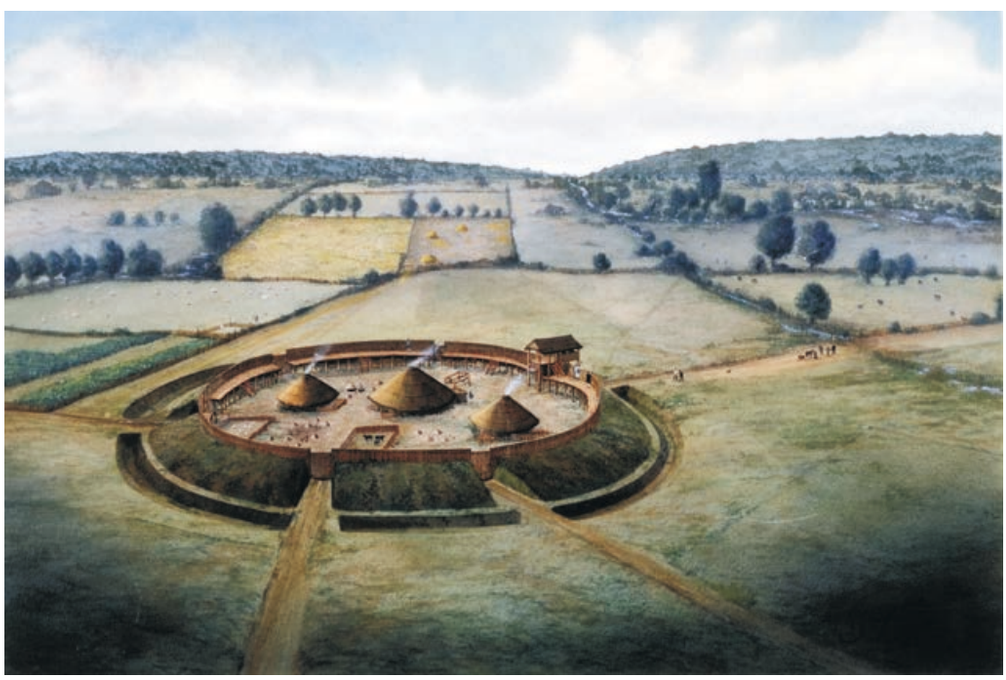
EAST ANGLIAN ARCHAEOLOGY



Frontispiece:
This reconstruction painting by Frank Gardiner has, since it was first created in the 1980s, become one of the iconic interpretative images of the Late Bronze Age, widely reproduced. It captures well the drama of the enclosure's form and location, dominating the local landscape. The picture is also an interesting document of the changing interpretation of the site; it was painted quite early in the course of the excavations, when only the causeways visible on the machined surface had been recognised and the enclosure was considered to have multiple entrances.

The Neolithic and Bronze Age Enclosures at Springfield Lyons, Essex: Excavations 1981–1991

by Nigel Brown and Maria Medlycott

with major contributions by
Sue Bridgford, Stuart Needham and
Peter Murphy

and contributions by
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Patricia Wiltshire

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For details of *East Anglian Archaeology*, see last page

Cover illustration:
Digital reconstruction of the Late Bronze Age enclosure, by Iain Bell

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Stuart Needham and Sue Bridgford would like to thank the various members of the British Museum's Department of Conservation (later, Department of Conservation, Documentation & Science) who helped physically or logistically with both the process of lifting the soil blocks from site to museum and the subsequent excavation and cleaning of the many refractory fragments uncovered. The block-lifting operations were sanctioned by Andrew Oddy, Head of Conservation. Those involved on site in addition to one of the authors (SN) were the late Peter Shorer, Paul Craddock (then of the BM Research Laboratory) and Linda Kendall in 1982; Hazel Newey, Fleur Shearman and Clare Ward in 1983. The painstaking task of excavation and cleaning was shouldered at different times by Alexandria Baldwin, Linda Kendall, Sandra Smith, Rachel Swift, Wendy Walker, Clare Ward, with the authors also getting dirty hands. The authors took responsibility for archaeological recording, while the conservators recorded the conservation techniques applied. The Department of Prehistory and Europe (and its various past guises) has lived with the lifted blocks for many years and is to be thanked for its patience and assistance given.

Summary

The excavations at Springfield Lyons were undertaken between 1981 and 1991, as part of a wider programme of archaeological fieldwork carried out in advance of a major urban extension of the town of Chelmsford in central Essex. The excavations were carried out by Essex County Council, with the financial support of English Heritage and additional support from the British Museum. Excavation focussed on a circular enclosure about 60m in diameter identified as a cropmark on aerial photographs. The enclosure was situated on a spur of land between two small streams at the top of a valley slope overlooking the river Chelmer. Before excavation the enclosure was considered likely to be a henge monument or possibly a Late Bronze Age enclosure of a kind which had then been recently identified at Mucking in south Essex. Excavation quickly established a Late Bronze Age date. The enclosure was fully excavated, and the site has given its name to the English Heritage single monument class description 'Springfield Type Enclosure' for such circular enclosures which are now seen to be a form of settlement type characteristic, particularly in eastern England, of the Late Bronze Age and earliest Iron Age.

The excavation showed that the substantial enclosure ditch was divided into segments by causeways of undisturbed natural gravel. There were two opposed entrances facing east and west. The east entrance was provided with an entrance structure, a double row of postholes inside the ditch are interpreted as the supports for a box rampart. Subsequently the enclosure ditch was recut with a shallower rather more sloping sided profile, and the east entrance structure remodelled. The interior of the enclosure contained a number of roundhouses, including a centrally placed building with a large porch aligned on the east entrance. Two- and four-post structures were also present together with a number of pits which were rather more common in the southern part of the enclosure particularly the south west quadrant.

The finds assemblage recovered was typical of the material generally associated with such Late Bronze Age circular enclosures. It included flintwork, loomweights, spindlewhorls, perforated clay slabs and a large pottery assemblage. The stratified sequence of pottery from the ditch fills illustrates the range of changes in vessel form and decoration typical of the first few centuries of the first millennium BC. An extensive programme of wet sieving yielded a substantial assemblage of charred plant remains, providing insights into the agricultural economy and crop processing activities. Most remarkable of the finds from the site were two large deposits of clay refractory material, which were recovered from low in the ditch fills in the butt ends of the ditch north of both the east and west entrances. The material was lifted in blocks and excavated under laboratory conditions at the British Museum. Apart from some crucible fragments the mould material was almost without exception derived from moulds for casting Ewart Park type swords. Given the particular nature of this material and its location in the ditch it seems reasonable to suppose that its deposition carried some symbolic meaning.

Examination of an area outside the east entrance of the Late Bronze Age enclosure revealed two large pits, both of which yielded early Neolithic decorated pottery. Subsequent trial trenching revealed these features to be part of a causewayed enclosure, which cut off an area of land between two small streams. The segments of causewayed ditch were formed by elongated pits, some of which had deeper shaft-like features. The causewayed ditch showed evidence of a number of recuts, and occasional artefact-rich deposits, it appeared that in some cases particular types of natural material had been selected for deposition. Subsequently the causewayed enclosure became a focus for deposition of Grooved Ware and Beaker material both in the upper ditch fills and in small pits and other features.

It is suggested that the unusual causewayed form of the Late Bronze Age enclosure ditch was a conscious emulation of the form of the nearby causewayed enclosure; and that the presence of that ancient site led to the selection of the particular spur on which the Late Bronze Age enclosure was constructed, rather than one of a number of other similar locations nearby.

Résumé

Les fouilles de Springfield Lyons se sont déroulées de 1981 à 1991. Elles faisaient partie d'un vaste programme de travail sur le terrain qui précéda une importante extension urbaine de la ville de Chelmsford dans le centre de l'Essex. Les fouilles furent entreprises par l'Essex County Council avec le soutien financier de l'English Heritage et, en complément, l'appui du British Museum. Elles portaient principalement sur une enceinte circulaire de 60m de diamètre qui fut identifiée comme une trace de cultures agricoles sur des photographies aériennes. L'enceinte était située sur un éperon de terre entre deux petits cours d'eau au sommet du versant d'une vallée surplombant la rivière Chelmer. Avant les fouilles, l'enceinte apparaissait comme étant probablement un monument de type « henge » qui est apparenté à un cromlech. Il pouvait également s'agir d'une enceinte de la fin de l'âge du bronze proche de celle qui avait été récemment identifiée à Mucking au sud de l'Essex. Les fouilles permirent rapidement de dater le monument de la fin de l'âge du bronze. L'enceinte a été complètement fouillée et le site a donné son nom à une description de classe de monument unique intitulée « Springfield Type Enclosure ». Cette classe de l'English Heritage s'applique à ce genre d'enceintes circulaires qu'on considère actuellement comme un type d'implantation caractéristique de la

fin de l'âge du bronze et du début de l'âge du fer, en particulier dans l'est de l'Angleterre.

Les fouilles ont montré que l'important fossé de l'enceinte était divisé en segments par des chaussées composées d'un gravier naturel qui était resté en l'état. Deux entrées se faisaient face, l'une étant orientée vers l'est et l'autre vers l'ouest. L'accès était équipé d'une structure d'entrée formée d'une double rangée de trous de poteaux à l'intérieur du fossé que l'on peut considérer comme les soutiens d'une « box rampart ». Par la suite, le fossé de l'enceinte a connu des modifications: il a perdu de sa profondeur et ses côtés sont devenus plus inclinés. La structure de l'entrée a également été remaniée. L'intérieur de l'enceinte contenait un certain nombre de rotondes avec un bâtiment en son centre qui présentait un grand porche situé dans l'alignement de l'entrée est. On a également découvert des structures de deux et de quatre poteaux ainsi que plusieurs fosses qui se trouvaient en plus grand nombre dans la partie sud de l'enceinte, en particulier dans le quadrant sud-est.

Les différents objets retrouvés sont caractéristiques des matériaux archéologiques qui sont généralement associés à ces enceintes circulaires de la fin de l'âge du bronze. Il s'agissait, entre autres, de débris de silex, de poids pour métier à tisser, de fusaïoles, de dalles perforées en argile et d'une grande quantité de poteries. L'ensemble stratigraphique des poteries présentes dans le fossé illustre bien la variété des changements dans les formes de vaisselle et dans la décoration qui sont caractéristiques des premiers siècles de notre ère. Un important programme de tamisage à l'eau a permis de mettre à jour une quantité importante de restes carbonisés de plantes, ce qui a apporté des éclaircissements sur l'économie agricole et sur le traitement des récoltes. Deux grands dépôts de matériaux réfractaires en argile constituent les découvertes les plus remarquables du site. Ils se trouvaient dans la partie basse du remplissage du fossé au nord des entrées est et ouest. Les matériaux ont été soulevés par blocs et fouillés dans des conditions de laboratoire au British Museum. En dehors de quelques fragments de creusets, presque tous les matériaux provenaient de moules destinés au moulage d'épées de type Ewart Park. Étant donné la nature particulière de ces matériaux et leur emplacement dans le fossé, il semble raisonnable de supposer que leur dépôt possédait une signification symbolique.

Deux grandes fosses sont apparues à l'examen d'une zone au-delà de l'entrée est de l'enceinte de l'âge du bronze tardif. Chacune de ces fosses contenait des poteries décorées du début du néolithique. Par la suite, un examen par tranchées d'essai a révélé que ces éléments faisaient partie d'une enceinte « causewayed » qui séparait une zone de terre entre deux petits cours d'eau. Les segments du fossé « causewayed » étaient formés de fosses allongées dont certaines s'apparentaient à des puits plus profonds. Le fossé « causewayed » présentait plusieurs traces de remaniements et contenait quelques dépôts riches en artefacts. Il est également apparu que dans certains cas, des types particuliers de matériaux naturels avaient été déposés à dessein. Par la suite, le fossé « causewayed » rassembla des poteries de type Grooved Ware et des matériaux de type Beaker qui étaient déposés dans les remplissages du fossé supérieur, dans de petites fosses et dans d'autres lieux.

L'enceinte de l'âge du bronze tardif présentait une forme « causewayed » inhabituelle et l'on peut supposer qu'elle imitait délibérément l'enceinte « causewayed » située à proximité. Ainsi, l'enceinte de l'âge du bronze tardif fut construite sur cet éperon particulier, plutôt que sur un autre emplacement semblable du voisinage, en raison de la présence de cet ancien site.
(Traduction: Didier Don)

Zusammenfassung

Die Ausgrabung von Springfield Lyons fand zwischen 1981 und 1991 im Rahmen eines breit gefächerten Programms archäologischer Feldforschungen statt, die im Vorfeld einer umfangreichen Stadterweiterung von Chelmsford in Mittel-Essex unternommen wurden. Die Ausgrabungen wurden vom Essex County Council mit finanzieller Hilfe von English Heritage und zusätzlicher Unterstützung durch das British Museum durchgeführt. Im Mittelpunkt stand eine Kreisgrabenanlage mit einem Durchmesser von etwa 60 Metern, die bei Luftaufnahmen als Bewuchsmerkmal aufgefallen war. Die Grabenanlage lag auf einem Landstück zwischen zwei kleinen Flüssen auf einem Talhang über dem Fluss Chelmer. Vor der Ausgrabung wurde angenommen, dass es sich bei der Grabenanlage um ein Henge-Monument oder womöglich eine spätbronzezeitliche Grabenanlage des Typs handeln würde, der kurz zuvor bei Mucking in Süd-Essex ermittelt worden war. Bei der Ausgrabung wurde schnell deutlich, dass die Stätte auf die späte Bronzezeit zurückging. Die Anlage wurde vollständig ausgegraben. Sie wurde zum Namensgeber der von English Heritage für Einzeldenkmale eingeführten Kategorie »Springfield Type Enclosure« für derartige Kreisgrabenanlagen, die heute als eine für die späte Bronzezeit und die Anfänge der Eisenzeit vor allem in Ostengland typische Siedlungsform gilt.

Bei der Ausgrabung zeigte sich, dass der massive Befestigungsgraben durch naturbelassene Kiesbrücken in einzelne Abschnitte unterteilt war. Es gab zwei gegenüberliegende Eingänge in Richtung Ost und West. Der Osteingang war mit einer Eingangsbastion versehen, eine Doppelreihe von Pfostenlöchern innerhalb des Grabens wurde als Stützwerk für einen Kastenwall gedeutet. In der Folgezeit erhielt der Befestigungsgraben ein flacheres, seitlich abfallendes Profil, und auch der Ostzugang wurde umgestaltet. Im Inneren der Grabenanlage standen mehrere Rundhäuser, darunter ein zentrales Gebäude mit einem großen Vorbau, der zum Osteingang hin ausgerichtet war. Des Weiteren gab es Zwei- und Vierpfostenbauten mit mehreren Gruben, die vor allem im Südteil der Grabenanlage und hier besonders im Südwestquadrant zu finden waren.

Der Fundkomplex wies die für spätbronzezeitliche Kreisgrabenanlagen charakteristischen Funde auf. Dazu zählten Silexartefakte, Webgewichte, Spinnwirteln, durchlöcherte Tonplatten und umfangreiche Keramikfunde.

Die Keramikschichtfolge in den Grabenverfüllungen illustriert die Bandbreite der für die Anfangsjahrhunderte des ersten vorchristlichen Jahrtausends typischen Änderungen bei den Gefäßformen und Gefäßverzierungen. Eine umfangreiche Nasssiebung förderte zahlreiche verkohlte Pflanzenreste zutage, die Einblicke in die Agrarwirtschaft und die Getreideverarbeitung gaben. Die erstaunlichsten Funde waren zwei umfangreiche Deponierungen von feuerfestem Tonmaterial, das aus den unteren Schichten der Verfüllungen an den Grabenenden nördlich des Ost- wie auch des Westeingangs stammte. Das Material wurde in Blöcken geborgen und unter Laborbedingungen im British Museum freigelegt. Neben einigen Schmelztiegelfragmenten stammte das Formenmaterial fast ausnahmslos von Gussformen für Schwerter des Typs »Ewart Park«. Die besondere Art dieser Funde und ihre Lage innerhalb des Grabens legen die Vermutung nahe, dass ihrer Deponierung eine symbolische Bedeutung zukommt.

Bei der Untersuchung eines Areals außerhalb des Osteingangs der spätbronzezeitlichen Anlage stießen die Archäologen auf zwei große Gruben, die beide frühneolithische Zierkeramik enthielten. In der Folge angelegte Suchschnitte zeigten, dass es sich um Teile eines Grubenwerks (»causewayed enclosure«) handelte, das ein Gebiet zwischen zwei kleinen Flüssen vom Umland trennte. Die einzelnen Abschnitte des Befestigungsgrabens bestanden aus länglichen Gruben, von denen einige tiefere, schachtartige Strukturen aufwiesen. Der Befestigungsgraben wurde offenbar mehrfach nachgearbeitet und enthielt vereinzelte artefaktreiche Deponierungen. In einigen Fällen wurden, wie es scheint, besondere Naturmaterialien zur Deponierung ausgewählt. In der Folgezeit entwickelte sich das Grubenwerk zu einem wichtigen Ort für die Deponierung von Rillenkeramik (»Grooved Ware«) und von Gegenständen aus der Becherkultur, die in der oberen Grabenverfüllung sowie in kleinen Gruben und anderen Strukturen gefunden wurden.

Es wird angenommen, dass die ungewöhnliche Form des spätbronzezeitlichen Befestigungsgrabens die Form des nahe gelegenen Grubenwerks bewusst nachahmte und die Existenz der prähistorischen Stätte der Grund dafür war, dass speziell dieses Landstück unter einer Reihe ähnlicher Standorte in der Gegend für den Bau der spätbronzezeitlichen Grabenanlage ausgewählt wurde.

(Übersetzung: Gerlinde Krug)

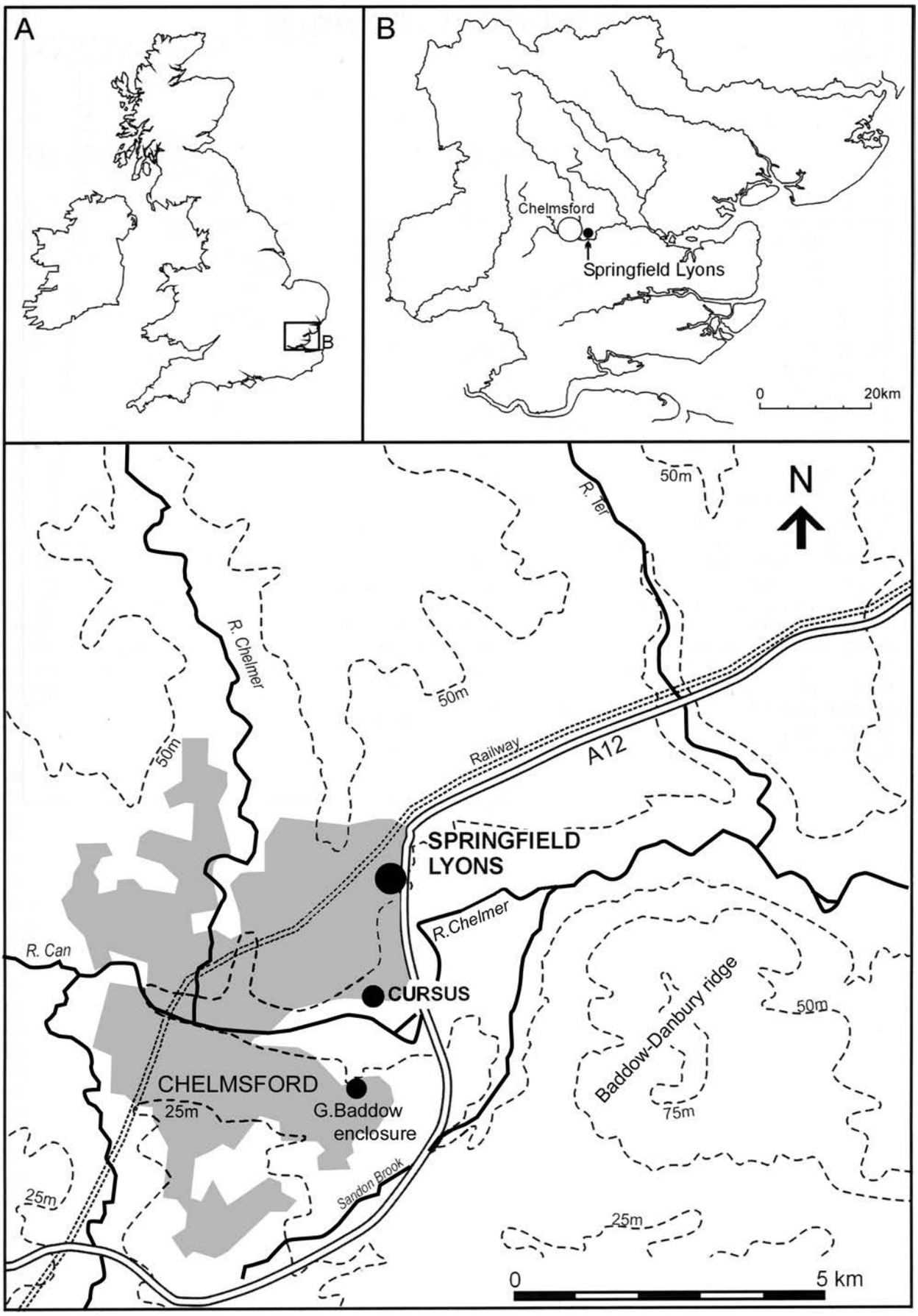


Figure 1.1 Maps showing main topographical features and location of the Springfield Lyons and Great Baddow enclosures together with the Springfield cursus

Chapter 1. Introduction

I. Location and topography

Springfield Lyons is located to the east of the old A12 London–Colchester road and west of the modern A12 bypass (Fig. 1.1), on the north-western outskirts of Chelmsford in central Essex within the Can/Chelmer river system. The Late Bronze Age enclosure lies about 3km north-east of the confluence of the Rivers Can and Chelmer. It overlooks the Chelmer which, from its confluence with the Can, flows east for about 15km to the head of the Blackwater estuary. The Springfield enclosure was constructed on a small spur, one of a series which occur along the upper edge of the north slope of the Chelmer valley. The spur at Springfield is defined by the shallow valleys of two small streams, now no more than spring-fed field ditches. On the Springfield side of the Chelmer the valley slopes are fairly even, to the south at Great Baddow the initial drop from the top of the valley side is relatively steep, the slope becoming more gentle as it approaches the valley floor. The southern side of the valley is dissected by the Sandon Brook which flows along the foot of the Little Baddow/Danbury ridge; this ridge is a significant feature in the local topography and Danbury is the highest point in southern Essex.

It is possible to divide the topography of Essex into three broad zones (Hunter 1999); from the north and west to south and east these comprise the Essex Till, an extensive deposit of chalky Boulder Clay forming a relatively high dissected plateau of heavy but very fertile clays. This gives way to a central belt of sands and gravels, a complex combination of terrace deposits and glacial outwash. Beyond this lies a broad coastal zone of extensive tracts of London Clay and gravel terraces with salt marsh fringing the creeks and estuaries. The Chelmer/Can river system forms a significant routeway linking the Blackwater estuary to the boulder clay plateau. The Springfield enclosure lies close to the edge of the boulder clay plateau. The geology of the immediate area around Springfield Lyons is complex, with alluvial/colluvial deposits in the valley bottom and in the valleys of small streams, and river gravels, overlain by cover-loams and sands, associated with the edge of the Anglian ice sheet, on the valley slopes (Bridgland 1994, 363; Hunter 1999).

II. On-site surface geology

by Tony J. Wilkinson

The subsoil over the whole of the excavated site at Springfield Lyons is glacial sand and gravel comprising flint, quartzite and vein quartz gravels, and pebbly sand. These 'Chelmsford' gravels underlie the nearby Springfield Till (chalky boulder clay) which was deposited during the Anglian glacial period. On site these gravels were weakly bedded and slightly contorted, possibly by periglacial activity, and include beds of dark brown loamy sand and brownish-yellow sand with a silt clay matrix. The high proportion of fines (silt and clay) makes recognition and interpretation of archaeological features difficult.

III. The project

The excavations at Springfield Lyons were part of a long-term project, undertaken between 1979 and 1991 by the Essex County Council Archaeology Section (since the mid 90s the Historic Environment Branch). A number of cropmarks were threatened by urban expansion of Chelmsford, which was planned in the early 1970s and executed in the late '70s and throughout the 1980s. Excavation, initially under the direction of Dave Buckley and John Hedges (funded primarily by Department of Environment/English Heritage, with additional financial contributions from Essex County Council and the British Museum), concentrated on two major cropmark monuments (Fig. 1.2). Firstly the Neolithic cursus which ran across the neck of an area of slightly higher ground just above the floodplain of the Chelmer in a bend of the river. This was the first site to be investigated, with excavation of the east and west terminals in 1979 and 1980 and further small-scale excavations and recording along the length of the cursus in 1984 and 1985 (Buckley *et al.* 2001). The second cropmark monument was that of a circular enclosure *c.* 60m in diameter, high on the valley side at Springfield Lyons, overlooking both the cursus monument and the Chelmer valley generally. Owing to its form and apparent relationship with the cursus, the most favoured interpretation of this site was that it represented a henge monument. An alternative explanation was that it could be a circular defended enclosure of the Late Bronze Age comparable to two enclosures excavated at Mucking in south Essex (Bond 1988). Excavation here also revealed part of a single circuit Neolithic causewayed enclosure and extensive Saxon settlement and cemetery.

Major excavations on the Springfield Lyons enclosure (Fig. 1.3 and 1.4) began in 1981 under the general direction of John Hedges and Dave Buckley and quickly established a Late Bronze Age date for the site. The original excavation objectives were to determine the date of the circular enclosure, the nature and extent of internal occupation features and provide, if possible, an explanation of the site's original function. To this end a substantial area of the enclosure ditch was excavated and all features within the enclosure interior were investigated. By the end of the 1983 season these objectives had been achieved and the circular enclosure securely dated to the Late Bronze Age. However the unexpected discovery of a large Saxon cemetery and settlement, partly within the Late Bronze Age enclosure but clearly extending well beyond it, led to the formulation of a new set of objectives, which were to determine the nature and extent of the Saxon cemetery and settlement. It was also decided to completely excavate the Late Bronze Age enclosure ditch and associated internal features. Excavation of the Saxon features continued through 1986 and 1987, and more sporadically through to 1991. This led

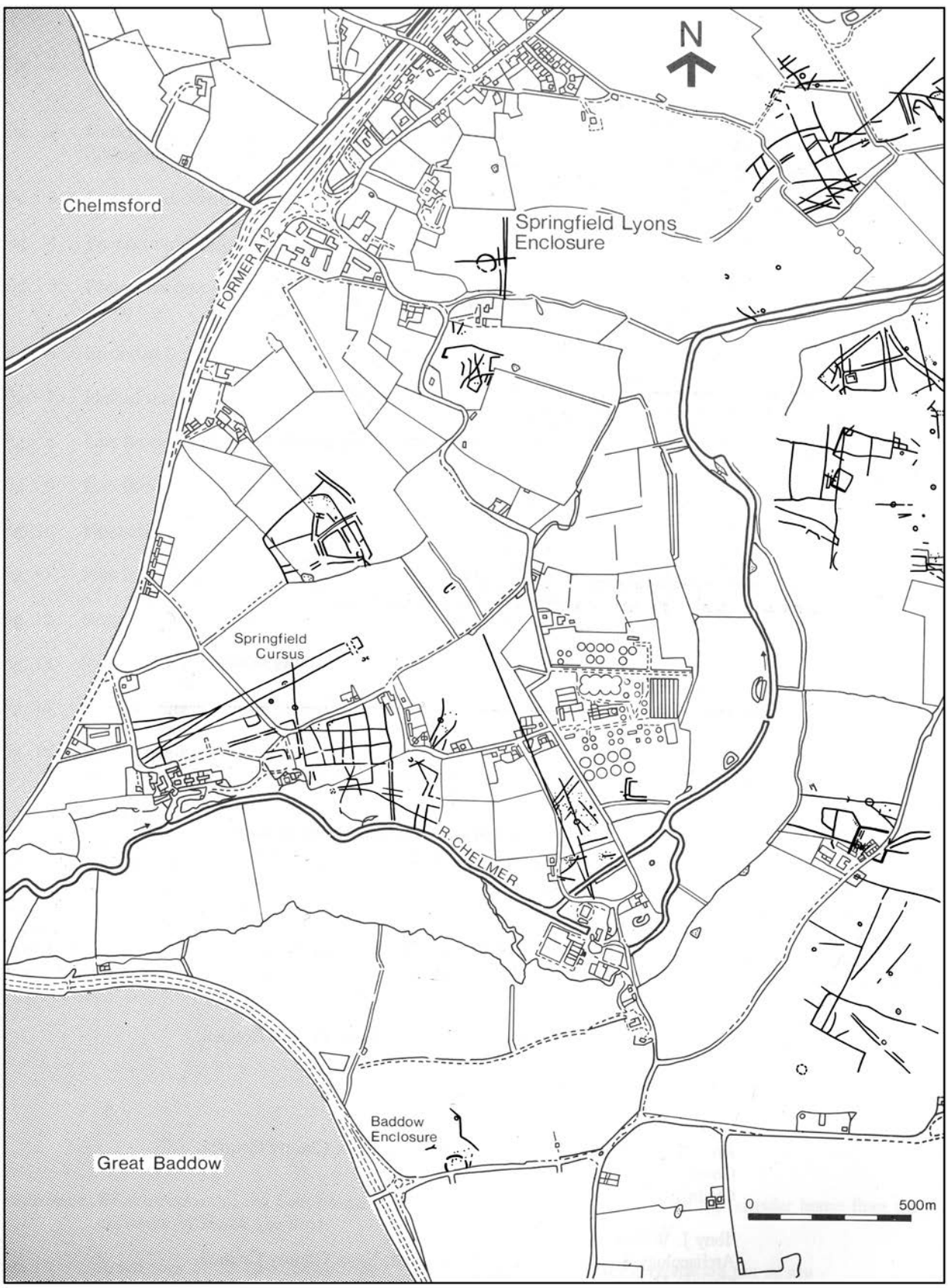


Figure 1.2 Cropmarks in the vicinity of Springfield Lyons. NB the roads, buildings and built up area of Chelmsford are shown as at *c.* 1980

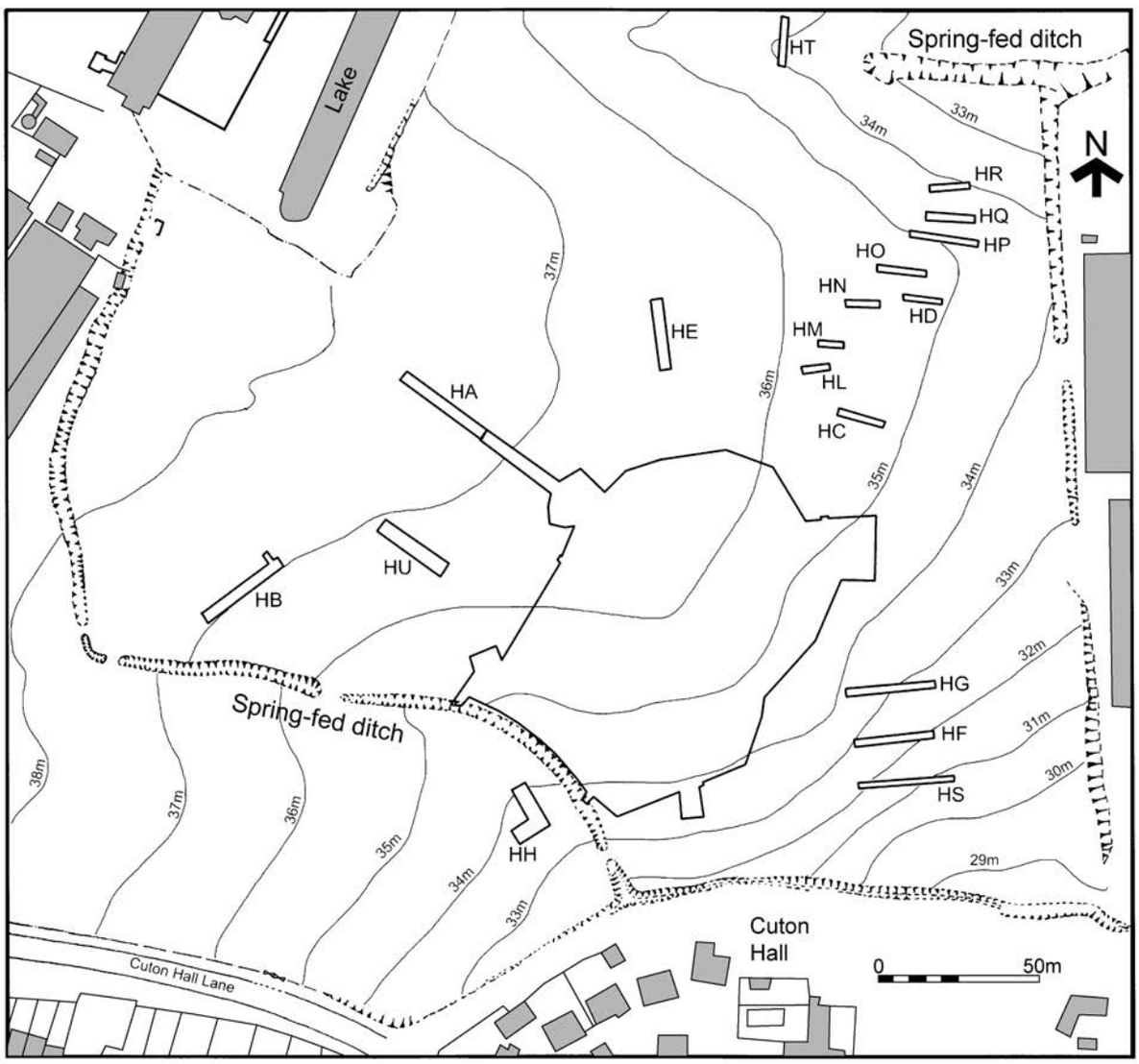


Figure 1.3 Plan showing all excavated areas

to a large area being excavated outside the Late Bronze Age enclosure mainly to the south and west. In order to define the limits of the Saxon cemetery, a number of trial trenches were excavated around the periphery of the main excavation area (Fig. 1.3, trenches HH, HB, HU, HA and HE). The excavation of the Late Bronze Age enclosure ditch north of the main east entrance had yielded a very large quantity of clay moulds for casting swords. Excavation of the interior of the enclosure had revealed no indication of metalworking and in order to investigate the possibility of metalworking immediately outside the entrance, in 1988 a rectangular extension to the main excavated area was opened (Fig. 1.3). This did not reveal any evidence for metalworking, but two very deep oval pits which yielded Neolithic pottery and flintwork were recorded. It appeared possible that these features were part of a causewayed enclosure running between the two shallow stream valleys. To test this proposition, additional trial trenching was undertaken between 1990 and 1991 (Fig. 1.3 trenches HS, HF, HG, HC, HL, HM, HN, HD, HO, HP HQ and HR). These revealed further large oval pits of Neolithic date, and some other features.

Interim reports were published on the cursus excavations in 1981 (Hedges and Buckley) and on the excavations at Springfield Lyons in 1987 (Hedges and Buckley). The site archive was created as the excavation progressed and work began on preparing the results for publication in the late 1980s and early 1990s, when substantial progress was made towards the publication of the cursus and the Saxon aspects of Springfield Lyons. However, budgetary pressures and changed responsibilities on the part of the principal excavators halted progress; a proposal for funding to finalise publication of the Springfield excavations was submitted to English Heritage in 1999, this was agreed and work on the publication project began in 2000. The excavations at the Springfield Cursus were published in 2001 (Buckley *et al.* 2001), and the Saxon settlement and cemetery at Springfield Lyons were published in 2005 (Tyler and Major 2005). The present volume on the Springfield Lyons Neolithic and Late Bronze Age enclosures, together with the few Iron Age and Roman features, is the third and final publication bringing the results of the fieldwork at Springfield to print.

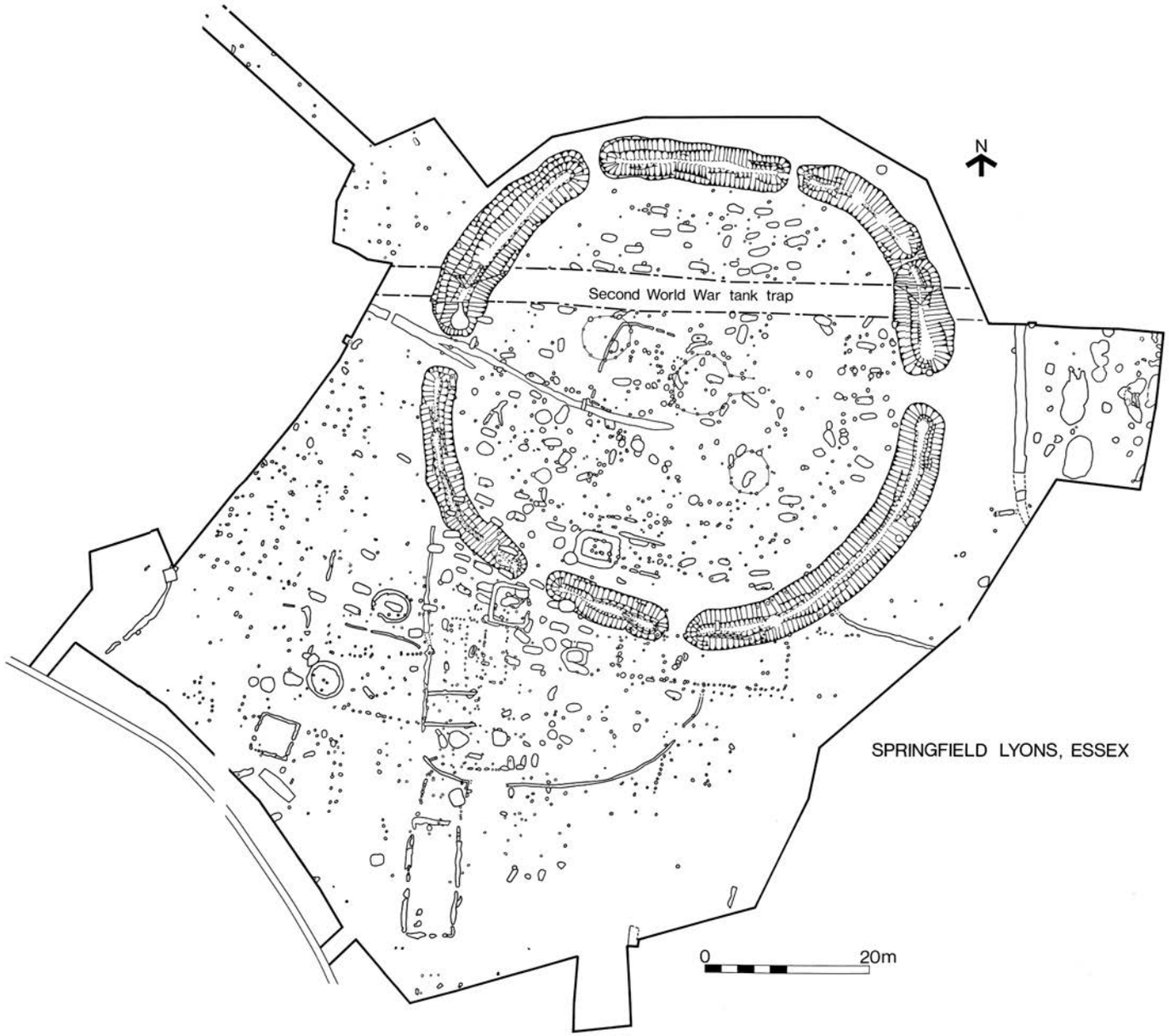


Figure 1.4 Plan of features of all periods in the main excavation area

Plate 1.1 Aerial photograph showing the Bronze Age circular enclosure, looking north. The main east facing entrance shows very clearly and the line of the WWII anti-tank ditch can be seen as a very straight dark mark running east–west across the centre of the photograph. Although not noticed until they were encountered during the course of excavation, the line of the Neolithic causewayed enclosure can be discerned as a curving arc of pit like features to the east of the circular enclosure. The line of the circular enclosure is not so clear north of the tank trap as it is to the south. (CUCAP BXK-1, Copyright reserved Cambridge University Collection of Aerial Photography)

The enclosure is part of a series of cropmarks stretching from immediately above the Chelmer floodplain to the crest of the valley slope (Fig. 1.2). The Springfield Lyons enclosure was discovered independently by both the Cambridge University Committee for Aerial Photography and the former RCHME Air Photographic Unit, National Monuments Record. Photographs of the site show around two thirds of the enclosure ditch and the main east-facing entrance, other breaks in the ditch circuit are less obvious (Plate 1.1 and Fig. 5.1). The pit-like features which define the causewayed enclosure were not noted, but can, with the benefit of hindsight, just be discerned on the photograph. The most striking feature is the broad straight line of a WWII anti-tank ditch, running east–west across the enclosure. This feature was part of General Headquarters (GHQ) line, the principle line of defence constructed against the threat of a German invasion in 1940 (Gilman and Nash 1995). The GHQ line ran from Yorkshire to the Wash, from the Wash to the Thames estuary and from London to Bristol. In Essex it ran from Great Chesterford following various rivers south to Chelmsford, from where, in the absence of rivers, an anti-tank ditch was dug, 6m wide and up to 3.7m deep, following a zig-zag route to the Thames estuary at Canvey Island.

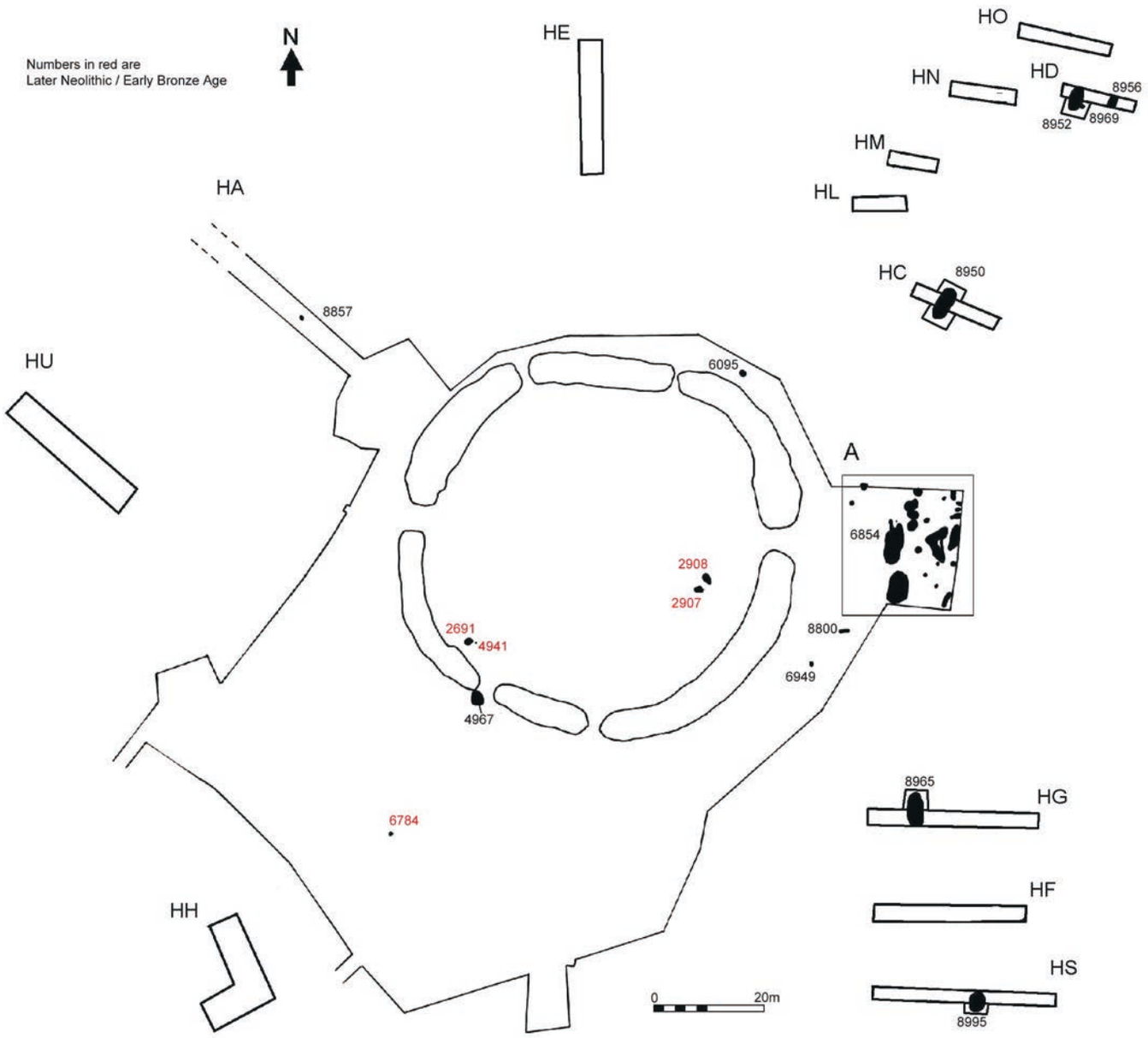


Figure 2.1 The plan above shows all excavated features of Neolithic or Early Bronze Age date. The larger scale plan on the facing page shows the eastern extension to the main excavated area which contained a concentration of such features

Chapter 2. The Excavations

I. Neolithic and Early Bronze Age

During excavation of the Late Bronze Age enclosure, a scatter of Neolithic pits, containing Mildenhall Ware, Grooved Ware and Beaker pottery, were recorded (Fig. 2.1). In 1988 a rectangular extension to the main excavated area was opened (Fig. 2.1 A, Plate 2.1) outside the main east-facing entrance of the Late Bronze Age enclosure, This revealed two very deep oval pits which yielded large quantities of Mildenhall style Neolithic pottery and flintwork. It appeared possible that these features were part of a causewayed enclosure running between the two shallow stream valleys. To test this proposition, additional trial trenching was undertaken between 1990 and 1995 (Figs 1.3 and 2.1, trenches HS, HF, HG, HC, HL, HM, HN, HD, HO, HP HQ and HR). This revealed further large oval pits of Neolithic date, part of an arc of pits forming a single circuit causewayed enclosure cutting off a spur of high ground between two small streams.

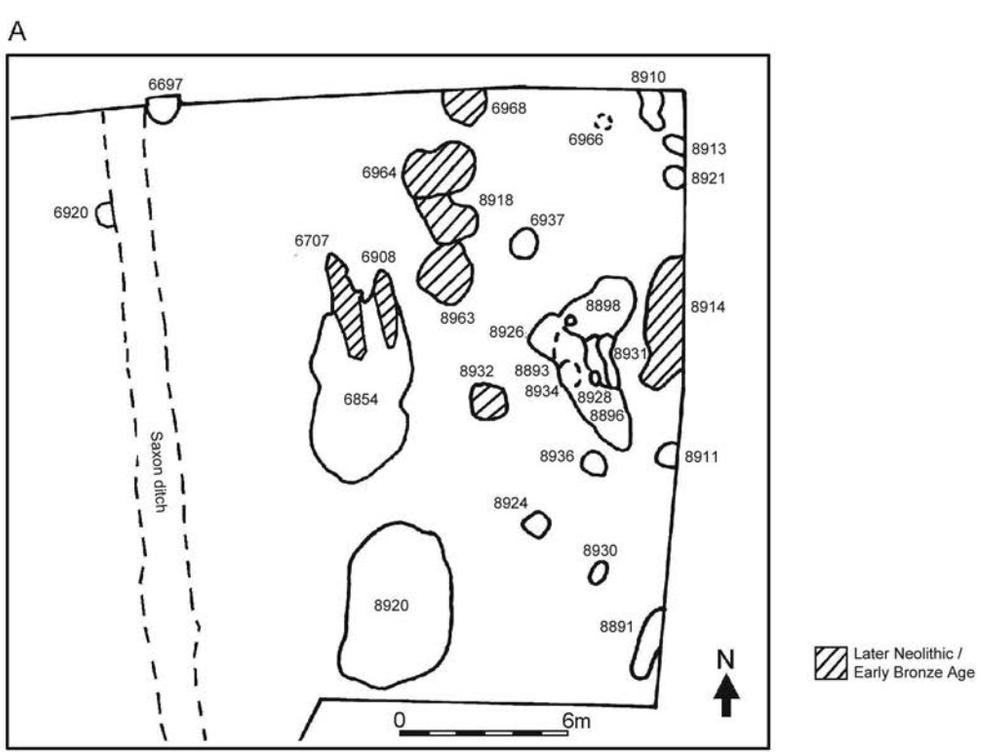
The causewayed enclosure

The excavated extent of the causewayed enclosure comprised seven large, roughly oblong pits. These are described below, starting with the northernmost pit and working sequentially southwards.

8994, Trench HQ
(Fig. 2.2)

This large, fairly deep, oblong pit (2.3m long, 1.6m wide and 0.72m deep) was quite steep-sided with a flattish bottom. The west side was particularly steep, the eastern rather more sloping. The sides, particularly to the west, had been prone to slumping, resulting in sandy layers towards the edges. There were no finds from the northern half of the feature.

The original cut was steep-sided and flat-based, the fills comprised; a sloping deposit of sand on the west side (11336), and an even spread of very stony, sandy silt over the entire base of the pit (11335), above which was a sandy silt with frequent stones (11334) containing a less stony sandy silt lens (11333). A flat-bottomed recut (Fig. 2.2 R1) with a gravely fill (11330) was only preserved on the west side. A second recut (Fig. 2.2, R2) mirrored the original cut, being flat-based and much steeper-sided on the west than the east. The primary fill of this recut on the west side was formed by a slump or dump of sandy natural (11331), a sandy silt layer (11329) formed a similar deposit on the east side, above which a sandy silt layer (11328), apparently deposited from the eastern side, extended over the whole base of the cut, Fills above 11328 had been removed by a third recut (Fig. 2.2 R3), in this case roughly V-shaped, but again steeper-sided on the west. The first three fills were a layer of sandy natural (11332), a silty fine sand layer with frequent pebbles (11327), and a slightly silty fine sand with sparse pebbles (11326). All these fills derived from the west side, and must have accumulated rapidly to preserve the steep slope on the west side which had been cut through sand layer (11331). A hollow left by the accumulation of these deposits was filled by (11325).



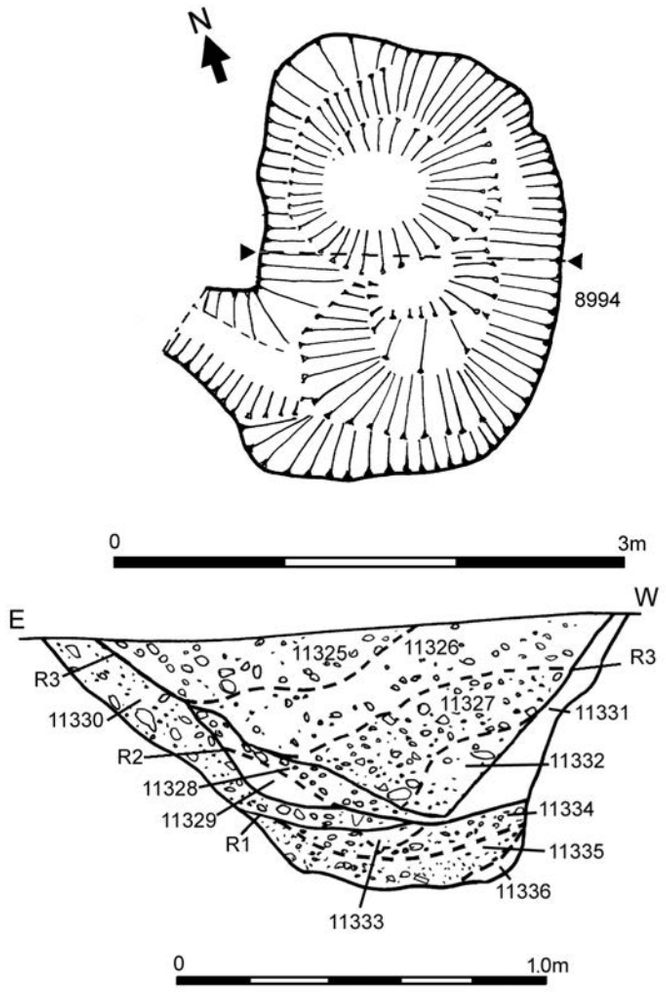


Figure 2.2 Causeway enclosure pit 8994, plan and section

8952, Trench HD
(Fig. 2.3)
An oval pit (6.1m long, 3.2m wide and 0.85m deep) located at the west end of the trench, defined on the stripped and cleaned surface as a less stony area. The trench was extended in 1991 to reveal the whole pit. The evidence from the section drawings is contradictory (see Fig. 2.3 section drawings) and one must have been mis-numbered. The feature was also overcut into the sandy natural and the original context sheets do nothing to resolve the issue.

The primary fill of the feature (11187), was quite stony. The junction between 11183 and 11187 was very difficult to see, as the difference between the two layers was basically one of texture. 11183 was a sandy loam layer with frequent stones. One section drawing showed this as the middle layer, below 11177 (Fig. 2.3), and the other as the uppermost layer (above 11177). Layer 11177 was sandy loam with fairly common small stones and was cut by a post-hole, 8969.

Two other features of Neolithic date were recorded in trench HD.

8969, a post-hole cut into the side of causewayed enclosure pit 8952, was vertical-sided and flat-bottomed. It cut fill 11177, but was not positively identified during excavation until the side of 8952 was reached, it appeared as a darker area within 11177, with flecks of charcoal, and there was a possible post-pipe.

8956, a feature to the east of 8952, the excavator was uncertain as to size and shape as the feature had been overcut at the edge and base. It had two fills (11162 and 11168) and produced a small quantity of possibly earlier Neolithic pottery.

8950, Trench HC
(Fig. 2.4)
Although not noted prior to excavation, with the benefit of hindsight this pit is visible on the aerial photographs of the site. The feature was roughly oval in plan with a slightly pinched 'waist', and the wider end to the south. The segment excavated was up to 1.1m deep and 3.2–3.8m wide, with steep sides and an almost flat bottom. A number of small pits (8971, 8972, 8975, 8976 Fig. 2.4) were cut into the base of 8950 through the primary silts. The stratigraphic sequence is summarised below.

The thin very sandy primary fill (11205, 11206) was cut by a number of small pits or post-holes which had been dug through this layer into the natural below (Fig. 2.4). **8971**, a possible stake-hole, showed as a circular, stone-free patch. Excavation revealed it to be steep-sided with a slightly rounded base and a sandy loam fill (11231). **8972**, a possible post-hole, showed as circular pale patch with a

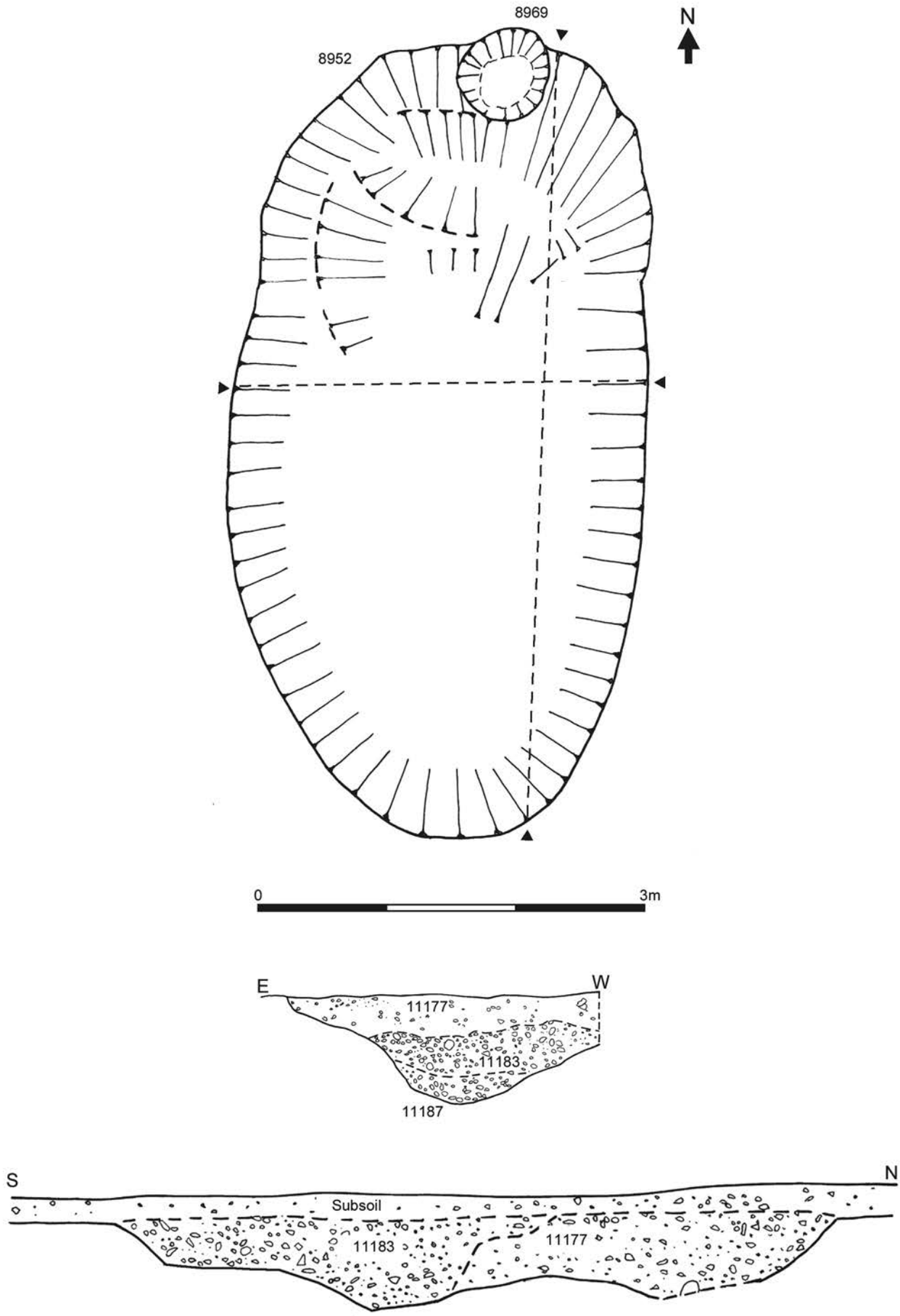


Figure 2.3 Causeway enclosure pit 8952, plan and section

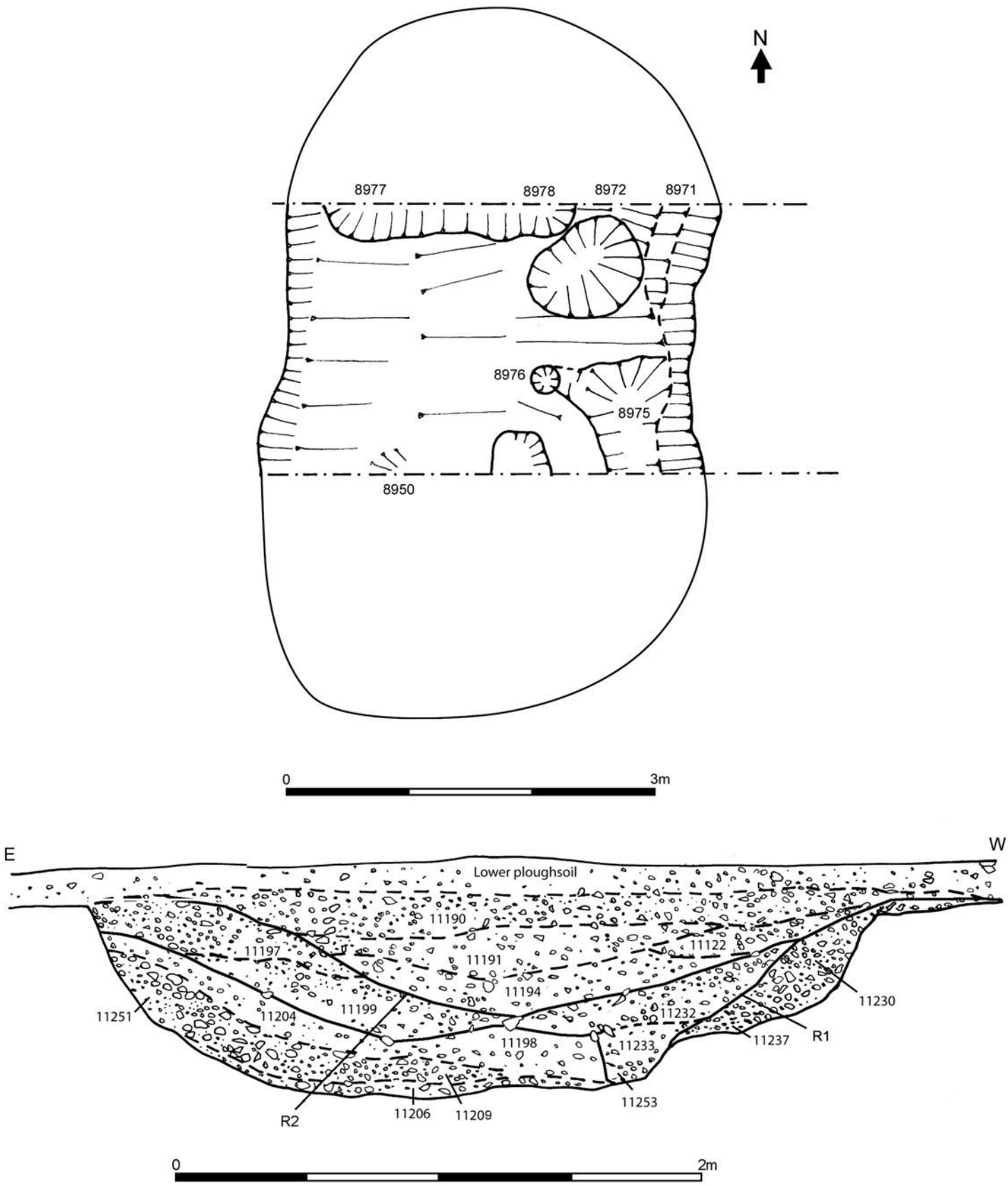


Figure 2.4 Causeway enclosure pit 8950, plan and section

very stony fill (11235). **8975** was an irregular oval pit with an almost flat base and steep sides. It had three fills, comprising a primary sand deposit (11245) a secondary stony fill (11240) and an upper silty fill (11238). **8976**, a small, roughly circular pit with steep sides and a pointed base was located immediately adjacent to 8975, and the silty fill (11275) was initially excavated as part of 8975. These features were sealed by a stony layer (11209 and 11251), with gravelly silty sand loam (1198 and 11204) above. A very stony layer (11230, 11237 in the section, 11250 elsewhere in the segment) occurred on the west side of the feature and contained some pottery. These fills were truncated by a recut (Fig. 2.4 R1) which mirrored the profile of the original feature. Similarly, in a process which mirrored the original construction of 8950, a small pit had been cut into the underlying layers. This feature was not identified during excavation, but the profile was noted in section and the two fills numbered (11233 and 11253). This feature was sealed by a deposit of loamy sand (11199 and 11232), overlain on the east side by a slightly stonier layer (11197). These fills were truncated by another recut (Fig. 2.4 R2) with shallow sloping sides, the initial fill was a sandy loam with sparse stones (11194) above which on the west side was a stony layer (11122). These fills were overlain by layer of silty sand loam 11191, the upper fill was an almost horizontal layer of sandy loam 11190, extending across most of the feature.

6854, main excavation area
(Fig. 2.5)
Prior to excavation this feature was visible as a large, rather amorphous area with a scatter of worked flint, Neolithic and Beaker pottery on the surface. It was initially thought that 6854 might represent a natural, presumably shallow, hollow utilised during the Neolithic/Beaker period, as its fill was very similar to the natural elsewhere on site. However it became apparent that this material had accumulated not in a natural feature but in the hollow left at the top of a large, roughly oval, pit, 5.8 x 3.22m and 0.5m deep, with a deeper shaft (1.68m deep) in the northern end of the pit. The sides of the pit varied from moderately steep at the southern end to steep at the northern end. The deeper shaft within the pit was almost rectangular in plan, with slightly rounded corners. The sides were nearly vertical up to the base of the larger pit, with the exception of the west side which was stepped at about mid-way. Thus although feature 6854 had a single number it clearly had two main elements, a broad relatively shallow pit and a deeper shaft. It appears that the shaft and the shallow pit area are contemporary and given that the edges of the shaft coincide with the edges of the pit on two sides, that they were conceived and dug as a single whole. It is possible that the shaft once held a post, but there is no evidence for a post-pipe or indeed of material falling in as the post was removed, (which must have happened before the depositional sequence described below developed), on balance therefore it is considered to be more likely that this feature was always an open shaft. The upper fills of 6854 were cut by two linear gullies (6707 and 6908/8894), these are described more fully under 'Later Neolithic and Early Bronze Age features' (below).

The feature was divided into nine segments (4301–9) and each layer in each segment given an individual number, the general sequence for the whole from the earliest fills to the latest earliest can be summarised as follows:

The primary fill of the shaft comprised a very thin layer of silty sand, possibly formed by trample when the feature was originally cut (9931). Above this was a silty clay loam with fairly large stones (9894), and Neolithic pottery. Above this was an intermittent layer of silty sand, found leaning up against the sides of the shaft base, this represented slumped or dumped natural (9914, 9915, 9927, 9938, not present in the section drawing). One of these deposits (9927) was cut by **8901** (Fig. 2.5, not on section), a small post-hole or pit, it had steep sides and rounded base, with a sandy, much iron-stained fill (9918). Further slumping of the sides of the shaft, or perhaps dumping of natural, appears to have taken place, as evidenced by sandy layers (9893, 9897), and two clayey sand loam fills (9876 and 9882), of these 9876 and 9893 are shown on the section drawing (Fig. 2.5). Fill 9876 contained flint, charcoal, mineralised animal bone and Neolithic pottery (Fig. 3.17, 49–50), whilst 9882 contained flint, charcoal and Neolithic pottery (Fig. 3.17, 48). The presence of this material may suggest that the apparent slumping was in fact purposeful deposition. Above these lay a clayey silt layer (9899), there was further deposition of natural material into the shaft appears to have taken place, as represented by layers 9895 and 9898, on the south and north sides of the shaft respectively. 9895 was overlain by a layer of loose sand (9891). At this point the shaft appears to have been recut (Fig. 2.5, R1). The primary fill of recut 1 comprised a gravelly sand layer (9864, 9865, 9902, 9913, 9925, 9926, 9932), which contained flint, charcoal and Neolithic pot. Above this on the southern side of the shaft was a sand layer with numerous small stones (9890). The shaft was recut again, forming a steep-sided, round-bottomed cut (Fig. 2.5, R2), the primary fill of recut 2 comprised a sandy silt loam (9872, 9875). This contained a relatively large amount of pot, including rims and a substantial piece of a bowl (Fig. 3.17, 44, 45 and 47). Animal bone was present, possibly originally in some quantities, but preservation was poor. Due to the positioning of the section baulk, the relationship between the shaft and the shallower southern end of the pit is not entirely certain, however it appears that the primary fill of this end of the feature comprised a sandy silt loam (9857, 9879, 9905). A third recut was at a shallower angle than that of the previous cuts, with a V-shaped base (Fig. 2.5, R3). The primary fill of recut 3 was a fine silty sand extending across the whole of the shaft and the shallower portion of the pit on the northern side, it almost reached the stripped surface on the east and west sides (9871, 9884, 9937). Above this was a dark, charcoal-rich layer present in the central part of the shaft only (9869 and possibly 9924). Above this was a silty sand loam layer extending over both the shaft and the northern part of the shallower pit (9863, 9889, and possibly 9924), this contained flint and Neolithic pottery. A well-defined sandy silt loam layer covered the top of the shaft and the northern end of the pit (9856, 9877, 9892), this contained flint, burnt clay, late Neolithic pottery (Fig. 3.19, 78). Two post-holes were identified around the edge of the shaft (**8903**, **8907**). It was not clear where these fit into the sequence of cuts and recuts of the shaft, although there is some suggestion that 8907 may have been below some of the shaft's later fills, which suggests that the post-holes and the shaft were contemporary with the earlier phases of

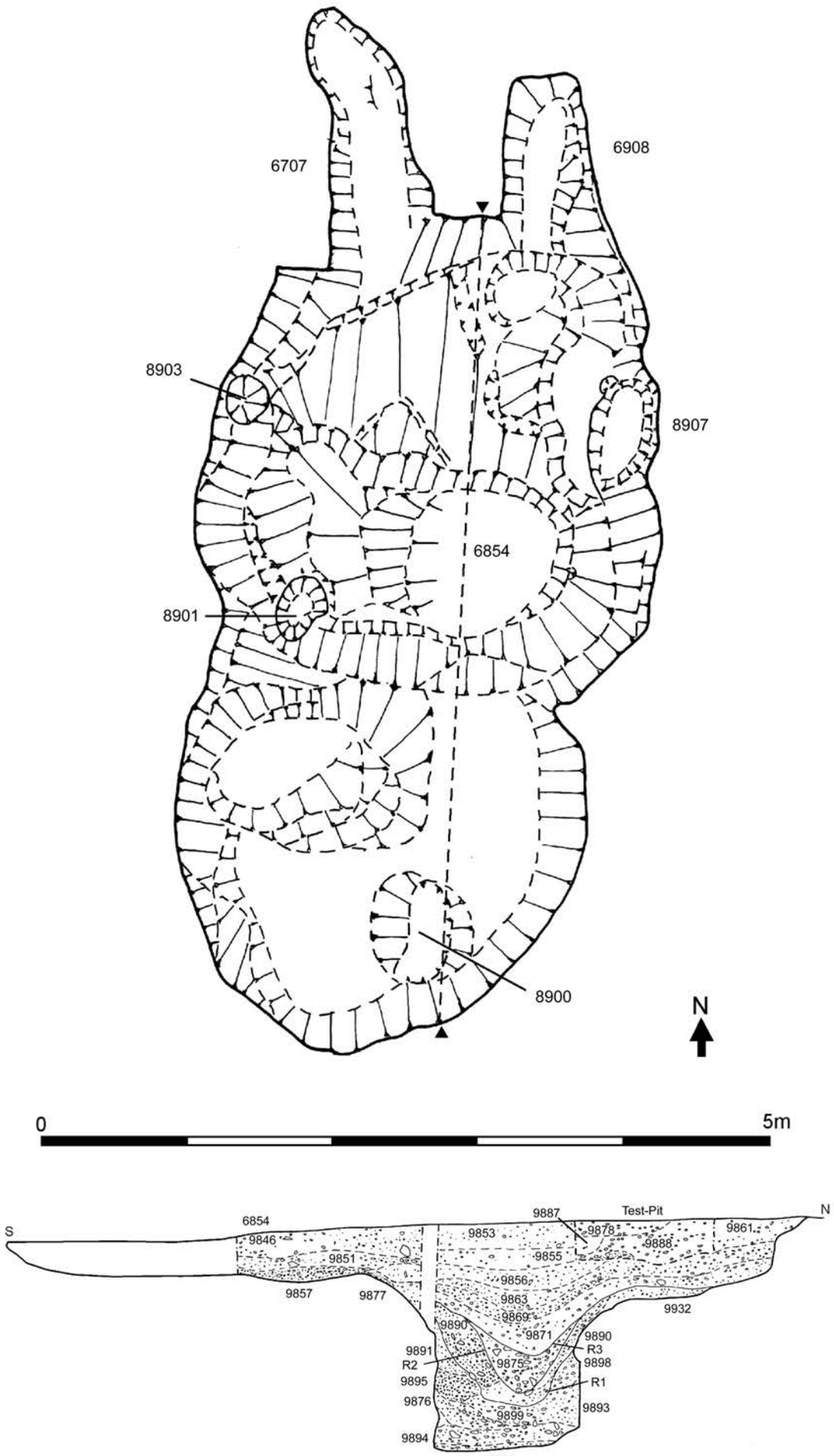


Figure 2.5 Causeway enclosure pit 6854, plan and section

the shaft. **8900** was a possible stake-hole cut into the shallower southern end of pit 6854. The base of the pit at this point was rather irregular, a thin layer of sandy gravel overlay much of the base of the feature at this end (9883, 9929), there were also two particularly stony areas of fill (9866/9922 and 9880/9923), which were apparently placed so as to level-off hollows in the base. These stones appear to have been placed directly on to the natural with no evidence of previous trampling or silting except at the very edge of the pit. Around the edge of the southern end of the pit was a wedge of gravelly fill derived from the crumbling of the pit sides (9862, 9870, 9904, 9907, 9908 and 9867, 9881, 9909, 9928 these layers do not appear on the illustrated section). In turn these layers, together with those filling the shaft and the northern end of 6854 were covered by a clayey silt loam (9851, 9855, 9861, 9887, 9888 in the illustrated section). It contained a couple of scrapers, as well as Neolithic pot, including some Grooved Ware and charcoal. The upper fill of 6854 was a clayey silt loam with some stones (9846, 9853, 9878 in the illustrated section), this contained charcoal, flint and Beaker pottery (Fig. 3.19, 85 and 89).

8920, main excavation area
(Fig. 2.6)
This was a large oval pit to the south of 6854, measuring 5.2 x 3.5 by 1.15m deep, steep-sided and flat-based. The two pits appear slightly offset, but the alignments of their long axis were virtually the same. 8920 had a relatively simple stratigraphy, although there is evidence of some recutting Some layers within the pit contained a substantial amount of pottery and flint, and probably originally bone, although the surviving bone was mostly mineralised and fragmentary.

The pit was divided into six segments (4310–4315), and the layers were numbered separately in each segment. The stratigraphic sequence is summarised below and illustrated in the section (Fig. 2.6).

A thin layer of primary silt and concreted stones (11106, 11118 on the section, 11117 in some other segments) covered most of the flat base of the pit, probably formed very quickly, partly as a result of trample during the original cutting of the pit. It contained flint and pottery (Fig. 3.18, 59). A wedge of sandy fill around the western edge of the pit (11082) probably accumulated soon after the pit was dug. These fills were sealed by a relatively thin layer of sandy loam (11072, 11075) with pebbles and some large stones, which contained flint, charcoal and Neolithic pottery. Above that layer an extensive silty clay layer, stonier on the east side (11071, 11053 on the section, 11119 in some other segments) included a large deposit of pottery (Fig. 3.18, 54–57) and some flint, together with what may once have been a large quantity of bone, although the surviving bone was heavily mineralised and largely unrecoverable. The upper part of this layer on the eastern side was differentiated by its sandy, iron-rich content (11098). A sandy layer with many stones along the east side of the pit (11051), contained flint, bone and charcoal, sealed the upper part of 11098. Both 11051 and 11098 were overlain by a relatively thick, very sandy layer, occurring only on the east side of the pit (11066, 11084). It resembled a re-deposited natural, but was considered unlikely to derived from the natural at the surface of 8920 (which was a loam), it may therefore have been the spoil created from the digging of a different pit. This layer was truncated by a sloping-sided recut (Fig. 2.6 R1). Three fills survived in this recut, a silty sand loam (11052 on the illustrated section 11103 in other segments), contained flint, charcoal, mineralised animal bone and pottery. The middle fill, a sandy silt layer with stones (11028 on the illustrated section, 11030 in other segments), contained flint and pottery. The upper fill of this recut (11026) was a silt loam layer on the west side of the pit, which contained flint and pottery. It is possible that 11027 a loamy sand layer high on the east side may also belong with these fills or may be part of a subsequent recut (Fig. 2.6 R2). This layer, and the fills of recut 1, had been truncated by another broad shallow recut (Fig. 2.6 R3). The primary fill on the east side was a stony silt loam (9990). This layer was sealed by a sandy silt loam (9989, 11001) containing flint, pottery and charcoal, above which was a fairly homogeneous clay loam (9982, 9988), which contained flint and pottery.

8965, Trench HG
(Fig. 2.7)
8965 was part of a large Neolithic pit revealed in trench HG (which was extended to establish the full plan). The excavated profile indicates a similar shape and size to pit 6854 on the main site, with a shallow pit into which was set a vertical-sided shaft. 8965 was roughly oval in plan 3.2m across and 8m long, the north end more rounded than the south. The shallow part of the feature averaged 0.52m deep, whilst the shaft was 1.75m deep, with a flat base. The shallow pit and the shaft may well have been contemporary. A post-hole (8973) was located within the shallow part of 8965, and apparently sealed by the upper fills of 8965. The pit was dug in two segments and the layers were numbered separately in each segment, the stratigraphic sequence is summarised below and illustrated on the section (Fig. 2.7).

A reddish, concreted clayey gravel (11256) forming the primary fill of 8965 appears to have slumped or been dumped from the east side and spread out along the base of the pit. A heavily concreted stony fill (11263) was deposited in the west side of the pit. These layers were truncated by a flat-based recut (Fig. 2.7 R1). The primary fill of which was a grey clay with unevenly distributed charcoal fragments (11252), this was sealed by a thick stony silty loam layer (11246) with iron-staining. In the shallow part of 8965 on the west side, a gravelly fill (11218), formed the lowest layer slumping slightly over the lip into the shaft. This was sealed by a silty sand loam layer (11264). These fills were truncated by another broad flat-based recut (Fig. 2.7 R2). A heavily concreted, very stony layer (11247) was observed in the section, it appears to fill a bowl-shaped pit cut from the base of recut 2 into fill 11246. A silty sand loam layer (11241) containing two patches of charcoal and burnt bone, comprised the primary fill of recut 2, this appears to cap layer 11247. Deposit 11241 was sealed by a deep layer of grey, stony sandy loam (11234). At this point, a post-hole (8973) with vertical sides and rounded base was cut into the shallow part of 8965. Layer 11234 was separated from 11217 by a gravelly fill (11261), 11217 was a clay sandy loam layer, paler than the deep final fill 11216. A piece of tegula was recovered from the stripped surface of 11216.

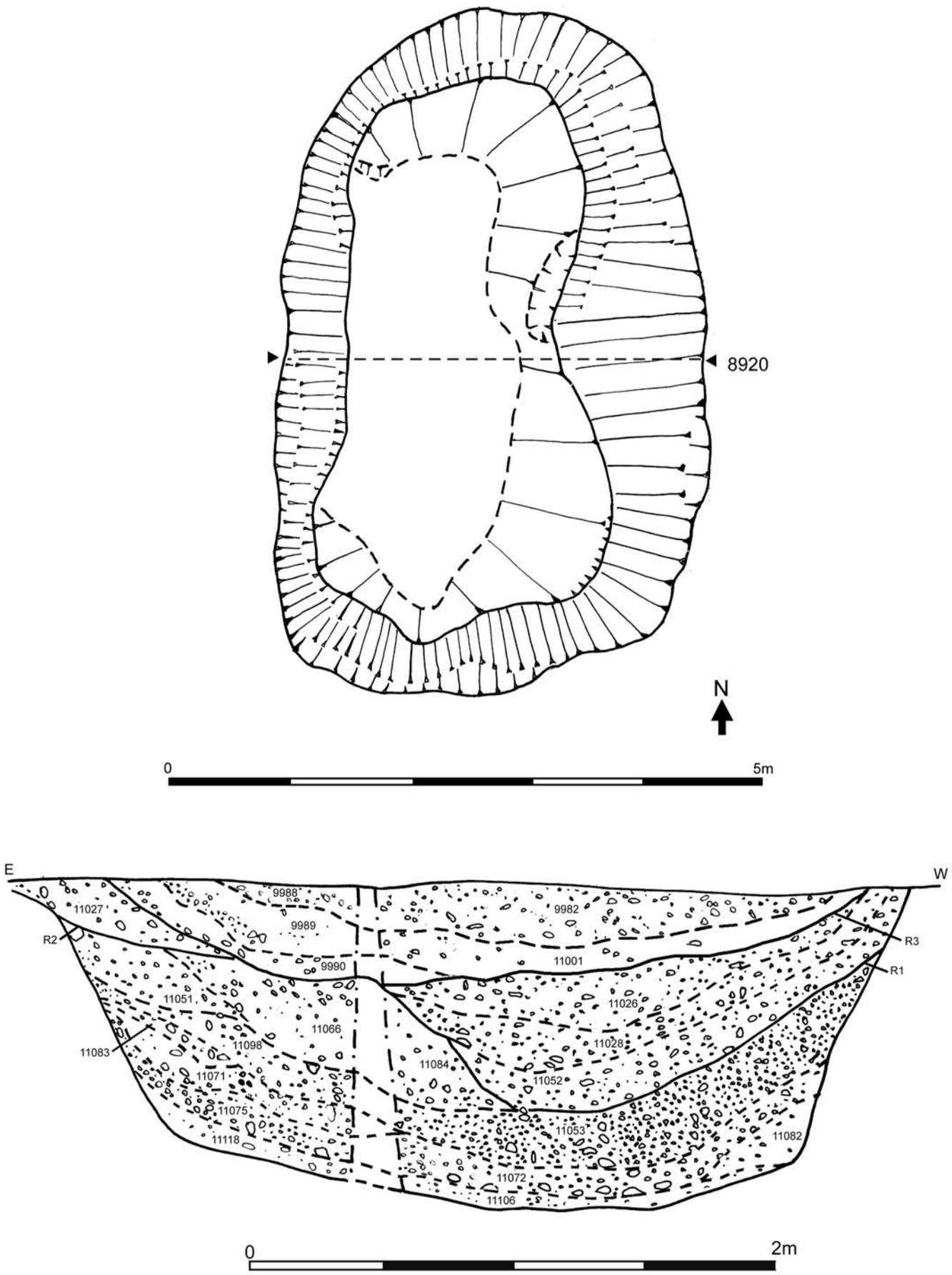


Figure 2.6 Causeway enclosure pit 8920, plan and section

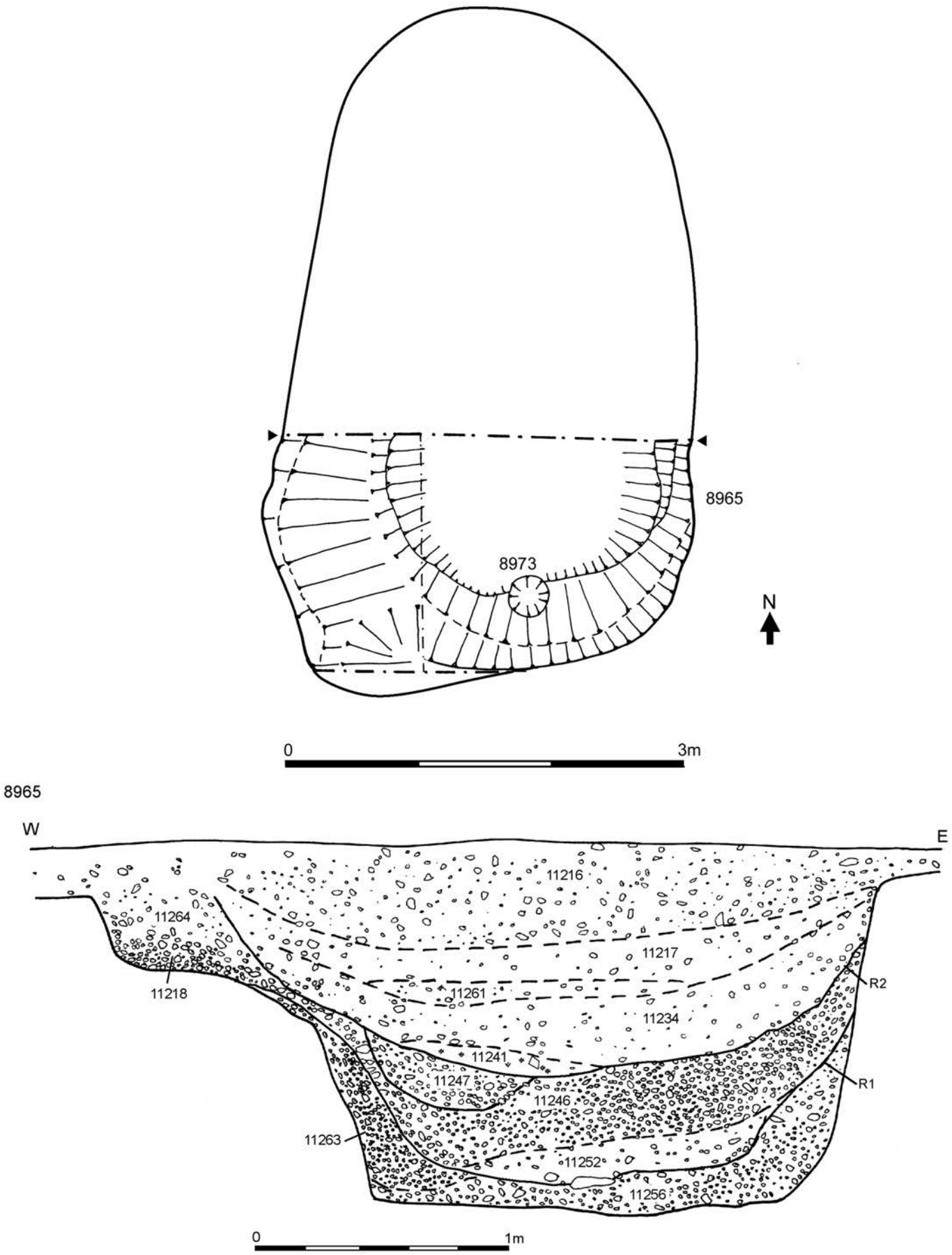


Figure 2.7 Causeway enclosure pit 8965, plan and section

8995, Trench HS
(Fig. 2.8)
A large shallow pit, 3m wide by 5m long, roughly oval in shape, with a north-east by south-west long axis. The excavated part was only 0.42m deep, but it appears that it was recut twice. No finds were recovered and the feature is ascribed to the Neolithic only on the basis of its position on the extrapolated line of the causewayed enclosure.

The primary fill (11341) comprised pebbles in a sandy matrix, below a heavily iron-panned sandy silt (11340). A broad shallow recut (Fig. 2.8 R1) was filled by a very stony layer, more stone than matrix (11339), this had a number of areas of root/animal disturbance. The eastern part of the feature was then recut again (Fig. 2.8 R2), the fill being a silty clay loam (11338). A final very flat-based recut (Fig. 2.8 R3) was filled by a uniform shallow sandy silt loam (11337).

The other Neolithic features
(Fig. 2.1)
The remaining features of Neolithic date can be divided into two main groups, those that occur just within the causewayed enclosure, which comprise a reasonably dense group of pits, post-holes and slots, and the more sparsely distributed features outside the causewayed enclosure.

Earlier Neolithic features inside the causewayed enclosure
Only a very small portion of the interior of the causewayed enclosure has been excavated and it is not known whether the density of features excavated is representative of the whole of the interior.

6937, this small, roughly circular pit (1m diameter) was located to the east of 8918 and 8963. Surface cleaning (9023) recovered group of Neolithic pottery (Fig. 3.16, 27–30). The silty loam fill (9843) contained flint and pottery.

To the east of feature 6854 was an area where the stripped surface showed a dense scatter of flint (including several arrowheads and scrapers) together with earlier Neolithic pottery. This was trowelled over for several excavation seasons, before finally being excavated in 1987, when it proved to be a group of features comprising pit 8896, which was cut by pit 8893, slot 8931 and post-hole 8928, and in turn cut 8926, 8934 and pit 8898.

8893, a very irregular shallow pit cutting across part of the intersection of pits 8896 and 8898 and maybe contemporary with 8931. The excavator was not entirely convinced it was a cut feature as the edges were so vague, it is possible therefore that it represented a final silting up of either or both features. It had a single fill (9996), a mottled silt loam with occasional charcoal flecks. It contained flint, including a point and an arrowhead, and Neolithic pottery.

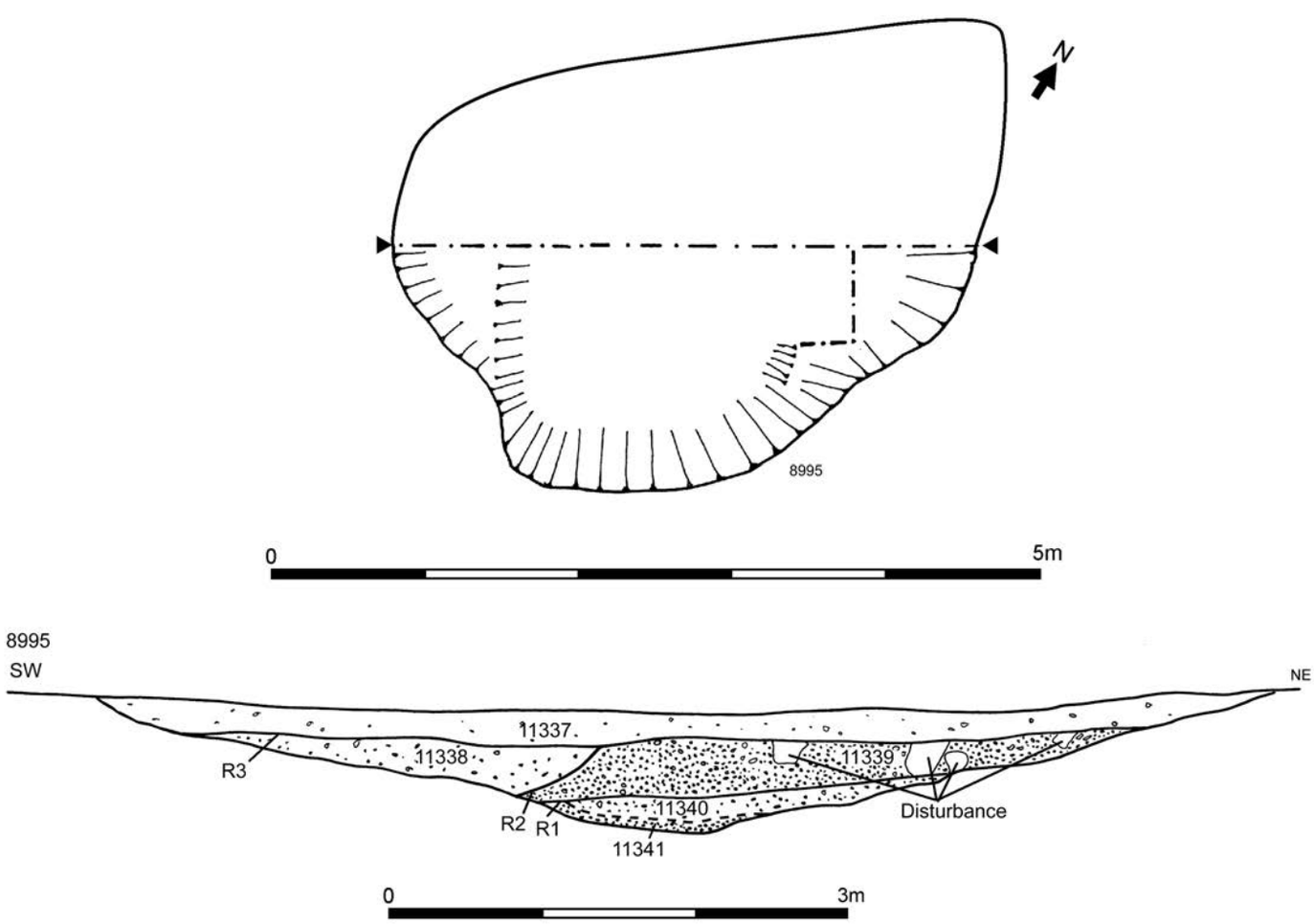


Figure 2.8 Causeway enclosure pit 8995, plan and section

8931, a short, shallow slot (15cm deep) with moderately sloping sides, cutting the eastern edge of 8896. The north end terminates in post-hole 8935 and the south end in post-hole 8938. The base of 8931 is rather irregular and it is possible that this, together with the two post-holes, represents a short wall of closely set posts. Two fills were identified, 9997 and 11043.

8928, a possible post-hole (34cm diam, 15cm deep) cutting 8896, distinguished by being marginally more charcoally than the fills of 8896. It had one fill (11025), containing struck flints and Neolithic pottery.

8896, a shallow oval pit (8896), with its long axis roughly north-west to south-east, measured 2.5 by 1.5m by 20cm deep. The east side was well-defined and moderately sloping. The west side was less well defined and had a shallower slope, the bottom was flat. It was dug in eight segments (4316–2, 4325), with the fills separately numbered in each segment. The layers were not consistent in nature across the feature and the matrix tended to vary within a single layer. An attempt has been made to correlate the fills. The primary fill was a sandy clay loam (11004) found along the west side of the feature. Above this was a thin stony band (11003). This was covered by a clay loam (9986, 9999, 11017, 11018, 11029, 11036, 11042), slightly less stony than Layer 1. It contained earlier Neolithic pottery and flint, pottery sherds from this layer fit others found in 8894, 8920 and 8898 (Fig. 3.17, 34–35). The upper fill was a clay loam with frequent stones (9984, 9998, 11002, 11034, 11035, 11039, 11044), this contained Neolithic pottery (Fig. 3.17, 41) and flint, including an arrowhead.

8926, a post-hole, probably cut by 8896 and excavated as part of that feature.

8934, this feature was visible in the bottom of 8896, although shallow it is probably the very base of a pit or post-hole cut by 8896. It was roughly oval, with shallow sloping sides and a slightly rounded base. There were two fills within it (11046, 11048), with 11046 possibly the fill of a post-pipe.

8898, an oval pit adjoining, and cut at its southern tip by, 8896. It measured approximately 3m by 1.5m by 28cm deep, with moderately sloping sides and a rounded base. It was dug in four segments (4325–8) with each of the fills individually numbered in each segment. The primary fill was a stony layer (11056, 11060, 11062, 11065), containing struck flint and Neolithic pottery (Fig. 3.17, 36). The uppermost fill was a silty loam (9858, 11061, 11055, 11058, 11064). It contained struck flints, Neolithic pottery, including some joining sherds that match others found in 6908, 8896 and 8920.

8910, a very shallow gully with gently sloping sides and a flat base in the north-east corner of the site, extending under the north baulk. It had a single clayey silt loam fill (9950/9952) which contained a few sherds of ?earlier Neolithic pot.

6966, a small circular pit or post-hole (0.5m diameter) located to the west of 8910. It contained flint and earlier Neolithic pottery (Fig. 3.16, 26).

8921, a very shallow feature (approx. 2cm deep), truncated by the eastern baulk. The excavator considered that it may represent the base of a shallow pit. The single fill (9975) contained flint and an ?earlier Neolithic potsherd.

8924, this circular pit (1m diameter, 15cm deep) was located to the south-west of 8926. It was shallow, with gently sloping sides and a flat base. It had a single clayey silt fill (9983/9994) containing flint and earlier Neolithic pottery.

8891, a short length of slightly curving gully (2.2m long by 0.7m wide) protruded from the south-eastern end of the baulk. It contained two fills; the upper stonier fill (9832/9966) contained flint, including a scraper, and Neolithic pottery, and the lower (9960) had flint and ?earlier Neolithic pottery.

Early Neolithic features outside the causewayed enclosure

4967, a single large pit was located some 70m to the south-west of the causewayed enclosure (near gap 3 in the Late Bronze Age circular enclosure ditch). This feature was badly disturbed by later features comprising a Late Bronze Age pit (4612) and the north wall of a Saxon building (2636), both of which contain residual Neolithic pottery, presumably derived from 4967. As far as it is possible to establish from the much truncated remains, the pit was originally oval in plan (2.2m x 1.5m), with moderately sloping sides and a slightly rounded bottom. It contained two fills, a primary loamy sand fill (5452) which contained pottery and flint, and an upper sandy loam fill (3934) which contained Neolithic and Bronze Age pottery, flint, baked clay and charcoal. A quern fragment was recovered from this feature (Major, Chapter 3, V below).

8857, a possible post-hole or oval pit with steep sides and a rounded base, located on the far western edge of the site. The single fill (9743/9783), a clayey sand, contained flint, charcoal and Neolithic pottery (Fig. 3.16, 31).

8800, this feature was approximately 4m long (it was truncated by Saxon ditch 6696) and 0.75m wide. It had a single fill (9659, 9660) which contained flint, including an end scraper and earlier Neolithic pottery. The finds were largely concentrated at the western end of the feature. 6m to the south-west of 8800 was a badly-damaged Saxon cremation (6949), when this was excavated it became apparent that the cremation had been cut through an earlier Neolithic feature and that the majority of sherds recovered were actually of Neolithic date (context 9600).

Later Neolithic and Early Bronze Age features

Later Neolithic and Early Bronze Age features inside the causewayed enclosure

Two parallel slot-like features (6707 and 6908/8894) cut the upper levels of the northern side of causewayed enclosure pit 6854 (Fig. 2.5). It is possible that the depression forming the top of the shaft in 6854 was still open when these were cut. The dating and relationship of 6707 and 6908/8894 suggests that they were contemporary in date and related in function. However they are difficult to interpret, it is possible that they may have formed all or part of a timber structure, although any such structure would have measured not more than 2m square.

6707, a slot-like feature measuring 2m long by 0.5m wide, it had a rounded butt end with moderately steep sides and a slightly rounded base. It was first investigated in 1985 when part of it was taken down in 2cm thick spits (7562, 7929, 7932, 7939, 7943, 7949, 7957), and then fully excavated in 1987, as a consequence whilst the finds from 1987 can be attributed to a particular layer, the

material from 1985 is not so clearly attributable, Beaker pottery was recovered from this feature (Fig. 3.19, 74). There were two silty loam fills (9844/9936), the lower with rather more stones (9852/9940)

6908/8894, a slot-like feature 1.5m long by 0.6m wide and 0.23m deep, this was numbered as two separate features but re-interpreted by the excavator as a primary cut (8894) and a recut (6908). Pottery sherds from the surface cleaning of these features (9834) fit others found in features 8896, 8926 and 8898 (Fig. 3.17, 33). The primary fill of cut 8894 was a silt loam with few stones (9848), this was cut by 6908, which contained two silt loam fills, the lower of which (9849) had few stones, the upper fill contained a quantity of burnt stone (9842/9845).

To the north-east of these two slots was a cluster of pits forming a linear arrangement apparently following a similar alignment to 6707 and 6808/8894. From north to south these were 6968, 6964, 8918, 8963.

6968, a pit, partially truncated by the baulk. The visible portion measured 1m by 1.5m by 64cm deep, and the excavator considered that it was probably originally oval in plan and similar in size to the adjacent pits 6964, 8918 and 8963. The excavated portion had fairly steeply sloping sides with a bowl-shaped base. The stratigraphy had been disturbed by a large ants' nest, however five layers could be distinguished in the portion closest to the baulk.

6964, a roughly oval pit (2.2 by 1.5m by 50cm deep), with a shelf on the west side, the deeper portion of the pit had steep sides and an undulating base. 6964 intersected with pit 8918 on the southern side but it was not possible to determine which cut which. Two layers were recorded, silty sand loam at the very base of the feature (9968) and an upper fill of sandy silt loam, but the finds (9965/9837) may include some collected from the surface of 8918. The finds included some small Grooved Ware sherds.

8918, an oval pit (1.7 x 1m x 45cm deep), just intersecting with 6964 to the north and cut by 8963 to the south. It had moderately sloping sides and a flat base. Three fills were identified; a primary sandy silt (9970) thickest on the east side of the feature, a stony layer on the west side of the feature (9974), and an upper fill of clay loam containing flint and some ?earlier Neolithic pottery.

8963, the southernmost of the three intersecting pits, it cut the southern edge of 8918. It was roughly oval in plan (2m x 1.7m), with moderate to steeply sloping sides. Two fills were recorded, a silty sand loam primary fill (9971) and 9969 which comprised the bulk of the feature. It contained flint and ?earlier Neolithic pottery.

8932, this feature was an almost circular pit (1.2m diameter) located to the south of 6937 with moderately steep sides and an almost flat base. It had two silty clay loam fills (11038 and 11041), both contained flint.

8914, a fairly shallow elongated pit truncated by the eastern baulk. The edges of this were difficult to see as there had been some root disturbance, but it was approximately 4m long from north to south, and 1m wide from the western edge to the baulk. It had moderate to steeply sloping sides and a flat base, and it was dug in four segments. The primary fill was a clayey silt loam (11080, 11081) containing flint, Neolithic pottery and Grooved Ware. Above this was a silty loam (11010) with considerable root disturbance, which contained flint and pottery. A stony fill along the west side of the pit (11077, 11079) contained flint and pottery. The upper fill was a silty clay loam (11006, 11019, 11074, 11076) containing flint, including a scraper, charcoal and pottery. The pottery comprised small abraded flint tempered body sherds and a single small unabraded sherd of Grooved Ware.

Later Neolithic and Early Bronze Age features outside the causewayed enclosure

6095, an oval pit of Late Neolithic date sited some 30m to the north-west of the causewayed enclosure. It measured 1.2m x 1m x 25cm deep, dish-shaped in profile with fairly steep sides and a flat base. The edges were difficult to find and the whole pit was badly disturbed by tree roots. It had a single clay loam fill (5701/5966), which contained Grooved Ware (Fig. 3.19, 68–69) and a flake from a polished flint axe.

2908, an oval pit located 29m to the west of the causewayed enclosure (within the later circular enclosure). It measured 2m by 1.2m by 30cm deep. It had four fills; the primary fill was a stony layer in a silty matrix (3536), containing flint. Above this was a loam layer (3559) containing sparse burnt bone and burnt clay. Above this was silty loam with a high charcoal content (3558). It also contained flint, burnt stones, burnt clay and possible Grooved Ware sherds. The upper fill was a silt loam (3557) containing stone, flint, charcoal and pottery probably of Early Bronze Age date.

2907, an irregular shaped pit located 1.5m to the south of 2908. Its single sandy loam fill (3528) contained flint, charcoal and Early Bronze Age pottery (Fig. 3.19, 94).

2691, an oval pit located some 8m to the north of 4967 (to the north-west of entrance 3 to the later circular enclosure). The feature had been disturbed by the cutting of Saxon grave 4919. One fill was recorded (3647/3203), containing flint and Grooved Ware pottery.

4941, a shallow circular pit or post-hole, only 20cm diameter, with moderately sloping sides located 50cm to the east of 2691. The single sandy silt loam fill (5425) contained a number of Grooved Ware sherds.

6784, an almost circular pit (0.5m diameter) sited to the south-west of the Late Bronze Age circular enclosure. It had moderate to steeply sloping sides and a slightly rounded base. The single silty loam fill (9433) contained flint, burnt bone and ?Grooved Ware (Fig. 3.19, 95).

Unallocated

A number of features were considered likely to be of earlier prehistoric date but could not be allocated with any confidence to a more specific period.

8913, this very shallow gully apparently aligned with the end of 8910, and was similar in dimensions, profile and fill. It was truncated by the eastern baulk. It contained flint.

8911, a possible oval pit, with shallowly sloping sides and a flat base. The finds were all from either on or just below the surface (9951/11063), mainly flint comprised flint and a small abraded potsherd of indeterminate date.

8936, an oval pit (1m x 0.75m) located to the west of 8911. It had moderately sloping sides and a slightly rounded base. The single clayey silt loam fill (11057/11059) contained flint and ?Neolithic pottery.

8930, a rather irregular oval pit (1m x 0.5m) located to the south-east of 8924. The single clayey silt fill (11033) contained flint and a small abraded potsherd of indeterminate date.

Approximately 6m to the north-west of causewayed enclosure pit 6854 were two small features, 6920 and 6697.

6697, a small pit on the edge of the site, it had been truncated by the tank-trap. It was oval in shape with moderately steep sides. It had a very silty fill (7554/7911), containing struck flint.

6920, a small pit or post-hole with a single fill (7981) containing struck flint and prehistoric pottery of indeterminate date. It was truncated by the late Saxon ditch 6696.

In addition there were a number of undated features amongst the northern group of trenches (HL-HR), comprising gullies and post-holes. It is evident from the dated features that there was activity in this area in the Neolithic, Late Bronze Age, Roman and post-medieval periods, so whilst it is possible that some of the undated features are Neolithic it is by no means certain.

II. Late Bronze Age

The Late Bronze Age features comprise the enclosure ditch; post-holes for a concentric double line of supports for an internal rampart; a gate structure at the east entrance; a large central roundhouse with the porch aligned on the east entrance, several smaller circular buildings; four-post structures and miscellaneous post-holes and pits (Fig. 2.9).

