



ENVIRONMENT AND LAND USE IN THE LOWER LEA VALLEY *c.* 12,500 BC—*c.* AD 600: INNOVA PARK AND THE FORMER ROYAL ORDNANCE FACTORY, ENFIELD

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SUMMARY

Excavations revealed aspects of the changing environment of the floodplain of the Lower Lea Valley from the Late Glacial to the early historic periods. Evidence for land use mostly related to activity along the western bank of a former stream. Wooden revetments (the earliest dated one being Early Bronze Age), ditches, gullies, pits, a driveway, land surfaces and associated 'midden-like' deposits provided evidence for seasonal or periodic use and, arguably, habitation, dating principally from the Middle to Late Bronze Age. The economy of the site was focused on stock rearing, grazing and the exploitation of river resources. The 'midden-like' deposits, identified as interleaved layers of silt, sand and gravel containing pottery, human and animal bone, as well as flint and bone tools, and other objects, may be compared with similar, more extensive deposits from sites such as Runnymede Bridge, Surrey. There was no evidence of further activity until the Late Iron Age to early Romano-British period, when a series of fish-traps, pits and a structure within an enclosure indicate renewed, again possibly seasonal, use of the area. An evaluation on the site of the former Royal Ordnance Factory produced evidence for the continuing importance of waterfront management in this floodplain environment, in the form of the wooden revetment of another stream channel, radiocarbon dated to the late or post-Roman period.

INTRODUCTION

Archaeological investigations were carried out on land at the former Rammey Marsh Sewage Treatment Works (Site 1; centred on NGR 536800 199200) and the former Royal Ordnance Factory (Site 2; centred on NGR 537300 198600) in the London Borough of Enfield (Fig 1). Both study sites are located upon the River Lea floodplain, with Site 1 west of the present course of the River Lea, and Site 2 lying east of the River Lea Navigation and between two channels of the present River Lea. The floodplain lies at between 16m and 20m aOD, with the valley side rising sharply to 30m aOD on the western edge and gradually to 50m aOD on the eastern side. The underlying geology is principally composed of Eocene London Clay, with the overlying deposits on the valley floor mapped as Kempton Park and floodplain gravels, with sands and gravel forming a series of river terraces.

The redevelopment of Site 1 took place in several stages between 1997 and 2001. Seven evaluations were undertaken, comprising 89 trenches, followed by five phases of targeted open-area excavation. The Phase I–III and V excavations were located in the north of

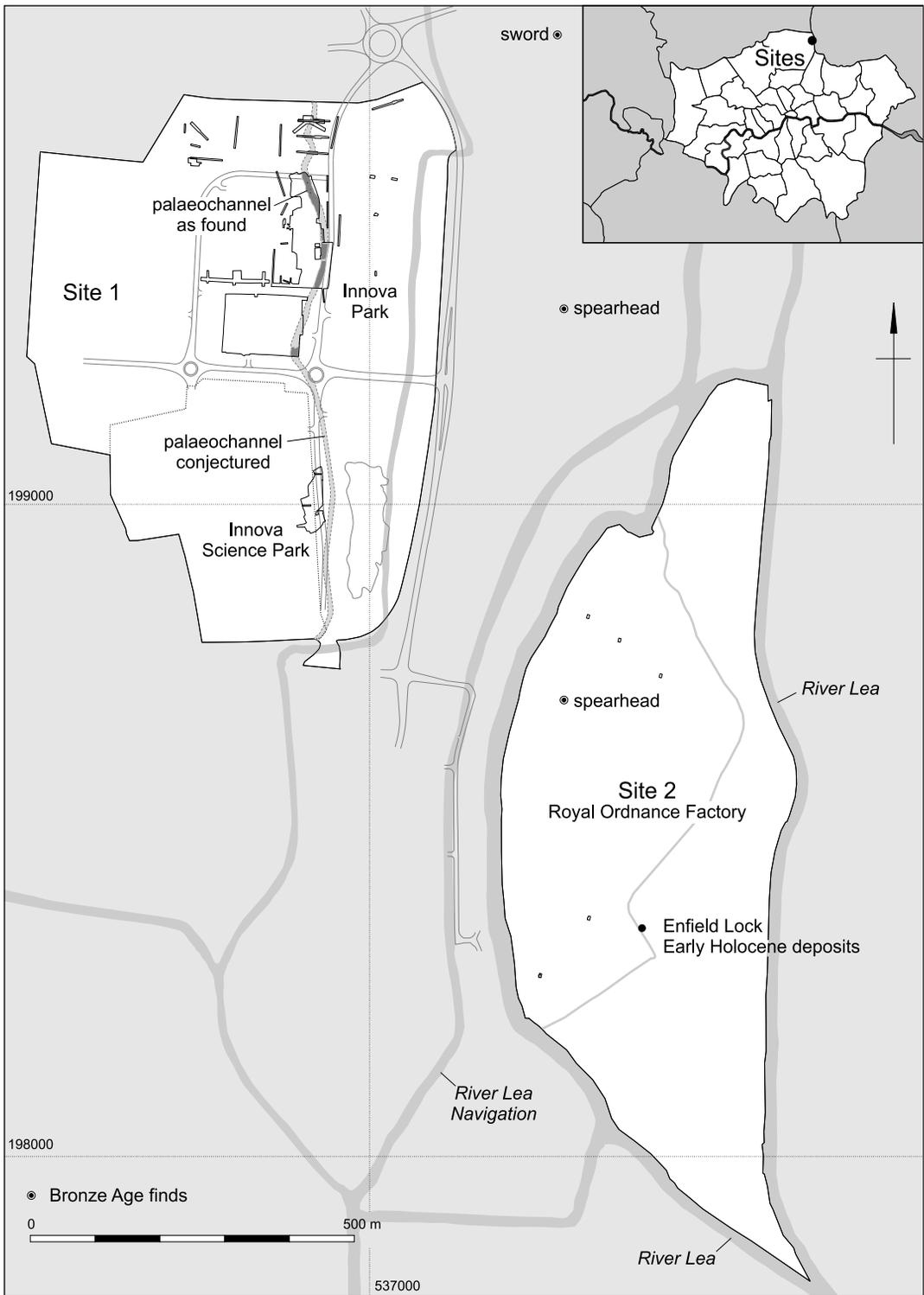


Fig 1. Site location, also showing previous investigations and finds

Site 1, an area now known as Innova Park. The Phase IV excavation was located in the south of Site 1, now Innova Science Park (Wessex Archaeology 2003). A two-phase archaeological evaluation was undertaken at Site 2 (in April 1997 and February 1998 (Wessex Archaeology 1999)), which allowed the design of a mitigation scheme following which the site was redeveloped without further excavation. Previous investigations at Site 2 were undertaken by Essex County Council (1989). Sediments, molluscs and pollen were analysed from a number of boreholes, with radiocarbon dating also applied (Bedwin 1991; Chambers *et al* 1996). This indicated a sedimentary sequence initiated in the early Holocene.

PALAEOENVIRONMENTAL BACKGROUND

The Lea Valley is well known for its Pleistocene deposits (Gibbard 1994). Prior to the Late Glacial Maximum (when glaciation reached its maximum extent, c.18000 BC), high-energy fluvial gravel deposition occurred punctuated by phases of lower energy organic sediment accumulation in a series of floodplain channels or depression fills (known as the Arctic Beds), dated 26000 to 21000 BC (Bates 1997a; Gibbard 1994). The Arctic Beds are a discrete organic layer that contain 'full glacial' plant assemblages (Reid 1949; Allison *et al* 1952) and 'steppe tundra' fauna (Lister & Sher 2001).

Towards the end of the last glaciation, meltwater discharge from the fast-flowing arctic river carved out the present floodplain of the Lea by downcutting from its earlier higher level and depositing reworked river gravels across the valley floor (Gibbard 1994). Erosion of the arctic bed deposits also occurred in many areas, the remnants of which can sometimes be observed as rafted blocks within the basal gravel and sands, while in other areas it was probably completely scoured with no remnants left. As the strength of meltwater discharge abated, a series of braided streams would have developed across the valley floodplain.

Studies from Late Glacial/Early Holocene deposits have been undertaken at a number of sites within the Lea Valley, including Nazeing and Broxbourne (Warren *et al* 1934;

Allison *et al* 1952), and Enfield Lock (Bedwin 1991; Chambers *et al* 1996; Site 2, Fig 1).

During the middle and later Holocene extensive aggradation of the floodplain occurred through overbank flooding and sedimentation on the valley floodplain. During this phase the gravel topography would have become submerged and lost. Channel stability may have been maintained but small tributary channels would have formed across the floodplain. Marshland development may have occurred during certain parts of this phase (Bates 1997). During the Bronze Age the floodplain was largely open and maintained by grazing, with probably larger but fewer watercourses within the Lea Valley. These channels were revetted and their course artificially defined if not modified in places. In the Iron Age and Romano-British phases the floodplain remained open, with further modification of the natural watercourses. Further north (Carthagen Lock) the river channels eroded older deposits, resulting in material being flushed down the valley. Seasonal flooding occurred, but sedimentation was limited.

ARCHAEOLOGY BACKGROUND

Activity in the Lea Valley has been recorded from the Palaeolithic onwards (Greater London Sites and Monuments Record; Wessex Archaeology 1997; MoLAS 2000). The Lea Valley has been identified as being of particular importance for the survival of Mesolithic remains (Austin 1997) and appears to have been a favoured area for settlement (Jacobi 1980; 1996), with activity apparently attracted to riverine locations (Reynier 1998). Remains of occupation have been found within the organic peat deposits which began accumulating in the area during the Mesolithic period. Such sites have the potential for the survival of organic and environmental evidence. Mesolithic finds have been found within or below stratified peat deposits in the Lea Valley, such as at Rikof's Pit, Broxbourne (Warren *et al* 1934; Allison *et al* 1952) and Millmarsh Lane, Enfield, where excavation recovered 120 struck flints dominated by flakes and blades, including two early Mesolithic microliths (*cf* MoLAS 2005, 25).

There is limited evidence for Neolithic

settlements within the Lea Valley floodplain, but this may be due to its burial under thick deposits of alluvium. Possible evidence for Neolithic woodland clearance is indicated in a layer of soot and charcoal rich alluvium at Millmarsh Lane, Enfield (Lewis 1995). Evidence of Late Neolithic/Early Bronze Age activity is present outside of the floodplain at Plevna Park, Edmonton (*cf* MoLAS 2005, 26)

There has been a large number of Middle and Late Bronze Age finds from within the Lea Valley (MoLAS 2005). The presence of wooden trackways and other sites within peat deposits in east London indicates the exploitation of the marshland and floodplain areas during the Middle and Late Bronze Age (Meddens 1996, 331–3; Thomas & Rackham 1996). Further to this, the presence of three isolated finds of Middle to Late Bronze Age weapons (see Fig 1), recorded close to former channels of the River Lea, may be considered in the light of the recognised pattern of deliberate deposition of metalwork in similar wetland locations (Bradley 1998).

Artefacts recovered during gravel extraction immediately north of the study area in 1952, which included *in-situ* wooden stakes, were interpreted as a possible Iron Age landing-stage, fishing-weir or dwelling. No particular concentrations of Roman or Saxon finds were known in the vicinity, but a now vanished medieval moated site and later manor house, Norris Farm, lay immediately to the south-west of Site 1 (Baker 1976, 228).

The channels of the Lea are known to have been extensively modified from the early post-medieval period, and probably long before (Baker 1976, 207–8). For much of the historic period the low-lying land of the study area was used as seasonal pasture, gradually enclosed from the 16th century onwards (*ibid*, 232–6). Site 2 was developed as the Royal Small Arms Factory from 1814, while Site 1 was developed as a sewage treatment works in the mid-20th century.

The predominant feature present throughout the main phases of human activity on Site 1 was a north to south-aligned palaeochannel (or stream: Figs 1–7, 10 & 11). The evidence suggests that this was a shallow, slow-running watercourse subject to seasonal fluctuation, flooding in the winter and

perhaps reduced to a trickle or completely dry during the summer. It is noteworthy that a stream in this approximate location has been recorded on historical maps of the area, its course not deviating greatly, at least in several centuries. It was diverted and finally infilled when the sewage works were constructed.

Report conventions and structure

This report is presented as a continuous chronological narrative incorporating the principal findings of a number of specialist reports. The full stratigraphic, finds and environmental archive from both sites will be deposited with the Museum of London; Site 1 under the site code RMA97, and Site 2 under the site code ONR97.

