post-holes and cooking pits/ hearths. Fuel debris from contexts (1448), a pit/post-hole C1447, and (1499), a cooking pit C1500, was identified as oak, hazel, the hawthorn group, blackthorn and probably birch. A small pit in group 2504, context (1477, C1485), filled with fire-cracked stones (and later overlain with midden material), was probably used for baking food. Associated charcoal, although scant, included blackthorn and oak. Charcoal was similarly sparse in residues from a stone-lined hearth/oven C2077 (Group 2530), contexts (1073), (2064) and (2076) which included blackthorn and probably hazel.

Evidence of tree clearance was indicated across the site by areas of surface burning and burnt tree-holes. Charcoal residues in these areas almost certainly relate to felling activities and/or the disposal of tree debris or scrub by burning. For example, charcoal-rich samples from contexts (63) and (64) (Group 805), identified as mainly oak, may relate to the remains of burnt-out oak trees. This interpretation, however, is not straightforward since small amounts of alder, birch and blackthorn were also present. These additional species may have accrued from the general disposal of waste from clear-felling mixed woodland or, perhaps, from dumped hearth debris. A single fragment of birch was identified from an area of *in situ* burning in context (75) (Group 2543).

Charcoal from truncated post-holes/ pits (291), (293) and (299) (Group 802), adjacent to a tree-throw, consisted of hazel and blackthorn. In addition to charcoal, context (458) (Group 803), a small pit-type feature C459, also contained the remains of foodstuffs such as hazel nutshell, and sloe stones; by implication at least part of this sample, which included oak, blackthorn and the hawthorn group, derived from hearth material.

Late Neolithic/Early Bronze Age c. 2400–1800 cal BC

Repeated episodes of land clearance appear to have continued well into the early second millennium cal BC (above p. 55). The frequency of oak in small quantities of charcoal collected from numerous areas of scorched soil and burnt spreads, suggests that oak probably formed the main woodland cover, with blackthorn, hazel and the hawthorn group in marginal or more open areas.

Evidence of clearance burning was recorded in contexts (302) Group 803, (1428) Group 2509, (78) and (135) Group 2543, (4108) and (4156/7) Group 4504, contexts (4489), (4490) and (4494) Group 4561 and context (4239) Group 2503. Associated charcoal was sparse but included oak, hazel, blackthorn, the hawthorn group, ash and alder. Root wood recorded from burnt surfaces in Group 4561, context (4490) and Group 2543, context (78), was identified as ash and oak respectively.

Deposits from the fills of structural pits are more likely to originate from dumped hearth debris as, for example, in contexts (53), (1328), (1450) and (1451) (Group 2503), which identified the use of hazel, the hawthorn group and blackthorn.

A small amount of charcoal (of unknown origin) was collected from context (1817) (subgroup 2550/2), a layer predating Burnt Mound I, and identified as oak, blackthorn and either hazel or alder; no other plant remains were found. Charcoal was also recovered from contexts directly related to activity at the burnt mound from subgroup 2550/3: from hearth/oven C1704, (1691) and Pit C1892 (1881); from the upper layers of the burnt mound (1487) and (1799); and from the fill of the trough C1651 (1653/1654). These indicated the use of firewood composed of mixed broadleaf species: oak, hazel ash, the hawthorn group, blackthorn and probably alder; an unusually large sample of charcoal recovered from (1654) contained mostly oak.

Middle Bronze Age c. 1200–1000 cal BC

Charcoal-rich samples were collected from Burnt Mound II trough fills (4479), (4459), (4478) and (4482), and from a layer that appeared to have been inserted between the trough and the cut, context (4497), possibly to act as a filter. These samples were in a much better state of preservation than those from elsewhere on the site and included a high ratio of narrow roundwood. The taxa named included oak, alder, hazel, ash, the hawthorn group, blackthorn, buckthorn, dogwood, willow/ poplar and elm. Although much of the oak consisted of heartwood this probably originated from fairly narrow roundwood. Charcoal residues from a possible hearth base (4477), however, was poorly preserved and infiltrated with reddish deposits; not surprisingly, correspondingly fewer taxa were identified: oak, ash, buckthorn, alder and the hawthorn group. Charred plant remains from woody species were also fairly frequent in this group, e.g. alder cones, hazel nutshell and sloe stones (above p. 118).

Well-preserved charcoal, including alder, buckthorn, the hawthorn group and very narrow oak roundwood, was also recovered from a layer in a palaeochannel M, (4483; Group 4564), which predated the trough construction.

Discussion

Deposits of charcoal were collected from features and burnt spreads dating from Neolithic and Middle Bronze Age occupation. The origin of the charcoal can be divided roughly into a) fuel from domestic hearths/ ovens and from burnt mounds and b) debris from trees clearance by burning. Despite the frequency of charcoal in many contexts, soil conditions were not conducive to long-term preservation and the potential of the charcoal to produce significant data was greatly reduced. With the exception of samples 273, 314, 310, 312 and 284 from the trough and palaeochannel M at Burnt Mound II, preservation across the site was very poor. There was no obvious explanation for this differentiation, especially since, in contrast, hearth samples from the Burnt

Mound II complex were degraded. Perhaps, the trough feature, which was timber-lined, offered greater protection. Overall, however, there is no doubt that alluviation and fluctuating water-levels on the floodplain accounted for much of the structural damage to the charcoal.

Early occupation

The site was mostly low-lying with numerous streams. The frequency of alder in the pollen deposits (Greig, below p. 131) is indicative of damp or waterlogged soils; flooding was recurrent throughout the winter months. Occupation of the site during the Neolithic period (*c.* 3600–3000 cal BC) appears to have been seasonal and possibly related to stock. Fuel residues from hearths in this area, Groups 2503, 2504 and 2530, although scant, indicated the use of oak, birch, hazel, blackthorn and the hawthorn group. It is probable that mixed deciduous oak woodland was extant on the better-drained soils and thus readily available as a source of firewood. There was little evidence to indicate cereal cultivation in this area (Monckton, above p. 119)

Tree clearance

Major episodes of tree clearance occurred over several centuries from the late third — early second millennia cal BC, possibly to increase grazing areas. Although the extent of felling is unknown, evidence of tree clearance was recorded across the site. Some trees were almost certainly burnt-out, which suggests that the aim was total destruction and removal rather than felling to promote coppice growth. Areas of scorched soils and burnt spreads may have resulted from bonfires from the disposal tree/ scrub debris as, for example, in contexts (57) Group 803 and (63) Group 805, which included oak, alder, birch, blackthorn and the hawthorn group. The slightly larger sample from context 63 (Group 805), the fill of a tree-throw with a burnt pit in the centre, consisted entirely of oak which may offer a more secure identification of the felled tree. Narrow roots from oak and ash trees occurred in contexts (4490) Group 4561 and (78) Group 2543. The apparent increase in soil moisture/ alluviation at this time may be partly attributable to tree felling and the associated reduction in water uptake (evapo-transpiration).

Burnt Mound I

Charcoal collected from hearth/oven contexts (1691) trough and tank contexts (1653/1651), (1582) and (1654), a pit context (1881), and from burnt mound contexts (1487) and (1799) represented fuel debris from heating stones to raise the temperature of the water in the trough. These samples were mostly very small and identified a similar range of taxa to that from domestic hearths in Neolithic contexts in Zone 2 (see above). A large quantity of (degraded) oak in context (1582), the base of the 'tank' next to the hearth, could be considered more indicative of species selection but owing to its fragmentation it was not possible to assess sourcing from managed woodland.

Palynological evidence from palaeochannel M, dating from about 2100–2000 to 1300–1100 cal BC, suggests that woodland consisted mainly of oak, alder and hazel with some beech, and marginal woodland or scrub including blackthorn/ cherry, purging buckthorn, and hazel (Greig, below p. 132). Elder (*Sambucus* sp.) seeds were also recorded.

Burnt Mound II

Burnt Mound II included a wood-lined trough, associated scatters of heat-cracked stones and possible hearth bases. A layer of charcoal apparently packed between the timber lining and the cut of the trough may have served as a filter to purify water entering the trough. In comparison with charcoal from elsewhere on the site, deposits in the trough and in the palaeochannel M, predating the trough, were large and particularly well preserved. The charcoal consisted predominantly of narrow roundwood and included a much broader range of taxa than apparent from earlier features. Interestingly, there appears to be more use of alder, which correlates with evidence from the pollen record indicating increased levels of alder and oak at this time, although this could also reflect the wetter character of the immediate environment in which the burnt mound was located. The use of additional species including elm, dogwood, purging buckthorn and willow/ poplar may also relate to environmental factors or to distribution patterns. The taxa identified from the charcoal deposits closely parallel those identified in the pollen record (below p. 131).

The high ratio of narrow roundwood in these deposits indicates that fuel supplies were obtained from juvenile growth such as that produced in coppiced or frequently cropped woodland. The felling of immature timbers to line the trough (below p. 125) and possibly to consolidate or revett the banks of the channel (above p. 49) may have initiated coppice-type growth that, in subsequent years, was used as fuel. Brushwood from the conversion of the timbers would also have provided a source of firewood, although this would only have been available during construction or repair work. Greig (below p. 132) suggests that the increase in tree pollen towards the end of this phase may have resulted from overgrown and denser woodland following abandonment of the site.

The character of the fuel used at Burnt Mound II compares favourably with that from a large burnt mound feature sited close to the River Dove at Cox Bank Farm, Marchington, a few miles west of Willington Quarry (Gale 2006). Large charcoal deposits from the mound indicated the exclusive use of narrow alder stems, although samples from the trough also included hazel and ash roundwood. The feature was based on an emergent spring (still extant today) where alders growing on the locally wet or boggy soils would have provided a ready source of fuel. Despite its poor quality as firewood (Edlin 1949; Porter 1990), the sites at Cox Farm and Willington Quarry made good use of alder, thus it could be argued that ease of access to adequate supplies of fuel was more important than the efficiency of the fuel.

Conclusion

The identification of selected samples from Neolithic and Bronze Age features indicated access to a wide range of woodland species but, owing to poor preservation of much of the charcoal, it was difficult to obtain significant data on the preferential selection of species (if any) related to function. More or less similar species were identified from domestic hearths and structural pits associated with Neolithic and Early Bronze Age occupation and from Burnt Mound I.

Burnt Mound II was located in an area of wetland. The preservation of associated fuel residues and deposits in these contexts was comparatively good and it was evident that firewood was composed mainly of narrow roundwood, which, as might be anticipated in this location, included a high proportion of alder.

Burnt tree-throw pits and areas of surface burning, probably resulting from bonfires of tree-felling debris and scrub clearance, indicated the widespread reduction of woodland across the site. Samples collected from these areas included oak, hazel, blackthorn, ash, birch and the hawthorn group.

WORKED WOOD

By Matthew Beamish

Introduction

Waterlogged wood was recorded from within the area of Burnt Mound II. The full report, including detailed methodology can be viewed at http://ads.ahds.ac.uk/catalogue/resources.html?willington_eh_2008.

The material comprised 32 clearly selected and *in situ* (bar post-depositional slumping) timbers lining a substantial rectangular pit or trough, approximately 2.2m × 1.3m × 0.25m (C4468) and 42 pieces from two clusters of pieces within an adjacent silted palaeochannel M (Fig. 54) which displayed little formal structure.

Of 73 pieces individually recorded 61 were in the round, six were half splits, three were radial splits, and three were tangential chips. Twenty seven pieces of wood bearing chop marks were recorded, of which 19 were roundwood with cut ends. Virtually all chop marks were on the ends of the pieces.

The Willington channel timbers, with the notable incidence of cut pieces, is a selected assemblage, although it is unclear whether these pieces came from immediately adjacent to the site or from some way upstream. If contemporary with Burnt Mound II and derived from the bank side it had clearly been rejected as fire-wood.

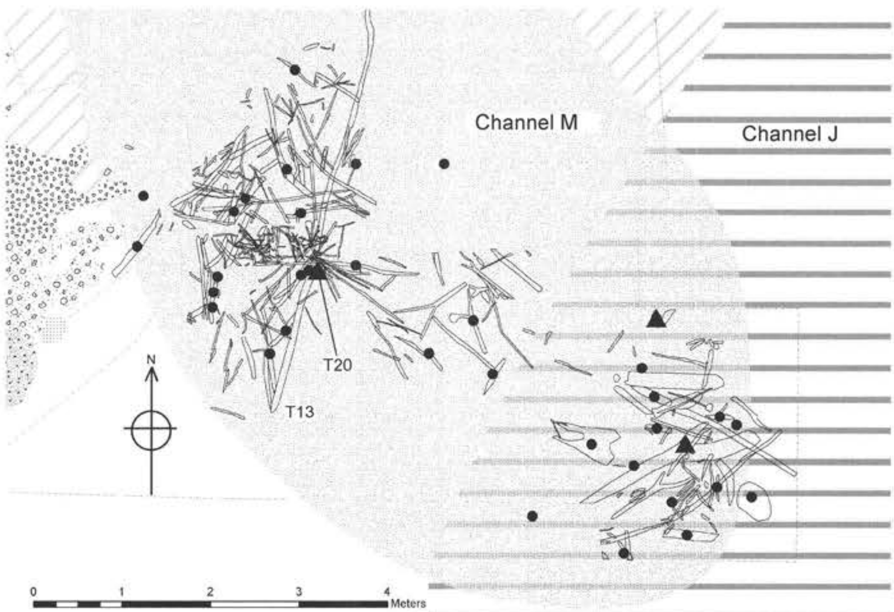


Fig. 54: Chopped (dot) and in situ (triangle) pieces in channel silts.

Both wood and charcoal identifications include substantial numbers of alder. The fuel charcoal identified is noted for the high ratio of narrow roundwood from juvenile growth (Gale, above p. 123), and although the channel timbers included some narrow pieces, it is not dominated by them. It is possible that the channel wood is an accumulation of by-product (mostly trimmings and some chips) from wood and coppice-work going on a little way upstream (the freshness of the cuts indicates that the pieces had not travelled far) along with a quantity of naturally derived pieces. Alternatively, the wood represents material dumped into a silting channel in order to consolidate the boggy ground and facilitate burnt mound activities.

Species Identifications, Ring Counts and Wood Size by Graham Morgan

Species identifications and ring estimations were carried out on 98 individual pieces. Identified species from the channel deposits included alder/hazel, ash, blackthorn, hawthorn, maple, oak, willow/poplar and rowan.

Identified species from the trough included alder/hazel, ash, maple, and willow/poplar. The willow/poplar is perhaps more likely to be willow in view of the local wet conditions.

Within the trough lining, the poles have perhaps been selected on the basis of their comparative size rather than their species, with the trees being laid down as they were cut from the wood. Of the ash poles, four showed evidence of having been cut before the growth of summer wood. The ash was notably free of buds and side branches particularly when compared with the field maple; side branching is possibly less likely in woodland ash trees than in open areas or hedges, and ash will possibly grow straighter than other trees. Field maple may well have more side budding than other trees. A piece of Field Maple (T21) had rather widely spaced first rings which suggests coppicing or re-growth.

Wood Technology and Trough Construction by Matthew Beamish

Twenty-four pieces from the Burnt Mound Channel M had evidence of cuts or chops. These were recorded on site. Twenty–six trough timbers had clear tooling evidence. Timbers showing cut marks were studied for further details that might indicate the type of tools that had been used for working the timbers, and what processes had been employed in the production of the pieces.

Marks and features were drawn at various scales including 1:1 acetate tracings, and photographed.

Conversion evidence

Within the trough, four timbers were fully or partially halved including two from the same maple roundwood (T40, T41); these had been laid flat face down just to the north of a nominal centre point reconstructed from a best fit rectangle to the corner posts (Fig. 57). Of the remainder, one piece used longitudinally appeared partly sharpened at one end (T67) and was either re-used, or perhaps a rejected stake. Two smaller pieces infilling gaps left by other timbers were radial (quarter) splits. All other timbers (including the corner stakes) were in the round. No pieces were jointed. Some timbers retained almost complete bark, whereas others did not; some if not all of this variation was clearly due to post-depositional processes. Preservation was better on either the undersides or those buried by infilling layers prior to the abandonment and weathering of the structure. There was little suggestion that any timbers had been de-barked prior to their use.

Split surfaces were undressed, although in two instances light relieving marks were recorded, one of which tallied with an area of difficult grain which had probably caused the splitting to fail. Marks on the end of a halved piece indicated that the split had probably been started with the same wide sharp blade (B4, Fig. 56) subsequently used to dress the hewn surface, and not a wooden wedge.

Five timbers had the distinctive obliquely faced ends indicative of felling wedges, indicating that these timbers were from the base of the tree (Fig. 57). Four pieces, T35 and 77 (alder), 81 (willow/poplar) and 87 (maple), were similar in showing curving grain just at or below the felled end, indicating that the trees were either growing upon uneven ground such as a stream bank, or that they were growing off a stump at an angle as would occur on a coppice heel (Rackham 1977, 66). However ring structures did not clearly indicate fast early growth for these pieces which coppicing would cause, although one piece from the channel deposits did.

Base timbers

The trough base comprised 13 timbers of which 10 were principal timbers, and a further three appeared to infill the larger gaps left between the first ten. Of the principal 10, every timber had its wider end in the north-east, so all the directions of growth were aligned from north-east to south-west. The result of this was that the 10 slightly thinner ends of the timbers lay between the uprights T31 and T86 at the south-western end, but only eight lay between the uprights at the north-eastern end with the two principal flanking timbers (T88 and T61) running from between the uprights in the west, to just short of them in the east.

Side wall timbers

Three timbers survived on southern, and northern linings, whilst a probable fourth timber was found slumped to the north of the northern wall (Fig. 55), on a broadly similar alignment, and of similar diameter and type (ash).

The state of preservation of the side wall timbers generally improved from top to bottom although compression distortion was more notable toward the base. Some

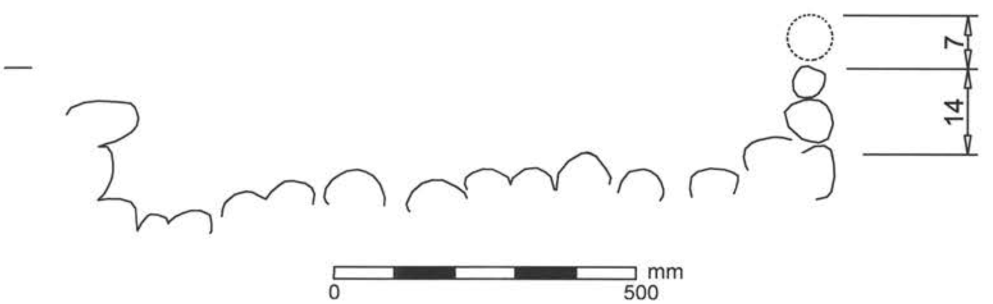


Fig. 55: East facing transverse section at mid point across emptied trough with recorded and suggested original side wall height.

choice was again displayed in the placing of the timbers in relation to their thicker and thinner ends.

The lining had been laid at least partially in a pit cut. The basal timbers projected beneath the cross-wall linings (Fig. 57; Fig. 62). The structure of the trough relied on the side timbers being retained by the four corner stakes. There was clear evidence that the side walls had initially been three timbers high, with some evidence of a fourth timber.

The pit cut which held the timbers (and was mostly obliterated by post-depositional slumping of the silty peats) was a maximum of 0.20m deep. This would have offered support to only two of the side wall timbers and thus further support either in the form of material packed behind the timbers, or perhaps a binding must have been used to prevent the upper side lining timbers from falling backwards. The latter would have failed to maintain the water bearing ability of the structure above a depth of some 0.14m (Fig. 55).

Construction Discussion

The orientation of the base timbers' growth directions clearly indicates that the builders had some preconception when the timbers were being laid out. Bronze Age round houses often display clear symmetry in their construction (Beamish 2005, 8; Guilbert 1982).

The five distinct felling wedge cuts identified perhaps gives a broad indication that the number of trees used in the construction was significantly fewer than the number of timbers used. Four pieces of ash timber had probably been felled in the late spring (T57, T59, T67 and T83). Although only one of these displayed a felling wedge (T57) with the possibility that all pieces were derived from the same tree, this timber was of significantly smaller diameter and had fewer rings than another (T83) and at least two trees were felled at this time. The off-centre heart from the southern side wall indicates that it was probably branchwood (T43). Interestingly, activity at the Burnt Mound in the late spring has also been suggested from alder cones in the charred plant remains (above p. 118).

The use of different species of timber does not appear related to the structural virtues or otherwise of the timbers as no particular structural strengths were demanded by the lining of the pit. Perhaps of some interest is the distribution of the species, which do appear in distinct clusters and are not distributed at random. This might indicate that felled trees were brought to the site, and cut to size for the lining. It is probable that the corner stakes were the first part of the construction, followed by base timbers, and side wall linings. The lining has been built in a systematic and considered manner.

The identification of spring wood only on a number of the ash pieces, if interpreted literally, indicates that the trough was built in the late spring or early summer.

Tooling and blades

All evidence for tooling was from sharp fine blades. Identifiable blade marks varied between 30mm and 45mm (Fig. 56). One complete blade profile of 37mm was recorded. All marks were clearly made by metal blades, although no reliable blade signatures were found, so it was not possible to produce any composite profiles.

