Investigation of the Lower and Middle Wentlooge Formation, and further excavation of a later Romano-British farmstead at Henbury Level (Plot 5000, Western Approaches Distribution Park, Avonmouth, South Gloucestershire)

Integrated Site Report

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The project was managed for OA by Stuart Foreman. The fieldwork was carried out by Paul Murray with the assistance of Hefin Meara, Chris Richardson and Tom Davies, who remained positive and produced excellent results under very wet and difficult conditions. This report was produced by Carl Champness. It summarises, and quotes freely from, the following specialist reports which are available in the site archive: Roman pottery by Edward Biddulph; Metalwork and glass by Ian Miller; Fired clay by Cynthia Poole; Worked stone by Ruth Shaffrey; Animal bone by Lena Strid; Fish, small mammal and amphibian remains by Rebecca A Nicholson; Charred and waterlogged plant remains by Wendy Smith; Microfossils by John E Whittaker; Pollen and Diatoms by Andrew Haggart; Insects by David Smith; and The sedimentary sequence by Richard Macphail. The illustrations were produced by Julia Moxham. The report was edited by Chris Hayden.

SUMMARY

In 2007 Oxford Archaeology carried out a staged field investigation at Plot 5000 of the Avonmouth Western Approaches Distribution Park on behalf of Gazeley UK Ltd, through the agency of CgMs/John Samuels Archaeological Consultants in relation to a planning application for warehouse development, associated offices and car parking facilities.

The development area is located within the Avonmouth Levels, a former salt marsh reclaimed from the sea, which contains a deep sequence of post-glacial alluvial deposits known as the Wentlooge Formation. The excavation of the site consisted of a twenty trench evaluation, targeted excavation of the densest concentration of archaeological features, and an investigation of the underlying alluvial sequence.

The investigation of the Wentlooge Sequence identified a northeast to southwest aligned ridge in the Mudstone bedrock underlying Plot 5000, the surface of which drops sharply to the southeast. The deposits in the depression formed by the Mudstone evidence outer estuarine influence and episodes of peat formation, and may have formed in a backwater channel or lagoon that was occasionally cut off from the tide. While the upper part of the sequence in Plot 5000 appears to similar to that which has already been investigated in Plot 4000, the lower part provides a new sequence through the Lower Wentlooge Formation which has not been recorded to a comparable depth within the Distribution Park. These lower deposits record a sequence of earlier Holocene hydrological and sedimentary change which extends beyond the depths reached in Plot 4000.

Plot 5000 lies close to Plot 4000 where Romano-British settlement has been identified by Wessex Archaeology. The excavations in Plot 5000 uncovered a series of interconnecting coaxial enclosures and droveways dating to the mid-late Roman period (2nd to 4th century AD), probably forming part of a permanent settlement. Several phases of enclosure suggest that this was part of a managed landscape that saw frequent periods of reorganisation, perhaps in response to environmental and sedimentary change. No clear structural evidence was identified in Plot 5000, and it seems likely that the remains in this area were related to the settlement identified in Plot 4000.

Environmental and sedimentary evidence from the Roman ditches indicates brackish conditions within an open landscape. The environmental indicators suggest a gradual transition from a high salt marsh to a slightly drier and more open environment on an alluvial island within the Levels. The Roman drainage of the site would appear to have been successful, but the area may still have been prone to flooding. The presence of domestic refuse, including crop processing waste and pottery, indicate that the site was predominantly dry, and more than just a seasonal pastoral settlement.

The archaeology recorded at the site adds to the growing body of evidence for Romano-British rural settlement on the Avonmouth Levels. Although the evidence from Plot 5000 provides no conclusive evidence for systematic reclamation in this part of the Levels, the appearance of permanent settlements on the Levels demonstrates that drainage and settlement did occur in the later Roman period. Such settlement could, however, have been opportunistic, and was probably dependent upon local hydrological conditions. It may also have been assisted by a slow down in the rate of sea-level rise during this period. The changes evidenced in Plot 5000 formed part of a process of modification and transformation of the Levels that was played out in many regions of the Severn Estuary.

Investigation of the Lower and Middle Wentlooge Formation, and further excavation of a later Romano-British farmstead at Henbury Level (Plot 5000, Western Approaches Distribution Park, Avonmouth, South Gloucestershire)

by Carl Champness, based upon reports by Edward Biddulph, Andrew Haggart, Richard Macphail, Ian Miller, Rebecca A Nicholson, Cynthia Poole, Ruth Shaffrey, David Smith, Wendy Smith, Lena Strid, John E Whittaker

INTRODUCTION

In 2007 Oxford Archaeology (OA) carried out archaeological investigations on behalf of Gazeley UK Ltd, through the agency of CgMs/John Samuels Archaeological Consultants in Plot 5000 of the Western Distribution Park, Avonmouth (Figs 1 and 2). The excavations were to mitigate the footprint of a proposed warehouse building and associated offices and car parking facilities.

The excavation consisted of twenty evaluation trenches (Fig. 3), targeted excavation of a dense concentration of archaeological features (Fig. 3), and geoarchaeological borehole survey (Fig. 4) to investigate the Wentlooge Sequence. Plot 5000 was considered to have high archaeological potential because of its proximity to Plot 4000, where Romano-British settlement had recently been identified (Wessex Archaeology 2008).

The evaluation revealed ditches and gullies forming enclosures and trackways which were focused on an alluvial island. A significant quantity of finds dating to the later Romano-British period (2nd to 4th century AD) was recovered. Roman pits and ditches were also found in other areas. Two areas were defined (Areas 1 and 2) which contained the densest concentrations of archaeological features.

The subsequent excavations of these two areas revealed a focus of Romano-British activity in the north central area of Plot 5000 (Fig. 3), defined by a concentration of ditches forming a series of small rectilinear enclosures which date from the mid to late Romano-British period. It seems likely that these enclosures were related to the settlement identified in the excavations in Plot 4000 (Wessex Archaeology 2008).

The work was carried out in accordance with a specification prepared by the client's consultant, Simon Mortimer (JSAC 2006), which had been approved by the South Gloucestershire Archaeology and Conservation Officer, D Haigh.

Site location and topography

The site lies on Henbury Level (part of the Avonmouth Levels), 0.75 km from the Severn Channel (Figs 1 and 2; NGR 5499 8348, at 6 m OD). Plot 5000 covers 6.37 ha. The combined footprint of the new warehouse and offices covers 32,535 m^2, the remainder (31,164 m^2) being taken up by car parks. The area is generally flat, with just 0.35 m between the highest and lowest points.

The solid geology consists of Triassic marl - Mercia Mudstone (Geological Survey of Great Britain 1981) which is overlain by marine alluvium and gravel and a band of post-glacial alluvial deposits known as the Wentlooge Formation.

The site is located on estuarine alluvium, covered with sandy silt subsoil and silty sand topsoil. Much of the southeast of the site was marshland under grass and reeds. The south of the site was extensively overgrown with brambles. The east was scrub littered with abandoned vehicles. The north was extensively disturbed by modern construction activity, and contained dumped piles of rubble, embankments and made ground associated with the current road and flood management features. The post-medieval fields are defined by substantial, modern and well-established drainage ditches ('rhines') and hedge-lines.

The site was extremely wet, particularly in the southern part, where the excavations were filled by 0.5 m of water within approximately 1 hour of machining. The main excavation area was also completely flooded during a period of bad weather. Features rapidly filled with water as they were being excavated, and a pump was used to keep them relatively empty as they were excavated and recorded.

Archaeological and environmental background

The present day topography of the area has undergone significant modification, and bears little resemblance to the prehistoric landscape. Evidence of early prehistoric surfaces and sites can be deeply buried beneath later accumulations of alluvium and made ground. The surface of the bedrock formed a 'topographic template', depressions within which were filled with alluvial and estuarine sediments during the Holocene. Mapping of the underlying bedrock topography is therefore key to interpreting the sedimentary sequence.

As part of distinctive coastal environment, the wider environmental context of the site is also important. To be able to interpret the site, it needs to be understood in terms of estuarine sedimentation and erosion processes, as a dynamic wetland environment with a specific plant succession that is confined to coastal edge environments.

Environmental background

The Holocene sediments in the area consist of complex sequences of estuarine alluvium, organic clay, and peats, deposited in a variety of environments representing, variously, alder carr, fen, reedswamp, intertidal saltmarsh, and mudflats. The currently accepted stratigraphic sequence for the Severn is based on work undertaken by Allen (1987; 1990) and Allen and Rae (1987). The deposits are macrotidal and well-mixed sediments, receiving fine sediment from many sources. At least four discrete lithostratigraphic formations, predominantly of sandy to silty clay, have been identified along the shores of the estuary in the intertidal zone, reaching depths of up to 20 m.

The sediment sequence identified within the area of the site is comparable to the Wentlooge Formation, and has been broadly divided into three main lithological units. The Lower Wentlooge Formation consists of estuarine and marine sands that were deposited during the early Holocene. The Middle Formation is characterised by silty clay alluvium and peat that reflect periods of changing sea-level and river flooding. The Upper Formation consists of pale green estuarine silty clays that began to accumulate 2500-3000 years ago and ceased to form in the Roman and post-Roman period. Reclamation during the Roman period is thought to have isolated the Wentlooge Surface within large areas of tidal wetland in the lower estuary. The soil that developed on this surface is recognised as the Wentlooge palaeosol in those places where post-Roman breaching of the Roman sea defences led to a resumption of tidal sedimentation, helping to bury and protect this surface. The overlying thick, largely pink, sandy to silty clays, termed the Rumney Formation, began to form at times ranging from the early medieval to the early modern periods. The present landscape developed following the later reclamation of the Levels that began in the medieval period.

Archaeological and historical background

The following discussion is based upon the desk-based assessment of Plot 5000 carried out by John Samuels Archaeological Consultants (JSAC 2006) and a desk-based assessment undertaken for ICI Severnside (Rippon 2000a), with additional information taken from reports on fieldwork in the immediate environment of the development area. Further information on medieval/post-medieval land-use is derived from the South Gloucestershire HER and geotechnical reports by Capita Symonds (2005 a and b).

The earlier prehistoric period

No features or finds of Bronze Age or earlier origin have been found within the Distribution Park. Peat deposits in the area have, however, been dated to the later Neolithic to middle Bronze Age.

Iron Age

The earliest known human settlement of the Levels dates from the Iron Age, and is best represented by the excavations at Hallen, some 2.5 km to the south (Gardiner *et al*. 2002). 'The settlement consisted of roundhouses within palisaded enclosures and seems to have been based on a pastoral economy in a relatively dry environment' (Wessex Archaeology 2001). Evidence for Iron Age activity has also been recovered at Green Lane, Redwick, *c* 1.8 km to the north of Plot 8000, and at Brynleaze Farm, a similar distance to the east (Barnes *et al*. 1993; Russet 1990-91).

Roman

Recent work (Summer 2005) at Plot 4000, immediately to the east of the present site, has exposed Roman enclosures, at least three roundhouses and possible evidence for metalworking at *c* 5.45 m OD, immediately below the topsoil. The post-excavation assessment illustrates that activity on the site spans the 2nd to 4th centuries AD. No evidence was found for Iron Age activity on this site (Wessex Archaeology 2006).

Prior to the excavations on Plot 4000, the only other recorded evidence for Roman activity within the Distribution Park was the discovery of a V-shaped Roman ditch from SSC:EA trial pit GO12 to the north of Plot 5000 (NGR ST 55289 84225; Lawler *et al*. 1992). Roman activity had been thought to be concentrated on the higher ground to the east of the Levels, although sites were known at Rookery Farm, *c* 2 km to the north of Plot 8000 and Elmington Manor Farm, *c* 1 km to the south-east of Plot 5000 (Jones and McGill 2005; Rippon 1996). Later activity is recorded at Ellinghurst Farm, *c* 0.8 km north-east of Plot 8000, and, dating to the 4th century AD, Crook's Marsh Farm, *c* 1.5 km south-west of Plot 5000 (Everton and Everton 1981; Juggins 1982).

Before the completion of the fieldwork, it was unclear whether the archaeology exposed at Plot 4000 was part of an island of Roman activity or was, in fact, part of a wider settled landscape. Although the reasons why certain plots within the Distribution Park were selected for settlement are not yet understood, it seems likely that hydrology was a significant factor. It is, however, now clear that Romano-British activity was not distributed uniformly across the Distribution Park. Settlement and enclosures are concentrated at particular locations, perhaps on slightly higher, drier ground.

Prior to the work on Plot 4000, archaeological fieldwork had focused on the Wentlooge sequence in an attempt to find archaeological deposits at depths in excess of 1.5 m below the current ground surface. It was, then, perhaps surprising, that the archaeology at Plot 4000 was exposed close to the present ground surface, suggesting that there has been little or no alluviation since. It is possible that in the middle of the Roman period the area was drained and managed in such a way that it was no longer as prone to alluviation. On Plots 4000, 5000 and 8000, where the maximum depth of topsoil is *c* 0.3 m (with the exception of slight undulations and mounds), the Roman and medieval ground surfaces were almost the same. Trenches recently excavated within Plot 8000 did not identify any anthropogenic evidence predating the medieval period.

Medieval

Place name and documentary evidence suggest that the Levels were exploited as meadowland in the late Saxon period, with settlement again centred on the higher ground to the east. Rippon (1996) has described the landscape at this time as 'irregular', characterised by dispersed settlements connected by droveways. Natural watercourses were frequently incorporated into these landscapes, giving many fields sinuous boundaries.

The Levels appear to have been largely unsettled during the early medieval period, but were utilised for seasonal grazing (Lawler *et al*. 1992; BaRAS 1998). The late 13th century is characterised by extensive drainage and management of the Levels.

Rippon (1996) has identified a change from the small irregular fields of the earlier medieval period to regularly arranged blocks of strip fields, with straighter droveways and small scale settlements, which he terms the 'intermediate' landscape. There is little evidence for significant medieval settlement of this date.

The South Gloucestershire HER contains an entry for Edsleigh Farm *c* 150 m north of Plot 5000. It notes that earthworks were thought to be the remains of a medieval farm, but excavation showed them to be of little substance. Record 5334, referring to the same farm complex, states: 'Medieval farmstead? (site of). Stands in classic position on the edge of Dyer's Common, surrounded by ridge and furrow. Not part of manor of Compton Greenfield C19th. Present farmhouse much modernised 1980's. Formerly *c* 18th/19th - showed signs of alternate development.'

Post-medieval

Extensive areas of ridge and furrow were mapped by Wessex Archaeology in their desk-based assessment of ICI Severnside (Rippon 2000a). The fact that the pattern consists of straight rows, with the furlongs corresponding to the regular and rectangular arrangement of fields, has been taken to suggest that it is late in date. Earlier ridge and furrow, typical of open-field arable farming, commonly results in the reversed 'S' - shape.

Dyer's Farmhouse (HER entry 6514) is located *c* 100 m north of Plot 5000. This is a converted longhouse with medieval origins, remodelled in the 17th and 19th centuries.

Previous archaeological work
Several of the plots with the Distribution Park have been subject to archaeological evaluation and excavation, mostly as part of developer funded projects.

The Upper Wentlooge sequence has been assessed previously on Plots 6010, 6020, 4000, 7000 and 8000. This sedimentary sequence consists of greyish brown to olive grey clays, a double peat band and greenish grey clays (Moore *et al*. 2002). The peat has been radiocarbon dated to the later Neolithic to middle Bronze Age and the palaeoenvironmental data suggests a potential sea-level index point of Bronze Age date (1520 - 1310 cal BC, 95.4%: 3151 ± 45 BP, at 3.69 m aOD). No features or finds of prehistoric archaeological origin have been found within the Distribution Park.

'During later prehistory, progressively rising sea levels caused ponding of freshwater river systems on the low-lying land of the Severn Estuary, resulting in the progressive accumulation of fen peat in these localised wet conditions. This peat accumulation occurred at rates exceeding those of sea-level rise. However, there is widespread evidence for a final phase of marine inundation during the late Iron Age and Roman periods, resulting in widespread alluviation and the development of marine transgressive saltmarsh vegetation. Alluvial deposition was probably exacerbated during this phase by changes in agricultural practises and other land-use, resulting in greater wash-off into local river systems' (Moore *et al*. 2002).

Druce (1998; 2000) has undertaken work at Gravel Banks and Oldbury, which involved investigating the underlying peat sequences. The Avonmouth Levels during the early prehistoric period are described as a complex sequence of mudflats, saltmarshes, reedswamps and raised bogs, which may have been periodically inundated. There was some evidence of stabilisation in the prehistoric period, but this appears not to have been long lasting or widespread. There is also growing evidence of Romano-British use of this area associated with dry-land conditions within parts of the Levels.

To the south of the site, Carter *et al*. (2003) undertook sedimentary and palaeoenvironmental analysis along the route of a 6 km pipeline which ran across the Levels between Pucklechurch and Seabank. Further monitoring work (Masser *et al*. 2005) along the route revealed evidence of Romano-British occupation at three sites. At Crook's Marsh, Romano-British occupation dating to the late 4th to early 5th century was found to extend out into the Levels. Environmental evidence recovered from the ditch fills suggests an open environment, with wheat and barley being grown locally. Analysis of diatoms and foraminifera from the ditches indicated that they were frequently flooded with saltwater. At Farm Lane and Lower Knole Farm, on the edge of the Levels, evidence of Roman activity dating from 2nd-4th century was also identified.

The Wentlooge Sequence has also been assessed during archaeological works at the following local sites: Avlon Works (Wessex Archaeology 2001), Katherine Farm (Allen *et al*. 2002), Cabot Park (1998) and the Avon Levels in general (Allen and Scaife 2001; Gardiner *et al*. 2002).

Aims

In summary, the aims of the excavation, as stated in the JSAC specification, were to:

·Determine the presence or absence of archaeological features, structures, deposits artefacts and ecofacts, and ascertain their extent, date and nature

·Identify phases and dates of past activity and identify areas of occupation and specialist economic activities

·If present, to define the character, extent, quantity and preservation of palaeoenvironmental evidence

·To investigate and assess the underlying alluvial sequence and its formation in the context of the Avon Levels and as part of the Severn estuary sequence

·To produce a full archaeological record for the site, including plans, sections, contexts, survey and photographs

·To assess the archaeological significance in a local, regional or national context

THE WENTLOOGE SEQUENCE

Introduction

The investigation of the Wentlooge Sequence at Plot 5000 provided the opportunity to investigate the underlying alluvial sequence to a greater depth (-10 m bgl) than most sequences obtained to date from the Western Approaches Business Park. In Plot 4000 the upper and middle sequences were only investigated to a depth of 5 m and therefore never fully characterised the deeper sequence and did not reach bedrock over most of the site (Wessex Archaeology 2006).

By investigating the underlying palaeogeography it is possible to develop a deeper understanding of the changing sedimentary and environmental sequence of the site. This is essential to understanding human activity in areas like the Avonmouth Levels and how these communities responded and adapted to environmental change.

Sampling methodology

A preliminary understanding of the site's sedimentary sequence was developed based on the correlation of the lithology from the existing geotechnical records for the development area. This work was undertaken prior to any fieldwork in order to help formulate the most suitable field sampling methodology. This work attempted to identify the gross morphology of the subsurface topography, including the location of localised topographic features such as major palaeochannels, bedrock islands or thick deposits of organics.

Eleven boreholes were, as a result, targeted on the north and north-east of the site to investigate the Wentlooge Sequence where a significant rise in the surface of the Mudstone was identified from the geotechnical records. Several boreholes were also targeted on a topographic low identified within the Mudstone towards the southeast of the site. The boreholes were drilled to recover intact column samples suitable for sediment description and palaeoenvironmental assessment. The drilling of each borehole was monitored by a geoarchaeologist. A continuous sequence of cores was retrieved using a Dando Terrier cable percussion rig for eight out of the eleven locations. Three locations were inaccessible due to ground water flooding and could only be sampled through hand augering.

The lithological data retrieved from the survey was inputted into computer modelling software and correlated into stratigraphic units. The units were correlated on the basis of texture, colour, inclusion and elevations. A plot of the Mudstone surface and cross-section of the sediment sequence across the site was produced to aid in the interpretation of the sediment sequence and the selection of samples for palaeoenvironmental assessment (Fig. 4).

