Burnt mounds in south Birmingham: excavations at Cob Lane in 1980 and 1981, and other investigations

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SUMMARY

Excavation in 1980 and 1981 of the burnt mound at Cob Lane, one of several mounds of heat-shattered stones and charcoal discovered in Birmingham in the 1950s and 1960s, revealed a pit, a burnt area and stakeholes under the mound and a former stream channel around it. The mound had been established on alluvium overlying an organic deposit, which together with the former stream bed contained palaeoenvironmental evidence for the presence of grazing animals and for tree clearance which may have resulted in soil erosion and alluvial deposition. More burnt mounds were subsequently found in south Birmingham through a systematic search of stream banks and in observations during ground disturbance. In addition to the Cob Lane excavation, stream-bank sections were cleaned and recorded at other sites, and contour and geophysical surveys were undertaken. Charcoal from sections of burnt mounds exposed in stream banks was submitted for radiocarbon dating. Calibrated radiocarbon dates from the Cob Lane site and from other burnt mounds in south Birmingham cluster in the period 1700 to 800 cal BC. Consideration of other evidence from the region suggests that this period (the 'Burnt Mound Period') in south Birmingham follows forest clearance and its environmental impact and precedes land division marked by fixed boundaries.

INTRODUCTION

In the 1950s and 1960s, Michael Nixon discovered eleven burnt mounds in south Birmingham, most of which were visible as layers of heat-shattered stones and charcoal in stream banks (Nixon 1980). Numerous burnt mounds had been recorded in various parts of Britain and Ireland at that time (eg Hedges 1977, fig 20), but none had previously been recognized in south Birmingham, although a few were known to the north of Birmingham (Hodder & Welch 1990). A radiocarbon date of 1500–800 cal BC, ie in the middle to late Bronze Age, for charcoal from the Yachting Pool site, one of those discovered by Nixon, drew attention to the especial importance of burnt mounds in an area in which this period was otherwise only represented by a few chance finds of bronze objects.

Burnt mounds elsewhere had been interpreted as places at which food had been cooked in water boiled by placing hot stones in it. The excavation of the Cob Lane burnt mound was undertaken on the assumption that this was the correct interpretation, and was intended to find out if the structure of the site was the same as that of burnt mounds elsewhere in Britain and Ireland, and whether the cooking had taken place as part of hunting in a wooded environment, or by a settled agricultural community in a largely cleared landscape. Re-consideration of the archaeological evidence during the excavation prompted other interpretations of burnt mounds, particularly as the debris from sweat or steam bathing (Barfield & Hodder 1987; papers in Buckley 1990; papers in Hodder & Barfield 1991). Following the excavation a systematic search of stream banks in south Birmingham was undertaken, to locate other sites (Barfield & Hodder 1989).

During the Cob Lane excavation, the stream bank section of the nearby Yachting Pool burnt mound was cleaned and drawn, and subsequently the Police Station site, on the same stream and between these two sites, was revealed by ground disturbance. Radiocarbon dates were obtained for charcoal from the Police Station site and from sections of burnt mounds exposed in stream banks, including some newly discovered sites. Contour and geophysical surveys were undertaken at some sites. Details of sites were revealed in small test excavations and, where sites were affected by development, through watching briefs and salvage recording.

EXCAVATIONS AT COB LANE, 1980 AND 1981 (SP 034810; Birmingham SMR 02262)

Introduction

The burnt mound in Cob Lane Park (Figs 1, 2, 3) was discovered by Michael Nixon in 1950, when it was visible as a 3 metre long exposure of heat-shattered pebbles and charcoal in the right (south-east) bank of Griffins Brook (Nixon 1980, no 6). The site was selected for excavation because it was the best-preserved burnt mound in close proximity to the University of Birmingham, which is only 3km distant, and it was thus logistically convenient as both a research site and as a training excavation for undergraduates of the then Department of Ancient History and Archaeology. In addition, the stream which exposed the site was also rapidly removing it, and indeed the unexcavated part of the site adjacent to the stream has been eroded away since the excavations. The excavations were conducted in June 1980 and June 1981 over a total period of six weeks and were directed by L H Barfield and M A Hodder. In 1982 a trench for a new sewer pipe was cut through the part of the site which was not available for excavation in 1980 or 1981 because it was covered by a path in use, and the trench section was observed and recorded.

The stream section, geophysical survey and extent of excavation (Fig 4 and Pl I)

The remains visible before excavation consisted of a layer of heat-shattered stones and charcoal in the stream bank, under which a pit 0.50m wide and 0.25m deep could be seen. A layer of burnt pebbles visible in the stream bed was derived partly from the erosion of the mound by the stream and also, as was later demonstrated, by deposits remaining *in situ* in an ancient, lower stream bed. A separate patch of pebbles in area C was exposed in the stream bank about 8m

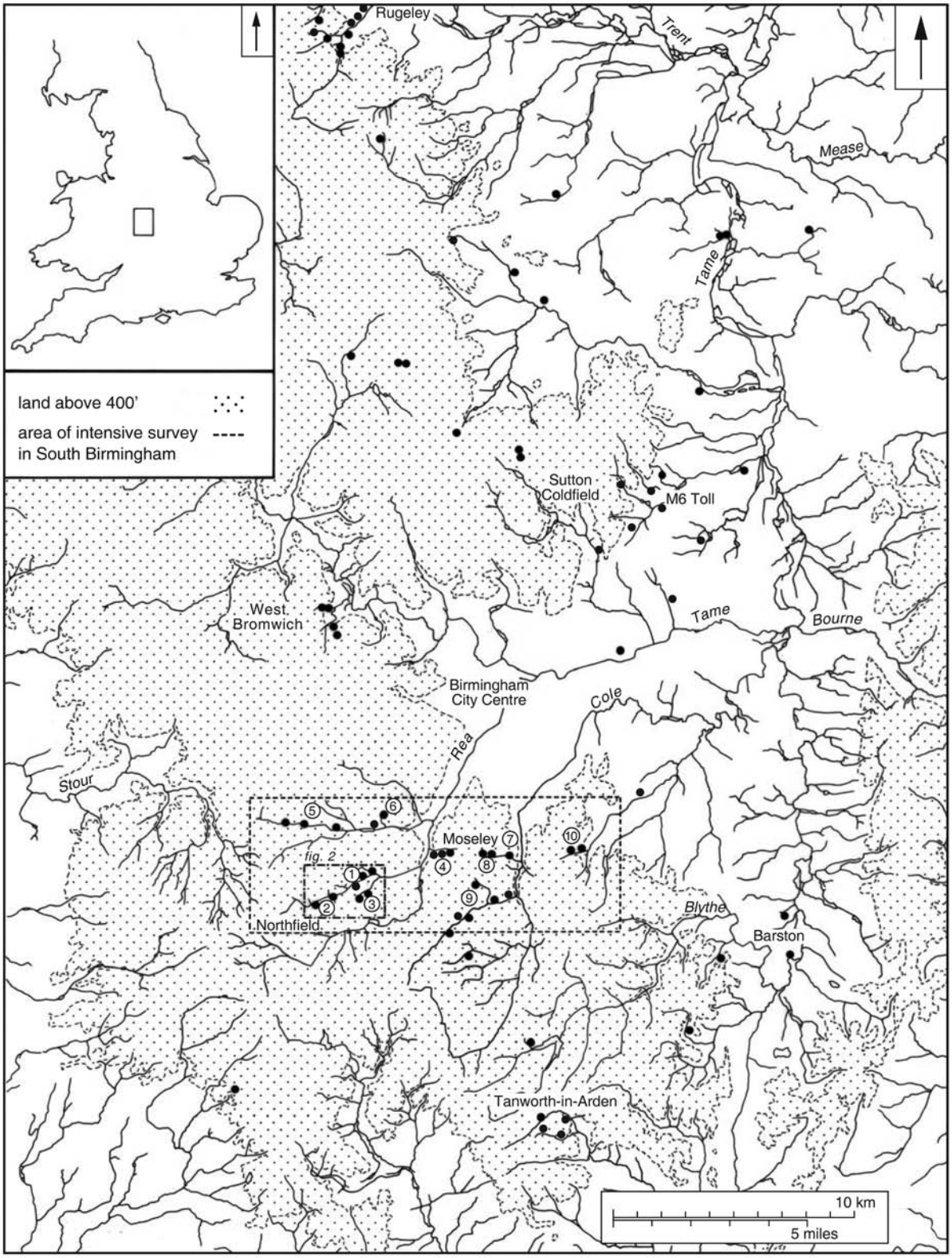

Fig 1 Burnt mounds in the Birmingham area
1 Cob Lane, Yachting Pool and Police Station; 2 Merritt's Brook (two sites); 3 Woodlands Park (two sites); 4 Highbury Park (two or three sites); 5 Bourn Brook (four sites); 6 Metchley (three sites); 7 Moseley Bog (two sites); 8 Moseley Golf Course (2 sites); 9 Chinn Brook (six sites); 10 Fox Hollies (two sites)

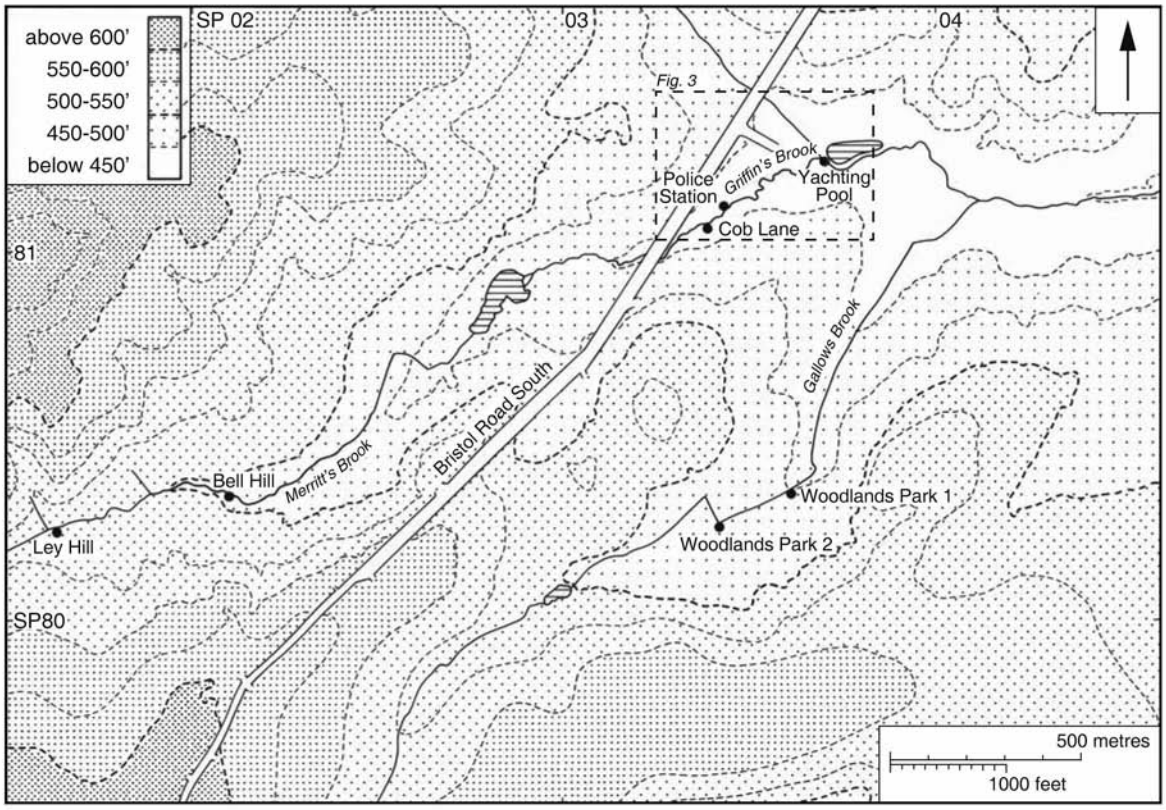

Fig 2 Burnt mounds on Merritt's Brook, Griffins Brook and Gallows Brook

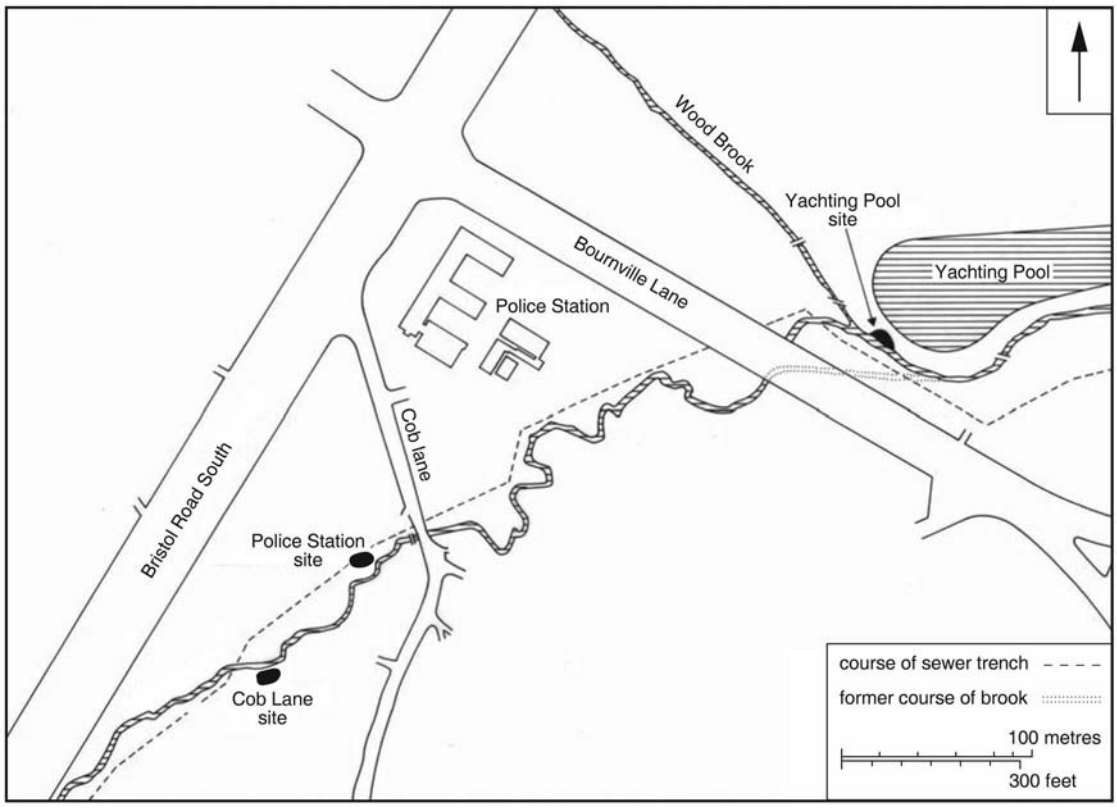

Fig 3 Cob Lane and nearby burnt mounds

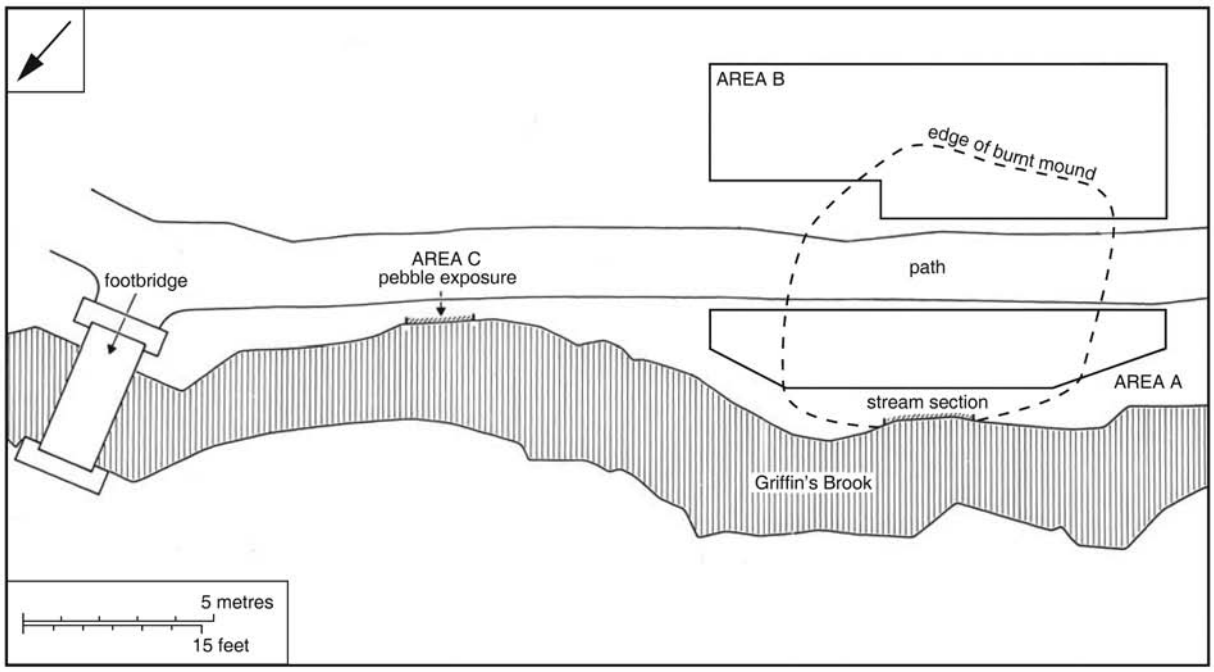

Fig 4 Cob Lane burnt mound: stream bank exposures and excavated areas

downstream of the main mound. These were stream-washed heat-shattered pebbles, without charcoal, which can be regarded either as an outlying part of the main mound or as material eroded from it by the stream and redeposited. This area was not investigated in the excavation.