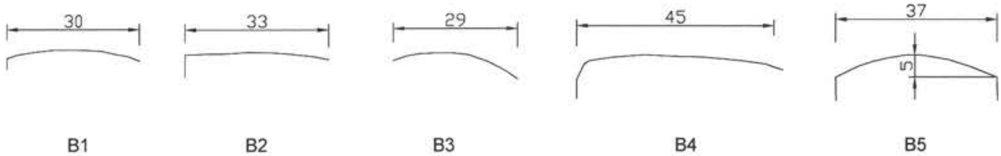


Fig. 56: Blade profiles; Blade 5 has a curvature index of 13.5.

Two of the blades could be reliably differentiated; a wide mark (B4) found on the cross cut end of timber 39, and an isolated complete narrow mark (B5) found part way up timber 83 where the tool had been embedded in the wood and subsequently removed.

Blade widths

The complete recorded blade width of 37mm falls comfortably within the range of those marks recorded for Flag Fen (Taylor 2001, 197).

Blade curvature

The blade curvature index for B5 (depth expressed as a percentage of width *cf.* Taylor 2001, 201) is 13.5%. This is identical to the 13.52% index for the lower assemblage from Flag Fen blades (Taylor 2001, 198). Broadly the curvature is conservative when compared to a broad Bronze Age axe curvature index range of 14.54 to 24.90%.

It is unwise to speculate too far on the types of tool used to process and fashion the lining and associated timbers of the Willington waterlogged deposits, as the assemblage is so limited. On a dataset of some 168 represented axe marks, Taylor found best comparison between the distribution curve of the Flag Fen assemblage blade width (15–55mm), and that for Lincolnshire socketed axes (Taylor 2001, 200), although noted that in general the Flag Fen blade widths were all slightly narrower than the widths of recorded axe heads, for which post-depositional shrinkage was probably responsible. The Willington examples could comfortably fall within these ranges and socketed axes may well have been the types of tool used. Nonetheless, a good match was found between the complete blade profile recorded and that of a narrow palstave type axe (unprovenanced) held within the University of Leicester metalwork reference collection.

POLLEN AND PLANT MACROFOSSILS

By James Greig

The pollen and plant macrofossils from seven profiles through palaeochannels and other organic layers were generally abundant and well-preserved (Fig. 3). Some of the material seemed to be of early Post Glacial date (Col. 1, Channel G (lower), Col. 7, Channel N). The post-Neolithic material assessed (Col. 1 (upper), Col. 4, Col. 5, Col. 6) seemed to show clear signs of human activity in the vicinity, seen in both pollen and plant macrofossils, offering the prospect of an important new understanding of the development and settlement of this alluvial landscape. Full analysis has been made of three samples each of column 5 the deposits from the wood-lined trough, and column 6 the sediments of a silted channel adjacent to the wooden trough. These show a

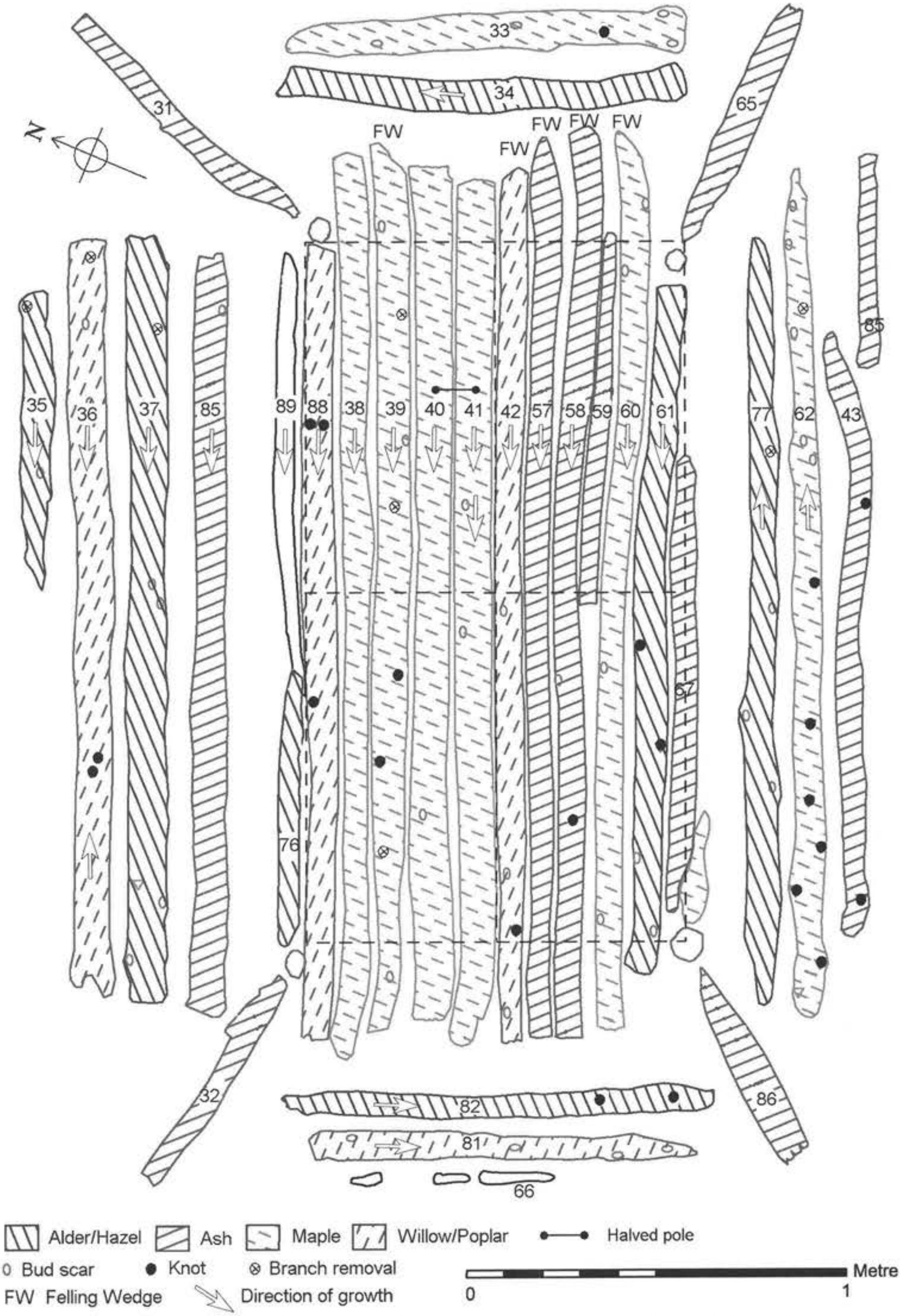


Fig. 57: Trough timber species, growth information and constructional information.

partly wooded landscape with some signs of local regrowth of woodland perhaps after Burnt Mound II became disused. The full report, including detailed methodology can be viewed at http://ads.ahds.ac.uk/catalogue/resources.html?willington_eh_2008.

Results

Both pollen and macrofossils are generally well-preserved and abundant in the material from Willington.

Column 1 *Channel G*

The pollen sample appears to be early Post Glacial, as it contains much *Pinus* (pine) *Betula* (birch) and *Corylus* (hazel) among trees and shrubs. The herbs include some taxa such as *Thalictrum* (rue), *Artemisia* (mugwort), *Polemonium* (Jacob's ladder) and *Armeria* (thrift), a combination known mainly from Late Glacial/early Post Glacial contexts in which there was herbaceous vegetation, as the landscape was only lightly wooded. Wetland plants include Cyperaceae, and aquatics include *Myriophyllum* (millfoil). *Corylus* arrived on most of England between *c.* 9500 and 9000 BP (*c.* 8800 cal BC and 8250 cal BC) and *Quercus* (oak), which was only found as a trace in this part of the core, somewhat after *c.* 9000 BP (*c.* 8250 cal BC; Birks 1989), so the likely age of this lower part of the profile is somewhat more than 10,000 years.

The radiocarbon dates of 11,410–11,230 cal BC (SUERC-7350;11405 $\pm$ 45 BP) from the top and 11,820–11,510 cal BC (SUERC-7351;11780 $\pm$ 45 BP) from the bottom of the profile agree with this conclusion from the pollen that this material is Late Glacial in age.

The macrofossil samples from the lower part support this conclusion of mainly Late Glacial material, with *Betula* (birch) and some *Salix* (willow) remains, together with those of a range of herbs mainly from wetland and aquatic habitats. Some of the macrofossil samples from the upper 0.50m contained charcoal and charred *Rumex* (dock), and *Sambucus nigra* (elder) which suggests there was some human activity in this part, or mixing with later material bearing signs of human activity.

Column 4 *Palaeochannel D*

The two spectra (1.0m and 0.7m) are essentially similar, with a range of trees and shrubs making up 20–28% of the total pollen, including *Fagus* (beech). The herbs include records of cereal and plantain, together with a range of weed and grassland plants. An occupied farming landscape therefore seems to be represented.

This could easily represent Roman or medieval periods, although *Centaurea cyanus* (cornflower), which might have been expected in such a landscape after about AD 1200, was not seen in the (small) counts, nor when the slides were scanned. Perhaps the material predates the high medieval period?

The macrofossils from one sample (248) were quite abundant, and include a substantial element from the dry land, including a number of weeds such as *Atriplex* (orache), *Chenopodium* (goosefoot), *Stellaria* (chickweed), *Aphanes* (parsley piert) and two species of *Valerianella* (cornsalad). These suggest that cultivated land is well represented here. Probable grassland plants include *Cerastium* sp. (mouse-ear chickweed) and *Leontodon* sp. (hawkbit). Human activity is shown by charcoal. There is also a marshland part of the flora with *Ranunculus flammula* (lesser spearwort), and some aquatic plants, *Potamogeton* (pondweed) and *Glyceria* sp (sweet-grass).

***Column** 5, fill of trough (Burnt Mound II)*

Trees and woodland

The pollen results from this short section of 0.25m sediment show about 22–40% tree and shrub pollen (excluding *Alnus* and *Corylus*). This shows that the general surroundings had some woodland with *Quercus* (oak), *Ulmus* (elm), *Fraxinus* (ash) and *Hedera* (ivy) with a trace of *Tilia* (lime). The small records of *Prunus* type (including sloe and cherry) and *Crataegus* (hawthorn) may represent woodland margins, scrub or hedgerows. They often occur in prehistoric sites such as this.

Alnus (alder) is the most abundant tree pollen type, and at least some of this is likely to have come from the immediate surroundings, since alder seeds and catkins, which are not usually dispersed far from their parent trees, were present among the macrofossils. Alders probably grew along the stream channels together with *Salix* (willow) which is also present in the pollen record. Seeds of *Sambucus nigra* (elder) were found, but no pollen; elder often grows well in places where the soil has been enriched by human occupation.

Ericales (heather) pollen hints at some heathland, although probably not on the damp lands of the floodplain.

Possible crops, weeds, grassland etc.

A number of pollen records probably represent plants of bare soil, and ones such as Caryophyllaceae correspond with seeds of *Stellaria media* (chickweed), and Chenopodiaceae with those of *Chenopodium* (fat hen, etc.). Pollen of *Aster*, *Artemisia* (mugwort) and *Anthemis* type are likely to represent weeds. A slight Cerealia type pollen record hints that cereal crops were grown or processed nearby or that cereal products were present in some form. Charcoal, which was present in the lowermost macrofossil sample, provides some more evidence of low level human activity in the area.

Seeds of *Potentilla anserina* (silverweed) and pollen of *Ornithopus perpusillus* (birds foot) hint at sandy or gravelly areas, which would have been made by moving channels.

Grasslands

There are several records of probable grassland plants such as *Ranunculus* (buttercup) together with seeds, *Plantago lanceolata* (ribwort plantain), *Sanguisorba minor* (lesser burnet), Lactuceae and Poaceae (grasses) although the latter can represent a whole range of habitats beside grassland. The signs of grassland correspond to dung beetles representing pasture.

Wetland

The pollen and seed record of mainly wetland plants such as *Filipendula* (meadowsweet), and seeds of *Lychnis flos-cuculi* (ragged robin), suggest a transition from damp grassland to bog with *Persicaria hydropiper* (water-pepper) seeds and a corresponding record of *Persicaria maculosa* type pollen; Cyperaceae (sedge) pollen with corresponding macrofossils of various *Carex* species and of *Scirpus sylvaticus* (wood club-rush), together with pollen of *Sparganium/Typha* (bur reed/reed-mace). Standing water is suggested by *Ranunculus* subgenus *Batrachium* (water crowfoot) seeds, as well as by some of the beetles studied by David Smith. These remains probably represent the wetland plants which grew in and around the organic deposit as it formed in the trough.

Change with time

The radiocarbon dates from the top and bottom of the profile show that the results cover a time span from about 1260–1000 cal BC (Poz-18006; 2845±35 BP) until about 1130–910 cal BC (Poz-18007; 2910±35 BP) a span of *20–180 years (68% probability)*.

A pollen diagram derived from only three samples can give only the barest indication of change, but there does appear to be an increase in tree pollen from the bottom to the top. This is mainly of *Quercus*, *Alnus* and *Corylus*, matched by a slight decline in Poaceae and Cyperaceae. There are also more macrofossil records of *Alnus* and *Sambucus* from the upper sample. These changes could be connected to an increase in woodland and a decrease in light demanding herbs as the site became overgrown after it had been abandoned. Or that part of the landscape may have been used less for occupation, and perhaps more for ceremonial purposes.

Column 6 *Palaeochannel M*

The results from the palaeochannel are generally rather similar to those of the fill of the trough cut into it, Column 5, although these results seem to cover a far longer time span, from about 2150–1940 (Poz-18029; 3665±35 BP) to 1320–1050 cal BC (Poz-18009; 2965±35 BP), according to the radiocarbon dates from the top and bottom of the profile.

Trees and shrubs

The main pollen types are *Quercus* (oak), *Alnus* (alder) and *Corylus* type (hazel). There are many smaller records, including *Fagus* (beech), which is thought to have arrived in the Bronze Age. The woodland edge, scrub or hedgerow indicators *Crataegus* (hawthorn), *Prunus* type (sloe or cherry) and *Rhamnus cathartica* (purging buckthorn) are present, and a trace of Ericales (heathers) which represents heathland. There is a similar proportion of tree and shrub pollen to that of Willington 5, around 25% excluding *Alnus* and *Corylus,* which suggests the presence of some woodland in the landscape. The presence of alder and elder seeds among the macrofossils shows that these grew on the spot.

Crops and weeds

There is a cereal type pollen record, as well as a number of weeds such as Chenopodiaceae corresponding with *Chenopodium* seeds, *Spergula* (spurrey) which can grow as a cornfield weed on sandy soils, *Rumex* corresponding with *R. conglomeratus* (clustered dock) seeds and with *R. acetosella* (sheep's sorrel) seeds, and *Anthemis* type. Charcoal provides further evidence of human activity.

Potentilla type pollen and *P. anserina* (silverweed) seeds may reflect plants growing on sand and gravel banks.

Grassland plants

There are records of *Ranunculus* (buttercup) pollen and seeds, *Plantago lanceolata* (ribwort plantain), *P. major/media* (greater/hoary plantain), Lactuceae (a range of composites that includes many grassland taxa) and Poaceae (grasses). *Filipendula* (meadowsweet) pollen and seeds, and pollen of Dipsacaceae (scabious) and *Carduus/Cirsium* (thistle) could represent damp grassland grading into swamp. The presence of beetles indicating grassland and dung (Smith, below p. 135) provide further evidence for grassland and pasture.

Wetland and aquatic plants

Wetland plants are represented by a 20% record of Cyperaceae and corresponding seeds of *Carex* (sedge), *Eleocharis* (spike-rush) and *Scirpus* (wood club-rush), all of which represent damp to wet conditions in the deposit as it formed. Some of the *Aster* type pollen could be from *Bidens* (bur marigold) and *Eupatorium cannabinum* (hemp agrimony). *Persicaria maculosa* type pollen corresponds with seeds of *P. hydropiper* (water-pepper) and of possible *P. maculosa* (persicaria), both of which grow on stream banks. *Sagittaria* (arrowhead), and *Sparganium/Typha angustifolia* (bur-reed or reed-mace) pollen is also present, and pollen together with seeds of *Alisma* (water plantain). *Ranunculus* subgenus *Batrachium* (water crowfoot) seeds indicate standing water, at least some of the time. Part of the beetle fauna also suggests swamp conditions (Smith, below p. 135).

The peats predating the trough (C4466, Sample 270), which may be comparable to Column 6, contained very abundant macrofossils. Evidence of trees and shrubs was provided by records of *Betula* (birch), *Alnus* (alder), *Crataegus* (hawthorn) and numerous buds, and the material seemed to consist of the remains of leaves, probably of trees. *Urtica dioica* (nettle) could be growing in damp woodland. Dry land herb communities may be represented by *Ranunculus* sect *Ranunculus* (buttercup) and *Rumex conglomeratus* (clustered dock), and the presence of charcoal showed some sign of human activity, perhaps connected with the burnt mound. As is usual with wetland deposits, most of the macrofossil flora was from marshy habitats with taxa such as *Lychnis flos-cuculi* (ragged robin), *Persicaria hydropiper* (water-pepper), *Eupatorium cannabinum* (hemp agrimony) and *Carex* sp. (sedge). Aquatic plants included *Ranunculus* subg. *Batrachium* (water crowfoot), *Oenanthe* sp (water dropwort) and *Glyceria* (sweet-grass).

Sample 4487 283 was an ashy material with relatively few macrofossils, most of which were aquatic and marshland taxa, such as *Ranunculus* subg. *Batrachium* (water crowfoot), *Eleocharis* sp. (spike-rush) and *Carex* (sedge).

The evidence of wet woodland could be quite local, showing conditions along the palaeochannel in which the evidence was preserved, or it could show that this was not a cleared and occupied place, but it was used for a burnt mound for some particular reason. There is no evidence of seasonal activity.

***Column** 7, Post Glacial to 2nd millennium cal BC ancient peat   Channel N*

The three pollen spectra are dominated by herbs, including *Thalictrum* (meadow or alpine rue), *Limonium* (sea lavender) and *Artemisia* (mugwort). The few trees and shrubs are mainly *Betula* (birch), *Corylus* (hazel), *Salix* (willow) and *Pinus* (pine) with a little *Alnus* (alder) in the top sample.

Pinus (pine) arrives about 9000 BP (*c.* 8250 cal BC), and *Alnus* (alder) after 8000 BP (*c.* 6900 cal BC; Birks 1989), which provides some indication of the likely date for this sequence. This looks like an early Post Glacial succession with herb-rich communities and developing woodland mainly of birch and willow.

Comparison with other sites

Our understanding of the development of the cultural landscape of the Trent Valley comes from short sequences covering various time periods and from a range of sites which have been studied. Palaeochannel fills can be of very varying ages.

The assessment results from Columns 1 and 7 seem to show a phase with pioneer woodland and herb vegetation being established in the early Post Glacial period. Unpublished results from Shardlow quarry show a somewhat later stage of woodland development with elm and pine.

The start of prehistoric clearance of the wildwood of lime, elm and oak in the Late Neolithic and Early Bronze Age and the first stage in the opening up of the river valleys to occupation is shown by the results from the site of Wellington (Herefordshire) in the Lugg valley (Greig 2004a). A similar sequence of events probably happened in the Trent Valley.

The results from the deposits above the second logboat at Shardlow SQB 04, 18 km down the Trent (Greig 2006), begin at around 1500 cal BC, when there was more tree pollen with *Quercus* (oak) and *Tilia* (lime), suggesting that some wildwood still existed at the start of the sequence there (or closer to the site), which had become reduced in the upper part of the profile to more like the Willington results, in which there is *Quercus*, but only very little *Tilia*. At the same time *Fagus* (beech) and Ericales (heathers) appear, indicating secondary woodland and heathland, respectively, as at Willington.

Sites set in landscapes with more evidence of occupation (or more intense or more local occupation) include Beckford and Bidford (Greig 2005) in the Vale of Evesham. A Thames Valley site under investigation is Yarnton (Oxfordshire), where the evolution and use of the landscape from the Neolithic to the Saxon period is being investigated (Allen *et al.* 1997). Bronze Age pollen results from Yarnton (Greig 2004b) with around 10% tree pollen at this stage, show far less signs of woodland than the sites in the Trent Valley. These results may reflect open landscapes either just around the settlements or perhaps more plausibly in the landscapes of the Vale of Evesham or the Thames Valley generally, where grazing and occupation prevented trees from becoming established there after clearance of the woodland. Thus the Trent Valley seems to have had more remaining woods as the result of less dense occupation in the prehistoric period, or the investigated sites may possibly have missed the centres of occupation.

INSECT REMAINS

By David Smith

Introduction

A total of 47 bulk samples was available for insect analysis. These came from seven sediment columns or groups of associated samples The full report, including detailed methodology can be viewed at http://ads.ahds.ac.uk/catalogue/resources.html?willington_eh_2008.

Results

The majority of the taxa present are beetles (*Coleoptera*) with a few individuals of caseless caddis flies (*Tricoptera*).