Sediment sequence

The borehole survey revealed a range of different sediment types associated with significant localised topographic features. The surface of the bedrock essentially defines the topography of the early Holocene landscape. Bates (1998) refers to this as the 'topographic template' and suggests that variations in the template largely dictated patterns of landscape evolution, as flooding and sedimentation ensued during the Holocene. On further examination of the Plot 5000 data, the elevations of the surface of the bedrock were found to vary locally to a significant degree, and these variations had influenced Holocene sedimentation patterns.

Bedrock

The underlying bedrock across the site is recorded as Mercia Mudstone, and was recovered during sampling as firm brownish red silt with fine grit inclusions and gypsum precipitate. The bedrock was reached in boreholes OABH 1, OABH 2 and OABH 3, and within the geotechnical investigations, with the surface lying at +1.06 m to -0.33 m OD. An elevation plot of the Mercia Mudstone (Fig. 4) illustrates the variation in the early Holocene topography.

The highest elevations were recorded within the northwestern sector of the site on the higher ground at a level at +1.06 m OD. The lowest levels were found to occur in the south-eastern sector down to -10.24 m OD in geotechnical borehole GIP BH4 and OABH 11. There is thus a significant drop in the elevation of the Mudstone surface from the northwest to the southeast of the site that probably represents a buried channel inlet of the Severn.

The rise in the Mercia Mudstone underlying the site may reflect the presence of a bedrock ridge that is believed to separate a former inlet of the river Severn from the present day river. This ridge is thought to underlie Pilning, Severn Beach and Seabank. Carter *et al*. (2003) estimate that the bedrock ridge would have passed below the high tide level by 5000 uncal BP (c 3800 cal BC). However, it still appears to have continued to affect sediment deposition and creek formation within the marsh, and may have been a significant influence on the location of late Roman settlement within the Avonmouth Levels.

The Holocene sediment sequence

The sediment sequences recorded at the Western Approaches Distribution Park comprises a sequence of Mudstone overlain by a tripartite sequence consisting of sediments of sandy silt, organic alluvium and clay-silt. On the basis of the broad sedimentation types this sequence has been divided into three main stratigraphic units.

The lower part of the sequence consisted of finely laminated, gently sloping sands and silts between -7.0 m and -6.43 m bgl. This unit varied across the southern area of the site. Deeper were sequences associated with the lowest elevations of the

Mudstone within OABH 11. The deposits consisted of microlaminated minerogenic bluish or greenish grey silty sand, becoming sandier with depth.

They appear to represent estuarine sedimentation within an active channel. The fine laminations identified within this deposit reflect intertidal fluctuations within a backwater inlet that was probably protected from the most severe marine tidal range. The gently sloping nature of the micro-laminations within the deposit may indicate a tidal edge environment associated with the mudstone ridge.

A significant change in the sediment sequence was marked with the presence of peat at -5.00 m bgl (+1.10 m OD). This change is also reflected in the sedimentation, the higher energy lower units, consisting of predominantly marine sands, contrasting with the silty clays from the levels above. This major transition in the sedimentology and hydrology has been radiocarbon dated to 3970-3790 cal BC (OxA-19584: 5086±33BP).

The middle part of the sequence consisted of a sequence of minerogenic bluish/greenish grey clay-silts interstratified with peat and organic deposits between -5.00 m bgl and -2.10 m bgl. This sequence represents a phase of rising and fluctuating sea level during the Neolithic and Bronze Age. The organic and peat deposits indicate periods of partial stabilisation of the wetland through emergent vegetation which were interspersed with periods of renewed estuarine flooding and a return to a saltmarsh environment.

The overlying upper sequence consisted of a large parcel of oxidized reddish structureless grey silty clays with a weathered upper surface with root voids. This unit is approximately 1.70 m in thickness. The surface of these deposits was between +5.24 m and +5.54 m OD and represents the level at which archaeological features were identified. It may represent the landsurface associated with the Roman archaeology which has been identified previously in the area as the BaRAS layer (BaRAS 1998) or Wentlooge Surface (Allen 1987).

Organic deposits

Six interstratified organic units were identified within the sequence:

- ·Peat I (-3.76 m OD to -3.91 m OD)
- ·Peat II (-3.10 m and - 3.16 m)
- ·Peat III (-1.41 m and -1.64 m OD)
- ·Peat IV (+1.70 m - +0.84 m OD)
- ·Peat V (+3.04 m - +2.84 m OD)
- ·Peat VI (+3.69 m - +3.25 m OD)

The lower peat units consisted of well-compacted reed peat that displayed a laminar structure. The upper most of these, Peat III, was found to preserve three distinct layers, consisting of a layer burnt reeds sandwiched between layers of waterlogged reeds.

The upper peats sequence consisted of dark blackish brown moderately humified silty peat with occasional identifiable plant remains. Some evidence of horizontal bedding structures or laminations was noted, and the upper peat showed signs of truncation.

Dating the sequence
A sequence of three AMS radiocarbon dates were obtained on samples of *Phragmites australis* (common reed) stem that were extracted from the lower and middle sequences from OABH 11. This was a well-stratified sequence selected since it was the deepest and best preserved on the site. The remains are believed to be *in situ*, forming part of the on-site vegetation community.

Table 1: Radiocarbon dates

Stratigraphy	***Depth (m below bgl)***	***Material***	***Lab Ref***	***™C13%***	***Result BP***	***Calibrated date BC (probability)***
Upper peat sequence	2.20-2.25	*Phragmites australis*	OxA-17583	-26.51	2799 ± 28	1020-890 (92%) 880-840 (3.4%)
Upper peat sequence	5.00-5.05	*Phragmites australis*	OxA-17584	-24.46	5086 ± 33	3970-3790(95.4%)
Lower peat sequence	7.40-7.45	*Phragmites australis*	OxA-17441	-26.65	6076 ± 39	5210-5160(5.1%) 5080-4840 (90.3%)

The results suggest that the lower peat sequences formed during the Mesolithic period (5210-4840 cal BC at 95.4% probability, and 5080-4840 at 90.3% probability) and that the upper peat sequences accumulated between the early Neolithic and late Bronze Age (3970-3790 cal BC and 1020-840 cal BC). A *terminus ante quem* for the formation of the upper sequence was provided by the Roman activity that was identified on its surface. This is consistent with the results from Plot 4000 that dated the middle sequence to the late Neolithic to early Bronze Age (2500-1700 cal BC). The upper peat sequence appears to have been better preserved in Plot 5000, which exhibited fewer signs of truncation of the upper peat surface.

The Plot 5000 sequence can be directly compared to the records from the evaluation at the Western Approach Business Park Plots 6010-6020 (Moore *et al*. 2002) and Plot 4000 (Wessex Archaeology 2007). It compares well with the published dates from the Avlon Works, Severnside (Wessex Archaeology 2001) and the known general sequence (Allen 1987; 1990; Allen and Rae 1987; Gardiner *et al*. 2002 etc). The peat sequences do not appear to be continuous across the landscape, and equating deposits is problematic. This suggest that a complex mosaic of vegetation and mire conditions probably existed at the same time.

Pollen analysis
Eighteen samples were taken from borehole OABH 11 between 0.30 m and 9.90 m (5.56 - -4.04 m OD) through all the main stratigraphic units.

The samples were subjected to standard pollen extraction techniques. Either 0.5 ml or 1 ml of fresh sediment was used, being measured by volumetric displacement in distilled water. Two *Lycopodium* tablets were added to the sample so that pollen concentration values could be calculated (Stockmarr 1971).

The slides were systematically scanned at 400x magnification until a either a total of 300 total land pollen (TLP) was reached or 40 traverses completed. All pollen and other significant content including fungal and algal spores, dinoflagellates and microscopic charcoal fragments were recorded. Pollen identifications were made using Moore *et al*. (1991), Reille (1992) and the reference type slide collection at the University of Greenwich. Nomenclature follows the recommendations of Bennett (1994a), Bennett, Whittington and Edwards (1994) and Stace (1991).

Results

One level at 3.20 m bgl proved to be non-polleniferous. A second at 9.90 m bgl within the lowermost unit, a light blueish grey silty clay, contained pollen in very low concentrations; only 12 grains were counted in 10 traverses and 25% of the pollen was so badly damaged as to be unidentifiable.

AM-OA11: -1 9.70-7.50 m bgl (-3.84 - -1.64 m OD)

Tree pollen averages 41% through this zone with *Quercus* reaching 19% at 9.00 m bgl. Other contributors include *Pinus* and *Ulmus* averaging 7 and 4% respectively. *Alnus glutinosa* values are high within the thin compact peat at 9.70 m bgl at 25%, and *Corlyus avellana*-type and *Salix* show peak values for the core at 22% and 2% respectively. Poaceae and Cyperaceae contribute most to herb frequencies with Chenopodiaceae and Plantaginaceae also consistently present. Aquatic pollen recorded includes *Myriophyllum spicatum* and *Potamogeton natans*-type in low percentages

AM-OA11: -2 7.50-5.10 m bgl (-1.64 - 0.76 m OD)

Quercus is again the largest contributor to tree pollen frequencies with similar values to the previous zone. *Ulmus*, *Betula*, *Alnus glutinosa* and *Tilia cordata* are also present in consistent percentages. One notable feature is the tenfold decline in *Pinus* values over the zone boundary from 8% to 0.8%, albeit with a recovery to 5% at 5.20 m bgl. Within the shrubs, Corylus avellana-type pollen is consistent, averaging 16%. Another characteristic of the zone is the peak in Cyperaceae pollen which reaches 29% at 7.40 m bgl followed by a peak in Chenopodiaceae pollen reaching 18% at 7.20 m bgl. Aquatic pollen representation falls to only 1% TLP through the zone, with *Hydrocotyle vulgaris* pollen reaching 2% at 7.40 m bgl.

AM-OA11: - 3 5.10-2.35 m bgl (0.76 - 3.51 m OD)

Quercus averages 26% in this zone and reaches a peak for the profile of 37% at 2.85 m bgl. However, most other tree taxa decline, with *Ulmus* falling from 5% to 1% over the zone boundary. *Corylus avellana*-type pollen is generally lower by an average of 4% to 12%. Gramineae and Cyperaceae average 18% and 5% respectively. One aspect of note is the first appearance of *Cerealia*-type pollen at 4.50 m bgl.

AM-OA11: -4 2.30-40 m bgl (3.51 - 5.46 m OD)

The main features of this zone include the fall in tree pollen percentages to 10% from 42% in the previous zone. Herbs, aquatics and spores also rise markedly, the latter two groups being dominated by *Potamogeton natans*-type peaking at 14% in the middle of the zone at 1.60 m bgl and *Pteridium aquilinum* which reaches 43% towards the top of the zone at 0.50 m bgl.

AM-OA11: -5 0.4 m bgl – surface (5.46 – 5.86 m OD)
This zone comprises only one count at 0.30 m bgl. It was defined because there is a marked increase in Lactuceae pollen to 29%. There are also complementary declines in *Corylus avellana*-type, Chenopodiaceae and *Pteridium aquilinum*. Of the Lactuceae grains 98% had their pollen preservation classed as amorphous.

Interpretation
The lowermost unit containing countable pollen was the thin, compact, partially humified, dark blackish brown peat between 9.70 - 9.75 m bgl, the first of a series of six peat beds in the profile. The pollen sample toward the top of the peat at 9.70 m bgl was dominated by *Alnus glutinosa* and *Corylus avellana*-type pollen with *Salix* pollen also present. Also of note here is the presence of type 143 fungal spores, reaching 24% within the peat. Type 143 has been attributed to *Diporotheca* sp., (Van Geel *et al*. 1981) a mildly parasitic fungus, which suggests that eutrophic to mesotrophic conditions existed at the sampling site at this time. Prager *et al*. (2006) have reported Type 143 as being abundant in the leaf litter of alder carr which would be in accord with the high frequencies of alder pollen. Salix pollen is often underrepresented in fossil samples, perhaps due to the low sporopollenin content of its exine affecting its preservation (Birks and Birks 1980). Salix may therefore have had a larger representation in the local vegetation than its low pollen percentages would suggest. Taken together with the presence of the aquatics *Myriophyllum spicatum*, *Potamogeton natans*-type, *Typha latifolia* and *Sparganium emersum*-type pollen it suggests that the environment was alder-willow carr with standing or slowly flowing freshwater and reedswamp in the vicinity. However the presence of marine and brackish diatoms such as *Hyalodiscus stelliger*, *Cocconeis placentula*, *Thalassiosira* sp. (a largely marine genus) and sponge spicules may point to the proximity of saline conditions. It is probable that this waterlogged alder-willow carr environment was initiated by a rising groundwater table presaging the arrival of fully marine conditions at the site.

The overlying sample within the water-lain blueish grey sandy silt at 9.20 m bgl shows a rise in both *Quercus* and Poaceae. Aquatic pollen of *Potamogeton natans*-type and *Sparganium emersum*-type may attest to the nearness of freshwater conditions although *Potamogeton natans*-type does include *Triglochin*. Of the two native species, T. maritima, the sea arrowgrass, is a common member of coastal saltmarsh communities. The presence of dinoflagellate cysts in the pollen sample also suggests there was a considerable marine influence, a suggestion enhanced by the presence of marine and outer estuary forams and ostracods.

At the site, marine conditions seem to have become less pronounced, and a second thin peat band formed between 9.02 - 8.96 m bgl. Within the peat, *Quercus* pollen frequencies rise, perhaps representing an increase in the regional representation of oak. *Alnus glutinosa* is present in lower percentages, suggesting the proximity rather than the presence of alder carr. Poaceae and Cyperaceae are well represented suggesting more open conditions may have existed than had been the case. The peat has a mineral component of silt and sand which might explain the presence of fully marine diatoms, organic-walled foraminifera and dinoflagellate cysts. There is little actual change in the pollen assemblage into the overlying structureless grey sandy silt which suggests that the thin peat band may represent a brief period of incipient saltmarsh soil formation within a largely intertidal mudflat environment.

The lowermost pollen count in zone AM-OA11-2 coincides with a third organic layer comprising compacted dark blackish brown peat. It shows a peak in Cyperaceae pollen with the presence of *Hydrocotyle vulgaris*, *Equisetum* and *Thelypteris palustris*, suggesting a freshwater reedswamp environment with areas of open, still or slowly flowing water. Plant macrofossil analysis confirms the presence of H. vulgaris and suggests that the Cyperaceae component may have been made up by *Schoenoplectus lacustris* and *S. tabernaemontani*. Insect evidence also suggests stagnant or slow flowing water with marsh and reed beds.

Cyperaceae pollen then falls abruptly, and there is an equally sharp rise in Chenopodiaceae pollen at 7.20 m bgl within the overlying water-lain blueish grey structureless sandy silt. The Chenopodiaceae or goosefoot family is a large one with 7 genera and perhaps up to 32 species that are native or probably native to the British Isles (Stace 1991), so viewed alone its diagnostic value is limited. However, some genera, such as *Atriplex* (oraches), *Salicornia* (glassworts) and *Suaeda* (sea-blites), contain species that are often dominant members of saltmarsh communities. It is probable, therefore, that the rise in Chenopodiaceae represents a transition to a saltmarsh and intertidal mudflat environment. This increase in marine influence probably extended to 5.20 m bgl where the foram and ostracod fauna contains marine and outer estuary species.

At 5.20 m bgl, just below the peat layer, pollen concentrations are particularly low at 1.9×10^3 grains/cm^3, and pollen preservation is poor with 23% unidentifiable, which might suggest drying of the site and loss of pollen through oxidation. This is hard to reconcile at first with the presence of marine and outer estuary ostracods unless there was a rapid change from marine to more subaerial conditions.

In the lower part of zone AM-OA11-3 there is a fourth organic layer, a 70 mm thick friable, dark blackish brown well humified silty peat. *Ulnus* pollen falls from 5% to 1% over the zone boundary which may represent the regional elm decline, though care needs to be taken since there is a change in depositional environment (and hence pollen preservation potential) from marine to more freshwater environments between these two levels. However, the date of 5086 ± 33 BP between 5.00 - 5.05 m bgl is in agreement with other dates for the elm decline in the region. In the Vale of Gordano, Gilbertson *et al*. (1985) dated the elm decline to 5050 ± 140 BP, whilst at Longney, Gloucestershire, Brown (1987) provided a date for the same event of 5090 ± 70 BP. Dates from the Somerset Levels seem to be slightly later with Beckett and Hibbert (1979) reporting dates of 4770 ± 50 BP and 4740 ± 45 BP from the Abbotsway and Sweet Track respectively. In a comprehensive review of 138 dates then available, Parker *et al*. (2002) gave a mean age of 5065 ± 270 BP for the English elm decline which is indistinguishable from the OABH 11 date.

Cyperaceae pollen rises within the peat layer at 5.00 m bgl, which suggests formation under freshwater reedswamp conditions. However, the high degree of humification and presence of a mineral silt component containing sponge spicules could equally indicate a saltmarsh soil.

Quercus percentages rise within the overlying light blueish grey silty clay, and there are consistent values for Chenopodiaceae, Cyperaceae and Poaceae. Dinoflagellate cysts are suggestive of a marine influence. Taken together with the low organic content of this silty clay layer this probably reflects deposition in a shallow mudflat environment which is in accord with the foram and ostracod evidence.

At 4.50m bgl is the first record of *Cerealia*-type. There is a debate at present concerning the reliable identification of fossil cereal pollen (Tweddle *et al*. 2005). Grass pollen usually has a psilate (smooth) or scabrate (slightly rough) surface and a single round pore surrounded by a ring-like annulus. Cereals are domesticated grasses, and their pollen is generally of larger size than that of most wild grasses. However, the distinction is not absolute and there is overlap in annulus size and grain diameter between cereal pollen and a number of wild grass species, many of which are potentially present in the coastal zone (Behre 2007). A more recent paper by Joly *et al*. (2007) suggests that a limit of 47 μm for grain diameter and 11 μm for annulus diameter was best at discriminating between the two groups, putting a minimum of large grass pollen types into the *Cerealia*-type group. The interpolated age of the level at 4.50 m bgl is about 5280 cal BP, a few centuries after the elm decline which is dated to about 5800 cal BP.

At 3.20 m no pollen was recovered from the sample, despite a repeat preparation being made. Exotic *Lycopodium* spores added to the sample were abundant and well preserved which suggests that the absence of pollen is not an artefact of the preparation process. It is unusual not to find some pollen in Holocene coastal and estuarine sediments if they have remained waterlogged. This therefore suggests the possibility of post-depositional removal through oxidation, perhaps a similar process to that suggested for the sample at 5.20 m bgl in a comparable stratigraphic position beneath the fourth peat layer.

Between 2.15 m and 3.00 m bgl, the fifth and sixth peat layers are separated by a light blueish-grey silty clay. The lower peat is well humified and characterised by high *Quercus* values. Poaceae and Cyperaceae are well represented and there are high pollen and microscopic charcoal concentrations.

In the count at 2.50 m bgl Quercus frequencies are the highest of all the levels counted at 37%. Above this level, Quercus and indeed most tree pollen frequencies fall, perhaps reflecting regional forest clearance at about 2900 cal BP within the late Bronze Age. There is also a rise in Chenopodiaceae, Poaceae and *Pteridium*, indicating a more open environment. The upper of the two peat layers at 2.20 m has the highest pollen and microscopic charcoal concentrations within the profile, suggesting low accumulation rates.

The blueish grey sandy silt above the peat has high frequencies of Chenopodiaceae pollen and *Pteridium* spores. Also notable is the presence of *Potamogeton natans* type. Pondweeds are freshwater aquatic plants found in lakes, slow flowing rivers, ponds and ditches, but care needs to be exercised in environmental reconstruction in coastal areas because, as has been mentioned above, the pollen type also includes *Triglochin*.

The pollen content of the upper levels of zone AM-OA11-3 show declining frequencies of tree pollen suggesting the landscape must have been quite open at this time. Pollen preservation also worsens with the amounts of amorphous pollen increasing. Dinoflagellate cysts are present at 6% at 0.50 m bgl which, together with high Chenopodiaceae values, suggests marine inundation. However, the reddish brown colour of the sediments suggests oxidation under subaerial conditions, a suggestion that is supported by the fact that virtually all of the Chenopodiaceae pollen in these levels is amorphous. This suggests initial deposition in the intertidal zone followed by drying out of the surface and pollen damage by oxidation.