The enclosure ditch

The enclosure ditch, F2500, was broadly circular in plan, albeit slightly faceted and notably flattened on its northern side (segment 4055). As excavated, it averaged 63m external diameter and 53m internal diameter, and enclosed a space of approximately 2200 sq. metres. On the stripped and cleaned surface the enclosure showed as a ditch divided into stretches of varying length (numbered 4050–4055, Fig. 2.10) by six causeways (1–6) two further causeways were revealed during excavation (3A and 6A).

The enclosure ditch was completely excavated, in 35 segments which were excavated in two halves with longitudinal and cross sections drawn (Fig. 2.11). The edge of the ditch varied in visibility, being clearest where the ditch cut a gravel subsoil, in the north-west corner of the site where the subsoil was a sandy brickearth, the ditch edge became very difficult to identify. There was a considerable build-up of iron pan on the ditch sides and sandy, iron-rich concretions had formed in places. The excavated ditch profile fluctuated in both width and depth, averaging 5m wide by 1.2m deep. It had clearly been dug as a series of separate segments with causeways in between. As part of the post-excavation process the ditch fills were divided into groups, Group 1 representing the primary fills, Group 2 the lower fills, Group 3 the middle fills, Group 4 the upper fill, and Group 5 the latest fills accumulating after the ditch went out of use.

During the course of excavation no recuts were identified, nor were any recuts suggested during the post-excavation process. That remained true during most of the preparation of this report, however examination of the section drawings began to suggest there must have been some recutting and a full reconsideration of the sections together with the likely form of the rampart suggested at least one major phase of recutting. The original ditch profile is thought to have been narrower, with a steep-sided and U-shaped profile (Fig. 2.12), the excavated spoil was used to construct a timber-framed box rampart (Fig. 2.13). A break in slope of the ditch side indicates a recut which removed most of the fill of the earlier ditch and created a broader, shallower ditch profile and it is suggested that the material from this recut was used to create a simpler dump rampart (Figs 2.12 and 2.13). Some ditch sections noted below may indicate further partial recutting or cleaning out of the ditch-fills, the sequence of which is described below under the specific length of ditch.

The fills for each ditch segment were numbered individually resulting in very many context numbers. During the post-excavation process these were grouped into a broader sequence of deposits numbered 1–5 on the basis of stratigraphic position, similarity in composition and the type and nature of finds, particularly pottery.

The finds included a large post-Deverel-Rimbury pottery assemblage, loomweights, spindlewhorls, perforated clay slabs, flintwork. Acid soil conditions precluded bone survival but charred plant remains were recovered from flotation samples. Two dumps of clay refractory debris for casting bronze metalwork (Ewart Park swords) were recovered from the lower ditch silts, one in the north butt end of the main east-facing entrance, and the other in the north butt end of the west-facing entrance. Together these two deposits probably comprise the largest quantity of such material ever recovered from an excavation in Britain.

The following text describes the interrupted enclosure ditch, starting at the eastern entrance and proceeding in a clockwise direction (Figs 2.10–2.11).

Causeway 1 (eastern entrance)

A 3.8m wide causeway across the enclosure ditch which was provided with a post-built gateway structure (see Gateway structure 6309 below) and was apparently the principal entrance.

Ditch 4051 (Figs 2.10–11, 2.14)

Eight segments (4000–4007) were excavated across 4051, which, at 44.5m long, was the longest of the stretches of interrupted ditch. The ditch was 5.6m wide at the Causeway 1 end, narrowing to 5m wide at the Causeway 2 end. It varied in depth from 1.9m at the deepest point at the Causeway 1 end, rising to 1.3m at the Causeway 2 end.

The ditch profile was fairly consistent, being V-shaped, with gently sloping sides, with a clearly steeper-sided slot-like profile at the base. This basal cut is considered to be the original phase of the ditch, which, based on the small surviving part of the lowest profile would have been a steep-sided U shape. The earliest ditch cut deepened at the butt end adjacent to Causeway 1, this was sufficiently marked that it was initially interpreted as a post-hole. Almost all the fill of this first ditch had been removed by a later recut, leaving just the lowest primary silts which comprised Group 1 fills and in one place (Fig. 2.14, 4005/6) the lowest fill of Group 2.

Group 1 These deposits represent the primary fill of the first ditch, they were generally very sandy, with intermittent stone lines. On the illustrated sections contexts 3050, 3067, 3068, 3104, 3157, 3468.

The ditch was then recut into a wider, somewhat shallower profile, which was subsequently eroded into the gently sloping sides of the excavated ditch profile. The layers within this recut in 4051 were fairly consistent and the general sequence can be summarised as follows:

Plate 2.1 Aerial photograph of the excavations looking north-west, taken in 1988. The Bronze Age enclosure ditch has been fully excavated and the causeways can be clearly seen, together with the rather 'flattened' northern arc of the ditch north of the WWII tank trap which shows as a broad very straight dark mark

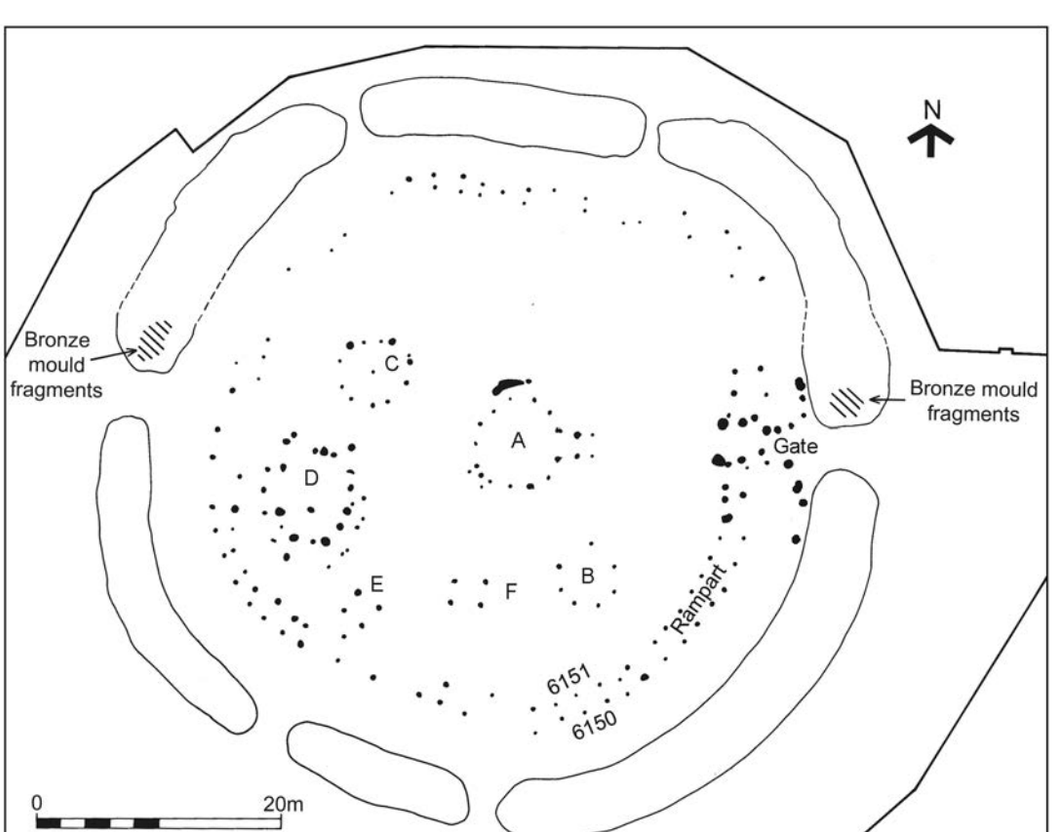


Figure 2.9 Plan showing the Late Bronze Age enclosure ditch together with the main structures, the location of the two deposits of casting moulds in the lower ditch fills are also shown

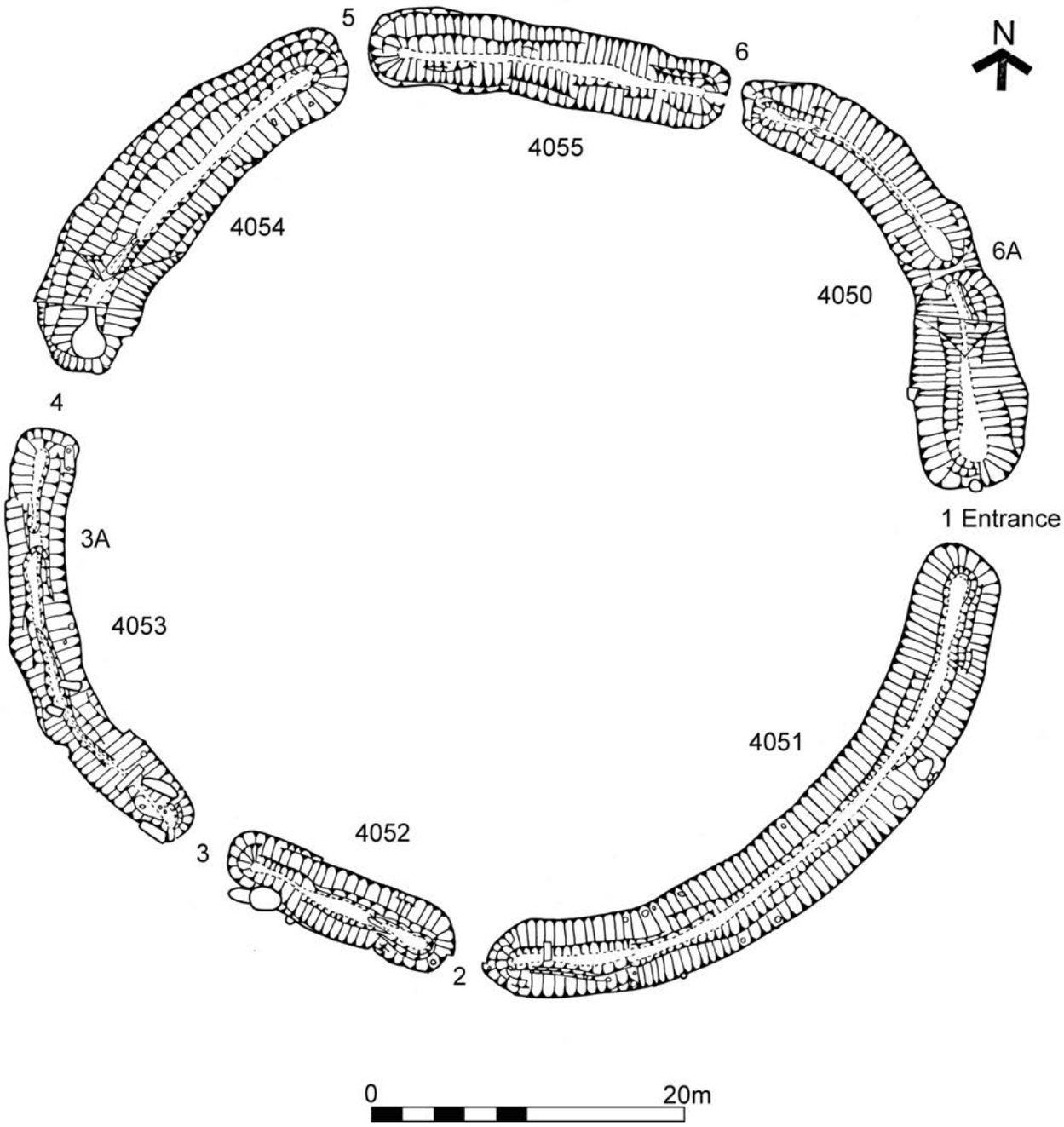


Figure 2.10 Plan of the fully excavated Late Bronze Age enclosure ditch showing the numbers assigned to the causeways and each separate stretch of ditch

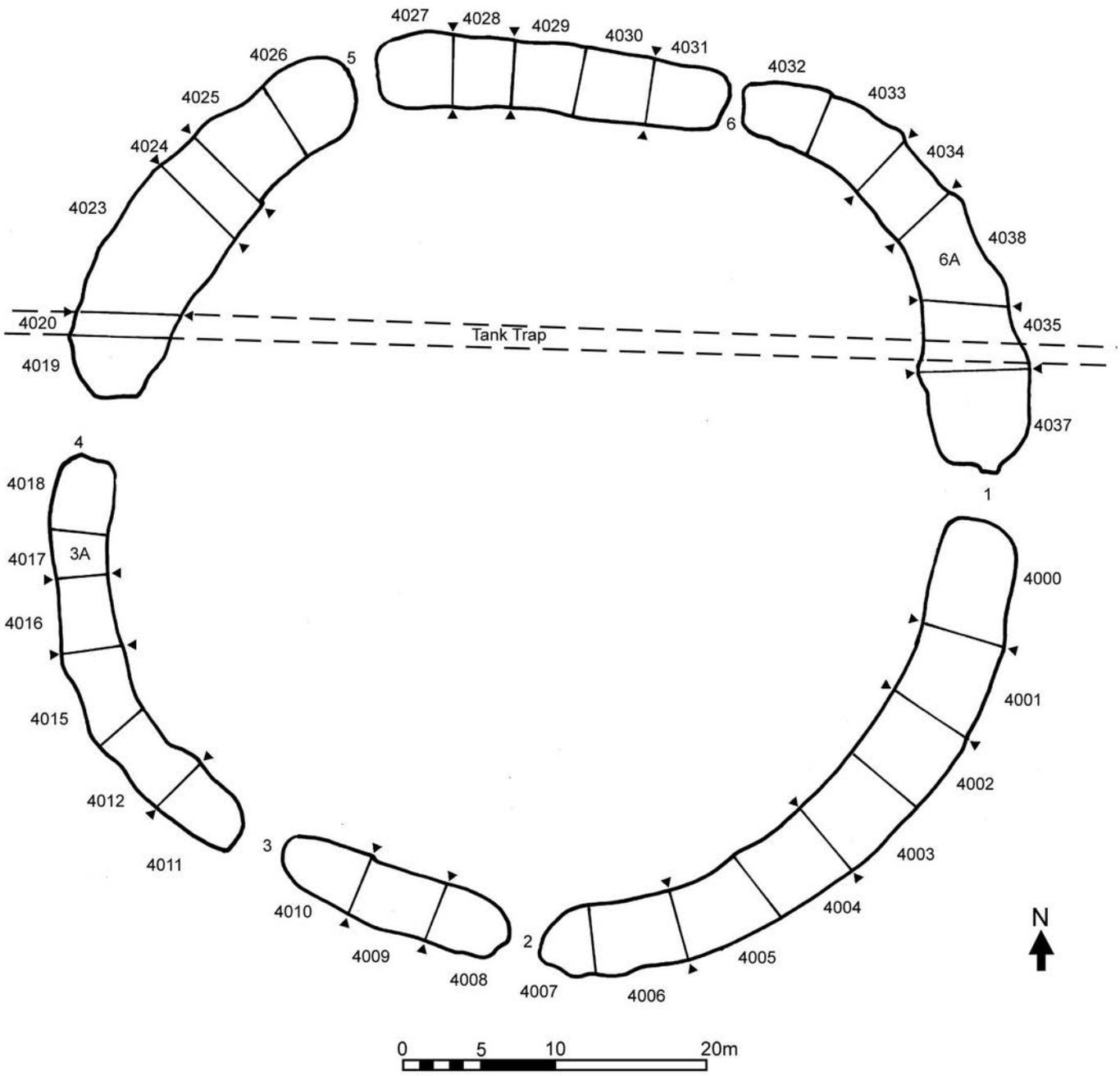


Figure 2.11 Plan of the enclosure ditch showing the location of the excavated segments the illustrated sections are indicated and the line of the WWII tank trap is also shown

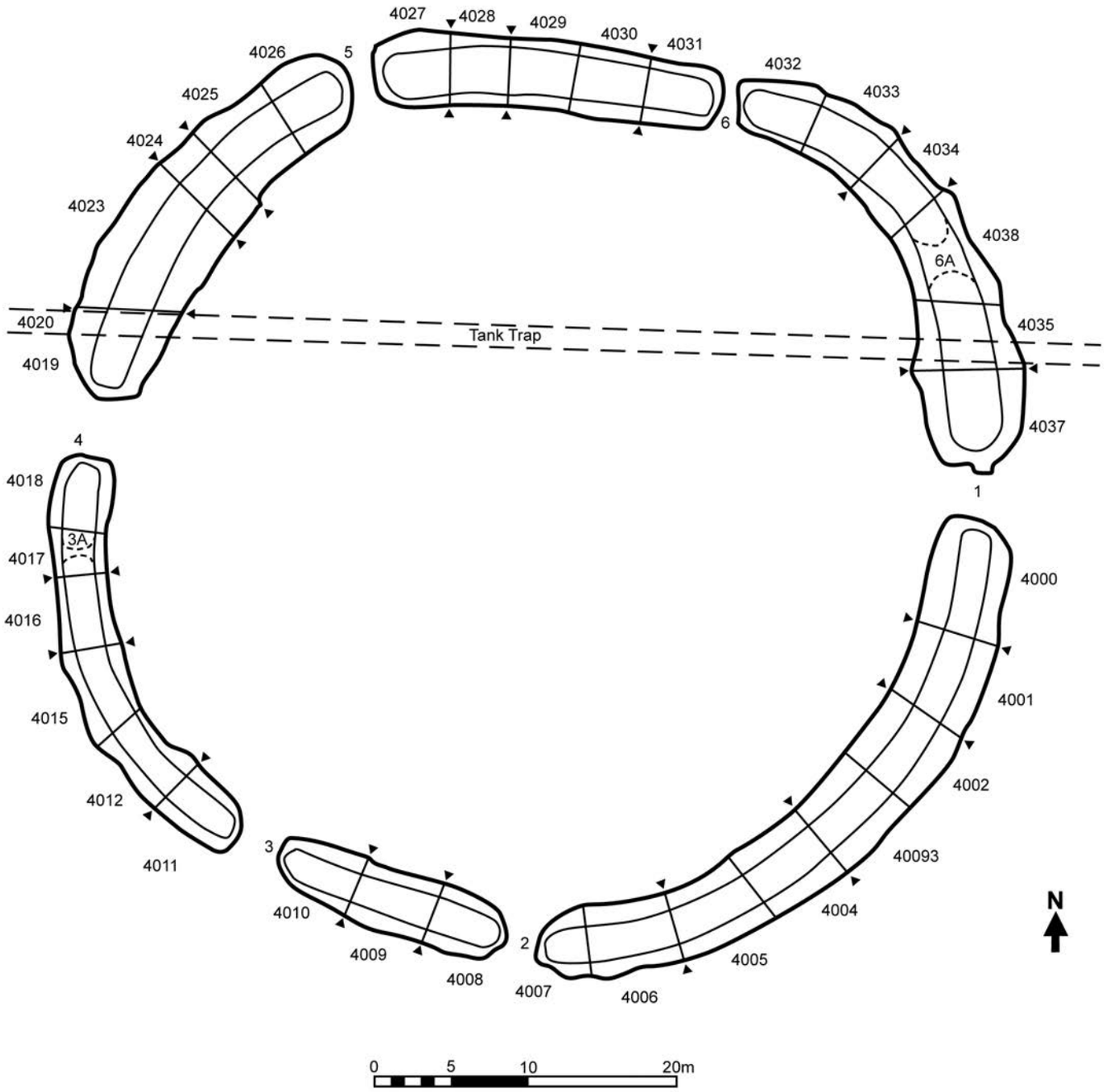


Figure 2.12 Plan of the Late Bronze Age enclosure ditch, the thick line is the ditch edge as excavated the thin line the conjectural width of the phase 1 ditch. The excavated segments, illustrated sections and line of the WWII tank trap are also indicated

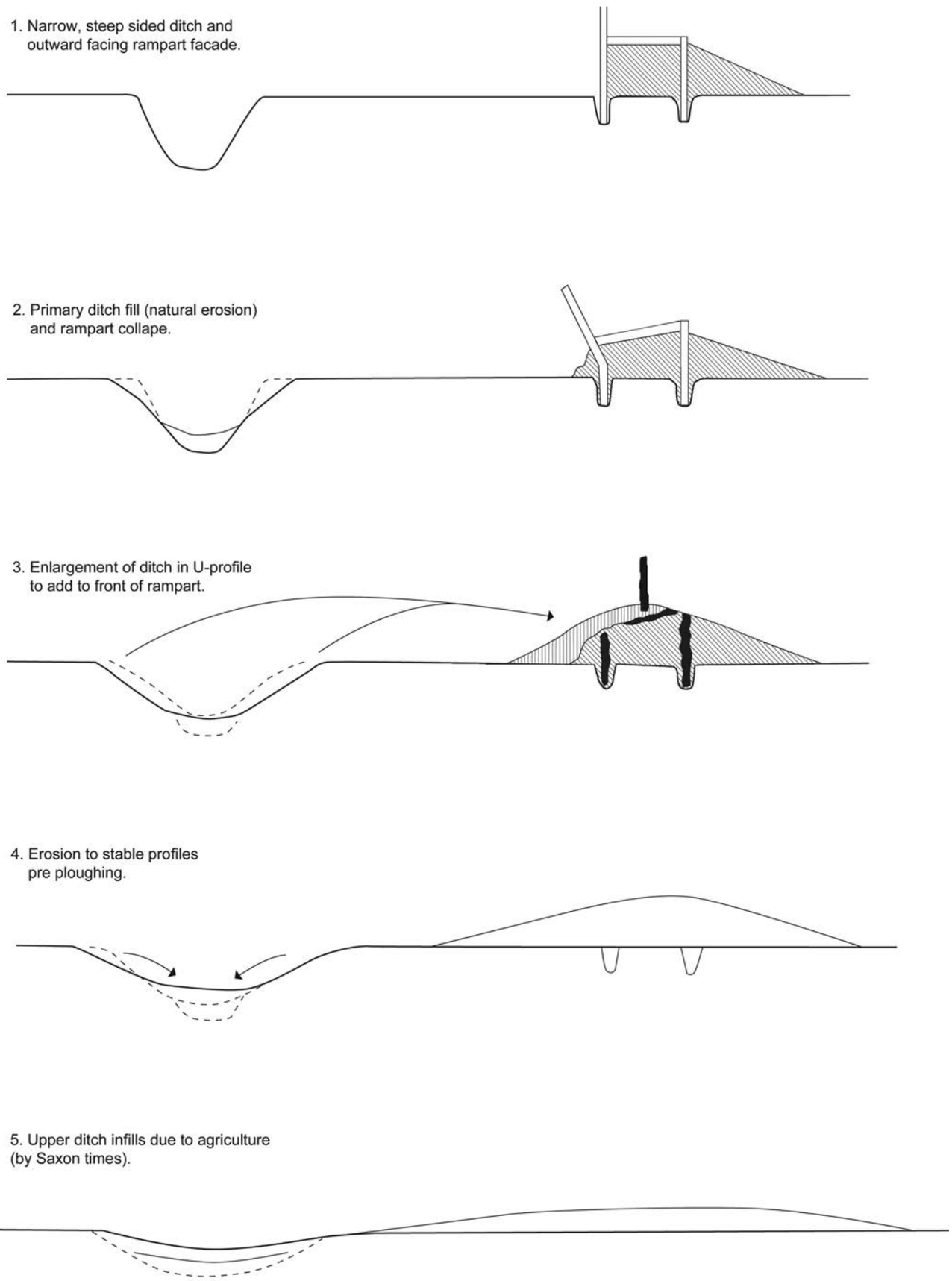


Figure 2.13 Suggested sequence of construction and decay of the Late Bronze Age enclosure ditch and internal rampart.
1. Relatively narrow steep sided phase 1 enclosure ditch with internal box rampart. 2. Sides of ditch erode timbers begin to decay and rampart becomes dilapidated. 3. Major refurbishment, ditch recut on broader shallower profile with internal dump rampart. 4. Once ditch and rampart cease to be maintained erosion creates a stable profile. 5. Agricultural use of the site begins to remove surface traces of the enclosure which was apparently still partly visible in the Early Saxon period but was subsequently completely levelled

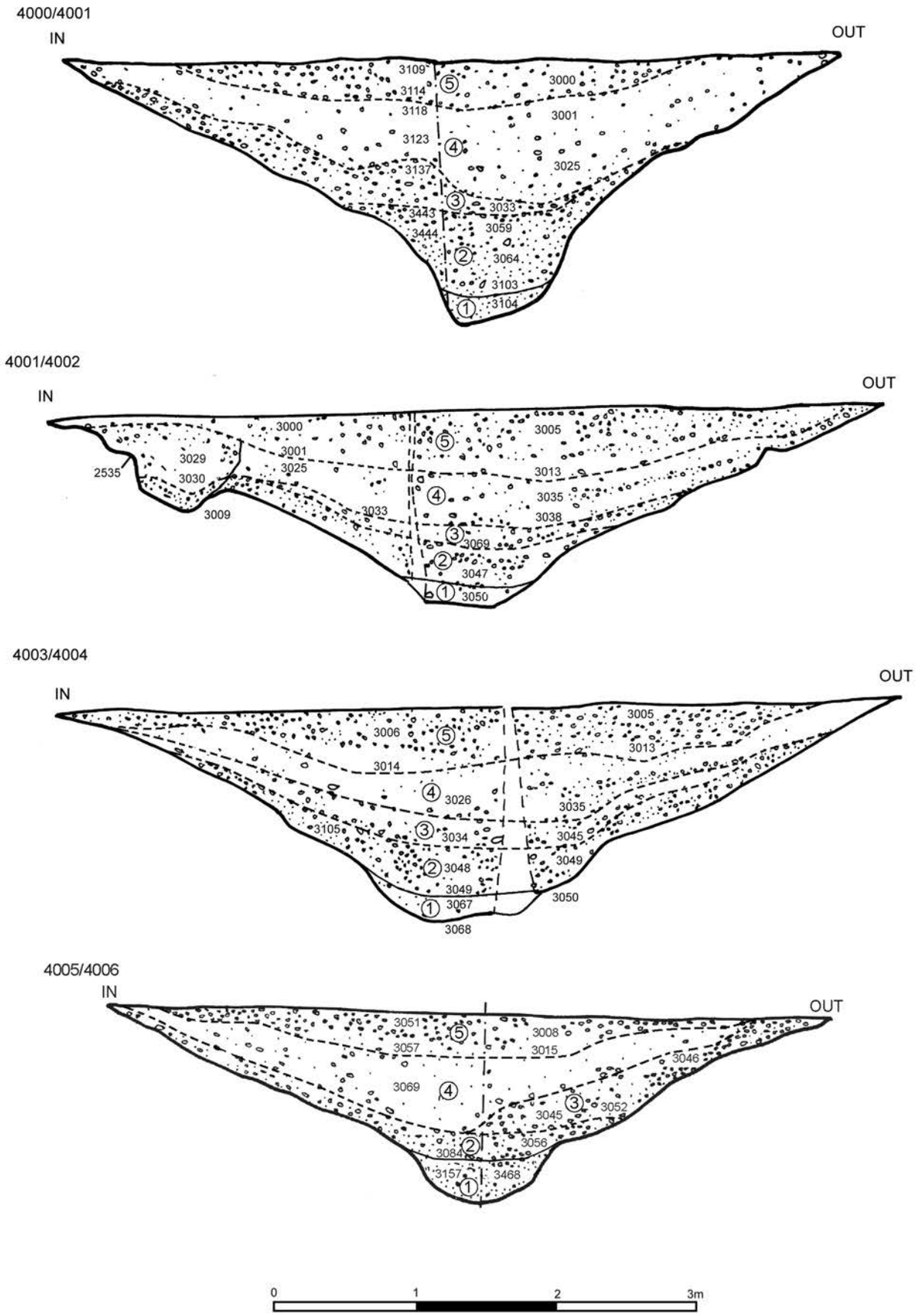


Figure 2.14 Sections 4000–4006 of the Late Bronze Age enclosure ditch (4051). 'Out' indicates outside edge 'In' indicates the ditch edge inside the enclosure. Numbers in open circles indicate the general stratigraphic position of fill groups used during the post-excavation process and most of the preparation of this report

Group 2 This consisted of a number of stony tip lines separated by thin layers of silt. These tend to slope further up the inner side of the segment and some of it may derive from material that has rolled down from an internal bank. On the illustrated sections contexts 3047, 3048, 3049, 3059, 3064, 3084, 3103, 3105, 3443, 3444 of which context 3084 is interpreted as belonging to the fill of the first ditch cut.

Group 3 Similar to Group 2, but appearing greyer. On the illustrated sections contexts 3033, 3034, 3045, 3046, 3052, 3056, 3069, 3137.

Group 4 A brown loam with varying amounts of sand and clay, relatively stone free, and about 20cm thick in the centre of the ditch which was separated by an intermittent stony layer from Group 3. On the illustrated sections contexts 3025, 3026, 3035, 3038, 3069, 3123.

Group 5 The top fill of ditch, similar to the plough-soil, with common stones and generally rather sandy. It contained some Roman and later pottery. On the illustrated sections contexts 3000, 3001, 3005, 3006, 3008, 3013, 3014, 3015, 3051, 3057, 3109, 3114, 3118.

In some places the interface between Groups 3 and 4 is rather step-like and that may indicate another phase of recutting or at least the last stage of cleaning out the ditch (Fig. 2.14, 4000/1, 4003/4, 4005/6). South of the main entrance the inside edge of the enclosure ditch was cut by a Roman pit (Fig. 2.14, 4001/4002).

Pottery and flint were recovered from all the segments dug. The greatest concentration lay towards Causeway 1, decreasing towards Causeway 2.

Causeway 2 (southern entrance)
A 2.5m wide causeway across the enclosure ditch.

Ditch 4052 (Figs 2.10–11, 2.15)
This is the shortest length of interrupted ditch, 16m long. Three segments were excavated across it (4008–4010). The ditch was 4m at its widest at the Causeway 2 end, narrowing to 3.1m at Causeway 3 end. It averaged 1.2m deep dropping at the western end to 1.4m. The ditch profile was fairly consistent, the sides gently sloping, with a slightly steeper-sided rounded profile at the base. The break in slope in the lowest part of the ditch which indicated the cut for the first ditch in 4051 is not so apparent here, though it is discernible on the inside edge. It is possible that this short length of ditch was completely recut. During excavation, except in the driest weather, the butt end adjacent to Causeway 3 had constant water seepage into the base of the ditch leading to flooding. The fills can be summarised as follows:

Group 1 The lowest fill was generally very sandy with intermittent stones, this fill might represent the sole surviving element of the fills of the first ditch or the primary fill of the recut. On the illustrated sections contexts 5237.

Group 2 This consisted of a number of stony tip lines separated by thin layers of silt becoming increasingly stony further down the Group. On the illustrated sections contexts 5235, 3733, 5236.

Group 3 A somewhat greyer sandy silt, with pockets of charcoal-rich soil which didn't form distinct layers, but appeared to be separate deposits made during the laying down of this layer. On the illustrated sections contexts 3726, 3783, 3787, 5101, 5121, 5135, 5141.

Group 4 A sandy silty loam, relatively stone free, and about 20cm thick in the centre of the ditch. This was separated by an intermittent stony layer from Group 3. On the illustrated sections contexts 3722, 3772, 5115.

Group 5 Top fill of ditch, occupying the centre of the feature and not reaching the sides. A sandy loam with relatively common stones. It contained some Roman and later pottery. On the illustrated sections contexts 3721, 3771, 5100.

Causeway 3 (south-western entrance)
A 3m wide causeway across the south-western entrance. This was diametrically opposite the north-eastern Causeway 6.

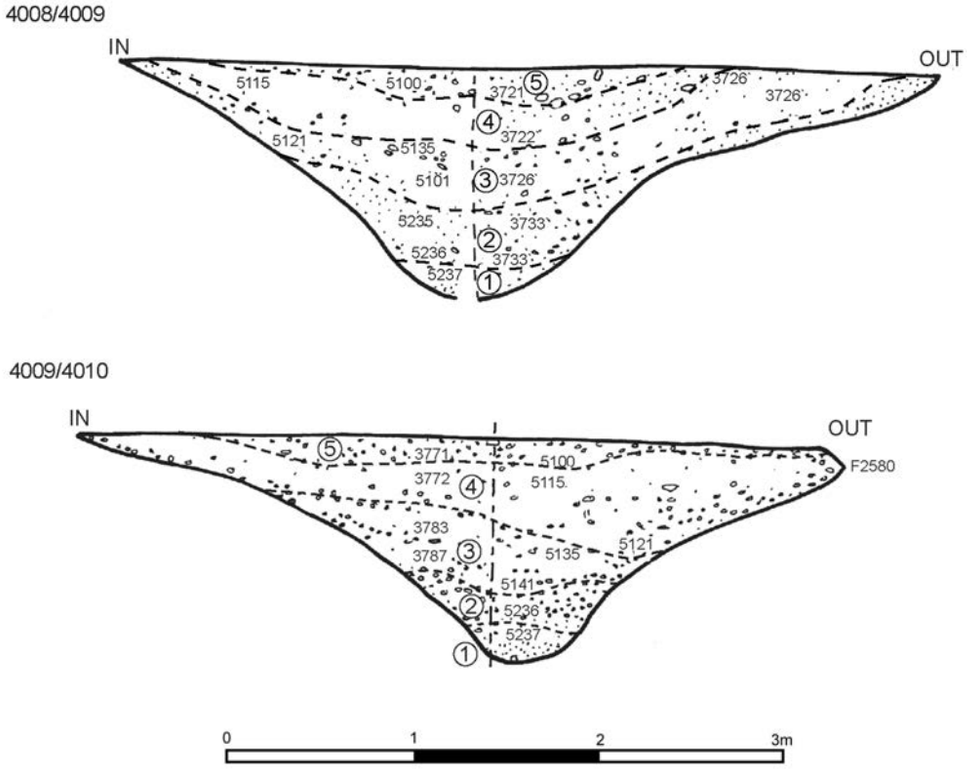


Figure 2.15 Sections 4008–4010 of the Late Bronze Age enclosure ditch (4052). 'Out' indicates outside edge 'In' indicates the ditch edge inside the enclosure. Numbers in open circles indicate the general stratigraphic position of fill groups used during the post-excavation process and most of the preparation of this report

Ditch 4053 (Figs 2.10–11, 2.16)

A narrow length of the enclosure ditch, 28.5m long, 4.1m wide at its Causeway 3 end narrowing to 3.8m wide at its Causeway 4 end. It was excavated in six segments (4011–12, 4015–18). The base of the ditch was quite uneven, varying from a depth of 0.95m at the southern end to 1.1m in section 4016, then rising to form a shallow narrow causeway (Causeway 3A) before dropping again to 0.9m. Causeway 3A was located directly opposite Causeway 6A in segment 4038 (ditch length 4050), making a southwest–northeast axis across the site. It was however lower than the causeway in 4038, and is located beneath a block of stony fill (9425) which may have been deliberately deposited in order to raise the overall height of the causeway. The profile also fluctuated somewhat in shape, in sections 4011 and 4015 it comprised very gently sloping upper levels before dropping steeply the last 50cm forming a flat-bottomed slot. By contrast section 4016 was of a broad rather V-shaped profile. The lowest part of the cut for the original ditch is most clear in segment 4011 (Fig. 2.16, 4011/12), elsewhere the break in slope is not so discernible, particularly on the outer edge. Except in the driest weather, the terminal closest to Causeway 3 had constant water seepage into it.

The fills are summarised as follows:-

Group 1 The primary fill of the first ditch cut comprised a loamy sand with common stones. On the illustrated sections contexts 5470, 9430, 9465, 9483, 9510.

The ditch was recut into a wider, somewhat shallower profile which subsequently eroded into the wider, gently sloping sides of the excavated ditch profile.

Group 2 Fine loamy sand layers becoming stony on the inner side of the ditch which may have rolled down from an internal bank. It was separated by a thin layer of stones from Group 3. On the illustrated sections contexts 5340, 5341, 5342, 9428, 9429, 9437, 9454, 9455, 9508, 9509.

Group 3 A silty sand loam, stonier and less heavily iron-stained than Group 2 forming a layer of variable thickness, it slopes slightly up the inner side of the ditch. On the illustrated sections contexts 5153/5529, 5199, 5339, 9376, 9404, 9436.

Group 4 A sandy silty loam with relatively common stones and frequent iron staining. On the illustrated sections contexts 5527, 9359, 9364, 9375, 9389.

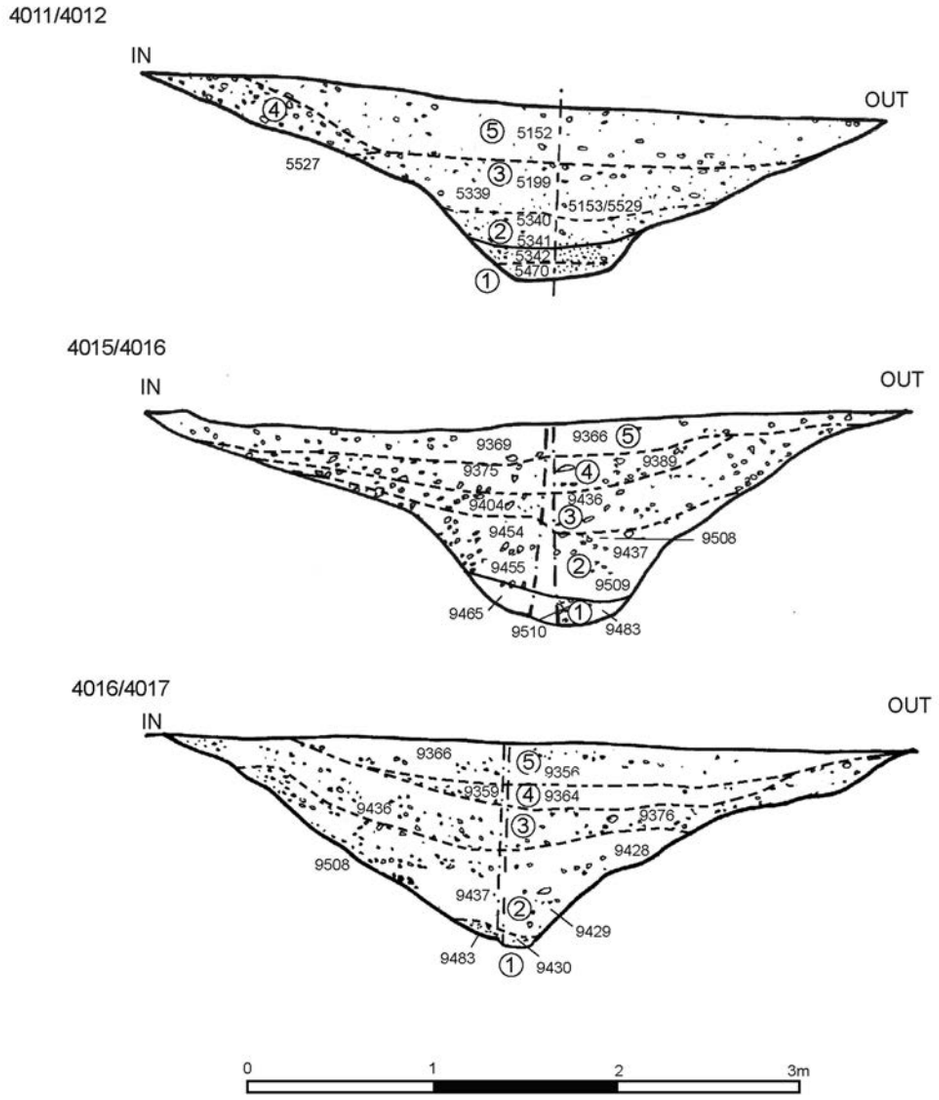


Figure 2.16 Sections 4011–4017 of the Late Bronze Age enclosure ditch (4053). 'Out' indicates outside edge 'In' indicates the ditch edge inside the enclosure. Numbers in open circles indicate the general stratigraphic position of fill groups used during the post-excavation process and most of the preparation of this report

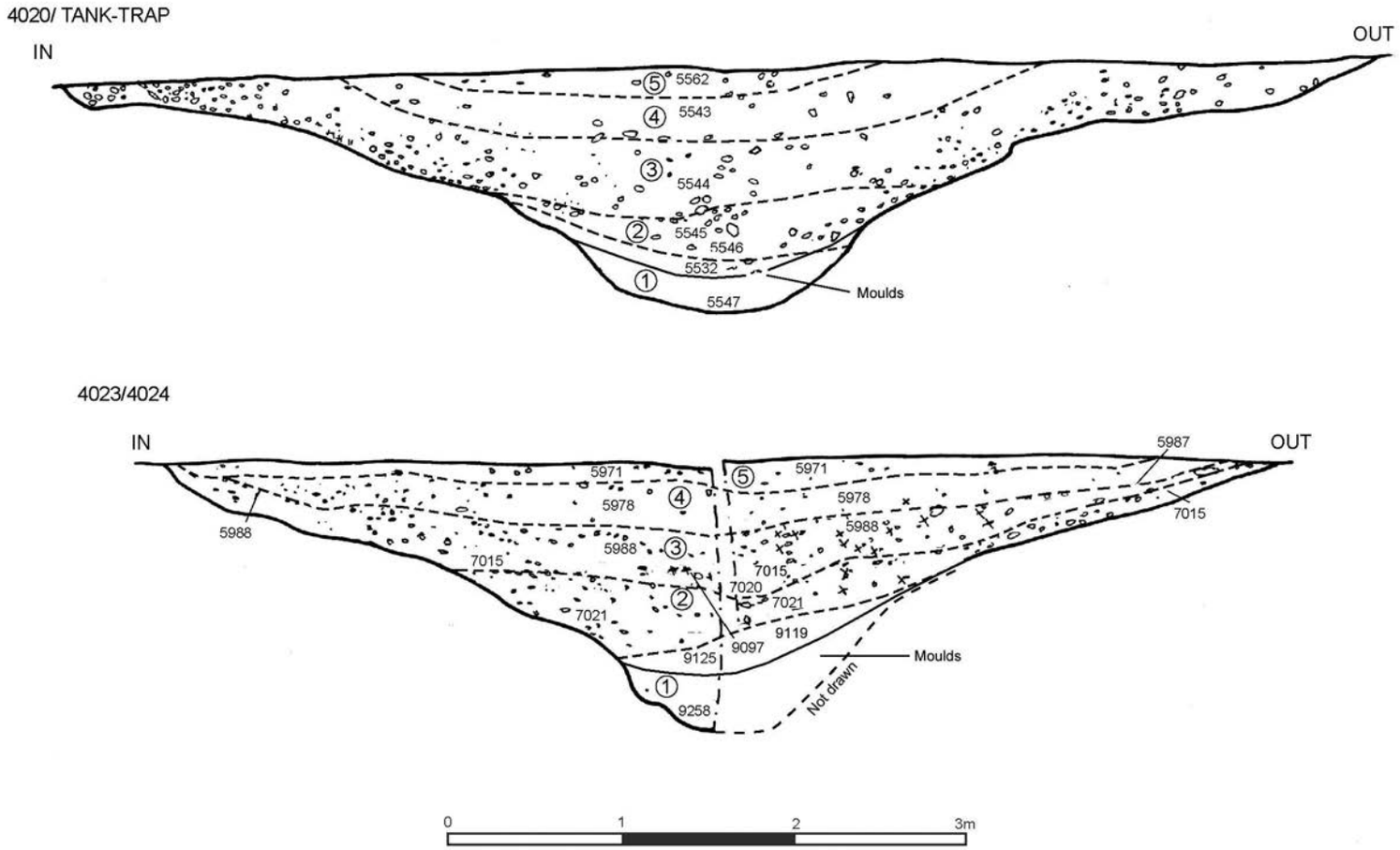


Figure 2.17 Sections 4020–4024 of the Late Bronze Age enclosure ditch (4054). 'Out' indicates outside edge 'In' indicates the ditch edge inside the enclosure. Numbers in open circles indicate the general stratigraphic position of fill groups used during the post-excavation process and most of the preparation of this report

Group 5 A silty loam forming the top fill of ditch with sparse stones, extending across to the edge of the outer side of the ditch. It contained some Roman pottery. On the illustrated sections contexts 5152, 9356, 9366, 9369.

Fills 5153 and 5529 (Group 3) in sections 4011 and 4012 respectively were almost black from the large amount of charcoal in them, they also contained a dump of burnt clay fragments, probably daub, and a distinctive group of pottery (Chapter 3, VII). Flotation samples produced a concentration of straw fragments, nutshells and a few cereal grains (Chapter 3, IX). The positioning of this deposit suggests that it was thrown in from the outer edge of the ditch.

Causeway 4 (western entrance)

This west-facing causeway was the widest at 4m. It was located diametrically opposite to Causeway 1.

Ditch 4054 (Figs 2.10–11, 2.17)

This stretch of ditch was excavated in six segments (4019–20, 4023–6) and was cut through by the tank-trap that bisected the site. Ditch 4054 was the widest portion of the enclosure ditch, measuring 27.5m long and 7m across at its southern end narrowing down to 5.5m at the northern end. It was deepest at its southern end at approximately 1.5m (precise measurements are not possible due to the disturbance caused by the lifting of casting-moulds *en bloc* see below) rising to 1.1m at the northern end. The ditch profile was fairly consistent, having gently sloping sides, with a clearly steeper-sided rounded base. This deeper basal cut is considered to be the original phase of the ditch, which, based on the small surviving part of the lowest profile, would have been a steep-sided U-shaped ditch. There is a distinct break in slope on both sides of the ditch as shown in segment 4020/tank-trap and 4023/24 rather higher up and that may relate to a partial recut or substantial cleaning out of the ditch. Something similar is

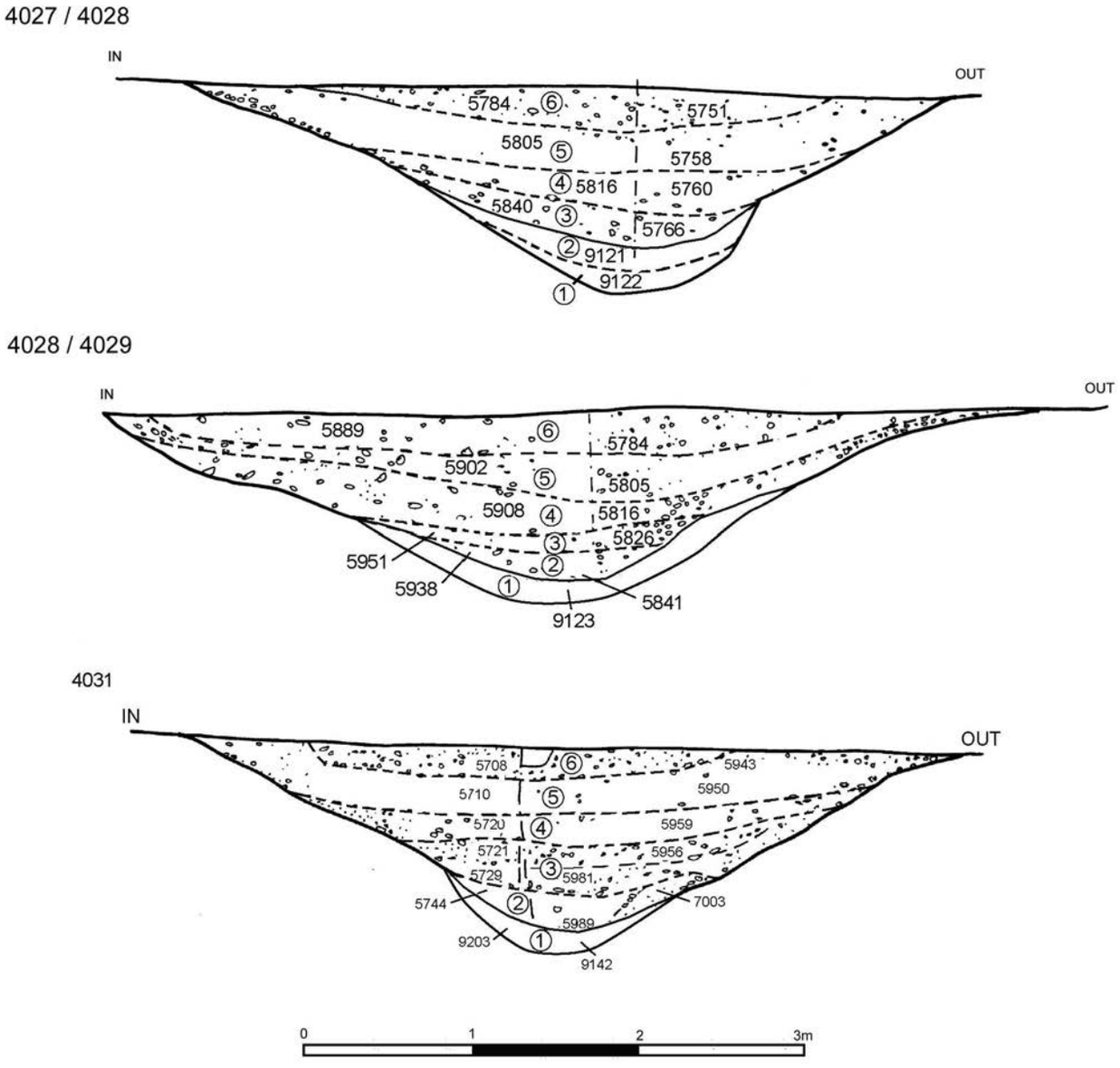


Figure 2.18 Sections 4027–4031 of the Late Bronze Age enclosure ditch (4055). 'Out' indicates outside edge 'In' indicates the ditch edge inside the enclosure. Numbers in open circles indicate the general stratigraphic position of fill groups used during the post-excavation process and most of the preparation of this report

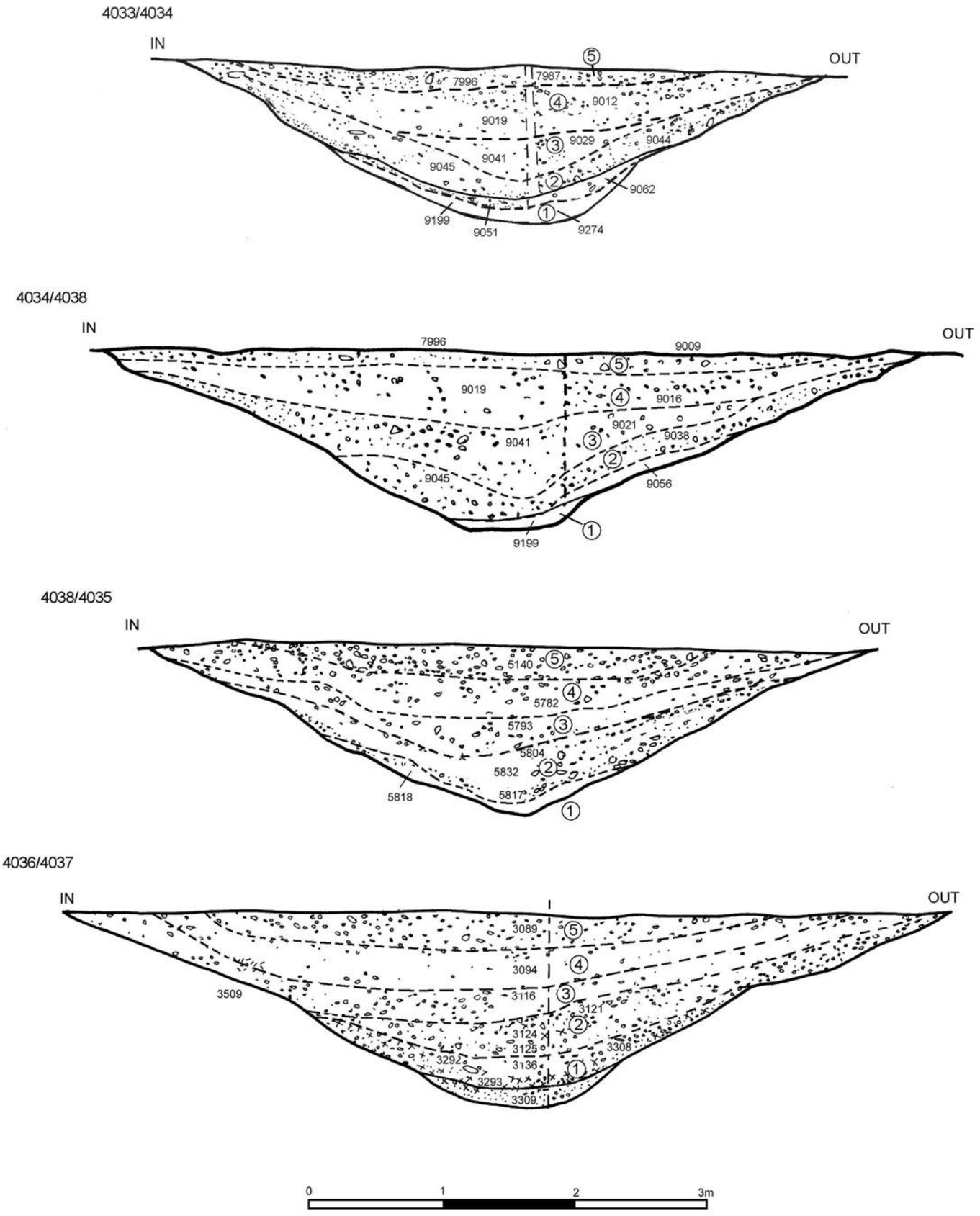


Figure 2.19 Sections 4033–4037 of the Late Bronze Age enclosure ditch (4050). 'Out' indicates outside edge 'In' indicates the ditch edge inside the enclosure. Numbers in open circles indicate the general stratigraphic position of fill groups used during the post-excavation process and most of the preparation of this report

observable on the opposite side of the enclosure in segment 4036/37, this maybe a reflection of the particular importance attached to the main east–west entrances and the part of the ditch on the northern side.

The fills are summarised as follows:-

Group 1 The primary fill of the first ditch cut comprised a loamy sand with patches of clay and a mottled appearance. On the illustrated sections contexts 5547, 9258.

The ditch was recut into a wider, somewhat shallower profile which subsequently eroded into the wider, gently sloping sides of the excavated ditch profile.

Group 2 Primary fill of the recut, a layer of almost pure clay with heavy iron staining apparently deliberately dumped in from somewhere else as the subsoil in this part of the site is not clay. The clay casting mould fragments came from these Group 2 deposits. On the illustrated sections contexts, 5545, 5546, 7021 and 5532, 9119, 9125 which may be the lowest fills of Group 2 or the upper fills of Group 1.

Group 3 A clayey silt layer, with many stones. On the illustrated sections contexts 5544, 5988, 7015, 7020, 9017, 9028, 9097. Large amounts of pottery were recovered from layer 9043 (equivalent to 9097 in the illustrated section).

Group 4 A silty sandy loam, quite stony, rather grey in colour. This layer petered out in section 4023 and is not observed in sections 4024–6. On the illustrated sections contexts 5543, 5978.

Group 5 A clay loam containing Roman pot. The upper levels had sparse stones but it became progressively stonier as it deepened. On the illustrated sections contexts 5562, 5971.

Excavations in 1983 revealed a deposit of bronze-casting moulds in the butt end (segment 4019, fill 5706) next to Causeway 4, mirroring the position of the bronze-casting moulds in the terminal next to Causeway 1. These were lifted in blocks by the British Museum for excavation under laboratory conditions. However, the excavation of the blocks meant that the lowest layers and the basal profile of the ditch could not be established in section 4019. The adjacent segment 4020, which mostly comprised the tank-trap, was partially dug by JCB prior to the excavation of segment 4019. However, the clay of layer 5532 in segment 4020 was mistaken for natural and the machine was stopped at this point. This turned out to be fortunate as further excavation of this segment, following the discovery of the moulds in segment 4019, revealed additional moulds. The deposit of moulds was not extensive in segment 4020 and appears to have petered out just before the tank-trap. Away from the section-line the deposit was rather scattered, with an average of 5–10cm between pieces. Segment 4023 was on the north side of the tank-trap. Again this was not fully bottomed when excavated in 1983 (see Fig. 2.17), and re-investigation in 1986 revealed a clay layer (9119) which contained a deposit of clay moulds. This deposit did not appear to be as dense as those in segment 4019. A large part of the deposit was lifted in blocks *c.* 30cm square. A few clay mould fragments were also recovered from the southern end of segment 4024 (layer 9125).

Causeway 5 (north-north-western entrance)

This causeway averaged 2m wide. It was located diametrically opposite to Causeway 2.

Ditch 4055 (Figs 2.10–11, 2.18)

This stretch of ditch was excavated in five segments (4027–31), it was a short, wide and almost straight segment, forming the northern side of the enclosure. It measured 23m long and 5m wide at its west end narrowing down to 4.5m at the eastern end. It averaged 1.1m in depth, and its profile comprised gently sloping sides and a steeper-sided rounded base. This deeper basal cut is considered to be the original phase of the ditch, which, based on the small surviving part of the lowest profile, would have had a steep U-shaped profile. Almost all the fill of this first ditch had been removed by later recuts, leaving just the lowest primary silts which comprised Group 1 and in one place (Fig. 2.18, 4027/8) Group 2 as well.

The fills are summarised as follows:-

Group 1 Primary fill of first ditch cut, a clayey sand loam. In places along the ditch it appears to be absent and may have been completely removed by the recut. On the illustrated sections contexts 9122, 9123, 9142, 9203.

The ditch was recut into a wider, somewhat shallower profile which subsequently eroded into the wider, gently sloping sides of the excavated ditch profile.

Group 2 A silty sand loam, with common small stones. On the illustrated sections contexts 5744, 5841, 5938, 5989, and 7003, together with 9121 which appears to have been part of the original cut.

Group 3 A clayey silt loam, quite stony, rather grey in colour. On the illustrated sections contexts 5721, 5729, 5766, 5826, 5840, 5951, 5956, 5981.

Group 4 A silty loam, very similar to Group 3 above, but with less stones. On the illustrated sections contexts 5720, 5760, 5816, 5908, 5959.

Group 5 A silty loam layer forming the top fill of ditch, common small stones, contained Roman pot. On the illustrated sections contexts 5710, 5758, 5805, 5902, 5943, 5950.

Group 6 A clay layer forming the top fill of ditch, this is stonier than the fills of Group 5. It contained Roman and Saxon pottery. On the illustrated sections contexts 5708, 5751, 5784, 5889.

Causeway 6 (north-north-eastern entrance)

A very narrow causeway, measuring only 1m wide at its narrowest point. Sited diametrically opposite Causeway 3.

Ditch 4050 (Figs 2.10–11, 2.19)

This stretch of the enclosure ditch was cut by the tank-trap which bisected the site and was excavated in six segments (4032–4038). It broadens considerably along its length, from 4m at its Causeway 6 end widening to 6.8m wide at its Causeway 1 end. The base of the ditch is not level, and the ditch segment can be subdivided into two parts, separated by a shallow causeway (Causeway 6A) in segment 4038 (Plate 2.2). Causeway 6A faced west-north-west and was diametrically opposite the equally shallow causeway in segment 4017 (ditch 4053). Layer 9022 was a gravelly layer overlying causeway 6A and overlapping slightly down each side of it. The segment was 1m deep at the northern end, dropping to 1.1m in section 4034 before rising to 0.23m deep at Causeway 6A, and then dropping down again to 1.5m at the terminal abutting Causeway 1. In profile it had gently sloping sides with a rounded base. A slightly deeper basal cut is considered to be the original phase of the ditch, the break in slope of this original cut is reasonably clear along most of the ditch length (Fig. 2.19, 4033/34, 4034/38 and 4036/37, Plate 2.3), however in part of the ditch the break in profile is not so clearly apparent (Fig. 2.19, 4038/35). There is a distinct break in slope on both sides of the ditch as shown in segment 4036/37 (Fig. 2.19) rather higher up and that may relate to a partial recut or substantial cleaning out of the ditch. Something similar is observable on the opposite side of the enclosure in segment 4020/tank-trap and 4023/24, this may be a reflection of the particular importance attached to the main east–west entrances and the part of the ditch on the northern side.

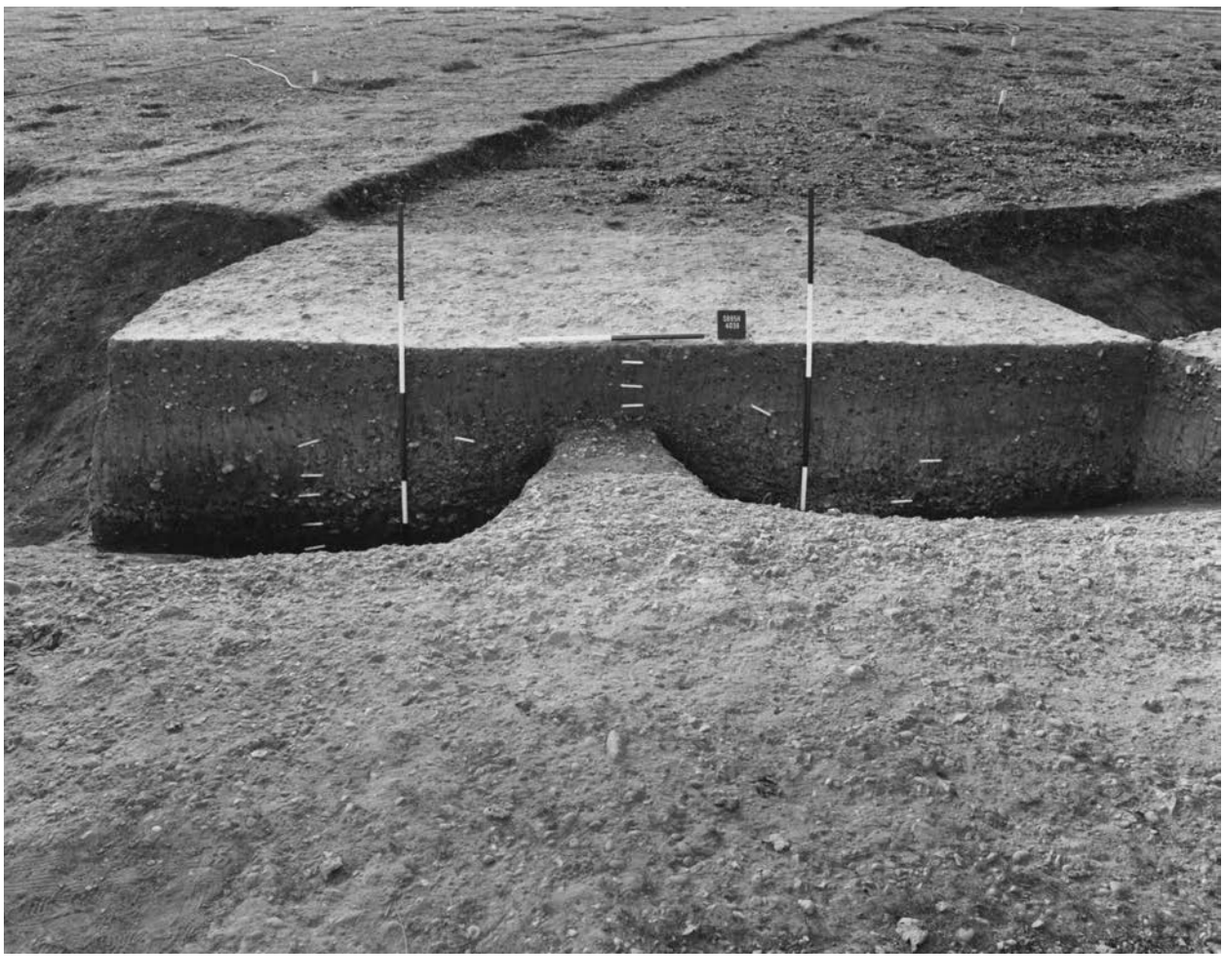


Plate 2.2 The Late Bronze Age enclosure ditch 4050, longitudinal section segment 4038 circular enclosure, showing Causeway 6A. This was one of two causeways which were not visible on the machine stripped surface of the site. The vertical scales are 2m and the horizontal 1m

The fills are summarised as follows:-

Group 1 This group of mixed clay and sandy clay layers represent the lowest fills of the ditch as excavated. The contexts 3309, 5818, 9199, 9274 are the primary fills of the first ditch cut, contexts 3136, 3292, 3293, 3308 (all fills within segment 4037) and 9051, 9062 (segment 4034) are the primary fills of the recut.

The ditch was recut into a wider, somewhat shallower profile which subsequently eroded into the wider, gently sloping sides of the excavated ditch profile. Primary fills of this recut were mostly of Group 2, with the exception of 3136, 3292, 3293, 3308 (Group 1).

Group 2 A silty clay loam, can be subdivided into thinner layers distinguished by different amounts of stone. The bottom of this layer contained the deposit of clay moulds excavated in sections 4035 and 4037. On the illustrated sections contexts 3121, 3124, 3125, 5804, 5817, 5832, 9038, 9044, 9045, 9056.

Group 3 A clayey loam, quite stony, common iron mottling. On the illustrated sections contexts 3116, 5793, 9021, 9041, 9029.

Group 4 A clay loam, very similar to Group 5 above, but with less stones. On the illustrated sections contexts 3094, 5782, 9012, 9016, 9019.

Group 5 A clay loam layer forming the top fill of ditch, common small stones, contained Roman pot. On the illustrated sections contexts 3089, 5140, 7987, 7996, 9009.

Segment 4037 was the terminal of the ditch on the northern side of Causeway 1. It was shallower than the opposing terminal, and whilst it did not have the very distinct steep-sided profile of the original ditch cut, the original profile was preserved with a quite clear break in slope above the primary fill 3309 (Fig. 2.19, 4036/37). Segment 4037 contained a large deposit of clay moulds in layers 3136 and 3292. The excavation of these was hampered by the extreme stickiness of 3136 and extensive iron concretion on and around the moulds. The moulds were excavated over two digging seasons, 1981 and 1982. Part of this deposit of clay moulds was lifted *en bloc* in 1982 by the British Museum for subsequent excavation in the laboratory.

The rampart

The presence of an internal rampart is attested by a concentric double line of post-holes, paralleling the line of the ditch (Fig. 2.9). These ranged in width from 22cm to 60cm and in depth from 15cm to 44cm, but the majority averaged around 38cm wide and 30cm deep. A number of these features had evidence for post-pipes and post-packing with stones.

The outer of these post-circles (6150) was located *c.* 5m in from the ditch, and the inner circle (6151) was *c.* 1.5m in from this. Not all of the post-holes in the circuit were found, and in the area north of the tank-trap neither of the arcs were clearly defined, here the nature of the subsoil made feature identification particularly difficult, and the slope of the site may have made this slightly higher northern side rather more prone to erosion and plough damage. Nonetheless a number of post-holes in this area

Plate 2.3 The Late Bronze Age enclosure ditch 4050, showing the fully excavated ditch butt end north of the main east entrance (segment 4036/4037). The ditch to the north is in the course of excavation and the method of excavation removing alternate segments to give longitudinal and cross sections shows clearly

have been tentatively identified as part of the concentric rings. The surviving post-holes in each ring averaged 2m apart, spaced so as to form pairs, one in 6150 and one in 6151; this was particularly neatly done in the south-east side of the enclosure. Allowing for the missing post-holes, a total of 144 post-holes may have formed the rings (72 in each ring). Of these 95 were positively or tentatively identified (51 in the outer and 44 in the inner ring), with a further 13 probably destroyed by later features. Finds were very rare, only 11 post-holes contained any finds at all, and of these only 3 contained pottery, which was of Late Bronze Age date.

The double ring is interpreted as the framing for a box rampart, filled by material from the ditch. The outer ring of upright posts (6150) is interpreted as supports for horizontal timbers which would have held in place the earth and gravel derived from the cutting of the ditch. The inner and outer rings were presumably tied together by cross-beams within the body of the rampart and maybe also at the top forming a walkway (Fig. 2.13). Considering the depth of the post-holes and the scale of the ditch, the rampart would have been 2–2.5m tall. This would have meant that the initial enclosure comprised a steep-sided ditch, with a broad empty berm in front of an imposing timber rampart. It is considered that the only entrances to the enclosure were those that faced east and west, thus whilst the ditch was interrupted the rampart was continuous. This interpretation contrasts with the original view of the site as having multiple entrances as depicted in the famous reconstruction painted by Frank Gardiner in the mid-1980s (Frontispiece). The east entrance was provided with a substantial entrance structure (6309 below).

The natural processes of erosion and decay would have led to collapse of the ditch sides and decay of the timbers and consequent slumping of the rampart infill. A phase of refurbishment then appears to have taken place, when the ditch was recut to a broader shallower profile (see above) and it seems reasonable to suppose that additional material from this recut was added to the front of the collapsed or collapsing box rampart to form a simple dump rampart, perhaps topped by a palisade (Fig. 2.13).

In due course following abandonment of the enclosure, erosion will have led to stable profiles for the bank and ditch. The positioning of the Late Iron Age pit containing a sword centrally within the enclosure (Fig. 2.34), together with the location of a Roman field-ditch which runs through the west entrance (Fig. 2.35), suggests that the overall form of the enclosure was still apparent. The enclosure ditch seems to have been still partially visible during the Early Saxon period, when a cemetery was established on the site, and the enclosure appears to

have formed a boundary, except on the south-west side, to the inhumation burials (Tyler and Major 2005). However the burials appear to be largely unconstrained by the location of the bank of the Bronze Age enclosure; perhaps indicating that it had been largely, perhaps totally, removed by ploughing or other means by that time (Fig. 1.4).

Gateway structure 6309

A gate structure (6309) was located at the eastern entrance (Causeway 1) to the enclosure (Figs 2.9, 2.20–22) and comprised two lines of roughly opposed post-holes, *c.* 3m apart. The structure appears to have had two phases, both aligned on the porch of roundhouse 4545.

The first phase of gate structure (Fig. 2.20), considered to be contemporary with the box-rampart, comprised features 6136, 6216, 6135, 2942, 2996, 2943, 6137, 2977, 6165. The innermost post-hole (6136) on the north side of the structure was the largest on that side, this was followed by 6135, which appears to have had at least one phase of replacement or additional support in the form of three smaller post-holes clustered around it (2942, 6216, 2996). The next post-hole, 2943, was slightly set back splaying the entrance slightly. The innermost post-hole (6137) on the southern side of the structure was also the largest on that side. The first post-hole of the inner rampart circuit (6138) was sited just behind it, their positioning would suggest that the rampart timbers were in place before the gate structure was erected, as otherwise it would have been very difficult to get access to erect the rampart posts. The next post-hole (2977) had a clear post-pipe suggesting a timber of 30cm diameter. 6165 is slightly set-back, though not so markedly as 2943, it had been cut by a Saxon grave. It is suggested that the actual gate lay between 2977 and 6135, which had been reinforced by several other posts, which may have been necessary due to the stresses and strains of opening and closing the gate.

The second phase (Fig. 2.20), considered to be contemporary with the recut ditch and suggested dump rampart, comprised features 2946, 2965, 6170, 6234, 2900, 2551, 2901, 2947, 6139, 4695, 2911, 2547 and possibly 6299. This group was set in front of the earlier gate structure. 2946 had a clear central post-pipe for a 30cm diameter timber. It is paired with 6139 on the southern side, and interpreted as a gate-post. Together they would have made an entrance *c.* 1.7m wide. Adjacent to 2946 was 2947, possibly a supporting post or pivot hole for a gate. 2965, 6170 and 6234 formed a slightly flared approach to the gate on the north side, with 4965 forming a similar function on the south side. To the north and south three posts on each side (2900, 2551, 2901 to the north, 2911, 2547, 6299 to the south) curved around the presumed terminals of the dump rampart presumably holding a revetment, adding to the imposing nature of the main entrance to the enclosure.

Internal features

The principal internal features are described below. They have been sub-divided into structures and groups of features. There were other pits and post-holes which have not been described, most of these were isolated features forming no spatial pattern and with no dating evidence.

Roundhouse A

A large roundhouse (4545) was centrally placed within the enclosure, with its elongated porch aligned on the main enclosure entrance (Fig. 2.9). The main surviving structural feature was a ring of post-holes, 7.5m in diameter, the porch was 3m long and 1.8m wide. Twenty three post-holes were identified (Fig. 2.23), these averaged 32cm in diameter and 30cm deep, they were largely steep-sided, and several had clear post-pipes with a packing of gravel. The post-holes at the entrance to the porch were however notably smaller, averaging 18cm wide by 10cm deep. The majority of the posts were evenly spaced at 1.6m intervals, except at the back of the building where the pattern was disrupted. The spacing here varied between 0.3m and 1.5m. It is possible that some of the more closely spaced post-holes were repairs or replacements. The area behind the building contained a large number of small pits and post-holes, and it is not possible however to be absolutely certain which post-holes were structurally integral to the roundhouse. On the northern side of the structure a possible external 'drip' gully survived in patches (2840, 4569, 4529 and 4829). Inside the structure post-holes 4613 and 4910, which lay on the central axis, may have helped support the roof. Post-holes 4946, 4942, 6134 and 4531 echoed the curve of the back wall and may have played either a supporting structural role or indeed formed internal fixtures (such as an 80cm-wide bench or bed). Alternatively it is possible that the post-ring formed the main internal structural support, with the roof-timbers extending beyond this to non load-bearing walls, in which case features 2840, 4569, 4529 and 4829 could mark the location of such a wall. Material from two of the post-holes was selected for radiocarbon dating, these were 2999 one of the porch door-posts, and 4575 which formed part of the rear wall.

Roundhouse B

This roundhouse was a post-built structure (6116), slightly oval in plan, measuring 4.8 x 5.2m (Fig. 2.24). Nine post-holes survived (6902, 2925, 2931, 2555, 2525, 2524, 2937, 2807, 6196) and the existence of a further one can be postulated between 6916 and 6902. There was no indication of a porch, or indeed where the entrance was. There were few finds, the few sherds of pottery were Bronze Age in date.

Roundhouse C

A circular post-built roundhouse (4999), measuring approx. 5.8m in circumference (Fig. 2.25). It consisted of a ring of 13 post-holes (4963, 4907, 4623, 4279, 4902, 4945, 4607, 4927, 4935, 4621, 4939, 4964, 4974) and a central post-hole (4980). The post-holes were all broadly similar in dimension and form, averaging 40 x 25cm, except 4621 and 4974 on the northern side which were noticeably wider. It is not possible to be certain as to the position of the entrance, but perhaps the east-facing gap between 4907 and 4623 is the most likely candidate, these post-holes were again slightly larger than many of the others, and the orientation would echo that of the neighbouring Roundhouse A. There were few finds; but those that were recovered included a number of Late Bronze Age pottery sherds, burnt clay and flints.

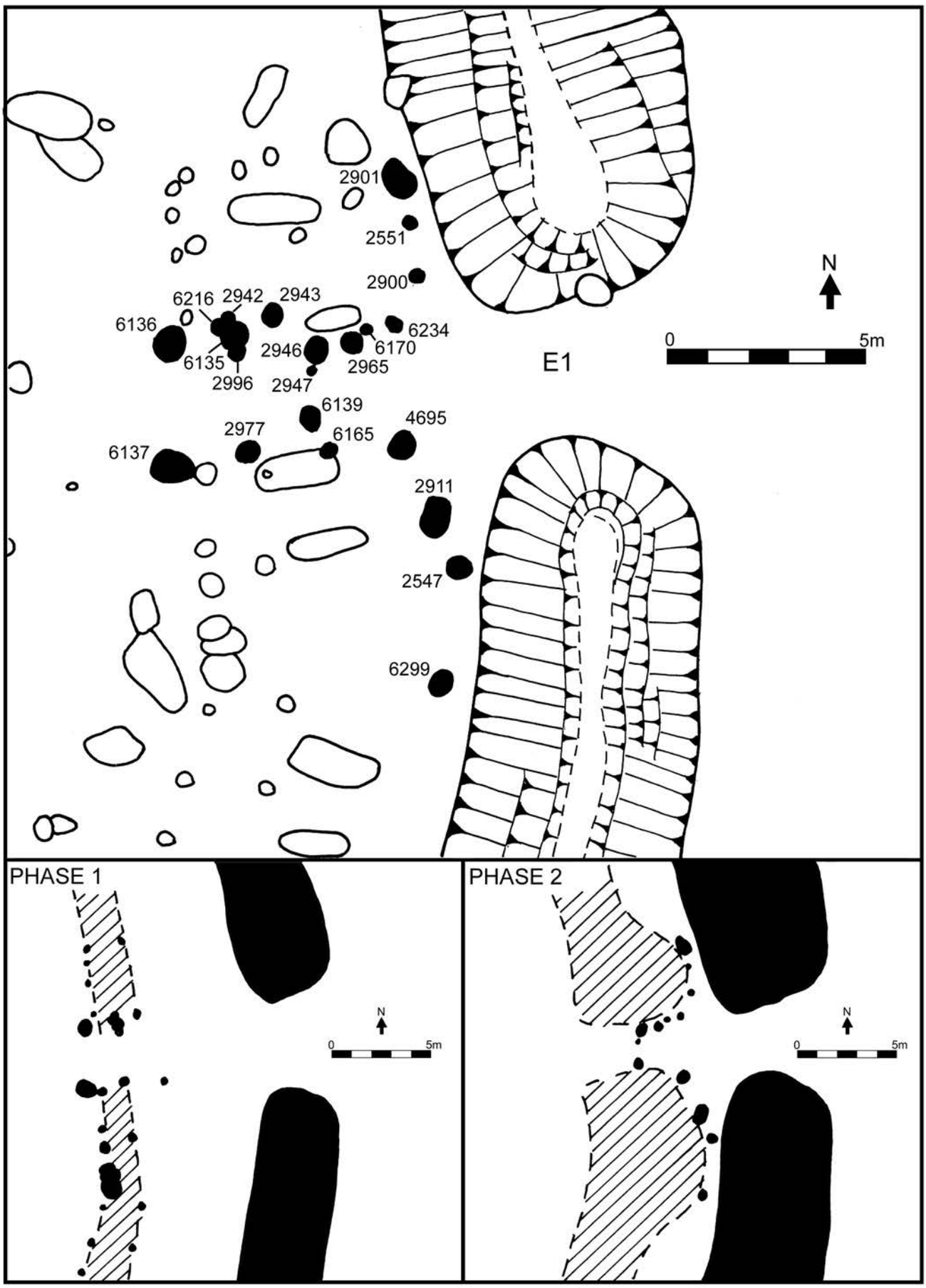


Figure 2.20 Upper plan shows all features considered to belong to the Gateway structure (6309). Lower plans show the plans of the first and second phase gate structures in relation to the suggested extent of the phase 1 box rampart and the phase 2 dump rampart

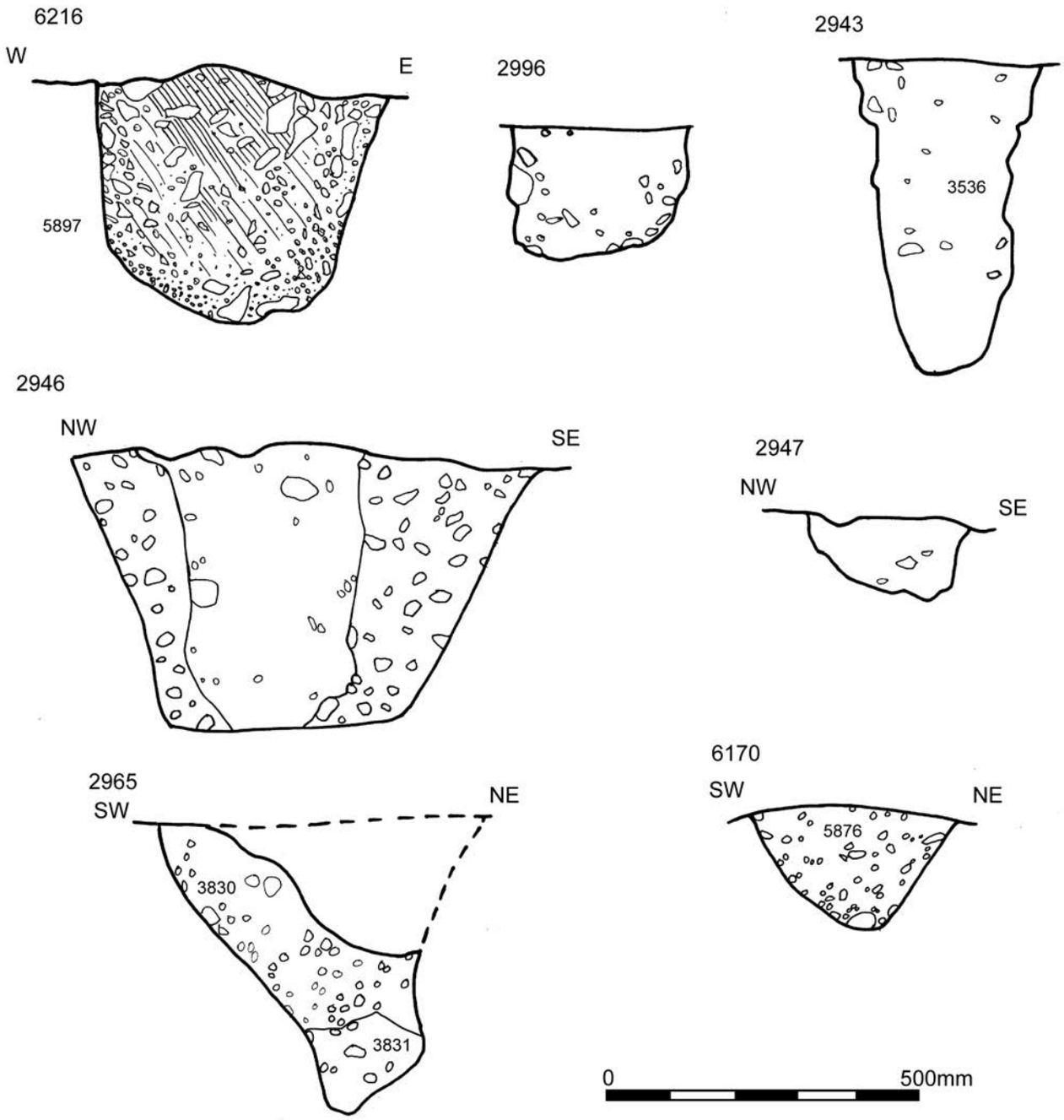


Figure 2.21 Gateway structure 6309 – sections of post-holes

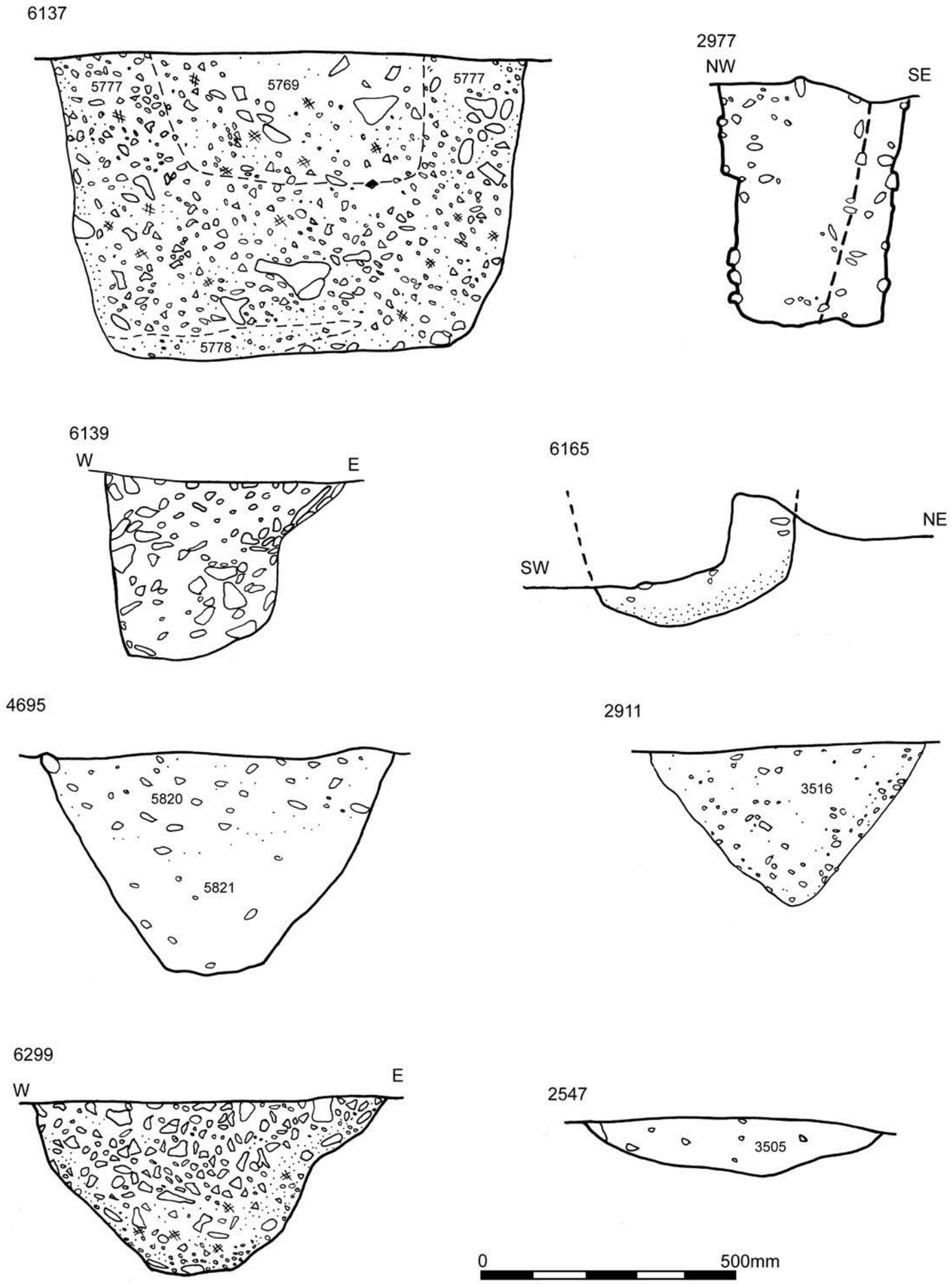


Figure 2.22 Gateway structure 6309 – sections of post-holes

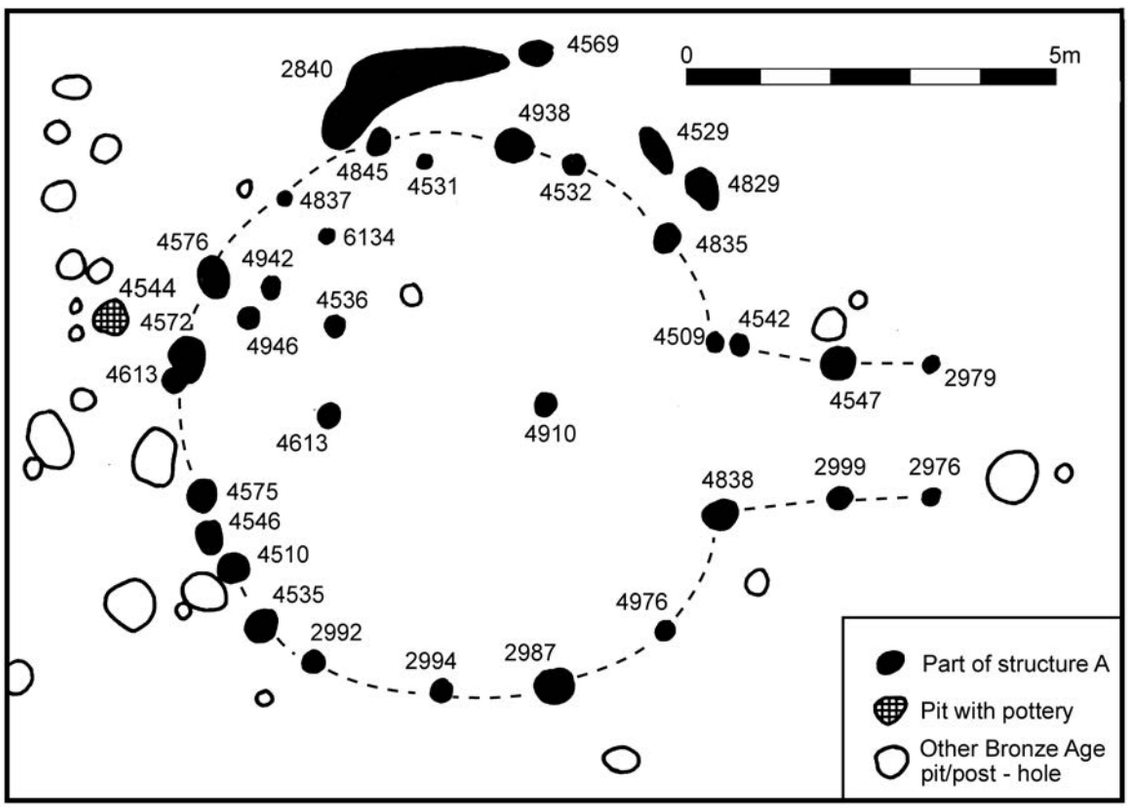


Figure 2.23 Plan of of structure A and associated features

Roundhouse D

This possible structure is less certain in plan than some of the other roundhouses (Fig. 2.26). However the post-holes appear to have formed a double-ringed post-built structure, located in the south-west quadrant of the enclosure. It was distinctly oval in plan, the outer ring of posts measuring 10.3 x 8.4m and the inner ring 7.7m x 6m, with a gap of 1.4m between the inner and outer ring. The outer ring comprised 14 post-holes (in clockwise direction 4922, 4789, 4934, 4665, 4666, 4713, 4648, 4631, 4812, 4811, 4876, 4918, 4778, 2625), and further post-holes can be postulated in the space between 2625 and 4789 where later features had cut through the roundhouse. Most of the post-holes were quite small (averaging 35 x 23cm), the exception being 4866 (75 x 35cm), and to a lesser extent 4922, 4648 and 4631 averaging (53 x 36cm). The inner ring comprised 12 post-holes (4809, 4307, 4511, 4515, 4825, 4717, 4720, 4799, 4855, 4880, 2831, 4873). These were rather larger than the outer ring (averaging 60 x 37cm). There were three internal post-holes (4826, 2620, 4653), set in a line, slightly to the south of the centre of the roundhouse; one of these, 2620, contained a clear post-pipe. It is not possible to identify an entrance. Many of the post-holes contained no finds, but a number contained a few sherds of Bronze Age pottery, flint and baked clay. Only post-hole 4511 contained any significant finds, comprising a relatively (compared to the other post-holes) large quantity of Late Bronze Age pottery and fragments of perforated clay slabs.

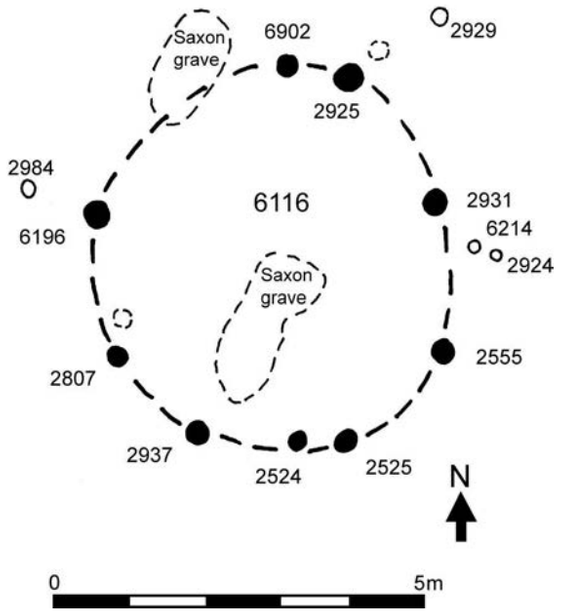


Figure 2.24 Plan of structure B

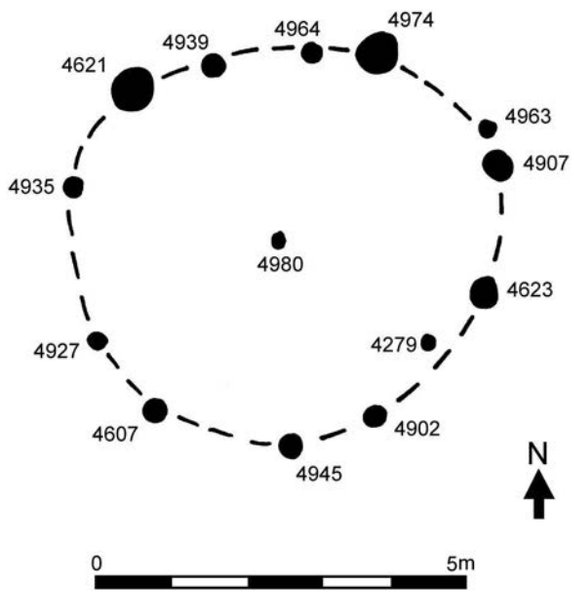


Figure 2.25 Plan of structure C

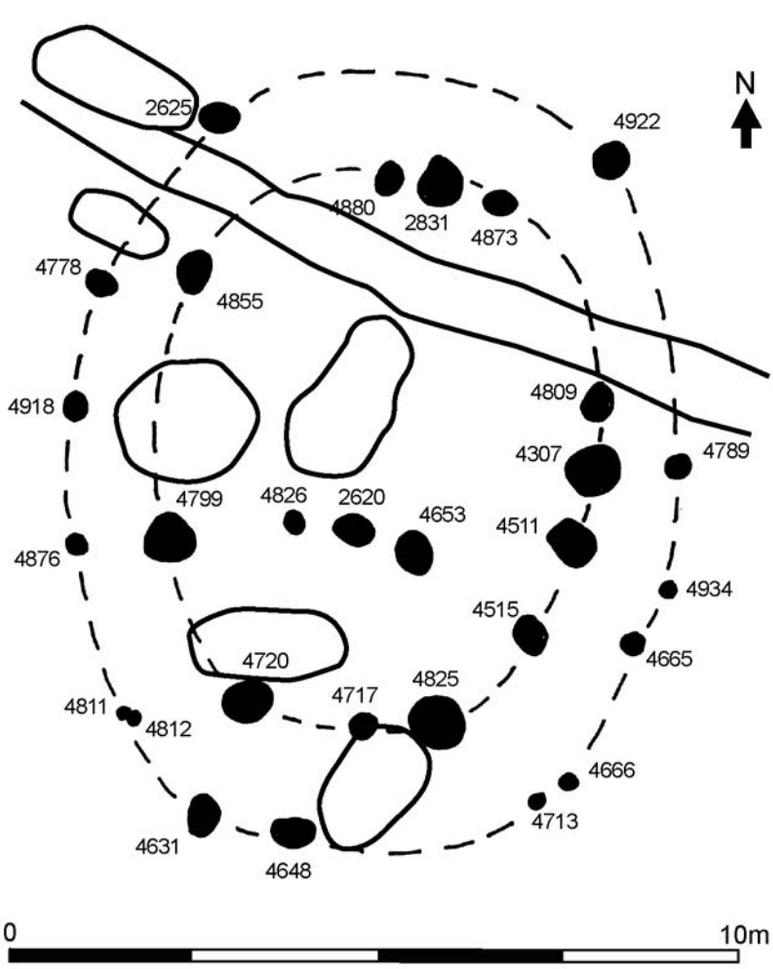


Figure 2.26 Plan of structure D

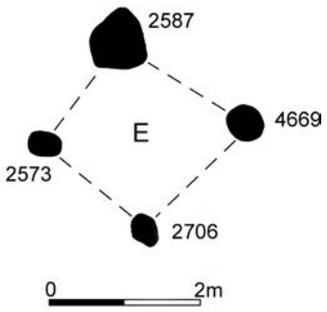


Figure 2.27 Plan of structure E

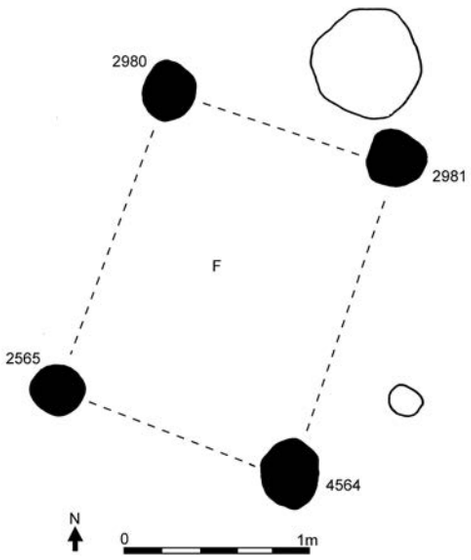


Figure 2.28 Four-poster F – plan

Four-poster E

This structure was located in the south-west quarter of the enclosure (Fig. 2.27). It comprised four posts (2587, 4669, 2706 and 2573) and measured 2m by 2.1m. The post-holes were steep-sided and deep, averaging 53cm wide and 47cm deep. Two of the post-holes contained distinct post-pipes. Small quantities of Bronze Age pottery as well as charcoal and some fragments of bone (both burnt and unburned) were recovered from these features.

Four-poster F

This possible four-post structure was located some 8.5m to the south of Roundhouse A (Fig. 2.28). The four posts (2980, 2981, 2565 and 4564) were arranged in a rectangle (2 x 1.3m), with the long axis orientated slightly to the east of north. The post-holes were all very shallow, averaging 30cm wide by 15cm deep. The only finds were a few flecks of charcoal and a couple of sherds of Late Bronze Age pot, from three of the four post-holes.

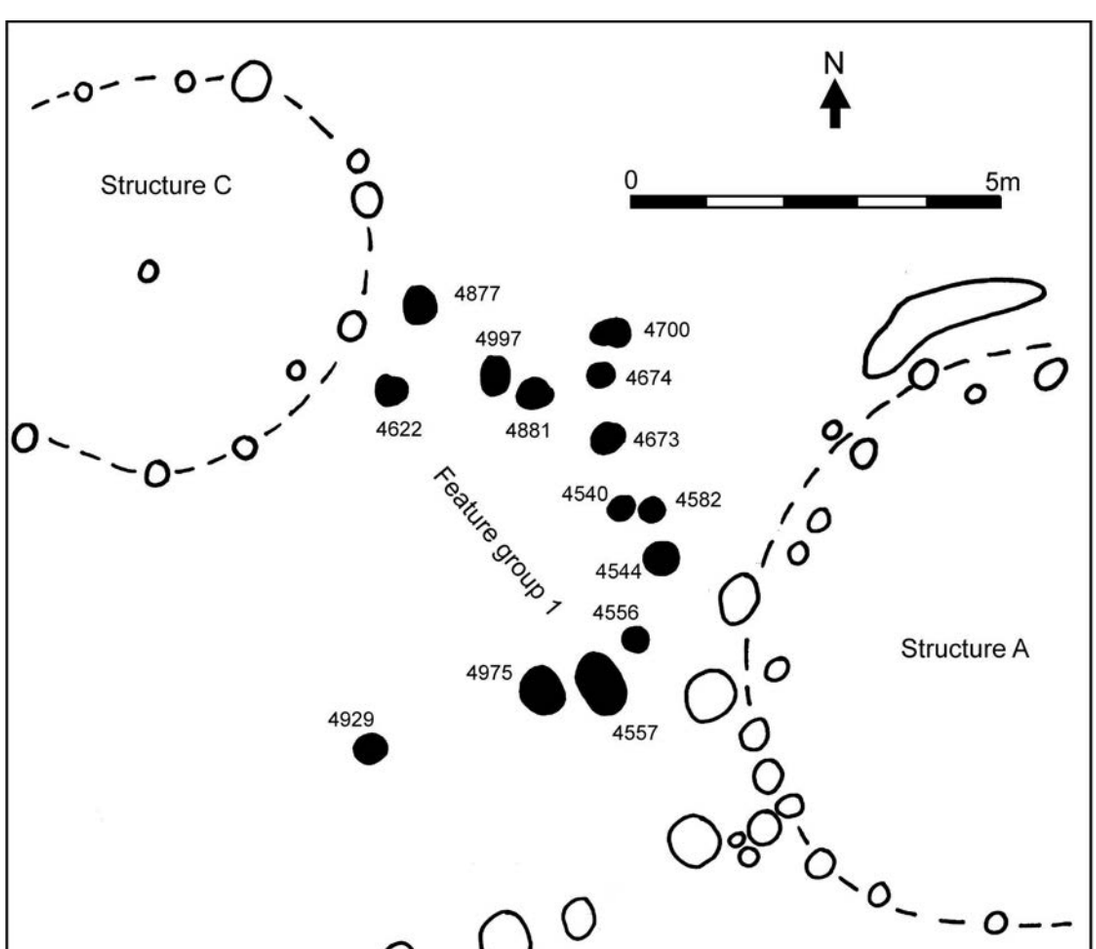


Figure 2.29 Plan of feature group 1 showing relationship with structures A and C

Feature group 1

Feature group 1 (Fig. 2.29) comprises an arc of fourteen small pits or post-holes (4877, 4622, 4997, 4881, 4700, 4674, 4673, 4544, 4582, 4540, 4556, 4557, 4975, 4929) located in the space between the rear of Roundhouse A and Roundhouse C. These ranged in size from 60cm wide x 48cm deep, to 38cm wide x 14cm deep. Pit 4544, located immediately to the rear of Roundhouse A, contained an apparently placed deposit, comprising large fragments from three different pots, the feature also contained burnt clay, flint and one piece of burnt bone.

Feature group 2

Feature group 2 (Fig. 2.30) comprises a group of five vertical-sided, round-bottomed pits or post-holes (4667, 6257, 4541, 6274, 4915). These averaged 49cm wide by 35cm deep. They appear to have formed a short alignment, 5m long, linking Roundhouse A and Roundhouse D. They contained some flint, charcoal, burnt clay, and 4915 contained a small quantity of Late Bronze Age pottery.

Feature group 3

It is difficult to disentangle feature groups 3 and 4 (Fig. 2.30). However for the purposes of this description feature group 3 is taken to be a short alignment of ten oval, steep-sided but quite shallow pits or post-holes (2986, 4842, 4843, 4651, 4668, 2841, 4629, 2539, 2537 and 4819). These averaged 65cm wide by 27cm deep. They appear to have formed a short alignment 11m long, at an approximate right-angle to pit group 2. There was a concentration of crop-processing waste from this feature group, as well as from feature group 4.

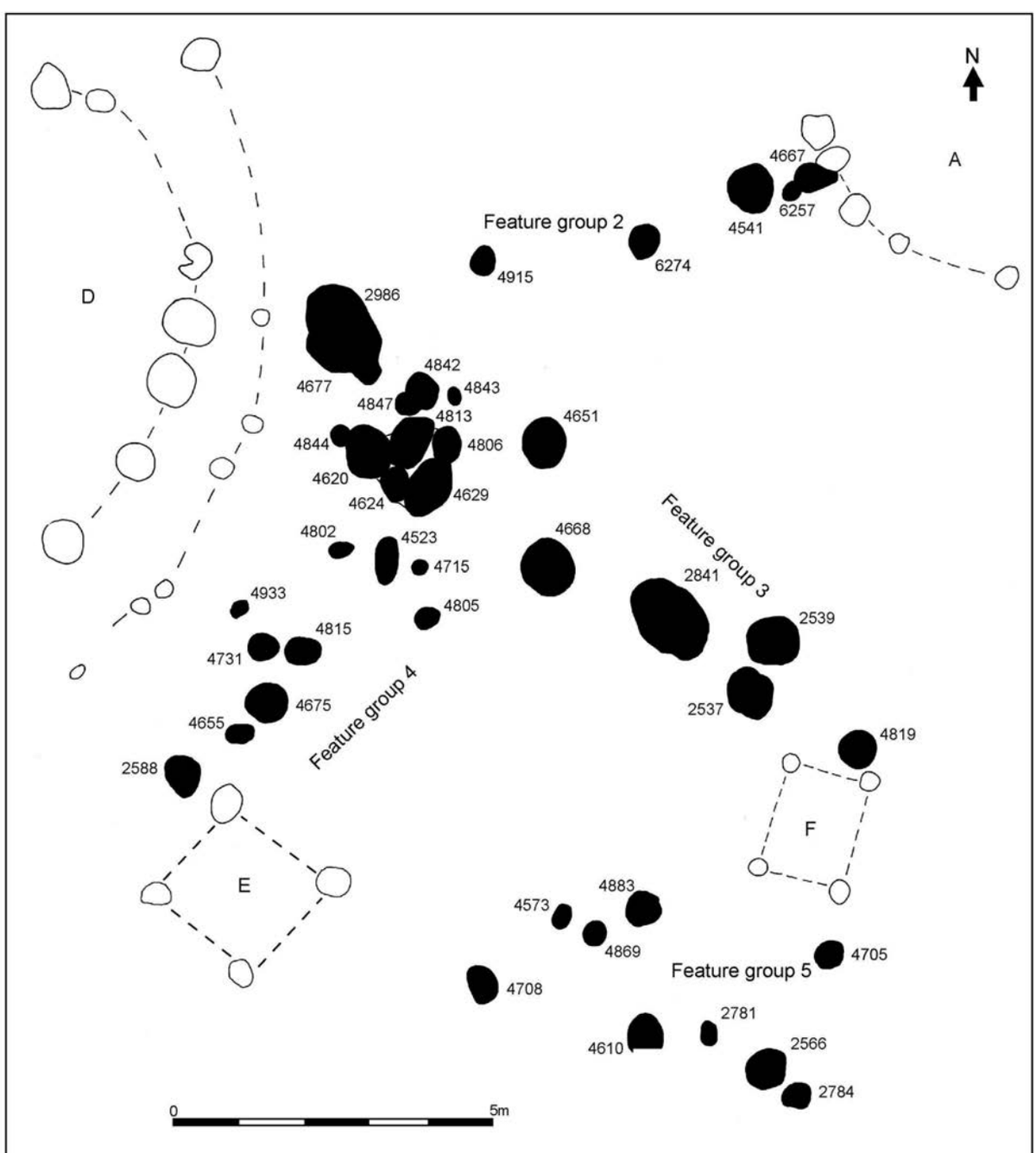


Figure 2.30 Plan of feature groups 2–5 showing relationship with structures A, D, E and F

Feature group 4

Feature group 4 overlaps with feature group 3 (Fig. 2.30). It comprises eighteen pits or post-holes set in a rough alignment some 7m long and 2.5m wide, at right-angles to feature group 3; it also echoes the shape of Roundhouse D located 1.5m to the west. The features can be divided into two sub-groups on the basis of size. Firstly there are the probable pits (4847, 4813, 4620, 4815, 4731, 4655 and 2588), oval in plan, mostly steep-sided and averaging 50cm wide by 40cm deep (although some were much shallower). Then there are the probable post-holes (4806, 4844, 4802, 4624, 4715, 4805, 4933 and 4675), these were either noticeably smaller, averaging 30cm by 30cm deep, or had clear post-pipes. The post-holes were mostly concentrated at the northern end of the alignment. Twelve of the features contained Late Bronze Age pot, and some burnt clay, flint, charcoal and a small amount of burnt bone were also recovered. Pit 2588 at the southern end of the alignment contained a compacted layer of large sherds of fine and coarse wares perhaps representing a placed deposit. There was a concentration of crop-processing waste from this feature group, as well as from feature group 3.