Prior to the 1981 excavation, the main area of the site was surveyed using both magnetometer and resistivity equipment. Both surveys clearly revealed the extent of the mound and allowed us to predict the area that needed to be uncovered in the subsequent excavation. The resistivity survey in fact most precisely mapped the mound that was subsequently excavated. The magnetometer showed the mound while high readings near the stream may relate to the hearth and the pit subsequently located in the excavation.

Two areas were excavated: one, Area A, adjacent and parallel to the stream, and the other, Area B, to the east, separated by a substantial path. The excavation eventually uncovered a total area of 64m^2 comprising almost half the area of the surviving burnt mound. The deposits underlying the path and a narrow strip between the excavation and the stream, left to keep the excavation from flooding, were not investigated, but the stream bank section was drawn and the deposit under the path was recorded when it was cut through by a trench for a sewer pipe. The entire excavated deposit was wet sieved through a 5mm sieve to ensure maximum finds retrieval, because of the small number of finds recovered from other excavated burnt mounds and the potential of any finds to provide evidence for the mound's function.

The mound

The mound (layer 4: Figs 5, 6 and Pl I) consisted of pebbles, fragmented by heating, in a charcoal-rich matrix. It was an irregular oval measuring 8.5m x 7.5m with a spread of stones running away from it on the south-eastern side. To the north-east and the south-west it was delimited by a contemporary stream bed into which quantities of stones had slumped. The maximum thickness of the mound as excavated was 0.50m although clearly originally it had been much higher. The upper surface of the mound in Area A was markedly level, possibly the result of truncation through quarrying to obtain material for surfacing the nearby Bristol Road. The mound surface was overlain by layers that resulted from the stream flooding and contained 19th- and 20th-century pottery. A pit or posthole had been dug from the top of the mound in area A. No stratification could be detected in the mound: the only differentiation was the slightly increased clay content in the lower part of the deposit interpreted as the result of natural soil formation processes, and this directly overlay the clayey alluvium described below. A radiocarbon date of 3140 ± 90 BP, 1700–1100 cal BC (Birm1087) was obtained from wood from the lower levels of the mound (layer 4).

The mound was almost wholly composed of quartzite pebbles from glacial drift deposits which would have been obtainable from the stream bed adjoining the site. During the 1980 excavation the quantity of stones excavated was calculated by counting the number of full buckets of stones excavated from the site. A sample bucket of stones weighed 19kg. The total of 100 buckets for the excavation thus amounted to a total of 1.9 tonnes. Individual broken stones weighed from

Plate I Cob Lane burnt mound: 1981 excavations looking south-west, showing the burnt mound surface (layer 4) exposed in Area B (left) and Area A (right) and Griffins Brook (far right). Scale 2m.

between 287g and 908g with a mean of about 340g. From this it is possible to calculate that the number of stones excavated in 1980 was about 5,600. The volume of mound material excavated in 1980 was about 2.8 cubic metres and this represents about a quarter of the mound, therefore it could be suggested that the total number of stones remaining in the mound until the excavation was nearly 45,000 with a weight of nearly 8 tonnes. The number of stones originally contained in the entire mound can only be guessed at but is potentially double this amount.

Features probably contemporary with the mound (Figs 5, 6 and 7, and Pl II)

There was a series of features below the mound and cut into the underlying alluvium. Of these the only clear structural elements contemporary with the mound were in area A and consisted of a rectangular pit and an adjacent burnt hollow; both were filled with heat-shattered stones and charcoal (Pl II; Figs 6 and 7).

The surviving part of the pit, which had been truncated, was approximately 1m square and 0.40m deep and on excavation appeared to extend into the former stream bank on the west side of the mound. Originally, however, it was probably separated from the stream bank by a now eroded fourth side incorporating some kind of sluice device. The pit had vertical sides and its south wall preserved traces of carbonized timber, probably the remains of a wooden lining. There were also two successive clay 'floors' or silt layers covering the bottom, resulting from successive periods of use or possibly from deposition of material by the stream when in flood.

Immediately adjacent to the pit on its side furthest from the stream bank was a very shallow oval hollow measuring approximately 2m by 1m whose surface was reddened by fire. This was originally interpreted as a hearth hollowed into the subsoil by constant use, but experiments and reconstructions of burnt mounds as sweat lodges suggested another interpretation, as the place within a sweat lodge where hot stones were placed, scorching the ground surface (see below).

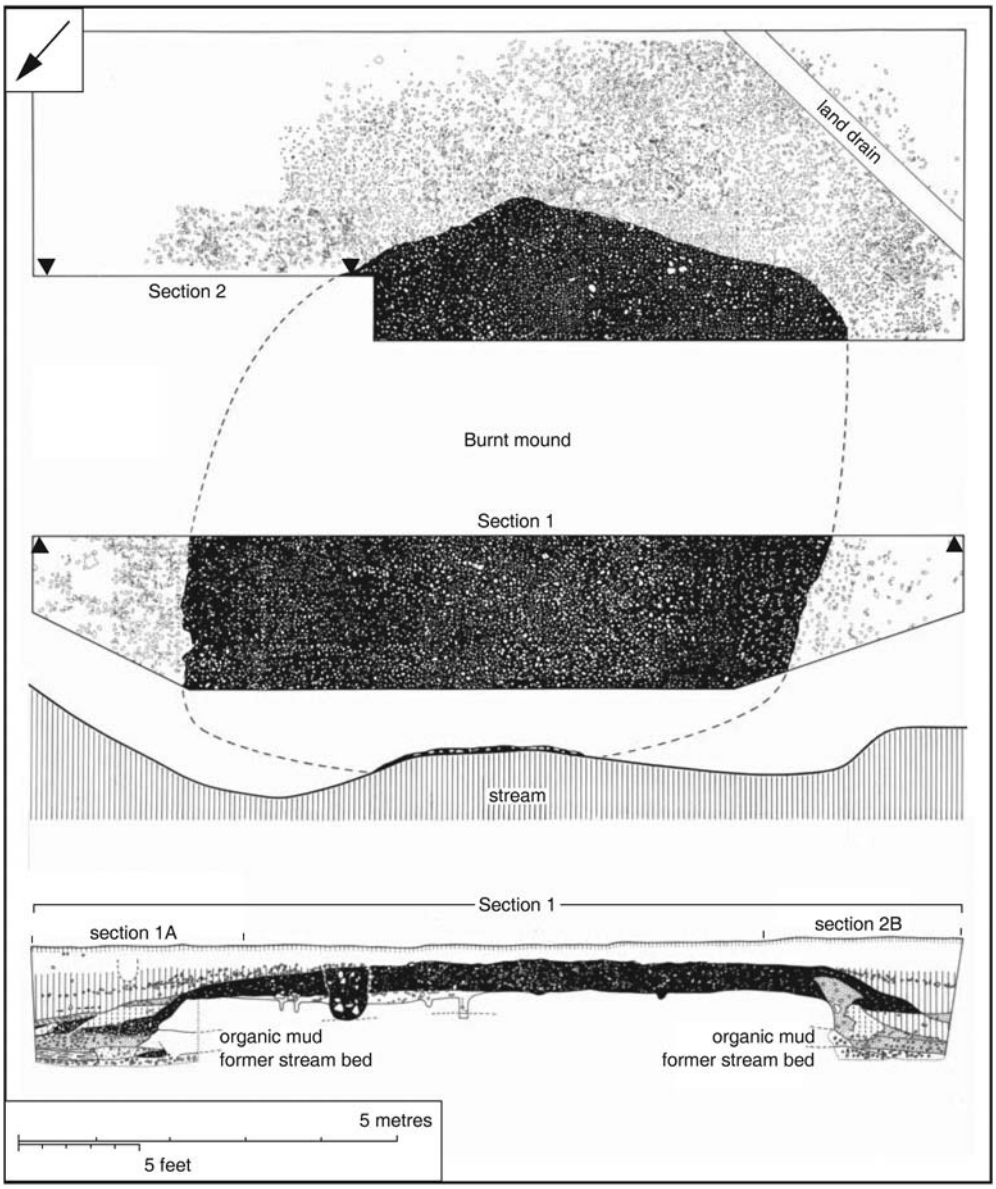

Fig 5 Cob Lane burnt mound: surface and section of mound exposed in 1980 and 1981 excavations

A second probable pit, 0.25m deep and 0.50m wide, was visible in the stream section (Fig 7) but could not be further excavated owing to the flooding from the stream. One posthole and several stake holes and root holes were also recorded on the surface below the mound in area A, but no patterns could be discerned in the stake holes and it is not possible to state for certain if they were connected with the function of the mound, but they can be interpreted as the remains of a sweat lodge (see below). No features were found under the mound in area B apart from an animal run of recent date.

The palaeochannels (Figs 5, 6 and 7; Pls III, IV and V)

During the Bronze Age the mound appears to have been located on a tight meander loop of the stream since the old stream bank was located in excavation both to the north-east and south-west of the mound, but was not seen on its south-eastern side in observation of a sewer pipe trench inserted after the excavation. The former stream bed of this loop to the west side was obscured by the modern course of the stream. It is possible of course that the loop in the stream may have been determined by the presence of the mound.

The Bronze Age stream bed (Fig 6, layer 5 on sections 1A, 1B and 2; Pls III, IV and V), *c* 0.75m below the present stream bed, also coincided with the top of a gravel deposit underlying the organic mud representing pre-mound activity (see below). The layer covering the bottom of the stream bed contained much organic debris, including tree trunks, probably derived from the organic mud in the bank and also produced the only prehistoric artefact from the site, a small flint blade of

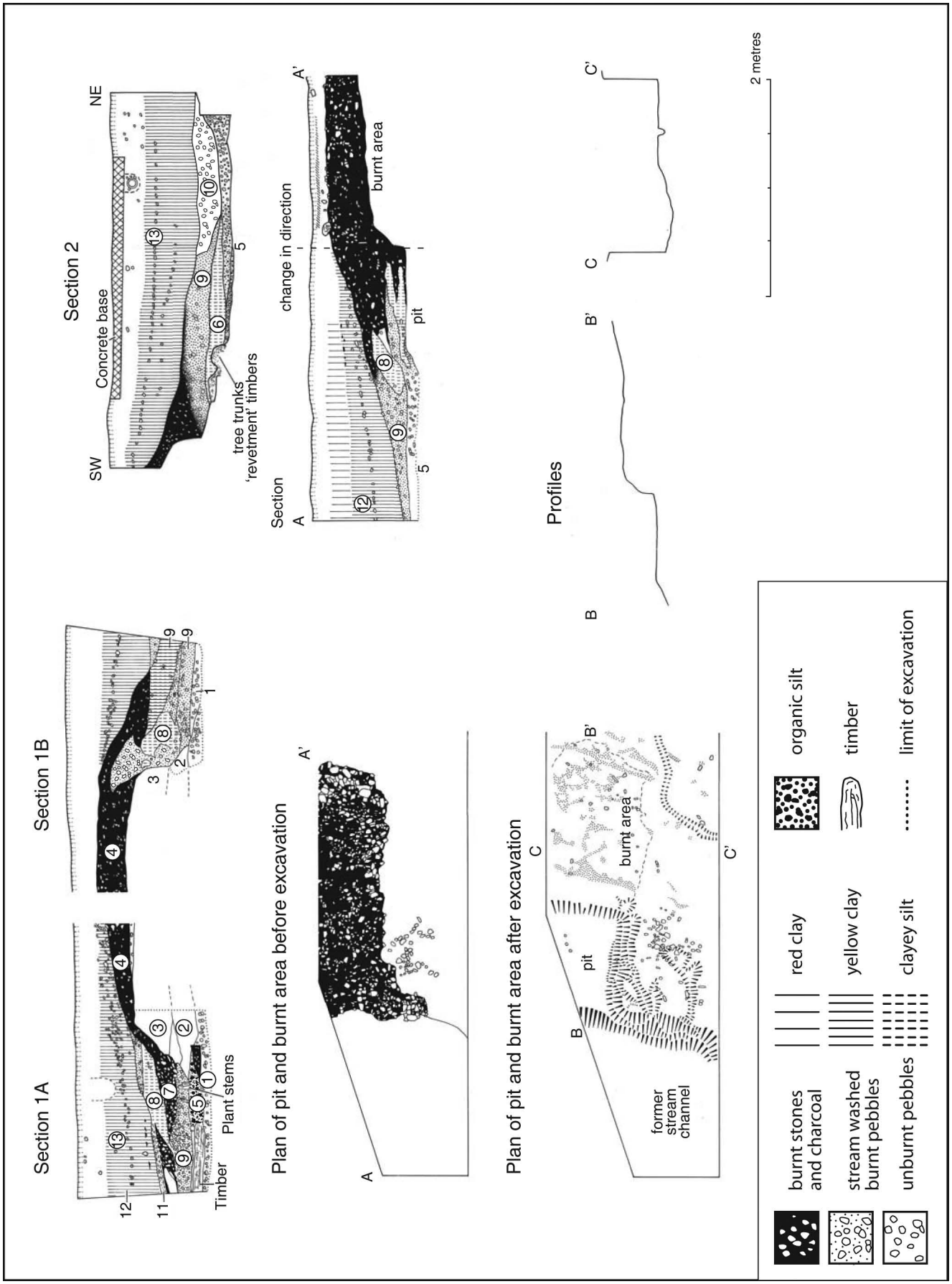

Fig 6 Cob Lane burnt mound: detailed sections. Note that Section 1B corresponds to section 2B on Fig 5

