Lancaster Imprints 35

On the Banks of the Humber:
Archaeological and Palaeoenvironmental Investigations at Goxhill, North Lincolnshire, and Paull, East Yorkshire, 2016-2020

Archaeopress

Lancaster Imprints 35

ON THE BANKS OF THE HUMBER

ARCHAEOLOGICAL AND PALAEOENVIRONMENTAL INVESTIGATIONS AT GOXHILL, NORTH LINCOLNSHIRE, AND PAULL, EAST YORKSHIRE, 2016-2020

Richard A Gregory, Stephen Rowland, Mairead Rutherford, and John Zant

Contributions by
Enid Allison, Nigel Cameron, Chris J Carey, Antony Dickson, Denise Druce, Julie Dunne, Richard P Evershed, H G Fiske, Christine Howard-Davis, Charlotte L Howsam, Vickie Jamieson, Richard Macphail, Julia Meen, Gwladys Monteil, Adam Parsons, Ian M Rowlandson, Ian Smith, John E Whittaker, and Jane Young

Illustrations by
Adam Parsons, Marie Rowland, and Maranda Wareham

Archaeopress Archaeology

Published in partnership by

ARCHAEOPRESS PUBLISHING LTD
13-14 Market Square
Bicester
OX26 6AD
United Kingdom
www.archaeopress.com

Oxford Archaeology (Lancaster office)
Mill 3, Moor Lane Mills
Moor Lane
Lancaster
LA1 1QD
www.oxfordarchaeology.com

For sales and distribution enquiries please contact:
ARCHAEOPRESS PUBLISHING LTD
www.archaeopress.com
info@archaeopress.com

ISBN: 978-1-80583-253-9
ISBN (e-PDF): 978-1-80583-254-6

Front cover: *Excavated Iron Age roundhouses in the main construction area at Goxhill; a Norse bell from the Soff Lane diversion, Goxhill*

Rear Cover: *East Halton Beck, view looking towards Immingham, on the Lincolnshire side of the Humber Estuary (cc-by-sa/2.0 - © Simon Tomson - geograph.org.uk/p/7146873); remains of a Romano-British roundhouse in the main construction area at Goxhill; excavating medieval features on the Soff Lane diversion at Goxhill*

The publication and appendices are available on the Oxford Archaeology Knowledge Hub at:
https://knowledge. oxfordarchaeology.com/library/13132

This book is available direct from Archaeopress or from our website www.archaeopress.com

Series editor: Richard Gregory
Indexer: Marie Rowland
Design, layout and formatting: Marie Rowland

Contents

List of Illustrations

Figures

Plates

Tables

Abbreviations

AGI	Above Ground Installation
ALGAO	Association of Local Government Archaeological Officers
AMS	Accelerator mass spectrometry
BSTFA	N,O-bis(trimethylsilyl)trifluoroacetamide
CIfA	Chartered Institute for Archaeologists
CLAU	City of Lincoln Archaeological Unit
DCM	Dichloromethane
dGPS	Differential Global Positioning System
EMHERF	East Midlands Historic Environment Research Framework
ER	External residues
FAME	Fatty acid methyl ester
GC	Gas chromatograph
GC-C-IRMS	Gas chromatography combustion isotope ration mass spectrometry
GC-MS	Gas chromatography-mass spectrometry
GIS	Geographical Information System
HdV	Hugo de Vries laboratory
HER	Historic Environment Record
HPLC	High-performance liquid chromatography
HPTJV	Humber Pipeline Tunnel Joint Venture
ICP-MS	Inductively coupled plasma mass spectrometry
LCFAs	Long-chain fatty acids
LiDAR	Light Detection and Ranging
LOI	Loss on ignition
LOIS	Land-Ocean Interaction Study
MFTs	Microfacies types
MYA	Million years ago
NG	National Grid
NISP	Number of identified specimens
NIST	National Institute of Standards and Technology
NLHES	North Lincolnshire Council's Historic Environment Service
NPP	Non-pollen palynomorphs
OA	Oxford Archaeology
OD	Ordnance Datum
OIL	Oblique incident light
OS	Ordnance Survey
PPL	Plane polarised light
RE	Rim equivalents
RPAZ	Regional pollen assemblage zones
SMT	Soil microfabric types
SUERC	Scottish Universities Environmental Research Centre
TLE	Total lipid extract
TLP	Total land pollen
TMCS	Trimethylchlorosilane
TNF	Total number of fragments
WSI	Written scheme of investigation
WYAS	West Yorkshire Archaeology Service
XPL	Crossed polarised light

Contributors

Enid Allison
Canterbury Archaeological Trust, 92A Broad Street, Canterbury CT1 2LU

Nigel Cameron
Centre for the Forensic Sciences, University College London, 35 Tavistock Square, London WC1H 9EZ

Chris J Carey
School of Applied Sciences, University of Brighton, Cockcroft Building, Lewes Road, Brighton BN2 4GL

Antony Dickson
Oxford Archaeology, Lancaster Office, Mill 3, Moor Lane Mills, Moor Lane, Lancaster LA1 1QD

Denise Druce
Oxford Archaeology, Lancaster Office, Mill 3, Moor Lane Mills, Moor Lane, Lancaster LA1 1QD

Julie Dunne
Organic Geochemistry Unit, School of Chemistry, University of Bristol, Cantock's Close, Bristol BS8 1TS

Richard P Evershed
Organic Geochemistry Unit, School of Chemistry, University of Bristol, Cantock's Close, Bristol BS8 1TS

H G Fiske
Freelance pottery specialist

Richard A Gregory
Oxford Archaeology, Lancaster Office, Mill 3, Moor Lane Mills, Moor Lane, Lancaster LA1 1QD

Christine Howard-Davis
formerly Oxford Archaeology

Charlotte L Howsam
Oxford Archaeology, Lancaster Office, Mill 3, Moor Lane Mills, Moor Lane, Lancaster LA1 1QD

Vickie Jamieson
formerly Oxford Archaeology

Richard Macphail
Institute of Archaeology, University College London, 31-34 Gordon Square, London WC1H 0PY

Julia Meen
Oxford Archaeology, Oxford Office, Janus House, Osney Mead, Oxford OX2 0ES

Gwladys Monteil
Freelance pottery specialist

Adam Parsons
Oxford Archaeology, Lancaster Office, Mill 3, Moor Lane Mills, Moor Lane, Lancaster LA1 1QD

Stephen Rowland
Oxford Archaeology, Lancaster office, Mill 3, Moor Lane Mills, Moor Lane, Lancaster LA1 1QD

Ian M Rowlandson
Freelance pottery specialist

Mairead Rutherford
formerly Oxford Archaeology

Ian Smith
Oxford Archaeology, Lancaster Office, Mill 3, Moor Lane Mills, Moor Lane, Lancaster LA1 1QD

John E Whittaker
Scientific Associate, Earth Sciences Department, Natural History Museum, Cromwell Road, London, SW7 5BD

Jane Young
Freelance pottery specialist

John Zant
formerly Oxford Archaeology, Lancaster office, Mill 3, Moor Lane Mills, Moor Lane, Lancaster LA1 1QD

Summary

Between 2016 and 2020, several archaeological and palaeoenvironmental investigations were undertaken across two areas of landscape on the northern and southern sides of the Humber Estuary, respectively at Paull (NGR TA 1749 2629), East Yorkshire, and Goxhill, North Lincolnshire (NGR TA 1006 2184). The stimulus for these investigations was the replacement of the Number 9 Feeder Gas Transmission Pipeline, which was constructed by National Grid and the Humber Pipeline Tunnel Joint Venture to reinforce their National Transmission System.

The earliest evidence recovered by the project relates to the Mesolithic and earlier Neolithic landscapes that existed in the estuary, comprising palaeoenvironmental and geoarchaeological data obtained through borehole coring at both Goxhill and Paull. This allowed for both the terrestrial environment and changes in sea level to be discerned across the earlier and middle phases of the Holocene, which formed a dynamic period when mainland Britain was in the process of separating from Continental Europe, as rising sea levels gradually submerged the former land bridge joining these two landmasses.

All of the archaeological evidence was confined to Goxhill, on the southern side of the estuary. Detailed analysis indicates that this area was visited, probably by peripatetic groups, during the Bronze Age, with the first evidence for more permanent settlement dating to the Early Iron Age. During this period, it seems that an area to the south-east of Goxhill village was managed and divided, perhaps to facilitate and regulate the movement of livestock around the landscape.

Good evidence was also obtained for later Iron Age settlement, within an excavated area to the north-east of Goxhill village. This initially comprised an unenclosed roundhouse settlement established in the latter centuries of the first millennium cal BC, adjacent to a tidal creek. It was followed by a second phase of Iron Age activity, which again related to an unenclosed roundhouse settlement in the same area, occupied into the terminal stages of the Iron Age, just prior to the Roman conquest, with livestock farming seemingly forming the main economic pursuit. Settlement in this area continued following the Roman conquest, as evidence of a third open settlement, containing roundhouses, was recorded, dating to the mid-/late first century AD. Settlement, however, appears to have expanded during this period and was also characterised by a series of sub-rectangular structures that may have functioned as hayricks. These remains, together with the palaeoenvironmental evidence, seem to suggest that pastoralism continued to represent an important economic concern, though in tandem with arable farming. Two subsequent phases of Roman settlement were also evident in this same area. The first, established in the early second century, was characterised by a series of circular and conjoined enclosures, some containing roundhouses, with the economy again based on mixed farming. During the later Roman period, in the late second/early third century, the settlement was then transformed, with a series of rectilinear enclosures being created across a large swathe of the landscape, emanating out from a settlement core. This settlement was engaged in mixed farming, though perhaps with a greater range of crops and livestock being exploited than previously. It also appears to have been more 'Romanised' in character, containing rectilinear timber buildings and receiving some imported Roman goods. Moreover, salt working also formed an element of the settlement's economy, which was perhaps undertaken at Goxhill for the first time in the later Roman period.

Very limited evidence for post-Roman activity was recovered (in the form of three unstratified sherds of fifth- to seventh-century pottery), though good evidence for later medieval activity was present in an area, south-east of Goxhill village, excavated prior to the construction of a road diversion. The evidence indicates three phases of medieval activity, dating between the tenth and mid-fourteenth centuries. It seems to relate to an area of medieval enclosure running south from Church Side, a road running out from the south-eastern side of the modern village, and was perhaps also associated with domestic dwellings originally situated on the street frontage. The evidence included trackways, enclosure boundaries, small structures, and rubbish pits, which may relate to a period when the medieval settlement had reached its maximum extent, prior to contraction in the mid-fourteenth century, possibly as a result of climate change or the ravages of the Black Death.

Acknowledgements

The archaeological investigations undertaken as part of the replacement of the Number 9 Feeder Gas Transmission Pipeline project owe their success to many individuals and also to the close co-operation of the different organisations involved with the project. Oxford Archaeology would like to thank Arcadis, National Grid, and the Humber Pipeline Tunnel Joint Venture, for commissioning the various stages of the project. For their liaison, organisation, and assistance with the project, both on and off site, Oxford Archaeology is especially grateful to Daniel Evans, Jenny Wylie, Kate Burrows, Helen Travers, and Lara Bishop of Arcadis; Sam Brewitt, Ruth Finlayson, Callum Fryer, Paul Hammond, Peter Lee, Joseph Marsh, Martin Somers, and Kevin Mara of the Humber Pipeline Tunnel Joint Venture; and Bryony Brown, Derek Cater, Allen Cartmell, Chris Clement, Steve Ellison, Brian McPhee, Paul Neary, and Tony Robertson of National Grid. Thanks are also extended to Alison Williams, Archaeological Advisor to North Lincolnshire Council, for her advice during the fieldwork.

The fieldwork was directed by Becky Wegiel with the assistance of Jeremy Bradley, Paul Dunn, Andrew Frudd, and Aidan Parker. They were supported by Alex Batey, Tom Broomfield, Steve Clarke, Tommy Dew, Emma Fishwick, Miranda Haigh, James Hodgson, Shanice Jackson, Vickie Jamieson, Rowan Kendrick, Hannah Leighton, Debbie Lewis, Meaghan Mackie, Andrew McGuire, Jon Onraet, Lynette Parkinson, Paul Simkins, Ben Sorrill, and Mike Tennant. The geoarchaeological coring, supervised by Mairead Rutherford, was undertaken by ESG, under the management of Neil Cooke.

Post-excavation analysis and publication of the archaeological and palaeoenvironmental data has benefited from the work of many individuals. These include numerous members of staff from Oxford Archaeology, who undertook the analysis of the stratigraphic remains (Richard Gregory and John Zant), artefacts (Antony Dickson and Adam Parsons), palaeoenvironmental materials (Denise Druce, Julia Meen, Mairead Rutherford, and Ian Smith), and human remains (Vickie Jamieson), as well as documentary research (Charlotte Howsam). Several external specialists have also been instrumental to the success of the project, through their analysis of artefacts (Julie Dunne, Richard P Evershed, H G Fiske, Christine Howard-Davis, Gwladys Monteil, Ian Rowlandson, and Jane Young), soils (Chris J Carey and Richard Macphail), and palaeoenvironmental remains (Enid Allison, Nigel Cameron, and John Whittaker). The historical maps used in this volume (Figs 84-7, 97-9, and 101) have been supplied by the National Library of Scotland and permission to use these is gratefully acknowledged. In addition, thanks are also extended to Historic England for permission to reproduce an aerial photograph (Pl 3) and cropmark transcriptions. One of the images (Pl 1) is a photograph in the public domain (under the Creative Commons Licence, taken by Chris @ www.geograph.org.uk). More generally, the fieldwork and post-excavation process have been greatly assisted by Stephen Rowland (Senior Project Manager), who provided project management for both elements of the project, and Richard Newman (formerly Principal Archaeologist, Humber Archaeology Partnership) and Alison Williams who kindly reviewed and provided valuable comments on draft elements of this volume.

Figure 1: The location of the pipeline and the sites of the Above Ground Installations at Goxhill and Paull

1

INTRODUCTION

R A Gregory and S Rowland

This volume presents the results of archaeological and palaeoenvironmental investigations undertaken between 2016 and 2020, across two areas of landscape on the northern and southern sides of the Humber Estuary, respectively at Paull (TA 1749 2629), East Yorkshire, and Goxhill, North Lincolnshire (TA 1006 2184; Fig 1). The stimulus for these investigations was the replacement of the Number 9 Feeder Gas Transmission Pipeline, which was constructed by National Grid (NG) and the Humber Pipeline Tunnel Joint Venture (HPTJV) to reinforce their National Transmission System. The investigations were specifically designed to locate and record any significant archaeological and geoarchaeological remains that might be impacted on during the construction of the pipeline, and their scope was devised, on behalf of NG and the HPTJV, by Arcadis (formerly Hyder Consulting (UK) Limited), who acted as the archaeological consultants for the project (Arcadis 2016). Oxford Archaeology (OA) were subsequently commissioned by Arcadis to complete the fieldwork and post-excavation assessment and analysis, which form the subject of this monograph.

This combined programme of investigation represents a considerable archaeological achievement and produced a rich dataset, containing stratigraphical, artefactual, and palaeoenvironmental information, with good chronological depth, which allows valuable insights into the character and use of the Humber Estuary during the prehistoric and historic periods. More specifically, geoarchaeological evidence (pollen and lithological data) was obtained from both Goxhill and Paull, which provides details of the evolving early prehistoric coastal landscape, whilst the investigations at Goxhill recorded numerous archaeological remains scattered across several investigated areas. These comprised remains dating to the later prehistoric period, which included good evidence for Iron Age occupation, as well as evidence for Romano-British and medieval settlement, enclosures, and field systems, together with some more piecemeal remains dating to the post-medieval period.

The Pipeline and its Estuarine Landscapes

The pipeline runs beneath the River Humber, in a north-east to south-west direction, with Above Ground Installations (AGI) at both Paull and Goxhill, which represent areas where the underground pipeline emerges to the surface. Of these, the Goxhill AGI includes two principal areas associated with the pipeline scheme, which formed the focus for the archaeological investigations (Fig 1). One formed the main construction area, on either side of East Marsh

Plate 1: The estuarine landscape at Goxhill, with Goxhill village in the foreground, Goxhill airfield (disused) in the centre, and the Humber Estuary and Humber Sea Terminal, North Killingholme Haven, in the background, looking east

Road, adjacent to the Goxhill AGI, *c* 2.6 km north of Goxhill village, and adjacent to the banks of the River Humber. In contrast, the second area lay closer to the centre of Goxhill and related to the construction of a diversion road, created as an element of the pipeline scheme, running off Soff Lane, which links with Chapel Field Road to the north. Topographically, these two areas fall within a flat landscape (Pl 1), within the Lincolnshire marshes, with Goxhill itself being one of several settlements located at the junction of the Outmarsh, an area of coastal plain below 10 m above Ordnance Datum (OD), and the slightly higher Middlemarsh, between the Outmarsh and the foot of the Lincolnshire Wolds (Ellis *et al* 2001).

On the northern side of the Humber, the main construction/investigation area associated with the Paull AGI was smaller in extent, encompassing two fields north-east of Thorngumbald Road and a car park, bordering the banks of the River Humber (Fig 1). As with Goxhill, this area also forms a low-lying coastal landscape (Pl 2) that, in this instance, is located within the north-western part of Holderness peninsula, with only minor variations in relief, mostly between *c* 5-15 m above OD, which define Holme Hill and Cow Hill to the south-east and east of the AGI, respectively (Catt 1990; Ellis 1995).

In both the Goxhill and Paull areas, land-use is dominated by arable agriculture within fields that are often large, rectangular, and bounded by substantial dykes, drainage ditches, and occasional hedgerows. Significantly, many of the dykes that flow into the Humber represent the formalised successors of ancient, natural watercourses, their sinuous courses contrasting with the straight lines and sharp angles of the ubiquitous drains associated with the post-medieval enclosure of the landscape (Catt 1990; Ellis 1995; Ellis *et al* 2001). On the south side of the Humber, one of the most significant watercourses is the East Halton Beck, which is also known as the Skitter Beck where it flows close to North and South Killinghome, -east of the Goxhill AGI (Fig 1).

Geologically, these two landscape areas are also comparable (Fig 2), with the solid geology on both sides of the estuary comprising chalk laid down during the Cretaceous period (Wood and Smith 1978). Specifically, on the southern side of the Humber, at Goxhill, this largely comprises the Burnham Chalk Formation, laid down between 94 and 83 million years ago (MYA; *ibid*), which is replaced to the north-east of Goxhill, close to the present-day coastline, by the Flamborough Chalk Formation. This latter chalk was laid down around 86-72 MYA and it extends across the Humber, where it then forms the chalk bedrock at Paull (*ibid*).

Following the formation of the chalk, the River Humber cut through the escarpment of the Lincolnshire and Yorkshire Wolds creating the Humber Gap, which separates the outer Humber Estuary from the inner estuary (Long *et al* 1998). The landscapes at Goxhill and Paull are therefore located in the outer estuary area. In addition, during the last Glacial Maximum, a large ice lobe formed a dam across the Humber Gap, which resulted in the creation of Lake Humber, an extensive proglacial lake. This lake eventually became completely silted in *c* 11,000 cal BC, though it remained an extensive wetland area (Bateman *et al* 2015; 2018; Buckland *et al* 2019). Following its disappearance, rivers and streams then became established in the Vale of York and the Humberhead Levels, which drained through the Humber Gap, with the water initially flowing over a large waterfall (termed the Humber Falls), which was situated at a knickpoint (Van de Noort and Davies 1993).