Feature group 5

Feature group 5 comprises a loose grouping of nine pits and post-holes located to the south of four-poster F and east of four-poster E (Fig. 2.30). To the south and east the area was extensively disturbed by a sequence of Saxon buildings (Tyler and Major 2005), and it is possible that further features have been lost. The features can be roughly divided into two sub-groups; possible pits (4573, 4705, 4869, 2781 and 2566) and probable post-holes (4708, 4883, 4610, 2784), the latter containing visible post-pipes. There was little variation in dimension, with an average width of 46cm and depth of 24cm. Five of the features contained Late Bronze Age pottery in small amounts. It is possible to see a rough alignment formed by post-hole/pits 4708, 4610 and 2566 on the southern edge of the group, echoing the line of the rampart and ditch, and also the northern posts of four-poster E. Similarly it is possible to argue that the eastern side of four-poster F aligns with features 4705 and 2566.

Feature group 6

A very loose grouping of nine pits and post-holes (6248, 4989, 2932, 2927, 2928, 2923, 6272, 2969, 2971) located

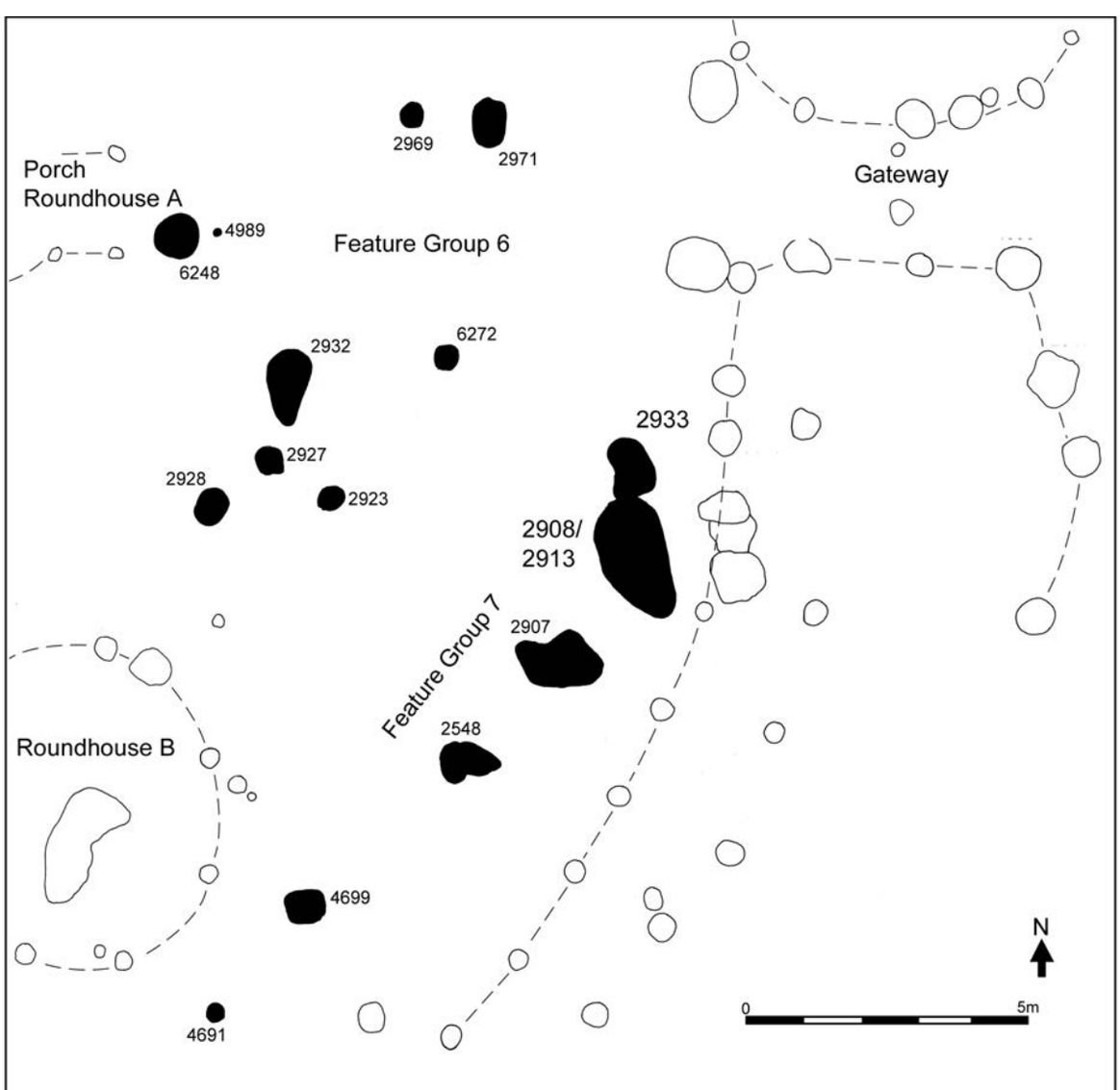


Figure 2.31 Plan of feature groups 6–7, showing relationship to entrance structure, bank and structures A and B

in the space between the gateway structure and Roundhouse A (Fig. 2.31). Post-hole 6248 was located directly outside the porch of Roundhouse A, with stake-hole 4989 next to it, and it is possible that these should be considered part of the structure. 2969 and 2971 were set slightly apart from the others and appear to have formed a link between the porch of Roundhouse A and the gateway structure. The features varied considerably in shape and size, ranging from irregular ovals (130cm wide by 35cm deep) to a small stake-hole (12cm wide by 12cm deep). Four of the nine features contained Late Bronze Age pottery in small quantities and a further two contained flint.

Feature group 7

A line of six pits (2933, 2908/2913, 2907, 2548, 4699, 4691), to the south of the gateway structure, roughly paralleling the line of the rampart (Fig. 2.31). All the features were roughly oval in plan, maximum dimensions ranging from 2m to 28cm wide, and quite shallow, averaging 33cm deep with the shallowest feature, 2548, only 8cm deep. Four of the features contained Late Bronze Age pottery in small quantities and another contained flint and burnt clay.

Feature group 8

A group of six features (2622, 6194, 6158, 2952, 4525 and 4502), located to the north-east of Roundhouse A (Fig. 2.32) . The World War II tank-trap cut off this group from the northern part of the enclosure and it is possible that it once formed a single group with the scattering of undated post-holes there. The features appear to delimit an open area of ground comprising much of the north-eastern quarter of the enclosure. 2622, 6194, 6158, 4525 and 4502 appear to have been post-holes, averaging 30cm wide by 35cm deep, with very steep or vertical sides and a flattish base. 4525 and 4502 contained small quantities of Late Bronze Age pottery. Feature 2952 appears to have been a pit (80cm wide by 35cm deep), with vertical sides and a slightly rounded bottom. The feature contained a deposit of Late Bronze Age pottery comprising large fine and coarse ware sherds belonging early in the suggested ceramic sequence for the site. An unusual feature of the deposit was that the pottery was largely placed in a vertical position within the feature and was distributed evenly throughout the fill.

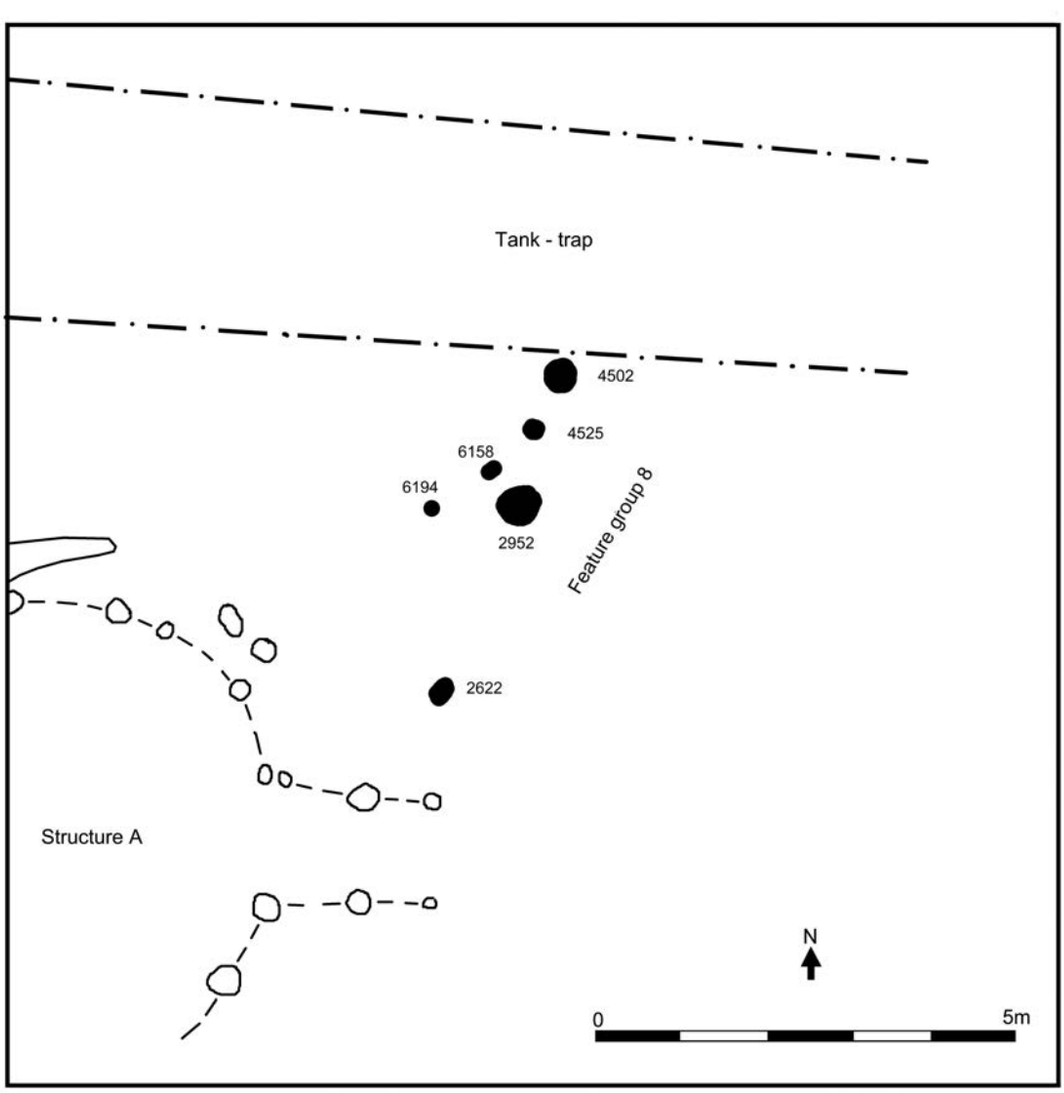


Figure 2.32 Plan of feature group 8 showing relationship with structure A and WWII tank trap

External features

There was relatively little evidence for Bronze Age activity in the excavated areas outside the enclosure (Fig. 2.33). There were very few cut features and less Bronze Age pottery was recovered either from surface layers or residual in later features, than from inside the enclosure. The cut features were clustered around the southern edge of the enclosure. 2632 was a circular pit with steep sides and a rounded base, which contained flint, burnt clay and Late Bronze Age pottery; it was located some 2.5m outside the enclosure and in front of Causeway 3. 2644 was a possible post-hole, located 3m to the south-east of 2632, it contained flint and Late Bronze Age pottery. 4833 was located 34m to the east of these two features, close to the outer edge of enclosure ditch segment 4051.

Post-hole 8984, in Trench HO (one of a series of trenches opened to the west of the main excavated area to try and trace the circuit of the causewayed enclosure), is one of the most interesting of the outlying features. It was shallow, with very steep sides and a slightly pointed base, the excavator considered that it had a stony packing. It contained a large part of a distinctive Late Bronze Age bowl (Fig. 3.33, 209), a small fragment probably from same pot, was recovered from amongst the sword-mould fragments in the lower fills of the enclosure ditch in segment 4037.

To the north-east of the circular enclosure in Trench HA were two features (Fig. 2.33). One was a very shallow pit (8839) with indistinct edges containing approximately a third of a small bowl or cup (Fig. 3.33, 207) lying on its side, the feature also contained a small amount of burnt bone (examined by S. Mays but not identifiable). Further to the north-east, part of pit 8811 was examined (the remainder was under the baulk), the finds included a sherd from a very thick-walled, large pot (Fig. 3.33, 208).

There were also numerous undated pits and post-holes, particularly to the south-west and west of the enclosure ditch, it is possible that some of these were Late Bronze Age in date. The features sited to the west are separated from the enclosure by a band of apparently open ground, averaging 10m wide.

III. Later Iron Age and Roman

Later Iron Age period

The circular enclosure seems to have ceased to be the focus of more or less continuous deposition, during the Early Iron Age. However there is evidence for other forms of activity in the low level scatter of pottery sherds found mainly in the upper fills of the enclosure ditch, and toward the end of the period, the digging of one, apparently highly significant, pit (Fig. 2.34).

Sherds of Middle and Late Iron Age pottery were recovered from the upper fills of the ditch (as was Early Roman pottery and tile), so it must have still been apparent as a ditch, albeit much shallower than it had been in its original form, and it is probable that the bank was also still partially upstanding. The distribution of Late Iron Age sherds is largely confined to the northern half of the site, and any associated settlement was located outside the excavated area. The most significant Late Iron Age feature was a single circular pit, 4583, centrally located within the Late Bronze Age circular enclosure. The pit had been lined with clay (unburnt) and a deliberately bent and

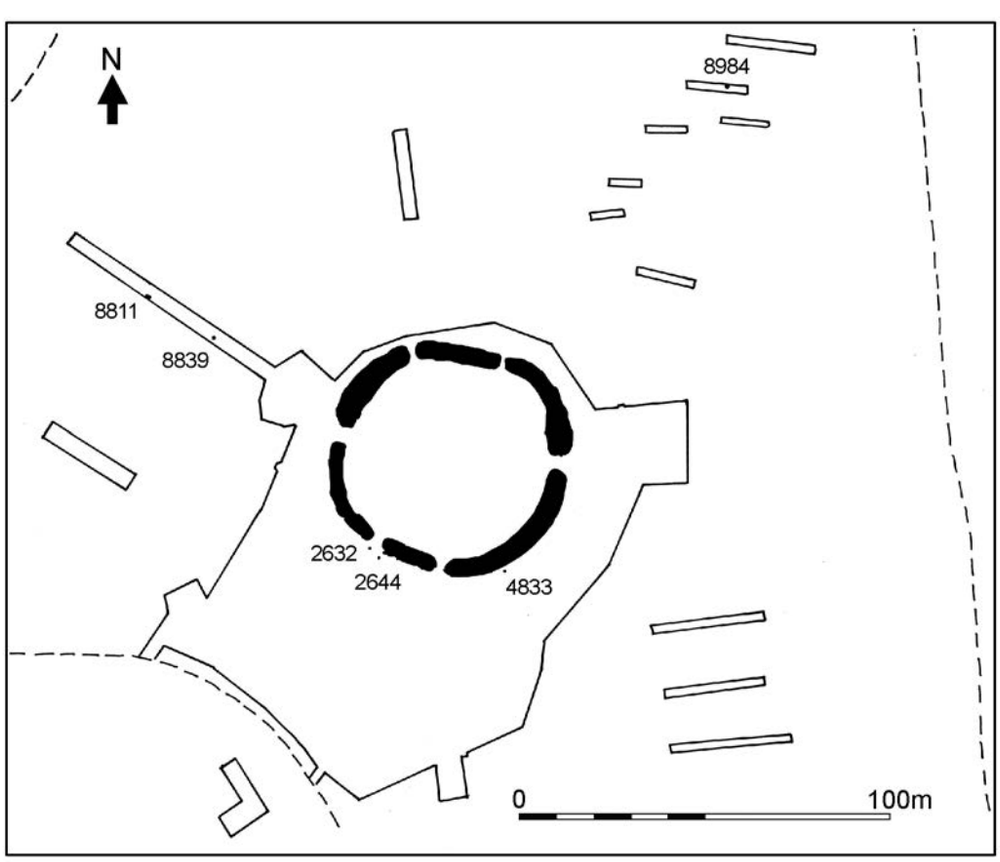


Figure 2.33 Location plan of Late Bronze Age features outside the enclosure. Late 20th century field boundaries are shown as dashed lines

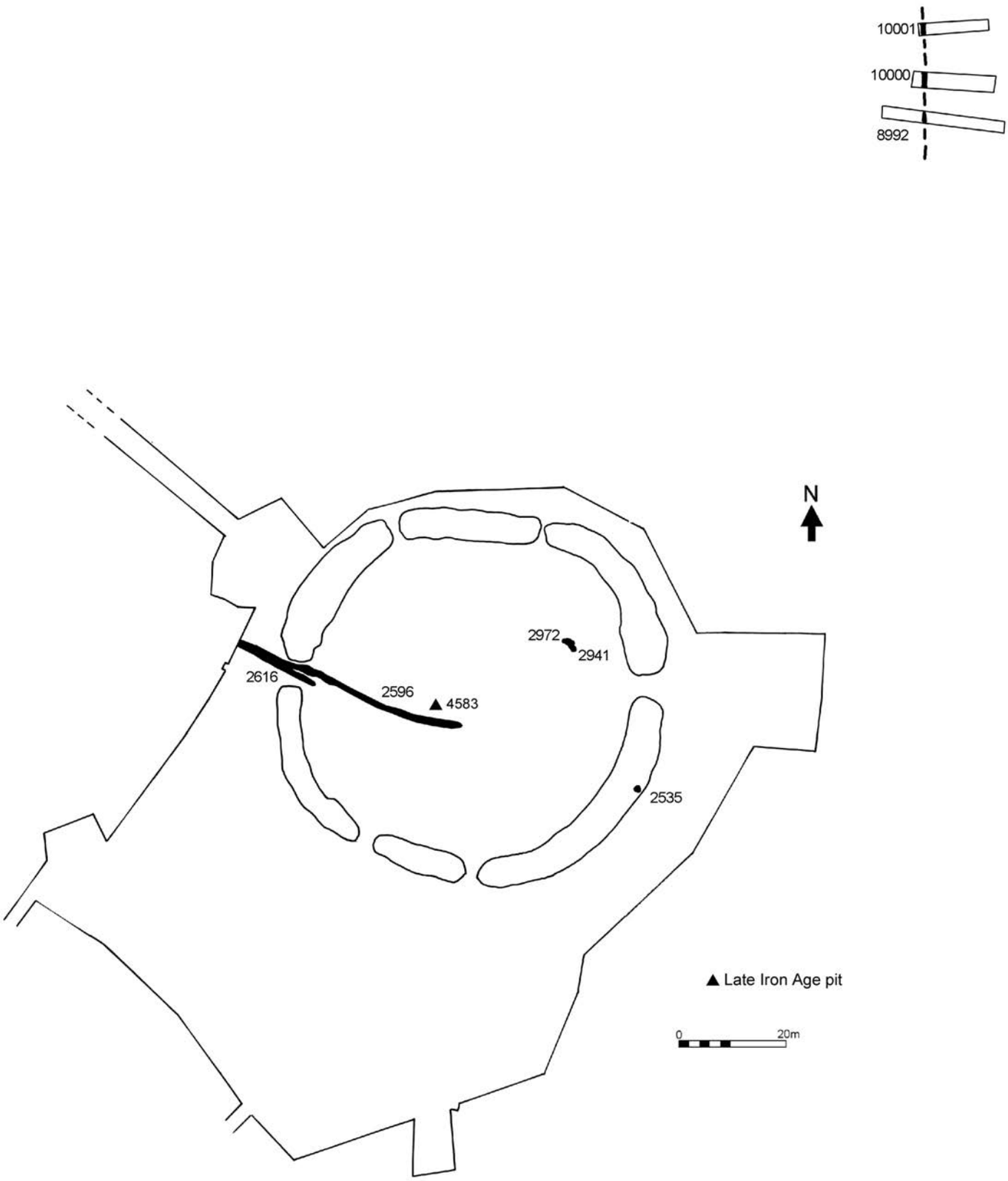


Figure 2.34 Site plan showing location of Late Iron Age and Roman features

twisted sword together with an iron framed scabbard with a laddered chape of a distinctive La Tène III form (Chapter 3, II) were placed within the pit, the scabbard also appears to have been broken and incomplete at the time of deposition. In addition a few fragments of iron tube, possibly representing the socket of a spearhead, were also recovered. It is thought that the pit was dug specifically to hold the sword and scabbard, which can only be considered as offerings deposited at the centre of the already ancient enclosure.

Roman period

Roman pottery (largely grey wares of Early Roman date; report in archive) and tile were present in the upper fills of the enclosure ditch (Groups 5 and 6). The ditch at that period would have been 40–60cm deep, and it is probable that the bank was still there, albeit in a degraded state. The Roman sherds largely come from the northern portion of the ditch and the terminals on either side of the eastern and western causeways. Sufficient remained of the northern half of the enclosure ditch in the Early Saxon period for it to serve as a boundary to the early fifth–early seventh century AD cemetery (Tyler and Major 2005).

A number of ditches and pits dating to the Roman period were identified (Fig. 2.34):

2596, an east–west ditch (39m long) which emerged from the western baulk, entered the circular enclosure through the main west-facing entrance (Causeway 4) and came to a butt end in the centre of the enclosure. It had two fills, containing, in addition to residual Late Bronze Age sherds, mostly Early Roman pottery, as well as a few sherds of coarser, probably later Roman grey wares and two Hadham Ware sherds. On this basis a third or earlier fourth century AD date is suggested.

2616, a short length of ditch (6m long) which intersected with 2596 at the entrance to Causeway 4. It contained no dating evidence, but was assigned by the excavators to the Roman period.

2941, an oval pit (approx. 1 x 2m) with gently sloping sides. It had a single sandy loam fill containing Early Roman grey wares, dating from the late first century to the third century. It cut pit 2972.

2972, an oval grave-shaped pit (2m x 1.2m). It was clearly cut by Roman pit 2941 and cannot therefore be a Saxon grave. The finds comprised a barbed and tanged flint arrowhead, Bronze Age and Roman pottery, fired clay and charcoal.

2535, an oval pit (1.5 x 1m) cut into the fill of the enclosure ditch on the southern side of the eastern entrance (segment 4001). It was first observed after the removal of the uppermost deposit layer as a semicircle of charcoal against the section with the base of a pot in the middle. The pit had steep sides and a rounded base, the sides had been lined with small branches and twigs, probably the remnants of a basket or wicker lining that had burnt *in situ*, heavily scorching and reddening the sides. The bottom fill of this pit seems to have been quite stony (Fig. 2.14). Spread across the upper fills of the pit was the majority of a Roman grey ware jar in fragments, including the base noted above. This had a surface deposit of charcoal but no other signs of burning, so it may have entered the pit after the fire had cooled down or gone out. The jar can only be assigned a date range of between the first and third centuries AD. It is possible that this feature represents some form of ritual activity.

8992/10000/10001, this ditch was recorded in Trenches HP, HQ and HR to the north-east of the main excavation area. It ran north–south, with steep sides and an average depth of 60cm.

Chapter 3. Artefactual and Environmental Evidence

I. Iron Age copper alloy

by Hilary Major

Copper alloy brooch; 9356, Ob No. 4557. The context is the top layer of the Late Bronze Age enclosure ditch, segment 4017. The object came from the base of the layer, with the spring lying vertically.

Bow brooch, with a twelve coil spring and axis bar. The curved bow is variable in width, and has a D-shaped section. There is a line down the centre of the bow. The brooch was in poor condition when excavated, particularly the foot, and very little of the foot now survives, the X-ray is our only record of its original shape. It was incomplete when excavated, but appears to be part of a returned foot, with the toe of the brooch missing, and probably missing the end of the return as well. Assuming that the X-ray shows this detached part of the foot in its correct position relative to the rest of the brooch, then it is likely that this is a Late Hallstatt brooch. It would fit into Hull's Type L (Hull and Hawkes 1987, 54–67) and is a possible example of his Type Lx — Late Hallstatt brooches continental in all features. He lists only two other examples of Type Lx, from St Paul's Cray in Kent, and from the Thames foreshore in London. It is, in any case, close to the continental prototypes of the form, and should be of a similar date; a date within the fifth century BC or soon thereafter appears reasonable.

II. Late Iron Age sword and scabbard

by I.M. Stead (September 1984)

This report is based on the preliminary examination of the objects. When plans were being made for completion of the Springfield Lyons publication reports it transpired that due to an unfortunate oversight the objects had been left unconserved at the British Museum and had disintegrated to such and extent that further examination was impossible (Val Rigby pers. com.).

The remains of an iron sword and scabbard were found in the upper filling of a pit (4583, layer 3859). The sword is broken and incomplete, the most substantial part being three joining pieces bent round into an almost oval shape. The surviving piece of blade is 530mm long and 43mm wide with no taper. It is thickened slightly at the centre. The very top of the tang survives separately; only 13.5mm high, it is rectangular in section and surmounted by a pronounced button terminal (now broken) up to 13.5mm in diameter. Part of the iron hilt-end, campanulate in shape and about 18mm high, also survives as a separate piece.

The scabbard is in many small fragments — the largest is 48 by 29mm — and only a small part of it is represented. It is made up of two plates: one (presumably the front plate) is curved and overlapped by a flatter plate. One fragment gives the full width as 46mm. There is a small piece of the thickened chape-end and three pieces with chape- binding — two with the cross-struts of a laddered chape.

Parts of an iron tube or socket were found with the sword and scabbard, and fragments possibly from the same object (?a spearhead) were in soil samples taken from the layer below.

The scabbard with laddered chape is a distinctive La Tène III form, and the remains of the sword may well represent a weapon of the same date (Stead 2005, 168–9, fig. 63). There is no indication that the sword was in its scabbard when deposited in the pit, but sword and scabbard probably belonged together. This is the first iron scabbard with laddered chape to have been found in Britain, but bronze examples are known.

III. Deposits of clay refractories for casting bronze swords

by Stuart Needham and Sue Bridgford

Introduction

(Plate 3.1, Table 3.1)

Excavation of the butt ends of the enclosure ditch produced two large deposits of clay refractory debris at the two main entrances, those facing east and west. The first was encountered in 1981 in the north butt of the east entrance; a longitudinal section had been defined in the ditch-butt 'cutting' and was excavated first on the east side (Fig. 2.11). Towards the base of the ditch the excavators cut through a mass of fired clay material which was saved in a series of bags as clods of artefact-rich soil (subsequently labelled A–U, W; Table 3.1). Although large in volume, the material was evidently made up of many fragments densely compacted; nevertheless, it was quickly recognised that it included clay mould fragments. Since more of the deposit was obviously still *in situ*, the excavator decided to call upon the assistance of the British Museum where one of the authors had recently completed a study of a comparable assemblage (Needham 1980a).

At the time, few finds of Bronze Age refractories (clay moulds, crucibles, tuyères, furnace or hearth linings *etc*) had been recognised in Britain (*e.g.* Tylecote 1962, 119 table 46). The prospect of a large deposit of such material in a well protected context and still *in situ* was inviting. It offered the prospects of detailed spatial relationships between fragments which might be interpretable in terms of casting sequence or organisation, as well as in terms of deposit formation. Moreover, the fact that none of the material, including that already excavated, had been cleaned gave the opportunity of applying suitable cleaning techniques that would maximise survival of the vital fine detail in the matrix surfaces on the moulds. This detail is susceptible to rapid loss with physical abrasion or wet washing because of the nature of the fabric.

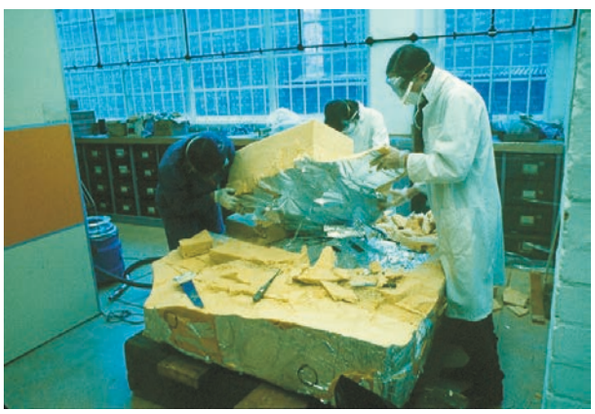
After discussions with Essex County Archaeology Section, it was decided that an attempt should be made to lift the part of the deposit remaining *in situ* as a block of soil to allow careful excavation and recording under

a

c

b

d



e

Plate 3.1 The process of lifting the clay refractories *en bloc* and their re-exposure in the British Museum; a) undercutting the soil block containing the refractory debris, b) encasing it in foam, c) lifting the clay refractories *en bloc*, d) unloading at the British Museum, e) removal of foam

Site location	*Year & context*	*Deposit*	*Block designation*	*Character*
East entrance; north butt – east side (section 4037)	1981 and 1982: 3136, 3292	1	A – U, W	Clods of soil excavated on site; dismantled later at BM to extract fragments
East entrance; north butt – west side (section 4037)	1982: 3136, 3292	1	V	Lifted block; excavated and recorded at BM (site plan 70)
West entrance; north butt (section 4019)	1983: 5706	2	Y (Y1, Y2)	Lifted block, later split into two before excavation and recording at BM (site plan 391)
West entrance; north butt (section 4019)	1983: 5706	2	Y3	Individually excavated and numbered on site: 8–20, 51; overlying south-west corner of block Y (site plan 392)
West entrance; north butt (section 4019)	1983: 5706	2	Y4	Individually excavated and numbered on site: 21–27; overlying south edge of block Y (site plan 393)
West entrance; north butt (section 4019)	1983: 5706	2	Y5	Individually excavated and numbered on site: 29–36; overlying south-eastern corner of block Y (site plan 394)
West entrance; north butt (section 4019)	1983: 5706	2	Y6	Individually excavated and numbered on site: 1–5, 47, 49, 50; from north-west periphery of block Y (site plan 391)
West entrance; north butt (section 4019)	1983: 5706	2	Y7	Individually excavated and numbered on site: 6, 48; outliers in zone between blocks Y & Z (site plan 391)
West entrance; north butt (section 4019)	1983: 5706	2	Z	Lifted block <1m north of Y (site plan 391)
West entrance; north butt (section 4019)	1983: 5706	2	Z2	Individually excavated and numbered on site: 37–46; directly overlying block Z (site plan 395)
West entrance; north butt (section 4020)	1983: 5532	2	Z1	Scattered fragments excavated on site from beneath machine-cut trench on south side of tank trap and immediately adjacent to block Z
North-west ditch segment (sections 4023 & 4024)	1986: 9119 & 9125	2 (northern spread)	9119.A-9119.Y	Series of small blocks of soil (*c*. 30cm square) and individual fragments lifted by excavators, 5m or more north-east of block Z (separated by tank trap)

Table 3.1 Labelling of material

laboratory conditions. The lift took place in June 1982 following a standard procedure; it was undertaken by British Museum Conservation under the direction of Peter Shorer. The ditch fill behind the long section had been taken down by normal hand excavation to expose the surface of the refractories and define the extent of the deposit as closely as possible. This was followed by the excavation of refractory-free soil from three sides and then partial undercutting beneath the deposit to leave it standing on a pedestal. A box of thick plywood was constructed around the deposit leaving a gap on all sides. After protection of the exposed surfaces with aluminium foil, the space between box and pedestal was then progressively filled with expanding polyurethane foam until this covered the top, at which point it was trapped inside under a pre-formed wooden lid. The lid was then secured to the box and the whole unit rocked to break the soil pedestal beneath. The box was then rolled on to its top to allow removal of unnecessary soil from the broken pedestal and the fixing of a basal cover of wood. At this stage it was ready to be lifted from the ditch by crane for removal to the British Museum. This block is referred to as 'V'.

A year later excavation had proceeded to the opposite side of the enclosure. Astonishingly, the excavators encountered another large deposit of clay refractories in an equivalent position at the base of the northern ditch butt flanking the western entrance (Fig. 2.11). This time the whole of the ditch 'cutting' was taken down as one, without any longitudinal section, so that the entirety of the concentrated deposit could be exposed in plan. This allowed a repeat of the block-lifting exercise, but this time on a larger scale with correspondingly greater logistical difficulties. The operation took place in August 1983 under the direction of Hazel Newey (Plate 3.1). In practice it was necessary to sub-divide the material exposed, most being lifted in a large block (Y) and the rest in a smaller block (Z). Only a small number of sherds of refractory were excavated prior to the block-lift, these mainly being peripheral to the main concentrations; clusters were later labelled for convenience Y3–Y7 and Z2 (Table 3.1).

Subsequently another small assemblage was hand-excavated in a narrow trench (otherwise machined) between Z and a 1939–45 tank trap cutting across the Bronze Age ditch. These finds (Z1) were thinly distributed as if the deposit was petering out. However, subsequent excavation of ditch fills just to the north of the tank trap in section 4023 revealed another scatter of refractory fragments at the same level, context 9119, as those to the south. This material was excavated in manageable blocks of soil labelled A–Y (not to be confused with Deposit 1 clods A–W) (Table 3.1).

Back at the Museum it was necessary to open up the plywood boxes and then cut off the upper surface of the polyurethane and part of the sides, but leaving enough wrapping around the base to continue to give support to the heavy soil block (the largest block was estimated to weigh 12 cwt). Underlying planks gave a rigid foundation. Marks indicating the horizontal on the boxes were transferred to the polyurethane.

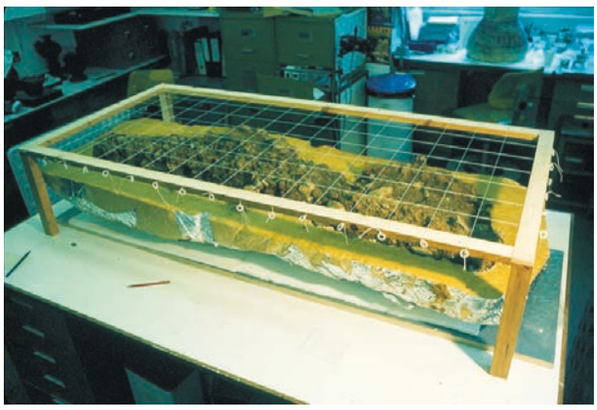


Plate 3.2 Block V with removable string grid for 3-dimensional recording

Excavation and recording methods
(Plate 3.2, Table 3.2)
The two deposits were excavated and processed at different times: Deposit 1 was largely excavated in the 1980s and early 1990s with completion in 2001; Deposit 2 was fully processed between 2008 and 2010. The clods of soil first excavated from Deposit 1 were not recorded to precise location, so detailed spatial relationships to material from the adjacent block (V) cannot be ascertained. However, it was believed that material in each given finds bag was probably excavated from a limited area as the material was unearthed, so it was considered worthwhile to retain the bag associations through use of the labels A to U and W. Within each bag there were usually a number of soil clods, each one of which might contain any number of refractory fragments; obviously the close proximity of objects within a given clod was a reflection of their proximity in the ground. Each clod was thus given a sub-label, hence: A1, A2, A3 etc.

For the material retrieved from lifted blocks, all objects deemed worthy of detailed study were immediately given precise coordinates within the local block grid established. Similarly, the fragments excavated individually on site (Y3–Y7 and Z2) were coordinated in relation to the site grid and related on plan to the outlines of the main blocks Y and Z.

The main blocks were assiduously planned as they were excavated using bespoke grids strung at 100mm intervals from a surrounding frame (Plate 3.2). The strings were designed to be removable so that they did not impede access to the surface under excavation. Block V was dealt with straightforwardly as a single block, but block Y had had to be split into two to facilitate movement between storage areas in the museum, each half having been re-shuttered on four sides. The split was done along a natural fracture that had developed during initial storage. Detailed plans of the two blocks were made and the edges superimposed to match the two sides. When it came to starting work on that block it proved possible to site the two portions close together by removing the wooden casing along the fractured sides and manoeuvring the trolleys on which the blocks were placed so that a constant gap was maintained across the original fracture line.

The result was a detailed 3-dimensional map of locations along with angles of pitch of significant fragments for blocks V, Y1, Y2 and Z. For block V, Deposit 1, each fragment was planned as an outline once its full extent appeared to be showing (this itself was not always a straightforward procedure); moreover, all but small amorphous fragments were also plotted in profile on both the X and Y axes of the grid, thereby recording the pitch of the fragments relative to horizontal (see archive). Obviously, the concealed underside of a fragment could only be interpolated in the profiles. The record comprises seven planned levels and twenty-three profiles for defined transects along the X- and Y-axes. For the Deposit 2 blocks the 3-D recording was simplified; rather than planning outline shapes, positions were instead simply recorded as point grid references; for many fragments this was taken at the centre of the visible fragment, but for larger sherds two to four points were measured, thereby indicating any inclinations in the surface of the piece.

Photography was not needed as a primary recording method for Deposit 1 because of the systematic planning; nevertheless, much was done of both overall surfaces and details during excavation. Fragments were also photographed by conservators after cleaning. Photography during excavation of Deposit 2 was undertaken at intervals, generally, if possible, prior to the lifting of a substantial number of fragments which had been largely freed from the matrix. The photographs were taken from directly above and a series was taken centred on each of the crossing points of the grid lines across the affected surface. This was a time-consuming exercise and was mostly undertaken at obvious breaks in order to minimise delays in excavation. The photographs were labelled in a batch at the end of the day using the grid point at the centre of each. The horizontal position of each fragment can be interpolated from the photographs in which it appears; there is obviously a shift in apparent position within the square from one photograph to the next as a result of the parallax caused by low camera position. The date of lifting was recorded for each fragment, thus allowing correlation with the photographic 'plan'.

Once a fragment had been freed from its soil matrix (whether from clods or *in situ* blocks), a value judgement was made as to whether it was likely to be informative in terms of type of object being cast or the technology of production; consideration was also given to its prospects for conjoins — for example, fragments abraded all round would have negligible potential in this respect. Based on these judgements it was decided whether to give the fragment a unique fragment number (*fr no*). Fragment numbers run serially (in the order processed within each block) from 1–790 for Deposit 1 and from 1000–1110, 1400–1431 and 1500–1984 for Deposit 2 (total 628, although several disintegrated on lifting). A proportion of the numbered fragments proved, after cleaning, to consist of more than one piece and, unless the pieces joined, they have been dealt with separately in subsequent analyses. Again there was a subtle difference of approach for the two deposits in that a slightly higher threshold was set for unique numbering in Deposit 2. Numbers were allocated before lifting and, because the mould fragments in Deposit 2 were more fragile, closely positioned fragments were more often lifted together than in Deposit 1.

The clods of soil, A–U and W were first recorded on a purpose designed A4 pro forma in order to show any spatial relationships between contained fragments. Thereafter, numbered fragments were treated the same as those excavated from blocks or direct from the site, each

		Deposit 1	*Deposit 2*	*Deposit 2 Context 9119*	*Total*
Crucible and possible crucible	Number	22			22
	Weight (g)	257			257
Gate fragments	Number	3	3		6
	Weight (g)	33	25		58
Inner valve	Number	339	365	11	715
	Weight (g)	2208	2485	31	4724
Inner valve with outer wrap	Number	228	278	72	578
	Weight (g)	2628	4939	804	8371
Outer wrap	Number	293	92	10	395
	Weight (g)	2445	1387	50	3882
Mould fragments attached to stone	Number	4			4
	Weight (g)	237			237
Stone and flint tools	Number		4		4
	Weight (g)		78		78
Horn core	Number		1		1
	Weight (g)		Soil attached		
Teeth and jaw bone	Number		1		1
	Weight (g)		5		5
Burnt timber (?modern)	Number			1	1
	Weight (g)			29	29
Pottery	Number	1	11		12
	Weight (g)	?	416		*c.*450
Copper/alloy	Number	1 (+ spot)			1
	Weight (g)	3.1			3.1

Table 3.2 Quantification of finds categories

being recorded on an individual record card. The card allowed various information to be entered on the front, while a sketch of the fragment was consistently drawn on the back. This latter was crucial since the friable nature of clay refractories makes it impossible to ink-mark the objects with their identification numbers. The information recorded on the front could include dimensions, the basic category of the material (inner valve, outer wrap, crucible, other), cross-reference to any conjoins found during processing, initial interpretation of object type cast and the part of the object (for inner valves), and any unusual features (for example, metal traces adhering). In the later stages of the post-excavation process all the key data from these cards was entered into an Excel spreadsheet for ease of manipulation and data analysis.

Finds other than refractory material were rare within the deposits (Table 3.2). Deposit 1 yielded one pottery sherd (fr 641, S), several small pieces of charcoal, a small fragment of copper/alloy (fr 195, E5), a further 'drop' of copper/alloy adhering to a flint (fr 805) and occasional burnt flints (excluding numerous natural flint pebbles from the local geology). Deposit 2 yielded eleven sherds of pottery (frs 1666 and 1758 from Y2, 1981–1983 from Y1; all joining to make a sizable crock — *NB* some numbers refer to multiple sherds), a piece of animal horn core (fr 803, Z), remains of a tooth (fr 1726, Y2), a possible stone tool (fr 1979, Y1), two flint flakes and a chip (frs 1713, 1716, 1760, all Y2) and further tiny pieces of charcoal. Context 9119, the apparent extension of Deposit 2 north of the tank trap, included a sizable chunk (118 x 36 x 31mm) of carbonised wood from a shaped timber of rhombic section; it is possible it came from the interface with the tank trap and is modern.

Cleaning after extraction

Clay refractories are notoriously difficult to process, because the fabric is very friable and therefore vulnerable to abrasion and dissolution. Much of the detail required for accurate identification of the bronze types cast and the precise technology involved is present as subtle surface features that can easily be stripped by wet-cleaning or insensitive dry-cleaning. The cleaning of the Springfield refractories was further exacerbated by the site soil conditions (see below). The British Museum's Department of Conservation and curatorial specialist were therefore faced with a difficult task, which, if vital information was not to be lost, required careful manual cleaning, largely using dry techniques. The work was thus extremely painstaking and time-consuming, but the benefit is complete confidence that the condition of the extracted fragments faithfully represents their in-ground condition. Relative differences in condition are likely to be strongly correlated with the condition as deposited in the Late Bronze Age, although differential weathering *in situ* may also need to be taken into account.

Soil matrix

The soil matrix enveloping Deposit 1 did not obviously differ from that of layer 2 in ditch segment 4050 — light yellow-brown silt with a clay fraction and a high iron content, which, once dry, set like concrete. The mobility of iron in the soil has resulted in many localised concretions and 'iron-pans', frequently in direct contact with original mould surfaces. Aside from the variations caused by differential iron accumulation, the soil matrix seemed relatively homogeneous. Natural gravel inclusions were frequent, as generally on the site. Sometimes clay

refractory pieces had become cemented to adjacent gravel pebbles.

The situation for Deposit 2 was different. Most of the soil matrix around the refractories was broadly similar to Deposit 1 in colour and consistency, though with a higher fraction of clay which made it harder to excavate dry. Gravel was again fairly abundant and blocks Y and Z each actually contained a limited patch of very fine clay of a distinctive whitish grey colour. A very similar and evidently larger spread of such clay was recovered by the excavators from context 9119, which yielded the northernmost group of refractories. It is possible that this northern body of clay was more extensive, for layer 2 in ditch segment 4054 is described as 'almost pure clay with heavy iron staining' (Chapter 2). If this is the same clay deposit, it would seem that it became more patchy or more mixed with yellower silt around the main refractory concentration. It is possible that this was clay ready for mould preparation.

It is worth noting that the thin layer underlying the refractory deposits, being the primary fill of the ditch, was noticeably though variably sandy in all ditch segments, yet no significant sand component was encountered amongst the refractories.

Objectives of the study

When the first deposit was discovered in 1981, there was some expectation, or hope, that this could be a crucial lead to the elusive metalworking installations of the Bronze Age. The deep enclosure ditch could have provided a serendipitous protective trap for material generated by casting activity nearby, perhaps just outside the enclosure. Soon after, however, the repetition of such a concentrated mass on the opposite side of the enclosure gave cause for fresh thinking and a new perspective. These two deposits seemed unlikely to be the result of the progressive and casual accumulation of casting debris direct from one or more metalworking zones, especially since it was becoming evident from the extensive excavations that the rest of the site was totally clean of such debris. By the time an interim account on the site was being written, consideration was being given to the two deposits representing foundation deposits marking enclosure construction (Needham 1987; also Needham 1993, 61). While this potential conclusion has severe repercussions on the directness of the connection with metalworking activity, it complicates rather than erases the questions of where that activity took place and how it related to the use and status of the site.

The assessment report for English Heritage (Brown *et al*. 2007) listed five specific objectives for the study of the refractory dumps:

- The date of the deposit within the Late Bronze Age
- Whether there is any evidence for a sequence of casting
- Where was metalworking taking place?
- Is there evidence for specialisation of production and/or selection of material for deposition?
- What are the broader implications for the practice of metalworking in the locality and region?

Conjoin search methodology

Large assemblages cannot be dealt with comprehensively for possible joins because the fragment-to-fragment combinations are enormous. Amorphous fragments can obviously be excluded from the search methodology, as too can small fragments unless there is some distinctive morphological element that might give a clue to potential connections. Fragments with morphological information surviving, but with abraded fractures are more problematic; they do not have the potential for unequivocal joins, but sometimes the character of the morphology combined with colour and thickness can give rise to persuasive links to another fragment, such that their belonging close together within the same valve is judged to be highly probable.

The strategy for the Springfield refractory assemblage was made a little more complicated by the fact that it comprised two discrete contexts. There needed to be a reasonably consistent approach to the search for joins/belongs internally within each deposit, and then again for joins/belongs between the two deposits. The search was restricted to inner valve fragments. The more crumbly nature of the outer wrap fabric considerably reduces the prospects for finding conjoins and even if some could be found (a few were found in passing) it is not clear that it would yield more information on casting technology than can be gleaned from the unlinked fragments.

The procedure adopted was as follows. The uniquely numbered valve fragments from Deposit 1 were all laid out on a table and the most morphologically diagnostic or large pieces first picked out for removal to a second table, in the process each of these being checked against any plausible matches already moved across. Material on table 2 was grouped according to which part of the sword was represented, hilt finials at one end, blade tips at the other. Thereafter, the remainder on the first table were inspected fragment by fragment and taken to table 2 for comparison whenever they seemed promising. These fragments were not, however, systematically compared with the rest on table 1, this only happening if some particular feature merited it. This procedure was undertaken by each of the two authors independently.

At the conclusion of the internal Deposit 1 search, numbered valve fragments from Deposit 2 were laid out on table 1 alongside those remaining from Deposit 1. Again, the most diagnostic or large pieces were picked out first for setting out on table 2, but these were kept in a separate group structure parallel to that for Deposit 1. Each was compared not only with its context peer group already moved to table 2, but also with the full selection of Deposit 1 on that table. This process then continued with each of the remaining fragments on table 1 in turn. The procedure described probably resulted in fewer comparisons being made between the two deposits than within either, but those that were made certainly embraced all the most diagnostic fragments with the highest potential for identifying conjoins.

Having completed this process for Deposit 2, further checks were made across the respective selections on table 2. The net result was a series of assembled *segments* of valves each comprising two or more fragments, as well as some individual distinctive pieces that had been laid out on table 2 early on in the process but for which no matches were actually found. Although a mixture of conjoins and

single fragments, all were numbered in a single sequence of 'segments' for consistency. Multiple-fragment segments are almost always made up of fragments that either join definitively or have 'abraded joins', where correspondence of outlines at the join combined with good match in colour, cross-sectional form and any distinctive features are judged to indicate original juxtaposition. Very occasionally a fragment that does not demonstrably join has been included in a segment; this depended on the presence of unusual features that matched across, but it was decided not to define many such linkages within segments because of the repetitious nature of the assemblage in morphological and fabric terms and thus the likelihood that some separate sword valves would have had very similar characteristics. However, where there is felt to be the possibility of a less secure link, this is recorded in the catalogue by cross-referencing the relevant segments and/or fragments.

Cataloguing and selection for illustration

All of the material left on table 2 was catalogued, but only a sub-selection illustrated (below). In addition, all gate and crucible fragments were catalogued, as were outer wrap fragments where they retained distinctive features — notably inter-valve ridges, binding or other impressions and splints. Although many valve joins and probable belongs were found within each Deposit, none at all were identified between them. The implications of this will be considered below, but it meant that the selected material from the two Deposits could be kept discrete in the catalogue; Deposit 1 runs from segment 1–70, Deposit 2 from 71–139.

Not all of the catalogued material could be illustrated within the available resources. Selection was based on ensuring a fair representation of the different elements of the sword valves, while incorporating all of the typologically most informative segments and in addition any technologically interesting pieces. It was also desirable to try to achieve a balance between the two deposits, insofar as the other considerations would allow. The small number of crucibles, gates and valves for other objects, were given a high illustration priority.

Inner valves and the objects cast

Fabric

The fabric is typical of the character seen elsewhere in Bronze Age inner moulds: a relatively fine clay with a good admixture of fine sand. It is moderately well fired in a predominantly oxygen-free environment giving it a largely consistent grey colour, although the outer skin of the valve can sometimes be oxidised to orange, pink or buff. Very occasional grits have been noted; they are assumed to be accidental inclusions.

Edge characteristics

Two aspects of the valve edges are of interest: the shape of the outer edges and that of the contact faces just inside them. The contact face is the small surrounding surface of a valve which on assembly makes contact with the complementary valve. As experienced in other assemblages, contact faces can vary between flat, marginally convex or marginally concave; moreover, they can be horizontal, in-sloped or out-sloped. All these variants are present at Springfield. The characteristics do not necessarily stay constant all round an individual valve. A further part of the definition of contact face involves the junction with the matrix, whether poorly or strongly defined, whether just an angle or stepped in profile. Because this junction is sometimes poorly defined, we have indicated its position (in our judgement) with an arrow in the drawn cross-sections (Figs 3.1–3.6). The outer edge of the valve may be acutely tapered, may have a small upturned lip, be of broader rounded form, or squared off to some degree. Most of these variations are not of significance for production technology and indeed form can change down the length of a valve, but they are a further aid to finding joining fragments, or those likely to be in close proximity. The lipped form is however a characteristic of the second-made valve, the clay having just begun to wrap around the outside of the first-made. Concave contact faces also tend to indicate second-made valves.

Contact face characteristics did not fall into a neat two-fold classification which might theoretically occur if the first-made valve always had its edges prepared in a consistent manner. The greater variability simply indicates that the mould-makers were not unduly concerned about the precise line of the contact between valves, only that they met well, and that would normally be ensured by pressing the second-made valve against that already formed.

Object types cast

One of the striking facts to emerge from our study is that, despite the size of the assemblage, virtually all of the identifiable objects to be cast were swords. Two exceptions are dealt with separately below. Inevitably, many fragments cover the relatively featureless blade portions of the weapon and, taking these in isolation, it would be possible to identify some of these as blades belonging to other types of object, such as knives, rapiers or spearhead blade-wings. In practice, however, this is not thought to be likely in the Springfield assemblage. Firstly, wherever blade fragments joined together to form larger segments they were, with one rather unusual exception (below), indisputably double-edged, bilaterally symmetrical and of the right proportions for swords. Some also join up with sword shoulder portions. Secondly, there are no distinctive features that would clinch a spearhead identification (*pace* Needham 1987), for example, the beginning of a midrib, or the strong convex curvature seen at the base of most spearhead blades. Finally, it was found that small fragments bearing blade edges had very similar cross-sectional profiles to fragments definitively for sword blades.

Swords

(Plate 3.3, Figs 3.1–3.7, Table 3.3)

Cast object thickness is difficult to evaluate with any precision. This can only be done when a full cross-section is available and any joins across that section will introduce potential error. Another problem, particularly for the hilt, is that the pattern might have been pressed more deeply into one valve than the other. Nevertheless, some approximate estimates can be given for full-width blade portions because the line between the as-cast edges can be taken to be the axial line about which the matrix void was symmetrical.

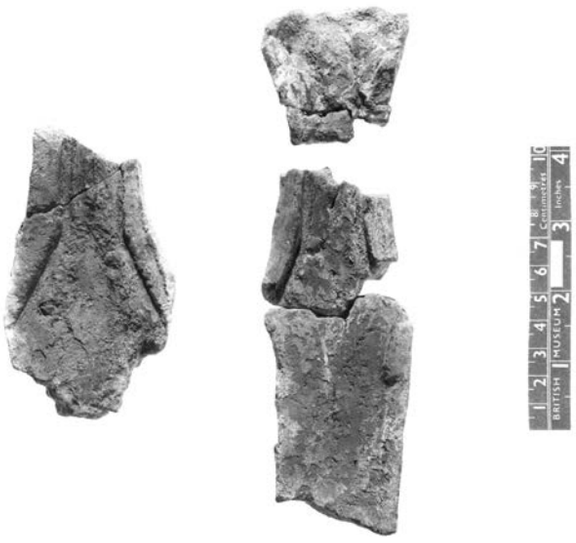


Plate 3.3 Examples of matrices for sword shoulders and hilt finials: left, segment 55; right, segments 56 and 65

Recognised hilts in the assemblage are universally 'flanged' (Figs 3.1, 3.3, 3.4), indicating that the products would have fallen into the broad family of flange-hilted swords. Indeed, the strength of these features would be one of the defining characteristics of the swords cast in the Springfield moulds, although they often taper out towards the finials (segments 63, 64, 76). The flanges continue in some form along the top of the shoulders, tapering out towards their apices. Flanges are not all of the same profile; while many are of classic sub-rectangular form (segment 55, 60, 67, 73, 75, 78, ?81), in a few cases the central septum of the grip simply thickens towards pronounced side angles (segment 79), some of these resulting in a markedly triangular profile (segments 56, 63). Irrespective of the precise form alongside the grip, flanges along the shoulder edges tend to the edge-thickened profile (segments 51, 84, 87, 89), again sometimes with a strong triangular profile (segments 53, 55, 56, 90). Only one shoulder fragment (segment 91) lacks edge thickening and actually seems to be a thinned edge.

The septums between the flanges are most often flat, or nearly so (segments 63, 64, 67, 76) except where interrupted in the central area by a linear protuberance that would have formed an axial slot for rivets (segments 55, 60, 75, 78, 81). On segment 55 the upstand for the slot has a dished top giving the effect of a fine beading all round the edge. Two cross-sections are more unusual. Segment 65 is concave in the centre with broad flattened sides instead of flanges, but this might have changed lower down this grip.

Segment 55	*c*. 55º
Segment 56	*c*. 40 (- 60º, in outward sweeping curve)
Segment 81/84	*c*. 60º
Segment 87	*c*. 57º (based on half-angle)
Segment 89	*c*. 55º (based on half-angle)

Table 3.3 Estimates of the angle of splay of shoulders

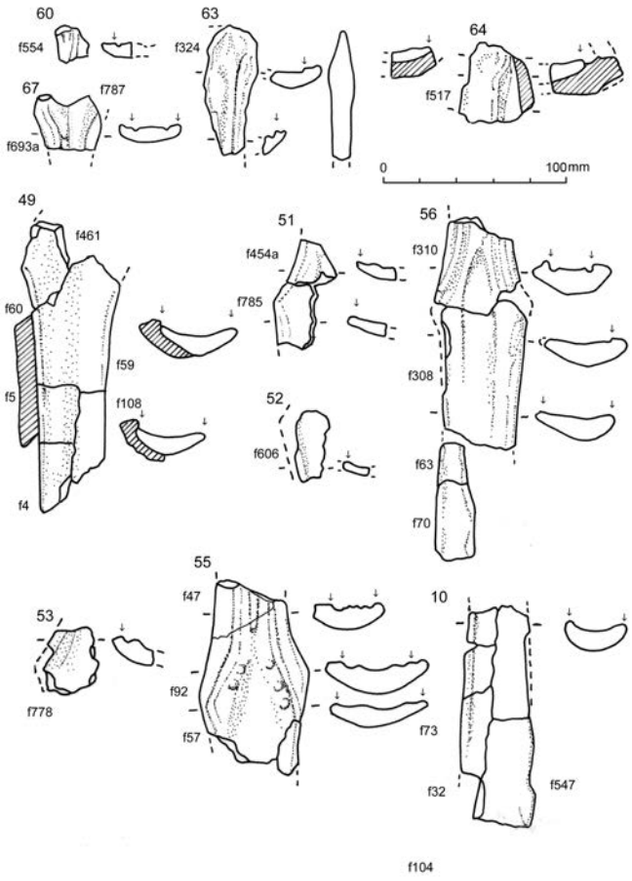


Figure 3.1 Refractory Deposit 1: segments for sword hilt finials, shoulders and ricassos; blade portion segment 10 almost certainly belongs to the same valve as segment 56. Scale 25%

Segment 79 is also concave, but a groove runs down the matrix more or less along the medial line, although slightly skew to it. This is not obviously damage and thus would have cast a rib running along the centre of the septum between its thickened-edge 'flanges'. Where hilt ribs occur on known swords they are often not neatly aligned, there presumably being no need for symmetry in a feature that became concealed by the hilt-plates. Their function is presumed to both strengthen the hilt and aid registration of the hilt-plates (Colquhoun and Burgess 1988, 66).

The full length of the grip (the central part of the hilt) has rarely survived. Where a reasonable proportion is extant, the sides are convex, often marginally so, the maximum width occurring below the mid-point with straighter stretches above (segments 55, 63, 78, 79). The neck of the grip is a little below the finials (segments 65, 78, 79). Hilt finials expand widely, in fish-tail form, with the possible exception of segment 64, where the expansion seems more spatulate. A defined straight top is sometimes apparent (segments ?67, 73, 76), but this can be complicated by the fact that the metal was poured from this end and a slight funnel may have been provided in the middle of the butt (notably segment 65). The overall shape of the hilts is typical of flange-hilted swords.

A good number of segments include part of the shoulders (Figs 3.1, 3.4; Plate 3.3), but often this is only a minor part, thus precluding critical information on the angle of splay or curvature. The line of the shoulder is

sometimes a sweeping curve expanding from the grip sides (segments 51, 56), but more often there is a distinct break of angle at the junction (segments 55, 75, ?78, 81, ?90). While the former two examples have gently concave shoulder lines, the angled ones are straight or even marginally convex (55, 81/84, 90) suggesting two variant styles of shoulder.

The angle of splay is difficult to ascertain in most instances, but is important in relation to the classification of swords, since Wilburton and virtually all earlier forms have more widely splayed shoulders than Ewart swords. To avoid the complications of shoulder curvature where it occurs, it is important for consistency that the angle is taken as that subtended by the tops of the shoulders. Where only one shoulder survives but the axial line can be established, then the half-angle can be measured, then doubled for comparison. The measurable results for five segments are given in Table 3.3, where it is apparent that four are reasonably consistent, between 55 and 60º. The fifth starts with a more gradual splay, but this increases to about 60º. The significance of these angles for the sword types cast will be discussed below.

The cross-sectional form of the shoulder edges has already been described above in conjunction with the grip flanges. Inside the flanged or thickened edges the shoulders thin before thickening strongly to a rounded mid-blade. Where the shoulder/grip junction survives well this swollen mid-blade can be seen tapering out, tongue-like, in the base of the grip (segments 55, 56, 78, 81/84), as known on many contemporary swords.

In a few cases bumps survive inside the shoulder edges; these would have produced rivet holes, or at least starter depressions for them. Two occur on segment 90, a minimum of one on segment 91, and there appear to be the remnants of three on the right-hand side of segment 55 with two scars discernible on the left-hand side. In other cases (segments 49, 51, 53, 56, 81/84, 82, 87, 89) there is no sign of specific protuberances, although the angular ridges of 53 and 56 might well have formed slots. Even for the others, the raised zones of the matrix inside the shoulder flanges could easily have produced thin webs in the casting for the later punching of holes or slots.

Beneath the shoulder apices, sides contract modestly in a concave line at the top of the blade. Several fragments retain evidence at this point for a ricasso having been cast in (Figs 3.1, 3.4); this is significant because an alternative is the formation of ricassos in post-cast working by deliberate blunting of the topmost stretch of the blade's edge. The notch to form the ricasso has a steep to vertical step between matrix and contact face (segments ?51, 52, 56, 87, ?88, 89, 92, 94, 95); this varies in height up to about 2.5mm (segment 92). (Segment 88 is only tentatively identified as from a sword — see 'Other objects' below). On a few other mould fragments there is either no indication or only vestigial hints of the ricasso notch (segments 49, 55, 84, 90). While weathering has clearly reduced the height and definition of some (observed for 51, 95) and edge chipping is another possible cause of loss (notably the left side of 56), it is unlikely that this explains the absence of a clear notch on all of these pieces. It is more likely that the full thickness of the ricasso on the model was sometimes, or perhaps even systematically, taken up entirely in one valve, logically the first-made one. The clay of the second valve would meet this ricasso infill more or less flush with the blade surface.

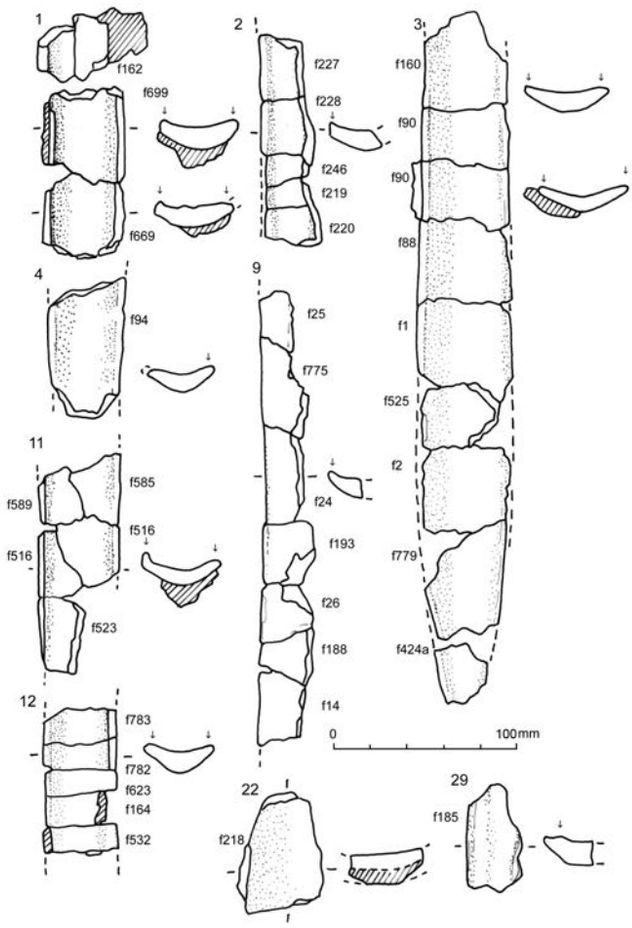


Figure 3.2 Refractory Deposit 1: segments for sword blades. Scale 25%

Most of the blade sections as cast would not have had any strongly delineated features (Figs 3.1–3.6). Some had a lenticular section, usually with slight concavity towards either side (*concave-lenticular*) thus giving a more sinuous bowed profile (with sinuosity: segments 1, 3, 11, 12, 29, 104; without obvious sinuosity: 4, 10, 97, 99, 100, 102, 112, 115). A number of matrices, however, retain a distinct crease along the mid-line, albeit a very obtuse angle in profile (e.g segments 16, 18, 20, 22, 48). These would produce a lozenge cross-section and, again, there is generally a tendency towards concavity to either side (*concave-lozenge*). A final variant has a relatively well defined midrib, broad and round-topped and standing proud of the blade wings (segments 82, 87, 89, 98). To some extent detailed blade section may relate to the part of the blade concerned; the midribbed segments, for example, are virtually all associated with the top of the blade running into the shoulders, although segment 98 may be a little lower. However, other shoulder segments featuring the mid-blade tongue do not have such well defined midribs (segments 49, 55, 56). This may not be a marked distinction, but it does nevertheless seem to distinguish between the two Deposits. Clear lozenge-sections on the other hand are mainly seen on the low part of the blade, approaching the tip; segment 22, however falls somewhere higher on the blade. That these all come from Deposit 1 may reinforce that there are subtle differences in the blade morphology between the two.

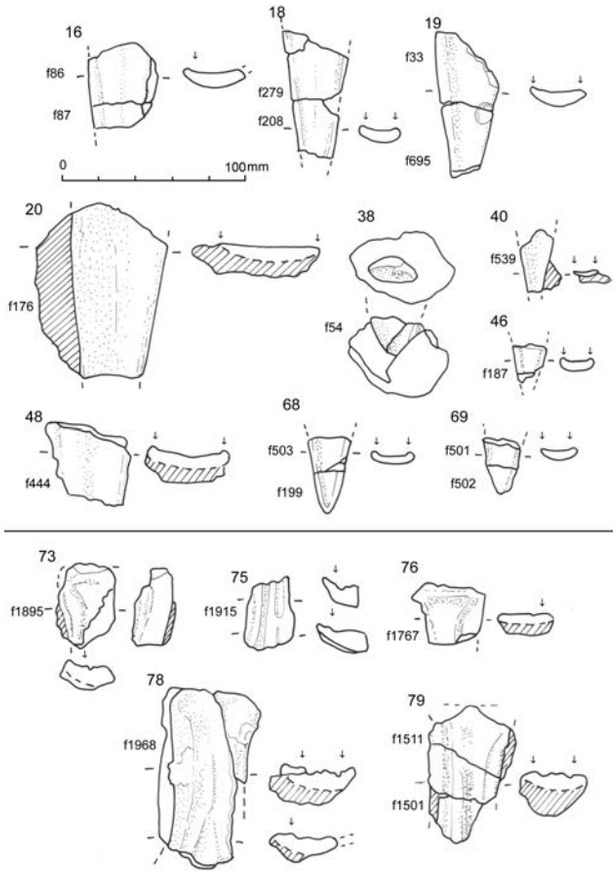


Figure 3.3 Refractory Deposit 1: segments for sword blade tips; Refractory Deposit 2: segments for sword hilt finials and grips. Scale 25%

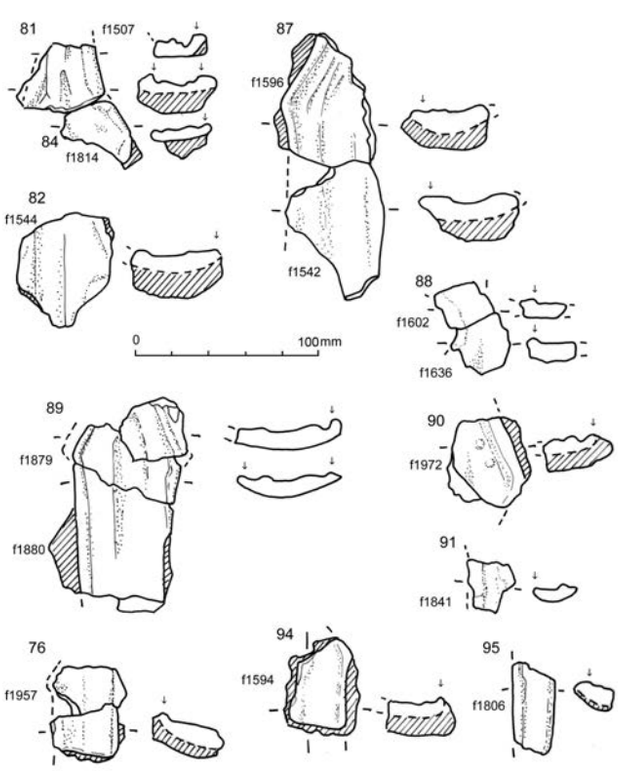


Figure 3.4 Refractory Deposit 2: segments for sword shoulder and ricasso zones; segment 88 is uncertainly classified. Scale 25%

Although any subtle features of the blade can be altered in post-cast working, this tends to be concentrated on the edges in order to create sharp and regular cutting edges with backing bevels, the latter not being present in the matrices. The mid-blade may well have received a little finishing, especially grinding to erase any imperfections and create the desired polished finish all over. However, such surface finishing would not normally alter the cast morphology significantly and it may be assumed that the variation in blade sections seen in the matrices was generally that intended for the finished swords.

Mould portions for blades can be sub-divided to some extent. Although blade width obviously changes considerably down the length of an individual blade, the full width of a floating segment is not especially helpful since sword blades of the relevant type can have very different absolute widths (see for example Colquhoun and Burgess 1988). A sample of 91 Ewart Park blades for which the maximum blade width was identifiable gave a mean value of 41.2mm, with standard deviation of 4.5 and a range of 29–54mm. A smaller sample of 23 Wilburton blades gave a mean of 42.6mm, standard deviation 4.7mm and range 33–51mm (Bridgford 2000 vol 2, 31). It is notable that a number of segments (20, 102, 104) have estimated blade widths considerably in excess of both these means, including one of 56mm which falls outside both ranges (segment 25).

These matrix-to-object comparisons are complicated by the fact that the width of the valve will not accurately reflect that of the finished blade. There could have been reduction from slight shrinkage on cooling, the removal of casting flashes and any grinding; meanwhile, hammering to thin and harden the edges would cause slight expansion. Thus, even an unused blade could have a different width from its matrix and further changes would occur with reworking necessary during the sword's use-life. Nonetheless, the average blade width in the Springfield moulds does appear to be greater than expected and this would generally be seen as an early characteristic within the type.

The position of blade portions is obvious when they have been joined up with the base of the shoulders. In other cases, however, indications have to be taken from the curvature and/or convergence of the edges. Most obvious are the tips, either with point intact or with strongly converging sides which could not be accommodated higher on the blade. Elsewhere identification depends on having restored a reasonable length of blade so that it can be seen that either there is an overall bowing of sides, indicating that the maximum width is present, or that there is marginal waisting, indicative of the neck of the blade.

Blade tips vary in shape and degree of convergence (Figs 3.3, 3.6). Those with essentially pointed tips can be acute angles (segment 68, 125) or more obtuse (121, 122). Another very acute angle is seen in segment 118, although the tip itself is missing. Segment 114 is likewise tapering only gradually, but it ends in a rounded tip, though this might have been modified during post-cast working. Overall the angle of taper just above the tip can be as little as 20º or up to about 35º. Segment 35 has a curious constriction for the last 20mm above the tip formed by concave bevels symmetrically set inside either edge. This was clearly a feature taken up from the pattern, but it does not correspond to any cross-sectional change at the tip

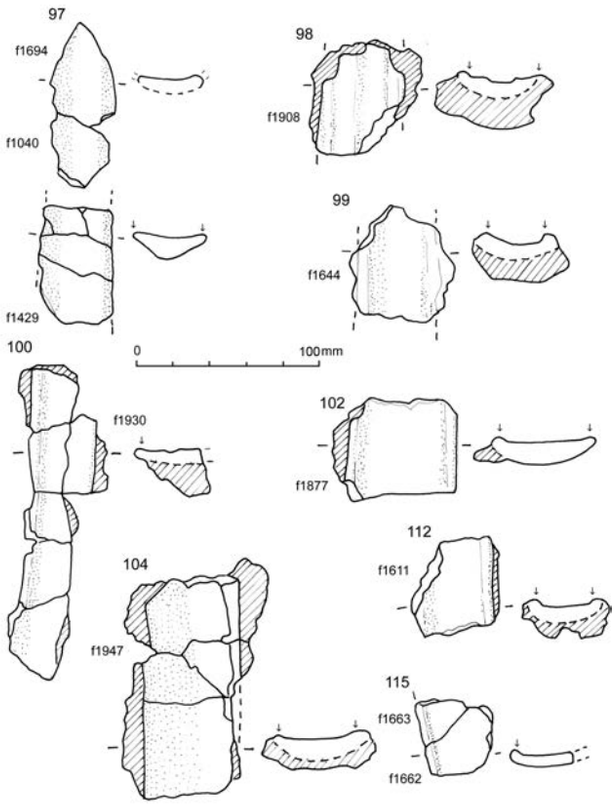


Figure 3.5 Refractory Deposit 2: segments for sword blades. Scale 25%

seen on actual bronze swords, so it might be assumed it was later worked out. One possible explanation of its origin is that the pattern was shaped thus to provide a slightly thicker entrance for casting from this end. However, this particular mould must have been poured from the hilt, for the contact face runs right round the tip.

Identifying the swords cast

With one exception (below), the shoulders represented amongst the Springfield assemblage can be matched among the large series of Ewart swords, for which angles of splay are mostly between 55 and 70º (Fig. 3.7). The other major sword series of the Late Bronze Age, the Wilburton series, is broadly earlier in date than Ewart swords; Wilburton swords are characterised by well splayed shoulders, with angles of splay above 70º and often above 80º, thus ruling out this identification for the cast products under discussion. While some even earlier types, those of Hemigkofen, Erbenheim and Clewer (Colquhoun and Burgess 1988, nos 62–94), have shoulder splays more comparable to those seen at Springfield, various other critical features of their hilts rule out these types too — thin, flat and broad hilt septums, the different shape of their grips and the virtual absence of slots in them.

In some cases it proved possible to estimate the shoulder width from the valves. Unlike the blade, the shoulder width would be little altered by post-cast working and in use and thus should give a closer estimate for the finished item. A sample of 109 Ewart hilts, for which the full shoulders were extant, gave a mean value of 50.0mm, standard deviation 3.8 and a range of 41–58mm. A smaller sample of 36 Wilburton hilts gave a mean of 58.8mm, standard deviation 4.7mm and range 50–72mm (Bridgford 2000, vol 2, 31). Among the Springfield segments it proved possible to estimate shoulder width for six matrices from Deposit 1 (segments 49, 50, 51, 55, 56, 57) and four from Deposit 2 (segments 82, 86, 87, 89). Although all the widths were greater than the mean for the Ewart Park swords, five out of the six from Deposit 1 (56, 50, 52, 54, 52 and 52.5mm respectively) were within one standard deviation thereof and all six were below the mean for the Wilburton swords. However, two of the four from Deposit 2 (56, 62, 62 and 54mm), exceeded the mean for Wilburton swords and fell outside the range for the sample of Ewart Park swords (but note, these are both based on surviving half-widths).

In addition to shoulder form, all other key attributes can be found recurrently within the Ewart range: the particular leaf-shape of the blade, the shape and flanging of hilt grip, the slot/rivet combinations and the two main blade section forms, as well as overall dimensions with the exception of the two broad-shouldered hilts. However, there is considerable variation on the combinations of features employed among the many Ewart swords known, variation that is not easily dealt with using traditional methods of classification (Colquhoun and Burgess 1988, 55–68). Although the Springfield products can be accommodated within the Ewart series, their specific feature combination is by no means frequent among extant sword finds.

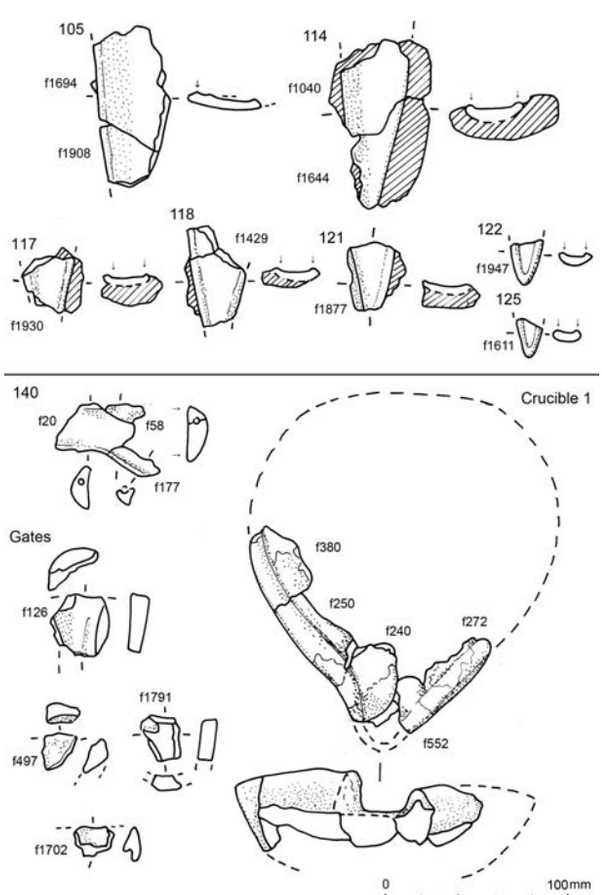


Figure 3.6 Refractory Deposit 2: fragments for sword blade tips; Deposit 1: fragments for possible sickle (frs 20/58/177); Deposits 1 and 2: gate fragments; Deposit 1: Crucible 1. Scale 25%

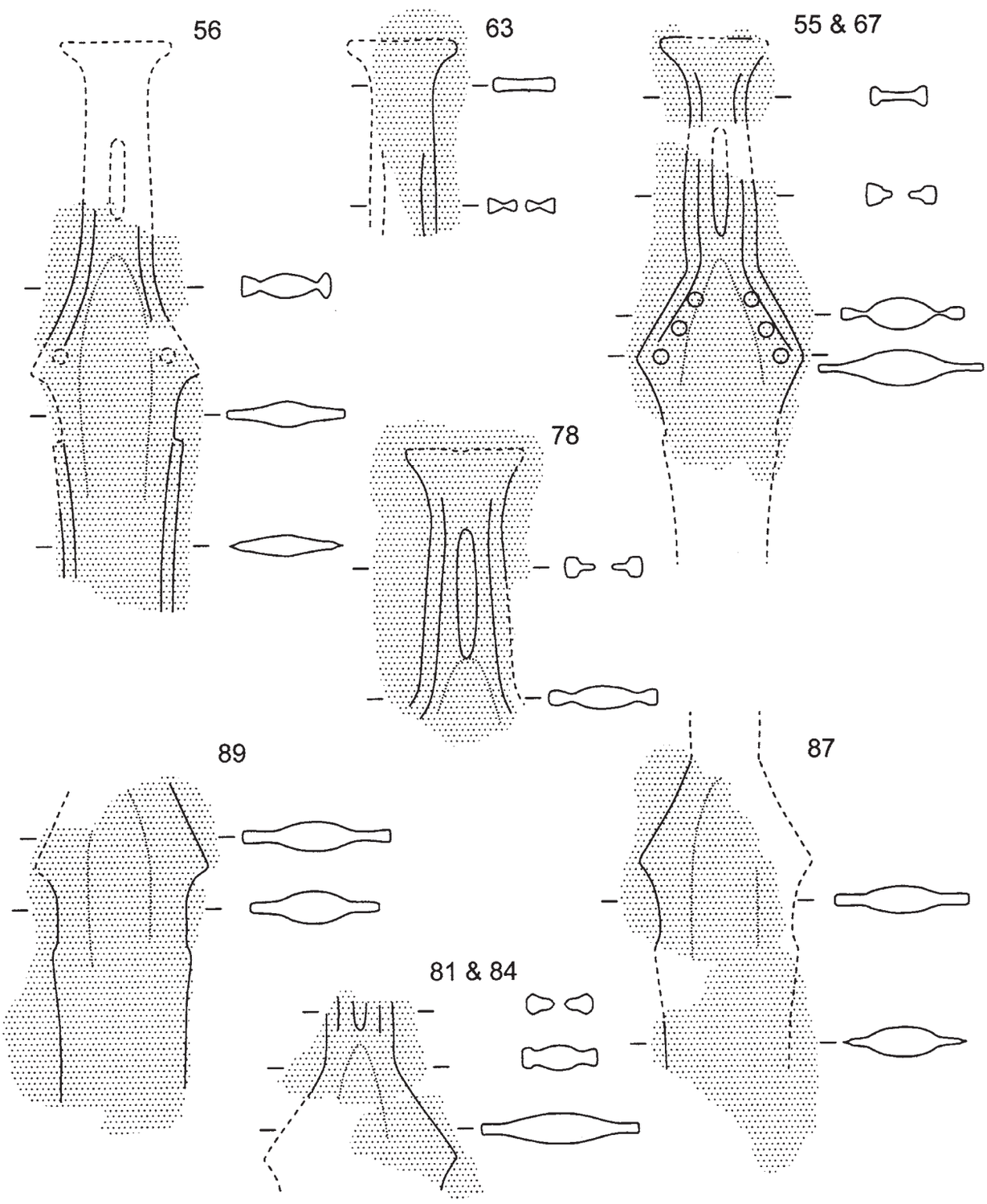


Figure 3.7 Sword reconstructions for the better preserved moulds for shoulders and hilt grips. Shading indicates the extent of surviving fragments. Solid lines are actual features represented on the fragments, dashed lines are extrapolations or mirror-imaged outlines. Cross-sections assume bifacial and, where necessary, bilateral symmetry; thickness is based on actual bronze swords. Outlines are slightly adjusted to allow for post-cast working. Drawn by Stuart Needham. Scale 50%

The most significant minority attribute is probably the grip-slot, assuming for the moment that these were intended to result in fully perforated slots; this is most likely for segments 55, 75. In Colquhoun and Burgess' corpus (1988) only 14 Ewart swords have grip-slots, compared to at least 235 with separate holes for the rivets (figures exclude fragments not securely attributed to the type). We could add a further 7 examples which Colquhoun and Burgess classified as Wilburton swords (mainly Wilburton variant G; nos 191, 228, 230, 231, 232, 234, 237), but which have grip-slots associated with shoulder splays of less than 65º, thus well within the Ewart range. In crossing between the types as previously classified, we are not assuming the primacy of any one feature in classification, but simply ensuring that we are making all the relevant comparisons within what is generally acknowledged to be a progression from Wilburton to Ewart swords.

The nature of the shoulder rivet emplacements on the Springfield products is more ambiguous. Some were certainly individual holes, but others seem to have projections for creating slots, although we cannot be sure they would have fully perforated the casting. Even so, the thinned linear zone cast would facilitate the punching of holes or slots during post-cast working. Shoulder-slots are an even rarer feature of Ewart swords than grip-slots, occurring on just six examples (Colquhoun and Burgess 1988, nos 256, 258, 266, 336, 583, 608); however, significantly, they also occur on six of the 'Wilburton' swords listed above (nos 191, 228, 230, 231, 232, 237). Most of these have quite short slots and occasionally they are combined with holes. These figures do not include a small number of swords with cast slot-like depressions which did not fully perforate the casting (such features are not always clear from published illustrations).

In summary, therefore, it is possible to conclude that cast slots or channels perforating the grip or shoulders were a minority feature of Ewart swords probably occurring on less than 20%. Simple perforation with individual holes, however produced, was by far the dominant practice for rivet emplacement in the Ewart sword series.

The second regular (but not universal) feature of the hilts that strikes us as rather unusual is the strength of the flanges (Fig. 3.7). This is best seen on the better preserved examples, segments 55, 56, 63, 75, 78, 81/84, and to a lesser extent on 60. In the case of segment 63 the flange seems to diminish towards the upper half of the grip and this may explain why other upper fragments, towards the finials, generally have slighter flanges (segments 64, 67, 73, 76). The flanges on segment 79, however, are only modest in height through what must be the greater part of the grip. Where flanges are strongly defined they can be either sub-square or triangular in section, as described above. Doubtless these profiles would have been modified to some extent in post-cast working, but this would likely be concentrated on the sides of the grip which remained visible after the fitting of the organic hilt-plates.

The great majority of Ewart swords have rather slight flanges, occasionally becoming minimal to non-existent (some of these grade into the classic un-flanged grip section of Gündlingen swords). There are just a small number of examples with more robust flanges, whereas a much higher proportion of Wilburton series swords have strong flanges, including some of those listed above as having Ewart-like shoulders. This link, in conjunction with the rivet slots, is an indication that the Springfield swords owed something to Wilburton production traditions, the fuller implications of which will be discussed below. A further connection lies in the lozenge to concave-lozenge sections of some of the blades. The great majority of Ewart swords have concave-lenticular sections, suggesting that the more lozengic profiles are another hang-over from the prevailing pattern on the preceding Wilburton series before standardisation on a new form. Less easy to match are the Springfield blade or blades seemingly with a relatively well defined rounded midrib, although again there is a minority amongst the Wilburton series with a more emphasised midrib, especially high on the blade (*e.g.* Colquhoun and Burgess 1988, nos 134, 150, 152, 160, 162, 166, 167, 169, 170, 173, 208, 219, 250). There are also occasional Ewart examples with this tendency (*e.g.* 270, 271, 277, 299, 584). This sectional form may just be one extreme of the broad range of concave-lenticular blades. Crisply defined rounded midribs, invariably delineated by grooves, are one defining feature of Carp's Tongue swords, but their relationship to the midribs under discussion is uncertain.

One very unusual sword form at Springfield remains to be discussed, that seen most clearly in segment 56, but possibly also in segment 51. The expansion of the shoulders in a sweeping curve from the grip is not an established feature of the Wilburton-to-Ewart sword progression. These sweeping lines are characteristic of Carp's Tongue swords, but this type only occasionally has more than vestigial grip flanges (*e.g.* Colquhoun and Burgess 1988, nos 670, 672, 683). Despite this, we cannot rule out an ancestral relationship, especially since segment 56 retains a deep rectangular ricasso, another recurrent feature of Carp's Tongue swords. On current definitions, segment 56 is not for a Carp's Tongue sword as such, but it is entirely possible that it anticipates that type in certain respects.

One can find but a handful of Ewart swords with no clear angle between grip and shoulders (*e.g.* Colquhoun and Burgess 1988, nos 261, 266, 326, 381, 491, 492, ?534). This may be a subtle and coincidental comparison, but one of three examples in the Blackmoor hoard (*ibid*, no 326), has not only the concave shoulders and deeply cut ricasso notches, but also strong grip flanges. Moreover, its grip is slotted, a recurrent feature at Springfield (although absent on segment 56 due to loss). The Blackmoor hoard is a context of considerable importance in falling intermediate between classic Wilburton and classic Ewart assemblages. It also includes a sword with a groove-defined midrib, several hilts with strong flanges and several with grip-slots (Colquhoun 1979), providing multiple cross-links to specific features in the Springfield assemblage.

Possible sickle

The only matrix definitively not for a sword is that on segment 140, comprising three joining fragments (frs 20, 58, 177; Fig. 3.6). The full width of a thin, blade-like impression is present, but it is too flat for a sword blade, even at its tip, and furthermore has marked asymmetry from one edge to the other. The lower edge (as drawn) is strongly curved, more accurately perhaps a curved angle; the upper edge is more or less straight. Almost in the middle of the cross-section there is a marginal inflection which would give rise to a slight thickening close to the

mid-line of the blade. The form of the edges, the thickness and not quite symmetrical section of the blade are all consistent with a sickle blade. It is probable that several centimetres of the tip end are missing. The angling of the lower edge suggests a position close to the haft-end of the blade, but there is no sign of sudden valve thickening to accommodate a socket, so either the socket was further away or it was a tanged form of sickle. Either type can be contemporary with the Ewart swords being cast.

Known examples of bronze sickles (or reaping hooks) most often have a gently curving lower edge, but others can be strongly curved and occasionally there is a rounded angle not unlike that on the Springfield matrix, as on the example from the Thames at Taplow, Buckinghamshire (Fox 1939, fig. 5 no. 8), or that possibly from the Thames at Brentford, London (Fox 1941, fig. 2 no. 18). This particular detail is, though, infrequent and need not have any particular significance.

Uncertainly identified matrix

Segment 88 (Fig. 3.4) is only tentatively identified as from a sword — both the form of the 'ricasso' and the valve cross-section differ in detail from the shoulder zone of other sword moulds. It is not obvious, for example, that there is any central thickening that would be required for the mid-blade of a sword. However, its strongly concave edge bordering a rather flat matrix profile has not brought to mind any other established bronze type.

Attendant debris and the technology of production

Outer wrap

(Plate 3.4)

Both gross morphology (where fragments are large enough) and fabric help identify outer wrap from inner valve material. Wrap is generally crumbly or laminar in structure with a light distribution of small voids from burnt out organic matter; the material is softer than that for valves, due to being less well fired. Oxidised colours can also be useful indicators but are not absolutely diagnostic because the colour change across the assembled mould — from unoxidised grey internally to oxidised orange/red externally — does not always correlate closely with the structural boundary between valve and wrap.

Outer wrap fragments do not appear to have survived in the expected proportion relative to inner valves. The wrap around assembled valves varies in volume, but can be thick so that the overall volume of wrap for one mould assembly can exceed that of the two valves. Translating this into relative weights would need to take into account different densities of the two components. Even without such quantification, it is clear that outer wrap is under-represented.

The fabric of the wrap undoubtedly played a large role in the frequent reducion to small amorphous fragments and ultimately to just disseminated clay within the soil matrix. It is noteworthy that during excavation the soil blocks yielded frequent red to orange discolorations that were undoubtedly refractory material no longer definable as separate entities; the dominant colour indicates oxidised fired clay and leaves little doubt that it originated for the most part in outer wrap (and conceivably other soft-fired objects), rather than valves. We cannot rule out the possibility that part of the under-representation of wrap is also due to a process of deposition in which valve material was preferentially selected (consciously or otherwise) over the less distinctive wrap. However, given the taphonomic processes at work, which affected wrap much more than valve, it is impossible to quantify the degree of differential loss. It must be borne in mind also that a process of preferential degradation could have already been happening in a primary context such as an open heap of refractory debris and then subsequently have been reinforced both during transit and within the final context.

Consequently there are relatively few pieces of wrap in good condition with significant features preserved. Where wrap is still attached to the back of the valves, it is usually only small traces, suggesting negligible bonding between the two components. This is not entirely surprising given the different fabric structure, the pre-drying or firing of the valves and the lesser temperature reached by the wrap during casting. It is noteworthy that a small number of sizable pieces of wrap tend to be attached to well preserved and identifiable inner valves (examples in Figs 3.1–3.6).

The wrap was often seen to be made up of two or even more layers, a frequent feature in bivalve mould construction. It may be that the application of thinner layers intermittently, rather than a single thicker layer, helped the clay to dry out thoroughly. Sometimes it is clear that the first wrap was not a completely enveloping layer, but comprised strips just sealing the valve junctions. Because of the underlying valve morphology these strips, or *fillets*, not only have a strongly crescentic cross-section, but also generally have a fine *inter-valve ridge*, being clay pressed into the inevitable groove at the valve junction (Plate 3.4; Curle 1932–3, 117). Eight examples of inter-valve ridges were noted. Side fillets have not often been explicitly identified, but were noted in the Middle Bronze Age assemblage from Grimes Graves (Needham 1991b, 154).

Prior to starting to apply wrap, the metalworker needed to be sure that the two valves (and any core, where this was appropriate) were correctly located and would remain thus during the investment with outer wrap. This was achieved by binding the already dried valves with thong or cord. The bindings therefore leave impressions in the innermost surface of the outer wrap; such impressions have often been observed in earlier studies and 22 examples have been listed for the Springfield assemblage; only four are from Deposit 2. Where alignment relative to the long axis of the mould could be established, the great majority were seen to run diagonally, which is to be expected of a single 'string' being wound helically round a long object. Of more interest is the fact that the bindings were evidently made of more than one material; seven impressions are well enough preserved to show longitudinal fibre-like striations, suggestive of reeds or some other fibrous plant material (Plate 3.4). In addition to those shown in the photo, at least one (fragment 504) and possibly three others (512, 513, 1904) are impressions of twisted cord/string, and others are fairly deep, square-profiled grooves more suggestive of cut leather thongs. Width variation, 1.5–5.5mm with an outlier of 10mm, presumably relates to this diversity. This suggests some opportunism in the material used for binding — perhaps use of whatever was to hand at the time.

In five cases charred fragments of binding were encountered *in situ* (fragments 512, 644, 1074, 1800,

1915). The survival of binding remains has not hitherto been noted on British moulds. Three samples were submitted for AMS dating but proved to yield insufficient carbon. Two others remain *in situ* (512, 1074; Plate 3.4).

One impression is entirely different in character; it occurs at this same structural interface on a fragment of fillet, but is unlike anything encountered by the authors before (fragment 533). It is a well-defined impression more or less square, 15mm across and up to 5mm deep. However, the impression extended as a narrow (4mm) rectangular profiled groove from one half of one side, this quickly being truncated at a fracture. An internal ridge projecting from this same side in fact makes it appear that this is the hook-like terminal of an object, the crooked end turning through two right angles. The object seems more likely to have been of carved wood than leather and, given its size and its perpendicular alignment to the fillet's curvature, it hardly looks like an accidental inclusion. Nevertheless, it is difficult to suggest a function, unless it was a temporary clamp for holding the valves; this would seem rather elaborate for the purpose.

The final technological feature to note is evidence for a splint. Long, rod-like voids have been observed in the body of inner valves since some of the earliest studies of clay moulds (*e.g.* Jarlshof — Curle 1933–4, 279; Irish examples — Hodges 1954, 64–5 fig. 2.1–2), but they are by no means a universal feature, even for long castings such as swords and spearheads for which the potential benefit of preventing distortion during drying is obvious. This is emphasised at Springfield, where no splint voids were found in the numerous sword valves, yet two occur instead in a single valve for a possible sickle blade (see above; segment 140). The two voids run parallel to either edge and thus are on converging alignments, although they do not meet (Fig. 3.6). If the object to be cast is correctly identified as a sickle, it is curious that such stabilising was required for such a relatively short blade, especially since the fabric of this valve is of normal refractory quality thereby preventing undue shrinkage and distortion. It is possible, perhaps, that this is merely the tip of a much larger casting of unrecognised type. There is also a possible splint void in fragment 115, but this is enigmatic since it is a fragment of wrap; the void is slightly curved, runs along a break for 37mm, is 4mm deep and at least 8mm wide.

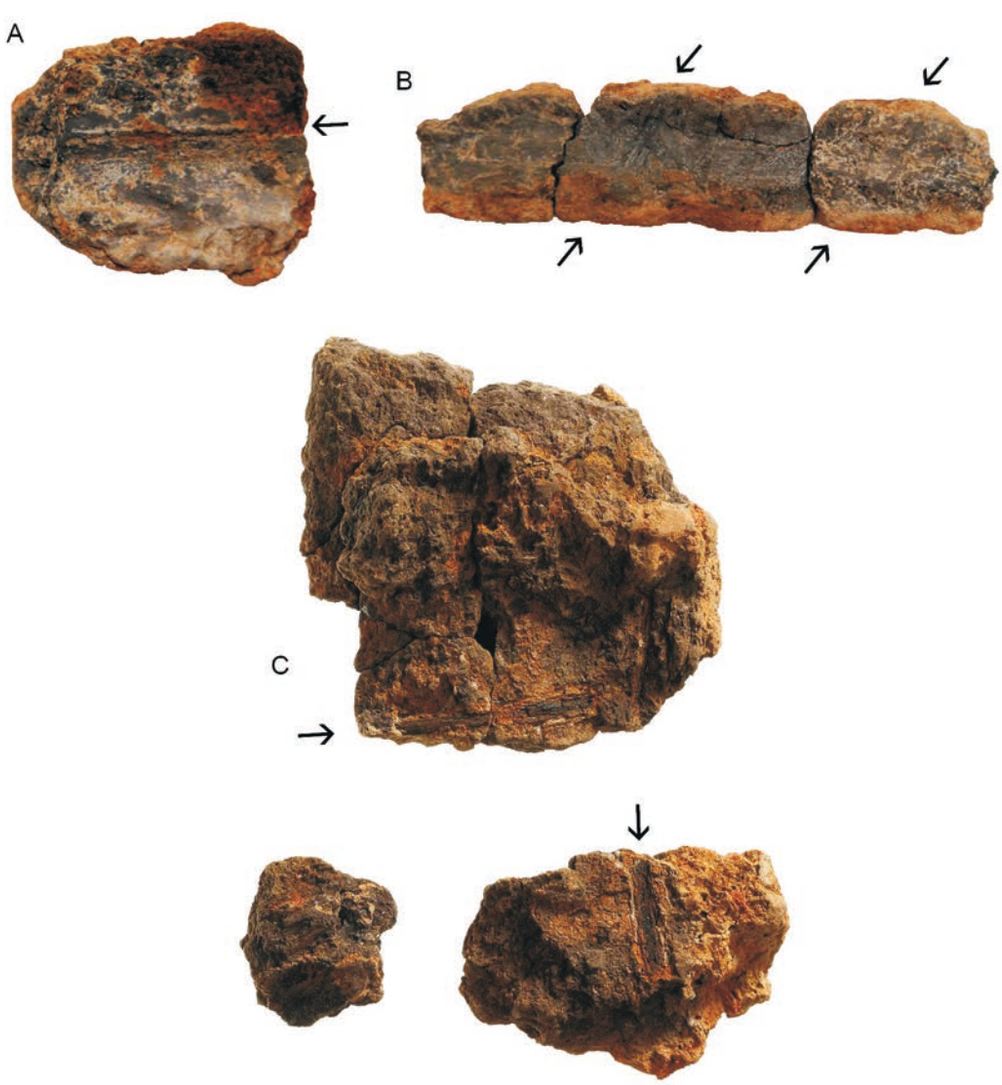


Plate 3.4 Fragments with selected technological features: a) inter-valve ridge (fr 93); b) organic binding impressions (fr 6/22/254); c) charred binding remnant (fr 1074)

More incidental features are a probable seed impression (fragment 780) and two longitudinal furrows (widths 3.5 and 4.5mm) along the back of valves close to an edge (fragments 190, 618).

Pouring gates

The gate provides a funnel at the top of the inner valves to facilitate the pouring of the molten metal. It needed to have a much wider mouth than the entry point to the matrix void (in this case the hilt finials of the swords). The funnel also acted as a reservoir to ensure that the mould would fill after the small amount of contraction that came with cooling. The gate can be achieved in two main ways, either integral, being extensions of the valves themselves beyond the point at which the matrix ended, or as a free-standing collar. The latter would be moulded onto the preformed and bound inner valves, its under-surface thus taking up the shape of their top edges. It would then have been removed, dried and probably fired, before being re-seated and held in place by the subsequent envelopes of outer wrap. Examples are known in Bronze Age assemblages such as Jarlshof, Shetland (Curle 1932–3, 120 fig. 30; Hamilton 1956, 28 fig. 14) and Holborough, Kent (Needham forthcoming).

Six gate portions have been identified in the assemblage, four being illustrated (Fig. 3.6). None are complete or near complete, but the collar type is implied by intact tops of moulds on segments 63, 67, 73, 76, 78; some of these extend for up to several millimetres beyond where the 'fishtail' tang would terminate, but this is insufficient depth for the casting jet that would be required and a non-integral gate is implied. Further support might come from a gate fragment (1702) which actually retains an asymmetrically concave basal 'seat', evidently created when it was moulded against a rounded rim, but it is rather shallow overall (max. internal depth 13mm). It is possible it was added to an already formed gate that was thought at risk of having an insufficient reservoir. On the other hand, one side of fragment 126 (left-hand; Fig. 3.6) may be a contact face; likewise fragment 1833. If these features are true, integral gates would appear to have been used as well.

The interior funnel of fragment 126 bears two rather crudely defined vertical furrows; it is not thought these would have any functional benefit, but they would not interfere with the casting operation and are presumably incidental. The other internal faces, of which only small portions survive, are unbroken curves or with one weak angle (77). The precise form of the rim of the gate fragments varies from roughly flattened to rounded or tapered. There was no need for a specific rim form and the final shaping sometimes produced irregular lips of clay along outer or inner edges (fragments 126, 1791).

Crucibles

Early in the laboratory excavation of Deposit 1 some fragments of crucible emerged and it seemed likely that this would be a recurrent if minor component of the assemblage. After full excavation of the two Deposits, however, relatively few unequivocal crucible sherds had been identified. A few fragments initially and tentatively identified as crucible were later re-identified as other refractories. This left just eleven sherds securely identified on the basis of fabric, with support from morphology where this was evident. Of these, the five largest join up to form two segments, which themselves may join together and are almost certainly from the same vessel — Crucible 1. The remaining six sherds are all smaller with a maximum weight of less than 10g; fabric and colour characteristics would certainly allow these to be small fragments of the same crucible. Indeed, three fragments (416, 495, 772) also show the transition from pale grey to more orange that is a feature of Crucible 1 (see below). Nine more fragments, again all less than 10g, are listed as possible crucible sherds. One possible crucible fragment (569) is, however, rather different on account of its greater density; it is moderately large (wt 55g) with rather rounded edges. None of this material, certain or possible, comes from Deposit 2.

Crucible 1, as reconstructed (Fig. 3.6), is represented by between 40 and 50% of the rim including the sides of the pouring lip, but not its end. However, much of the central bowl is lacking, so overall representation is much less, around 25%. The rim is somewhat flattened in places, though not neatly squared; it varies in thickness from 7 to 14mm, generally thickening away from the pouring lip. Reconstituting the fragments in order to assess rim line and angle is tricky, but it appears that the rim could not have fallen in a single plane; instead, it must have risen up significantly to a point several centimetres behind the lip, probably on both sides. Raised stretches of rim in this position have been noted at Mucking North Ring (Needham 1988, 22 no. 5) and, more subtly, at Dainton (Needham 1980a, fig. 5b). The orientation would need to be such that molten metal in the bowl would not run out through the lip unless the vessel was tipped, but the raised stretches of wall would ensure no spillage over the rim once pouring was in progress. The best-fit alignments suggest that the walls were vertical to slightly incurved close to the lip, but more out-curved towards the widest point and thus presumably around the rest of the bowl. There is a subtle crease running round the bowl internally (seen in frs 250 and 380); this does not appear to have run round a contour but instead describes a gentle swag between pouring lip and the point of maximum width.

The overall reconstruction is of a rather shallow vessel less deep than half the maximum width (estimated width 150–160mm); thus it would have approximated to less than a hemisphere, but actually was strongly pear-shaped comparable to that at the Breiddin (Tylecote and Biek 1991, 148 fig. 60). If metal had been allowed to solidify *in situ*, the ingot formed would thus be similar to the example in the Berwick-on-Tweed hoard, Northumberland (Needham *et al.* 2007, no. 36). Estimating the maximum capacity before metal flowed out of the lip can only be very approximate; the ingot formed could have been about 120mm diameter and up to 25mm thick in the middle. This ingot would be a little larger than the Berwick-on-Tweed one, which weighs 758g, so the maximum melt in the Springfield crucible could easily have been sufficient to cast a sword (Needham 1980a, 207 table 2).

The pouring lip is unusually deep and wide (*c.* 25 x 30mm), with a rectangular profile viewed end-on. This would have facilitated rapid pouring of the melt, but it would have been essential for the pouring gate on the mould to have been at least as wide. The lip itself is missing, but it is clear that the body of the vessel thickened rapidly inwards along the axial line, much more so than the walls to left and right. The maximum extant thickness is 24mm (fragment 240).