Narrative sections relating environmental evidence to the changing dynamics of the past environment, the resources it could support and an interpretation of the economy are based on numerous detailed analyses of the sedimentary sequences (Chisham 2004; Bates 1997b), the soils and soil chemistry (Macphail & Crowther 2004), pollen (Scaife 2005), charcoal (Gale 2004), charred and water-logged plant remains (Stevens 2005), and snails (Allen 2005). Environmental analysis is restricted both temporally and spatially by the limited number of archaeological features and deposits available, reflecting the overall low level of activity. Likewise, key findings of detailed analyses of flint (Leivers 2005a), prehistoric pottery (Leivers 2005b), Iron Age/Romano-British pottery (Mephram 2005), metalwork (Jones & Cooke 2005), wood (Jones 2005), human bone (McKinley 2005), animal bone (Knight 2005a), worked bone, stone and fired clay (Knight 2005b) have been integrated into the narrative.

In this report context numbers in the text are shown thus: [1]. Accession numbers given to certain artefacts from the site are shown thus: <1>. Report plans show the maximum extent of stream channel deposits as excavated. The actual edge of the channel in particular periods was sometimes indicated by timber revetments (below), although as might be expected, the evidence was often unclear due to repeated episodes of erosion (see Brown 1997).

THE MAIN PALAEOCHANNEL AND ITS ENVIRONS

An early post-glacial and Bronze Age sedimentary sequence is derived from a palaeo-

channel running through the centre of Site 1 (Figs 1–2). Analysis of this feature is used to interpret the environment in the following sections. The sedimentary sequence is summarised in Table 1. The pollen data from

Table 1. Sedimentary sequence from palaeochannel, Site 1. Suggested concordance of sediment sequences at Innova Park and Enfield Lock (Chambers *et al* 1996; Site 2)

Unit	Context (see Fig 2)	Pollen Zone (Fig 14)	Description	Enfield Lock (Column B; Chambers <i>et al</i> 1996).
1	4314 (5009)	2	Uniform very dark greyish brown clay loam alluvium.	Dark grey sandy loam (with bone)
				Yellow-brown sand lens
				Grey brown clay loam
2	4316 (5008)	2	Dark brown sandy silt banded alluvium-indicating episodes of organic inwash, typical of river edge conditions.	Dark brown clay
3	4316 (5008)	2	Very thin lens of organic mud/peaty clay.	Dark grey clay
4	5005 (5006 / 5010)	2	Dark greyish brown organic silt with loose sand represents resurgence of higher energy alluviation sealing the drier conditions represented below. Whether this is overbank floodplain alluvium or channel edge deposits is uncertain. Presence of gravel and artefacts testify to higher-energy alluvial conditions, typical of a river edge.	
5	4321	1b	Formation of organic horizons, incipient peat and immature azonal soils within the silty loam alluvium, indicate more prolonged episodes of drier floodplain conditions. Although Bronze Age pottery and bone were found on and in this horizon, the deposits seem to be Early Holocene and these artefacts lay on, and have been pushed into these deposits.	Shelly marl
6 & 7	5321	1b	Alluvial sands and silts truncate the underlying organic sequence. The presence of humic laminations and lenses indicate fluctuation in the overbank alluviation, and humic matter occurring in slacks. Eventually a putative incipient soil is proposed to have formed in the upper portion of this sequence (unit 7A), indicating stability across this part of the floodplain and reduction of fluvial activity prior to resurgence in alluviation.	
8	4323	1a/b	Organic muds, peaty silts and humified peat with sporadic bands of minerogenic inwash indicate a decrease in flooding, and creation of waterlogged conditions supporting a rich vegetation on the floodplain, and some encroachment of woody taxa indicated by fragments of wood in the peat. The sharp upper boundary indicates truncation of this organic sequence.	Organic muds 8290±80; 7520-7080 cal. BC; Beta-68555 8200±80; 7460-7050 cal. BC; Beta-68556 9550±70; 9210-8720 cal. BC; Beta-68557
9	5004	N/A	Laminated silts with fine humic lenses containing <i>Pisidium</i> valves and indicating overbank sedimentation under generally low energy conditions, with accumulation of organic material in slack areas and lower energy conditions.	Silty clay
10	5003	N/A	Basal gravel with some sand, indicating high energy probably Devensian Late glacial meltwater. No evidence of the presence of arctic bed deposits.	Gravel

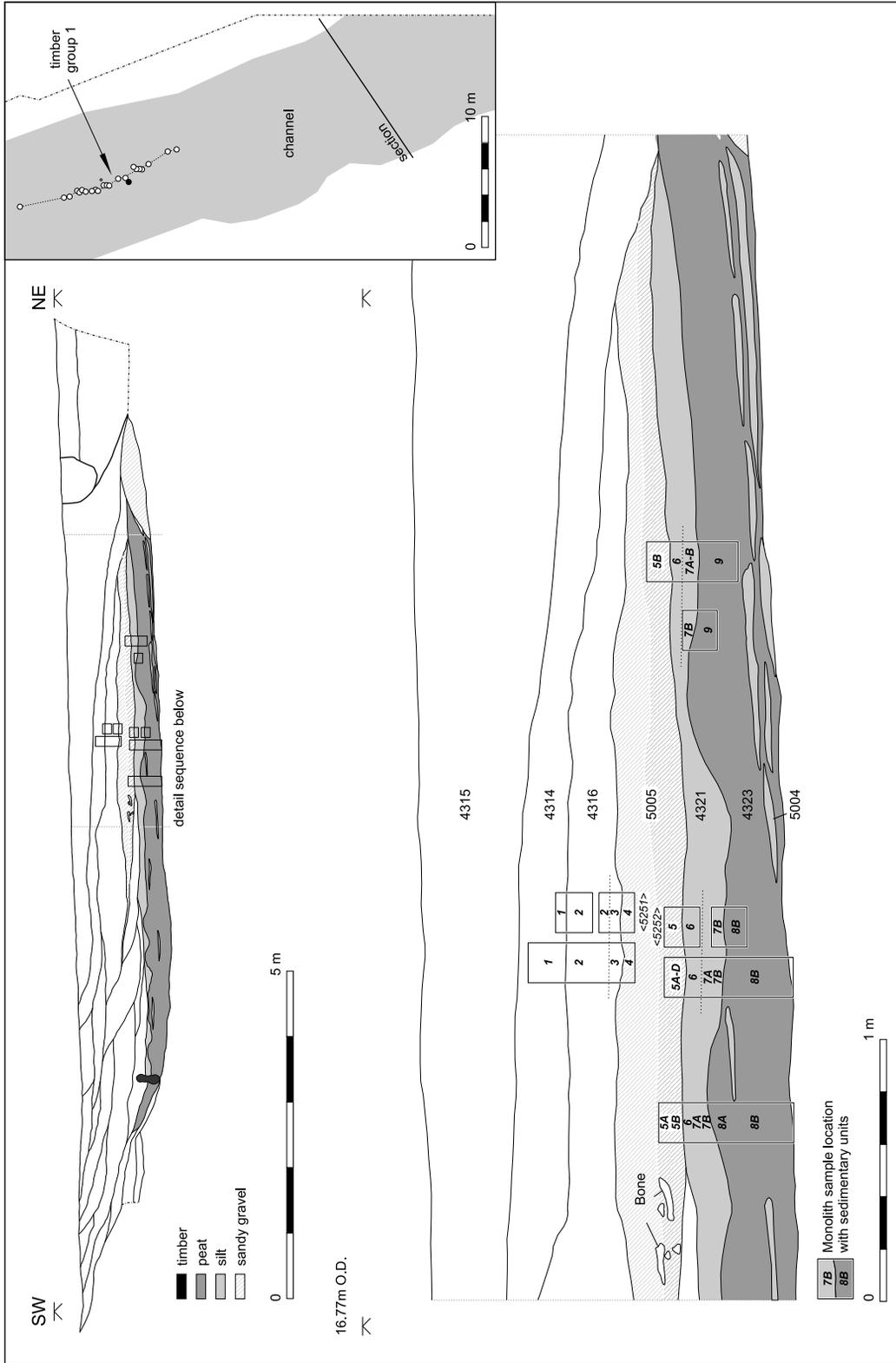


Fig. 2. Section showing the recovered sediment sequence (see Fig 3 for location)

this sequence and its comparison with the radiocarbon dated sequence from Enfield Lock (located on Site 2) indicate that the lower portion of this sequence (units 9–5) represents an Early Holocene (c.9500–8200 cal BC) floodplain environment (Chambers *et al* 1996). The sedimentary sequence here compares well with that published from the Enfield Lock sequence (Table 1). The fine-grained alluvium above (units 4–1) indicates Bronze Age and later channel edge and channel margin deposits. A chronological break is observed towards the upper part of the sequence (between units 4 and 5) that dates between the early Holocene and the Middle Bronze Age.

CHRONOLOGICAL NARRATIVE

Pre-Middle Bronze Age (Period 1, c.12500–1500 BC)

Environment

Pollen (see Fig 14) and waterlogged plant remains (see Table 2) provide a detailed picture of both the floodplain and the wider environment. Remains from the organic mud (unit 8) indicate a generally open floodplain landscape comprising herbs and grasses, including meadow-sweet (*Filipendula ulmaria*) which is typical of the warming temperatures of the Early Holocene. Most of the non-tree species from the waterlogged remains are indicative of wet herbaceous grassland, with sedges, mare-tails, meadow-sweet and cowbane present in high numbers. This open floodplain was dotted with trees. The higher drier landscape beyond was more wooded with birch (*Betula* sp.) and pine (*Pinus* sp.). Downy birch (*Betula* cf. *pubescens*), silver birch (*Betula pendula*) and aspen (*Populus tremula*), with some dwarf birch (*Betula nana*), were probably all fringing the edge of the floodplain. The presence of waterlogged seeds of meadow-sweet, bogbean (*Menyanthes trifoliata*), and marsh cinquefoil (*Potentilla palustris*) indicates a large tract of fen marsh at the channel margin and floodplain edge. The watercourses were fringed with typical fen plants, including grasses, sedges and bogbean. There is also pollen evidence of willow (probably dwarf willow (*Salix herbacea*) or tealeaf willow (*Salix phyllcifolia*), as at

Nazeing (Allison *et al* 1952)) on or fringing this habitat.

After the accumulation of the organic mud, the alluvial deposits (unit 7) indicate wetter conditions, probably near a channel. This is confirmed by increases in sedges (*Carex* sp.), yellow and white water lily (*Nymphaea* sp.), water milfoil (*Myriophyllum spicatum*), and cysts of green algae (*Pediastrum*). The sedge and rush (*Juncus* sp.) component would have become more dominant towards the channel edge and extended into the channel itself. Within the channel, seeds of water-crowfoot (*Ranunculus* subg. *Batrachium*) grew with their leaves either drifting in long trails or floating in clusters on the water surface. Seeds of pondweed and water lily indicate a relatively slow flowing, shallow, and, in places, probably quite highly vegetated watercourse. We can suggest that the broad Lea Valley contained a number of watercourses flowing over the gravel terraces, but we cannot be sure of their precise location at this time.

The areas excavated comprised a dryish open floodplain, and we can surmise the lower floodplain to the east may have been wetter, containing pools of water. Throughout the deposits analysed by Chambers *et al* (1996, fig 4) there was an abundance of microscopic charcoal recorded during pollen analysis. Although they suggested that this might be anthropogenic, it might also be due to higher temperatures c.9000 BP allowing a greater number of natural or accidental fires (Huntley 1993, 212). Nevertheless, the records of 'fine charcoal and angular charcoal' from soil micromorphology in unit 5 indicate a local charcoal source and burning that might correspond to that recorded by Chambers (*et al* 1996) at Enfield Lock to the south-east. A layer of soot and charcoal within alluvium at Millmarsh Lane, Enfield provides possible evidence for Neolithic woodland clearance in the Lower Lea Valley (Lewis 1995). The diverse environment would have offered an ideal location for hunting wildlife that both lived on or was passing through the flood plain. The open woodland at the edges of the floodplain would have provided soft fruit edible by both animals and humans. Human activity for most of this period may have been restricted to visits to exploit fish, birds, migrating or browsing herds, possibly including aurochs, and plant resources at

varying and appropriate times of the year. As such the evidence of human activity may then be sparse and limited to small-scale, highly localised camps covering areas less than 20–30 square metres. Of some relevance here may be the unstratified and residual flint assemblage from Site 1, which includes a number of blades, bladelets and microliths of Late Mesolithic or Early Neolithic type (Leivers 2005a). Although a small amount of Palaeolithic flint was also recovered (a small ovate hand axe and two large blades), these were heavily patinated, rolled and damaged, and had potentially been transported far from their original context of deposition (*ibid.*).

While the precise location of the watercourse, or courses, is unknown for much of the period, the valley was clearly subject to occasional seasonal (winter) flooding. The rich fertile soils which gradually developed would have been suitable for pasture throughout most of the year, though the floodplain itself may have been too damp and therefore unsuitable for crop cultivation.