Column 5 (trough fill)

Four samples of material from the timber-lined trough of Burnt Mound II were analysed during this study. The insect faunas recovered are all very similar in their nature and, as a result, will be discussed together, as though the deposit represented a single unit. The vast majority of the insect faunas recovered are associated with aquatic and waterside environments. Ecological groups 'a' (aquatic) and 'ws' (waterside) account for 57–71% of the total fauna recovered. The water beetles consist of a relatively narrow range of species that, today, are usually associated with slow flowing or stagnant waters such as ponds, pools and marshes, for example, the various *Hydreanidae* recovered, notably *Octhebius minimus* and *O. bicolon*, which are all typical of these water conditions (Hansen 1987). Other taxa associated with this environment are the hydraenid *Hydrochus elongatus* and hydrophilids *Coelostoma orbiculare* and *Cymbiodyta marginella* along with the aquatic *Cercyons* such as *C. convexiusculus* and *C. sternalis* (Hansen 1987). A slight contrast to this is the presence of a small number of the elmid 'riffle beetles' *Elmis aenea* and *Oulimnius spp.*. Elmids are usually associated with faster flowing water conditions and a sandy or gravely substratum (Holland 1972). However, it is thought that these two taxa are more tolerant of slower flowing and siltier conditions than many in this family and often appear to enter back channels at times of flood (Smith 2000).

Many of these species inhabit waters that are full of a range of waterside and floating vegetation. The presence of a rich stand of such vegetation is also suggested by a number of the phytophage (plant feeding) species recovered. The clearest indicators for this are a range of chrysomelid 'leaf beetles' and curculionid 'weevils'. *Plateumaris braccata* is associated with the common water reed (*Pragmites australis* (Cav.) Trin. ex Steud) and *Donacia bicolor* with bur reeds (*Sparganium spp.*). Similarly the weevil *Notaris acridulus* is associated with reed sweet-grass (*Glyceria maxima* (Hartm.) Holmb). The small orthoperid *Corylophus cassidoides*, which is present in all samples from column 5, is usually found in decaying reed swamp vegetation (Harde 1984).

Given the dominance of both aquatic and waterside species in the samples from the fill of the trough it suggests that the area of the burnt mound became flooded as the result of channel change or rising water table.

One problem when considering this type of insect fauna is that cut-off channel and back swamp deposits often appear to 'collect' insects mainly from the local environment (Smith *et al.* 2001; Smith and Howard 2004). This means that insects from this kind of deposit frequently are not helpful for reconstruction of the surrounding landscape and that pollen often provides the clearest indication. This may also be the case with the material from the Willington burnt mound.

Despite this there is a limited range of insect species which probably do represent conditions on the drier land nearby. There are several indicators for the presence of rough grassland or grazing. This includes Geotrupes and *Aphodius* dung beetles, which feed on the droppings of a range of large herbivores. In addition, there is a range of weevils that are associated with rather weedy grassland; such as, *Gastroidea viridula* (associated with dock (*Rumex* spp.)), *Apion aethiops* (associated with vetches (*Vicia* spp.)), *Sitona* species (associated with clover (*Trifolium* spp.)), *Ceutorhynchus rugulosus* (associated with chamomiles and mayweeds (*Anthemis* and *Matricaria* spp.)), *C. asperifoliarum* (associated with borages (*Boraginaceae*)) and Mecinus pyraster and *Gymentron* spp. (which are both associated with plantain (*Plantago lanceolata* L.)). However, it is difficult to establish whether the presence of these species indicate larger open clearances maintained for pasture as part of Neolithic/Bronze Age farming practice (i.e. Robinson 2000) or natural clearances maintained by deer, beaver and other 'wild' animals (i.e. Buckland and Edwards 1984; Coles and Orme 1983; Vera 2000). For example, channel change and river undercutting can often result in the development of rough grassland in the floodplain leading to the development of 'wild meadows' (Smith *et al.*, 2005). The extent of clearance, and its significance, was also investigated through the pollen from this section (above p. 131).

A similar problem occurs when the small numbers of taxa associated with deadwood and trees are considered. Those taxa directly associated with living trees and leaves, such as *Haltica* spp. and *Rhynchaenus* spp., could not be identified to species level. This means that it is not possible to see if their hosts were willow (*Salix* spp.) and alder (*Alnus glutinosa* (L.) from the riverside or came from other tree species within nearby dryland woodland or forest. A similar difficulty is encountered with species associated with dead trees and associated forest fungi; such as *Melasis buprestoides*, *Asphidiporus orbiculatus*, *Platypus cylindrus* and *Sterocorynes truncorum*. Though clearly associated with deadwood, these taxa are again not host specific. They may represent local riverside trees or have come from forest further away. Also, they may have an origin in the large amount of small wood and timber used in the trough. Indeed, a similar explanation for the presence of this range of dead wood feeding species at some of the Somerset Levels trackways was advanced by Girling (1980; 1984).

A very small fauna of species that are often associated with human occupation and housing is also present. This consists of a few *cryptophagids* and *lathridiids*, as well as the 'spider beetle' *Tipnus unicolor* (i.e. Hall and Kenward 1990; Kenward and Hall 1995). However, their presence should not be taken as a direct indicator of human activity; these are species that also occur in dead timber and in dry plant litter in a wide range of natural circumstances. Evidence of many of the other species of beetles associated with human activity is missing.

Column 6 *Palaeochannel M*

The insect fauna recovered from the column associated with palaeochannel M is essentially similar to that from Column 5. Many of the same species which suggested limited evidence for rough grassland from Column 5 samples are also encountered here. Again it seems clear that the mound is associated with a slow flowing water channel filled with marshy vegetation located within some form of clearing. However, one difference between this fauna and that from Column 5 is the presence of *Dermestes lardarius*, which may be significant. This is a species of 'hide beetle' that is often associated with dried, prepared skins and food waste, though it is often found in birds nests and dead timber, usually at the woodland edge (Peacock 1993). Despite the presence of this insect, no other indicators for food waste or human occupation were present.

Conclusions

The insect faunas recovered from the troughs and channels at Willington are typical of those recovered from a number of cut-off channels of varying dates in the Middle Trent Valley (Greenwood and Smith 2005). Equally, such cut-off channels and backswamps seem to be a common component in the Trent throughout this period (Knight and Howard 2004). Unfortunately, the restricted nature of the terrestrial taxa makes any form of wider landscape reconstruction difficult. This means that no meaningful comparison to related insect faunas from the Trent basin, such as those from Bole Ings (Brayshay and Dinnin 1999) or Croft (Smith *et al.* 2005), is possible.

To date, the number of insect faunas examined from burnt mounds in the Trent Valley and nationally is extremely limited. In the Trent basin only those from Girton, Nottinghamshire (Kitchen 2008) and Castle Donington, Leicestershire (Smith 2001; Smith and Howard 2004) have been examined in any detail. As with Burnt Mound II at Willington, these seem to have been associated with the banks of cut-off channels or backswamps beside or within highly vegetated channels of slow flowing water. There is evidence at both sites for some degree of local woodland clearance.

Like the Willington results, these other burnt mound faunas also have produced no indicators for the presence of food waste or human occupation. There are no remains of the 'flesh flies' or 'corpse flies', which one might expect to be associated with food waste and the use of these mounds as cooking/feasting sites (i.e. O'Kelly 1954). There is also a complete lack of human ecto-parasites such as head or body louse (*Pediculus humanus* L.) or human fleas (*Pullex irritans* L.). Both species of parasite are fairly common in settlement sites (i.e. Kenward and Hall 1995) and might be expected to be associated in some numbers with the waste of 'sweat lodges' (i.e. Barfield and Hodder 1987). Certainly, regardless of whether these burnt mounds are being used for the cooking of animals or as 'sweat lodges', it seems unlikely that they were being used intensively or continuously for long periods of time.

DISCUSSION

There is evidence of visits to this wooded floodplain island, perhaps to hunt and forage, from the Upper Palaeolithic onwards, with occupation becoming more frequent in the later fourth millennium cal BC. Activity is probably task specific and seasonal, but repeated many times over the centuries until *c.* 3000 cal BC. A Late Neolithic ceramic phase is entirely absent here (but present a kilometre east Wheeler 1979; Fig. 1). In this period of ceramic silence, landscape clearance by fire begins. Probably by the mid third millennium cal BC, and within this context of an opening landscape, a well-formed Burnt Mound, possibly with associated pits and post-holes is established centrally on the low island. Small quantities of Beaker pottery are found across the site. Alluviation has definitely begun by the end of the third millennium whilst fire clearance continues. A ring ditch with a central burial pit and possibly an external bank is sited on the end of the island that is now becoming buried in flood silts. There is a suggestion that a further burial was added on the southern side of the monument in the later Early Bronze Age, or Late Bronze Age. Toward the end of the second millennium cal BC a second Burnt Mound is established to the east, in a more fully open landscape.

Deposit formation beneath trees and the survival of archaeological deposits

The majority of the Neolithic occupation of the site occurred in an uncleared wooded landscape. The site's palaeoecology includes evidence of the numerous trees which had become established and died between the warming period in the eighth millennium cal BC and the start of tree clearance, which can be interpreted as having started toward the end of the third millennium cal BC. Some of these trees preceded, some succeeded and some were contemporary with the Neolithic occupation.

In an alluvially-buried unploughed environment every tree that had grown on the buried land surface could be expected to have left some form of soil deformation during and at the end of its life (whether a natural death or as a result of human intervention), although Robinson argues that within dense Flandrian II woodland trees would have decayed where they stood (Robinson 1992, 51).

In an unmanaged woodland or 'wildwood', trees in all states of life and death are represented. The major contributor to the formation of subsurface deposits is the "tree-throw" and some clarity in the definition of this term is required if the differences between the various deposits and voids (that will be *subsequently* infilled) created with the falling of a tree are to be understood.

The formation of tree-throw pits

The account below follows Lambrick (2003, 245–246) except in the emphasis on some key areas. The mechanics of tree-hole stratigraphy have been well explained in the literature (e.g. Lambrick 2003) although it is clear that these explanations and especially their detail have failed to permeate widely within the archaeological community. The possible derivations of the contents of these features are complex and need to be fully understood to allow an understanding of the chronological sequence. These complexities were not appreciated by the author during the excavation, but have become evident in analysis.

When a tree dies it may eventually fall or be easily blown (or *thrown)* over depending upon the species and size of the tree, whether it has died quickly or slowly, its susceptibility to rot, and the depth, compaction and aerobic qualities of the soils on which it has grown (hence *tree-throw pit*). The extent of the fall and the characteristics of tree and soil conditions will affect the size of 'tree hole' (Darvill 2002) formed, i.e. the volume of root that is pulled from the ground, and inversely the volume of root matter that is left *in situ*. Some trees will die back without falling, in which case all of the developed root structure is left *in situ*. A heavy old tree that falls fully to the floor probably will be mostly uprooted leaving perhaps 10–15% of its roots *in situ*, whereas a smaller lighter tree may fall against a more mature neighbour and have only a small proportion of its root system disturbed.

The extent of the root volume torn from the ground will directly affect the extent and depth of soil and subsoil deformation. The heavy old tree that falls fully to the floor leaving only 10–15% of its roots *in situ* will create a hollow or 'pit' where A, B and C soil horizons are pulled upward with the trees roots. Subsequently these soils will be naturally weathered back into the hollow from which they were pulled. Careful inspection of the stratigraphy will reveal that the material is cross-bedded or *redeposited* (Fig. 58.3).

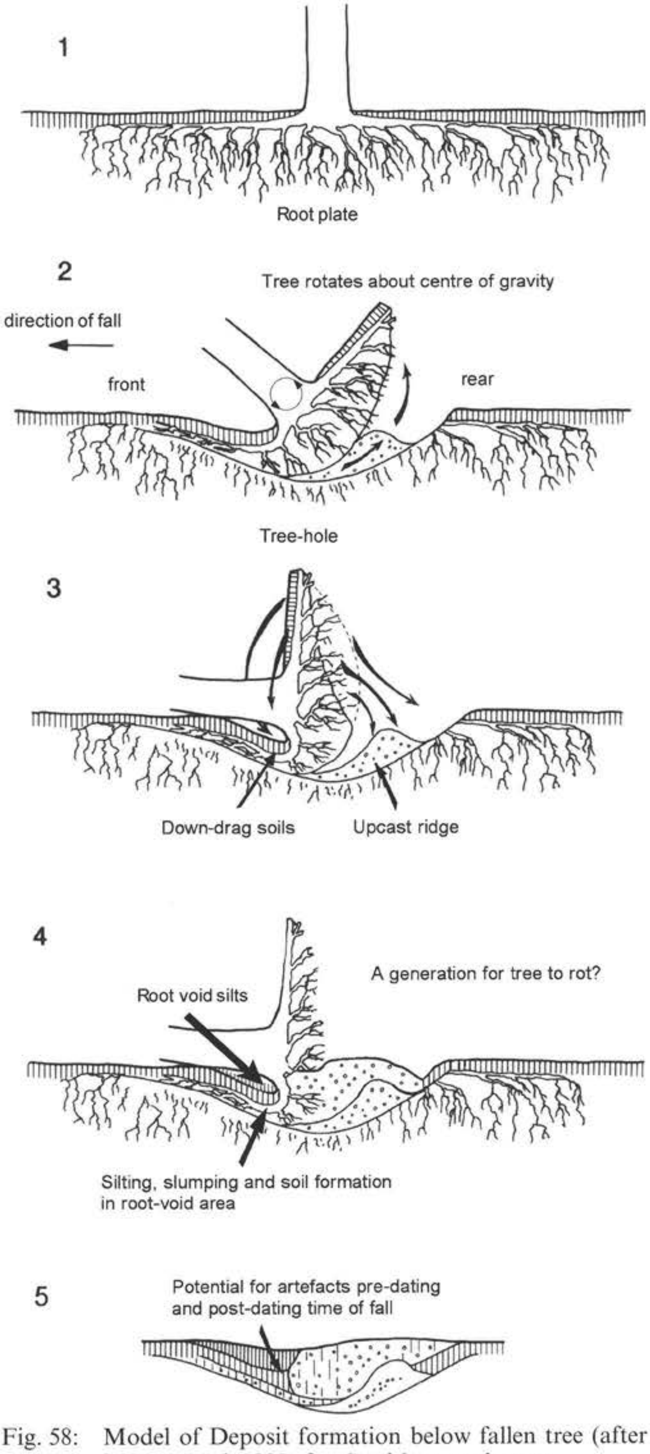


Fig. 58: Model of Deposit formation below fallen tree (after Moore *et al.* 1992, fig. 6) with amendments.

In addition to the ripping out of soil with the broken roots, heavier mature and well rooted trees will also displace a body of subsoil beneath the point of fall, by virtue of the substantial forces released, and so create a *pit* which may be concave and regular and have all the appearance of a *cut feature* if fully excavated. The displaced subsoil is pushed back and up so creating a ridge of *natural* that, if the site is untruncated, can survive as a positive feature which may be visible in plan, sometimes called 'kick-up' (Evans *et al.* 1999, 242), or 'hummock' (Goldberg and Macphail 2006, 199) and here called an '*upcast ridge*'.

The trunk of the tree has moved down during the fall, and while the roots behind the fall have rotated upwards, the roots in front of the fall have rotated downwards, so dragging down the soils in which they have been growing; this rotation drags the *in situ* soil from a horizontal to a vertical axis. The root-ball of the fallen tree sits above these displaced soils cleanly dividing what was once above the roots to one-side, and what was below to the other. The displaced topsoil (hereafter *down-drag units*), and the silts that will in time replace these *in situ* roots (hereafter *root-void units*) are the most commonly recognised archaeological signature. In plan this deposit is often crescentic but can be linear or semi-circular. In profile this deposit has a credible and real external edge but an internal edge that is poor, and often undercuts the redeposited cross-bedded natural *upcast ridge* near the base.

The down-drag deposits will contain surface artefacts within the displaced topsoil from activities predating or contemporary with the living tree. Following the fall of the tree, there will be a period of potentially many decades in which the trunk of the tree, and some of the larger roots slowly rot *in situ*. On the soil micromorphological evidence, a slow infilling with humic material of this part of some tree-throw pits has been suggested for some time (Courty *et al.* 1989, 127) and re-iterated more recently (MacPhail and Linderholm 2004 33, fig. 33). Until the roots have fully rotted away and any hollow infilled, artefacts discarded or deposited adjacent to the root area may enter the root-void. The lack of compaction and open nature of these infills, are also noted as ideal places for burrowing (Courty *et al.* 1989, 127). Therefore the silted root-void may contain artefacts which both pre-date, and are contemporary with the fallen tree.

Late Upper Palaeolithic — Mesolithic

Sporadic activity in these periods is suggested by the lithics; Willington's Trent Valley location falls within a recently suggested model of large-scale seasonal movements over several hundred kilometres along a south-west north-east corridor (Cooper, above p. 112; Pettitt 2008).

Early to Middle Neolithic occupation (*c.* 3600–3000 cal BC)

Evidence for the occupation of the site in the Early to Middle Neolithic is relatively substantial. Use of the area is of some five centuries in duration, covering the ceramic span of Early Neolithic Bowl, Mildenhall, and the Peterborough Ware sub-styles Ebbsfleet, Mortlake and Fengate (Woodward, above p. 82). This phase, dated to *c*3500–3000 cal BC (Marshall *et al.*, above p. 72), follows sporadic but identifiable Late Upper Palaeolithic and Mesolithic activity in the same location (Cooper, above p. 112). The co-appearance of Mesolithic and Neolithic deposits in similar low-lying terrace edge locations in south-east England has prompted some authors to ask if such zones had become culturally and social significant by virtue of their distinct topography, vegetation and the variety of resources that they offered (Lewis and Welsh 2004, 105). The distinct low-lying topographic back-drop for these sites may, however, be the key to their survival and identification through developer funded programmes; stream-edge settlement relatively quickly protected from erosion by an alluvial blanket that has both afforded protection to the deposits, and also signalled a rising water-table and a decreasing attraction to people.

It seems most likely from the site's stratigraphy that the occupation is occurring within an essentially uncleared landscape, with areas of grassy vegetation indicated by charred macro-fossils (Monckton, above p. 117). Direct palynological evidence to corroborate this is not available, although a parallel study has suggested that large-scale clearance is not occurring until the late Neolithic (Greig, above p. 134). Certainly there are clear repeated attempts to open a wooded landscape many centuries later. Abraded Early to Middle Neolithic pottery is present in the down-drag soils and silted root-voids of fallen trees, such that if openings were created during these few centuries of occupation, the woodland had substantially regenerated prior to the more intensive clearance beginning in the third millennium. Few pit groups were recorded, and those that were found contained only small quantities of material.

Radiocarbon determinations on sherd residues from the Willington assemblage, and comparisons with other reliable dates for Peterborough Ware from around the country, has suggested that the tradition was current for about five or six hundred years, between *3510–3360 cal BC (68% probability)* and *2970–2890 cal BC (68% probability)*, a considerably shorter span that that previously indicated of *c*. 3400–2500 cal BC (Gibson and Kinnes 1997), although there is near concordance on the tradition's start. This new study has reaffirmed the primacy of Ebbsfleet Ware to the two other styles, but also further supports doubts over any chronological succession from Mortlake to Fengate (Gibson and Kinnes 1997), indicating, on the information available, that if either of these two later styles were the earlier, it was Fengate and not Mortlake.

The proximity of occupation to the remains of fallen trees has been considered. Given a density of trees within uncleared wildwood of perhaps one every 2–4m it would be very difficult for remains of contemporary settlement not to appear spatially related to evidence of those trees. Abrasion studies (Woodward, above p. 99) have revealed degrees of fragmentation clearly indicating that the essentially surface occupation evidence (spreads, hearths) remain of a similar type over a substantial length of time, and that residual Early and Middle Neolithic pottery is becoming incorporated in Middle Neolithic (and later) deposits.

The dating of deposits below fallen trees is fraught with problems (above p. 140), although there have been good results in dating those tree pits where burning has been protected *in situ.* Careful consideration of the mechanics of tree-fall and consequent impact on adjacent archaeology has shown that in some cases occupation has occurred adjacent to, and contemporary with fallen trees (Pit 279, above p. 22).

Radiocarbon dating of Pit 279 demonstrated that the charred remains it contained were of different ages. This explicit residuality was also apparent in the pottery from the pit which included Plain Bowl (some of which was abraded) along with Peterborough Ware. The tradition of burying selected cultural elements in pits specifically dug for the purpose has become an established part of our understanding of Neolithic and later prehistoric behaviour in recent years (e.g. Thomas 1999; 64–74; Gibson 1999, 160); this act of deposition has been discussed in terms of *transforming the significance of a place* (Thomas 1999, 72), and the *creation of place* (Garrow 2006, 235), making particular locations memorable and important specifically in a regime of impermanence and revisit. The careful excavation and analysis of one pit site with such themes in mind has revealed fascinating patterning in Neolithic pit deposition (Garrow *et al.* 2005), it being argued that parts of surface spreads of soil including both recently deposited and residual material were periodically backfilled into small pits dug for the purpose, the pits also being clustered and clearly grouped.