The basic fabric of the crucible is sandy and it is highly fired to a pale grey colour. There are many fine voids from burnt out material and fine fissures have begun to develop especially towards the pouring lip, presumably due to prolonged thermal stress. Much of the thick body is oxidised to an orange colour towards the exterior. This is curious given it is normally assumed that the crucible would have been placed under a charge of charcoal and top-heated in order to raise the contents to the high temperature required. Parts of the underside of the body have fractured away and, since this seemed to coincide with the colour junction (pale grey to orange), consideration was given to the possibility that this had spalled away during the last melting and that some raw clay had quickly been applied in an oxidising environment (*i.e.* once removed from the charge) in order to hold the vessel together for long enough to pour its contents. However, closer scrutiny suggests the coincidence of fracture and colour change is not perfect and where the orange exterior survives there is not an obvious boundary to the grey interior. On balance, therefore, it seems most likely the partial oxidisation developed in the furnace; this implies that there was a superfluity of oxygen being supplied to the underside of the vessel, presumably this is where the forced draught from bellows was directed by means of a clay nozzle (tuyère) with charcoal all round and above the vessel ensuring a reducing environment everywhere except on the underside.

The interior surface of Crucible 1 has sizable areas covered with a thin slip of clay between 1 and 4mm thick, the thickest tending to be over the slight internal angle. On fragment 240 the layer seems to feather out towards the rim, but on 250 it extends over the rim top and covers 60% of the extant exterior. This happens to a lesser extent on fragment 272. They would seem to be remnants of an originally continuous layer which has flaked away to a variable degree; the interior coverage varies between 0 and 90% for individual sherds. Since it was not well bonded to the vessel body, flaking could have occurred at various stages after the last use. Possible impregnation from soil makes it difficult to be sure, but the colour of the slip seems to be a buffer grey than the rather bluish pale grey of the vessel.

Slips have been noted on Bronze Age crucibles a number of times (Dainton, Bestwall Quarry, Nursling, Jarlshof, Holborough, Runnymede, Cranford Lane, Beeston Castle and Potterne — see Table 3.7 for references). They are interpreted as re-linings to extend the use-life of a vessel whose surface is beginning to deteriorate to the point it might put unwanted inclusions into the bronze melt. There is certainly evidence on the Springfield crucible, as on others, for thin slaggy deposits trapped in the surface beneath the re-lining; these show that the concealed surface had previously had contact with molten metal. In addition to the thin slaggy crust, the original surface shows frequent discoloration from metal — pallid green and purplish hues and occasional tiny green spots — whereas such discoloration had not yet developed on the new surface.

Copper/alloy object

One copper/alloy fragment was found within Deposit 1. Its maximum dimension is 18.2mm and weight, 3.1g. It is broken on three sides, but the fourth (10mm long) appears to be original and has a fairly thick rounded profile which thickens gradually towards the interior (maximum surviving, 7mm). Although little of the faces survive, they appear to present a plano-convex form which cannot be reconciled with any cast implement type and is undoubtedly some from of ingot or excess metal cooled in a shallow bowl such as a crucible.

Analysis of sherd size and abrasion

Given the fact the outer wrap was generally much more crumbly than the material of the inner valves, abrasion analysis was limited to the latter.

Abrasion of the edges and surfaces of valves were classified into five simple categories:

1 – virtually pristine
2 – minor damage
3 – medium damage
4 – major damage
5 – almost complete abrasion

Relatively few sherds were assigned to categories 1 or 5 and these categories were therefore combined with 2 and 4 respectively for all further consideration. It is notable that, despite considerable loss of surface detail, even the most damaged fragments were not abraded to the extent that the broken edges were wholly rounded. This suggests that the catalogued material had not been exposed on open ground for any great length of time; however, more comminuted and diffuse material was not included in the analysis.

During study, we were not conscious of any difference in the condition of fragments from the separate locations. However, analysis shows that while approximately 15% of fragments in Deposit 1 had suffered only minor damage, very few of the fragments from Deposit 2 were in such good condition. The reasons for this are not clear but may include more adverse burial conditions in Deposit 2 and, to a lesser extent, the need for overnight soaking to facilitate the excavation of Blocks Y and Z. Given that the large Blocks V and Y provided both the largest numbers and most spatial detail for Deposits 1 and 2 respectively, further analysis was limited to these. Where multiple fragments were held under the same number, those which joined were treated as one fragment and those which did not were kept separate in the statistics.

Although all the major levels within Block V contained fragments in all states of abrasion, the application of a simple Chi-squared test with 5 % significance levels showed a clear and statistically significant difference between the distributions of the states of abrasion within the upper and lower parts of the deposit (defined respectively as the top three and bottom four planned layers). The lower levels contained a significantly higher proportion of more damaged fragments than the upper part. The virtual absence of the 'minor damage' category within Block Y effectively reduced analysis to two categories: 'medium' and 'major' damage. Although the results were similar to those for Block V, the perceived bias towards greater damage within the lower layers proved not to be statistically significant.

A similar approach was taken to investigate whether there were any changes in fragment size spectra with depth within Blocks V and Y. Weight was chosen as the variable that would most closely reflect the relative size of fragments. The overall distributions were similar for the two blocks, both being skewed heavily towards small size with a long 'tail' representing larger pieces. However,

while Block V had a pronounced bias towards the smallest category, less than 5g, the modal distribution for Block Y *en masse* clearly lay between 5 and 10g. However, Block Y was not internally consistent in this respect: a bias towards very small pieces in the lower levels is at variance with the 5–10g modal value in the higher levels; the difference is statistically significant. Paradoxically, the lower levels also had a higher proportion of larger pieces, greater than 10g; although this difference was found not to be statistically significant, it tends to reinforce that there was some genuine variation in size spectrum with depth in Deposit 2. The same analysis for Block V produced similar trends, but nothing statistically significant.

Analysis of conjoin patterns and other spatial information
(Tables 3.4–3.5)

Deposit 1
Any spatial analysis of Deposit 1 is hampered by the fact that approximately half was lifted as clods without locational information. Nevertheless, some consideration is worthwhile. The bags of clods (A-U, W) contained varying amounts of refractory debris and some will have had very limited prospects for cross-links; it is believed the bags represent localised groups in the ground. However, as many as 37 of the conjoins found cross between bags (only one cross-link, such as A to R, was counted per reconstructed segment if there were more than one fragment from either of those bags). Cross-links involve as many as 17 different bags with the frequencies shown in Table 3.4. Eight bags have 5 or more cross-links and amongst these A, D, E, G, R and T have particularly strong cross-links to one another — between 5 and 6 in each case.

The number of cross-links may simply be a product of this material all having been in close juxtaposition, but given that much of the bagged material must have lain immediately alongside block V, it is surprising that only four of the 30 defined segments, plus crucible 1, involve cross-joins between the bags and the whole of lifted block V (a total of 6 cross-links). Those four segments and the crucible only gave links to four bags (A, B, J, M) and in two cases (A, M) only a single fragment was conjoined.

The explanation may lie in the distributions found within V itself. The lifted soil block was 1.48 by 0.46m at maximum with a wavy 'edge' away from the long-section; most of this soil yielded refractory material, albeit in varying density. Eleven mould segments have multiple fragments (between 2 and 5) from that block and in most cases their locations are close together (Table 3.5). Only four segments include fragments over 0.2m apart, the maximum being 0.38m. One fragment of Crucible 1 (fr 380) is, however, more widely separated (total spread 0.73m) although the remaining three sherds in V are within 0.17m of one another. With the exception of fr 380, these distances seem small given the block was almost 1.5m long, even allowing for the fact that the refractory material was not evenly distributed through the block (the biggest concentration was in the southern half, towards the butt end). If this pattern extended across the deposit, it is possible that the clods in bags B, J and M were amongst those closest to the long section and much of the other material, especially that in bags A, D, E, G, R and T, was further away (only a single fragment in segment 49 linked A to V).

When excavation began on block V, the micro-stratigraphy of fragments was seen to be important to establishing whether it had formed by sequential accumulation. Completion of excavation confirmed not only that the total deposit had a rather limited thickness (as above), but also that there were no obvious lenses, other than localised ones formed by small groups of fragments. Clusters were, however, juxtaposed with tilted fragments, sometimes so strongly tilted that their projected depth represented a significant part of the full depth of the deposit at that point. Moreover, the tilt lines of fragments long enough to show inclination were not all in the same direction; there are instances of opposing inclinations within a few centimetres of one another. These observations all point to a lack of time depth in the Deposit and are potentially reinforced by the fact that three mould segments with multiple fragments from V, along with Crucible 1, are represented in at least three of the planned 'levels'. If there was any incremental accretion to the deposit over time, it must have been in the form of laterally accumulating dumps.

Although some conjoining fragments were 'articulated' in the ground and presumably broken *in situ*, all others, even when only separated by a short distance, must be explained in other ways. One theoretical possibility is that limited distributions within the overall spread were caused by a series of specific discards of material direct from post-cast breakage of the moulds, each discard being focussed on a different spot. However, since there is only partial representation of all the mould valves, sometimes very little being present, one would have to suggest that only selected pieces were being discarded in the ditch, the rest going elsewhere. Any more incidental passage of mould fragments into the ditch (for example, through the gross reworking of surface refuse), while potentially explaining the limited and variable percentage presences of individual moulds, is less easy to reconcile with either the conjoin distributions observed or the fact that the total deposit is dense with rather abrupt limits.

Perhaps the most likely explanation for the patterns observed lies in the mode of transfer of the debris from a source location to the ditch. If the conjoined segments had started either as intact large portions or in tight clusters within, say, a primary debris heap, then it is possible that piecemeal shovelling to transfer material to the ditch resulted in the retention of the original spatial pattern in just slightly more dispersed form. One possibility is that some of the conjoins found might actually have still been joined together in larger mould fragments in the source deposit; in the process of transfer they were becoming more fragmented, but the fragments were not generally being dispersed widely within their new context in the ditch. Alternatively, if the fragments of a given mould were already at the excavated size in the source deposit, they were evidently partially clustered there and not thoroughly mixed with other material during the process of transfer. Either or both of these patterns could easily arise if the whole ditch deposit was made up of a number of bags, baskets or shovelfuls of debris brought from the source deposit.

Bag	*A*	*B*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*L*	*M*	*P*	*Q*	*R*	*S*	*T*	*W*
No of cross-links	9	3	8	7	1	5	4	7	7	2	2	2	2	6	3	5	1

Table 3.4 Occurrence of cross-links (within reconstructed mould segments) for Deposit 1

Deposit 2

Deposit 2 comprises a major concentration (Y1/Y2) with maximum dimensions of 1.85 x 1.2m, then a gap of 0.85m before a lesser concentration (Z) of approximately 0.6 x 0.35m. The interruption of the modern tank trap means we cannot know whether the latter was originally continuous with the third spread of refractories in context 9119; this covered approximately 0.30 x 0.25m. None of these sub-deposits had much thickness. Although the grid strings for Y1 and Y2 were at different levels it was possible to determine the approximate difference at the join as being 15mm. Depths for Y1 were reduced by 15mm to compensate and enable analysis of the deposit as a whole. The vast majority of fragments in block Y were at depths between 80 and 150mm below the grid strings, with outliers as little as 60mm or as much as 180mm beneath. The underlying pottery (frs 1981–1983) was deeper still, extending down to 245mm. The main range of 70mm is not necessarily the average thickness since at any one point the top and bottom of the deposit will have tended to be more restricted. Plotting the data according to level indicates that the uppermost outliers lay to one side of the deposit and the lowermost to the other, but that the three main levels of deposit covered much the same area. Plotting the X and Y co-ordinates against depth indicates that the deposit sloped upwards from grid point 200/600 to 1200/1200 and that the average depth was probably closer to 50mm. The inclination of the dip was only gentle and it should be borne in mind that the string grid may not have been exactly horizontal relative to the *in situ* orientation. The modest number of recorded depths for block Z range between 78 and 121mm with occasional outliers between 69 and 139mm; those fragments essentially formed a single lens.

The number of valve segments involving joins is much fewer for Deposit 2, just 13 compared with 30. Most of these link fragments distributed within block Y with just a single example (segment 97) providing a link between Y and Z. This is not entirely surprising given that block Y contained much the majority of material. The other small group from context 9119 was freed from soil too late to be included in the conjoin search.

As with Deposit 1, the maximum spread of conjoining fragments is most frequently less than 0.20m (8 of 13; Table 3.5). However, the distances go up to a higher limit than for Deposit 1, which was restricted by the 1.5m length of the recorded block. Most extreme is segment 97 which includes 3 fragments in the detached sub-deposit Z, an isolated fragment from in between (Y7), and one from the southern half of block Y, giving a full span of approximately 2.5m. The next greatest distance is almost 1m between the two fragments constituting segment 109, then 0.5m for four in segment 106. Given differences in the level of recording possible for Deposits 1 and 2 as well as their different total extents, it is hard to attribute much significance to these greater spreads in Deposit 2. However, segment 97 unequivocally establishes a link between the main concentration represented by block Y and the detached sub-group, Z, just to the north; they must have had something in common in terms of source material, implying that they probably represent a single brief phase of deposition. It is possible that the small gap between was not deliberate.

Vertical differences between joining fragments were consistently small, in ten cases (one in block Z) being less than 23mm, with two others at 33 and 35mm. Although a much smaller range than the full depth range cited above for block Y, it is not known how these relate to deposit depths locally.

Minimum numbers of moulds

(Table 3.6)

As with any fragmented remains, a realistic estimate of the number of complete objects represented has to be based on the repetition of distinctive components. The figures presented in Table 3.6 exclude very small parts of the

Deposit 1			*Deposit 2*		
Segment (& no of fragments)	*Nearest distances (cm)*	*Maximum spread (cm)*	*Segment (& no of fragments)*	*Nearest distances (cm)*	*Maximum spread (cm)*
2 (5)	1, 2, 3, 7	13	87 (2)	44	44
8 (2)	0	0	88 (2)	18	18
15 (2)	2.2	2.2	89 (2)	7	7
17 (2)	21	21	97 (5)	5, 12, 60, 200	250
18 (3)	8, 23	31	103 (2)	32	32
27 (2)	29	29	105 (2)	8	8
31 (4)	7, 12, 13	19	106 (4)	25, 26, 28	50
35 (2)	38	38	107 (2)	15	15
50 (2)	8	8	108 (2)	18	18
56 (2)	4.5	4.5	109 (2)	99	99
57 (3)	15, 20	34	114 (2)	20	20
Crucible 1	7, 17, 56	73	115 (2)	2	2
-			135 (2)	8	8

Table 3.5 Distances between joining fragments (taken to centre points of each)

component in question, but otherwise count both fully and partially represented examples (see segment catalogue and illustrations for detail). Hence these are not necessarily bare minimum figures. For simplicity we have also given a combined figure for both confident and hesitant identifications to the relevant component. We have, however, excluded segment 60, because it is uncertain whether it is finial or shoulder, and segment 88, because it may not be for a sword at all.

Although there is a fairly wide range of 'minimum numbers' for the Deposits individually (from 5 to 18) or combined (from 13 to 29), such variability would not be out of keeping with assemblages that were randomly selected with respect to the part of the mould represented. Moreover, there is no obvious bias towards one or other end of the sword. The combined figure for finials is low, but this part of the mould might be vulnerable to preferential destruction because of its proximity to the gate receiving the full impact of the molten metal. The figure for 'neck of blade' is also low, in this case possibly due to the difficulty of identifying this part of the blade which in isolation depends on recognising subtle waisting at the minimum width. The high figure for shoulders might conceivably be due to some being just one side of the shoulders (*cf* the three blade parts listed, for which both sides are always present), hence there is a risk of double counting two shoulders that actually belonged to a single valve. Left/right-side duplication is also theoretically possible for the grip and finials, but less likely because of the narrowness of these features.

Rather than focussing on any individual figure as a strict minimum number, we are inclined to use the whole set of figures, making allowance for the cautionary points just made, to suggest that the moulds in the whole refractory assemblage represent at least 20 valves and therefore at least 10 mould assemblies for casting swords. This could be a significant underestimate given our impression of valve representation (above). It is of some interest that the balance between the two Deposits seems remarkably even. Aside from the fact that virtually all of the valves are identified as for sword casting, this is the first good evidence to suggest an element of more careful selection in the choice of fragments for either Deposit. This need not necessarily imply wholesale selection, for we should not rule out the superimposition of a selected group upon unselected 'background' debris. The occurrence of crucible fragments (possibly all from one vessel) and a probable sickle mould in Deposit 1 alone does not point either way with regard to selection.

The number of catalogued segments involving the blade without any of the components listed in Table 3.6 is 25 for Deposit 1 and 14 for Deposit 2. Little can be drawn from these figures since the cataloguing of blade fragments was more restricted than for the more distinctive features and there are many uncatalogued fragments, albeit generally small, which would bolster the representation of blades generally. It is worth noting though that the widest part of the blade is almost certainly represented in a number of segments.

Component of sword	*Deposit 1*	*Deposit 2*	*Combined*
Finial	5	8	13
Grip	10	8	18
Shoulder	11	18	29
Ricasso (-zone)	8	8	16
Neck of blade	6	8	14
Near blade tip	11	10	21
Blade tip	10	10	20

Table 3.6 Numbers of segments containing all or part of a range of distinctive sword components. (Figures combine certain and less certain attribution to the component)

Conclusions

Fragment representation and formation process

Given the size of the assemblages recovered from the two deposits, the number of conjoins found seems modest. In part this may be due to how easily refractory material abrades or erodes, resulting in the rapid loss of detailed correspondence between originally joining edges. Undoubtedly many more fragments than have been included in the reconstructed segments belonged to common valves. However, as explained above, the similarity of valve fabric and features across the assemblage forces us to take a minimal approach to valve reconstruction. Overall, therefore, it is extremely difficult to quantify the proportions of any given valve that might be present in the assemblages. Even allowing for these methodological problems, however, we do not believe that the deposits originally contained the fragmented remains of a series of complete moulds; on the contrary, our impression is that many individual valves are represented only partially. Key support comes from Crucible 1, the distinctive character of which allows us to be sure that only a minor portion was present, or survived, in Deposit 1. This conclusion immediately suggests that the debris is not the result of the primary discard of the debris of metal casting directly into the ditch butts. The patterns seen in the abrasion analysis are also not obviously reconcilable with a straightforward primary discard scenario. Either the debris was being discarded simultaneously in other locations as well as the ditches, or the partial representation of objects is due to a process of re-deposition of a fortuitous selection of fragments which had initially accumulated elsewhere.

The two Deposits present a degree of symmetry. Most obvious is their placement low in the ditch butts, in the primary silts of the recut ditch, alongside the two main entranceways, in both cases north of the entrance. They also had a similar thickness, broadly similar quantities of material, similar gross assemblage condition (abrasion and size), comparable object type composition (overwhelming preponderance of moulds for swords) and, finally, they represent similar numbers of cast objects. Even the refuse histories of the two Deposits look similar. In both cases it can be argued that they originated in dumps which had weathered long enough to give a statistical difference in abrasion from top to bottom, and that in the piecemeal transferral of this material to the ditch bases, this abrasion difference was effectively inverted, although in the process the vertical distinctions may have become more diffuse. The main differences are, firstly, that Deposit 1 contained some crucible fragments (all one vessel?), while Deposit 2 was rather more widely spread along the length of its ditch segment. Nevertheless, overall they give the impression of being orchestrated deposits meant to be read as comparable; either they reflect an

important duality in which both halves needed to be seen to be equally weighted, or they were sequential and it was felt important that the second event followed closely the principles established in the first. The lack of cross-joins between the two Deposits certainly allows the possibility of a time lapse, but an alternative explanation is that these were contributions from different metalworking groups.

Production technology

The basic technology employed by the Springfield metalworkers is that now familiar for the Middle to Late Bronze Age in Britain and more widely across Europe. Moulds were formed of fine clay pressed sequentially against the two faces of a pattern for the object to be cast, thereby forming two complementary valves (*e.g.* Hodges 1954). There is only negative evidence at Springfield for the nature of the pattern; none of the blade matrices shows any evidence for a prepared edge bevel demonstrating that finished bronze swords themselves were not being used. More likely therefore the patterns were carved from wood, examples of which survive in a bog find from Tobermore, Co Derry (Hodges 1954, 67 fig. 3). The absence of any grain impressions in the matrix surfaces need not be an obstacle to this interpretation since a desire to minimise the amount of post-cast working of the bronze might encourage the metalworkers to create highly sanded wood patterns. Wood-grain pattern has only very occasionally been noted on mould matrices (Curle 1932–3, 118; Curle 1933–4, 279) and is said to been transferred to a finished bronze sword from Ireland (Jope 1953, 39).

While splints are sometimes used to give added support to valves, especially long valves, they have only occasionally been noted in British mould assemblages (*e.g.* Nursling, Jarlshof) and the only example at Springfield is, curiously, in a valve for a sickle rather than a longer casting. The implication is that the careful selection, drying and pre-firing of the clay for the valves precluded distortion to a sufficient extent that the metalworkers saw no advantage in incorporating splints.

After pressing the first valve against the pattern, its surrounding edges needed to be trimmed more or less to the medial line in cross-section to form a contact face which would be met by the second-made valve. Trimming does not appear to have been done in any systematic way, instead the slope and curvature of the contact faces is rather variable. Moreover, along the thicker edges of the hilt, shoulders and ricasso it seems that the plane of contact was often offset from the medial line. These asymmetries do not matter in practice, providing that no clay is allowed to overlap the front of the pattern, since this would risk damage to the valve as the pattern was extracted. But it is essential to make allowances for these asymmetries when assessing the cross-sectional forms of the bronze products (Needham 1980a, 182–3). No registration devices between valves, such as are familiar on bronze and some stone moulds, have been identified at Springfield, but actually there would be less need for them if the contact faces were irregular, for any idiosyncratic undulations would aid registration. So too would any slight lip at the edge of second-made valves lapping around the first-made one.

Once the valves were formed and re-assembled without the pattern in place, they were bound together using a variety of binding types — leather thong, cord and reed-like plants — presumably reflecting what material was to hand at any given time. The binding impressions occur in the morphologically undiagnostic outer wrap and cannot often be associated with the specific types cast; this inhibits finding any connection between binding material and particular metalworking groups. The binding was always applied in helical fashion, as is almost invariably the case. Having been bound, the gate would need to be formed unless already integral with the valves. Although the evidence is not strong, there are indications that both integral gates and collar gates were present amongst this assemblage, but again it is not clear whether this relates to distinct metalworking groups. The swords were consistently cast from the hilt end; this had the advantage of giving a rather larger cross-section of aperture than at the tip, thus ensuring quicker flow of the rapidly cooling metal. With the gate in place the whole could be enveloped in wrap. There is evidence that this was sometimes built up in layers starting with fillets along the valve junctions. Both drying and the escape of steam during pre-heating and casting were also assisted by the fabric, which is usually fairly crumbly and often has many small vesicules from burnt out organic 'chaff'.

After pouring the molten metal and allowing it to cool, the mould assembly had to be broken open to release the bronze casting. This invariably resulted in much fragmentation, though individual fragments could vary considerably in size. The wrap material mostly split away from the back of the valves, there having been poor adhesion at this boundary. The bindings would have been incinerated; in theory one might expect most to be carbonised in this trapped environment, yet only vestigial remains were found as carbonised matter (and this is the first time they have been noted). It is likely that such fragile carbonised remains would simply disintegrate once exposed to weathering agents.

A range of post-cast working remained to be done on the swords. The casting jet, or sprue, needed to be snapped off the butt end; this would be made easier by the fact that hilt's tang had a thin profile, even if the jet expanded abruptly beyond it. Jet removal might not result in a clean line, and it is clear from the bronze swords themselves that it was not considered vital to make the butt neat, presumably because it was to become concealed under hilt-plates and pommel-piece. All of the sides would need to be fettled, that is the removal of fine webs of metal which had seeped into the inter-valve cracks. The thick sides of the hilt, shoulders and ricassos would then be ground smooth as either flat or convex surfaces. Fine details such as the crispness of angles at grip/shoulder junction or within the ricasso notch could thereby be enhanced. In contrast, the blade edges below the ricassos would need to be sharpened, in the process ironing out any irregularities in their line (extant finished swords have very regular outlines), and forging neat backing bevels; the Springfield matrices show that edge bevels were produced entirely in the post-cast working. This required extensive and skilful grinding and hammering, as well as some annealing (reheating to alter the internal metal structure).

The Springfield moulds have clear features designed to form, or start, the emplacements for rivets. Perforations may not have been complete in the casting, but the forming of dimples and furrows for holes and slots respectively left a thinner web of metal and made the task of punching through considerably easier. If largely formed in casting,

the perforations still might need reaming out to remove any obstructions to the passage of the rivets; the exception to this would be where dowels were used to form the rivets as seen, exceptionally, at Norton Fitzwarren (Needham 1989). The hilt grip zone between the flanges might also need tidying up; although destined to be covered by organic hilt-plates, undue irregularities could obstruct a snug fit. Finally, all the parts of the bronze casting due to remain exposed in the finished weapon — essentially the blade, but also the narrow sides of the hilt — would require a high finish for visual impact; any surface irregularities would need to be ground out and overall symmetry restored where this had not been maintained in production, followed by fine polishing.

Background and chronology

Despite the poor condition of much of the assemblage, it has been possible to glean a considerable amount of typological information from the valves with regard to the precise form of swords cast. One immediate observation is that there was no particular homogeneity in sword type and we need to explain this low level of standardisation. In general terms it has been possible to identify all the swords as one variant or another of the familiar Ewart sword of the eponymous metalworking stage, broadly dated to circa 1000–800 BC (Needham *et al.* 1997). However, this simple identification masks their position within a potentially complex evolution from Wilburton to Ewart swords (Colquhoun and Burgess 1988, 55–68); it would seem that the Springfield swords have an important place in this sequence alongside the Blackmoor hoard, with which we have found multiple connections.

That the Springfield swords are attributed to the Ewart end of the spectrum hangs primarily on their narrowly splayed shoulders. Yet it has been shown above that a few other critical features hark back more to the range of swords defined within the wider-splayed Wilburton series. The indications from both this assemblage and a few relevant hoards are that there was no simple, staged progression in form. Instead, it may be that certain metalworking schools were deviating from a presumed norm for early Wilburton weapons and producing more diversity in style. It is possible that the diversity seen in the Blackmoor hoard or the Springfield assemblage could stem from either rapid change or multiple parallel lines of deviation. Either scenario suggests a certain dynamism or heterogeneity in the styles of swords produced.

The second issue that must be addressed here is when this divergence occurred. Schemes of straightforward typological evolution would tend to see it as an intermediate, or transitional stage between the presumably pre-existing Wilburton style and the presumably succeeding Ewart style. A gross chronological succession from Wilburton to Ewart metalworking traditions cannot be doubted given the independent dating evidence published thus far, but there is room for much complexity in detail, especially when it comes to individual object types. The Blackmoor hoard itself does seem to be genuinely chronologically intermediate on the evidence of three radiocarbon dates, but other as yet unpublished dates on the comparable Waterden hoard, Norfolk (Colquhoun and Burgess 1988, pl 168F), might suggest that the process of diversification under discussion was under way earlier, perhaps contemporary with mainstream Wilburton metalworking.

Given these issues, the need for close dating of the Springfield deposits was cogent. Unfortunately rather few of the potential samples for radiocarbon dating proved viable; particularly disappointing was the failure of carbonised binding traces which would have been inextricably tied (in both senses) to the casting activity we wish to date. We are left with just a single date on charcoal from each of the refractory deposits and no conclusive evidence that they are not residual (SUERC-23732; -23952; Meadows *et al*., Chapter 4). Bayesian analysis of these dates in conjunction with all others representing the Late Bronze Age phase suggests a deposition date in the eleventh or tenth centuries BC (Meadows *et al.*, Fig. 4.6). This overlaps both a good part of the currency of Wilburton metalwork and that of Blackmoor metalwork (as currently understood; Needham *et al.* 1997). This is not inconsistent with an expected date in or close to the tenth century based on the typological links identified with swords of the Blackmoor stage.

Refractory assemblages of the Late Bronze Age and their significance

(Table 3.7)

The number of recognised groups of refractory debris has been steadily growing over the past thirty years. Despite this, few can be attributed to the Middle Bronze Age (just four sites to our knowledge) and we shall focus here on the much greater wealth of data from Late Bronze Age and earliest Iron Age assemblages in Britain (*c.* 1150–600 BC). At least 36 sites are known to the authors (Table 3.7), though many of these are as yet unpublished and there are doubtless others amongst the many recent developer-funded sites. Many groups, however, are rather scant with little diagnostic material from either the typological or technological points of view. Five yielded one or more crucible fragments, but no identified clay moulds (Table 3.7: Mile Oak, Aldermaston, Bramber, Carshalton, Burderop Down).

The survival of decent, analysable assemblages of refractories depends upon them finding their way quickly into a protective environment. Such is provided by sub-surface features which, once filled, ensure the cessation of exposure-related weathering and diminish massively the likelihood of gross physical reduction due to surface activities. This does, however, present us with a conundrum since the very contexts that preserve the most useful assemblages may also be those that are, in various possible ways, special cases. Where material reached a protective environment occasionally rather than habitually, the surviving debris could be a very partial record of metalworking activity on the site and therefore potentially very unrepresentative, representing just a brief snapshot of that activity. This makes it more difficult than for most other materials to judge what might be a 'typical' or representative body of refractory debris for a given situation. This problem would certainly be accentuated by any very deliberate selection of material to serve a ritual purpose, but it is a factor even where such deliberation is absent.

The best evidence to redress the potential imbalances caused by selective survival in features is likely ultimately to come from well preserved occupation or midden deposits which have incidentally but regularly incorporated debris from on-site metalworking and had limited subsequent reworking. Redress will depend on sites with a

Site	*Context*	*Types cast in clay moulds [min. no.]*	*Other refractory categories**	*References Comments*
Jarlshof, Shetland	Dwellings III and IVa, and middens in immediate environs	Sword hilt and blade, Ewart [?7] Socketed axe, faceted [8] Socketed gouge [1] Pin head, sunflower [1] ?Rod (?cire-perdue casting)	Crucible (re-lined) Gate Core	Curle 1932–3, 112–25; Curle 1933–4, 275 fig. 43, 276, 278–83 figs 46–49; Hamilton 1956, 18–29 fig. 14. Minimum numbers according to Curle 1932–3, 112–6.
Cladh Hallan, Outer Hebrides	Various occupation/midden deposits	Sword blade Spearhead, fillet-defined Spearhead, ivy blade Chape, tongue Round socket Socketed axe, complex moulding Socketed axe, standard moulding Knife Razor, bifid Sheet ornament, corrugated Pin shank Bracelet	Crucible Gate	Trevor Cowie – pers. comm. Provisional list prior to completion of study
Runnymede Bridge, Surrey	Various occupation/midden deposits	Razor, heeled bifid [1] Oval beaded socket, ?knife or sickle [1] Unidentifed objects	Crucible or furnace lining (re-linings)	Needham 1980b, 13 no 6; Needham 1991a, 151, 154 fig. 65 C1–5; Needham and Spence 1996, 184, 186 fig. 99 C32–33. Further unpublished material
Potterne, Wiltshire	Occupation/midden deposits	?Knife or weapon blade [1]	Crucible (re-linings) Gate	Bayley and Morris 2000. Moulds and gate from low stratigraphic positions. Crucibles from varied levels, some certainly earlier Iron Age.
Whitchurch, Warwickshire	Occupation/midden deposits	Spearhead	?Bowl-hearth linings, vitrified	Waddington and Sharples 2011, 53. Not fully studied
Breiddin, Powys	Various contexts including rampart core	?Sword blade [1] Round socket (grooved), ?spearhead [1] ?Pin shank [1] ?Socketed axe [1]	Crucible ?Core	Tylecote and Biek 1991. Some material unpublished
Traprain Law, Lothian	Various levels	Sword hilt and blade [1] Socketed axe, faceted [1] Spearhead, lunate [1] ?Socketed gouge mouth [1] 'Narrow blade'	Crucible	Cree and Curle 1921–2, 213–5 fig. 14, & passim; Burley 1955–6, 127, 153–4. Moulds of other periods represented – e.g. door-knob ferrule, pins.
Cullykhan, Aberdeenshire	Metalworking area beside a structure	Unidentified objects	Crucible	Greig 1972. May be Early Iron Age
Burderop Down, Wiltshire	Ploughsoil (Area B)	-	Crucible (?re-lined) Stone mould for socketed axe	Gingell 1992, 110–1 fig. 80.3. LBA by general association
Beeston Castle, Cheshire	Topsoil and other contexts. Scattered in Outer Ward and Outer Gateway of Medieval Castle	Knife or weapon blade [1] Unidentified object	Crucible (re-lining)	Howard 1993. Refractory fragments not necessarily all Bronze Age
Mile Oak, Sussex	Topsoil (trench K)	?Mould, unidentified object	Crucible	Russell 2002, 58–60. Probably LBA on basis of majority of pottery from trench K.
Stonea, Cambridgeshire	Topsoil	Round socket [1] ?Socketed axe, faceted [1]	?Crucible (from silt layer 862)	Needham 1996. EtIA pottery from layer with crucible.
Springfield, Essex	Ditch, towards base of fill in two discrete ditch butts beside main entranceways	*Deposit 1*: Sword [5] ?Sickle [1] *Deposit 2*: Sword [5]	*1:* Crucible (re-lining) Gate *2:* Gate	This report
Mucking North Ring, Essex	Ditch (various levels: 2, 4, 5, 6)	Knife/sword blade [1] Sickle/knife blade [1]	Crucible	Needham 1988. Ditch of ring-work.
Norton Fitzwarren, Somerset	Pit (F16; or ditch butt)	Sword hilt and blade, Ewart [1]		Ellis 1989, 6 fig. 3; Needham 1989. Pottery in pit.

Site	*Context*	*Types cast in clay moulds [min. no.]*	*Other refractory categories**	*References* *Comments*
Richard Lander School, Cornwall	Pit	Sword hilt, Wilburton [1] – single unopened mould		Needham in Gossip forthcoming. Pottery in pit.
South Hornchurch, Greater London (Essex)	Pit (4262)	Sword blade [1]		Guttmann and Last 2000, 336 fig. 14, 344–5 fig. 19. Pit lies within landscape of houses, field boundaries and enclosures
Shorncote Quarry, Gloucestershire	Pit (1251)	Socketed axe, ribbed class B [1] Unidentified object		Morris 1994. In upper fill of large pit or water-hole, possibly set within post enclosure with house a little to north.
Cotswold Community, Gloucestershire	Pit (18304)	Palstave, ?Late type [1] ?Palstave [1] Unidentified objects	Gate	Poole 2010, 143–51. Possible metalworking pit with burnt clay lining and other burnt debris in fill.
Highstead, Kent	Pit (B80)	Pin, disc-headed [6] Knife/weapon blade [1] Round socket [1]	?Core	Needham 2007c. Pottery in pit. Pit B80 lay outside enclosure B70, 5m west of entrance. A crucible came from an Iron Age pit (B214) well to south of B80.
Cranford Lane, Greater London	Pit (near entrance through ditch?)	?Sword ?Spearhead	Crucible	Mark Birley – pers. comm.
Bestwall Quarry, Dorset	Pit (F312)	Palstave, ?Late type [1] Socketed axe, ribbed class C [1]	Crucible (second fragment with 2-phase re-lining, from pit F375)	Needham and Woodward 2009. Pottery in pit. Pit within LBA settlement 3, Field G.
Church Lane, Nursling, Hampshire	Pit (8730; salvaged from quarry)	?Pin shank [1] Unidentified objects (published as channel-bladed spearhead on advice from Needham, but doubtful)	Crucible (re-lined)	Rees 1993, 36–7 fig. 10. Pottery in pit suggest LBA/EtIA. Evidence for splints.
Barleycroft, Cambridgeshire	Pit (F459)	?Spearhead blade [1] Knife/weapon blade [1] Unidentified object	Crucible	Chris Evans – pers.comm.
Maxey, Cambridgeshire	Pit (?)	Spearhead, plain pegged Spearhead, ?lunate Chape, tongue Round-socket mouth	Gate	Ian Meadows – pers. comm. (not fully studied)
Fimber, East Yorkshire (N Humberside)	Pit (apparently cut through bank of linear dyke system)	Sword hilt and blade, Wilburton [1] Chape, long-tongue [1] Socketed axe [1]	Core	Mortimer 1905, 188–9; Burgess 1968, 32 fig. 21.1, 63–4. (Further abraded material)
Sigwells, Somerset	Pit (at overlap of trenches VIIA and IV)	Spearhead, lunate [1] Chape, long-tongue [2] Ferrule, cylindrical [1] Palstave, ?Late type [1] Socketed axe, ribbed class C [2] Tang or bar-chisel [1]		Richard Tabor – pers.comm. Further finds of refractories from the site since this pit group
Aldermaston, Berkshire	Pits (F27, F85, F103)	?Moulds for unidentified objects	Crucible (from F27, F84, F85)	Bradley *et al* 1980, 244 fig. 20.1–5. Moulds not convincing from illustrations
Dainton, Devon	Pit, plus scatter (at least 9m across) on land surface around	Sword, ?Wilburton [2] Spearhead, channel-bladed [1] Spearhead, lunate [2] Ferrule, long cylindrical [2] Ring [1 mould for 2 castings]	Crucible (re-lined) ?Gate	Needham 1980a. Material outside pit small and amorphous. Pottery also in pit.
Halfhide Lane, Turnford, Hertfordshire	Pits and post holes in feature cluster	Sword hilt and blade, Ewart [2]	Crucible	Unpublished (British Museum). Pottery associated. Features include short façade with entranceway.

Site	*Context*	*Types cast in clay moulds [min. no.]*	*Other refractory categories**	*References Comments*
Holborough, Kent	Pits and post holes (total of 18) spread over at least 40m, but most from pit 335	Sword, Wilburton [4] Round socket [1] Axe blade, ?palstave [1] Socketed hammer/chisel [1] Thin tang or strip [1] Blade, spear or razor [1] Ring-handle, ?razor [1] Ring or ring-component [2] Ornamental disc, concentrically moulded [3] Unidentified objects [5]	Crucible (rim heightened) ?Collecting lining Gate	Needham forthcoming (Canterbury Archaeological Trust excavation)
Reading Business Park, Berkshire	Tree-throw hollow (680; Area 5)	Spearhead [1]		Moore and Jennings 1992, 22; Northover 1992
Greenfields (A120 site 28), Essex	Three lowest layers filling a pingo (1057)	Sword hilt and blade (amongst assemblage of over 500 fragments, >2kg)		Mepham 2007
Sandy Lane, Charlton Kings, Gloucestershire	Burnt mound site; specific context unknown	Spearhead, fillet-defined [1]		Chris Young – pers.comm. Identification by SB
Loanhead of Daviot, Grampian	Inner edge of enclosure of former burial site	Sword blade [1] ?Socket mouth [1]		Kilbride-Jones 1935–6, 290, 300 fig. 10C, 302–3
Bramber, Sussex	With or in proximity to bronze hoard	-	Crucible	Aldsworth *et al* 1981, 11
Huntsman's Quarry, Kemerton, Worcestershire	6 contexts	Assemblage of c.200 fragments		Ann Woodward – pers. comm.
Mucking South Rings, Essex	Unknown	?Chape, tongue [1] Unidentified object		Unpublished. (No systematic search of clay assemblage)
Aylesford, Kent	Unknown	Pin, disc-headed [1 valve for 3 pins]		Needham 2007c, 263. From Late Iron Age burial site, but presumed to be Bronze/Earliest Iron Age, as is some pottery.
Carshalton, Queen Mary's Hospital, Greater London	Unknown	-	?Crucible	Adkins and Needham 1985, 35 no 408. General association with LBA ring-work site.

* No attempt has been made here to enumerate as numbers of fragments or minimum numbers; the column simply denotes presence, and for crucibles also the occurrence of certain features. Outer wrap has not been listed since it is invariably present with inner valve, albeit in varying proportion.

Table 3.7 Late Bronze Age refractory assemblages from Britain discussed in the text (ordered by context type)

reasonable yield of refractory debris in order to overcome small-sample biases. An assemblage of reasonable size (*c.* 200 pieces) from Jarlshof, Shetland, came from a variety of contexts in and around two of the houses (Dwellings III and IVa), but it does not show an especially varied repertoire of objects cast: sword, socketed axe, socketed gouge and pin (Table 3.7 for references). A larger assemblage again recovered from a variety of occupation contexts at Cladh Hallan, Outer Hebrides, promises to represent a much larger range, being a mixture of weapons, weapon accoutrements, tools, toilet implements and ornaments (Trevor Cowie, pers. comm.). Persistent excavation of refuse deposits at Runnymede Bridge, Surrey, has also given rise to a modest sized assemblage with variety in object types. Other assemblages accumulated from varied occupation contexts include that from Breiddin, Powys, which yielded only small mould fragments with probable identifications to sword blades, spearhead socket, pin shank and socketed axe. There is a comparable range (more positive identifications) from deposits at Traprain Law, East Lothian, but elsewhere material identifiable as moulds can be minimal, abraded or ambiguous (*e.g.* Beeston Castle, Cheshire; Stonea, Cambridgeshire; Potterne, Wiltshire; Whitchurch, Warwickshire).

Refractories have normally come from features interpreted as pits, though occasionally post holes are also represented. Aside from Springfield, there is only one clear case of material from ditch deposits, at Mucking North Ring, although the Norton Fitzwarren feature may be a ditch butt. Object representation can be minimal: a minimum of one sword from each of Norton Fitzwarren, Somerset, Richard Lander School, Cornwall, South Hornchurch, Greater London, and Turnford, Hertfordshire; just a single socketed axe identifiable at Shorncote Quarry, Gloucestershire, or a single spearhead (from a tree-throw hollow) at Reading Business Park, Berkshire. Other pit groups have little more: Cotswold Community, Gloucestershire, with probably two palstaves represented and other poorly identified material; Highstead, Kent, with multiple moulds for pins, but only two other tentative types; Cranford Lane, Greater London, with possible sword and

spearhead represented; Bestwall Quarry, Dorset, with one socketed axe and one palstave; Nursling, Hampshire, with possible pin shank and uncertainly identified object; or Barleycroft, Cambridgeshire, with a thin-blade object and possible spearhead.

Against this (not exhaustive) background, it may only be chance that some sub-surface features yield more informative assemblages — both greater in quantity and representing a more diverse metalwork repertoire. Dainton, Devon, is perhaps the archetypal pit group in this country; it contained moulds for two swords, spearheads of two types, two ferrules and two rings. The site also illustrated graphically how dependent good refractory survival is on context — a large scatter of mould fragments on the surface surrounding the pit were highly abraded, offering no information on types cast or technology. A group from Maxey, Cambridgeshire, appears to have had the casting debris for two types of spearhead and long tongue chapes. This form of chape recurs at Fimber, North Humberside, alongside sword and socketed axe moulds, as well as more abraded material, and again at Sigwells, Somerset, associated with a well varied group: socketed axe, palstave, tang or bar-chisel, two types of spearhead and ferrule (further refractory material has been excavated from the site since this pit group — Richard Tabor, pers. comm.).

Last but by no means least, is Holborough, Kent. Here the metalworking assemblage comes, unusually, from as many as 18 cut features, although a single pit contained by far the largest group dominated by sword moulds. Other types represented are not always securely attributed to specific types, but are very diverse: socketed hammer or chisel, axe blade, a tang for a tool, tubular sockets, blade edge of razor or spearhead, ring-handle probably for razor, rings, concentrically-moulded ornaments and other possible ornamental plaques. This kind of range is only really matched at Cladh Hallan.

Some contexts are more individual: a burnt mound produced a spearhead mould at Sandy Lane, Gloucestershire, an Early Bronze Age enclosed cemetery yielded a Late Bronze Age sword mould at Loanhead of Daviot, Aberdeenshire, and a pingo was the repository of a large group of moulds for swords at Greenfields, Essex.

The Springfield assemblage makes an interesting contrast with these richer pit groups. Although a much greater quantity of metalworking debris survived, for once this has not resulted in diversity. Instead we have an extraordinarily limited range — effectively a single object type, the sword, with the potentially accidental inclusion of a part valve for a sickle. Swords are in fact one of the best represented types amongst identifiable mould fragments elsewhere and it is worth reviewing their incidence and associations. Of the sites reviewed, 12 have securely identified sword moulds. A further six have fragments that are insufficient to determine whether for the blades of swords or other long-blade implements such as rapiers, knives or sickles; these will not be considered further in this discussion.

In four of the twelve assemblages only sword fragments have been identified, but this is unsurprising because three may contain nothing more than parts of a single mould (Richard Lander School, Norton Fitzwarren, South Hornchurch); even the fourth (Turnford) has a minimum of just two moulds, both for swords. In all other cases where two or more different mould assemblies can be identified, they add types other than swords. These encompass a wide range of types and there are no obvious patterns of repetition other than might be expected of the metalwork repertoire of the period. While assemblages like that at Dainton might appear to represent the specialist production of weaponry and associated accoutrements, this is not obviously repeated at other sites, so 'specialisation' might be that of the particular casting episode(s) rather than of the metalworking group responsible. Associated types at Fimber were socketed axe and a long tongue chape, the latter an obvious accoutrement for the sword being cast. The chape association is repeated amongst the much more diverse occupation assemblage at Cladh Hallan, but no other sword-containing assemblages have chapes and, conversely, Maxey and Sigwells have chapes but no swords. The multiple-type assemblages involving swords seem, if anything, to include an eclectic mix of object classes, although some caution in interpretation is necessary for the multi-context assemblages which may conflate longer sequences of activity.

One possible exception to this pattern comes from the Greenfields site in Essex. A provisional report on a group of over 500 refractory fragments (weighing >2kg) only identified swords among the products (Mepham 2007). If this assemblage was indeed restricted to swords, then it will be important to establish a minimum number of castings.

Setting Greenfields aside, the comparative evidence otherwise emphasises the unusual character of the large Springfield assemblage. Here, despite the accumulation of large groups, the material was kept almost without exception to moulds for swords. In this respect it may be, if not unique, then exceptional and this may tie in with its role as a foundation deposit. The association of swords, albeit through their production debris, with the main entranceways at Springfield has potentially intriguing connotations; it might, for example, be a way of symbolising that passage through the entrance in question was under tight control and led to a zone controlled by a warrior elite. We would not wish to extrapolate too widely from the specific Springfield context, but it is just possible that a similar symbolic importance guided the deposition of sword mould fragments at Norton Fitzwarren, where the feature they occupied may actually have been a ditch terminal alongside an entrance (excavation trenches were unfortunately too limited).

Holborough Quarry should also be brought back into this discussion; although the total assemblage is very mixed, it comes from features covering a sizable area, 40m or more, and may also cover a span of time. Yet the vast majority of the distinctive sword-mould debris comes from a single pit, F335, with lesser quantities in another pit, F328, just two metres away. There is no evidence that these features flank an entranceway, but the quantity and freshness of the refractory groups is obviously indicative of rapid deposition in these pits and is suggestive of deliberate deposition for some purpose other than simply disposal.

Moulds can be redolent of specific object functions while refractories can more generally hold connotations of control over the production of metalwork; hence these might seem to be natural material for selection as ritual offerings. If so, it is nevertheless difficult to identify unequivocal ritual deposits on other sites. This could in part be put down to the ambiguity of many individual

features containing refractory (or other) material. Further difficulties could hypothetically arise if the process of production was generally kept somewhat apart from everyday activities; refractory debris might have been exploited to ritual ends by the metalworkers themselves so that the ritual contexts remained equally detached from everyday occupation. It is true that we have cited the presence of scatters of refractory fragments in amongst domestic occupation material on a number of sites, but these too are open to alternative interpretation; was metalworking indeed practised in close proximity to more subsistence oriented activities? Were some of these sites 'special' and thus unusual in showing co-occurrence? Or could small quantities of the debris have been brought in from outside the settled area?

The well preserved sequence of deposits and structures at Jarlshof gives an unusual opportunity to address some of these questions, although it is difficult to unravel the sometimes contradictory phasing of material by Curle and Hamilton. Hamilton concluded that the metalworking represented an episode late in the lifetime of the two structures involved (Hamilton 1956, 21–5, 29); certainly the presence of mould fragments surviving in good condition in floor deposits and infilling wall-chambers puts deposition at a terminal phase of the use of those dwellings; this is reinforced by the fact that outside the dwellings the moulds tended to lie on top rather than under a layer of blown sand late in the sequence. It is possible therefore that metalworking took place in the dwellings, or that the debris was introduced to them, after they had ceased to be used for domestic purposes. Some of this material could represent closure deposits, not least that in the small wall-chamber B in Dwelling III which was 'used as a convenient dump for refuse' including many fragments of clay moulds and a number of stone artefacts before being closed with a loosely built wall (Hamilton 1956, 24). A deposit of charcoal on the floor of house IVa may have been a stockpile for melting bronze, as suggested by Hamilton (1956, 24), but even this does not demand that metalworking actually took place within the structure.

In seven of the sword-mould containing assemblages it is possible to identify the type of sword present. Four are of Wilburton type (Dainton, Fimber, Richard Lander School, Holborough) and three of Ewart type (Norton Fitzwarren, Turnford, Jarlshof). Springfield adds to the last tally, but is expressly early in the Ewart sequence (Blackmoor phase). Overall then, these sword moulds from various parts of the country cover the Wilburton-Blackmoor-Ewart sequence of the Late Bronze Age well. Restudy of the Traprain Law pieces, which include hilt fragments, might add to this picture but the others only have parts of the blade represented and this is less diagnostic of type.

Wherever a reasonable amount of material is well preserved there is almost invariably outer wrap in association, sometimes of course still attached to valve fragments. Gates too should be reasonably well represented, being generally of well fired fabric and an integral component of the assembled mould. In addition to Springfield they have been noted in at least seven Late Bronze Age assemblages (bearing in mind that some have yet to be fully studied). More frequently identified, and doubtless more easy to recognise, are crucible fragments — some 23 recorded sites including Springfield, though few allow much by way of reconstruction. Core pieces, however, are rare, but this is presumably because they generally become crumbled or powdered during extraction from a cast socket.

Deposit function and significance for site and region

The total excavation of the ditch fills of the Springfield enclosure gives confidence that no similar deposits were left unexcavated. We must acknowledge, however, the possibility that coherent deposits or scatters of related material originally lay on the land surfaces inside and outside the enclosure and that these were subsequently destroyed by long-term agricultural activity. More surprising perhaps is that, aside from the two small pieces of copper/alloy amongst the refractories, the site yielded no other Late Bronze Age metalwork. Although metalwork was not casually abandoned in quantity during this period, it is not uncommon now for large-scale excavations to recover modest assemblages of small bronze objects, or fragments of larger ones. If metalworking had been practised on any scale, or habitually, within or close to the enclosure, it is likely to have given rise to incidental losses of small pieces of scrapped metal and the small waste from production, as seen for example at Runnymede Bridge, Potterne, Burderop Down and Breiddin, amongst other sites. While the constant attrition of material in surface deposits could have caused loss from those contexts, it is hard to believe that none would have found its way into feature fills. The conclusion would seem to be that metalworking was not a regular pursuit within the excavated area and, moreover, that bronze items in use were carefully curated and returned to metalworkers when defunct, or alternatively, were deliberately deposited elsewhere.

If it is correct to suggest there was little on-site metalworking, it does not follow that the occupants of the site had no control over metalwork production. Indeed, Buckley *et al.* (1986, 262–4) have identified a small concentration of contemporary hoards within a radius of 5km of the Springfield Lyons site and suggest this is indicative of a focal area of activity in the Late Bronze Age. Some of the hoards are long lost, but noteworthy in the surviving Boreham and Little Baddow hoards are classic scrap and ingot components, material appropriate to the metalworkers' domain. Without necessarily seeing these hoard finds as precise indicators of the locations of metalworking, they might nevertheless point collectively to either a metalworking zone, or to a zone where deposition was seen to be necessary for strategic ritual purposes. Whichever interpretation is considered, it is intriguing that this focus of metalwork lies coastwards (east) of the Springfield and Great Baddow enclosures.

The dating of the Springfield refractory deposits is crucial both for site history and its bearing on the metalworking tradition represented. The primacy of the deposits in the recut ditch can be tied in with their discreteness in depositional terms; they are evidently not casually accumulated refuse from activity alongside and, moreover, no comparable material was found in any other context on the site. It is thus hard to escape the conclusion that these were foundation deposits with the avowed purpose of commemorating the beginning of the site's life after the re-construction of the impressive enclosure.

A large assemblage of metalworking refuse might be assumed to represent random fall-out from the activities of

resident metalworkers. This has been discussed above for refractory yielding sites in general, but the occurrence of foundation deposits would certainly undermine such an assumption, for it would immediately imply careful selection of material to best serve the propitiatory needs of the act. The evidence for selection at Springfield is quite striking, with virtually every identifiable valve fragment being consonant with the casting of swords. One might of course, deduce that this was the debris from a foundry specialising in sword production, but this was not the output of a brief casting episode and it seems intrinsically unlikely that no other types, such as weapons and weapon accoutrements, would be cast by a smith who happened to specialise in weapon production. Moreover, it has been shown above that this particular selection does not fit an established pattern that might be related to specialist production. In this regard the single deviant mould, possibly for a sickle, is instructive — it may have been an accidental inclusion which escaped screening, or alternatively the small fragments were misunderstood by the selector as being for a sword blade, an easy mistake if not closely scrutinised or already in poor condition. It is therefore extremely unlikely that the deposits represent in any holistic way the output of a metalworking tradition or metalworking group, and we need to think instead of them being a contrived abstraction from the source tradition.

Despite this, the assemblage is remarkably informative about those aspects of the source tradition that they do reflect upon. This is partly seen in various technological features and partly in the rather surprising typological range within a regular and prestigious Late Bronze Age weapon type over a short time-span. Above all, however, the deposition of these large specialised deposits of refractories at strategic locations on a probable high-status site allows certain aspects of the social behaviour to be elucidated. Firstly, it can be argued that this material for casting moulds was deemed to be invested with attributes that went beyond the pure technology of production. These sword moulds may have reflected poignantly on the local leader and his group. Collectively, they may have summarised recent martial history and the better represented moulds might have been the very ones that produced the armoury of the day. Secondly, whatever the precise relationship between them, it would appear that the local leader could call upon metalworkers to deliver not only cast bronze swords, but also the highly charged material of their production. The very act of depositing this material not only implied control over production, but control over the producers as well. The bronze smiths of the Springfield area may not have been the autonomous detached bodies so often in the past envisaged for the Bronze Age.

Context	*Cores*	*Struck nodules*	*Thermally fractured pieces*	*Blades*	*Blade-like pieces*	*Flakes*	*Formal retouch*	***Total flint***
Neo features	70	20	185	7	103	2967	67	**3419**
Neo area	11	3	5	2	58	746	32	**857**
GW	5		13			217	6	**241**
Neo and GW			1		1	49	7	**58**
Beaker/GW	3		2			67	3	**75**
Beaker features	8	4	13	2	2	348	28	**405**
Beaker Neo			5			39	2	**46**
late Neo/EBA			10	1	1	370	4	**386**
EBA	0	3	2	0		16		**21**
LBA F2500	283	917	671	20	84	8272	76	**10327**
LBA	8	28	20	1	12	328	4	401
MOD		1			1	20		**22**
IA						5		**5**
ES	10	28	20	9	21	677	11	**776**
LS	10	20	9	1	18	479	11	**548**
Pre			2			25		**27**
E					1			**1**
HC						3		**3**
HD	1	5	1		3	41		**51**
HF	6	5	1		5	102		**119**
HG	2	4			4	60	1	**71**
N	1				2	3		**6**
Nat feature							1	**1**
R	3	6	5		4	86	4	**108**
S			6			11		**17**
UD	12	34	30	3	40	786	11	**916**
US	53	56	38	28	124	1991	54	**2344**
Total flint	**486**	**1138**	**1039**	**74**	**484**	**17708**	**324**	**21253**

Table 3.8 Composition of the assemblage

IV. Flints

by Elizabeth Healey
(Figs 3.8–3.15, Tables 3.8–3.13)

Lithic artefacts were found in practically every context excavated including features and surface contexts; they number over 21,000 and are summarised in Table 3.8. All aspects of lithic artefact production, from raw material acquisition through core reduction to finished and broken or worn artefacts and their deposition, are present. However, the disentangling of the artefacts into discrete assemblages is not always straightforward and there is some indication of residuality (*cf* Saville 2002). The contextual summaries of the data presented below, therefore, must be understood in this light.

Methodology

The artefacts were sorted and classified according to conventional categories in order that they might be readily comparable with other assemblages. However, it should be borne in mind that such an approach usually only reflects the objects at a particular, and often final, stage in their life histories and consequently is rather static. Other ways of measuring variation are also controversial largely because we often do not know what factors, for example raw material size, shape and quality, initial reduction strategies, use and re-sharpening and so on, gave rise to the different shapes. Cultural influences, whether tacit or explicit, will also have affected shape.

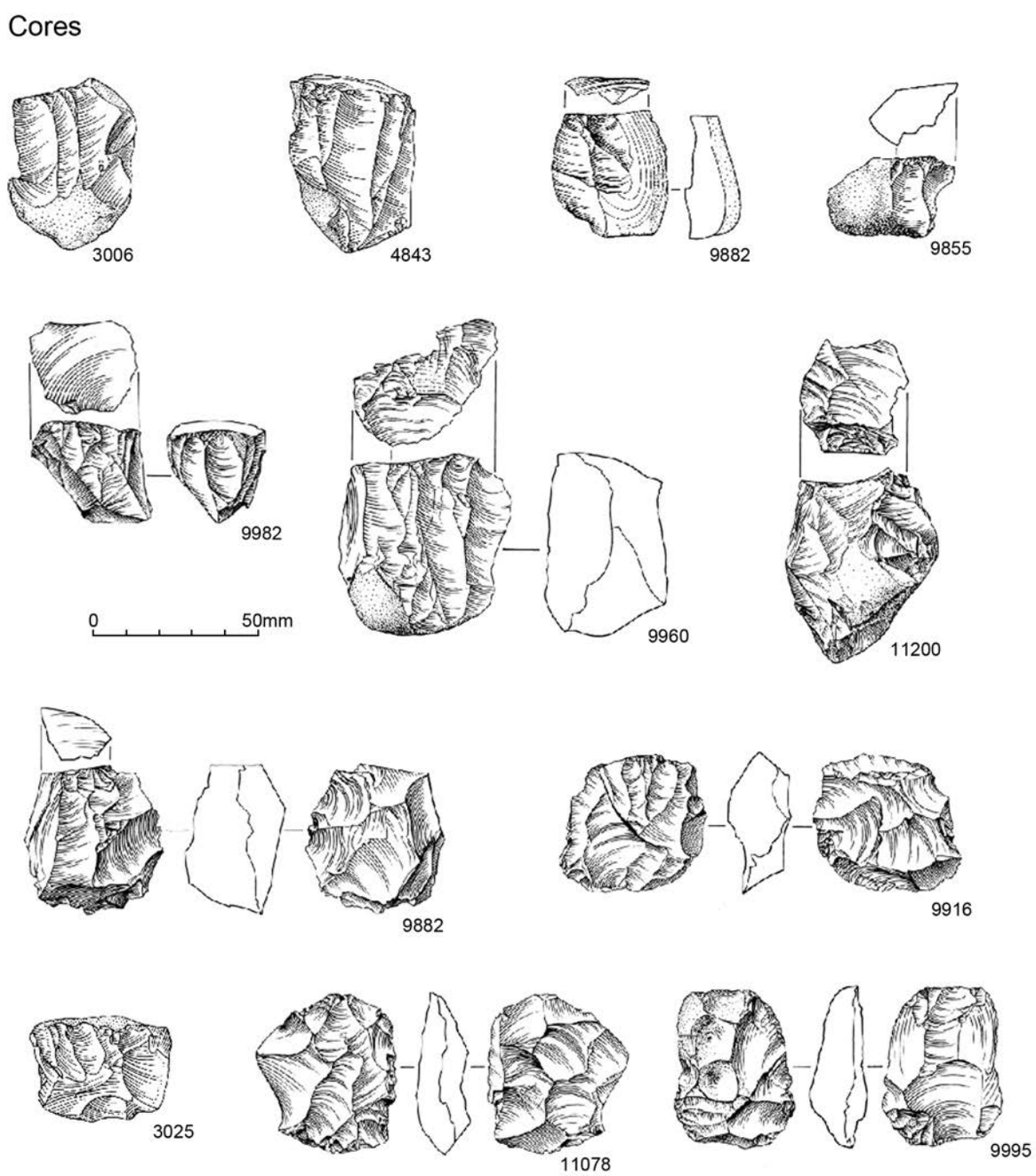


Figure 3.8 Flint cores (the numbers are object numbers)

Context	*Scrapers*	*Denticulates*	*Piercers*	*Serrated*	*Truncated*	*Backed*	*Knives*	*Fabricators*	*Arrowheads*	*Laurel Leaves*	*Bifacials*	*Flakes from polished impl.*	*Worn edges*	*microliths and microburin*	*Burins*	*Other*	***Totals***
Neo. Features	26	1	3	12		2	1		7	2	1	2	7	1		*2	**67**
Neo. Area	8		3	7				2	4	4	2	2					**32**
Grooved Ware features	1			3								1	1				**6**
Neo/GW features	5	1	1														**7**
Beaker/GW features	3					1			1								**5**
Beaker features	23	1		1		2						1					**28**
Beaker/ Neo	1			1													**2**
Late Neo/EBA	4																**4**
LBA F2500	29	13	14	1	2		1	1	4	1		1				9	**76**
LBA						1	1					1					**3**
ES	8	1						1				1					**11**
LS	4	2	4			1	1										**12**
HG			1														**1**
R	3								1								**4**
UD	7			2					1					1			**11**
US	23	3	3	5	2	2			7	3		3		1	1	1	**54**
																	0
	145	**22**	**29**	**32**	**4**	**9**	**4**	**4**	**25**	**10**	**3**	**12**	**8**	**3**	**1**	**12**	**323**

* in Neo features, other = 1 hammerstone and one ‘flaked hole’

Table 3.9 Formal retouch by context

Raw material choices
Flint is the only raw material exploited for chipped stone tools and although it occurs abundantly locally (p.1), a range of different types were used ranging from flint with soft chalky cortex, presumably derived directly from the chalk, to pebbles with chatter marked cortex to the occasional use of distinctive Bullhead flint. Much of the non-pebble flint which occurs in good sized nodules is flawed and when hit breaks along thermal cracks and so seems to be rather unpredictable for knapping. Nevertheless it is used extensively and conjoinable pieces are sometimes recovered from the Neolithic pits.

Technological strategies
The main focus of reduction is one of flake production from a single platform (*e.g.* Fig. 3.8, 3006, 4843, 9855) or, less frequently, changed orientation cores (*e.g.* Fig. 3.8, 9882, 9916). Blades and even blade-like pieces are remarkably rare (less than 1% of the debitage) and there is only one certain blade core. Almost all of the flakes and other products have uni-directional scars on their dorsal surfaces suggesting that only one flaking face of a core was in use at any one time despite the fact that there are a number of changed orientation cores. Occasional flakes with faceted platforms and multi-directional scarring and a thin curved profile suggest that some sort of bifacial thinning was practised too. Generally there is little evidence for core preparation — the cores do not appear to have been deliberately shaped and maintained and modification to the edge of the striking platform is rare. Most of the reduction seems to have been carried out with a hard hammer as suggested by the resolved bulbs of percussion. Diffuse bulbs are occasionally noted, generally on blades. These are likely to be the result of a different and specific technology probably involving the use of soft hammers and not fully represented in the assemblage.

Only one hammerstone (Fig. 3.14, 5190) was recovered from a section of the Neolithic ditches, context 9876 (F6854).

Classification of modified pieces
(Table 3.9)
In this section the main retouched types present are described and a breakdown by context is given in Table 3.9. More detailed contextual information is given where appropriate.

The typological range of the artefacts suggests that activity on the site extends from the Mesolithic through to the late Bronze Age, although the majority of the retouched artefacts were recovered either from Neolithic contexts or from the Late Bronze Age enclosure F2500.

Artefacts from most conventional typological categories are present, but pieces with apparent edge retouch which does not modified the shape of the blank are difficult to categorise with certainty because the edge chipping may be due to post-depositional factors as much as to use (Mallouf 1982; McBrearty *et al.* 1998). It is particularly noticeable for instance, that the artefacts from the upper levels of features and from surface contexts have much more chipping on their edges. For this reason only the more regular pieces have been included in the tables although some of the others may be mentioned in the appropriate sections below.

Scrapers
(Table 3.10)
Scrapers are ubiquitous and form the most numerous category. Classification is traditionally based on the location and angle of retouch and the type of blank (Clark 1960); some variation has been considered to be chronological (Riley 1990) and can also be paralleled in the dimensions of unmodified flakes (see for example Wainwright 1972). Although these schema are broadly followed here for comparative purposes (see Table 3.10 the universality of such classificatory schemes does not take into account variations in raw materials, reduction strategies and the use and re-shaping of tools, a factor which might be important when an unusually high number of artefacts has been discarded at the end of their use life, or deliberately deposited for some other reason. Most of the scrapers are made on squat flakes (about 80%), and a few on thermally shattered flakes; they vary considerably in size. There are eight thumbnail scrapers (all under

	End	*Extended end*	*End and side*	*Sub-discoidal*	*side*	*uncl*	*not observed*	***Total***	
Neo	1	4	7	2		1	11	**26**	2 thumb nail
Neo Area		1	4	1		1	1	**8**	1 thumb nail
GW							1	**1**	
GW/Neo	1		2				2	**5**	
GW/EBA		1	1		1	1		**4**	
Beaker	2	3	8	1	4	2	3	**23**	1 thumb nail
Beaker /GW				2	1			**3**	
Neo-Beaker			1					**1**	
LBA	1	2	10	1	1	6	8	**29**	2 thumb nail
ES		2	1		1	1	3	**8**	
LS	1		1				2	**4**	
R			2			1		**3**	
UD		1	5	1				**7**	
Area	1	2	4	3		3		**13**	2 thumb nail
US		1	5	2		1	1	**10**	
Total	**7**	**17**	**51**	**13**	**8**	**17**	**32**	**145**	

Table 3.10 Scraper types by context

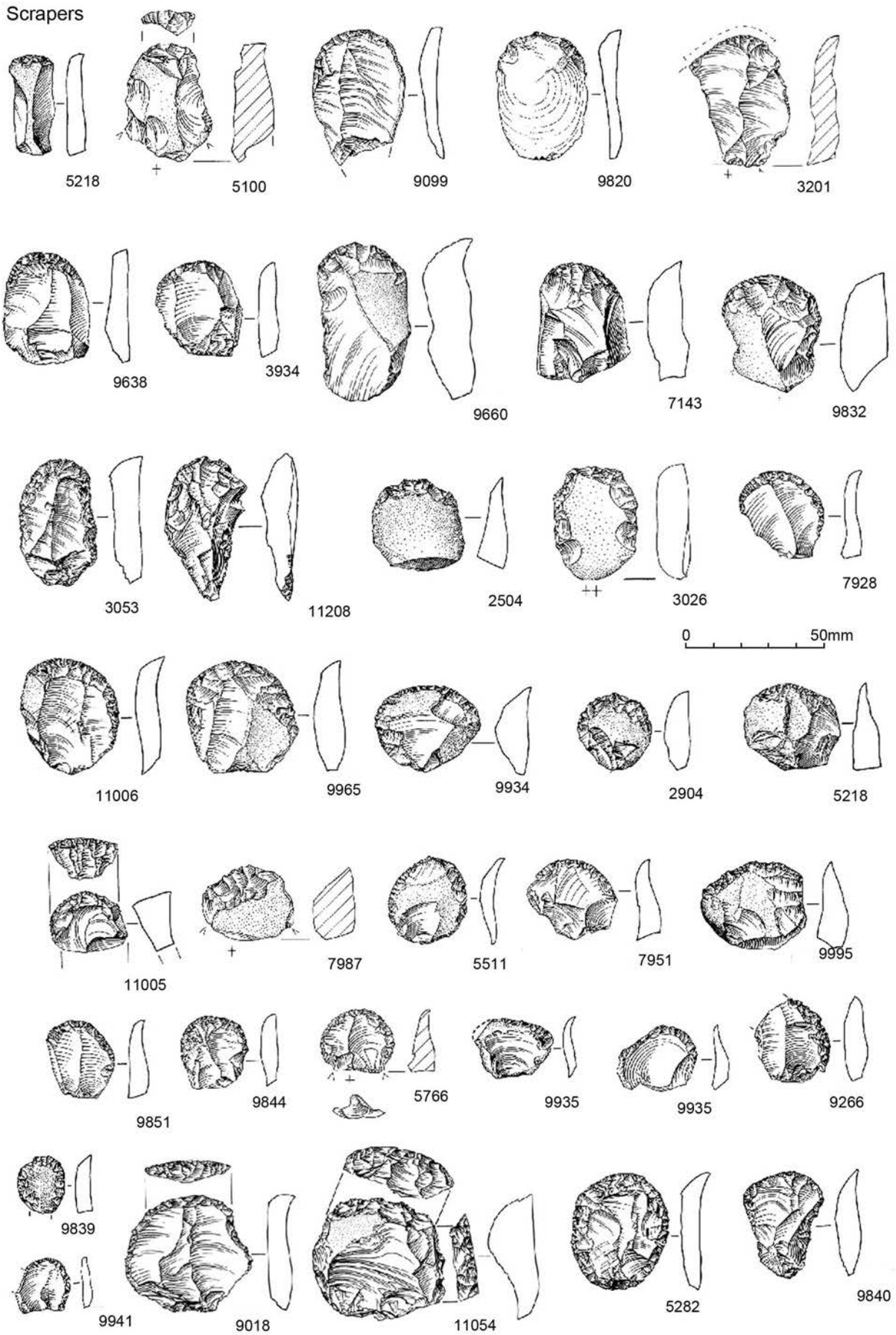


Figure 3.9 Scrapers (the numbers are object numbers)

20mm in maximum dimension) and about 60% are over 30mm in length (about half of which are over 40mm). As can be seen in Fig. 3.9 they vary in thickness from thin (5282; 5511 to quite thick (9660, 11054). Very few end scrapers are present, the majority having more extensive retouch on their ends and sides, though sub-discoidal types are rare. Retouch varies from acute to abrupt. All this suggests that scrapers do not represent a single functional type.

Arrowheads
(Table 3.11)
These have been categorised according to Green's main types: leaf-shaped, barbed and tanged and transverse (Green 1980; 1984), and their distribution is summarised below in Table 3.11.

Context	*Leaf-shaped*	*Transverse*	*Barbed and tanged*	***Total***
Neolithic features	5	2 ?		**7**
Neolithic area	4			**4**
GW/Beaker		1		**1**
LBA	3	1	1	**5**
UD		1		**1**
other/us	5		3	**8**
Total	**17**	**5**	**4**	**26**

Table 3.11 Arrowheads by type and context

Leaf-shaped arrowheads (17)
Of the 17 leaf-shaped arrowheads six are complete, or reconstructable, four are butt fragments and two tips. They range in length from 18 to 53mm and include several fragments which may be from even longer arrowheads One belongs to Green's class 3C, one to class 3A and one to class 2A; two others are probably class 3B. Seven have rounded bases and and two have attenuated tips (Fig. 3.10, 5119 and 5114). Five have pointed bases and one is slightly angular. Fourteen are all invasively retouched over both faces and two have invasive retouch on one face and the butt end of both faces, but edge retouch on the rest of the ventral face. Two other fragments seem to be unfinished. One has invasive serial flaking around the point on alternate surfaces; the other (Fig. 3.10, 5511) is more crudely retouched and may have broken in manufacture. The majority are made on light or medium coloured grey or brown flint, only one, the unfinished example is made on dark grey flint. They are normally considered to be earlier Neolithic in date though are known in Early Bronze Age contexts (Green 1984, 33). At Springfield the majority occur in Neolithic contexts and those from F2500 were probably from Neolithic features destroyed by the construction of the Late Bronze Age ditches.

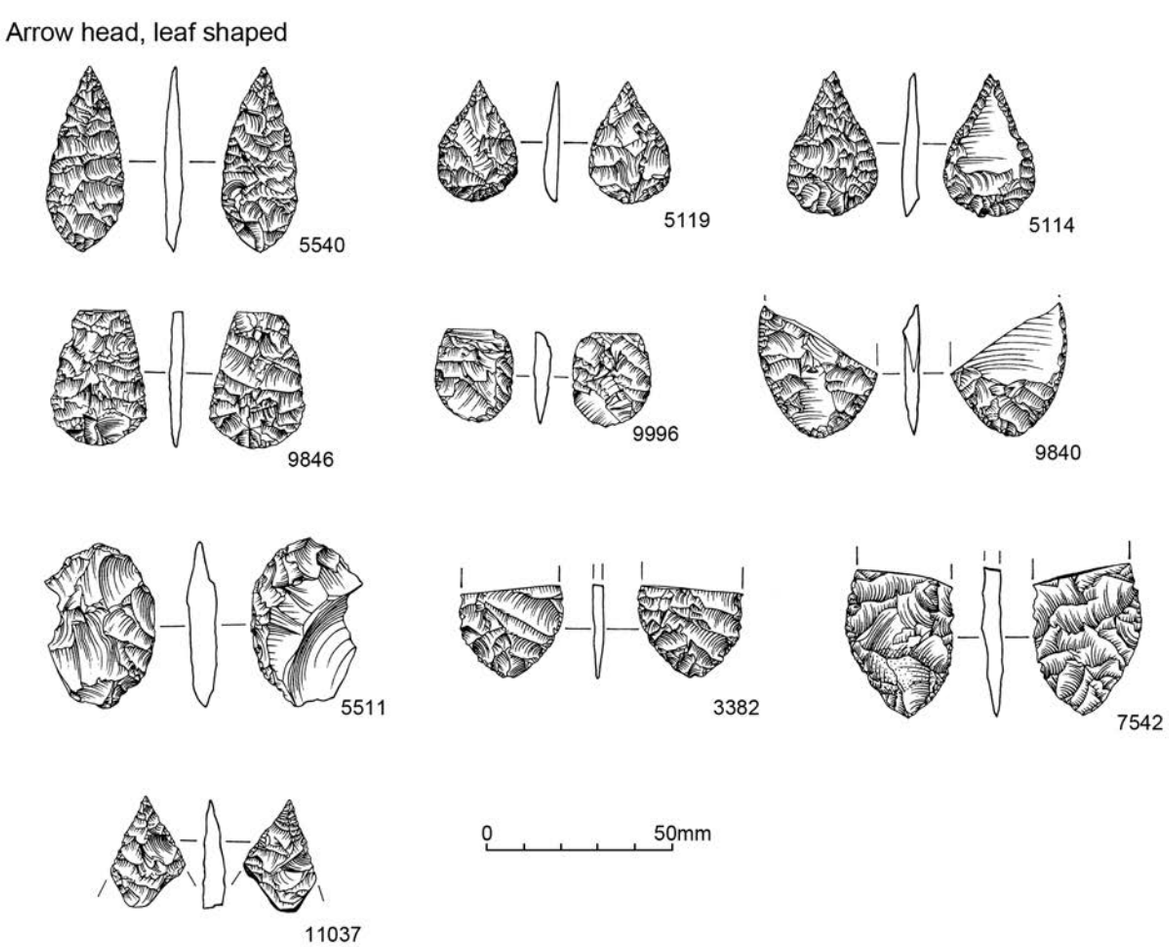


Figure 3.10 Leaf-shaped arrowheads (the numbers are object numbers)

Transverse arrowheads (5)
One of the transverse arrowheads (Fig. 3.11, 7939) is of petit tranchet or chisel-ended form. It is made on the segment of a blade and abruptly retouched on the broken edges but no retouch on either face of the artefact (Green 1984, 25). It was recovered from a Beaker context F6707 but is more likely to derive from Neolithic activity.

Two (Fig. 3.11, 5805 and 5124) are of Green's oblique type having an r:t ratio of 0.63 and 0.64 respectively (Green 1984, 25). Both have bifacial flaking on their edges and 5124 is retouched on the dorsal surface. Two others are probably oblique arrowheads, possibly unfinished. One is retouched on its thicker edge and a further sub-triangular flake which has alternating retouch delineating its form (Fig. 3.11, 9846). Although found in a variety of contexts, they almost certainly belong to the later Neolithic activity (Green 1984, 34).

Barbed and tanged arrowheads (4)
There are four barbed and tanged arrowheads, all unstratified or from undated contexts. Two are quite large (Fig. 3.11, 2504 and 3586) (one being 40mm in length). Both are bifacially flaked all over both surfaces. One has extended oblique barbs and the other square; they fall into Green's Conygar Hill type with a characteristic triangular outline This form is more usually associated with food vessels in burial contexts than Beakers (Green 1984, 34–5). The two others are less formally shaped and made;

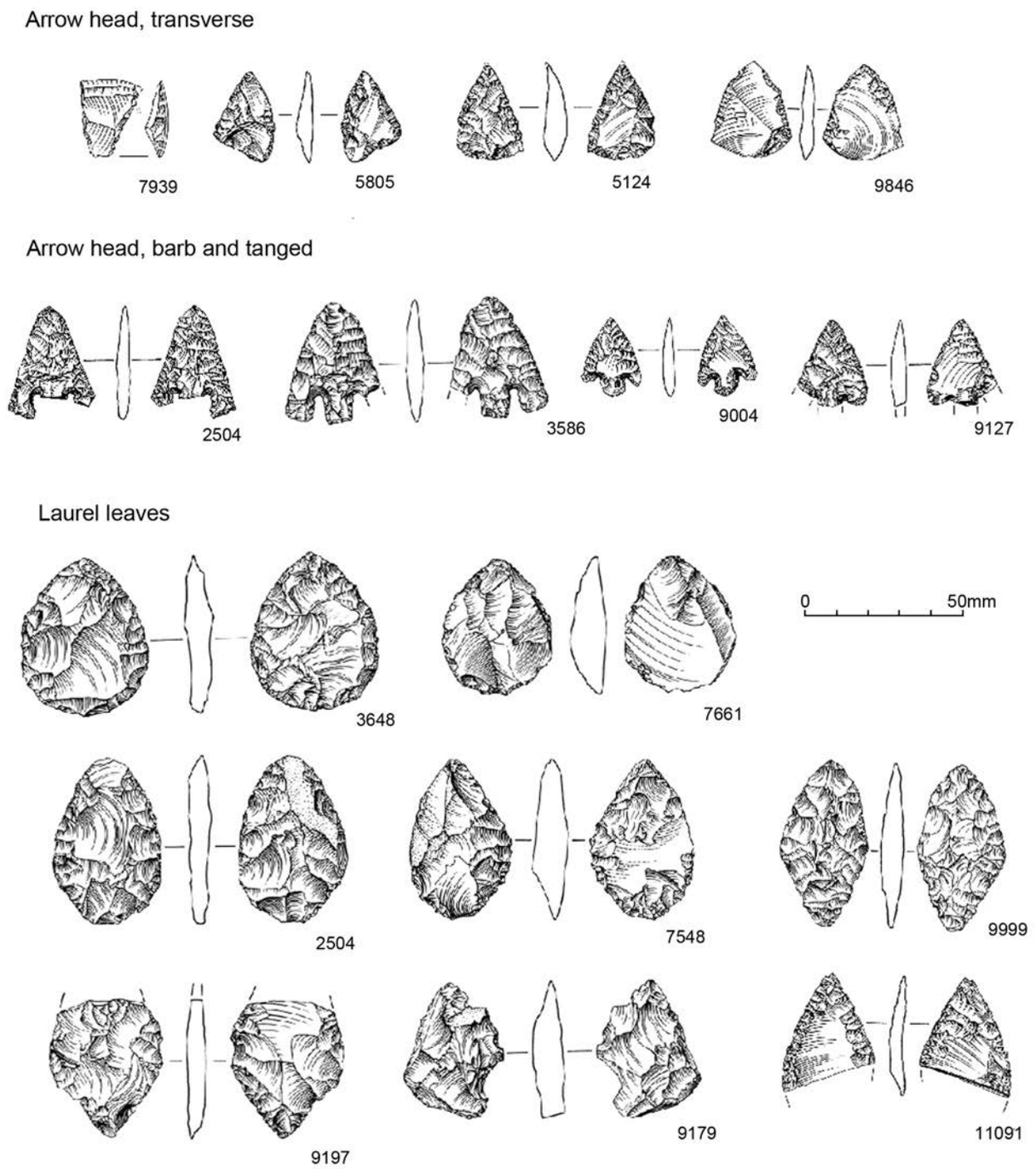


Figure 3.11 Other arrowheads and laurel leaves (the numbers are object numbers)

they have short, pointed barbs with the tang being longer than the barbs. They both have semi-invasive flaking which does not remove the original flake scar on the ventral surface. They fall into the Sutton category and as such are likely to be Beaker or Early Bronze age in date.

Laurel leaves
These are bifacially flaked leaf-shaped objects appreciably larger and thicker than leaf-shaped arrowheads. Half (five examples) are flaked all over both faces (*e.g.* Fig. 3.11, 3648, 2504, 9999). They measure between about 40 and 50mm in length and 35 to 40mm in width and are between 6 and 10mm thick. Although they are more or less symmetrical in shape with a lenticular longitudinal section, one of the longer edges sometimes seems to have been privileged over the other (*e.g.* Fig. 3.11, 7548), as if a cutting edge. Most come from Neolithic contexts at Springfield and they typically occur in earlier Neolithic assemblages in the south of England, for example at Hurst Fen (where they were first recognised Clark 1960) and at Windmill Hill (Smith 1965), and other causewayed enclosures (Saville 2002).

Serrated pieces or microdenticulates
Serrated edges occur on a variety of blanks. They are defined by a contiguous series of fine denticulations (between about 9 and 12 per cm compared to an average of 13.7 per cm at Windmill Hill (Smith 1965)). At Springfield Lyons a variety of blanks have been chosen, from blade-like pieces with straight edges (Fig. 3.12, 7939, 7802), to flakes (of non-standardised form) with concave edges (Fig. 3.12, 5255, 9912, 9840); the serrations rarely extend along the entire length of the available edge. Some are double edged (Fig. 3.12, 9840) and where this is not the case the opposite edge is left unmodified and in some instances has cortex possibly forming a back (Fig. 3.12, 7943). Each denticulation is formed by the removal of a single spall from the ventral face. A very narrow band of gloss parallel to the edge is often present and is generally presumed to have been occasioned in use. It has been suggested that they were used for cutting silica rich plants such as cereals or reeds although the precise material is not known (*cf* Saville 2002). The type is most almost exclusively found in Early/Middle Neolithic assemblages (Saville 2002) and this is borne out by their concentration in Neolithic contexts here.

Knives and backed pieces (15)
This is a rather heterogeneous category which often includes both more formal types and those with edge retouch. The best example (Fig. 3.13, 9051), which seems to belong in the plano-convex category (Clark 1932), is pointed at one end and rounded at the other and shaped with fine serial pressure retouch; it was recovered from the primary silt of the Late Bronze Age enclosure. There is also a small triangular knife with semi-invasive retouch around the edges and bifacially on the butt (Fig. 3.13, 7036). Other pieces are less modified in shape and include some which have been backed (which may be curved) and have one long straight edge (Fig. 3.13, 9101). There are other pieces which have retouch on a concave edge which appears to form a back to a straight cutting edge although it is not always possible to determine how deliberate this is. The two pressure flaked knives may be Early Bronze Age in date but the other forms are not diagnostic, though the contextual information suggests that they are unlikely to be Neolithic.

Fabricators
Fabricators belong to a category determined both by shape and wear. They tend to be elongated, often rod-like, objects which exhibit heavy wear or rounding on one or both ends and sometimes on the side (see Saville 1977, 10–11 for definitions). Only three certain examples are present among the Springfield Lyons assemblage and none are particularly heavily abraded. One (Fig. 3.13, 9018) is made on a thick (9.5mm) elongated removal (over 50mm in length) both sides of which have been retouched — the right edge bifacially. The proximal end is abraded but the distal end broken. It was found on the surface in the Neolithic area. Another (Fig. 3.13, 3004) is made on black flint and is considerably more irregular. It is of similar dimensions although thicker. It has been retouched along the sides and the ends flaked and slightly abraded; there is a further fragment from an unstratified context. A fourth (not illustrated) is broader and flatter, almost scraper-like in appearance, but with heavy retouch on the ends and sides which are rounded and crushed. Fabricators have a long chronological span from the upper Palaeolithic and are not particularly distinctive in form although a comparison of those from Windmill Hill and West Kennet Avenue by Smith has suggested that the flatter, less triangular sectioned forms are earlier Neolithic (Smith 1965). They are also known to occur in Saxon graves where they are thought to be strike-a-lights (Meaney 1981) so it may be significant that one was found in an early Saxon context. Their purpose in prehistoric assemblages is unconfirmed, but some use-wear analysis corroborates their use as strike-a-lights (Stapert and Johansen 1999).

Flakes with worn edges
A few flakes have parts of their edges rounded through use (Fig. 3.13) though the wear is considerably less heavy than that on fabricators. The wear is often on a prominent part of the edge. Examination at 20x magnification reveals striations across the thickness of the edge suggesting that it may have been used in a scraping rather than cutting motion perhaps of a hard object or dry hide. Macroscopically similar rounding on the edges is also present on a few of the scrapers. At Springfield they were found only in Neolithic features and similar wear on flakes has been noted in Neolithic assemblages for example at Windmill Hill (Smith 1965) though Saville also noted their presence in Mesolithic contexts (1977, 7).

Pick
This is an unusual type more usually associated with Mesolithic toolkits (Saville 1977); this particular example (Fig. 3.14, 5117) is made on an elongated nodule of flint and flaked along the long edge to form a point, but with cortex remaining on the butt. The point is quite thin and has no obvious signs of wear. It was found in an unstratified context. A similar example was found at Kelvedon (Rodwell 1988). Two other small pick-like objects (classified with the piercers Fig. 3.12, 3136 and 9037) found in the Late Bronze Age ditch F2500 may belong with this category.

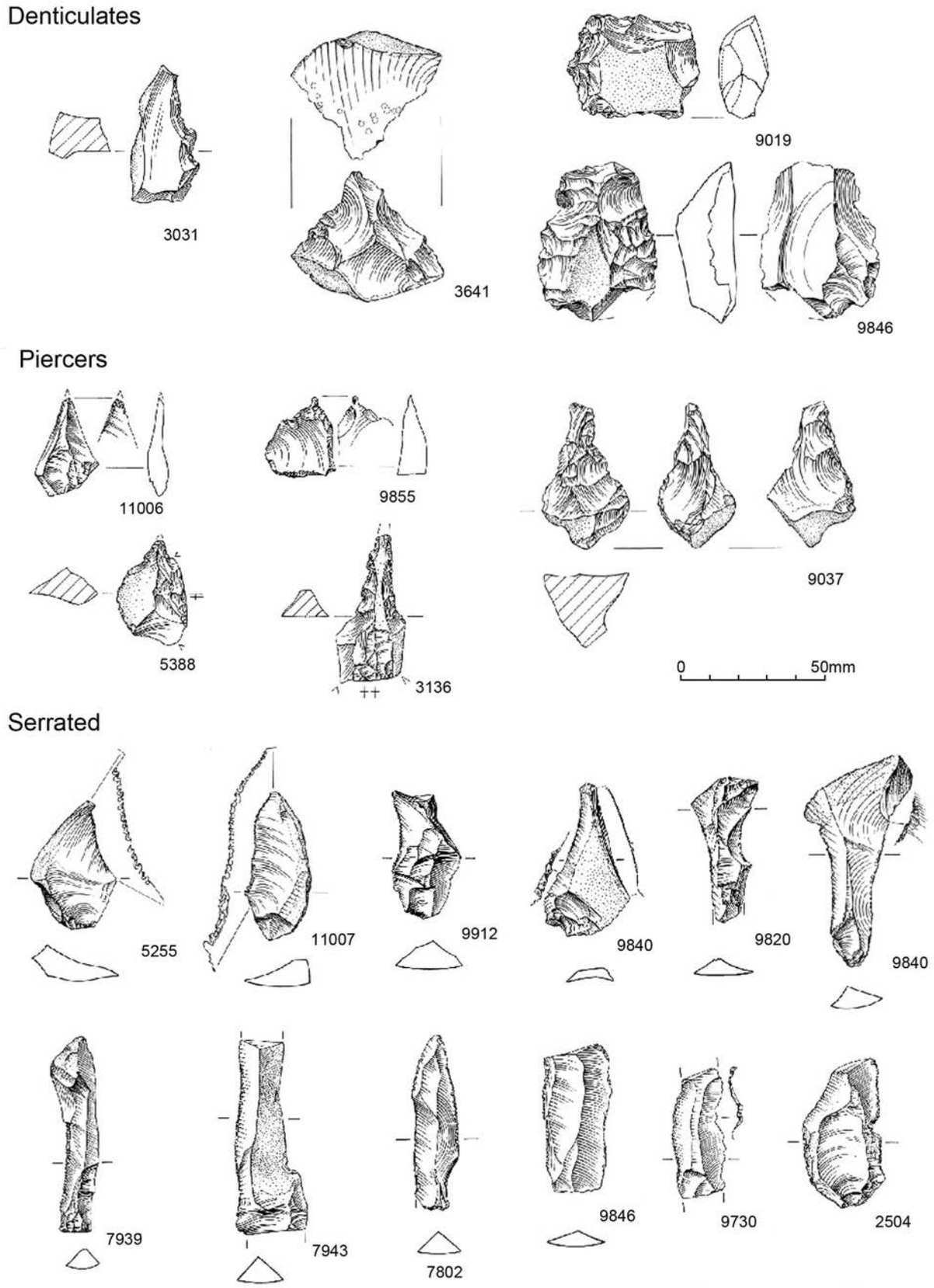


Figure 3.12 Denticulates, piercers and serrated pieces (the numbers are object numbers)

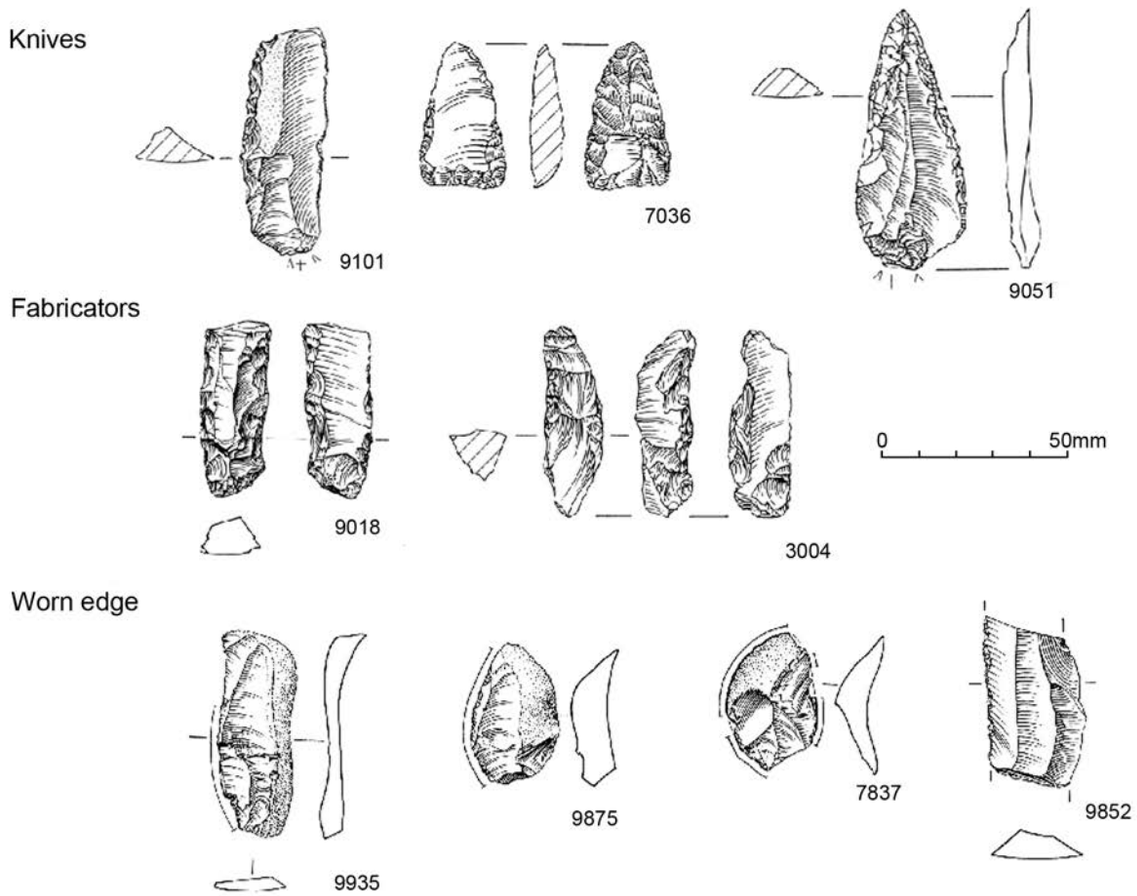


Figure 3.13 Knives and fabricators (the numbers are object numbers)

Piercers
This category includes objects with retouch delineating a point such as might have been used for perforating. They are found sporadically in most contexts, but they seem to concentrate in F2500. They range from pieces with elongated points (Fig. 3.12, 3136) to those with short thick points (Fig. 3.12, 5388). The shape and thickness of the points make it unlikely that all were used for the same task: some are short and have fairly wide points, others are thin and have been retouched to a point following the edge of the flake rather than shaping it (Fig. 3.12, 11006) and others are more like borers. The form is also vulnerable to damage and may be under-represented in the totals.

Denticulates
This form is characterised by large contiguous notches on relative thick blanks which are sometimes thermally fractured (Fig. 3.12, 3641). The denticulation is usually formed by a single blow at a fairly abrupt angle and in some cases difficult to distinguish from a core whose platform edge has not had the spurs removed. In contrast to cores, however, incipient cones of percussion or ring cracks (not dissimilar from those formed by percussion on lithic artefacts when making 'music' (Cross *et al.* 2002)) are often evident on the ventral face suggesting difficulty in removing the flake to form the notch. None show any other obvious signs of use. Denticulates and notches form substantial components of trampled assemblages and we should be open to the possibility that some of the denticulates are a result of trampling or other damage (*cf* McBrearty *et al.* 1998). Although often associated with later Neolithic industries, at Springfield almost all occur in Late Bronze Age contexts.

Flakes from ground and polished objects
These are flakes which have dorsal scarring with one or more ground and polished facets which have been struck from larger objects, most probably axes (one has the side facet). All the others seem to be from the surface of the object and polished discoidal knives cannot be entirely discounted. It is noteworthy that they are made of a distinctive light grey or brown flint which is rarely seen elsewhere in the industry suggesting that axes might have been imported as finished objects. Although only two were found in Neolithic features it is likely that they are Neolithic in date.

Microliths (2 plus microburin and notched piece)
Two microliths were found. One appears to be the fragment of an obliquely blunted point, shaped by abrupt retouch (possibly on an anvil at the tip on the right edge of the blank). The other has an inversely retouched base. The sides are also abruptly retouched to form a point. There is also a microburin.

Other
This includes a bifacial object (Fig. 3.14, 9876) made on a nodule of flint from one of the causewayed enclosure ditches. It is orange-brown in colour and has a thin hard cortex. One edge has more retouch than the rest.

A lump of flint with a natural hole which has been exposed by flaking was found in F6854, it is possible that this was deliberate, and retained as a curiosity.

The distribution and contexts of the artefacts

As indicated above, the typology of the chipped stone artefacts indicates that there was activity on the site from the Mesolithic through into the late Bronze Age. As can be seen from Tables 3.8 and 3.9 lithic artefacts were recovered from all contexts excavated, although their distribution was uneven. By far the majority (over 50%) came from the Late Bronze Age enclosure ditch F2500 and only just over a quarter from Neolithic and Early Bronze Age contexts of which the majority are from the Neolithic features.

Mesolithic

The earliest occupation is evidenced by the two microliths and a possible microburin recovered from F8896. There is also a blade core and a number of blades (less than 50) which may belong to this horizon although it is not possible to quantify it in any meaningful way. The blades are often patinated. Where observable the proximal end of the blade shows a linear striking platform remnant and a diffuse bulb of percussion. Two are overshot and one is part crested, testifying to the systematic reduction of the cores, a characteristic which is rare in the rest of the assemblage. The blade core is systematically and regularly worked. This technology is unlike that used in the rest of the assemblage which is predominantly flake-based using hard hammer percussion. Mesolithic technology is of course well documented in the area (Wymer 1977 *inter alia*).

Earlier Neolithic contexts

(Table 3.12)

More than 3100 artefacts were found in earlier Neolithic features, mostly in the causewayed enclosure ditches and a further 855 from the surface in the general Neolithic area. In addition there are types which are conventionally considered to be Neolithic in date which have been found in other contexts where they are likely to be residual. Such artefacts include leaf-shaped arrowheads, laurel leaves, serrated flakes and pieces with worn edges. The composition of the assemblages in different features is summarised in Table 3.12.

Causewayed enclosure ditches

The amount of flint present in each ditch segment of the causewayed enclosure is varied: the majority of the lithics were found in F6854 and F8920 while F8952, F8969 and F8956 had very few. The pottery was also unevenly distributed though to what extent this indicates deliberate deposition of particular types of artefacts, a feature noted in other causewayed enclosures (Richards and Thomas 1984, Thomas 1999; Saville 2002; Garrow *et al*. 2005; Garrow 2007), is not always clear and not as straightforward as once thought (Bradley 2004).

The majority of the artefacts (over 85%) are unretouched flakes and a further 8% are cores. The flakes are generally small (the majority are under 30mm in length) and squat in shape. Those recovered from the enclosure ditches seem to be the discard from core reduction as several refits were effected and other groups of flakes appear to have come from the same nodule. This is further corroborated by a number of small but complete flakes (under 10mm in length and some under 5mm which are unlikely to be the result of trample) in the residues from flotation. It is probable then, that knapping and/or retouch took place in the area and that the debitage was discarded in the ditches, though probably as practical factor of domestic disposal rather than ritual deposition.

The entire core reduction sequence in the Neolithic seems to have taken place on site. There are some primary flakes as well as a high proportion of flakes which have areas of cortex on their dorsal surfaces. The predominance of resolved bulbs of percussion suggests that most of the flake reduction was done with a hard hammer. Cores are varied in size and in the extent to which they are reduced. It would appear that the available nodules had been frost damaged so that nodules tended to shatter on impact; it is clear from Table 3.12 that shattered fragments outnumber the identifiable cores. When worked successfully the maximum use often seems to have been made of the nodule and it is worked from one or more directions (Fig. 3.8, 9882, 9916), usually in a regular pattern, the platforms having clear geometric relationships. Some are flat and relatively thin and of sub-discoidal form (Fig. 3.8, 11078 and 9995). Although of a relatively standard size there is no clear evidence of preferred blank type among the retouched component although they tend to be larger than the majority of the remaining flakes. Other knapping and tool production trajectories are suggested by occasional flakes which seem to derive from the manufacture of a bifacially worked object. They have faceted platforms and a relict margin with a distinctively concave profile typical of the manufacture of a bifacial object. There are also some small flakes which seem to result from retouch.

Retouched pieces

For reasons stated above it is difficult to determine whether the edge damage is deliberate or the result of some post-depositional activity, so that only the more standardised forms have been included here.

Leaf-shaped arrowheads

Although only five of the 17 leaf-shaped arrowheads were found in early Neolithic features (F8920; F8893; F8896 F8800) and what appears to be a fragment broken in manufacture from F4967, four others were found in the area and it is likely that the rest, though residual in later contexts, derive from this phase of activity. Leaf-shaped arrowheads are found at most Neolithic sites, often in high numbers in causewayed enclosures, leading to the suggestion that some enclosures were the scenes of conflict particularly when they cluster in entrances (Saville 2002, 97–98). The limited exposure of the enclosure at Springfield makes it difficult to estimate their significance.

Scrapers

As in practically every other context, scrapers are the predominant category (almost 50% of the formal tools and 32% of all retouched pieces from the earlier Neolithic features), They range in type from small button-like scrapers (*e.g.* Fig. 3.9, 9941) which has retouch around most of its perimeter, to more substantial forms like Fig. 3.9, 9965 with retouch only slightly encroaching on the side. Some are irregular and/or have minimal retouch. Fig. 3.9, 9995 is an anomalous form. Although lumped

	Content of feature										*Details of formal retouch*							
Feature	*Cores*	*Struck nodules*	*Chunks, unidentifiable thermal shatter*	*Blades*	*Blade-like flakes*	*Flakes*	*Edge ret/ util*	*Worn edge*	*Formal retouch*	***Totals***	*Scrapers*	*Serrated*	*Denticulated*	*Backed and knives*	*Piercer*	*Arrowhead*	*Other*	*Description of other*
Causewayed enclosure ditch																		
6854	31	6	52	1	5	811	11	6	29	**952**	13	5	2		3	1	5	2 bifacial ret; 1 biface, 1 hammerstone; 1 flake from pol impl; 1 flint with hole
8950	1	1	11		6	166	2		1	**188**	1							
8920	8	2	38		25	577	3		9	**662**	5	2				1	1	tip of sickle or knife?
8956	1				2	10			1	**14**						1		
8965	2	1	7	1	12	155			1	**179**				2				
8969						5				**5**								
8952	1		10		1	54			2	**68**	1						1	flake from pol impl
Neo and Beaker																		
8894	2		4	1	1	109	1		7	**125**	6			1				
Early Neo features inside causewayed enclosure																		
8930						2				**2**								
6937			1		10	8				**19**								
6966	1					5	1			**7**								
8891		1				11			1	**13**	1							
8893	5		19			27	2		2	**55**						1	1	poss microburin
8896	7	1	15		7	264	3	1	6	**304**		3			1	1	1	poss burin’
8898	1	2	2		2	170				**177**								
8910						10				**10**								
8921			1							**1**								
8924						12	1			**13**								
8926	1	1	4	1	4	129	1		2	**143**	1	1						
8928			1			13				**14**								
8934			1		1	7				**9**								
Early Neo features outside causewayed enclosure																		
4967	2		4			53			3	**62**	2					1		
8800					12	69	1		4	**86**	2	1				1		
Totals	**63**	**15**	**170**	**4**	**88**	**2667**	**26**	**7**	**68**	**3108**	**32**	**12**	**2**	**3**	**4**	**7**	**9**	
Later Neolithic and EBA features																		
2691			1			16			1	**18**	1							
2908			8			352			5	**365**	3			1			1	indet ret
6095						2				**2**								
6707	6		6		1	188	6	1	25	**233**	17	4	1	1			2	1 flake from polished impl; 1 flake from ret
6908	3		3			76			3	**85**	3							
6964					1	26			2	**29**	2							
6968			5			39			1	**45**		1						
8914			4			65	1		2	**72**	1				1			
8918					1	8				**9**								
8932			2	1		12	1			**16**								
Totals	**9**	**0**	**29**	**1**	**3**	**784**	**8**	**1**	**39**	**874**	**27**	**5**	**1**	**2**	**1**	**0**	**3**	

Note some features are mixed early and later Neolithic

Table 3.12 Lithic assemblages from selected Neolithic features

together under the heading of scrapers it is unlikely that these artefacts had the same function and it is unfortunate that such an ubiquitous type is so poorly understood.

Serrated pieces
The majority of the artefacts with serrated edges and gloss were found in earlier Neolithic contexts (19). However, it is interesting that they were not recovered from the Late Bronze Age enclosure ditches which had a high proportion of Neolithic types. It may be that their use and discard was in a different area.

Knives
Only one formal knife (Fig. 3.13, 9101) was recovered from Neolithic contexts. It has abrupt retouch on its left edge forming a backing and nibbling edge retouch along the right edge which appears slightly crushed. Three other examples on flakes, all from the early Neolithic causewayed enclosure ditches, are more *ad hoc* but appear to have abrupt retouch on a convex edge forming a back, and to have a cutting edge opposite the backing.

Flakes from polished implements
Ground and polished axes are regularly found in causewayed enclosures, whether complete or fragmentary and their re-use is not unusual. At Springfield only flakes were found; no complete axes or identifiable fragments were recovered. Two of the flakes struck from polished tools were found in early Neolithic features, F8894, F6854. The rest were from surface contexts. This is perhaps a little unexpected but may suggest that whatever the reason for the deliberate deposit of artefacts in the enclosure ditches the flakes from the axes were not part of this.