Early Bronze Age revetment

The earliest clear evidence of *in-situ* human activity relates to the maintenance of the bank of the stream channel on Site 1. A single upright oak timber post <6672>, one in a series that appeared to form a linear structure, possibly a revetment to prevent erosion of what was then the bank (Fig 3: timber group 1), provided a radiocarbon date of 1750–1530 cal BC (3388±30 BP; NZA-20912). Apart from the early date, these timbers were not otherwise distinguished from the components of the Middle to Late Bronze Age revetments described in more detail below.

A pit, two pits/postholes and a gully could potentially be assigned to this period on stratigraphic grounds, but none produced datable finds. A north to south-aligned gully [3591] and a pit [3680] were both sealed beneath deposits securely dated to the Middle and Late Bronze Age. Further to the south, two pits within pit group B and one pit within pit group A were cut by Middle Bronze Age features. It is likely that the floodplain adjacent to the river was exploited at an early date — certainly the

revetment indicates that some importance was attached to maintenance of the channel bank — perhaps as a mooring, watering place or fishery, as well as to control natural erosion of a meandering stream. Presumably any agriculture, permanent settlement or winter pasture would have been sited on the drier, lightly wooded, shallow valley sides.

Middle to Late Bronze Age (Period 2, c.1500–700 BC)

Environment

Although the recovered ceramics can be divided into Middle and Late Bronze Age forms, there is not enough environmental or undisturbed stratigraphic data confidently to subdivide the period across Site 1. However, from the few cases where phasing was possible, no significant difference was detected in either the environment or economy between the Middle and Late Bronze Age.

Sediment units 1–4 (above and see Fig 2) indicate initially a higher-energy alluviation comprising well-sorted sands with angular gravel. The latter may derive from channel deposits or channel-edge deposits. Although there has been subsequent earthworm mixing, it seems that at least some of the gravel has been introduced from a calcareous bed and contained some washed-in shell fragments (Macphail & Crowther 2004). This suggests reactivation of the channel, but this high-energy flow was apparently short-lived and indeed was subject to exposure and soil formation processes after deposition and was succeeded by finer alluviation (Chisham 2004). The high-energy flow led to erosion of earlier deposits, and this may account for the lack of the calcareous shelly deposits as seen at Enfield Lock (Chambers *et al* 1996), though those deposits may never have occurred here. The presence of angular microscopic charcoal in the sediment thin-sections points to local human activity.

Further upwards, more massive alluvial deposits were recognised, and in unit 3 there is evidence of more earthworm burrowing suggesting post-channel soil activity, or that drier episodes occurred on a wide, ill-defined channel margin. Subsequent drying out of these later deposits and fluctuations in the ground water table led to a number of post-

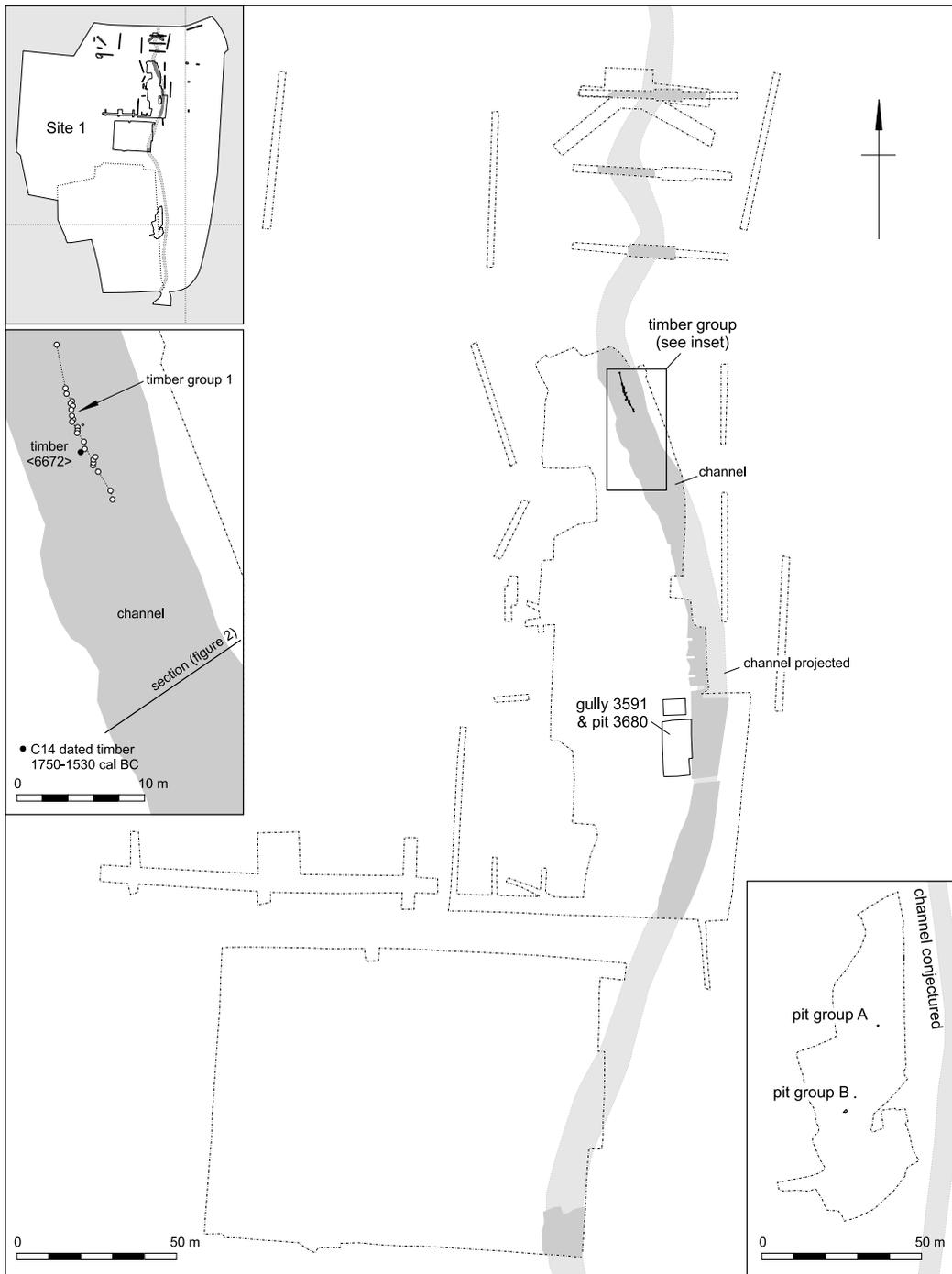


Fig 3. Plan of possible Early Bronze Age features, with detail plan of timber group 1

depositional effects, including oxidation of organic matter and secondary mineral (iron and calcium sulphate) formation. The

channel edge was defined by the presence of timber structures interpreted as revetments (Fig 4).

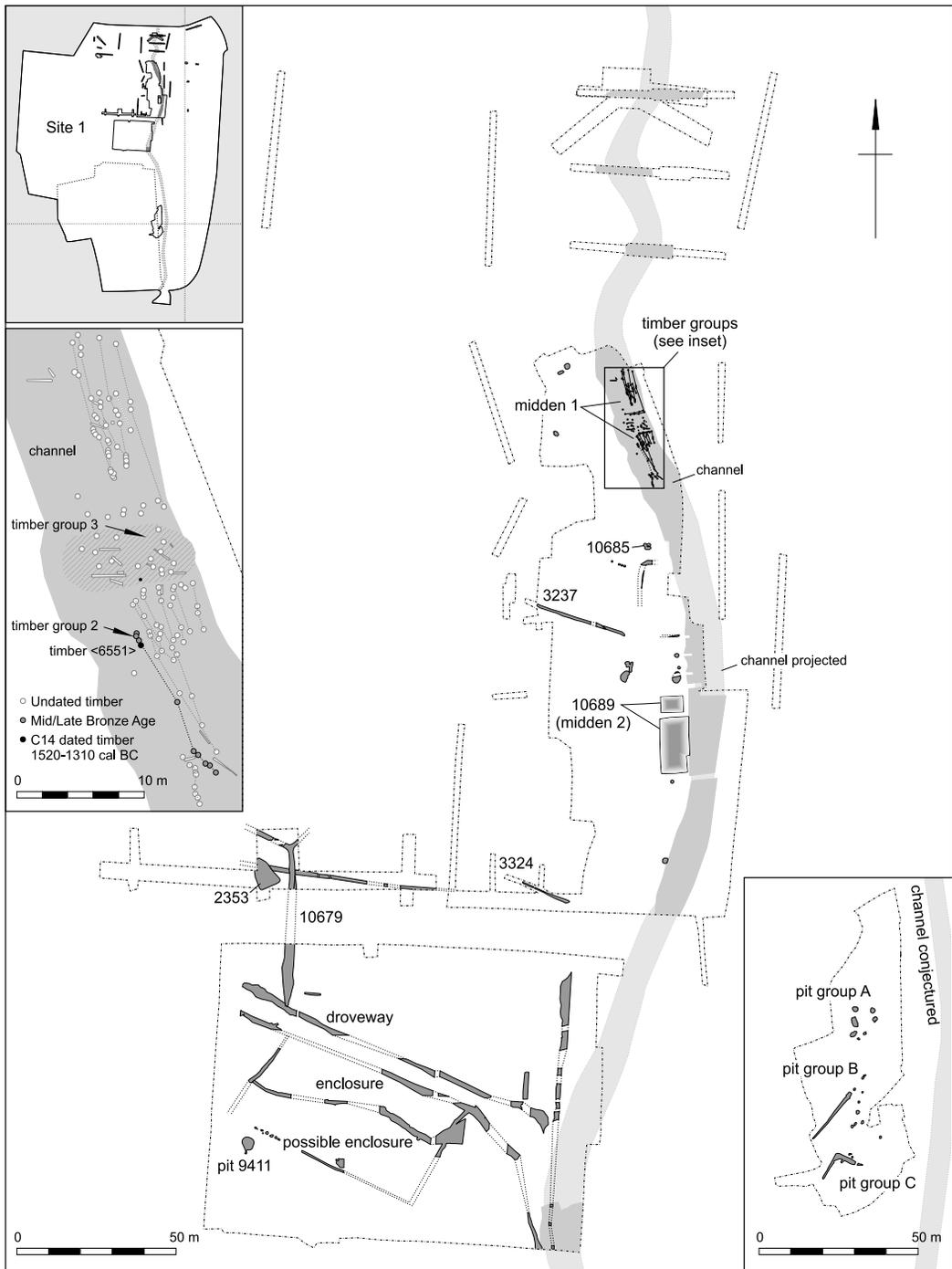


Fig 4. Plan of Middle to Late Bronze Age features with detail plan of timber groups 2 and 3

It is clear from the dominance of aquatic snails found in Middle to Late Bronze Age pits [4026] and [3839], which included *Valvata*

cristata, *Bithynia tentaculata*, *Bathymphauls contortus*, and *Pisidium* spp. (Allen 2005), that flooding occurred and that the ground

water table was relatively high. Indeed peat near the base of Late Bronze Age pit [9411] indicates the accumulation of plant material under marshy conditions and a fine alluvium was recorded in many other pits. It is evident that fine overbank sedimentation occurred during flood episodes and filled and sealed both the channel and several of the pits. This alluvium subsequently dried out and was subjected to soil formation processes across the site, as indicated by the reprecipitation of iron (causing orange staining).

The vegetation as recorded in the pollen (Scaife 2005, pollen zone 2) and waterlogged plant remains (Stevens 2005) is clearly distinct from, and contrasts markedly with that from the Early Holocene record. The floodplain remained a largely open landscape with few trees and pockets of dense scrub (hazel (*Corylus avellana*), elder (*Sambucus nigra*), and blackthorn/sloe (*Prunus spinosa*)), with some bramble (*Rubus* sp.) and bracken (*Pteridium aquilinum*). A substantial part of the floodplain was a damp grassland habitat, possibly pasture, supporting ribwort plantain (*Plantago lanceolata*), dandelion types (*Taraxacum* spp.), and buttercups (*Ranunculus sceleratus*), for example. The presence of waterlogged seeds of fat-hen (*Chenopodium album*), henbane (*Hyocyamus niger*), nettle (*Urtica dioica*), and chickweed (*Stellaria media*), amongst others, indicates wasteland and humanly disturbed, nitrogen rich habitation and pasture soils. Elsewhere rough grassland and possibly some arable were present as indicated by species including buttercup, plantain and dock (*Rumex* spp.). Alder (*Alnus glutinosa*) was present (unit 3, base of context 4316: see Fig 2), which was probably growing on the valley floor and adjacent to the channel in clumps with some scrub. The small quantities of oak (*Quercus*), elm (*Ulmus* spp.), beech (*Fagus sylvatica*), and hazel pollen die out in the upper levels, while the grassland taxa become more important indicating a very open and drier, but damp, floodplain. Charcoal indicates the availability of oak (presumably scattered on the higher slopes), blackthorn, and the hawthorn/*Sorbus* group, as well as alder and hazel (Gale 2004). There is also cereal pollen, indicating that it was dry enough to support cultivation on the better drained soils of the tops and sides of the valley.