The final zone is characterised by one count at 0.30 m bgl with high percentages of amorphous Lactuceae pollen, reduced Chenopodiaceae frequencies and no dinoflagellate cysts indicating open terrestrial conditions.

Waterlogged plant remains

Potentially productive highly organic ('peaty') layers were identified during the recording of the lithology of the sediment cores and were subsampled for the recovery of waterlogged plant macrofossils. These subsamples were washed directly over a 0.25 mm mesh sieve, and the retained flot was stored in water in a cold store at between 8º – 10º C. Samples were sorted for waterlogged plant and insect remains under a low-power microscope at magnifications between x12.5 and x16.

Identifications were made using Oxford Archaeology's reference collection and illustrations or photographs in Floras or standard keys (eg Cappers *et al*. 2006 and Stace 1997). Nomenclature for the plant remains follows Stace (1997) for indigenous species and Zohary and Hopf (2000) for cultivated species. The traditional binomial system for the cereals is maintained here, following Zohary and Hopf (2000, 28, table 3; 65, table 5).

Three peat deposits were found to preserve waterlogged plant remains suitable for further analysis. The waterlogged plant sequence is shown in Table 2.

Peat layer III: -7.45 to -7.40 m bgl

The lowest sample studied from OABH 11 is particularly notable for the abundance of waterside and aquatic plants which dominate the assemblage. These include bulrush (*Typha* spp.), common reed (*Phragmites australis* (Cav.) Trin. ex Steud.), common/slender spike-rush (*Schoenoplectus lacustris* (L.) Palla/*tabernaemontani* (C.C. Gmel.) Palla), marsh-pennywort (*Hydrocotyle vulgaris* L.) and rushes (*Juncus* spp.). A number of orache (*Atriplex* spp.) seeds were recovered which are likely also to be related to the waterside/marsh environment.

These remains appear to form three distinct layers, consisting of a layer of charred common reed fragments sealed by layers of waterlogged common reed fragments above and below it. The abundance of plants of semi-aquatic to fully aquatic environments also suggests that this deposit is likely to be on the edge or just within a body of water or watercourse.

Peat layer VI: -2.20 to -2.25 m bgl

The peat samples from the middle sequence were extremely poor, but did produce one insect elytra (see below) and quite a few (N = 15) glasswort (Salicornia spp.) seeds. Glasswort is considered a plant of saltmarsh and saltmarsh pools.

Peat Layer VI: -1.90 to -1.95 m bgl

The remains from this layer were not particularly rich or diverse, and they probably do not, therefore, provide reliable indicators of the nature of the surrounding environment. The sample is dominated by rush (*Juncus* spp.) seeds, which are often prolific in waterlogged deposits, and could have been derived from anywhere on the spectrum from damp ground to waterside (including estuarine) habitats. The recovery of water-cress (*Rorippa* spp.) seeds does, however, suggest that water of at least shallow depth was present.

The prehistoric waterlogged remains from the sequence suggest that the late Mesolithic environment was reed fen, with abundant waterside plants, the majority of which were not halophytes. This seems consistent with results for this period from elsewhere in the Severn Estuary, which suggest a period of marine regression/peat initiation at *c* 5000 cal BC, peaking at *c* 4500 cal BC (Druce 2005, 47). The upper deposits from OABH 11 (which are probably of Bronze Age date) were not as productive, but do generally suggest that salt marsh or estuarine conditions prevailed.

The presence of 'reed peats' has been noted elsewhere on the Severn Estuary, on the Caldicot Levels at 3530-3250 cal BC (95% probability), and 2140-1860 cal BC (95% probability; Walker *et al*. 1998, 55–7), and at Goldcliffe at *c* 3000 cal BC and 1320-1040 cal BC (95% probability; Timpany 2007, 198–9). This suggests that gradual change from alder carr landscapes to reed fen (possibly after periods of marine transgression) occurred repeatedly in the estuary. The vegetation of the Severn Estuary appears to repeatedly alter through cycles of marine transgressions and regressions, returning areas of vegetation back to scoured mud-flats, which develop into salt-marsh and which, if conditions of regression prevail (either through natural or artificial means, such as drainage), can progress to reed fen, alder carr, or even broadleaf woodland (eg Bell 2000). Deposits similar to the peat horizons detected at Plot 5000 have been identified elsewhere on the Avonmouth Levels (eg Carter *et al*. 2003; Druce 2005) and throughout the Severn Estuary (eg Bell 2000; Druce 2005). The wide range of dates for such deposits suggests that this process has occurred repeatedly in the estuary, and frequently at a very local scale (eg the 1990s seawall breach at Porlock Weir).

Table 2: Waterlogged plant sequence through the Wentlooge Sequence in OABH 11

N^E = estimate score from fragmented material

Habitat Codes: Aq = aquatic, ~Aq = semi-aquatic (ie shallow water), B = bogs, F = fens, M = marsh, SM = salt-marsh, Ws = waterside and Typ = typical

Sample Depth (below modern ground surface)		**1.90 - 1.95m**	**2.20 - 2.25m**	**7.40 - 7.45m**	
Sample volume		**0.205 L**	**0.320 L**	**0.342 L**	
Radiocarbon determination	**HABITAT**	**-**	**1019–849 cal BC (OxA-17583)**	**5205–4846 cal BC (OxA-17441)**	
WATERLOGGED PLANT MACROFOSSILS					
Chenopodium spp./ *Atriplex* spp. - internal structure	-	-	1	-	goosefoot/ orache
Atriplex spp.	-	-	-	25	orache
Salicornia spp.	SM/Ws	-	15	-	glasswort
Rorippa spp.	Typ Ws	13	-	-	water-cress
Hydrocotyle vulgaris L.	B/ F/ M/ Ws	-	-	11	marsh pennywort
Galium spp. (*G. verum*/ *mollugo* type seed)	-	-	-	2	bedstraw
POACEAE – medium-sized caryopsis	-	4	-	-	grasses
Juncus spp.	Ws/ D	100^E	-	-	rush
Schoenplectus lacustris (L.) Palla/ *tabernaemontani* (C.C. Gmel.) Palla	Ws/~Aq	-	-	100	common/ grey club-rush
Carex spp. - 3-sided	Ws/ D	-	1^E	2	sedge
Phragmites australia (Cav.) Trin. ex Steud. - leaf fragments	Ws/ Aq	-	-	++++	common reed
Typha spp.	Ws/ Aq	-	-	5	bulrush
Unidentified - ? NYMPHACEAE seed internal structure	-	-	-	50	-
Unidentified	-	-	-	2	-
CHARRED PLANT MACROFOSSILS					
cf. *Phragmites australis* (Cav.) Trin. ex Steud – culm node	Ws/ Aq	-	-	3	most likely common reed
cf. *Phragmites australis* (Cav.) Trin. ex Steud – leaf	Ws/ Aq	-	-	++++	most likely common reed

Insect remains

Insect remains were preserved within the two peat samples encountered at -2.20 to -2.25 m and from -7.40 to -7.45m bgl in OABH 11. Only the lower of these samples had sufficient abundancy to be suitable for further analysis. The nomenclature used follows Lucht (1987).

Peat layer III: -7.45 to -7.40 m bgl

This sample produced a large insect fauna given the small amount of material processed. The species of beetle recovered are dominated by a range of water beetles such as *Chaetarthria seminulum*, *Coelostoma orbiculare* and *Cymbiodyta marginella* and *Cercyon sternalis* all of which indicate the presence of slow flowing or stagnant water (Hansen 1986). The staphylinid *Lathrobium* spp. is also commonly associated with marsh areas and reed beds. The weevil *Thyrogenes* spp. is normally associated with a range of sedges (*Carex* spp.), club rushes (*Scirpus* spp.) and burr reeds (*Sparganium* spp.; Koch 1992).

Peat Layer VI:-2.25 to -2.20 m bgl

This sample produced a single fragment of the water beetle *Coelostoma orbiculare*. This species is normally associated with shallow, slow flowing and often stagnant water (Hansen 1986).

The insect remains recovered from the lowest peat deposit indicate an area of slow flowing or stagnant water, which contained a bed of waterside vegetation. There are no insect indicators for the presence of estuarine conditions suggesting that the environment was probably dominated by freshwater rather than being coastal.

Similarly dated deposits have been recovered from the Wentlooge formation on the English side of the Severn Estuary. These include a number of freshwater peats, often interleaved with estuarine clays, from Minehead Bay, Somerset (Jones *et al*. 2005), Westward Ho!, Devon (Girling and Robinson 1987; Tetlow 2005) and the local peat deposits at Gravel Banks, Severn Beech, Somerset (Tetlow 2005). The species mentioned above are often present at these sites suggesting that freshwater environments similar to those seen at Avonmouth were present at these locations. The freshwater reed and sedge marsh environment suggested by the Avonmouth insects is also seen in a range of Wentlooge deposits of similar date from a number of locations on the Welsh side of the Estuary (Smith *et al*. 2000, Tetlow 2008, Walker *et al*. 1998).

Ostracods and foraminifera

All but one of the 12 samples from the Wentlooge sequence contained a varied and interesting array of microfossils.

Lower Wentlooge sequence: -9.30m to -5.00 m bgl

The lower sequence (below -5.20 m bgl) has a large brackish mudflat and saltmarsh component, but also two horizons (-5.20/5.25 m bgl and -9.25/9.30 m bgl) with a large number of marine and outer estuary species were identified. This indicates that a much larger estuary or embayment was present that was subject to intermittent marine and outer estuarine influences. The presence of peats within this lower sequence may indicate the presence of an offshore bar.

Upper Wentlooge sequence: -5.00 m to -2.70 m bgl
The samples from the middle sequence down to the peat at -5.00 m bgl contain a brackish assemblage (large population with low diversity) which reflects, in ascending order, an accreting sequence of estuarine mudflats or creeks through to mid-high saltmarsh.

The two samples from the upper sequence reflect largely emergent land, which was, however, still subject to marine flooding from time to time. The peat deposits represent semi-brackish conditions, with increasing freshwater inputs.

Of particular note was the presence of several cold to cool indicator species that would suggest a pre-Holocene date for part of the lower sequence. Many of these species, like *Elphidium albiumbilicatum* and Ostracod *Hemicytherura clathrata*, are only known in this country from raised beach sediments in Sussex (late Marine Isotope Stage (MIS) 7/early MIS 6). However, the radiocarbon dating of the lower peat at -7.40 m bgl to the mid Holocene (5210-4840 cal BC; OxA-17441: 6076±39BP) indicates that these species are residual.

Diatoms
Six samples from OABH 11 were prepared for diatom analysis. Diatoms were found in only 4 of the 6 samples and where present were in variable concentrations and states of preservation (Table 3). The assessed assemblage indicates a broad transition from marine to brackish diatoms up the profile, suggesting a decline in marine influence. Preservation was generally very poor or completely absent.

Table 3: Summary of diatoms from OABH11 (+ present, ++ common, +++ abundant)

Depth (m)	9.70-71	9.01-02	7.40-41	5.00-01	2.85-86	2.20-21
Diatoms						
Polyhalobous						
Paralia sulcata		+				
Podosira stelliger	+	+				
Cymatosira belgica		+				
Polyhalobous to mesohalobous						
Actinoptychus senarius		+				
Cocconeis scutellum		+				
Mesohalobous						
Diploneis interrupta						++
Oligohalobous indifferent						
Cocconeis placentula	+					
Hantzschia amphioxys		+				
Unknown salinity tolerance						
Cocconeis sp.		++				
Coscinodiscus sp.						
Cyclotella sp.	+	+				
Diploneis sp.		+				
Nitzschia sp.						
Pinnularia sp.	+				+	
Surirella sp.						
Synedra sp.	+					
Thalassiosira sp.	+	++				
Others						
Foraminifera		+				
Sponge spicules	++	++		++	+	+

Interpretation
The sediments from Plot 5000 are comparable to many sequences investigated in the Severn Estuary by numerous workers on the Welsh and English sides of the Severn. The sequence is comparable to the middle-upper Wentlooge Formation (Allen 1987; 1990; Allen and Rae 1987; Carter *et al*. 2003). If the middle and upper sequence represents local estuarine conditions typical of the Wentlooge Formation, the lower sequence (below -5.20 m bgl) is strikingly different. Here, although the assemblage still has a large brackish mudflat and low saltmarsh component, two horizons (-5.20/5.25 m bgl and -9.25/9.30 m bgl) with large numbers of marine and outer estuary species suggest a much larger estuary or embayment existed which was subject to intermittent marine and outer estuarine influences. The presence of peats within this lower sequence may indicate channel activity and the presence of an offshore bar which was washed away catastrophically from time to time.

In terms of the palaeohydrology of the site the foraminifera and ostracods, and to a lesser extent the diatoms, provide a good indicator of changing hydrological conditions throughout the sequence. There is an immediate change in the microfossil signature from the sediment below the peat at -5.00 m bgl (+1.10 m OD) to those above. This is also reflected in the sedimentation, with the lower sequence being higher energy, consisting of predominantly sand as opposed to the clays from the level above. This major transition in the sedimentology and hydrology has been radiocarbon dated to 3970-3790 cal BC (OxA-17584: 5086±33BP).

Marine deposits appear to have accumulated to just over 1.5 m OD, indicating an intertidal channel environment surrounded by low tidal mud flats. The presence of peat horizons within the lower formations is unusual, and may be related to the sharp dip in the surface of the underlying Mudstone. The three lower peat units (I, II and III) indicate that at least three decreases in the rate of sea-level rise occurred during the Mesolithic period that allowed wetland vegetation to become established.

The samples from the middle sequence contain a mixed assemblage of brackish and freshwater deposits which reflects, in ascending order, an accreting sequence of estuarine mudflats or creek through to mid-high saltmarsh, with the two uppermost deposits reflecting largely emergent land, which was, however, still subject to marine flooding from time to time. The middle sequence consists of interstratified silty clays and peats (Peats IV-VI) which relate to the development of wetland systems during the Neolithic and Bronze Age. This period saw the development of marshland systems and large expanses of alder carr and reedswamp, which were dissected by areas occupied by eroding creeks. The peat deposits represent predominantly freshwater environments with only occasional brackish incursions.

The date for the formation of the peat units in the Middle Wentlooge sequence is comparable to those for other radiocarbon-dated Neolithic and Bronze Age sequences in the Severn Estuary. Several of these buried wetland surfaces have been investigated (Druce 1998 and 2000 and Carter *et al*. 2003) but associated human activity has only been identified in the Somerset Levels (Coles and Coles 1986). Further comparisons of individual profiles in the wider area demonstrate variability in terms of the altitude and lithology of the various peat units. Allen (2002) has noted that many early Holocene surfaces are not preserved at their original height due to differential consolidation and compaction by the overlying sediments. This makes the lateral correlation of these sequences problematical.

The upper sequence of reddish grey silty sand represents an increase in marine incursions following a rapid rise in sea-level from 1020-890 cal BC (92% probability; OxA-17583: 2799±28 BP) in the late Bronze Age. This saw the development of high salt marsh conditions in areas that were formerly middle salt marsh environments. The late Roman occupation of the site coincided with a slow down in the rate of sedimentation and marine incursions in the late Roman period. This allowed a stabilisation surface to develop on the elevated parts of the marsh that were relatively free from flooding. This surface may not have formed a true soil but rather reflected a partial stabilised surface.

ROMANO-BRITISH SETTLEMENT

Archaeological features

The Roman archaeology (Fig. 5) was found at a depth of *c* 0.5 m below ground level, sealed beneath a thin silty clay alluvial derived topsoil. The features consist predominantly of ditches and gullies, with the exception of six small pits, one large working hollow and two disturbed spreads probably created as the result of animal trampling. A boundary ditch found during trenching in Plot 6030/6040 may represent the northwestern edge of the Roman enclosures, although it is not securely dated. A summary of the main archaeological features and deposits are presented below. Full descriptions of features and deposits can be found within the site archive.

The features have been phased on the basis of their stratigraphic relationships, artefactual evidence and spatial associations. Phasing was hindered by the low density of datable finds, and issues of artefact residuality resulting from the small size of most of the assemblages. This was exacerbated by the fact that most of the pottery recovered consists of undiagnostic body sherds with a broad date range from the 2nd to the 4th centuries AD.

Phase 1: Late Iron Age and early Romano-British activity

The only evidence for activity predating the 2nd century AD was recovered in the northwest of the site. Six pits and a working hollow were assigned, on the basis of a combination of stratigraphic and pottery evidence, to a period between the late Iron Age and the 2nd century AD.

A shallow oval working hollow (4129) contained six sherds of early Romano-British pottery. This was cut by a northwest-southeast linear ditch (5005) which dates from the 2nd century. Five other shallow pits (4016, 4043, 4213, 4150, 4106 and 4127) which make-up Group 5000 were also assigned to this phase. Pit 4043 was particularly rich in small bones, especially from juvenile eels (*Anguilla anguilla*) and sticklebacks (Gasterosteidae). Three of the larger eel vertebrae had been burnt. A small perch (*Perca fluviatilis*), several possible tiny cottids (Cottidae), vole (*Cleithrionomys*/*Microtus* sp.), mouse (*Mus*/*Apodemus* sp.) and amphibian bones were also present.

The working hollow (4129) also contained the roughly moulded end of small cylindrical pedestal or bar with rough irregular surfaces covered in fine chaff impressions. This fragment may have formed the top of a pedestal or end of a bar (Fig. 13). It is possible that the fired clay derives from a hearth or oven furniture. It may also may reflect small-scale secondary salt processing activity.

This group of late Iron Age of early Romano-British features possibly indicates activity prior to the drainage of the site in the 2nd century AD. The function of the pits is not clear from their form. However, the charcoal, daub, burnt bone and pottery within the upper fills is probably derived from domestic rubbish deposits. It is likely that this activity represents seasonal exploitation of the Levels by communities based on higher ground to the east.

Phase 2: 2nd century Romano-British activity

The earliest division of the site (Fig. 7) was defined by the main NW-SE linear ditches (5001 and 5005), and three smaller enclosures (5002, 5003 and 5011/5006) which ran NE-SW, roughly at right angles to the larger ditches. This phase of activity may have included the first attempt to drain the surface of the site. A set of similarly orientated ditches was identified in Plot 4000 (Wessex 2008). The rectangular enclosures are thought to represent animal enclosures and pens. A break in the NW-SE aligned ditches 5001 and 5006 may represent an entrance, perhaps intended to help corral animals. No internal features or deposits were identified within the enclosure. Pottery was general very scarce in these early features, which is consistent with the interpretation of them as animal enclosures.

Two pits, 4185 and 4158, located just to the north-east of the entrance were both cut by a pair of later parallel ditches (5010), and were sealed under an extensive uneven spread of material (5004) which may have been produced by animal trampling.

The main post-medieval drainage ditch that separated Areas 1 and 2 runs parallel to the main drainage ditches 5001 and 5005. Since the three smaller perpendicular enclosures ditches (5002, 5003 and 5011/5006) identified in Area 1 do not continue into Area 2, it seems likely that they led up to a Roman ditch on the same line as the modern drainage ditch. It was not possible to establish a direct stratigraphic relationship between the Roman and later ditches. However, the identical alignments are suggestive of a degree of continuity in the maintenance of drainage ditches in this area from the 2nd century up to the present day.

Phase 3: 2nd-3rd century Romano-British activity

There seems to have been a substantial reorganisation of the landscape between the 2nd and 3rd centuries (Figs 8 and 9). A series of relatively small rectangular enclosures was created as part of a network of field boundaries (5007, 5012, 5013, 5014, 5016, , 5018, 5019, 5025 and 5026) and trackways (5010). Some of these enclosures appear to have been associated with further internal enclosures or pens (5008 and 5009) which, again, suggests a pastoral function.

The ditches followed alignments similar to those of the settlement enclosures recorded in Plot 4000, suggesting that both sites formed part of a linked series of coaxial enclosures. This coincided with an expansion of activity on the settlement in Plot 4000.

A series of rubbish deposits were found in the upper deposits of enclosure ditches 5019, 5014 and 5016 (Fig. 9). These deposits consisted of black brown silty clay that contained much pottery, animal bone, fired clay and charcoal. This material appeared to be in a series of dumps which were concentrated along particular stretches of ditch. They probably derived from the settlement identified in Plot 4000.