Plate 2: The watching brief at the Paull AGI in progress, with the estuarine landscape in the background, looking north-east

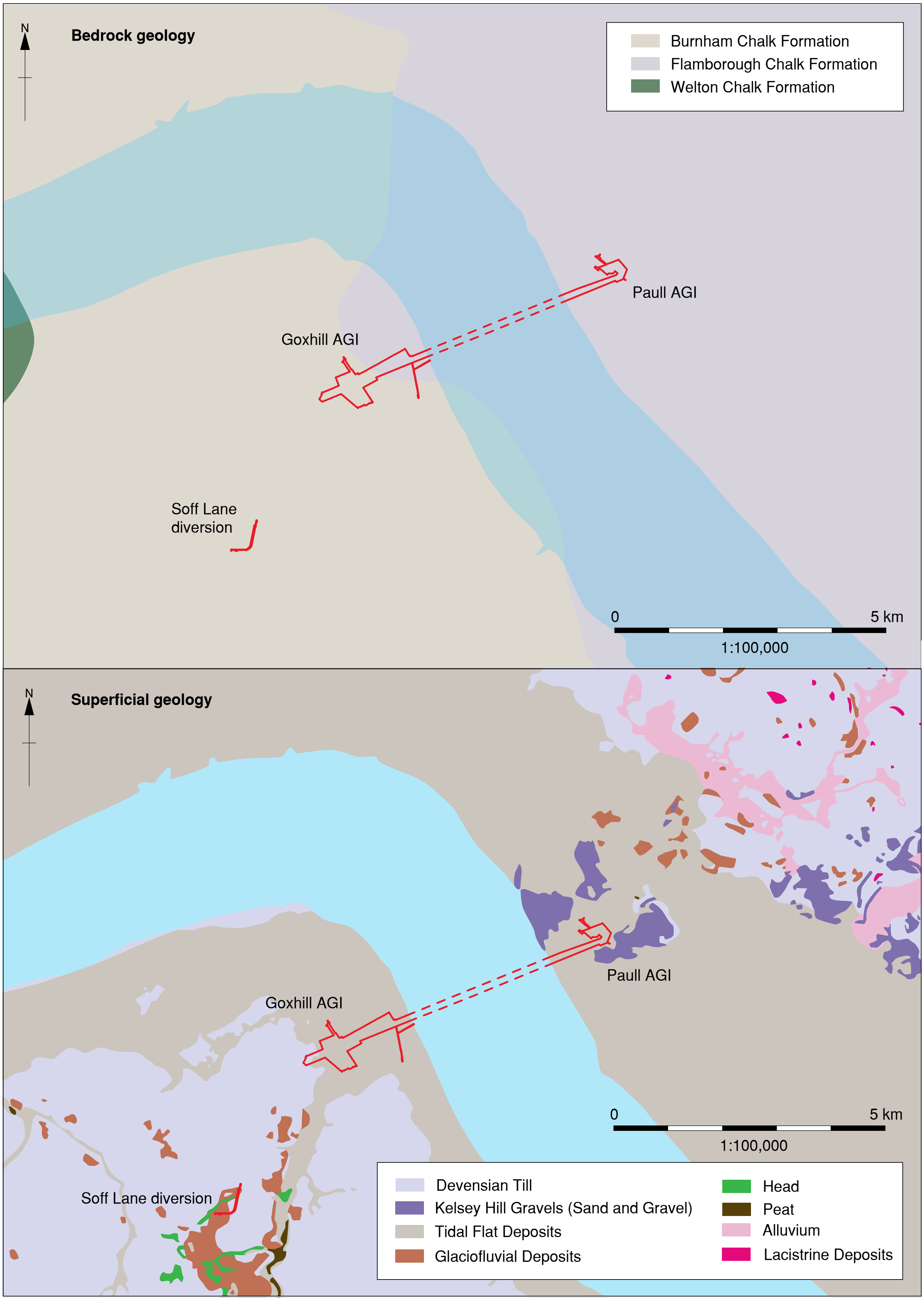


Figure 2: Solid and superficial geology at Goxhill and Paull (Contains British Geological Survey materials © UKRI [2023])

Above the Cretaceous bedrock are superficial geological deposits laid down during the last glacial period, between 116,000 and 11,000 years ago (Ellis *et al* 2001, 7). These include Devensian Till, surrounding Goxhill, with small patches also present close to Paull, along with larger areas of Kelsey Hill Gravels, which were deposited at a similar time (*ibid*). However, at around 10,000 cal BC when the knickpoint (having formed the position of the Humber Falls; *above*) in the Humber Gap had eroded, and when sea levels were also low, the River Humber and its tributaries carved out deep channels through these superficial deposits (Dinnin 1995; Lillie 1997). These channels were set within shallower valleys, which rapidly filled with alluvial sediments and peat as sea levels subsequently rose (*Ch 2, p 21*; Pethick 1990, 59; Long *et al* 1998). This resulted in the estuarisation of the Humber in its lower reaches, with this process of infilling represented at both Goxhill and Paull by Tidal Flat Deposits forming thick layers of clay and silt alluvium that formerly supported a rich wetland environment, most of which was reclaimed in historical times (Ellis 1995, 9). Presently, the principal soils covering the superficial geology are unsurprisingly gleys, characterised by poor drainage, though west and south of Goxhill there are also areas of somewhat better-drained brown earths (Ellis *et al* 2001, 9).

Archaeological and Palaeoenvironmental Investigations

Preliminary investigations

Prior to the main phase of archaeological work, undertaken in 2016-20 (*p 1*), several preliminary phases of archaeological investigations were carried out. Their explicit purpose was to determine the extent and character of the archaeological and palaeoenvironmental resource across the areas that might be affected by the construction of the pipeline.

Desk-based surveys

The first preliminary investigation comprised a study of the available aerial-photographic evidence (Amec 2007). Significantly, this revealed cropmarks on the southern side of the Humber, suggesting that the main construction area at the Goxhill AGI (*p 1*), and its immediate environs, contained buried archaeological features and palaeochannels (Fig 3; Pl 3). Cropmarks were also identified on the northern side of the Humber, which were suspected to relate to later prehistoric and Roman-period activity, though these lay some distance to the north-east of the Paull AGI (*ibid*).

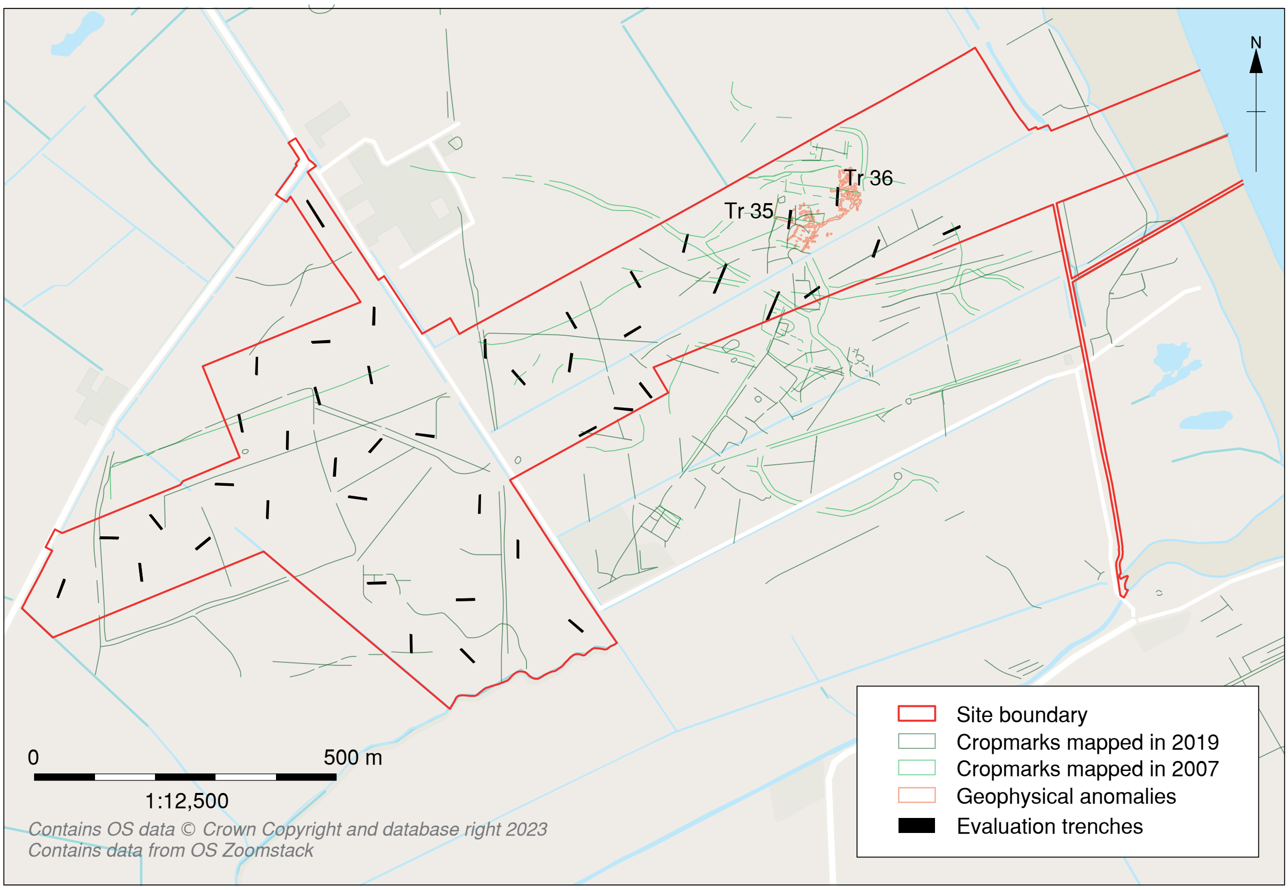


Figure 3: Cropmarks, geophysical anomalies, and archaeological trial trenches at the Goxhill AGI (main construction area) and its environs

Plate 3: Cropmarks at the Goxhill AGI (Source: Historic England Archive)

This was followed by an integrated study of the aerial photographic and Light Detection and Ranging (LiDAR) data (Deegan 2014), and a desk-based assessment and walk-over survey (Hyder Consulting (UK) Limited 2014), which collated all known archaeological evidence from the pipeline route and its immediate environs. These studies suggested that the main construction site at the Goxhill AGI, and its environs, contained several palaeochannels and a palimpsest of archaeological remains, dating to the prehistoric, Roman, medieval, and post-medieval periods. The evidence included records of artefact findspots, including surface scatters of prehistoric stone tools, cropmarks, and, for the later historic periods, information obtained from documentary and cartographic sources. In contrast, the evidence obtained for the Paull AGI suggested that, whilst some evidence for prehistoric and historic activity existed in the wider areas surrounding the Paull AGI (in the form of prehistoric and Roman findspots and cropmark sites), there was limited evidence for archaeological remains directly within this area, and its immediate environs.

Geophysical survey

Following the completion of the desk-based studies, a further phase of non-intrusive investigation was undertaken in 2014 to provide clarification on the extent and form of the archaeological remains. This included geophysical survey across the two fields associated with the Paull AGI (*p 2*) and also across the main construction area at the Goxhill AGI (*p 1*; Archaeological Services WYAS 2014; Bartlett 2014). The survey north of the Humber, at Paull, yielded little useful information, but that to the south at Goxhill recorded several concentrations of anomalies suggestive of buried archaeological remains (Fig 3). East of East Marsh Road, the anomalies appeared to represent a series of small, rectilinear ditched enclosures and possible pit groups, seemingly part of an area of settlement activity previously identified from aerial photographs (Amec 2007). The survey team also noted a surface scatter of Roman pottery in this area (Bartlett 2014), which hinted at the possible date of the settlement. Two linear anomalies, interpreted as a probable ditch and a field boundary, were also identified to the west of East Marsh Road (*ibid*), where other remains of possible medieval date had been recorded by aerial photography (Amec 2007; *above*).

Field evaluation

Following on from the geophysical survey (*above*), the potential archaeological remains at both the Goxhill and Paull AGIs were examined through several discrete phases of intrusive investigation. The first occurred in 2014 and comprised an archaeological watching brief undertaken during ground investigation works in the main construction area at Goxhill (HFA 2015). This recorded an undated ditch, as well as some of the buried palaeochannels that were visible from the air (*above*). A small amount of Roman pottery, dating to the second to third centuries, was also recovered (*ibid*).

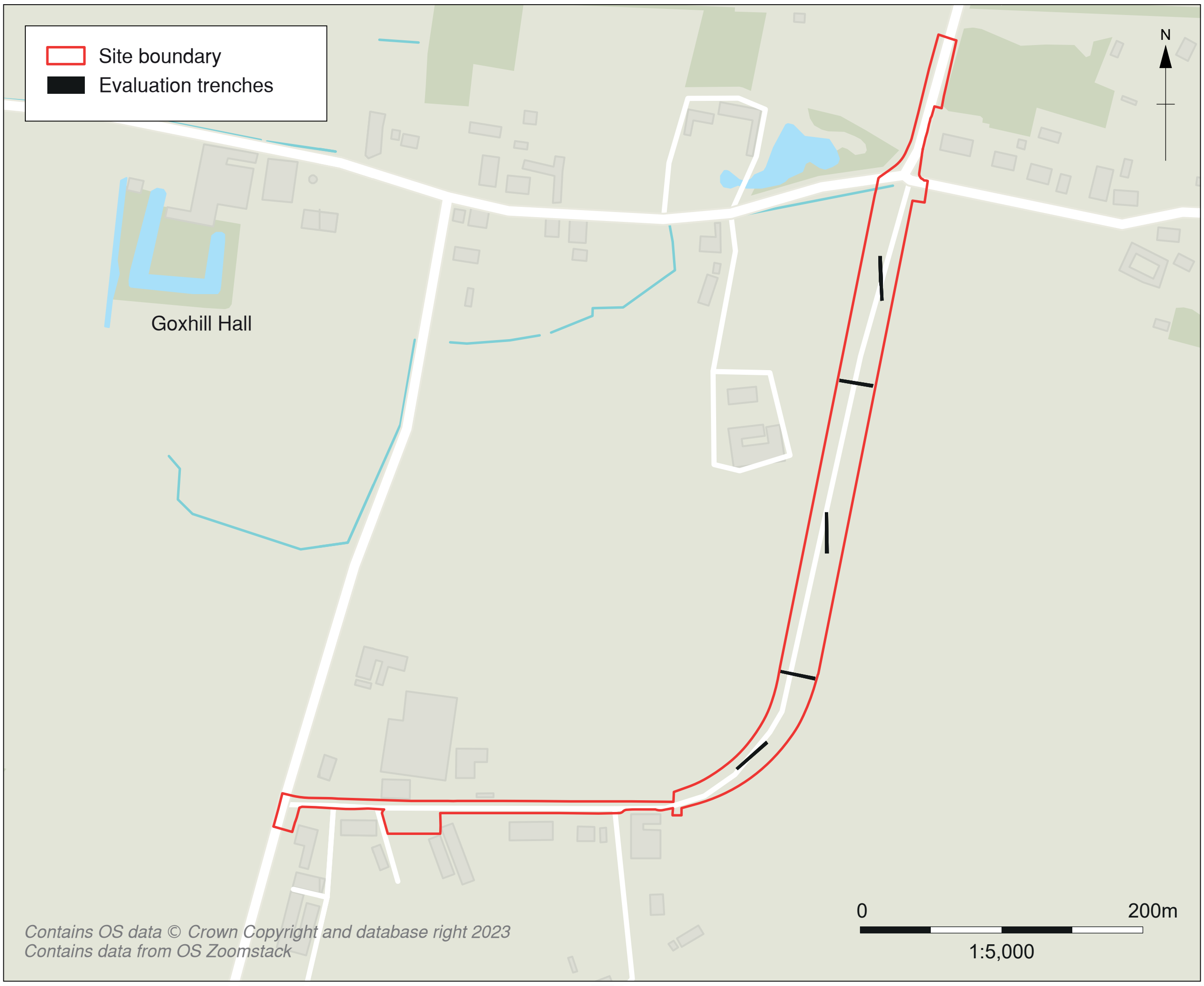


Figure 4: Archaeological trial trenches along the Soff Lane diversion

This was then followed by archaeological trial trenching. At Goxhill, this comprised the excavation and recording of 43 trenches in the main construction area (Fig 3), and five trenches along the route of the Soff Lane diversion, near Goxhill village (Fig 4; OA North 2016a). In the former area, some trenches were sited to investigate the cropmarks and geophysical anomalies identified previously (Amec 2007; Bartlett 2014), which was aided by consulting the cropmark transcriptions held by the North Lincolnshire Council's Historic Environment Service (NLHES), whilst others were placed randomly to look for any remains that had not been identified by the earlier works (Pl 4).

In the main construction area, 15 of the 43 trenches contained archaeological features, seemingly part of the settlement previously identified to the east of East Marsh Road (*above*). Further evidence for the existence of a complex of palaeochannels, perhaps a relict system of tidal creeks, was also obtained. Two trenches (35 and 36; Fig 3), targeting the area containing the densest concentration of cropmarks and geophysical anomalies, revealed a series of ditches and pits, as well as a timber structure and possible industrial features, along with a small assemblage of Roman pottery (OA North 2016a). Significantly, one ditch also yielded a Roman-period urn containing cremated human remains. Trenching to the south and west of this area revealed further ditches and several more palaeochannels. Archaeological remains, principally ditches, were also found to the west of East Marsh Road, some seemingly related to an undated field system, others to probable post-medieval field boundaries (*ibid*). In the area of the road diversion, four of the five evaluation trenches contained ditches that, on ceramic evidence, appeared to relate to activity during the medieval period, with some sherds potentially dating as early as the tenth/eleventh century (*ibid*).

North of the Humber, at Paull, three evaluation trenches were also excavated (Fig 5; OA North 2021). These were positioned along the course of a *c* 180 m-long pipeline trench, which was designed to link with a reception shaft, that would receive the pipeline as it emerged from beneath the Humber.

Plate 4: Excavating an evaluation trench at the northern end of the Soff Lane diversion

No archaeological remains, however, were encountered in these trenches, though they did provide some details on the sequence of natural deposition in this coastal area.

Mitigation works: open-area excavation and watching briefs

It was clear from the field evaluation that all the archaeological remains in the AGI areas were concentrated on the southern side of the Humber, at Goxhill. Therefore, a further programme of archaeological works was developed. The main purpose was to excavate and record any archaeological remains within the two key areas identified by the earlier studies, these being the main construction area (*p 1*) and the Soff Lane diversion (*p 2*). The strategy adopted by the archaeological mitigation was defined in a written scheme of investigation (WSI), prepared by Arcadis (2016) and approved by NLHES, which had a number of specific aims:

- to determine the existence or absence of archaeological remains and where these exist;
- to establish the character and complexity of any archaeological remains;
- to establish the date of the archaeological and significant palaeoenvironmental deposits;

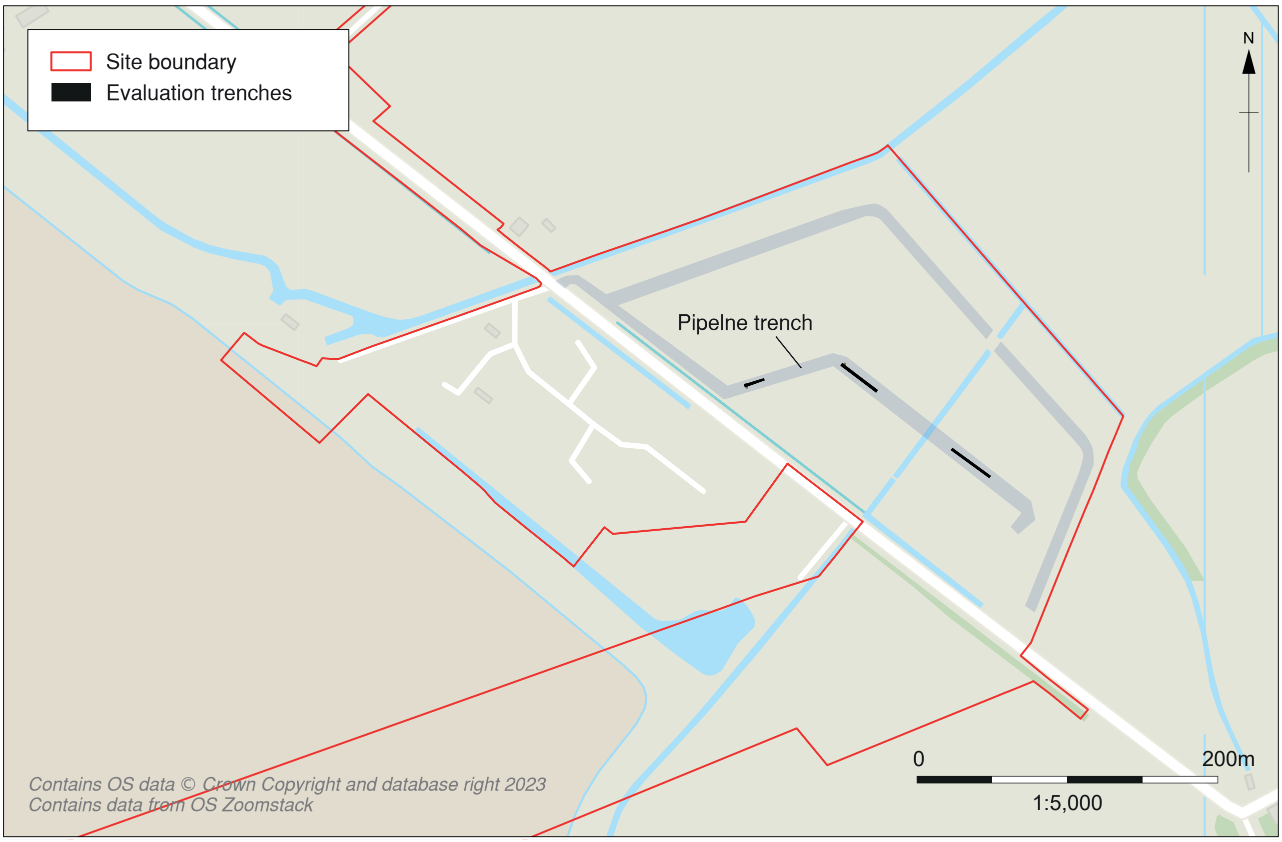


Figure 5: Archaeological trial trenches at the Paull AGI

- to establish the environmental significance of the excavated archaeological and palaeoenvironmental deposits;

- to place any archaeological and geoarchaeological discoveries into the local and, where appropriate, regional/national context, and to assess the implications of any such discoveries for the current understanding of the development of the area.