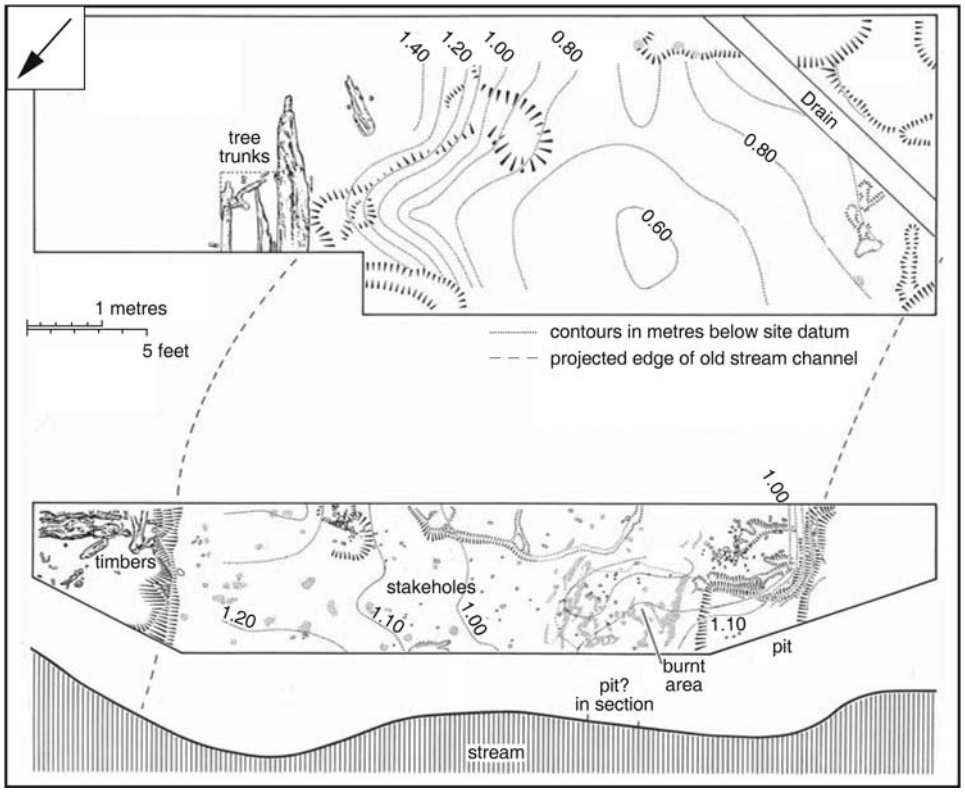

Fig 7 Cob Lane burnt mound: features below mound

Mesolithic or early Neolithic type, which may likewise have been derived from the mud.

The north-eastern river channel had narrow plant stems growing vertically through its bank of clayey alluvium (Fig 6, section 1A, and Pl III). Although the stems had initially been wrongly interpreted as a stake revetment (Barfield & Hodder 1980), substantial horizontal tree trunks embedded in layer (5) are more convincing candidates for such a structure. Two large tree trunks (one of them identified as alder) set parallel to the edge of the bank in the stream bed in area B (Fig 6, section 2; Pls IV and V) had burnt stones banked up over them and these resemble a trunk in a similar position in area A. These would have been visible when the mound was in use and do give the impression of some sort of revetment even though the timbers also resemble trunks contained in the organic mud (Fig 6, sections 1A and 1B, layer 2) running below the site. As section 1A and Pl III show, layer 2 was undercut by stream erosion.

In the section of Area B (Fig 6, section 2; Pl V) a thin layer of clayey alluvium (layer 6) covers the timbers. This layer contained a cow molar. Since this layer contains some burnt pebbles and the overlying burnt mound dump follows the contours of the wood below, it can be interpreted as a slump from the bank on to the timbers rather than a continuation of the alluvium deposit (layer 3) over the organic mud (layer 2). Above these deposits (Fig 6, sections 1A, 1B, 2) were dumps of burnt stones and charcoal which had been tipped or slipped down the bank during the life of the mound and successive layers of this deposit (7) alternated with layers of clean clayey silt (8), stream-washed burnt pebbles (9) and gravel (10). Successive dumps of burnt mound material and silt appear to have formed further out into the stream finally raising the bed of the stream (11) in the process by approximately 0.40m. The upper level in the stream bed represents a time when the stream had ceased active flow and comprises a continuous clay deposit (12) apparently formed in standing water. This process of sedimentation had been interrupted at one point by a thin scatter of burnt and unburnt pebbles (13), an event that may relate to the levelling or quarrying of the mound (see above). An iron object found in this layer may be part of a horseshoe suggesting a relatively recent date. Nineteenth-century debris, probably worm sorted, covered the surface of layer 12 in the stream channel as well as the surface of the burnt mound (layer 4).

Pre-mound stratigraphy (Fig 6, sections 1A and 1B; Pl III)

Cutting back the banks of the buried stream channels at both ends of the site revealed evidence of the geomorphological development of the site prior to the formation of the burnt mound. A gravel deposit (layer 1) underlay the site at a depth of 1.45m below the present ground surface. Above the gravel was a layer of organic mud (layer 2), 0.25 to 0.30m deep, containing tree trunks, branches, large numbers of hazelnut shells and beetle remains. This deposit also

Plate II Cob Lane burnt mound: pit and burnt hollow near former stream bank at south-west end of Area A, looking west. Scale 1m.

contained a sheep or goat bone, one of two animal bones from the prehistoric levels of the excavation. A radiocarbon date of 3120 ± 70 BP, 1530–1210 cal BC (Birm 1143) was obtained from hazelnut shells in the organic mud.

Above the horizon of organic mud lay a clean uniform layer of white to orange clayey alluvial silt (layer 3) some 0.45 m thick. In area B the surface of this alluvial silt rose towards the middle to a height of *c* 0.60m above the surrounding surface (Fig 5) suggesting that a natural rise in the floodplain had been selected for the burnt mound.

The course of the stream at the time of the formation of the organic mud is uncertain but by the time the burnt mound was created the stream must have flowed quite close to its present course, although in a much tighter loop, which went further east but no further north than its present course: the mound was not visible in the opposite stream bank.

Finds

The only find associated with the burnt mound itself was a single animal tooth. Another bone and a flint were associated with deposits underlying the mound, together with plant and beetle remains. An iron object and 19th-century pottery overlying the mound are not described here.

FLINT, *by L H Barfield*

The distal end of a blade of flint with a trapezoidal cross section, 1cm in width. Dark brown to black flint with grey mottling. Marginal edge damage is present and it is clear that the blade has been snapped. The competent blade technology suggests a Mesolithic or early Neolithic date for this piece. It was found on the surface of the gravel in the Bronze Age stream bed (layer 1), into which it was possibly washed from the organic mud (layer 2) or earlier deposits.

Plate III Cob Lane burnt mound: former stream channel on north-east side of mound, as shown in section 1A. Scale 2m.

ANIMAL BONES, *by G W W Barker (Department of Archaeology, University of Cambridge)*

1. From lower organic mud deposit (layer 2). Sheep/goat (probably sheep), first phalange, proximal and distal epiphyses both fused therefore not a young individual.
2. From alluvium layer overlying 'revetment' in area B (layer 6). Cow, first or second upper molar, from an individual older than 6 months. Burnt.

Radiocarbon dates

Two radiocarbon dates were obtained from the site, both of them by conventional radiometric dating from bulk samples. They have been calibrated with Oxcal V3.9

Birm 1143: From hazel nut shells in the pre mound organic mud (layer 2)

3120 ± 70 BP 1530–1210 cal BC

Birm 1087: From unidentified wood from the lower levels of the mound (layer 4)

3140 ± 90 BP 1700–1100 cal BC

These dates suggest that little time elapsed between the deposition of organic mud underlying the mound and the accumulation of the mound itself.

In addition, a thermoluminescence date of *c* 1300 BC was obtained from a burnt stone from the burnt mound deposit. The site archive does not give a source for this.

Dendrochronology

by Ruth A Morgan (formerly Department of Archaeology and Prehistory, the University of Sheffield)

Four wood samples were submitted for potential tree-ring dating (Table 1). One of the timbers was possibly revetment material associated with the burnt mound at Cob Lane, while the other three were recovered during salvage recording of the Police Station burnt mound (see below) from an organic layer underlying the burnt mound.

Plate IV Cob Lane burnt mound: tree trunks on north-east side of mound, Area B. Scale 1m.

Thin slices of the tree-trunks were cut and deep-frozen for cleaning of the transverse surface. This indicated the possible revetment timber to be alder (*Alnus glutinosa* Gaertn), and the three other trunks to be oak (*Quercus* spp). Annual ring widths were recorded on two trunks (Table 1), both exceeding 100 years; they were measured on a Bannister incremental measuring machine linked to an Apple microcomputer, on which cross-matching could also be carried out (Morgan 1988; Baillie 1982).

Growth patterns were compared with each other, and with available data from the second millennium BC from which the trunks are thought to date. These include long oak chronologies for Ireland and for central Germany (Pilcher *et al* 1984), and floating chronologies such as those from the Meare Heath and Tinney's trackways in the Somerset Levels (Morgan 1988). No correlation was found between the two trees, nor with the reference chronologies with the exception of a possible match of timber 1 from the Police Station site with the Irish chronology in the 13th century BC which could not be confirmed. The narrow growth rings in the oak indicates that the trees were growing in less than satisfactory conditions, like the Irish bog oaks.

Table 1 Details of the wood samples analysed for dendrochronology from the Cob Lane and Police Station excavation

Sample No	No of growth rings	Dimensions of section mm
Cob Lane		
1. Alder	? wide rings	290 x 200
Police Station		
1 Oak	116 *	180 x 100
2 Oak	51	140 x 35
3 Oak	105 * + *c* 40	190 x 130

* rings measured – average width 0.7mm

Charcoal and waterlogged wood lower case

by Rowena Gale

INTRODUCTION

Twenty-seven bags of charcoal from the burnt mound and seven bags of waterlogged wood from an area pre-

Plate V Cob Lane burnt mound: detail of tree trunks in Area B, as shown in section 2. Scales 1m and 2m.

dating the mound were submitted for species identification. Identification was undertaken to indicate the character of woodland in the local environment and the selection of fuel to heat the stones.

PREPARATION AND EXAMINATION

Where contexts were represented by multiple samples of charcoal a single sample was selected for examination, thereby reducing the number to thirteen.

Waterlogged wood samples mainly consisted of narrow cylinders of bark from which the wood had decomposed and larger fragments of bark from more mature wood. Wood fragments were rare but hazel nutshells were frequent. Five of the seven samples were desiccated and structurally collapsed. Up to three fragments were selected from each sample for examination.

The samples were prepared using standard methods (Gale & Cutler 2000). Anatomical structures were examined using incident and transmitted light on a Nikon Labophot-2 compound microscope at magnifications up to x400 and matched to prepared reference slides of modern wood.

RESULTS

The taxa identified are presented in Table 2. Classification follows that of *Flora Europaea* (Tutin, Heywood *et al* 1964–80). Group names are given when anatomical differences between related genera are too slight to allow secure identification to genus level. These include members of the Pomoideae (*Crataegus, Malus, Pyrus* and *Sorbus*), and Salicaceae (*Salix* and *Populus*). When a genus is represented by a single species in the British flora, it is named as the most likely origin of the wood, given the provenance and period, but it should be noted that it is rarely possible to name individual species from wood features and exotic species of trees and shrubs were introduced to Britain from an early period (Godwin 1956; Mitchell 1974). The anatomical structure of the charcoal/ wood was consistent with the following taxa or groups of taxa:

Betulaceae. *Alnus glutinosa* (L.) Gaertner, European alder

Table 2 Cob Lane burnt mound: charcoal and wood

Key: X = present; XX = predominant

Sample	*Alnus*	*Corylus*	*Frangula*	Pomoideae	*Prunus*	*Quercus*	Salicaceae	Bark
Charcoal								
Stream bed contemporary with burnt mound(layer 5)								
BV81/22	X	X	-	-	-	X	X	XX
Lower part of burnt mound (layer 4)								
BV80/47	XX	-	-	X	-	X	X	X (unburnt)
Organic mud containing hazel nutshell and beetles, separated from the burnt mound by a layer of alluvium or colluvium but producing a radiocarbon date virtually identical to that from the burnt mound (layer 2)								
BV81/66	X	-	X	-	-	-	-	XX
BV81/67	XX	-	X	X	X	X	-	X
Fill of oval heat-reddened hollow under mound and adjoining pit on former stream bank								
BV81/92	XX	-	-	X	X	X	-	-
Lowest part of burnt mound(layer 4)								
BV81/ A106	-	-	-	-	-	*cf.* X	-	-
Fill of pit on former stream bank adjoining oval hollow								
BV81/107	XX	-	-	X	X	X	-	-
BV81/108	X	-	-	-	-	-	-	-
Spread of burnt mound material into contemporary stream channel (layer 7)								
BV81/109	XX	-	-	X	-	X	-	X (some unburnt)
Fill of pit on former stream bank adjoining oval hollow								
BV81/A113	XX	-	-	-	-	X	-	X
Possible animal burrow under burnt mound								
BV81/B124	XX	-	-	X	-	X	-	X
Spread of burnt mound material into contemporary stream channel (layer 7)								
BV81/A133-134	X	-	-	-	-	-	-	X (some unburnt)
Spread of burnt mound material into contemporary stream channel (layer 7)								
BV81/A135	X	-	X	-	-	X	-	-
Waterlogged wood								
Organic mud containing hazel nutshell and beetles, separated from the burnt mound by a layer of alluvium or colluvium but producing a radiocarbon date virtually identical to that from the burnt mound (layer 2)								
BV80/A67	X	nutshell	-	-	-	-	-	X
BV81/141	-	X	-	-	-	-	-	-
Spread of burnt mound material into contemporary stream channel (layer 7)								
BV81/A66	-	-	-	-	-	-	-	X
BV81/66	X	-	-	-	-	-	-	-
Fill of former stream								
BV81/20	X	-	-	-	-	-	-	-

Corylaceae. *Corylus avellana* L., hazel

Fagaceae. *Quercus* sp., oak

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, which includes *Prunus spinosa* L., blackthorn; *P. padus* L .; bird cherry; and *P. avium* L., cherry. It was not possible to distinguish which species was present in the charcoal.

Salicaceae. *Salix* sp., willow, and/or *Populus* sp., poplar. In most respects these taxa are anatomically similar.

DISCUSSION

Woody vegetation of the area

Evidence from the charcoal and waterlogged wood suggests that in the Bronze Age the immediate vicinity of the stream and burnt mound was colonized with wetland species including alder, willow and alder buckthorn. Drier soils supported woodland including oak and probably hawthorns and blackthorn.

Pre-mound

Uncarbonized wood pre-dating the mound included alder and hazel and it is probable that this material represents fallen debris from local trees. The abundance of hazel nutshells suggests that the stream was not overhung with dense woodland (hazel requires adequate light to flower and fruit).

The burnt mound deposit

The greater diversity of taxa in the fuel debris from the burnt mound almost certainly reflects species selection associated with heating the stones. Wetland species, particularly alder, predominated in the samples suggesting that much of the fuel was gathered very locally, whereas oak, the hawthorn group and *Prunus* probably grew on drier land nearby.

Selection of fuel

It was not possible to establish whether the stones were heated using firewood or charcoal. Charcoal would have provided the most efficient heat source but would have introduced an additional (and lengthy) process in its production. The use of firewood therefore seems more likely.