Feature 5010 consisted of two parallel ditches running NW – SE in the northeast corner of the site. The ditches were very similar in profile and contained two naturally accumulated silty fills.

Phase 4: 3rd-4th century Romano-British activity

The 4th phase of activity on the site is characterised by the abandonment of the smaller enclosures and the reorganisation of the site into larger units (5022) aligned NW – SE (Figs 10-11) associated with two associated (5021 and 5020). The two trackways and the ditches appear to define a large enclosure.

Unphased features

There are several features on the site that could not be assigned to a particular phase either on stratigraphic grounds or on the basis of datable artefacts. In some cases, however, on the basis of their form, fills and alignment, a Romano-British date can be tentatively suggested.

Ditches 4258 and 4256 were only encountered at the eastern limits of the excavation. Neither ditch produced any datable material or shared any stratigraphic relationships with datable features. Based on the nature of the fills and the dimensions of the features they are likely to be related to the main phase of late Romano-British activity.

Ditch 4134 appeared to cut enclosure ditch 5022 but was not recorded beyond it. It is therefore likely to be a late addition, probably in the later Roman phase.

Parallel ditches 4090 and 4092, part of Group 5023, consisted of shallow ditches with a single fill. The north-south orientation of these ditches does not appear to respect any of the other Roman alignments within the site and therefore could not be assigned to a particular phase.

Modern

One wide drainage ditch (5024) crossed Area 2 from E to W, and appeared to join up with the modern ditch that separates Areas 1 and 2, as it was not visible in Area 1.

Finds from the Romano-British ditches

Pottery

Some 630 sherds, weighing 10 kg, were recovered from the excavations. The pottery was in good, unabraded condition, with a mean sherd weight of 17 g, suggesting that deposition occurred near areas of occupation. Roman pottery forms the whole of the assemblage with the majority of the assemblage being of mid to late Roman date (Fig. 12). The assemblage largely comprises local sand-tempered coarsewares, in both oxidised and reduced fabrics.

The assemblage was dominated by three fabrics, which together accounted for over 80% by EVE. Fabric B11 was the most important of these (Table 4). The earliest form in this fabric was a bead-rimmed jar (CH; cf. Gillam 1957, type 118) that was manufactured during the 1st and 2nd centuries AD. These were replaced by everted-rim cooking pots (CK), which arrived after AD 120 and became the commonest vessel type in the fabric.

Dishes and bowls were also frequently recorded. Plain-rimmed dishes (JB; Gillam 1957, type 329), sometimes with a slight groove below the rim, were marginally better represented than deep bead-and-flanged straight-sided bowls (HB; Gillam

1957, type 228), although the former had a longer date range, beginning in the 2nd century, compared with the late Roman chronology of the latter. Other notable, though rare forms were a so-called fish dish (JD) and lid (L).

Fabric R30 comprised a range of sandy grey wares probably of local origin, although a north Wiltshire source (beyond the material identified as R35) for some pieces is suspected.

Continental imports were restricted to samian. Few forms were identified from rims – Drag. 18/31 and a bowl or dish in fabric S30 – but a base, also in S30, which was stamped internally with an eight-petalled rosette, may have belonged to a Curle 11 bowl; a similar stamp was found during excavations at Exeter's forum basilica (Dickinson 1979, 184). Body sherds in S30 and S40 were probably part of Drag. 31 dishes.

Table 4: Quantification of Roman pottery by fabric

Fabric	***Sherds***	***%***	***Weight (g)***	***%***	***MV***	***%***	***EVE***	***%***
B10	3	<1%	19	<1%				
B11	186	29%	2778	28%	41	41%	4.08	39%
C20	2	<1%	22	<1%				
F51	5	1%	118	1%	2	2%	0.23	2%
F60	3	<1%	6	<1%				
G	1	<1%	14	<1%				
M22	7	1%	228	2%	3	3%	0.27	3%
M23	2	<1%	222	2%	2	2%	0.38	4%
M41	1	<1%	13	<1%	1	1%	0.03	<1%
O10	34	5%	336	3%	4	4%	0.31	3%
O20	11	2%	129	1%	3	3%	0.17	2%
O40	52	8%	450	4%	2	2%	0.11	1%
O50	5	1%	63	1%				
O80	2	<1%	55	1%				
R10	12	2%	260	3%	1	1%	0.2	2%
R20	5	1%	18	<1%				
R30	151	24%	2640	26%	18	18%	2.46	24%
R35	3	<1%	28	<1%				
R49	3	<1%	30	<1%				
R85	131	21%	2374	24%	20	20%	2.01	19%
S20	1	<1%	5	<1%				
S30	12	2%	114	1%	2	2%	0.12	1%
S40	4	1%	120	1%				
TOTALS	636	-	10042	-	99	-	10.37	-

Few context-groups were dated earlier than AD 120; two context groups (4130 in ditch 4129 (Fig. 6), and 4159 in ditch 4157) contained bead-rimmed jars in fabric B11 and so could have arrived during the late Iron Age or 1st century AD, although the type remained current well into the 2nd century. Groups dating to the mid Roman period (c AD 120-250) accounted for 20% of the assemblage by EVE. A number of groups were dated exclusively to the 2nd century (Table 5). Activity is likely to have continued into the first half of the 3rd century, although groups that may have been deposited after AD 200 tend to have relatively long date ranges beginning in AD 160.

Small amounts of Severn Valley bowls and Mancetter-Hartshill mortaria reached the site during this time. Most samian arrived from Central Gaul. Context-groups dated to the late Roman period took a 38% share of the assemblage, pointing to a significant increase in site activity during the later 3rd and 4th centuries (Table 6). Oxidised wares made a smaller contribution compared with the mid Roman period. Mortaria also appeared to be of declining importance after AD 250, although the Mancetter-Hartshill vessels were joined by Oxford products, which probably accompanied F51 dishes.

There was no evidence of pottery use in the form of residues and wear. However, three vessels, all in Oxford fabrics, were burnt: a dish (Young 1977, type C45) and two white ware mortaria (Young 1977, type M22). The mortaria were burnt on the rim, with some external and internal burning on the body externally and internally. A band of scorching was recorded near the rim on the dish's internal and external surfaces. All three are likely to have seen use on the hearth, probably as cooking vessels.

*Table 5: Roman pottery, AD 120-250/70. Quantification by EVE. * = fabric present, but with no rims surviving*

Fabric	Jar	Jar/bowl	Bowl	Bowl/dish	Dish	Mortarium	Total	%
B10							*	
B11	0.56				0.42		0.98	47%
M23						0.31	0.31	15%
O10							*	
O20		0.07					0.07	3%
O40			0.04				0.04	2%
O80							*	
R30	0.07		0.31				0.38	18%
R49							*	
R85	0.2						0.2	10%
S30				0.05	0.07		0.12	6%
S40							*	
Total	0.83	0.07	0.35	0.05	0.49	0.31	2.1	-
%	40%	3%	17%	2%	23%	15%	-	-

The absence or paucity of drinking forms, such as flagons, cups and beakers (although a small jar from deposit 4170 could have functioned as a beaker) and dominance of jars and bowls that served both as dining and cooking vessels, suggests that the pottery derived from relatively low-status occupation. The absence, too, of imported amphorae and decorated samian points to a community with little need of, or access to, specialist continental products, although it should be noted that importation of such material had ceased or reduced in volume by the late Roman period.

That said, compared with the pottery assemblage recovered from the nearby settlement at Farm Lane (Tyers *et al*. 2005, fig. 7), the inhabitants of Plot 5000 seem to have enjoyed a relatively good supply of mortaria and plain samian during the 2nd century (Fig. 12). It is worth making two other observations. First, the ratio between jars on the one hand and dishes and bowls on the other (cf. Evans 2001) – 40% jars against 42% dishes/bowls by EVE in the mid Roman period and 54% jars against 39% in the late Roman period – places the site close to urban centres, like Cirencester and Alcester (Biddulph forthcoming). Second, the proportion of Dorset black-burnished ware is higher than that of other local assemblages (Farm Lane in the 2nd century and Crook's Marsh in the 3rd and 4th).

*Table 6: Roman pottery, AD 250-410. Quantification by EVE. * = fabric present, but with no rims surviving*

Fabric	Jar	Jar/bowl	Bowl	Bowl/dish	Dish	Mortarium	Lid	Total	%
B10								*	
B11	1.14		0.75	0.08	0.58		0.08	2.63	37%
F51					0.23			0.23	3%
M22						0.27		0.27	4%
M23						0.07		0.07	1%
M41						0.03		0.03	<1%
O10	0.06							0.06	1%
O20					0.04			0.04	1%
O40	0.07							0.07	1%
O50								*	
R10	0.2							0.2	3%
R30	1.52	0.08	0.31	0.05				1.96	28%
R35								*	
R85	0.78	0.08	0.09		0.56			1.51	21%
S30								*	
Total	3.77	0.16	1.15	0.13	1.41	0.37	0.08	7.07	-
%	53%	2%	16%	2%	20%	5%	1%	-	-

An explanation may lie in the pattern of the site's ceramic supply. Local coarse wares and Severn Valley wares are better represented at Farm Lane and Crook's Marsh than at Plot 5000, while the ratios of jars to bowls/dishes resemble those for the roadside settlement at Pomeroy Wood, east Devon: 50%:39% in the 2nd and 3rd century by vessel count and 54%:45% in the later 3rd and 4th centuries (Seager Smith 1999, fig. 168). It is reasonable to suggest that the pattern of ceramic supply to Plot 5000 conformed more to a south-western tradition than a Gloucestershire and Thames Valley tradition. The pottery at Avonmouth, and the ideas that determined how it was selected and used, would have been familiar to an inhabitant of Pomeroy Wood (although not entirely – the Avonmouth population retained a north-eastern focus with the supply of Severn Valley wares and Mancetter-Hartshill mortaria), suggesting strong cultural links between the two regions. This in turns hints at a settlement at Plot 5000 that was of sufficiently high status to exert a cultural or economic pull that could not be achieved by other settlements in the area.

Fired clay

Fired clay amounting to 129 fragments (534 g) was recovered from ditches, shallow pits and a working hollow. Preservation was poor with a very low mean fragment weight of 4 g, and few diagnostic pieces. A few pieces were tentatively interpreted as oven or hearth furniture, possibly plate, fire bar and pedestal (Figs 13-14). All were made in a fine sandy clay with ferruginous pellets and in many pieces added chaff and chopped straw, fired to light brown, pink or grey, and derived from the local estuarine clays. The contemporary settlement site on Plot 4000 produced slightly less fired clay, all nondiagnostic. The assemblage probably represents domestic activity, though the type of hearth/oven furniture identified is also commonly found on briquetage production sites and small scale secondary salt processing activity on the periphery of the settlement is a possibility in view of the sites proximity to the Severn Estuary.

Metalwork and glass

The metalwork consisted of seven pieces of iron, including 5 amorphous lumps showing little or no magnetism in ditch terminus 4169 (context 4172) and three pieces of copper alloy, consisting of a length of wire and two small pieces of sheet (Table 7).

The glass comprises two beads, one of which may be of shale or a similar material, rather than glass, and a vessel body sherd, which is possibly late post-medieval or modern.

Table 7: Summary of metalwork and glass finds

Context	***Material***	***Count***	***Category***	***Identification***	***Feature***
4060	Glass	1	Jewellery	Bead	Ditch 4061
4060	Glass?	1	Jewellery	Bead	Ditch 4061
4079	Glass	1	Vessel	Sherd	Ditch 4078
4086	Fe	1	Footwear	Hobnail	Rectangular tank 4089
4118	Cu alloy	1		Sheet	Ditch 4113
4172	Fe	5		Lumps	Ditch 4169
4180	Cu alloy	1		Wire	Ditch 4179
4279	Fe	1	Cutlery	Whittle tang knife	Ditch 4277

Worked stone

A total of five pieces of worked stone were found during the excavations. These include a possible processing stone, a large block, one rotary quern and two chunks with smoothed surfaces.

A large block of stone and a rotary quern are both made of pebbly sandstone from the Quartz Conglomerate beds of the Upper Old Red Sandstone; they are of very similar lithology (although the block is more pebbly) and may be from the same outcrop. Although much of the Old Red Sandstone from the Avonmouth / Portishead vicinity, (the Portishead Beds conglomerate) is generally red in colour with mainly milky white quartz inclusions (Barford 1984, 16), the stone here does resemble samples of Portishead Beds collected from the Portishead cliff exposures (Shaffrey 2006). The quern and block thus probably had a source approximately 12km from the site. The rotary quern is of an unusual style for this lithology (projecting-hopper) and is Roman in date, possibly late Roman (Shaffrey 2006, 42). A quern of similar stone was found at Plot 4000 (Wessex Archaeology 2006), and it is possible that this derived from the same source. The block is now too small to have been used to make a rotary quern, although this does not preclude it having been bigger to start with. In isolation it does not provide evidence for stone working but it has been moved some distance and was presumably intended for use – perhaps in construction.

In addition to the rotary quern and block, two small chunks of Old Red Sandstone, both with one smoothed face, were recovered from hollow 4129 (context 4130); their function is unclear. A further piece (4209) was located on the surface of ditch group 5019, damaged on all sides but with two opposing very smooth and concave surfaces, may have been some sort of processor but is too incomplete to be certain.

Eight thinly bedded fragments of fine-grained grey micaceous sandstone were also recovered from the excavation. None of these fragments show any definite evidence for use. A number of similar fragments were recovered during work at Plot 4000 (Wessex Archaeology 2006, 12).

Animal bone

The animal bone assemblage consisted of 516 refitted fragments, of which 128 (24.8%) could be determined to taxon (Table 8). All the animal remains were counted and weighed, and where possible identified to species, element, side and zone (Serjeantson 1996; Worley forthcoming). Sheep and goat were identified to species where possible, using Boessneck *et al*. (1964) and Prummel and Frisch (1986). Ribs and vertebrae, with the exception of atlases and axes, were classified by size: 'large mammal' representing cattle, horse and deer, and 'medium mammal' representing sheep/goat, pig and large dog. For ageing, recordable loose third molars, mandibles with two or more recordable teeth (Grant 1982) and bones with fused and/or unfused epiphyses (Habermehl 1975) were noted. Sex estimation was carried out on cattle pelves, sheep pelves, and pig canine teeth, using data from Boessneck *et al*. (1964), Prummel and Frisch (1986), Schmid (1972) and Vretemark (1997). Measurable bones were noted according to von den Driesch (1976). Withers' height of horse was calculated using May (1985). A full catalogue of the assemblage can be found with the site archive.

The species present included cattle (Bos taurus), sheep/goat (Ovis aries/Capra hircus), pig (Sus domesticus), horse (Equus caballus), dog (Canis familiaris), red deer (Cervus elaphus), bank or field vole (Myodes glareolus/Microtus agrestis) and frog (Rana sp.). A few indeterminate bird bones were also found. Most. bones were in a good condition, with few traces of gnawing or burning. The assemblage is very similar in composition to the adjacent assemblage from Plot 4000. Species that were only found in Plot 4000 include mole (Talpa europea), domestic fowl (Gallus gallus) and passerine (Passeriformes sp.); all were represented by only one bone (Grimm 2006).

Unfortunately, the Plot 5000 assemblage comprises fewer than the 300 bones from the three major domesticates (cattle, sheep/goat and pig) required for an intrasite analysis (Hambleton 1999, 39-40). Even if the bones from Avonmouth Plot 4000 were added, cattle, sheep/goat and pig would only constitute 108, 120 and 32 fragments each (Table 9; Grimm 2006). However, a tentative conclusion from the small assemblage would be that pig were of less importance than cattle and sheep/goat. The scarcity of deer bones is consistent with other Romano-British rural sites, indicating that hunting was a rare event.

Regardless of species, bones from almost all body parts were retrieved, which would indicate that cattle, sheep/goat, pig and horse were slaughtered and butchered on the site. Three juvenile bones were recovered: one cattle frontal bone and two sheep/goat carpal bones, which provide an indication that animal rearing took place at the associated settlement. Bones suitable for fusion were few in number but tentatively suggest that most cattle and sheep/goat were slaughtered as subadults or adults, whereas most pigs were slaughtered as subadults. The two cattle mandibles that could be aged belonged to old animals, one in the age category Old Adult and one in the Senile category (cf. Halstead 1985). The sheep/goats show a larger range of age categories, with a slight predominance of young adults.

Although there are several Romano-British sites along the Severn estuary, animal bone assemblages are rare and often small or summarily reported (Everton and Everton 1981; Gardiner *et al*. 2002; Hinton and Dobson-Hinton 1950). In the Iron Age the Levels are believed to have been used for seasonal grazing, mainly for cattle. Sites situated on the edges of the Levels and further inland were dominated by sheep (Bell *et al*. 2000, 347; Gardiner *et al*. 2002, 10, 25). Land transformation is consistent with the relatively high number of sheep/goat at Avonmouth, since cattle are generally better suited for wetland grazing than sheep.

Table 8: Summary of animal bone (NISP)

	Cattle (Bos taurus)	***Sheep/goat (Ovis aries /Capra hircus)***	***Sheep (Ovis aries)***	***Pig (Sus domesticus)***	***Horse (Equus caballus)***	***Dog (Canis familiaris)***	***Red deer (Cervus elaphus)***	***Bank vole /Field vole (Myodes glareolus /Microtus agrestis)***	***Bird***	***Frog (Rana sp.)***	***Frog/toad (Anura)***	***Medium mammal***	***Large mammal***	***Indeterminate***
Skull fragments	5		3	1		1								
Mandible	7	8		5	1								1	
Loose teeth	11	14		10	3								2	1
Hyoid												1		
Axis	1	1												
Vertebra												2	4	
Rib												7	12	
Sacrum														
Scapula	2	2			1									
Humerus	2	4			1								1	
Radius	3	3		1	1									
Ulna														
Carpal		2										1		
Metacarpal	2		1		1									
Pelvis	3	2												
Femur	1				1			1			1			
Patella					1									
Tibia	3	4		1										
Tibiotarsus									1					
Tibiofibula										1				
Calcaneus	1	1												
Astragalus					1									
Metatarsal	1	4	1		1		1							
Tarsometatarsus									2					
Phalanx 1					1									
Phalanx 2				1										
Indet. metapodial														
Long bone									1			37	17	
Indeterminate													1	296
Total (NISP)	42	45	5	19	13	1	1	1	4	1	1	48	38	297
Weight (g)	2647	376	226	253	1301	5	18	0	0	0	0	46	320	424

The composition of the assemblage from Plot 4000 and Plot 5000 suggests subsistence animal husbandry rather than specialised pastoral settlement. This is consistent with the assemblages from Plot 4000 (Wessex Archaeology 2006).

*Table 9: Number of bones/taxa at Plot 4000 and Plot 5000. * including 58 bones from an articulated skeleton*

	Plot 5000	***Plot 4000***
Cattle	42	66
Sheep/goat	45	69
Sheep	5	66*
Pig	19	13
Horse	13	15
Dog	1	8
Red deer	1	2
Bank vole /Field vole	1	
Mole		1
Domestic fowl		1
Passerine		1
Indeterminate bird	4	
Frog	1	1
Frog/toad	1	4
Small mammal		2
Medium mammal	48	49
Large mammal	38	38
Indeterminate	297	
TOTAL	**516**	**336**

THE ENVIRONMENT OF THE ROMANO-BRITISH DITCHES

The Roman ditches

Most of the Roman ditches were relative shallow, with the majority being less then 0.50 m deep and the deepest being just under 1 m. The ditches were cut into the weathered surface of the upper alluvium and sealed by alluvial greyish brown topsoil. The ditches were filled with estuarine alluvium, which rarely showed any significant stratification. Where stratification was recorded this was largely due to recutting of the ditches or dumps of rubbish deposits. Micro laminations were noted within the lower fills of the earlier phased ditches, indicating a tidal-influenced environment. However, a stabilisation deposit was identified in a number of the ditches dating from the late Roman period suggesting a drying out of the site over time.

Monolith and bulk samples were taken through a range of ditches and deposits in order to represent a range of features and phases across the site. Samples for pollen, small bones, ostracods, molluscs and sediment descriptions were processed from these sequences.