Laurel leaves
Two of the laurel leaves come from Neolithic features and the rest were found in the Neolithic area. As a form they are typical of earlier to middle Neolithic assemblages (Saville 2002, 99).

Bifacial
A small hand-axe-like object, 60 x 54 x 23mm, (Fig. 3.14, 9876) was recovered from F6854. It is shaped with flakes removed from both faces but cortex has been left on the rounded butt. It is made on a pebble with thin cortex and is orange brown in colour. It seems to be in the same condition as the rest of the material and does not appear to be rolled or worn in anyway and so has been included in the Neolithic repertoire.

Denticulates
Denticulates are rare in the earlier Neolithic contexts. They include a large flat core-like object (Fig. 3.12, 9019) from F6854 which as been flaked around the edges forming a denticulated edge, and another flake from the same feature with edge chipping forming coarse denticulations (9846). The third piece, 3031 from F6707, is a fragment of a flake with two deep denticulations formed by the removal of two contiguous flakes. It could have been caused by accidental damage and may only have a fortuitous resemblance to a denticulate.

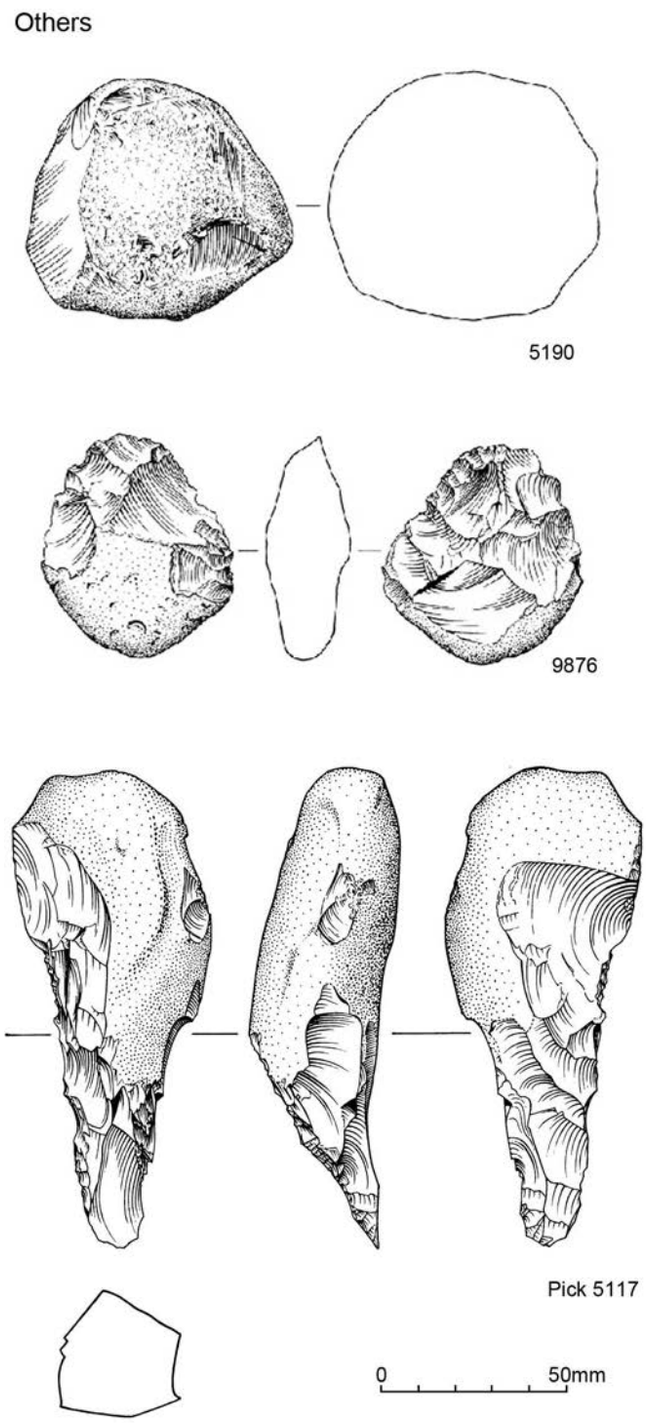


Figure 3.14 Other flint tools
(the numbers are object numbers)

Piercers
Piercers are not particularly common in the assemblage generally and only three examples come from earlier Neolithic features. They are small and squat and made on naturally pointed flakes. It is possible that the retouch is the result of post-depositional damage. A fourth flake with a pointed end has chipping along the sides (one concave) which converge to form the point but there is no retouch on the tip.

Fabricator
Two rod-like objects were found in the Neolithic area. The more complete example (Fig. 3.13, 9018) is a thick elongated flake which has been retouched on its edges (the right one bifacially). The striking platform remnant survives but the bulb of percussion has been flaked away. The other piece is too fragmentary to classify.

Hammerstone
One hammerstone (Fig. 3.14, 5190) was recovered from F6854. It is a large nodule of brown grey flint with a fresh cortex. One end is quite heavily abraded and there is abrasion on ridges.

The reasons for the presence of lithics (and other artefacts) in causewayed enclosures and their ditches are probably multifarious. The majority of the artefacts seem to result from domestic activity not performed in the ditches (Saville 2002) and their deposition in the enclosure ditches may have been expedient disposal. Exactly how and why this took place is particularly difficult to disentangle though some have suggested structured and even possibly ritual deposition (Richards and Thomas 1984; Thomas 1999; Saville 2002; Bradley 2004; Garrow *et al*. 2005; Garrow 2007) but at Springfield, even though a limited area was excavated, it does seem that only certain types were regularly disposed of in this way (particularly arrowheads and serrated pieces) and others were not (flakes from polished axes, laurel leaves, *etc*). Further studies, both functional and spatial, in less mixed deposits at other more comprehensively excavated enclosures may help to elucidate such questions (*cf* Beadsmore *et al*. 2010).

Late Neolithic/Early Bronze Age contexts and artefacts
(Table 3.12)
Compared to the earlier Neolithic features, fewer artefacts were recovered from later Neolithic/Early Bronze Age features (about 400 artefacts and a similar number from Beaker contexts). A substantial number of these came from F6707, F2908 and F8894. Most of these are flakes, the proportions being very similar to the earlier Neolithic features. Technologically it is difficult to separate out an assemblage particularly as there may have been some mixing. Retouched artefacts are rare, but the typologically distinct forms are considered below.

Transverse arrowheads
The transverse arrowheads are likely to be late Neolithic in date. Two are of Green's oblique type and although not found in late Neolithic contexts almost certainly derived from the activity associated with the Grooved Ware. Oblique forms tend to be associated with Clacton/Durrington Walls sub-styles (Green 1984, 33). The chisel-ended example (Fig. 3.11, 7939) was recovered from a surface context in the area of Grooved Ware/Beaker activity outside the main east entrance of the Late Bronze Age enclosure.

Barbed and tanged arrowheads
Based on conventional associations one would expect that the barbed and tanged arrowheads would belong in these contexts, however they are either unstratified or from a Late Bronze Age feature. It is likely however, that they derive from activity (possibly burials) of Early Bronze Age date especially as one is calcined and may originally have been associated with a cremation.

Scrapers
As remarked above it is difficult to relate the scrapers to particular time periods. The scrapers from F6707 are not markedly dissimilar from those in earlier Neolithic contexts but those from F2691 and F2908 are on the larger side and perhaps less regular. The edge of one from F2691 is also heavily rounded from use. A small thumbnail type of scraper from the area in which Beaker pottery was found (9839) may well related to that phase of activity (Bamford 1982; Wainwright 1972).

Other
Two possible knives, similar to those from the earlier Neolithic contexts, were recovered from F6707 and F2908. Both have one abruptly retouched back and light chipping on the presumed cutting edge.

Late Bronze Age contexts
(Fig. 3.15, Table 3.13)
The majority of the finds from contexts of this date come from the enclosure F2500.

Large quantities of lithics (over 10,500 *i.e.* almost half of all the lithics recovered) were found in the ditches of this enclosure (Table 3.13). The segments of this ditch cut a number of Neolithic features and so many of the lithics are likely to be residual, especially as most of the lithics were found in segments nearest to the causewayed enclosure ditches or to other Neolithic features and may be Neolithic in date. The possibility that some are contemporary with the enclosure ditch should not be discounted as discussed below.

Indeed the flint is not evenly distributed in the ditches as can be seen from Table 3.13 and Fig. 3.15, (see also Fig. 2.10). Over 40% of the lithics come from ditch 4051 with a quarter of those from segment 4001. Adjacent ditch 4050 has a large quantity in the end segment 4037 where the bronze mould fragments were found. Other segments have sporadically high numbers (see Fig. 3.15).

Stratigraphically few artefacts (not more than 10%) were recovered from the surface of the enclosure ditches, most coming from Group 4 fills (the late silts with residual later Bronze Age pottery) and from the last phase of the Bronze Age occupation in the middle silts. Only a very small percentage (between 1 and 2%) come from the primary silts, except in ditch 4055 where it is as high as 6%, but we should note that the lowest quantity of lithics (under 4%) come from ditch 4055.

The assemblage is dominated by a high proportion of struck and/or thermally shattered nodules and flakes. Most cores are very irregular and sometimes difficult to distinguish from the shatter. The more regularly worked pieces are often globular or have orthogonal platforms. The striking platforms tend to be a thermal scar and the cores are rarely worked around their circumferences and the volume of the nodule is not maximised. Most of the flakes are squat and short (87% are under 40mm in length and only a few are over 60mm in length). They all have prominent bulbs of percussion suggestive of reduction by hard hammer and some cortex on the back (this is a very high proportion compared to Neolithic assemblages such as Etton in which over 50% of the flakes had no cortex at all (Middleton 1998). Blade technology is rare, although

Segment		***Total***	*Cores*	*Struck nodules*	*Thermal*	*Flakes*	*Scrapers*	*Denticulates*	*Piercers*	*Knives*	*Arrowheads*	*Serrated*	*Other*	*Notes/description of other*
4051	4000	**263**	5	5	8	245								
	4001	**1505**	48	94	142	1220							1	abr edge retouch
	4002	**433**	32	55	83	260	1	2						
	4003	**334**	14	28	34	255	1	1	1					
	4004	**212**	7	19	9	175	2							
	4005	**694**	15	36	49	591	2						1	thermal piece with edge retouch
	4006	**424**	7	60	61	292	1	1	1				1	end retouch
	4007	**284**	6	55	35	186	1	1						
4052	4008	**122**	4	11	10	97								
	4009	**269**	10	29	23	203	1		3					
	4010	**94**	2	8	6	78								
4053	4011	**236**	4	16	25	190					1			
	4012	**424**	1	19	6	398								
	4015	**161**	1	2	2	156								
	4016	**507**	4	56	13	432	1	1						
	4017	**144**	4	9	3	124	1		1				2	1 retouch or damage; 1 retouch on ventral face
	4018	**158**	2	7	3	146								
4054	4019	**5**				4	1							crude may be fortuitous
	4020	**0**												
	4023	**457**	3	30	28	391	2	1	1	1				
	4024	**461**	15	52	13	378	1						2	1 flake from polished impl; 1fl crushed edge, ? from chopper
	4025	**40**		1		39								
	4026	**22**	1		2	19								
4055	4027	**86**	2	2	1	79	2							
	4028	**83**		2	1	78	1		1					poss piercer
	4029	**53**		2		50							1	hollow scraper
	4030	**144**	9	21	7	106	1							
	4031	**45**				45								
4050	4032	**181**		16	1	163	1							
	4033	**141**		13	3	124	1							
	4034	**516**	13	33	18	444	2	3	1	1		1		knife is pressure flaked
	4038	**174**	5	8	2	157	1						1	truncated core reused as hammerstone
	4035	**174**	10	20	9	132	2		1					
	4036	**40**	4	1		33			1				1	fabricator
	4037	**910**	42	189	64	605	1	3	3				3	1 piercer has robust long point; 2 retouched in concave edge; 1 truncated
Surface		**530**	13	22	10	481	2		1	1				
Totals		**10326**	**283**	**921**	**671**	**8376**	**29**	**13**	**15**	**3**	**1**	**1**	**13**	**Total retouched = 76**

Table 3.13 Flint from F2500 by segment

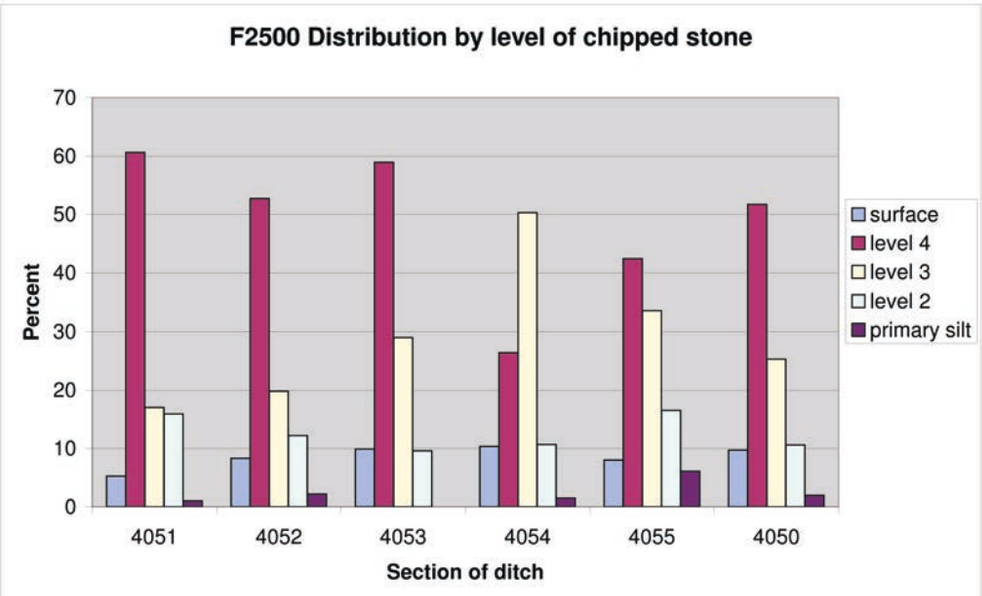


Figure 3.15 Comparison of quantity of flint per segment and level from F2500

there is a very fine blade core that is almost certainly residual. Only 0.5% of the chipped stone is retouched. The proportion of retouched pieces by level more or less complements the general assemblage, but spatially they are not necessarily in proportion to the overall quantity of flint.

Retouched pieces

Although formal tools are relatively numerous (the second highest concentration of such artefacts) they form only a small proportion of the artefacts in the ditch (less than 0.5%). They are present throughout the ditch deposits but are concentrated in the upper levels (Table 3.13). Many are probably residual from the Neolithic deposits disturbed by the digging of the enclosure ditch and it is not easy to identify a later Bronze Age lithic assemblage (but see Humphrey and Young *e.g.* 1999). Potentially some forms such as the denticulates (Fig. 3.12), which seem to be concentrated in Late Bronze Age features and are noticeably rare in Neolithic contexts, may be contemporary. Similarly piercers seem to concentrate in F2500 and as distinctive forms we might note especially the heavy borer (Fig. 3.12, 9037) and a long pointed drill-like object (Fig. 3.12, 3136); it is also likely that some of the scrapers belong to such a context. However, the fine plano-convex knife (Fig. 3.13, 9051), leaf-shaped arrowheads and an oblique arrowhead are likely to be residual.

Small lithic assemblages, some with refitted debitage, are now regularly documented in Late Bronze Age enclosures, for example the North Ring at Mucking (Bond 1988), Broomfield (Saville 1995), Boreham Interchange (Martingell 1999), Manor Farm (Holgate 1994), South Hornchurch (McDonald 2000), Springfield Park (Harding 2003), as well as Lofts Farm (Holgate 1988a) and Broads Green (Holgate 1988b), the latter two being among the lithic assemblages listed by Humphrey and Young 1999). They seem to establish that flint working continues regularly into the Late Bronze Age.

Discussion

The wide chronological range of the contexts and the intercutting of features at various times brings issues of residuality in the assemblage from Springfield Lyons. This makes it difficult to assign pieces to particular horizons or to quantify the levels of activity represented by the chipped stone at any particular point in time so that much of the artefact dating is based on more traditional culture-historical attibutions rather than contextual ones.

Nevertheless at Springfield it would appear that knapping of some intensity took place somewhere on the site during the earlier Neolithic and the products were then discarded or placed in the causewayed enclosure ditches, whether simply as a safe way of disposal of refuse, or as caching, or a more meaningful act is at present difficult to elucidate. The ratio of cores to flakes is very varied so might suggest selective deposition and ideally one should look at refits across features (*cf* Garrow *et al.* 2005, Beadsmore *et al.* 2010). The possibility of refitting and the presence of flakes of similar materials suggest that careful technological and contextual analysis might allow the reconstruction of the placing of the material in some of the less disturbed features. Studies of the reduction sequences might produce a fuller picture of how people selected their raw materials and manipulated technologies to achieve their purposes although the mixed nature of the deposits makes this far from straightforward at Springfield.

In many ways the Neolithic component of the assemblage is broadly similar to those found in many other causewayed enclosures, although of course each site is slightly different from the next and there is no 'prescribed' repertoire in spite of apparently overarching similarities. It is relatively easy to document and compare sites based on the make-up of the assemblages and the technologies present, but it is not always clear that we are comparing like with like; for instance sometimes particular forms such as arrowheads may have had a defensive role in some cases *e.g.* Crickley Hill (Dixon 1988) though in others their presence is more sporadic (*cf* Saville 2002). It is difficult to come to any conclusion

about the reason for the arrowheads at Springfield Lyons because of the small area of the causewayed enclosure excavated. Whatever interactions happened inside causewayed enclosures it is likely that the artefacts found in them had some relevance to the activities taking place, whether routine or otherwise (Saville 2002, 102; Bradley 2004). Most are likely to have been the result of domestic rather than ritual activity and hopefully when more suitable assemblages are available it will be possible to attempt comprehensive functional and spatial analyses, but it is also important to consider how and where they were disposed of in relation to other activities on the site.

Despite extensive Late Bronze Age activity it has proved difficult to extricate late lithic material from the assemblage, especially when much of the Bronze Age activity took place adjacent to the Neolithic causewayed enclosure and clearly disturbed some of that activity. Undoubtedly some of the lithics belong to the Late Bronze Age and it is suggested that many of the smashed nodules and flakes in F2500 result from activity at this time; it is likely that the denticulates are a specific product and possibly some of the the piercers and scrapers. Regular occurrences of flint working after the early Bronze Age indicate a general decline (see for example Ford *et al*. 1984) but it is now fairly generally accepted (Humphrey and Young 1999) that the use of stone tools continues through the later Bronze Age and into the Iron Age, albeit in a more *ad hoc* way than that familiar from Neolithic assemblages, possibly as Edmonds (1995, 188) suggests, because in this case they were almost entirely utilitarian and no longer had a social role.

V. Worked stone

by H. Major

There were few stone objects from the site, other than those made from flint. This is normal for a prehistoric site in Essex, due to the lack of hard stone in the area other than glacial erratics.

Four definite or possible saddle quern fragments were found. One potential quern fragment made from quartzitic sandstone is Neolithic in date, from pit 4967. It is possible that this formed part of a structured deposit, as was the case at the Springfield Cursus, where a quern was found in association with cremated animal bone (Major 2001). The causewayed enclosures at Orsett and St Osyth both had saddle quern fragments in their main ditches (Hedges and Buckley 1978, 290; Major 2007). In the case of St Osyth, they were possibly part of a structured deposit.

The other three pieces of saddle quern were from late Bronze Age contexts, including the one definite saddle quern fragment recovered, which was made from a quartzitic sandstone boulder. The other two fragments were sandstone and sarsen. Sandstones of various types are the most common materials used for late Bronze Age saddle querns in Essex; they are often modified natural boulders, and it is rarely possible to trace the source.

One piece of stone from a late Bronze Age context was definitely non-local. A lump of greensand weighing 1000g was recovered from post-hole 2606. The stone probably came from Kent, and although there are no surviving signs of working, it is likely that it was part of a saddle quern. More recent excavations in close proximity to Springfield Lyons produced a definite fragment of greensand quern which may be late Bronze Age in date (Every 2003. It could be later in date: since it is not specified in the report whether it is a saddle quern or a rotary quern). There are fragments of greensand from several other Bronze Age sites in the county, including coastal sites at North Shoebury (Buckley and Major 1995) and Heybridge Basin (Major 1988), which are possible contact points for trade with Kent.

The remainder of the stone artefacts comprised two pieces of stone (probably natural pebbles from the gravel) which may have been used as rubbers, and a slabby fragment that may have been deliberately shaped into a rough square. All three pieces were from late Bronze Age contexts.

Saddle querns

(not illustrated)

1. Quartzitic sandstone. A possible saddle quern fragment; one surface appears to be worn, although it is slightly undulating. Wt. 404g, Neolithic pit 4967

2. Quartzitic sandstone. Fragment from the almost vertical edge of a saddle quern made from a natural boulder. The underside and edge have been left in their natural state and the grinding surface is worn. The thickness of the stone is fairly constant. 124x110mm, Th. 36–44mm. Wt. 942g. <2366>, fill 3013, Enclosure Ditch 2500

3. Fragment of burnt sarsen, possibly from the edge of a saddle quern. One face may be worn. Wt. 110g. Context 4523, Late Bronze Age PH 4523.

4. Sandstone. A probable fragment of saddle quern, with a very smooth, dished surface, 85x66mm, Th. 38mm. Wt. 210g. <3260> Fill 3941, Enclosure Ditch 2500

VI. Neolithic pottery

by Nigel Brown

A total of 2,601 sherds weighing 15.124kg was recovered from the excavation. The majority of the pottery belongs to the earlier Neolithic (2394 sherds, 14.029 kg), the remainder being mainly Grooved Ware or Beaker (297 sherds, 1.095 kg). Most of the pottery was derived from Neolithic features and superficial deposits in the area of the causewayed enclosure close to the main east entrance of the Late Bronze Age enclosure. However, some derived from pits in and around the Late Bronze Age enclosure and therefore outside the causewayed enclosure.

The pottery has been recorded using a system adapted from one used to record later prehistoric pottery from Essex (details in archive).

Fabrics present were:

		% sherd count	*% weight*
A	Flint, S 2 well sorted	2	1
B	Flint, S-M 2	22	20
C	Flint, S-M 2	16	20
D	Flint, S-L 2 poorly sorted	22	40
E	Flint and sand, S-M 2	6	7
H	Sand, S 2	2	1
I	Sand, S-M, 2–3	1	1
M	Grog, often with some sand or flint	6	5
O	Quartz and flint and some sand S-L 2	6	10
P	Sparse very fine sand occasional M-L flint	1	1
Q	S-L flint, S-M grog 2	1	1

Where:

Size of inclusions
S = less than 1mm diameter
M = 1–2mm diameter
L = more than 2mm diameter
Density of inclusion
1 = less than 6 per cm^2
2 = 6–10 per cm^2
3 = more than 10 per cm^2
Rim forms present
1 = Simple
2 = Rolled
3 = Externally thickened
7 = Internally decorated/bevelled

Of all rim sherds present 28% by sherd count, 23% by weight were form 1, 47% by sherd count 48% by weight were form 2, 24% by sherd count 28% by weight were form 3, 1% by sherd count and weight were form 7.

Many of the plain rims (form 1) are of Grooved Ware and Beaker vessels, and all of the internally decorated/bevelled rims (form 7) are Grooved Ware or ?Collared Urn (Fig. 3.19, 70–3, 95)

Early Neolithic
(Fig. 3.16–3.18, 1–60)
Few of the vessels were sufficiently reconstructable to attribute to a specific form, although the general nature of the forms present can be suggested. Simple round bodied bowls (*e.g.* Fig. 3.16,1; 3.17, 44, 46), and larger deeper bag shaped bowls (*e.g.* Fig. 3.16, 13; Fig. 3.17, 45, 47, 48), occasionally with a slight neck (*e.g.* Fig. 3.17, 51) predominate, with some round or slack shouldered S profiled bowls (*e.g.* Fig. 3.17, 33–34). None of the vessels where the profile survives reasonably well are carinated. However, the assemblage included some carinated sherds (*e.g.* Fig. 3.16, 29, 30; Fig. 3.17, 39, 40) and there are also a few angular shoulder sherds with rows of stab and drag decoration below the shoulder (*e.g.* Fig. 3.16, 6, 23, 25; Fig. 3.17, 35, 43). In addition to those few sherds with stab and drag, decorative techniques include; ripple burnish or burnished lines (*e.g.* Fig. 3.16, 1, 19; Fig. 3.17, 42; Fig. 3.18, 56), light stroke patterns (*e.g.* Fig. 3.16, 19; Fig. 3.17, 32), finger furrowing on rims (*e.g.* Fig. 3.16, 2–4, 21; Fig. 3.17, 48), and occasional fingernail impressions, there is a single example of a lug (Fig. 3.18, 60), and a single small sherd with cord impressions from a surface context (Fig. 3.16, 24) might belong with this material, although since cord impression is very rare in Mildenhall assemblages it may be of later date.

By far the largest number of reconstructable forms, or rims which could reasonably be judged as likely to derive from open or closed forms, are derived from open forms, there are also some neutral forms; very few closed forms were present. The assemblage can be ascribed to the Mildenhall style generally used to describe the decorated early Neolithic pottery in a broad area of eastern England south of the Wash. The predominance of open forms and general lack of shouldered vessels is similar to Mildenhall assemblages from Orsett (Kinnes 1978), Brightlingsea (Brown 2008), the Stumble (Brown 2012), and Kingsborough (Gibson and Leivers 2008). Some other assemblages have rather more closed and shouldered forms including St Osyth (Lavender 2007), Hurst Fen (Longworth 1960) and possibly the sites at Spong Hill (Healy 1988), and Kilverstone (Knight 2006). There also appears to be some variation in rim form, markedly rolled rims occur quite frequently at Springfield (*e.g.* Fig. 3.16, 8, 9, 11–18; Fig. 3.17, 36, 38), as they do at Brightlingsea (Brown 2008), something the material from these sites has in common with the plain bowl assemblage from Broome Heath (Wainwright 1972). By contrast such rim forms are rare at Kilverstone (Knight 2006), Etton (Kinnes 1998), and appear to be largely absent in the material from the Kingsborough causewayed enclosures in North Kent (Gibson and Leivers 2008). Similarly whilst thickened rims are present at Springfield, the assemblage generally lacks the elaborately thickened or expanded rims which are striking components of assemblages at Kilverstone (Knight 2006), Hurst Fen (Longworth 1960) and Etton (Kinnes 1998). It now seems reasonable to regard Mildenhall assemblages as representing, not so much a regional style, as a ceramic reflection of a '….network with altogether looser connections in which none of the major sites is wholly single style…' (Cleal 1992, 303).

Mildenhall style pottery dates from the fourth millennium BC and recent reviews suggest a duration of up to five or six hundred years (Gibson and Leivers 2008; Healy forthcoming), roughly within the period 3,800–3,200 BC.

Grooved Ware
(Fig. 3.19, 61–74, 83)
The small size of the assemblage, together with the relatively small sherd size and the lack of reconstructable forms makes classification difficult. However, the decorative techniques on sherds derived from features and deposits toward the eastern edge of the main excavated area, in and around the causewayed enclosure, include plastic decoration on the interior of rims (Fig. 3.19, 70–73, 83), dot filled lozenges (Fig. 3.19, 68), rows of oval impressions (Fig. 3.19, 67) and grooved lines (Fig. 3.19, 69) sometimes opposed (Fig. 3.19, 74). All are appropriate to the Clacton sub-style (Wainwright and Longworth 1971), and all can be paralleled at the Clacton type site (Longworth *et al.* 1971, pls xxxv–xxxviii). Sandy fabrics dominate amongst this material though grog tempered sherds are also present. The material recovered from pit 2691, and residual in later features which cut it (Fig. 3.19, 61–66), is rather different with decoration comprising applied cordons and finger impressions, all the sherds are grog tempered. The differences with the Clacton-style material are apparent, and whilst confident attribution to one of the Grooved Ware sub-styles is difficult the material may belong to the Durrington style (Wainwright and Longworth 1971). In the light of Garwood's (1999) chronological review the Grooved Ware would date broadly to the third millennium BC. The variation seen at Springfield might be functional but may well represent difference in the date of deposition within that long period of time.

Beaker
(Fig. 3.19, 74–93)
The small size of the assemblage, the generally very small sherd size and lack of reconstructable forms makes attribution to any of the classificatory schemes used to describe Beaker pottery difficult. Comb impressed decoration predominates though finger impressions also

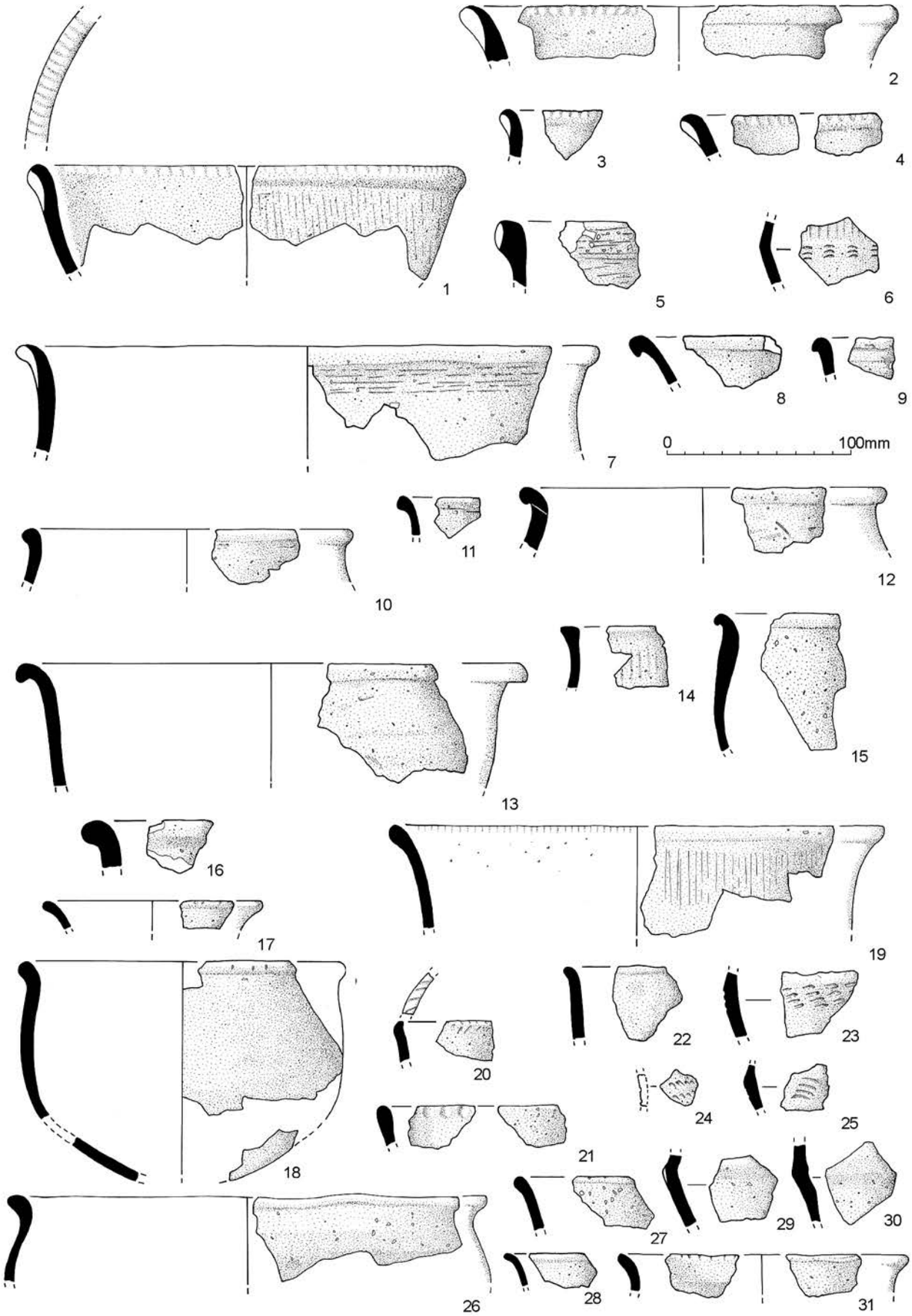


Figure 3.16 Early Neolithic pottery from external features and from the causewayed enclosure

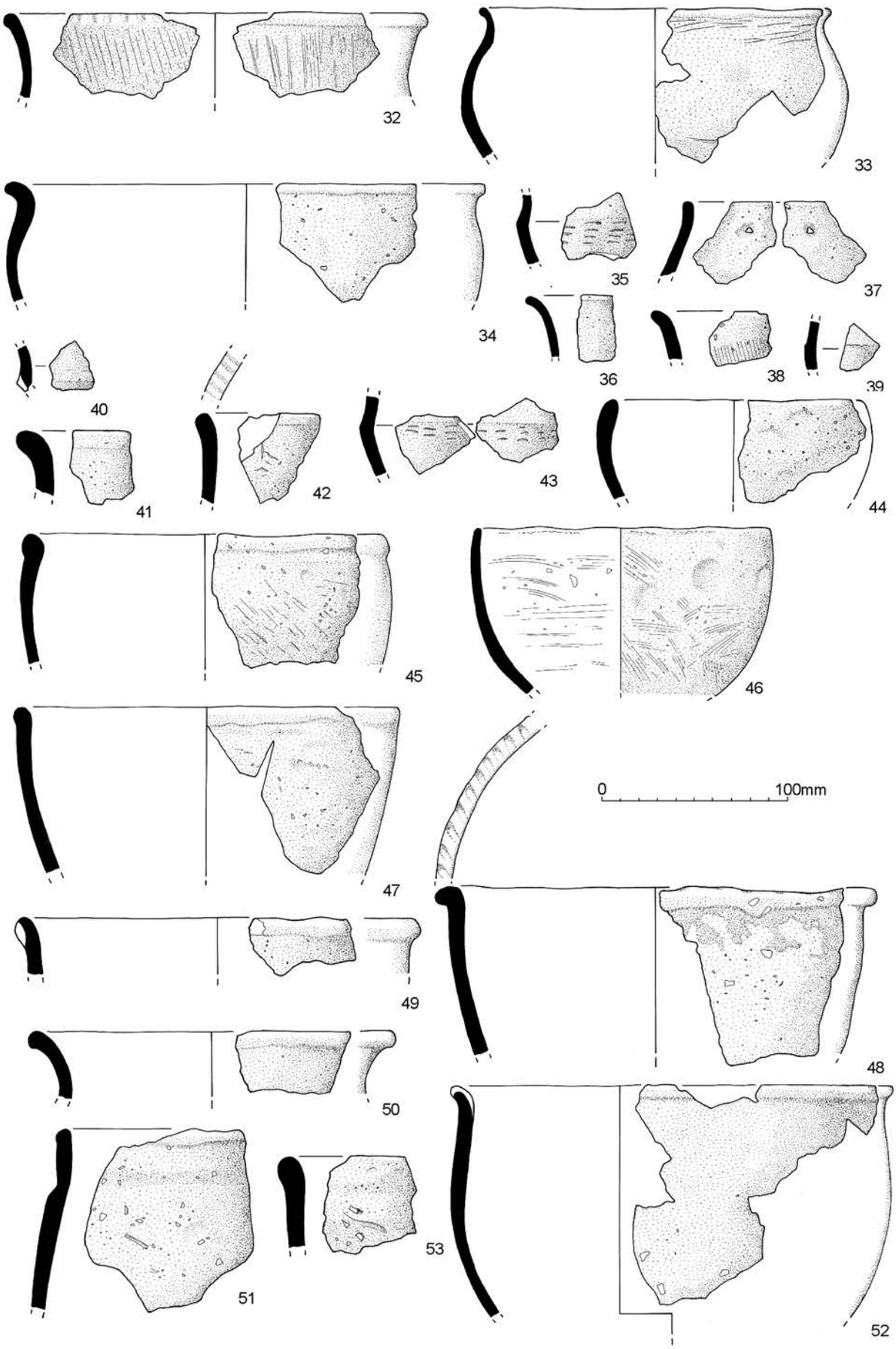


Figure 3.17 Early Neolithic pottery from the causewayed enclosure

occur (Fig. 3.19, 90, 91). A small lug/strap handle might be from a Beaker (Fig. 3.19, 75), a few other sherds (Fig. 3.19, 92–94), may belong with this material or the Grooved Ware pottery. Dating is problematic, however much of the Beaker and the Clacton-style Grooved Ware was recovered from slots F6908 and F6707 and the upper fills of F6854 into which they were cut. Both the Beaker and Grooved Ware material was of similar sherd size and condition, accordingly a date within the period when both Grooved Ware and Beaker were in use between about 2,500 and 2,100 BC may be suggested (Needham 2005).

? Collared Urn

(Fig. 3.19, 94–96)

One sherd in a grog tempered fabric, with stabbed impressions on the exterior of the rim and cord impressions on the interior (Fig. 3.19, 95) may be from a Collared Urn, as may a flint tempered sherd with stabbed impressions above and below what appears to be the base of a collar (Fig. 3.19, 94). A very small vessel in a large temperless fabric with a marked collar and concave neck might also belong with this material. However, all this material could be accommodated in the general range of Grooved Ware and Beaker pottery, for instance the rim (Fig. 3.19, 95) could be the top of the rim of a Durrington Walls-style Grooved Ware vessel.

Distribution and deposition

The majority of Mildenhall-style pottery was recovered from features associated with the causewayed enclosure. The largest quantity came from the two large pits which formed part of the causewayed ditch, F6854, F8920, together with nearby features and superficial deposits. A total of 236 sherds weighing 2.350kg was recovered from F6854. Most of the pottery derived from layers in the central shaft (9875, 9876, 9882) and comprised large often joining sherds of several vessels, but never representing more than half a vessel (Fig. 3.17, 44–50). Feature F8920 produced 255 sherds weighing 2.537kg. Most of this material was recovered from layers toward the bottom of the feature (11053, 11071) and again comprises large often joining sherds of several vessels (Fig. 3.17, 51–53; Fig. 3.18, 54–60).

A linked group of pits 8926, 8896 and 8898 (Fig. 2.1) produced a rather smaller quantity of pottery (47 sherds 0.374kg, 157 sherds 0.677kg and 185 sherds 0.889kg respectively) and yielded joining sherds of the same vessel (Fig. 3.17, 33). This may suggest that these features were backfilled at the same time.

The superficial deposits also yielded a significant amount of material (817 sherds weighing 3.090kg) the majority of the classifiable pottery being Mildenhall style. These layers may in part represent deposits similar to those at the Stumble (Wilkinson *et al.* 2012) which have somehow managed to escape complete destruction by

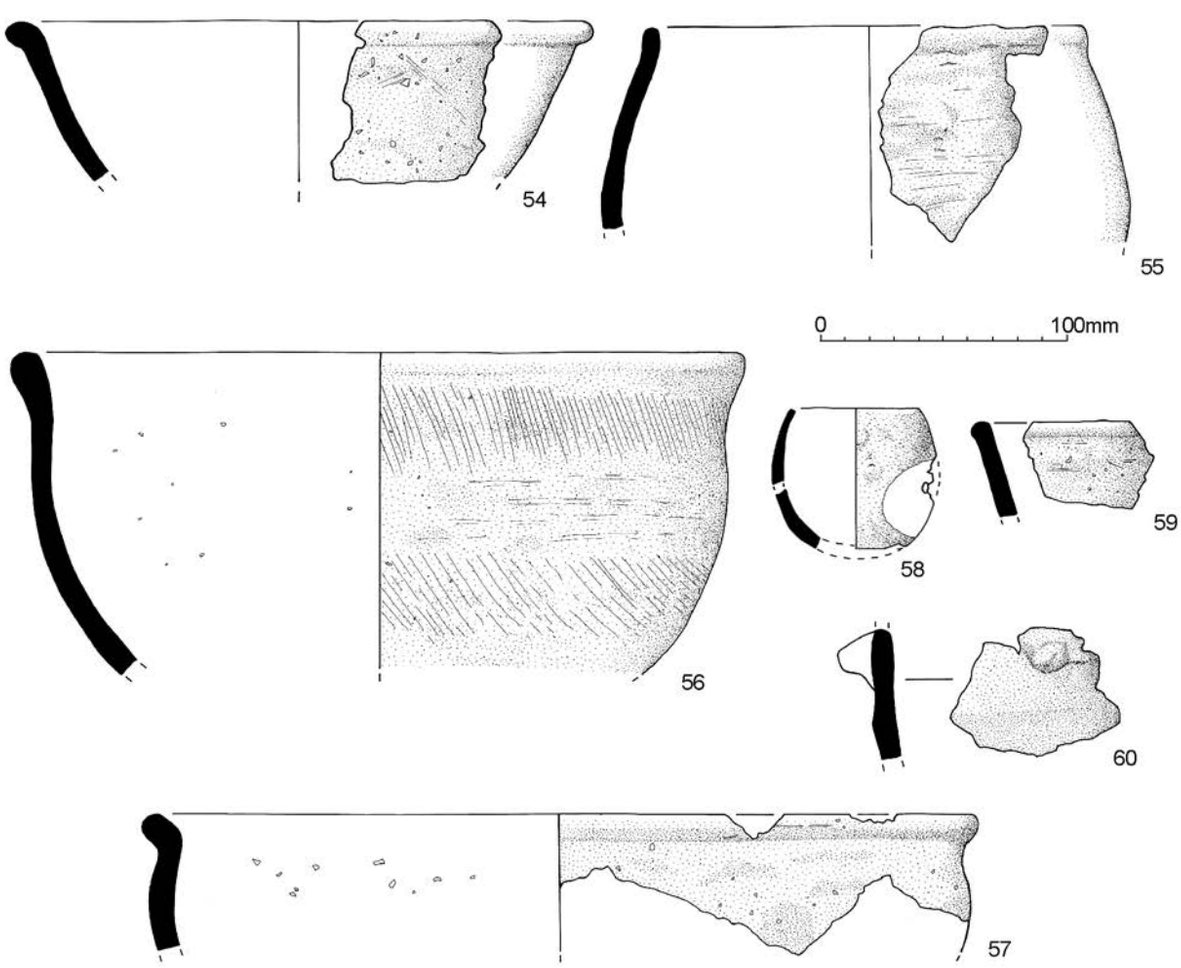


Figure 3.18 Early Neolithic pottery from the causewayed enclosure

ploughing. Some of this superficial deposit, may be the upper fills of underlying features, one large rim sherd was recovered lying vertically directly above where the pit complex 8898, 8926, 8896 was later revealed. However, other quite large sherds were recovered from areas with no underlying features, and in part these layers may represent some of the original ground surface surviving in a slight hollow, just possibly created by people and animals passing between and around the pits of the causewayed enclosure. Two of the sherds recovered from areas with no underlying features, joined to a sherd from the upper fill (9862) of F6854. This may indicate that the final fill of F6854 and at least part of the superficial layers were deposited in a manner similar to that suggested for features at Spong Hill (Healy 1988, 106).

About 75m south-west of the causewayed enclosure, another large pit F4967/4612 had been considerably disturbed by a Saxon building. This pit, and the features which cut it, produced a considerable quantity (149 sherds, 1.050kg) of Mildenhall pottery (Fig. 3.16, 1–13).

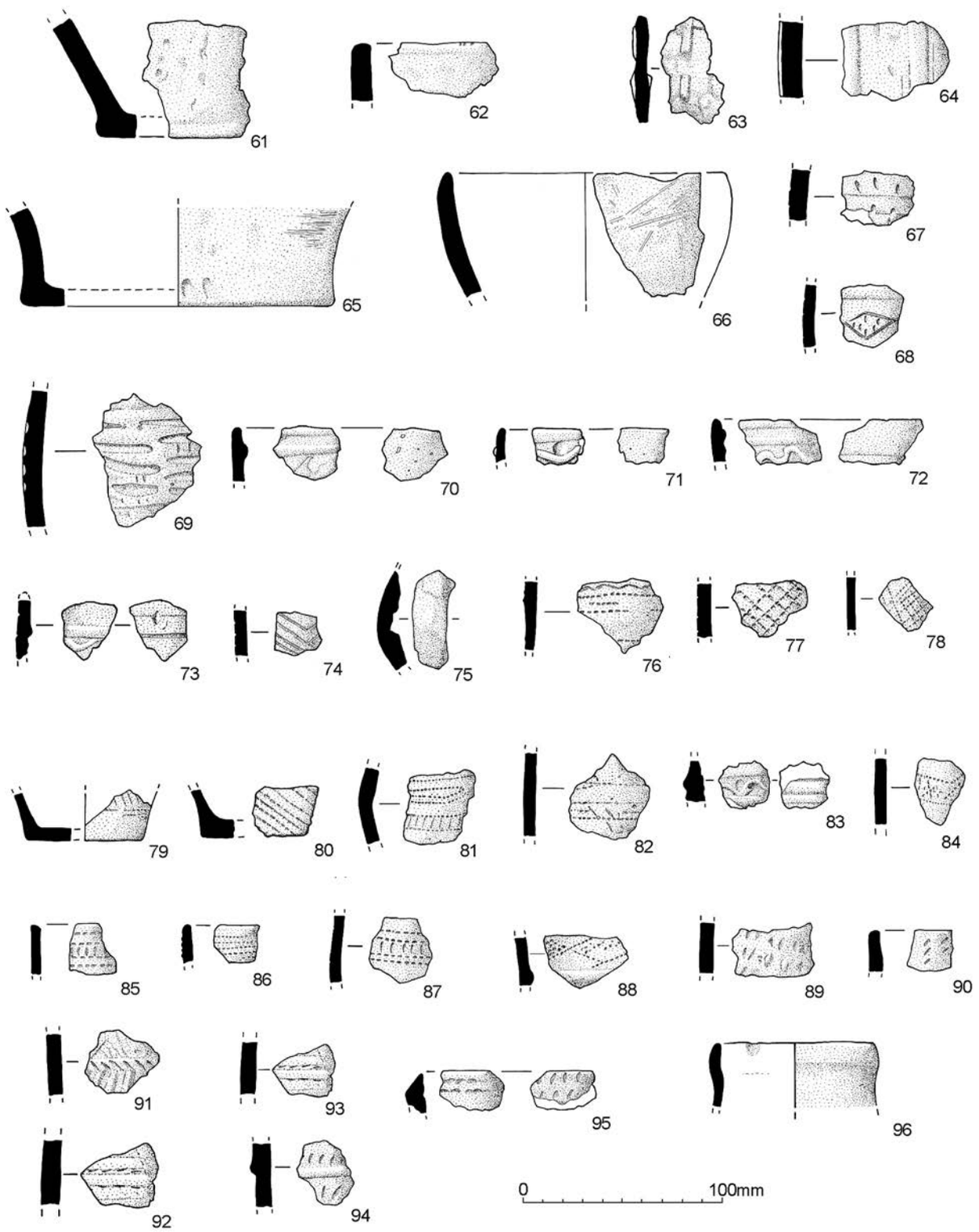


Figure 3.19 Grooved Ware, Beaker and related pottery

The pottery in this pit is probably the result of similar depositional practices as those which had taken place in F6854 and F8920. Given the relatively large sherd size and good condition, and presence of joining sherds in F6854, F8920 and F4967/4612, the pottery from these features was probably deposited quite soon after breakage.

The relatively large sherd size of the Mildenhall pottery deposited in quite large deep pits, contrasts with the smaller sherd size of the Beaker and much of the Grooved Ware material which was recovered from shallow features and superficial deposits. This contrast reflects a more general pattern of changing depositional practice between the earlier and later Neolithic in eastern England (Healy forthcoming).

Catalogue of illustrated pottery

The illustrated pottery represents the full range of variation and comprises 45% by sherd count of all rim, decorated, or otherwise diagnostic, sherds.

Fig. No.	*Drawing No.*	*Feature/Context*	*Rim Form*	*Comments*	*Fabric*
3.16	1	F4967 C3934	3	Very smooth surfaces, with burnish surviving. Ripple burnish on rim and exterior. Interior slightly abraded, patches of heavy abrasion on exterior. Fracture shows clear join where rim has been thickened, by addition of strip of clay to exterior.	E
	2	F4967 C3934	3	Exterior wiped, interior partly abraded. Light fingertip fluting on interior of rim. Fracture shows clear join where rim has been thickened, by addition of strip of clay to exterior.	D
	3	F4967 C3934	2	Light fingertip fluting on top of rim, smoothed surfaces.	C
	4	F4967 C3934	3	Light fingertip fluting on rim smoothed surfaces ?originally burnished.	C
	5	F4967 C3934	3	Wiped surfaces, join where rim has been thickened by a strip of slag.	D
	6	F4967 C3934	-	Stab and drag on shoulder, lightly incised vertical lines on neck. Smoothed ?originally burnished	O
	7	F4612 C3918	2	Exterior wiped below neck, abraded interior. Break shows rim added as separate strip of clay, coil join visible in break. Open bowl.	D
	8	F4612 C3918	2	Smoothed surfaces interior ?originally burnished. Open bowl.	C
	9	F4612 C3918	2	Wiped surface	D
	10	F4612 C3918	3	Smoothed surfaces partly abraded.	C
	11	F4612 C3918	3	Smoothed surfaces with some burnish surviving.	B
	12	F2636 C3915	2	External wiped surface, fracture shows rim added to top of vessel wall as separate strip of clay.	D
	13	F2636 C3904	2	Wiped surfaces, interior partly abraded, open bowl	D
	14	Surface C7548	3	Light stroke pattern on neck. Smoothed surfaces partly abraded	B
	15	C5561 Surface seg 4026	2	Wiped surfaces. Open round bodied bowl.	D
	16	Surface C9003	2	Smoothed interior, exterior partly abraded.	C
	17	C9820	2	Smoothed surfaces partly abraded, small bowl or cup.	B
	18	Surface C9840	2	Smoothed exterior partly abraded interior, fingernail impressions on exterior of rim. Round bodied slightly closed bowl.	C
	19	Surface C9840 F6854 C9862	3	Light stroke pattern on neck. Ripple burnish on top and interior of rim. Smoothed/burnished surfaces, patch of abrasion on lower part of exterior. Possibly same vessel as No. 32 Open bowl.	B
	20	Surface C9840	3	Abraded, incisions on top and front of slightly inturned rim, making chevron pattern.	B
	21	Surface C9840	1	Smoothed surfaces, abraded, light fingertip impressions on interior of rim	C
	22	Surface C9940	2	Wiped surfaces	C
	23	Surface C9840	-	Stab and drag on shoulder	C
	24	Surface C9840	-	Cord impressions on exterior, interior surface missing	C
	25	Surface C9541	-	Smoothed surfaces, stab and drag on shoulder.	E
	26	F6966 C9102	2	Open bowl with slight rounded shoulder and concave neck, abraded and burnt.	D
	27	F6937 C9023	2	Exterior of rim abraded and possibly burnt.	C
	28	F6937 C9023	2	Burnished rim of fine bowl.	A
	29	F6937 C9023	-	Shoulder, break shows that the shoulder has been emphasised by the addition of a separate strip of clay. Smoothed surfaces.	C
	30	F6937 C9023	-	Shoulder sherd exterior wiped, interior partly abraded.	C
	31	F8857 C9783	2	Fingernail impressions on interior of rim, wiped surfaces.	C
3.17	32	F8926 C11007	3	Open bowl, light stroke pattern on neck. Ripple burnish on top and interior of rim. Smoothed originally burnished surfaces. Possibly same vessel as No. 19.	B
	33	F8926 C11007 F8898 C11055 F8896 C9999 C9834 Surface	2	Open bowl, round bodied with slight neck wiped exterior smoothed surfaces partly abraded.	C

Fig. No.	*Drawing No.*	*Feature/Context*	*Rim Form*	*Comments*	*Fabric*
	34	F8896 C9999	2	Open bowl, burnt and abraded	D
	35	F8896 C9999	-	Smoothed surfaces partly abraded, stab and drag below shoulder	E
	36	F8898 C11056	2	Smoothed surfaces with traces of burnish surviving.	A
	37s	F8898 C9999	1	Post-firing perforation below rim, the hole has been drilled from the outside apparently after an earlier attempt to drill through from the inside, the two holes being slightly misaligned.	C
	38	F8898 C11051	1	Lightly incised vertical lines on smoothed exterior.	O
	39	F8898 C11056	-	Slight shoulder with smoothed surfaces	A
	40	F8898 C11056	-	Break shows angular shoulder added as separate strip of clay. Smoothed surface	A
	41	F8896 C9984	3	Smoothed surfaces abraded, abrasion particularly heavy on exterior.	E
	42	F8891 C9960	1	Wiped exterior, traces of faint ripple burnish on rim and interior.	B
	43	F8891 C9960	-	Stab and drag on shoulder, smoothed surfaces. Two sherds not joining but probably from same bowl.	B
	44	F6854 C9875	1	Plain slightly closed bowl slight irregular thumb impressions on surfaces as a result of vessel formation.	D
	45	F6854 C9875	2	Plain open bowl, groove below rim, smoothed interior wiped exterior.	D
	46	F6854 C9922	1	Open bowl, irregular thumb impressions on exterior as result of vessel formation. Wiped surfaces, patch of abrasion on exterior, possibly result of vessel use.	D
	47	F6854 C9875	2	Plain open bowl, wiped surfaces, slight irregular groove below rim on exterior.	D
	48	F6854 C9882	2	Open bag-shaped vessel, interior slightly abraded traces of light fingertip fluting on top of rim. Black deposit on exterior below rim, could be mineral concretion but might be result of cooking.	D
	49	F6854 C9876	3	Smoothed surfaces, slight traces of black deposit below rim. Break shows extra strip of clay applied to exterior to thicken rim.	C
	50	F6854 C9876	2	Rim and neck of open bowl, abraded.	E
	51	F8920 C11103	2	Large vessel with short upright, shallow neck, most of rim missing. Wiped surfaces,.patch of abrasion on exterior.	D
	52	F8920 C11103	2	S profile bowl, smoothed surfaces, badly affected by concretion. Break shows rim added as separate strip of clay.	C
	53	F8920 C11103	2	Wiped surfaces, ?open bowl.	O
3.18	54	F8920 C11053	2	Open bowl, wiped surfaces, interior badly affected by concretion	D
	55	F8920 C11053	1	Closed bowl, wiped surfaces.	C
	56	F8920 C11053	3	Vertical burnished lines below rim, horizontal at shoulder, sloping on lower body, surfaces particularly the interior heavily affected by concretion.	O
	57	F8920 C11053	2	Rim of very large storage/cooking vessel. Wiped surfaces badly affected by concretion	D
	58	F8920 C11119	1	Small cup, interior carefully smoothed, exterior smoothed but somewhat irregular with marks left by vessel formation as a 'thumb pot' What appears to be a firing spall on exterior, may in fact result from the surface flaking off during an attempt to drill a hole from the interior. Exterior surface flaked off towards base.	P
	59	F8920 C11117	2	Wiped surfaces	D
	60	F8950 C11230	-	Lug. Smoothed surfaces abraded, particularly on interior.	B
3.19	61	F2691 C3203	-	Flat base, vertical row of fingertip impression on exterior of vessel wall.	M
	62	F2691 C3203	1	Flat rim	M
	63	F2691 C3203	-	Finger impressed applied vertical and ?horizontal cordons. Interior missing.	M
	64	F2691 C3203	-	Applied plain vertical cordons	M
	65	Residual Saxon grave F4919 C5394	-	Flat base, slight trace of finger impressions on exterior toward base. ?Same vessel as 61	M
	66	F4941 C5425	1	Open bowl wiped exterior	M
	67	F2970 C3592	-	Rows of vertical impressions separated by incised lines	M
	68	F6095 C5966	-	Dot filled incised lozenge below horizontal incised line.	I
	69	F6095 C5966	-	Grooved lines with fingernail impressions on the ridges between	M
	70	F6854 C9936	7	Wavy applied cordon on internal rim bevel	I
	71	F6854 C9936	7	Wavy applied cordon on internal rim bevel	M
	72	F6854 C9856	7	Lightly grooved line on exterior wavy applied cordon below internal rim bevel.	I
	73	F8914 C11030	7	Top of rim missing Incised lines on exterior, internal wavy line cordon	I
	74	F6707 C7929	-	Incised chevrons on exterior	M

Fig. No.	*Drawing No.*	*Feature/Context*	*Rim Form*	*Comments*	*Fabric*
	75	F2986 C3610	-	Lug handle, exterior abraded	I
	76	Surface C7939	-	Horizontal comb impression, blank zone on neck above three horizontal comb impressed lines above comb impressed chevrons.	B
	77	Surface C7939	-	Comb impressed chevron pattern.	Q
	78	Surface C7939	-	Comb impression with? Filled and reserved lozenge pattern	B
	79	Surface C7939	-	Base. Abraded comb impression above blank zone.	B
	80	Surface C9830	-	Base, comb impressed exterior	Q
	81	Surface C7939	-	Shoulder, horizontal comb impressed line, with irregular pendant chevron below, above blank zone above double horizontal row linked by vertical rows.	B
	82	F6908 C9834	-	Horizontal rows of comb impression above and below blank zone, abraded.	I
	83	F6908 C9834	?7	Grooved line on exterior, wavy line cordon on interior.	M
	84	F6707 C7932	-	Comb impressions flanked by blank zones	Q
	85	F6854 C7947	1	Double row of horizontal comb impressions, above row of vertical stabbed impressions, above horizontal double row of comb impressions, above blank zone	I
	86	F8654 C7933	1	Horizontal comb impressed lines	I
	87	F6854 C7933	-	Double row of horizontal comb impressions, above row of vertical stabbed impressions, above double row of comb impressions, above blank zone. Possibly same vessel as 85	I
	88	F6854 C7933	-	Comb impressions in filled and reserved lozenge pattern, abraded	Y
	89	F6854 C9846	-	Finger pinched rustication	Q
	90	F6854 C9935	1	Smoothed surface, vertical ?cord impressions	E
	91	Surface C9910	-	Fingernail 'false cord' impression, forming chevron pattern.	Q
	92	Surface C9910	-	Fingernail 'false cord' impressions producing vertical and ?horizontal cordon effect	Q
	93	Surface C9004	-	Close set fingernail 'false cord' impressions, abraded	Y
	94	F2907 C3539	-	Horizontal stabbed impressions above cordon defined by close set fingernail impressions, a second row of stabbed impressions may be bounded by a similar cordon but this is obscured by the break.	C
	95	F6784 C9433	7	Stabbed impressions on exterior cord impressions on interior, ?Grooved Ware or possibly Collared Urn.	M
	96	Surface C9541	1	Faint trace of impressed lines on slight collar. One finger impression on interior of rim probably result of vessel manufacture.	O

VII. Late Bronze Age pottery

by Nigel Brown

Introduction

This report was written in the late 1980s. Apart from some updating to take account of the small amount of pottery recovered from trenches excavated after that date, and some additional references to material from more recently published sites, no major amendments have been made.

A substantial quantity of pottery was recovered from the site. Internal features produced 478 sherds (2.851kg), 1,349 sherds (3.690kg) were residual in later features or recovered from surface contexts, the enclosure ditch yielded 11,511 sherds (81.437kg), and external features 172 sherds (0.756kg), giving a total of 13,929 sherds (90.089kg). The pottery has been recorded using a system devised for prehistoric pottery in Essex (details in archive).

Fabrics present in the Springfield assemblage are:

A Flint, S, 2 well sorted
B Flint, S-M, 2
C Flint, S-M, with occasional L, 2
D Flint, S-L, 2 poorly sorted
E Flint, and sand, S-M 2
F Sand, S-M, 2–3, with addition of occasional L flint
G Sand, S, 3
H Sand, S, 2
I Sand, S-M, 2–3
J Sand, S, 2 with veg. voids particularly on surfaces
K Quartz, flint and grog (often with deep rounded or sub-angular voids), S–1, 1–2
L Quartz sometimes with some sand, S-L, 2
O Quartz and flint and some sand S-L, 2 poorly sorted
P Sparse very fine sand may have occasional M-L flint or sparse irregular voids
Q Flint S-L, Gray S-M 2
R Shell M-L, soft often laminated fabric
U Flint S-L, 2 with occasional irregular voids
V Flint S-M 1

Definitions

Size of inclusions
S = less than 1mm diameter
M = 1–2mm diameter
L = more than 2mm diameter

Density of inclusion
1 = less than 6 per cm^2
2 = 6–10 per cm^2
3 = more than 10 per cm^2

Description and affinities

The illustrated pottery (Figs 3.20–3.33) represents the full range of forms and decorative techniques.

Form A: Jar round bodied with short upright or flared rim.
These vessels are often plain (*e.g.* Fig. 3.20, 5, 6, 16 although some examples (Figs 3.23, 70; 3.26, 124) have cabled rims and others (Figs 3.24, 79; 3.26, 108) have rows of finger impressions on the upper body, one has the impression on the upper body and the rim (3.30, 177) and one example has a finer pinched rim giving a 'pie crust' effect (Fig. 3.31, 191). The interior of the rims occasionally have a thumb groove giving a concave internal profile (*e.g.* Figs 3.23, 70; 3.31, 191). Sometimes, there is a sharp angle between the rim and body on the interior giving a bevelled effect (*e.g.* Figs 3.20, 6; 3.28, 137). The rims are usually simple, flattened or rounded. Two very large jars have applied plain or decorated neck cordons (Figs 3.30, 169; 3.32, 205), these vessels also have developed T rims.

Form A jars occur widely in Late Bronze Age assemblages *e.g.* Lofts Farm (Brown 1988a fig. 15, 57), Broads Green (Brown 1988b, fig. 5.7), Runnymede (Needham and Longley 1980, fig. 21, 52–53, fig. 2.9, 217), Mucking North Ring (Barrett and Bond 1988, fig. 31.1) Mucking South rings (Brudenell forthcoming, fig. 105). The form is equivalent to Aldermaston Form 8 (Bradley *et al.* 1980).

Form B: Jar convex or fairly straight-sided with inturned or hooked rim.
These vessels are invariably undecorated and generally coarse, rims are simple rounded or flattened. One jar (Fig. 3.29, 154) has a sharply defined bevelled rim.

Form B jars occur widely in Late Bronze Age assemblages *e.g.* Broads Green (Brown 1988b, fig. 5.4). Petters Sports Field (O'Connell 1986, fig. 54, 263–264). Mucking North Ring (Barrett and Bond 1988, fig. 20.8). The form is equivalent to Aldermaston Form 5 (Bradley *et al.* 1980).

Form C: Jar bipartite with cylindrical or slightly concave neck, round shouldered.
These vessels are invariably plain with simple rims. One example (Fig. 3.20, 11) has a bead rim. These vessels form only a minor component of the Springfield assemblage.

Form C jars may be paralleled at North Shoebury (Brown 1995a, fig. 64.70) and are similar to vessels from Runnymede (Longley 1980, forms 14a and b) and Carshalton (Adkins and Needham 1985, fig. 5, 12–13).

Form D: Jar round or slightly angular shoulder with concave neck and out-turned rim.
These vessels are frequently decorated with fingertip impressions on shoulder and/or rim (Figs 3.24, 85; Fig. 3.25, 88, 92). They commonly occur in the later ditch silts.

Form D jars occur widely in later Late Bronze Age assemblages *e.g.* Lofts Farm (Brown 1988a, fig. 15.45), Staple Howe (Brewster 1963, fig. 41.1 and 7), Petters Sports Field (O'Connell 1986, fig. 43, 17 and 19).

Form E: Jar slack shouldered with upright or slightly outturned rim.
These vessels are frequently plain (*e.g.* Fig. 3.21, 28; 3.28, 145; 3.29, 158) although examples with cabled rims also commonly occur (*e.g.* Fig. 3.22, 57; 3.25, 90).

Form E jars are a common component of Late Bronze Age assemblages *e.g.* North Shoebury (Brown 1995a, fig. 65.78, 93), Mucking North Ring (Barrett and Bond 1988, fig. 21.35), Carshalton (Adkins and Needham 1985, fig. 3.1, 2 and 5), Petters Sports Field (O'Connell 1986, fig. 45, 46 and 48).

Form F: Jar tripartite angular or rounded shoulder flared rim.
These vessels occur in two varieties, large jars with widely flared rims (*e.g.* Fig. 3.24, 78; 3.25, 89; 3.26, 118) and smaller vessels with shorter less widely flared rims (*e.g.* Fig. 3.23, 63). The larger vessels generally have well smoothed or burnished surfaces sometimes with small neck cordons (*e.g.* Fig. 3.24, 78) or rippled shoulders (*e.g.* Fig. 3.29, 162). They generally occur in the upper ditch fills.

Comparable vessels are known from a wide range of Late Bronze Age or Early Iron Age assemblages *e.g.* West Harling (Clark and Fell 1953, fig. 14, 53–55, fig. 16.92) Mucking (Jones 1979, fig. 6). A single vessel (Fig. 3.24, 77) with finger impressed shoulder and nail impressions on the exterior can be closely paralleled by a sherd from West Harling (Clark and Fell 1953, pl. vi, 7) and is similar to material from Staple Howe (Brewster 1963).

Form H: Round bodied open bowls.
Vessels of this form are subdivided into four groups:

1. Plain open bowls tending to a hemispherical form (*e.g.* Fig. 3.20, 15 and 17), a number of small thin walled cups with smoothed or burnished surfaces occur in this form (*e.g.* Fig. 3.20, 4; 3.28, 147; 3.31, 189). These simple bowls occur very widely *e.g.* Broads Green (Brown 1988b, fig. 5.12, 13), Mucking North Ring (Barrett and Bond 1988, fig. 21.18, fig. 22.81). One vessel (Fig. 3.32, 199) has a slight bead rim and is equivalent to Runnymede form 5b (Longley 1980).

2. Vessels with slight shoulder and short upright rim (*e.g.* Fig. 3.20, 7; 3.22, 59; 3.27, 132). These vessels although often in quite fine fabrics generally lack any careful finish and are closely comparable to vessels from North Shoebury (Brown 1995a, fig. 64.69) and Lofts Farm (Brown 1988a, fig. 15.33). One vessel (Fig. 3.22, 59) in an almost temperless fabric has very carefully finished surfaces and appears similar to a vessel from Petters Sports Field (O'Connell 1986, fig. 56, 267). Another (Fig. 3.29, 151) has a slightly inturned rim and appears similar to a vessel from Thwing (Manby 1980, fig. 10.7).

3. Large globular bowls (Fig. 3.21, 32, 33; 3.22, 50; 3.23, 62), these vessels are generally well smoothed or burnished, the pot illustrated as Fig. 3.22, 50 being a particularly well finished example. However, coarser vessels also occur (*e.g.* Fig. 3.23, 62). Similar vessels are found in a range of Late Bronze Age sites *e.g.* Aldermaston Wharf (Bradley *et al.* 1980, fig.16.116F) These vessels are not easy to parallel although they have some similarity with pottery from the Netherlands (Bakker *et al.* 1977, fig. 8.7 and 13). Although vessels of this form are not obviously included in the Aldermaston type series (Bradley *et al.* 1980, fig. 11), Aldermaston fig. 14.62 may be from a similar bowl.

4. Small globular bowls with bead rims (Fig. 3.24, 76; 3.26, 114) these vessels are well finished with smoothed or burnished surfaces. They are equivalent to Runnymede form 7b (Longley 1980).

Form I: Bipartite angular bowls.
These vessels occur in both coarse (Fig. 3.29, 161) and fine wares (Figs 3.26, 100; 3.32, 204). They can be widely

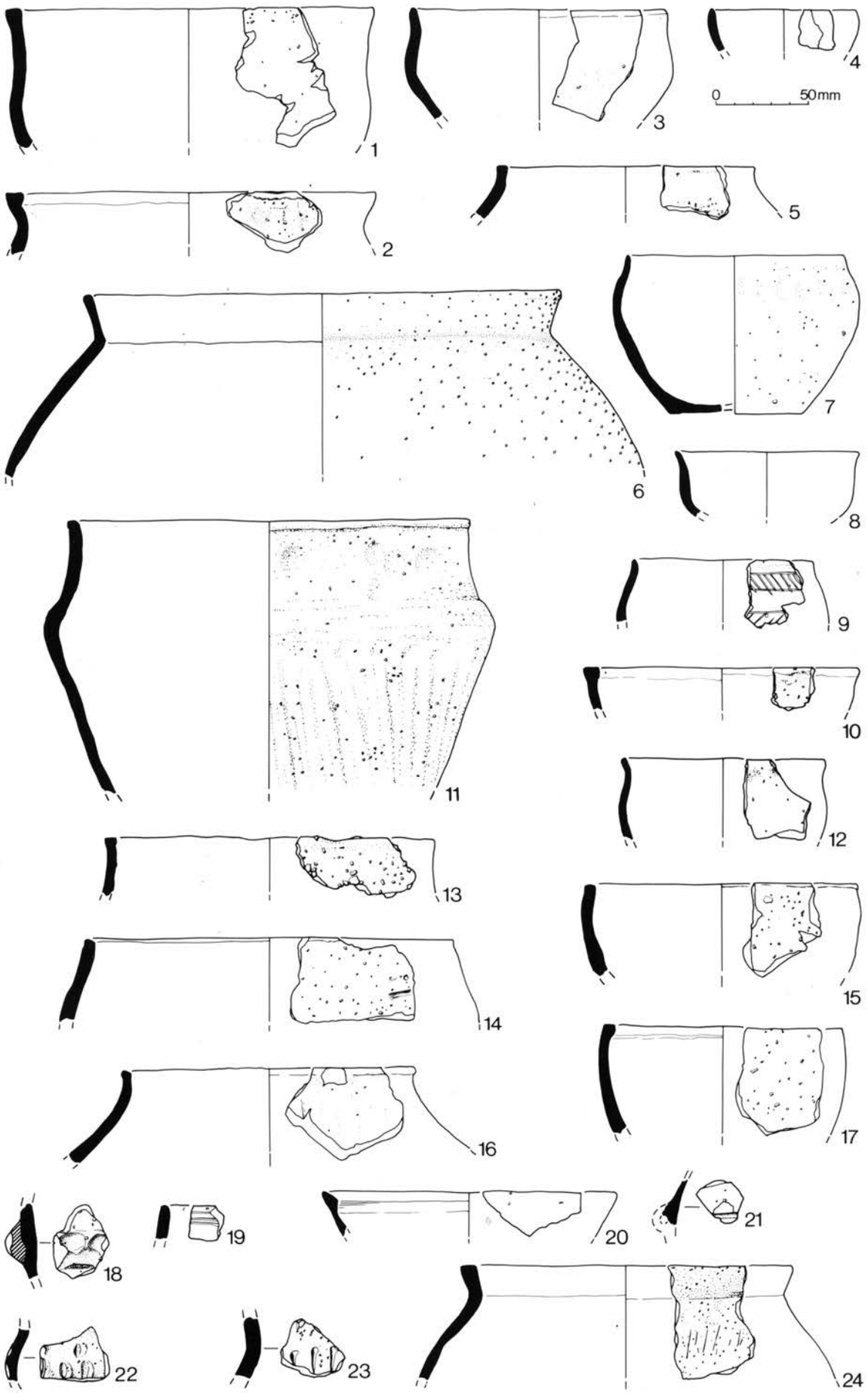


Figure 3.20 Late Bronze Age pottery from internal features , 1–24

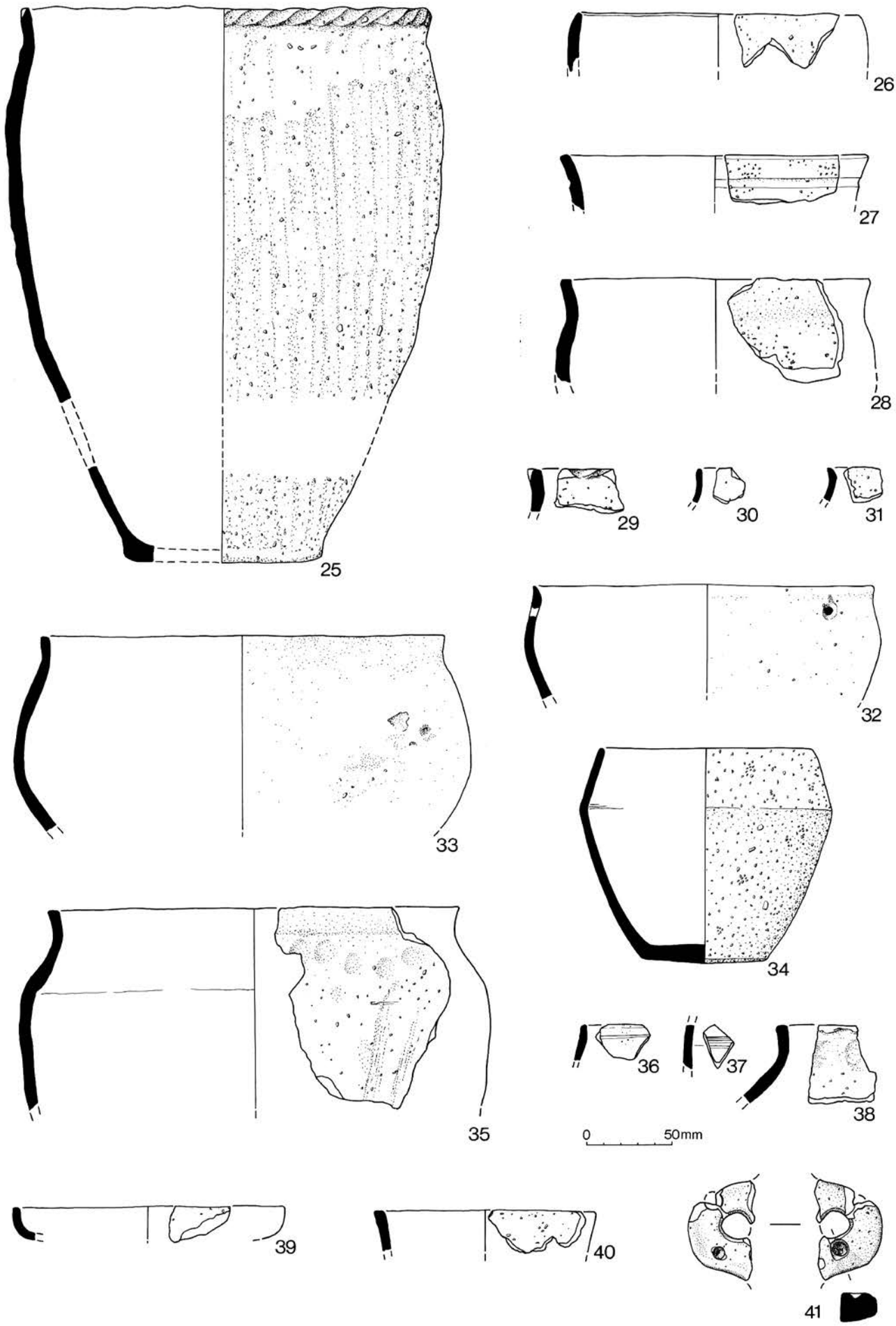


Figure 3.21 Late Bronze Age pottery from internal features, 25–41

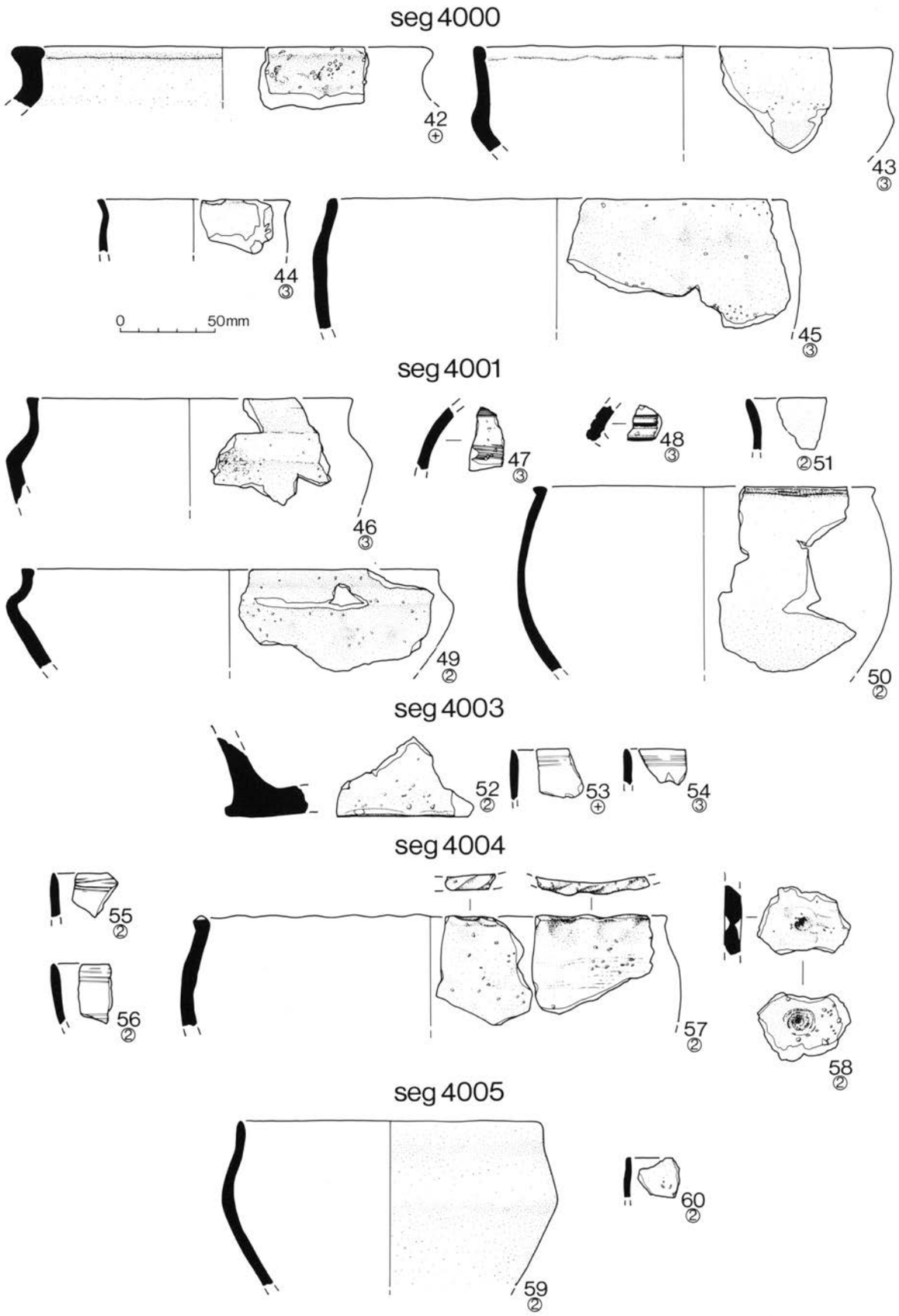


Figure 3.22 Late Bronze Age pottery from enclosure ditch , 42–60

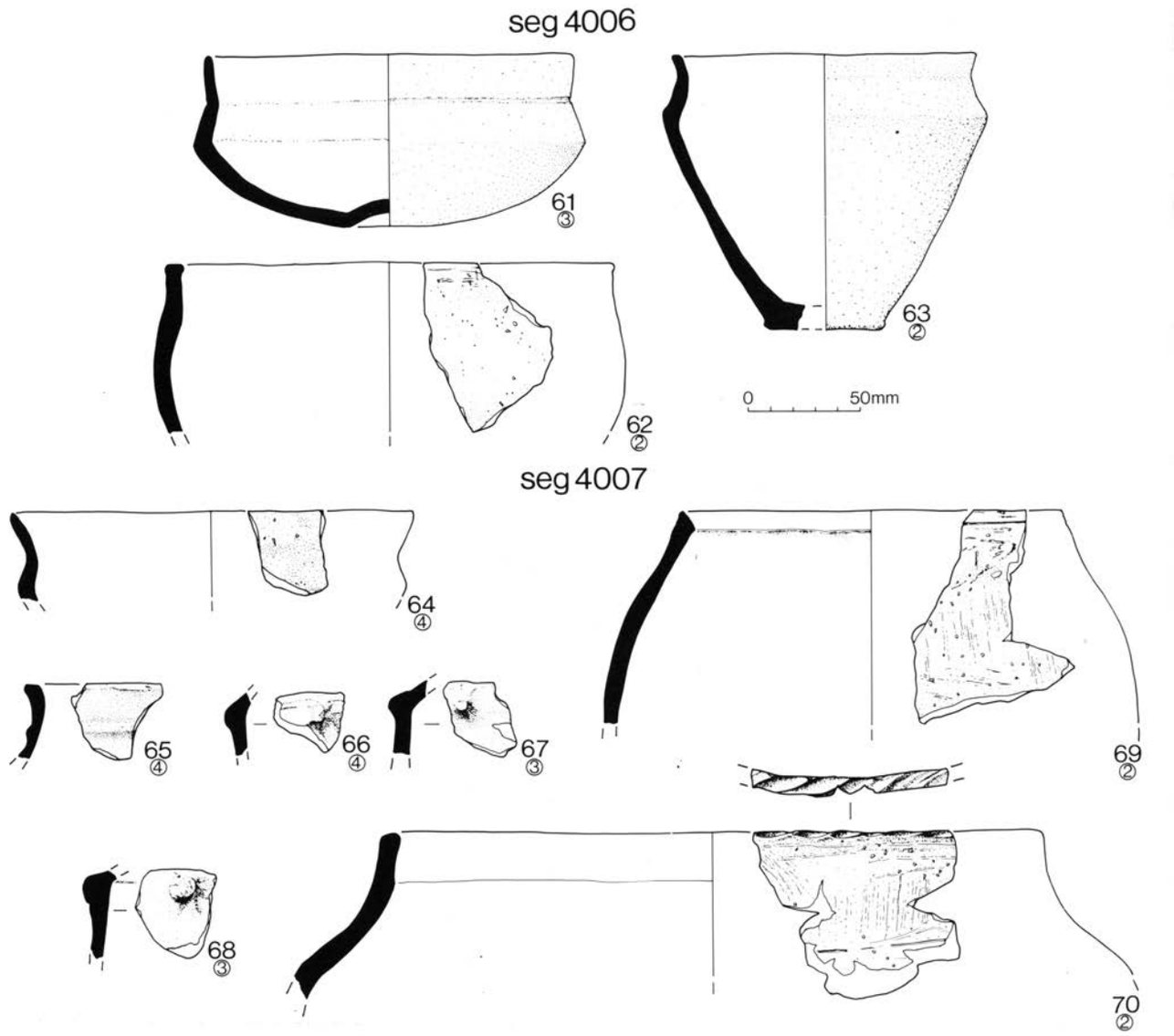


Figure 3.23 Late Bronze Age pottery from enclosure ditch, 61–70

paralleled in Late Bronze Age assemblages *e.g.* Minnis Bay (Worsfold 1943, fig. 6). Equivalent to Mucking North Ring form 18 (Barrett and Bond 1988) and Runnymede form 4a (Longley 1980).

Form J: Bowl tripartite round shouldered with flared, everted or upright rim.
Vessels of this form (Figs 3.20, 3; 3.26, 104) are possibly best regarded as a variation on form K bowls (see below).

Form K: Bowl tripartite angular shoulder with flared or upright rim.
In the Springfield Lyons assemblage form K bowls occur in a very wide range of variations, no two being quite the same (*e.g.* Figs 3.22, 43, 49; 3.23, 61, 64). Rims are usually plain and rounded, one (Fig. 3.22, 43) has internal beading. Surfaces are well smoothed and/or burnished. Decoration rarely occurs, one sherd (Fig. 3.30, 180) possibly from a form K vessel has a lightly grooved chevron above the shoulder. An omphalos-based bowl (Fig. 3.23, 61) has a single grooved line at the neck, this vessel is closely paralleled by a bowl from Heathrow (Canham 1978, fig. 17.59). A few sherds from the late ditch fills (*e.g.* Fig. 3.22, 48; 3.24, 72; 3.28, 140; 3.32, 195) are probably from form K bowls and have grooved lines above the shoulder. They are reminiscent of the decorated form K bowls which are a prominent part of the Darmsden-Linton style (Cunliffe 1968). However, except in a couple of instances (Fig. 3.22, 48; . 3.29, 159) the grooved lines are shallower and narrower than in local Darmsden-Linton vessels (Brown 1988a) and in general the form K bowls at Springfield lack the rather standardised form which is characteristic of these bowls in Darmsden-Linton assemblages *e.g.* Brown 1988a, 1992. One vessel with a low shoulder and marked internal rim bevel (Fig. 3.28, 149) is hard to parallel amongst Late Bronze Age assemblages locally but is very similar to a bowl from northern France (Brun 1986, pl. 32.1.1).

Form L: Bowl, flared, open.
These vessels are uncommon and generally have smoothed and occasionally burnished surfaces, with

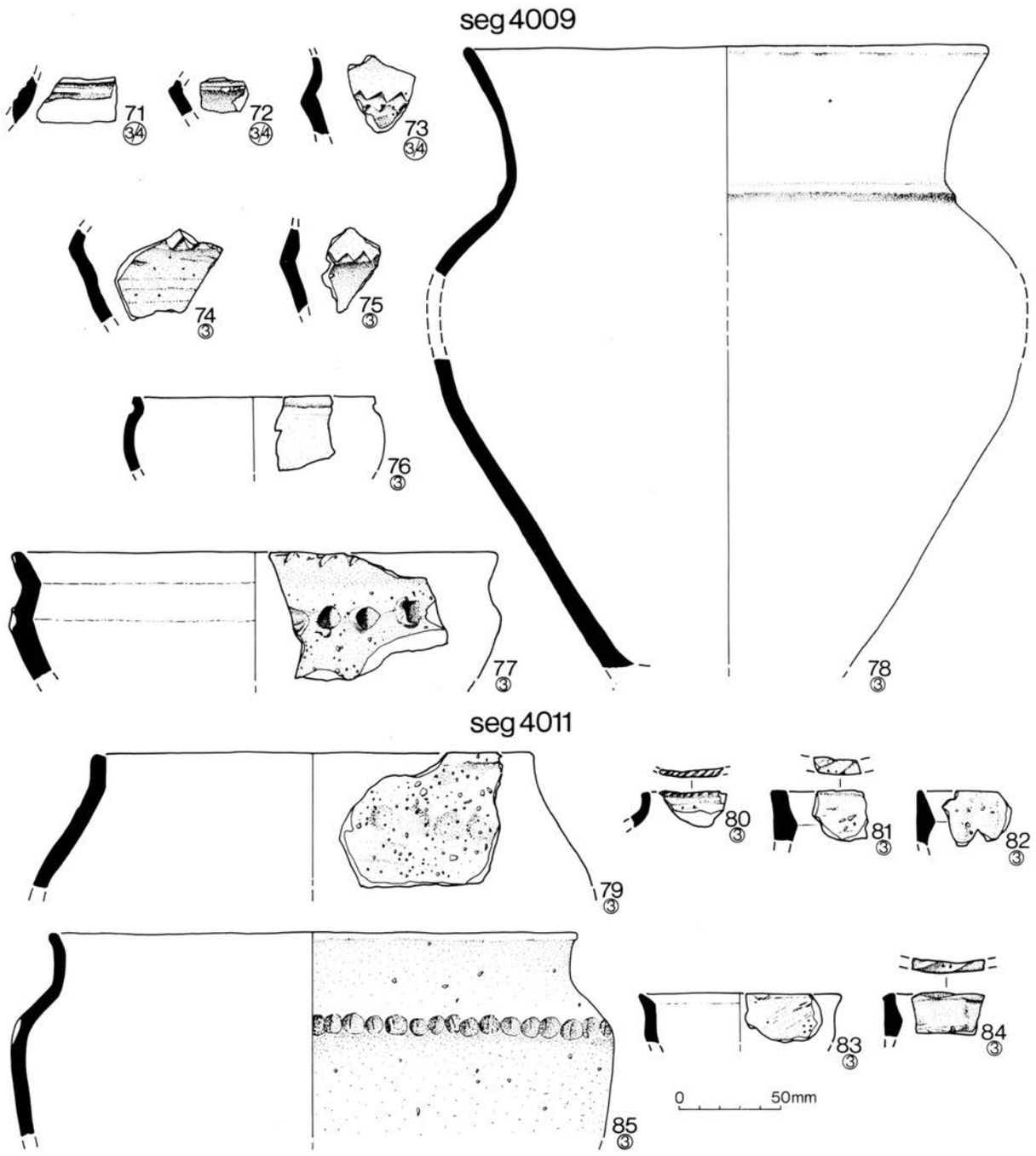


Figure 3.24 Late Bronze Age pottery from enclosure ditch, 71–85

marked internal rim bevel (Fig. 3.20, 20) or flat topped internally thickened rim (Fig. 3.32, 194). The latter vessel can be closely paralleled at Mucking North Ring (Barrett and Bond 1989, fig. 52) and among the Darmsden-Linton pottery from Lofts Farm (Brown 1988a, fig. 14.59), Staple Howe (Brewster 1963, fig. 44.2).

Form M: Bowl, round bodied, flared rim.
These vessels have a tendency to slack almost straight-sided profile (*e.g.* Figs 3.20, 8, 12; 3.22, 44). Sometimes the rim has a distinct internal bevel (*e.g.* Figs 3.24, 83; 3.26, 105; 3.33, 207).

Form N: Jar, tripartite, high angular or rounded shoulder, short upright or slightly everted rim.
Jars of this form are usually quite small and occasionally decorated with rows of finger or nail impressions at the shoulder (*e.g.* Fig. 3.26, 123; 3.28, 142; 3.32, 193). One (Fig. 3.32, 193 has a roughly cabled rim. Vessels of this form occur mainly in the upper ditch fills and can be widely paralleled in local Late Bronze Age and Early Iron Age assemblages *e.g.* Lofts Farm (Brown 1988a, fig. 15.44), Hadleigh (Brown 1987, fig. 4.5), Rook Hall (Adkins *et al.* 1984–5, fig. 15.45, 46).

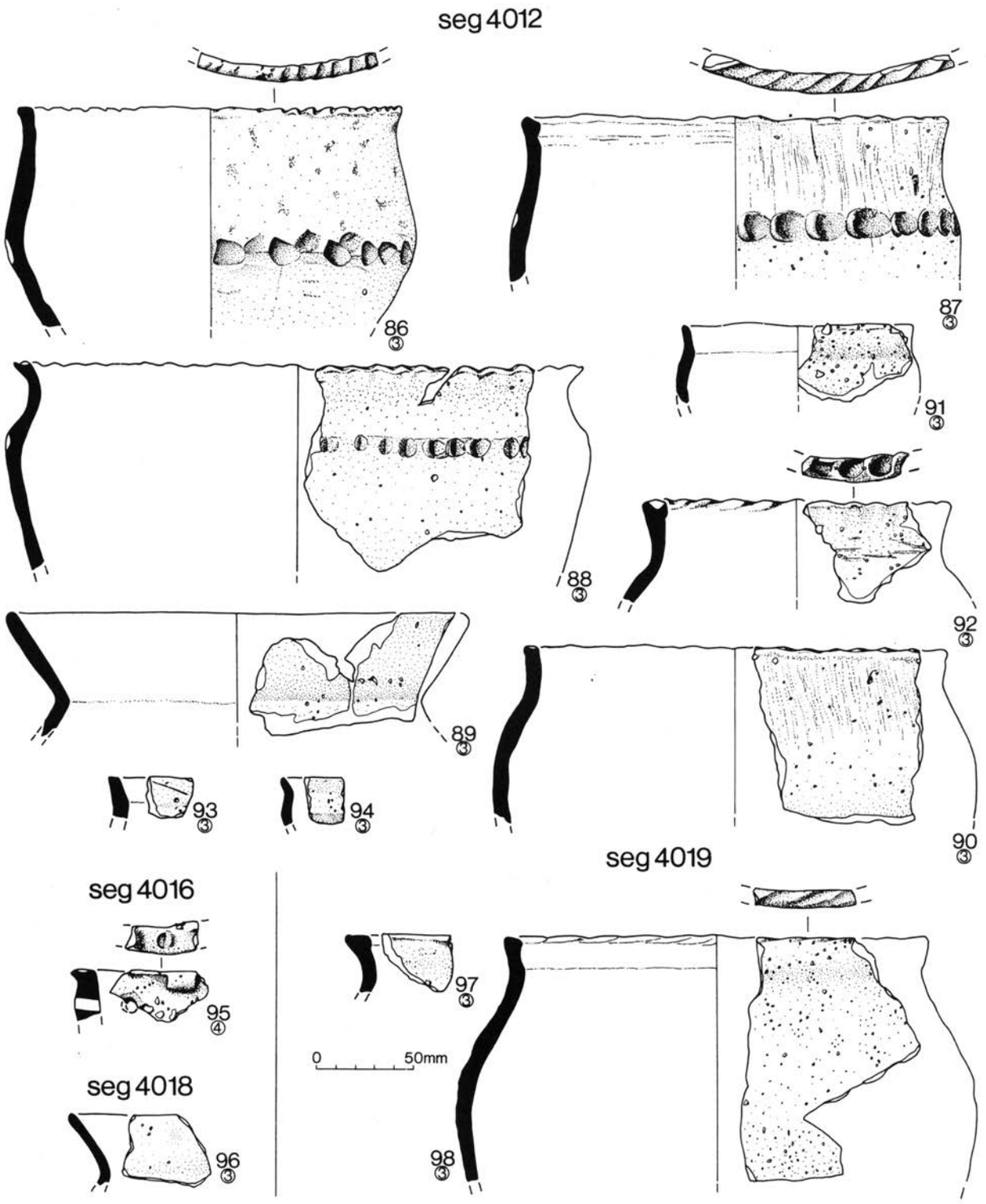


Figure 3.25 Late Bronze Age pottery from enclosure ditch, 86–98

Form O: Bowl, biconical bead rim.
Only one sherd (Fig. 3.29, 156) identifiable to this form was recovered from the site. Such bowls frequently occur in decorated assemblages *e.g.* Lofts Farm (Brown 1988a, fig.14.30), Petters Sports Field (O'Connell 1986) West Harling (Clark and Fell 1953, figs. 15.69 and 16.97), Staple Howe (Brewster 1963).

Form Q: Jars, bucket shaped.
A few rim sherds apparently from large straight-sided vessels were recovered, although they are generally of insufficient size (*e.g.* Figs 3.27, 126, 130; 3.28, 136) to be certain of their form.

Form R: Jar, barrel shaped.
These vessels are generally of large size often with bevelled rim (Figs 3.23, 69; 3.30, 164; 3.32, 203), one jar

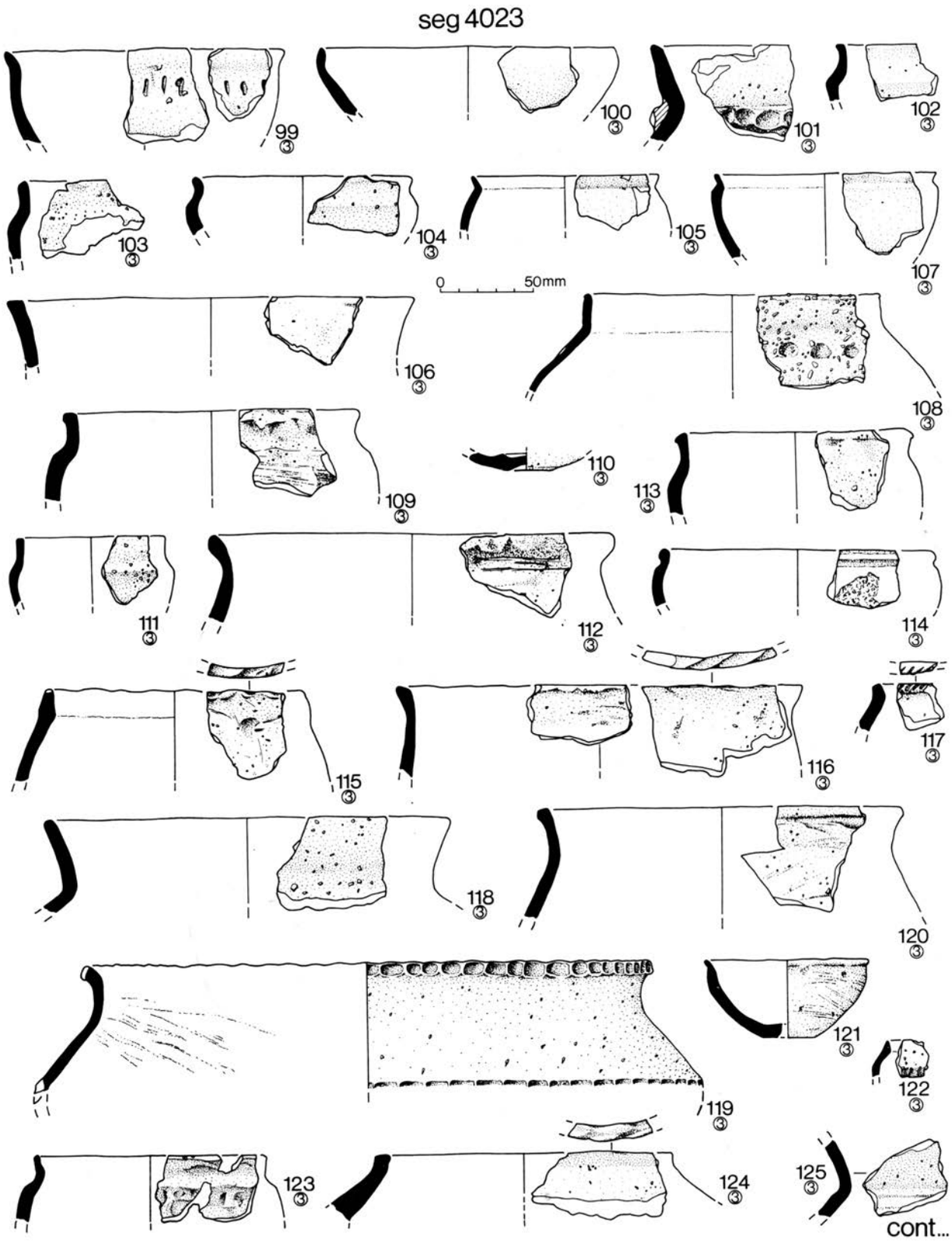


Figure 3.26 Late Bronze Age pottery from enclosure ditch, 99–125

has cabled decoration on the exterior of the rim (Fig. 3.21, 25) one has a row of fingertip impressions on the body (Fig. 3.30, 164). Another has profuse fingertip rustication. On this pot there is a blank zone below the rim, and some sherds have undecorated areas indicating the existence of one or more other blank zones (Fig. 3.32, 203). If the reconstruction of the vessel is correct, it provides a close parallel for vessels from the Netherlands (Bakker *et al.* 1977, fig. 8.4).

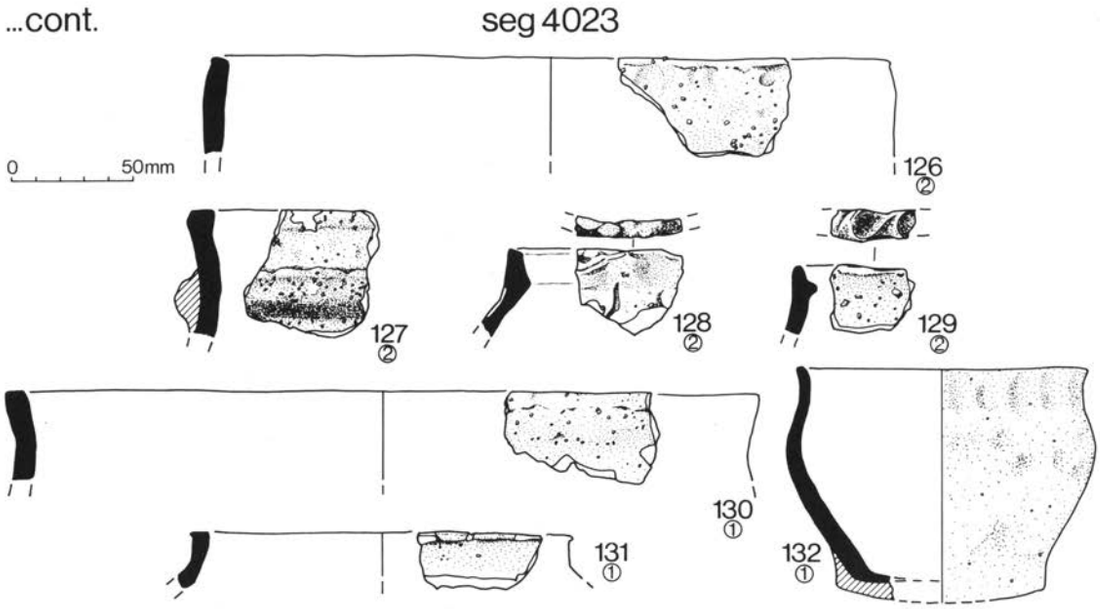


Figure 3.27 Late Bronze Age pottery from enclosure ditch, 126–132

Form S: Jar, bipartite, angular.
Few vessels of this form were recognised. They are generally plain (Fig. 3.21, 34); one from the upper ditch silt has a finger impressed shoulder, and slashed decoration on the rim (Fig. 3.25, 86).

Miscellaneous
Three sherds from 4009 probably all from a single angular bowl have deeply impressed triangles at the shoulder (Fig. 3.24, 73–75). These sherds provide a very close parallel for material from West Harling (Clark and Fell 1953, pl. iii 10, 12–14). The West Harling sherds were tentatively related to continental *kerbschnitt* decorated pottery. A sherd decorated in a similar fashion was recovered from Mucking North Ring (Barrett and Bond 1988, fig. 21, 36).

Some sherds from form H cups have one or more zones of horizontal lightly incised or combed lines (Figs 3.21, 36, 37; 3.22, 53–56; 3.28, 147). Such decoration occurs widely on similar pots including a number of sites in Essex (*e.g.* Brown 1995a, fig. 63.54, 56; Brudenell forthcoming; Harrison 2000, fig.17, 50).

Three sherds derive from a small vessel with pinched up knobs (Fig. 3.23, 66–8). Small knobbed pots occur widely in Deverel-Rimbury assemblages and there is some indication that they may be a relatively late component of Deverel-Rimbury assemblages (Brown 1995b, 129). A small knobbed pot from Coombe Warren (Field and Needham 1986) indicates that vessels of this kind occasionally occur in Late Bronze Age assemblages. The Springfield sherds support the occasional survival of this vessel form into the Late Bronze Age, the sherds are largely unabraded and there is little or no Deverel-Rimbury material from the site, so there seems little chance of their being residual.

Several sherds (the largest illustrated Fig. 3.28, 141) derive from a single perforated base, the perforations made before firing.

Date
The ditch fills provide a stratified sequence, since, as noted above, during the course of the excavation and throughout the post-excavation process no recuts were recognised, the pottery from the ditch was examined using four fill groups; primary fills (group 1), lower fills (group 2), middle fills (group 3), and upper fills (group 4). The upper fills (4) frequently contained later (Roman or Saxon) pottery and the Late Bronze Age (LBA) material is considered residual. These groups are indicated on the illustrations by the number in a circle or + for pottery from surface cleaning. This appears to be borne out by the high percentage of abraded sherds in the upper fill (Fig. 3.34). Of all pottery from the ditch, 4% of sherds were recovered from group 1 fills, 22% from group 2, 51% from group 3 and 23% from group 4.