The fieldwork methodology employed was detailed in a project design (OA North 2016b) and was undertaken in accordance with professional guidance issued by the Chartered Institute for Archaeologists (CIfA 2014). The methodology adopted a staged approach, with an initial programme of pre-construction open-area excavation, followed by archaeological watching briefs carried out during the construction works.

Open-area excavation

This element of the fieldwork was completed between May and October 2016 and comprised detailed excavation across four areas. One, Area A, at the northern end of the Soff Lane diversion, covered approximately 0.3 ha (Fig 6; Pl 5), targeting the putative medieval ditches recorded during the evaluation (*p* 6). This excavation exposed more of these ditches and also produced additional archaeological remains.

The other three areas were within the main construction area to the north-east, with Areas B and C, covering *c* 2.06 ha and *c* 1.53 ha respectively (Fig 7; Pl 6), targeting the (seemingly) Romano-British settlement east of East Marsh Road (*p* 6). In this area, the earlier archaeological works had also identified what appeared to be the core area of the settlement, defined by a particularly dense concentration of archaeological features. It proved possible to design the pipeline in such a way as to avoid this core area completely, with Areas B and C sited to the south and south-west, on either side of a modern (east/west) field boundary. The third open-excavation area followed the route of a permanent pipeline (referred to hereafter as the PP Trench) and formed a *c* 10 m-wide strip extending around the northern and western sides of

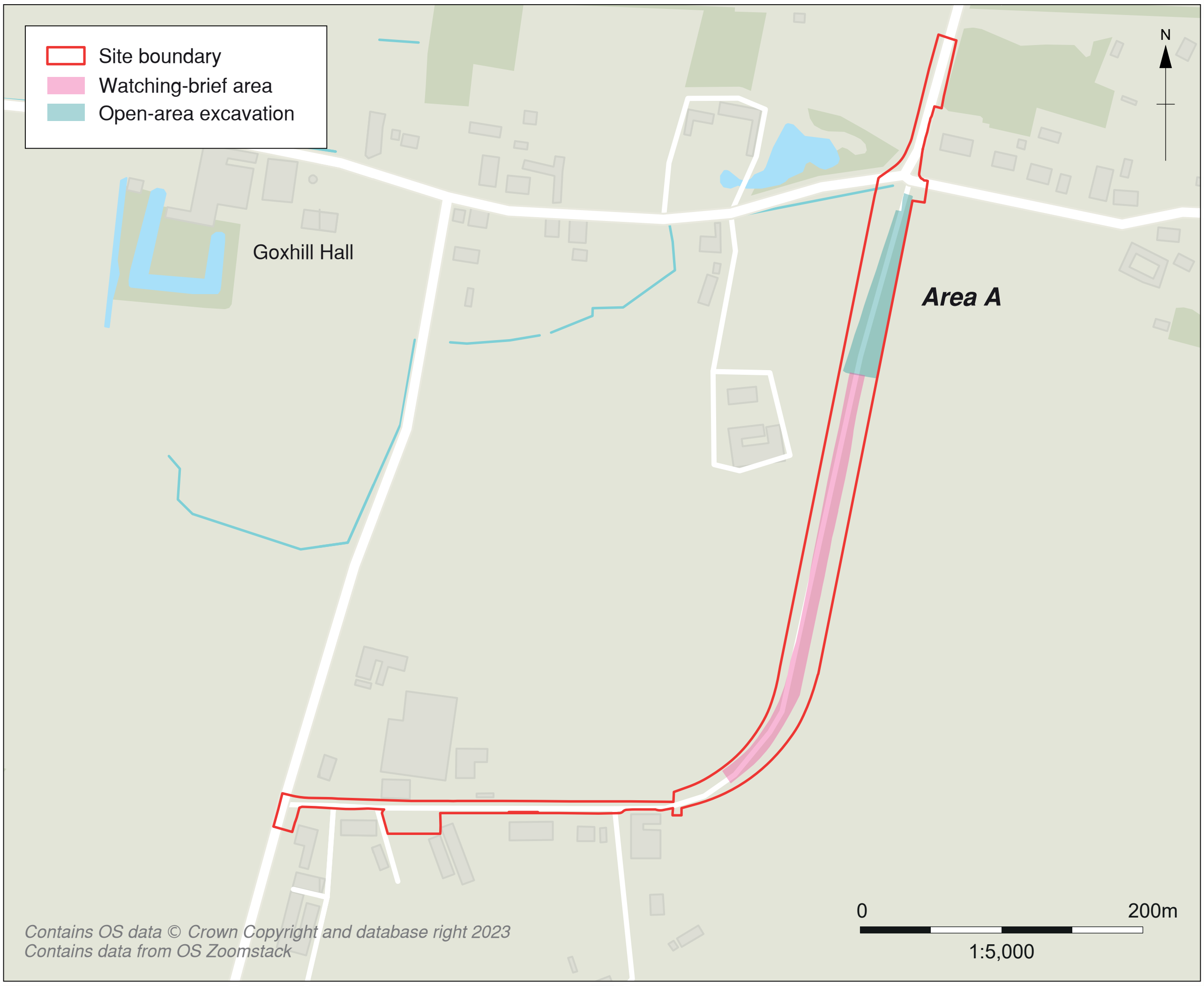


Figure 6: The open-area excavation trench and watching-brief area along the Soff Lane diversion, Goxhill

Plate 5: Excavating Area A, at the northern end of the Soff Lane diversion

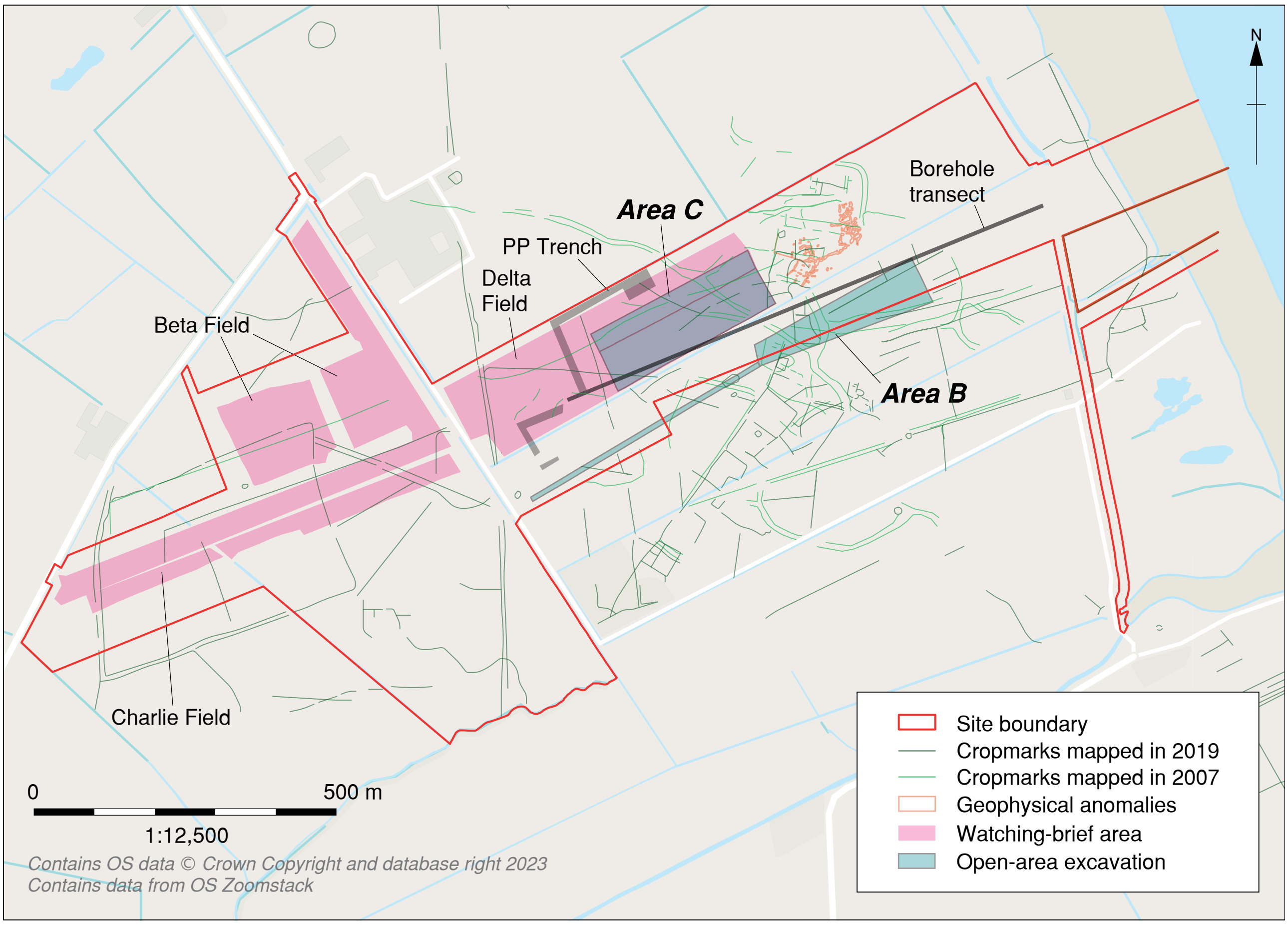


Figure 7: The open-area excavation trenches, watching-brief areas, and borehole transect in the main construction area, Goxhill

Plate 6: Excavating Area C, east of East Marsh Road

Area C. Somewhat surprisingly, in view of its distance from the presumed settlement core, Area B contained a dense concentration of archaeological features, particularly in the western half of the area. Most of these were located on a slightly elevated site between two palaeochannels that, on aerial photographic evidence (Amec 2007), probably converged to the south of the area investigated. Area C lay within the same modern field as the presumed settlement core and also contained numerous archaeological features (though less densely concentrated than in Area B), together with further palaeochannels. In contrast, few archaeological features were recorded in the PP Trench.

At the commencement of all four open-area excavations, modern topsoil and buried agricultural soils were incrementally removed, down to the uppermost archaeological horizon, or the top of the natural geology, whichever was encountered first. Stripping was carried out by tracked 360° mechanical excavators that were fitted with wide (minimum 1.8 m) toothless ditching buckets, in order to produce an even and clean stripped surface, and each mechanical excavator operated under the supervision of a suitably experienced archaeologist (Pl 7).

As each area was stripped, it was allowed to weather (*ie* allowing the soil minerals to oxidise, potentially allowing better visibility of archaeological remains) over a period of several days. The stripped surfaces were then inspected for any features of archaeological interest, and when any features or deposits were identified these, together with areas in their immediate vicinity, were cleaned by hand. All features were planned using a differential Global Positioning System (dGPS), accurate to +/- 0.01 m, or a Total Station. Altitude information was established above OD and a photographic record was maintained.

Following the initial stripping and feature identification, those areas containing significant archaeological features and deposits were subject to detailed hand excavation and recording (Pl 8). Smaller features were either completely excavated or half-sectioned, whilst larger examples such as ditches were sample excavated in a series of slots, with the percentages removed being dictated by the size of the feature (OA North 2016b). Excavated slots through linear features were positioned to recover complete profiles and other significant locales, such as ditch termini, and intersections between features were also targeted. All excavated remains were recorded stratigraphically, including the compilation of written descriptions on *pro-forma* context sheets and an appropriate pictorial record (comprising high-resolution digital photographs and scaled plans and sections). In addition, the features/deposits were surveyed and levelled, using a dGPS or Total Station.

Plate 7: The archaeological supervision of the mechanical stripping of topsoil in Area B

Plate 8: Excavation of archaeological features in Area B

Plate 9: Taking bulk samples from a palaeochannel in Area B

During these works, all the hand-collected finds were retained, recorded by context on-site (with some of the more significant objects being located three-dimensionally), and subsequently processed off-site. Palaeoenvironmental sampling of soils from excavated features was also undertaken in accordance with standard guidelines (Campbell *et al* 2011) and involved taking a total of 266 bulk samples (up to 40 litres in volume) from deposits that were deemed to have environmental potential (Pl 9), or that might be significant in terms of radiocarbon dating. Following removal from site, the soil samples were processed using hand-flotation techniques to recover charred and waterlogged plant remains and charcoal, other palaeoenvironmental residues, and small artefacts. Specifically, the samples were processed using a modified Siraf-type flotation machine, whereby the flots were collected in a 250 μm mesh and either air-dried (for charred plant remains and charcoal) or kept wet (for waterlogged remains). In addition, soil monolith samples were taken by hand through several features that were judged to contain sequences of deposits with potential for the preservation of pollen, diatoms, microfauna, and pedological (soil) data (Pl 10).

Watching briefs

Following commencement of the pipeline construction, a watching brief was also implemented during topsoil stripping of areas within the pipeline easement on both sides of the Humber, which was designed to locate and record any significant archaeological features in areas that had not been subject to detailed open-area excavation. At Goxhill, this watching brief was undertaken intermittently, between 2016 and 2020 (in accordance with the construction programme), and focused on several areas that lay adjacent to the open-area investigations. It observed topsoil stripping along the route of the Soff Lane diversion, south of Area A (Fig 6), and also across an area to the east of East Marsh Road (termed Delta Field) within the main construction area, north and south-west of Area C, and adjacent to the PP Trench (Fig 7). Two other areas (termed Beta and Charlie Fields) were also observed covering the main construction area to the west of East Marsh Road. Where archaeological remains were identified, these were rapidly cleaned and, together with a suitable buffer zone, were fenced off. The archaeological features were then surveyed, investigated, recorded, and sampled in accordance with the methodologies employed during the open-area excavations.

At Paull, the watching brief focused on two fields north-east of Thorngumbald Road and a foreshore area adjacent to the banks of the River Humber, which formed elements of the AGI (Fig 8; *p 2*). Within these areas, following the stripping of the topsoil, it was

Plate 10: Extracting soil monoliths from a Romano-British ditch in Area C

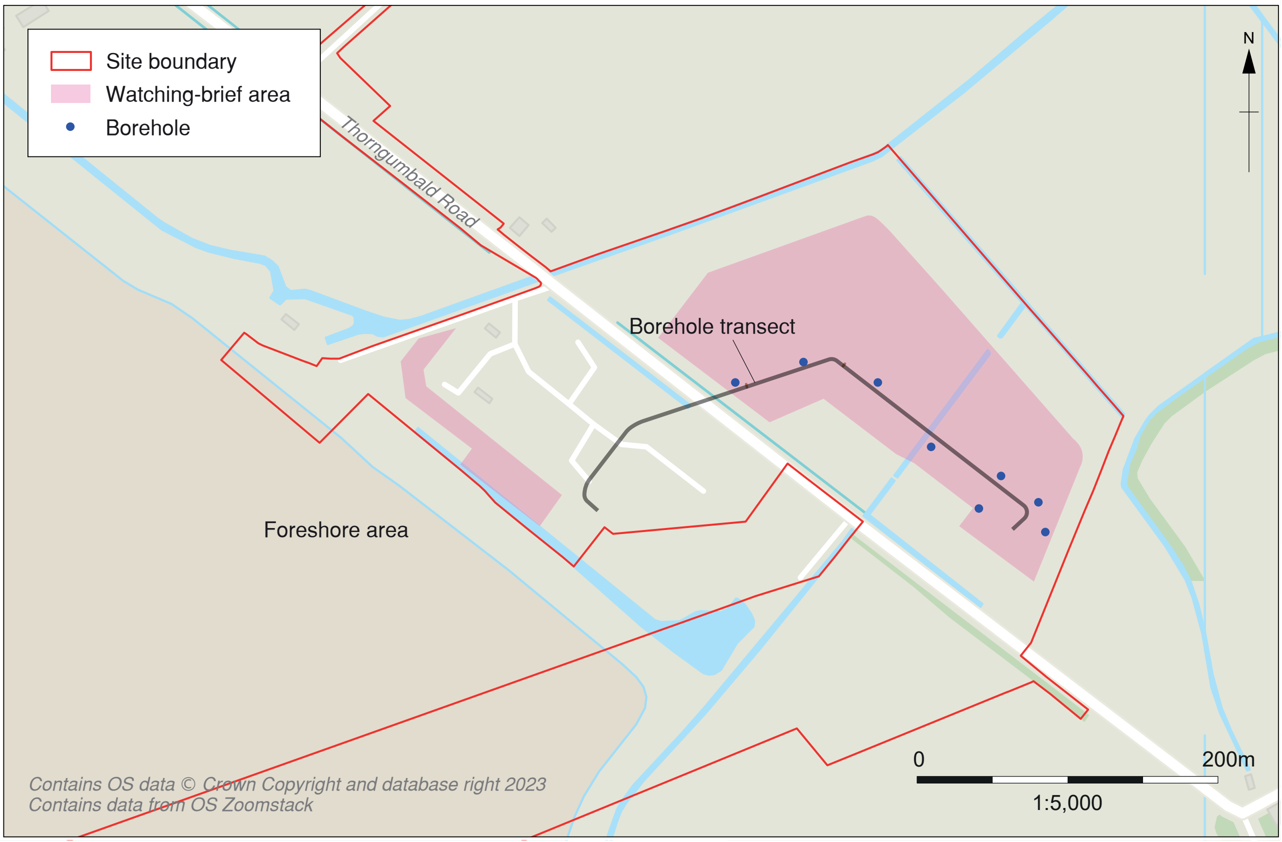


Figure 8: The watching-brief area and borehole transect at the Paull AGI

apparent, however, that no archaeological features or deposits were present (OA North 2021)

Borehole sampling

In addition to archaeological excavation and monitoring, a programme of borehole sampling was also completed in order to obtain pollen monoliths and lithostratigraphic data that might provide evidence for the ancient environment on both sides of the Humber. At Goxhill, 17 boreholes (BH 1-17) were drilled at intervals of *c* 50 m in an 800 m-long transect aligned north-east to south-west, running between Areas B and C, within the main construction area (Fig 7). Similarly, at the Paull AGI, eight boreholes (BH A-H) were drilled along the course of the pipeline trench, which had formed the focus of the archaeological evaluation (Fig 8).

At each of these borehole locations, a test pit was initially hand-excavated, to check for the presence of live services, and the borehole cores were then extracted in 1 m sections using a tracked borehole rig (Pl 11). Following extraction, the cores were given a unique number and the relative depth of each 1 m section was recorded for extrapolation from the above OD height at the surface. The core samples were also examined and recorded on site on summary *pro-forma* sheets following professional guidance for geoarchaeology (English Heritage 2007). The deposits with the best potential for specialist assessment were noted during the fieldwork and these were capped and resealed to prevent deterioration or contamination.

Plate 11: The tracked borehole rig extracting cores at Paull

Archive consolidation and post-excavation assessment

The next stage of work, which followed all the intrusive investigations, entailed checking, ordering, and consolidating the stratigraphical, artefactual, and palaeoenvironmental archives generated by the fieldwork. As part of this consolidation process all records, including drawings, were scanned digitally and context records were entered into an online database. The survey data and drawings were integrated into a Geographical Information System (GIS) computer package, which, along with the database, allowed the integration and interrogation of the stratigraphic data.

It was evident that the Paull AGI contained a notable absence of archaeological remains, and hence there was no scope for additional analysis (OA North 2021). It did, however, contain significant palaeoenvironmental and lithological sequences, which were recommended for analysis (*ibid*) in order to address a series of key research aims (*Ch 2, p 25*). Moreover, these research aims were relevant for the sequences of natural deposits recorded in several of the cores extracted along the borehole transect at Goxhill.

In contrast, the archaeological mitigation works at Goxhill produced a wealth of data, which was, therefore, subjected to formal assessment, in accordance with professional guidelines and best practice (ALGAO 2015; Historic England 2015). This resulted in the production of a post-excavation assessment report that considered, both quantitatively and qualitatively, the recorded stratigraphy, artefacts, and palaeoenvironmental materials (OA North 2022). This report included a statement of potential and a series of updated research aims and objectives that could be addressed by further analysis, the scope of which was also outlined in the report. These aims and objectives were formulated following a review of the *East Midlands Historic Environment Research Framework* (EMHERF 2021) and were grouped around four main themes, with an associated set of research questions:

Theme 1 (chronology and processes of change)

This theme was concerned with refining the chronological development of prehistoric, Romano-British, and medieval activity at Goxhill. The associated research questions included:

- When was the landscape first divided, and how did boundaries and field systems develop over time?

- Is it possible to determine change, dislocation, or continuity between the identified major and sub-divided chronological periods?

- Is it possible to refine the dating of the later Iron Age and earlier Romano-British settlements in Areas B and C?

- Is it possible to refine the chronology of the putative medieval structures, boundaries, enclosures, and pits in Area A?