Small bones

Fish remains, together with those of small mammals and amphibians, were recovered from bulk soil samples sieved to 0.5 mm as part of the soil flotation process: bulk sample volumes were in the range 20-40 litres of whole earth. The majority of remains were observed in the 2.0-0.5 mm residue fractions, which were only retained if bones were seen in the larger fractions. In addition, a number of 2 litre incremental samples were taken through the Roman ditch fills, primarily for molluscs. Bones extracted from the residues from these samples are also considered here.

All bones were in excellent condition, which allowed the identification of extremely tiny bones from fish of only a year old. In total, over 1000 bones were identified from samples 40 and 60 (Table 10), almost all of which were from young eels (*Anguilla anguilla* L.) and sticklebacks (Gasterostidae); the great majority of stickleback bones came from sample 40 from pit 4043.

This early Romano-British pit contained 441 identified bones from an extremely limited range of fish: almost all the remains were from small and tiny eels and sticklebacks, the latter including the three spined stickleback *Gasterosteus aculeatus* L. and also probably the closely related nine spined stickleback *Pungitius pungitius* L.. Two tiny bones from sole (*Solea solea* L.) were also identified and a single scale fragment was tentatively identified as perch (*Perca fluviatilis* L.). One stickleback spine had been burnt in limited oxygen, giving the bone a blue colour. In addition, a bank vole (*Myodes glareolus* Schreber) mandible and a house mouse (*Mus musculus* L.) tooth were also identified.

The fish remains from 2nd to 3rd century enclosure ditches were almost entirely from eel, again including bones from fish under 100 mm long. Stickleback, flatfish (including plaice, flounder or dab – Pleuronectidae) and herring or sprat (Clupeidae) were represented by several bones, while rays, including the spotted ray (*Raja montagui* Fowler) were represented by several teeth and dermal denticles. A single small cyprinid (Cyprinidae) vertebra was the only bone from an exclusively freshwater fish, although both eels and sticklebacks inhabit fresh as well as salt water. Toad, probably natterjack toad (*Bufo calamita*), frog (*Rana* sp.), and water vole (*Arvicola amphibius* L.) was also identified.

The fish assemblage from Plot 5000 is unusual in being so dominated by bones from just two small and tiny fish: eel and stickleback. Both are commonly found in estuarine conditions: three-spined sticklebacks (*Gasterosteus aculeatus*) spawn in freshwater but are commonly found in coastal waters and brackish estuarine lagoons while eels spawn in the Sargasso sea, entering the mouths of British rivers as three year old elvers in May-June whence many of them migrate upstream. The damp nature of the surroundings is confirmed by the presence of bones from water vole, frogs and toads within the ditch fills.

The ubiquity of very small euryhaline fish suggests that the features in which the small fish remains were abundant were at least seasonally wet and probably regularly flooded, probably (although not necessarily) with brackish water. The tiny ray dermal denticles in sample 60 and bones from tiny dover sole (*Solea solea* L.) in the pit sample 40 are from exclusively marine fish, possibly accidentally stranded. The abundance and excellent condition of bones in these samples would suggest that the eel and stickleback may have lived, at least for a short time, in standing water within the features.

Table 10: Fish, small mammal and amphibian bones from soil samples

Species	*Sample*					
	40	*60*	*43*	*50-56*	*89*	*TOTAL*
Raja montagui		1				1
Rajidae		3				3
Anguilla anguilla	269	632		1		901
cf.Clupeidae		5				6
Cyprinidae		1				1
Gasterosteus aculeatus	13			1		13
Pungitius pungitius	4					4
Gasterostidae	150	8		2	3	163
cf.Perca fluviatilis		1				1
Pleuronectidae		3		1		4
Solea solea	2					2
Flatfish indet.	1	2				3
Mus musculus	1	1	1			3
Apodemus sp.		2				2
Myodes glareolus	1					1
Arvicola amphibius			1			1
Mouse/vole indet.		3			1	4
Bufo cf. calamita				3		3
Bufo sp.		1				1
Rana sp.					5	5
Aunura/reptile indet.		2		4	3	9
Total	441	659	2	12	12	1126

Although this interpretation would place the fish remains outside the cultural domain, it is evident that at least some human rubbish found its way into at least ditch 4277 (context 4279) and possibly also into pit 4043 (context 4045). In both cases a small number of bones were burnt, probably during rubbish disposal, and in ditch fill 4279 a small number of the larger eel bones appear distorted in a manner typical for cess. Both the eels and sticklebacks could have been eaten, but in this case small and fragile bones would be unlikely to survive (Nicholson 1993).

The Romano-British population, however, does not seem to have been particularly fond of fish: their remains are extremely rare at rural sites (Locker 2007). The general lack of bones from larger fish at Plot 5000 would suggest that fishing was not practised to any great extent, although some smaller flatfish and eels were evidently eaten. Whether elvers were caught by trapping or netting is not proven from the evidence. In the recent past, however, elvers were extensively fished along the Severn Estuary and were often made into 'elver cakes' and fried (Phillips and Rix 1985, 122).

Pollen
Four samples from two monoliths (61 and 65) were taken through the Romano-British drainage ditches. All pollen and other significant content including fungal and algal spores, dinoflagellates and microscopic charcoal fragments were recorded.

Pollen preservation within the Roman ditches show generally declining frequencies of pollen, suggesting a quite open landscape at this time. Pollen preservation also worsens up the monoliths with increasing amounts of amorphous pollen. The poor preservation of much of the pollen may suggest deposition in an intertidal zone followed by drying out of the surface and damage by oxidation and aerobic conditions.

Plant remains
Eight samples were collected for the recovery of charred plant remains from ditches, pits and subrectangular features. Three of the samples (pit 4043, fill 4045, sample 40; ditch 417,9 fill 4181, sample 56 and ditch 4277 fill 4279, sample 60) produced mixtures of cereal grain, cereal chaff and weed and wild plant seeds. However, the earlier deposit was strongly dominated by cereal grain, whereas the two later deposits were dominated by weed/wild taxa (Table 11).

Sample 40 (mid 2nd – 3rd C, pit 4043, context 4045) was dominated by a large quantity of highly clinkered, indeterminate cereal grain and smaller fragments, which could either be cereal grain or large grass caryopses. Those taxa that could be identified to genus were either barley (*Hordeum* spp.) or indeterminate wheat (*Triticum* spp.). Notably, wheat glume bases (which would either be emmer - *Triticum dicoccum* Schübl. - or spelt - *Triticum spelta* L.) were absent; however, free-threshing type rachis nodes were observed in sample 40.

Samples 56 and 60 were dominated by a wide range of weed/wild taxa, but especially common/slender spike-rush (*Eleocharis palustris* (L.) Roem. and Schult./*uniglumis* (Link) Schult.), goosefoot (*Chenopodium* spp.), indeterminate melilot/medick/clover (*Melilotus* spp./*Medicago* spp./*Trifolium* spp.), orache (*Atriplex* spp.), vetch/vetchling (*Vicia* spp./*Lathyrus* spp.) and sea club-rush/wood club rush (*Bolbosschoenus maritimus* (L.) Palla/*Schoenoplectus* spp.). Sample 60 varied from sample 56, in that it contained several charred broad beans (*Vicia faba* L. ssp *minor*) and indeterminate vetch/and/or garden peas (*Vicia* spp./*Pisum sativum* L.).

There are a number of similarities between the remains recovered from Plot 5000 and those from Plot 4000 and Crook's Marsh. Large pulses, for example, were also recovered from Plot 4000 (Stevens forthcoming) and at Crook's Marsh (Jones 2005). There also appears to be limited evidence for the cultivation of free-threshing type wheat (*Triticum aestivum* L./*turgidum* L.) at Plot 5000 as well as at Plot 4000 (Stevens forthcoming) and Crook's Marsh (Jones 2005). The weed/wild taxa from Plots 4000/5000, Farm's Lane and Crook's Marsh are not identical, but the presence of small-seeded legumes and members of the goosefoot family (Chenopodiaceae) is consistent between the sites (Jones 2005; Stevens forthcoming).

Table 11: Charred plant remains recovered from Roman deposits

Sample	**40**	**56**	**60**	
Context	**4045**	**4181**	**4279**	
Feature Type	**Pit 4043 - rubbish dump**	**Ditch 4179**	**Pit 4277 - rubbish dump**	
Period	**Roman - M2C - 3C**	**Roman - 3/4C**	**Roman - 3/4C**	
SAMPLE VOLUME (L)	**20**	**40**	**30**	
FLOT VOLUME (ml)	**20 ml**	**40 ml**	**100 ml**	
PROPORTION OF SAMPLE SORTED	**100%**	**100%**	**100%**	
SEEDS PER LITRE (CHARRED)	**27.05**	**6.03**	**20.03**	
SEEDS PER LITRE (MINERALISED)	**0.95**	**0.1**	**1.6**	
FLOT				
CEREAL GRAIN				
Hordeum spp. - hulled	1		5	barley
Hordeum spp.	47		35	barley
Triticum spp. - indeterminate	36		5	wheat
Cereal - indeterminate	118[E]		100[E]	cereal
Cereal/Large POACEAE - indeterminate	100[E]	5[E]	50[E]	cereal/large grass
CEREAL CHAFF				
Hordeum vulgare L. – six-row rachis node	1			six-rowed barley
Triticum spelta L. – glume base		9		spelt
Triticum aestivum L./*turgidum* L. – type rachis node	5		1	bread/rivet wheat
Triticum sp. – glume base		10		glume wheat
Triticum sp. – rachis node	1	13		wheat
Triticum sp. – glume/lemma fragments		+		wheat
Triticum sp. – awn	+	+		wheat
Cereal - indeterminate rachis internode		8		cereal
Cereal/Large POACEAE – rachis internode			3	cereal/large grass
Cereal/Large POACEAE – culm node	2	3	2[E]	cereal /large grass
DETACHED EMBRYO				
Cereal/Large POACEAE – detached embryo	5	1	5	cereal/large grass
PULSES				
Vicia faba L. ssp. minor			3	broad bean
Vicia faba L. ssp. *minor*/*Pisum sativum* L. - fragmented			5[E]	broad bean/garden pea
Vicia sp./*Pisum sativum* L.			7[E]	vetch/vetchling/garden pea
FABACEAE - detached, large hilum			1	pea family
TREE/SHRUB				
Corylus avellana L. - nutshell fragments (est. whole nut)	1			hazel
Unidentified - fruit stone/nutshell fragment		1		-
WEED/WILD PLANTS				
Ranunculus spp.			4	buttercup
Chenopodium spp.	4		3	goosefoot
Chenopodium spp./*Atriplex* spp. - indeterminate internal structure	4		28	goosefoot/orache
Atriplex spp.	3	5[E]	8	orache
CARYOPHYLLACEAE – indeterminate, internal structure	3			pink family
Polygonum sp./*Rumex* sp./*Carex* sp.- indeterminate internal structure	1			knotgrass/dock/sedge

Sample	**40**	**56**	**60**	
Context	**4045**	**4181**	**4279**	
Feature Type	**Pit 4043 - rubbish dump**	**Ditch 4179**	**Pit 4277 - rubbish dump**	
Rumex cf. *acetosella* L.		2		possible sheep's sorrel
Rumex spp.	1	2	6	dock
Rumex sp. - perianth intact	1?			dock
Brassica cf. *nigra* L.		1		possible black mustard
Rorippa sp.		1		water-cress
Raphanus raphanistrum L. - capsule fragment			1	wild radish
BRASSICACEAE - unidentified		1		cabbage family
Vicia spp./*Lathyrus* spp. - large-sized	1	1		vetch/vetchling
Vicia spp./*Lathyrus* spp. - small-sized	1		12	vetch/vetchling
Melilotus spp./*Medicago* spp./*Trifolium* spp.	7	34	9	melilot/medick/clover
FABACEAE - detached hilum		1		pea family
FABACEAE – indeterminate (immature)			1	pea family
FABACEAE – indeterminate pod fragment	1			pea family
APIACEAE - indeterminate	1			carrot family
Plantago major L.		1	4	greater plantain
Prunella vulgaris L.		1		selfheal
Galium spp.		1		bedstraw
Anthemis cotula L.	5	1	23	stinking chamomile
Eleocharis palustris (L.) Roem. & Schult./*uniglumis* (Link) Schult.	3		108	common/slender spike-rush
Bolboschoenus maritimus (L.) Palla/*Schoenoplectus* spp.	12		21	sea club-rush/wood club-rush
cf. *Bolboschoenus maritimus* (L.) Palla/*Schoenoplectus* spp. - internal structure		3E	2	poss. sea club-rush/wood club-rush
Carex spp. - 2-sided			10	sedge
Carex spp. - 3-sided		2		sedge
CYPERACEAE - unidentified, fragment			1	sedge family
Cynosurus cristatus L.			1	crested dog's-tail
Avena sp. – floret base	2E			wild/cultivated oat
Avena sp. – awn fragments (< 5mm)	+	+		wild/cultivated oat
Avena sp. – pedicel				wild/cultivated oat
cf. *Avena* sp.			1	possible wild/cultivated oat
Avena sp./*Bromus* sp.	14E		8E	wild/cultivated oat/brome grass
Bromus sp.		1		brome grass
POACEAE – indeterminate small caryopsis	3	22	11	grass family
POACEAE – indeterminate medium caryopsis	9	18	19	grass family
POACEAE – indeterminate large caryopsis		3	22	grass family
POACEAE – indeterminate basal rachis node		2		grass family
POACEAE – indeterminate culm node		3	7	grass family
POACEAE – indeterminate culm base		1		grass family
Unidentified	1	23E	25E	-
Indeterminate	25E	25E	26E	-
TOTAL CPR IDENTIFICATIONS (FLOT)	**419**	**205**	**583**	
HEAVY RESIDUE CHARRED PLANT REMAINS				
4 - 2mm Heavy Residue Fraction				
CEREAL GRAIN				
Hordeum spp.	3			barley
Triticum spp.	2	2	1	wheat
Cereal grain - indeterminate	40	4	14	cereal
Cereal/POACEAE - indeterminate		1	2	cereal/large grass
CEREAL CHAFF				
Triticum spelta L. - glume base		2		spelt
Triticum sp. - glume base		1		wheat

Sample	40	56	60	
Context	4045	4181	4279	
Feature Type	Pit 4043 - rubbish dump	Ditch 4179	Pit 4277 - rubbish dump	
Cereal/POACEAE - indeterminate, culm node		2		cereal/large grass
PULSES				
Vicia faba L. ssp. *minor*/*Pisum sativum* L. - fragmented			1E	broad bean/garden pea
WEED/WILD				
Vicia sp./*Lathyrus* sp.		1		vetch/vetchling
Melilotus sp./*Medicago* sp./*Trifolium* sp.		1		melilot/medick/clover
Galium sp.		1		bedstraw
Avena sp./*Bromus* sp.	1			wild/cultivated oat/brome grass
Bromus sp.		1		brome grass
Indeterminate		1		-
TOTAL CPR IDENTIFICATIONS (4 - 2mm HR)	**46**	**17**	**18**	
2 - 0.5mm Heavy Residue Fraction				
CEREAL GRAIN				
cf. *Triticum* sp. - tail grain	1			possible wheat
Cereal/POACEAE - indeterminate	25E	2E		cereal/large grass
CEREAL CHAFF				
Triticum aestivum L./*turgidum* L. – type rachis node	1			bread/rivet wheat
Triticum sp. - rachis node	1			wheat
Triticum sp. - glume base		3		glume wheat
Cereal - indeterminate, internode	2	1		cereal
Cereal/POACEAE - indeterminate, culm node	1			cereal/large grass
DETACHED EMBRYO				
Cereal/POACEAE - detached embryo	1			cereal/large grass
WEED/WILD				
Atriplex spp.	7			orache
CARYOPHYLLACEAE - unidentified, internal structure	2			pink family
BRASSICACEAE - unidentified	1			cabbage family
Polygonum spp./*Rumex* spp./*Carex* spp.- indeterminate internal structure	1			knotgrass/dock/sedge
Rumex spp.	2	1		dock
Vicia spp./*Lathyrus* spp.	7	1E		vetch/vetchling
Melilotus spp./*Medicago* spp./*Trifolium* spp.	5	2		melilot/medick/clover
APIACEAE - unidentified	1			carrot family
Anthemis cotula L.	3			stinking chamomile
cf. *Eleocharis palustris* (L.) Roem. & Schult./*uniglumis* (Link) Schult. - internal structure		2		poss. common/slender spike-rush
Bolboschoenus maritimus (L.) Palla/*Schoenoplectus* spp.	2E			sea club-rush/wood club-rush
Avena sp. - awn		1		cultivated/wild oat
Avena sp. - floret base	2			cultivated/wild oat
Avena spp./*Bromus* spp.	2E			cultivated/wild oat/brome grass
POACEAE - small-sized caryopsis	1	1		grass family
POACEAE - medium-sized caryopsis	7E	2		grass family
UNIDENTIFIED	1			-
INDETERMINATE		3		-
TOTAL CPR IDENTIFICATIONS (2 - 0.5mm HR)	**76**	**19**	**0**	
MINERALISED PLANT REMAINS				

Sample	**40**	**56**	**60**	
Context	**4045**	**4181**	**4279**	
Feature Type	**Pit 4043 - rubbish dump**	**Ditch 4179**	**Pit 4277 - rubbish dump**	
2mm - 0.5mm Heavy Residue				
CEREAL GRAIN				
Cereal/POACEAE - indeterminate, highly fragmented			++	cereal/large grass
CEREAL CHAFF				
Cereal/POACEAE - straw fragments (unquantified)	+			cereal/large grass
DETACHED EMBRYO				
Cereal/POACEAE - detached embryo			1	cereal/large grass
WEED/WILD PLANTS				
Urtica dioica L.	1?			common nettle
CHENOPODIACEAE/CARYOPHYLLACEAE	3	1	5	goosefoot/pink family
Vicia spp./*Lathyrus* spp.	3		5	vetch/vetchling
APIACEAE - unidentified			1	carrot family
Sambucus nigra L.	2?			elder
Anthemis cotula L.			1	stinking chamomile
Eleocharis palustris (L.) Roem. & Schult./*uniglumis* (Link) Schult.			13	common/slender spike-rush
Bolboschoenus maritimus (L.) Palla/*Schoenoplectus* spp. - highly fragmented			2E	sea club-rush/wood club-rush
Avena sp. - floret base, fragment			1	cultivated/wild oat
POACEAE - small-sized caryopsis	1?		6	grass family
POACEAE - medium-sized caryopsis			2	grass family
POACEAE - culm node			1	grass family
UNIDENTIFIED	9	3	10	-
TOTAL MPR (occurs in 2 - 0.5mm HR only)	**19**	**4**	**48**	
TOTAL CPR (FLOT + 4 - 2mm and 2 - 0.5mm HR)	**541**	**241**	**601**	
OTHER MINERALISED REMAINS				
2 - 0.5mm Heavy Residue				
Isopoda			2E	wood lice and their relatives
Unidentified insect	1			-
Unidentified insect/segmented worm			++	-

Key: N^E = estimated score and $N^?$ = questionable antiquity, potentially modern/sub-fossil.
Semi-quantification scale: + = <5 items, ++ = 5-25 items, +++ = 25 - 100 items and ++++ = >100 items

The relative proportions of the various cereal crop products and by-products does, however, seem to suggest that there is some patterning of activities across the entire site, but the data is presently quite limited and further results are required to test the observed pattern. What is notable from Stevens (forthcoming) work at Plot 4000 and Jones' (2005) work at Crook's Marsh and Farm Lane, is that cereal grain was never particular abundant. At Plot 5000, on the other hand, cereal grain was frequently quite abundant accounting for 68.95% (N = 373) of all identifications in sample 40 and 35.27% (N = 212) of all identifications in sample 60. At Plot 4000, cereal chaff frequently dominated assemblages (eg linear pit 18021, ash spread 15098 and house gully 15019). This was also the case of Crook's Marsh (Jones 2005, 70) and was generally the pattern for the less-rich deposits from Farm's Lane (Jones 2005, 64).

Finally, there is one notable difference between the results of Plot 5000 and Plot 4000: mineralised plant remains were only recovered from Plot 5000 although 'cessy concretions' have also been noted at Crook's Marsh (Jones 2005, 69).

The charred plant remains examined from one mid Roman sample and two mid-late contexts suggest that cereal processing activities were taking place in the immediate vicinity and there seems little reason to presuppose that these were not cultivated locally, albeit possibly further away from the marsh edge. The abundance of charred plant remains from this and other later-period Roman sites in the region suggests that Roman reclamation/drainage projects known from elsewhere in the Severn Estuary were also occurring in this region.