The numbers of finds from the down-drag and root void soils at Willington are generally low; and they are not present in the significantly high numbers recorded from root-voids and down-drags elsewhere (e.g. 770 flints and 165 sherds pot at Barleycroft, Cambridgeshire) which has led to an interpretation of *utilised tree-throws* involving intentional deposition or caching (Evans 1999, 247–9, Evans 2006, 15). Where higher numbers are recorded at Willington (e.g. Group 2518) substantial degrees of abrasion to the pottery are apparent (Woodward, above p. 99 and archive).

Substantial deposits of Early Neolithic material have also been found in a Thames edge location at Dorney, Buckinghamshire (Allen *et al.* 2004). The material, which included pottery, lithics, axe fragments, fired clay, animal bone and charred remains, was found both as surface spreads (middens) and infilled tree-throw holes. A difference noted between the presence of residual material at the base of tree-throw infill and denser *fresher* material near the top does indeed support the notion that the surface accumulations and middening occurred after the tree had fallen (Allen *et al.* 2004, 91). Within the model of 'down-drag' and 'root-void', the residual material may belong to the former unit, and the contemporary material to the latter and rather than indicating that significant clearance had or was occurring, such deposits may be a good indication that the activity is immediately adjacent to a fallen tree, and still within woodland.

Other authors have suggested how fallen trees might, with the addition of a sheet or similar, form effective tents (Evans *et al.* 1999, 249). The use of live tree boughs by gypsies to form the ridges for simple shelters is documented in both an 18th century Hungarian oil painting (Fraser 1992,158) and also in an early 19th century English study 'The Gypsy Encampment' by Thomas Hand (Antique Collector 1986), while small gypsy camps of open hearths and tents invariably at the foot of one or two closely set trees are relatively commonly depicted e.g. 'Travellers Reposing', 1807 (Pyne 1971, 120), 'A gypsy encampment' by David Payne, (Sotheby's 1983, 191) and 'Gypsies in a forest clearing' by Jas Stark, (Sotheby's 1982). The example of the use of trees in this way (with good allowance for artistic romantic indulgence) in a historic context is intended to demonstrate no more than that to people leading nomadic or least non-sedentary existences without fixed structures, trees would have formed attractive shelters.

An hypothesis of a Mesolithic tradition of tree-throw deposition has been tentatively suggested (Allen *et al.* 2004, 92), based upon the relative frequency with which Mesolithic material is found in tree-throw deposits, and the subsequent development of such deposition in the Neolithic. However, unless archaeologists have a very clear understanding of tree-throw mechanics, and the dynamics affecting artefact deposition when such deposits are excavated and recorded, this debate is unlikely to progress.

At Willington, there is otherwise little evidence of the site being cleaned or tidied (*cf.* Evans *et al.* 1999, 249) as suggested as most artefacts were found within surface deposits. Three spreads were found above usage features perhaps as acts of intentional redeposition of midden material, although the accumulations may have simply developed as surface deposits after the usage features became redundant.

Structural remains from the site, consistent with other Middle Neolithic sites (Bradley 2007, 94) are scant and difficult to interpret with any confidence, although a number of short arcs of post-holes were present. In places, similar features of very different date are juxtaposed horizontally and vertically. Substantial occupation is evident in both the second half of the fourth, and late third millennium cal BC but there is no compelling evidence for permanent buildings in either period. The demise of substantial Early Neolithic rectangular buildings (e.g. Lismore Fields, Buxton, Derbyshire, Garton 1987) in the Middle and Late Neolithic and replacement by more lightly built circular and oval structures now seems clear nationally (Bradley 2007, 94).

A group of small pits and post-holes containing sherds of Early to Middle Neolithic date were also found in areas of Late Neolithic occupation approximately 1km north-east (Wheeler 1979, fig. 3 Group A, 65). The site lies 2.5km to the south-west of the Potlock cursus (Knight and Howard 2004, 64). A recently obtained determination from a basal fill of the cursus ditch of 3340–3020 cal BC (KIA-2768; 4465±–30 BP) (A. Myers *pers. comm.)* combined with the deposition of Peterborough Ware at depth in the ditch, found in another intervention (Guilbert 1996, 11), can suggest only that some activity at the cursus and the Middle Neolithic occupation of the island area might be of the same broad phase. If land was being specifically cleared around cursus monuments (Barclay and Hey 1999, 70), in this instance the clearance had not extended up the river valley to the island site. More extensive clearance in the Thames valley, when compared to the Trent Valley, may be occurring in the Neolithic (Greig, above p. 134).

There is evidence of food preparation in the cooking-pit, hearth and oven-type features recorded, several of which were contemporary with the Peterborough Ware phase of occupation. Hearths of Early Neolithic date as isolated features are not uncommon (e.g. Drury 1978, 10 and fig. 7), and appear within structures that have been identified, but ovens with superstructures are rare, an example coming from Rinyo in Rousay (Childe and Grant 1938, 15).

The notably small lithic assemblage points to task specific occupation, with butchery, plant harvesting and hide scraping suggested (Cooper, above p. 112). Distribution of lithics and tool types shows clustering of pieces, particularly on the northern edge of the island, and in the area on which Burnt Mound I was later established. Distribution in relation to the contours shows that the activities were confined to certain areas of the island and not simply the highest points (Fig. 53). Microwear analysis of lithics from the soil and Middle Neolithic spread sealed below Burnt Mound I has indicated meat butchering and the cutting (sickling) or scraping of soft wood or plant matter, and the scraping of greasy hide. This analysis also indicates that the use of some tools was very short-lived (O'Donahue, above p. 114). More instances of plant as opposed to meat or animal working are indicated within the use-wear; the presence of sickles, but no evidence of cultivated remains (Monckton, above p. 119) implies the processing of gathered resources, which would be seasonal activity.

The demonstrable diet (limited by the absence of a bone assemblage) at the Willington island is one of dairy foods, the meat of ruminant and pig (Graham *et al.*, above p. 106; Browning, above p. 116), and gathered resources such as hazelnuts, sloes and haws (Monkton, above p. 116). The use of plant or insect wax, such as beeswax has been identified (Graham *et al.*, above p. 106). The riverine location of the Willington island would have been within a varied and rich wild resource habitat. There is no evidence of cultivated plants (Monckton, above p. 119).

The organic residue analyses (Graham *et al.*, above p. 101) also indicate that the consumption of dairy products was common and that the meat from ruminants (cattle, sheep or goat) and pigs was also being cooked in the vessels concerned. One Mortlake sherd and one of Fengate style both contained evidence from dairy products, and a second Fengate sherd was shown to contain ruminant adipose fat (Woodward, above p. 98). In addition, two of the samples, one of Fengate style and one generalised Peterborough Ware sherd, contained traces of plant wax or of insect wax, such as beeswax. Samples producing positive results were located in all areas of the site, and evidence of dairy products and animal fats were found in both the southern and the northern sectors of the site (Woodward, above p. 98).

The evidence of Neolithic diet and cultivation within the East Midlands has recently been summarised (Monckton 2006, 265). Rare instances of cereals within fourth millennium cal BC deposits do exist (Lismore Fields, Jones 2000 and the Aston Cursus, Loveday 2000), and have also been identified in low numbers within the ditch of the nearby Potlock Cursus (Monckton and Moffet 1996). Where identified these cereals are invariably accompanied by some gathered remains, such as blackberry, sloe, haw, and crab apple. The Mesolithic backbone of collected resources does appear to maintain an importance in both the fourth and third millennium cal BC (*cf.* Robinson 1992, 53). The total absence of cultivated remains from the Early and Middle Neolithic deposits on the island site is possibly attributable to the specific flood-plain location of the site, although both Potlock and Aston cursus are also sited on the valley bottom, and seasonal late summer or early autumn occupation might also lead to a partial reflection of the economy within the charred assemblage. Nationally there is a decline in the evidence of Neolithic cereal cultivation from the second half of the fourth millennium cal BC onwards (Bradley 2007, 94).

The Willington occupation evidence suggests episodes of short seasonal occupation of mostly wooded areas, possibly related to specific tasks in the yearly round, repeated over several centuries.

The presence of pottery temper *possibly* from the Charnwood Forest area (Johnson and Whitbread, above p. 87) is interesting firstly in the potential movement of specific resources over some distance, and secondly as it lies within 10km of the probable source of the Group XX axe source near Blackbrook Reservoir (Bradley 1989). The prevalence of finds of Group XX axes is in the White Peak of Derbyshire (Cummins 1974, McK Clough and Cummins 1988). Loveday has discussed the possible role of the cursus monuments in the control of commodities such as Group XX axes (Loveday 2004). Loveday argues that the Group XX axe distribution has clearly resulted from social process and that the White Peak is a 'displaced centre' (Loveday 2004,7); the cursus monuments may have acted as mechanisms controlling exchange between and within communities, other studies also suggesting that axe distribution was controlled.

The Late Neolithic and Bronze Age

There is no clear evidence of occupation following the end of the Peterborough Ware phase at the end of the fourth or in the early third millennium until the establishment of Burnt Mound I, perhaps 800 years later, and no Late Neolithic ceramic traditions are represented within the assemblage. Very occasional fragments of abraded Beaker pottery appear in tree-holes and other fluvially disturbed contexts.

Transformation of the Landscape 2500–1750 cal BC

Clearance

The radiocarbon dating programme for burnt tree pits was unusually successful (*cf.* Campbell and Robinson 2007, 22) and suggests that major clearance of oak, blackthorn, hazel and hawthorn (Gale, above p. 120) from areas of the flood plain was concentrated in the mid third to mid second millennia cal BC. This indicates that during the Late Neolithic the immediate area developed a different economic importance, probably as part of pasture expansion, and that a low-lying island surrounded by stream channels was no longer an attractive focus for occupation, seasonal or otherwise. Possibly contemporary with the start of this activity is the Late Neolithic terrace edge occupation associated with Durrington Walls and Clacton styles of Grooved Ware 1km to the north-east (Manby 1979) (Fig. 1), although it is perhaps also possible that these clearance phases post-date the Grooved Ware settlement, and are directly associated with a Beaker phase, also represented by domestic activity on the terrace edge (Wheeler 1979, 69).

A similar Late Neolithic/Early Bronze Age date for the clearance of the wildwood some 130km south-west has been suggested (Greig 2004a), and evidence of early second millennium clearance has been identified at Wellingborough, Northamptonshire, 80km south-east (Brown 2000, 57). Within the Trent Valley, Early Bronze Age clearance with some remaining woodland is suggested at Staythorpe, Nottinghamshire (ARCUS 2001; Davies 2001), while some evidence of persisting wildwood is recorded in the mid-second millennium at Shardlow, and there appears to be less evidence of intensive clearance (Greig, above p. 134). In other areas of the East Midlands (Clay 2006, 73–4), it is suggested that whilst the terraces were cleared by the first half of the early third millennium, parts of the floodplains remained wooded (Brown 2000, 54).

There appears to have been little time delay between tree-fall and the burning episodes, otherwise the burning would neither be as primary, nor as deep within the (truncated) profile. The burnt sandy clays are most probably derived from the substratum below torn up by the root system, that has subsequently fallen back into the pit (*cf.* Fig. 58.3). It is of course possible that the burning of the woodland passed through trees standing and fallen, live and dead, but a more compelling explanation is that the trees were hauled over and subsequently burnt, a scenario also interpreted for Irthlingborough, Northamptonshire (MacPhail and Goldberg, 1990, 429), although this activity appears to have been mostly earlier than at Willington, between *c.5300 to c.3330 cal BC* (Harding and Healy 2007, 52).

Many trees of British woodland will regenerate if a tree is felled, sending up new shoots. The active grubbing out of root systems shows a clear intention to rid the ground of particular trees. The practise of grubbing out trees is made more easy by using the trunk as a lever (RHS 2008). This might have been made easier by killing the tree by perhaps ring-barking, and then returning the following year to pull down (*cf.* Goldberg and MacPhail, 2006, fig. 9.8). However, anecdotal evidence suggests that grubbing out is much easier if the tree is live and in full leaf; this is firstly because the crown of the tree acts as a sail, and any wind can be utilised to rock the tree, and secondly the roots harden as a dead tree seasons, making grubbing more difficult (M. Taylor *pers. comm.*).

Some interpretations of the burning evidence can be made. The clearance of the area was clearly not a single one-off event fulfilled in a generation, but was ongoing and recurring for at least 500 and perhaps up to 1000 years. However, it is unclear and beyond the scope of this study to identify further whether clearances were continuous or sporadic over this period. The repeated burnings might indicate the use of fire within grazing lands, to promote new shoots (Gale, above p. 122), but as the burning was recorded within the profiles of burnt out fallen trees of some maturity, this does not seems likely. Alternatively, the evidence may indicate the ongoing use of slash and burn agriculture combined with an animal stock level insufficient to maintain the clearings throughout the third and into the second millennium cal BC.

The Willington evidence augments the proposed model of extensive clearance of some areas of the Middle Trent by at least the Late Neolithic (Knight and Howard 1994, 119), signalling that areas surrounding significant monuments remained perhaps only partly cleared, and further that the extent of clearance each side of the river

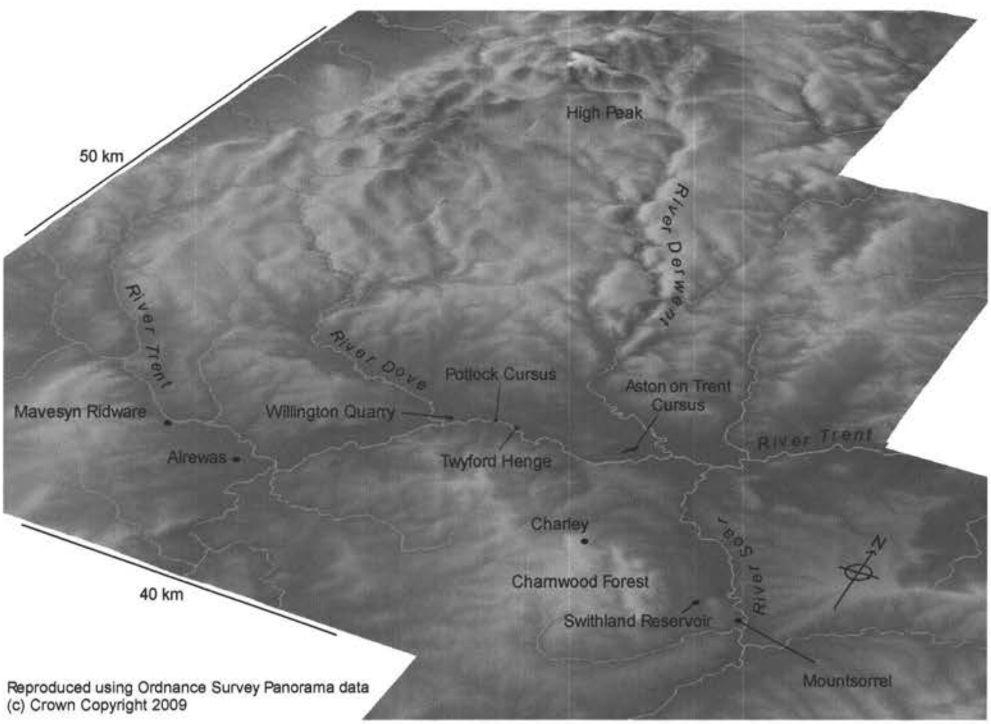


Fig. 59: Digital surface model showing the Middle Trent, possible temper and Group XX sources within the Charnwood region, the High Peak and Neolithic cursuses at Potlock and Aston-on-Trent, and causewayed enclosures at Alrewas and Mavesyn Ridware.

corridor at this part of the confluence zone had not exceeded perhaps 500m on the northern side.

In the second millennium the much reduced woodland is of oak, alder and hazel with some beech and woodland margin species. The environment following the abandonment of Burnt Mound II is of slightly increased woodland of oak, ash and elm woodland, with alder, elder and willow growing nearby, and some indications of cereals and pasture in the vicinity (Greig, above p. 131). Grazing and some open areas is also evidenced by the insect remains (Smith, above p. 135). On the basis that Burnt Mound II is not used intensively, or for very long (below p. 156) the disuse of the Burnt Mound and regrowth of woodland is signalling a wider change in land-use in the area.

The act of repeated fire clearance before the onset of alluviation may be the cause of the poor survival of certain material categories. The charcoal is noted for its' poor preservation (Gale, above p. 121) and it is noted that the sherds sent for lipid analysis had been heated to a temperature probably in excess of any expected usage temperature at some stage (Graham *et al.*, above p. 106).

The indications that extensive alluviation is occurring at Willington in the Middle Trent Valley at the end of the third and start of the second millennium cal BC., contrasts with the Upper Thames Valley where there is no extensive alluviation until the Roman period (Barclay *et al.*, 2003, 45).

BURNT MOUNDS

General Review and Distribution

Burnt or boiling mounds are defined as mounds 'of fire-cracked stones, normally accompanied by a trough or pit which may have been lined with wood, stone or clay' (English Heritage 1999). There are currently two orthodox interpretations which vary in emphasis between burnt mounds being places where 'heated stones were used to boil water primarily for cooking purposes' (English Heritage 1999), and 'most are best interpreted as sauna baths of some kind, although a few might have been used as cooking sites' (Darvill 1988). The repeated heating of stones followed either by immersion in water-bearing pits (troughs) or by quenching with water being poured over them, results in their thermal fracture with the stones becoming increasingly small until they are ultimately disposed of, along with quantities of charcoal and ash in a surrounding mound often with the pits central to the deposit. Rarely are artefacts recovered from burnt mound deposits, despite large scale excavation and sampling, which has presented great difficulty for their interpretation, although some recently excavated examples (e.g. Wareham, Dorset; Ladle and Woodward 2003 and Tangwick, Shetlan; Moore and Wilson 1999) run counter to this trend.

The investigation of Burnt Mounds, and argument as to their function, has been ongoing since their recognition in the late 19th and early 20th centuries (e.g. Cantrill and Jones 1911; Layard 1922). In 1913, Cantrill was claiming that 'stone-boiling once ranged from the Shetlands to the English channel' while citing historic and contemporary ethnographic accounts from the Hebrides, Ireland, New Zealand and Polynesia (Cantrill 1913, 648) and in this period the explanation of burnt mounds as the cooking sites of seasonal hunting parties became a broad consensus, further supported through excavation and successful experiment in the 1950s (O'Kelly 1954).

Consideration of the lack of evidence of food debris combined with ethnographic and historic references led to the steam-bathing interpretative challenge in the 1980s (Barfield and Hodder 1987), which was swiftly countered with persuasive argument that these sites were primarily for cooking, and secondarily for bathing, with evidence from Irish texts, historic accounts and folk-lore (O'Drisceoil 1988; 2002). Other explanations, some supported by experiment have also included leather shield manufacture (Coles 1979, 198), textile production (Jeffrey 1991) and brewing (Moore 2007). Many other activities might also have used large quantities of hot water and steam, including the softening/dyeing of basketry woods (*cf.* Heseltine 1982, 9–12)

The arguments of the 1980s combined with the identification of burnt mounds in regions where hitherto such sites were rare, if not absent, has seen a resurgence of interest in the phenomenon. Burnt Mounds have now been identified in both highland and lowland areas of England, Wales, and Scotland. In Ireland; over 4000 burnt mounds (*fulacht fiadh)* had been identified by 1990 (Buckley 1990, 9), and 4,500 by 1993 (O'Drisceoil 2002); 819 excavation records for *fulacht fiadh* are held on the Irish excavations database (Department of the Environment, Heritage and Local Government, Ireland and Department of the Environment, Northern Ireland, 2004).

Where Burnt Mounds are identified, it is not uncommon for more examples to exist within relatively close proximity (e.g. Parker and Jarvis 2007, 211; Knight 2002, 147); single linear developments have led to the identification of multiple sites (e.g. Maynard, 1993). The English Heritage National Inventory (NMR) currently holds records for 186 burnt mounds whilst the National Monuments Record of Scotland lists 1720 (Archaeological Data Service 2005). The Monuments Protection Programme (England) project listed around 100 Burnt Mounds in 1988 (Darvill 1988). These figures demonstrate the near doubling in numbers of known sites in twenty years, much of it due to developer funded programmes. The likelihood is that many thousands of burnt mounds remain undiscovered. In the light of the recent detailed excavation of burnt mounds in the East and South Midlands, and South-West, where burnt mounds have previously received little recognition or attention (e.g. Beamish and Ripper 2000; Richmond *et al.* 2006; Best and Gent 2007), discussion of their distribution remains in essence a discussion of visibility, and for new discoveries, the application of archaeological development control. Welch discussed the association of burnt mounds with poorer soils (Welch 1995, 11), whilst acknowledging that the historical distribution of mounds probably reflected a lack of visibility. Studies on the Fen edge of burnt mounds (*pot-boiler)* sites have shown although some are found in close proximity to lithic scatters, many others are not, and a link between areas of settlement and burnt mounds can not be made (Silvester 1991, 87); the location of these burnt mounds marking the transition from dry to wet zone (Bradley 2007, fig. 4.14).