- Is it possible to refine the chronology of later Iron Age and earlier Romano-British handmade pottery and generic medieval pottery fabrics, and, if so, will these contribute to regional type-series and chronologies?

- To what extent does the dating evidence correlate with, or deviate from, regional chronologies for Iron Age, Romano-British, and medieval rural settlement?

Theme 2 (understanding landscapes)
This theme aimed to situate the archaeological remains at Goxhill within the wider cultural and natural landscape. The formulated research questions included:

- Can the pollen data be used to determine the character of the local environment and sea-level change in the Humber Estuary during the earlier prehistoric period?

- Can the palaeoenvironmental data be used to determine the character of the local environment and land-use/clearance during the later Iron Age, Roman, early and later medieval, and post-medieval periods?

- In what way was settlement and other activities influenced by, or utilised, natural features and topography?

- Was settlement location and landscape division influenced by early phases of settlement and demarcation?

- How do the excavated boundaries, field systems, and enclosures relate to those boundaries and settlements (contemporary or otherwise) in the wider landscape, depicted on modern and historical mapping, and in other documentary sources, and detected by remotely sensed methods (*eg* LiDAR, aerial photographs, geophysics)?

Theme 3 (settlement/enclosure organisation, development, and function)
This theme focused on understanding the layout and development of prehistoric and historic settlements and enclosures, and their place in local and regional socio-economic networks. The research questions that might contribute to this understanding included:

- Do the artefactual assemblages provide any clues about the nature of contemporary domestic settlement, or otherwise, and trade or exchange?

- What insights do the palaeoenvironmental remains provide on the rural economy and land-use?

- Is there any evidence for industry, associated with areas of settlement, and how can this be interpreted (*eg* salt-making)?

- How does the evidence for settlement and enclosure compare with those from comparable sites in the region, and what can this tell us about the place of these communities within wider socio-economic networks?

Theme 4 (the inhabitants)
This final theme aimed to advance understanding of the social status, beliefs/perceptions, and lifestyles of the communities that occupied the scheme area in the prehistoric, Roman, and medieval periods. The associated research questions included:

- What information do the palaeoenvironmental and artefactual remains provide on diet, the role of different foods, and food-preparation practices, and 'waste' disposal?

- Can the social status of the communities which inhabited the scheme area be determined from the artefactual, palaeoenvironmental, and stratigraphic remains?

Post-excavation analysis
With the aims and objectives, and research questions, set out in the Goxhill post-excavation assessment in mind, together with the recommendations for additional palaeoenvironmental analysis for the borehole samples from Paull, a programme of analysis was instigated. This focused on the most significant stratigraphical, artefactual, and palaeoenvironmental data generated by the fieldwork and included a programme of radiocarbon dating. For each individual element, however, the level of analysis varied depending upon the nature of the information recorded and its potential to address the project's research questions.

Stratigraphic analysis
Stratigraphic analysis focused solely on the Goxhill AGI, which contained all the archaeological remains recorded during the fieldwork. During the post-excavation assessment, the stratigraphic data was examined, with an emphasis being placed on understanding the character of the activity that this information reflects and its sequence, which in many

instances could be determined by the relative positions of stratigraphic units (*eg* intercutting ditches, pits, and postholes). In addition, the artefactual materials from individual stratigraphic units, along with several radiocarbon dates acquired as part of the assessment, were essential in determining the date of deposits and features. This allowed the archaeological remains to be placed into a chronological and sequential framework, with several broad phases of activity being identified extending between the prehistoric and post-medieval periods (OA North 2022).

Analysis, therefore, refined and, where necessary, revised this scheme of phasing through a detailed and critical review of the primary context records, drawings, and photographs. This resulted in a draft stratigraphic text, which was also supplied to the artefactual and palaeoenvironmental specialists to assist them in their own analyses. During the assessment key stratified deposits had also been identified, containing charred plant remains, charcoal, and animal bone, that could be targeted for radiocarbon dating (*p 18*), and following the completion of this dating, and also the artefactual analyses, the stratigraphy and phasing was subject to final review and (where necessary) revision, and the project database was updated. This, in turn, allowed for a more nuanced interpretation of the stratigraphy and allowed for the production of a final stratigraphic text and a series of associated phase plans.

Artefact analysis

Whilst the archaeological investigations at Goxhill yielded a range of artefactual assemblages of different classes of material, all of which were assessed, most of these were small and poorly preserved, and were therefore considered to have low potential for analysis (OA North 2022). The main exceptions were the Iron Age and Romano-British pottery (1960 sherds; 33.86 kg; maximum of 971 vessels), as well as medieval and later pottery (121 sherds; 1.105 kg; maximum of 75 vessels), an understanding of which was crucial for dating some of the most significant phases of activity, as well as potentially providing details relating to the production, supply, and use of the ceramics, and the cultural affiliations of the groups using the vessels.

These pottery assemblages were therefore subjected to full analyses (*Appendix 1*; *Ch 5*, *p 157*). The methodology adopted included counting and weighing the sherds, according to the accepted guidelines (MPRG 1998; Slowikowski *et al* 2001; Darling 2004; PCRG *et al* 2016). The fabric of the pottery was then determined and coded in accordance with the fabric series developed by the City of Lincoln Archaeological Unit (CLAU; *cf* Darling and Precious 2014) and the Lincoln Fabric Type Series (Young *et al* 2005; Collyer 2018), as well as the fabric series under development for North Lincolnshire Museum, and those used in several recent studies on comparable ceramics from the region (Boyle *et al* 2011; Rowlandson 2012a; 2012b; 2013a; 2103b; 2014; Rowlandson and Fiske 2020a; 2020b; 2021; 2023; 2024; Rowlandson *et al* 2014; 2017; 2021). The East Midlands Iron Age coding scheme was also used for recording the prehistoric pottery, particularly the rim, body, base, and decorative attributes, and to facilitate standardised comparisons (Knight 1998; 2002). Finally, rim equivalents (RE) were recorded and an attempt at a 'maximum' vessel estimate was made following Richard Pollard (1990).

In addition to the typological studies of the pottery, 36 Iron Age and Romano-British sherds were deemed suitable for organic-residue analysis. This analysis was therefore undertaken using standard methodologies and techniques (*cf* Correa-Ascencio and Evershed 2014; *Appendix 2*), and it aimed to identify the composition of the residues (*ie* fats (lipids), waxes, and resins) on these sherds that might, in turn, provide evidence for the processing and consumption of animal, plant, and aquatic products (*cf* Evershed 2008a; Roffet-Salque *et al* 2017). In the context of the Goxhill assemblage, it was anticipated that this study would also allow the residues from different fabric groups to be compared.

Palaeoenvironmental analyses

Post-excavation assessment of the palaeoenvironmental remains from Goxhill considered the quantity, quality, and character of the plant macrofossils contained within the processed flots (material recovered during the hand flotation of the bulk soil samples; *p 12*). Following this assessment, 16 flots, representing *c* 6% of the assessed assemblage, were identified to have the best potential for analysis of charred plant remains and charcoal, whilst five flots containing waterlogged plant material were also identified, which again held good potential for analysis.

For the charred and waterlogged plant remains, this analysis entailed examining the flots with a Leica MZ6 binocular microscope, at up to x40 magnification, extracting the plant remains, and then, when possible, identifying these and quantifying them. During this process, whilst whole charred fruits/seeds and cereal-ear fragments were counted, highly fragmented remains such as charred cereal grain fragments, fine chaff (*eg* awns, lemma/palea), and waterlogged fruits/seeds (of which there are often 100s) were quantified using a scale of + to ++++ (where + represents less than five items; ++ between six and 25; +++ between 26 and 100; and ++++ over 100 items). Other material, such as indeterminate plant remains (*eg* <2 mm leaf and wood fragments), and non-vegetative macrofossils, such as ostracods (minute aquatic crustaceans) and foraminifera (single-celled planktonic animals with perforated chalky shells), were also quantified using this method. Identification was aided by comparison with a modern reference collection and with reference to the digital seed atlas of the Netherlands (Cappers *et al* 2006). Plant nomenclature followed Stace (2019) and the results were entered into the project database.

Charcoal analysis followed a standard procedure, whereby at least 100 charcoal fragments from each analysed flot were selected for identification. Identification was based on diagnostic anatomical characteristics (*cf* Schweingruber 1990; Hather 2000). Charcoal was fractured and examined initially on the transverse section, at low magnification using a stereomicroscope, and then on the transverse, radial and tangential sections at up to x400 magnification, using a Brunel SPD400BD metallurgical microscope. Fragments with properties pertaining to heartwood (indicated by the formation of tyloses within vessels), sapwood, and roundwood were recorded. As with the plant remains, nomenclature followed Clive Stace (2019).

During the palaeoenvironmental assessment of the bulk soil samples for plant remains and charcoal, a single wet-sieved flot, from a 30-litre bulk sample, and 13 dried flots, from 10-litre samples, were also assessed for insects, with the dried flots being re-wetted for the purposes of the assessment. During this process, the smaller flots (~15 ml or less after re-wetting) were examined in their entirety, while the rest were subjected to paraffin flotation to extract insect remains following the methods of Harry Kenward and colleagues (1980). Both re-wet flots and paraffin flots were then assessed by scanning in industrial methylated spirits, using a low-power stereoscopic zoom microscope (x10), which resulted in three samples being selected for detailed analysis (OA North 2022). With this analysis, beetle (Coleoptera) and true bug (Hemiptera) sclerites were removed from the paraffin flots onto moist filter paper for identification using a low-power stereoscopic zoom microscope (x10-x45). Identification was by comparison with modern insect material and with reference to standard published works, with the minimum numbers of individuals and taxa being recorded, whilst the taxa was also divided into broad ecological groups (*cf* Kenward *et al* 1986; Kenward 1997; Smith *et al* 2020). Aquatic taxa were subtracted from the rest of the assemblage to calculate percentages of particular ecological groups among the terrestrial insect faunae. Insects other than adult beetles and bugs were recorded semi-quantitatively as: + 1-3 individuals; ++ 4-9; +++ 10-25; and ++++ >25. Other groups of invertebrates were simply recorded as present, common, or abundant. Nomenclature for Coleoptera and Hemiptera, and information on ecology, followed several standard works (Southwood and Leston 1959; Hansen 1987; Cox 2007; Luff 2007; Lott 2009; Lott and Anderson 2011; Duff 2012; 2016; 2018; 2020; Foster *et al* 2014; 2020; Bantock and Botting 2018).

In addition, three monolith samples extracted from archaeological features recorded at Goxhill were subject to pollen analyses, as were the materials recovered from one of the boreholes (BH 11) located on the borehole transect (*p 14*) and from the eight boreholes north of the Humber, at Paull, which were also subjected to a complementary study concerning diatoms (*p 14*; see *Chapter 2* for specific methodologies). The purpose of these analyses was to elucidate the nature of, and changes to, the ancient environment and landscape on, and in the vicinity of, the Paull and Goxhill AGIs.

Several other monolith samples from Goxhill were also subjected to soil micromorphological analysis to determine the character of the sampled deposits and the processes involved in their formation. The methodology adopted included impregnating the monoliths with a clear polyester resin-acetone mixture ahead of curing and slabbing in order to produce 22 thin sections. These thin sections were further polished, with 1000 grit papers, and analysed using a petrological microscope under plane polarised light (PPL), crossed polarised light (XPL), and oblique incident light (OIL), at magnifications ranging from x1 to x200/400. Thin sections were described, ascribed soil microfabric types (SMT) and microfacies types (MFTs), and counted according to standard methods (Bullock *et al* 1985; Courty *et al* 1989; Courty 2001; Macphail and Cruise 2001; Macphail and Goldberg 2018; Stoops 2003; Stoops *et al* 2018; Goldberg *et al* 2022). In addition, 29 bulk soil samples were also analysed to determine the presence of organic matter (through loss on ignition; LOI) and carbonate (CO_3), with inductively coupled plasma mass spectrometry (ICP-MS) elemental analyses also being undertaken on these samples. Again, all these techniques followed standard methods (Goldberg *et al* 2022), and the resulting data were also subjected to statistical analysis.

Finally, the Goxhill open-area excavations produced some animal bone (1167 hand-collected bones and 211 fragments recovered during sieving) that was subjected to analysis, whilst one of the evaluation trenches also produced human remains (*p 6*), which were also subjected to additional scrutiny. During the analysis of the animal bones, modern comparative material was consulted where necessary and reference was made to several standard works on animal bones in order to assist in species identification (Sisson and Grossman 1938; Schmid 1972; Halstead and Collins 1995). Measurable bones were also recorded (*cf* von den Driesch 1976), and standard abbreviations were applied for teeth (*cf* Hillson 2005). In addition, during recording, the diagnostic zones for both mammals and birds were noted (*cf* Dobney and Rielly 1988; Cohen and Serjeantson 1996). The assemblage also includes several cattle-sized fragments of bone, which were classified as 'large mammal' and smaller sheep/goat or pig-sized fragments that were classified as 'medium mammal'. Some of the bone has been classified as 'Horse', though this material is fragmentary and could derive from horses, donkeys, or mules.

The states of preservation of the animal bone were also considered by comparing the bone to the large mammal (>5 kg body weight) weathering stages (*cf* Behrensmeyer 1978) and, also, since much is root affected, to the sub-surface root-affected erosion grades (*cf* Brickley and McKinley 2004). All hand-collected bones were recorded at erosion stages 2 (good), 3 (moderate), 4 (poor), and 5 (very poor). The proportion of fractures judged to be 'recent' was not estimated, but such fractures are common. Root etching (*cf* Binford 1981; Lyman 1994, 375-7) was recorded where clearly visible. When discussing the bone in the following chapters, TNF is used to refer to total number of fragments and NISP refers to number of identified specimens.

In terms of the human remains, these comprise cremated bone, which was examined in accordance with standard guidelines (McKinley 2004). This involved examining the material with reference to weight, fragment size, and colour, which would help to determine survival and the temperature and efficiency of the cremation process.

Scientific dating

An integral element of the project was a programme of radiocarbon dating, designed to establish a secure chronological framework for the archaeological remains at Goxhill, and natural deposits within the borehole cores extracted from both Goxhill and Paull. During the post-excavation assessment, 16 radiocarbon dates were therefore obtained, in order to aid the interpretative process required at that stage. These were all from Goxhill, being derived from samples from archaeological features and samples extracted from several of the cores along the line of the borehole transect (*p 14*), and also from a monolith taken from a palaeochannel. During the analysis phase, additional radiocarbon dating was undertaken. This included the successful dating of 11 samples from the borehole cores at Paull (*p 14*), four samples from the borehole cores from Goxhill, and 29 samples from archaeological features and palaeochannels at Goxhill.

Of these 60 dated samples, 36 represented single-entity short-lived items (*cf* Ashmore 1999), comprising either charred seeds, charcoal (with short-lived species or small items of roundwood being selected), or animal bone, recovered from archaeological features and palaeochannels at Goxhill, or fragments of bark contained in the borehole cores. The remaining samples were all from organic materials extracted from borehole cores and other pollen cores, which involved acquiring paired radiocarbon dates on the humin and humic fractions contained within these samples (*cf Ch 2, p 28*). Although these samples differed, all were dated at the Scottish Universities Environmental Research Centre (SUERC) using the accelerator mass spectrometry (AMS) technique (*cf* Dunbar *et al* 2016).

Within this volume, the results derived from this programme of radiocarbon dating are presented as conventional radiocarbon ages (Stuiver and Polach 1977) and are quoted in accordance with the international standard known as the Trondheim convention (Stuiver and Kra 1986). The results have been calibrated using IntCal20 (Reimer *et al* 2020) and OxCal v4.4 (Bronk Ramsey 2009), and the date ranges have been calculated using the maximum intercept method (Stuiver and Reimer 1986). The dates are cited at the 95% confidence level, and the calibrated date ranges have been rounded outwards to five years where the error measurement is less than ±25 BP and to ten years when it is greater than this (*cf* Mook 1986), using the 'round by' function in OxCal v4.4.

Following the completion of the radiocarbon-dating programme, those multiple assays obtained from specific deposits and features were also subjected to statistical testing. This was undertaken to establish their consistency and, in turn, to assist in the formulation of a chronological hypothesis that, in some instances, could be further explored through Bayesian modelling (*p 19*). The statistical technique employed was the non-Bayesian chi-square (Ward and Wilson 1978) used to determine whether duplicate dates are actually of the same age. Within the test, the level of significance was set at 0.05 (T'(5%)), with v representing the degree of freedom; dates are considered statistically consistent when the T value (T') is lower than the critical value (T'(5%)). All the dates were derived from separate entities and hence were not from the same radiocarbon reservoir. Therefore, the chi-square test was performed using the Combine function in OxCal v4.4, which merges the radiocarbon dates following calibration and provides an agreement index (A_{comb}). Within this index, good agreement between the combined dates is indicated by an A_{comb} value that is greater than the An value (*ie* the individual critical value).

In order to refine the dating of some of the most complex remains from Goxhill, which had good stratigraphic interplay, chronological modelling was then undertaken based on *a priori* archaeological information. Importantly, this allowed the chronology and phasing of the remains to be further refined, which, together with the detailed review of the stratigraphic data (*p 15*), resulted in revisions to the provisional phasing established during the assessment, though in broad terms the sequence remained valid. In addition, an age/depth deposit model was employed to provide further chronological detail relating to natural sediments identified in the boreholes at Paull (*p 14*). The modelling at both Goxhill and Paull adopted a Bayesian approach (*cf* Bronk Ramsey and Lee 2013; Bayliss and Marshall 2022; Griffiths 2022) and was performed using OxCal v4.4 (Bronk Ramsey 2009). Following standard convention, the outputs from this modelling (posterior-density estimates) are quoted in italics and are at the 95% probability level, unless otherwise stipulated, whilst two probability distributions are shown for each result in the output plots. That in outline is the calibrated radiocarbon date, whilst the dark distribution represents the posterior-density estimate produced by Bayesian modelling. Within the plots, the brackets and OxCal Command Query Language keywords define the model exactly (*ibid*). The agreement indices are also depicted on the respective model plots.

Landscape analysis

A final stage of analysis involved considering the excavated remains at Goxhill in relation to the wider surrounding landscape, particularly through analysis of the remotely sensed sources. One of the key sources consulted was the cropmark data, as it was considered that this would be a viable way of identifying possible areas of activity and landscape features that were contemporary with some of the archaeological remains. This evidence, along with the geophysical survey results, had been initially reviewed during the preliminary phases of the project (*p 5*), with cropmark transcriptions being supplied by the NLHES to inform the position of the evaluation trenches (*p 5*) and open-area excavations (*p 8*). However, during analysis, this evidence was revisited, as following the completion of the open-area excavations, the cropmark and LiDAR evidence had been reconsidered as part of an extensive programme of aerial mapping undertaken by Historic England along the inner Humber Estuary (Fleming and Royall 2019), which significantly covered the main construction area at Goxhill. This proved particularly useful as it indicated that the cropmarks mapped at the start of the project were actually much more extensive, forming elements of a larger system of ancient enclosures and field systems, which were partly excavated by the open-area trenches in the main construction area.

Structure of the Volume

The structure of this volume adopts a chronological approach, with archaeological and palaeoenvironmental remains being split into a series of period-based chapters. Hence, *Chapter 2* begins with a discussion of the earliest evidence acquired by the project. Specifically, this relates to the palaeoenvironmental and lithological data derived from the borehole transects at Goxhill and Paull, which provide valuable evidence on the estuarine landscapes that existed during the Mesolithic and Early Neolithic periods. All the archaeological remains recorded during the project, however, were located on the southern side of the Humber at Goxhill, and *Chapter 3* presents the evidence for prehistoric activity and details a small collection of Late Neolithic and Bronze Age artefacts and features, along with evidence of Iron Age land division and settlement. *Chapter 4* then considers the extensive stratigraphic, artefactual, and palaeoenvironmental evidence for Romano-British activity. This also related to early settlement, the form of which markedly changed across this period, which in its later stages also included the creation of an extensive system of enclosures, trackways, and fields. *Chapter 5* is principally concerned with the medieval archaeology recorded during the mitigation works, which included boundaries, pits, and possible building remains, along with an assemblage of medieval artefacts, that probably related to activity at the edge of medieval settlement close to Soff Lane. This chapter also outlines the post-medieval remains that were recorded, which relate to agricultural activity dating to this period. Finally, *Chapter 6* provides a brief synthesis of the evidence and places the archaeological and palaeoenvironmental remains within their regional context through a discussion of several key themes and concepts.

In addition to the main chapters, this volume also contains three digital appendices accessible through OA's on-line Knowledge Hub. *Appendix 1* describes the prehistoric and Roman pottery recovered by the project; *Appendix 2* presents the results of the analysis of organic residues from a selection of the prehistoric and Romano-British ceramic vessels; whilst *Appendix 3* lists the species of insects and other invertebrates identified during the analysis of several natural and archaeological features.