The channel itself appeared to have had

small stands of alder fen shrub growing along its edge, with sedge-dominated grassland comprising sweet-grasses (*Glyceria* sp.), spikerush (*Eleocharis palustris*), rushes and sedge. There is also a good indication of more open areas along the channel edge with species of both grasslands and disturbed nitrogen rich soils. These latter species especially may proliferate at parts of the river edge where animals come down to drink, churning up the bank into a mixture of dung and mud. This environment may have been common around some ditches, while it is possible that occasional alders and some shrub vegetation lined others. Around these features the landscape was generally open. There is no real indication of hedgerows. Thorns of hawthorn and/or sloe within waterlogged ditch deposits from other prehistoric sites have often been taken to indicate the presence of hedges (Allen & Robinson 1993, 121–3), but are generally absent here.

The channel seems to have been very slow flowing, possibly with cut-off sections forming small, highly vegetated ponds. It is probable that sedges were thick across many parts of the floodplain and along the channel edge. The eastern floodplain lies at a lower level and, although not studied here, probably survived as a wetter landscape as it does today, with marsh and peaty soils.

Channel revetment

An alignment of vertical timbers (timber group 2) (Figs 4–6) appeared to form another revetment within the stream channel on Site 1. It included oak stake <6551>, which provided a radiocarbon date of 1520–1310 cal BC (3145±35 BP; NZA-20913), perhaps suggesting a southward extension of the Early Bronze Age revetment. This date is consistent with the accepted *floruit* of the Deverel-Rimbury pottery found in deposits which accumulated around it (Leivers 2005b). Further timbers, apparently forming north–south rows, are undated, but are assumed to indicate progressive reclamation of the west bank of the channel during the Bronze Age. A profile of the channel bank and a section through timber group 2 is shown in Fig 7. A less dense group of timbers (timber group 3: see Fig 4), many of which were not *in situ*, seems to indicate an area

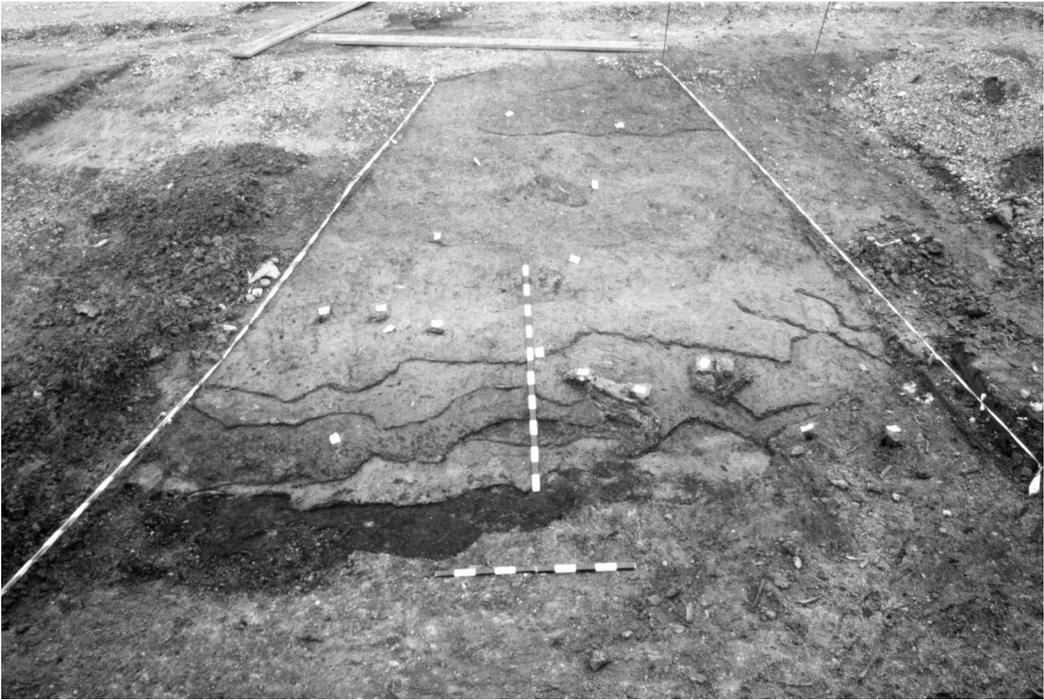


Fig 5. View of the southern part of 'Midden' 1 and timber group 2, pre-excavation (1 and 2m scales)



Fig 6. View of section through bank edge and 'midden' 1 deposits and timber group 2 (0.5m scale)



Fig 7. Detail plan and sections showing the western bank of the stream channel and timber group 2

of later disturbance, probably by a Period 3 droveway.

The timbers were too poorly preserved for detailed recording. While many of the stakes had been formed from complete roundwoods, half and quarter conversion techniques were also in use. Several of the stakes appeared to have been roughly fashioned from radially split planks and demonstrated a rectangular section and sharpened point. Only a small number of stakes were identified as boxed-halved or boxed-quartered. Eight timbers have been interpreted as planks on the basis of their shape and size. Where identifiable these seem to have been tangentially split from the parent timber.

The few tool marks noted were facets, often slightly concave in profile, present either longitudinally for the complete length of the stake, or restricted to the area of the point, possibly suggesting the use of a stone or bronze adze. Whilst an adze would have initially created an undulating surface, a 'second adzing would remove most or all of these and leave little trace of the tool' (Orme & Coles 1983, 33), it is therefore difficult to ascertain whether an axe or adze was used to shape the stakes. The stakes were most commonly shaped into pencil points, however chiselled and wedge-shaped points, with one or two facets respectively, were also recorded. The number of faces on the pencil points varied from three to eight, with four being the most commonly occurring. The tips of a number of stakes had been damaged from the force used to insert them into the ground, suggesting they may have been quite soft (green) when converted and utilised (Jones 2005).

The revetment indicates the need to consolidate the stream bank at this point, presumably as part of a wider concern to manage the braided streams of the area. The lack of revetment elsewhere on Site 1 may indicate the provision of mooring facilities, and may have been required in this particular location because of the proximity of habitation, or of a frequently utilised place. Such would account for the concentrations of artefacts in this area (below). The concentration of finds around the revetment piles and the irregular pile spacing suggests a simple waterfront, perhaps with wattle and plank horizontal members, rather than the

substantial, even defensible, platform and stockade proposed for the Late Bronze Age waterfront at Runnymede (Needham 1991, 114–15).

Associated deposits — 'Midden' 1

Analysis of the distribution of artefacts (human bone, animal bone, metal work, worked stone, fired clay, and pottery) recovered from the layers deposited around the revetment timbers showed no significant patterning, and the deposits probably represent the unstructured deposition of refuse from nearby activities, accumulating on and burying a land surface. The range and quantity of material may support the suggestion of at least temporary occupation in the vicinity, although that cannot be proved (below). The layers should be considered within the wider discussion of 'midden-like' deposits, and are referred to here as 'Midden' 1. Animal bone from these deposits was not analysed in detail, but was broadly similar to that from 'Midden' 2 (below). A small quantity of human bone from layer [4111] showed brown discoloration typical of burial in an organic-rich environment.

Metalwork from these deposits included an incomplete copper-alloy, wire-form bracelet <6622> (Fig 8, no. 1) and part of a copper-alloy bar <6660> decorated with incised lines, presumably part of an item worn on the wrist, arm or neck (Fig 8, no. 2). The latter object is paralleled by a cast bronze torc from the Ebbesbourne Wake Hoard, Wilts (Moore & Rowlands 1972, fig 75). An unusual copper-alloy disc with a raised central cone <6590> (Fig 8, no. 3) was also recovered. Decorated with concentric embossed rings surrounding the central cone, the manner in which the metal is folded at the edge of the disc suggests it was once fastened to a less resilient (probably wooden) disc. No exact parallels have been found (a similar item came from 'Midden' 2, below), although cone-shaped gold and copper-alloy objects were used as buttons during the Early Bronze Age and are known from several 'Wessex' graves (Annable & Simpson 1964, catalogue nos 56, 181, 233, 375, 465, 472, 483). It is assumed to have been some form of decorative fitting, either a clothing fastener or attached to an item of weaponry such as a helmet or shield.

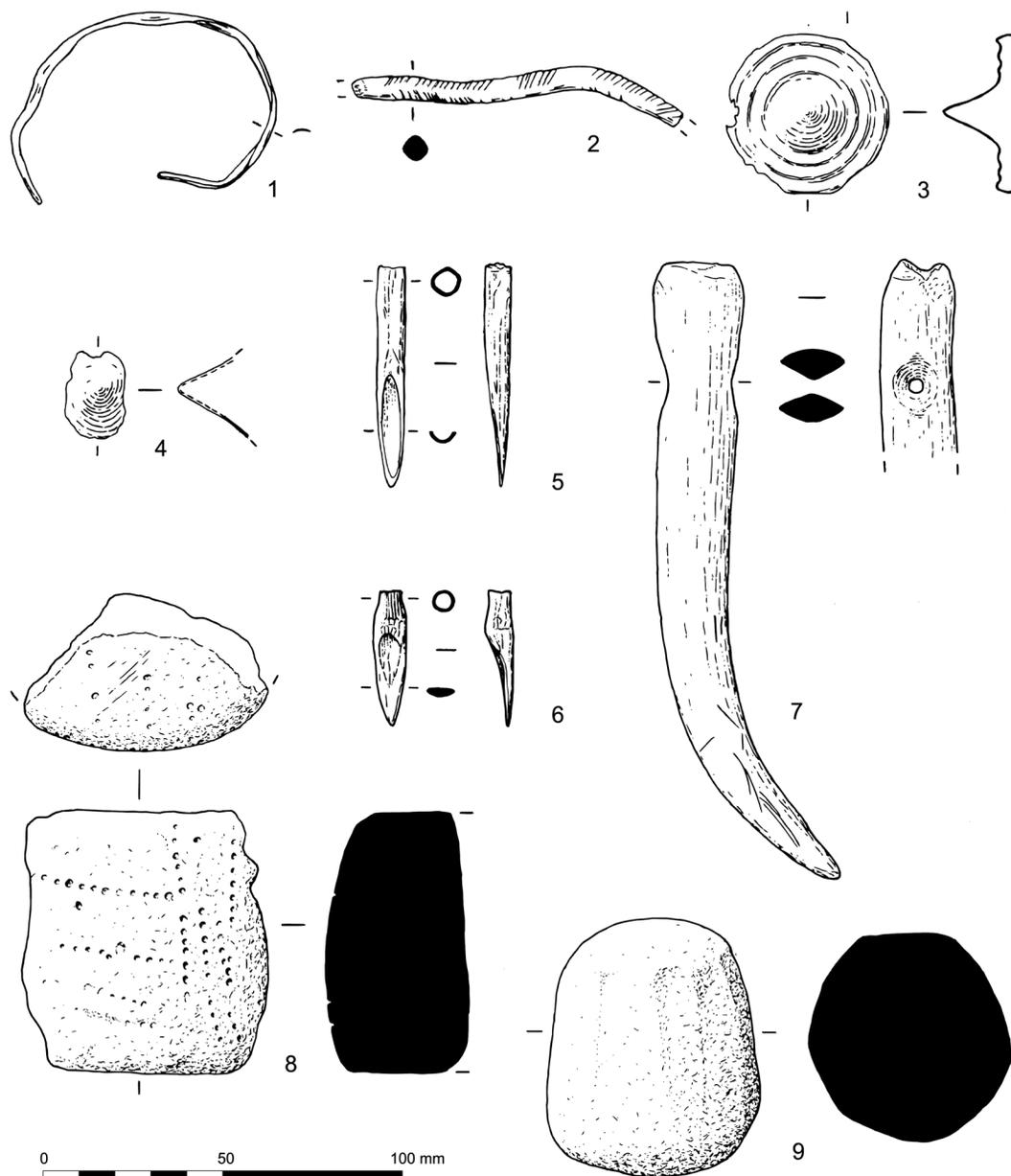


Fig 8. Middle to Late Bronze Age objects: copper alloy (nos 1–4), worked bone (nos 5–6), antler (no. 7), and fired clay (nos 8–9)

Stone objects appear to be functional and made from locally and regionally available materials. These objects include a broken and reused saddle quern, a whetstone, and a finished puddingstone ‘ball’ or hammerstone. As might be expected at this period, the majority of the worked flint recovered comprises debitage (cores

and flakes) with few examples of tools, predominantly scrapers (Leivers 2005a).

Worked animal bone includes an antler pick and a pointed sheep/goat tibia. The antler was from a large, mature stag and damage to the bone suggests it may have been discarded after use. Longitudinal wear on the tip of the sheep/goat tibia indicates it may have been

used as a gouge. Other worked bones include two other bone points <6586 & 6564> (Fig 8, nos 5–6), which have parallels in a shuttle tip or gouge from Potterne (Seager Smith 2000, fig 90, object 13) or needles and gouges from Billingsborough, Lincs (Chowne *et al* 2001, fig 37, objects 5–7). A further find was an antler with a bored hole <6667> (Fig 8, no. 7).