In the late 1980s the draft pottery report ascribed a date of between 1000 and 800BC, probably in the ninth century, for the plain ware from the lower ditch silts. The ninth century date was suggested largely on the basis of the association with the casting moulds for Ewart Park swords, Ewart Park metalwork being thought, at that time, unlikely to date much before 900BC. The later decorated material from the middle silts was suggested to be of eighth century date. However, since that time the chronological range of Ewart Park metalwork has been back-dated to 1020–800 BC (Needham 2007b), and a rather more refined radiocarbon chronology is now available for the site. The radiocarbon dating estimates a start for the Late Bronze Age enclosure of *1210–980 cal BC 95.4% probability* (for details see Chapter 4 below). Current views on the dating of post-Deverel-Rimbury plain ware, such as the material from the lower ditch fills, would accord reasonably well with that, and a date in the latter part of the range might be suggested. The large, plain, rather globular bowls (Fig. 3.21, 32 and 33) from a pit apparently associated with the large central roundhouse (structure A) are the kind of vessel generally considered to be early in the Late Bronze Age ceramic

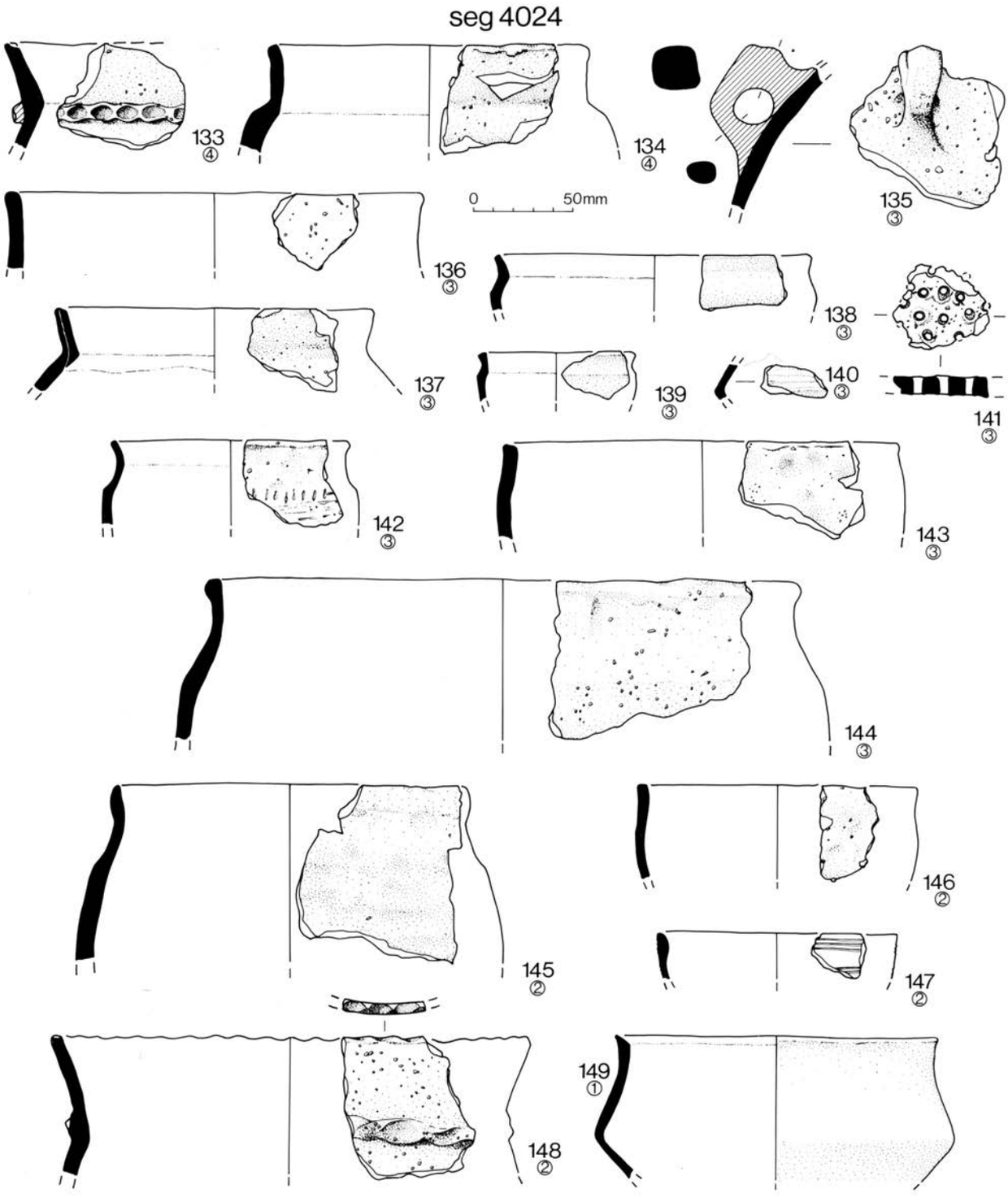


Figure 3.28 Late Bronze Age pottery from enclosure ditch, 133–149

sequence, and would be compatible with the radiocarbon dating estimate for the first build of structure A *1080–930 cal BC 95.4% probability* (for details see Chapter 4 below).

The stratified sequence from the enclosure ditch silts demonstrates the general trends in vessel form and to some extent increased use of decoration (Figs 3.21–3.31) which characterise the development of pottery in the early first millennium BC. There are a number of differences between the pottery from group 1 and 2 fills and that from group 3 fills. Sandy fabrics (E-J) comprise 13% of the sherds from group 1 and 2 silts and 24% from group 3 fills. Of rim sherds from Class I jars with fingertip decoration, 4% are from group 1 silts, 11% from group 2 and 76% from group 3. Shoulder sherds from Class I jars with fingertip impressions show a similar pattern; none were recovered from group 1 silts, 10% from group 2 and 84% from group 3. These differences appear to confirm the

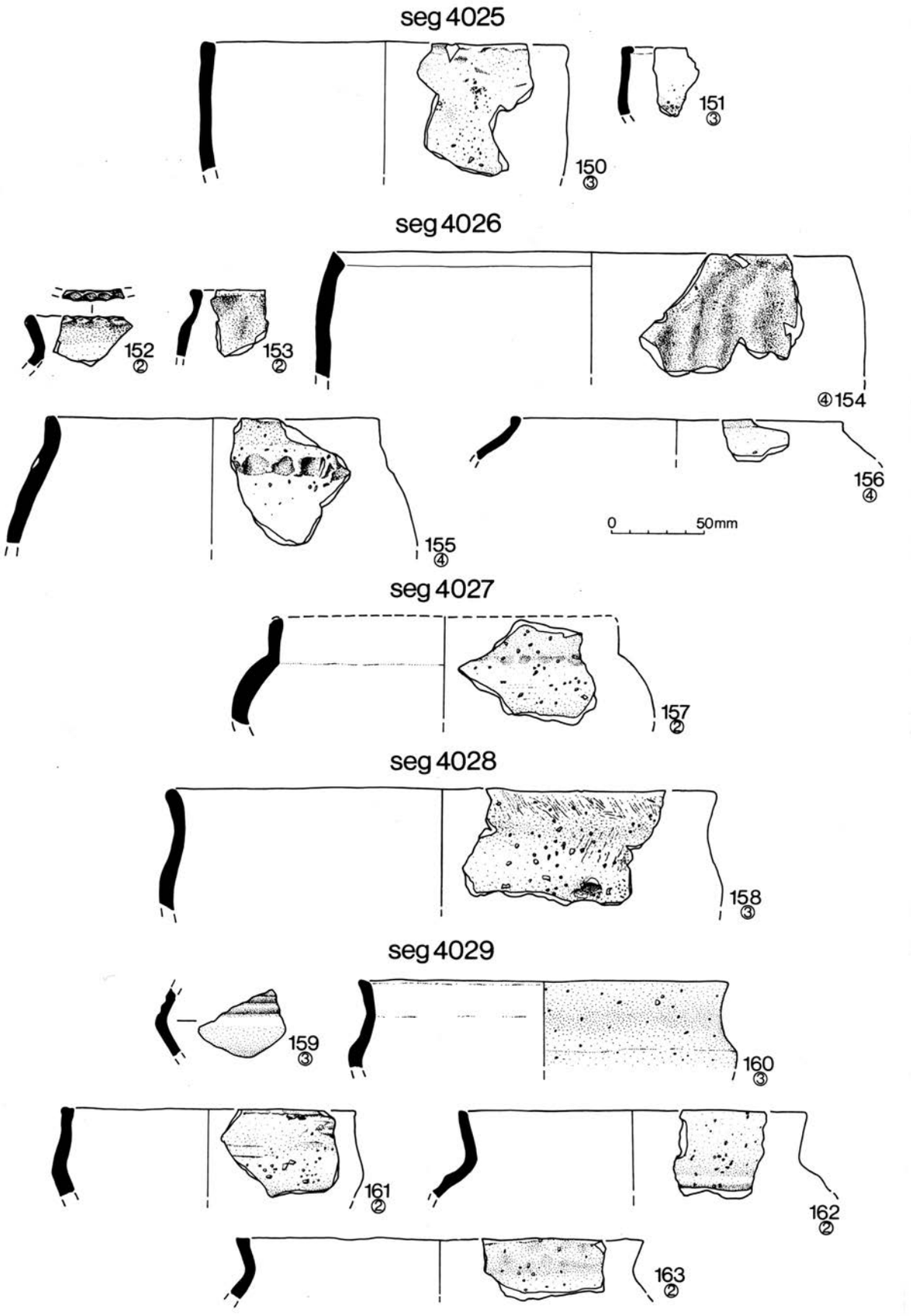


Figure 3.29 Late Bronze Age pottery from enclosure ditch, 150–163

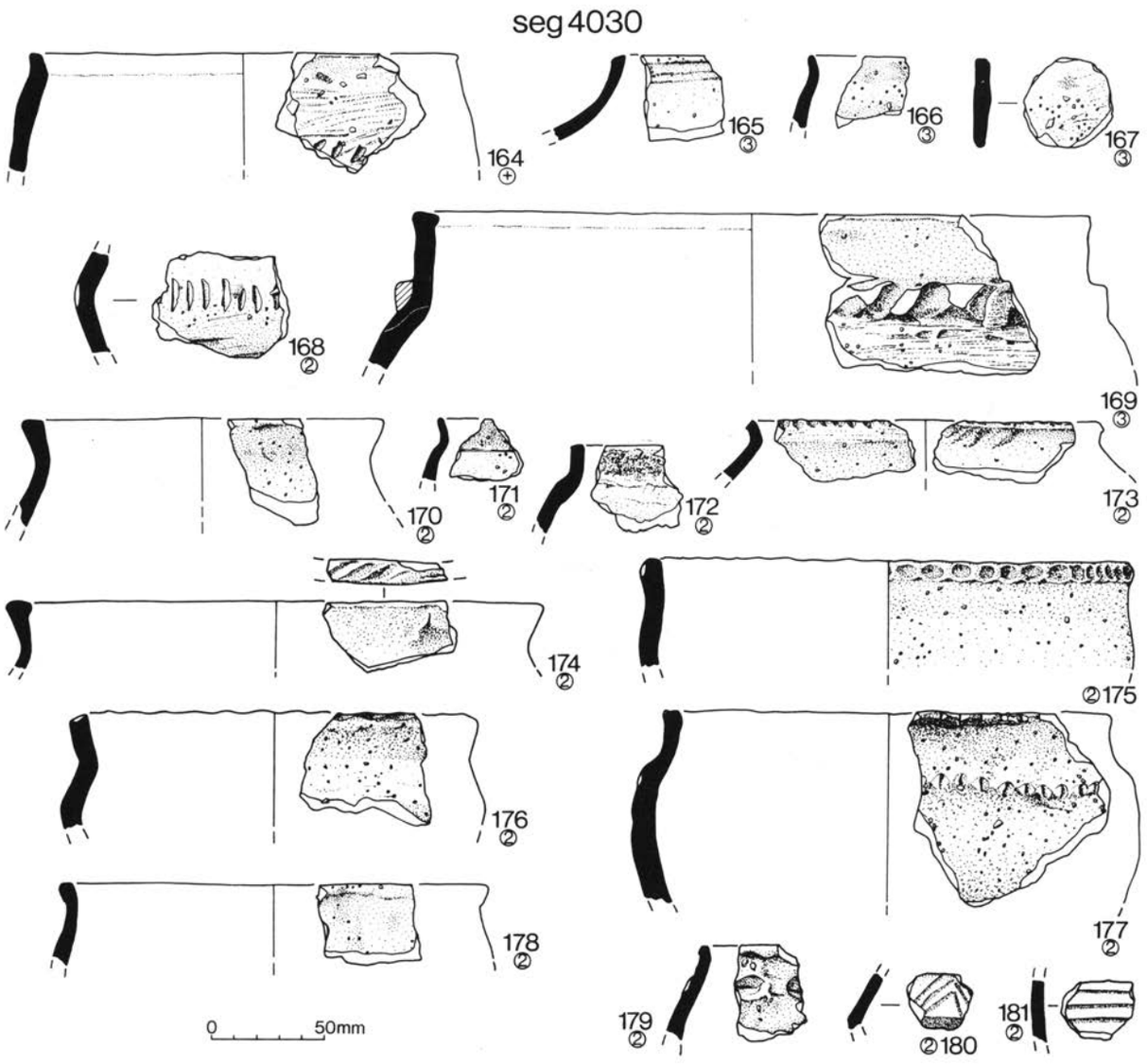


Figure 3.30 Late Bronze Age pottery from enclosure ditch, 164–181

long suggested trend in the development of earlier first millennium BC ceramics toward more frequent use of decoration (Barrett 1980; Needham 2007b).

Locally, in Essex, later pottery seems to show a tendency toward sandy fabrics and general diversification of fabric types as the earlier first millennium BC progresses (Brown 1988a), and similar trends have been noticed elsewhere (Needham and Longley 1980). The pottery from the group 3 ditch silts is typical of such later post-Deverel-Rimbury 'decorated' material and includes jars with decoration at shoulder and/or rim (*e.g.* Fig. 3.24, 85; 3.25, 86–88, 90, 92, 98; 3.26, 119), and some jar forms which are markedly angular (*e.g.* Fig. 3.22, 46, 3.24, 77) together with tripartite fine jars (*e.g.* Fig. 3.24, 78, 3.25, 89). Bowls occasionally have omphalos bases (*e.g.* Fig. 3.23, 61; 3.26, 110) and include round bodied (*e.g.* Fig. 3.26, 107, 121) some with bead rims (Fig. 3.24, 76; 3.26, 114) and more angular forms (*e.g.* Fig. 3.23, 61; 3.29, 159; 3.26, 100) some with grooved lines above the shoulder. This material can be broadly paralleled locally by pottery from the upper ditch fills and lower well fills at Lofts Farm (Brown 1988) and from classic sites further afield like West Harling (Clark and Fell 1953) and Staple Howe (Brewster 1963).

Such pottery has traditionally been considered Early Iron Age but following the publication of some seminal studies in 1980 (Barrett 1980; Barrett and Bradley 1980), has tended to be regarded as Late Bronze Age. The recent reassessment by Needham (2007b) of the pottery chronology of the early first millennium BC has suggested that such assemblages be described as earliest Iron Age, bringing the terminology almost full circle. Some sherds from the group 3 silts (Fig. 3.22, 48; 3.24, 71, 72; 3.28, 140; 3.29, 159) appear to be from shouldered bowls with grooved decoration above the shoulder, somewhat similar to fine ware bowls characteristic of the Darmsden-Linton style. However, the strongly carinated rather standardised bowl form which is so characteristic of the local Darmsden-Linton assemblages (*e.g.* Brown 1988a; 1992) is absent from the Springfield assemblage. Indeed the multiplicity of fine bowl forms seems to be characteristic of 'decorated' assemblages contrasting with the rather

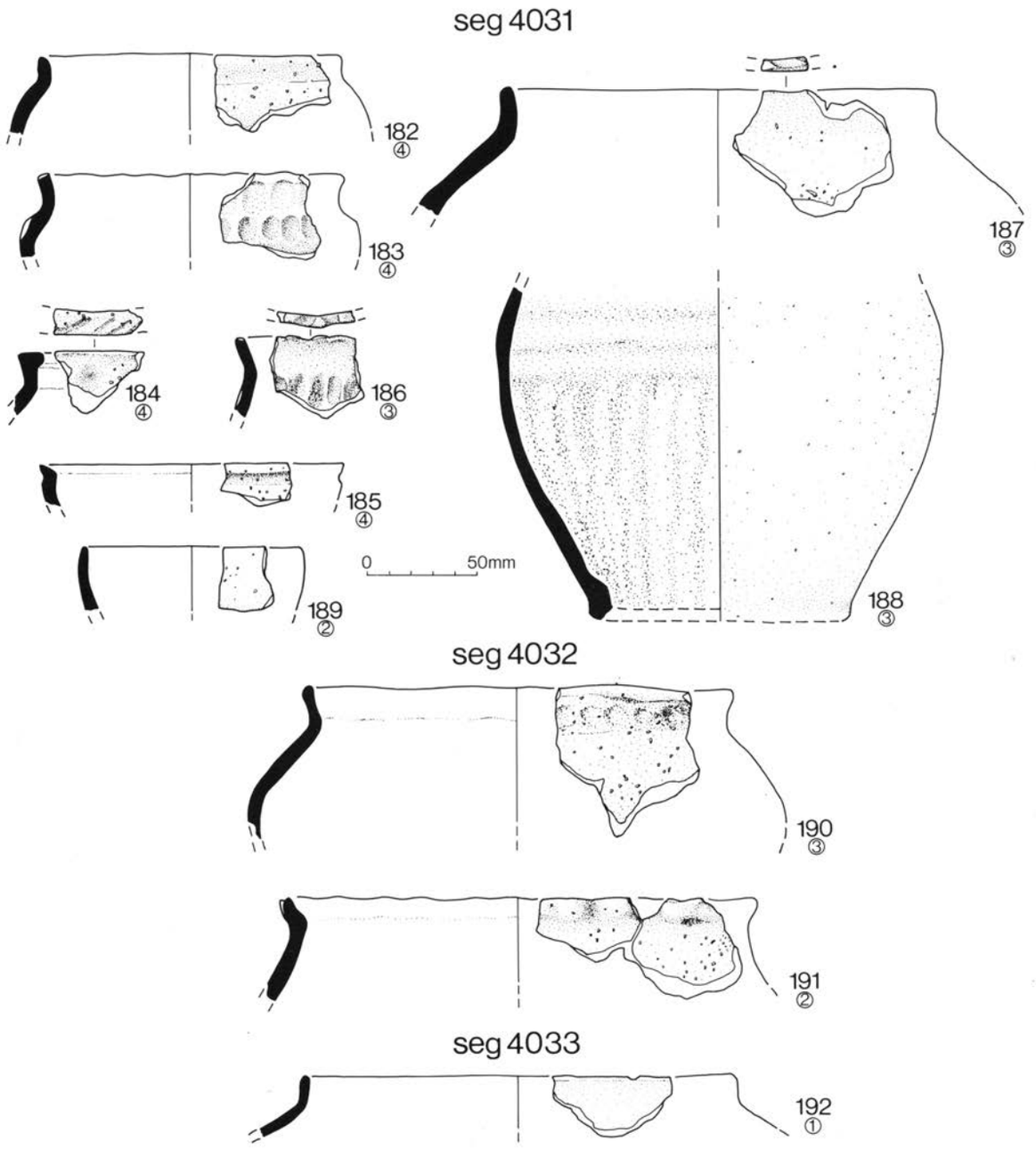


Figure 3.31 Late Bronze Age pottery from enclosure ditch, 182–192

standardised bowls of Darmsden-Linton assemblages. The radiocarbon dating estimates an end for the Late Bronze Age enclosure of *840–690 cal BC (95.4% probability)* and a late ninth or eighth century BC date for the decorated assemblage from the group 3 fills of the enclosure ditch would seem appropriate. It therefore seems that the Springfield enclosure had gone out of use before the development of the Darmsden-Linton style. A few body sherds in sandy fabrics F-J from the upper ditch fills on the north side of the enclosure may be of Middle Iron Age date. The fabrics are similar to Middle Iron Age pottery from sites elsewhere in Essex (*e.g.* Little Waltham, Drury 1978, Asheldham Camp, Brown 1991a and Witham, Brown 1993).

Distribution

(Figs 3.34–37)

Relatively little pottery was recovered from the primary ditch silts (Fig. 3.34), where it did occur it was mostly in the northern half of the enclosure. The lower silts show a concentration in the eastern half of the site with a particularly large deposit in the butt end north of the main entrance (seg 4037). There is relatively little pottery from the west of the enclosure apart from two quite large deposits in the north-west (segs 4023 and 4024) and south-west (seg 4012). The middle silts show major concentrations in these same locations (segs 4023, 4024 and 4011, 4012). The upper silts show a fairly even distribution with a concentration in the south-west ditch. Pits in the south-west corner of the enclosure have a concentration of crop cleaning waste and other refuse

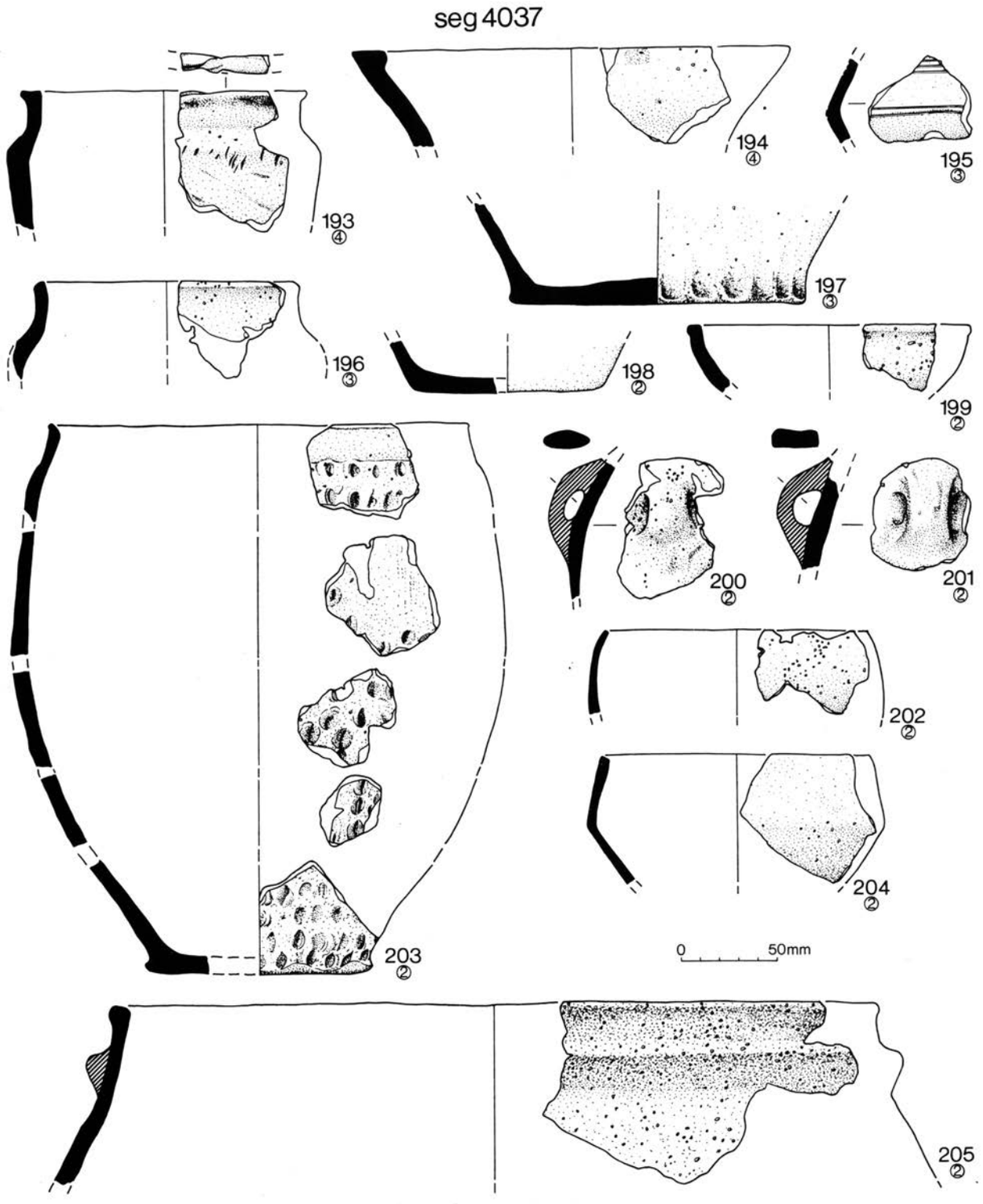


Figure 3.32 Late Bronze Age pottery from enclosure ditch, 193–205

(below, IX). If surface middens had also existed in this area, erosion of this material into the ditch after abandonment *might* account for the concentration of pottery in the south-west ditch but the presence of a bank makes this unlikely, this, and the condition of the pottery, make intentional deposition more likely.

The large deposit of pottery in the middle fills of segments 4023 and 4024 seems to represent material perhaps originally deposited elsewhere and subsequently removed from there and deposited in the ditch. The material includes a wide range of fine and coarse jars, bowls and cups; there were few joining sherds and the material was of quite small sherd size and with a relatively high frequency of abraded sherds (Fig. 3.34).

The material from the middle fills of segments 4011 and 4012 was quite different. It consisted of a deposit

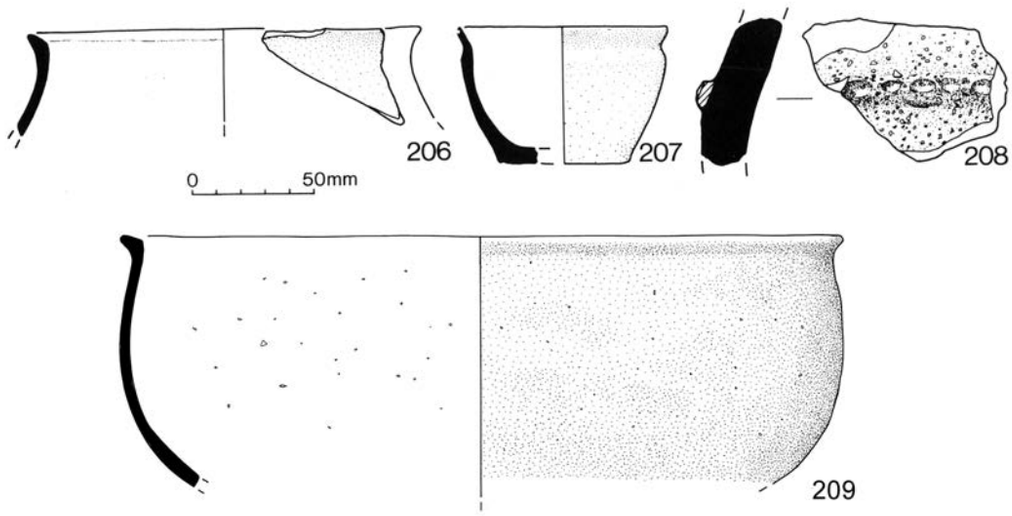


Figure 3.33 Late Bronze Age pottery from external features, 206–209

dominated by the distinctive fabric K with numerous sherds of Class I jars, many with finger impressions on rim and/or shoulder. As noted above, the layer (contexts 5153 and 5529) which contained the majority of this deposit of pottery was clearly derived from outside the enclosure. Fabric K did not occur inside the enclosure. With the exception of three sherds from segment 4023, two from seg 4030 and pottery residual in Saxon features cutting, or close to, segments 4011 and 4012, the fabric occurred only in segments 4011 and 4012. A large area outside the enclosure to the south and west was examined but no occupation from which this pottery could derive was revealed. Charred plant remains from the deposit show a concentration of straw fragments together with nutshells and a few cereal grains, possibly indicating a deposit derived from fires linked to cooking. It is possible that the deposit may represent casual reoccupation of part of the site, however it seems at least as likely that the material may represent the deliberate deposition into this part of the ditch, of debris from an event, perhaps involving feasting, which marked the end of the active use of the site. A similar large dump of pottery was found in the ditch of the Lofts Farm enclosure (Brown 1988a), both deposits seem to occupy similar positions at the 'back' of the enclosure. This material seems to be the last major act of deposition at the Springfield enclosure before the burial of a deliberately bent sword during the Late Iron Age (see II above).

The distribution of pottery in Bronze Age features within the enclosure shows two groupings, a major concentration in the south-west quadrant and a more diffuse series of deposits around the central roundhouse (Fig. 3.35–6). In general there is little pottery from the north of the enclosure, although the presence of the tank trap on that part of the site may have distorted this distribution. Most of the pottery occurs in the western half of the enclosure. Very few Bronze Age features were recorded outside the enclosure.

These distributions obviously do not take account of superficial deposits subsequently lost through ploughing of the site. However, the general pattern seems to be borne out by the occurrence of pottery residual in Saxon features (Fig. 3.37). There was relatively little pottery from the Saxon features in the north of the enclosure, although perhaps rather more than might have been expected from the distribution of pottery in Bronze Age features. The concentration of pottery in the south-western quadrant is particularly marked. However, there is little indication of the concentration of deposits around the central roundhouse. Outside the enclosure there is a general scatter of small quantities of pottery, larger amounts occur close to the ditch on the south-west side and on the east side near external features of Bronze Age date.

The large quantity of Bronze Age pottery in Saxon features in the south-west of the enclosure may reflect the presence of surface deposits or middens in the area, which the Saxon features cut through, but which were subsequently destroyed by ploughing. The possibility of surface deposits having been present in this area of the enclosure has been noted above and fits with other evidence (below, IX) for general rubbish disposal to this part of the site. If such deposits were kept away from the central roundhouse this would explain the relative lack of residual Bronze Age pottery in that area.

The lack of residual Bronze Age pottery from Saxon features outside the enclosure (Fig. 3.37) is a further indication that the Late Bronze Age occupation was concentrated within the enclosed area. The distribution of the Late Bronze Age pottery recovered from cleaning the cover-loam subsoil (Fig. 3.37) also emphasises this point. This distribution shows a concentration of material towards the stream to the south-west of the site. This may reflect some activity close to the stream, or may be the result of movement of material down slope.

The distribution of fine wares in Bronze Age features across the site (Fig. 3.36) shows a cluster around the central roundhouse, but a larger concentration in the south-west quadrant. However, examination of the average sherd weight (Fig. 3.36) shows that the deposits around the central roundhouse generally contain large fine ware sherds and include the largest such sherds. In contrast the fine wares from the concentration in the south-west of the enclosure are of small sherd size. This may indicate that the features in south-west quadrant were receiving fine wares as rubbish some distance from the point of breakage. The large sherds from features around

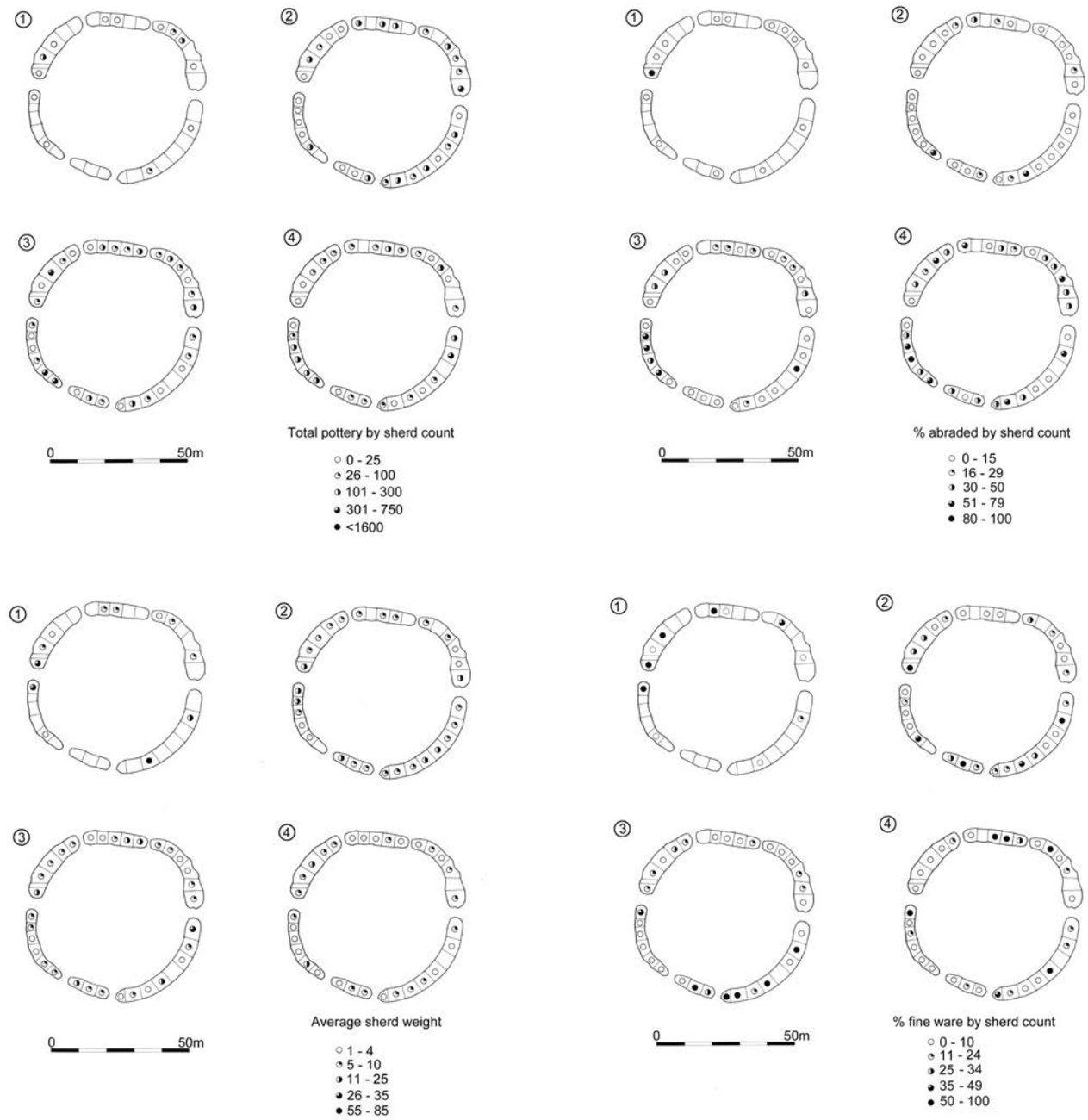
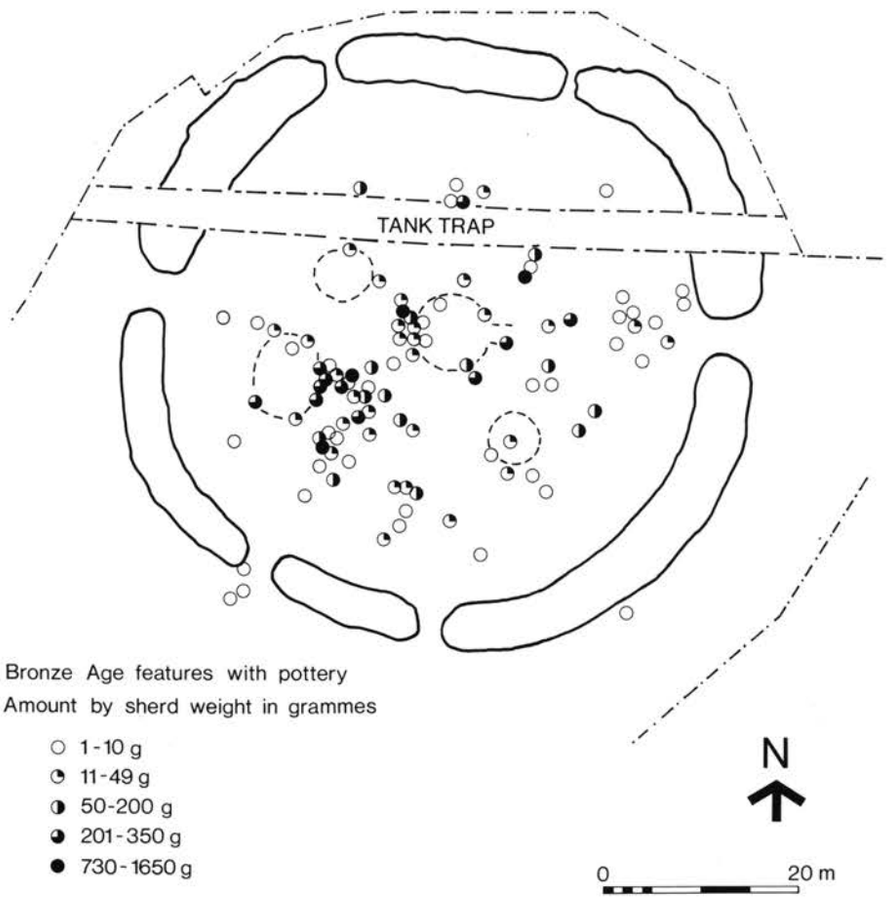


Figure 3.34 Distribution of Late Bronze Age pottery in the enclosure ditches by fill group. The fill group is indicated by numbers in open circles

the central roundhouse suggest an association with consumption of food and drink. These deposits appear to be more than a simple reflection of rubbish disposal. The pits which produced these large sherds (F2952, F4544, F2588, Figs 3.21, 25–34; 3.20, 6–12) only contain pottery which is early in the suggested ceramic sequence. That these deposits seem only to have been made for a short time, may indicate that they are deliberate deposits, connected with the establishment of the site. Moreover, the features also contained large sherds of coarse wares, so there may be no simple distinction between cooking and consumption. Some of the carbonised remains (IX below) from the central roundhouse also appear likely to derive from cooking.

The distribution of fine wares in the group 1 ditch silts shows a number of apparently significant deposits concentrated in the west and north (Fig. 3.34), however the quantities involved are very small. The group 2 silts show concentrations in the south, east and north-west, whilst the group 3 silts show marked concentrations in the south and east and a more diffuse concentration in the north-west (Fig. 3.34), a reversal of the pattern observed in the primary silts. There is a major concentration of fine wares in the group 4 ditch silts on the north side which is problematic in that it does not appear to relate to the earlier patterns of deposition within the enclosure or the ditch fills. This material is of small sherd size (Fig. 3.34) and quite abraded, it is possible that it may derive from activity outside the enclosure. As noted above the evidence points



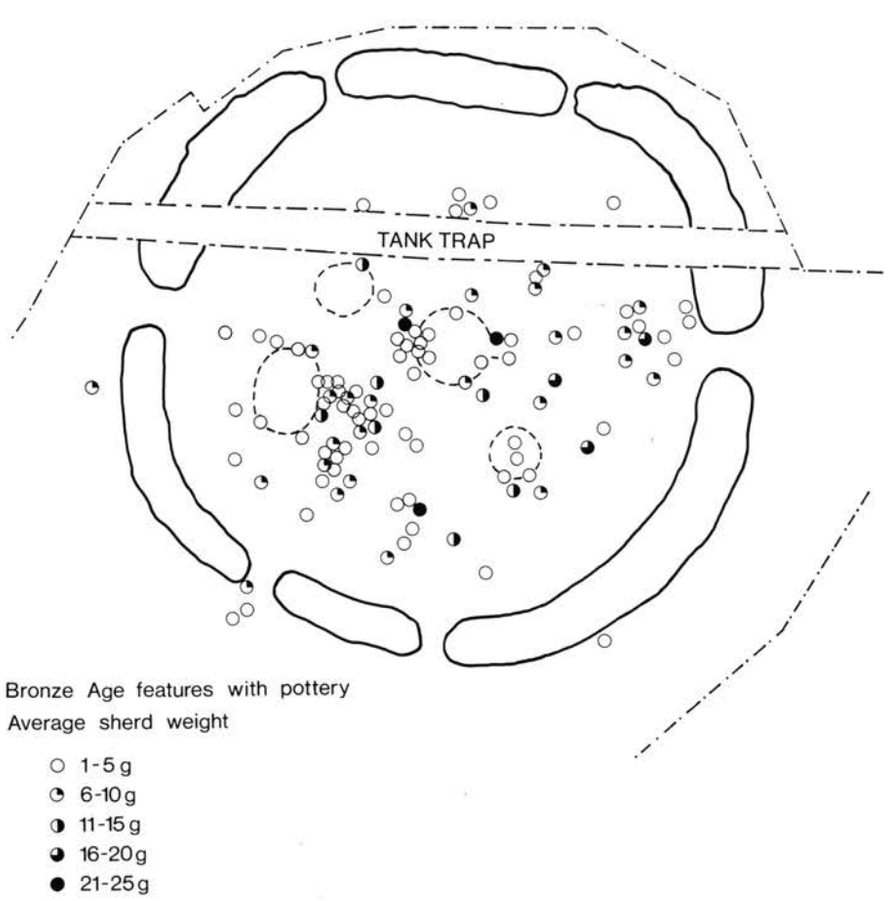


Figure 3.35 Features with Late Bronze Age pottery showing quantities recovered

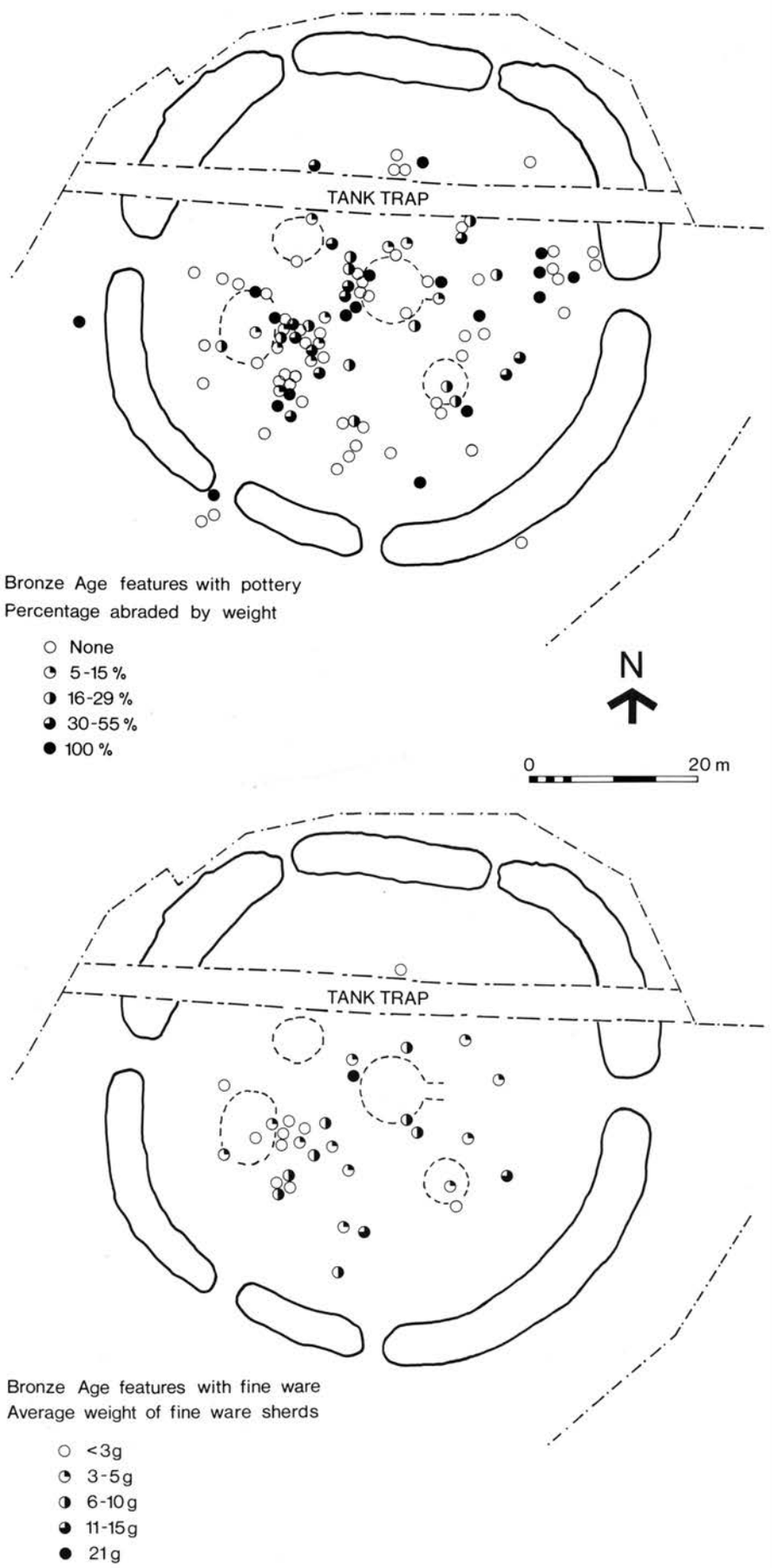


Figure 3.36 Distribution of Late Bronze Age pottery upper shows percentage of abraded pottery, lower shows features with fine ware with the average weight of fine ware sherds indicated

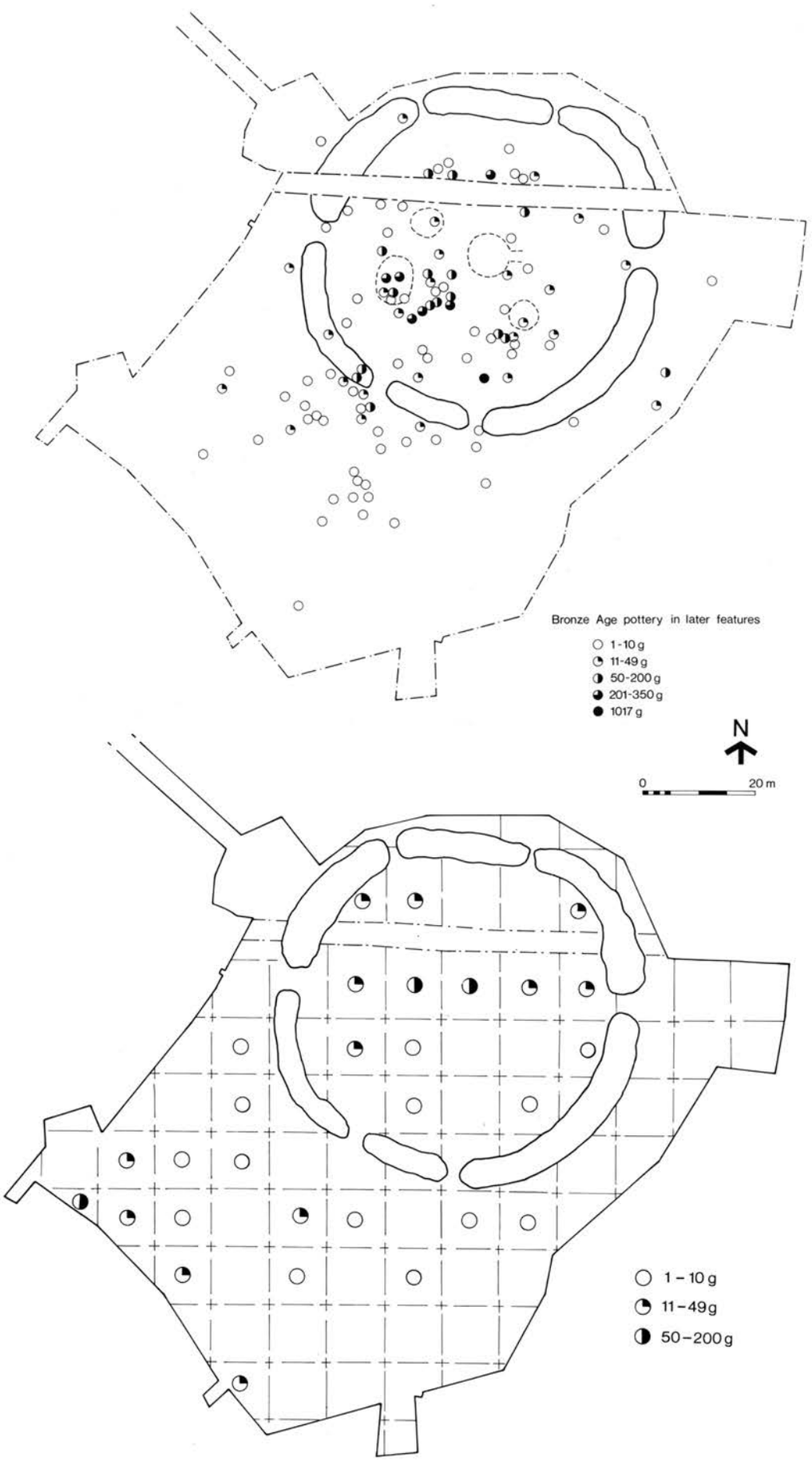


Figure 3.37 Distribution of Late Bronze Age pottery, showing quantity recovered from later features(upper) and quantity recovered from surface cleaning by 10m grid square

to there being little Late Bronze Age occupation outside the enclosed area. However, only a small area outside the north ditch has been examined and the various test trenches around the main excavation area did not really examine the land to the north of the enclosure (Fig. 1.2), and it may be that external occupation existed in this area.

The general distribution of pottery both within the enclosure and in the ditch fills shows a number of differences between the east and west halves of the enclosure, and to some extent between the north and south. Fine wares are concentrated in the south and east of the ditch, and occur as large sherds around the central roundhouse in the east of the enclosure. Small fineware sherds occur in the south-west where there appears to have been a concentration of dumps of ceramic refuse (Fig. 3.36). Similarly, large rubbish deposits occur in the ditch on the west side (Fig. 3.34).

Manufacture

Many of the techniques of manufacture noted in Late Bronze Age assemblages elsewhere and discussed by Adkins and Needham (1985) occur in the Springfield assemblages, *e.g.* vertical smearing (Fig. 3.21, 25) and bases joined to pots by pinching occasionally producing a protruding foot (Fig. 3.32, 197). Occasionally dense temper occurs on the bottom of bases, but this trait does not appear to be as common in the Springfield assemblage as it is in the pottery from some other Late Bronze Age sites.

Whilst it is possible that some of the pottery may have been brought to the site from far afield, visual inspection of the fabrics reveals nothing which need necessarily be of non-local origin. Clay suitable for potting could have been obtained from the Boulder Clay which outcrops 400m north of the site or from the extensive silt and clay deposits adjacent to the Chelmer.

Burnt flints were present on the site and quartz and sand were freely available in the local gravels. The crystalline structure of the quartz pebbles on the site has often weathered in such a way that they could easily be crushed to produce temper, in the same manner as the fire-cracked flint.

A variety of techniques of vessel formation occur in the Springfield pottery. Some of the small cups appear to be simple thumb pots (Fig. 3.26, 121), the rippled effect visible on some sherds (*e.g.* Fig. 3.20, 11 interior) seems likely to be the result of incompletely smoothed coils. Slab building is harder to demonstrate, but the relatively thin rectangular sherds of vessels such as Fig. 3.20, 6 and 3.21, 25 may be the result of this method. Occasionally, vessels display signs which Rye (1981, 72) describes as characteristic of pots formed by drawing (*e.g.* Fig. 3.29, 154; 3.31, 188). Both 154 and 188 have the vertical finger marks typical of this method of vessel formation. The interior of 154 has been carefully smoothed and burnished removing all trace of finger marks. This treatment of the interior of the vessel which would not normally be visible, may be designed to reduce porosity in a vessel intended to hold liquid. The exterior of 188 has been similarly treated, although in this case, in the right light, it is still possible to see the drawing marks beneath the smoothed surface. The interior has been left unsmoothed, it is noticeable that the finger grooves change from vertical to horizontal on the upper part of the vessel. Rye (1981, 72) notes that drawing is sometimes used in conjunction with coil building. This may be the case with 188, the lower part of the vessel formed by drawing with the upper portion added as a series of coils.

In common with most Late Bronze Age assemblages, pre-firing perforations are generally absent from the Springfield pottery. This is a marked contrast with preceding Deverel-Rimbury assemblages, where rows of pre-firing perforations below the rim frequently occur (Adkins *et al.* 1984–5). This may be the result of a change in the method of lid attachment in the Late Bronze Age, leather or fabric lids being tied onto large jars utilising neck cordons such as that on 208. The single rim with a pre-firing perforation (Fig. 3.25, 95) at Springfield is likely to be a residual sherd. The only other pre-firing perforations are those on the sherds of strainer base (Fig. 3.28, 141). Post-firing perforations occasionally occur, that on the fine bowl Fig. 3.21, 32 may be a repair hole, or possibly intended for an organic handle (Pryor 1984, pls 1 and 3). One bowl (Fig. 3.21, 33) bears the scar of a perforation which was begun but not finished. An attempt had been made to drill through a handle Fig. 3.21, 41 presumably in an effort at repair. Two sets of holes were started, the lower set were badly out of line and never finished. The upper pair had caused the handle to break before the drilling was completed. A single sherd has an uncompleted perforation (Fig. 3.22, 58). Perforated sherds commonly occur on Late Bronze Age sites (*e.g.* Staple Howe, Brewster 1963; Petters Sports Field, O'Connell 1986). One sherd roughly shaped into a disc (Fig. 3.30, 167) may be a blank for such an object. These perforated sherds are generally described as spindlewhorls (Brewster 1963, O'Connell 1986). However, spindlewhorls from Late Bronze Age sites are generally well made and finished, often decorated, such as those from Springfield itself (VIII below), Staple Howe (Brewster 1963), Runnymede (Longley 1980) and elsewhere. They may have been valued personal possessions. There is a very marked contrast with the crude perforated sherds and it seems possible the two sets of objects may have had quite different functions.

Catalogue of illustrated sherds

Fig	*Drawing No*	*Feature/ Context*	*Form and/ or Class*	*Decoration/Surface Treatment/Condition*	*Fabric*
3.20	1	F2517	H. III		C
	2	F2517	?D, I	Faint finger marks below rim as a result of rim formation.	D
	3	F2540	J, IV	Smoothed surface.	B
	4	F2540	H, V	Smoothed surface.	A
	5	F2540	A, I		B
	6	F2588	A, I		D

Fig	*Drawing No*	*Feature/ Context*	*Form and/ or Class*	*Decoration/Surface Treatment/Condition*	*Fabric*
	7	F2588	H, III	Faint finger marks below rim as a result of rim formation.	B
	8	F2588	M, V	Smoothed surfaces, slightly abraded.	A
	9	F2588	H, V	Smoothed surface? originally burnished, two zones of incised horizontal and sloping lines on exterior.	A
	10	F2588	H,III		B
	11	F2588	C, I	Vertical finger wiping below shoulder, horizontal at shoulder. Slight finger marks on neck as result of vessel formation. Traces of sooting/black deposit on shoulder.	
	12	F2588	M, V	Smoothed surfaces, faint finger marks below rim as a result of rim formation.	
	13	F2588	-, I		D
	14	F2841	B, I		D
	15	F2841	D, III		D
	16	F2841	A, I	Faint vertical finger wiping on neck.	D
	17	F2841	H, III		D
	18	F2841	-, I	Applied finger impressed neck cordon.	D
	19	F2841	-, V	Smoothed surfaces, horizontal incised lines on exterior.	A
	20	F2987	L, IV	Smoothed surfaces.	A
	21	F2987	-, ?IV	Horizontally pierced lug, smoothed surfaces.	A
	22	F2995	-, I	Double row of fingertip impressions.	B
	23	F4511	-, I	Wedge shaped stabbed impressions on neck.	D
	24	F4508	A, I	Vertical scratch/wipe marks on neck.	D
3.21	25	F2952	R, I	Vertical finger wiping on exterior, 'cabled' rim.	D
	26	F2952	B, I		D
	27	F2952	B, IV	Smoothed surfaces, wide shallow grooved line on exterior.	B
	28	F2952	E, I		D
	29	F2952	- , I	Cabled rim.	C
	30	F4544	- , ?I	Smoothed with partly surviving burnish.	A
	31	F4544	- , ?IV	Smoothed.	A
	32	F4544	H, IV	Smoothed with partly surviving burnish, single surviving post-firing perforation.	A
	33	F4544	H, IV	Smoothed? originally burnished exterior partly abraded. Scar on exterior from unfinished perforation.	B
	34	F4544	S, I	Abraded, possibly burnt.	D
	35	F4603	D, I	Finger wiping below shoulder, faint finger marks on neck as a result of rim formation.	D
	36	F4651	?H, ?V	Smoothed, partly abraded surfaces, single lightly incised line on exterior.	A
	37	F4651	?H, ?V	Smoothed partly abraded surfaces. Body sherd with three incised lines on exterior.	A
	38	F4902	A, I	Faint finger impressions on exterior as a result of rim formation.	C
	39	F4993	Dish or possibly lid	Smoothed surfaces, ?originally burnished.	A
	40	F4902	H, III		D
	41	F4569	Lug	Two unfinished perforations.	B
3.22	42	C3545	A , I		D
	43	C3118	K, IV	Smoothed partly abraded surfaces.	B
	44	C3123	M, V	Smoothed partly abraded surfaces.	A
	45	C3123	B, I	Faint finger impressions below rim as a result of rim formation.	D
	46	C3025	N, I		C
	47	C3025	, IV	Smoothed surfaces, two zones combed lines.	B
	48	C3025	K, IV	Grooved line above shoulder.	E
	49	C3033	K, IV	Smoothed exterior partly abraded.	C
	50	C3039	H, IV	Smoothed surface ? originally burnished.	B.
	51	C3039	-, IV	Smoothed surfaces.	A
	52	C3049	-, I		L
	53	C9268	?H, V	Smoothed surfaces, abraded, zone of combed lines below rim.	A
	54	C3034	?H, V	Smoothed surfaces zone of combed lines below rim.	A
	55	C3044	?H, V	Smoothed surfaces zone of combed lines below rim.	A
	56	C3044	?H, V	Smoothed surfaces, patches of burnish surviving, partly abraded. Two zones of combed lines on exterior.	A
	57	C3053	E, I	Cabled rim, slight finger impressions below rim as result of rim formation. Extensive concretion.	C
	58	C		Unfinished perforation.	D

Fig	*Drawing No*	*Feature/ Context*	*Form and/ or Class*	*Decoration/Surface Treatment/Condition*	*Fabric*
	59	C3056	H, IV	Smoothed surfaces ? originally burnished.	P
	60	C3056	?H, V	Smoothed surfaces ? originally burnished.	A
3.23	61	C3069	K, IV	Smoothed partly abraded surfaces, one shallow grooved line on neck, omphalos base.	E
	62	C3084	H, III	Partly smoothed surfaces.	C
	63	C3084	F, I	Black deposit on interior.	D
	64	C3627	K, IV	Smoothed surfaces partly abraded.	B
	65	C3627	-, II	Small neck cordon, smoothed surfaces.	E
	66	C3627	-, III	Pinched up lug, probably same vessel as 67 and 68.	E
	67	C3641	-, III	Pinched up lug, probably same vessel as 66 and 68.	E
	68	C3641	-, III	Pinched up lug, probably same vessel as 66 and 67.	E
	69	C3652	R, I	'Grass' wiping on exterior.	C
	70	C3652	A, I	'Grass' wiping on exterior.	D
3.24	71	C5115	- , IV	Grooved line on neck.	C
	72	C5115	K, IV	Grooved lines above shoulder.	E
	73	C5115	-, IV	Deep triangular decoration on shoulder, probably same vessel as 74 and 75.	B
	74	C5135	-, IV	Deep triangular decoration on shoulder, probably same vessel as 73 and 75.	B
	75	C5135	- , IV	Deep triangular decoration on shoulder, probably same vessel as 73 and 75.	B
	76	C5135	H, IV	Smoothed surfaces.	B
	77	C5135	F, I	Fingertip impressions at shoulder and rim.	D
	78	C5135	F, II	Smoothed surfaces with patches of burnish surviving.	E
	79	C5153	A, I	Row of finger impressions on neck, heavily abraded exterior.	F
	80	C5153	- , ? IV	Fingernail impressions on exterior of rim.	B
	81	C5153	- , I	Cabled rim.	L
	82	C5153	- , I		K
	83	C5153	M, V		K
	84	C5153	- , I	Cabled rim.	K
	85	C5153	- , I	Fingertip impressions on shoulder, partly abraded.	K
3.25	86	C5529	S, I	Fingertip impressions on rim, finger impressions on shoulder partly abraded.	K
	87	C5529	E, I	Cabled rim finger impressions on shoulder, 'grass' wiping on neck.	K
	88	C5529	D, II	Finger impressions on rim and shoulder.	K
	89	C5529	F, I	Smoothed abraded surfaces.	F
	90	C5529	E, I	Cabled on rim, 'grass' wiping on partly abraded exterior, slight black deposit on interior.	F
	91	C5529	H, III	Irregular rim with internal bevel.	D
	92	C5529	?D, I	Finger impressions on rim abraded.	F
	93	C5529	- , I		K
	94	C5529	J, ?V	Smoothed surfaces abraded.	M
	95	C4366	-, I	Finger impressions on rim, single pre-firing perforation.	D
	96	C5670	?F, II	Smoothed surfaces, partly abraded.	C
	97	C5657	- , I		D
	98	C5657	A, I	Cabled rim, thumb groove below rim on interior. Some concretion on exterior.	D
3.26	99	C9043	E, I	Stabbed wedge shaped impressions on neck, abraded. Some concretion on exterior.	Q
	100	C9043	I, I	Smoothed surfaces, partly abraded, patches of burnish surviving.	E
	101	C9043	?F, I	Applied finger impressed neck cordon.	D
	102	C9043	N, II	Smoothed partly abraded surfaces.	E
	103	C9043	N, I		C
	104	C9043	J, IV	Partly abraded.	C
	105	C9043	M, IV	Smoothed surfaces.	A
	106	C9043	- , II	Smoothed surfaces partly abraded.	C
	107	C9043	M, V	Smoothed surfaces partly abraded interior.	E
	108	C9043	A, I	Row of finger impressions above shoulder, abraded.	D
	109	C9043	N, I		C
	110	C9043	? IV	Omphalos base with raised ring in interior.	B
	111	C9043	H, V	Partly abraded.	C

Fig	*Drawing No*	*Feature/ Context*	*Form and/ or Class*	*Decoration/Surface Treatment/Condition*	*Fabric*
	112	C9043	- , I	Slightly thickened rounded rim with rough finger impressions on the exterior.	D
	113	C9043	N, I		D
	114	C9043	H, IV	Groove below beaded rim, smoothed surfaces partly abraded.	A
	115	C9043	R, I	Cabled rim 'grass' wiped exterior.	O
	116	C9043	R, I	Cabled rim.	V
	117	C9043	- ? II	Smoothed surfaces, fingernail impressions on exterior of rim.	A
	118	C9043	F, I	Abraded.	V
	119	C9043	D, I	Finger impressions on shoulder and exterior of rim, abraded interior.	L
	120	C9043	A , I	Finger marks below rim as a result of rim formation.	A
	121	C9043	H, V	'Grass' wiped exterior.	P
	122	C9043	V	Fingernail impressions on shoulder.	C
	123	C9043	N, I	Finger impressions on shoulder.	L
	124	C9065	A, II	Cabled rim, smoothed surface.	E
	125	C9065	, II	Furrowed neck, smoothed surface	B
3.27	126	C9065	?Q, I	Faint finger impressions below rim as a result of vessel formation.	D
	127	C9065	A, I	Plain applied neck cordon.	D
	128	C9065	- , I	Irregular stabbed impressions on neck, ?cabled rim.	C
	129	C9567	- , I	Finger impressions on top of rim.	F
	130	C9048	Q, I		D
	131	C9048	A, I	Interior of rim added as a separate strip of clay.	C
	132	C9048	H, III	Faint finger impressions below rim as a result of rim formation, base applied as separate slab.	D
3.28	133	C5978	- , I	Applied finger impressed neck cordon.	D
	134	C5978	N, I		D
	135	C5988	- , I	Abraded, applied lug/handle.	O
	136	C5988	Q, I		B
	137	C5988	A, I		C
	138	C5988	M, IV	Smoothed surfaces, partly abraded.	E
	139	C5988	M, V	Smoothed surfaces, slightly abraded.	E
	140	C5988	K, IV	Shallow grooved lines on shoulder.	E
	141	C5988	? IV	Base with pre-firing perforations.	B
	142	C9097	N, I	Fingernail impressions on shoulder, 'grass' wiping below shoulder.	C
	143	C9097	B, I	Faint finger marks on exterior as result of vessel formation.	D
	144	C9097	D, I		D
	145	C7020	E, I	Faintly rippled surface due to inadequately smoothed coils.	I
	146	C7020	H, III		D
	147	C7020	H, IV	Two zones of horizontal combed lines on exterior, smoothed surface abraded.	A
	148	C7015	?R, I	Applied finger impressed neck cordon, finger impressions on rim.	D
	149	C9125	K, IV	Smoothed, ?originally burnished surfaces, partly abraded. ?Same vessel as 206.	A
3.29	150	c9017	Q, I		O
	151	C9125	H, III	Surfaces damaged, probably during process of excavation and cleaning.	D
	152	C5869	-, II	Fingertip impressions on exterior of rim.	E
	153	C9017	H, IV	Smoothed surfaces? originally burnished, abraded at shoulder.	A
	154	C5852	B, I	Vertical finger marks on exterior, burnished interior. Some concretion on interior.	B
	155	C5869	E, I	Row of finger impressions above slight shoulder.	B
	156	C5852	O, IV	Smoothed surface.	A
	157	C5840	A, I	Top of rim missing, faint finger impressions at neck, as a result of vessel formation. Some concretion on interior.	D
	158	C5816	E, I	Exterior of rim 'grass' wiped, black deposit on interior of shoulder, partly abraded exterior.	D
	159	C5902	K, IV	Smoothed surfaces, grooved lines above shoulder. Some concretion on exterior.	B
	160	C5761	J, III	Somewhat abraded.	L
	161	C5929	I, III	Some abrasion on exterior.	O
	162	C5929	?F, I	Furrows above shoulder, interior abraded.	D
	163	C5908	D, I	Faint finger impressions below rim as a result of vessel formation.	D

Fig	*Drawing No*	*Feature/ Context*	*Form and/ or Class*	*Decoration/Surface Treatment/Condition*	*Fabric*
3.30	164	C9126	R, I	Row of fingertip impressions with 'grass' wiping above.	O
	165	C5959	A, II	Smoothed surfaces.	E
	166	C5959	N, I		
	167	C5956	-,-	Shaped disc made from potsherd.	D
	168	C5956	-,I	Slashed decoration on shoulder.	O
	169	C5959	A, I	Applied finger impressed cordon, 'grass' wiped below cordon, some concretion on interior.	D
	170	C5956	?D, I		D
	171	C5956	?V	Incised line on neck.	O
	172	C5956	N, I		R
	173	C5956	A, II	Fingertip impressions on inside of rim.	C
	174	C5956	, I	Roughly cabled rim.	V
	175	C5956	E, IK	Finger impressions on exterior of rim.	D
	176	C5956	F, I	Finger impressions on rim.	
	177	C5956	A, I	Finger impressions on shoulder and exterior of rim.	D
	178	C5956	R, I		O
	179	C5956	E, I	Finger impressions below rim.	D
	180	C5956	?K, IV	Smoothed surfaces, abraded with shallow grooved lines forming chevron above shoulder.	E
	181	C5956	? IV	Smoothed surface, shallow grooved lines on exterior.	E
3.31	182	C5708	A, I		C
	183	C5708	D, I	Finger impressions on rim and shoulder, faint finger marks below rim as a result of rim formation.	E
	184	C5708	?A, I	Shallow grooved lines on top of rim.	D
	185	C5708	M, IV	Internally bevelled rim with slight groove below on exterior.	C
	186	C5720	- , I	Fingertip impressions on rim and shoulder.	P
	187	C5720	A, II	Finger impression on rim, smoothed surfaces, somewhat abraded. Some concretion on interior.	E
	188	C5710	R, II	Exterior well smoothed, ? originally burnished some slight abrasion and concretion, vertical rippling on lower part of vessel interior horizontal on upper, as a result of vessel formation.	C
	189	C5721	H, V	Smoothed surfaces somewhat abraded.	O
	190	C5608	A, I	Faint finger impression below rim as a result of rim formation.	C
	191	C5624	A, I	Finger impressions on exterior of rim, some concretions.	D
	192	C9062	A, II	Smoothed surfaces, with patches of surviving burnish, some concretion on exterior.	A
3.32	193	C3094	N, I	Roughly cabled rim, fingernail impressions on neck. Some concretion on exterior.	H
	194	C3094	L, III	Slight concretions on exterior.	G
	195	C3116	K, IV	Narrow grooved line on shoulder and neck.	E
	196	C3116	N, I		D
	197	C3116	- , I	Base joined to walls with heavy pinching producing a slightly protruding foot. Some concretion.	D
	198	C3124	- , ?II	Flat base, smoothed surfaces, concretion on interior.	B
	199	C3124	H, IV	Smoothed surfaces somewhat abraded, slightly beaded rim.	B
	200	C3125	-, ? I	Lug/handle, smoothed surfaces.	C
	201	C3125	-, ? I	Lug/handle.	D
	202	C3125	B, Z	Abraded.	B
	203	C5124/ 3125	R, I	Fragmentary vessel with fingertip impressions on exterior. Blank zone below rim, some sherds indicate the presence of at least one other blank zone.	D
	204	C3136	I, IV	Smoothed surface, abraded.	A
	205	C3136	A, I	Plain applied neck cordon.	D
3.33	206	F6033	K, IV	Smoothed surfaces, somewhat abraded, ?same vessel as 149.	A
	207	F8839	M, V	Some concretion around rim.	I
	208	F8811	?Q, I	Applied finger impressed cordon.	D
	209	F8984	H, IV	Large round bodied bowl, everted internally bevelled rim, smoothed originally burnished surfaces, traces of burnish survive on top of rim.	A

VIII. Fired clay objects

by Hilary Major

Perforated clay slabs

(Figs 3.38 and 3.39)

162 fragments of perforated clay slab were found, weighing 1930g. The fragments were mostly small, with few pieces having more than one or two perforations present. Some pieces with no holes present may have been from unperforated slabs, particularly those in the vegetable tempered fabric.

Two main fabrics were present, in almost equal quantities by weight. The first fabric was quite hard fired, often with a considerable amount of sand and flint grit temper, similar to much of the coarse pottery found at the site. The second fabric was quite heavily vegetable tempered, with sparse inclusions of sand. A small number of the slabs were in fabrics intermediate between these two extremes, *i.e.* with both sand/grit and vegetable inclusions in moderate amounts.

None of the fragments had measurable dimensions, but the form is well known from other sites. They would originally have been rectangular, with about six holes, and grooves along two or more sides. An almost complete example from North Shoebury, Essex, measures 176 x 152mm, and is about 20mm thick (Barford 1995, 127). Their purpose remains obscure. Their distribution at Springfield Lyons would tend to suggest that they are not associated with textile production. 86% of the loomweight fragments and two-thirds of the spindlewhorls were found in the main enclosure ditch, whereas only 29% of the slab fragments came from the ditch. This distribution appears to be reversed at the Mucking North Ring, which is comparable in date. At Mucking, almost all of the perforated clay slab fragments came from the enclosure ditch, but a smaller proportion of the loomweights (Bond 1988, 42; the report is not entirely clear on this point, but most of the illustrated loomweights are from the interior of the enclosure). Nevertheless, at both sites the pattern of disposal of textile equipment made from fired clay is broadly different from that of perforated clay slabs.

1. Slab corner, with part of a perforation. Sand and flint grit. <3193> Fill 3977, Feature 2620
2. Corner, with a groove along one side, 17mm thick. Fairly hard orange fabric with sand and vegetable temper. <4521> Fill 9035, Main ditch segment 4038
3. Fragment with the edges of two perforations present. 27mm thick. Sand and flint gritted. <4313> Fill 9045, Main ditch segment 4034
4. Grooved edge, one complete perforation and the edge of two others, *c.*16mm thick. Vegetable tempered. <2647> Fill 3671, Feature 4515

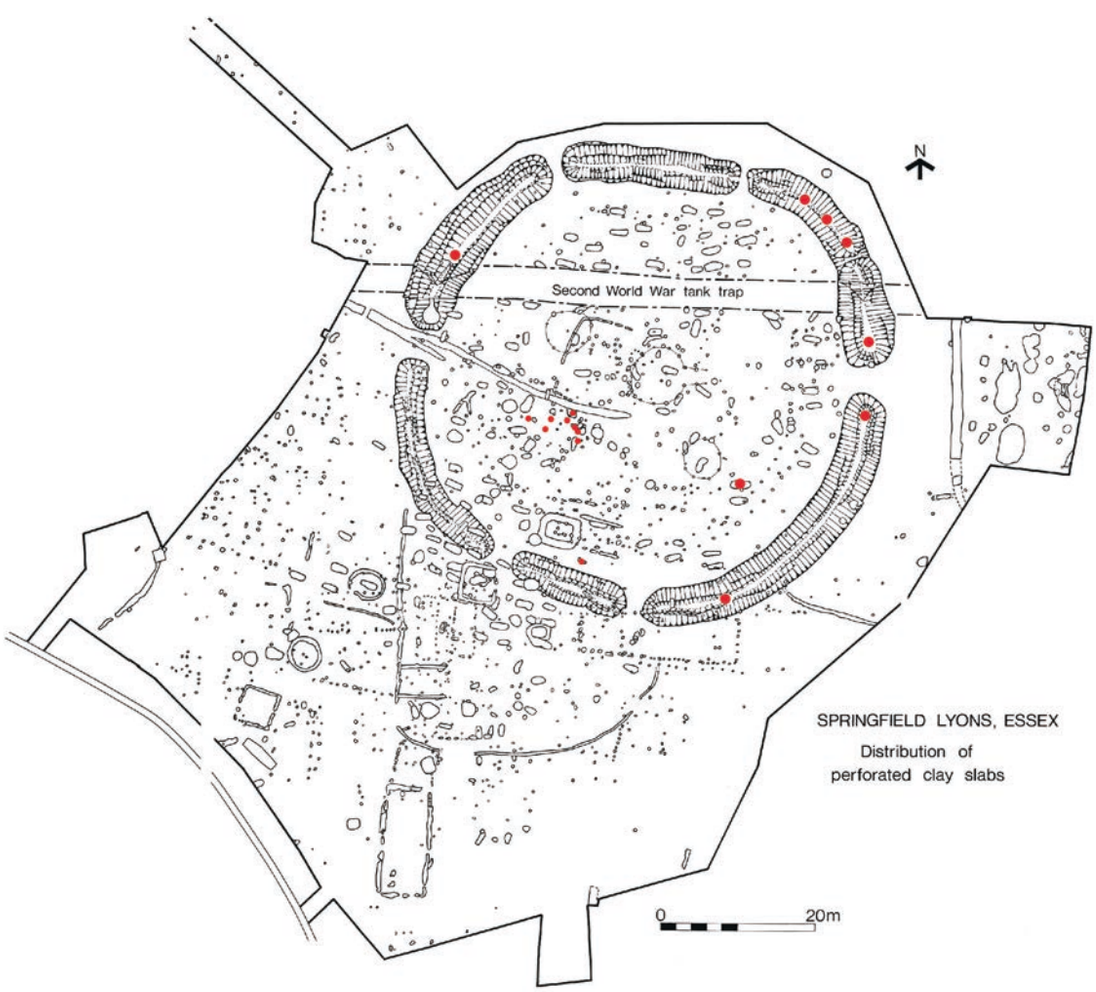


Figure 3.38 Distribution of perforated clay slabs, the location from which slab fragments were recovered is indicated by red dots

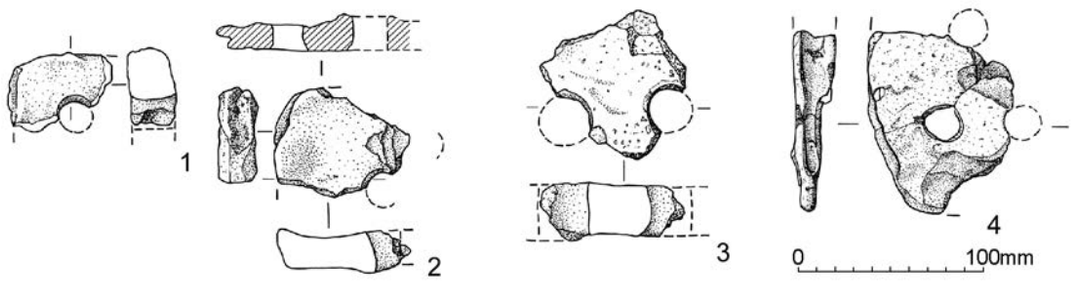


Figure 3.39 Fragments of perforated clay slabs

Spindlewhorls
(Fig. 3.40)
Six fired clay spindlewhorls were found, forming the largest group of Bronze Age spindlewhorls from Essex. As a group, their shape is quite variable, ranging from biconical to hemispherical. Four are decorated using fingernail or fingertip impressions, techniques that echo those found on pottery of the period. Two of the whorls have a single row of fingernail impressions round their middles, one has multiple rows of fingernail impressions, and the fourth has fingertip decoration.

The majority of the Bronze Age spindlewhorls known from the county are biconical in form, so this relatively large group usefully illustrates the variety of forms in use at the time. Most of the whorls from other sites are plain, although surface erosion might entirely remove lightly incised decoration such as that on No. 5, below, and more of the spindlewhorls might originally have been decorated. There is a close parallel for No. 9 from Stansted (Major 2004).

5. Fragment, with part of the hole. The surface is decorated with lines of closely spaced fingernail impressions. The fabric is brown and rather soft, with few inclusions. Wt. 5g. <3377> Context 5529, Main ditch segment 4012

6. Complete. Rounded biconical form, with one row of fingernail impressions round the middle. Sandy, orange-brown fabric. Wt. 20g. <3312> Fill 5541, Saxon grave 6033

7. Fragment, with part of the central hole. The surface is decorated with finger impressions. Diameter *c.* 35mm. <3457> Fill 5634, Main ditch segment 4019

8. Approx. 20% of a hemispherical spindlewhorl in fine clay. Wt. 3g. <3905> Fill 7294, Feature 6354

9. Complete biconical whorl, with a lip round the hole at one end. Decorated with fingernail impressions round the middle. Sandy fabric. Wt. 40g. <4312> Fill 9045, Main ditch segment 4034

10. Fragment with a flat base, probably a truncated biconical spindlewhorl. Surviving height 19mm. Fine, sandy fabric. Wt. 4g. <4414> Fill 9043, Main ditch segment 4023

Late Bronze Age loomweights
(Fig. 3.41)
Twenty fragments of loomweight were recovered, weighing a total of 3691g. Their shape, where identifiable, is a truncated pyramid, a typical late Bronze Age form in south-eastern England. The difficulty in determining the form of most of the weights is due to the fact that most of the cores are poorly fired because of their thickness, and have crumbled away, leading to a high degree of fragmentation of the better fired surfaces of the weights.

The type has been discussed by Barford and Major (1992). They are rarer than the cylindrical loomweights

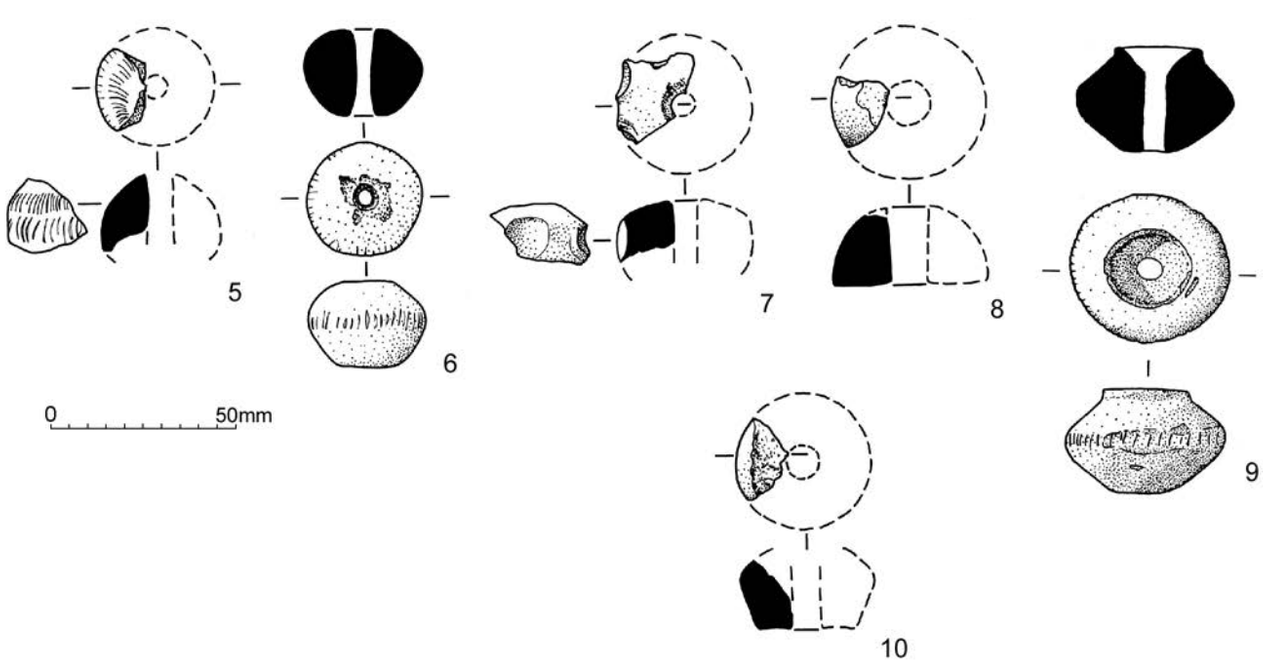


Figure 3.40 Spindlewhorls

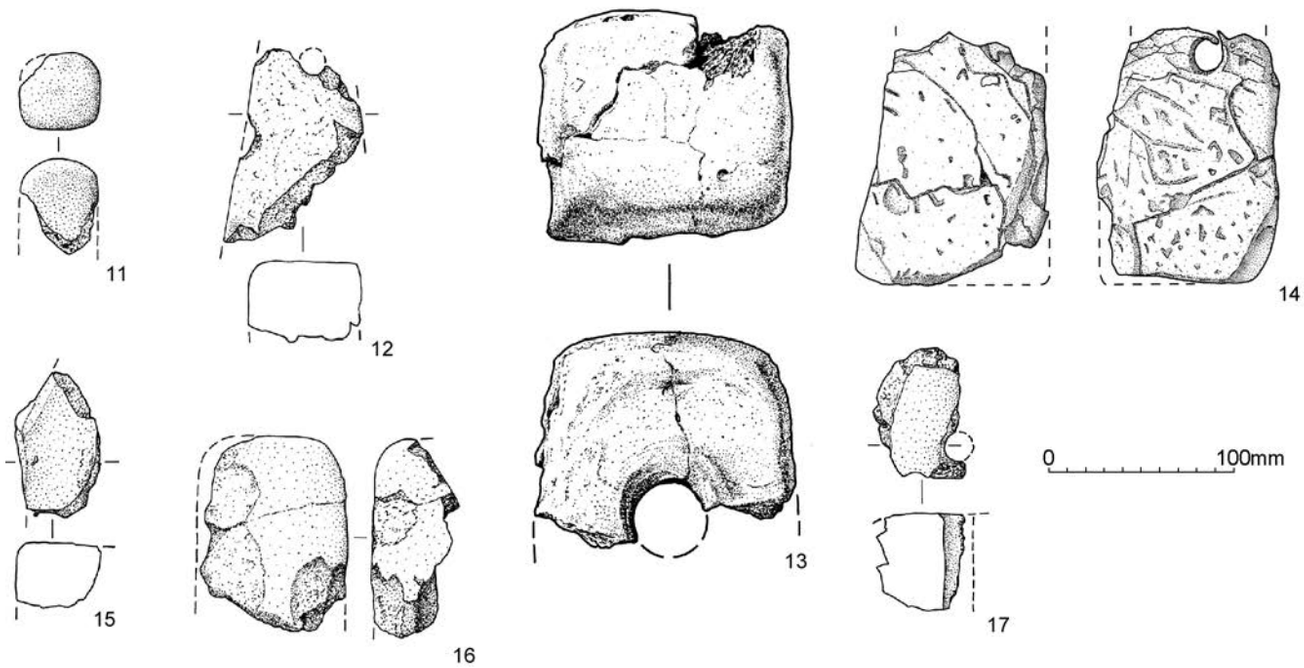


Figure 3.41 Fragments of Late Bronze Age loomweights

that can also occur on late Bronze Age sites, and are probably a later development than the cylindrical type, continuing into the early Iron Age. Their distribution within the county is concentrated in South Essex, although this may merely reflect the distribution of excavated sites in the county rather than the true extent of wool-producing areas.

11. Possible loomweight fragment comprising the end of a bar, *c.* 40mm square. The fragment is friable and rather mottled, with few inclusions. Wt. 90g. <3343> Fill 5529, Main ditch segment 4012

12. A very fragmentary loomweight of uncertain form, but probably a truncated pyramid. Part of a single perforation is present, with a diameter of about 18mm. The surviving side of the weight is 60mm wide. The fabric is very crumbly, brown in colour and has sand and grit temper. Wt. 750g. <3354> Fill 5653, Main ditch segment 4019

13. The top of a truncated pyramid loomweight, broken across the hole. The top is almost flat, and measures *c.* 60 x 55mm, with a hole diameter of 22mm. The fabric is orange-brown, fairly friable and has sand and pebble temper. Wt. 335g. <3361> Fill 5653, Main ditch segment 4019

14. The base of a truncated pyramidal loomweight, broken across the hole. The fabric is brown and crumbly, with sand and small pebble inclusions. Wt. 1270g. <3401> Fill 5664, Main ditch segment 4019

15. Possible loomweight fragment; the edge of a block, possibly perforated. Sandy orange fabric with a black core, occasional pebbles. Wt. 130g. <3669> Fill 5988, Main ditch segment 4024

16. Three joining pieces from the end of a block, probably a loomweight. Wt. 355g. <3585> Fill 5908, Main ditch segment 4029

17. Possible loomweight fragment with one flat surface with a hole at right angles to it. Very fragmentary, fine fabric. Hole diam. *c.* 18mm. <3831> Fill 7032

Other baked clay objects

(Fig. 3.42)

Most of the other baked clay from the site consisted of amorphous lumps. Some of this probably derived from structural daub, but only one piece (No. 20, below) had possible wattle marks. The only identifiable object, apart from those described above, was a spherical ball (No. 18).

18. An almost spherical ball with a fairly well smoothed surface. Orange/red clay with fairly sparse sand. Diam. 30mm, wt. 28g. <2565>, Fill 3582, Feature 2967

19. Fragment, possibly from the rim of a small, crude vessel. The surface is in poor condition, and the shape may be spurious; the shape is not as regular as the drawing suggests. It was originally thought to be a possible crucible, but there is no reduction of the surface, and this interpretation now seems unlikely. Rather soft orange/red fabric with sparse sand. Wt. 14g. <4968> Fill 9436, Feature 4016

20. Slabby fragment in a fairly hard fired, sandy fabric, partly reduced. This is possibly burnt structural daub, although the flat surfaces may not be original. There are two grooves, which may be the marks of wattles, diam. *c.* 20mm. <2057> Context 3043, Feature 4002

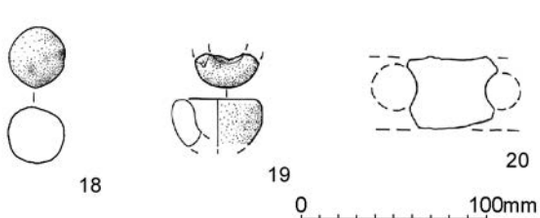


Figure 3.42 Other baked clay objects

IX. Carbonised plant remains from Neolithic, Late Bronze Age and Roman contexts

by Peter Murphy

Introduction

The excavation at Springfield Lyons provided an opportunity to obtain assemblages of charred remains of crops and other plants dating from the Neolithic, Beaker, later Bronze Age, Iron Age, Roman, Early and Late Saxon periods. These periods are not equally well represented, but very informative collections of material came from later Bronze Age and Late Saxon contexts, and some information has been gained on the agriculture of the other periods. In this report the prehistoric and Roman material is considered: the Saxon archaeobotanical remains are not presented here, having been published in Tyler and Major (2005). There follows a short general discussion of long-term trends in the environment and agrarian economy of this area, based partly on the charred plant remains from the excavations and partly on studies of valley sediments of the Chelmer and its tributaries.

This report was completed in 1990. The biological nomenclature has not been updated when preparing it for publication. The text has been changed only to take account of radiocarbon dates received since 1990.

Methods

Bulk samples were taken from pits, post-holes, the enclosure ditch and other features. The standard sampling unit was a container of eight litre capacity (containing approximately 10kg of soil). Several sample units were taken from most contexts, in order to assess the distribution of plant remains through the deposits. Total volumes processed per context were variable, depending partly upon the quantities of charred plant material present, as assessed during flotation, but in some cases entire layers were floated. Plant remains were extracted using a simple flotation tank (Williams 1973) on site, collecting the flots in a 0.5mm mesh. The residues were retained in a 1mm mesh.

In some layers, particularly charcoal-rich layers in some of the deeper features (5721 and 9043 in the Late Bronze Age enclosure ditch, and 9788, 9857, 9863, 9865, 9869, 9876 and 9903 in the deep early prehistoric feature 6854), ferrimanganiferous concretions formed a high proportion of the matrix of the deposits. Much of the matrix would therefore not disaggregate during flotation and charred plant material present could not be extracted efficiently by flotation since coating and impregnation with mineral deposits increased its density. This problem has been encountered previously; at Lofts Farm, Essex, for example most deposits at the site were affected (Murphy 1988a). At Springfield the problem was largely confined to deep prehistoric deposits with much charcoal, which presumably acted as a substrate for precipitation of metal ions. The Saxon deposits were scarcely affected. At present there seems to be no solution to this problem; but it should be noted that retrieval of material from the contexts listed above was poor.

The dried flots frequently included quantities of silt, sand and even small pebbles washed over during flotation on site; control of water flow had proved difficult. To separate these from the charred plant material a second flotation in the laboratory was necessary. Mats of modern fibrous roots were also present in many samples. Most charred plant macrofossils trapped in these mats were extracted by washing out under running water, over a 0.5mm mesh. Once dried, the roots were teased apart to extract any remaining seeds. The dried flots were sorted under a binocular microscope at low power.

The residues were scanned over fairly quickly to check whether or not flotation had effectively separated charcoal *etc* but have not usually been examined in detail since, due to acid soil conditions, they rarely contained more than occasional chips of burnt bone. Full lists of material identified with notes on problems of identification are given in Tables 3.14–3.18. Detailed descriptions of the crop plant remains are given below.

Context No		*3934*	*7427*	*11061*
Cereal indet	cafr	+	+	-
Cereal indet	ca	2	4	-
Triticum spp	ca	3	2fr	-
Avena sp	ca	-	2	-
Triticum spelta L	gb	-	1	-
Chenopodium sp		1fr	-	-
Polygonum aviculare agg		-		1
Prunus spinosa L		-	fr	-
Bromus mollis/secalinus		-	1	-
Gramineae indet		1	-	-
Indet seeds *etc*		-	-	1
Total sample volume (litres)		**32**	**64**	**21**

Abbreviations
ca – caryopses; fr – fragments; gb – glume base

Table 3.14 Charred cereals, seeds *etc* from Neolithic contexts

Contamination

Archaeological deposits at well-drained sites are commonly contaminated by modern plant material and the deposits at Springfield were no exception. Fibrous roots, fungal sclerotia, seeds and in some samples remains of wild oat and two-row hulled barley were present. No practical difficulty was experienced in distinguishing and discounting these uncharred contaminants, apart from some seeds of Chenopodiaceae (see note 4 in Table 3.15). The possibility of contamination by modern charred plant material is potentially more serious since it might be difficult to detect. In practice, however, this is not thought to be of any significance. A detailed study of contamination at nearby Springfield Cursus showed that modern charred cereals from stubble-burning were present in the topsoil, but failed to detect any penetration of these into deeper levels. It is also noticeable that this recently-charred material is quite different in appearance from ancient material; it is very well preserved and does not have the silty coating, filling concavities, which characterises ancient charred seeds from the loam-based deposits of this area. No such well-preserved material was observed in the present samples.

However, as at any multi-period site lacking deep stratigraphy or sediment cover, contamination of earlier features with charred material from later phases of activity has to be considered, and will be discussed below.

Impressions on pottery
A sample of the pottery from the site, comprising pottery nos 300–432 and 640–739, was inspected for impressions of plant material. Most of these sherds were of Late Bronze Age date. The majority had a coarse flint gritting. There were some inclusions of plant material in a number of sherds, but these consisted almost entirely of unidentifiable scraps of stems, leaves *etc*. No definitely identifiable impressions of cereal remains were seen, though P688 (3625) shows what may be an internal impression of a cereal inflorescence bract and P705 (3666) shows an indistinct impression of a structure resembling a wheat spikelet.

Neolithic–Beaker
The few Neolithic contexts excavated were sampled extensively, but yielded very little charred plant material (Table 3.14). Samples were taken from the isolated pits 3934 and 7427 and from the group of early prehistoric contexts in the eastern extension of the site (contexts 9788, 9842, 9844–51, 9855–7, 9863–5, 9869, 9871, 9873, 9875, 9876, 9882, 9890–1, 9893–5, 9899, 9903, 9908, 9910, 9935, 9941, 9996, 11044, 11053, 11061, 11089, 11091, 11097, 11100, 11101, 11103, 11114, 11117: in total *c.* 1600 litres of soil.

This very large volume of soil processed from the eastern extension produced only a single carbonised nutlet of *Polygonum aviculare* and an indeterminate seed from 11061, although quantities of small finds and bone fragments were retrieved. The pit 7427 lay within the main area of the late Saxon settlement and adjacent late Saxon features contained abundant cereal remains. The material from 7427 included at least two categories of macrofossils which are considered to be intrusive: two large *Avena* caryopses and a *Triticum spelta* glume base. The material from this feature is not reliable. Pit 3934 produced three wheat grains in association with Mildenhall pottery. None is well preserved, but an elongate grain of emmer-type (*Triticum* cf *dicoccum*) and a short grain of a free-threshing hexaploid wheat (*Triticum aestivum/compactum*) were present. The latter was submitted for radiocarbon dating in an attempt to confirm Neolithic cultivation of free-threshing wheat at the site, but produced a radiocarbon date of 855±27 (ca AD 1050–1260: OxA-20559). Assuming that the archaeological dating of the feature is correct, this grain must have been intrusive.

In short, the evidence for Neolithic crop production at the site is very slight and debatable. It is, indeed, possible that *all* cereal remains from Neolithic contexts could be intrusive, (since some certainly are), a possibility that could only be tested by dating all the grains. In the 1980s it seemed reasonable to process large soil volumes from Neolithic contexts at open, multi-period sites such as Springfield Lyons, since this had not previously been attempted and the outcome was unpredictable. With the benefit of hindsight, and considering the sparse and dubious results from this and other similar sites in the region, it seems more appropriate to focus effort on well-sealed Neolithic sites where the possibility of contamination can be discounted (see, for example, Wilkinson *et al*. 2012, 71–114).

Later Bronze Age
Samples were taken from the fill of pits and post-holes and from the main enclosure ditch (Tables 3.15 and 3.16). Most of the internal features sampled are dated on artefactual grounds to the Later Bronze Age but others, whilst thought to be of this date, are less securely dated. The enclosure ditch fills are likely to have included deposits formed over a long period; indeed there are grounds for thinking that the ditch may have survived as a surface feature into the early Saxon period. Furthermore the comparatively loose fills of the ditch may have been prone to disturbance by tree roots and burrowing animals. The upper fills have also produced Middle-Late Iron Age and Roman pottery sherds. Consequently samples from the ditch fills are considered to be less reliable for reconstructing the later Bronze Age economy than the internal features.

Crop plants
(Figs 3.43–3.45)

1. Wheats (*Triticum* spp)
Grains and spikelet fragments of wheats form the most abundant crop plant remains in the Bronze Age samples. The majority of grains are elongate, with flat or slightly concave ventral surfaces (Fig. 3.43 a, b). These are of *Triticum dicoccum* (emmer) and *Triticum spelta* (spelt) from two-grained spikelets. Context 5606 produced a very slender gain with a convexly curved ventral surface (Fig. 3.43 c). This is probably from a terminal one-seeded spikelet either of *T. dicoccum* or perhaps *T. monococcum* (einkorn). A very few short rounded grains are from free-threshing hexaploid wheats (Fig. 3.43 d).

Detached rachis internodes from brittle rachis wheats occur sporadically, usually in samples containing large quantities of other spikelet fragments. There is considerable variability in size and robustness (Fig. 3.44 j, k). The larger specimen illustrated has striations on its outer surface, a feature confined to hexaploid wheats (G.C. Hillman, pers. comm.). This particular internode must therefore be of spelt.

Glume bases and spikelet forks are common. The term 'spikelet fork' is usually used to describe the bases of spikelets including both glume bases and an attached rachis internode. This term is used in this report, but in fact there are no intact forks with all these elements. The term 'spikelet base' is used here in a restricted sense to describe badly damaged forks which have lost their internode and also the outer surfaces of the glume bases. Examples are illustrated in Fig. 3.44 d–f to show specimens at varying stages of fragmentation and abrasion. In general these are too poorly preserved to be identified, though some, from their overall size, are tentatively identified as spelt or emmer.
The spikelet fragments have been identified from characteristics of size and morphology defined by Helbaek (1952, 216–8), Hillman (forthcoming) and Jacomet (1987), though many fragments were too badly damaged or obscured by encrusted sediment to be identified specifically. Due to their generally poor state of preservation few 'spikelet forks' could be measured and thus the examination of spikelet width distribution (Helbaek's Dimension A) or more complex multi-dimensional studies are not possible. Attached internodes were not usually present and it was therefore in most cases impossible to determine the type of spikelet disarticulation, though in any case Hillman (1981, 188) has shown that this latter criterion is not wholly reliable for the separation of species in mixed assemblages of glume wheats. Measurement have, however, been made of glume base widths, at the articulation point. Only bases from securely-dated Bronze Age contexts have been measured. Damaged specimens were not usually measurable and some bases, though intact, have been omitted because they were of a shape which made precise orientation for measurement difficult. Single measurements of glume base widths were taken from spikelet forks.

The distribution of measurements is shown as a histogram in Fig. 3.45. Figures given by Helbaek show that spelt glume bases generally have widths in the range of approximately 0.9–1.6mm, whilst emmer and einkorn bases are narrower, but the width distribution for these species overlaps with the lower end of the spelt distribution. Jacomet (1987, table 13) gives a width range for spelt of 1.1–1.4mm. The distribution at Springfield indicates the presence of at least two wheat species, though it is not simply bimodal. However, it is clear that a high proportion of the bases have widths greater than 1mm and these are thought to be predominantly or exclusively of spelt. Morphological criteria used for

		Pits (Bronze Age)															Pits (probably Bronze Age)					Post-holes							
Context Number		*3365*	*3558*	*3610*	*3670*	*3671*	*3674*	*3683*	*3790*	*3827*	*3850*	*3977*	*5695*	*3596*	*3760*	*3775*	*3830*	*3950*	*5348*	*5594*	*5595*	*5606*	*5667*	*3126*	*3666*	*3770*	*3878*	*3982*	*5189*
Cereal indet	(fr)	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	_	+	+	-	-	+	+	+	+	+
Cereal indet	(ca)	6	1	2	232	15	29	8	38	16	21	8	5	9	28	88	-	11	1	4	1	22	-	-	6	2	8	24	23
Cereal indet	(cn/cf)	-	-		[4]	[1]	[1]	-	[7]	-	[3]	-	-	-	[1]	[4]	-	-	-	-	-	-	-	-	-	-	-	[1]	-
Hordeum sp	(ca)	-	1	1	25	3	10	2	15	8	18	2	2	2	35	39	-	3	-	-	-	7	-	-	-	1	2	8	8
Triticum spp	(ca)	1	4	3	155	20	25	10	41	9	53	6	3	13	82	94	3	3	1	2	1	4	-	-	6	4	4	13	8
Triticum spp	(bri)	-	-	-	10	4	-	1	-	-	2	2	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Triticum spp	(gb)	-	-	-	84	15	20	-	4	2	3	10	-	-	8	6	-	-	-	-	-	2	-	-	-	-	6	3	6
Triticum spp	(spf)	-	-	-	3	3	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Triticum spp	(tspf)	-	-	-	-	-	-	-	-	-	(?)1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Triticum spp	(spb)	1	-	-	58	14	8	1	3	6	2	1	1	-	8	6	-	-	-	-	-	-	-	-	1	1	2	-	-
Triticum spelta L	(gb)	1	-	4	159	12	24	-	3	2	10	5	-	1	8	11	1	-	-	-	-	2	-	-	2	8	3	1	-
Triticum spelta L	(spf)	-	-	-	4	1	3	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Triticum cf spelta L	(spb)	-	-	-	-	-	-	-	1	1	-	-	-	-	-	2	-	-	-	-	-	-	-	-	1	2	-	-	-
Triticum dicoccum Schubl	(gb)	-	-	-	43	18	7	-	3	2	9	-	-	-	3	2	-	-	-	-	-	-	-	-	2	-	1	-	2
Triticum dicoccum	(spf)	-	-	-	18	6	1	-	3	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Triticum cf diococcum	(spb)	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Secale cereale L	(m)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Vicia faba var *minor*		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-
Leguminosae (large seeded) cr fr/seeds		-	-	-	[1]	-	-	-	-	-	[2]	-	-	-	-	[1]	-	[1]	-	-	-	-	-	-	+	-	-	-	-
Ranunculus acris/repens/bulbosus		-	-	-	-	-	-	-	-	-	(?)1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(?)1	-	-	-
Ranunculus flammula L		-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thlaspi arvense L		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Stellaria cf graminea L		-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caryophyllaceae indet		-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Montia fontana L subsp *chrondosperma*		-	-	-	1	-	-	-	1	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Chenopodium album L		-	-	-	[16]	[7]	[6]	-	[13]	[1]	[15]	-	-	-	[9]	[16]	[1]	-	-	-	-	-	-	-	[2]	[1]	[2]	[2]	[1]
Chenopodium sp		-	-	-	-	[1]	-	-	-	-	[1]	-	-	-	-	-	-	-	-	-	-	[1]	-	-	-	-	—	-	[1]
Atriplex patula/hastata		-	-	-	[3]	[1]	-	-	[6]	-	[6]	-	-	-	[2]	[1]	-	-	-	-	-	-	-	-	[1]	-	-	[2]	-
Chenopodiaceae indet		-	-	-	[16]	[6]	[6]	[1]	[12]	[2]	[15]	[1]	[2]	[1]	[8]	[20]	[2]	[1]	-	-	-	[1]	-	-	[3]	[2]	[2]	[2]	[1]
Malva sylvestris-type		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Medicago/Trifolium-type		-	-	-	-	-	-	-	2	1	3	-	-	-	3	12	-	-	-	-	-	1	-	-	1	6	-	-	-
Vicia/Lathyrus spp co		-	-	1	51	5	9	4	9	3	4	-	-	-	10	6	3	11	-	-	-	-	3	-	6	2	4	-	-
Vicia/Lathyrus spp s		-	-	-	17	-	1	-	6	1	4	-	-	-	3	-	1	2	-	-	-	2	1	-	-	2	1	1	1
Lathyrus nissolia L		-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Crataegus monogyna Jacq		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Polygonum aviculare agg		-	-	1	2	-	-	1	6	-	3	-	-	-	1	2	-	-	-	-	-	-	-	-	2	-	-	-	-
Polygonum persicaria/lapathifolium		-	-	-	23	2	2	1	23	6	17	-	-	-	7	13	1	-	-	-	-	6	-	-	6	-	2	2	2
Polygonum convolvulus L		-	-	-	8	1	2	1	19	-	8	-	2+fr	-	1 fr	10	-	-	-	-	-	-	-	-	5	-	-	-	-
Rumex acetosella agg		-	-	-	7	1	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	9	-	-	-	-	-
Rumex sp		-	1	-	3	-	1	1	5	1	11	-	1	-	4	4	-	-	-	-	-	-	-	-	-	1	1	1	1
Polygonacceae indet		-	-	-	4	-	-	-	16	-	13	-	-	-	1	10	-	-	-	-	-	-	-	1	2	-	-	-	1
Corylus avellana L		-	-	-	-	-	-	-	-	[1]	[2]	-	-	-	-	[1]	-	[1]	-	-	-	-	-	-	-	-	-	-	-
Plantago lanceolata L		-	-	-	1	2	-	-	1	-	1	-	-	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Galium aparine L		-	-	-	4	1	1	-	-	4	2	1	fr	2	1	1	-	-	-	-	-	-	-	-	-	-	1	-	-
Galium sp		-	-	-	-	-	-	-	-	-	1fr	-		-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Sherardia arvensis L		-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sambucus nigra L		fr	-	-	-	-	-	-	-	-	-	-	-	-	-	-	fr	-	-	-	-	-	-	-	1	-	-	-	-
Anthemis cotula L		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	—	-	-	-
Tripleurospernum maritimum (L) (Koch)		-	-	-	2	1	-	-	2	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Compositae indet		-	-	-	-	-	1	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Eleocharis sp(p)		-	-	-	2	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carex sp(p)		-	-	-	1	1	1	-	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromus mollis/secalinus		-	-	2+fr	60+fr	9+fr	8+fr	-	8+fr	2	7	fr	-	3	15+fr	18+fr	-	1	fr	-	-	1	-	-	1	1 fr	1+fr	6+fr	1
Avena sp	(ca)	-	?2+fr	-	-	-	-	-	1	-	-	-	-	-	2	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-
Avena sp	(af)	-	-	-	[8]	[2]	[1]	-	-	-	-	[1]	-	-	[1]	-	-	-	-	-	-	-	-	-	-	-	[1]	[2]	[1]
Arrhenatherum elatius var *bulbosum* tu		-	-	-	2fr	5+fr	-	-	-	-	1	-	-	7+fr	2	2+fr	-	-	-	-	-	-	-	24	-	12+fr	-	-	-
Gramineae (large)		-	1	-	6	1	3	-	8	-	2	-	2 fr	2	4	9	-	3	-	-	-	-	-	-	-	-	1	2	1
Gramineae (medium)		-	-	1	1	-	1	1	1	-	-	-	-	-	-	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-
Gramineae (small)		-	-	-	5	2	1	-	2	-	1	-	1	-	3	-	-	-	-	-	-	-	-	-	-	-	-	1	1
Indeterminate seeds etc		-	2	3	49	3	4	3	14	3	17	2	5	2	11	16	1	1	-	-	-	1	-	1	14	8	6	5	-
Root/rhizome frags		-	-	[1]	[1]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stem fragments		-	-	-	-	-	-	-	-	[1]	-	-	-	-	[1]	-	-	-	-	-	-	-	-	-	-	-	[1]	-	-
Thorns		-	-	-	[2]	[1]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Buds		-	-	-	[1]	-	-	-	[1]	-	[1]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Charred cokey material		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-
Total sample volume (litres)		24	32	24	136	80	48	32	81.4	56	152	24	16	53.3	88	89.6	24	32	24	32	24	24	16	8	32	18.4	32	16	8
Number of samples		3	3	1	16	10	6	3	15	2	15	2	2	7	9	21	3	3	1	3	3	2	2	1	3	4	2	2	1

All taxa are represented by fruits or seeds except where indicated.
Abbreviations:
af awn fragment; bri brittle-rachis internode; ca caryopses; cf culm fragments; cn culm node; co cotyledon; fr fragment; fs fruitstone; gb glume base; ri rachis internode; s seed; spf spikelet fork; spb spikelet base; tspf terminal spikelet *fork;* tu tuber

Notes
(1) 'Cereal fragments' refers to fragments comprising less than half a grain not including the germ area. 'Indeterminate cereal grains' refers to badly deformed grains, fragments comprising more than half a grain and germ area fragments. Only the latter category is quantifiable.
(2) *Triticum* sp Glume bases, fragmentary, deformed, or intermediate between *T. spelta* and *T. dicoccum* in size or form.
(3) Spikelet bases. This term is used to describe spikelet forks lacking not only the internode (which is commonly missing from the forks) but also all but the extreme bases of the glumes.
(4) Seeds of Chenopodiaceae have not been counted since numerous charred embryos and testa fragments indicate that there has been much fragmentation. Abraded charred embryos are inconspicuous and would easily be overlooked during sorting. Furthermore intrusive modern Chenopodiaceae seeds, where present, can often only be separated from ancient specimens by crushing to see whether the internal tissues are charred. For these reasons reliable counts could not be obtained.
(5) Chenopodiaceae indet. Embryos, underdeveloped seeds, seeds with testas 'blistered' during charring or seeds encrusted with sediment.
(6) Due to deformation during charring there is a continuous range of forms between *Medicago lupulina*-type and *Trifolium pratense*-type. Seeds in these two genera have not been separated.
(7) *Polygonum persicaria/lapathifolium*. These nutlets are normally 'puffed' into a sub-spherical shape by charring. The two species have not been separated.
(8) Polygonaceae indet refers to embryos lacking nutlet coats.
(9) *Arrhenathereum elatius*. Only well-developed intact 'tubers' have been counted. Fragments and underdeveloped tubers are also present.
(10) Gramineae (large) refers to *Bromus/Avena*-sized caryopses badly deformed and lacking any surface detail. Gramineae (small) indicates caryopses of *Poa* size, some of which show a pattern of pericarp cells which resemble *Poa*, though other species have not been excluded. Gramineae (medium) incudes caryopses of various forms, intermediate in size.
(11) *Vicia/Lathyrus* sp. These genera are represented mainly by isolated cotyledons or abraded seeds lacking hilums. 5606 (521) and 3670 (116) include seeds with narrow linear hilums, tentatively identified as *Vicia* cf *hirsuta*. Seeds from 3670 (326) have wedge-shaped hilum scars and are referred to *Vicia* cf *sativa*. No very well preserved seeds are present.
(12) *Carex* spp. Nutlets from 3670 (116) and 3775 (173) are bifacial with verrucose surfaces, angular outlines, short stipes and undeveloped beaks. They are referred to the secion Muehlenburgianae (Nilsson and Hjelmqvist 1967, 483) and match most closely *C. divulsa*. Nutlets from 3671 (239) and 3674 (174) are trifacial with relatively smooth surfaces.