Archive

The project archive was collated and indexed in accordance with accepted professional guidelines (Walker 1990; Brown 2011; CIfA 2020). It includes all artefacts recovered and the primary site records (including context sheets, drawings, and photographs, with indices), together with all other digital records and databases generated during the project, and copies of the various reports and other documents produced. These latter elements also include all the unedited specialist reports that were generated during post-excavation analysis. Most of the environmental soil samples were discarded after analysis and prior to archive deposition, but otherwise the material archive comprises all finds recovered during the project. The bulk of the archive, from all archaeological works undertaken south of the Humber, in North Lincolnshire, has been deposited with the North Lincolnshire Museum in Scunthorpe (accession number: GXAX), and the smaller archive generated by the works in the vicinity of Paull, north of the river, has been deposited with the East Riding of Yorkshire Museum Service in Beverley (accession number: ERYMS (BAG) 2024.44).

2

EARLY LANDSCAPES AND CHANGING SEA LEVELS

M Rutherford and R A Gregory

The earliest evidence recovered during the project represents palaeoenvironmental, radiocarbon, and lithological data obtained from boreholes extracted from both sides of the Humber, at Goxhill and Paull. At Goxhill, these comprised 17 boreholes drilled along an 800 m-long transect, across the main construction area, whilst eight boreholes were drilled at Paull, along a *c* 180m-long transect (*Ch 1, p 14*). This data has proved highly significant, providing evidence for the character of the landscape and importantly sea-level change across the earlier parts of the prehistoric period.

The borehole data initially covers the Mesolithic period, an era when a hunter-gatherer lifestyle was in place, with communities procuring what they needed from the environment (Bird-David 1992, 40), rather than producing it by farming, although, at times, they do seem to have been engaged in modifying the natural environment, through burning and small-scale clearance. Chronologically, the period is lengthy, spanning some 5700 years from the end of the last Ice Age (*c* 9700 cal BC), through the Holocene epoch, up until *c* 4000 cal BC. Across this period, there were also several cultural and technological changes (the latter principally evident by changing stone-tool types), which, together with the evidence from radiocarbon dating, have allowed the period to be chronologically divided. Indeed, the most recent chronological scheme, devised by Chantel Conneller (2022, 23-5), envisages a four-fold division of this period. She therefore identifies an 'Early Mesolithic', between the ninety-fourth/ninety-third and eighty-second/eightieth centuries cal BC; a 'Middle Mesolithic', dating to the eighty-second to seventieth centuries cal BC; a 'Late Mesolithic' between the seventy-second and fifty-second centuries cal BC; and a 'Final Mesolithic', extending from the fifty-second to thirty-ninth centuries cal BC. Within this scheme, the palaeoenvironmental evidence derived from Paull and Goxhill principally relates to those estuarine landscapes that existed from the latter part of the Middle Mesolithic period through the remainder of the Mesolithic period.

The borehole data also relates to the earlier Neolithic period, the era when farming and its associated trappings (*eg* pottery, monuments and tombs, and changing domestic architecture and stone-working technology) were first introduced to the British Isles (*cf* Cummings 2017; Bradley 2019). Inevitably, the adoption of farming also resulted in major changes to the natural landscape, associated with clearance to create arable and pastoral land, which on nearby Holderness may have started at a comparatively early date spanning the latter part of the fifth and early part of the fourth millennia cal BC (*cf* Beckett 1981). The period is also characterised by the Elm Decline, which forms a major pollen event across Britain and Ireland, that at many sites (although by no means all) is coincident with the onset of agriculture (*cf* Whitehouse *et al* 2014; Woodbridge *et al* 2014; Kearney and Gearey 2020). That said, this decline could also be down to disease, or a complex set of interrelated factors, possibly including disease, human impact, and climate change (*cf* Parker *et al* 2002; Grosvenor *et al* 2017). Palaeoenvironmental evidence relating to this period, suitable for detailed analysis, was present at Goxhill and also specifically covers the period when farming may have been first introduced into the Humber region.

Background

Rising sea levels and the fate of Doggerland

One of the main palaeoenvironmental events evident along the North Sea coastline, across the Mesolithic and earlier Neolithic periods, relates to changes in relative sea level (*ie* the balance between the amount of water in the ocean (globally) and the movement of the earth's crust (locally)). Over the earlier half of the Holocene, *c* 12,000-6000 years ago, these changes were highly dynamic and resulted in the creation of different and fluctuating landscapes and coastlines, and in turn human geographies, along eastern Britain, which presented different opportunities, and at times constraints, for hunter-gatherers and the first agriculturists who inhabited the area.

The study of sea-level change is, however, a highly complex subject that involves interweaving numerous sources of data, which can include sea-level index points (derived from lithological and palaeoenvironmental data), seismic data, and bathymetry, allowing for the topographical mapping of former landscapes that have now been submerged (*cf* Ridgway *et al* 2000; Sturt *et al* 2013). Although complex, with the data being open to various interpretations, it is evident that following the last (Devensian) glaciation, and at the start of the Holocene, a large expanse of land was positioned to the east of the Humber Estuary, which has been termed 'Doggerland', after Dogger Bank, a large sandbank now located in a shallow part of the North Sea (Coles 1998). This former landscape extended out across the southern part of the North Sea basin and joined present-day mainland Britain with Continental Europe (specifically the Low Countries and Scandinavia; Fig 9). It formed a vast low-lying area interspersed with lakes, rivers, and wetlands, and coastlines available for exploitation by Early Mesolithic people. Indeed, Doggerland is considered to have been one of the most attractive and important areas for human settlement in North West Europe in the early Holocene (Peeters *et al* 2019, 22) and would have formed an important migration route, with the first Mesolithic groups entering into eastern Britain, coming out of Doggerland from the east, and colonising similar (and familiar) environments, which

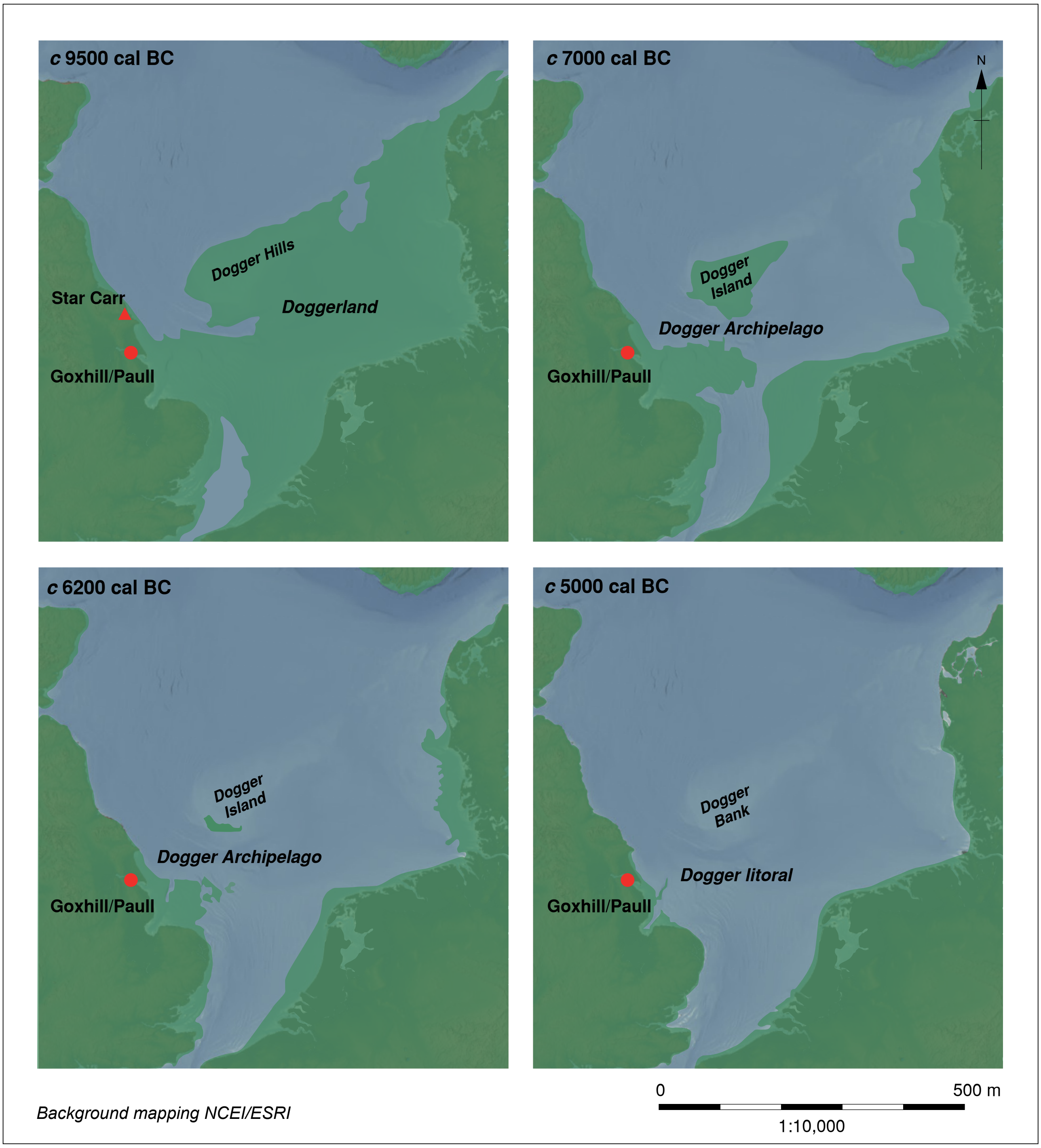


Figure 9: The form and disappearance of Doggerland

seem to have been those close to lowland lakes and rivers (Conneller 2022, 36). Principal amongst these early sites was Star Carr, and other sites next to the shores of a large former lake, north of Flixton, in the Vale of Pickering, which were occupied by pioneering Mesolithic groups in 9400-9300 cal BC (*op cit*, 39).

During the early Holocene, rising sea levels, caused by the melting of glaciers, resulted in the gradual inundation of Doggerland. Palaeogeographic reconstruction suggests that inundation of the northern part of Doggerland occurred rapidly from around 12,000 years ago, with concomitant loss of land. Then, in around 7500 cal BC, Britain and Doggerland began to separate, with the final separation occurring no later than 6500 cal BC, with Doggerland being divided and forming the Dogger Archipelago (Walker *et al* 2022). Rather catastrophically, across this period nearly 20,000 km^2 of Doggerland were submerged in 8000-7500 cal BC, with a further 36,000 km^2 of land being lost in the seventh millennium cal BC (Sturt *et al* 2013). Pollen evidence acquired from the bed of the present-day North Sea, 100 km east-south-east of the Humber Estuary, suggests that, at this time, the remaining areas of Doggerland were covered by a mature hazel (*Corylus avellana*) and oak (*Quercus*) woodland, with some evidence for saltmarsh environments, with both environments presumably being exploited by Mesolithic people who were still present in this lowland area (*cf* Gearey *et al* 2017). It has been argued, however, that this gradual shrinking of Doggerland caused a massive movement of population, with Mesolithic groups, who had adapted to exploiting both coastal and terrestrial resources, making a concerted push into eastern and northern Britain (*cf* Waddington 2015).

Inundation of Doggerland continued and, at around 6200 cal BC, further major environmental disasters occurred, which must have impacted the Mesolithic communities occupying its remaining areas (Dogger Island and the Dogger Archipelago), as well as other coastal areas on Britain's eastern seaboard. One of these was a short-lived climatic downturn (known as the 8.2 ka event; Barber *et al* 1999; Hu *et al* 1999), which may have caused a sea-level rise of up to 4 m over only a few centuries, resulting in a further loss of land and possibly also a population decline in more marginal areas on the British mainland (Wicks and Mithen 2014; Walker *et al* 2022). The second environmental catastrophe was the Storegga tsunami, the largest known Holocene tsunami event to hit the North Sea basin, caused by a massive submarine landslide in the Norwegian Sea (Bondevik *et al* 2012). This created waves over 5 m high, which undoubtedly caused devastation to Mesolithic coastal communities in Doggerland and parts of coastal mainland Britain; however, it does seem that the Humber Estuary was not directly impacted by this catastrophe (Walker *et al* 2022). In any event, by *c* 5500 cal BC a littoral fringe (Dogger Littoral), adjacent to the Humber and the Wash, was all that remained of Doggerland (*ibid*).

These dramatic alterations in sea level, and the disappearance of vast areas of landscape, also had an impact on the form of the Humber Estuary, which was originally a river valley located on the western edge of Doggerland. Fortunately, for the Humber area, shoreline data and the influence of relative sea-level change has been considered in detail by the Land-Ocean Interaction Study (LOIS), resulting in a series of palaeogeographical reconstructions for the estuary across this highly dynamic period (Metcalfe *et al* 2000; Shennan *et al* 2000a; 2000b; Van de Noort 2004, pl 1). More specifically, these suggest that by *c* 6000 cal BC, at the time when Dogger Island and the Dogger Archipelago were still in existence (*above*), estuarine conditions existed in a relatively narrow channel within the outer Humber Estuary, with sea level about 17 m below present (Metcalfe *et al* 2000). It also seems, based on pollen, diatom, and radiocarbon data from freshwater peats, that extensive eutrophic palaeoenvironments (nutrient-rich floodplain/riverside wetlands) were present within the estuary, with a mosaic of hazel-oak fenwood, sedge (Cyperaceae) fens, and open standing water, and some evidence for possible short-lived marine incursions (Fig 10).

From about *c* 5000 cal BC, when sea levels were around 10 m below present and the Doggerland Littoral was in existence (*above*), locations in the outer estuary record the transgression of intertidal environments across previously eutrophic wetlands, with the limit of intertidal sediments roughly at the confluence of the River Ancholme with the main Humber channel (*ibid*). Then between *c* 4000 cal BC, when sea levels were at *c* 7 m below present, and *c* 3000 cal BC, when sea levels had risen to 5 m below present, the transgression continued up to the inner Humber estuary. These changes had an impact on the hydrology within the inner estuary, with impeded freshwater drainage, causing ponding, waterlogging, and paludification (conversion of forest to swamp/bog; *ibid*).

Further details, relating to sea-level change and the later Mesolithic and earlier Neolithic environments in the Humber Estuary, are also illustrated through previous palaeoenvironmental work across this area (Fig 11). Specifically, data from Union Dock, Kingston-Upon-Hull, in the outer estuary, provide a limiting age for a basal peat unit followed by a transgressive contact. The basal peat is dated 7330-7050 cal BC (8170±45 BP; SRR-4747) at -8.91 m to -8.93 m OD, and the transgressive contact is dated 5640-5480 cal BC (6645±45 BP; SRR-4746) at -8.80 m to -8.78 m OD (Long *et al* 1998). Abundant tree pollen within the peat indicates the presence of a well-developed forested environment, which existed for around 1500 years before the site was inundated

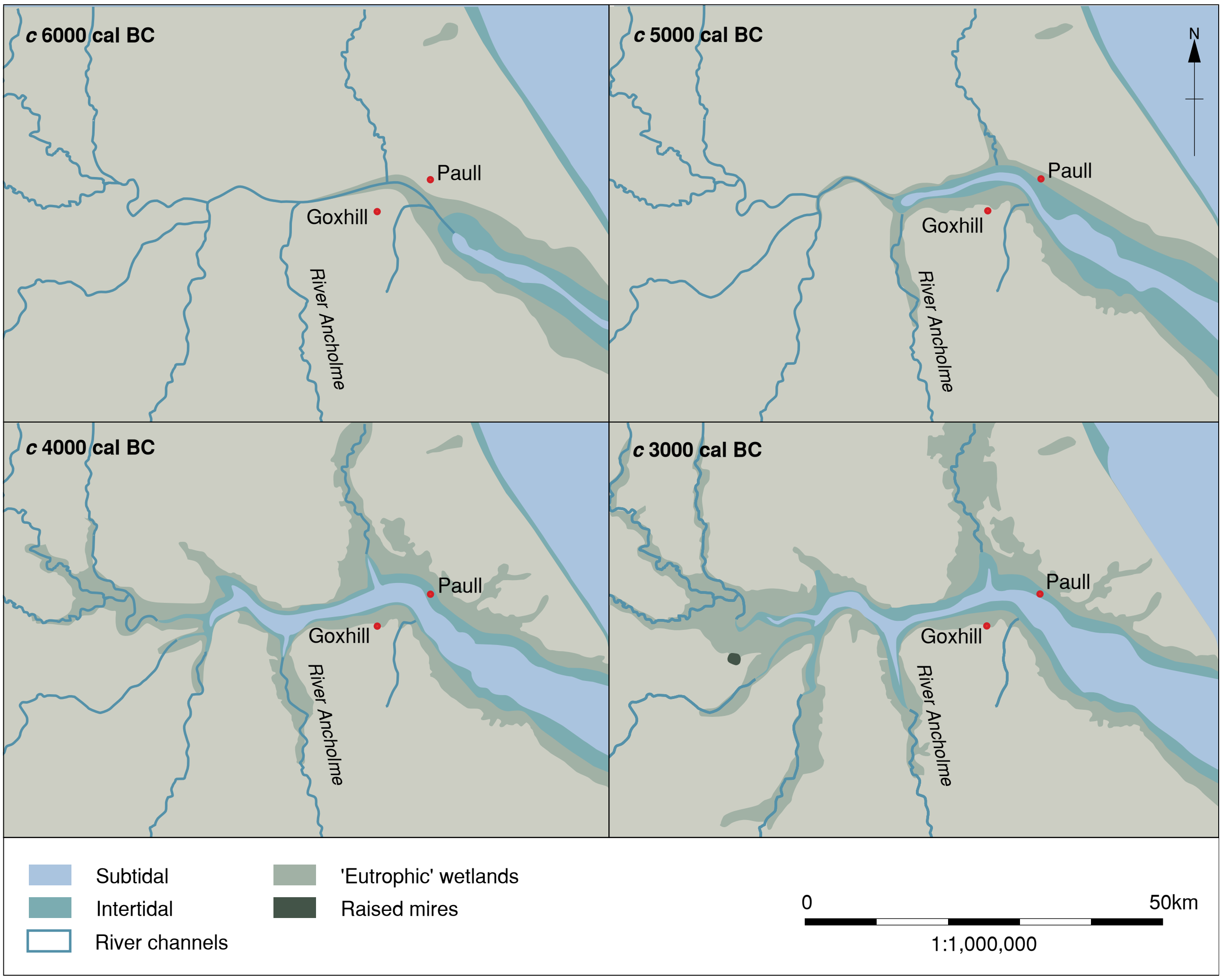


Figure 10: Palaeogeographical reconstructions for the Humber Estuary during the later Mesolithic and earlier Neolithic periods

(*ibid*). A thick deposit of clay also separated this peat from an overlying intercalated thin peat unit, representing saltmarsh environments initiated during a reduction in tidal flooding, which was later overlain by Tidal Flat Deposits.

Data from Sunk Island, in the outer estuary, also provide limiting ages for the bottom and top of a peat unit dated 7740-7490 cal BC (8555±65 BP; AA25582), at -11.95 m OD, and 6220-5850 cal BC (7145±60 BP; AA25581), at -11.67 m OD (Shennan *et al* 2000b). The latest date (*terminus ante quem*) for the formation of a woody detrital peat from the Market Place at Kingston-Upon-Hull is 6030-5660 cal BC (6970±100 BP; IGS-C14/99), at -11.5 m OD, and the peats were overlain by estuarine transgressive silts and clays after 5990-5620 cal BC (6890±100 BP; IGS-C14/100), at -9.73 m OD (Van de Noort and Ellis 2000).

The Holderness lowlands provide further palaeoenvironmental data relating to the character of the Mesolithic and earlier Neolithic landscapes surrounding the Humber Estuary. Stephen Beckett (1981), for instance, proposed several regional pollen assemblage zones (RPAZ), one of which (RPAZ2), covering a period when there was a rise in hazel, ending with a rise in alder (*Alnus*), was estimated to date to *c* 7000-5000 cal BC (Flenley 1987). During this period, expansion of elm (*Ulmus*) and oak is also evident, with elm apparently expanding prior to oak (*ibid*). RPAZ3 covers the period from the alder rise to the Elm Decline (estimated to be *c* 5000-3000 cal BC, with the Elm Decline dated further north, at Gransmoor, to 4040-3770 cal BC (5099±50 BP; SR-229; Beckett 1975). Mixed woodland of lime (*Tilia*), oak, hazel, and elm probably developed on the till-based soils with, lime particularly frequent on the more-freely draining sand and gravel-based soils (Dinnin 1995).