Within the Midlands, the new eastern and southern examples join previously identified clusters from around the tributaries of Tame and Trent in south Staffordshire and Warwickshire (Cantrill 1913, 649; Hodder 1990). In Derbyshire, burnt mounds remain rare, with the only other examples identified at Netherseal, on the Seal Brook (David Budge *pers. comm.*), and possibly at Baslow and Bubnell (English Heritage 2007, NMR Monument 965779). In Nottinghamshire, examples include Holme Dyke, Gonalston (Elliot and Knight 1998) and Waycar Pasture, Girton (Garton 1993a). In Leicestershire, a single example has been recorded near the River Soar at Birstall, and two associated with the River Trent at Castle Donington (Beamish and Ripper 2000); at least three in close proximity have been exposed by a stream tributary of the River Wreake at Brooksby (Parker and Jarvis 2007, 211), while burnt mound type deposits were suggested across an area of valley bottom in a test-pit survey through alluvium adjacent to the River Wreake at Syston (Beamish 2003, 147).

Evidence of function

Important evidence has been recovered from two particular mounds in recent years. At the Middle Bronze Age site at Wareham, Dorset, Deverel-Rimbury pottery including globular urns and at least one vessel 'designed for the communal consumption of food or drink' was found in direct association with a burnt mound (Ladle and Woodward 2003, 275). At Tangwick, Shetland, a complex burnt mound was also clearly used for formal food preparation, probably on a seasonal basis (Moore and Wilson 1999). A relatively substantial Late Bronze Age pottery assemblage from storage and serving vessels (some of which were decorated) was excavated, over half of which showed spalling, splitting and other damage consistent with the placing of vessels in hot water (MacSween 1999, 218; Moore and Wilson 1999, 230). Animal bone was entirely absent and other foodstuffs were *negligible*, despite routine bulk sampling (Moore and Wilson 1999, 226).

Attempts have been made at classifying burnt mounds in Scotland according to broad morphoplogy, appearance as solitary or grouped mounds, association with structures and settlement evidence (Barber and Lehane 1990, 67). Certainly, the differences between small isolated burnt mounds (e.g. Burnt Mound II) and the deposits of fire-cracked stone and charcoal recorded on some settlement sites (e.g. Green Park, Berkshire, Brossler *et al.* 2004) demonstrates that burnt mounds achieved different forms in different locations over time, even if their origins and perhaps their functions were similar.

However without clear and detailed chronologies the disentangling of single and grouped burnt mounds is much more problematic; the interpretation of adjacent mounds as contemporary (and therefore grouped) or not, when the span of usage may have been a generation or less requires detailed sampling and scientific dating. Burnt mounds were in use for at least 1500 years. Over such a long time period, the formation of sequential mounds in suitable areas, and the development if not evolution of function should perhaps be anticipated. To this lengthy history must be added changes within settlement patterns, mobility and social change.

Burnt Mound I

Burnt Mound I comprised a classic kidney-shaped spread and clearly defined central features, and had been partly rebuilt in the north. The burnt mound, in use between *2260–2140 cal BC* and *2040–1920 cal BC (68% probability)* (Marshall *et al.*, above p. 67) was located over a pre-existing Middle Neolithic spread left many centuries earlier, which itself contained abraded Early Neolithic material, indicating that this small area of some 50 m^2 was, and became again, a favoured spot.

Burnt Mound I appears to be in isolation. There are incidences of broadly contemporary Beaker pottery on the island, and there is also evidence for fire clearance in the period of the burnt mound's use, but specifically the burnt mound sits in cleared, or partially cleared woodland with no other evidence for occupation, and belongs in Barber's Class 1 typology.

The location of the burnt mound on the apex of a low island has some parallels (Barber and Lehane 1990, 77), and might indicate that the surrounding land has become waterlogged. However, the siting of the mound away from stream edges indicates that flowing water was not a requirement in its use.

The *mound* of Burnt Mound I, was very shallow and the stone within it, scant. The total stone content of the layer can be estimated at 112.5kg which is small when compared with other quantified mounds (e.g. 918kg Wareham, Dorset, Ladle and Woodward 2003, 268).

Internal features of the mound comprise two water-bearing pits (interpreted as *trough* and *tank*) separated by a shallower dry pit interpreted as a *hearth* or *oven*. The profile of the dry pit was bowl shaped, whereas the *trough* and *tank* had much sharper, near vertical sides with flat bases. The preservation of undercut edges in the *trough* is evidence that the feature's life was relatively short (i.e. years rather than decades), and that it had been backfilled as the undercut sides had not slumped, a similar scenario also found at Calne, Dyfed (James 1986, 259). The backfill contained fragments of cow tooth, and following backfilling a short period of silting preceded later flood inundation.

Stones in an upper layer of the dry pit appeared cracked *in situ,* as also found at Birstall, Leicestershire (Ripper forthcoming a), and it seems possible that these were in the position of their last quenching. A description of Maori steaming ovens provides a direct analogue: meat, between layers of green leaves, was placed on a bed of hot stones in a small pit, and covered with a matting lid, onto which several pints of water were poured before the whole was earthed over (Cantrill and Jones 1911, 256). If this interpretation is correct for Pit C1704, it is a clear indication that the pit had been used in at least two ways, as the upper bed of *in situ* cracked stones lay over probable back-fills above earlier evidence of heating at the base. The fragments of perforated clay plate recovered from a dump layer in the adjacent *tank* might have served the same function as green leaves, lessening contact between meat and stones but allowing the cooking of the food. The adjacent *trough* feature contained no evidence for *in situ* burning.

Bulk sieving of layers has yielded fragments of sloe stones and hazel nutshells from the later tank, and sloe stones from the *hearth* or *oven*. Fragments of nut and possibly sloe were also identified from burnt mound layers at Little Marlow (Giorgi 2006, 81). Fragments of possible oven plate were also recovered from the *tank* while cow tooth was excavated from the *trough*; all these indicators are taken as evidence of food preparation. Despite the demonstrable residuality of the pottery within the burnt mound, no charred plant remains were recovered from samples from the underlying spread and features, and the residuality of plant remains from the Burnt Mound itself is not suspected other than within the Late Neolithic/Early Bronze Age phase to which it belongs. Radiocarbon determinations from the mound layer of 2300–2040 cal BC (SUERC-7598; 3775±35 BP) and 2040–1880 cal BC (OxA-15111; 3610±29 BP) showed the presence of material of different ages, but both dates were consistent with the interpreted span of usage of the mound. The radiocarbon dating of the pit fills from Burnt Mound I was very successful and indicated that the dated deposits contained neither residual or intrusive material (Marshall *et al.*, above p. 67).

Oven plates of Neolithic and Early Bronze Age date are very rare, and no parallel can be found for one in a Late Neolithic or Early Bronze Age context, or in direct association with a burnt mound, although a fragment of perforated plate came from a four post structure 16m from the substantial burnt mound at Green Park, Reading, Berkshire (Brossler *et al.*, 2004, 94). In the later Bronze Age and Iron Age, perforated plates become increasingly common, although their interpretation as oven furniture, is rarely supported by the context of deposition (e.g. Major 1988, 280; Adkins and Needham 1985, 37).

The charred plant remains, as for the earlier Neolithic activity, indicate use of the burnt mound in the late summer or early autumn period (Monckton, above p. 119) and fuel residues indicated the use of oak, hazel, ash, the hawthorn group, blackthorn and probably alder (Gale, above p. 121).

The pebble-lined hollow

The association between this feature and the burnt mound is spatial, and contemporaneity cannot be proved stratigraphically as no relationship existed. The surface was cut by two small undated pits, and overlay an earlier undated deposit. If the origins of the hollow were contemporary with the Early or Middle Neolithic activity, it is arguable whether or not it had remained an open feature when the Burnt Mound was in use, as the alluviation probably develops at this time (Marshall *et al.*, above p. 68). Certainly the feature was not back-filled or closed, but filled with alluvium, and had remained open until flooding events.

The provision of a pebble surface must either have been designed to make good poor ground — ground that received heavy usage at certain times, or to facilitate some other practice.

The plan of the hollow, which is slightly sinuous, is interesting, as there is a clear turn in its line adjacent to the tank area; indeed, when first exposed this feature was described as an 'approach" to the burnt mound. Its shape and morphology is also resonant of the entrance/façade of Neolithic mortuary structures, but here no indications of such a deposit were found.

No immediate parallels have been identified for the hollow, although at Whittlesey, Cambridgeshire, the combination of Late Neolithic metalled surfaces possibly relating to watering holes, with a number of later burnt mounds has been recorded (Knight 2002, 147). A similar explanation could be suggested for the Willington surface, although the requirement of a 'watering-hole' for stock here, in a riverine landscape bisected with streams is doubted.

On the basis of contemporaneity with the burnt mound, the following observations can be made. The base of the hollow was cut at a level somewhat higher than the base of the hearth or oven C1704, and with no other evidence to suggest that it held water or was waterlogged in its use, this feature must have usually remained dry. However the gravelly clay in which the hollow lay was not at all free-draining, and it is likely that water running into the hollow would have been retained for a period of time, although it is probable that the hollow drained to the south-west, possibly into the tank area. The making good of the ground suggests either repeated use, or formality. It is curious that if the pebble-lining were to make good what had become a quagmire in use, that the hollow itself was not infilled and raised rather than being left as a depression that would have held water in wet weather. To line a sunken hollow indicates that the level of the feature was integral to practical or symbolic function. If the hollow were formed by use, then any trampling was discrete, channelled and perhaps enclosed by barriers of which no evidence has survived. Alternatively, if the hollow was intentionally dug out and lined its form was also integral to its function.

A possible interpretation is that the hollow was an area in which woollen cloth could be processed. Jeffrey has outlined the historical evidence for fulling, and the suitability of burnt mounds as areas of textile production (Jeffrey 1991); this interpretation has been re-iterated by a number of authors (e.g. Best and Gent 2007, 72). Woollen garments and items likely to get wet, require fulling to prevent shrinkage — this can be achieved by agitating the cloth in hot water preferably with a soap agent to degrease the fibres (Jeffrey 1991, 101). The violent agitation of felted cloth against a hard surface, improves its weather-proof qualities and larger burnt mound troughs are sometimes interpreted as receptacles in which fabric could be walked or trampled (Jeffrey 1991, 103); the pebble-lined hollow at Burnt Mound I might have served as a substantial 'waulking' area engaging groups, rather than individuals, in trampling woollen cloth in warm water, or urine.

Alternatively, the hollow may be related to communal bathing in shallow water. The combination of cooking followed by cleansing as part of the intended use of fulacht fiadh is explicit in the Irish text 'The Romance of Mis and Duib Ruis', and also in Keating's 'The history of Ireland' (O'Drisceoil 1988).

The dating programme revealed that a substantial spread and features underlying the burnt mound dated to the fourth millennium cal BC, and that the burnt mound proper dated from at least 1000 years later. All the pottery and much of the flint within the burnt layers and the mound features was therefore residual, and this was confirmed by microwear and abrasion studies. There was no indication of such a time lapse in the recorded stratigraphy as the chronologically separate layers sat one on top of another. This sharp chronological gap only became apparent with the detailed application of radiocarbon dating.

Burnt Mound II

Burnt Mound II also appears in isolation, but on this occasion the activities were on the edges of a channel that became slow flowing, and ultimately cut off. The burnt mound was waterlogged, with striking preservation. Burnt Mound type activity was evident in layers cut by the trough construction, and clearly this activity had continued on the site for a period of time. The use of the trough, the last phase of activity, is estimated at between *1240–1150 cal BC* and *1130–1040 cal BC (68% confidence)* (Marshall *et al.*, above p. 68).

The trough

The trough had a volume of some 400 litres. Rectangular troughs of similar size are relatively common (Heawood and Huckerby 2002, 36; Smith and Kenney 2002, 29; Best and Gent 2007, 6), although rarely are they as well preserved as this example (Fig. 60; Plate 5). The trough was lined with selected and carefully assembled poles of mixed species probably chosen for their size, and probably fashioned using socketed or palstave axes.

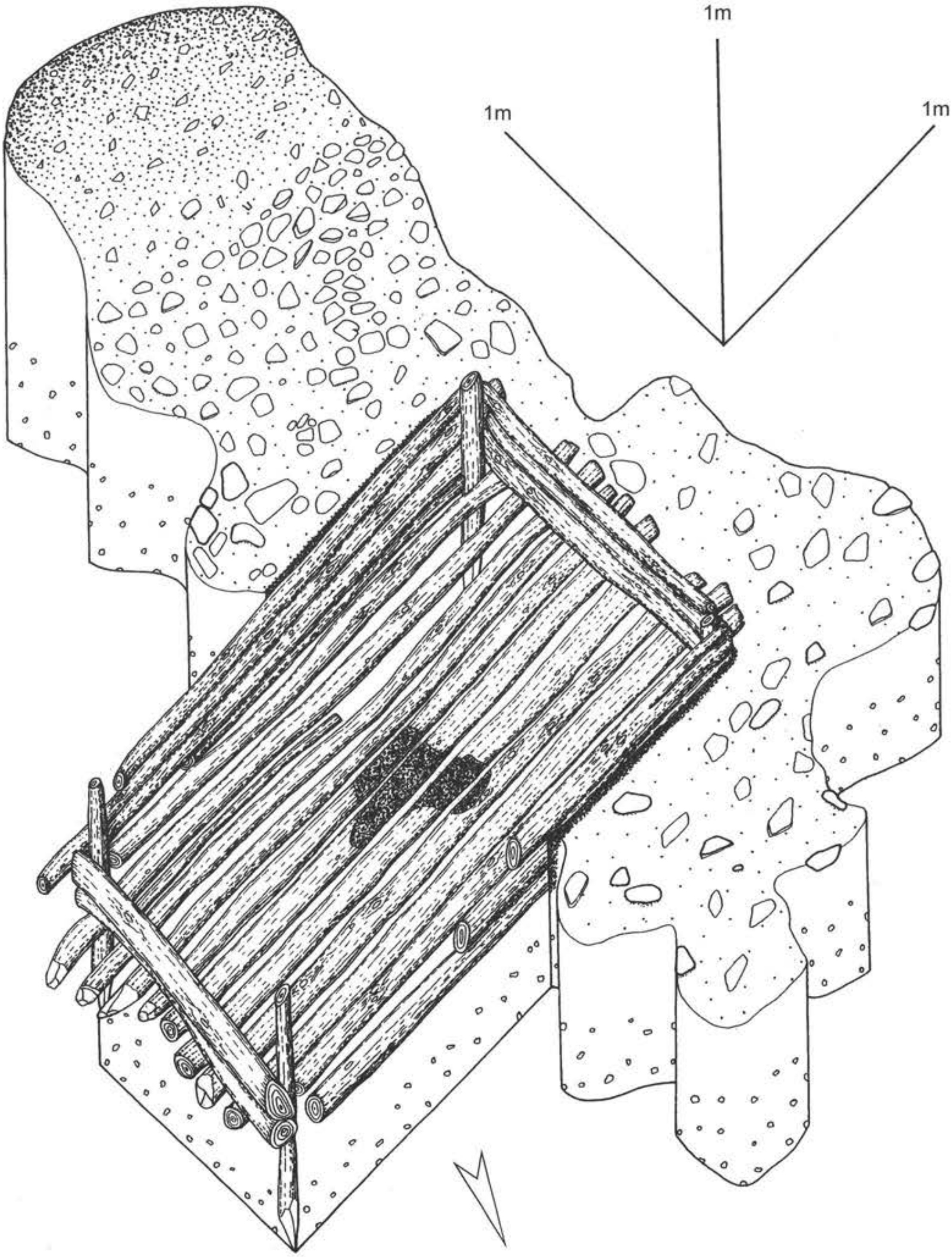


Fig. 60: Reconstruction of trough prior to slumping, showing construction, possible charcoal filter, central charring, spread of burnt stone, and possible hearth location.

A trough with a part round-wood lining was recorded at Charlesland, Wicklow (Molloy n.d.), while surviving corner stakes have been recorded at Knoxspark, Sligo (Deevy n.d.) and Ballynabarny, Wicklow, Ireland (Stafford n.d.). A rectangular trough with rounded corners probably derived from corner stakes has been recorded at Burlescombe, Devon (Best and Gent 2007, 6).

Ground consolidation

The loose timbers recorded in the base of the adjacent channel were clearly not part of an *in situ* structure; however their density in this area, and the presence of a single upright on which a number of them converged does suggest that their presence was not simply coincidental. Two explanations seem possible. The first is that they represent an attempt at consolidating the marshy ground in the base of a channel that had become cut off and stagnant. A similar explanation was suggested at Waycar Pasture, Nottinghamshire (Garton 1993a, 149). Elsewhere, the making good of boggy ground with dumps of brushwood was recorded adjacent to a burnt mound at Clare, Mayo (Zajak n.d.). The second explanation, is that they represent part of a collapsed revetment. Evidence of a post-built revetment predating a burnt mound spread was identified at Curraheen, Cork (Russell n.d.), while at Ballycroghan, Co Down, Ireland (Hodges 1956) channel revetment using pegged roundwood with brushwood behind was found near to a roundwood-lined trough of similar dimensions to the Willington example (albeit of a more complex arrangement).

The later phase of the burnt mound with identified trough was probably sited next to a well vegetated cut-off or slow flowing channel (Smith, above p. 136) beside which burnt mound type activity had already occurred. Secondary phases have been recorded at similar sites, e.g. Sparrowmire Farm (Heawood and Huckerby 2002, 45). Some evidence of the trough being used *dry* in some way, was preserved in the area of central charring recorded, and this could be consistent with the light quenching of stones to produce steam, although the small size of the charred area indicates that the charring was possibly accidental and might have arisen when the water table was low. No evidence of any covering structure was found.

There is possible evidence for the intentional packing of a charcoal filter between trough timbers and construction cut, although, as for a similar layer recorded below trough timbers at Attireesh, Mayo, Ireland, this may have accumulated during use (Gillespie n.d.). No evidence of the caulking of timbers, which occasionally has been preserved, was found (e.g. Hodges 1956, 19), implying that the holding of water was not a problem.

The trough was backfilled with layers of stone that remained loose, fresh and uncompressed until re-excavated (*cf.* Heawood and Huckerby 2002, 38). This indicates, as the layers were unweathered, that the backfilling occurred as part of a single event, probably the abandonment, and possibly closure, of the site. The weight of stone back-filled into the trough slightly exceeded that shown to be required for boiling a similar volume of water — i.e. the back-fill could easily represent some of the stone used in the last heating of the trough.

There is little conclusive evidence of function from the remains identified, and no significant finds from the feature fills. Evidence consists of a weathered and possibly gnawed Ox heel-bone (calcaneum) from a contemporary channel fill also with fire-cracked stone, and from the surface of the site and not securely stratified two horse/ox ribs, one with possible butchery marks, and part of a human adult male femur. A further piece of horse femur, also showing cut marks, was recovered from an adjacent and later palaeochannel. Charred remains again included very small quantities of hazel nut shell, sloe stone and fruit stone (Monckton, above p. 118). Within the insect fauna, the hide beetle was detected in the pre-trough deposits (contemporary with some hot stone activity) but not in the infill of the trough (the abandonment phase). The presence of this beetle might suggest food waste nearby, but also may indicate other possibilities (Smith, above p. 136). The hope that insect and beetle analysis might provide definitive positive indications of burnt mound use has not been realised, a result paralleled in other studies (A.G. Brown *pers. comm.*); however, the absence of insect indicators in significant numbers and lack of food waste or settlement evidence all indicate that these sites saw a low intensity of use and a limited number of visits.

Evidence of construction and use in the late spring to summer comes in the form of charred alder cones with seeds attached (Monckton, above p. 117) which is supported by recognition of a late spring cut in the growth pattern of timbers from the trough (Morgan, above p. 125). The suspected pastoral landscape context has supporting evidence in the waterlogged remains, and it can be argued that the site existed within cleared river pastures with specifically damp grassland grading into swamp (Greig, above p. 133). There is an indication of increased woodland in the decades following the trough's last use. The fuel used on the mound included a high incidence of narrow roundwoods with more use of juvenile alder probably from coppiced or frequently cropped sources (Gale, above p. 123), the pollen record also indicating that alder and oak have become more prevalent at this time. The requirement for large quantities of fuel and the *cleared* context of the Burnt Mound are obviously at odds, and it may be that ease of access to adequate supplies of any fuel such as stands of alder on the fringes of marshy ground was an important factor in the siting of the mound, and the macrofossil evidence indicates that alder and elder grew by the burnt mound (Greig, above p. 133).

A mound of broadly similar date to Burnt Mound II from the region was recorded at Sandwell Park, Staffordshire, 1410–980 cal BC (Birm-1268: 2970 $\pm$ 69 BP) (Hodder, 1990, 107).

The formation, structure and use of burnt mounds

Some authors have argued that burnt mounds were clear constructions and not just *haphazard dumps* and purely the results of disposal (Moore and Wilson 1999, 232). Most recorded mounds have a clear extent; edges are usually consistent and remarkably uniform, and rarely feathered or irregular. Willington Burnt Mounds I and II are here at variance, as the earlier monument is classically formed and defined, and the later was not, although evidence for a longer duration for the first is not present.