Several fragments of fired clay loom-weights were recovered from within the channel deposits, all cylindrical in shape, some more convex-sided than others. Three fragments <6560> recovered from layer [4073] were decorated with impressions from a six-toothed comb (Fig 8, no. 8). A complete cylindrical object <6667> (Fig 8, no. 9) was recovered

from channel deposit [4074]. It resembled clay reels from Danebury (Poole 1984), except it was not perforated.

Pottery of Middle Bronze Age date has been identified as deriving from two basic vessel types, which correspond to the standard division of Deverel-Rimbury ceramics into coarser bucket- or barrel-shaped and finer globular vessels (Leivers 2005b). Some of the bucket-shaped jar rims recovered have finger-tip or nail impressions or incised lines on the top. Decoration on the body takes the form of horizontal, vertical and horseshoe-shaped cordons, some with finger-tip or nail impressions (Fig 9, nos 1–2). There are a small number of lugs/knobs.

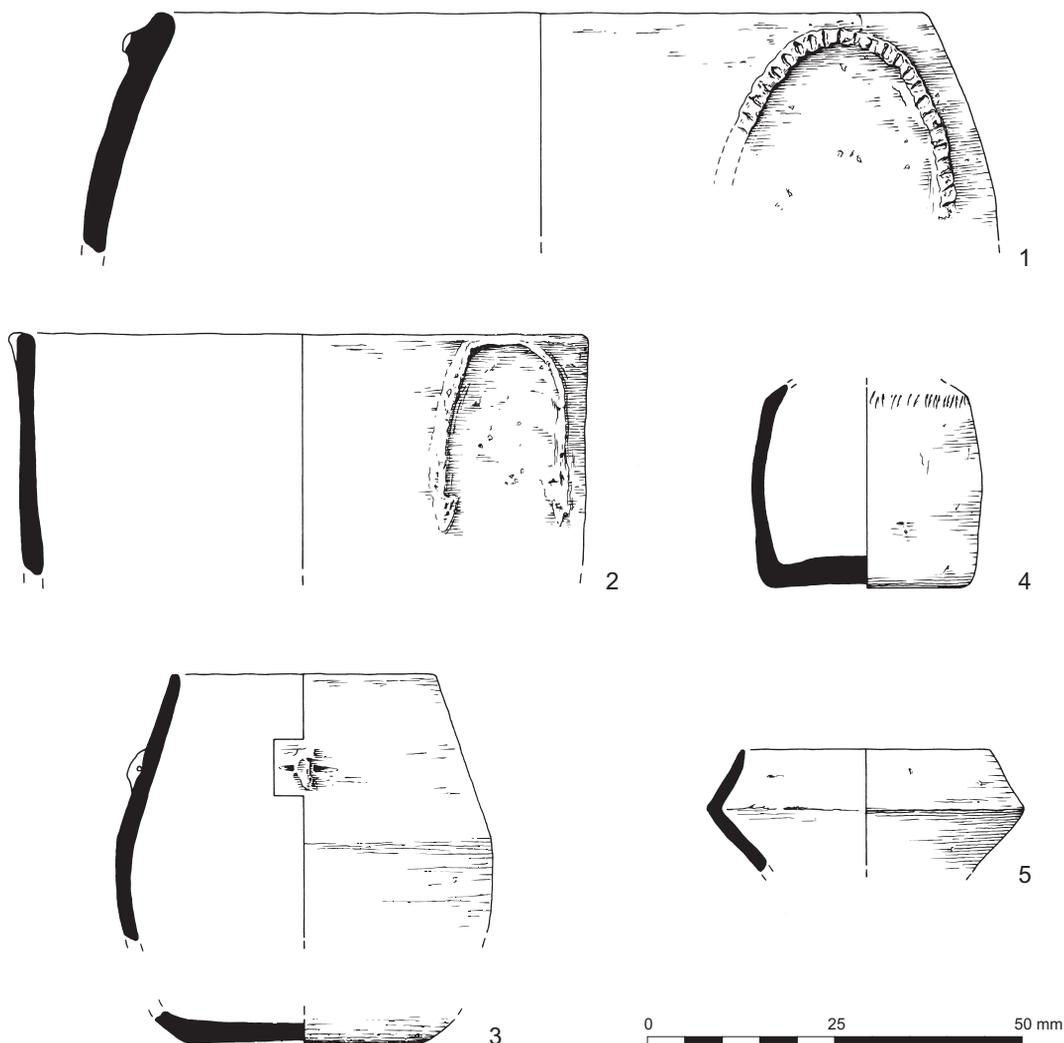


Fig 9. Middle Bronze Age vessels (nos 1–3) and Late Bronze Age vessels (nos 4–5)

Sherds of globular vessels recovered were also decorated. Decoration consists of tooled or incised geometric motifs on the upper body, or incisions on the shoulder. Lugs/knobs are present, either vertically perforated (Fig 9, no. 3) or plain. Globular vessels are an uncommon element in the Lower Thames valley/Kent regional Deverel-Rimbury group (Ellison 1980), although more examples are now known from excavations on settlement sites in the London region (Brown & Cotton 2000, 87).

The occurrence of fine fabrics is characterised by the presence of very marked obtuse-angled shouldered bowls (Fig 9, no. 5), and various jar forms (Fig 9, no. 4) confirm continued deposition into the Late Bronze Age. All of the fabrics can be considered locally-manufactured: the standard tempering agents neither prove nor preclude this, but the absence of non-local materials makes a local clay source likely.

Few contemporary features were recorded in the northern part of Site 1. Three shallow pits lay to the west along the western bank of the stream. The function of these pits is unclear. South of the revetted area the bank

became a shallow gentle slope. Several pits/post pits and postholes were dispersed across this slope. Post pit group [10685] may have formed a four-posted structure with evidence of at least one post having been replaced. Small sherds of a Post-Deverel-Rimbury (PDR) type vessel recovered from [10685] may post-date the disuse of the structure. Several ditches to the south and south-west may be remnants of field or enclosure boundaries. Given the ‘domestic’ character of most of the finds, we might suggest that they derive from a small settlement or seasonal encampment that has been almost entirely truncated by the construction of the mid-20th-century sewage works, or which lay just outside the area of excavation.

‘Midden’ 2

On Site 1, a deposit [10689] (Fig 10) situated in a hollow by the bank of the stream was identified during excavation as a possible midden. It may originally have been far more extensive. Just beyond the four-posted structure (above), the bank became steeper but was truncated to the south by modern



Fig 10. ‘Midden’ 2 under excavation. View looking south along the former stream channel which shows as the dark strip through the centre of the picture

activity leaving only a few indicators of the upper bank. The 'midden' comprised numerous interleaved layers of sands, gravel and silts, no more than 0.3m deep in total. A large quantity of worked flint and animal bone, and smaller quantities of pottery (198 sherds) were recovered from these layers. The worked flint assemblage from the 'midden' comprises debitage only; no flint tools were identified. A copper-alloy cone <3403> (Fig 8, no. 4), probably a fragment of an item similar to <6590> (above), was also recovered.

The animal bone assemblage was dominated by cattle, although sheep/goat, pig and wild species were present (below, 'The Middle to Late Bronze Age economy') in similar proportions to those reported at other documented Later Bronze Age settlements and at midden sites, such as Runnymede Bridge. The animal bone analysis concluded that most bones appear to represent domestic refuse, but that special activities such as feasting could not be ruled out.

Bones from species such as birds, red and roe deer, and aurochs (although the latter may have been rare by the Middle Bronze Age and would conventionally be seen as residual material eroded from further upstream) are generally in good condition, and, as some have been worked or butchered and are found within cultural layers full of butchered domesticates, are probably cultural artefacts. At Runnymede (Needham & Spence 1996) distinct periods of rapid and slow accumulation, the latter containing bones from wild animals, the former including some articulated remains and deposits thought to be from specific activities such as 'stew pot' waste, were identified. Very seldom were such episodes obvious in the 'midden-like' deposits at Innova, although several conjoining parts within some of the layers indicated direct deposition following butchery. As the size of the assemblage is very much smaller than Runnymede, and fluvial action may have obscured some patterns, detailed analysis of differences between individual layers was not undertaken, but this could form the basis of further work.

There was considerable evidence for post-depositional modification of the 'midden-like' deposits. Surface modification of two

cattle bones from these layers is indicated by marks characteristic of trampling, being superficial, shallow, smooth walled and multidirectional (Olsen & Shipman 1988). Trampling may have been caused by humans, but domestic mammals can also cause such marks. Other bones are dramatically different in condition between their proximal and distal parts, or from side to side, suggesting that the poorly preserved part had been immersed in a hostile environment, perhaps partially buried in the sand. It appears that most of the bones that accumulated in the 'midden' or in the palaeochannel were subject to scavenger and water activity which dispersed smaller bones and contributed to the destruction of less dense parts. Brean Down (Levitan 1990), like Innova, had a large proportion of mandibles amongst deposits that were interpreted as representing simple refuse disposal, probably because this bone is one that survives scavenging by dogs.

A heavily fragmented human skull vault was recovered from the channel (context [3337]) close to 'Midden' 2. 85% of the skull was present, with the facial portions of the skull absent. While it may have derived from the 'midden' itself, the deposition of human remains, particularly skulls, in streams and other watery places is a familiar pattern in later prehistoric Britain and is well documented in relation to the Thames and its tributaries (*eg* Bradley & Gordon 1988; Knüssel & Carr 1995; Cotton 1996, 88–9, 94). One possible interpretation of the four-post structure [10685] (above) would be as an excarnation platform (*cf* Ellison & Drewett 1971). At the Late Bronze Age eyot site at Wallingford (Whitecross Farm), the presence of human skull fragments was interpreted as evidence for the disposal or display of human remains (Thomas *et al* 1986, 195).

The pottery shows a potentially significant chronological and spatial distribution, and indicates that 'Midden' 2 is a somewhat later feature. For the purposes of this report, 'Midden' 2 layers are divided into two groups, north and south. In the southern group, 71 sherds weighing 1,001g were recovered from 23 layers. The majority (60 sherds) were PDR types, suggesting a predominantly Late Bronze Age date for the formation of these deposits. Only a single sherd weighing 7g derives from a fine bowl, with the rest of

the assemblage from coarser vessels. The majority are plain body sherds: only two rims are present, both at under 5%. Deposits of ‘domestic refuse’ are considered the most likely source of this material.

From the northern group, a slightly larger quantity of pottery was recovered (127 sherds weighing 1,405g; the majority is PDR, 82 sherds). The relative proportions of coarse to fine fabrics are comparable north and south of the gully, as is the very low incidence of rim sherds.

Interpretative issues concerning the origin and significance of these deposits are considered in more detail in the discussion (below). The deposits appear to contain a more limited range of material than those accumulating around the revetments (‘Midden’ 1, above). The ceramic evidence for post-depositional (southward) movement within the ‘midden’ and the interleaving of refuse-producing silts with sand and gravel layers suggests a distinct fluvial contribution to the formation of the deposit. This may have been a midden, periodically covered and disturbed by water flowing (perhaps seasonally) in the channel, but alternatively the refuse may have washed downstream from a focus of activity to the north, possibly in the vicinity of the revetment or beyond the limits of excavation to the north and accumulating (and surviving later truncation) in a natural hollow.

Two shallow gullies aligned north-west to south-east may have demarcated the original northern [3237] and southern [3324] extent of ‘Midden’ 2 (see Fig 4), which had clearly suffered from horizontal truncation. These gullies appear to be part of a pattern of land division which survived best to the south. A small number of inter-cutting pits in the vicinity of the ‘midden’ suggests activity in the area over a long period. A series of enclosures and pits lay to the south-west.

Enclosures and pits

Ditches delimited several enclosures and a droveway leading down to the stream. The two ditches that formed the droveway appeared to turn southwards at the edge of the stream (Fig 4).

A rectilinear enclosure, measuring c.60m by 10m and aligned north-west to south-

east, was joined to the southern ditch of the droveway. No evidence for an entrance survived. A gully and pit alignment to the south may represent the remnants of a second rectilinear enclosure of comparable size. The only features within the enclosures have been interpreted as tree and shrub throw holes due to their irregular nature. A sizeable quantity of pottery was recovered from a large pit [9411] to the south of the pit alignment.

To the north of the droveway lay a number of ditches, presumably components of further enclosures. A north to south-aligned ditch close to the western bank of the stream may represent an early attempt at irrigation or flood control. Ditch [10679] (Fig 4) must form part of a later phase of enclosure, as it cut the northern droveway ditch. It produced a rotary quern and a single fragment of human bone, abraded and weathered, with longitudinal splitting suggestive of surface exposure.