Compared to oak, wetland species such as alder and willow make low-grade firewood and although alder appears to have dominated in the fuel debris this may be related to availability/ access rather than preference. The combination of oak and alder evidently provided an adequate heat source for activities at the mound site.

Evidence of woodland management was inconclusive. The considerable size of the burnt mound suggests either that the site was used over some long period or that activities occurred frequently over a shorter time-span. If the latter, demands on local woodland may have been sufficient to require some form of management to ensure a continuous supply of firewood. If, however, the site was used relatively infrequently local woodland would have undergone natural regeneration.

Environmental deductions from beetle fauna from beneath burnt pebble mound

by P J Osborne (formerly Department of Geological Sciences, University of Birmingham) (Report written in 1985)

The deposit from which these beetles were recovered consisted of plant debris mixed with coarse sand in roughly equal proportions. It lay beneath the burnt pebble mound but separated from it by a thin layer of yellow silt (see Fig 1) and so clearly pre-dates it. The radiocarbon dates (see above) indicate that the time which elapsed between the deposit of the beetle layer and accumulation of the pebble mound was very short. The environment suggested by the beetles in the lower deposit is therefore likely to be the one in which the burnt mound accumulated.

The beetles listed (Table 3) were almost all recovered from layer 2 (see Fig 6). Layer 5 consisted of similar material but with an admixture of burnt pebbles which had presumably slipped down the stream bank. The beetles from layer 5 were almost identical with those from 2 so have not been listed, the few species which occurred in 5 but not in 2 have been added to the list, marked with an asterisk (*). Nomenclature follows Kloet and Hinks (1973) and the numbers given are the minimum number of individuals required to account for the skeletal parts recovered.

THE ENVIRONMENT OF THE COLEOPTERA

All the species recorded from this deposit are still to be found in Britain today and almost all could probably be found in suitable habitats in the West Midlands. It is unlikely, therefore, that the climate of the time was greatly different from that of the present day.

A number of aquatic species was recorded of which the majority were indicative of running water. These include *Platambus maculatus*, *Hydraena britteni*, *H. gracilis*, *Elmis aeneus, Esolus parallelopipedus* and *Limnius volckmari*, at least 66 individuals altogether. In addition the staphylinid *Dianous coerulescens* occurred, a species usually found in wet moss beside rapids and waterfalls. The species which require still or slowly

Table 3 Cob Lane burnt mound: Coleoptera species list

(* = species occurring in layer 5 but not in layer 2)

Carabidae	
Carabus granulatus L.	1
Carabus problematicus Hbst	1
Loricera pilicornis (F.)	1
Clivina prob. fossor (L.)	2
Patrobus atrorufus (Strom.)	1
Trechus obtusus Er or quadristriatus (Schr.)	3
Trechus secalis (Pk.)	1
Trechus sp.	5
Bembidion stomoides Dej	3
Bembidion ?tibiale (Dufts.)	1
Bembidion harpaloides Serv.	1
Bembidion guttula (F.)	3
Pterostichus madidis (F.)	1
Pterostichus melanarius (ILL)	1
Pterostichus minor (Gyll.)	1
Pterostichus niger (Schall)	3
Pterostichus nigrita (Pk)	5
Pterostichus oblongopunctatus (F.)	3
Pterostichus strenuus (Pz.)	5
Abax parallelepipedus (Pill. et Mitt)	3
Agonum albipes (F.)	1
Agonum assimle (Pk.)	1
Dytiscidae	
Platambus maculatus (L.)	2
Agabus bipustulatus (L.)	1
Gyrinidae	
Orectochilus villosus (Mull.)	1
Hydrophilidse	
Cercyon sp.	1
Megasternun obscurum (Marsh.)	14
Hydrobius fuscipes (L.)	1
Hydraenidae	
Ochthebius sp.	1
Hydraena britteni Joy	5
Hydraena gracilis Germ.	10
Hydraena riparia Kug.	1
Limnebius truncatellus (Thunb.)	4
Limnebius ?truncatellus (Thunb.)	5
Ptiliidae	
Acrotrichis sp.	1
Leiodidae	
Agathidium atrum (Pk.)	3
Agathidium laevigatum Er.	2
Silphidae	
Necrophorus sp.	1
Silpha atrata L.	4
Scydmaenidae	
Neuraphes sp.	2
Stenichnus sp.	1
Staphylinidae	
Micropeplus fulvus Er. or *Straphylinoides* (Marsh.)	1
Anthobium ?atrocephalum (Gyll.)	3
Olophrum fuscum (Gr.)	1
Olophrum piceum (Gyll.)	2
Acidota cruentata Mannh.	1
Lesteva herri Fauvel	7
Lesteva punctata Er.	6
Carpelimus sp.	1
Anotylus rugosus (F.)	8
Stenus spp.	5
Dianous coerulescens (Gyll.)	1
Lathrobium terminatum Gr.	2
Lathrobium spp.	5
Xantholinus linearis (Ol.) or *longiventris* Heer	1
Quedius sp.	2
Tachinus sp.	4
Alaeocharinae indet.	1
Pselaphidae	
**Batrisodes venustus* (Reich.)	1
Bryaxis	4
Lucanidae	
**Sinodendron cylindricum* (L.)	1
Geotrupidae	
Geotrupes sp. (p?)	12
Scarabaeidae	
Aphodius spp.	5
Serica brunnea (L.)	3
Dascillidae	
Dascillus cervinus (L.)	1
Byrrhidae	
Simplocaria semistriata (F.)	1
Dryopidae	
Dryops sp.	7
Elmidae	
Elmis aenea (Mull.)	20
Esolus parallelopipedus (Mull.)	4
Limnius volckmari (Pz.)	25
Buprestidae	
Agrilus sp.	1
Elateridae	
Salatosomus bipustulatus (L.)	1
**Dalopius marginatus* (L.)	1
Denticollis linearis (L.)	1
Throscidae	
Trixagus dermestoides (L.)	2
Cantharidae	
Rhagonycha sp.	2
Anobiidae	
Ochina ptinoides (Marsh.)	2
Ptinidae	
Ptinus ?fur (L)	1
Melyridae	
Dasytes aeratus Steph.	1
Rhizophagidae	
Rhizophagus sp.	4

Table 3 Cob Lane burnt mound: Coleoptera species list (continued)

Cryptophagidae	
Cryptophagus sp.	1
Cerylonidae	
Cerylon fagi Bris	1
Cerylon histeroides (F.)	3
Cerambycidae	
Grammoptera ruficornis (F.)	1
Pogonocherus hispidus (L.)	1
Chrysomelidae	
Plateumaris sp.	1
Chrysomela aenea L.	2
**Chaetocnema* sp.	1
Attelabidae	
Deporaus betulae (L.)	1
Curculionidae	
Phyllobius spp.	3
Sciaphilus asperatus (Bonsd.)	3
Strophosomus sp.	5
Liophloeus tessulatus (Mull.)	1
Leiosoma sp.	2
Eremotes sp. (sens. lat.)	2
Trachodes hispidus (L.)	4
Acalles ?ptinodes (Marsh.)	2
*Ceutorhynchus sp.	1
Scolytidae	
Scolytus sp.	1
Hylesinus crenatus (F.)	1
Leperesinus varus (F.)	2
Dryocoetinus villosus (F.)	1
Ernoporus caucasicus Lind.	4
The Shield Bug, Pentatoma rufipes and the Alder Fly, Sialis were also recorded.	

moving water, such as *Agabus bipustulatus*, *Hydrobius fuscipes* and *Hydraena riparia,* account for less than half a dozen individuals and could well have all been washed in from some distance. According to the beetle evidence, then, Griffins Brook at this time was flowing rapidly, probably over a bottom free from mud or silt but consisting of stones, gravel and coarse sand. This would agree with the lithological evidence as the sampled material consisted chiefly of coarse sand which was overlying gravel, the plant fraction having the appearance of flood refuse. The beetles show little evidence of aquatic vegetation apart from algae coating stones.

The terrestrial fauna was derived from the terrain through which the stream was flowing so, not surprisingly, a number of the species are typically found in waterside habitats. Amongst the Carabidae, *Loricera pilicornis*, *Bembidion stomoides*, *B. guttula*, *Pterostichus minor*, *P. nigrita* and *Agonum albipes* are all consistently found in the proximity of water, as well as the staphylinid *Dianous coerulescens* already mentioned.

The greater part of the non-aquatic fauna, however, was presumably culled from habitats through which the stream was flowing but not necessarily from the stream banks. The environment best represented amongst these seems to be woodland. Amongst the predaceous Carabidae, *Pterostichus oblongopunctatus* is an unequivocal forest species while *Pterostichus strenuus*, *Agonum assimile* and *Patrobus atrorufus* are usually found in woodland. Members of the Leiodid genus *Agathidium* are found on tree fungi while the pselaphid *Batrisodes venustus*, a considerable rarity nowadays, is found in rotten wood and under bark, frequently with the ant *Lasius fuliginosus*. *Sinodendron cylindricum* spends its larval life in rotting logs of deciduous trees, members of the genus *Agrilus* are woodborers as larvae, and two of the Elaterids, *Selatosomus bipustulatus* and *Denticollis linearis,* live in decaying wood. *Cerylon fagi* and *C. histeroides* and nearly all *Rhizophagus* species are found under the bark of dead wood and both the species of cerambycid recorded are woodborers in their larval stages. Amongst the phytophagous chrysomelids and curculionids *Chrysomela aenea lives* on alder (*Alnus*) and *Liophloeus tessulatus* is associated with ivy (*Hedera*), which is also the host plant of the anobiid *Ochina ptinoides*. *Trachodes hispidus* and *Acalles ptinoides* pass their larval lives in dead branches on the floor of woodland and members of the genus *Eremotes* are woodborers in various trees. All the scolytids recorded live in wood of deciduous trees, *Hylesinus crenatus* and *Leperesinus varius* principally in ash (*Fraxinus*), *Dryocoetinus villosus* in oak (*Quercus*) and *Ernoporus caucasicus* in lime (*Tilia*).

Despite this plethora of species requiring wood in some form not all the beetles recorded are dense forest species. Many, such as *Carabus granulatus*, *Pterostichus niger*, *Abax parallelopipedus, Dascillus cervinus, Dalopius marginatus, Dasytes aeratus, Grammoptera ruficornis, Sciaphilus asperatus* and *Deporaus betulae,* are more often found in woodland which is open enough to permit the growth of a ground layer of herbs and shrubs. A few species, for example *Clivina fossor, Trechus obtusus/quadristriatus, Pterostichus madidus* and *P. melanarius*, are not at all associated with woodland but are typical of open ground with only short vegetation, while dung beetles, usually associated with grassland, were also present. Unfortunately the members of the genus *Geotrupes*, of which fragments from at least twelve individuals were recovered, were not named to species level. Although most *Geotrupes* species are found in open pasture land some live in light woodland so their evidence is inconclusive. Most species of the genus *Aphodius*, too, live in the dung of grazing animals, and *Anotylus rugosus*, though not exclusively connected with dung, is most often found in this pabulum.

From this mosaic of pieces of evidence, therefore it is suggested that the environment in which the people

responsible for the burnt pebble mounds were living, or into which they migrated, was primarily open woodland with a shrub layer and ground herbage. There would have been copious leaf litter and probably moss on the ground. Open ground probably existed at places on the banks of the stream and there may have been places for watering livestock in the vicinity. Grazing land was to be found somewhere not too far away. The stream itself, the present-day Griffins Brook, was clear and running over a gravelly or sand bed with little evidence of mud or silt accumulation in the immediate neighbourhood, although quieter water was available somewhere not too distant. The climate seems to have been quite similar to that of the present day.

ENVIRONMENTAL IMPLICATIONS OF THE CADDIS FLIES (TRICHOPTERA) FROM BENEATH THE BURNT PEBBLE MOUND

by Bridget Wilkinson (report written in 1985) (Table 4)

Remains of Caddis larvae were plentiful in the material sampled for beetles. As with the beetles, the majority described here come from layer 2, with a few additions from layer 5, these being indicated by an asterisk (*). The figures are the lowest number of individuals of each species represented by the fragments recovered. Classification in the species list follows that of Limnofauna Europaea (Illies 1978).

Amongst this assemblage it is noticeable that the species represented by numbers of individuals in double figures, *Drusus annulatus, Potamophylaxc cf. latipennis, Chaetopteryx cf villosa, Silo pallipes, Sericostoma personatum* and *Odontocerum albicorne*, all live in similar situations. All are found in small streams running over stones or gravel. Other, less well-represented species, also share this preference and these include *Rhyacophila dorsalis, Polycentropus irroratus, Goera pilosa, Silo nigricornis* and *Lasio cephala basalis*. Some of these, analogous to the beetle *Dianous coerulescens*, have a preference for rapids while others simply require a fast flow of water, but all require clean water and a bottom free from mud and silt. A minority of the individuals recorded, perhaps seven to eight, are usually found in more slowly moving water, such as rivers and lake margins. Amongst these are *Cyrnus trimaculatus, Hydropsyche pellucidula* and *Brachycentrus subnubilus*.

The environment most strongly indicated, therefore, is a small rapidly flowing stream running over a stoney bed, but with calmer stretches somewhere not far away. The fact that most of these species would be inhibited by large fluctuations in water temperature suggests that the stream was shaded by overhanging trees. This idea is given support by the presence of a number (eight) of specimens of *Lype reducta* which lives on submerged rotten sticks. A break in the overhanging canopy somewhere nearby is, however, suggested by the occurrence of *Hydropsyche angustipennis*. This species has a preference for warm or organically polluted water. As pollution would affect the whole water body for some distance, and is contra-indicated by all the rest of the fauna, it would seem that a stretch of water with locally raised temperature due to continuous exposure to the sun is more probable.

Finally, the single example of *Beraea pullata* must be presumed to have been washed in from some distance, also. The larva of *B. Pullata* is semi-aquatic, living amongst wet plant detritus at the water's margin.

Table 4 Cob Lane burnt mound: Trichoptera species list

(* = species occurring in layer 5 but not in layer 2)

Rhyacophilidae	
Rhyacophila sp. (*dorsalis* group)	3
Glossomatidae	
Agapetus sp.	1
Hydropsychidae	
**Hydropsyche augustipennis* Curtis	2
Hydropsyche pellucidula Curtis	2
Hydropsyche siltalai Dohler	1
Polycentropodidae	
Polycentropus irroratus Curtis	2
Cyrnus trimaculatus Curtis	1
Psychomyidae	
Lype cf *reducta* Hagen	8
**Tinodes* sp.	1
Brachycentridae	
Brachycentrus subnubilus Curtis	4
Limnephilidae	
Drusus annulatus Steph.	14
Potamophylax cf. *latipennis* Curtis	10
Cf. *Halesus* sp.	4
Chartoperyx cf. *villosa* F.	13
Goeridae	
**Goera pilosa* F.	1
Silo nigricoris Pictet	2
Silo pallipes F.	14
Lepidostomatidae	
Lasio cephala basalis Kol.	1
Seriocostomatidae	
Seriocostoma personatum K. & Sp.	21
Beraeidae	
Beraea pullata Curtis	1
Odontoceridae	
Odontocerum albocorne Scop.	14

Finally, the single example of *Beraea pullata* must be presumed to have been washed in from some distance, also. The larva of *B. Pullata* is semi-aquatic, living amongst wet plant detritus at the water's margin.