Pollen diagrams from Cess Dell, Holderness (Tweddle 2000), provide a date of 9150-8620 cal BC (9490±70 BP; AA-30870) for the start of a sustained rise in hazel. Interpolated ages for a rise in oak, but without alder, is estimated at *c* 6780-5890 cal BC, with a marked increase in alder estimated at *c* 5890-5110 cal BC, although the rise in alder may be related to site-specific

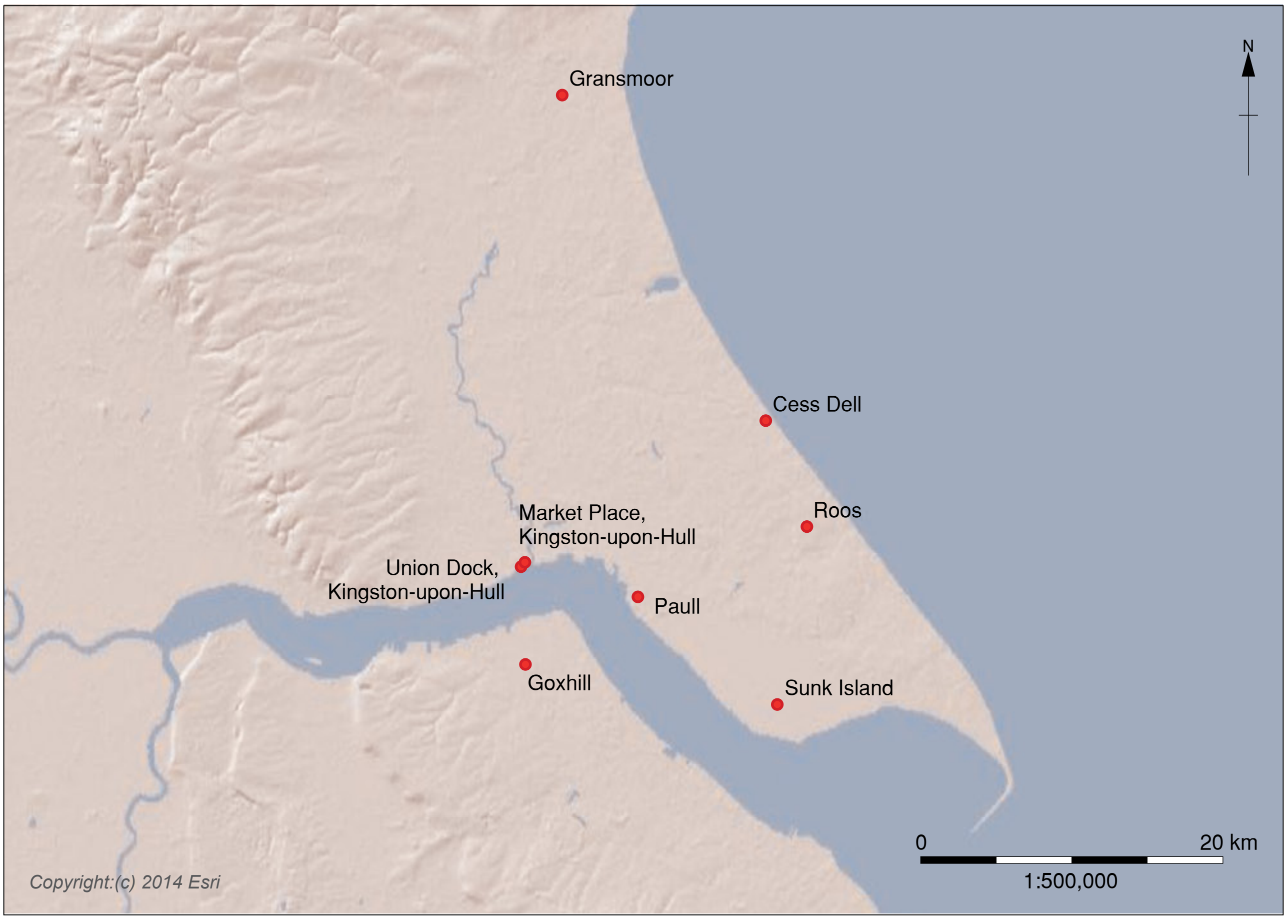


Figure 11: Palaeoenvironmental sites mentioned in the text

factors. Moreover, the rise in alder and decline in other tree types (*ie* hazel and birch (*Betula*)) is interpreted as perhaps relating to declining species being out-competed by alder, oak, and elm; however, there is also a suggestion that the taxa were responding to wider climatic fluctuations associated with the deterioration in climate at *c* 6200 cal BC (the 8.2 ka event; *p* 23). Finally, pollen data from Roos, again in Holderness, suggest that a mixed oak/hazel/elm woodland dominated the catchment between 8610-8010 cal BC (9101±85 BP; AA-33290) and 6470-6230 cal BC (*c* 7525±65 BP; AA-32292), with little evidence for disturbance to the canopy during this period, including low microcharcoal counts and no evidence for anthropogenic interference with the vegetation (*ibid*).

Early Landscapes at Paull and Goxhill

Within the Humber Estuary identifying wetland estuarine deposits has been of prime importance for determining sea-level change, landscape character, and human impact across this area during the period when Doggerland was being submerged in the earlier half of the Holocene (*cf* Van de Noort 2004; *p* 23). Significantly, it was recognised at an early stage that both Paull and Goxhill had the potential to contain such deposits, which was subsequently confirmed by the borehole transects across these areas that produced evidence for sequences of buried peats and other estuarine sediments, potentially formed during this dynamic period. With the sediments identified, recorded, and assessed (OA North 2021; 2022), it was then realised that detailed analysis might answer a set of key research aims. These included:

- Providing a clearer understanding of the stratigraphy and chronology of the site;
- Furnishing local and regional palaeoenvironmental data, which could be correlated with previously published data;
- Interpreting the character of the local environment and sea-level change in the Humber Estuary during the earlier prehistoric period;
- Establishing the aquatic depositional environments and salinity conditions at the sites;
- Interpreting the vegetational sequence and establishing the nature of the depositional

environments in order to contextualise possible human activity;

- Informing understandings of the economic role of hunter-gatherers during the Mesolithic period, and early farmers during the Neolithic period.

Methodology

The analysis adopted several different methodological techniques to realise the full potential of the data and to address the identified research aims (*above*). Specifically, these included deposit modelling, pollen and diatom analysis, and radiocarbon dating.

Deposit modelling

Following extraction of the eight cores from Paull and 17 cores from Goxhill (*Ch 1, p 14*; Fig 12), these were transported to the SOCOTEC UK Ltd laboratories at Doncaster, South Yorkshire, where an OA palaeoenvironmentalist assessed the stratigraphy of the opened cores to check for the presence of any potential buried land surfaces or peat horizons. Selected cores were then transferred to OA's Lancaster Office for palaeoenvironmental sub-sampling and analysis. The lithologies of the cores were also recorded and this data was entered into geological modelling software to allow for the identification of stratigraphic units across the two sites.

Pollen analysis

One core from Paull (BH-H) and another from Goxhill (BH-11) were sub-sampled for pollen analysis, with a total of 32 volumetric sub-samples collected from the former and 53 from the latter. These sub-samples were prepared using a standard chemical procedure (method B of Berglund and Ralska-Jasiewiczowa 1986), using HCl, NaOH, sieving, HF, and Erdtman's acetolysis, to remove carbonates, humic acids, particles >170 microns, silicates, and cellulose, respectively. The samples were then stained with safranin, dehydrated in tertiary butyl alcohol, and the residues mounted in 2000 cs silicone oil. Slides were examined at a magnification of 400x by ten equally spaced traverses across at least two slides to reduce the possible effects of differential dispersal on the slides (Brooks and Thomas 1967). Pollen counts of 300-500 grains have been achieved for the sub-samples analysed.

The data are presented as percentage values on pollen diagrams, constructed using the computer programs TILIA-GRAPH and TG-View (Grimm 1991-2011) and based on a total land pollen (TLP) sum that includes trees, shrubs, and herbs. Fern spores, non-pollen palynomorphs (NPP), microscopic charcoal, deteriorated grains, and reworked pollen grains (from pre-Quaternary geological deposits) are expressed as percentages of TLP, plus the respective sum to which they belong.

To aid interpretation of the pollen data, the pollen assemblage diagrams have been visually zoned. Pollen identification was made following standard keys (Moore *et al* 1991; Faegri *et al* 1989), and a modern reference collection. Plant nomenclature, fungal spore, and other NPP identification and interpretation follow several standard works (Stace 2010; van Geel 1978; van Geel and Aptroot 2006). NPP are prefixed by HdV (corresponding to their listing in the NPP catalogue in the Hugo de Vries laboratory, University of Amsterdam, Netherlands).

Diatom analysis

Diatoms are single-celled algae with shells made from silica, and their presence in buried sediments is a strong indication of open water, in the form of a stream channel, pond, estuary, or marsh. Furthermore, the type of diatom can be used to suggest the nature of the habitat; for example, whether it was subject to tidal inundation or freshwater. Given this, several of the cores from Paull and Goxhill were initially assessed for the presence of diatoms (OA North 2021) and, although this indicated that preservation of diatoms was poor in the Goxhill samples, six samples from Paull (in BH-H) were suitable for analysis. The results from this are presented in the palaeoenvironmental narrative that follows, which also integrates the diatom data derived from the Goxhill assessment.

Diatom preparation followed standard techniques (Battarbee *et al* 2001) and, accordingly, two coverslips were made from each sample and fixed in Naphrax for diatom microscopy. A large area of the coverslips on each slide was scanned for diatoms at magnifications of x400 and x1000 under phase contrast illumination.

Diatom floras and taxonomic publications were consulted to assist with diatom identification (*inter alia*; Hendey 1964; Krammer and Lange-Bertalot 1986; 1988; 1991a; 1991b; Hartley *et al* 1996; Witkowski *et al* 2000). The salinity preferences of diatom species are indicated by specific halobian groups (*cf* Hustedt 1953; 1957, 199), which include:

- Polyhalobian: >30 g l-1;
- Mesohalobian: 0.2-30 g l-1;
- Oligohalobian–Halophilous: optimum in slightly brackish water;
- Oligohalobian – Indifferent: optimum in freshwater, but tolerant of slightly brackish water;
- Halophobous: exclusively freshwater;
- Unknown: taxa of unknown salinity preference.

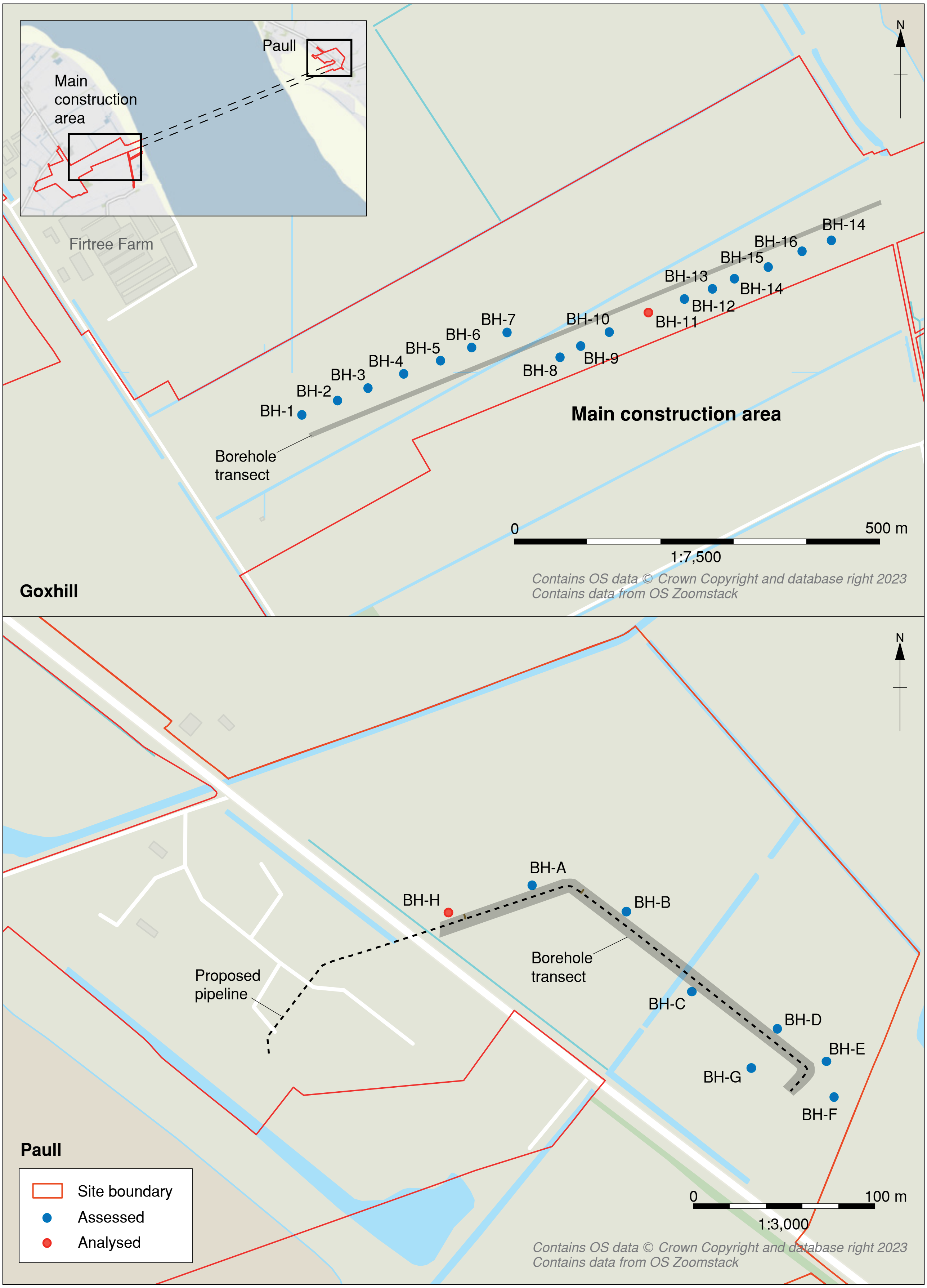


Figure 12: Location of the borehole cores at Paull and Goxhill selected for palaeoenvironmental analyses

Radiocarbon dating

Samples from the top and bottom of the peats from BH-H, at Paull, and BH-11, at Goxhill, were subjected to radiocarbon dating and calibration (*Ch 1, p 18*). In the absence of discrete plant macrofossils, or wood, sub-samples were extracted for the dating of both humin and humic acid fractions.

Each of the paired humin/humic dates from the sub-samples were then subject to the chi-square test to establish their consistency (*Ch 1, p 18*). Following testing, it was evident that several of the samples are statistically inconsistent, with the humin fractions providing older dates. This, however, is probably down to their composition, as the humin fraction is composed of organic detritus that can be a heterogeneous mix of organic matter, which, in this instance, might have suffered from contamination through the introduction of reworked geological material (*cf* Brock *et al* 2011). Indeed, at both Goxhill and Paull, pollen analysis determined that the humic fraction largely includes materials of Carboniferous age, and some probable Cretaceous reworking was also noted.

In contrast, the humic acids reflect the *in situ* products of plant decay and, although these can be mobile in groundwater in weakly acidic and slightly alkaline peatlands, they are usually homogeneous and may provide a more secure radiocarbon date (*cf* Hamilton and Kinnaird 2022). Therefore, given these factors, in those instances where the paired dates were inconsistent, the humic-acid fraction assay has been used to date the respective deposits.

Furthermore, the dates from one of the cores at Paull (BH-H) were also used to produce an OxCal age/depth deposit model (*Ch 1, p 19*), which allowed the formation date of an undated deposit of peat to be estimated (*p 29*), as well as other significant palaeoenvironmental events. Within this model, as the sediments under question do not seem to have suffered from any severe episodes of erosion (*ie* that were caused by marine inundation), the rate of sediment accumulation is assumed to be constant.

Overall, the dating of the peat sequences from Paull and Goxhill was highly successful. It demonstrated that those organic 'packages' suitable for analysis ranged in age from the Middle and Late Mesolithic periods, at Paull, and the Late Mesolithic and earlier Neolithic periods, at Goxhill.

Lithology, stratigraphy, and chronology

The results from the deposit modelling of the Paull and Goxhill borehole sequences clearly show that peat started to accumulate during the Mesolithic period, overlying sands and gravels of probable Devensian age. Assessment of marine aggregate deposits from the Humber Estuary suggests that at both sites these underlying sands and gravels comprise glacial outwash deposits, and while some may correlate with the last glacial maximum, most probably reflect melting and retreat of the ice sheet as the climate ameliorated (Wenban Smith 2002). Following sea-level rise, deposition of marine clays and silts, and probable erosion of some peat deposits, ensued at both sites, prior to further deposition of peat deposits during the Neolithic period. These deposits were then overlain by marine and/or brackish marine alluvium associated with renewed transgression.

Paull

The earliest evidence for the accumulation of peat directly overlying Devensian sands and gravels was in the westernmost part of the site. In this area, thin layers of peat intercalated with silts were recorded in BH-H, between -12.88 m and -10.2 m OD (Fig 13), which proved conducive to palaeoenvironmental analysis and radiocarbon dating.

Considering these in a little more detail, three thin layers of peat were identified. The lowest sealed the Devensian sand and gravel deposits, and there was a clear and sharp contact between these two sedimentary units. A Middle Mesolithic date for this Lower Peat was established (at -12.79 m to -12.80 m OD), as paired radiocarbon assays (SUERC-76296/7) of its humic/humin acid fractions are statistically consistent, providing combined dates of 7580-7480 cal BC (Table 1). The OxCal age/depth model also estimates that the top of this peat layer (at -12.72 m OD) dates to a similar period, specifically *7560-7450 cal BC* (Fig 14)

Overlying this Lower Peat was a deposit of clay/silt, although this was variably preserved/disturbed. The radiocarbon dates derived from underlying and overlying deposits indicate that this deposit dates to the Middle Mesolithic period and was accumulating during the mid-eighth millennium cal BC. Above this was the second layer of peat, which was again sealed by clay/silt; however, the contact between this second, Middle Peat unit and the overlying deposit was not seen, due to the sediment not being fully retained within the core. This peat layer was located at a depth of -12.20 m to -11.92 m OD and, although it was not directly radiocarbon dated, its age can be estimated from the OxCal age/depth model. This indicates that it began to form in *7460-7240 cal BC* (at -12.20 m OD), with recorded deposition ending in *7380-7140 cal BC* (at -11.92 m OD), and hence it also dates to the Middle Mesolithic period.

Above the Middle Peat was a third layer of peat (Upper Peat), which sealed a deposit of clay/silt, although the precise contact area between these deposits was unclear, due to the crumbly nature of the peat. This underlying clay/silt also sealed a thin deposit of shelly silt, which the OxCal age/depth model estimates to date to between *7130-6820 cal BC* (at -10.92 m OD) and *7090-6780 cal BC*

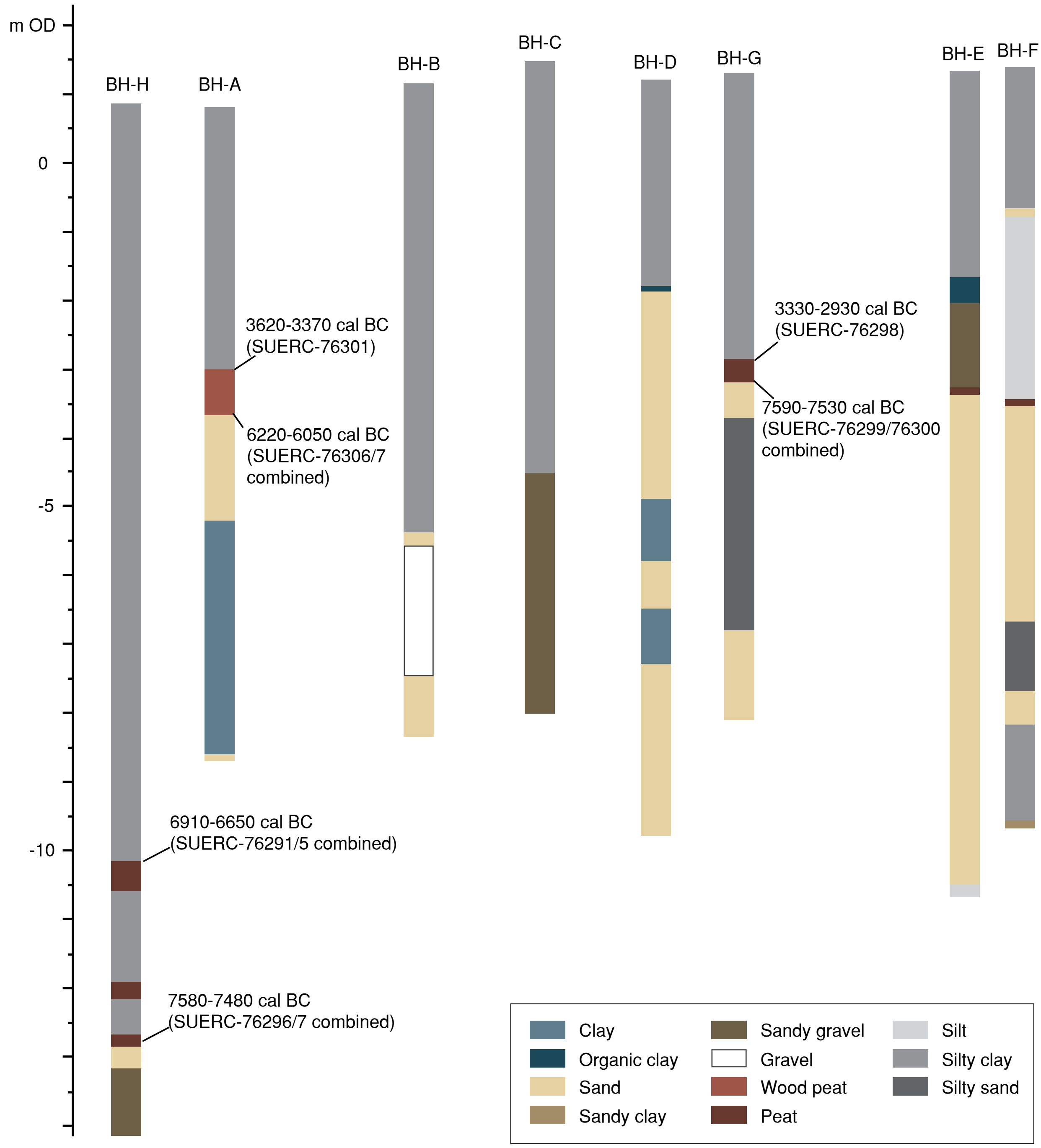


Figure 13: The lithostratigraphic sequence recorded at Paull

(at -10.76 m OD; Fig 14). Paired humin/humic dates were also gained from the top of the Upper Peat (at -10.23 m to -10.24 m OD). These are statistically consistent (though with a slightly poor agreement), with a combined date of 6910-6650 cal BC (SUERC-76291/5; Table 1), indicating that this peat formed in the Late Mesolithic period. Indeed, the OxCal age/depth model suggests that this peat began to accumulate in *7020-6750 cal BC* (at -10.66 m OD), at the start of the Late Mesolithic period (*p 21*).