Layer [2353], an amorphous spread of greyish brown silty clay covering an area of c.53m² lay immediately to the west of ditch [10679]. Investigation revealed a depression/hollow, containing at least two phases of waterborne deposits — evidence of episodic flooding. Artefacts recovered included pottery and animal bone.

Some 170m to the south of the droveway were signs of concentrated activity, in the form of 61 pits clustering in three discrete groups, designated A, B and C (see Fig 4), most of which produced Middle Bronze Age pottery. Pit group A contains larger pits, many of which intercut. Pits in group B are smaller and more dispersed, while pits in group C are smaller and form a more compact group. Evidence of specialised function was not recovered. Two ditches immediately to the west may represent remnants of enclosures. This concentration of features may suggest localised activity, although possibly over a long period. Given the evidence of episodic flooding (above), this may have been in the form of a seasonal encampment on the western bank of the stream.

The Middle to Late Bronze Age economy

The open, damp floodplain of Site 1, with dry soils on the valley tops and sides, would

have supported pasture, corralling of animals, and some small-scale cultivation. While relatively infrequent in the samples, the presence of both hazel and sloe probably indicates some utilisation of wild resources. The eastern floodplain of Site 2 and beyond, by contrast, seems to have been wetter, being at a lower altitude, and supported marsh and peats. Consequently this area seems to have been used for other activities. Visibly this is represented by the disposal of metal objects in this area (above, 'Archaeological background'; Fig 1), perhaps indicating a focus of 'ritual' and 'votive' activity, although wetland resources were no doubt also exploited.

The evidence for cultivated species is limited but both hulled barley (*Hordeum vulgare*) and emmer wheat (*Triticum dicoccum*) appear to have been grown (Table 3). The absence of spelt wheat (*Triticum spelta*) may be significant as this only occurs in Britain from the later Bronze Age (cf Hinton 1982). Whilst there is evidence for continued Late Bronze Age activity on Site 1 (above), it may be that crop husbandry was an aspect of the Middle, rather than the Late Bronze Age economy of the site. The weed species are generally uninformative, but there is no reason why fields were not cultivated on the drier floodplain soils and on the valley slopes at the fringes of the floodplain. That large seeded crop species are predominant may suggest that the crops were brought to the area as semi-cleaned grain or spikelets after they had been threshed, winnowed, and sieved within the field following harvest in the late summer. The level of representation here may further suggest that crop production was not one of the main activities on the site.

The animal bone recovered is not necessarily representative of the wider economy as most came from deposits adjacent to the channel and could potentially represent very specific activities. Although these are broadly characterised as 'domestic refuse' (above, "Midden' 2'), they were produced by activities that left well-preserved bones which were not exploited for their marrow (Knight 2005a).

The majority of animals represented were cattle (see Table 4). We can suggest that cattle and sheep/goats were pastured on the floodplain for part of the year at least.

Animals may have been driven to the river to drink, and the droveway and enclosures are best interpreted as related to pasture and stock-rearing. Most of the herd was used for traction or breeding, with the majority of the sexed bones (admittedly only a small number) from females or castrates. Some cattle were culled at their first or second year, probably males used for meat.

A wide range of sheep/goat ages was present, and it is likely that the majority of animals represented were selected from the herd for meat, but a few were kept into maturity for wool, milk, and breeding. The presence of domestic neonates suggests breeding on or near this site, and the greater proportion of females to males makes practical sense in terms of maintaining a flock, but may also indicate a focus on meat production, where the males are killed at their optimum meat age (culled before their third winter) with females retained for breeding purposes. Sheep are far more common than goats, but the keeping of both may have acted as protection against species-specific disease.

Pigs were primarily kept for meat and were culled in the second or third winter for autumn-born animals and third winter for spring-born animals (calculated using Erynk 1997). Some older females were kept for breeding. Dogs (see Table 4) were of average stature for the Bronze Age. While a proportion of the wild animals that were recorded (see Table 4) may have been natural deaths and washed up in the river, they do indicate some of the wild animals (red deer, roe deer, fallow deer, and waterfowl) available to the local population, and some were certainly butchered.

The small number, but wide variety, of bones from wild species is a common feature of Bronze Age palaeochannel sites in Britain, which include Runnymede Bridge, Surrey (Done 1991; Serjeantson 1991; 1996), Whitecross Farm, Oxon (Powell & Clark 2005), and Caldicot, Gwent (McCormick 1997). At the first and last of these waterside sites, birds and mammals that have a freshwater habitat (goose, ducks, crane, water vole, otter, and beaver) were found in small numbers, roughly proportionate to the size of the assemblage. At Runnymede, the site closest to Innova, wild cat, fox, owl and badger remains, as well as deer, testify to the

possible presence of woodland nearby, or at least to the exploitation of woodland, as do wild boar at Whitecross Farm. The wild animals may in part have become incorporated into an assemblage after a natural death (eg polecat, otter, vole), but others were thought likely to have provided a small supplement to the diet, and some animals could well have been utilised for non-meat products, such as pelts or perhaps feathers.

Overall this suggests relatively self-contained communities with small herds and flocks, probably using the Lea Valley floodplain as seasonal grazing, with dogs (Table 4) to help with protection and herding of the flocks. The river was an important part of this economy, in terms of watering the animals and perhaps also for transport.

Apparent hiatus

No features can be securely dated to the Early to Middle Iron Age. There was no opportunity to investigate whether this was due to changes in the local settlement pattern or economy and/or to environmental changes, due to lack of close dating of the upper parts of the sediment sequences examined (above). Either substantially wetter conditions or the cessation of flow within the stream channel would potentially have led to the area becoming less suitable for previous, possibly seasonal, land-uses. Use of the floodplain may have continued in a less intensive manner.

Late Iron Age to early Romano-British (Period 3, 70 BC–AD 150)

In places at least two possible phases of activity were defined on stratigraphic grounds within Period 3, but these could not be chronologically separated or correlated with certainty across Site 1 (Fig 11). Ceramic evidence suggests that the period might extend from the immediately pre-Conquest period to no later than the first half of the 2nd century AD, with a focus in the second half of the 1st century AD (Mephram 2005).

Environment

As was the case for the previous period (Period 2, above), there is not enough environmental data to provide detailed

interpretation of the two Period 3 phases. No significant differences in either the environment or economy could be identified between the two.

Dating evidence for the upper alluvial sediments is lacking. Nevertheless, the pollen from Late Iron Age/early Romano-British pit [9708] (pit group E, Fig 11) is indicative of very diverse floodplain grassland typical of pasture and waste ground, as well as both cereal pollen and weeds of arable cultivation. This is typical of an open herbaceous agricultural environment. Pine and oak probably stood on the valley tops and sides, with hazel and heather (*Calluna vulgaris*) on the floodplain, and some alder and willow at the channel edge. However, the edges of the channel appear to have been mostly open with clumps of nettle and buttercup, and with reeds extending into the channel itself. There is little indication of the fen marsh component seen in earlier periods, or for vegetation within the channel itself, although water-crowfoot and horned pondweed (*Zannichellia palustris*) from pit [4026] (Fig 11) indicate some pools of stagnant water.

The slightly increased scrub element may indicate some formation of hedges. The ground around the pits and ditches appears to have grown thick with nettles and buttercups.

Peat was again observed near the base of a number of pits, and in pit [9708] it formed the lowest excavated fill, suggesting that the pit was originally dug into a high ground-water table, but also had inputs of floodwater from the river. There was some evidence of drying and stabilisation of the upper surface of the peat in this pit, forming an incipient soil horizon. Overbank alluvium sealed this peat indicating continued, presumably seasonal, flooding and inundation (Chisham 2004).

Overall, there was no evidence for dramatic environmental change from the Bronze Age. The main detectable environmental development seems to have been the reduction of woodland due to human activity, although changes took place in the nature of activities conducted on the floodplain (below).

Exploitation of river resources

In the north of Site 1 at least five poorly-preserved circular structures (see Fig 11)

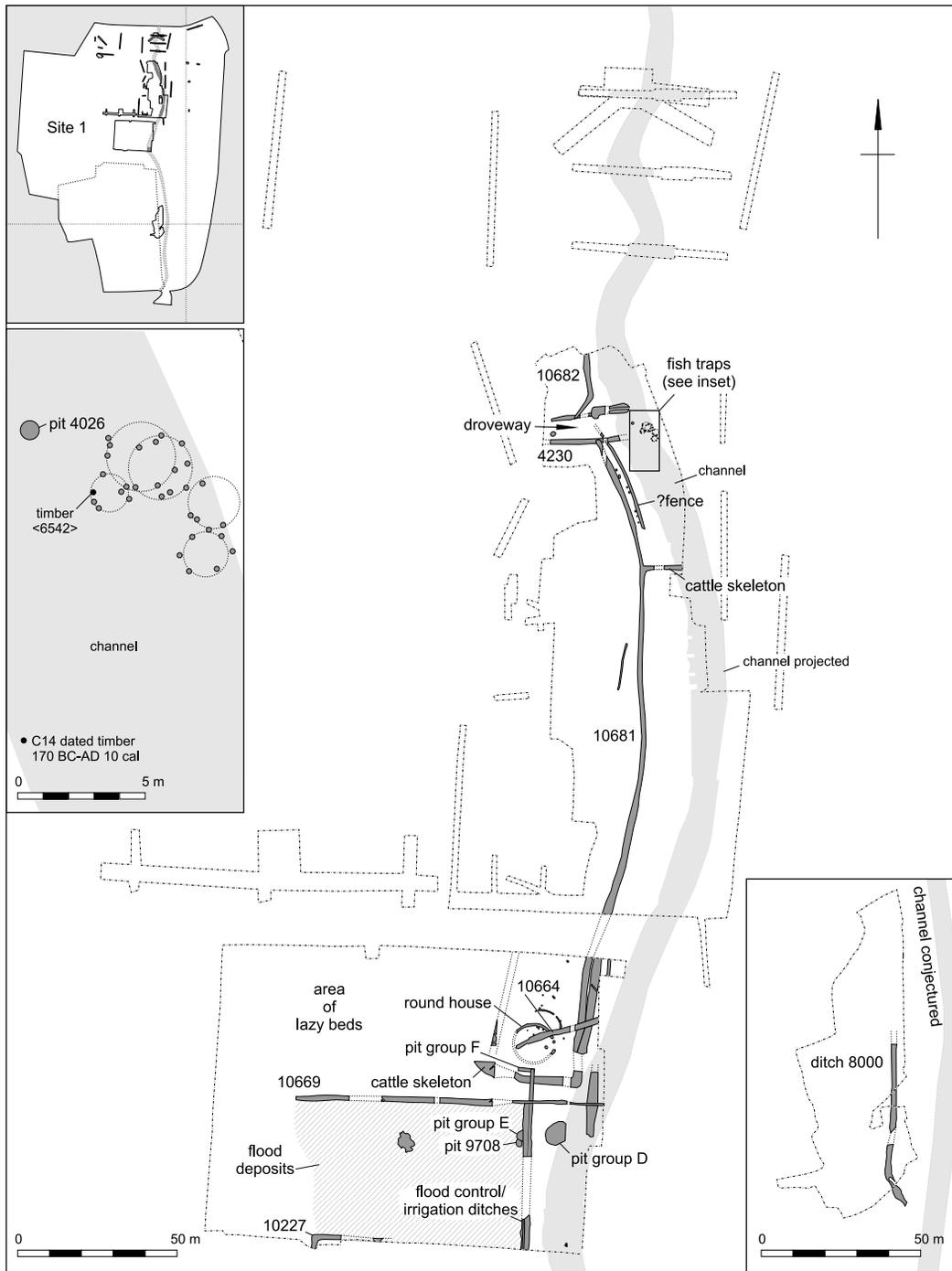


Fig 11. Plan of Late Iron Age to early Romano-British features, with detail plan of the fish-traps

were recorded within the channel. These were between 1.5m and 2.6m in diameter, built from small, crudely worked stakes and

woven twigs and branches: they are interpreted as fish-traps. A radiocarbon date of 170 cal BC-AD cal 10 (2062±30 BP; NZA-20911)

was provided for one of the branch-wood stakes <6542> (below, 'Radiocarbon dating') which indicates this activity may predate the main period of occupation (below).

An east–west-aligned ditch terminated within the channel, immediately west of the fish-traps. The ditch may relate to an access route or driveway only clearly demarcated in the later phase.