Although the appearance of burnt mounds corresponds with clearance episodes, and the backdrop of mounds with palynological evidence tends to be one of pasture, the contemporary visibility of burnt mounds in lowland contexts such as the Willington examples will still have been poor. Burnt Mound II was surrounded by marshy ground with nearby stands of alder; relocation of the site, particularly in the late spring or summer when use is indicated, would be hampered by lush, fast-growing vegetation. However the layer of compacted alkaline rich stone and charcoal would inhibit initial regrowth and soil formation, and therefore the immediate area of the mound would remain clear of vegetation in the short term. In the New Forest, extant burnt mounds were noted as supporting different vegetation, usually heather (Pasmore and Pallister 1967, 14). Therefore the discovery of a mound perhaps a year or two after last use would be easier if it had been intentionally laid out and compacted, with each successive re-use serving to further enhance the monument and ease relocation.

Experiments of boiling water in troughs using hot stones inspired by burnt mound excavations at Sutton Park, Warwickshire (Burrows 1929, 297) and at Carne, Dyfed, Wales (James 1986, 261) required a hot stone to water ratio of around 1 kilogram to 1 litre. An experiment maintaining a boil for 220 minutes in order to cook 4.5kg of meat at Ballyvourney, Cork, Ireland (O'Kelly 1954), required at least twice as much stone as water. (The Ballyvourney figure is a weight estimate as the experimenter published the volume of stone mound used, and not its weight, and this has been estimated using a density of 2500kg per m^3 (Gieck 1983, Z2-3; Sandstone), with 40% void allowance). All the experiments show that boiling large quantities of water was an expensive arduous exercise requiring quantities of fuel, stone and time, although with bigger troughs, larger quantities of meat could be prepared together (O'Drisceoil 2002, 94).

The total weight of stone from Burnt Mound I is estimated to be no more than 212kg, while that of Burnt Mound II is estimated to be 1175kg. On an averaged ratio of 3:2 (stone to water) and using Buckley's maximum estimation of 12 uses for a coarse sandstone before becoming unusable (Buckley 1990), Burnt Mound I was used up to 14 times, and Burnt Mound II, 23 times. These figures are very broad estimates as many variables are involved not least that both stone deposits were complete and had not been robbed or eroded (fire-cracked stone along with sherds of Peterborough Ware were found on the surface of the ring ditch 70m west of Burnt Mound I, with no clear *in situ* derivation), and that the thermal fracture qualities (and hence reuse) of river pebbles and cobbles of sandstone and quartz, are similar. Qualitative comparison is also made difficult by the smaller starting sizes of glacially and fluvial eroded cobbles and pebbles in comparison with outcropping bedrock; Buckley considered stone of less than 50mm to be effectively spent (Buckley 1990, 171) whereas further use might have been considered where large stone was less readily available.

Modelling of the radiocarbon results from each mound suggests that Burnt Mound I was in use for *20–430 years (95% probability)*, and probably *80–320 years (68% probability)*. Burnt Mound II trough was in use for between *20–210 years (95% probability)* and probably *40–150 years* (*68% probability*).

From the combined archaeological and scientific evidence each burnt mound trough might have been used annually or bi-annually for not longer than one or two generations. The estimated usage span at 68% probability for a burnt mound with a particularly tight chronology at Burlsecombe, Devon, is between *0 and 30 years* (Marshall *et al.* 2007, 61).

Burnt mound function

Small quantities of possible food waste (nut shell, fruit stones and animal bone) were recovered from both burnt mounds; the majority of indicators were recovered from

Burnt Mound I from charred pit layers interpreted as dumps of material stemming from final use, which were intensively bulk sampled. The same bulk samples also produced small fragments of oven plate, which are significant finds. Although the possibility of a residual derivation of these fragments must remain, given the context of the burnt mound, the lack of any other residual indicators in the pit fills (including the charred remains as proven by radiocarbon dating) lends weight to the reliability and primacy of the finds.

These small amounts of evidence were all recovered from the features of the burnt mounds, and virtually all resulted from the bulk sampling of dumps of charred material thought to stem from their final uses. Despite intensive sampling for Burnt Mound I, the layers of fire-cracked stone and charcoal did not contain any material besides spent fuel and fire-cracked stone.

The two burnt mounds contrast at a number of levels: the central troughs in shape and volume; locations on apex of a low island and a stream edge; presence of secondary features on one, and absence on the other; Late Neolithic date and Middle Bronze Age date.

The sloe stones and hazel nut shells might survive fruit and nut consumption, perhaps cooked along with meat, although they may also have been accidentally incorporated and possibly stem from the burning of food-rich branches in the case of the sloes. The nut shell may be present as a fuel, although if the nuts were not consumed on site, the broken shells would have required transportation to the site. Charcoal samples from Burnt Mound I showed firewood was composed of mixed broadleaf species including oak, hazel, ash, the hawthorn group, blackthorn and probably alder. In the case of Burnt Mound II, narrow alder roundwood was the favoured fuel, although oak, alder, hazel, ash, the hawthorn group, blackthorn, buckthorn, dogwood, willow/ poplar and elm were all represented.

Consideration of the overall evidence from Burnt Mounds I and II lends credence to the interpretation of these sites as areas of food preparation, probably on a yearly basis, with activity taking place in the late Spring or Summer. Each site is used for perhaps a generation of less. There is not evidence of 'feasting' from these sites, but there is enough to support the notion that burnt mounds were areas of 'special' cooking.

Burnt mounds should be an expected part of Bronze Age archaeology in any area with suitable stone and water; the demonstration of absence, such as that for the otherwise pastoral Bronze Age landscape of the Nene Valley at Raunds, Northamptonshire (Harding and Healy 2007, 267), and perhaps the lack of identification in some upland areas (e.g. Derbyshire Peak) does imply that burnt mounds are genuinely absent from some areas, and meaningful explanation of this distribution may be possible in the future, but not on the basis of current knowledge. The Welland Valley, adjacent to the Nene Valley has previously been identified as a possible cultural boundary (Pryor 2002).

If the limited indicators from Burnt Mound I are accepted as convincing evidence that cooking was an important function of these monuments, it is worth reiterating that they all came from dumps of charred material within the pits and not the burnt mound layer per se. Therefore, the lack of general debris from this site and perhaps many other burnt mounds is a function of how, rather than if, food was prepared and consumed leaving little trace, and how sites were cleaned after use. The lack of insect evidence may well be attributable to the sporadic use and limited activity at these sites effectively preventing the development of any 'indicative' insect fauna (bar the single possible indicator from Burnt Mound II). Evidence of any other activities that may have utilised hot or warm water is extremely tentative, and remains speculative; other activities suggested for burnt mounds do however need to be accommodated within the slow and sporadic rhythm of usage that is becoming clear for some burnt mounds. In short, the craft production of textiles for instance, seems unlikely where activity is apparently so infrequent, unless it was performed as a specialist activity in addition to other processing elsewhere. Evidence of other Late Neolithic/Early Bronze Age activity in the area is evident in the numerous ring ditches and surviving mounds of round barrows, and also the possible henge monument at Twyford (Harding with Lee 1987, 116–7).

Dating overview

Burnt Mound I was of Late Neolithic or Early Bronze Age date, and Burnt Mound II of Middle Bronze Age date. The radiocarbon modelling has indicated a *c.640–960 year gap* between their uses.

Burnt mounds, although now acknowledged as having a Neolithic currency are still generally held to be Later Bronze Age in date (Bradley, 2007, 214). An initial assessment and recalibration of some 87 dates from 58 burnt mounds from Britain and Ireland shows a broadly even distribution between the mid 3rd millennium cal BC and the second quarter of the 1st millennium cal BC.

Although earlier Neolithic dates have been determined from 'fire-pits', i.e. pits filled with deposits of burnt stone and charcoal but with no associated mound or spread (e.g. 3640–3370 cal BC Beta-68472; 4720 ± 60 BP Greenlaw, Dumfries-Galloway, Scotland) (Maynard 1993, 35) dates from burnt mounds where a spread or mound is an integral part of the evidence appear to span a broadly continuous sequence which starts with a date of 2900–2300 cal BC (GU-7865; 4030 ± 60 BP) from Kilmartin, Argyll, Scotland (Anthony *et al.* 2001, 924). There is a clear distinction between the heating of water and creation of steam as a one-off episode leaving perhaps solitary pits with no related spread of burnt stone, and the formalisation of such a site as a *monument* that is intentionally defined, used, revisited and sometimes redefined over a period of time.

The dating of Willington Burnt Mound I places it in the earlier part of this emergent chronology, where it joins other examples with usage dates in the later third and early second millennium cal BC from the north Midlands, East Anglia, and Wales. Other isolated examples currently beyond this zone, are from the south Midlands, the south coast and the Scottish Borders. All the above Burnt Mounds could be consistent with the chronology currently assigned for the prevalence of Beaker material between 2400 and 1800 cal BC (Bradley 2007, 144), although those at the earlier end of the range may have been slightly too early to have had any such associations. A number of Norfolk burnt mounds have a direct relationship with Beaker material e.g. Hoe and Overa Heath, Quidenham, (Apling 1931, 365 and 368), and Northwold, (Crowson and Bayliss 1999). The Norfolk Fens have been suggested as an area of early burnt mound development (Crowson and Bayliss 1999, 247). On the basis of the radiocarbon dates, this area can now be augmented to include a swathe of central Britain, although there appears fewer early examples from the south Midlands and southern England in general; this may well be a function of visibility and dissemination.

The troughs from earlier burnt mounds tend to be small and circular e.g. Burnt Mound I, and Birstall, (Beamish and Ripper 2000), and the large rectangular troughs are generally found on later burnt mounds although the overall validity of this observation has yet to be tested.

THE RING DITCH

The ring ditch enclosed a small monument with a single grave pit. Despite careful excavation, no evidence was found of a mound within the ditch. No inorganic grave goods had been placed with the interred. The size and shape of the central grave pit suggest that any burial it might have contained, was probably crouched.

The surface of the monument was physically higher than the surface of the burnt mound 70m to the east, and it was also cut through alluvium (whereas the burnt mound was sealed by alluvium). The ring ditch therefore post-dated the burnt mound. A *terminus ante quem* for alluviation of *2200–1980 cal BC (*Marshall *et al.*, above p. 68) suggests that the ring ditch was constructed in the Early Bronze Age or later. There was no evidence of an internal mound, and also no evidence that the internal area had been deepened to form a Pond Barrow. The absence of a mound may not be entirely explained by homogenisation through flooding. A clay mound would have remained extremely resilient to flood damage. This must indicate that the spoil from the ditch was removed from the area, or possibly placed outside the ditch as a bank. A ring ditch with external bank and no internal mound is suggested for a phase of Barrow 6 at Raunds, Northamptonshire (Harding and Healy 2007, fig. 4.1).

A number of sherds probably from a later Early Bronze Age biconical or cordoned urn were found outside, and over the ditch to the south; the number of sherds from the same vessel suggests that an urned burial may have been disturbed in the immediate vicinity. This disturbance may have been by the plough although as the finds were some way below modern plough depth (Fig. 30) this was not a recent event. The addition of urned burials on the periphery of already established monuments is a common phenomena, with examples from the East Midlands including Cossington, Leicestershire (Thomas 2007, 15).

Two round barrows were excavated in the terrace excavations to the north (Wheeler 1979, 73 and 75) and numerous ring ditches of Neolithic and Bronze Age burial mounds are also recorded in the locality. An upstanding mound has recently been identified on Hull Bank some 700m to the south (Guilbert and Garton 2007).

ISLAND VISITS

The recurrent theme of the prehistoric occupation of this site appears one of transience. Surviving evidence suggests that activity was seasonal, and does not represent year-round occupation. No individual episodes of activity have had a long duration, and most have left ephemeral traces although the repetition of the middle Neolithic occupation over several centuries left an accumulation of remains. The burnt mounds lying within boggy zones within the flood plain were used for short periods before being abandoned, and even the ceremonial ring ditch and grave became inundated with flood silts and subsumed into the landscape.

The location of these deposits in alluvially buried and wet environments has been the key to their survival, and the application of archaeological development control, the means of their subsequent identification. The preservation of fragile occupation surfaces at certain levels in what have now become unattractive/unoccupiable areas is now well attested, and the continued investigation of these zones will further broaden our understanding of past lives.

ACKNOWLEDGEMENTS

I would like to thank all members of the site teams (especially Tim Higgins and Sue Ripper) and each and every specialist contributor to the analysis. I would also like to thank the archaeological consultant Simon Collcutt, the Planning Archaeologist Dave Barrett, RMC Aggregates (Western) Ltd, managers Tony Rowley, Brian Johnson and Mark Ely, Stephen Woods of Cemex (UK) and Sarah Reilly of English Heritage.

Peter Marshall and Derek Hamilton would like to thank Frances Healy, Jane Kenney, Adam Tinsley, Alex Bayliss and Cathy Tyers for comments and discussion on approaches to refining the dating of Peterborough Ware. Ian Whitbread and Elizabeth Johnson would like to thank John Carney from the East Midlands District of the British Geological Survey for taking the time to view images of the samples and for his valuable comments. James Greig gratefully acknowledges the support of English Heritage while doing the assessment phase of this work. Angela Monckton is grateful to Martin Shore, Wayne Jarvis and Alex Beacock for processing samples and stones, and to Matthew Beamish for help taking samples, producing information from the site database and for information about the site. Figures 51 and 52 were drawn by David Hopkins, and Figures 45–50 and Figure 60 by Michael Hawkes.

Many thanks go to Patrick Clay for managing the excavation phases and editing the final text, and to Maisie Taylor and Lesley McFayden for their helpful comments and also for those from anonymous referees. I am very grateful to the University of Leicester Archaeological Services for their full support in the preparation of this paper, and the Derbyshire Archaeological Journal and editor Pauline Beswick, for its publication. I would also like to take this opportunity to thank my family for suffering a prehistorian in their midst, especially one to whom the burnt mound and tree-fall cards have been dealt.

The excavations were funded by RMC Aggregates (Western) Ltd and English Heritage, while the analysis and publication has been funded by the Aggregates Levy Sustainability Fund, administered by English Heritage, and Cemex (UK) who acquired RMC in 2005.

REFERENCES

Adkins, L. and Needham, S.P. (1985) New research on a Late Bronze Age enclosure at Queen Mary's Hospital, Carshalton. *Surrey Archaeological Collections* 76: 11–50.

Alexander, J., Ozanne, C.P. and A. (1960) Report on the investigation of a round barrow on Arreton Down, Isle of Wight. *Proceedings of the Prehistoric Society* 26: 263–302.

Allen, T., Hey, G. and Miles, D. (1997) A line of time: approaches to archaeology in the upper and middle Thames valley, England. *World Archaeology* 29.1: 114–129.

Allen, T., Barclay, A., Lamdin-Whymark H. (2004) Opening the wood, making the land: the study of a Neolithic landscape in the Dorney area of the Middle Thames Valley. In J. Cotton and D. Field (eds): 82–98.

Anthony, I.M.C., Sanderson, D.C.W., Cook, G.T., Abernethy, D. and Housley, R.A. (2001) Dating a burnt mound from Kilmartin, Argyll, Scotland. *Quaternary Science Reviews* 20: 921–5.

Antique Collector (1986) (November Issue) *The Antique Collector*. London.

Apling, H. (1931) Bronze Age settlements in Norfolk. *Proceedings Prehistoric Society of East Anglia* 6: 365–370.

ApSimon, A.M. (1960) Report on flints and Neolithic and Bronze Age pottery from barrow 4 at Swarkestone, in E. Greenfield, The excavation of barrow 4 at Swarkestone, Derbyshire. *DAJ* 80: 19–40.

Archaeological Data Service, Arch Search (2005) http://ads.ahds.ac.uk/catalogue/search/boolean.cfm [Accessed 29.10.2008]

ARCUS (2001) *Assessment of environmental evidence from Staythorpe, Nottinghamshire.* Sheffield: University of Sheffield.

Bamford, H. (1985) *Briar Hill. Excavation 1974–197.* NDC Monograph 3. Northampton: Northampton Development Corporation.

Barber, J. and Lehane, D. (1990) Arran: Machrie North and Glaister. In V. Buckley (ed.): 77–79.

Barclay, A. and Hey, G. (1999) Cattle, cursus monuments and the river. In A. Barclay and J. Harding, (eds), *Pathways and ceremonies: the cursus monuments of Britain and Ireland.* NSG Seminar Papers 4: 67–76. Oxford: Oxbow.

Barclay, A., Lambrick, G., Moore, J. and Robinson, M. (2003) *Lines in the Landscape: Cursus monuments in the Upper Thames Valley*. Thames Valley Landscapes Monograph 15. Oxford: Oxbow Books.

Barfield, L. and Hodder, M. (1987) Burnt mounds as saunas, and the prehistory of bathing. *Antiquity* 61: 370–79.

Barnatt, J. (1994) Excavations of a Bronze Age unenclosed cemetery, cairns, and field boundaries at Eagleston Flat, Curbar, Derbyshire 1984, 1989–90. *Proceedings of the Prehistoric Society* 60: 287–370.

Barnett, S. (in prep.) *Thermoluminescence dates for Neolithic and Bronze Age pottery from Hill Farm, Willington, Derbyshire.*

Barton, R.N.E. (1992) *Hengistbury Head, Dorset. Volume 2: the Late Palaeolithic & Early Mesolithic Sites.* Oxford University Commitee Archaeology Monograph, 34.

Beamish M.G. (1997) *An Archaeological Watching Brief during Haul Road Construction at Willington Quarry Derbyshire.* Unpublished ULAS Report 97/97.

Beamish, M.G., Browning, J.C., Cooper, L.P., Greig, J., Harvey, D., Marsden, P.L., Monckton, A.M. and Robinson, W. (2000) *Willington Quarry Extension, Willington South Derbyshire. Post-Excavation Assessment Zones 1–8*. Unpublished ULAS Rep 2000–54.

Beamish, M.G. and Ripper, S.A. (2000) Burnt mounds in the East Midlands. *Antiquity* 75: 37–8.

Beamish, M.G. (2003) Syston, Fosse Way (SK 618 127). *Transactions of the Leicestershire Archaeological and Historical Society* 77: 147–8.

Beamish, M.G. (2005) Bronze Age Settlement at Ridlington, Rutland. *Transactions of the Leicestershire Archaeological and Historical Society* 79: 1–26.

Best, J. and Gent., T. (2007) Bronze Age Burnt Mounds and Early Medieval Timber Structures at Town Farm Quarry, Burlescombe, Devon. *Archaeological Journal* 164: 1–79.

Birks, H.J.B. (1989) Holocene isochrone maps and patterns of tree spreading in the British Isles. *Journal of Biogeography* 16: 503–540.

Bowman, P. and Liddle, P. (2004) (eds) *Leicestershire Landscapes*. Leicestershire Museums Archaeological Fieldwork Group. Monograph No 1. Leicestershire County Council.

Bradley, P. (1989) The Archaeology and Petrology of Group XX axes. In A. Gibson (ed.) *Midlands Prehistory: Some recent and current researches into the prehistory of central England:* 180–95. British Archaeological Reports, British Series 204. Oxford.

Bradley, R. (1970) The Excavation of a Beaker Settlement at Belle Tout, East Sussex, England. *Proceedings of the Prehistoric Society* 36: 312–379.

Bradley, R. (2007) *The Prehistory of Britain and Ireland*, Cambridge: Cambridge University Press.

Bramwell, D. (1971) Excavations at Fox Hole Cave, High Wheeldon, 1961–1970. *DAJ* 91: 1–19.

Brayshay, B.A. and Dinnin, M. (1999) Integrated palaeoecological evidence for biodiversity at the floodplain-forest margin. *Journal of Biogeography* 26: 115–31.

Brewster, T.C.M. and Finney, A.E. (1995) *The excavation of seven Bronze Age barrows on the moorland of North East Yorkshire*. Leeds: Yorkshire Archaeological Society, Yorkshire Archaeological Report No. 1.

Bronk Ramsey, C. (1995) Radiocarbon calibration and analysis of stratigraphy', *Radiocarbon* 36: 425–30.

Bronk Ramsey, C. (1998) Probability and dating. *Radiocarbon* 40: 461–74.

Bronk Ramsey, C. (2001) Development of the radiocarbon calibration program. *Radiocarbon* 43: 355–63.

Brossler, A., Early, R. and Allen, C., Green Park, (2004) *Reading Business Park Phase 2 Excavations 1995 — Neolithic and Bronze Age Sites.* Oxford Archaeology. Thames Valley Monograph 19. Oxford: Oxbow Books.

Brown, A.G. (1999) Characterising prehistoric lowland environments using local pollen assemblages. *Quaternary Proceedings* 7: 585–594.

Brown, A.G. (2000) Floodplain Vegetation History: Clearings as Potential Ritual Spaces? In A. Fairbairn (ed.): 49–62.

Buck, C.E., Cavanagh, W.G. and Litton, C.D. (1996) *Bayesian Approach to Interpreting Archaeological Data*. Chichester: Wiley.