The counts given normally refer to total numbers of seeds or other elements. Figures in square brackets are the numbers of samples in which a given seed-type or other element was present: this is used where counting presented difficulties.

Table 3.15 Charred plant remains from Bronze Age pits and post-holes

Context number		*3051*	*3057*	*3069*	*3084*	*5153*	*5529*	*5721*	*5929*	*9037*	*9040*	*9043*	*9065*	*9069*	*9369*	*9375*	*9404*	*9454*	*9455*	*9567*	*9631*
Cereal indeterminate	(fr)	-	-	-	+	+	+	+-	+	-	+	+	-	-	+	-	+	-	-	-	-
Cereal indeterminate	(ca)	-	1	3	-	22	9	-	9	1	-	4	-	-	2	1	-	1	-	-	-
Cereal indeterminate	(cn/fr)	-	-	-	-	-	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-
Cereal indeterminate	(ri/fr)	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Hordeum sp	(ca)	-	-	-	-	5	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Hordeum vulgare L emend Lam	(ca)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Hordeum sp	(ri)	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Triticum spp	(ca)	-	1	5	-	15	9	-	8	-	1	3	1	-	3	-	3	-	-	1	-
Triticum spp	(bri)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Triticum spp	(gb)	-	-	2	-	-	-	-	-	-	-	2	-	-	-	-	1	-	-	-	-
Triticum spp	(spb)	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Triticum spelta L	(gb)	1	1	1	-	-	-	-	2	2-	-	-	-	-	-	-	-	-	-	-	-
Triticum spelta L	(spf)	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Triticum dicoccum Schubl	(gb)	-	-	-	-	-	1	-	-	-	-	5	-	-	-	-	1	-	-	-	-
Avena sp	(ca)	-	-	-	-	6	-	-	-	-	-	-	-	-	-	-	1cf	-	-	-	-
Avena sp	(af)	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Leguminosae (large seeded) co fr/ seeds		-	-	-	-	5fr	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ramunculus acris/repens/bulbosus		-	-	-	-	1cf	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chenopodium album L		-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Chenopodium sp		-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chenopodiaceae indet		-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Medicago/Trifolium-type		-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vicia/Lathyrus spp		-	-	-	-	1co	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Prunus cf spinosa	(fs/fr)	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	+	-	-	-	-
Polygonum persicaria/lapathifolium		-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polygonum convolvulus L		-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rumex sp		-	-	1	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polygonaceae indet		-	-		-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Corylus avellana L		-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
Hyoscyamus niger L		-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantago lanceolata L		-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Gallium aparine L		-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sambucus nigra L		-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anthemis cotula L		-	-	-	-	16	-	-	1cf	-	-	-	-	-	1	-	-	-	-	-	-
Bromus mollis/secalinus		-	-	-	-	3	-	-	-	-	-	-	-	-	1cf	-	2	-	1cf	-	-
Arrhenatherum elatius var *bulbosum* tu		-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Gramineae indet		-	-	-	-	9	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-
Indeterminate seeds etc		-	-	-	-	9	2	-	1	—	-	1	-	1	-	-	-	-	-	1	1
Total sample volume (litres)		**20**	**105**	**330**	**150**	**232**	**72**	**7**	**45**	**390**	**165**	**180**	**330**	**14**	**135**	**120**	**180**	**45**	**45**	**150**	**75**

Abbreviations and notes as in Table 3.15
Additional contexts sampled, which produced no macrofossils were: 3157, 5761, 9047, 9048, 9119, 9271, 9374 9465

Table 3.16 Charred cereals, seeds *etc* from contexts within the Late Bronze Age enclosure ditch

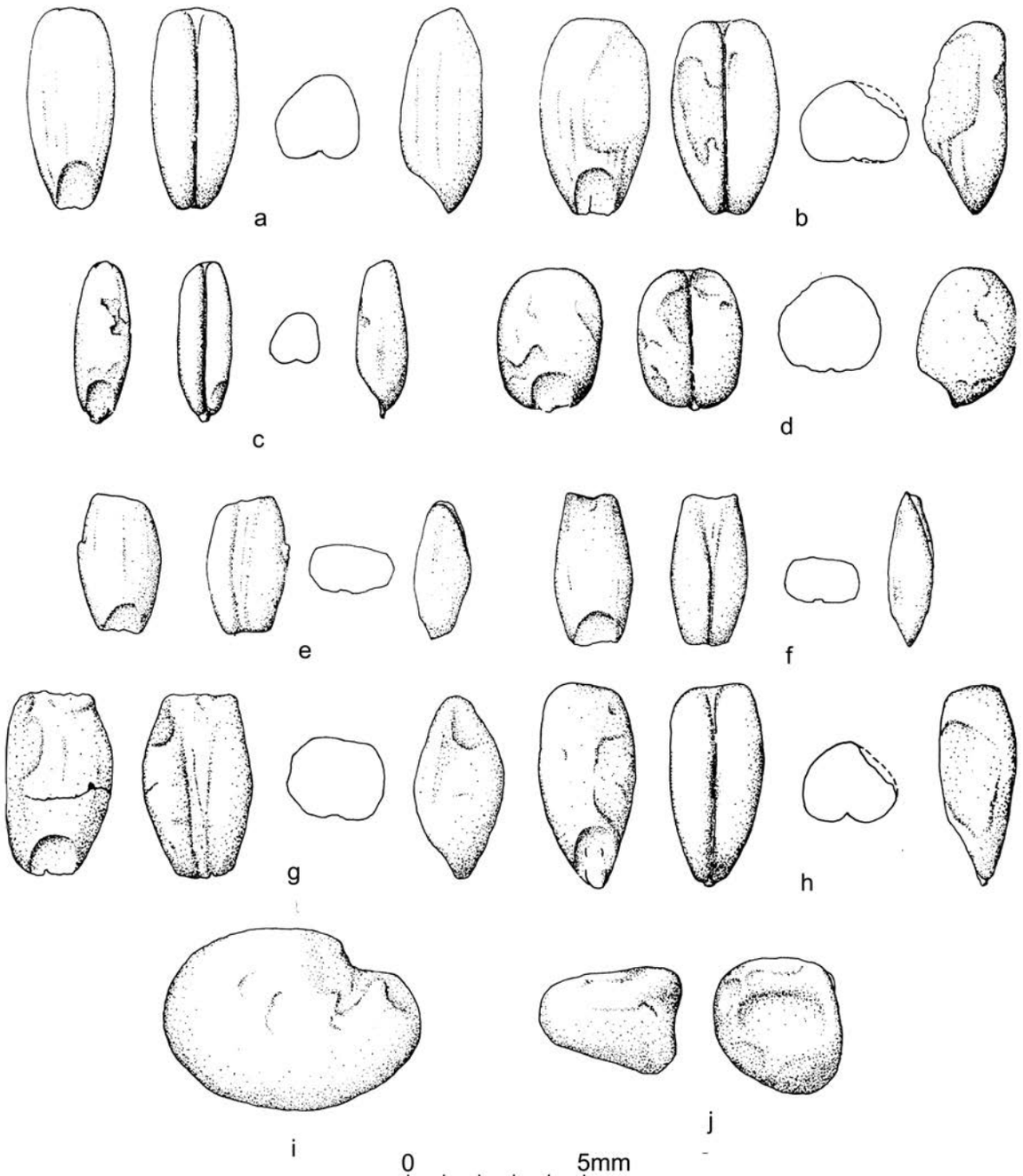


Figure 3.43 Cereal grains and pulse seeds a., b. *Triticum* spp (typical grain forms) 3760 (137 and 138); c. *Triticum* cf *dicoccum* (one-grained spikelet) 5606 (521); d. *Triticum* cf *aestivum* 3558 (114); e., f. *Hordeum vulgare* (lateral spikelets) 3760 (138), 3596 (106); g. *Hordeum vulgare* (median spikelet) 3670 (119); h. *Secale cereale* 3859 (195), [Late Iron Age]; i. *Vicia faba* 3666 (115); j. Indeterminate pulse seed 3850 (402)

the identification of spelt bases were the angle of the primary keel; (>90%), rounded curvature of the rest of the glume and conspicuously strong venation (Fig. 3.43, g, h). Spikelet forks of spelt are rare, but a few have striated rachis internodes attached.

On the criterion of size alone the remaining glume bases could be of emmer and/or einkorn. More detailed examination of glume base and spikelet form morphology, however, suggests that only emmer is present. On the better-preserved forks the outer faces of the glumes, viewed from above, slope inwards; no einkorn-type forks with near-parallel glumes were seen (the original angle between the glume bases, viewing the spikelet fork from the front, is not easily determinable in most cases, since in-curving of the glumes has apparently occurred during carbonisation). The glumes themselves do not in general show very sharply prominent keels and the angles of the secondary keels are mostly obtuse, though there are a few exceptions to this, such as a base from 3670 (320). In the absence of any definite grains or spikelet forks of einkorn, these few glumes are thought to be extreme forms of emmer.

2. Barley (*Hordeum* sp)

Only one context from a fill of the enclosure ditch (5153) produced barley rachis fragments. One specimen is an almost complete internode (Fig. 3.44, m). It has curled slightly during carbonisation and is damaged at its lower end, but is around 3mm in length and under 1mm across the lower node. It is a slender internode from a lax ear. The bases of the glumes are not very well preserved, but the surviving lateral glumes do not appear to diverge markedly from the axis of the rachis. There is also the lower part of a rachis unfortunately rather encrusted with tar and sediment (Fig. 3.44, l). The first rachis internode is short and straight.

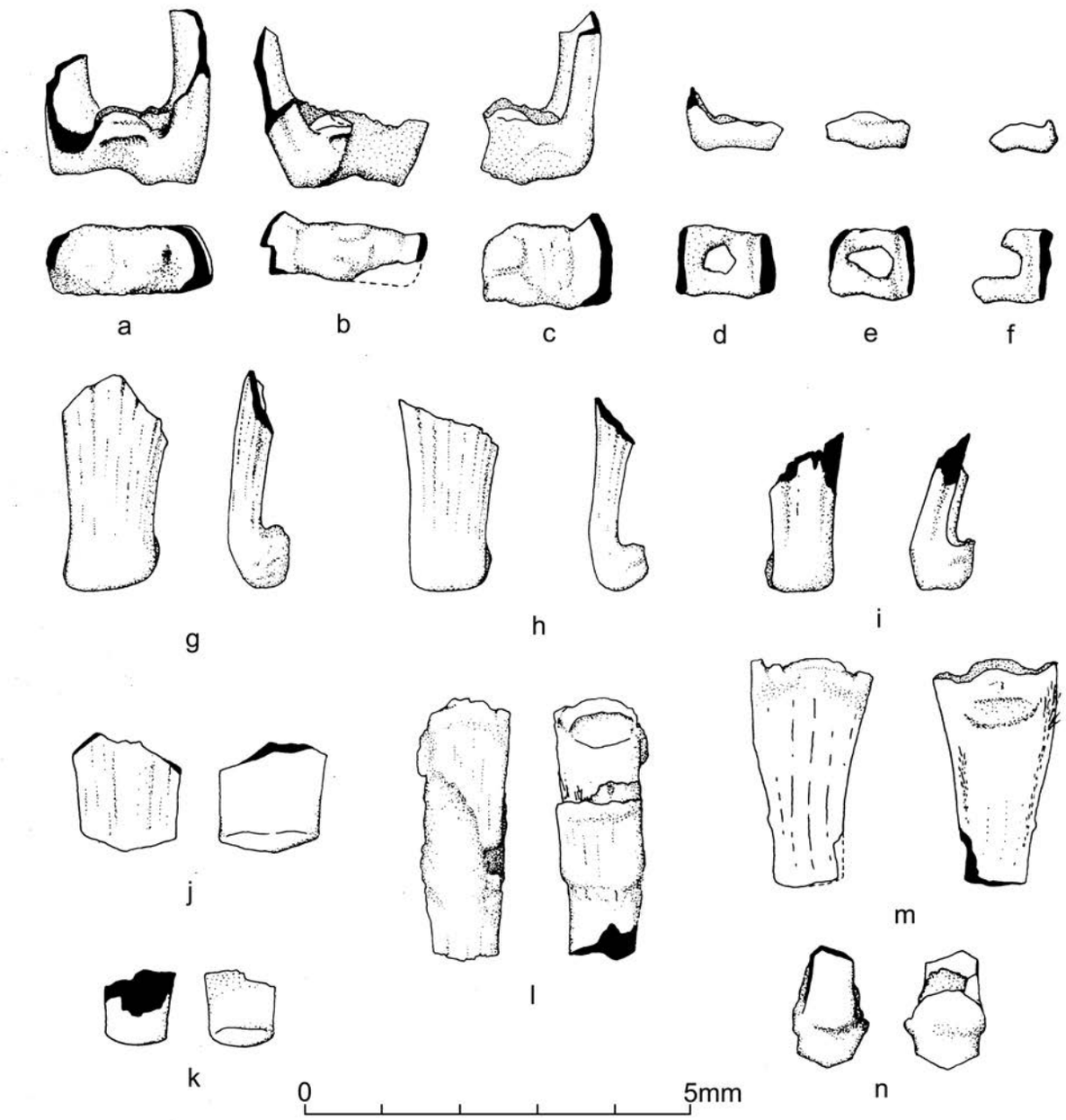


Figure 3.44 Cereal rachis and spikelet fragments: a., b. *Triticum dicoccum* partial spikelet forks: in (a) glumes have curved in, in (b) they remain divergent. 3670 (119), 3790 (228); c. *Triticum spelta* partial spikelet fork 3670 (119); d.–f. *Triticum* spp 'spikelet bases' 3670 (117), 3674 (345), 3670 (324); g., h. *Triticum spelta* glume bases 3670 (117), 3670 (326); i. *Triticum dicoccum* glume base 3670 (317); j. *Triticum spelta* rachis internode 3670 (116); k. *Triticum* cf *dicoccum* rachis internode 3671 (121); l. *Hordeum* sp base of rachis partly obscured by encrustation of tar. 5153 (455); m. *Hordeum* sp rachis internode 5153 (452); n. *Secale cereale* rachis node 3950 (263)

There are traces of pubescence on the adaxial side of the second internode. The collar is very badly abraded.

Barley grains are less frequent in these samples than wheat grains. Almost all examples are very poorly preserved. So far as can be determined only hulled grains are present. Asymmetrical lateral grains are present in a few samples (Fig. 3.43, e, f) but most grains are too deformed to determine whether they are median or lateral. The presence of six-row hulled barley can be established with certainty, but the possibility that other types of barley are present cannot be excluded.

3. Rye (*Secale cereale*)

One rachis node of rye (Fig. 3.44, n) came from pit 3950, a feature tentatively dated to the Bronze Age on archaeological grounds. However the presence of rye and of *Anthemis cotula* in this feature suggests that it belongs to a later site phase. The Middle Iron Age pit 3859 also produced a single rye grain (Fig. 3.43, h), see below.

4. Oats (*Avena* spp)

Poorly preserved oat caryopses and awn fragements were present in a number of samples. In the absence of floret bases there is no evidence for the presence of cultivated oats. The *Avena* remains could be from a weed species.

5. Pulses

Fragments of cotyledons from large leguminous seeds were present in several contexts but intact seeds and cotyledons were present in only three. 3666 (sample 115) produced three cotyledons of horsebean (*Vicia faba* var *minor*). These are 7.5mm, 7.00mm and 6.8mm in length, 5.8mm, 5.0mm and 4.5mm in breadth respectively. The largest and best preserved specimen is illustrated in Fig. 3.43, i.

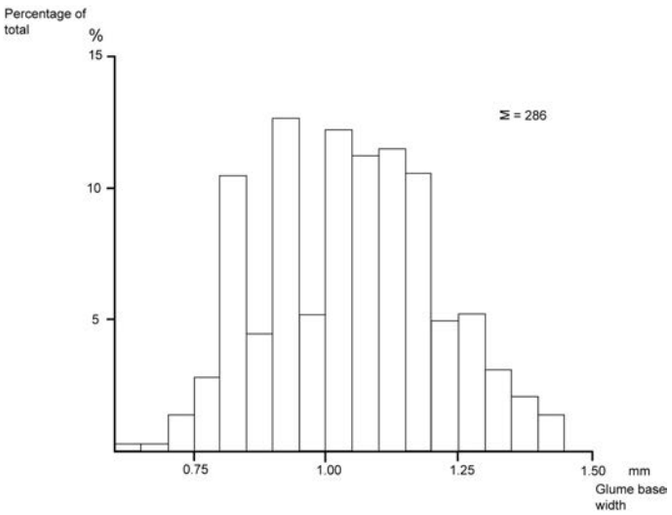


Figure 3.45 Bar chart of glume base widths

Leguminous seeds were also present in 3850 (sample 402) and 5153 (442). An example from 3850 is illustrated in Fig. 3.43, j. The cotyledon length is 4.1mm. There is a deep groove between the two cotyledons, at the upper end of which is the triangular radicle scar. No trace of the hilum survives. The specimen is thought to be too poorly preserved for close identification, though it shows some resemblances to pea (*Pisum sativum*). The seed from 5153 has a cotyledon length of 4.0mm and the cotyledons are not prominently convex. The hilum depression is faint but the hilum appears to have been narrow, about 2–3mm in length and with roughly parallel sides. The seed appears to be of a large-seeded species of *Vicia*.

Conclusions

Later Bronze Age crops comprised spelt (*Triticum spelta*), emmer (*Triticum dicoccum*), free-threshing hexaploid what (*Triticum aestivum s.l.*), six-row hulled barley (*Hordeum vulgare*) and field beans (*Vicia faba* var *minor*). A few specimens could possibly be of einkorn, and one insecurely-dated context produced a rachis node of rye. If all 28 contexts definitely or probably of Bronze Age date (excluding enclosure ditch samples) are considered, wheat grains occur in 26 contexts and barley grains in 20. Numerically the wheat : barley grain ratio is 2.95:1 (568:192). Spikelet fragments of *Triticum spelta* occur in 18 contexts and of *Triticum dicoccum* in 12. The spelt : emmer glume base ratio (including bases attached as spikelet forks/bases) is 1.85:1 (289:156). No free-threshing wheat rachis nodes were seen.

A similar range of crops has been reported from other Late Bronze Age sites: Black Patch, Sussex (Hinton 1982) and Lofts Farm, Essex (Murphy 1988a). At all three sites the main cereal crops are spelt, emmer and barley. At Springfield spelt is comparatively more abundant than emmer, whether assessed in terms of frequency or numerically, but at the other two sites emmer is the main wheat. Helbaek (1952, 208) considered spelt to be an Iron Age introduction and certainly it is in general the commonest wheat at Iron Age sites (Jones 1978, Murphy 1977). Rare spelt glume bases have, however, been reported from a Middle Bronze Age context at North Shoebury, Essex (Murphy 1995) and from the upper fill of Middle Bronze Age pits at West Row, Mildenhall, Suffolk (Murphy 1983), though at neither site is there any reason to suppose that it was a major crop. It is, however, now clear that by the later Bronze Age spelt cultivation was a significant feature of the arable economies of some sites in the south and east of England; the main crops of later first millennium agriculture were thus already established by the later Bronze Age.

Wild plants

Fruits, seeds and tubers of wild species will be discussed here; charcoal is considered below. The distribution of wild taxa is given in Tables 3.15 and 3.16.

Samples from the Bronze Age pit 3558, which apparently pre-dates the enclosure, contained only a single *Rumex* nutlet and poorly-preserved grass caryopses, probably including *Avena* sp.

The samples from the main Bronze Age phase of occupation contained far more remains of wild plants, with a much wider range of species. Charred hazelnut shells (*Corylus avellana*), seeds of elder (*Sambucus nigra*), hawthorn fruitstones (*Crataegus monogyna*) and *Prunus* fruitstone fragments are likely to represent the seasonal gathering of wild fruits and nuts. The remaining fruits and seeds are thought to represent contaminants of cereal and pulse crops.

The most abundant weed taxa in these samples are *Chenopodium album*, *Atriplex patula/hastata*, indeterminate Chenopodiaceae, *Vicia* and *Lathyrus* spp, *Polygonum aviculare*, *Polygonum persicaria/lapathifolium*, *Polygonum convolvulus*, *Rumex acetosella*, *Rumex* spp, *Galium aparine*, *Bromus mollis/ secalinus* and small Poa-type grass caryopses. Other weeds, identified at lower frequencies are *Thlaspi arvense*, *Malva* cf *sylvestris*, *Medicago/Trifolium*-type, *Hyoscyamus niger*, *Plantago lanceolata*, *Sherardia arvensis*, *Tripleurospermum maritimum* and *Avena* sp.

The weed seed assemblages from Springfield are, overall, quite similar to those reported from Iron Age sites in Southern Britain (*cf* Murphy 1977, Jones 1978), but there are some exceptions to this, for example, in the genus *Polygonum*. At later sites the predominant species are commonly *P. convolvulus* and *P. aviculare*. Here, nutlets of *P. persicaria/lapathifolium* are more abundant (the two species have not been separated since the majority of nutlets were 'puffed' into an undistinctive sub-spherical shape during carbonisation, though there are some definite *P. lapathifolium*). These two plants occur widely as arable weeds often in damp habitats (Simmonds 1945). Their relative abundance at Springfield is probably related to cultivation of poorly-drained gravel-based soils on the lower terraces or floodplain.

Seeds of other marsh and wet grassland plants were identified at low frequencies in the samples. These include *Ranunculus flammula, Montia fontana* subsp. *chrondrosperma, Eleocharis* sp and *Carex* spp. Several forms of *Carex* nutlets are present, including some closely matching *C. divulsa*, a sedge characteristic of damp grassland and roadsides (Jermyn 1974, 189). Jones (1978, 105) has argued that the occurrence of seeds from wetland plants in association with charred cereals is an indication that tillage extended onto poorly-drained soils, which at Springfield occur on the margins of the Chelmer floodplain.

Fruits of *Galium aparine* were present. According to Reynolds (1981, 112) this weed is confined to autumn-sown crops when grown under 'primitive' conditions. Tubers of the onion couch grass (*Arrhenatherum elatius* var *bulbosum*) were extracted from 7% of samples. These tubers were probably uprooted together with the cereals during harvesting.

The samples from the middle-upper fills of the enclosure ditch produced few weed seeds but do show one significant difference from the pit and post-hole samples, in that fruits of *Anthemis cotula* are present. Apart from one dubiously-dated specimen from pit 3950 this weed was not present in pit and and post-hole samples of definite Bronze Age date; the only mayweed species present in these samples is *Tripleurospermum maritimum*. It therefore appears that *A. cotula* was introduced to this area in the very late or post-Bronze Age, after the pits and post-holes went out of use but before the enclosure ditch was completely in-filled. Jones (1981) associates the spread of this weed with an extension of arable farming onto heavy poorly-drained soils. *A. cotula* also occurred in samples from the Late Iron Age pit 4583 (context 3859) (see below).

Charcoal

Fragments larger than 6mm were identified from three contexts containing conspicuous charcoal concentrations.

3666	(Sample 115)	*Quercus* sp Oak. Non-twiggy wood and root. Common *Fraxinus* sp (ash). Non-twiggy wood and root. Common *Corylus/Alnus* sp Hazel/alder. Twiggy. Present
3558	(Sample 14)	*Quercus* sp. Non-twiggy wood, including some conspicuously fast and slow-grown wood
5667	(Sample 529)	*Quercus* sp. Non-twiggy wood, some slow grown

Sample composition and taphonomy

(Figs 3.46–3.49)

Variations in the concentrations and relative abundance of cereal grains, chaff, straw, weed seeds and charcoal in feature fills must originally have been related to different types of activities involving plant materials. In this section spatial variations in sample composition will be examined in an attempt to provide information on these activities, and on the ways in which the assemblages of charred plant remains may have been formed (Figs 3.46–3.49).

a) Charcoal

The majority of features contained relatively low concentrations of charcoal in their fills; mean concentrations of under 1g of charcoal (>2mm) per litre of soil. Exceptions to this were the post-hole 3666 (2999) (2.23g/litre) and two pits, 3558 (2908) (1.96g/litre) and 5667 (6076) (4.27g/litre). Identifications of charcoal from these features have been given above. Some ditch fills also contained much charcoal, but this was heavily mineralised and difficult to extract.

3666 was part of the porch of the main roundhouse. Besides its relatively high charcoal content it is unusual in other respects: it was the only context containing seeds of field bean, it produced one of the four elder seeds from the site, and it contained some charred 'cokey' material, probably a burnt food residue. These characteristics suggest that its fill included material from a domestic hearth, introduced, presumably, via cracks in the post-hole fill due to drying out and to movement of the post.

3558 and 5667 were from pits at the periphery of the enclosure just inside the ditch. 3558 is believed to pre-date the enclosure. 5667 contained no cereal remains, 3558 very few. In each feature oak charcoal from mature wood (non-twiggy) is present. Unfortunately the samples from these features provide no basis for assessing the origins of the plant remains present.

b) Cereal gain, chaff and straw

For each Bronze Age context mean numbers of wheat spikelet fragments per litre of soil and mean numbers of cereal grains (of all species) per litre of soil have been calculated.

Clearly all the samples are to a greater or lesser extent mixed, probably including charred cereal remains produced by more than one activity. There are some variations in the relative abundance of chaff and grain, however. 3670 and 3674 from pit 4511, for example, include a relatively high proportion of spikelet fragments and it is likely that these contexts include a proportion of crop-cleaning waste. On the other hand 3982 and 5189 from post-hole 4651 contained fairly high concentrations of grain, but fewer spikelet fragments. Nevertheless it is not possible to relate any of the cereal samples from the site to a specific crop processing activity with certainty, and detailed quantitative analysis of sample composition is unlikely to be informative.

The distribution of grain, chaff and straw across the site is shown in Figs 3.46–3.49. It is quite clear that cereal remains in general were most common in the south-west central area of the enclosure. Straw fragments occurred only in samples from features within this area. Samples from peripheral areas of the enclosure contained few or no cereal remains. This distribution evidently indicates preferential disposal of charred cereal remains in this part of the site. It would appear that crop processing activities may have been concentrated in this area.

Cereal remains were either absent or very uncommon in samples from the enclosure ditch fills; the lowest fills produced no material. This may have been related partly to a rapid accumulation of the lowest fills, and in part to poor retrieval resulting from mineralisation of carbonised plant material (see above). However, the results contrast markedly with those from the Late Bronze Age enclosure at Lofts Farm (Murphy 1988a). There, despite similar problems of mineralisation by ferrimanganiferous deposits, most of the cereal remains came from the enclosure ditch, which may imply that crop processing took place outside the enclosure. The results from Springfield suggest that crop processing took place within the enclosure and that the internal bank formed a barrier for the dispersal of charred cereals. Consequently little material found its way into the ditch fills.

c) Fruits, nuts, pulses

The distribution of charred *Corylus* (hazel) nutshell fragments, of charred fruitstones and seeds of *Prunus* (sloe), *Crataegus* (hawthorn) and *Sambucus* (elder) and of charred beans (*Vicia faba*) is shown in Fig. 3.49. These macrofossils show a distribution largely complementary to that of the cereal remains: contexts containing high concentrations of cereals did not contain remains of nuts, fruits or pulses. This may suggest that the fills of features containing remains of these plants included charred debris from domestic cooking hearths rather than from crop processing activities.

In summary, although interpretation of sample composition in terms of activities is inevitably tentative, it does seem clear that cereal processing was confined to one restricted area of the site, where charred waste products were discarded. Charred food waste from domestic activities was less concentrated. All the samples examined seem to have come from one of these two sources. There are no large deposits which might relate to crop storage and the location of storage areas cannot therefore be suggested.

Context No		*3859*
Cereal indet.	(fr)	+
Cereal indet	(ca)	11
Hordeum sp	(ca)	4
Triticum spp	(ca)	12
Triticum spp	(spb)	2
Triticum spelta L	(gb)	5
Triticum spelta L	(spf)	1
Triticum dicoccum Schubl	(spf)	1
Secale cereale L	(ca)	1
Leguminosae (large seeded co fr)		+
Chenopodium album L		[1]
Chenopodiaceae indet		[1]
Vicia/Lathryus spp	(co)	2
Rumex spp		4
Polygonaceae indet		3
Corylus avellana L	(ns fr)	[3]
Anthemis cotula L		1
Bromus mollis/secalinus		3
Gramineae (small)		2
Indeterminate seeds etc		5
Number of samples		20

Abbreviations as in Table 3.15

Table 3.17 Charred plant remains from Late Iron Age pit

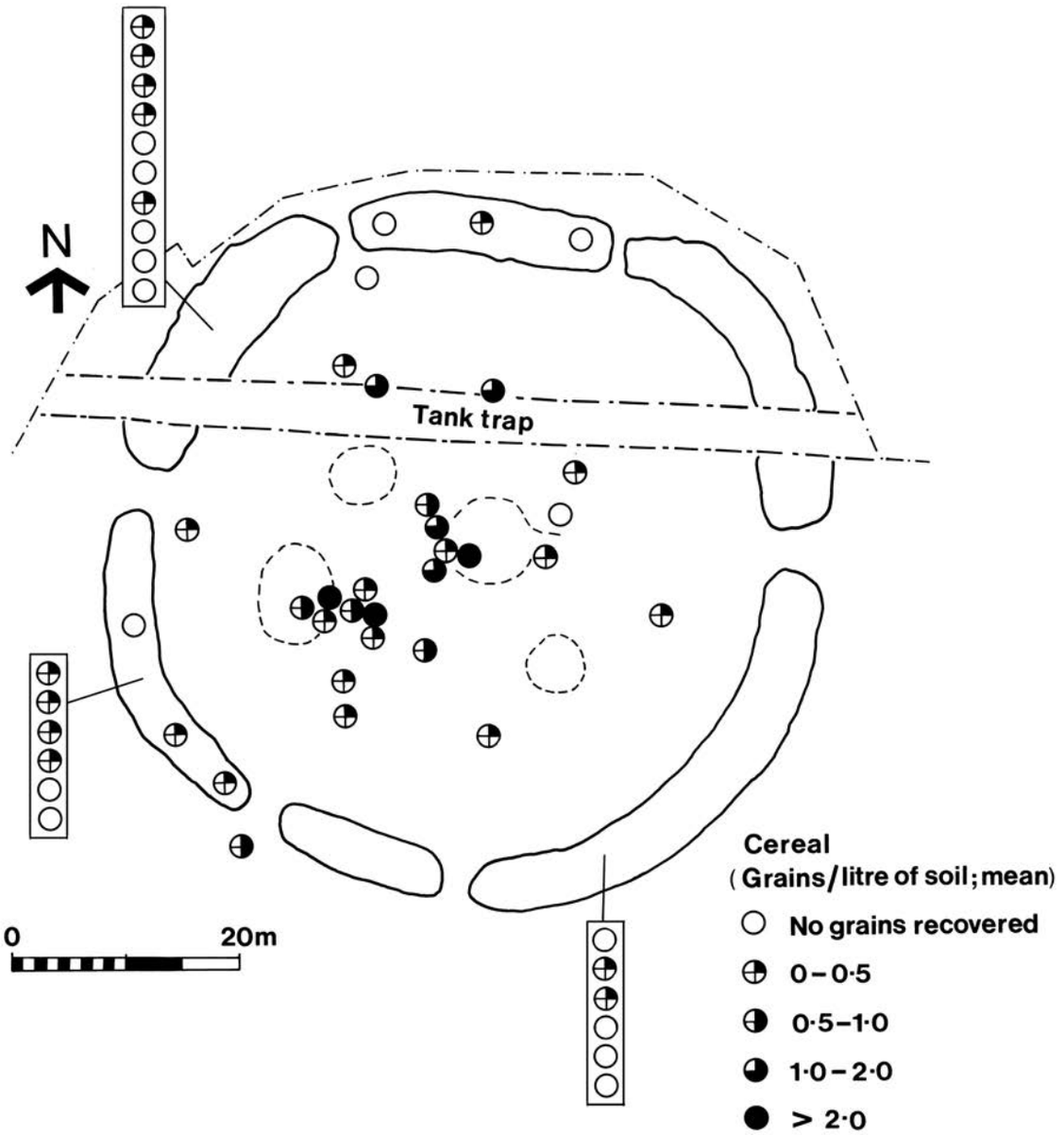


Figure 3.46 Distribution of cereal grains from Late Bronze Age features and enclosure ditch. The 'columns' of samples from sections of the enclosure ditch refer to successive layers within the ditch at each point

Late Iron Age

Charred plant material from the Late Iron Age pit 4583 (context 3859) is listed in Table 3.17. It produced grains of barley, rye and wheat (both elongate and short forms), spelt and emmer spikelet fragments and weed seeds including *Anthemis cotula*. Although *Secale* is not unknown from Iron Age contexts in England the possibility that this grain is intrusive must be considered, given the frequency of rye in Saxon contexts at the site.

Roman

Samples were collected from the fills of two pits (2535, 4991) at the Springfield Lyons excavation and from a pit (1177) and field ditch (1284) at the site of the Neolithic cursus at Springfield Barnes. Charred crop plant and weed seed remains from these contexts are listed in Table 3.18.

In addition, pit 2535 contained very large quantities of charcoal. Pieces of charcoal from the fills 3009 and 3029 were lifted intact from the deposits. The pieces examined were all of oak (*Quercus* sp). Much of the charcoal consisted of a thin 'skin', up to about 10mm thick, but generally less, around a core of soil. The charcoal 'skin' included the outer rings of branches, approximately 50–100mm in diameter, which had been superficially charred. 3009 also contained some larger charcoal fragments up to about 300mm from mature oak wood. The significance of this dense charcoal deposit is uncertain, but it might be related to the clearance of scrub growing on the remains of the Late Bronze Age enclosure or, perhaps, might be related to charcoal burning.

The sparse assemblages of crop plant remains and weed seeds are similarly difficult to interpret. Clearly there was no settlement at either site, and the plant material may just represent small-scale crop processing and cooking during transient activities at the sites, or alternatively may have been derived from domestic refuse spread on fields.

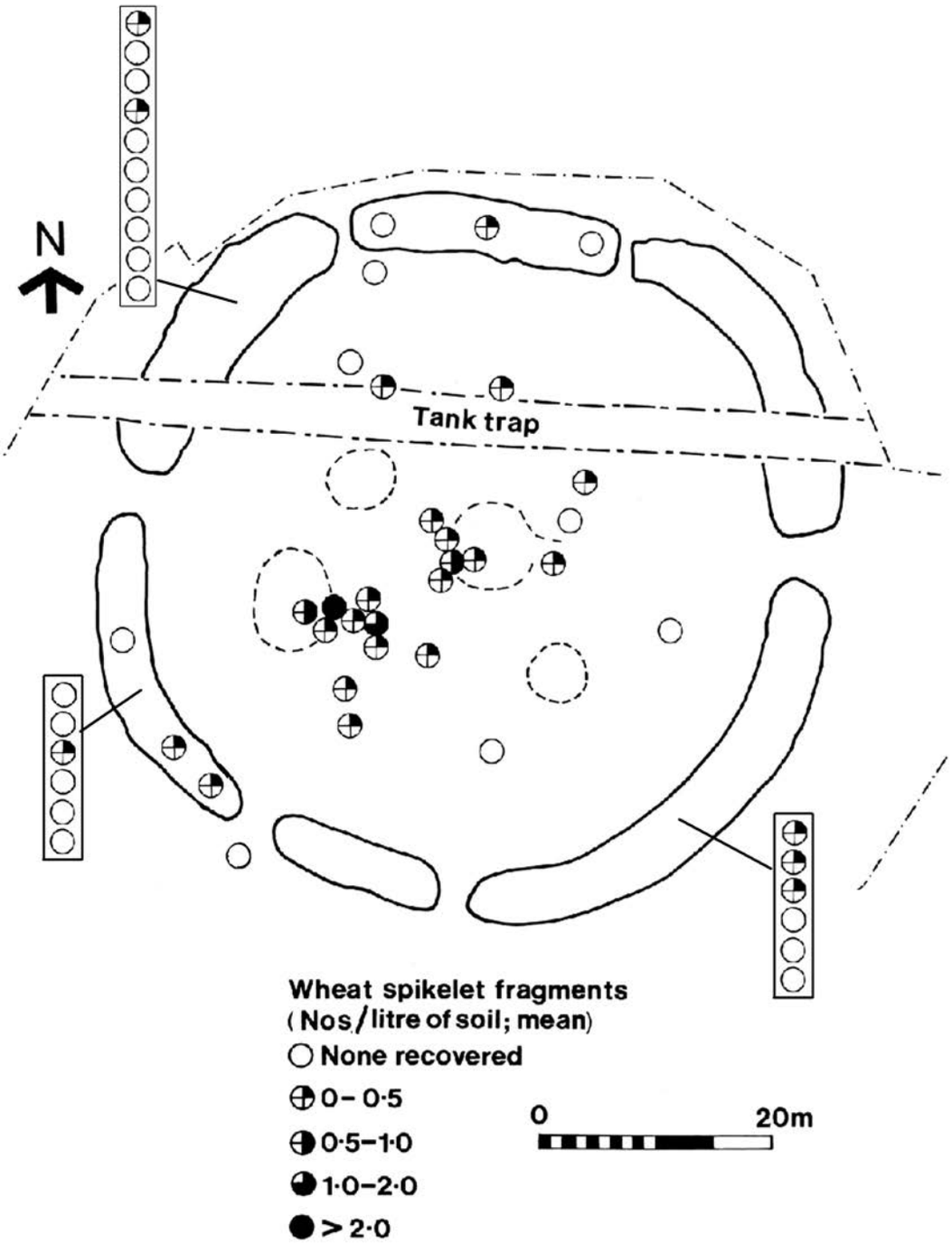


Figure 3.47 Distribution of wheat spikelet fragments from Late Bronze Age features and enclosure ditch. The 'columns' of samples from sections of the enclosure ditch refer to successive layers within the ditch at each point

Environment and agrarian economy: a general discussion

(Table 3.19)

The results from the excavation and from river valley sections exposed during construction of the A12 Chelmsford Bypass in 1984–5 (see Appendix) provide a basis for presenting a reconstruction of long-term environmental and agrarian changes in this part of the Chelmer valley, placing the results from the Springfield later Bronze Age enclosure in a wider temporal and spatial context.

Within the valley three zones characterised by distinctive soil-types and drainage conditions are distinguishable:

1. The floodplain. The floodplain deposits comprise the organic fills of Holocene palaeochannels incised into the sub-alluvial gravels and covered by oxidised clay loam and silty clay loam alluvial sediments deposited by overbank flooding. On the level surface of these alluvial deposits soils of the Fladbury 1 Association, stoneless clayey gleyed soils, are developed (Hodge *et al.* 1984, 194).

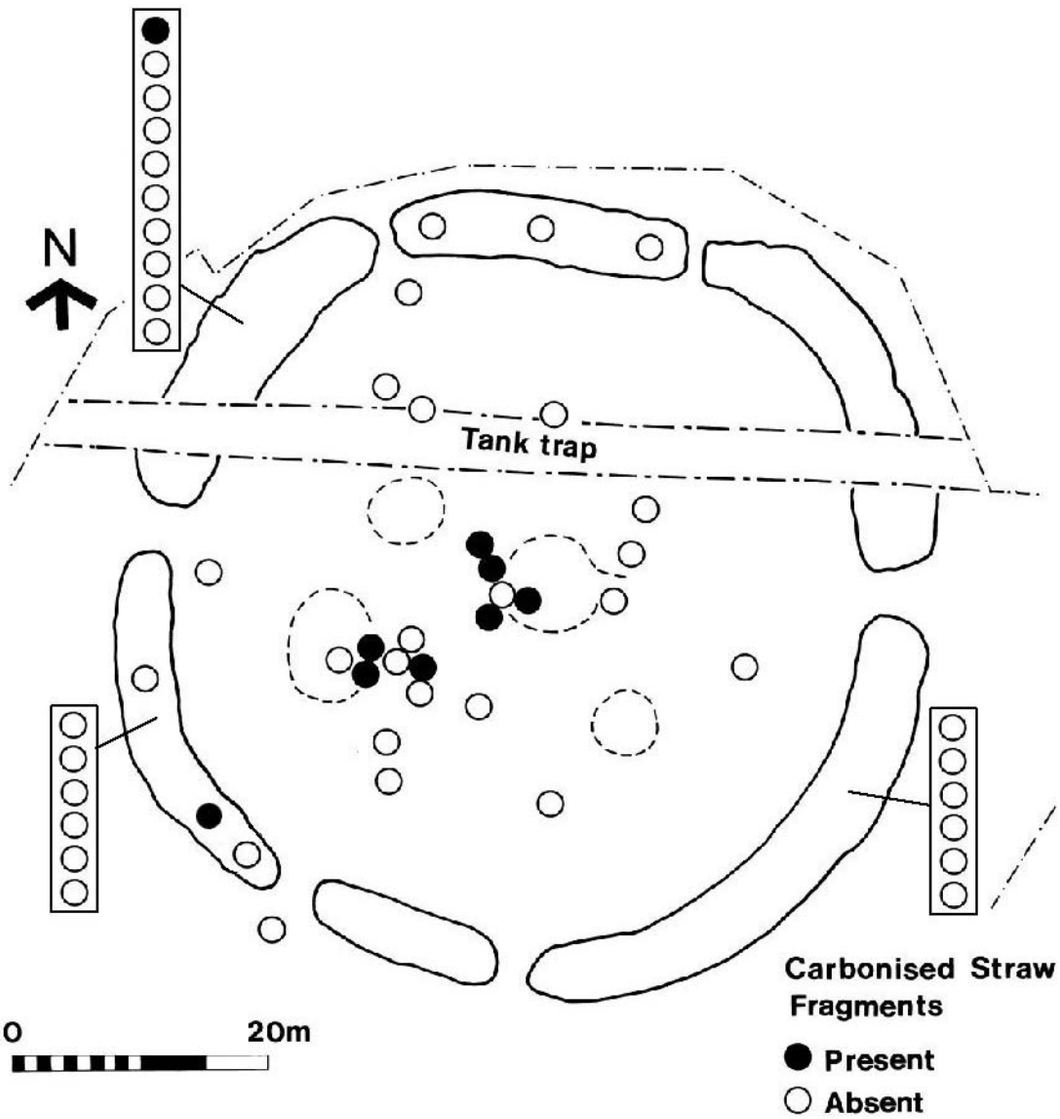


Figure 3.48 Distribution of carbonised straw fragments from Late Bronze Age features and enclosure ditch. The 'columns' of samples from sections of the enclosure ditch refer to successive layers within the ditch at each point

2. Terrace and glacial gravels. Soils of the Efford 1 Association (Hodge *et al.* 1984, 173) form a wide belt between the alluvial soils to the south and the southern margin of the chalky till. The soils in this zone are stony, mainly well-drained loams with gravel subsoils, both terrace and glacial gravels. The cropmark sites, including the cursus at Springfield Barnes and the enclosure at Springfield Lyons, lie within this zone.

3. Glacial Till. The Hornbeam 3 Association comprises fine loamy over clayey soils, most of which are prone to seasonal waterlogging, developed on the chalky till (Hodge *et al.* 1984, 221). Soils of this type occur to the north and west of the Springfield sites.

The Till margin in the immediate area is rarely more than 1km from the river channel, and therefore all three zones were easily accessible from the excavated sites. Clearly, however, all three zones have undergone major changes since the early Neolithic, from which the earliest evidence for a significant human presence in this area comes.

The results from earlier prehistoric (early Neolithic to Beaker) pits and other features are extremely sparse. An early-middle Neolithic pit at Springfield Lyons yielded a few grains of emmer and bread/club wheat, though the latter proved to be intrusive; and Late Neolithic features at the cursus site produced some remains of emmer, bread/club wheat, and wild fruits and nuts (Murphy 2001). These samples indicate some cereal farming and wild plant food gathering. Sparse assemblages of this type seem to be characteristic of early prehistoric features cut into glacial and terrace gravels in this area, and only at exceptionally well-preserved sites are substantial assemblages of charred macrofossils obtained. Results from the Stumble (Blackwater estuary Site 28), a site sealed beneath estuarine sediments, indicated a Neolithic economy in which cereal production and gathering both seem to have been significant (Murphy 1989; Wilkinson *et al.* 2012), and it is probable that the Springfield sites were associated with a similar type of economy. Charcoals from the cursus were mainly of oak, with some sloe, hazel, hawthorn-group and possibly lime (Murphy 2001). Soil pollen analysis at the Stumble and other sites in the Blackwater estuary indicates a late Neolithic landscape densely covered with oak-lime-hazel woodland, with

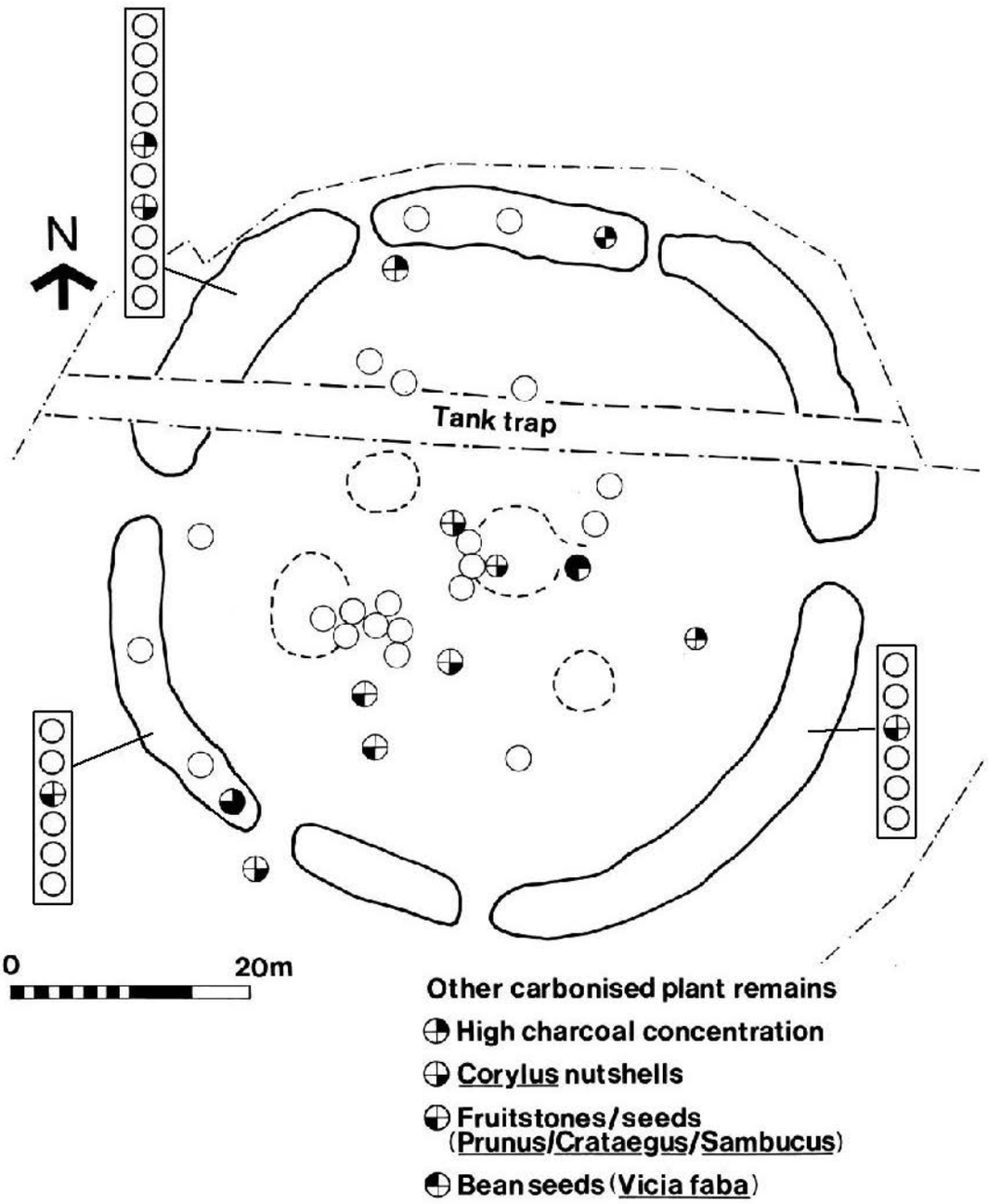


Figure 3.49 Distribution of other carbonised plant remains from Late Bronze Age features and enclosure ditch. The 'columns' of samples from sections of the enclosure ditch refer to successive layers within the ditch at each point

remarkably little evidence for clearance (Scaife 2012). It is probable that conditions were similar throughout much of the Chelmer/Blackwater catchment, through at Springfield some extensive and long-lived clearance is indicated by the presence of the cursus. However, no early prehistoric valley sediments or buried soils were available for study, and local conditions in the Springfield area can only be surmised by analogy with the more informative Blackwater sites.

The earliest sediments seen on the Chelmsford Bypass were detritus muds dated to 3710± 80 BP (HAR-6682) BP at the base of a palaeochannel in a section exposed during construction of the Chelmer Bridge. Macrofossils indicate a dense local cover of wet alder woodland, with mixed deciduous woodland on dryer soils in the vicinity. Weed taxa are present but rare. By 3200 ± 70 BP (HAR-6683) the Chelmer Bridge channel had largely silted up and local vegetation was dominated by ruderals and segetals. Unfortunately pollen analysis was uninformative at this site, through similar detritus muds in an infilled channel at Little Waltham, dated to around 3360BP, produced a pollen assemblage indicating a local cover of alder woodland, in a generally open landscape (Peglar and Wilson 1978). Large-scale permanent clearance of woodland in this area is thus thought to be related to a Bronze Age arable expansion. Extensive deposition of mineral alluvium by overbank flooding post-dated 3200BP at the Chelmer Bridge section.

More detailed information on Late Bronze Age farming is provided by the large assemblages of charred plant remains from the Springfield Lyons enclosure. Crops identified were spelt, emmer, bread/club wheat, six-row hulled barley, and horsebeans. The oat grains present are probably from a weed species. The weed flora associated with the cereals implies that the main arable areas were on the terraces and floodplain, extending onto quite poorly drained soils. There is no firm evidence for cultivation of soils on the chalky boulder clay to the north and west. The distribution of plant remains seems to indicate that cereal crops were being processed within the enclosure.

The evidence for local activity in the Iron Age and Roman periods is rather poor. A single Iron Age pit from the enclosure produced some cereal remains of uncertain significance. Roman features at the Springfield Lyons enclosure produced rather enigmatic results. There are some crop plant remains, but one pit contained only large quantities of charcoal, representing charred oak branches. This may simply be related to site clearance; possibly the enclosure, being an obstacle to cultivation, became overgrown with scrub. However extensive field systems, some definitely of Roman date, are known from cropmarks in this area, and there can be little doubt that the landscape was largely farmland. Roman field ditches and pits at the cursus site produced some charred remains of cereals, perhaps derived from domestic refuse used as manure. It seems reasonable to infer use of the floodplain at Springfield as a meadow or pasture.

In a section along the road-line at Sandon Culvert the base of an infilled channel was dated to 1770 ± 70 BP (HAR-6580). Macrofossils indicate locally open conditions at this site which persisted, with no regeneration of willow or alder carr, throughout the infilling of the channel, the top of which is dated to 860 ± 70 BP (HAR-6570). Continued arable farming in the vicinity is indicated by the presence of charred cereals (including spelt) throughout the channel deposits and by the presence of a flax capsule fragment near the top of the section. The evidence available does not suggest that there was any post-Roman woodland regeneration.

The main results are summarised in Table 3.19. Three main phases seem to be distinguishable. Prior to the later Bronze Age the evidence for landscape use from the Springfield area is very sparse: results from survey and excavation in the Blackwater estuary provide a much more informative picture (Wilkinson *et al*. 2012). The later Bronze Age, however, is marked by the earliest evidence for large-scale arable farming, for clearance of woodland on the Chelmer terraces, clearance of valley-floor alder woodland and, after 3200BP the deposition of alluvial sediment by overbank flooding. There is some slight evidence for localised scrub development on the Springfield Lyons enclosure in the Roman period but in general the terraces and floodplain seem to have been open, under pasture, meadow and arable since the later Bronze Age. The range of cereal crops cultivated shows some changes but also considerable elements of continuity. Emmer, the main early prehistoric wheat was still of importance in the later Bronze Age but in later periods seems to represent no more than a contaminant of other cereals; spelt, apparently first introduced in the later Bronze Age continued to be cultivated, it is thought, into the Early Saxon period and was still present, perhaps as a contaminant, in Late Saxon contexts. Free-threshing hexaploid wheat is present sporadically throughout, but apparently only becomes a major crop in the Late Saxon period, together with oats and rye (Murphy 2005). Barley is represented from the Middle Bronze Age onwards.

Context No.				*3009*	*3029*	*3111*	*5482*
Feature No		*1177*	*1284*	*2535*	*2535*	*2535*	*4991*
Cereal indet	fr	+				+	
Cereal indet	ca			1		2	1
Triticum sp(p)	ca	14		2			
Avena sp(p)	ca					1 cf	1
Triticum sp.	gb	12					
Triticum sp.	ri	7					
Triticum sp.	spb	1					
Triticum spelta L	gb	29					
Triticum spelta L.	spb	1					
Vicia faba L. var *minor*	s						1
Chenopodium album L.							+
Atriplex sp.						+	
Chenopodiaceae indet.						+	+
Medicago lupulina-type			3				1
Rumex sp.							3
Hyoscyamus niger L.							2
Anthemis cotula L.			1				
Cyperaceae indet.		1					
Bromus mollis/secalinus		7					
Gramineae indet.		5	6				
Indet. Seeds etc						2	6
Sample volume (litres)		14	25	8	8	16	16
% flot sorted		100	100	25	100	100	100

Abbreviations as in Table 3.15

Table 3.18 Charred plant remains from Roman contexts

	Field crops											
	Emmer	*Spelt*	*Bread/ club wheat*	*Barley*	*Oats (cultivated)*	*Rye*	*Horse bean*	*? Pea*	*Flax*	*Location of arable area (inferred from crops, weed flora, field systems)*	*Environment of Springfield Lyons site*	*Valley floor*
Late Saxon	+	+	*	*	*	*	+	+	+	Shift to clay soils Flax-growing on floodplain	Settlement	Sandon Culvert channel. 1770–860BP. Open fen, no significant development of willow or alder carr
Early Saxon	?	+	+	+	?	+	-	+	-	?	Rough weedy glassland	
Roman	-	*	-	-	?	-	+	-	-	Terraces and floodplain margin	? Overgrown with scrub subsequently cleared	(Floodplain at Chelmsford pasture/meadow)
Iron Age	+	+	-	+	-	+	-	-	-	?	?	
Late Bronze Age	*	*	+	*	?	-	+	?	-	Terraces and floodplain margin	Settlement (Little Waltham) pollen analysis implies terraces largely cleared of woodland	Chelmer Bridge channel 3710–3200BP. Initially alder carr replaced by weedy herbaceous vegetation
Early Middle Bronze Age	+	-	-	+	-	-	-	-	-	?	?	
Late Neolithic	+	-	+	-	-	-	-	-	-	?	? (Soil pollen analysis in Blackwater estuary indicates extensive oak/lime/hazel woodland)	
Early-Middle Neolithic	+	-	-	-	-	-	-	-	-	?	?	

? – tentative identification
+ - present
*- abundant

Table 3.19 Summary of environmental and agrarian change in the Springfield area, with results from adjacent areas in parenthesis

Chapter 4. Radiocarbon dating

by John Meadows, Gordon Cook, Chris Bronk Ramsey

I. Introduction

Four bulk charcoal samples were dated by liquid scintillation counting soon after the excavation (Buckley and Hedges 1987), and a further 20 samples of carbonised plant remains were dated by Accelerator Mass Spectrometry (AMS) in 2009, as one component of the publication project. The results confirm at least three broad phases of occupation at Springfield Lyons, in the later Neolithic, Late Bronze Age, and early medieval periods. Although the AMS samples were selected under a Bayesian chronological modelling approach (Buck *et al.* 1996), the scarcity of suitable samples, lack of reliable relative dating information, and frequent occurrence of residual or intrusive material limited the precision that could be obtained by chronological modelling. Nevertheless, AMS dating of short-lived, single-entity samples has produced a much more robust and precise chronology than was previously available.

II. Objectives

The renewed radiocarbon dating programme addressed several related objectives:

- the chronology of the later Bronze Age occupation, including the construction and use of the circular enclosure and of the roundhouses and pit clusters within it; the Springfield Lyons site is recognised as a type-site for this form of enclosure, but it is not known whether the buildings and the enclosure ditch are strictly contemporaneous, or whether either existed without the other
- the chronology of the associated pottery sequence, which has implications for many other sites within Essex and the region
- the dates of use of the typologically diagnostic sword-moulds found in the enclosure ditch terminals, which may be significantly earlier than the dates of deposition of swords made in the same Ewart Park tradition.

In addition, one sample was submitted to test whether a single grain of free-threshing wheat from a context containing Mildenhall pottery was cultivated in the early Neolithic, as free-threshing wheat is very rare in this period. The dating programme did not attempt to date the occupation of the site in either the Neolithic or early medieval periods.

III. Sample selection and analysis

Two samples of bulk charcoal, collected in 1983 by D.G. Buckley, were dated by liquid scintillation counting of benzene in 1984–85 at the British Museum, with funding from Essex County Council. Laboratory procedures employed at this time are described by Burleigh *et al.* (1976). Two more bulk charcoal samples were submitted in 1984 by Peter Murphy through the Ancient Monuments Laboratory. These were also dated by liquid scintillation counting, using the standard counter, at the Harwell laboratory (Walker and Otlet 1988), following laboratory procedures described by Otlet and Warchal (1978) and Otlet (1979). Results of all four bulk samples were published in Buckley and Hedges (1987).

The original BM measurements, BM-2313 and BM-2314 (Ambers *et al.* 1987) were subsequently revised when a systematic laboratory error was discovered (Bowman *et al.* 1990). The corrected results, BM-2313R and BM-2314R, have relatively large error terms. Furthermore, all four of the bulk charcoal dates may be subject to moderate wood-age offsets (due to the inclusion of charcoals with a significant intrinsic age) and it is possible (particularly given the AMS results) that these bulk samples contained charcoals from more than one period of occupation. Attempts were therefore made to locate any leftover charcoal from these samples, which could have been dated by AMS, but it would appear that all of it was used to produce the original radiocarbon dates.

Carbonised plant macrofossils from flotation samples (Murphy 1990) were made available by the archive (Norwich Castle Museum and Art Gallery) for radiocarbon dating. These came from fills of the enclosure ditch, pits and post-holes related to Structure A (the main roundhouse), and other pit clusters within the enclosure, but not from the other post-built structures. Identifications of the specimens selected for dating in 2009 were confirmed by Peter Murphy. Although wood charcoal from flotation samples (Murphy 1990) was archived following archaeobotanical analysis, it had not been retained. The only wood charcoal available for the renewed dating programme was therefore that which could be recovered during the laboratory excavation of the enclosure ditch eastern (3136 (4037)) and western (5706/9119 (4019/4023)) gateway terminals. These charcoals were identified by Dana Challinor.

No waterlogged plant remains, bones, or carbonised food residues on pottery were recovered. A ‘blob of carbonised food’ (Peter Murphy) from the fill of pit 3770, thought to be related to the occupation of Structure A, was dated (SUERC-23197). All the other AMS samples consisted of a single-entity short-lived plant macrofossil or charcoal fragment.

Two samples of carbonised plant stems embedded in the clay packing used to seal the two halves of sword moulds were submitted. These stems were used to wrap or bind the mould valves together, as shown by the reticulate impressions made in the clay, and must therefore have been green when used, and thus contemporary with the use of the moulds for casting. Unfortunately, neither sample yielded enough carbon for AMS dating. A second charcoal sample from one of the enclosure ditch fills, 5706/9119 B, also failed, again because the sample was too small.

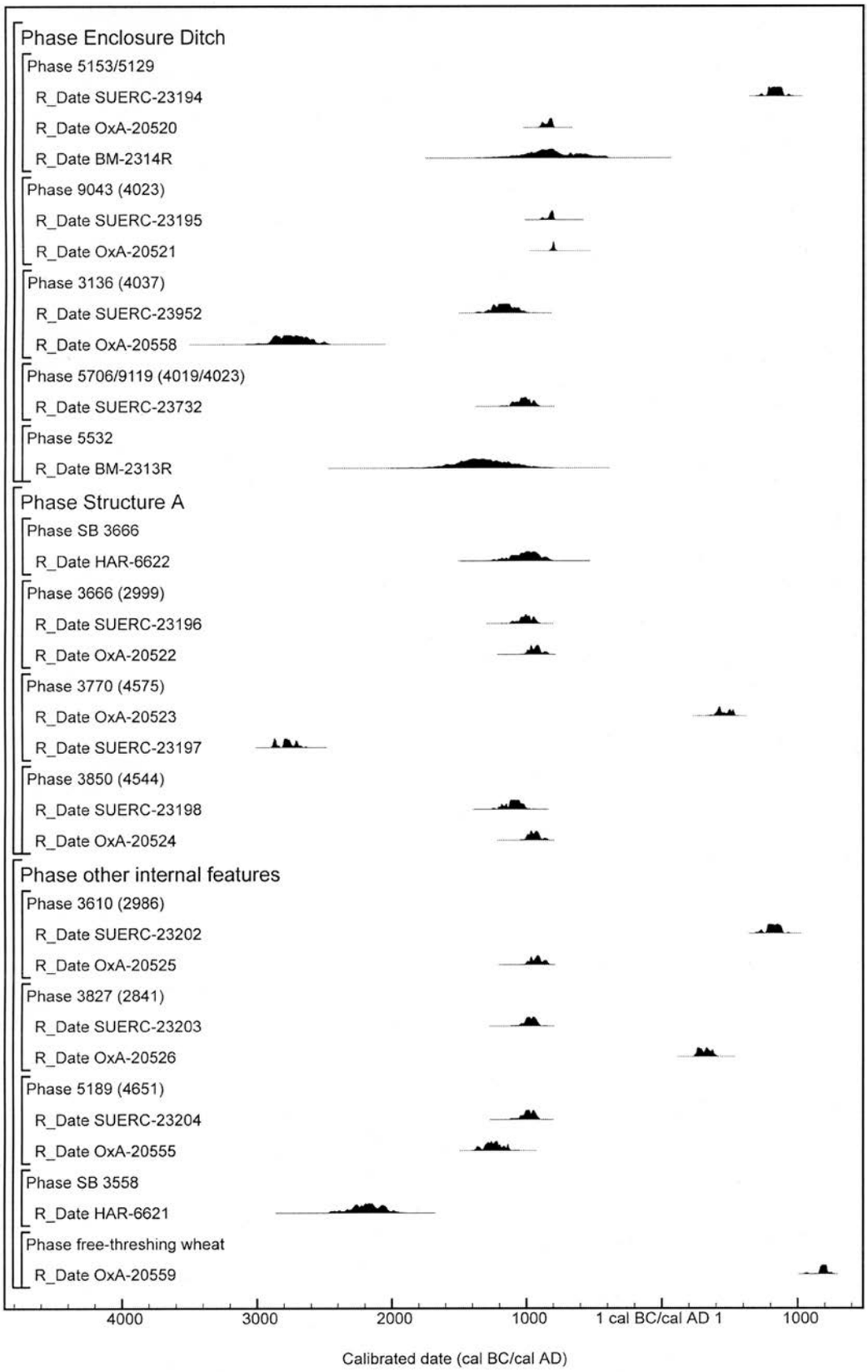


Figure 4.1 Calibration of Springfield Lyons radiocarbon results by the probability method

Laboratory number	*Sample*	*Material dated*	*$\delta^{13}C$ (‰)*	*Radiocarbon age (BP)*	*Calendar date (95% confidence)*
Enclosure Ditch					
BM-2313R	5532	bulk charcoal, *Acer* sp. (maple)	-26.8	3090 ±150	1690–920 cal BC
BM-2314R	5153	bulk charcoal, *Quercus* sp. (oak) and *Acer* sp. (maple)	-23.1	2670 ±140	1200–400 cal BC
OxA-20520	5153/5529 A	tuber, *Arrhenatherum* sp.	-26.2	2688 ±30	910–800 cal BC
SUERC-23194	5153/5529 B	nutshell, *Corylus avellana* (hazel)	-21.9	1195 ±30	cal AD 710–940
OxA-20521	9043 (4023) A	grain, *Triticum* sp. (glume wheat)	-22.2	2629 ±28	830–780 cal BC
SUERC-23195	9043 (4023) B	grain, *Triticum* sp. (glume wheat)	-21.7	2665 ±30	900–790 cal BC
SUERC-23732	5706/9119 (4019/4023) A	charcoal fragment, *Quercus* sp. (oak) sapwood	-25.2	2855 ±35	1130–910 cal BC
SUERC-23952	3136 (4037) A	charcoal fragment, *Alnus/Corylus* (alder/hazel) roundwood	-25.0*	2950 ±45	1320–1010 cal BC
OxA-20558	3136 (4037) B	charcoal fragment, *Alnus/Corylus* (alder/hazel)	-26.4	4180 ±90	2930–2490 cal BC
Structure A					
OxA-20522	3666 (2999) A	broad bean, *Vicia faba*	-19.1	2785 ±29	1010–840 cal BC
SUERC-23196	3666 (2999) B	grain, *Triticum* sp. (wheat)	-21.9	2845 ±30	1120–910 cal BC
HAR-6622	SB3666	bulk charcoal of *Quercus* sp. (oak), *Fraxinus* sp. (ash), *Alnus/Corylus* (alder/hazel)	-24.1	2830 ±70	1260–820 cal BC
OxA-20523	3770 (4575) A	tuber, *Arrhenatherum* sp.	-28.0	1617 ±29	cal AD 380–540
SUERC-23197	3770 (4575) B	blob of carbonised food	-25.1	4195 ±30	2900–2670 cal BC
OxA-20524	3850 (4544) A	grain, *Triticum* sp. (glume wheat)	-22.3	2793 ±29	1020–840 cal BC
SUERC-23198	3850 (4544) B	grain, *Hordeum* sp. (barley)	-24.7	2905 ±30	1260–1000 cal BC
Other internal features					
OxA-20525	3610 (2986) A	grain, *Triticum* sp. (glume wheat)	-22.6	2777 ±30	1010–830 cal BC
SUERC-23202	3610 (2986) B	grain, *Triticum* sp. (glume wheat)	-21.2	1205 ±30	cal AD 700–900
OxA-20526	3827 (2841) A	grain, *Triticum* sp. (glume wheat)	-19.4	1723 ±27	cal AD 240–410
SUERC-23203	3827 (2841) B	grain, *Hordeum* sp. (barley)	-22.8	2820 ±30	1060–900 cal BC
OxA-20555	5189 (4651) A	grain, *Hordeum* sp. (barley)	-25.1	2999 ±35	1390–1120 cal BC
SUERC-23204	5189 (4651) B	grain, *Hordeum* sp. (barley)	-23.2	2830 ±30	1060–900 cal BC
HAR-6621	SB3558	bulk charcoal, *Quercus* sp. (oak)	-24.9	3760 ±70	2460–1970 cal BC
OxA-20559	3934	grain, *Triticum aestivum/compactum* (free-threshing wheat)	-23.8	855 ±27	cal AD 1050–1260

*assumed value; the sample was too small to permit a separate $\delta^{13}C$ measurement

Table 4.1 Radiocarbon results, Springfield Lyons. Unless indicated, each sample consisted of a single, short-lived organism

The AMS samples were dated at the Scottish Universities Environmental Research Centre in East Kilbride (SUERC; technical procedures are described by Vandenputte *et al.* (1996), Slota *et al.* (1987), and Xu *et al.* (2004)), or at the Oxford Radiocarbon Accelerator Unit at Oxford University (OxA; laboratory methods are given by Bronk Ramsey *et al.* (2002; 2004)). Internal quality assurance procedures at both laboratories and international inter-comparisons (Scott 2003) indicate no laboratory offsets, and validate the measurement precision quoted.

IV. Results

(Fig. 4.1, Table 4.1)

The radiocarbon results shown in Table 4.1 are conventional radiocarbon ages (Stuiver and Polach 1977). The calibrated date ranges have been calculated by the maximum intercept method (Stuiver and Reimer 1986), using the program OxCal v4.1 (Bronk Ramsey 1995; 1998; 2001; 2009) and the IntCal09 data set (Reimer *et al.* 2009), and are quoted in the form recommended by Mook (1986), with date ranges rounded outwards to decadal endpoints. The probability distributions of the calibrated dates, shown in Fig. 4.1, have been calculated using the probability method (Stuiver and Reimer 1993), and the same data.

V. Interpretation

(Figs 4.2–4.6, Table 4.2)

Carbonised plant remains are preserved under a wide range of burial conditions, and their post-depositional taphonomy may therefore be uncertain. This is less important when the dating objective is to know the date of the macrofossil itself, as with sample 3934, a free-threshing wheat grain from a pit containing Mildenhall pottery, which was expected to give a fourth-millennium date. Instead, this grain is medieval (OxA-20559, 855 ±27BP, cal AD 1050–1260) and it appears to be intrusive, and may even be more recent than the Saxon post-hole and grave which cut the 'Neolithic' pit.

When the objective is to date the context in which the sample was found, we must rely on archaeological evidence to argue that the sample provides a reliable date for its deposition in that context. This is a reasonable assumption when the plant remains were burnt *in situ*, or appear to have been redeposited in a single event (for example, a rake-out from a furnace), but where there is no obvious functional relationship between the charred plant material and the context in which it is found, it cannot be assumed that the date of the sample corresponds to the date of the context.

In some contexts, such as post-hole fills, most carbonised plant remains are likely to be derived from routine domestic activities contemporary with the occupation of the associated structure, and such samples therefore tend to produce radiocarbon results which are close to their date of deposition. In these situations, we might expect statistically consistent radiocarbon results (following Ward and Wilson 1978) from pairs of short-lived single-entity samples from the same context. If two such samples cannot be of the same radiocarbon age, however, we would infer that either or both must be residual or intrusive, and that they do not reliably date their deposition. For this reason, pairs of single-entity samples were submitted from each context, to obtain some indication of how relevant the results would be to the dating of individual features.

As Springfield Lyons is a multi-period site, there was a significant risk that residual or intrusive plant remains were selected for dating. This is borne out by the fact that in general, pairs of samples from individual contexts gave

Context	*Laboratory code*	*Radiocarbon age (BP)*	*T'*	*periods represented*
Enclosure ditch				
5153/5529	OxA-20520	2688 ±30	1220.8	late Bronze Age, early medieval
	SUERC-23194	1195 ±30		
9043 (4023)	OxA-20521	2629 ±28	0.8	late Bronze Age
	SUERC-23195	2665 ±30		
3136 (4037)	SUERC-23952	2950 ±45	162.8	middle-late Bronze Age, late Neolithic
	OxA-20558	4180 ±90		
Structure A				
3666 (2999)	OxA-20522	2785 ±29	2.1	late Bronze Age
	SUERC-23196	2845 ±30		
3770 (4575)	OxA-20523	1617 ±29	3699.1	early medieval, late Neolithic
	SUERC-23197	4195 ±30		
3850 (4544)	OxA-20524	2793 ±29	7.2	middle-late Bronze Age
	SUERC-23198	2905 ±30		
Other pits				
3610 (2986)	OxA-20525	2777 ±30	1351.3	late Bronze Age, early medieval
	SUERC-23202	1205 ±30		
3827 (2841)	OxA-20526	1723 ±27	743.6	late Bronze Age, Roman
	SUERC-23203	2820 ±30		
5189 (4651)	OxA-20555	2999 ±35	13.5	middle-late Bronze Age
	SUERC-23204	2830 ±30		

Table 4.2 T' test results, Springfield Lyons. Ward and Wilson (1978) tests of statistical consistency between radiocarbon results on pairs of single-entity samples from single contexts. A test statistic (T') above 3.8 means that the results are inconsistent at the 0.05 significance level

results that are not statistically consistent with a single radiocarbon age, as indicated by the high values of the test statistic, T', in Table 4.2 (T' >3.8, ν=1; Ward and Wilson 1978). Of nine pairs of samples dated, only two (9043 (4023) A and B, and 3666 (2999) A and B) *could* be of the same radiocarbon age. The other pairs of samples *must* be of a different dates, and often they represent different periods of occupation. These discrepancies considerably complicate the interpretation of the site chronology.

The scatter of results obtained on pairs of single-entity samples from single contexts also brings into question the validity of the earlier results on bulk samples, which could have incorporated charcoals of different dates, whose average date does not relate to any event in the archaeological record. Although HAR-6621 (3760 ±70BP, 2460–1970 cal BC) was a bulk sample, the charcoal was concentrated in a burnt layer, and it is therefore assumed that most, if not all of it was freshly deposited. There may be a significant wood-age offset, as the charcoal was only identified as oak, with no information on maturity, but this cannot account for the difference between the result and the expected date of the context; the feature was believed to be a late Bronze Age pit that pre-dated the late Bronze Age enclosure, HAR-6621 indicates it belongs to the late Neolithic or early Bronze Age occupation at the site.

The other bulk samples produced broad date ranges that include the expected dates of their contexts and the dates of associated single-entity samples, so that while we cannot show that their results are reliable (because of concerns about wood-age offsets and the presence of residual or intrusive charcoal), they are not apparently misleading. The inconsistency in date between the two single-entity samples from context 5153 suggests that the bulk charcoal sample from the same context, BM-2314R, may have included charcoals of more than one date. Nevertheless, the great majority, if not all of the charcoal in the bulk sample must have been derived from the Bronze Age occupation, rather than the early medieval period.

Although the dating evidence for individual contexts is generally unsatisfactory, an interpretation of the overall chronology of the Bronze Age enclosed settlement is proposed here. This interpretation relies on a Bayesian chronological model which uses all the radiocarbon results from samples that could be of Bronze Age date, omitting results that must relate to other periods of occupation. The Bayesian approach (Buck *et al.* 1996) is based on the belief that we are not primarily interested in the dates of individual samples, which can be accurately estimated by the calibration of single radiocarbon results (Fig. 4.1, Table 4.1), but in the dates of events in the archaeological record that are associated with, and constrained by the dates of those samples.

Figure 4.2 shows the chronological model, which has been implemented using the program OxCal v4.1 (Bronk Ramsey 2009). The Bronze Age samples are regarded as representative of a continuous phase of activity (Bronk Ramsey 2000), with a beginning and an end whose dates are estimated by the model, based mainly on the scatter of the calibrated radiocarbon results. A phase of occupation beginning earlier or ending later than these estimated dates (*begin LBA occupation* and *end LBA occupation,* Fig. 4.2) should have produced a broader scatter of radiocarbon results than that observed. Bayesian chronological models can also incorporate relative dating constraints based on stratigraphic relationships between contexts, if it can be argued that the samples are not residual or intrusive. The model shown in Figure 4.2 does not rely on stratigraphic relationships, except in one case. We have assumed that the samples from context 9043 (4023) are more recent than that in the stratigraphically-earlier context 5706/9119, which is readily apparent, in any case, from their radiocarbon results.

The four bulk charcoal samples are treated as *termini post quos* for their contexts. *Termini post quos* can affect the estimated date of the end of the late Bronze Age occupation phase, but not its beginning; it is therefore less significant whether these four samples include material that pre-dates the enclosed settlement. The situation with eight single-entity samples is more complex. SUERC-23203, SUERC-23204, SUERC-23732, SUERC-23952, OxA-20520 and OxA-20525 are the only Bronze Age dates from their respective contexts, and it is therefore difficult to assess whether they reliably date their deposition. For the purpose of this discussion, it has been assumed that they do. Two Bronze Age samples (SUERC-23198 and OxA-20555) are apparently residual in their contexts, but may still relate to the occupation of the enclosed settlement, if not to an earlier, pre-enclosure phase of Bronze Age activity. The model treats these samples as statistical outliers, to obtain an estimated probability that they date their contexts. The low probability calculated for OxA-20555 (P:4%, Fig. 4.2) may imply that this sample genuinely pre-dates the enclosed settlement.

Figures 4.3 and 4.4 show the estimated start and end dates of the late Bronze Age occupation in more detail. These probability distributions are *posterior density estimates* of the dates of these events. Date ranges based on posterior density estimates are conventionally reported in italics to emphasise that, unlike the calibrations of individual radiocarbon results in Table 4.1, they depend on all the chronological information included in the model, and would change if further samples were dated or if the model structure were altered according to a different interpretation of the chronological relationships between samples. The model estimates that the settlement was occupied in *1210–980 cal BC* (95.4% probability) or *1120–1010 cal BC* (68.2% probability) (*begin LBA occupation*; Fig. 4.3) and abandoned in *840–690 cal BC* (95.4% probability) or *820–760 cal BC* (68.2% probability) (*end LBA occupation*; Fig. 4.4). The model also calculates a *Span*, or estimated duration of the Bronze Age phase, of *150–360 years* (95.4% probability) or *190–280 years* (68.2% probability) (*duration LBA village*; Fig. 4.5). These estimates imply that the site was probably occupied throughout the tenth and ninth centuries cal BC, and perhaps as early as the eleventh or twelfth century cal BC.

The Structure A samples (even excluding those from 3770, and HAR-6622, which may be subject to a wood-age offset) are not all of the same date (T'=10.6, T'(5%)=7.8, ν=3), so probably do not solely date the abandonment of this building. The model estimates when the structure was built and abandoned (*build Structure A, 1080–930 cal BC*, 95.4% probability, Fig. 4.2) and (*abandon Structure A, 980–840 cal BC*, 95.4% probability, Fig. 4.2), indicating that Structure A may have had a relatively short period of use within the overall

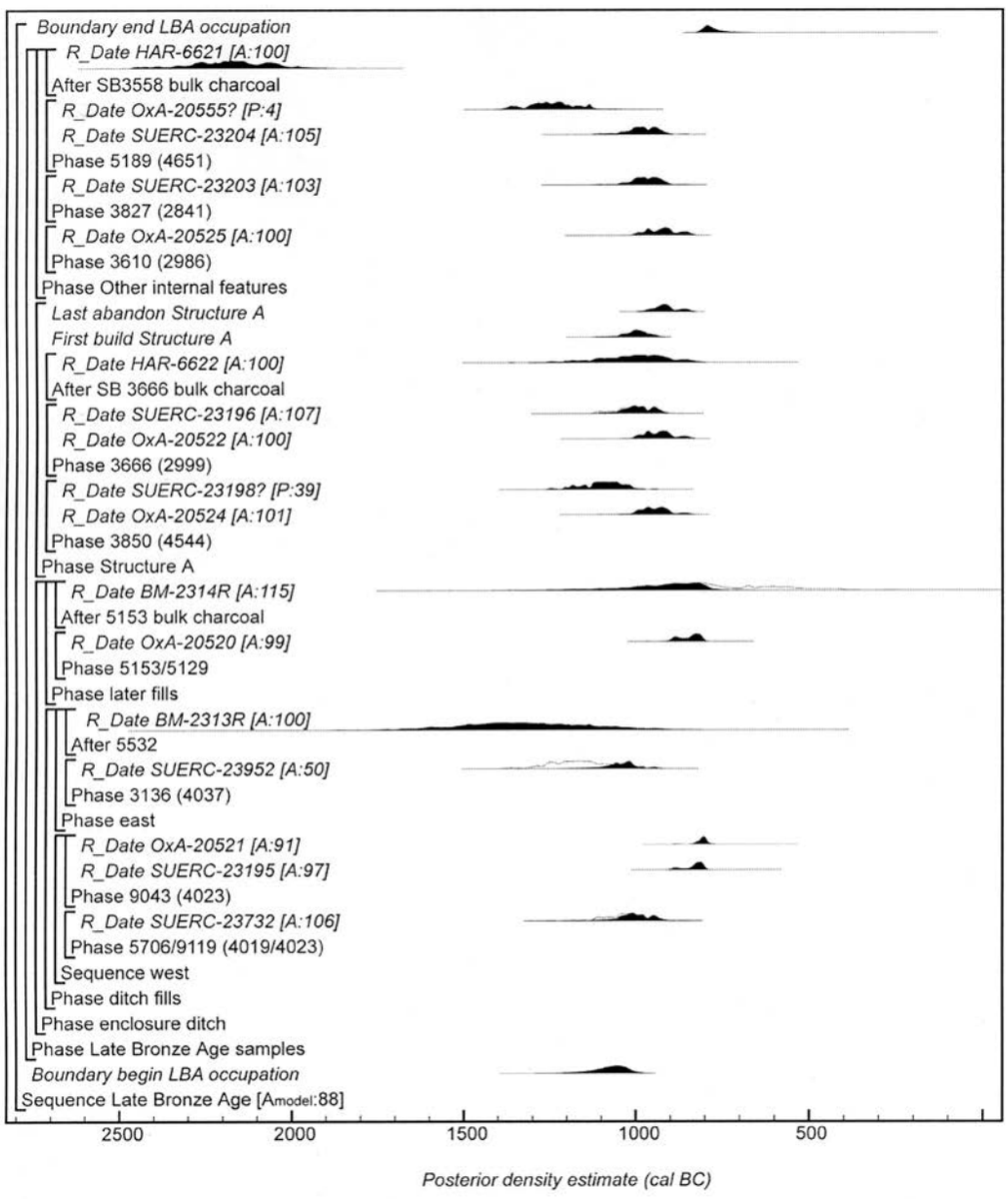


Figure 4.2 A Bayesian model of the Bronze Age radiocarbon results from Springfield Lyons. The square brackets and OxCal keywords define the model structure precisely. For samples included in the model, two distributions are shown: that in outline is the simple calibrated date, as in Figure 1, while the solid distribution is the model's posterior density estimate of that sample's date. The satisfactory overall index of agreement (A_{model} >60) indicates consistency between the relative dating embodied in the model structure and the radiocarbon results included in the model

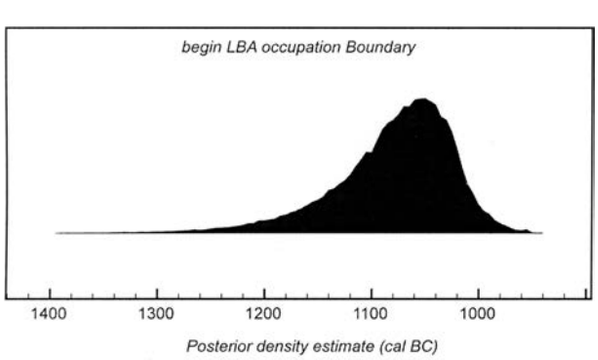


Figure 4.3 The start of late Bronze Age occupation, derived from the model shown in Figure 4.2

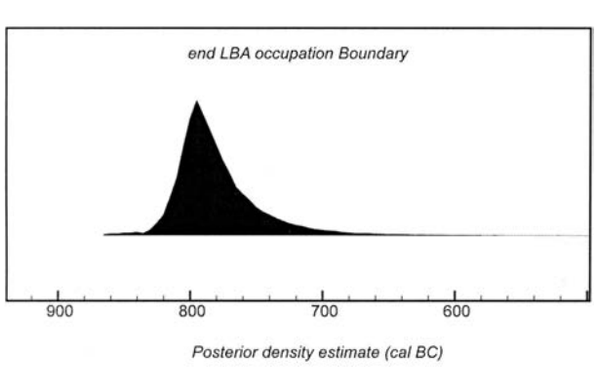


Figure 4.4 The end of late Bronze Age occupation, derived from the model shown in Figure 4.2

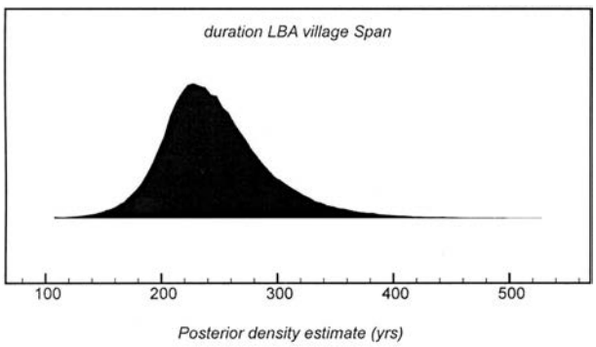


Figure 4.5 The duration of the late Bronze Age settlement, derived from the model shown in Figure 4.2

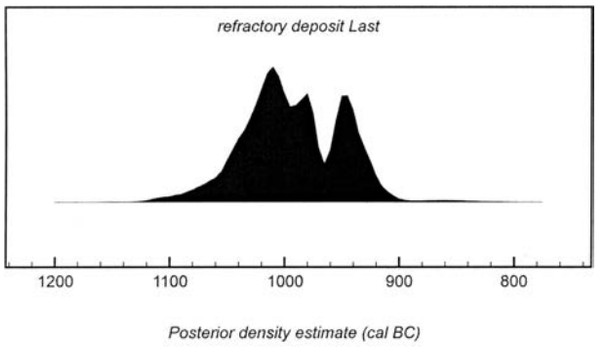


Figure 4.6 The date of the refractory deposits, assuming these were deposited as a single event

enclosed settlement occupation, but these estimates are based on a small number of samples.

Assuming that the refractory deposits represent a single event associated with SUERC-23952, SUERC-23732, and BM-2313R, the Bronze Age results from contexts in which refractory ceramics were deposited, the model estimates of the date of this event; this is *1080–910 cal BC* (95.4% probability) (*refractory deposit*; Fig. 4.6). Such a date would be consistent with the interpretation that the refractory ceramics were deposited towards the beginning of the Bronze Age occupation, but it assumes that the two single-entity samples (SUERC-23952 and SUERC-23732) are not residual. Although these results are statistically consistent ($T'=2.8$, $T'(5\%)=3.8$, $\nu=1$; Ward and Wilson 1978), there is only one Bronze Age result from each context, and the estimated date for the refractory ceramics should therefore be treated with caution.

The two new Neolithic results (OxA-20558 and SUERC-23197) are on material that cannot have had an intrinsic age or a mixture of dates (the food blob, SUERC-23197, must have coalesced before or during charring). Although each sample was apparently residual in the context in which it was found, these results imply that there was some sort of activity on the site in the earlier third millennium cal BC. The free-threshing wheat grain from 3934, a pit containing Mildenhall pottery, did not produce the anticipated fourth-millennium date; instead, this grain is medieval, and, as the pit was cut by an Saxon post-hole and grave, it may well be intrusive. The glume wheat grains are either late Bronze Age in date, or Roman–early medieval. All four barley grains and the broad bean dated to the late Bronze Age, as did one of the *Arrhenatherum* tubers. The other tuber, and the hazelnut shell, were early medieval. The range of dates among the post-Roman plant remains suggests either extended or repeated occupation.

VI. Conclusion

A more detailed absolute chronology is now available for the several phases of occupation at Springfield Lyons, thanks to the dating of 20 short-lived, single-entity radiocarbon samples, in addition to the original four bulk charcoal samples. The precision with which the late Bronze Age enclosed settlement can be dated has been restricted by a lack of suitable samples, and by the frequent occurrence of residual or intrusive carbonised plant remains in late Bronze Age contexts. A Bayesian chronological model which uses only the Bronze Age results estimates that the enclosed settlement was occupied in *1210–980 cal BC* (95.4% probability) (*begin LBA occupation*; Fig. 4.3) and abandoned in *840–690 cal BC* (95.4% probability) (*end LBA occupation*; Fig. 4.4).

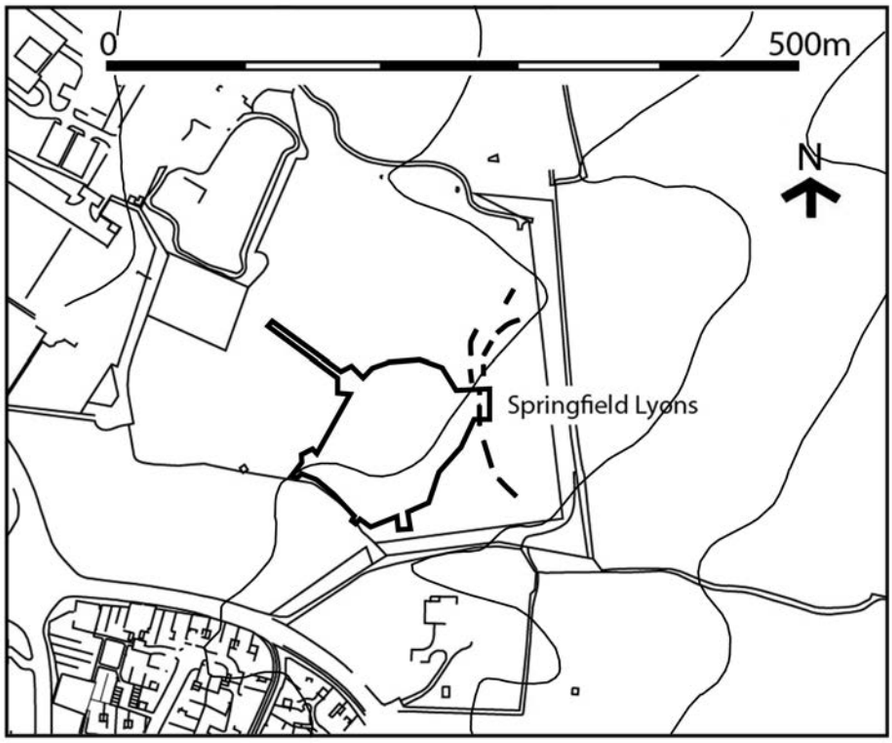


Figure 5.1 Cropmark plot of the Neolithic causewayed enclosure, after Oswald *et al* 2001

Chapter 5. Discussion

I. Introduction

This report represents the last in a series (Hedges and Buckley 1981, Hedges and Buckley 1983, Buckley and Hedges 1987, Buckley *et al.* 2001, Tyler and Major 2005) arising directly from a major programme of excavations carried out by Essex County Council in the 1980s. The work was funded initially by the Department of the Environment and subsequently English Heritage, with additional financial support from the British Museum and Essex County Council. Since the present publication was prepared thirty years after fieldwork at Springfield began; before turning to discussion of the results of the excavations at Springfield Lyons, it is worth briefly putting the origins of the Springfield project into its historical context.

The area north-east of Chelmsford, on the northern side of the Chelmer valley, was first considered for large-scale development in the mid 1960s and confirmed as a development area in the mid 1970s. At that time it was referred to as the East Springfield Development Area, but in the late 1970s the majority of the area became known as Chelmer Village, a name which is still used today. A range of cropmarks (Fig. 1.2) were identified within the proposed development area including a large circular enclosure at Springfield Lyons toward the top of the valley slope, and lower down, just above the floodplain, the cropmark of a cursus. The Advisory Committee for Archaeological Excavation in Essex recognised the archaeological potential of the area early on and identified it as a priority for a long-term excavation project, regularly submitting it to the Department of the Environment for funding. These applications by the committee led to financial support for two seasons of excavation (1979 and 1980) which examined the east and west ends of the Springfield cursus (Buckley *et al.* 2001).

Following that work, Essex County Council prepared a report *Archaeological Potential of the Springfield Development Area* (Buckley and Hedges 1981), which set out the rationale for continued excavations at Springfield. The report explicitly attempted to address concerns that the research objectives of rescue excavations were not particularly well articulated and that consequently some were '….neither as well conceived nor as productive as might be.' (Renfrew 1978). An issue echoed by more recent concerns over the research value of fieldwork carried out as a result of the implementation of PPG16. Funding for an initial season of excavation at the Springfield Lyons cropmark enclosure was secured; at the time the enclosure was considered likely to be a henge, although the possibility of it being a Late Bronze Age circular enclosure, like those recently excavated at Mucking, was also considered (Buckley and Hedges 1981). This first season of excavation at Springfield Lyons took place in 1981–2; it established a Late Bronze Age date for the enclosure and revealed a hitherto unsuspected Saxon cemetery. Subsequently a series of short reports were produced setting out research objectives and costings for further seasons of excavation. Since a large deposit of clay casting moulds had been recovered from the enclosure ditch at the main east-facing entrance, one of the subsequent excavation seasons opened a rectangular area outside the entrance; this was intended to explore the possibility of evidence for metal working in the vicinity. No such evidence was revealed, but two large features were recorded which, upon excavation, yielded assemblages of early Neolithic pottery and flintwork and were subsequently shown, by trial trenching, to be elements of a causewayed enclosure. The trial trenching was the last excavation work undertaken as part of the Springfield project and took place in 1990–1.

II. Early Neolithic

(Fig. 5.1)

The two large pit-like features (6854, 8920) outside the main east-facing entrance, were the first elements of the causewayed enclosure to be recorded, the subsequent trial trenching revealed a number of other features (Fig. 2.1) which apparently formed a single circuit enclosure. More recently, re-examination and transcription of aerial photographs has resulted in the mapping of a curving arc of causewayed ditch, with an outer ditch on the northern side (Fig. 5.1 and Oswald *et al.* 2001, fig. 4.12). Of the excavated features the two pits initially encountered were the most complex in terms of their structure and the artefacts deposited within them. Pit 6854 was an oval feature with two main elements, a broad relatively shallow pit and a deeper (1.68m) shaft. It appears that the shaft and the shallow pit were contemporary and that they were initially conceived and dug as a single whole. This seems particularly likely given that the edges of the shaft coincided with the edges of the shallow pit on two sides. A number of post-holes appear to have been associated with the shaft, which was flat-based and steep-sided, indeed the lower 1m (Fig. 2.5) or so of the sides was nearly vertical. The lowest fills across the base were almost horizontal and seem more likely to be the result of human rather than natural deposition. Above these lowest layers the fills must have accumulated very rapidly to preserve the steep sides of the pit (assuming that the sides were not held in place by some kind of lining). That might have been the result of rapid slumping of the upper levels, although deliberate deposition seems more likely, perhaps particularly if the broad shallow upper part of the pit was indeed open at the same time as the shaft. Material in these deposits included pottery (*e.g.* Fig. 3.17, 48–50), flint, and it seems possible that substantial quantities of bone might originally have been present (above p.11), perhaps supporting the interpretation of deliberate deposition. The shaft was recut three times, the first recut was flat-based, the other two more rounded (Fig. 2.5). The primary fill of the second recut (9875) also contained ceramics (Fig. 3.17, 44, 45 and 47) and again a substantial amount of bone may originally have been present. In a number of places hollows in the base of the broad shallow pit were

filled with gravel not likely to have been derived from the immediate vicinity (above p.11) and in one case the fill of one of these hollows contained a large part of a plain bowl (Fig. 3.17, 46) this appears to support the interpretation that the hollows had been deliberately filled, using both natural and artificial materials.

The adjacent feature to the south (8920) was similar in plan but lacked the deep shaft-like element of 6854. This feature was again steep-sided and flat-based and the initial fill, like that of 6854 was broadly horizontal, presumably deliberately deposited; and included flint and pottery (Fig. 3.18, 59). An extensive layer 11053/11098 yielded a substantial quantity of pottery and once again may originally have contained a large amount of bone (above p.13). This deposit included large and sometimes joining sherds from a range of vessel forms, including a small cup (Fig. 3.18, 54–8); mostly with smoothed, burnished and occasionally decorated surfaces, contrasting with the generally coarser finish of the pottery from 6854. This feature had been recut two or possibly three times (Fig. 2.6), the first recut was slightly off centre and the primary fills (11028/11052) were again relatively artefact rich (Fig. 3.17, 51–3). The later recut or recuts, were much shallower and flat-based (Fig. 2.6) stretching across almost the entire width of the pit.

Of the features revealed in the trial trenching (Fig. 2.1) those closest, 8950 to the north and 8965 to the south, were most similar to the two features investigated in the main excavation area. The southern pit, 8965, was comparable in shape and form to 6854, oval in plan and comprising a shallow pit into which was cut a deeper steep-sided feature. Here again the accumulation of the lower fills must have been quite rapid either through natural slumping or purposeful backfilling. A flat-based recut had a layer of primary fill which did not appear to derive from the surrounding natural (above p.13) and may have been deliberately included using material brought from elsewhere (though not necessarily all that far away). Judged from the section (Fig. 2.7) the upper, stony fill of this recut may have filled the upper shallow pit as well. A subsequent recut was also broadly flat-based, and a small pit dug into the base of this recut contained a very stony fill (11247) and was sealed by a relatively stone free deposit (11241). Judged by its position relative to 11247, the fact that it contained two small deposits of burnt bone and charcoal, and in particular its slightly mounded appearance in the section (Fig. 2.7) 11241 seems to be clearly an act of deliberate deposition. It was sealed by a fairly deep layer (11234), with a post-hole (8973) cut into its southern edge reminiscent of the post-holes associated with the shaft in 6854. Capping 11234 was a near horizontal layer apparently deposited in a similar manner to 11241 and possibly another placed deposit. This was in turn sealed by a layer (11217) rather similar to 11234. The fairly deep upper fill may have accumulated naturally, over a fairly lengthy period, in a hollow left by the slumping of the pit fill (above p.13).

The northern feature 8950 was similar in plan to 8965 and 8920, but rather shallower and like 8920 lacked the deeper 'shafts' seen in 6854 and 8965. Following the accumulation of a shallow primary fill across the base of 8950, a number of small pits or post-holes were cut through the primary fill into the natural (Fig. 2.4). These features were sealed by a series of stony layers, which were truncated by a recut which reflected the profile of the original cut, a small pit had been dug from the base of this recut into the fills below (Fig. 2.4) in a similar manner to the small pit which cut through the primary silt. A further recut lacked any indication of post-holes or other features cut into its base. Further afield, the Neolithic features identified by the trial trenching; 8952 and 8956 to the north and 8995 to the south (Fig. 2.1) were rather different, somewhat smaller and shallower lacking the repeated recuts of the other features.

The location of the main excavated area at Springfield means that a large area outside the causewayed enclosure was examined. Although the construction of the Late Bronze Age enclosure and the extensive early Saxon cemetery and later settlement had disturbed much of the area, there were clear signs of Neolithic activity. Just outside the Late Bronze Age enclosure about 75m south-west of the causewayed enclosure, a large early Neolithic pit F4967, had been considerably disturbed by Saxon features. This pit, and the features which cut it, produced a considerable quantity of Mildenhall pottery (Fig. 3.16, 1–13). The assemblage included fine wares with a variety of decoration (Chapter 3, VI) together with a possible quern fragment (Chapter 3, V). The material in this pit is probably the result of similar depositional practices as those which had taken place in F6854 and F8920. The relatively large sherd size, generally good condition and presence of joining sherds in the pottery from F6854 and F8920, and F4967/4612, suggest that the pottery in all these features was probably deposited quite soon after breakage. These are not the only features where pottery evidence may suggest deliberate selection of material. About 6m east of 6854 a small group of shallow intercutting features 8896, 8920, 8998 and an adjacent surface context, all contained joining sherds from the same Neolithic bowl (Fig. 3.17, 33). The sherds are unabraded suggesting that their deposition was not the result of the accidental incorporation of discarded debris. The presence of unabraded joining sherds in the 'surface' deposits and from feature fills indicates that in this area, the 'cover loam' deposits were in part the remains of the Neolithic surface which contained both early Neolithic and later Neolithic material. Similar patterns of deposition have been recorded at the Stumble (Brown 2012) in the intertidal zone of the Blackwater estuary, where large areas of Neolithic land surface are preserved.

The features comprising the causewayed enclosure, and quite possibly the external feature 4967, show a clear focus on the digging of pits, and the incorporation therein of various selected deposits of artefacts and other materials. Such practices are of course widely documented at a variety of causewayed enclosures and indeed other Neolithic sites. At Springfield, the pit-like nature of the causewayed segments is very marked. A number of other causewayed enclosures have similar segments of pit-like causewayed ditch (*e.g.* Upton Cambridgeshire, particularly the south-west circuits; Briar Hill Northamptonshire, particularly the west side of the inner circuit; Radley Oxfordshire and a few of the segments at Kedington Suffolk, Oswald *et al.* 2001 figs 3.2, 4.4, 4.22 and 5.21). Locally a few of the features which comprise the enclosure at St Osyth (Germany 2007, 11, and figs 7–8, 11–12) are similar to those at Springfield, though even they are mostly somewhat longer. Indeed the Springfield features are perhaps most comparable to the pits which intercut or linked together to form the

causewayed ditch segments at St Osyth (Germany 2007, 11) and apparently Orsett (Hedges and Buckley 1978, 228). By contrast with those two sites, based on the (admittedly limited) excavated evidence at Springfield, there appears to have been no attempt to create lengths of ditch through the digging of rows of conjoined pits, although it is possible that 6854 and 8920 are sufficiently close that their upper levels may once have been linked by a very shallow cut subsequently removed by ploughing. The Springfield features resemble, in terms of form and content, the phase 2 pits at Etton, which were dug into the earlier linear ditches of the enclosure (Pryor 1998, 45–51, 370–371).