Structural evidence

Traces of what was at most a single small farmstead were focused on a possible roundhouse, represented by the construction trench of a circular structure with associated roof-drip gully, lying *c.*170m to the south of the fish-traps. The entrance faced north-east, into the prevailing wind during winter months, which may hint at seasonal (summer) occupation, although it might simply relate to the importance of the channel. The structure lay within a rectangular ditched enclosure, beside the west bank of the stream. Several postholes within the structure and in the area immediately to the north may represent internal divisions, or features within the enclosure, such as drying-racks. Pottery from the structure and the various pits around it indicates that they date from the mid- to late 1st century AD; the presence of some imported pottery may be indicative of pretensions to status (Mephram 2005) as well as the changing post-Conquest economy (below). The occupiers may have been involved in agriculture, seasonal grazing, and exploiting the river resources.

Two groups of inter-cutting pits lay to the south of the enclosure. Pit group D produced a heavily corroded copper-alloy coin, possibly an as or dupondius <10104> struck during the 1st to 2nd centuries AD. The second group (E) comprised two large pits. Pottery recovered from the pits included an almost complete poppyhead beaker and part of a carinated bowl from pit group D, while a good example of an imitation Gallo-Belgic platter came from pit group E. The function of these pits remains unclear, although they contained small quantities of refuse.

A series of ditches to the south and west of the roundhouse enclosure may define further rectilinear enclosures, and probably represents irrigation or flood control.

Waterborne flood deposits covered much of the area immediately to the south of ditch [10669], and the ground water table was high (above, 'Environment'). A single shallow north to south-aligned ditch [8000], parallel with the western bank of the stream some 200m south of the roundhouse enclosure, may have had a similar function.

Agriculture

A short distance to the west of the roundhouse enclosure lay faint traces of agricultural features. These may have been 'lazy beds', an early form of ridge and furrow on a small scale, a technique employed for crop growing in wetlands (Newton 2000). The features are poorly dated, but overlay Bronze Age features. They only became visible as they weathered in the course of fieldwork.

Livestock control

The second phase of activity in this period (Fig 11) seems to relate to stock control, particularly managing access to and from the stream. In the north of Site 1, ditches [10682] and [4230] formed part of a driveway or track that led from the west down to the stream. To the north and south, ditches ran parallel with its west bank. Immediately to the south, an alignment of post pits situated between two parallel ditches forms a possible fenced boundary *c.*30m in length. The inner ditch [10681] continued south along the bank for a further *c.*150m. A later ditch [10664] bisected the roundhouse and its enclosure, indicating continued activity after the disuse of that structure.

A short distance south of the fenced boundary, ditch [10681] branched east towards the stream. An almost complete articulated cattle skeleton was recovered from this branch (Fig 12). Its positioning suggests some disturbance by water action, with rapid burial, perhaps by fluvial silts. Deliberate burial is indicated, as all limbs had become detached from the girdles and, while these joints do naturally disarticulate relatively quickly, cut marks were recorded on the humerus. Presumably the limbs were removed to fit the carcass into the feature more easily.



Fig 12. Almost complete articulated cattle skeleton from ditch [10681] (1m and 0.5m scales)

The Late Iron Age to early Romano-British economy

The site was evidently more concerned with agricultural production than with consumption, like the larger enclosed site at Thames Valley Park, Reading (Barnes *et al* 1997). Charred plant remains from contexts interpreted as hearth waste dumped in pit [9708] (pit group E) indicate that both hulled six-row barley and emmer were cultivated, while spelt, introduced in the later Bronze Age, appears to have become equally, if not more, important. A number of other crops that have rarely been found in the London area at this period were also consumed and some possibly even cultivated. These include oats (*Avena* sp.), coriander (*Coriandrum sativum*), flax (*Linum usitatissimum*), fig (*Ficus carica*), and lentil (*Lens culinaris*) (Stevens 2005). The last may have been imported and it is certain that fig was imported from the Continent. Similarly, cultivated oats, while recorded from northern England and Scotland (Greig 1991), are more rarely recorded from the South, although they have been recorded from pre-Roman contexts at

Asheldham hillfort in Essex (Murphy 1991), and a few other sites in London (Straker 1984).

The charred assemblages all contained high counts of sedges, and species such as spikerush, perhaps indicating that crops were now being grown on the floodplain (Jones 1988a; 1988b). The high number of vetch (*Vicia/Lathyrus* sp.) seeds, which has been noted on many sites in southern England from the later Iron Age to the Roman period (Jones 1981), may be a sign of declining, or poor, soil fertility, but also may relate to changes from spring to increased autumn sowing.

Charred seeds of hemlock (*Conium maculatum*), a species thought to be a Roman introduction, were present in pit [9708] (pit group E). The good representation of rachis fragments of barley and straw in this feature suggests the burning of waste from threshing, raking and coarse-sieving, activities often conducted shortly after harvest. However the high presence of glume chaff suggests that the assemblages derive from the dehusking of hulled wheats conducted as the crops are taken from storage.

The fact that larger weed seeds dominate most of the other charred assemblages suggests, as with the Bronze Age, that crops were generally stored as semi-clean grain or spikelets. This would suggest that threshing, raking, winnowing, coarse and fine sieving were all conducted in the field prior to the crops being brought to the site to be stored. The glume chaff from pit [9708] (above), however, suggests that waste from these earlier stages has been mixed with later stages. Whether the material was brought to the site as fuel or was obtained from crops stored or exchanged as sheaves is unclear. Given the high presence of oats, the assemblage may have come from crops originally stored as sheaves to be used as fodder but then processed for human consumption instead.

The animal bone evidence was sparse, and mostly from the central excavation area of Site 1, and limited to a few specific features. The poor, flaky condition of the bone is a testimony to high winter groundwater conditions in the features. Sheep/goats were more common than in the Bronze Age, with cattle providing the majority of the remaining farmed animals. A cattle skeleton from near roundhouse [10660] indicates some unusual or specific deposition. The overall number of remains here is low and may suggest that animal husbandry was less significant, or that the animals were not butchered, processed or deposited on this site. Alternatively the adverse burial environment may have destroyed the majority of the remains. The droveway and boundary features of Phase 2 indicate that animals could have been driven from pasture on higher land to the west, to be watered at the river, and perhaps mainly grazed the floodplain meadows in the summer or autumn.

Fish were obviously a part of the local economy, as seen by the fish-traps in the river; their remains, however, were not recovered on site in anything other than incidental quantities. This may be due to poor preservation, or the fact that they were taken elsewhere to more permanent and larger settlements for processing and consumption.

Overall this period indicates renewed or increasing exploitation of the area in the Late Iron Age to early Romano-British period. Use of the floodplain and the area

excavated may have been less intensive than in the Bronze Age, but more extensive use of other parts of the landscape, such as the higher ground to the west of the excavated area, may be indicated. As previously, the main permanent settlement may well have lain on the higher, drier land, with only a range of specific activities represented on the floodplain and at the channel's edge.

The presence of fig, lentil and coriander suggests that the inhabitants were able to trade with passing traffic. All are recorded occasionally from sites in London (Davies with de Moulins 2000; Straker 1984; Willcox 1977) but are otherwise rare outside it. A similar origin may be suggested for some of the pottery assemblage (Mephram 2005). Given the location of the site close to both Ermine Street (the major Roman routeway to the North) and the River Lea, trade from *Londinium* seems likely. River channels were presumably used for communication, as the supposed Romano-British log boat at Rammey Marsh testifies (Holmes 1952; Holmes & Hayward 1955). We may suggest that farm produce and fish were exchanged for non-local ceramics and imported exotics, such as figs, coriander and lentil, samian vessels, amphorae and their contents. The smaller numbers of wild animals (see Table 4) may also point towards a trade and product-based, farmed economy during this period.

Later activity (Period 4, post-AD 150)

No further changes to the landscape within the Lower Lea Valley are apparent from the recovered data, and there is very little evidence suggesting the type of activities, if any, that were taking place within the Lower Lea Valley during this period. Evidence that some channels of the Lea continued to be managed into the late/sub-Roman period was recovered from Site 2, where a slightly-built, wooden revetment was exposed (Fig 13). A curving line of stakeholes was positioned roughly parallel to the bank, and was fronted by two large pieces of worked wood. The stakeholes appeared to represent a line of structural supports for a waterfront revetment. A number of collapsed round-wood oak stakes were recorded, the largest and most complete 1.30m long and up to 0.07m in diameter. The exact form of this

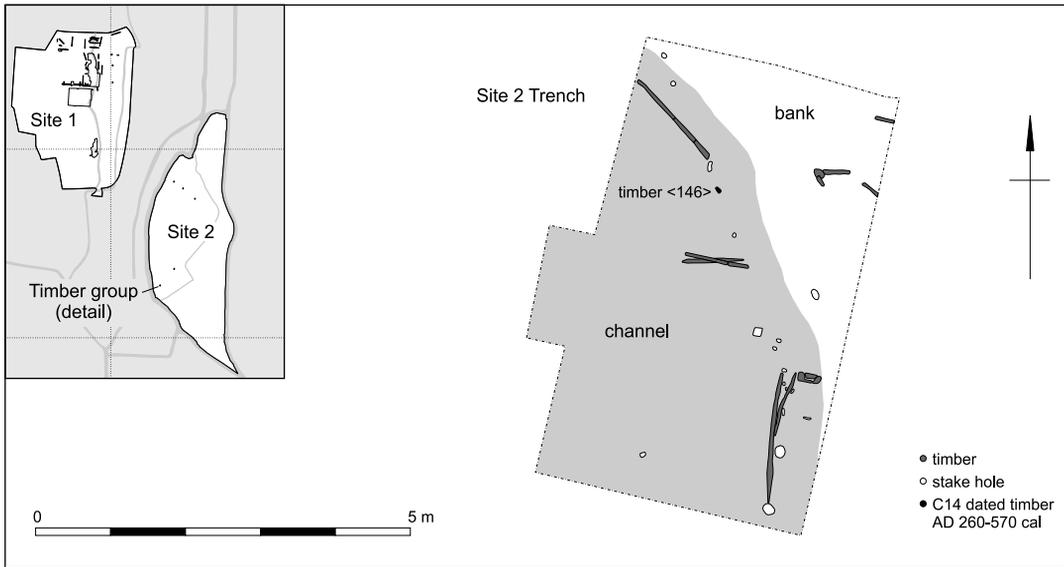


Fig 13. Plan of the Late to Post-Roman revetment on Site 2

structure is unclear; it may have consisted predominantly of thin upright stakes with more substantial stakes occurring at intervals. The main body of the revetment was likely to have been relatively lightweight, perhaps wattle (the stakes are relatively insubstantial), with the larger timbers positioned near the base. A radiocarbon determination from timber <146> provided a date of cal AD 260–560 (1610±50 BP; GU-7209).

Some continuing use of the area is indicated by a single pit [8062] (not illustrated) located close to the group B pit alignment in the south of Site 1. The pit contained 15 sherds of organic-tempered pottery of Early to Middle Saxon date (Wessex Archaeology 2003, 14). A socketed spearhead of Early to Middle Saxon type <6594> came from an upper fill of the stream channel on Site 1.

DISCUSSION

The two sites reported here offer useful insights into the changing landscape, environment, and human activity in this part of the Lower Lea Valley from the Late Glacial period through much of the Holocene, demonstrating the potential for future, wider, landscape studies. The use of the valley and its watercourses as a food resource from at least the Late Mesolithic is hinted

at by residual flint tools and consideration of all strands of environmental evidence. Radiocarbon dating indicates that the stream bank was revetted in the Early Bronze Age (Period 1), if not before. Although no other features can be firmly dated to this period, the revetment indicates that control of the braided, meandering stream channels of the Lower Lea, the surrounding floodplain, the water resource itself, and perhaps also water transport was of importance to local communities from an early date.

The principal phase of activity on Site 1 was the Middle to Late Bronze Age (Period 2), when the site is thought to have functioned as a specialist, possibly seasonal settlement or encampment, mostly concerned with stock rearing and summer grazing, principally of cattle. No structures were identified, but pits and the range and quantity of material incorporated in the 'midden' deposits (below) are suggestive of an unenclosed settlement, dispersed along the stream bank, more intensively used to the north, while a series of paddocks and droveways lay to the south. It is assumed that agriculture, winter grazing and more substantial, permanent settlements were located on drier ground above the river floodplain, while the lower lying wetlands to the east, closer to the main channels of the Lea, were a focus for the deposition

of 'votive' offerings (see Fig 1), as well as providing hunting and fowling. Comparable evidence to test this interpretation should be sought from other sites in the area. In the absence of evidence for domestic structures and the truncation of deposits on the higher, drier floodplain on the western part of the site, the conjectured Bronze Age settlement may have been arranged in a similar manner to Bradley Fen, Cambs (CAU, nd), where activity areas lay adjacent to the edge of a swamp, but dwellings and paddocks were set well back, on slightly higher ground.

The two areas of Middle to Late Bronze Age 'midden-type' deposition ('Middens' 1 and 2) are significant, although circumstances did not allow them to be examined in the same detail as the research excavations of similar deposits at Runnymede Bridge. The use of the term 'midden' appears justified within the definition offered by Needham and Spence (1996, 25–6), in that analysis suggests these are occupation refuse deposits, accumulating deliberately and sequentially in one location, although modified by post-depositional processes.