SUMMARY OF THE EVIDENCE PROVIDED BY THE INSECTS ON THE ENVIRONMENT, *by P J Osborne and Bridget Wilkinson*

These two aspects of the fauna, investigated separately, show surprising unanimity in their environmental

implications. Both suggest a clear stream with a stony or gravel bottom running rapidly through woodland. There is evidence from each fauna for more slowly moving water somewhere about but in neither case is this evidence strong enough to suggest that still or slowly flowing water was the principal habitat, or anything other than a minor one or one at a considerable distance. Again, both insect groups suggest that although the stream was overhung by trees open, unshaded stretches were to be found.

Members of other insect orders were very sparse but, such as they were, their evidence did not conflict with that from the beetles and caddis flies. The shield bug, *Pentatoma rufipes*, is usually found in open woodland or hedgerows and the alder fly, *Sialis*, is aquatic as a larva. As it usually lives in mud at the bottom of slowly moving water *Sialis* must belong with the minority group of beetles and caddises which represent this habitat.

pH and phosphorous analysis

Because of the paucity of finds, particularly animal bone which might support interpretation of burnt mounds as debris from a cooking process, pH and phosphate measurements were taken at the Cob Lane and Woodlands Park A (see below) sites by Andrew Moss and Rebecca Roseff to determine whether burnt or unburnt bone might be present at the sites and whether soil acidity might preclude its preservation (Moss & Roseff n.d.). At Cob Lane the background pH values ranged from 4.9 to 7.4, but were mainly in the range of 5.5 to 5.6, and those in the burnt mound deposit ranged from 6.9 to 7.2. At Woodlands Park A, the back ground pH values ranged from 5.8 to 7.2, and those in the burnt mound deposit ranged from 4.8 to 6.3. The Cob Lane pH values, neutral to basic, would not preclude preservation of bone and do not therefore explain for its absence, but the conditions at Woodlands Park A are acidic enough to decompose bone. The mean phosphorous values for the Cob Lane background and mound were 763 µg/g and 633 µg/g respectively and at Woodlands Park A these values were 1477 µg/g and 750 µg/g. These values show no evidence for the presence of bone on either site. If burnt bone was present then combustion must have been complete.

OTHER BURNT MOUNDS IN SOUTH BIRMINGHAM

Griffins Brook, tributary of River Rea (Figs 1, 2, 3)

(ORIGINALLY WOOD BROOK): YACHTING POOL, BOURNVILLE LANE (SP 0368 7120; West Midland Burnt Mound Survey No 7; Birmingham SMR 02883)

This site was found by Michael Nixon in 1953, when it was visible as a layer of burnt stones and charcoal up to 0.50m thick and exposed for 6m along the north bank of Griffins Brook (Nixon 1980, no 7), 400m downstream from the Cob Lane site, but it was originally on Wood Brook prior to the re-routing of Griffins Brook about 1920 (Figs 2, 3). A sample of charcoal from the stream section was dated to 2960 ± 140 BP, 1500–800 cal BC (Birm-697). Nearby, a 'black layer' approximately 0.15m thick was visible in May 1964 along the north bank of the brook, 5 to 10m north-west of the confluence of Wood Brook and the present Griffins Brook.

In 1980, during the course of the Cob Lane excavation, the exposed stream section was cleaned and drawn. The bank was subsequently revetted to prevent further erosion of the site. More of the burnt stone layer has since been observed to the west of that visible in 1980.

The lowest deposit observed in the exposure was a gravel and sand, which was overlain by a dark grey silty clay containing charcoal and wood fragments and a sandy silt with some charcoal. This was in turn overlain by an orange clayey alluvial silt, like that recorded under the Cob Lane burnt mound. The burnt mound deposit lay over the alluvium. It was 0.40m to 0.80m thick and composed of burnt quartzite pebbles and charcoal with some lumps of burnt sandstone, and was overlain by topsoil 0.20 to 0.30m thick. A scatter of burnt stones in the adjacent stream bed is probably derived from the section. It was difficult to define the limits of the mound from the section but we can ascertain that it was at least 12m in diameter since there is no evidence that pebbles in the section have been moved by stream action. A square cut into the alluvium under the burnt mound deposit, 0.30m wide in section and filled with burnt stones, was probably part of a pit. Another possible pit was observed. A wooden stake, 0.5m in diameter, emerged from the clayey alluvium at the level of the base of the mound and was embedded in the underlying organic deposit.

Groundworks for a new sewer pipe in the area between Griffins Brook and Bournville Lane in 2007–8 (not that shown on Fig 3, but on a similar line) revealed two features to the east of the burnt mound, neither of which were contemporary with it. A shallow hollow containing heat-shattered stones produced a radiocarbon date of 360–260 cal BC, and a small pit containing late Neolithic Grooved Ware pottery produced a radiocarbon date of 2860–2540 cal BC (Rann 2008; Ian Greig pers comm.).

POLICE STATION SITE, COB LANE (SP 034 812; West Midlands Burnt Mound Survey No 34; Birmingham SMR 20017)

This site lies 75m to the north of the Cob Lane burnt mound close to, but not on the present course of, the Griffins Brook (Figs 2, 3). It was discovered on 22 April 1982 by L H Barfield in the course of turf

stripping prior to the construction of a major sewer trench parallel to the Bristol Road. Rescue excavation and recording was carried out two days later with the help of a mechanical excavator and the site was substantially destroyed by the subsequent construction of the sewer trench on 26 April 1982.

The machine-cut trench showed that the mound was about 5m across and up to 0.60m high. The pre-mound sequence is similar to that of Cob Lane with an organic mud containing wood and tree trunks lying below a clayey alluvial silt which was here some 0.20m thick. Many large timbers were thrown up from the organic level when the sewer trench was excavated and three samples of these, all oak, were selected for dendrochronological study (above, p 25). A radiocarbon date of 3290 ± 60 BP, 1690–1440 cal BC (Birm 1149) was obtained for charcoal from the mound. Of the samples there was a possible match of timber 1 with the Irish chronology of the 13th century BC which could not be confirmed. The narrow growth rings in the oak indicate that the trees were growing in less than satisfactory conditions, like the Irish bog oaks.

No trace of this site was visible in the section of the stream less than 10m away although it is unlikely that the scatter of stones does not extend that far. The non-appearance of the stones at this point is probably due to their lying below present stream level.

Merritts Brook, tributary of River Rea (Figs 1, 2)

BELL HILL (MERRITTS BROOK 1) (SP 020804; Birmingham SMR 02884; West Midlands Burnt Mound survey no 5)

A deposit of heat-shattered stones and charcoal 0.30m thick was recorded, extending for 6m along the south bank of Merritts Brook (Nixon 1980, no 5)

LEY HILL (MERRITTS BROOK 2) (SP 01378012; Birmingham SMR 02885; West Midlands Burnt Mound survey no 4)

A deposit of heat-shattered stones and charcoal, 0.30m thick, was exposed in both banks of Merritts Brook, extending for 16m along the north bank and 7m along the south bank. A radiocarbon date of 3070 ± 100 BP, 1550–1000 cal BC (Birm 300) was obtained for charcoal from the stream section. There are possible gulleys into the stream on the north bank (Nixon 1980, no 4).

Gallows Brook, tributary of River Rea (Figs 1, 2)

WOODLANDS PARK A (SP 036 803; West Midlands Burnt Mound Survey no 35; Birmingham SMR 20061)

The site was discovered in 1982 by E F Mason and was subsequently further investigated by magnetometer and resistivity survey, through further inspection of the exposed section, through observation of a construction pit for a manhole, and excavation of a sewer pipe trench in 1997 (Spall 1998), and through observations by M Hodder following cutting back of the banks of the stream as a safety measure in December 1999. It consists of an exposure of burnt stones about 60m long in the south bank of the stream, comprising intact mound deposit for a distance of 11m and a scatter of stream-deposited pebbles extending a further 50m downstream. The maximum thickness of the mound is 0.50m and it overlies an orange alluvium. Towards the eastern end of the exposed section there may be a former stream bed: the mound deposit here is grey charcoal-free alluvium with burnt stones. There is a possible pit in the stream bank towards the east end of the mound. Following cutting back of the stream banks in 1999, the burnt mound was revealed in section on the north bank, where it had not been visible in 1982, as an exposure 20m long and up to 50cm thick, with a clear mound profile at its western end.

There is no trace of the mound on the ground surface. A magnetometer and resistivity survey was conducted adjacent to the south bank of the stream in 1982. This consisted of three transects parallel to the stream with measurements taken at metre intervals and revealed the mound as a truncated oval area extending 3m south from the stream bank. The resistivity measurements produced a somewhat clearer picture than the magnetic survey. The south-east edge of the mound was subsequently recorded in a manhole pit in 1997, showing that it extends for 7.5m south of the present stream line.

A charcoal sample extracted from the stream section produced a radiocarbon date of 3020 ± 50 BP 1410–1110 cal BC (Birm 1211).

WOODLANDS PARK B (SP 030281; West Midlands Burnt Mound Survey no 36; Birmingham SMR 20016)

This was found in 1982 by L H Barfield, only 70m upstream of Woodlands Park site A. It is a short exposure of stream-washed pebbles 3m long and only about 0.20m thick, overlain by grey alluvium and resting on orange alluvium. The mound was not visible in trenches 1m away from the stream's south bank therefore it is either under the north bank of the stream or has been largely washed away by the stream. An undated pit was recorded near the stream bank exposure (Spall 1998).

Un-named stream, tributary of River Rea, Highbury Park (Fig 1, no 4)

HIGHBURY PARK 1 (SP 068 824; West Midlands Burnt Mound Survey no 8; Birmingham SMR 02882)

A small exposure of scattered heat-shattered stones and charcoal was observed by L H Barfield beneath a land drainage pipe issuing into the south bank of the stream. Charcoal produced a radiocarbon date of 2975 ± 80 BP, 1410–970 cal BC (Birm 1099).

HIGHBURY PARK 2 (SP 066 824; West Midlands Burnt Mound Survey no 61; Birmingham SMR 20014)

M Ehrenberg observed a mound approx 13m long, 7m wide and 0.40m high, on the south bank of the stream, whose extent was clearly indicated by parching. A rectangular area on the side of the mound which was not affected by parching possibly reflected an infilled trough or pit.

HIGHBURY PARK 3 (SP 0674 8241; Birmingham SMR 20856)

M Hodder observed two parched areas, slightly raised, on the south side of the stream in July 1994. This may be a burnt mound or could be the end of a former field boundary.

Bourn Brook, tributary of River Rea (Fig 1, no 5)

RIDGACRE NEAR MOOR FARM (SP 004934; West Midlands Burnt Mound Survey no 1; Birmingham SMR 02888)

A small accumulation of large heat-shattered stones with traces of charcoal was recorded near the base of the north bank of the Bourn Brook, at a depth of about 1m. The site is now destroyed (Nixon 1980, no 1)

RIDGACRE BETWEEN MOOR END FARM AND NONSUCH FARM (SP 011834; West Midlands Burnt Mound Survey no 2; Birmingham SMR 02887)

This site was visible as heat-shattered stones in a black deposit with charcoal, 0.15m to 0.20 m thick, under 0.20 to 0.50m of reddish alluvium and loam, extending for more than 3m along the south bank of the Bourn Brook. A radiocarbon date of 3970 ± 100 BP, 2900–2100 cal BC (Birm 799) was obtained from charcoal (Nixon 1980, no 2).

CALIFORNIA, NORTHFIELD ROAD (SP 022832; West Midlands Burnt Mound Survey no 3; Birmingham SMR 02886)

A small exposure of heat-shattered stones with charcoal was recorded in the north bank of the Bourn Brook. The site is now buried (Nixon 1980, no 3).

HARBORNE RESERVOIR (SP 0339 8313; Birmingham SMR 20822)

A very clear section was visible in the north bank of Bourn Brook, consisting of a layer *c* 2.2m long and up to 0.40m thick composed of heat-shattered stones and charcoal in its lower part and heat-shattered stones in a charcoal-free matrix in its upper part, overlain by an orange-brown silty clay. The burnt mound overlies a layer of light grey clayey silt 25cm thick, which in turn overlies gravel forming the stream bed. On each side of the burnt mound, burnt stones, and burnt stones with charcoal, run into former stream channels. That on the east is *c* 2.8m across. The bases of both former channels are below existing stream level. The burnt stone deposits filling both channels are overlain by a grey-brown clayey silt. Excavations indicated that the majority of the burnt mound had been removed through stream erosion, but a number of units with palaeoenvironmental potential were recorded. The mound was within the sedimentary deposits of a river terrace. The burnt mound deposit overlay grey silt over stream gravels. Palaeoenvironmental samples were taken from sondages through floodplain materials and from the burnt mound material. Insect faunas showed both fast and slow-flowing waters in the channel deposits. Dung beetles were also found, indicating areas of grazing and open pasture (Krawiec *et al* 2008).

(TRIBUTARY OF BOURN BROOK) METCHLEY (Fig 1, no 6); SP041836; West Midlands Burnt Mound Survey no 60; Birmingham SMR 01682)

Observations and excavations during clearance works for a new psychiatric hospital revealed two or three burnt mounds and other features, including probable hearths and pits containing burnt stones, along a 75m length of a former stream course (Jones 1989; Hodder 2004, 37 and fig 17).

Coldbath Brook, tributary of River Cole (Fig 1, nos 7 and 8)

MOSELEY BOG 1 (SP 09348204 West Midlands Burnt Mound Survey no 11; Birmingham SMR 02263)

This site was discovered by L H Barfield in 1982. A measured survey in December 1997 recorded a layer of heat-shattered stones and charcoal nearly 14m long and about 0.30m thick in the north bank of the Coldbath Brook, and a thinner layer 4m long on the south bank. The heat-shattered stone deposit overlies an orange-yellow silty clay. On the south side of the stream the site survives as a low but prominent mound about 12.5m east–west and 6.5m north–south. Probing showed that this is composed of compacted stones. A small excavation adjacent to the stream revealed the burnt mound surface. On the north side of the stream heat-shattered stones are visible on a path surface and up to about 3m from the stream. There is a particular concentration to the north-east of the stream bank deposit, on a marked rise in the path which presumably reflects the mound surface. The visible remains suggest that the mound is approximately circular and about 13m in diameter. A resistivity survey in 1998 confirmed the extent of the mound on the north side of the stream and located a possible former stream channel further north.

On the south side of the stream an area of low resistance may indicate the location of a pit or trough under the mound. Charcoal from the exposed section produced a radiocarbon date of 2830 ± 80 BP, 1260–1230 (1.4%) or 1220–820 (94%) cal BC (Birm 1114).

MOSELEY BOG 2 (SP 0936 8204; Birmingham SMR 20623)

An exposure of heat-shattered stones 3.3m long and up to 0.14m thick is visible in the north bank of the stream about 11m east of the other burnt mound.

MOSELEY GOLF COURSE A (SP 085819; West Midlands Burnt Mound Survey no 31; Birmingham SMR 02264)

A small exposure of burnt stones about 3m long and 0.20m thick was found in the north bank of the stream.

MOSELEY GOLF COURSE B (SP 084819; West Midlands Burnt Mound Survey no 2; Birmingham SMR 02265)

A small exposure of burnt stones about 3m long and *c* 0.20m thick was found in the stream section on the south bank of the stream. No charcoal was noted.

Chinn Brook, tributary of River Cole (Fig 1, no 9)

BAYSTON ROAD (SP 076795; West Midlands Burnt Mound Survey no 30; Birmingham SMR 02266)

A narrow band of burnt pebbles, probably a scatter from the edge of a burnt mound, was observed by L H Barfield at the base of a humic layer overlying Mercia Mudstone, on the south side of Chinn Brook. A thermoluminescence date of *c* 1800 BC was obtained from a heat-shattered stone from this site (no reference given in archive).