Buck, C.E., Litton, C.D. and Smith, A.F.M. (1992) Calibration of radiocarbon results pertaining to related archaeological events. *Journal of Archaeological Science* 19: 497–512.

Buckland, P.C. and Edwards, K.J. (1984). The longevity of pastoral episodes of clearance activity in pollen diagrams: the role of post occupation grazing. *Journal of Biogeography* 11: 243–49.

Buckley, D.G., Hedges, J.D. and Brown, N. (2001) Excavations at a Neolithic cursus, Springfield, Essex, 1979–85. *Proceedings of the Prehistoric Society* 67: 101–62.

Buckley,V. (ed.) (1990) *Burnt Offerings. International Contributions to Burnt Mound Archaeology*. Dublin: Wordwell Ltd.

Buckley,V. (1990) Experiments using a reconstructed fulacht with a variety of rock types: implications for the petro-morphology of fulachta fiadh. In Buckley,V. (ed.): 170–174.

Burchell, J.P.T. and Piggott, S. (1939) Decorated prehistoric pottery from the bed of the Ebbsfleet, Northfleet, Kent. *Antiquaries Journal* 19: 405–20.

Burrows, W.L. (1929) Note on Prehistoric Cooking Site and Camping Ground in Sutton Park, Warwickshire. *Transactions of the Birmingham Archaeological Society* 52: 291–300.

Campbell, G. and Robinson, M. (2007) Environment and Land Use in the Valley Bottom. In J. Harding and F. Healy, (ed.) *The Raunds Area Project. A Neolithic and Bronze Age Landscape in Northamptonshire*, London: English Heritage: 18–36.

Cantrill, T.C. and Jones, O.T. (1911) Prehistoric cooking places in South Wales. *Archaeologica Cambrensis* 11.3: 17–34.

Cantrill, T.C. (1913) Stone-boiling in the British Isles. *Report of the British Association for the Advancement of Science*, Volume ??? : 647–649.

Charters, S., Evershed, R.P., Goad, L.J., Blinkhorn, P.W. and Denham, V. (1993) Quantification and distribution of lipid in archaeological ceramics — implications for sampling potsherds for organic residue analysis and the classification of vessel use. *Archaeometry* 35: 211–223.

Childe, V.G. and Grant, W.G. (1938) A Stone-Age Settlement At The Braes Of Rinyo, Rousay, (First Report) Orkney. *Proceedings of the Society for Antiquities of Scotland* 73: 6–31.

Clark, J.G.D., Higgs, E.S. and Longworth, I.H. (1960) Excavations at the Neolithic site at Hurst Fen, Mildenhall, Suffolk. *Proceedings of the Prehistoric Society* 26: 202–45.

Clay, P. (2006) Neolithic and Early to Middle Bronze Age. In N. Cooper (ed.) *The Archaeology of the East Midlands: An Archaeological Resource Assessment and Research Agenda for the East Midlands.* Leicester Archaeology Monograph 13: 161–184.

Clay, P. and Beamish, M.G. (1998) *Design Specification for archaeological recording at Willington, Derbyshire*. ULAS unpublished.

Cleal, R.M.J. (1986) *The Later Neolithic in Eastern England.* Unpublished PhD thesis, University of Reading.

Cleal, R.M.J. (1995) Pottery fabrics in Wessex in the fourth to second millennia BC. In I. Kinnes and G. Varndell (eds): 185–194.

Coles, J. (1979) *Experimental Archaeology*. London: Academic Press.

Coles, J. and Orme, B. (1983) Homo sapiens or Castor fiber? *Antiquity* 57: 95–102.

Cooper, L. and Jacobi, R.M., (2001). Two Late Glacial finds from North-west Leicestershire. *Transactions of the Leicestershire Archaeological and Historical Society* 75: 118–21.

Cooper, L., (2002) A Creswellian campsite, Newtown Linford. *Transactions of the Leicestershire Archaeological and Historical Society* 76: 78–80.

Cooper, L. (2004) The hunter-gatherers of Leicestershire and Rutland. In P. Bowman and P.Liddle (eds): 12–29.

Cooper, L. (2006) Archaeological Assessment of the Trent-Soar Confluence Zone. *Transactions of the Leicestershire Archaeological and Historical Society* 80: 1–26.

Cooper, L. (forthcoming) 'The lithics' in N. Finn, forthcoming.

Cooper, L. and Humphrey, J. (1998) The Lithics. In M. Beamish, 'A Middle Iron Age site at Wanlip, Leicestershire'. *Transactions of the Leicestershire Archaeological and Historical Society* 70: 1–91, (66–74).

Copley M.S., Berstan R., Dudd S.N., Docherty G., Mukherjee A.J., Straker V., Payne S. and Evershed R.P. (2003) Direct chemical evidence for widespread dairying in prehistoric Britain. *Proc. Nat. Acad. Sci. USA* 100: 1524–1529.

Copley, M.S., Berstan, R., Mukherjee, A.J., Dudd, S.N., Straker, V., Payne, S. and Evershed, R.P. (2005) Dairying in antiquity. III. Evidence from absorbed lipid residues dating to the British Neolithic. *Journal of Archaeological Science* 32: 523–546.

Cotton, J. and Field, D. (eds) (2004) *Towards a New Stone Age. Aspects of the Neolithic in south-east England.* CBA Research Report 137. London: Council for British Archaeology.

Cotton, J. (2004) Two decorated Peterborough bowls from the Thames at Mortlake and their London context. In J. Cotton and D. Field (eds): 128–147.

Courtney, T. (1976) Excavations at Melbourne, Derbyshire, (1973). *DAJ* 96: 62–69.

Courty, M.A., Goldberg, P. and MacPhail, R.I. (1989) *Soils and Micromorphology in Archaeology*. Cambridge: Cambridge University Press.

Crowson, A. and Bayliss, A. (1999) Dating a burnt mound and its beakers at Northwold, Norfolk. In J. Evin, C. Oberlin, J.P. Daugas and J.F. Salles (eds) *Actes du 3ème congrès international «Archéologie et 14C» Lyon, 6–10 Avril 1998* (Revue d'Archéometrie Suppl 1999 et Soc Préhist Fr Mémoire 26): 243–248.

Cummins, W.A. (1974) The neolithic stone axe trade in Britain. *Antiquity* 48: 201–205.

Darvill, T. (1988) Monuments Protection Programme, Monument Class Descriptions: Burnt Mounds (revision). Available from: http://www.eng-h.gov.uk/mpp/mcd/bm.htm [Accessed 10.11.2008].

Darvill, T. (2002) *Concise Oxford Dictionary of Archaeology*. Oxford. Oxford University Press.

Department of the Environment, Heritage and Local Government, Ireland and Department of the Environment, Northern Ireland (2004) *Database of Irish Excavation Reports*. Available from: http://www.excavations.ie [Accessed 13.11.2008].

Davies, G. (2001) *Interim Statement on the Archaeological Works at Staythorpe Power Station. Unpublished ARCUS Report 438f.*

Deery, M.B. (n.d.) Knoxspark Burnt Mound. *Irish Excavations Bulletin record 2000:0891.* Available from http://www.excavations.ie [Last Accessed 7.11.2008].

Donahue, R.E. (1991) *Microwear analysis of lithic artifacts from the Mesolithic and Neolithic site at Lismore Fields, Buxton*. Unpublished report for the Trent and Peak Archaeological Trust.

Donahue, R.E. (1994) The current state of lithic microwear research. In N. Ashton and A. David (eds) *Stories in stone*: 156–168. Oxford: Lithic Studies Society.

Donahue, R.E. (1999) The microwear analysis of the flint artefacts from Upper Ninepenc. In A. Gibson *The Walton Basin Project: Excavation and survey in a prehistoric landscape, 1993–1997*. CBA Research Report No. 118: 100–112. London: Council of British Archaeology.

Donahue, R.E. (2000) *The lithic microwear analysis of the Royal Dock School site: evidence for a specialised hide processing area*. Unpublished report for the Museum of London Archaeological Service.

Donahue, R.E. (2002) *Microwear analysis of lithic artefacts from a late Neolithic pit from the site of Eye Kettleby*. Unpublished report for the University of Leicester Archaeological Services.

Donahue, R.E. (n.d.) *Microwear analysis of flint artefacts from the Whitwell Long Cairn site*. Unpublished report for the Creswell Crags Heritage Centre, Nottinghamshire.

Drury, P.J. (1978) *Excavations at Little Waltham 1970–71*. CBA Research Report 26. London: Council for British Archaeology

Dudd, S.N., Gibson, A.M. and Evershed, R.P. (1999) Evidence for varying patterns of exploitation of animal products in different prehistoric traditions based on lipids preserved in surface and absorbed residues. *Journal of Archaeological Science* 26 (12): 1473–1482.

Edlin, H.L. (1949) *Woodland Crafts in Britain*. London: Batsford.

Elliot, L. and Knight, D. (1998) A burnt mound at Holme Dyke, Gonalston, Nottinghamshire. *Transactions of the Thoroton Society of Nottinghamshire* 102: 15–21.

English Heritage (1999) NMR Monuments Thesuarus. Available from: http://thesaurus.english-heritage.org.uk/thesaurus.asp?thes_no=1 [Last Accessed 28.10.2008].

English Heritage (2007) National Monuments Record. Available from: http://pastscape.english-heritage.org.uk/TextPage.aspx [Accessed 13.11.2008].

Evans, C., Pollard, J., Knight, M. (1999) Life in Woods: Tree throws, "Settlement" and Forest Cognition. *Oxford Journal of Archaeology* 18: 241–254.

Evans, C. and Hodder, I. (2006) *A woodland archaeology. Neolithic sites at Haddenham.* Cambridge: McDonald Institute Monograph.

Evans, D.C. (2006) An engraved Neolithic plaque and associated finds from King's Stanley, Gloucestershire. *Past* 52: 3–5.

Evans, J.G. and Simpson, D.D.A. (1991) Giants Hill 2 long barrow, Skendleby, Lincolnshire. *Archaeologica* 109: 1–45

Evershed, R.P., Heron, C. and Goad, L.J. (1990) Analysis of organic residues of archaeological origin by high-temperature gas-chromatography and gas-chromatography mass-spectrometry. *Analyst* 115: 1339–1342.

Fairbairn, A., (ed.) (2000) *Plants in Neolithic Britain and Beyond*. Neolithic Studies Group Publication. Oxford: Oxbow Books.

Finn, N. (forthcoming) *Excavations at Eye Kettleby, Leicestershire: the Prehistoric Landscape.*

Ford, S. (1987) *East Berkshire archaeological survey*. Berkshire County Council Dept Highways & Planning Ocassional Paper 1.

Ford, S. and Pine, J. (2003) Neolithic ring ditches and Roman landscape features at Horton, 1989 to 1996. In S. Preston (ed.) *Prehistoric, Roman and Saxon Sites in Eastern Berkshire. Excavations 1989–1997*: 13–85. Thames Valley Archaeological Services Ltd Monograph 2. Reading: Thames Valley Archaeological Services Ltd.

Fraser, A. (1992) *The Gypsies*. London: Blackwell.

Gale, R. (2006) *Cox Bank Farm, Marchington, Uttoxeter, CBF 6: charcoal*. Unpublished report prepared for Stoke-on-Trent Archaeological Society,

Garrow, D. (2006) Pit settlements. In C. Evans and I. Hodder : 233–237.

Garrow, D., Beardsmore, E. and Knight, M. (2005) Pit clusters and the temporality of occupation: an Earlier Neolithic site at Kilverstone, Thetford, Norfolk. *Proceedings of the Prehistoric Society* 71: 139–157.

Garton, D. (1987) Buxton. *Current Archaeology* 9.8, 103: 250–253.

Garton, D. (1993a) A Burnt mound at Waycar Pasture near Girton. *Transactions of the Thoroton Society of Nottinghamshire* 97: 148–149.

Garton, D. (1993b) A Late Upper Palaeolithic near Newark, Nottinghamshire. *Transactions of the Thoroton Society of Nottinghamshire* 98: 126–9.

Garton, D. and Beswick, P. (1983) The Survey and Excavation of a Neolithic Settlement at Mount Pleasant, Kenslow, 1980–1983. *Derbyshire Archaeological Journal* 103: 7–40.

Gelfand, A.E. and Smith, A.F.M. (1990) Sampling approaches to calculating marginal densities. *Journal of the American Statistical Association* 85: 398–409.

Getty, R. (1975) *Sisson and Grossman's The Anatomy of the Domestic Animals.* 5th edition London, Toronto: W. B. Saunders Company Philadelphia, Vol 1, Vol 2.

Gibson, A. (1995) First impressions: a review of Peterborough Ware in Wales. In I. Kinnes and G. Varndell (eds) : 23–39.

Gibson, A. (1996) *The later Neolithic pottery from Wollaston and Irchester Quarries, Northamptonshire*. Unpublished specialist report for Northamptonshire Archaeological Unit.

Gibson, A. (1999) *The Walton Basin Project. Excavation and Survey in a Prehistoric Landscape 1993–7*. CBA Research Report 118. London: Council for British Archaeology.

Gibson, A. (2005) *The Neolithic pottery from Kings Stanley, Gloucestershire*. Unpublished specialist report on behalf of a private client.

Gibson, A.M. and Loveday, R. (1989) Excavations of the cursus monument of Aston-on-Trent, Derbyshire. In A. Gibson, A. (ed.) *Midlands Prehistory* British Archaeological Reports British Series 204: 27–50. Oxford: Archaeopress.

Gibson, A.M. and Kinnes, I. (1997) On the urns of a dilemma: radiocarbon dating and the Peterborough problem. *Oxford Journal of Archaeology* : 65–72.

Gieck, E. (1983) *Engineering Formulas.* (4th edition) Heilbronn, Germany: McGraw-Hill.

Gillespie, R. n.d., Two fulchta fiadh, Attireesh, Mayo. *Irish Excavations Bulletin* 2001:884. Available from: www.excavations.ie [Accessed 12.11.2008].

Gilks, W.R., Richardson, S. and Spiegelhalther, D.J. (1996) *Markov Chain Monte Carlo in practice*. London: Chapman and Hall.

Giorgi, J.A. (2006) The Charred Plant Remains. In Richmond *et al.* 2006: 80–84.

Girling, M.A. (1980) The fossil insect assemblage from the Baker Site. *Somerset Levels Papers* 6: 36–42.

Girling, M.A. (1984) Investigations of a second insect assemblage from the Sweet Track. *Somerset Levels Papers* 10:78–91.

Goldberg, P. and Macphail, R.I. (2006) *Practical and Theoretical Geoarchaeology*. London: Blackwell Science.

Greenfield, E. (1960) The Excavation of Barrow 4 at Swarkestone. *DAJ* 80: 1–48.

Greenwood, M. and Smith, D.N. (2005) A survey of Coleoptera from sedimentary deposits from the Trent Valley. In D.N. Smith, M.B. Brickley and W. Smith (eds) *Fertile Ground: Papers in Honour of Professor Susan Limbrey*. AEA Symposia No. 22. Oxford: Oxbow Books.

Greig, J. (2004a) *Prehistoric lime woods of Herefordshire; pollen and seeds from Wellington Quarry, Marden, Herefordshire*. Unpublished Report 04.01.

Greig, J. (2004b) *Report on pollen from Bronze Age deposits, Yarnton site 17 waterholes 10049 and 10104, site 21 water holes 15014 and 15072, and site 4c waterhole 16010 Yarnton, Oxfordshire*. Unpublished Report 04.08.

Greig, J. (2005) *Prehistoric to early medieval landscape change in the Avon valley; the pollen and waterlogged seeds from sites 5006 and 5007 at Beckford, Worcestershire*. Unpublished Report 05.10.

Greig, J. (2006) *Report on pollen from Shardlow quarry, SQB04, Derbyshire*. Unpublished Report 06.05.

Grimes, W.F. (1960a) Neolithic pottery and a flint axe from Mixnam's pit, Thorpe, Surrey. In W.F. Grimes (ed.) *Excavations at defence sites, 1939–1945, Volume 1, Neolithic and Bronze Age*: 181–185. London: H.M.S.O.

Grimes, W.F. (1960b) Neolithic pits at Heathrow, Harmondsworth, Middlesex. In W.F. Grimes (ed.) *Excavations at defence sites, 1939–1945, Volume 1, Neolithic and Bronze Age*: 186–197. London: H.M.S.O.

Guilbert, G. (1982) Post-ring symmetry in Roundhouses at Moel y Gaer and some other sites in Prehistoric Britain. In P.J. Drury (ed.) *Structural Reconstruction: Approaches to the Interpretation of the Excavated Remains of Buildings:* British Archaeological Reports British Series 110:67–86. Oxford.

Guilbert, G. (1994) *TPAT Summary Excavations Report.* Trent and Peak Archaeological Trust.

Guilbert, G. (1996) Findern is dead, long live Potlock — The Story of a Cursus on the Trent Gravels. *PAST* 24: 10–12.

Guilbert, G. and Garton, D. (2007) Newly Discovered Round Mound Beside the Trent, at Hull Bank, on Hargate Pasture, Egginton. *DAJ* 127:19–32.

Hains, B.A. and Horton, A. (1969) *British Regional Geology. Central England (Third Edition)*. London: HMSO.

Hall A.R. and Kenward H.K. (1990) *Environmental Evidence from the Collonia, The Archaeology of York 14/6*. London: Council for British Archaeology.

Hansel, F.A., Copley, M.S., Madureira, L.A.S. and Evershed, R.P. (2004) Thermally produced omega-(o-alkylphenyl) alkanoic acids provide evidence for the processing of marine products in archaeological pottery vessels. *Tetrahedron Letters* 45 (14): 2999–3002.

Hansen, M. (1987) The Hydrophilidae, Coleoptera, of Fennoscandia and Denmark Fauna. *Fauna Entomologyca Scandinavica* 18. Leiden: Scandinavian Science Press.

Harde K.W. (1984) *A Field Guide in Colour to Beetle.* London: Octopus books.

Harding, A.F., with Lee, G.E. (1987) *Henge Monuments and Related Sites of Great Britain — Air Photographic Evidence and Catalogue.* British Archaeological Reports (British Series) 175. Oxford: Archaeopress.

Harding, J. and Healy, F. (ed.) (2007) *The Raunds Area Project. A Neolithic and Bronze Age Landscape in Northamptonshire*. London: English Heritage.

Hart, C.R. (1985) Aleck Low and Upper House Farm, Derbyshire: Prehistoric artefact scatters. In D. Spratt and C. Burgess (eds) *Upland settlement in Britain: The 2nd millennium B.C. and after*. British Archaeological Reports (British Series) 143: 51–69. Oxford: Archaeopress.

Head, R. and Young, R. (2000) Lithics. In N.J. Cooper, *The Archaeology of Rutland Water: Excavations at Empingham in the Gwash Valley, Rutland, 1967–73 and 1990*. Leicester: Leicester Archaeology Monographs 6: 60–66.

Healy, F., Heaton, M. and Lobb, S.J. (1992) Excavations of a Mesolithic site at Thatcham, Berkshire. *Proceedings of the Prehistoric Society* 58: 41–76.

Heawood, R. and Huckerby, E. (2002) Excavation of a burnt mound at Sparrowmire Farm, Kendal. *Transactions of the Cumberland and Westmoreland Antiquaries and Archaeological Society*, CW3, ii: 29–49.

Henson, D. (1985) The flint resources of Yorkshire and the East Midlands. *Lithics* 6: 2–9.

Heseltine, A. (1982) *Baskets and Basket Making*. Shire: Aylesbury.

Hillman, G. and Mears, R. (2007) *Wild Food.* London: Hodder & Stoughton.

Holgate, R. (1988) *Neolithic Settlement of the Thames Basin.* British Archaeological Reports (British Series) 130. Oxford: Archaeopress.

Holland, D.G. (1972) *A Key to the Larvae, Pupae and Adults of the British Species of Elminthidae*. Scientific Publication 26. Ambleside: Freshwater Biological Association.

Hodder, M. (1990) Burnt Mounds in the English West Midlands. In Buckley, V. (ed.): 106–111

Hodges, H.W.M. (1956) The Excavation of a group of Cooking Places at Ballycroghan, Co Down. *Ulster Journal of Archaeology* 18: 17–28.

Hughes, E.G. and Crawford, G. (1999) Excavations at Wasperton, Warwickshire 1980–1985. Part 1: the Neolithic and Early Bronze Age. *Transactions of the Birmingham and Warwickshire Archaeological Society* 99: 9–45.

Hughes, G. (1995) *An Archaeological Evaluation at Hill Farm, Willington, Derbyshire, 1995*. Unpublished BUFAU Report No 343.

Hughes, G. (2000) *The Lockington Gold Hoard: An Early Bronze Age Barrow Cemetery at Lockington, Leicestershire*. Oxford: Oxbow.

Humble, J. (2006) Flint and stone artefacts. In S. Parry *The Raunds Area Survey*: 46–60. Oxford: Oxbow Books.

Ixer, R. (2002) Appendix 2: Petrographic Descriptions. In G. Coates *A Prehistoric and Romano-British Landscape. Excavations at Whitemoor Haye Quarry, Staffordshire, 1997–1999*. British Archaeological Reports (British Series) 340: 94–97. Oxford: Archaeopress.