Ostracods and foraminifera

A total of 10 samples, taken from 5 monoliths collected from Roman ditches, were assessed for microfaunal analysis of the foraminifera and ostracods (Table 12). Earthworm granules, molluscs and 'freshwater ostracods' were found in all samples, fish and/or amphibian bones in 8 samples (from all monoliths), slug plates in 7 samples (but not from Monolith 62), and brackish ostracods in 3 samples from 3 monoliths (but not from M61 and M63).

Six species of 'freshwater ostracods' and one brackish, estuarine ostracod were found. In some monoliths, especially in samples 62, 64 and 65 the ostracods were quite common. Of the 'freshwater ostracods', 5 species tolerate low salinities (and often actually prefer them) and live in temporary shallow coastal pools and ditches (Meisch 2000). One species, *Ilyocypris getica* (the largest European *Ilyocypris*) has an interesting distribution (Meisch *et al*. 1996), extending from circum-Mediterranean regions to eastern Europe and eastern Asia. It is, however, very rare in western Europe, except for a few previous records within the wetlands of the Severn Estuary. As these areas are important feeding grounds for migratory waterfowl and waders, it is tempting to suggest that the ostracods have been transported in mud by migrating birds. It is, however, also possible to suggest as an alternative, that the Romans themselves could have accidentally introduced it. The remaining freshwater species is *Tonnacypris lutraria*, an inhabitant of wet grass and grassy ditches.

The associated microfauna is brackish and characteristic of estuarine mudflats and creeks: three ubiquitous species of foraminifera (Haynesina germanica, *Elphidium williamsoni*, and a brackish Ammonia), and in monolith 62, a fourth, *Elphidium gerthi*; in 62, 64 and 65 these were accompanied by the ostracod, *Leptocythere castanea*.

Table 12: Microfossils from the Roman ditches

OSTRACODS

Monolith	M61		M 62		M 63		M 64		M 65	
depth	1-6cm	9-14cm	3-8cm	31-36cm	18-22cm	30-35cm	8-13cm	29-34cm	5-10cm	35-40cm
Context	*4263*		*4264*		*4073*		*4074*		*4128*	
Ilyocypris getica	x	x	xx	xx	o(f)	x	o(f)	xx	x	x
Candona angulata	x	x	x	xx	x(f)	x(f)				
Sarscypridopsis aculeata				x				x		x
Leptocythere castanea (1)				x				x		x
Cyclocypris laevis								x		
Heterocypris salina								x	x	x
Tonnacypris lutraria (2)								x		x
FORAMINIFERA										
Haynesina germanica (1)	x	x	x	x	xx	xx	x	xx	x	x
Elphidium williamsoni (1)	o	x	x	x	x	x	x	xx	x	x
***Ammonia* spp. (brackish) (1)**	o	x	x	x	x	x	x	x	x	x
Elphidium gerthi (1)			x	x						

o - one specimen; x - several specimens; xx - common; (f) fragments only
"Freshwater" ostracods that can tolerate low salinities
2: Ostracod living in wet grass/grassy ditches
1: Brackish tidal mudflat/low saltmarsh species

Mollusca

Molluscs from a mixed group of small 2 litre samples, specifically collected for the retrieval of snails, and bulk samples that were taken for the retrieval of charred plant remains, but were also found to contain molluscs.

The preservation and abundance of molluscan remains were highly variable across the site. Whilst the samples from the sequence in OABH 11 ranged from poor to low quality, the samples from the ditch sequences produced well-preserved and rich assemblages, some of which was suitable for further analysis. One sample in particular, sample 53, from a boundary ditch context (4011), part of the Roman rubbish deposits, produced a rich assemblage of well-preserved snails.

The Roman ditch assemblage is a mixture of terrestrial, freshwater and brackish water species, similar to the assemblage identified at Plot 4000. The assemblage was dominated by Evan's Marsh group (Evans 1972) including species such as Vallonia puchella. There was, however, a much larger brackish element to the assemblage than was recorded in Plot 4000, consisting of *Hydrobia* spp. and *H. Ventrosa*. This may indicate that the Plot 5000 activity was closer to the marshland edge.

The ditches were found to have been actively draining the area, remaining mostly wet and never seasonally drying out. Lower samples from the earlier Roman ditches appeared to have a higher brackish assemblage than those from the late Roman period.

The Roman palaeosol

A putative Roman palaeosol, evident from very dark coloured mottling which penetrates into the upper part of the little-ripened River Severn marine sediments, was identified at 0.38-0.49 m in depth (5.57 m OD), the level at which the Roman features were identified. This surface was preserved in only parts of the site, with later ploughing having disturbed other areas. Such dark mottled palaeosols have been investigated through sediment micromorphology locally at Avonmouth at Cabot Park (Kites Corner) and Katherine Farm (Allen *et al*. 2002; Walker *et al*. 1999), and show that relict humic soil has been preferentially impregnated with iron and manganese, a typical phenomenon of accreting alluvial/flooded soils where there has been periodic landscape stabilisation (eg Lewis *et al*. 1992). The mottled pattern is also associated with burrowing by soil fauna, hence the poorly distinguishable junction between this palaeosol and the underlying sediments.

Renewed inundation and 'wetting' of the soil can cause slaking and structural collapse, as has been recorded at Cabot Park and Katherine Farm (and at Goldcliff, Gwent and along the Blackwater, Essex; Macphail 1994; Macphail and Cruise 2000). If this occurred through brackish water flooding the presence of Na+ ions causes major structural collapse because of soil dispersion (Hazelden *et al*. 1987). Inundation by freshwater is much less effective on soil dispersion, as at Three Ways Wharf, Middlesex, and as recently recorded at the Channel Tunnel Rail Link site of Tank Hill Road, Kent (Lewis *et al*. 1992; Macphail 2007).

The Roman environment

The samples from the Roman ditches indicate an open environment dominated by grasses (Poaceae and Cyperaceae, with Lactuceae, Chenopdiaceae, Brassicaceae and *Pteridium*). Tree pollen is very low suggesting a large open landscape with only a few trees. The remains of fish bones from some of the ditches indicate that they were still affected by marine sedimentation and therefore must have been connected to the tide.

The pollen samples from the Roman ditches indicate a gradual decrease in marine influence and increase in drainage over time. Large periods of stable dry conditions were clearly interrupted by occasional estuarine inundation. The presence of Dinoflagellate cysts and organic walled forams within samples recovered from the some of the earliest phased Roman ditches broadly suggest greater estuarine influence at this time, indicating at least periodic marine inundation of the earliest Roman enclosure ditches. The pollen, mollusca and ostracod assemblages from later phases of enclosure indicate decreasing marine influence and a gradual drying out of the ditches themselves. This also corresponds with a slight rise in cereal grains.

The environmental indicators suggest a gradual transition from a high saltmarsh to a slightly drier and more open environment. The Roman drainage of the site would appear to have been successful, but the area may still have been prone to flooding. As foraminifera do not live in freshwater and the ostracods can all tolerate low salinities, it is clear that the ditches were predominately brackish and were probably connected to a creek system with tidal access at least in high spring tides. The ditches were probably, therefore, originally cut to remove salt from the land and make it more suitable for farming. They may also have had to be well-maintained in order to keep out the saltwater, as the area was always close to marine incursion. This could account for the lack of major plant debris in the ditch sediment, at the same time allowing for the large numbers of earthworm granules which also occur in the samples washed in from nearby soils. Molluscs, fish and amphibians were also abundant within the ditches.

The limited but growing evidence for farming communities of middle–late Roman date on the Avonmouth Levels suggests that these settlements had fully adopted a 'transformation strategy' (*sensu* Rippon 2000b, 146) and were not merely eking out an existence at Avonmouth, but were actively reclaiming the land from marine influence. The settlements were well positioned at the salt-marsh/dry land interface to exploit marine, riverine, salt-marsh and arable environments in the vicinity (eg Bell 2000, 90–1).

DISCUSSION

The Wentlooge sequence

The investigation of the Wentlooge Sequence has identified a complex sequence of hydrological and environmental change in the area since the post-glacial period. The lower sequence is characterised by high-energy deposits and marine indicators that suggest that the area was once part of a larger marine embayment or backwater lagoon. Since the end of the last glaciation, sea level has risen rapidly from a point 5 m below its current level. This sequence appears to have been protected from the more extreme tidal range of the Bristol Channel. On at least three occasions it was cut off from marine influence and emergent vegetation appears to have become established. The presence of a burnt layer of reeds may indicate that these stabilised environments were attractive to Mesolithic groups. The bedrock ridge may have been sufficiently elevated above the level of flooding at this time to offer attractive locations in which to exploit both the marine and backwater marsh environments.

The transition into the middle sequence is marked by the deposition of intercalated silty clay and peats which indicate the end of outer estuarine influences and the silting up of the embayment by the early Neolithic period. This coincided with the inundation of the bedrock ridge that would have buried former early prehistoric dry landsurfaces. The environmental indicators suggest a transition from marine conditions to brackish mid to high salt marsh environments during the Neolithic and Bronze Age. The estuary may have been more confined to something like its present shoreline at this time.

On at least three separate occasions sea-level rise decelerated, sedimentation began, and emergent vegetation once again started to develop across parts of the Levels. The current sea-level curve for the southwest (Heyworth and Kidson 1982; Haslett *et al* 1998; 2001a; 2001b) provides some indication of the magnitude of these changes. During the Neolithic and Bronze Age, sea levels were 1-4m below current levels.

The area was characterised by dynamic wetland environments with marshland systems and large expanses of alder carr and reedswamp, dissected by areas occupied by eroding creeks. The sequence appears to repeatedly alter through cycles of marine transgressions and regressions, returning areas of vegetation back to scoured mud-flats, which develop into salt-marsh and then back to reed fen and alder carr.

The upper sequence appears to have accumulated quite rapidly during a period of accelerated sea-level rise between the early Iron Age and the early Romano-British period. Alluvial deposition was probably augmented during this period by changes in agricultural practices and other land-use, resulting in greater wash-off into local river systems (Moore *et al*. 2002). The upper surface of the alluvium appears to have stabilised by the early Roman period suggesting that sedimentation had significantly reduced by this period. The preservation of this surface and the alluvial topsoil may indicate that some limited alluviation occurred over the Roman surface in parts of the site.

The complex interrelationship between human communities and the sequence of environmental change within the Levels is also becoming increasingly clear. Plot 5000 has provided further evidence that early prehistoric communities were exploiting and also altering the environment of the Levels.

Evidence for early prehistoric exploitation of the Avonmouth Levels

In Plot 5000 the evidence of burnt reed deposits dating to the late Mesolithic suggest that early prehistoric communities were accustomed to manipulating the environment in order to increase the availability of resources. Whether the evidence of reed burning indicates man-made burning (either by accident or design) or a wholly natural event (possibly through lightening strike during a period of drought), however, is unclear. Other examples of burning events dating to this period in the Severn Estuary have been detected at Goldcliffe (eg Bell 1995: dated 5250–5550 cal BP) and the Caldicot Levels in Wales (eg Walker *et al*. 1998, 75). Elsewhere in England some authors have argued that Mesolithic peoples were intentionally modifying reed beds by burning them back in order to improve access to open water, possibly improving hunting opportunities as well (eg Star Carr: Hather 1998).

Similar evidence of charred woody and herbaceous stems was identified in the peat deposits from Plot 4000 dating from the late Bronze Age. This has been interpreted as evidence of land clearance by early prehistoric communities to encourage seasonal grazing (Wessex 2007). This fits in with Gardener *et al*.'s (2002) suggestion that the Levels were being predominately used extensively for seasonal pasture.

Romano-British settlement

The excavation revealed that Plot 5000 is on the edge of a low status agricultural settlement, predominantly of later Romano-British date (2nd to 4th century AD), but with indications of minor (perhaps seasonal) occupation in the late Iron Age and early Romano-British period. The main focus of the Romano-British settlement is likely to lie to the north-east, in Plot 4000, where excavation has uncovered roundhouses and other evidence indicating domestic occupation (Wessex Archaeology 2007). The ditches recorded in both plots seem to be part of a series of coaxial settlement and livestock enclosures, lying on a northeast to southwest alignment on the edge of an elevated island of alluvium within the Avonmouth Levels.

The main difference between Plots 4000 and 5000 is the absence of Romano-British domestic structures in the latter. The distribution and character of the Roman features in Plot 5000 suggests that they were a series of small animal enclosures and droveways, presumably associated with the settlement in Plot 4000. Some of the ditches in Plot 5000 contain concentrations of finds that suggest the deliberate dumping of domestic rubbish deposits. These are unlikely to have been transported far from the originating settlement.

The phasing of features suggests an evolving network of field systems, enclosures and trackways, representing significant reorganisations of the landscape over a 200 year period. The changes appear to be in response to occasional marine inundation that decreased in the late Roman period.

The activity in Plot 5000 appears to have declined from the late 3rd century with possible abandonment during the 4th century AD.

Romano-British economy

The settlement to which the features in Plot 5000 were related appears to have been of low status, judging by the poor range of high status material culture. The absence or paucity of drinking forms, such as flagons, cups and beakers, and dominance of jars and bowls that served both as dining and cooking vessels, suggests that the pottery derived from relatively low-status occupation. The absence, too, of imported amphorae and decorated samian points to a community with little need of, or access to, specialist continental products.

There was very little metal work, and the limited assemblage of glass beads and a knife is consistent with a small agricultural settlement. There was no evidence of any high status buildings either here or in Plot 4000 nor of specialised economic activities.

The environmental evidence suggests a mixed farming economy. This is in keeping with the interpretation of Masser *et al*. (2005) at Crook's Marsh, which indicated continuous arable cultivation rather than the seasonal pastoral activity suggested by Gardiner *et al*. (2002). Although the animal bone assemblage is too small to draw any firm conclusions, it suggests that sheep/goats may have been as important as cattle in the settlement diet and economy, although cattle and a range of other species are certainly represented in the domestic rubbish deposits. In spite of the coastal location, fish do not seem to have formed a substantial part of the diet, although there is some evidence for the cooking of eels and other species. The charred and waterlogged plant remains include evidence for cereal processing and consumption (charred grain and chaff). Cereal processing is further attested by the recovery of quernstones.

This raises the key question of why these communities were living out in the marsh. Rippon (2000b) has suggested a possible link with the villa estates and tenant farmers of the North Somerset Levels. Similar networks of villa estates are known to ring the edge of the Avonmouth Levels and could have been actively involved in the process of settlement expansion onto the Levels. The digging of the drainage ditches at the site would have required a good deal of time and resources, and these ditches would have had to be regularly maintained. Such endeavours may not have been beyond the capacities of small farming communities, but they would appear to represent a high risk strategy without the support of such estates.

Romano-British landscape of the Avonmouth Levels

The environmental evidence suggests that the settlement was located within a high saltmarsh that was actively drained to facility settlement and agriculture. Brackish environmental indicators from the Roman ditch fills suggest a connection to a wider, tidally influenced drainage system. Similar systems of 'ring dykes' surrounding island settlements have been suggested on the North Somerset Levels by Rippon (1997). The presence of domestic deposits within the ditches indicates periods of stabilisation, with perhaps seasonal inundation during high spring tides.

The settlement would appear to have been located within an alluvial island that was sufficiently elevated to have been above all but the highest of spring tides. The environmental evidence suggests the site became drier by the 3rd-4th century. The ditches appear to have been used to facilitate drainage and possibly to help remove salt from the land. The site appears to have been used primarily for pastoral enclosures and pens, but also contained domestic rubbish deposits which suggest that arable cultivation was probably occurring on more elevated parts of the island.

The evidence from Plot 5000 provides no conclusive evidence for systematic reclamation in this part of the Avonmouth Levels. The excavated enclosure ditches seem too small and localised to form part of any large-scale drainage. Both Crook's Lane and the Plot 5000 site were located on slightly elevated alluvial islands. These islands would appear to have been sufficiently elevated to remain dry throughout most of the year. Elevated bedrock highs were found to underlie both sites suggesting that the underlying palaeography still had a significant influence on hydrology and sedimentation patterns.

The evidence of permanent settlements on the Levels demonstrates that drainage and settlement did occur in the mid Roman period, but this could have been opportunistic, assisted by a slow-down in the rate of sea level rise that appears to have set in from the mid 3rd century AD (Allen and Fulford 1990, 316-17). Moreover, this was quite clearly part of a process that was playing out in many regions of the Severn Estuary during this period (eg Masser *et al*. 2005, 84).

Romano-British activity across the Levels

Field systems and trackways comparable to those at Avonmouth are known on the Gwent Levels (Bell and Neumann 1997), North Somerset Levels (Rippon 2000b) and Oldbury Levels (Green and Solley 1980). The chronology of settlement in the Severn Estuary seems to be broadly comparable with evidence from these other areas.

A Roman inscription found at Goldcliff on the Welsh side of the Severn (Boon 1980), supported by the discovery of seabank defences (Allen 2002), has long suggested the possibility of Roman Military involvement in the reclamation of the Gwent Levels where environmental evidence indicates freshwater conditions within the ditches (Juggins 1982). Part of this systemic reclamation, evidenced as blocks of long large fields, still survives today within the Wentlooge Levels close to the legionary fortress of Caerleon. This suggestion has, however, been tempered more recently by the discovery that not all of the Gwent Levels were reclaimed and that many areas such as Caldicot remained as high salt marsh (Meddens and Beasely 2001).

The difference between what occurred on parts of the Gwent Levels and on the Avonmouth Levels could perhaps be explained by the proximity of the Gwent Levels to the Roman fortress at Caerleon. The legions would have required significant food resources and areas of pasture that would have needed to be close enough to the fortress to be adequately protected. It thus appears likely that the more managed reclamation of the Wentlooge Levels was partly stimulated by the establishment of the fortress in the 1st century. This fits closely with the date at which the larger drainage ditches on the Gwent Levels were cut.

The evidence from the Avonmouth Levels indicates more opportunistic modification associated with alluvial islands from the late 2nd-early 4th century. The distribution of activity on the Levels appears to represent a piecemeal process of exploitation and modification as has been suggested by Rippon (2000b). Different areas of the Levels appear, however, to have developed differently, with differing levels of modification and reclamation occurring depending on both the specific needs of the communities involved and the hydrological and sedimentary conditions in particular areas.