It was also apparent from the deposit model that other deposits of peat were present across the site, though the extent of these was variable. In addition, assessment of these indicated that none were particularly suitable for additional analysis (OA North 2021). For example, peat was present in BH-A, located close to BH-H in the western part of the site, but at a much shallower depth (Fig 13), less than -4 m OD. Paired humin/humic dates (SUERC-76306/7) from the base of this deposit (at -3.59 m to -3.60 m OD) are statistically consistent (though with a slightly poor agreement) and provide a combined date of 6220-6050 cal BC (Table 1), suggesting that this peat, although Late Mesolithic in date, formed following the establishment of the upper layer of peat

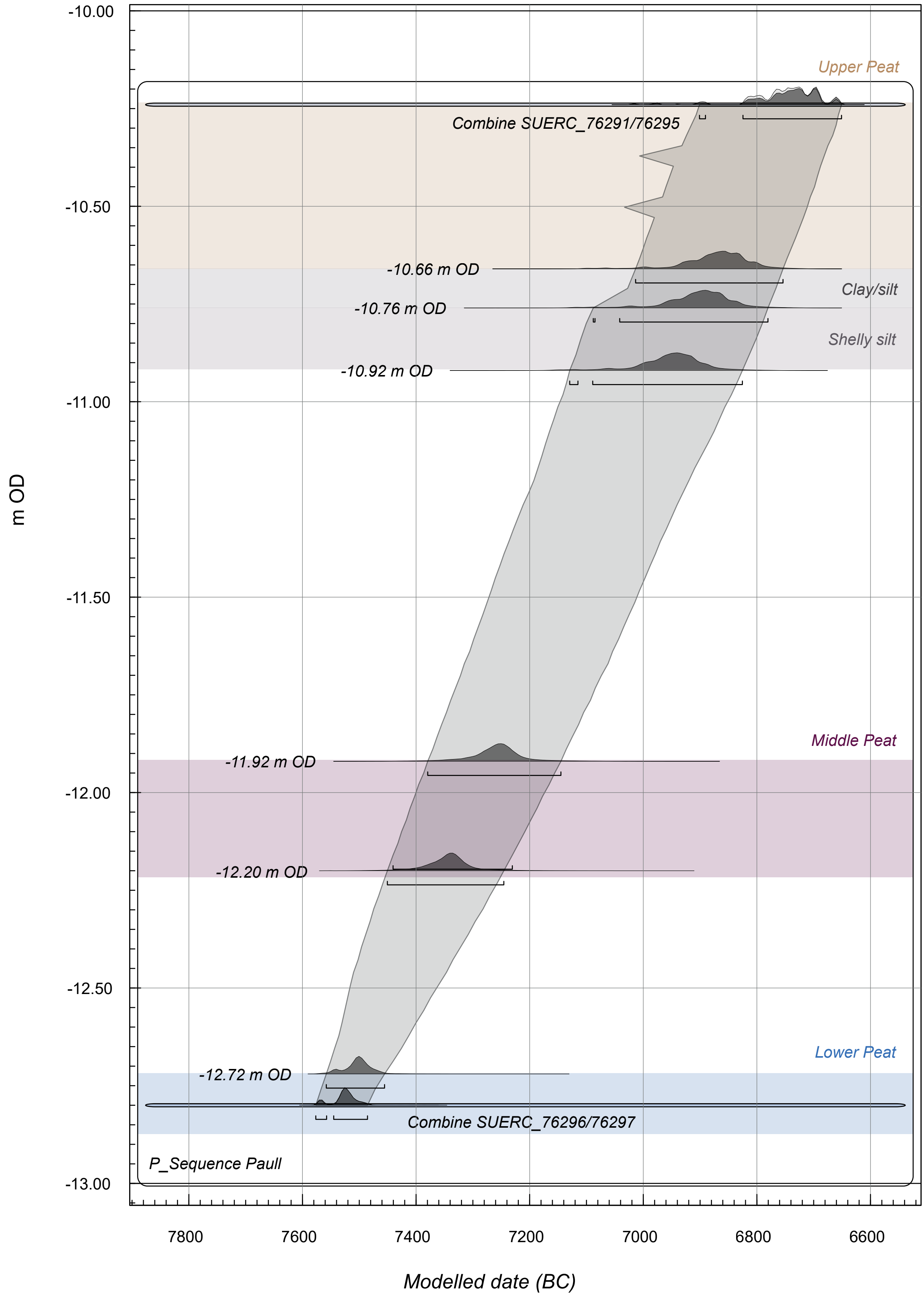


Figure 14: The OxCal age/depth model indicating the dates of the Lower Peat, Middle Peat, and Upper Peat in BH-H, Paull

Core	Altitude m (OD)	Laboratory code	Material/ fraction	Radiocarbon age (BP)	δ^{13}C (‰)	Calibrated date range (95% confidence)	Chi-square test	Combined date (95% confidence)
BH-A	-2.99 to -3.0	SUERC-76301	Peat/humic fraction	4701±24	-29.2	3620-3370 cal BC	Failed	
		SUERC-76305	Peat/humin fraction	4841±21	-29.1	3655-3530 cal BC		
	-3.59 to -3.60	SUERC-76306	Peat/humic fraction	7207±21	-30.2	6090-6005 cal BC	Passed (T′=3.2; T(5%)=3.8; *v*=1; A_{comb}=46.5% (An=50%))	6220-6050 cal BC
		SUERC-76307	Peat/humin fraction	7289±23	-30.1	6225-6075 cal BC		
BH-G	-3.35 to -3.36	SUERC-76298	Wood bark roundwood	4436±24	-28	3330-2930 cal BC		
	-3.67 to -3.68	SUERC-76299	Peat/humic fraction	8466±21	-28.5	7585-7505 cal BC	Passed (T′=1.4; T(5%)=3.8; *v*=1; A_{comb}=94.3% (An=50%))	7590-7530 cal BC
		SUERC-76300	Peat/humin fraction	8521±24	-28.9	7595-7530 cal BC		
BH-H	-10.23 to -10.24	SUERC-76291	Peat/humic fraction	7866±23	-31	6825-6640 cal BC	Passed (T′=3.4; T(5%)=3.8; *v*=1; A_{comb}=49.2% (An=50%))	6910-6650 cal BC
		SUERC-76295	Peat/humin fraction	7947±21	-32.2	7035-6695 cal BC		
	-12.79 to -12.80	SUERC-76296	Peat/humic fraction	8434±25	-30.5	7580-7470 cal BC	Passed (T′=0.1; T(5%)=3.8; *v*=1; A_{comb}=130.6% (An=50%))	7580-7480 cal BC
		SUERC-76297	Peat/humin fraction	8439±24	-31.6	7568-7486		

Table 1: Radiocarbon dates from peat deposits in the borehole cores from Paull

identified in BH-H (*p 29*). Paired dates from the top level of the peat in BH-A (at -2.99 m to 3.0 m OD) are inconsistent, though on the basis of the humic acid date, this level potentially dates to 3620-3370 cal BC (4701±24 BP; SUERC-76301; Table 1), which falls at the end of the earlier Neolithic period. Together with the date from the base of this deposit, it therefore seems to suggest that this comparatively thin layer of peat formed over a long period and most likely suffered from erosion, probably as a result of fluctuating sea levels.

Moving further east, there was no peat in the central part of the site (in BH-B to BH-D), but, at the far eastern end, peat was again recorded in BH-G and BH-E, also at depths of *c* -4 m OD (Fig 13). As with the peat in BH-A (*p 29*), the peat units recovered from these boreholes were quite thin and may, in part, have been eroded, which is also confirmed by radiocarbon dating. Specifically, radiocarbon dates were obtained from a layer of peat in BH-G from its base and upper level. Those from the base (at -3.67 m to -3.68 m OD) include paired humin/humic dates (SUERC-76299/76300), which are consistent, providing a combined date of 7590-7530 cal BC (Table 1). This combined date indicates that the base of this peat formed in the Middle Mesolithic period, at a similar time to the lower peat layer identified in BH-H (*p 28*). The radiocarbon assay from the top (at -3.35 m to -3.36 m OD) of this peat was obtained from a piece of wood bark and this, in stark contrast, returned a later Neolithic date of 3330-2930 cal BC (4436±24 BP; SUERC-76298), implying that an area of peat potentially dating to the Late Mesolithic and earlier Neolithic had been lost to erosion.

In addition to the peat deposits, thick layers of alluvium were also recorded. In one area, BH-C, these directly overlaid the Devensian sands and gravels, though in others they sealed the layers of peat identified in the five boreholes.

Goxhill

The deposit model for Goxhill indicates that a series of alluvial layers interspersed with thin woody peat deposits accumulated above the Devensian sands and gravels (Fig 15). The lowest of these peat deposits was identified in BH-11, which lay above a deposit of silty clay. In an adjacent borehole (BH-10), this peat and underlying silty clay were also recorded, though at this location the peat was at a slightly higher level, and it was also evident that the underlying silty clay directly sealed the Devensian sands and gravels. This seems to suggest that the lower peat accumulated within a

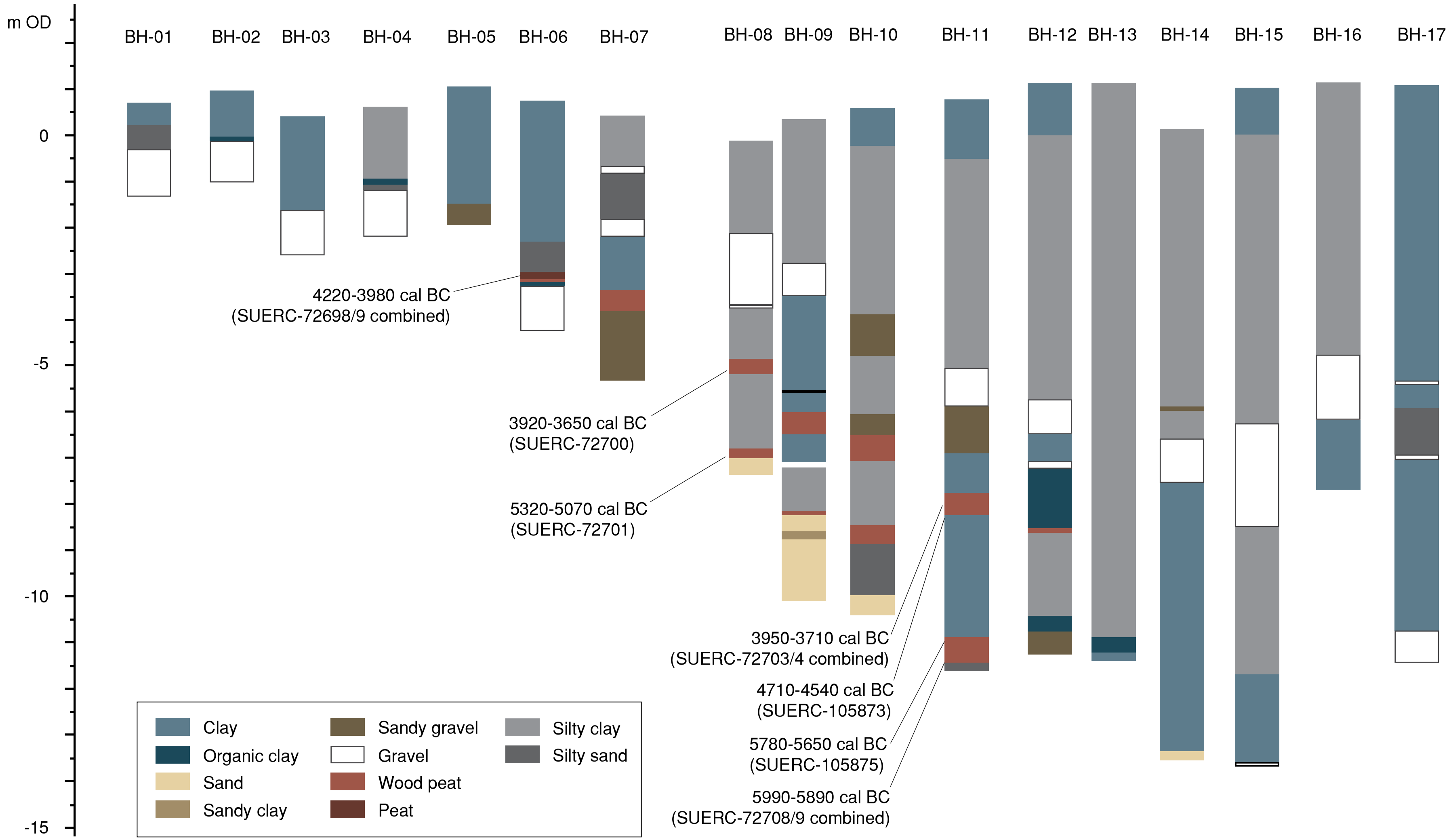


Figure 15: The lithostratigraphic sequence recorded at Goxhill

former channel, or sloping foreshore area, which fell towards and ran parallel with the present-day estuary, and contained a basal deposit of alluvium. In terms of the date of this lower peat, paired humin/humic dates (SUERC-72708/9) obtained from near its base (at -11.29 m to -11.30 m OD), in BH-11, were consistent, producing a combined date of 5990-5890 cal BC (Table 2). Paired humin/humic (SUERC-105875/6) dates were also obtained from the upper levels of this peat (at -10.92 m to -10.93 m OD), again in BH-11, though these were inconsistent, showing considerable variation. The potentially more reliable assay on the peat's humic acid (*p 28*) does, however, provide a date of 5780-5650 cal BC (6834±27 BP; SUERC-105875), and when this is taken in conjunction with the combined date from the base of the peat it indicates that this organic deposit formed in the Late Mesolithic period, across the earlier part of the sixth millennium cal BC.

It also seems likely, on stratigraphic grounds, that identical, or at least very similar, deposits of peat were present in BH-09 and BH-08 to the south-west, which, in these instances, directly sealed the Devensian sands and gravels. That in BH-08 was higher than in BH-09, and both were also higher than the lower peats in BH-10 and BH-11 (*p 31*). This therefore seems to confirm that this organic layer accumulated in a former channel, which sloped upwards, away from the present-day Humber, in a south-westerly direction. The peat in BH-08 was also subjected to radiocarbon assay, though the paired humin/humic dates (SUERC-72701/2) from its base (at -6.55 m to -6.56 m OD) are inconsistent. Based on the dating of the humic-acid fraction, however, it is possible that this deposit began to form in 5320-5070 cal BC (6259±27 BP; SUERC-72701). Hence, this peat, in a similar way to the peat in BH-11, also dates to the Late Mesolithic period, though it formed several centuries later. This could therefore suggest that the peat that initially accumulated lower down in the channel (in BH-11), in the earlier part of the sixth millennium cal BC, gradually expanded upslope during the latter parts of this millennium.

The Lower Peat in BH-08 to BH-11 were sealed by a deposit of organic-rich silt and clay, which was overlain by a second thin, woody peat unit. This Upper Peat was also present in BH-12 to the north-east, and probably also in BH-06 and BH-07 to the south-west, though at these locations the Upper Peat directly sealed the Devensian sands and gravels. As with the lower peat, the upper peat also sloped upwards in a south-westerly direction, mirroring the profile of the suspected earlier channel (*above*). The date of this upper peat unit was determined via a suite of radiocarbon dates from BH-11, BH-08, and BH-06 (Table 2). Those from BH-11 include

Core	Altitude m (OD)	Laboratory code	Material/ fraction	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (95% confidence)	Chi-square test	Combined date (95% confidence)
BH-6	-2.93 to 2.94	SUERC-72698	Peat/humic fraction	5202±27	-27.6	4160-3950 cal BC	Passed (T'=2.9; T(5%)=3.8; v=1; A_{comb}=60.2% (An=50%))	4220-3980 cal BC
		SUERC-72699	Peat/humin fraction	5281±29	-27.7	4240-3990 cal BC		
BH-8	-4.69 to -4.70	SUERC-72700	Bark	4982±29	-26.4	3920-3650 cal BC		
	-6.55 to -6.56	SUERC-72701	Peat/humic fraction	6259±27	-28.3	5320-5070 cal BC	Failed	
		SUERC-72702	Peat/humin fraction	6409±29	-28.2	5480-5310 cal BC		
BH-11	-7.81 to -7.82	SUERC-72703	Peat/humic fraction	5023±29	-28.2	3950-3700 cal BC	Passed (T'=0.1; T(5%)=3.8; v=1; A_{comb}=124.6% (An=50%))	3950-3710 cal BC
		SUERC-72704	Peat/humin fraction	5032±29	-28.1	3950-3710 cal BC		
	-8.18 to -8.19	SUERC-105873	Peat/humic fraction	5777±27	-28.4	4710-4540 cal BC	Failed	
		SUERC-105874	Peat/humin fraction	5993±27	-28.4	4990-4790 cal BC		
	-10.92 to -10.93	SUERC-105875	Peat/humic fraction	6834±27	-28.2	5780-5650 cal BC	Failed	
		SUERC-105876	Peat/humin fraction	7231±27	-25*	6220-6010 cal BC		
	-11.29 to -11.30	SUERC-72708	Peat/humic fraction	7032±29	-29.7	5990-5840 cal BC	Passed (T'=0.7; T(5%)=3.8; v=1; A_{comb}=98.0% (An=50%))	5990-5890 cal BC
		SUERC-72709	Peat/humin fraction	7079±29	-29.8	6020-5890 cal BC		

Table 2: Radiocarbon dates from peat deposits in the borehole cores from Goxhill

two sets of paired humin/humic dates from its base and upper level. Those from the base (SUERC-105873/4, at -8.18 m to -8.19 m OD) are inconsistent, though the date from the humic fraction suggests it began to form at the close of the Late Mesolithic period in 4710-4540 cal BC (5777±27 BP; SUERC-105873). The paired dates (SUERC-72703/4) from its upper level (at -7.81 m to - 7.82 m OD) are, however, consistent and provide a combined date of 3950-3710 cal BC. This latter date, together with the basal date, therefore indicates that this peat unit accumulated across the Late and Final Mesolithic periods, and into the earlier Neolithic period. The other dates from the Upper Peat in BH-08 and BH-06 are comparable, dating to the Final Mesolithic and earlier Neolithic periods. Specifically, a fragment of bark from BH-08 (at -4.69 m to -4.70 m OD) dates to the earlier Neolithic period (3920-3650 cal BC; 4982±29 BP; SUERC-72700), whilst paired, and consistent, humin/humic dates (SUERC-72698/9) from BH-06 (at -2.93 m to 2.94 m OD) provide a combined date of 4220-3980 cal BC, which spans the Final Mesolithic period.

The deposit model indicates that the Upper Peat was then covered by a layer of silty clays, with herbaceous and shelly debris (recorded in BH-11, BH-12, BH-08, and BH-09), which was later overlain by a series of sand and gravel deposits (BH-7 to BH-12; Fig 15). Overlying the sand and gravels was a final deposit of alluvium, composed of silt and clay. Moreover, this formed a very substantial deposit, which in places (*ie* in BH-12) was up to 8 m thick.