The concentration on pit-like features at Springfield may be considered as part of the particularly strong interest in the digging and filling of pits which is sufficiently characteristic of the early Neolithic in the east of England that it has been suggested as something of a regional tradition (Garrow *et al.* 2006, 82–83). A striking example of this was recorded at St Osyth causewayed enclosure where deposition of artefacts and other material took place in pits inside the enclosure (Germany 2007) rather than, as is more usual, the enclosure ditch. At Springfield the enclosure itself seems to have been formed by particularly large pits, reflecting both the regional emphasis on pits and the way in which different groups could use similar practices in rather different ways, producing the diversity which might be said, somewhat oddly, to be typical of early Neolithic sites.

Some of the features of the causewayed enclosure were specifically targeted for recutting, the recuts, at least in the first instance, mirroring both the original form of the feature and the material deposited in it. Post-holes associated with a number of the features, particularly the deeper 'shaft' in 6854, may have acted as markers. It seems unlikely that posts marking these features would have been necessary simply to relocate them. Their location would have been reasonably apparent particularly if, as with other causewayed enclosures, the spoil from them was used to create a more or less continuous bank. Accordingly the posts in addition to any function as markers may have encompassed broader symbolic purposes. Interestingly it is not just major features which were deliberately back-filled but quite shallow pits and scoops as well. There are also indications that particular types of 'natural' materials were sometimes selected for back-filling rather than simply material which lay close to hand, or which had been created by human action. This, perhaps, reflects Gibson's (2003) view of the significance in the Neolithic of returning materials to the earth which provided them in the first place.

In considering the length of time during which the causewayed enclosure was made and used, it is clear from the recutting sequence that several episodes were involved. Though whether the gap between the digging of the features which constituted the causewayed enclosure and the successive recuts was a question of months or years is uncertain. It is possible that the features that eventually comprised the causewayed circuit were not conceived and executed as a single architectural whole but as an episodic sequence. In such a case the ceremonial attached to the digging of individual elements may have been at least as important as the eventual architectural whole, rather in the manner that Pryor (1985, 301–303) suggested for the cursus and other monuments at Maxey.

The sequence of radiocarbon dates from the causewayed enclosure at St Osyth (Germany 2007) is a reminder that the use of such sites could be quite short-lived. However, it is worth recalling that 'use' in this instance refers only to the kinds of practices which involved digging features deep enough to penetrate the subsoil and depositing material in an archaeologically recoverable way. The act of monument construction transforms the landscape and once built, monuments can be used and their meanings manipulated in many different ways (Bradley 1993; 1998). Whilst there can be little doubt that a primary concern of those who constructed the causewayed enclosure at Springfield was with digging into the ground and burying material at particular locations, subsequent uses may have been of a kind that did not leave archaeological traces. One way in which a monument in the landscape may be incorporated into the patterns of daily life is through avoidance and it is possible that at some point subsequent to its construction that happened at Springfield. The lack at Springfield Lyons of Peterborough Ware of broadly Middle Neolithic date has been remarked upon (Brown 1997), and since Peterborough Ware is closely associated with the early phases of the Springfield cursus (Buckley *et al.* 2001) about 2.5km to the south-west, its absence at Springfield Lyons seemed particularly striking. However, recent excavations in advance of industrial development slightly downslope from the Springfield Lyons excavations and only about 100m to the north-east have yielded Peterborough Ware (Manning and Moore 2003). Such a location could be construed as just within or immediately outside the causewayed enclosure, the material was recovered from a surface layer which had been preserved in a limited area beneath the ploughsoil. The recovery of Peterborough Ware from a superficial context also occurred at Great Holts Farm about 8km to the north-east (Germany 2003, 9), and there is an interesting contrast between its occurrence in such contexts and its incorporation in the ditch, post-holes of the timber circle and other features at the east end of the cursus.

Later Neolithic activity at Springfield Lyons is represented by small pits with Grooved Ware (*e.g.* F2691, F6095) and/or flintwork (F2972) outside the causewayed enclosure. It is clear that the two large pits, F6854 and F8920, which were integral to, and perhaps some of the most significant features of, the causewayed enclosure, were a focus of activity during the later Neolithic. Two parallel slots were cut into of the upper fills of F6854 at its northern end. These slots are associated with Beaker and Grooved Ware sherds, which were also recovered from the upper fill of F6854 and surface contexts nearby (Figs 3.19, 70–2, 76–81, 85–93). The pottery is generally of small sherd size but mostly unabraded. The recovery of both Grooved Ware and Beaker from the same range of contexts is unusual in the east of England where those two types of pottery are infrequently associated (Cleal 1984). The Grooved Ware and Beaker material seems to represent the last acts of deposition at the causewayed enclosure and its immediate vicinity. A very few sherds apparently from collared vessels (Fig. 3.19, 94–96), might be somewhat later, but could be accommodated within the general range of Beaker and Grooved Ware ceramics. The absence of any indication of Middle Bronze Age activity at Springfield Lyons contrasts with other parts of the Chelmer valley. For instance a range of material of that

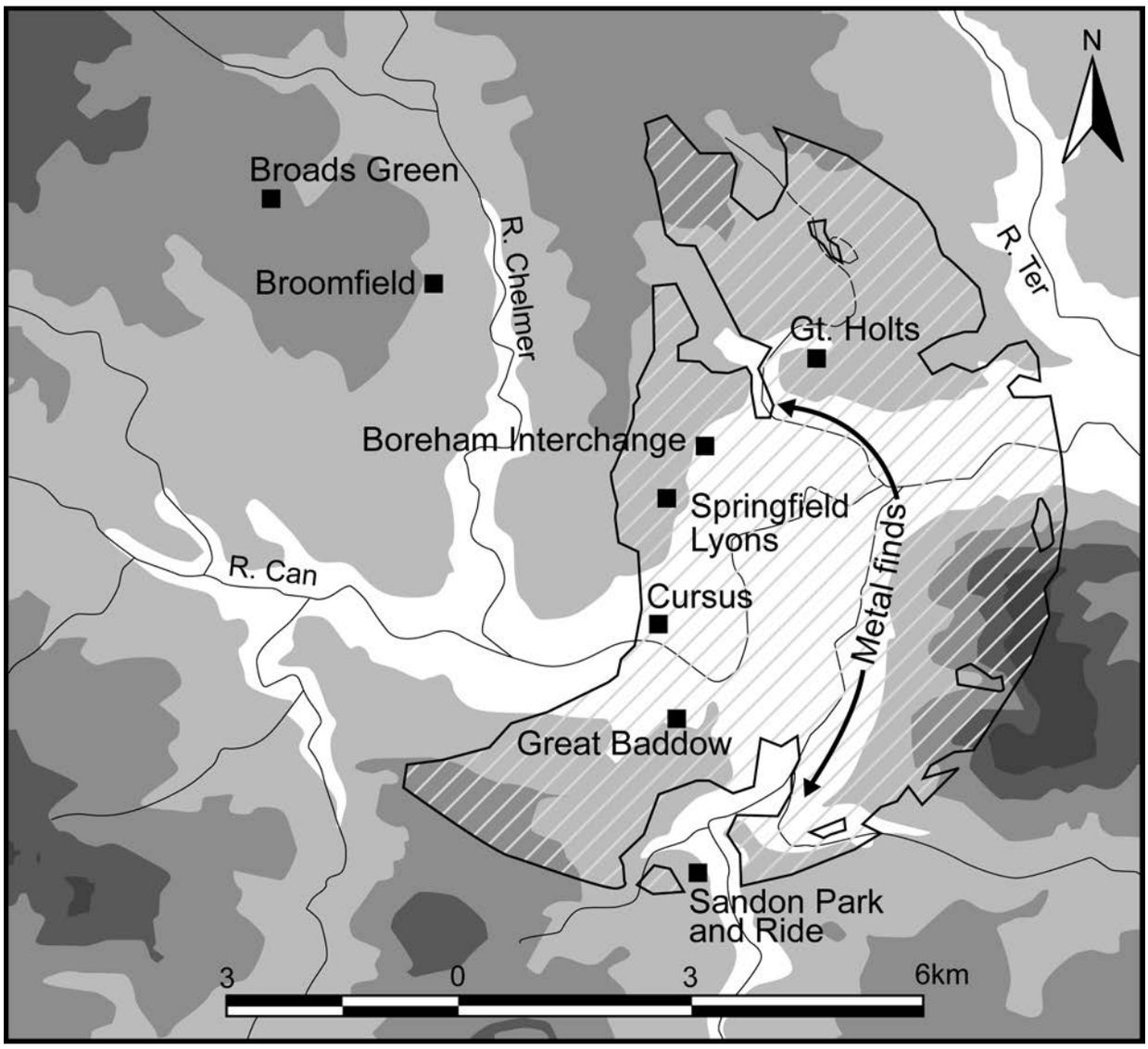


Figure 5.2 Springfield Lyons in relation to LBA sites and other key locations mentioned in the text, including Sandon Park and Ride where recent excavation has revealed extensive unenclosed LBA settlement (Brooks pers comm.). The general location of an arc of LBA metalwork finds both hoards and individual items is also indicated (see Buckley *et al* 1986; Brown 1991b). The view shed indicates what might have been visible (in the absence of tree cover *etc*) from a notional point 2m above the ground surface at Springfield Lyons, there is an arbitrary 5km cut off. The site has commanding views to the south and east toward the higher ground at Baddow and Danbury. Contours are at 15m intervals

date was present at Springfield Cursus (Buckley *et al.* 2001) and cremation burials with Deverel-Rimbury urn have been recovered from Great Baddow (Brown and Lavender 1994).

III. Place and time: the Bronze Age enclosure
(Figs 5.2–5.8)

The creation and use of the monuments at Springfield Lyons was clearly integrated with events in the wider area of the Chelmer valley (Fig. 5.2; Brown 2001). It is worth considering that point before turning to a discussion of the Late Bronze Age enclosure since it appears to have a direct bearing on its location. The area east of the confluence of the Chelmer and Can rivers is a strategic location, a point of transition where the Chelmer and its tributaries provide access up onto the boulder clay plateau to the north and west, and along the Chelmer valley east, toward the Blackwater estuary and the sea beyond; both the plateau and the river valley seem to have been utilised during the Neolithic though in rather different ways (Brown 1997). Recent research further north in the east of England has revealed a rather similar pattern of differential landuse between river valley and clay 'uplands' (Garrow 2007, 10–11); which reinforces the notion that the Springfield monuments were created at a broad transitional zone in the landscape.

There is a notable concentration of Mesolithic finds toward the top of the Chelmer valley slope south of the river around Great Baddow (Jacobi 1980; 1996) that may be the first indication of the long-term significance of the general location east of the Can/Chelmer confluence. Interestingly whilst there is evidence for Mesolithic activity at the east end of the Springfield Cursus (Buckley *et al.* 2001) the quantity of Mesolithic flintwork recovered from Springfield Lyons is limited to just a couple of pieces

(Healey above p.90). A considerable range of evidence is available regarding Neolithic occupation in the Chelmer valley/Blackwater estuary river system derived from a range of fieldwork (summarised in Brown 1997) and cropmark evidence (*e.g.* Ingle and Saunders 2011). There is a marked variation in the distribution of monuments within the river system. Oval or sub-rectangular long mortuary enclosures or barrows occur throughout, but only in the Springfield area were larger and more complex monuments, the causewayed enclosure and cursus, built. Given the strategic location of this area it may have been selected for the construction of such monuments, at a point of transition for people moving along the river system and to and from the boulder clay plateau. Normally scattered groups of people may have had the opportunity to gather in the Springfield area perhaps seasonally.

The site chosen for the construction of the Springfield Lyons causewayed enclosure does not appear to have had any significant previous use. The spur between two small streams on which it lay offered commanding views, although the views are now much obscured by housing and industrial development. Its location at a transitional point in the landscape accords with the liminal associations which appear to be characteristic of causewayed enclosures (Thomas 1999, 43–44). Prior to these recent developments the Chelmer valley, viewed from this location, formed a large, bowl-like arena bounded to the south by the valley side at Great Baddow; looking east the view took in about 3km of the fairly flat ground of the valley and floodplain of the Chelmer, toward the steep rise of the Danbury/Little Baddow ridge. To the north-east the valley slope runs in a series of small spurs toward the modern village of Boreham; whilst to the north and west the view is quickly cut off by the gently rising ground of the edge of the boulder clay plateau (Fig.5.2).

Based on the general dating of the artefacts recovered from it, the causewayed enclosure was probably constructed relatively early in the sequence of monuments in the Springfield area, pre-dating the cursus, although a few sherds of plain bowls recovered from surface contexts during excavations at the cursus suggest that there was some kind of activity here too during the early Neolithic. The two monuments became prominent features of the landscape and were clearly used, however sporadically, for millennia. The cursus (assuming that there was no significant tree cover between them) and the causewayed enclosure were intervisible. For significant periods the two monuments were in contemporary use, though they were constructed in different ways, in very different form, in very particular locations and presumably served different purposes. The causewayed enclosure, composed of deep pits, was a monument of broadly curvilinear form and sited at a high point in the local topography. The cursus was, by contrast, much more regular in plan, linear and broadly rectilinear in outline, and located just above the floodplain. The cursus remained a focus of activity throughout the Early and Middle Bronze Age, whereas the causewayed enclosure lacks any archaeologically recoverable evidence for use and might have been avoided, though the banks and ditch were presumably still visible.

Toward the end of the Middle Bronze Age a small spur on the upper slope of the northern side of the valley was again occupied. However, rather than the Springfield Lyons spur the site chosen was a very similar location just 800m to north-east. This site (Fig. 5.3; Lavender 1999), at the modern A12 Boreham Interchange, comprised a curving arc of ditch which may once have formed a C shaped enclosure, any ditch which might have existed on the eastern side would have been destroyed by construction of the A12. One part of the ditch had a distinct deposit of bone, antler and pottery in a charcoal-rich matrix. This deposit lay close to a small post-built structure 4.5 x 2.2m. Elsewhere in the interior were fence lines but none of the houses ancillary structures or storage pits characteristic of contemporary domestic sites in Essex or elsewhere (*e.g.* Brown 1996, Ellison 1981, Bruck 1999). The small rectangular structure at Boreham Interchange, in common with a similar structure from an unenclosed site at Broads Green (Brown 1988b) about 7km to the north-west, has been interpreted as a shrine (Brown 1996), partly by analogy with the better preserved waterlogged remains of a shrine at Bargeroosterveld, Netherlands (Waterbolk and Van Zeist 1961). The Boreham interchange site continued into the Late Bronze Age, when the putative shrine was demolished, its posts removed, and the post-holes filled with a range of deposits (Lavender 1999). These contained Late Bronze Age pottery of a kind characteristic of the earlier fills of the Late Bronze Age enclosure ditch at Springfield Lyons, but with fragments of some very distinctive pots, including a highly decorated bowl most probably imported from the continent (Brown 1999a). It thus appears that the Boreham Interchange shrine was demolished and sealed whilst the Late Bronze Age enclosure at Springfield Lyons was flourishing, quite possibly at about the time that the second phase ditch and rampart were constructed at Springfield. Needham (1993) has noted that the Late Bronze Age saw the transfer of shrines and religious structures into domestic compounds. Something of the sort may have occurred at Springfield Lyons. It might appear that the simplest way of achieving that would have been to construct the circular enclosure on the Boreham Interchange site. Instead the Springfield Lyons spur was chosen and it is necessary to consider why this may have been.

Many examples of Late Bronze Age circular enclosures are now known and a number have been examined by more or less extensive excavation (*e.g.* Brown 1996, Manby 2007). They have much in common, notably their circular form, substantial enclosure ditches, presence of one or more post-built roundhouses and very similar assemblages of artefacts. These similarities (Fig. 5.4) are very clear and have usefully allowed incorporation of these distinctive enclosures into general schemes of archaeological classification (*e.g.* Needham 1993, Manby 2007), and Springfield Lyons has given its name to the English Heritage Single Monument Class description for such enclosures. However, these similarities mask considerable differences, in for instance the scale of the enclosure (*e.g.* Manby 2007 fig. 36.1; Allen *et al.* 2008 fig. 24) particularly if the West Harling sites are included (Clark and Fell 1953, Bradley 1984). Differences in internal layout are particularly marked, some sites such as Thwing (Manby 1980; 2007) and South Hornchurch (Guttman and Last 2000) have single roundhouses, others like Springfield and Mucking North Ring (Bond 1988) have several roundhouses and ancillary structures. The contrast between the internal layout at Springfield (Fig. 5.5 and period 1 at Mucking North Ring

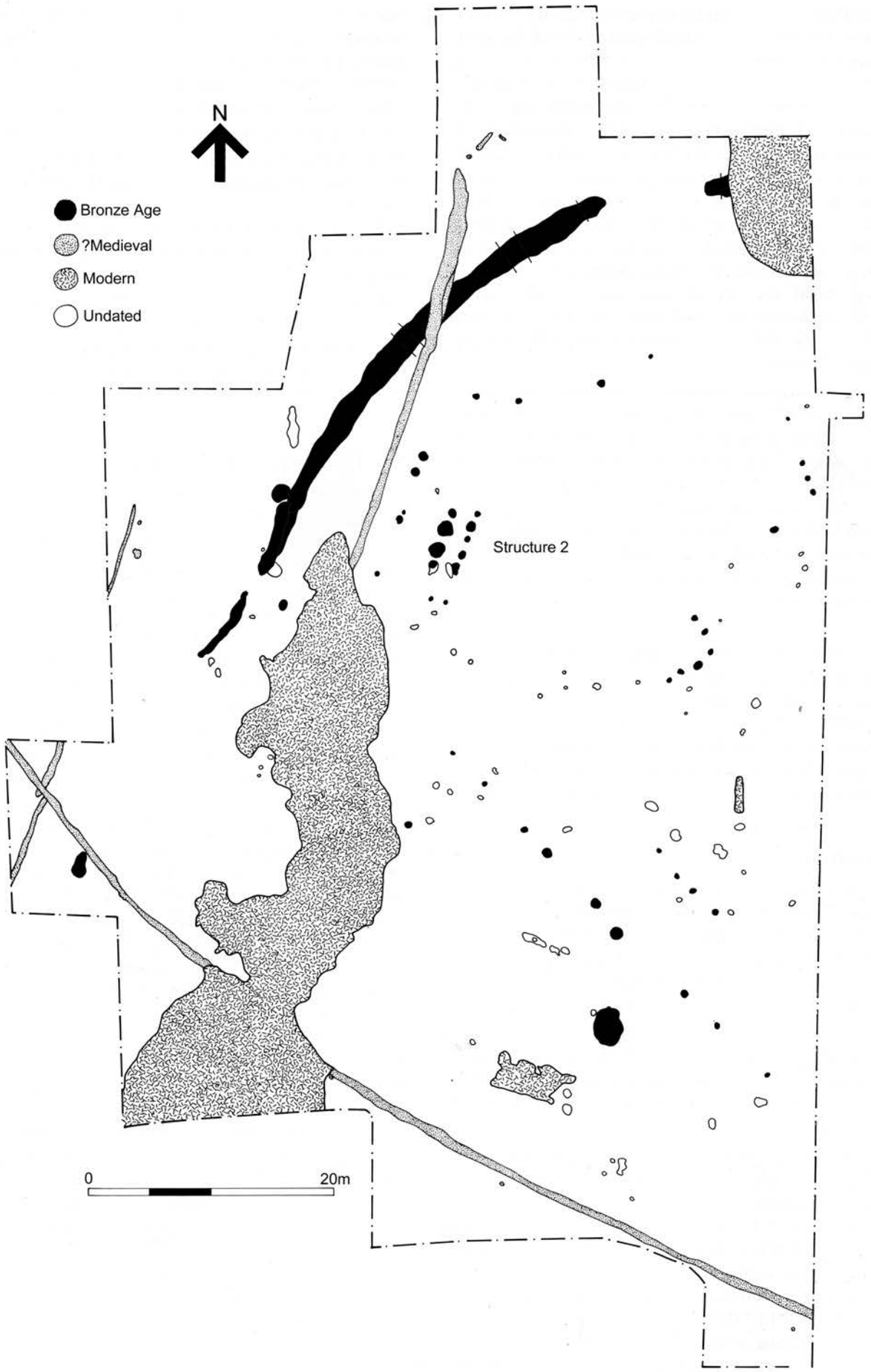


Figure 5.3 Plan of the Boreham Interchange site, the curving arcs of ditch are considered to be part of an enclosure, though the exact form is uncertain, it may be that there was never a complete circuit and the site may have been C-shaped. The east side of the site has been destroyed by the A12. The post-hole building marked 'structure 2' has been interpreted as a shrine

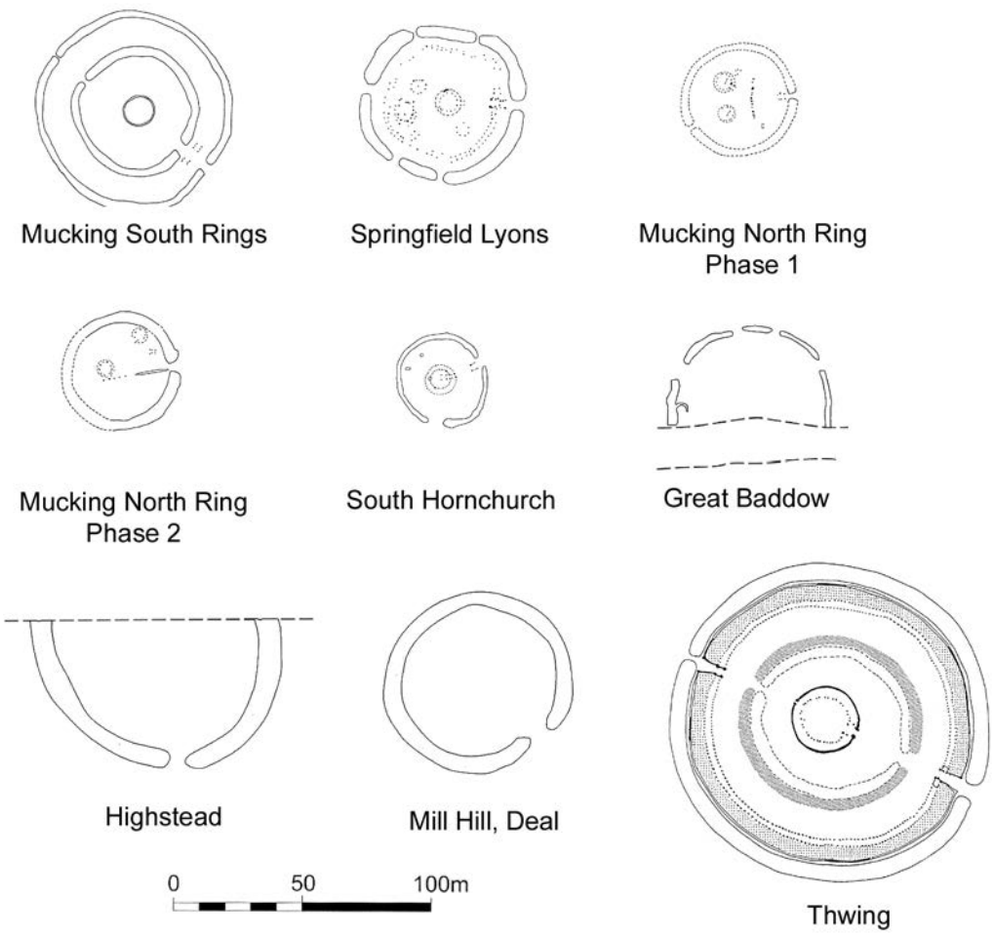


Figure 5.4 Comparative plans of LBA circular enclosures (after Hedges and Buckley 1987 and Manby 2007). The general similarity of plan is apparent, some of the variation, particularly in terms of size and and layout embodied in these sites is also indicated. Interestingly the cropmark plan of the Great Baddow enclosure shows a causewayed ditch rather like the excavated ditch of its near neighbour at Springfield Lyons

is particularly striking. Anyone entering the Springfield enclosure would have been immediately confronted by the rather grand porch of the centrally placed roundhouse. Whereas at Mucking a row of substantial posts indicates that a large fence or screen shields the roundhouses, which lay toward the back of the enclosure, from anyone approaching through the east entrance (Parker-Pearson 1993; Needham 1993). The contrast between Springfield and Mucking North Ring is even more marked when the rearrangement of the interior in the second phase at Mucking, the close proximity of contemporary settlement at Mucking and the possibility that the phases published in 1988 are but two in a sequence of Late Bronze Age shifting roundhouses, some pre-dating the enclosed phase at Mucking (Brudnell pers. comm.), are taken into account. It seems clear that each enclosure was constructed and used in ways which reflected and embodied particular histories. The Late Bronze Age circular enclosures, of which Springfield Lyons is a prime example, were quite clearly embedded in, and part of, a productive economy and it is apparent that the occupants of Springfield Lyons were deeply involved in agricultural and other aspects of production. Besides the large pottery assemblage and flintwork, artefacts recovered from the site include loomweights, spindlewhorls and perforated clay slabs. Weeds present in the charred plant remains recovered from the site (Murphy above) indicate that not only were the light soils of the gravel terrace exploited but that agricultural cultivation also extended onto the heavier clay soils and the damp conditions of the valley floor. However, it is clear that these circular enclosures also had a symbolic purpose or function, and it is that symbolic value which may explain the particular location and form of the Springfield Lyons enclosure.

It is very striking how hard it is for archaeologists to distinguish Late Bronze Age circular enclosures from Neolithic henges, on the basis of their plans as revealed by aerial photography. In Essex alone the enclosures at Springfield Lyons itself, Mucking (Jones and Bond 1980) and Ferriers Farm (Havis 1992) were all, when first identified, considered likely to be henge monuments. This may well be something more than simple coincidence of form (Manby 2007); it is possible, as Clare (1987) has suggested, that the people who constructed the Late Bronze Age enclosures deliberately echoed an archaic form to create a link with an ancient past. Gosden and Lock (1998) use the concepts of 'genealogical history' and 'mythical history' to address prehistoric people's understanding and use of the past, and these notions may be helpful in considering the nature of the Springfield

Figure 5.5 Digital reconstruction by Iain Bell. This view is looking north from a point south of the enclosure, the viewpoint is rather closer to the enclosure than that in Fig. 5.7. The imposing nature of the timber rampart is apparent and provides a reminder of the large quantity of timber which may have been needed to build it. The dominant position of the central roundhouse with its prominent porch is also clear as is the substantial nature of the gate at the main east facing entrance

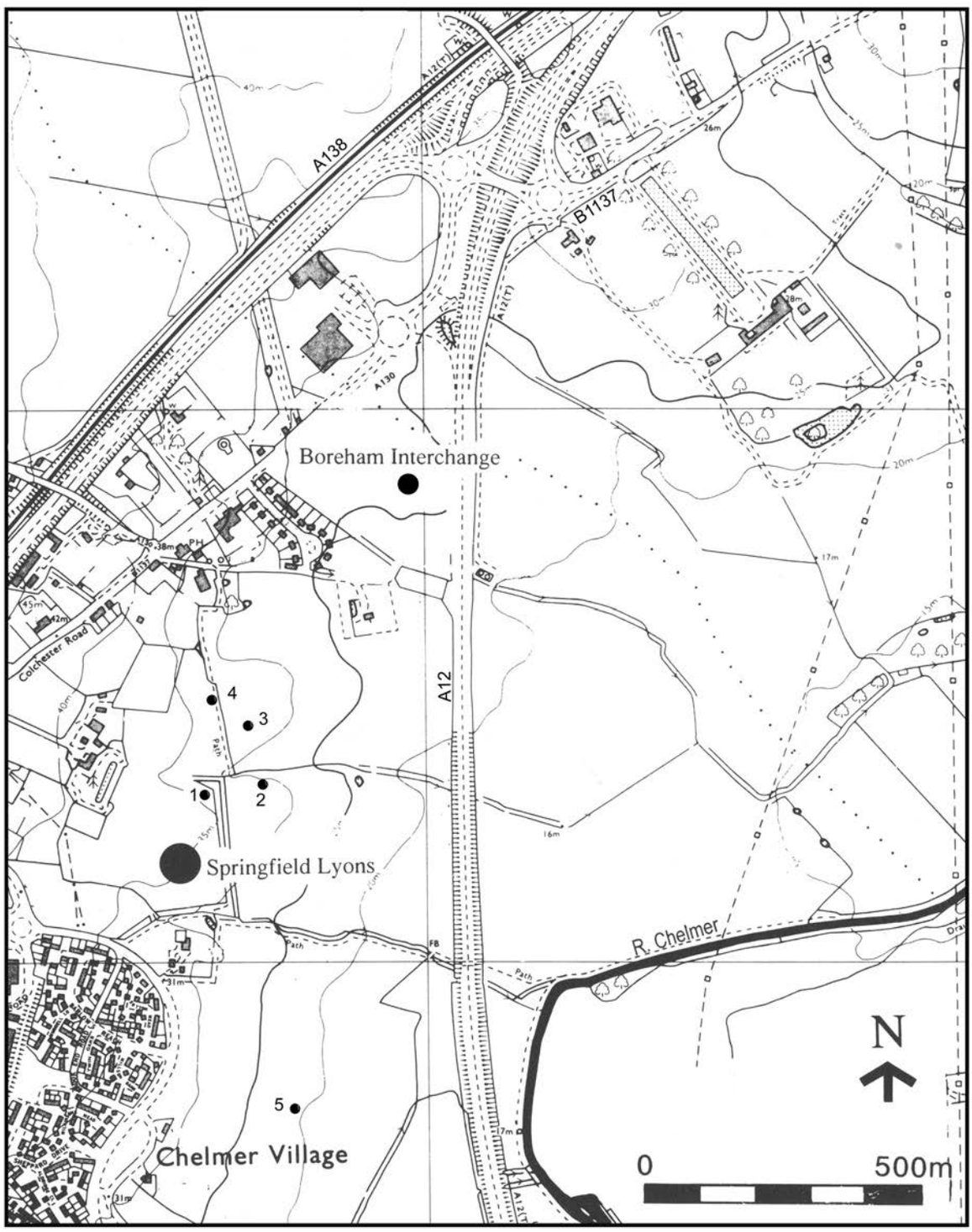


Figure 5.6 Map showing relationship between Springfield Lyons and Boreham Interchange, each occupied small spurs part of a series which run along the upper slope of the Chelmer valley. Contours are at 5m intervals. Numbers refer to evidence of LBA settlement and possible fields as noted in the main text

Lyons enclosure and Late Bronze Age circular enclosures more generally. Genealogical history describes what for non-literate societies '…is the main device employed through which to recount history… in which relations of blood and kin are specified and become the basis for recounting stories about these known individuals' (Gosden and Lock 1998, 5). This history about known and named individuals from the past linked to living individuals and groups was essentially about the recent past (though in this case recent might be a term extending over several centuries). Mythical history dealt with a deeper past of gods and ancestral spirits. These beings were often associated with ancient landscape features whether natural or of human construction; the obscurity of

Figure 5.7 Digital reconstruction of the LBA enclosure by Iain Bell which shows the first phase ditch and rampart from a point west of the enclosure.

As is generally the case with reconstruction the detail is conjectural but the general impression is perhaps the main point. The short length of 'corduroy' road leading to the entrance is entirely conjectural and all the main internal structures are shown within the enclosure although it is not in fact clear whether they were all contemporary or not. The interior of the bank is shown as unrevetted whereas in this phase it could very well have been retained within a box frame. The standing water and rushes shown growing in the ditch are very much a reflection of experience during the course of the excavations, throughout the autumn, winter and spring the ditch held water and the excavated segments were quickly colonised by reeds. This image shows the relationship with the eroded remains of the Neolithic causewayed enclosure, and indicates the visual similarity which may have existed between the ancient Neolithic causewayed ditch and the 'modern' LBA enclosure ditch. In the background the LBA settlement evidence along the stream valley to the north of the site is shown; the roundhouses are conjectural but there is excavated evidence for at least one substantial rectangular building (Manning and Moore 2004)

whose origins offered considerable scope to create and manipulate the past for social and political advantage in the present (Bradley 1998; 2002).

If the builders of the Late Bronze Age circular enclosures generally exploited this mythic history in adopting an architectural form that reflected the ancient henge monuments. It may be that those who conceived and constructed the Springfield Lyons enclosure took the conscious link with mythic history embodied in the typically circular form further, and made it both more explicit, and more immediate. Here the new Late Bronze Age circular enclosure was constructed immediately west of the remains of the Neolithic causewayed enclosure. The numerous causeways of the Springfield Lyons circular enclosure, so unlike most of the other known Late Bronze Age enclosures (*e.g.* Fig. 5.4, Champion 1994 fig. 12.2), appear to consciously echo the adjacent Neolithic site. The construction of the Springfield Late Bronze Age enclosure, adding a new element and through doing so 'reactivating' a far older one, appears to be an example of the creative manipulation of the landscape of the kind that Gosden and Lock (2007) have examined in the Iron Age landscapes of the Berkshire Downs. In the case of Springfield it was perhaps not so much that an ancient and dormant feature of the landscape, the causewayed enclosure, was '…being recharged and given new meaning through a changed set of relationships' (Gosden and Lock 2007, 291), but rather the ancient site may have been used to connect the builders of the new circular enclosure to a mythic history, the meanings embodied in the old site being explicitly transferred to the new, enhancing the authority of those who created and used it.

The presence of the Neolithic causewayed ditch as an ancient landscape feature at Springfield appears not only to have been used to shape the form of the Late Bronze Age enclosure itself but also to structure its relationship with, and impact on, its landscape setting. Where significant areas have been investigated around other Late Bronze Age circular enclosures they are closely embedded in their contemporary landscapes; elements of which run up to the enclosure ditch. That is particularly clear at South Hornchurch (Guttman and Last 2000) and is also apparent at Mucking (Jones and Bond 1980; Bond 1988, Clark 1993). The quite extensive excavation immediately outside the Springfield enclosure has not revealed contemporary occupation. The early Saxon cemetery and later Saxon settlement overlay and extended well beyond the Late Bronze Age enclosure. Examination of Late Bronze Age pottery residual in these later features supports the lack of extra-mural occupation. Large quantities of residual Late Bronze Age pottery were recovered from the later features inside the enclosure with much less from those outside. A similar pattern is revealed by examination of Late Bronze Age pottery recovered from hand cleaning (above p.124) of the machine stripped surface of the excavated area. The immediate vicinity of the enclosure seems to have been kept clear of contemporary occupation. However, there is a range of evidence from nearby, indicating that the enclosure was indeed set in a wider settled landscape (Fig. 5.6). Whilst in general trial trenching to trace the line of the causewayed enclosure produced little of obviously Late Bronze Age date, a small pit (8984 Fig. 2.33, Fig. 5.6, 1) was located in one of the trenches about 100m north-east of the main east entrance of the Late Bronze Age enclosure. About 100m further to the east of pit 8984, excavation in advance of industrial development at Springfield Park (Manning and Moore 2003) revealed several phases of Late Bronze Age settlement (Fig. 5.6, 2). The occupation included an area of buried soil, a rectangular building, post-holes forming fence lines and a variety of pits, including one which contained the remains of a cremation burial or possibly redeposited pyre material (McKinley 2003). The range of artefacts — which included flint, pottery, spindlewhorls and perforated clay slabs (but no fragments of casting moulds) — is comparable to that from the Springfield Lyons enclosure. Based on the pottery evidence (Court and Mepham 2003) the occupation appears to be contemporary with the earlier phases of the Springfield Lyons ceramic sequence. It is possible that pit 8984 is part of this same occupation, suggesting open settlement running along the south side of the valley of a small stream. North of the stream evaluation trenches (Fig. 5.6, 3) have revealed what appear to be roughly rectangular ditched enclosures, probably fields (Manning and Moore 2003), and a length of Late Bronze Age field ditch (Fig. 5.6, 4) was recorded during excavations slightly further to the north-west (Pocock 2006). Evaluation in advance of housing development about 500m south-east of the Late Bronze Age enclosure (Fig. 5.6, 5) revealed a range of small features possibly indicative of Late Bronze Age or Early Iron Age occupation (Hutcheson *et al.* 1996). Though fragmentary this evidence suggests that the valley slopes, running down from the Springfield Lyons enclosure toward the Chelmer, were a patchwork of ditched fields and unenclosed settlement. However, the immediate vicinity of the Springfield enclosure was kept clear of contemporary occupation, the remains of the Neolithic causewayed enclosure perhaps forming the boundary of a kind of precinct in front of the Late Bronze Age enclosure kept clear of the clutter of domestic life (Fig. 5.7). If this interpretation of the Springfield enclosure in its contemporary landscape is correct, the closest parallel may be with a site at Malleville-sur-le-Bec in Normandy (Fig. 5.8, Mare 2005). Excavations at that site have revealed a Late Bronze Age circular enclosure very similar in plan to Springfield Lyons and separated to the east, by a zone kept clear of contemporary features, from a dispersed settlement of roundhouses.

Whilst the construction of the Springfield Lyons enclosure may have enabled its builders to exploit an ancient mythic history, the debris from bronze casting deposited in the ditch terminals north of the main east- and west-facing entrances, attest to much more tangible actions in the contemporary world. The objects cast from the moulds represented in these deposits were, with one exception, all swords and, although the material from the east entrance was somewhat better preserved, there seems to be little difference in composition between the two deposits. However, it does seem as though more than one episode of casting is represented (Needham and Bridgford above p.72) and the mould debris was curated before being deposited into the ditch terminals. Pit 8984 which lay about 100m outside the enclosure, contained a large part of a fine, burnished plain ware bowl (Fig. 3.33, 209). A small rim sherd recovered from amongst the casting mould debris from the enclosure ditch north of the east entrance, whilst it does not join, appears likely to come from the same vessel. That may suggest a link to where the metalworking actually took place, or at least where the

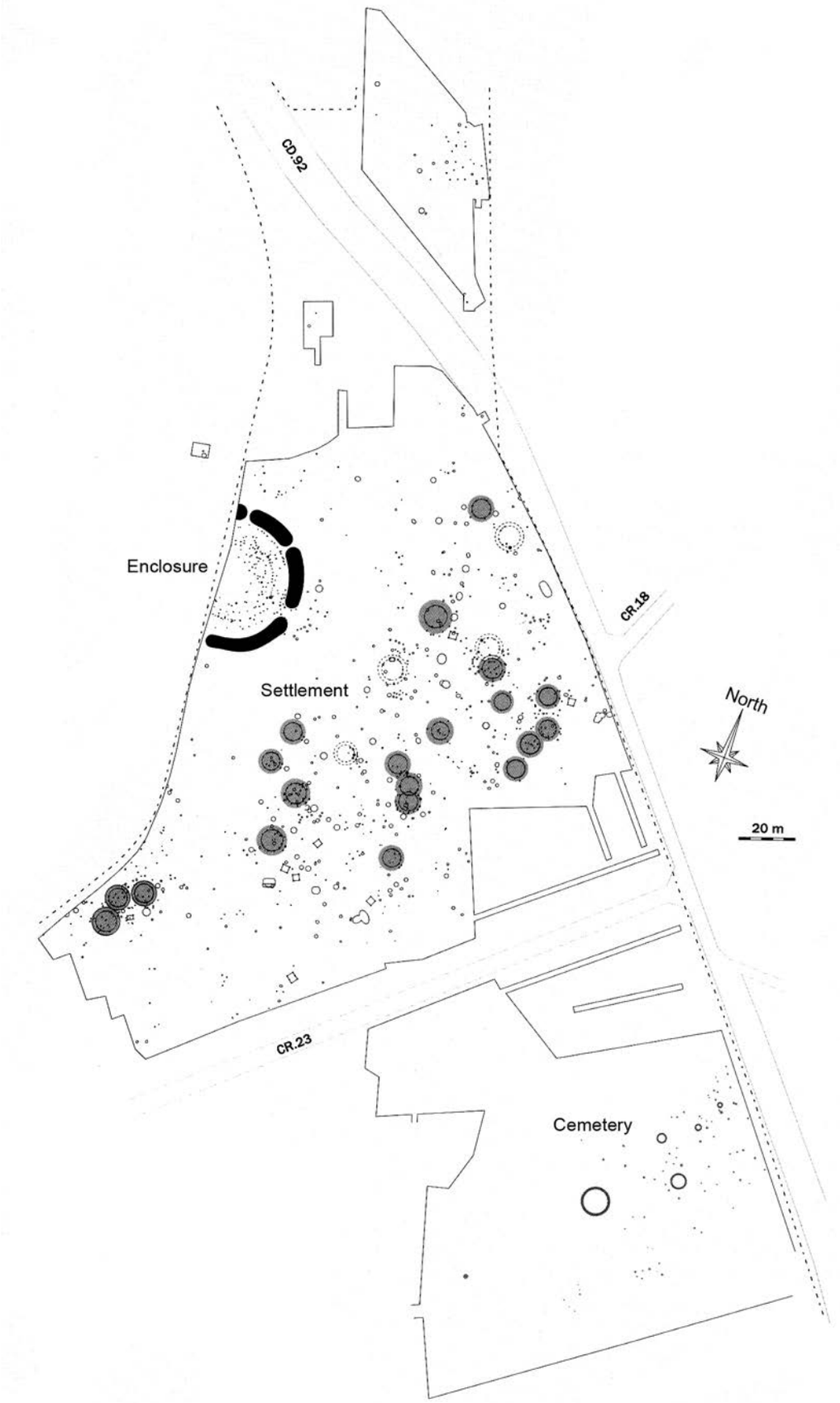


Figure 5.8 Plan of the enclosure and extra mural settlement at Malleville-sur-le Bec (after Mare 2005). The segmented form of the enclosure is a striking parallel for Springfield Lyons and it is possible the setting of Springfield was similar to this, an unoccupied zone immediately around the enclosure and extensive open settlement to the east running down the valley slope toward the Chelmer

debris from the casting was originally deposited however temporarily. It appears that the individual or group responsible for the establishment and development of the Springfield enclosure organised the production of swords, in all likelihood to give them to key followers or supporters, creating a highly visual statement of the relationship between giver and receiver binding them into a new political structure, making a vivid intervention in genealogical history. In this context the fact that the sword casting was not a single event is interesting, indicating that rather than a single ceremonial occasion bringing together the full range of supporters, there was a sequence of making and distributing swords reflecting a more or less complex and protracted series of political and social manoeuvres.

The deposition of mould debris in the north terminals of the east and west entrances is perhaps a reflection of the wider pattern of differentiation between north and south seen at a range of Bronze Age sites. That the casting mould deposits from the enclosure ditch are completely dominated by fragments from sword moulds, perhaps deliberately selected from originally more diverse assemblages deposited elsewhere (Needham and Bridgford above), suggests the symbolic value of this material. The choice to deposit this material in *both* east and west entrances might be a reflection of the territorial area in which the builders of the enclosure sought to assert their authority. Although assemblages of sword mould debris were deposited at both east and west entrances, the entrances themselves were treated rather differently. In both phases of ditch and rampart it was only the east entrance which was provided with a substantial gate structure. This differential treatment might well reflect general cosmological concerns resulting in a particular emphasis on the east-facing entrance, combined with the more local significance of the east-facing entrance leading to and from the Chelmer valley with the Blackwater estuary and wider world beyond. As noted above, the Springfield Lyons enclosure commands wide views to south and east along the Chelmer valley, and Manby (2007) has pointed out that the enclosure at Great Baddow (Brown and Lavender 1994) south of the Chelmer, which apparently forms a pair with Springfield, has a complimentary outlook west and north along the valley of the Chelmer and its tributary the Can. If the two enclosures were conceived and built as a functional pair, this joint ability to visually dominate a large area to both east and west may well have been significant. The deposition of mould material at both east and west entrances at Springfield might be a reflection of the giving of swords to allies and dependants from both east and west.

It may be that the collecting up of the mould debris and its deposition into the enclosure ditch was part of a culminating event; with all the swords made and distributed, the new political structure and its relations to both the ancient mythic history and the recent genealogical history were embodied in the newly refurbished enclosure. The material was deposited in the enclosure ditch soon after the ditch had been recut and the rampart remodelled. It may be that the shrine at nearby Boreham Interchange was dismantled and its post-holes backfilled with a distinctive ceramic assemblage including sherds from a bowl probably imported from Europe (above p.161). Needham (1993) has suggested that during the Late Bronze Age, shrines and religious structures were incorporated into what otherwise appear to be domestic sites, and Manby (2007) has noted that point with regard to the Late Bronze Age circular enclosures. However, whilst the Springfield Lyons enclosure appears to replace the Boreham Interchange site, there is no sign at Springfield of the kind of structures that have been interpreted as shrines at Boreham Interchange and Broads Green (Brown 1996). It seems possible that the overall form of the Springfield enclosure may have embodied a range of symbolic meaning such that a separate structure within it was not needed to enable ritual or religious acts to be carried out there.

The Chelmer valley/Blackwater estuary was clearly a routeway important in facilitating the intricate network of exchange relations which played a vital part in Late Bronze Age society, ultimately responsible for bringing the raw materials for sword manufacture to Springfield. A traveller, many of whom were no doubt relatively local but some arriving from quite far afield (Kristiansen 1998, 96), approaching the enclosure from the river would have moved up through a landscape of fields and farms, until they reached the line of the low banks and shallow hollows which marked the remains of the Neolithic causewayed enclosure. Passing through that line they would enter a zone clear of the familiar structures of everyday life, dominated by the gate structure of the main entrance to the circular enclosure. In the Late Bronze Age enclosure's first phase, the segmented ditch would have mirrored the form of the ancient causewayed enclosure; the new ditch, backed by an imposing rampart, would leave the visitor in little doubt of the present strength of those who built it. At the same time the archaic form of the enclosure, set so close to the remains of the causewayed enclosure, might act more subtly but no less clearly on the mind of the visitor, suggesting that the occupants were also able to bring the power of an ancient spirit past into the contemporary world.

IV. After the Bronze Age

Material including decorated post-Deverel-Rimbury pottery of earliest Iron Age date appears to have been the last act of deposition into the enclosure ditch. Thereafter, in a way curiously reminiscent of the manner in which deposition ceased at the causewayed enclosure during the Early and Middle Bronze Age, there appears to have been a hiatus in deposition at the enclosure until the end of the first millennium BC. Long after it ceased to be occupied, the Springfield enclosure probably remained as a significant earthwork, offering the possibility, like the Neolithic causewayed enclosure before it, of reuse or manipulation by later generations. During the Late Iron Age, a sword was ritually deposited, the blade coiled up in a pit dug at the centre of the Bronze Age enclosure. This pit is so centrally placed that there seems little doubt that the form of the enclosure was still visible and accorded a significant role in how Late Iron Age communities understood their world. The deposition of the sword is a particularly clear example of the way that Bronze Age sites and material could be reused in the Late Iron Age; this seems to have been a fairly regular practice and probably served a variety of purposes (Hingley 2009). Local examples include the construction of a major roundhouse adjacent to an early Bronze Age cemetery at Harlow Temple. The Temple at Elms Farm, Heybridge

may also have been constructed on the site of a significant Middle Bronze Age structure (Atkinson pers comm. and Atkinson and Preston forthcoming). Similarly a Bronze Age axe was included in the grave goods of the Lexden burial (Foster 1986). Once again part of the attraction of this Iron Age reuse of Bronze Age artefacts and sites may well have been to recruit a mythic or genealogical history into the present (Hingley 2009). It seems possible that the Springfield enclosure was associated with the genealogical history of people in the Late Iron Age stretching back seven or eight hundred years. If so, it is conceivable that the stories told about the ancestral connections with Springfield may have carried with them a memory of the making and giving of swords, lending a particular significance to the sacrifice of a modern sword, bent and placed in a circular pit at the centre of the circular Springfield enclosure. It is possible that similar ritual activity continued into the Roman period, when a pit with much burnt material was inserted into the largely silted enclosure ditch. During the Roman period the Bronze Age enclosure seems to have remained visible and to have featured in land division, an east–west field ditch bisected the enclosure running out through the west entrance.

By far the most significant reuse of the Bronze Age enclosure occurred during the Early Saxon period when it formed the focus of a major cemetery (Tyler and Major 2005). The northern arc of the Bronze Age ditch seems to have been respected by the Saxon graves, whereas the southern, downslope ditch is not and may already have been largely invisible, perhaps as a result of ploughing in the Roman period. This reuse of earlier monuments for cemetery sites in the Early Saxon period appears to be a widespread phenomenon (*e.g.* Williams 1998) and is represented elsewhere in Essex by the burials at the Orsett causewayed enclosure (Hedges and Buckley 1978) and possibly at Ardleigh (Brown 1999b). These local examples appear to quite deliberately eschew association with Roman remains. The Bronze Age enclosure at Springfield was chosen in preference to the Roman town of Chelmsford to the south or the villa and other major Roman buildings at Boreham to the north (Lavender 1993; Germany 2003). Perhaps this represents a new social order seeking to establish legitimacy by association with features that could be linked with a mythic past (Gosden and Lock 1998; Williams 1998).

In the later Saxon period a settlement was established south and west of the cemetery. This settlement may have lasted into the eleventh century (Tyler and Major 2005) and it is possible that its successor was the Domesday manor of Cuton Hall. The manorial centre may, at some time, have shifted slightly further south across a small stream to the vicinity of the existing late medieval/early post-medieval Cuton Hall. If this is the case a manorial centre recorded by the Domesday commissioners may indirectly owe its position to the establishment of a, by then long forgotten, Bronze Age enclosure, 2,000 years before; an enclosure which in turn had been located with respect to a Neolithic monument 2,000 years or so before that. Once forgotten the Springfield Bronze Age enclosure remained unknown until the late twentieth century, when archaeologists began to examine and reveal something of its ancient and long-lasting significance in the landscape, imbuing it with a significance of their own.

Whilst most of the area to the north, south and east has now been covered with housing or industrial development; at the time of writing the site of the fully excavated Bronze Age enclosure and its immediate surroundings, including the line of the causewayed enclosure ditch, remains undeveloped. Precise development plans have yet to be finalised for this area but it is *hoped* that the circular form of the Late Bronze Age enclosure can be reflected in the master plan, as a conscious effort to allow the site to continue to assert its influence into the future.

Appendix: Valley sediments of the Chelmer and Sandon Brook

by P. Murphy, T.J. Wilkinson and Patricia E.J. Wiltshire

Introduction

The alluvial deposits of the rivers Chelmer and Blackwater and their tributaries are discussed by Bristow (1985, 69), who distinguishes an upper predominantly clayey unit and a lower gravelly unit, termed the 'sub-alluvial gravels'. Deposition of the gravels is considered to have begun in the Devensian, whilst the upper finer-textured sediments formed during the Flandrian, though until recently no direct dating evidence has been available.

There is now a considerable body of data indicating that post-glacial river valley sedimentation has been strongly influenced by human activity and, conversely, that valley sediments can provide information on changing patterns of land use (Limbrey 1978, Robinson and Lambrick 1984, Shotton 1978). For this reason, sections exposed in the valley of the Chelmer and a tributary stream, the Sandon Brook, were recorded and sampled during bridge and culvert construction for the new Chelmsford Bypass in 1984–5. Details of these sections are given here, together with some further data from bore logs in the valley floor adjacent to the cursus and from a section recorded by Peglar and Wilson (1978) at Little Waltham. Further borehole logs from other parts of the catchment are discussed by Bristow (1985, 80) but since these appear to show very similar sequences of sediments and since there is no dating evidence from these boreholes they will not be considered further here.

This report was completed in the late 1980s. It provides an account of the relevant stratigraphy, dating and palaeoecology of the Chelmer and Sandon Brook, but has not been revised to take into account subsequent changes in biological nomenclature nor more recent publications on alluvial sequences.

Sediments and stratigraphy

Old Chelmsford Bypass (A12): borehole logs

Logs from exploratory boreholes sunk during site investigations for this road, and now held at the Institute of Geological Sciences, were examined. The boreholes from the base of the valley floor show the underlying surface of sub-alluvial gravels to be undulating, varying from about 1.0 to 2.8m, below the present ground surface. Organic deposits occur where there are depressions in the gravel surface (see Fig. A1, B, C), though in most boreholes fine-textured mineral alluvium directly overlies the gravels. The depressions are thought to be former channels infilled with muds and detritus muds. For example, the lower sediments in borehole 236 (TL 7207 0631) are recorded as follows:

2.50–2.60m	Soft grey-brown peat
2.60–2.75m	Very soft grey silty clay
2.75–3.25m	Gravel, with some grey sandy clay
3.25–6.00m	Dense sand and gravel

This borehole apparently records a transition from high to low energy fluvial sediments — very much the sedimentary sequence which would be expected to occur in an abandoned river channel.

Overlying these organic deposits, and elsewhere resting directly on the gravel surface, are deposits of mineral alluvium. These sediments seem to be quite variable, including pockets of sand and sometimes some decayed plant remains, but in general the logs record lower soft grey silty or clayey silt overlain by firm brown silty or sandy clay (see Fig. A1). As would be expected, the ground level of the floodplain shows only slight variation in elevation.

The Little Waltham section

This section was described by Peglar and Wilson (1978). Overlying river gravels and filling a former river channel was a silty, coarse organic detritus mud, 0.75m thick, covered by 1.5m of 'grey clay and sand' on which was a further 1m of 'brown clay' (Fig. A1, A). This sedimentary sequence is clearly very similar to that recorded in borehole logs 234 and 236 at the old Chelmsford Bypass. A date of 3360 ± 80BP was obtained for the detritus mud. Results from pollen and macrofossil analysis are given by Peglar and Wilson (1978).

The New Chelmsford Bypass

During construction work for this road in 1984–5, sections through valley sediments were exposed, and the opportunity was taken to record these sections and to obtain samples for radiocarbon dating and palaeoecological studies.

Chelmer Bridge (TL 74387 06547)

Following construction of the bridge abutments, a new river channel was dug, and it was possible to examine hurriedly the sections exposed in part of this channel during a short suspension of construction work. The deepest section of Holocene sediments (section 1) was visible at a point about 40m upstream from the south bridge abutment.

Section 1
(Fig. A1, D)

0–130cm	Yellowish-brown silty clay loam, becoming greyer and more mottled with depth; well developed sub-angular blocky peds; very rare rounded and sub-angular flints and quartz pebbles up to 2cm; very rare fragments of heat-shattered flint; fibrous roots and worm burrows, deceasing with depth; boundary merging over about 10cm.
130–185cm	Grey silty clay loam, yellowish brown on ped faces; weakly developed sub-angular blocky peds; stoneless; fine dark brown roots extending vertically; sharp boundary.
185–195cm	Detritus mud; very dark greyish brown organic silt loam paler and less organic at base; wood fragments fairly common in top 5cm, rarer below; rare charcoal fragments sharp boundary.

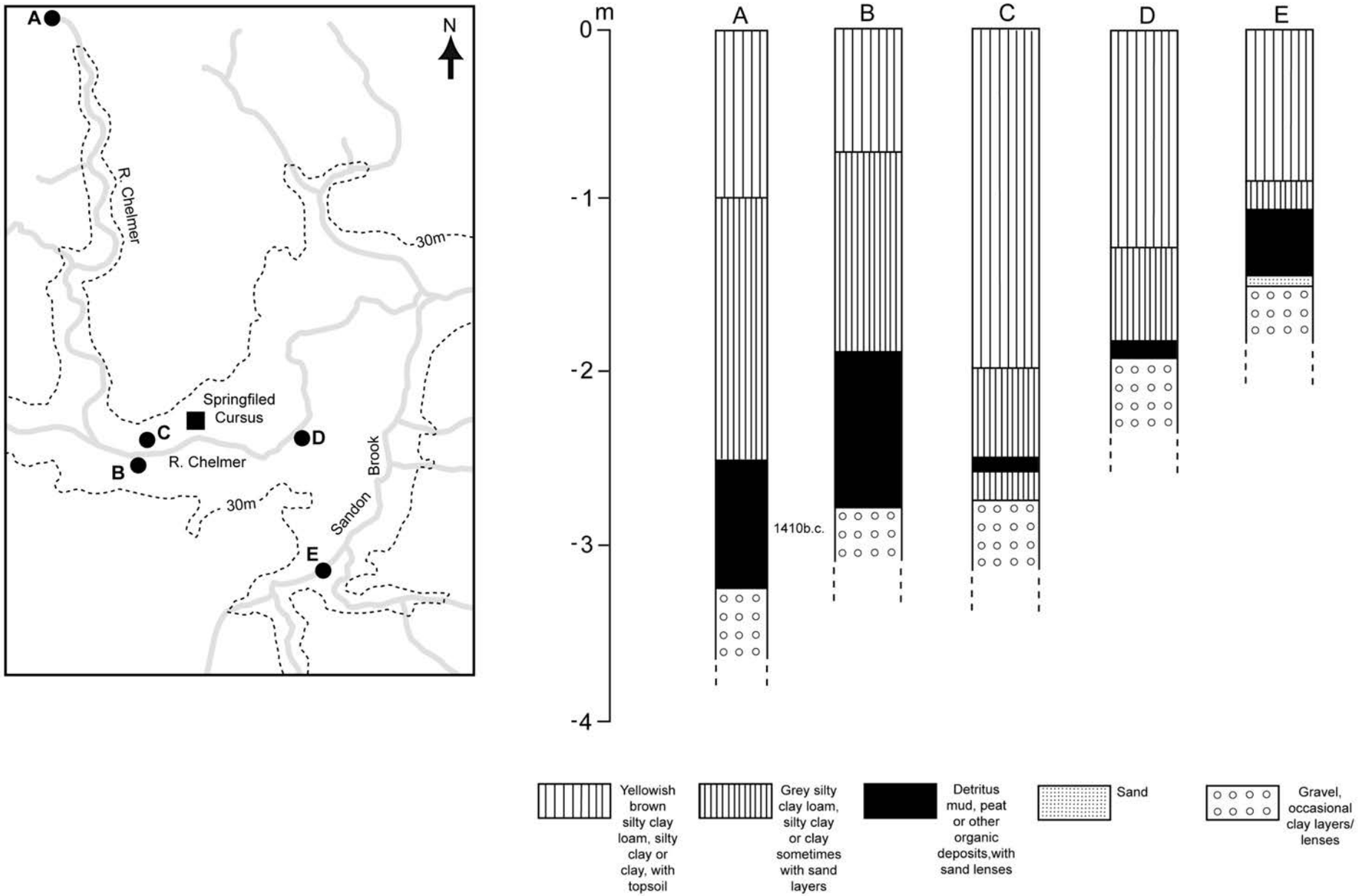


Figure A1 Valley sediments of the Chelmer and tributaries

a) Little Waltham (Peglar and Wilson 1978); b) Old Chelmsford Bypass. Borehole No.234 at TL 7199 0623; c) Old Chelmsford Bypass. Borehole No.236 at TL 7207 0631; d) Chelmer Bridge at TL 74700 04550; e) Sandon Culvert at TL 74700 04550. There is considerable lateral variation in the depth and character of the deposits depending upon the position of sections or boreholes with respect to in-filled channels, but these sections summarise typical sequences at each site

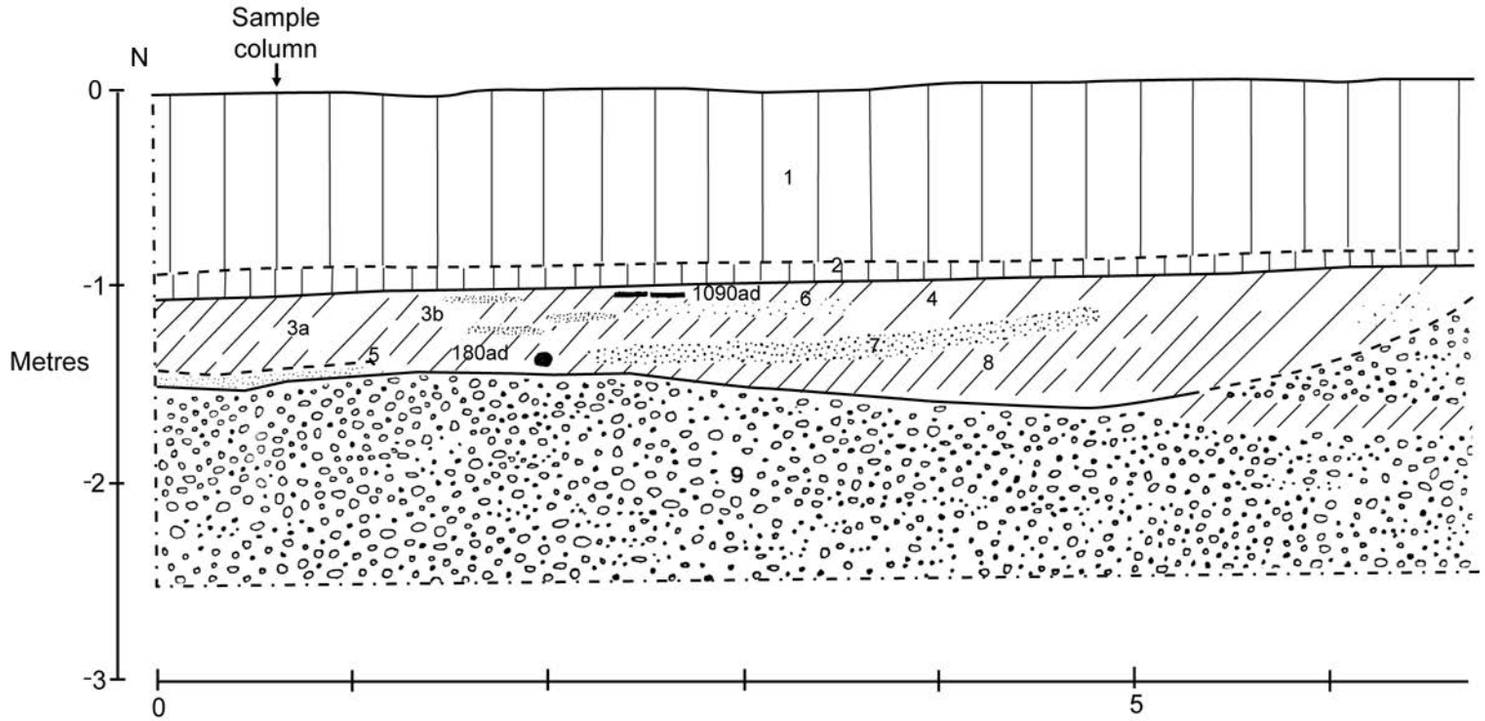


Figure A2 Measured sketch section across the Sandon Brook buried channel

195–230+ cm	Rounded to sub-angular flint gravel in grey coarse sand; moderately soft and loose some large woody roots penetrating from above.

From this point, the new channel had been dug for about 40m in the direction of the bridge abutments. The channel sides did not give a very clear section since they were cut at an angle of about 45 degrees and the faces were obscured by slipped material. Partial cleaning of the section revealed that the underlying gravel surface rose steadily towards the bridge so that just by the bridge abutments the lower grey silty clay loam and organic woody silt loam were absent, and the gravel was covered by only about 75cm of yellowish-brown silty clay loam. At a point about 25m from the Bridge the basal organic deposit was thicker and much woodier (section 2). This appeared to be laterally continuous with the detritus mud in section 1, though subsequent analysis of samples indicates that this impression was mistaken and it is probable that two non-contemporaneous infilled channels were, in fact, present.

Section 2 (recording only the lowest 40cm of the section)

0–10cm	Grey silty clay loam; weakly developed sub-angular blocky peds; almost stoneless; becoming more organic below; charcoal flecks; sharp boundary.
10–32cm	Detritus mud: very dark greyish-brown organic silt loam packed with wood fragments including branches up to *c*. 10cm diameter; sharp boundary.
32–40+ cm	Rounded to sub-angular flint gravel in grey coarse sand.

A sample of wood from the base of the detritus mud in section 2 was dated to 3710 ± 80BP (HAR-6682) and wood from the top of this deposit gave a date of 3200 ± 70BP (HAR-6683).

Sandon Culvert (TL 74700 04550)
(Fig. A1, E; Fig. A2)
This vertical section was exposed in the valley of Sandon Brook, a tributary of the Chelmer, at the site of excavations for a road culvert. A drawing of the section showing a profile across a buried channel is given in Fig. 2. The sediments at the edge of the channel, from which samples for palaeoecological studies were removed, were as follows:

0–90cm	Yellowish-brown silty clay loam; moderately developed sub-angular blocky peds; very rare flint pebbles; becoming greyer and more mottled with depth; worm burrows throughout; merging boundary.
90–105cm	Pale grey clay loam; very weak ped development; stoneless; rare orange mottles at top; sharp boundary.
105–143cm	Detritus mud; humic dark grey silt loam with some sand; abundant wood fragments and leaves, the wood lying horizontally; rare small charcoal fragments at base; merging boundary.
143–150cm	Dark grey medium coarse sand with patches of silt; poorly sorted; some wood fragments; sharp boundary.
150–250cm	Sub-angular to well-rounded flint gravels in orange and dark reddish-brown coarse sand; weakly stratified; moderately soft and loose.

A sample of wood from near the base of the detritus mud gave a radiocarbon date of 1770 ± 70BP (HAR-6580), whilst wood from near its top was dated to 860 ± 70BP (HAR-6570).

Plant macrofossils (Chelmer Bridge and Sandon Culvert)

Sampling and retrieval

Column samples, sub-divided usually at 5 or 10cm vertical intervals were collected for macrofossil analysis. The macrofossil samples, 0.5kg in weight, were disaggregated by soaking in water or NaOH solution as necessary and then graded in sieve banks with a minimum mesh of 250 microns. The sieved fractions were sorted under a binocular microscope at low power, picking out fruits, seeds, leaves, buds, twigs, mosses and charcoal. Insect remains and occasional small mammal teeth were also present. The fine fraction (500–250 microns) was not completely sorted but only scanned over: the only seeds present were of *Juncus* spp., for which counts were therefore not obtained. Plant remains identified are listed in Tables A1 and A2. Nomenclature has not been up-dated for this published report.

The Chelmer Bridge sections

The results from plant macrofossil analysis of the basal sediments (coarse woody detritus mud with overlying grey silty clay loam) in the infilled channel seen in section 2 at Chelmer Bridge are given in Table A1 and summarised in Fig. A3. Percentages of fruits and seeds of the more abundant taxa are plotted individually, but percentages of the more uncommon taxa are presented as ecological groups. Unidentified macrofossils and partly identified specimens of uncertain habitat are omitted. *Juncus* seeds were not counted and are thus not included. Wood from the base of the organic deposit yielded a radiocarbon date of 3710BP, whilst wood from its top surface was dated to 3200BP. It seems unlikely that the 22cm of woody detritus mud in this section represents continuous sedimentation over a 500 year period: the younger date may relate to renewed sedimentation after a period of non-deposition and/or erosion.

The macrofossil assemblage from the lowest 12cm of the woody detritus mud is dominated by fruits (and female 'cones') of alder (*Alnus glutinosa*), indicating the presence of fen alder woods fringing the channel from about 3710 BP. Ellenberg (1988, 277) lists character species for this type of woodland (*Alnetalia glutinosae*) and amongst these *Salix* sp. (willow), *Lycopus europaeus* (gipsywort) and *Solanum dulcamara* (woody nightshade) are represented as macrofossils in this or the overlying sample. Immature fruits of lime (*Tilia* sp.) make up 8.5% of the assemblage, and other woodland and scrub taxa (*Moehringia trinervia*, *Ilex aquifolium, Rubus fruiticosus, Prunus* sp., *Crataegus monogyna, Corylus avellana, Quercus* sp., *Salix* sp., *Sambucus nigra, Solanum dulcamara* comprise 4.4% in total.

Macrofossils of weed taxa and wetland/aquatic herbs are uncommon in the basal sample, but in the sample from 10–20cm these taxa increase markedly in abundance. *Alnus* fruits comprise only 12% of the assemblage, but Chenopodiaceae (*Atriplex* and *C.album*) rises to 32.8%, Other ruderals and segetals include *Rumex* spp., *Urtica dioica*, *Stellaria media*, *Polygonum aviculare*, *Solanum nigrum*, *Galeopsis* sp., *Plantago major*, *Lapsana communis*, *Sonchus oleraceus* and *Sonchus asper.*

The topmost sample from the silty clay loam at 0–10cm produced an assemblage in which weed taxa predominate. Again the main taxa are *Rumex* spp., *Urtica*

	Section 1			*Section 2*		
Depth (cm)	*180 – 185*	*185 – 190*	*190 – 195*	*0 – 10*	*10 – 20*	*20 – 32*
Ranunculus acris / repens / bulbosus	-	-	1	8	18	1
Ranunculus sceleratus L.	-	-	-	11	-	-
Ranunculus subgenus *Batrachium*	-	-	-	-	2	-
Thalictrum sp.	-	-	1	-	-	-
Chelidonium majus L.	1	-	-	-	-	-
Fumaria officinalis L.	-	-	-	1	-	-
Cruciferae indet.	-	-	-	2	-	-
Lychnis flos-cuculi L.	-	-	-	1fr	1fr	-
Stellaria media – type	-	-	-	10	46	-
Stellaria sp.	-	-	-	-	3	18
Moehringia trinervia (L) Clarv.	-	-	-	-	2	-
Caryophyllaceae indet.	-	-	-	-	2	1
Chenopodium album L.	-	-	-	33	140	3
Chenopodium sp.	-	-	-	2	-	-
Atriplex sp.	-	-	-	79	51	-
Chenopodiaceae indet.	-	-	-	69	44	-
Tilia sp. (immature fruits)	-	-	-	-	1	17+cf5
Ilex aquifolium L.	-	-	-	-	-	1
Rubus fruticosus agg.	-	-	-	-	1	-
Rubus sp.	-	-	-	1	-	-
Potentilla spp.	-	2	1	1	-	-
Aphanes arvensis L.	-	-	-	1	-	-
Prunus sp.	-	-	-	-	-	2
Crataegus monogyna Jacq.	-	-	-	-	2	2
Rosa – type (thorn)	-	-	-	-	-	+
Epilobium sp.	-	-	-	-	2	-
Berula erecta (Hudson) Coville.	-	-	-	-	1	-
Aethusa cynapium L.	-	-	-	1	-	-
Polygonum aviculare agg.	-	-	-	-	1	-
Polygonum sp(p).	-	-	-	2	13	3
Rumex (sp(p) (perianths absent or poor)	-	-	-	35+4cf	75	3
Urtica dioica L.	-	5	-	145	66	22
Alnus glutinosa (L) Gaertner (fruits)	-	-	-	-	86	148
A. glutinosa (‘cones)	-	-	-	-	10	40
Corylus avellana L.	-	-	-	-	+	1+
Quercus sp. (cupule frags)	-	-	-	-	-	1
Salix sp. (capsule frag)	-	-	-	-	-	1
Solanum dulcamara L.	-	-	-	-	1	-
Solanum nigrum L.	-	-	-	-	9	-
Solanum sp.	-	-	-	1fr	-	-
Mentha arvensis/aquatica	-	2	-	21	6	-
Lycopus europaeus L.	-	1	-	19	26	-
Prunella vulgaris L.	-	-	-	-	9	-
Stachys sp.	-	-	-	1	2	-
Lamium.cf. album L.	-	-	-	1	-	-
Lamium sp.	-	-	-	-	1cf	-
Galeopsis tetrahit/speciosa	-	-	-	2fr	3	3
Ajuga sp.	-	-	-	-	1fr	-
Plantago major L.	-	-	-	1	4	-
Sambucus nigra L.	-	-	-	5	4	4
Lapsana communis L.	-	-	-	-	1	-
Cirsium/Carduus sp.	-	1	-	1	4	-
Sonchus oleraceus L.	-	-	-	-	3	-
Sonchus asper (L) Hill.	-	-	-	-	2	-
Compositae indet.	-	-	-	-	2	-
Alisma plantago-aquatica L.	-	-	-	22	56	2

Alismataceae indet.	-	-	-	18	5	-
Juncus spp.	-	-	-	+	+	+
Sparganium sp.	-	-	-	1	-	-
Elocharis uniglumis/palustris	-	-	-	2	-	-
Carex spp.	-	17	38	5	6	4
Cladium mariscus (L) Pohl.	-	-	-	-	-	2cf
Scirpus sp.	-	1	1	-	-	-
Charcoal	-	+	-	+	-	-
Twigs/wood	+	+	+	+	+	+
Buds/bud scales	-	-	+	-	+	+
Leaf fragments	-	-	-	-	+	+
Thorns	-	-	-	-	+	+
Indeterminate seeds etc.	-	16	10	7	14	25

Unless otherwise indicated taxa are represented by fruits or seeds. Nomenclature and taxonomic order after Clapham et al 1962. Further samples from Section 1 contained only the following plant remains: 195 – 200cm. wood fragments; 170 – 180cm. wood fragments, bud-scale fragments, charcoal; 160 – 170cm. charcoal.

Table A1 Plant macrofossils from Sections 1 and 2 at the Chelmer Bridge

dioica, Chenopodiaceae and *Stellaria media* with occasional seeds of *Fumaria officinalis*, *Alphanes arvensis*, *Aethusa cynapium*, *Lamium* sp., *Galeopsis* sp., and *Plantago major. Alnus* fruits are absent but wetland and grassland herbs occur at relatively low frequencies. The sample contains charcoal fragments. The abundance of *Urtica dioica* and the appearance of *Ranunculus sceleratus* imply damp, open, nutrient-rich conditions in this part of the valley from 3200BP.

These three samples clearly indicate a major change in local vegetation between 3710BP and post-3200BP, from a cover of fen alder woodland to open vegetation with a high proportion of weeds. Interpreting a change of this type is problematical, for local vegetation change could have been brought about by channel migration or by human activity, Given the presence of charcoal in the topmost sample, and the proximity of a major Late Bronze Age settlement with radiocarbon dates for its earlier phases in the range 2830-2780BP, it seems reasonable to suggest that the vegetation changes registered in this section are related to more intensive use of the valley floor for grazing *etc*. in the Bronze Age.

The organic deposits sampled in section 1 were believed, in the field, to be continuous with those in section 2, but analysis of macrofossils and pollen (see below) indicates that these deposits differ significantly both in lithology and their biota. They are therefore thought to be sediments infilling another, non-contemporaneous but undated channel. Macrofossils were sparse and poorly preserved, but include *Carex* nutlets with occasional fruits and seeds of wetland, grassland and weed taxa.

The Sandon Culvert section

Fig. A4 summarises the results of plant macrofossil analysis of samples from the infilled channel at this site and a full species list is given in Table A2. Again, percentages of fruits and seeds of the most abundant taxa are plotted individually, other taxa being shown as broad ecological groups.

The sediments in the channel seen at the Sandon Culvert included similar detritus muds to those at Chelmer Bridge but also some sandy sediments, implying intermittent stream flow as the channel became infilled. The samples from this site produced richer assemblages than those from the Chelmer Bridge and this might be related to these different conditions of deposition. Alternatively valley size might be relevant: in a small valley, the seed catchment area is likely to have included a more diverse range of habitats than a similarly-sized catchment in a large valley with an extensive floodplain.

Wood, twigs, leaf fragments, buds and bud-scales were abundant in the detritus mud in the Sandon Culvert channel and fruits and seeds of woodland, scrub and hedgerow plants were identified. Taxa present include *Moehringia trinervia* (three-nerved sandwort), *Acer campestre (field maple), Rubus fruticosus* (bramble), *Rubus idaeus* (raspberry), *Prunus spinosa* (sloe), *P.domestica* subsp. *Insititia* (bullace), *Crataegus monogyna* (hawthorn), *Thelycrania sanguinea* (dogwood), *Anthriscus sylvestria* (cow parsley), *Mercurialis perennis* (dog's mercury), *Corylus avellana* (hazel), *Quercus* sp. (oak), *Salix* sp. (willow/sallow), *Solanum dulcamara* (bittersweet) and *Sambucus nigra* (elder). It appears that the macrofossils in this deposit are derived from at least two types of vegetation. The remains of *Salix* spp. probably came from willows and sallows growing in the valley floor in the immediate vicinity: *Salix caprea, cinerea, fragilis* and *purpurea* nowadays rapidly colonise wet valley floor sites unless artificially cleared (Jermyn 1974, 40). *Acer campestre, Thelycrania sanguinea* and *Mercuriallis perennis* are particularly characteristic of well-drained calcareous soils (Clapham *et al.* 1962) and the remains of these plants are likely to have been dispersed from woodland or possibly hedgerows at dry sites on the flanks of the valley.

Despite this diverse range of tree, shrub and woodland herb taxa, macrofossils of woodland plants are not numerically abundant in these samples, and *Alnus* is, surprisingly, not represented. Evidently conditions were fairly open in the vicinity throughout the infilling of the channel from 1770 to 860BP.

Wetland and aquatic taxa are well represented, and it seems possible that the relatively wide range of taxa

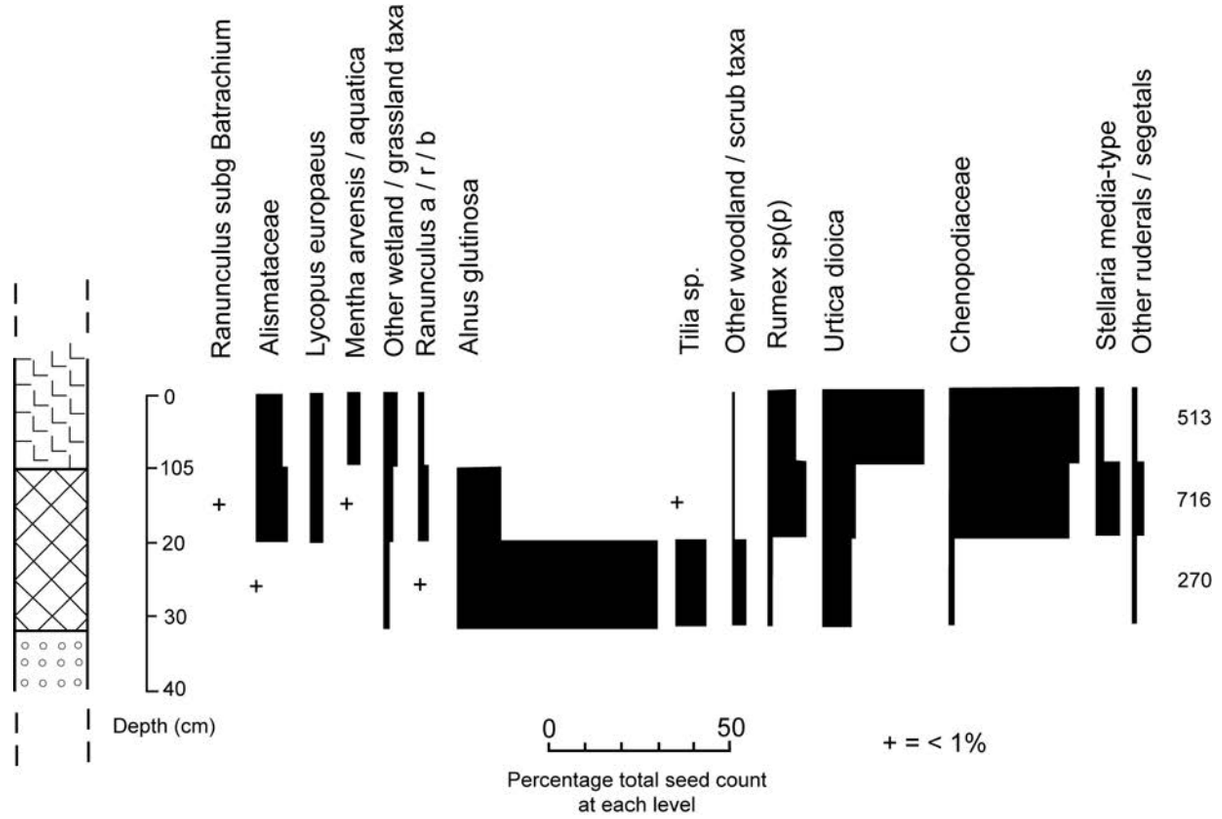


Figure A3 Chelmer Bridge (Section 2). Plant macrofossils (summary diagram)

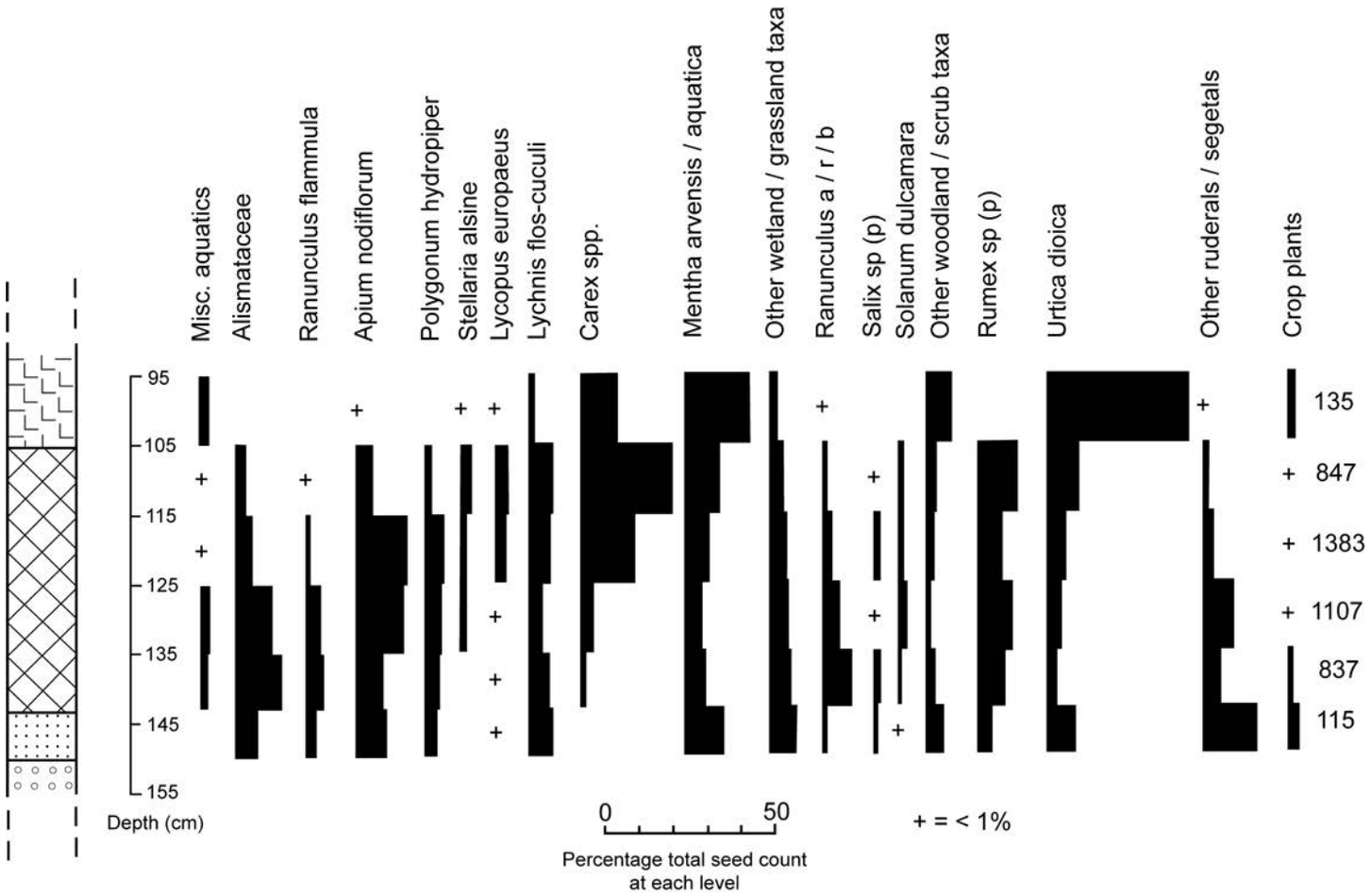


Figure A4 Sandon Culvert. Plant macrofossils (summary diagram)

	Section 1		Section 2			
Depth (cm)	*95 – 105*	*105 – 115*	*115 – 125*	*125 – 135*	*135 – 143*	*143 – 150*
Ranunculus acris/repens/bulbosus	1	11	33	56	71	2
Ranunculus flammula L.	-	7	15+CF7	48	56	4
Ranunculus sceleratus L.	-	1	1	-	-	-
Ranunculus subg. *Batrachium*	1	1	3	6	5	-
cf. Nymphaeaceae	-	-	-	-	1	-
Fumaria officinalis L.	-	-	-	2	-	-
Rorippa cf. microphylla (Boenn) Hyl.	-	-	1	3	-	-
Viola sp.	2	-	-	1	-	-
Hypericum sp.	6	4	3	1	1	1
Silene sp.	-	-	1	-	-	-
Lychnis flos-cuculi L.	2	58	88	37	46	8
Stellaria plulstris/graminea	-	-	3	6	2	-
Stellaria cf. holostea L.	-	-	-	7	4	-
Stellaria alsine Grimm.	1	28	22	19	-	-
Stellaria sp.	-	3	7	4	8	1
Moehringia trinervia (L) Clair	-	-	1	-	1	-
Caryophyllaceae indet	-	-	-	-	2	-
Montia fontana L. subsp. *chondrosperma*	-	1	4	5	4	2
Chenopodium album L.	-	-	12	18	8	1
Atriplex sp.	-	5	5	9	6	3
Chenopodiaceae indet.	-	2	3	7	5	2
Malva sp.	-	-	-	1	-	-
Linum usitatissimum L (capsule frag)	-	+	-	-	-	-
Acer campestre L.	-	9	9	-	-	-
Filipedula ulmaria (L) Maxim	-	4	34	13	7	3
Rubus fruticosus agg.	9	4	-	3	7	-
Rubus idaeus L.	1	-	-	-	-	-
Rubus sp.	-	-	fr	-	-	-
Potentilla erecta (L) Raüschel.	-	-	-	2cf	1	-
Potentilla reptans L.	-	-	3	3	1	-
Potentilla sp.	-	1	4	4	1	-
Aphanes arvensis L.	-	-	-	2	1	1
Aphanes cf. *microcarpa* (Boiss + Reuter) Rothm.	-	1	2	6	5	-
Prunus spinosa L.	-	-	1+fr	fr	1	-
Prunus domestica subsp. *insitittia*	-	-	-	-	1	-
Crataegus monogyna *jacq.*	-	fr	2+fr	-	1+fr	2
Rosaceae indet. (thorn)	-	+	-	+	+	-
Epilobium sp.	-	3	37+3cf	33	30	2
*Thelycrania sanguinea (*L) Fourr.	-	4+fr	2+fr	2	-	-
Anthriscus sylvestris (L) Hoffm.	-	1	-	-	-	-
Apium nodiflorum (L) Lag.	1	41	202	153	66	10
cf. *Berula erecta* (Hudson) Coville.	-	2	4	-	-	-
Oenanthe aquatica (L) Poiret.	=	=	=	=	1	-
Oenanthe sp.	-	-	-	5	4	-
Umbelliferae indet.	-	2	4	3	-	-
Mercurialis perennis L.	-	1	-	-	-	-
Polygonum aviculare agg.	-	-	1	17	5	3
Polygonum hydropiper L.	-	13cf	9+57cf	6+43cfr	2+32cf	4cf
Polygonum lapathifolium L.	-	-	-	1	-	-
Rumex acetosella agg.	-	-	-	1	4	-
Rumex sp.	-	101	99	112	70	5
Urtica urens L.	-	-	1	1	-	-
Urtica dioica L.	56	84	83	45	24	10
Corylus avellana L.	-	+	+	-	-	-
Quercus sp.1 (cupule frags)	-	+	+	+	-	-
Quercus sp. (leaf frags)	-	+	+	-	-	-
Salix *sp. (capsules/frags)*	-	1	21	10	16	2
cf. *Anagallis arvensis* L.	-	-	-	-	1	-
Boraginaceae indet.	-	-	2	-	-	-
Solanum dulcamaraU L.	-	15	24	22	10	1
Linaria vulgaris Miller	-	-	-	1	-	-
Scrophularia sp.	1	-	-	-	-	1
Rhinanthus minor L.	-	1	-	-	-	-
Mentha arvensis/aquatica	26	87	105	63	50	13
Lycopus europaeus L.	1	33	49	9	5	1
Prunella vulgaris L.	-	1	-	5	12	-

Stachys sp.	-	5	4	3	3	-
Galeopsis – tetrahit/speciosa	-	1	5	2	1	-
Scutellaria sp.	-	-	1	-	3	-
Labiatae indet	-	4	2	-	-	-
Plantago major L.	1	4	5	9	1	-
Galium sp.	-	-	-	1	3	-
Sambucus nigra	1	2	14	10	11	4+fr
Bidens cernua	-	-	3	2	3	-
Bidens tripartita L.	-	1	-	-	-	-
Eupatorium cannabinum L.	-	5	3	-	-	-
Anthemis cotula L.	-	2	3	19	2	8
Cirsium/Carduus sp.	-	4	5	8	13	1
Lapsana communis L.	-	-	2	-	2	-
Sonchus asper (L) Hill.	-	-	-	8	3	1
Compositae indet.	-	-	2	3	7	-
Alisma plantago-aquatica L.	-	6	42	101	97	6
Alismataceae indet. (embryos)	-	17	16	12	13	1
Potamogetonaceae indet.	-	1	7	10	9	-
Juncus spp.	+	+	+	+	+	+
Iris pseudacorus L.	frag(?)	fr	fr	-	-	-
Lemna sp.	3	3	3	1	-	-
Sparganium sp.	-	9	6	8	9	2
Typha sp.	2	6	4	1	1	-
Eleocharis uniglumis/palustris	-	-	10	20	12	-
Isolepis setacea (L) R.Br.	-	-	-	-	-	1
Carex spp.	14	219	220	43	14	-
Gramineae indet.	-	-	8	16	20	-
Cereal indet.*	1	1	-	-	2	-
Triticum sp.*	1	-	1	-	-	-
Triticum spelta L. (glume base)*	1	2	1	4	4	2
Triticum spelta L. (spikelet fork)*	-	-	-	-	1	-
Triticum spelta L. (rachis internode)*	-	1	-	-	1	-
Triticum sp. (glume base)*	1	1	-	2	-	1
Triticum sp. (spikelet base)*	-	-	-	-	4	1
Avena sp. (Awn fragment)*	-	-	-	-	+	-
Bromus sp.*	-	-	-	-	1	-
Charcoal*	+	+	++	+++	++	+
Twigs/wood	+	+++	+++	+++	+++	+
Buds/bud-scales	-	+++	+++	+++	+++	+
Leaf fragments	-	++	++	++	++	+
Indeterminate seeds etc.	2	21	47	28	22	5
Total 'seed' count	135	847	1383	1107	837	115

Unless otherwise indicated taxa are represented by fruits or seeds. Carbonised specimens are marked with an asterisk. Nomenclature and taxonomic order after Clapham *et a*l. (1962)

Table A2 Plant macrofossils from the Sandon Culvert section

compared to that from the Chelmer Bridge is related to active stream flow at this site. Taxa identified include *Ranunculus flammula* (lesser spearwort), *Ranunculus sceleratus* (celery-leaved crowfoot), *Ranunculus* subg. *Batrachium (crowfoot), Rorippa cf.* microphylla *(watercress) Hypericum* sp. (St John's wort), *Lychnis flos-cuculi* (ragged robin), *Stellaria alsine* (bog stitchwort), *Montia fontana* (blinks), *Filipendula ulmaria* (meadowsweet), *Epilobium* sp. (willow hereb), *Apium nodiflorum* (fool's watercress), *Oenanthe* spp. (water dropworts), *Polygonum hydropiper* (water pepper), *Rhinanthus minor* (yellow rattle), *Mentha arvensis/ aquatica* (probably water mint), *Lycopus europaeus* (gipsywort), *Scutellaria* sp. (skullcap), *Bidens cernua* and *B. tripartita* (bur marigold), *Eupatorium cannabinum* (hemp agrimony), *Alisma plantago-aquatica* (water plantain), Potamogetonaceae (pond weeds), *Juncus* spp. (rushes), *Iris pseudacorus* (yellow flag), *Lemna* sp. (chickweed), *Sparganium* sp. (bur-reed), *Typha* sp. (reed-mace), *Eleocharis palustris/uniglumis (*spike-rush) *Isolepis setacea* (bristle scirpus), *Carex* spp. (sedges). At 135–143cm fruits of Alismataceae account for 13.1% of the total 'seed' count but above this decline steadily in frequency: at 125–135cm 10.2%, at 115–126cm 4.2% and at 105–115cm 2.7%. This seems to indicate that local conditions became progressively drier as the channel became infilled with mineral sediment and plant debris. Concurrently increasing frequencies of *Carex* spp. indicate development of mixed sedge fen.

Grassland plants identified are *Ranunculus acris/repens/bulbosus* (buttercups), *Potentilla reptans* (creeping cinquefoil), *Potentilla erecta* (tormentil), *Linaria vulgaris* (toadflax) and *Prunella vulgaris* (self-heal),

Fruits and seeds of weeds occur throughout the deposits, colonising in part natural disturbed habitats produced by river action. *Urtica dioica* is relatively most

abundant in the mineral sediments overlying the organic detritus muds, as in the Chelmer Bridge section.

The remains of crop plants are of particular interest. Carbonised grains and spikelet fragments of spelt (*Triticum spelta*) were found in all the samples, and remains of oats (*Avena* sp.) occurred near the base of the sequence. The sample from 105–115cm included a capsule fragment of flax (*Linum usitatissimum*). Charcoal fragments were present in all samples. These crop plant remains clearly indicate cultivation within the catchment, apparently continuously from l770BP to 860BP.

In summary, these results indicate persistence of locally open conditions from the Roman to Late Saxon periods, with no evidence for extensive colonisation of the valley floor by willows or sallows. Remains of cereals and flax indicate apparently continuous arable farming throughout this period.

Microscopic analysis of sediments from the Chelmer Bridge section

Introduction

A monolith of 30cm length (from 165–195cm) was taken from section 1 for palynological investigation. Samples were not taken from section 2, which was then thought to be laterally continuous with section 1, because the large pieces of wood in the coarse detritus mud in section 2 made the insertion of a monolith tin or the collection of pollen samples at closer intervals virtually impossible.

Methods

Samples were taken at 2.0cm intervals and the matrix removed by standard techniques (acetolysis and hydrofluoric acid treatment). The concentrated remains were stained with safranin and mounted in glycerol jelly. Two slides were made for every sample and the total area of each slide was scanned for pollen, spores, charcoal and microbial remains. No attempt was made to quantify the findings.

Results

The results are shown in Table A3. Pollen was absent in many of the samples and, even where present, was in a very poor state of preservation so that very few grains could be identified with any degree of confidence. The only grains which were present consistently in the fossiliferous samples were those of *Pinus* and Cyperaceae.

There was a marked change in the microfossil content of the sediments at 180cm; to the naked eye, there was little, if any, difference between the sediment at this depth and those above. However, this depth was probably part of the transition from silty clay to the detritus mud.

The sediments from 166–178cm were devoid of pollen although bacterial filaments were present. Angular charcoal fragments were also sparse but iron sulphide framboids were relatively abundant, especially in levels 176 and 178cm.

Pollen and fungal remains were confined to, and charcoal was more abundant at, between 180–195cm — in other words to the detritus mud and in its transition to the upper, silty clay.

Discussion

With such paucity of evidence, it is very difficult to draw any detailed conclusions as to the environment represented by these sediments. However, there are some points of interest in the findings. There was obviously a sudden and marked change in the pattern of sedimentation above 180cm and the distribution of microfossils shows this quite clearly.

The bacterial filaments were probably of Cyanobacteria and/or a '*Sphaerotilus*' type bacterium. Cyanobacteria are not dependent upon an external source of carbon but respond markedly to mineral eutrophication, and they are often abundant on the surface of muds prone to periodic drying. *Sphaerotilus* type bacteria respond to carbon eutrophication.

The hyphae of both Oomycota and Ascomycota were abundant in the detritus mud at the base of the section. These fungi may have been aquatic forms and, indeed, the elongated and curved spores which are characteristic of aquatic hyphomycetes were in evidence (Webster and Descals 1981). These fungi are usually to be found on decaying plant litter, and large numbers are often found where there is a high input of leaves and seeds to a body of water.

Some species also require a considerable flow of water before sporulation will occur so that the presence of their spores might indicate a considerable throughput of water during the period of deposition of the detritus mud. A periodic flow of water might, at least in part, be an explanation for the paucity of both microfossils and macrofossils in the sediments from section 1.

The presence of iron sulphide framboids indicates that the deposit was highly anaerobic and that matrical iron was finding its way into the sediments. The source is often iron-rich soil (Wiltshire *et al.* 1994). Framboids are often found in the deep muds of slow-moving bodies of water, ponds, and water holes. Their presence often indicates inwash of ferruginous soil into a deposit and a very low redox potential. The charred fragments in the basal deposits were probably derived from local fires in the environs of the site.

The pollen assemblage presented in Table 3 is rather peculiar, probably because of the periodic flooding and inwashed soil which could bring pollen from a number of origins. It is, of course, also possible that the pollen had been secondarily derived, or redeposited.

Pinus (pine) and Cyperaceae (sedges) were the only plants to be recorded consistently in the detritus mud. The consistent presence of pine in all the palyniferous levels leads to the conclusion that there were pine trees growing within a few miles of the site. Long distance transport is usually indicated by the occasional pollen grain whilst, in these sediments, pine was certainly one of the most abundant to be found. Macrofossils of *Alnus* (alder) were abundant at the base of section 2 whilst no alder pollen was found in the areas of section 1 (see above). This presents a dilemma since alder pollen is produced in vast quantities, is exceedingly distinctive and is relatively resistant to decay. So, even though the fossil evidence from section 1 is poor, one might expect to find at least some alder pollen deposited from an alder carr only 40m downstream. If periodic flooding did indeed occur, one would expect flood water mingling with that upstream, carrying alder pollen with it and depositing at least some grains in the sediments of section 1.

Depth (cm)	*166*	*168*	*170*	*172*	*174*	*176*	*178*	*180*	*182*	*184*	*186*	*188*	*190*	*192*	*194*
Stratigraphy															
Grey Silty Clay	+	+	+	+	+	+	+	+							
Transition Layer									+						
Black Detritus Mud										+	+	+	+		
Humic Clay														+	+
Pollen & spores															
Betula														+	
Pinus								+	+	+	+	+	+	+	+
Salix								+					+		
Prunus-type											+				
Cyperaceae								+	+	+	+	+	+	+	
Poaceae								+	+		+			+	
Filipendula								+			+				
Caryophyllaceae												+			
Geranium												+			
Asteraceae (fenestrate)								+							
Filicales indet							+	+							
Other Pollen (decayed)								+	+	+	+	+	+	+	
Microbes															
Bacterial Filaments	+	+	+	+	+	+	+	+	+	+	+				+
Oomycota									+	+	1	2	3	2	+
Ascomycota										+	1	2	3	2	+
Carbonised fragments	+	+	+	+	+	+	+	+	+	+	3	3	3	2	2
Iron pyrites framboids	+	+	+	+	+	1	2	2	1	1	2	3	2	2	3

+ = Present
1 = Frequent
2 = Abundant
3 = Very Abundant

Table A3 Palynomorphs

What is very obvious from the data presented here is that some agency, possibly local clearance, caused erosion and the deposition of minerogenic material over the detritus mud. If the framboids are indicative of flooding, then the site continued to be periodically inundated for some time, the surface clay being colonised by the filamentous bacteria described above.

The base of the detritus mud at section 2 was dated to 3710BP and the top dated to 3200BP, and a change from alder woodland to an open, weed-dominated habitat after about 3200BP is thought to be related to the establishment of the Late Bronze Age enclosure at Springfield Lyons.

The results in this report suggest that some agency caused soil erosion and that the site was kept open, probably by grazing. The latter might be indicated by the very obvious presence of the filamentous bacteria in the silty clay since, if heavy grazing did persist near to the channel, there is every chance of the sediments and any standing water becoming polluted with animal excreta. This would enhance both the bacterial forms mentioned above. But the original interpretation of the field evidence now needs to be modified. There is no doubt that the pattern of events at section 1 reflect those of section 2 but the consistent presence of pine pollen and the complete absence of alder would suggest that the deposits from section 1 are not contemporaneous with those of section 2. Furthermore, it is exceedingly difficult to ascertain which is the earlier.

Conclusions

The sediments analysed here show evidence of human activity throughout. The site appears to have been an abandoned river channel which was prone to periodic inundation and which received considerable amounts of plant debris, as evidenced from the microbial remains. The lack of preservation of plant remains might have been due to a scouring effect of flood water.

A sudden change in the environment is evidenced by the deposition of silty clay over the detritus mud containing the pollen, fungal and most abundant charcoal remains. This would indicate soil erosion through some form of land management. However, the presence of abundant iron sulphide framboids indicate that there had also been some soil erosion in the period when the basal deposits were accumulating. However, it would appear that the sediments in section 1 are not contemporaneous with those of section 2 so that the events recorded here may not be related to the establishment of the Late Bronze-Age enclosure at Springfield Lyons. It is not possible to determine the relative age of the sediments at section 1 from the evidence presented here.

General conclusions

The sediments seen in these two sections relate to phases of channel silting, followed by more extensive deposition of fine mineral alluvium, probably deposited by overbank flooding, once a simplified channel pattern was established. Radiocarbon dates on organic channel fills from the Chelmer Valley are 3360BP at Little Waltham and 3710BP–3200BP at the Chelmer Bridge. The channel at the Sandon Culvert was infilled much later, between 1770 and 860BP.

In a geological sense the alluvium and sub-alluvial gravels belong to the same cycle of sedimentation, beginning in the Devensian and continuing into the Flandrian (Bristow 1985, 69) but there is a clear discontinuity in deposition between these two sedimentary units. At the Sandon Culvert the proximity of the lower radiocarbon sample to the top of the valley gravels indicates phases of non-deposition between early Holocene times and the Roman period. This may have resulted from intermittent through-flow of water along the valley, with sediments being carried downstream. Alternatively, the absence in this section of earlier deposits can be accounted for by the accretion of sediments within a laterally moving river channel or channels.

There is no evidence that early prehistoric land use had a significant effect on the hydrological and alluvial regimes of the catchment. Although the existence of the cursus clearly indicates some extensive and long-lived clearances, there are grounds for suspecting that Neolithic activity was concentrated on the gravel terraces, and, as Robinson and Lambrick (1984, 4) note, arable farming on flat and freely-draining terrace soils would not have resulted in a significant increase in the sediment load of streams.

The sections described in this report give no indication of valley-floor water-table levels in the Neolithic, though in the Crouch and Blackwater estuaries buried soils and Mesolithic–Neolithic settlements pre-dating the local marine transgression have been recorded from coastal sections at low elevations (around the 0m contour) close to valley axes (Wilkinson and Murphy 1986). It is reasonable to suppose that water-table levels were similarly low further upstream in the Chelmer Valley close to the cursus. However, since exposures of sub-alluvial deposits in this area are ephemeral and on a small scale the chance of detecting any early prehistoric settlement evidence in the valley floor is slight.

The results from macrofossil analysis at the Chelmer Bridge indicate that at 3710BP the valley floor was covered locally by fen alder woods with evidence for mixed deciduous woodland in dryer locations. Pollen analysis was unfortunately not informative at this site, though at Little Waltham an organic channel fill dated to 3360BP produced a pollen spectrum with 21.6% *Alnus* pollen, 35.6% Poaceae, 6.0% Cyperaceae and 4.2% *Plantago lanceolata* implying localised fen woods in the valley floor, with a generally open surrounding landscape. After 3200BP the Chelmer Bridge channel had largely silted up and local vegetation was open and dominated by weeds. This is thought to be related to more intensive use of the valley floor during the Bronze Age. Deposition of extensive areas of mineral alluvium as a result of over-bank flooding began after 3200BP.

The Sandon Culvert section exposed organic channel fills deposited during the Roman and Saxon periods. There is no evidence for any post-Roman regeneration of willow or alder carr in this valley floor and remains of crop plants are consistently present in the deposits. This seems to imply continuous agriculture within the catchment of this small stream.

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