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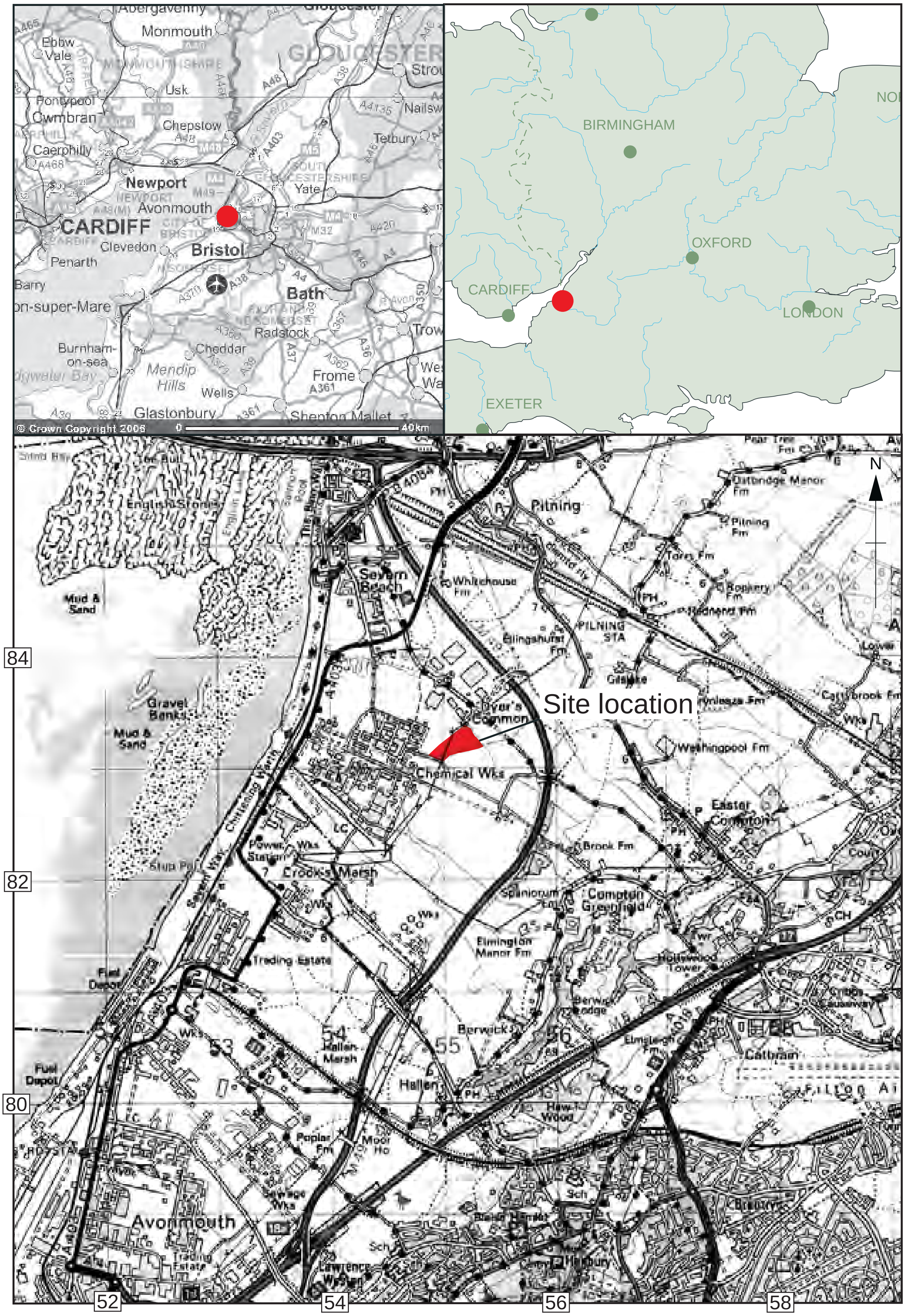

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Figure 1: Site location

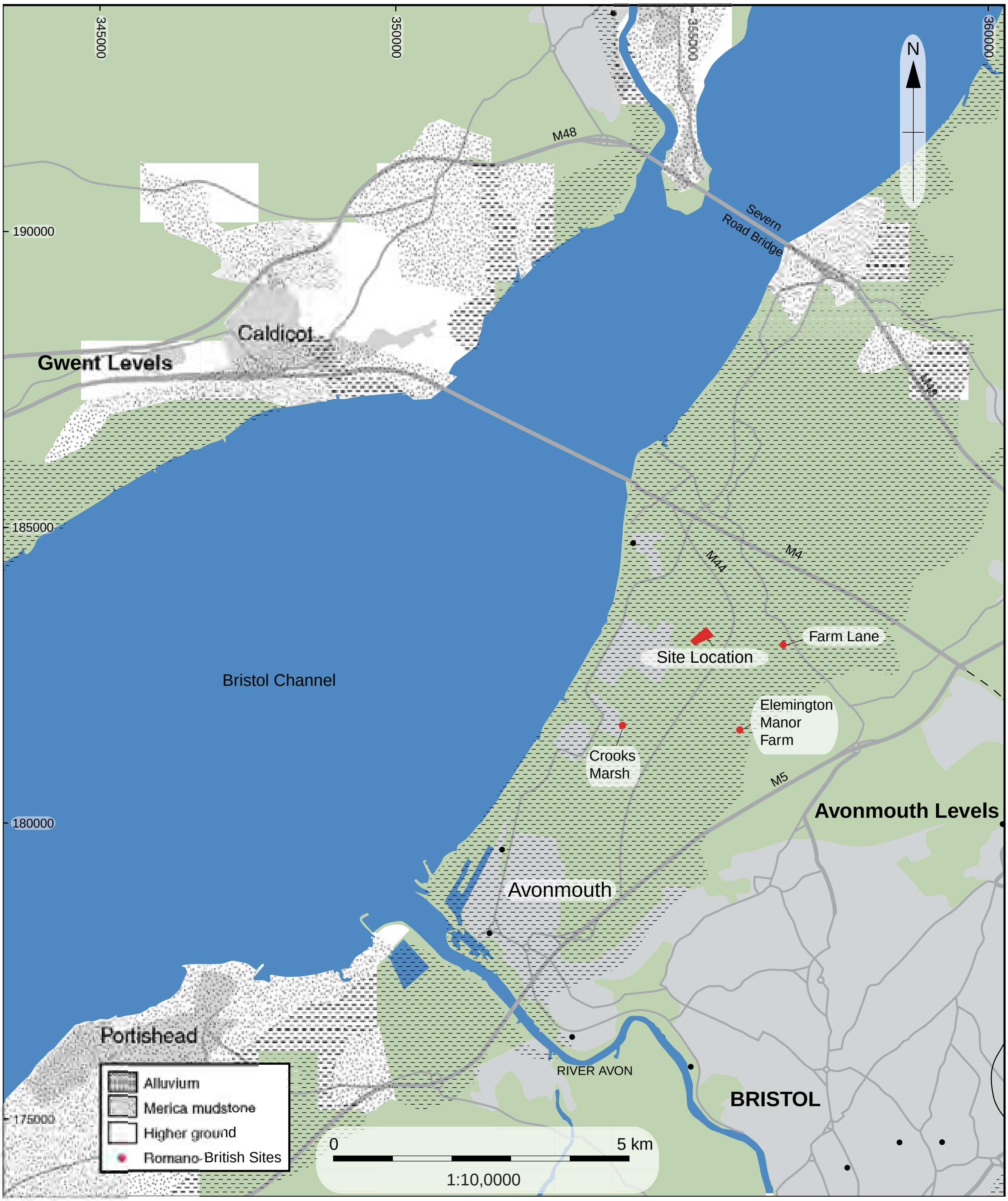

Figure 2: Romano-British sites around Avonmouth

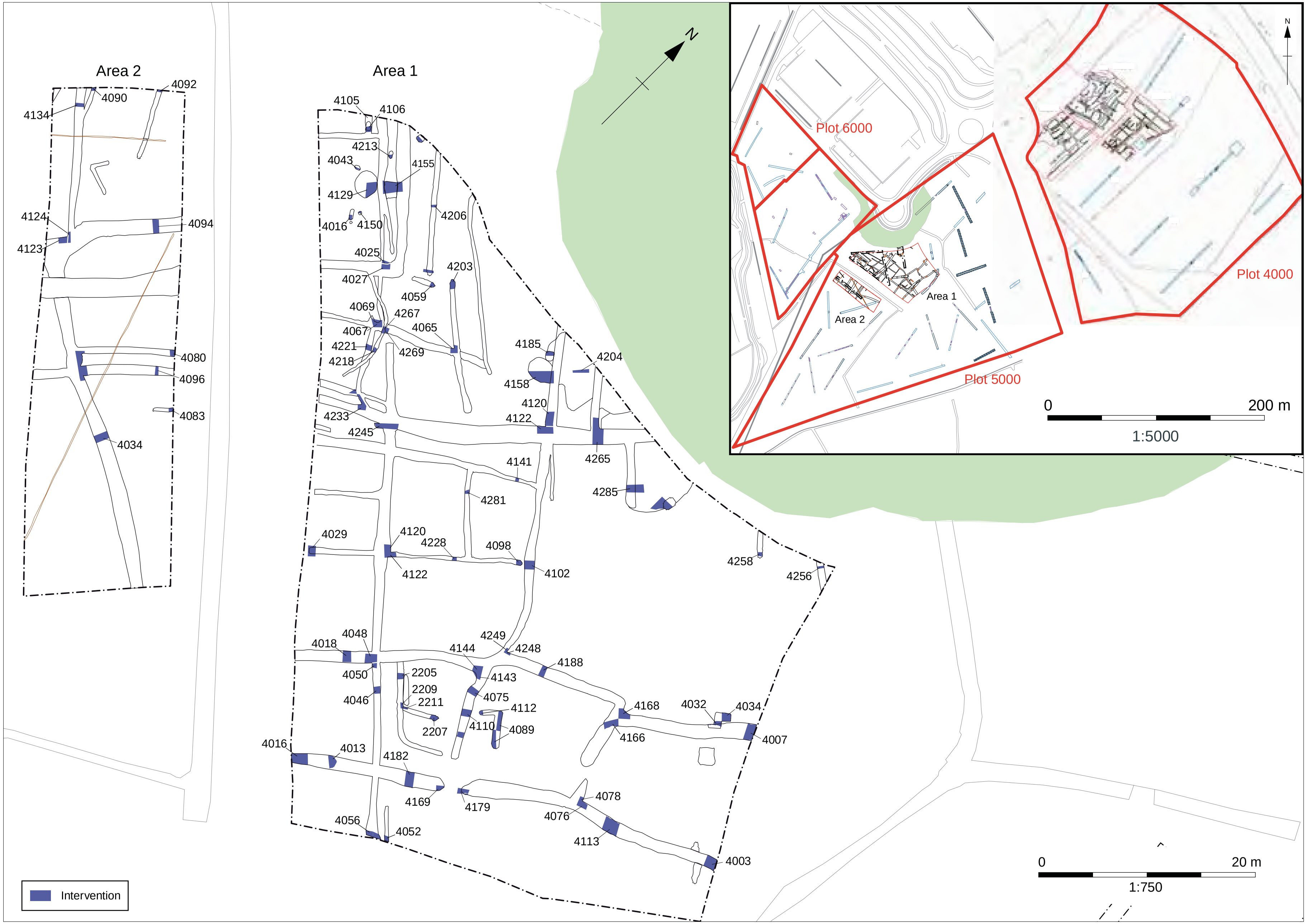

Figure 3: Excavation and trench location

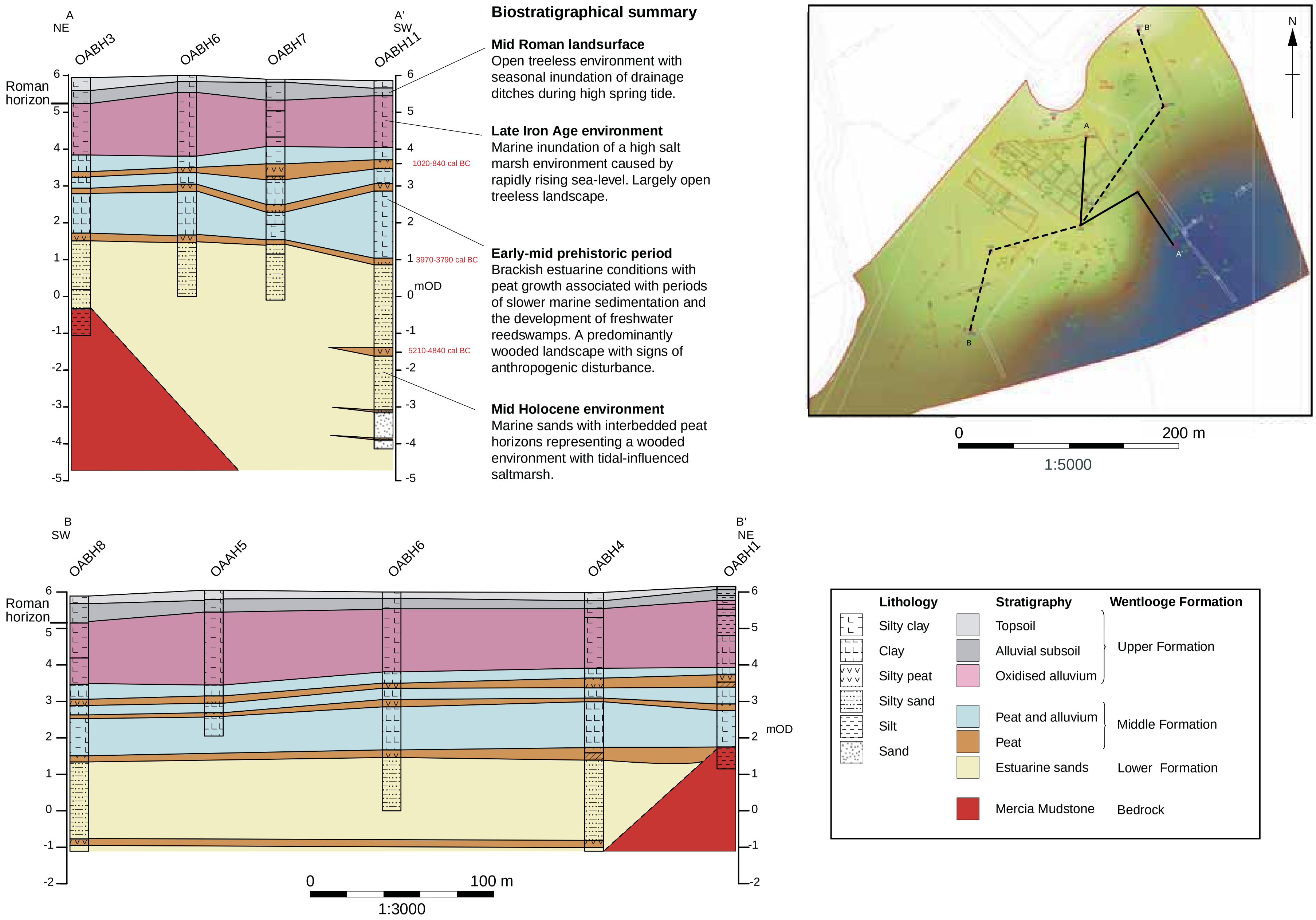

Figure 4: A plot of Mercia Mudstone elevations, showing borehole locations and cross-sections