Jackson, W.J. (1949) Peterborough (Neolithic B) pottery from High Wheeldon Cave, Earl Sterndale, near Buxton. *DAJ* 69: 72–77.

Jacobi, R.M., Garton, D. and Brown J. (2001) Field-walking and the Upper Palaeolithic of Nottinghamshire. *Transactions of the Thoroton Society of Nottinghamshire* 105: 17–22.

James, H.J. (1986) Excavations of Burnt Mounds at Carne, Nr. Fishguard, 1979 and 1981. *Bulletin of the Board of Celtic Studies* 33: 245–265.

Jeffrey, P. (1991) Burnt Mounds, Fulling and Early Textiles. In M. Hodder and L. Barfield (eds): 97–108.

Johnson, A.E. (1997) *Willington Quarry Extension, Derbyshire. Topsoil Magnetic Susceptibility and Gradiometer Survey*. Unpublished report Oxford Archaeotechnics.

Jones, G. (2000) Evaluating the importance of cultivation and collecting in Neolithic Britain. In A.S. Fairbairn (ed.): 79–84.

Jones, P. (in prep.) *A Henge, pit row avenue, boiling pit, burnt mound and waterhole at Staines Road Farm, Shepperton.* Surrey Archaeological Unit.

Keiller, A. and Piggott, S. (1939) *A survey of the Prehistory of the Farnham district. Guildford*, Surrey Archaeological Society.

Kenward H.K. and Hall A.R. (1995) *Biological Evidence from Anglo-Scandinavian Deposits at 16–22 Coppergate*. The Archaeology of York 14/7. London: Council for British Archaeology.

Kinnes, I. and Longworth, I.H. (1985) *Catalogue of excavated Prehistoric and Romano-British material in the Greenwell Collection*. London: British Museum Press.

Kinnes, I. and Varndell, G. (eds) (1995) *'Unbaked Urns of Rudely Shape'. Essays on British and Irish Pottery for Ian Longworth.* Oxford: Oxbow.

Kitchen, E. (2008) *The use of insect remains to determine the nature of activity taking place upon a prehistoric burnt mound, located in Waycar Pasture, Girton.* Unpublished BA thesis. Institute for Archaeology and Antiquity, University of Birmingham.

Knight, D. and Howard, A.J. (1994) *Archaeology and alluvium in the Trent Valley*. Nottingham: Trent and Peak Archaeological Trust.

Knight, D. and Howard, A.J. (2004) *Trent Valley Landscapes. The Archaeology of 500,000 Years of change*. Kings Lynn: Heritage Marketing and Publication.

Knight, D., Marsden, P. and Carney, J. (2003) Local or Non-Local? Prehistoric Granodiorite-Tempered Pottery in the East Midlands. In A. Gibson (ed.): *Prehistoric Pottery: People, Pattern and Purpose*. Prehistoric Ceramics Research Group Occasional Publication No.4. British Archaeological Reports (International Series) 1156: 111–125. Oxford: Archaeopress.

Knight, M. (2002) Whittlesey, Bradley Fen. *Proceedings of the Cambridge Antiquarian Society* 91: 147.

Ladle, L. and Woodward, A. (2003) A Middle Bronze Age House and burnt mound, Bestwall, Wareham, Dorset: an interim report. *Proceedings of the Prehistoric Society,* 69: 265–277.

Lambrick, G. (2003) An Explanation of Tree-throw hole stratigraphy. Appendix 1, in A. Barclay *et al.*: 245–6.

Lawrence, G.F., (1929), 'Antiquities from the Middle Thames', *Antiquaries Journal* 86, 69–97.

Lawson, A., Brown J.E. and Healy, F. (1986) *Barrow excavations in Norfolk 1950–82*. East Anglian Archaeology 29.

Layard, N.F. (1922) Prehistoric Cooking Places in Norfolk. *Proceedings Prehistoric Society* 3: 483–498.

Le Bas, M.J. (1968) Caledonian Igneous Rocks. In P. C Sylvester-Bradley and T.D. Ford (eds) *The Geology of the East Midlands*: 41–58. Leicester: Leicester University Press.

Leeds, E.T. (1912) On Neolithic pottery from Buston Farm, Astrop. *Oxford Archaeological Society Report*: 114–8.

Leeds, E.T. (1922) Further discoveries of the Neolithic and Bronze Ages at Peterborough. *Antiquaries Journal* 12: 220–237.

Leeds, E.T. (1940) New discoveries of Neolithic pottery in Oxfordshire. *Oxoniensia* 5: 1–12.

Lewis, J.S.C. and Welsh, K. (2004) Perry Oaks — Neolithic inhabitation of a west London landscape. In J. Cotton and D. Field (eds) *Towards a New Stone Age. Aspects of the Neolithic in south-east England.* CBA Research Report 137: 105–9. London: Council for British Archaeology.

Longworth, I. (1969) Five sherds from Ford, Northumberland, and their relative dating. *Yorkshire Archaeological Journal* 42: 25–31.

Loveday, R. (2000) Aston: a barrow preserved. *Current Archaeology* 167: 38–39.

Loveday, R. (2004) Contextualising Monuments. The Exceptional Potential of the Middle Trent Valley. *DAJ* 124: 1–12.

MacPhail, R.I. and Goldberg, P. (1990) The micromorphology of tree subsoil hollows: their significance to soil science and archaeology. In L. Douglas (ed.) *Soil Micromorphology: A Basic and Applied Science.* Amsterdam: Elsevier: 425–429.

MacPhail, R.I. and Lindeholm, J. (2004) Neolithic Land use in south-east England: a brief review of the soil evidence. In J. Cotton and D. Field (eds): 29–37.

MacSween, A. (1999) Pottery. In H. Moore and G. Wilson: 218–225.

Major, H. (1988) Fired Clay. In N. Brown 'Late Bronze Age Enclosure in Essex. *Proceedings of the Prehistoric Society* 54: 280.

Manby, T.G. (1956) Neolithic 'B' pottery from East Yorkshire. *Yorkshire Archaeological Journal* 39: 1–8.

Manby, T.G. (1958) A Neolithic site at Craike Hill, Garton Slack, East Riding of Yorkshire. *Antiquaries Journal* 38: 223–236.

Manby, T.G. (1975) Neolithic occupation sites on the Yorkshire Wolds, Yorkshire. *Archaeological Journal* 47: 23–59.

Manby, T.G. (1979) Neolithic and Bronze Age pottery. In H.Wheeler 1979: 146–162.

Manby, T.C. (1988) The Neolithic Period in Eastern Yorkshire. In T.G. Manby (ed.) *Archaeology in Eastern Yorkshire: Essays in Honour of T.C.M.Brewster FSA*: 35–87. Sheffield: J.R. Collis, University of Sheffield.

Marsden, P. and Woodward, A. (forthcoming) Prehistoric pottery. In N. Finn forthcoming.

Marshall, P.D., Hamilton, W.D., Woodward, A. and Beamish M.G. (in prep.) *A precise chronology for Peterborough Ware?*

Marshall, P.D., Hamilton, W.D., Tyers, I., Cook,G., van der Plicht and Bronk Ramsey, C. (2007) Scientific Dating. In J. Best and T. Gent (eds) : 47–68.

May, J. (1971) A Neolithic site at Aston Hill, near Minninglow, Derbyshire. *DAJ* 91: 31–36.

May, J., Elsdon, S.M., Phillips, P., Guir, H. and Donahue, R. (1996) Earlier Neolithic artefacts from pits and hollow. In J. May (ed.) *Dragonby: report on excavations at an Iron Age and Romano-British settlement in North Lincolnshire, Vol. I* : 38–41. Oxford: Oxbow.

Maynard, D. (1993) Burnt Mounds around a Pipeline in Dumfries and Galloway. *Tranactions of Dumfriesshire Galloway Natural History and Antiquities Society* 68: 33–52.

McK Clough, T.H. and Cummins, W. (1988) *Stone Axe Studies. Volume 2.* Council for British Archaeology Research Report 67. London.

Middleton, H.R. (1998) Flint and chert artefacts. In F. Pryor (ed.): 215–51.

Molloy, B. (n.d.) Site CA1, Charlesland, Wicklow. *Irish Excavations Bulletin* record 2003: 2075. Available from http://www.excavations.ie [Last Accessed 7.11.2008].

Monckton, A. and Moffett, L. (1996) *Charred plant remains from Potlock Cursus, Derbyshire*. Archive report for Trent and Peak Archaeological Unit.

Monckton, A. (2006) Environmental Archaeology in the East Midlands. In N. Cooper (ed.): 259–286.

Monckton, A. (forthcoming a) Charred plant remains. In S.Ripper forthcoming a.

Monckton, A. (forthcoming b) Charred plant remains. In S.Ripper forthcoming b.

Mook, W.G. (1986) Business meeting: Recommendations/Resolutions adopted by the Twelfth International Radiocarbon Conference. *Radiocarbon* 28: 799.

Moore, H. and Wilson, G. (1999) Food for thought: a survey of burnt mounds of Shetland and excavations at Tangwick. *Proceedings of the Society of Antiquaries of Scotland* 129: 203–237.

Moore, J. (1997) The infernal cycle of fire ecology. In P. Topping (ed.) : 33–40.

Moore, J. and Jennings, D. (1992) *Reading Business Park. A Bronze Age Landscape. Oxford Archaeological Unit. Thames Valley Landscapes: The Kennet Valley, Vol 1*. Oxford: Oxbow.

Moore, W.R.G. and Williams, J.H. (1975) A Later Neolithic Site at Ecton. *Northamptonshire Archaeology* 10: 3–30.

Moore, D. (2007) *Ale, brewing and fulacht fiadh: Archaeology Ireland.* Available from http://mooregroup.wordpress.com/2007/10/08/the-archaeology-ireland-article/ [Accessed 1.12.2008].

O'Drisceoil, D.A. (1988) Burnt Mounds: cooking or bathing? *Antiquity* 62: 671–80.

O'Drisceoil, D.A. (2002) An Experiment in Bronze Age Cooking: The Fulacht Fiadh, Castlemary 1993. In A. Davidson and H. Sabiri (eds) *The Wide Shores of Gastronomy*: 87–95. Berkeley, California, USA: Ten Speed Press.

O'Kelly, M.J. (1954) Excavations and experiments in ancient Irish cooking places? *Journal of the Royal Society of Antiquities in Ireland* 95: 105–55.

Parker, M. and Jarvis, W. (2007) Brooksby Quarry, Melton Road, Brooksby (SK 655 155). *Transactions of the Leicestershire Archaeological and Historical Society* 81: 211.

Pasmore, A.H. and Pallister, J. (1967) Boiling Mounds in the New Forest. *Proceedings of the Hampshire Field Club and Archaeology Society* 24: 14–19.

Peacock, E.R. (1993) *Adults and Larvae of Hide, Larder and Carpet Beetles and their Relatives, Coleotera: Dermestidae, and of Derodontid Beetles, Coleoptera: Derondontidae*. Handbooks for the Identification of British Insects 5/3, London: Royal Entomological Society of London.

Percival, S. (n.d) *The Prehistoric pottery, Browick Road, Wymondham*. Unpublished specialist report Norfolk Archaeological Unit.

Pettitt, P. (2008) The British Upper Palaeolithic. In J. Pollard (ed.) *Prehistoric Britain*: 18–57. Blackwell publishing.

Philp, B.J. (1973) A Neolithic site near Baston Manor, Hayes, Kent. In B.J. Philp (ed.) *Excavations in West Kent 1960–70*: 5–20. Dover: Kent Archaeological Rescue Unit. Second Report in the Kent series.

Piggott, S. (1954) *The Neolithic* cultures *of the British Isles*. Cambridge: Cambridge University Press.

Piggott, S. (1962) *The West Kennet Long Barrow: Excavations 1955–56*. London: H.S.M.O.

Porter, V. (1990) *Small Woods and Hedgerows*. London: Pelham Books.

Posnansky, M. (1963) The Lower and Middle Palaeolithic Industries of the British East Midlands. *Proceedings of the Prehistoric Society* 29: 357–394.

Pryor, F. (1998) *Etton. Excavations at a Neolithic causewayed enclosure near Maxey, Cambridgeshire, 1982–7*. London: English Heritage Archaeological Report 18.

Pryor, F. (2002) The Welland Valley as a Cultural Boundary Zone. In T. Lane and J. Coles (eds) *Through Wet and Dry. Essays in Honour of David Hall*: 18–32. Lincolnshire Archaeology and Heritage Reports Series No 5. WARP Ocassional Paper 17.

Pyne, W.H. (1971) *Microcosm or, A picturesque delineation of the arts, agriculture, and manufactures of Great Britain in a series of above a thousand groups of small figures for the embellishment of landscape*. New York: Benjamin Blom.

Rackham, O. (1977) *Neolithic woodland management in the Somerset Levels: Garvin's, Walton Heath and Rowland's Tracks*. Somerset Levels Papers 3: 65–72.

Reaney, D. (1968) Beaker burials in south Derbyshire. *DAJ* 88: 68–81.

Reimer, P.J., Baillie, M.G.L., Bard, E., Bayliss, A., Beck, J.W., Bertrand, C.J.H., Blackwell, P G., Buck, C.E., Burr, G.S., Cutler, K.B., Damon, P.E., Edwards, R.L., Fairbanks, R.G., Friedrich, M., Guilderson, T.P., Hogg, A.G., Hughen, K.A., Kromer, B., McCormac, G., Manning, S., Bronk Ramsey, C., Reimer, R.W., Remmele, S., Southon, J.R., Stuiver, M., Talamo, S., Taylor, F.W., van der Plicht, J. and Weyhenmeyer, C.E. (2004) IntCal04 Terrestrial radiocarbon age calibration, 0–26 Cal Kyr BP. *Radiocarbon* 46: 1029–58.

RHS (2008) *Tree stump removal, Royal Horticultural Society, Gardening Advice*. Available from http://www.rhs.org.uk/advice/profiles1102/tree_stumps.asp [Accessed 25.11.2008].

Richmond, A., Rackham, J. and Scaife, R. (2006) Excavation of a Prehistoric Stream-side Site at Little Marlow. *Records of Buckinghamshire* 46: 65–101.

Riley, D.N. (1957) Neolithic and Bronze Age pottery from Risby Warren and other occupation sites in North Lincolnshire. *Proceedings of the Prehistoric Society* 23: 40–56.

Riley, D.N. (1973) Neolithic site at Normanby Park. *Lincolnshire History and Archaeology* 8: 51–59.

Ripper, S. (forthcoming a) *A Burnt Mound and human skull deposition at Watermead Park, Birstall, Leicestershire.*

Ripper, S. (forthcoming b) *A Burnt Mound at Willow Farm, Castle Donington, Leicestershire.*

Robertson-Mackay, R. (1987) The neolithic causewayed enclosure at Staines, Surrey: excavations 1961–3. *Proceedings of the Prehistoric Society* 53: 23–128.

Robinson, M. (1988) The significance of the tubers of Arrhenatherum elatius (L.) Beauv. from site 4 cremation 15/11. In G. Lambrick *The Rollright Stones: megaliths, monuments and settlement in a prehistoric landscape*. London: English Heritage Report No 6: 102.

Robinson, M. (1992) Environmental Archaeology of the River Gravels: Past Achievements and Future Directions. In M. Fulford and E. Nichols *Developing Landscapes of lowland Britain. The archaeology of the river gravels.* London: Society of Antiquaries of London, Occasional Paper 14: 47–62.

Robinson M. (2000) Further considerations of Neolithic charred cereals, fruit and nuts in Plants in Neolithic Britain and beyond. In A.S. Fairbairn (ed.) 85–90.

Russell, I. (n.d.) Curraheen 4, Cork, Fulachta fiadh. *Irish Excavations Bulletin record* 2002:0299. Avalilable from www.excavations.ie [Accessed 16.11.2008].

Russell-White C. and Barber, J. (1990) Preface. In V. Buckley (ed.) : 59.

Saville, A. (1979) Flint artefacts. In H. Wheeler: 58–220.

Silvester, R.J. (1991) *The Fenland project, number 4: Norfolk survey, the Wissey embayment & Fen causeway*. East Anglian Archaeology Reports 52.

Smith, D.N. (2000) Disappearance of elmid 'riffle beetles' from lowland river systems — the impact of alleviation. In T. O'Connor and R. Nicholson (eds) *People as an Agent of Environmental Change*: 75–80. (AEA Symposia No. 16). Oxford: Oxbow Books.

Smith, D.N. (2001) *The Insect remains from Willow Farm Business Park, Castle Donington, Leicestershire*. The University of Birmingham Environmental Archaeology Services. Report 22. Unpublished report for the University of Leicester Archaeological Services.

Smith, D.N. and Howard, A.J. (2004) Identifying changing fluvial conditions in low gradient alluvial archaeological landscapes: Can Coleoptera provide insights into changing discharge rates and floodplain evolution? *Journal of Archaeological Science* 31: 109–20.

Smith, D.N., Roseff, R. and Butler, S. (2001) The sediments, pollen, plant macro-fossils and insects from a Bronze Age channel fill at Yoxall Bridge, Staffordshire. *Environmental Archaeology* 6: 1–12.

Smith, D.N., Roseff, R., Bevan, L., Brown, A.G., Butler, S., Hughes, G., Monckton, A. (2005) Archaeological and environmental investigations of a Late Glacial and Holocene river valley sequence on the River Soar, at Croft, Leicestershire. *The Holocene* 15: 353–77.

Smith, I.F. (1956) *The Decorative Art of Neolithic Ceramics in South-East England*. Unpubl PhD., University of London.

Smith, I.F. (1965) *Windmill Hill and Avebury*. Oxford: Clarendon.

Smith, I.F. (1974) The Neolithic. In A.C. Renfrew (ed.) *British Prehistory: A New Outline*: 100 = 136. London: Duckworth.

Sotheby's Catalogue (1982) Sale Catalogue, sale date 7.7.1982. London

Sotheby's Catalogue (1983) A Catalogue of Victorian Paintings, sale date 14.7.1983. London.

Stafford, E. (n.d.) Ballybarny burnt mounds. *Irish Excavations Bulletin record 2002:1948*. Available from http://www.excavations.ie [Last Accessed 7.11.2008].

Stuiver, M. and Kra, R.S. (1986) Editorial comment. *Radiocarbon* 28: 2B, ii.

Stuiver, M. and Polach, H.A. (1977) Reporting of 14C data. *Radiocarbon* 19: 355–63.

Stuiver, M. and Reimer, P.J. (1986) A computer program for radiocarbon age calculation. *Radiocarbon* 28: 1022–30.

Stuiver, M. and Reimer, P.J. (1993) Extended 14C data base and revised CALIB 3.0 14C age calibration program. *Radiocarbon* 35: 215–30.

Taylor, M. (2001) The Wood. In F. Pryor *Flag Fen Basin*: 167–228. London: English Heritage.

Thomas, J.S. (2007) *Monument, Memory, and Myth. Use and Re-Use of Three Bronze Age Barrows at Cossington, Leicestershire*. Leicester: Leicester Archaeology Monograph 14.

Thomas, J. (1999) *Understanding the Neolithic*. London: Routledge.

Thurnham, J. (1861) *Society of Antiquaries of London Archaeologia: or miscellaneous tracts relating to antiquity*. 38: 404–421.

Topping, P. (ed.) (1997) *Neolithic Landscapes*. Neolithic Studies Group Seminar Papers 2. Oxford: Oxbow Mongraph 86.

Vera, F. (2000) *Grazing Ecology and Forest History*. Wallingford: CABI Publishing.

Ward, G.K. and Wilson, S.R. (1978) Procedures for comparing and combining radiocarbon age determinations: a critique. *Archaeometry* 20: 19–31.

Welch, C.M. (1995) A Bronze Age 'Burnt Mound' at Millwich. *Transactions of the Staffordshire Archaeological Society* 36: 1–15.

Wheeler, H. (1972) The Findern Cursus. *DAJ* 90: 4–7.

Wheeler H. (1979) Excavation At Willington Derbyshire 1970–1972. *Derbyshire Archaeological Journal* 99: 58–220.

Williams, D. (1995) Ceramic petrology. In Hughes and Woodward (1995): 14–15.

Williams, D.F. (2000) The Petrology of the Prehistoric Pottery. In Hughes (2000): 60–61.

Williams, D.F. (forthcoming) *A Petrological Note on Neolithic Pottery from Hill Farm, Willington, Derbyshire*.

Wilmot, G. (1938) Neolithic 'B' pottery from Yorkshire. *Proceedings of the Prehistoric Society* IV: 338.

Wood, E.S. (1971) The excavation of a Bronze Age barrow; Green Howe, North Deighton, Yorkshire. *Yorkshire Archaeological Journal* 43: 2–32.

Woodward, A. and Hancocks, A. (forthcoming) *The prehistoric pottery from Hill Farm, Willington, Derbyshire.*

Zajak, S. (n.d.) Clare, Mayo, fulacht fiadh, *Irish Excavations Bulletin record* 1998:482. Available from www.exavations.ie [Accessed 16.11.2008].

The Society gratefully acknowledges the financial support of English Heritage in the publication of this paper.