WALKERS HEATH, CHINN BROOK RECREATION GROUND (SP 068789; West Midlands Burnt Mound Survey no 33; Birmingham SMR 02267)

A long exposure of burnt pebbles was observed by L H Barfield on the south east bank of Chinn Brook.

CHINN BROOK (SP 0747 7934: Birmingham SMR 20796)

M Hodder observed heat-shattered pebbles on the surface near the north bank of Chinn Brook.

HIGHFIELD ROAD (SP 09458017; West Midlands Burnt Mound Survey no 44; Birmingham SMR 20752)

An exposure of heat-shattered stones at least 2m long was observed by L H Barfield, overlying gravel and under grey silt.

PARKWAY, YARDLEY WOOD (SP 089800; West Midlands Burnt Mound Survey no 10; Birmingham SMR 02880)

A small exposure of heat-shattered stones and charcoal was observed by L H Barfield in the side of a short drainage channel issuing into the north side of Chinn Brook.

(ON SWELL BROOK, TRIBUTARY OF CHINN BROOK) BILLESLEY COMMON, HOLLIE LUCAS ROAD (SP 081 809; West Midlands Burnt Mound Survey no 9; Birmingham SMR 02881)

A low mound of heat-shattered stones and charcoal was exposed in contractors' trenches. Small-scale excavations in 1952 revealed that the burnt mound deposit measured 13m x 10 m and had an average thickness of 0.20m, rising to 0.35m. To the north-west there was a thick deposit of blackish soil filling an overlying hollow in underlying boulder clay (Nixon 1980, no 9).

Broomhall Brook, tributary of River Cole (Fig 1, no 10)

FOX HOLLIES PARK 1 (SP 125822; West Midlands Burnt Mound Survey no 13; Birmingham SMR 02878)

This site is visible as a low, firm horseshoe-shaped mound, approximately 14m x 9m and 0.20 to 0.30m high (Nixon 1980, no 13). There is a short raised bank 10m long to its east. Geophysical survey revealed other features extending up to 60m from the mound, including additional spreads of burnt stone, probable pits and hearths and former stream courses (Jones 1991). A small excavation revealed burnt stones over grey clay.

FOX HOLLIES PARK 2 (SP 121821West Midlands Burnt Mound Survey no 12; Birmingham SMR 02879)

A tiny exposure of heat-shattered stones and charcoal was observed in the stream bank (Nixon 1980. No 12).

DISCUSSION

Burnt mounds in south Birmingham and beyond: date, form, function, distribution and context

It is beyond the scope of this report to attempt an overview of all fieldwork on burnt mounds, or all discussions of them, other than to note the increasing recognition and serious consideration of burnt mounds in the years since the Cob Lane excavation, partly stimulated by alternative interpretations. Rather, this discussion concentrates on four aspects of the south Birmingham sites in comparison with other burnt mounds, particularly concentrating on those sites in other parts of the midlands and elsewhere in

lowland England: their dates, from radiocarbon, thermoluminescence or associated objects; their forms as revealed by excavation or visible as surface features, in stream banks or through geophysical survey; interpretation of their function from archaeological and ethnographic evidence and experiments; and their distribution and context in terms of contemporary settlement and land use, leading to a consideration of the particular local significance of south Birmingham's burnt mounds and directions for further research into them.

DATE

The nine radiocarbon dates obtained for burnt mounds in south Birmingham (Fig 7) exhibit a close grouping ranging from 1700 to 800 cal BC at two standard deviations, the only outlier being that from Ridgeacre, but they must be viewed with caution. At all sites except Cob Lane only one sample was submitted, and even at Cob Lane there is only one sample from the burnt mound deposit itself; all dates except those from Cob Lane and the Police Station are from stream sections rather than excavated contexts; all were from bulk samples and all except those from Cob Lane (which were from wood and hazelnuts) were from charcoal, possibly resulting in older dates from heartwood; and all dates were obtained some time ago from conventional radiometric dating of bulk samples rather than AMS and therefore lack the greater precision and smaller standard deviations now routinely expected for radiocarbon dates.

Radiocarbon dates have been obtained for other burnt mounds in the West Midlands. A burnt mound in Sandwell Valley in West Bromwich, north-west of Birmingham (Fig 1; Hewitt & Hodder 1988, 19–20), produced a similar date to the south Birmingham sites (1700–900 cal BC), but slightly earlier dates ranging from 1870–1390 cal BC were obtained from the two burnt mounds on tributaries of the River Tame, Langley Brook and Collets Brook, excavated on the line of the M6 Toll motorway on the north-east side of Birmingham (Fig 1; Fitzpatrick 2008, 506–8 and fig 215). Further afield, both the dates from Sharmer Farm near Leamington Spa (Ellis & Shotton 1973) at 1450–900 cal BC, that from Rodway in Shropshire (1312–1168 cal BC) (Hannaford 1999), that from Cox Bank Farm near Uttoxetter in Staffordshire (1430–1250 cal BC) (Stoke-on-Trent Mus Archaeol Soc 2009), and one of the dates from the burnt mound at Milwich in Staffordshire (1510–1170 cal BC) are consistent with those from south Birmingham while the other date from Milwich, 1800–1400 cal BC, is slightly earlier, but the excavator notes that it may be from heartwood (Welch 1997).

In the Trent Valley, north of Birmingham, associated artefacts and thermoluminescence dates suggest that some burnt mounds in this region are late Neolithic to early Bronze Age in date (Knight & Howard 2004, 57). A burnt mound at Willington contained impressed Peterborough type late Neolithic pottery and flints 'in some quantity', and lay near other late Neolithic spreads, pits and postholes (Beamish & Ripper 2000; Beamish 2001) and the Gonalston burnt mound produced thermoluminescence dates of 2290–1590 BC and 3140–2300 BC and an infra-red stimulated luminescence date of 3050–2130 BC (Elliot & Knight 1998). Burnt mounds at Girton in Nottinghamshire produced dates of 2140–1910 and 2200–1970 cal BC but water pits on this site were dated to 1130–920 cal BC and 1120–890 cal BC, which are consistent with the south Birmingham burnt mound dates (Guilbert & Garton 2007), as is the date range of 1145–835 cal BC for the Castle Donington burnt mound (Coward & Ripper 1999).

Altogether these dates suggest that burnt mounds were in use in the surrounding region over a slightly longer period than that indicated by the dates from the south Birmingham sites, and perhaps show that in a regional context the Ridgeacre date is not so much of an outlier as was first thought, but they also extend the period back in time rather than forward and still point to the use of burnt mounds ceasing by the very early first millennium BC. Burnt mounds and related sites elsewhere in England date from the late third millennium BC into the early first millennium BC. At Little Marlow, Buckinghamshire, dates of 1745–1385 cal BC, 2140–1920 cal BC and 2475–2140 cal BC were obtained from two burnt stone spreads and a burnt mound respectively (Richmond *et al* 2006), at Patching in Sussex a waterlogged pit associated with a burnt mound was dated to 900–800 cal BC (Stevens 1997), at Green Park in Berkshire the burnt mound contained late Bronze Age pottery and sealed a pit dated to 1220–890 cal BC (Brossler *et al* 2004,128), the burnt mound at Bestwall in Dorset was associated with middle Bronze Age features dated by pottery (Ladle & Woodward 2003). Radiocarbon dates available for Fenland burnt mounds in 1991 ranged from 2500–1900 cal BC while undated examples under peat must be second or early third millennium BC in date (Silvester 1991, 85–7). Four burnt mounds at Bradley Fen in the Cambridgeshire Fens produced dates ranging from 2300 to 1510 cal BC (Mark Knight, pers comm). However, dates from Welsh, Scottish and Irish burnt mounds, while principally within the second millennium BC and including some earlier dates, extend further into the first millennium and there are some dates in the medieval period (Kelly 1990, table 1; Williams 1990, fig 61; Barber 1990, table 4; Brindley & Lanting 1990).

FORM

The physical features of burnt mounds in south Birmingham are summarized in Table 5. The characteristic and most prominent feature at all the sites was, of course, a mound of heat-shattered stones and charcoal. Where its extent could be determined, the

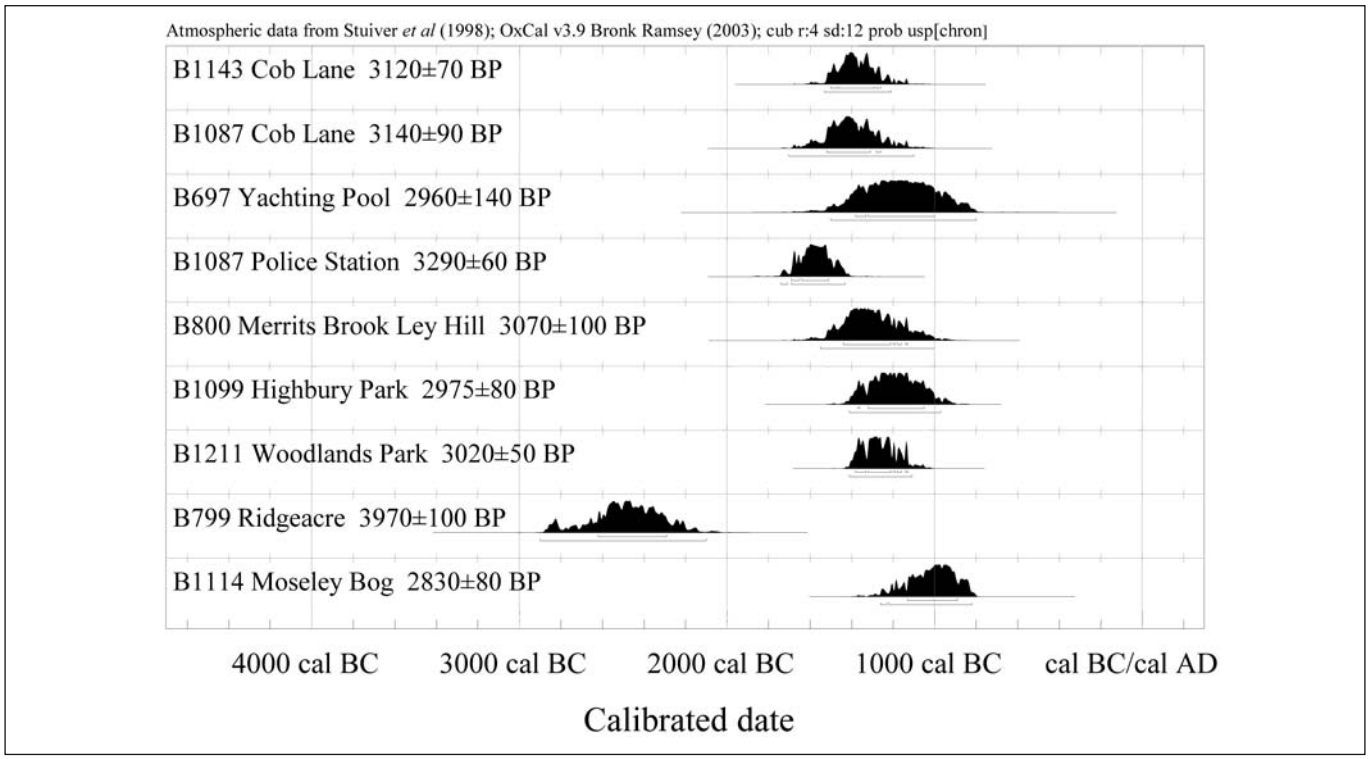

Fig 8 Burnt mounds in south Birmingham: radiocarbon dates

mound was generally oval in form, up to 20m across and up to 80cm high. Of the south Birmingham sites, only that at Fox Hollies Park had the kidney or crescentic plan common at sites elsewhere in Britain and Ireland, but the exact form of those unexcavated sites visible only as stream bank exposures is not known, and at excavated sites and those visible as mounds the original form may have been modified by slumping of the burnt stone deposit after abandonment or by later disturbance. The mounds seem to have originally had a domed profile: at Cob Lane the flat surface probably resulted from later truncation. At some sites there was a spread of burnt stones, often charcoal-free, close to the mound itself. At Cob Lane the unexcavated Area C was on the other side of the former stream channel and Moseley Bog site 2 is a very small exposure of heat-shattered stones similarly close to the main burnt mound. Spreads of heat-shattered stones were also noted at Metchley and Fox Hollies. The two small exposures at Moseley Golf Course may be another example of this.

The most consistent feature other than the mound itself, whether found in excavation, visible in stream bank sections or detected by geophysical survey, is a pit or pits under or adjoining the mound. Hearths, or more correctly areas of burning rather than actual hearth structures, were found in excavation at Cob Lane and Metchley and interpreted from the geophysics results at Fox Hollies. The other features found at Cob Lane were a possible tree trunk revetment alongside the former stream bank and stake holes in the surface of the alluvium under the mound, but no patterning could be discerned amongst them. A stake was recorded in the section at the Yachting Pool site.

The size of south Birmingham burnt mounds is generally consistent with those elsewhere in Britain and Ireland, although a few much larger sites have been recorded, notably the burnt flint spread at Green Park in Berkshire which was about 85m long up to 25m wide and 0.2m deep (Brossler *et al* 2004, 128). It may well be that the kidney, crescent or horseshoe shape of burnt mounds surviving as upstanding features in Ireland, Scotland and Wales is not the most common form of these sites and that oval, circular or more amorphous shapes predominate, certainly in lowland Britain: for example, the Bradley Fen burnt mounds were oval or irregular in plan. Barber (1990) drew attention to the range of forms of Scottish burnt stone sites, from single kidney-shaped burnt mounds to groups of mounds of simpler form to mounds associated with structures to burnt mound material on settlement sites. Oval or circular burnt mounds appear to be the norm in Dyfed (Manning & Crane 1988) and elsewhere the occurrence of burnt stone spreads as well as mounds proper has been noted: in the Wissey Embayment in the Fens over 300 burnt flint sites were recorded but only eight of these were identifiable as mounds and the rest were spreads of burnt flint (Silvester 1991, 85–7 and fig 49), and at Little Marlow the sites consisted of mounds and burnt stone spreads (Richmond *et al* 2006).

A wood-lined pit or trough (eg Beamish & Ripper 2000), clay lined such as at Rodway and Patching (Hannaford 1999; Stevens 1997) or stone lined where

Table 5 Burnt mounds in the south Birmingham area: summary of known features

Site	Shape	Max width (m)	Max height (m)	Pit	Hearth or burning	Burnt stone spread nearby	Distance from nearest mound	Alluvium under mound
Cob Lane	Oval	8.5	0.50	X	X	X	74m	X
Yachting Pool		12	0.80	X			319m	X
Police Station		5	0.60	X			74m	X
Merritts Brook 1		6	0.30				680m	
Merritts Brook 2		16	0.30				680m	
Woodlands Park A	Oval	20	0.50	X			98m	X
Woodlands Park B		3	0.20				98m	X
Highbury Park 2		18.5	0.40	X			49m	
Ridgacre Moor End Farm		3	0.20				710m	
Harborne Reservoir		2.2	0.40				1160m	X
Metchley				X	X	X	1140m	
Moseley Bog 1	Oval	13	0.30	X		X	950m	X
Moseley Golf Course A		3	0.20			X	950m	
Billesley Common, Hollie Lucas Road	Oval	13	0.35				1310m	
Fox Hollies Park 1	Crescentic	14	0.30	X	X	X?	330m	

suitable stone is available, such as flagstone in Orkney (eg Hedges 1977), and an adjacent hearth are standard features on most excavated burnt mound sites. Pits or troughs are often visible on the surface where sites survive as visible mounds, and pits and hearths or heat-affected areas are easily detected in geophysical survey. Groups of pits have been recorded at several sites, under, cut into and alongside the burnt mound. The larger pits may have been waterholes, like those, some of them lined, which were found close to burnt mounds at Green Park and Girton (Brossler *et al* 2004, 128; Guilbert & Garton 2007). Three of the burnt mounds at Bradley Fen were accompanied by watering holes, which were shafts within larger hollows around the mounds. One of them was approached by a metalled ramp and lined with a wattle fence. There were also remains of wooden ladders (Mark Knight, pers comm). The ditches and pits around the Patching burnt mound included a waterlogged pit (Stevens 1997) that could have acted as a waterhole. Hearths or burnt areas without a clear structure underlie or adjoin many burnt mounds. The heavily discoloured shallow pit interpreted as a hearth at Girton (Guilbert & Garton 2007) and the fire-reddened scoops in the subsoil interpreted as hearths at Bradley Fen (Mark Knight, pers comm) are similar to the burnt area at Cob Lane.