Figure 5: Detailed phased site plan

Figure 6: Plan of 1st phase, late Iron Age/ early Roman features and sections

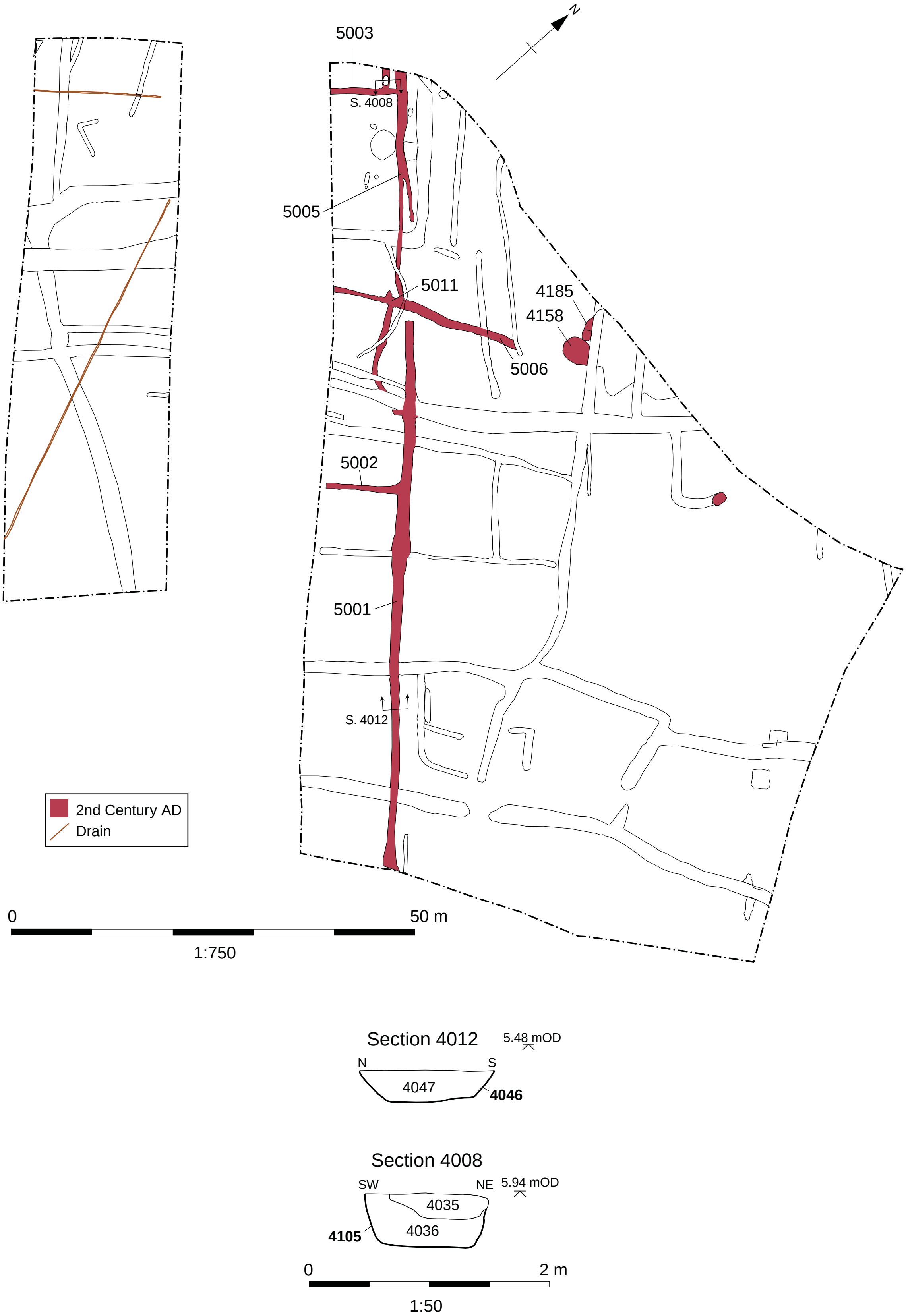

Figure 7: Plan of 2nd phase Roman features

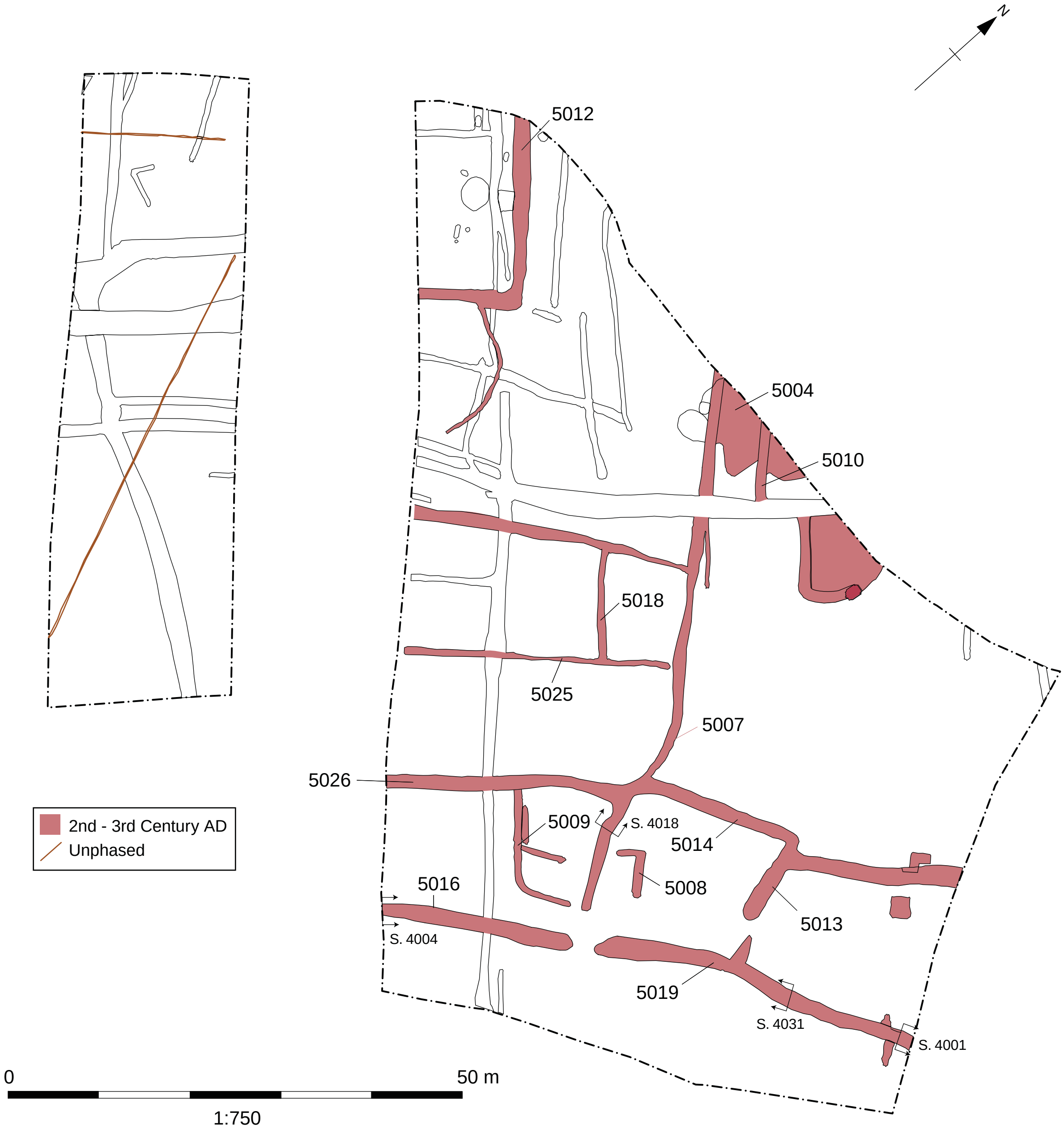

Figure 8: Plan of 2nd - 3rd Century Roman features

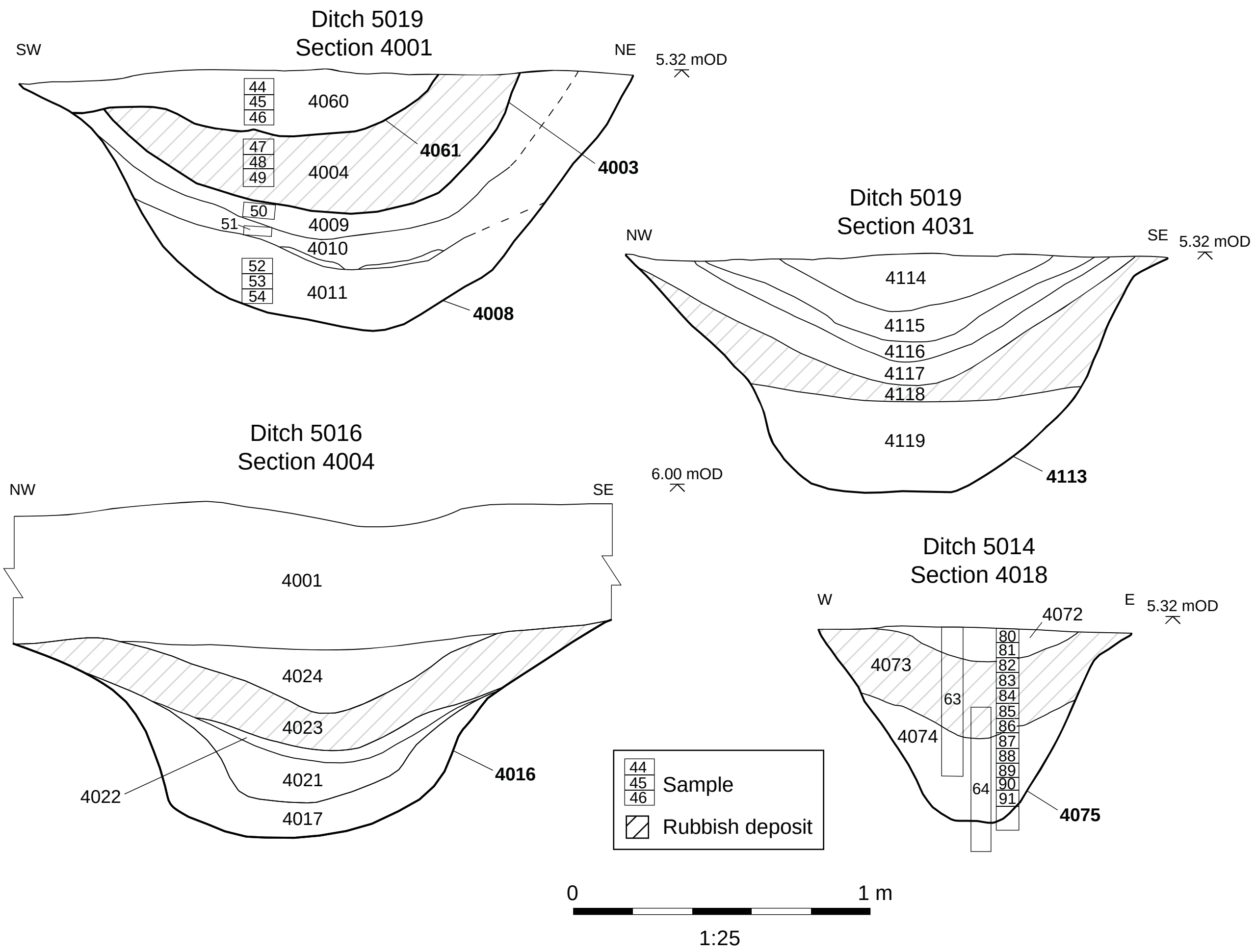

Figure 9: Sections of 2nd - 3rd Century features

Figure 10: Plan of 3rd - 4th Century Roman features

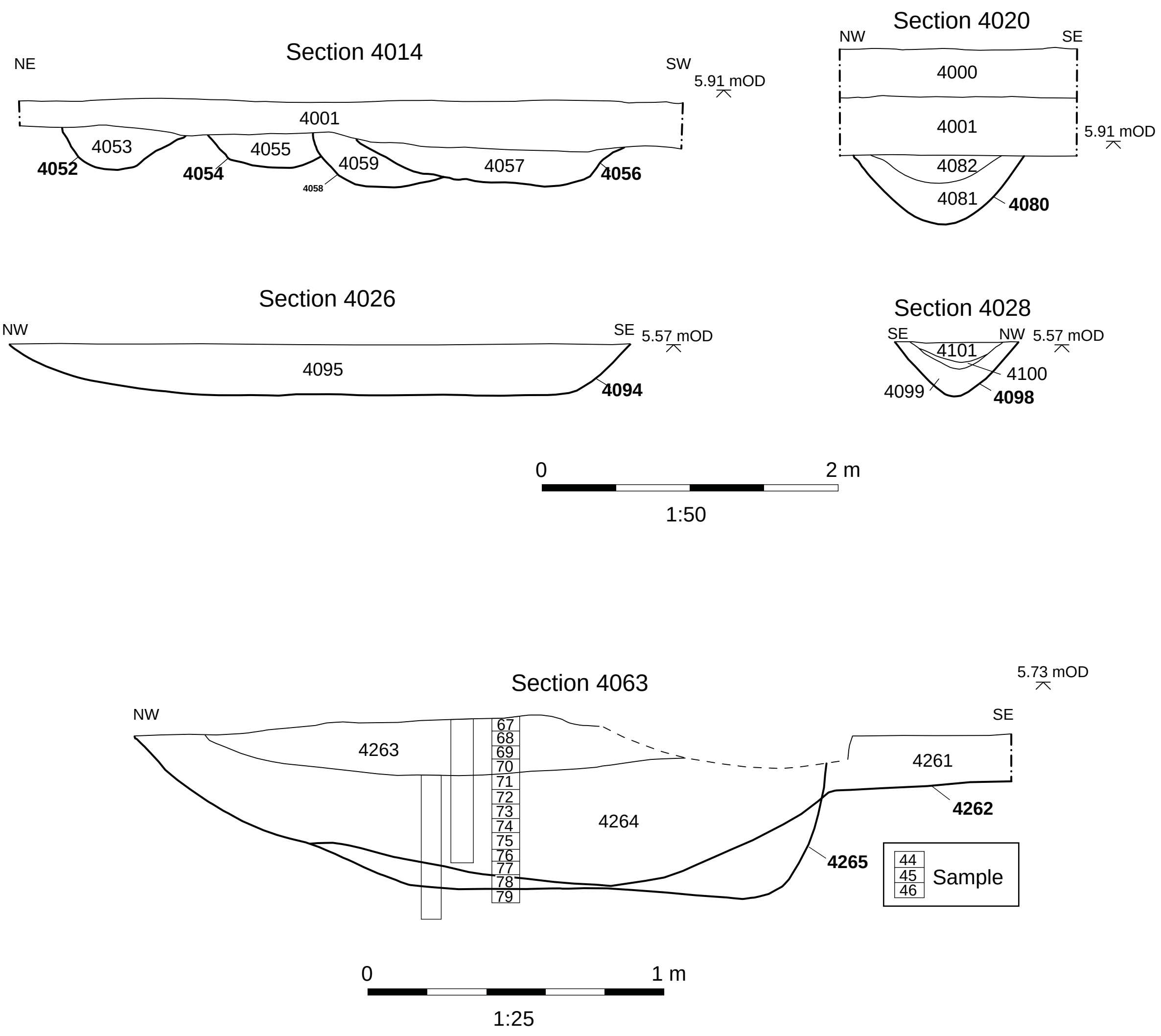

Figure 11: Sections of 3rd - 4th phase features

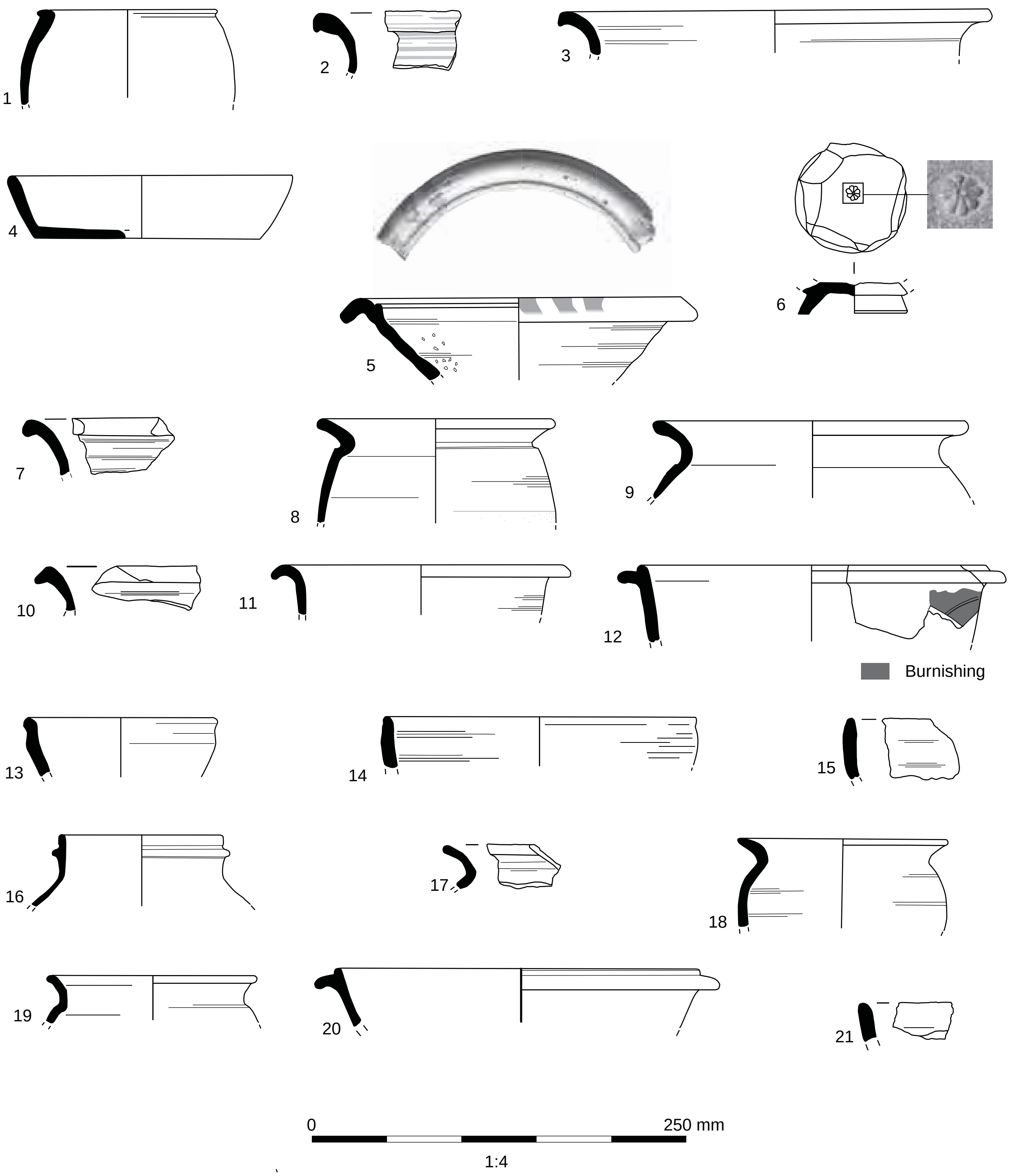

Figure 12: Roman pottery nos 1-21

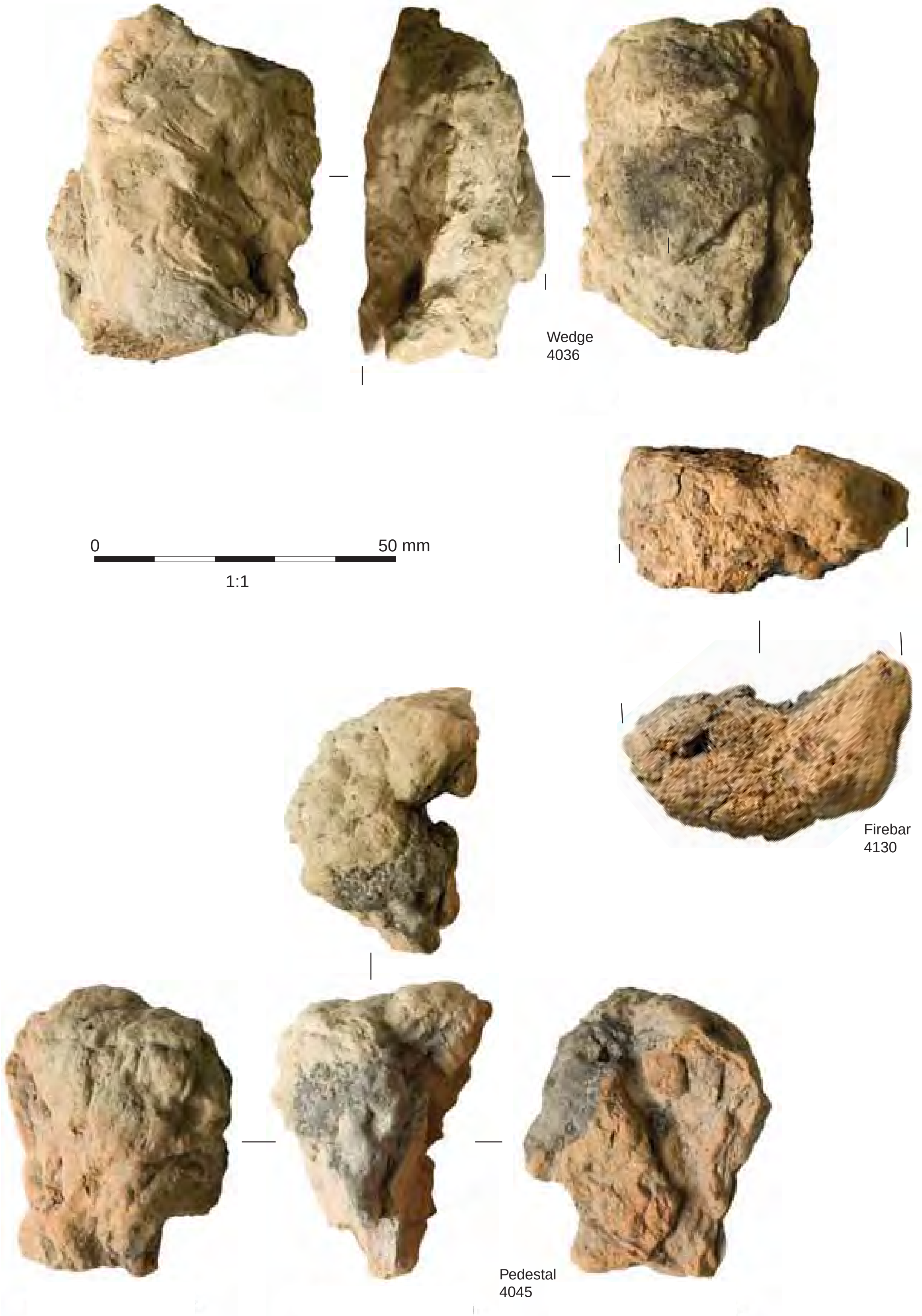

Figure 13: Photos of fired clay

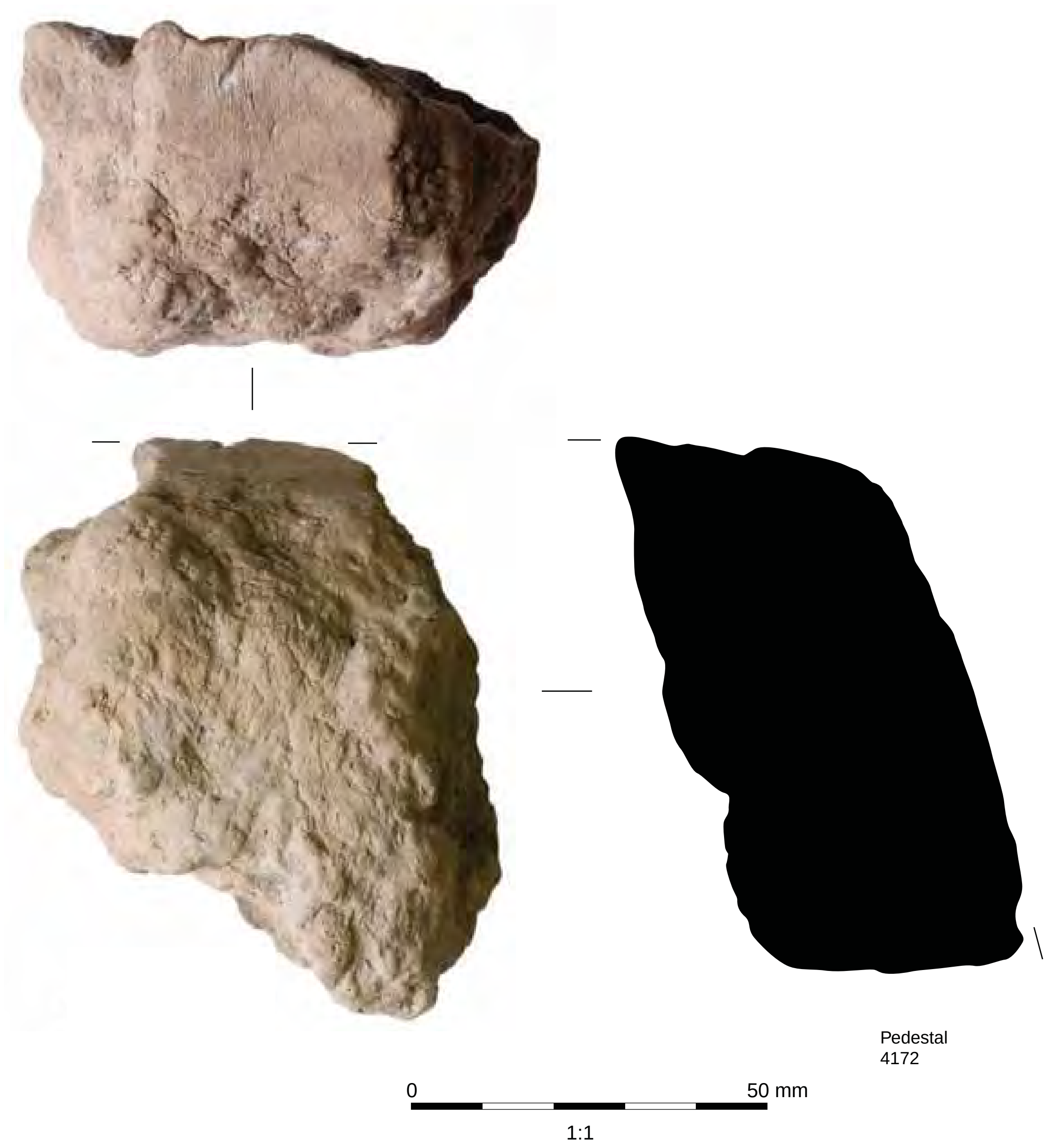

Figure 14: Photos of fired clay

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