How the deposits formed, and the type of activity or settlement they represent is only partially understood. 'Midden' 1, accumulating on the ground surface around the revetments, produced the widest range of animal bone and artefacts, perhaps hinting at the location of the main focus of activity. Alternatively, waste from a nearby settlement may have become incorporated into material used as packing behind each stage of waterfront construction. To the south, 'Midden' 2 showed clearer evidence of episodic formation and post-depositional disturbance by scavenging animals and water action. Like Area 6 at Runnymede, the Innova 'middens' may have lain at the very edge of a settled or utilised area (Needham 1991, 379).

Two principal interpretations have been advanced to explain the accumulation of more substantial deposits of organic and other waste in the Late Bronze Age. To summarise, 'midden interpretations' explain the deposits in terms of simple refuse dumping from settlement and activity elsewhere (incorporating the effects of concentrated stock management and possible 'ritual' deposition), while 'settlement interpretations' see material accumulating from

activity (particularly stock-rearing) and settlement *in situ* (Lawson 2000, 266–71). Related factors might include seasonal occupation, specialised function, use as an exchange centre, or as a periodic gathering place for a relatively mobile population. Although these comments were written about a Late Bronze Age site in distant Wiltshire, they are relevant here.

The Site 1 'middens' produced plentiful refuse, but little evidence for other settlement features or structures, suggesting either extensive truncation or temporary occupation and use. Overall, the range of animal bone, pottery and artefacts from the 'midden-type' deposits is not atypical of Middle or Later Bronze Age domestic settlement sites in the wider region. Certainly the range of material is far wider than that associated with the Late Bronze Age revetment or landing-stage at Anslow's Cottages, Burghfield (Butterworth & Lobb 1992, 88–94, 106–28). There is evidence for stock rearing, butchery, food preparation, bone- and flint-working, weaving, and possibly hunting. Examination of the environmental evidence and animal bone suggests a possible specialised function connected with summer grazing of livestock, and the interleaving of refuse and alluvial deposits in 'Midden' 2 might support the idea of seasonal or periodic occupation from the Middle to Late Bronze Age. The vast majority of animal bones were disarticulated and appear to be domestic refuse. As at Runnymede Bridge, the occurrence of large unfragmented bones within palaeochannel contexts could indicate differential disposal of waste from larger animals away from the main occupation or activity areas.

Although parallels for Deverel-Rimbury pottery are not common in the immediate Lea Valley, the range of fabrics and forms is typical of Deverel-Rimbury assemblages from the middle and lower Thames (Brown 1995), many of which are largely funerary (Gardner 1924; Barrett 1973). Domestic assemblages in the region are less well known, but have been identified in west London at Isleworth (Hull 1998), Heathrow (for instance Barrett 1984; Cotton *et al* 1986; Jefferson 2003; O'Connell 1990; Wessex Archaeology 2004), and in Essex at Stansted Airport (Leivers 2008). The Innova Park 'midden' assemblages are broadly consistent with these.

The site produced few items that could be considered exotic (although the copper-alloy disc/cones may be an exception). However, many of the items present and conjectured (pottery, fired clay, meat, fish, milk, hides, cloth, flint, grains *etc*) could have been produced on site and/or exchanged with other sites in the region. There is no reason why the site could not have functioned as both one element within a settlement network tied to a transient seasonal agricultural cycle and as a periodic local market place.

It is accepted that midden-type material may contain more complex patterning than might be expected from standard domestic discard (*eg* Needham & Spence 1996, 242–8). No specifically ‘placed’ Bronze Age deposits were identified, although the problems inherent in defining let alone distinguishing ‘ritual’ activity are well documented (*eg* Brück 1999).

The occurrence of human bones in ‘midden’ and channel contexts, as well as the possible four-post-structure, should at least serve as a reminder that there may have been ‘ritual’ or funerary activities taking place in the vicinity. While disarticulated human bone is a common find on Middle to Late Bronze Age settlement sites, it seems that the Thames and its tributaries may have been particularly venerated and favoured for the disposal of some element of the local population (above, ‘Midden’ 2). Only the copper-alloy disc/cones might relate to ceremonial activity and while some of the pottery or animal bone could have derived from special activities such as feasting, there is no particular evidence of this; moreover, as the timescale of individual accumulations is far from clear, any consideration of detailed refuse quantification would be of limited value.

Two final points deserve emphasis. First, the long period of accumulation of the ‘midden’ deposits reflects the site’s enduring importance in the local economy and possibly settlement pattern. The site was clearly concerned with stock raising, grazing and control, as part of an organised system which included crop growing and permanent settlement on drier land at the edges of the floodplain. Second, Deverel-Rimbury pottery indicates that the Innova ‘middens’ started to form in the Middle Bronze Age, although

larger middens elsewhere have previously been characterised as being a feature of the early 1st millennium BC (Lawson 2000, 271–2). While classic midden sites such as Runnymede are thought to have been abandoned due to social and agricultural changes of the mid-1st millennium BC, the lack of Early Iron Age material at Innova suggests other explanations are needed here. Emerging farming practices or political changes might have had an impact, but in such a marginal niche, even slight changes in the local fluvial regime might have forced the abandonment of this site. There is no evidence for further use/occupation of the site until the Late Iron Age/Early Roman period (Period 3), and if activities such as grazing, hunting and fishing did continue in the intervening period, it must have been in a far less intensive manner, which left no material remains. Clearly there is a need to develop understanding of the local settlement pattern through the 1st millennium BC, but these excavations have provided an important contribution to the study of land-use and the economy of this part of the Lower Lea Valley in the Bronze Age and in the period of the Late Iron Age/Roman transition, and illustrate the considerable archaeological potential of similar sites on the floodplain.

Pollen

The main conclusions of the pollen analysis have been integrated into the relevant sections of the main report. The full text is available in the project archive (Scaife 2005). The pollen diagram is shown in Fig 14, correlated against the stratigraphic units described above (Palaeochannel Sediments) and illustrated in section in Fig 2.

Waterlogged and charred plant remains

The main findings of the analyses of charred and waterlogged plant remains have been integrated into the relevant sections of the main report. This section provides the supporting data for the early Early Holocene (Table 2) and Middle to late Bronze Age (Table 3) material. The full text and tabulated data are available in the project archive (Stevens 2005).

Table 2. The Early Holocene waterlogged plant remains

Period		1	1	2
Feature Type		Channel	Channel	Channel
Feature		5003	5003	5003
Context		g10690	g10690	g10690
Sample		4323	5004	4265
Volume		5234W	5236W	5275W
Flot size (ml)		11	11	1000g
		80	15	5267W
				800
SPECIES				
<i>Charaogonia</i>	stonewort	-	+++	-
<i>Lycopodium/Musci</i>	moss	+	-	-
<i>Pinus sylvestris</i>	pine	cf.1	-	-
<i>Nuphar lutea/Nymphaea alba</i>	waterlily	-	-	+
<i>Ranunculus</i> L. sp.	buttercup			
subg <i>Ranunculus arb</i>		+	-	-
<i>Ranunculus</i> subg. <i>Batrachium</i>	water crowfoot	+	+	-
<i>Thalictrum alpinum</i>	alpine meadow rue	+	-	-
<i>Thalictrum palustris/flavum</i>	meadow rue	+	-	-
<i>Betula nana</i> (seed)	dwarf birch	+	-	-
<i>Betula nana</i> (catkin scales)		+	-	-
<i>Betula</i> cf. <i>pubescens</i> (seeds)	downy birch	++	+	-
<i>Betula</i> cf. <i>pubescens</i> (catkin scales)		+	+	-
<i>Populus tremula</i>	aspen	+	-	++
<i>Filipendula ulmaria</i>	meadow-sweet	+	-	-
<i>Potentilla</i> sp. L.	tormentil	-	+	-
<i>Potentilla palustris</i>	marsh cinquefoil	+	+	-
Apiaceae (<i>Bupleurum</i> , <i>Pimpinella</i> , <i>Oenanthe</i> type)		-	-	-
<i>Aethusa cynapium</i>	fools parsley	-	-	-
<i>Cicuta virosa</i>	cowbane	+	+	-
<i>Solanum</i> cf. <i>dulcamara</i>	wood nightshade	-	-	+
<i>Menyanthes trifoliata</i>	bog bean	+	+	+
<i>Lamium</i> sp.	dead nettle	-	-	-
<i>Hippuris vulgaris</i> L.	mare's tail	+	+	-
<i>Cirsium/Carduus</i>	thistle	-	+	-
<i>Potamogeton</i> sp.	pondweed	+	+	-
Juncaceae	rushes	-	-	-
<i>Scirpus sylvaticus</i>	wood club rush	++	-	-
<i>Schoenoplectrus lacustris</i>	club-rushes	+	++	-
<i>Carex</i> sp. L. (trigonous)	sedge	++	++	-
<i>Carex</i> sp. L. (lenticular)	sedge	+ 1ch	+	+ 1ch
<i>Sparganium erectum</i>	bur-reed	+	+	-
<i>Daphnia</i> cf. <i>obtusa</i> (<i>Ephippium</i>)	waterflea	-	-	-

Key:

- + 1–10 items
 ++ 10–50
 +++ 50+ items
 ch charred

The animal bone

The main findings of the animal bone analysis have been integrated into the main report. Table 4 summarises the species distribution by period; the full report and supporting tables are available in the project archive (Knight 2005a).

Catalogue of illustrated Bronze Age Pottery

Full fabric descriptions and the catalogue of vessels are available in the archive report (Leivers 2005b). The illustrated Bronze Age vessels (Fig 9) comprise:

Middle Bronze Age

1. Rim from convex-profiled bucket with horse-shoe cordon; fabric F24. Context 4118, 200mm diameter.
2. Rim from bucket with applied horseshoe cordon; fabric F24. Context 4073, 150mm diameter.
3. Rim, perforated lug, angled body sherd and base of a Globular urn; fabric F2. Contexts 4073, 4111, 4248 and 4356, 110–150mm diameter.

Late Bronze Age

4. Jar with diagonal impressions on shoulder; fabric F3. Contexts 4111 and 4356, 120mm diameter.

5. Rim from biconical bowl; fabric F4. Context 4102, 110mm diameter.

Radiocarbon dating

All samples were of mature wood, all probably oak. Areas close to the outer rings of the original timber were selected and sampled for dating. The results are given below in Table 5; calibrated using the atmospheric data from Stuiver *et al* (1998) and the OxCal programme ver 3.9 (Bronk Ramsey 1995; 2001) and are expressed at the 95.4% confidence level with the end points rounded outwards to 10 years following the form recommended by Mook (1986).

ACKNOWLEDGEMENTS

Wessex Archaeology gratefully acknowledges the assistance of Mr T Simpson, Mr S Barden and Mr H Griffith (Kennet Properties), Mr J Forsyth (London Borough of Enfield), Mr P Handley (Teesland Development Co Ltd), as well as Fairview Homes Plc and their consultant Mr D Hawkins (CgMs). Particular thanks are due to Mr R L Whitehead (English Heritage).

The excavations at Innova Park and Innova Science Park were directed by Kevin Ritchie and managed by John Dillon and Mark Roberts. The evaluation at the Former Royal Ordnance Factory was directed by Nicholas Cooke and Jacqueline I McKinley and managed by John Lewis.

Table 5. Radiocarbon determinations from Sites 1 and 2

Feature type	Context	Material	Result no.	$\delta C^{13}\%$	Result BP	Cal date
<i>Site 1</i>						
Fish-trap	4103	stake, poss. oak, c.10 outer rings branchwood. Sample 6542	NZA-20911	-26.99	2062±30	170BC-AD10
Revetment, timber group 1	4265	stake, oak, outer c.7 rings. Sample 6672	NZA-20912	-25.54	3388±30	1750-1530BC
<i>Ex situ</i> , timber group 3	4353	stake, oak, outer c.9 rings. Sample 6605	NZA-20906	-24.84	2984±35	1380-1050BC
Revetment, timber group 2	4079	stake, oak, outer c.10 rings. Sample 6551	NZA-20913	-26.38	3145±35	1520-1310BC
<i>Site 2</i>						
Revetment	146	stake, oak, c.13 (9 sapwood, 4 heart, fast growth)	GU-7209	-27.9	1610±50	AD260-570

The post-excavation stages of the project were managed by Mark Roberts, Lisa Brown, and Bruno Barber. Kevin Ritchie acted as principal author of this report, in consultation with the entire project team. Stephanie Knight would like to thank Sheila Hamilton-Dyer for identification of some of the bird and fish bones. Julie Gardiner and Karen Walker provided helpful comments on an earlier draft of this article. The text was edited by Bruno Barber, Alistair Barclay and Michael Grant. The illustrations are by Karen Nichols and Kitty Brandon.

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