In addition to the stone buildings at, for example, Liddle Farm (Orkney) and Drombeg (Co Cork) (Hedges 1977; Fahy 1960), various timber structures have been found at burnt mounds. At Bestwall in Dorset, a burnt mound was interpreted as succeeding a circular timber house whose entrance it adjoined (Ladle & Woodward 2003), and at Patching there was a group of twenty postholes to the north-east of the burnt mound, apparently clustered around a shallow gully 5m long (Stevens 1997). One of three burnt mounds and burnt stone spreads at Little Marlow lay next to a palaeochannel and surrounded a group of postholes whose posts may have originally stood in the water of the palaeochannel. Some large unburnt stones nearby may have been weights for a cover for the structure represented by the postholes (Richmond *et al* 2006). The Green Park burnt mound lay alongside a group of roundhouses; the postholes of one of them contained burnt flint (Brossler 2004, 128 and fig 3.7). One of the hearths at Bradley Fen was partly surrounded by postholes, suggesting an enclosing structure (Mark Knight, pers comm), and one of two troughs at Castle Donington was filled with fragments of fired clay suggesting a daub superstructure (Coward & Ripper 1999).

FUNCTION

The function of burnt mounds can be interpreted from their form and associated structures as discussed above, from associated objects, and from the relationship of the burnt mounds to contemporary settlements and palaeoenvironmental evidence for contemporary land use, which are discussed in more detail below. At the start of the Cob Lane excavation it was assumed that the interpretation of burnt mounds as the debris from a cooking process was correct and that the main question to be resolved was whether the cooking was in the context of a hunting regime, and therefore involved cooking wild animals at a distance from contemporary settlements (eg O'Kelly 1954), or part of a farming economy, and therefore forming part of a permanent settlement where domestic animals were kept and cooked (eg Hedges 1977). For this reason particular

attention was accorded to the recovery of animal bone from the site. Only two bones were found, one in the organic mud pre-dating the burnt mound and separated from it by alluvium, and the other in deposits representing slumping of the burnt mound deposit into the contemporary stream. Despite sieving the whole of the excavated deposit, no bones were found in the mound itself. The absence of bone in the mound as opposed to the underlying organic layer might be explained in terms of a greater acidity for the stone dump, but pH values suggest that bone should survive in the Cob Lane site (but not at Woodlands Park where conditions were more acidic), and phosphorus values suggest that no bone was present. In any case, the fact that mound material had washed down into the stream bed where conditions were similar to those of the underlying organic levels should have meant that bone should have been preserved, at least in the lower deposits of the mound and the stream channel. The absence of animal bone, despite soil conditions being conducive to its preservation, argues against the Cob Lane burnt mound being used for cooking.

The only artefact found at Cob Lane was a flint blade of Mesolithic type, and the only object found in any of the excavated burnt mounds in the immediate vicinity is a single piece of pottery from a site in Sandwell Valley (Hewitt & Hodder 1988, 19–20). Although burnt mounds in general have usually been regarded as artefact-poor, the occurrence of artefacts is variable. At Girton there was no evidence for occupation, and the site seems to have been regarded as a water source (Guilbert & Garton 2007); at Little Marlow there were few artefacts (Richmond *et al* 2006); and at Patching there was some flint and a small quantity of pottery in features associated with the burnt mound (Stevens 1997). By contrast, one site at Willington contained late Neolithic pottery and flints and charred hazel nut shells and sloe stones, and ox and ox or horse bones, some of then burnt, were found in a palaeochannel adjoining another mound (Beamish 2001). At Castle Donington cattle teeth were found in the unlined trough of the burnt mound and there were bones of domestic animals in an adjacent palaeochannel (Coward & Ripper 1999), and at Birstall a palaeochannel adjoining the burnt mound contained a decapitated horse skull, butchered cattle or aurochs and human bones including two human skulls, one with unhealed cut marks (Ripper 1997), although the relationship of this assemblage to the burnt mound is uncertain. The exceptionally large burnt mound at Green Park contained over 250 sherds of late Bronze Age pottery (Brossler *et al* 2004, 128). The large quantity of middle Bronze Age pottery at Bestwall, principally from a pit which was wrapped around by the burnt mound and a nearby quarry pit, is interpreted as being deposited after abandonment (Ladle & Woodward 2003).

It was at Cob Lane that the traditional cooking explanation for burnt mounds was rejected and the sweat bath interpretation substituted (Barfield & Hodder 1987). In addition to the absence of bone or any other debris, the other arguments in favour of the sweat bath hypothesis include the sites' location in wet locations themselves unsuitable for settlement, as discussed below, and close to water suitable for a cold plunge after a sweat bath, which is a common practice recorded in the ethnographic literature (*ibid*). The stake holes could be from the temporary tent-like structures used on many recent sweat lodge sites.

Many experiments have taken place to demonstrate how hot stones can be used to boil water and food cooked in it (eg O'Kelly 1954; O Drisceoil 1988). Reconstructions of burnt mounds as sweat lodges based on ethnographic evidence, contemporary practice and the excavated remains at Cob Lane (Hodder 2004, 39–42) have replicated the archaeological evidence and therefore validated this alternative interpretation, although they do not, of course, invalidate other interpretations. In these reconstructions the stakeholes are interpreted as the remains of a sweat lodge consisting of a tent on a framework of bent-over branches. The burnt hollow is in the centre of the tent and results from placing heated stones there. The lined pit is a sump in which water from the stream is stored, and from which it is ladled over hot stones placed on the ground inside the tent. The mound of heat-shattered stones and charcoal is the remains of the fire on which the stones were heated: it consists mainly of fragments of heat-shattered stone which were too small to take out of the fire and place in the sweat lodge (the quartzite pebbles used at Cob Lane and the other south Birmingham sites crack when heated but do not shatter: they break when they are moved) and charcoal, resulting from incomplete combustion of the wood fuel in a reducing atmosphere.

The structures at Drombeg and Ballyvourney can be reinterpreted as sweat lodges, with the troughs being for collection of heated stones, rather than as containers for water into which stones were dropped (Hodder & Barfield 2003), and the timber structures adjoining burnt mounds at Bestwall and Patching could also be reinterpreted as sweat lodges. The excavator of Bestwall suggests that the timber structure was succeeded by the burnt mound, but it cannot be a coincidence that the entrance to the structure opened onto the burnt mound and both could therefore have been contemporary, the unconsolidated burnt mound material spreading over the remains of the house after abandonment. At Little Marlow, it was suggested that a timber structure next to a palaeochannel at one of the burnt mounds could have been a sweat lodge whose covering was weighted down by large stones (Richmond *et al* 2006). At Bradley Fen a 'hearth', which was a fire-reddened hollow like that at Cob Lane, may have been enclosed by a timber structure (Mark Knight, pers comm), and waterholes adjoining or close to several burnt mounds, as described above, may have served the same purpose as that suggested for the pit at Cob Lane. The smaller areas of heat-shattered stones near to burnt mounds proper, as noted above, may be sweat lodge sites.

Debate about the function of burnt mounds is likely to continue, but perhaps it is best to regard the sites as debris from the use of hot stone technology for a variety of purposes. The variation in form, associated structures and artefacts, and relationship to contemporary settlements may reflect different functions, contrary to the views of Barber (1990). The grouping of sites and their close proximity to each other may result from different sites being used for different purposes, or their successive disuse and replacement for whatever reason or reasons. The close dating of nearby sites, such as those in the south Birmingham area, makes it difficult to tell whether they were in use at the same time, but the dates from Little Marlow and possibly those from Bradley Fen suggest successive use.

Interpretations of the function of burnt mounds based on distribution and associated features demand deliberate survey to locate sites, such as that undertaken in south Birmingham and a very few other locations such as the Fens, and investigation of areas around the burnt mound rather than, as at Cob Lane and several other sites, just the mound itself. These considerations also apply to the relationship of burnt mounds to contemporary settlements.

DISTRIBUTION AND CONTEXT

The place of burnt mounds in contemporary settlement and land use patterns can be inferred from their national and local distributions and the physical locations of individual sites, in addition to demonstrable relationships to domestic structures or the inclusion of domestic debris, and palaeoenvironmental (including palaeoecological and geoarchaeological) evidence of the landscape preceding and during their use. The palaeoenvironmental evidence from Cob Lane and other south Birmingham sites is discussed in the subsequent section.

Several more burnt mounds have been discovered in south Birmingham and elsewhere in the Birmingham area since the Cob Lane excavation (Fig 1). In north Birmingham the general distribution and density of burnt mounds found on tributaries of the River Tame, by fieldwalking (in which the sites have been identified as concentrations of heat-shattered stone and charcoal on ploughed field surfaces) and excavation as well as by searching stream banks, mirrors that in the south. As in south Birmingham, the clusters of known sites elsewhere in the Birmingham area reflect areas of detailed field survey: the Rugeley area, in the 1930s and more recently (Hodder & Welch 1990; Welch 1997, 13); Sandwell Valley (Hewitt & Hodder 1988); the Sutton Coldfield area (Birmingham & Warwickshire Archaeol Soc 1999; Nichol 2007); Barston (Burnett 2009); and Tanworth in Arden (fieldwork by Michael Nixon: Warwickshire Hist Environ Rec). Of the 50 burnt mounds recorded in Shropshire, most are on the edges of the former wetlands of north-west Shropshire and the Weald Moors. Some 29 have been found on the Weald Moors and there is some grouping in twos and threes (Hannaford 1999). In Britain and Ireland as a whole, the occurrence of burnt mounds is now known to be far more widespread than that mapped by Hedges (1977, fig 20). Indeed, the extent of the distribution of burnt mounds is such that their absence from specific areas can only be confidently asserted where they have not been found in detailed field survey, such as in the Cheviots of north-east England (Topping 2008, 339).

In areas where detailed survey has taken place the distribution of burnt mounds is not even, such as in the Fens. Over 300 burnt flint sites, including mounds and spreads of burnt flint, were found along the fen edge in the Wissey Embayment, and were more numerous than spreads of worked flint, but although similar sites were recorded elsewhere in the Fenland survey they did not seem to occur in such quantities (Silvester 1991, 85–7 and fig 49). At Bradley Fen in Cambridgeshire burnt mounds seem to occur every 60m along the edge of the fen (Mark Knight, pers comm). Over 70 burnt mounds have been found in Swaledale and Wensleydale in north Yorkshire, generally near small streams within 50m of the springhead and in locations with a wide aspect (White 2005, 30).

Burnt mounds are almost invariably located in wet locations, in permanently boggy ground or on land adjoining streams and prone to flooding: whatever their function, it required easily accessible water. The immediate area of the Patching burnt mound is liable to flooding and therefore unsuitable for permanent habitation (Stevens 1997) and it was suggested that the sites at Little Marlow could only have been used seasonally because of flooding (Richmond *et al* 2006).

In terms of the relationship of burnt mounds to known contemporary settlements, there seem to be two groups: those burnt mounds which are physically part of a settlement and contain domestic debris, and those that are not adjoined by but are physically close to a settlement located on drier land. Contemporary land use around burnt mounds is indicated by palaeoenvironmental and geoarchaeological data and, perhaps more subjectively, the quality of agricultural land, as perceived in modern terms, in the areas in which they occur.

The large burnt mound at Green Park lay alongside a late Bronze Age settlement consisting of a group of round houses, but the structures at Bestwall and Patching are best interpreted as being specifically related to the function of the burnt mounds, as suggested above. The late Neolithic material at Willington suggests an adjoining settlement, and at Chalfont St Giles (Buckinghamshire) there was Bronze Age worked flint around two burnt mounds (Smithson 1984). In the Wissey Embayment, burnt mounds and burnt stone spreads occurred both close to and away from settlement sites represented by worked flint concentrations (Silvester 1991, 85–7 and fig 49). At Little Marlow there was some evidence of mid to late

Bronze Age activity on a gravel terrace 0.5km from the burnt mounds (Richmond *et al* 2006), and at Castle Donington there were Bronze Age flint scatters, pits, a post-built roundhouse and ring ditch 200 to 300 metres from the burnt mound (Coward & Ripper 1999).

In southern and eastern England it has been suggested that burnt mounds lay on boundaries. Fieldwalking around deposits of Bronze Age metalwork (both single finds and hoards) in the West Sussex coastal plain located burnt mounds near watercourses, occupying an 'edge' location in the landscape, defined by the watercourse. Metalwork was found close by, separating the burnt area from associated settlements. Lithic scatters of late Bronze Age date suggest that contemporary settlement or activity foci are located on adjacent rising ground (Dunkin 2001). At Bradley Fen (Cambridgeshire) weapon hoards of *c* 1200 BC were deposited on the fen edge near early Bronze Age burnt mounds and middle Bronze Age land divisions respected existing burnt mounds. A line of burnt mounds along the fen edge was demarcated by a ditch parallel to the fen edge and land units defined by parallel ditches running at an angle to the fen edge each related to a burnt mound. Early to middle Iron Age settlements occupied these land units (Mark Knight pers comm, *contra* Pryor 2003, 289–93 and fig 62, which erroneously suggests that the burnt mounds, land divisions and settlements were contemporary).

At Little Marlow, analysis of pollen in peat beside the stream on which one of three burnt mounds or burnt stone spreads lay showed that the burnt mound had been constructed and used in a landscape which had substantial areas of open agricultural land. There were pastoral indicators, cereal pollen, 'weeds of cultivation' and plants of disturbed ground, and there was a decline in lime in the early to middle Bronze Age (Richmond *et al* 2006). Pollen from layers underlying the burnt mound at Troedrhiwgwinau (Powys) showed that it lay in an alder carr with oak, elm, lime, ash and hazel. Pollen of weeds in lower levels indicates some disturbance of forest cover and agricultural activity. The consistent presence of *plantago lanceolata* suggests predominantly pastoral activity, but there was also an increase in grass and bracken, and cereal type pollen and weeds suggesting cultivation. Continuing high tree pollen values suggest that the wet area continued to be wooded. There was no carbonized grain or chaff in the burnt mound, but charcoal in the burnt mound shows that locally available alder was principal wood used as its fuel (Caseldine & Murphy 1989). A pollen diagram from the vicinity of three burnt mounds at Mooghaun Lough (Co Clare) indicates that the first substantial human impact on the environment was in the early Bronze Age and that there was major woodland clearance at the time of the burnt mounds, in the middle to late Bronze Age (Molloy 1997).

At Troedrhiwgwinau, the similarity of the sequence of deposits underlying the burnt mound to that at Cob Lane was noted. The burnt mound overlay a thin layer of grey silty clay (15cm thick) containing some burnt stone and charcoal in its upper part. The grey silty clay overlay a mixed clay and gravel layer with lenses of organic material, including branches and tree trunks, and hazelnut shells. The excavators suggested that interference with forest cover indicated by the pollen sequence described above would have increased runoff, leading to wetter conditions on the valley floor which might have promoted development of alder woodland. The organic deposit probably represents a backswamp or former channel, with deposition taking place under relatively still conditions, while the overlying silty clay probably represents an overbank flood deposit on which the burnt mound was constructed. Subsequent silty clay deposits overlying and abutting the mound are interpreted as the result of increased cultivation in the vicinity (Caseldine & Murphy 1989).

Closer to south Birmingham, the Millwich burnt mound overlay a 'fine orange material' over fine gravel (Welch 1997), possibly a similar deposit to the silty clay alluvium under the Cob Lane site. To the north, a thick inorganic alluvium was deposited on top of a peat bed at Brampton on the middle Trent between 1370 and 900 cal BC (Knight & Howard 2004, 81), and under the burnt mound at Gonalston in Nottinghamshire the terrace gravels were overlain by an intermittent layer of grey silty clay then a thick alluvial deposit of virtually stone-free silty clay (Elliott & Knight 1998).

The excavator noted that the Millwich burnt mound lay away from more fertile soils and may therefore have been used periodically by groups operating away from their home environment, whether hunting or grazing animals (Welch 1997). In Orkney, burnt mounds are located on or near good agricultural land (Hedges 1977), and in Dyfed they are on both good and poor land (Manning & Crane 1988). Distribution of burnt mounds in Shropshire is lowland and coincides with Grade 1 agricultural land (Ehrenberg 1991).

Environment and land use in Bronze Age south Birmingham

In summary, south Birmingham's burnt mounds date to the middle Bronze Age, broadly consistent with dates obtained for burnt mounds elsewhere. Features associated with the mounds include burnt areas, pits, some of them lined, stakeholes and possible stream bank revetments, and subsidiary spreads of heat-shattered pebbles. They are often close to other burnt mounds. Different sites may result from different uses of heated stones, but experiments have shown that the excavated features at Cob Lane are consistent with use as a sweat lodge. Evidence from other sites suggests that most burnt mounds lay within an agricultural landscape, possibly lying on boundaries between different land uses, and there is some evidence for related settlements.

The paucity of other archaeological evidence in Birmingham for the period in which burnt mounds were in use (which we might term the 'Burnt Mound Period' in the Birmingham area) enhances the significance of the sites themselves and especially the proxy evidence for human activity immediately preceding the formation of the mounds which is provided by the environmental data associated with them. Although more burnt mounds have been discovered in south Birmingham since the Cob Lane excavations took place, the archaeological evidence other than burnt mounds datable to the middle Bronze Age in the area still consists solely of two palstaves (Stechford: SMR 02903; King's Heath: SMR 20108), and a few more palstaves have been found elsewhere in Birmingham and its surroundings (Thomas 1974, 20; Watson 1989). A pit found in a watching brief during the construction of the Northfield Relief Road, about 2km from Cob Lane, produced radiocarbon dates calibrating to between 2120 and 1500 cal BC (Miller 2007), ie in the early Bronze Age and just overlapping with the earlier end of the range of dates obtained from the burnt mounds in south Birmingham, but within the broader date range from elsewhere, as discussed above. A watching brief and salvage recording near the Yachting Pool burnt mound in 2007 located a shallow hollow which contained heat-shattered pebbles but produced an Iron Age radiocarbon date, and a small pit containing Neolithic Grooved Ware pottery and therefore considerably pre-dating the burnt mound (Rann 2008; Ian Greig pers comm).

The discovery of Bronze Age features other than streamside burnt mounds in south Birmingham, now predominantly a built-up urban area, is of course always going to be a matter of chance, as in the case of the pit at Northfield. The burnt mounds have mostly survived in open spaces alongside streams; as discussed above, one would expect their users to have lived on slightly higher, drier ground nearby, which is where people live today and is therefore occupied by modern houses. Although it is not possible to say whether all the sites were in use at the same time, the density of known sites must reflect the density and general location of contemporary settlements. In south Birmingham the density of known burnt mounds, mostly recorded as exposures in stream banks, is greater than one site per mile of stream walked and, as it is estimated that only 20% of the total length of stream bank is visible, there are likely to be many more sites as yet undiscovered (Barfield & Hodder 1989).

The stratified sequence of four successive deposits: gravel stream bed, organic mud containing tree trunks, clean silty clay alluvium or colluvium, burnt mound, was observed at Cob Lane, the Police Station site and the Yachting Pool site, all of which occupy the same valley. At Woodlands Park, also on a tributary of the River Rea, the organic mud level was absent but the mound overlay alluvium, and alluvium deposits underlying burnt mounds are also visible in the stream bank sections at Moseley Bog and Sheldon Country Park, both on tributaries of the River Cole.

Although its gravel bed was found, the edges of the pre-mound stream channel at Cob Lane could not be recognized, thus the stream may have been wide, and the gravel deposit observed at Woodlands Park similarly suggests a broad stream. The absence of deposits over the gravel before the organic mud might suggest that the organic mud with its tree trunks represents a major episode of forest clearance in the vicinity in the middle Bronze Age. The radiocarbon dates from the mound and from the organic mud at Cob Lane suggest that these deposits and the clean silty clay which separates them were formed over a relatively short period of time, although the inclusion of a possible Mesolithic worked flint suggests that earlier, derived material was also incorporated. The growth rings in tree trunks in the organic mud could not be related to known regional dendrochronological sequences, but the possible match of an oak from the Police Station site with the Irish chronology around the 13th century BC would be consistent with the calibrated radiocarbon date. The rapid formation of the organic layer might have been caused by a phase of clearance resulting in increased run off during which time the stream was blocked by felled trees. The interpretation of a rapid accumulation is supported by the beetle evidence for a fast-flowing stream, in which slowly accumulating deposits would not be retained.

The organic mud at Cob Lane and the former stream channel around the burnt mound (whose deposits were probably derived from the organic mud) contained large quantities of well-preserved plant material comprising large tree trunks (mainly alder; there was oak in the equivalent context at the Police Station site), unburnt wood fragments (alder and hazel), plant root systems, an abundance of hazel nut shells, a sheep or goat phalange and a coleoptera assemblage which is remarkably well preserved and gives a vivid picture of the stream and its immediate environs, indicating a similar environment to that at present, with similar temperatures. Overall the floral and faunal evidence indicates a fast-flowing stream through open woodland, in which hazel trees would bear fruit. The woodland included lime, indicated by the species *Ernoporus caucasicus*, an insect that feeds on lime (Greig 1982), and alder on wetter land near the stream edge. There was also grassland, with grazing animals indicated by dung beetles.

The white to orange clayey silt overlying the organic mud found at Cob Lane, the Police Station site and the Yachting Pool site was, by contrast with the organic mud, remarkably free from vegetation debris. This deposit might have resulted from soil erosion down valley slopes, or from stream erosion, as a result of increased runoff following tree clearance and cultivation or periods of heavy rainfall, and subsequent deposition. Subsequently a meandering stream cut a

bed through these deposits forming a channel which lay approximately 1.5m below the present ground level in Cob Lane. It was on one of these meander loops that the burnt mound was located. Whether these processes were anthropogenic, natural, or perhaps more likely a combination of the two, this was the setting for the formation of the burnt mound. Charcoal in the Cob Lane mound shows that alder and oak were used as fuel to heat the stones, reflecting use of trees growing on wet land next to the burnt mound and on nearby dry land. Although there is no direct evidence for woodland management, it is implied in order to maintain a fuel supply.

In contrast with the rapid build-up of deposition prior to the use of the burnt mound, the subsequent formation of deposits was relatively slow and represented by the silting up of the former stream channel with the eventual formation of the present stream flowing at approximately 1m above the Bronze Age channel. The overlying clean silt may relate to successive phases of flooding and slow-flowing water. It is notable that accumulation of silt through alluviation or colluviation like that preceding the burnt mound is absent after the Bronze Age use of the mound. The mound would have been a visible hump, like other burnt mounds in the Midlands, until the 19th century when it was probably partly removed.

Whatever their function or functions, the palaeoenvironmental evidence suggests that south Birmingham's burnt mounds immediately follow radical landscape change consisting of extensive tree clearance on the valley slopes and subsequent soil erosion resulting in the deposition of clayey silt deposits in the valley floor. The tree clearance implied by the contents of the organic mud could have been the first significant forest clearance in the West Midlands as a whole, judging from the relative paucity of Neolithic and early Bronze Age evidence which suggests sparse and possibly transitory settlement in much of the region in these periods (eg Garwood 2007, 2–3). On the north side of Birmingham, a pollen sequence in the organic fill of a palaeochannel near the River Tame at Perry Barr runs from 2890–2580 cal BC to 240–420 cal AD. At a point in the sequence whose date can be interpolated as around 1500 cal BC, ie at the earlier end of the date range for burnt mounds in south Birmingham, reductions in *Tilia*, *Alnus* and *Quercus*, the latter disappearing from the record almost completely, and associated peaks in Poaceae and Cyperaceae suggest the opening up of both dry and wetland tree communities, with grasses and sedges expanding as a result of this (Tetlow *et al* 2009). Elsewhere in the West Midlands, there is evidence for extensive woodland clearance from the early Bronze Age onwards: the Bronze Age was probably the time of the greatest environmental change in the region after the early Holocene and saw replacement of woodland by grassland, heathland, cultivated land and hedgerows (Greig 2007, 46).

The deposition of alluvium with no visible organic content over organic-rich material, like that observed at Cob Lane and the other south Birmingham sites, has also been noted in the Severn-Avon valleys and radiocarbon-dated to the late Bronze Age in some places. There are considerable lags between woodland clearance and the accumulation of these inorganic horizons, possibly resulting from slow deterioration of soils and then subsequent erosion (Shotton 1978; Brown 1982). Woodland clearance in the vicinity of the Cob Lane burnt mound could therefore have begun some time before the accumulation of the silty clay deposit, but the closeness of the radiocarbon dates from the organic material under this deposit and the burnt mound over it show that its accumulation was rapid.

In the West Midlands as whole, metalwork of middle Bronze Age date has been found and cremation cemeteries have been dated to this period, but few middle Bronze Age settlements are currently known, and there is as yet no evidence for field systems like those in other parts of the country. Middle Bronze Age metalwork finds tend to be low-lying, along streams (Ehrenberg 1991). The occurrence of fewer metalwork finds of middle rather than later Bronze Age date in the Birmingham area and surrounding region has led to the suggestion that there was an expansion of settlement in the middle Bronze Age, followed by a decline in the late Bronze Age (Watson 1998; Vine 1982, 97–9). Cremation cemeteries in the region at Bromfield in Shropshire and Ryton on Dunsmore in Warwickshire have produced dates ranging from the middle of the second millennium to the early first millennium (Bateman 1978; Stanford 1982) and are therefore broadly contemporary with the south Birmingham burnt mounds.

At Fisherwick on the River Tame to the north of Birmingham, pottery was associated with a group of postholes representing a structure and a gully which produced dates of 1400–750 and 1750–950 cal BC (Smith 1976) and to the south, at Barford in the Avon Valley, there was late Bronze Age pottery and a feature was dated to 1376–910 cal BC (Cracknell & Hingley 1994). At Kemerton (Worcestershire) the majority of features dated to the late Bronze Age (11th to 7th century BC) and consisted of numerous clusters of postholes representing timber buildings of circular or near-circular form, many with domestic waste close to them. Several large pits associated with the buildings were interpreted as waterholes subsequently used for rubbish disposal. The majority of pottery from the site is late Bronze Age. Pollen from one of the pits is dominated by grasses and other species suggesting an open landscape with much grassland (Jackson & Napthan 1998).

The earliest recognizable land boundaries in the region are mid to late Bronze Age in date. A major 'territorial' boundary ditch dated between 1300–850 BC effectively sealed off a land unit in a bow of the River Avon at Wasperton (Warwickshire) (Palmer 2002), at

Childswickham (Worcestershire), there was a large Bronze Age boundary ditch (Patrick 2001), and the Shire Ditch on the Malvern Hills (Worcestershire/ Herefordshire) may be Bronze Age in origin (Bowden 2005, 16–17). A linear ditch at Barford may belong to the late Bronze Age phase of the site (Cracknell & Hingley 1994). Shallow ditches indicating a field system at Kemerton appear to originate in the late Bronze Age and include a ditched trackway (Jackson & Napthan 1998).

Consideration of the evidence from south Birmingham burnt mounds alongside that from the surrounding region for the same period (the 'Burnt Mound Period' in the Birmingham area) suggests that, whatever their function, the burnt mounds were established after soil erosion resulting from the first extensive woodland clearance in the area. There is evidence of grazing animals and remaining woodland, implying management as wood pasture. The clearance implies increasing population, but the location of settlements related to the burnt mounds is as yet unclear. It is possible that, if pastoralism was predominant, there was some mobility even if only seasonal, and that the sites therefore relate to a territory rather than to a fixed settlement. In this context they would have had an important function as a fixed point in the territory, like long barrows or causewayed enclosures in earlier periods, which might have been the focus for seasonal meetings. If the sites were all in use at the same time then the spacing between them may indicate the extent of those territories. As suggested for other areas, south Birmingham's burnt mounds may themselves lie on territorial boundaries. The streams they adjoin may themselves have formed a boundary; if other boundaries existed they may have been simply strips of uncleared or regenerated woodland acting as hedges, like those around assarted land in the medieval period, rather than deliberately constructed boundaries. The woodland remaining after clearance preceding the burnt mounds, including alders growing on wetter ground near the stream and oak on the valley slopes, was exploited as a fuel for heating stones at the burnt mound. Trees may have been coppiced to ensure a continuing supply of fuel. The end of the 'Burnt Mound Period', indicated by disuse of the burnt mounds in south Birmingham and elsewhere around 900 cal BC, could have resulted simply from a general cessation of the processes undertaken at them or the adoption of different methods for these processes which did not result in the formation of burnt mounds, or might be part of wider social change. Increasing population could have led to pressure on land and resources and this may have been exacerbated by increased runoff and more frequent flooding, the result either of climatic change or intensity of land use or a combination of both, which would have made burnt mounds inaccessible for much of the year as well as reducing the extent of land usable for agriculture. Greater control of land is implied by the construction of ditched boundaries elsewhere in the region: this may have been accompanied by the enforced or voluntary abandonment of existing settlements and the creation of new ones, possibly the first fixed settlements in the region.

Future work on south Birmingham's burnt mounds

In south Birmingham and the surrounding area, the characteristics of burnt mounds are: the large number of sites; their relatively narrow date range; their visibility; the frequent association of burnt mounds with reservoirs of environmental data contained in underlying deposits, in underlying and coeval former stream courses and in nearby wetland; and the very few discoveries in the area as yet of features or objects likely to be contemporary with burnt mounds. Rather than investigating details of burnt mounds themselves, future work should therefore make the most of their potential to provide information on the past environment and the processes influencing it prior to burnt mound formation and during use of the sites. It should also draw on the potential of burnt mounds to indicate the general location of contemporary settlements and therefore to test whether such settlements were permanent or seasonal, as discussed above. Such research would consist of:

Recording and interpreting sediments and their formation at exposed sections though burnt mounds or through the excavation of small areas, accompanied by radiocarbon dating.

Sampling organic deposits, including peat, associated with or close to burnt mounds and analysing them for pollen, beetles and plant macrofossils, accompanied by radiocarbon dating.

Geophysical survey on currently open land near known burnt mounds to locate related settlements, followed by evaluation and excavation of features detected.

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ABBREVIATIONS

SMR Sites and Monuments Record

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