Palaeoenvironmental analysis

M Rutherford (pollen and NPP) and N Cameron (diatoms)

Detailed analysis was undertaken on two cores, BH-H, from Paull, and BH-11, from Goxhill, which both contained the better preserved palaeoenvironmental remains at the respective sites. With the core from Paull, analysis focused on the three units of peat, these being the Lower and Middle peats, dating to the Middle Mesolithic period, and the Upper Peat, dating to the Late Mesolithic period (*p 28*). Analysis also considered data from the silts and clays beneath and overlying the upper peat, as these appeared to be *in situ*. Overall, where possible, the pollen data have been grouped into specific pollen zones to aid interpretation. In addition, diatom samples were also considered from the deposits surrounding these peat units, which proved informative for discerning water conditions at the site.

Similarly, with the core from Goxhill, analysis focused on the two recorded peat units, the Lower Peat, dating to the Late Mesolithic period (*p 31*), and the Upper Peat, which accumulated between the Late Mesolithic and earlier Neolithic periods (*p 33*). Analysis also focused on the clays between and overlying these two peat units, and considered the diatom data gathered during the assessment of this core. Specific pollen zones were also constructed in order to assist the interpretation of the data.

Paull

Lower Peat: -12.88 m to -12.72 m OD (Middle Mesolithic period)

Although the pollen data from this peat deposit (Lower Peat: Fig 16) suggest the presence of several environmental habitats, the dominant signal reflects the presence of a hazel-type scrub or woodland (Table 3). In addition, other tree pollen was also recorded, suggesting that possible birch carr, as well as stands of mixed elm, oak, and pine (*Pinus*) also existed. Overall, these assemblages are typical of developing woodlands, prior to the arrival of alder and lime.

Evidence of wetland environments may also be inferred. This is evident from the pollen of sedges, grasses (Poaceae), and meadowsweet (*Filipendula*), as well as that from aquatic plants, including bulrush (*Typha latifolia*), pondweed (*Potamogeton*), and water-milfoils (*Myriophyllum verticillitum*), and the freshwater algal taxon, *Botryococcus* (HdV-766; Fig 17); however, wetland taxa account for less than 5% of the total taxa counted in this peat unit.

The bottom of the peat dates to 7580-7480 cal BC and its upper levels are also estimated to date to a similar period (*p 28*). This indicates that the assemblage is later than other comparable regional assemblages associated with a rise in hazel, specifically that recorded at Cess Dell, Holderness (*p 24*), which dates the Early Mesolithic period (9150-8620 cal BC; 9490±70 BP; AA-30870; Tweddle 2000). The expansion of oak on Holderness has also been estimated to date to a slightly earlier period, *c* 8530-7960 cal BC (*cf* Bateman *et al* 2001), which spans the transition between the Early and Middle Mesolithic periods (*p 21*). Therefore, as on Holderness, it seems likely that at Paull mixed hazel, oak, birch, and elm woodland also covered the outer Humber Estuary during the latter phases of the Middle Mesolithic period, until the expansion of alder and lime. It was also apparent from the pollen data at Paull that there is no evidence for marine influence during this period, and it therefore seems that peat formed immediately prior to the main inundation of Doggerland, at a time when eastern Britain was still attached to Continental Europe (*p 22*).

Freshwater deposition: -12.72 m to 12.20 m OD (Middle Mesolithic period)

Above the Lower Peat (*above*) was a deposit of clay/silt that was mostly disturbed and unsuitable for pollen analysis; however, one sample (D20) from the upper part of this deposit (at -12.46 m OD) did contain

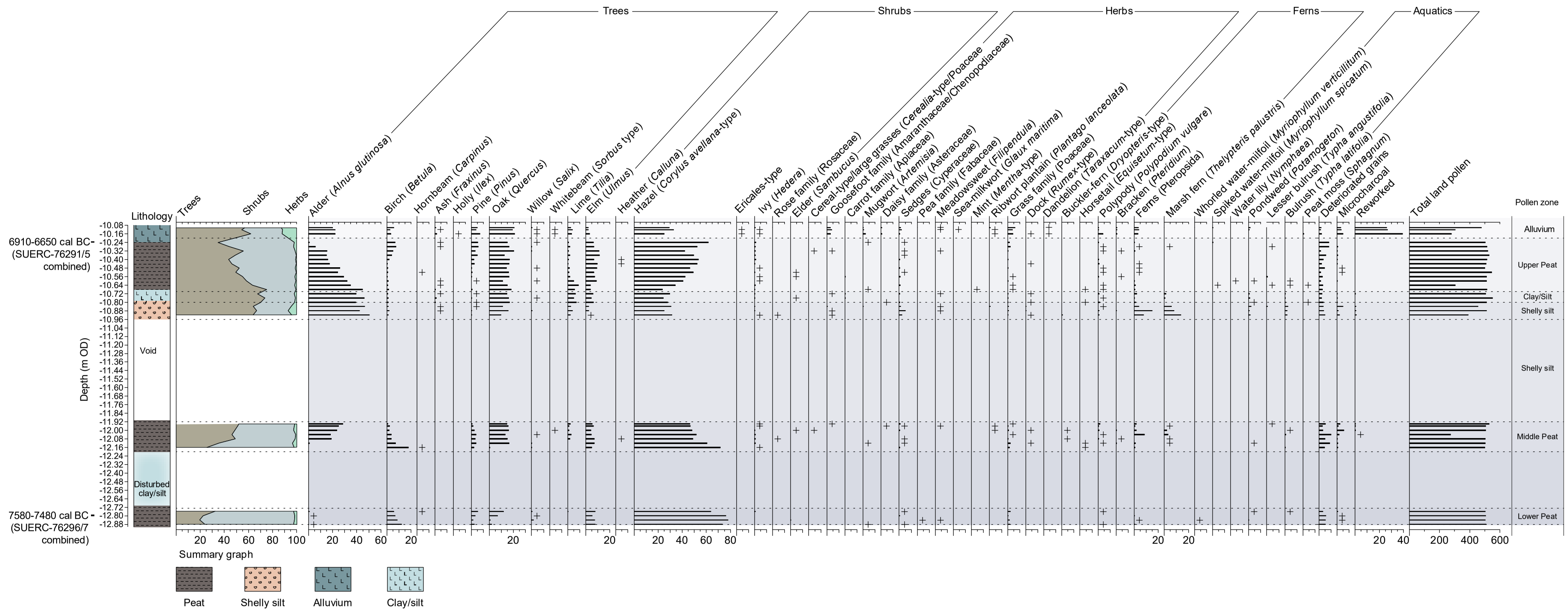


Figure 16: Pollen percentage diagram for the peat units and surrounding deposits in BH-H, Paull

Zone name	Altitude (m OD)	Assemblage characteristics
Lower Peat	-12.88 to -12.72	Characterised by shrub and tree pollen, which was dominated by hazel (*Corylus avellana*)-type, with birch (*Betula*), elm (*Ulmus*), oak (*Quercus*), willow (*Salix*), and pine (*Pinus*), and rare occurrences of alder (*Alnus*) and lime (*Tilia*). Sedges (Cyperaceae) and grasses (Poaceae) were the most common herb pollen, with meadowsweet (*Filipendula*) and mugworts (*Artemisia*) also recorded. There were rare occurrences of fern spores, including common polypody (*Polypodium vulgare*) and monolete ferns spores (Pteropsida), as well as the pollen of aquatic plants (*eg* bulrush (*Typha latifolia*), pondweed (*Potamogeton*)), and the freshwater algal type, *Botryococcus* (HdV-766). Microcharcoal was present in small quantities
	-12.72 to -12.20	The sediments were disturbed and were not sub-sampled for pollen. Diatoms were present at -12.46 m OD
Middle Peat	-12.20 to -11.92	Characterised by abundant hazel-type and alder, with commonly occurring oak and decreasing frequency of birch. Lime was consistently recorded, along with elm and ivy (*Hedera*). Compared to the Lower Peat, a greater diversity of herb pollen was present, and this included mostly grasses and sedges, but also docks/sorrels (*Rumex*-type), pollen form the daisy family (Asteraceae), ribwort plantain (*Plantago lanceolata*), and rare cereal-type/large grass pollen, probably derived from coastal or wetland grasses, such as sweet-grasses (*Glyceria*-type). Rare pollen of the goosefoot family (Amaranthacerae /Chenopodiaceae) was also recorded. This represents a large group of plants including taxa that are known from coastal locations, *eg* glassworts (*Salicornia*) and sea-blites (*Suaeda*), as well as from cultivated or waste ground, *eg* fat-hen (*Chenopodium album;* Stace 2019). Fern spores increased in quantity, and included common polypody, monolete ferns, bracken (*Pteridium*), and marsh fern (*Thelypteris palustris*). This increase is coincident with occurrences of the pollen of aquatic plants and freshwater algae, in particular *Botryococcus* (HdV-766) and *Pediastrum* (HdV-760). A relatively diverse NPP assemblage was also recorded. There were occurrences of *Sordaria* (HdV-55A/B), *Podospora* (HdV-368), *Coniochaeta xylariispora* (HdV-6), *Diporotheca* (HdV-143), HdV-4, HdV-11, HdV-18, and HdV-128. There were rare occurrences of foram test linings and dinoflagellate cysts, towards the top of the peat unit. Microcharcoal particles were present in moderate amounts, in particular towards the top of the peat
	-11.92 to -10.92	Sediments were not present in the core/too disturbed for pollen analysis
Shelly Silt and Clay/Silt	-10.92 to -10.66	Relatively low counts of hazel-type, oak, lime, and elm, and greater abundance of the pollen of alder and aquatic plants, and fern spores. Fern spores, in particular monolete ferns (Pteropsida) and marsh fern, were present in large numbers, along with the pollen of aquatic taxa, including pondweed and bulrush. Freshwater algae, including *Botryococcus* HdV-766 and *Pediastrum* (HdV-760) were common, as were occurrences of the fungal spores *Glomus* (HdV-207), *Spirogyra* (HdV-131), and *Gloeotrichia* (HdV-146). There were rare occurrences of foram test linings and pollen of the goosefoot family
Upper Peat	-10.66 to -10.24	Alder and lime declined, and hazel-type, oak, and elm increased. Grasses and sedges occurred consistently, along with docks/sorrels, meadowsweet, mugworts, and rare cereal-type/large grasses. Fungal spores were present and include occurrences of *Kretzschmaria deusta* (HdV-44), *Coniochaeta xylariispora* (HdV-6), *Diporotheca* (HdV-143), and HdV-18
Alluvium	-10.24 to -10.08	Alder and lime increased, and the herb assemblage was diverse, including grasses, sedges, mugworts, goosefoot family, and sea-milkwort (*Glaux maritima*). The alluvial deposits were characterised by reworked spores of Carboniferous age. Several species of dinoflagellate cysts were also recorded. These included some which are found today (*eg Operculodinium centrocarpum*) and those that are exclusively of Cretaceous or Jurassic age (*eg Cribroperidium* sp) and therefore represent reworked material. Foraminiferal test linings were also present and may be *in situ* or could be reworked from older sediments. Microcharcoal particles were present in moderate numbers and the fungal spore *Gelasinospora* (HdV-1) was also recorded

Table 3: Pollen zonation and assemblage characteristics for BH-H, Paull

high numbers of diatoms. Although these exhibited moderate to poor preservation, it was evident that they represent a moderately diverse freshwater diatom assemblage (Table 4). Indeed, there is no evidence of marine influence in the assemblage, as mesohalobous and polyhalobous taxa are entirely absent. Notably, freshwater planktonic diatoms are dominant, typical of open-water conditions, and include *Cyclotella radiosa* and *Cyclotella krammeri*. Both these species populate relatively deep bodies of freshwater (Houk *et al* 2010),

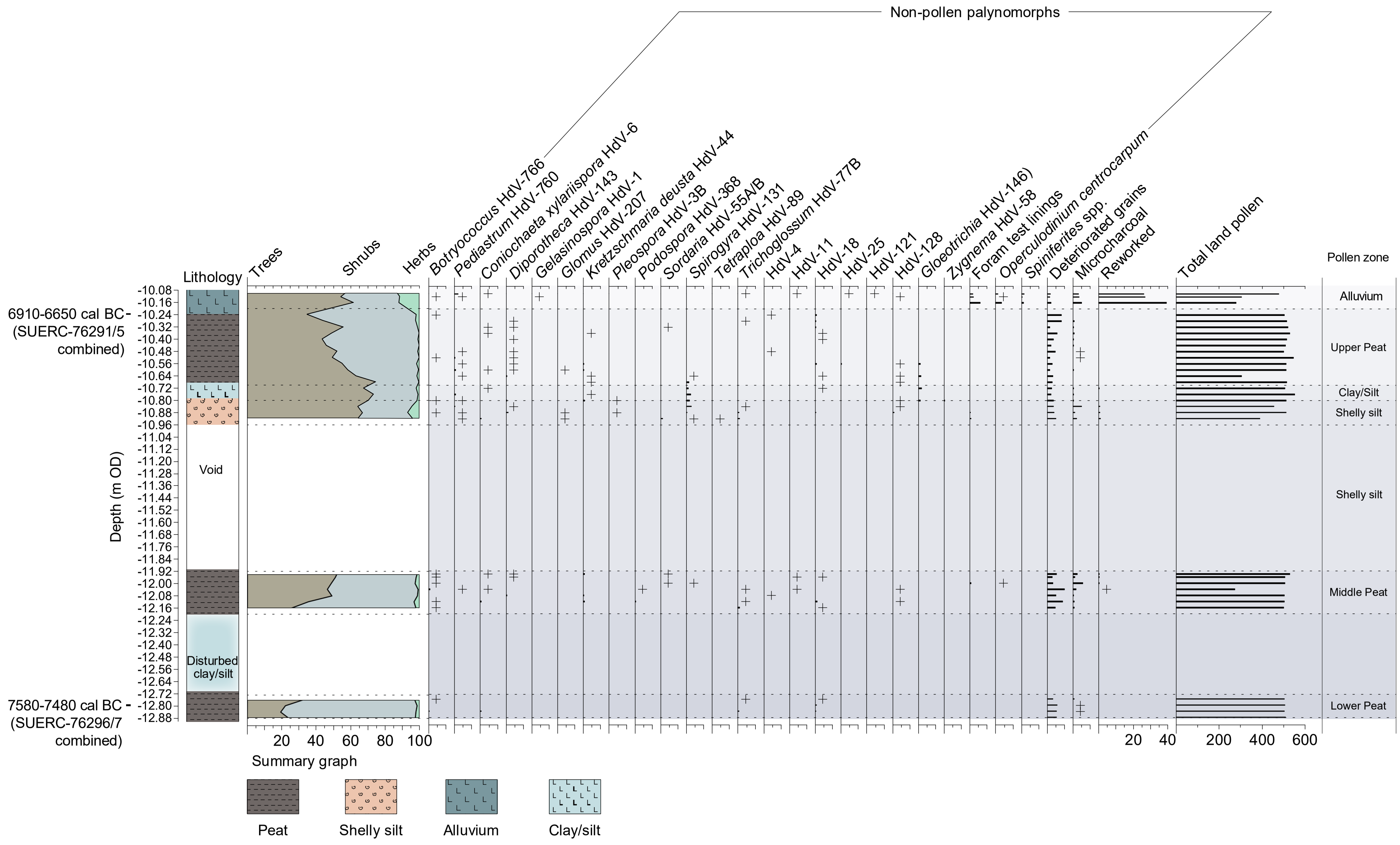


Figure 17: Non-pollen palynomorph percentage diagram for the peat units and surrounding deposits in BH-H, Paull

Diatom type/ conditions	Diatom Taxon	Frequency
Slightly brackish water (Oligohalobous Halophilous to Indifferent)	*Epithemia turgida*	1
Oligohalobous Indifferent (optimum in freshwater)	*Aulacoseira granulata*	1
	Cocconeis placentula	1
	Cyclotella krammeri	3
	Cyclotella radiosa	3
	Epithemia adnata	1
	Gomphonema augur	1
	Stephanodiscus neoastrea	1
	Synedra capitata	1
	Synedra ulna	1
Unknown Salinity Group	*Gyrosigma* sp	1

Note: 1= present; 3= very common

Table 4: Diatoms in sample D20

which implies that the deposit of clay/silt at Paull represented a freshwater lake sediment, whose upper levels are estimated to have formed in the third quarter of the eighth millennium cal BC (*p 28*).

Middle Peat: -12.20 m to -11.92 m OD (Middle Mesolithic period)

The Middle Peat sealed the freshwater lake sediment (*p 34*) and it probably accumulated between *7460-7240 cal BC* and *7380-7140 cal BC* (*p 28*), during the terminal centuries of the Middle Mesolithic period (*p 21*). During this time, the pollen assemblages (Fig 16; Table 3) suggest that there was a transition to a wetter environment, based on the increase in alder pollen, which probably reflects the expansion of alder-carr habitats. Whilst a wetter, alder-carr environment may have been present at Paull, other tree species were also recorded, suggesting that a mixed woodland existed in the drier areas fringing the site. Specifically, oak is present, which may have expanded on dry soils as alder became dominant in wetland areas, and there is also evidence for elm and lime, both of which require moist, but well-drained, soils (Sterry 2008).

Importantly, this evidence of an expansion in alder fits with the wider regional evidence. For instance, at Union Dock, also in the outer estuary, though slightly further west of Paull (*p 23*), the expansion of alder occurred during a similar period, immediately after 7330-7050 cal BC (8170±45 BP; SRR-4747; Long *et al* 1998). In addition, in a similar fashion to Paull, this rise in alder also appears to be coincident with declining values of hazel-type pollen and increasing values for lime. Similarly, the rise in alder at Sunk Island, which is also located in the outer estuary, further east of Paull (*p 23*), is dated after 7740-7490 cal BC (8555±65 BP; AA25582), and well before 6220-5850 cal BC (7145±60 BP; AA25581; Shennan *et al* 2000b), and hence, again, could date to a similar period to that recorded at Paull and Union Dock. In contrast, the evidence from nearby, and inland, Holderness suggests a later date for the alder expansion, where it is dated to 7030-6490 cal BC (7830±60 BP; AA-30873) at Cess Dell (*p 24*; Tweddle 2000). Overall, this seems to imply that within the outer estuary the expansion of alder occurred relatively early and may reflect an increase in wetland conditions during the middle-late eighth millennium cal BC, which facilitated its expansion. Moreover, this pattern seems to suggest that across the region its expansion was probably diachronous/time-transgressive, being dependent on local conditions that were conducive to its development (*cf ibid*). It is also possible, however, that its expansion was additionally stimulated by a more oceanic and wetter climate, as Doggerland was inundated and Britain became separated from the Continent following sea-level rise in the late eighth millennium cal BC (*p 22*; Innes *et al* 2011).

At Paull the expansion of wetland areas is further supported from occurrences of a diverse range of plant species that can tolerate or thrive in wet conditions, such as grasses, sedges, docks/sorrels (*Rumex*-type), marsh fern (*Thelypteris palustris*), as well as freshwater algae. Together these species may reflect areas of sedge fen, scattered amongst the alder-carr habitats.

NPP, specifically *Sordaria* (HdV-55A/B) and *Podospora* (HdV-368; Fig 17), also suggest that these wetland areas were perhaps used by grazing animals, as these are coprophilic forms associated with both animals and people (Blackford and Innes 2006). Perhaps significantly, microcharcoal particles were also present in the Middle Peat and were more commonly recorded in its upper levels (Fig 16). These could, in turn, reflect the presence of Mesolithic groups in the area, with the charcoal deriving from encampments/areas of clearance either directly around the wetland area at Paull or from the wider regional area, with the charcoal perhaps being transported to the site by water.

Finally, evidence of increasing sea levels may also be inferred. For instance, towards the top of the peat, subtle indicators of marine environments appear for the first time (*ie* foram test linings and dinoflagellate cysts), suggesting the possible development of saltmarshes.

Fluctuating marine/freshwater conditions: -11.92 m to -10.66 m OD (Middle/Late Mesolithic period)
The possible marine influence identified in the upper levels of the Middle Peat (*p 38*) was also detected higher up the BH-H core. Specifically, two samples from a deposit of shelly silt (between -10.92 m OD and -10.76 m OD), estimated to date to the Middle/Late Mesolithic transition (*p 28*), contained low numbers of poorly preserved diatoms (in samples D18 (at -10.84 m OD) and D19 (at -10.92 m OD)), though these were dominated by brackish and marine species that indicate the presence of a tidal environment (Table 5). The marine taxa comprise *Paralia sulcata* and *Rhaphoneis amphiceros*, whilst mesohalobous taxa comprise the benthic diatoms *Diploneis didyma*, *Nitzschia punctata*, *Nitzschia navicularis*, and *Scoliopleura tumida*. There are also rare occurrences of oligohalobous indifferent taxa, but these include diatoms such as *Fragilaria pinnata* that has a broad salinity tolerance (Morales *et al* 2013). In addition to the diatoms, there is also some pollen and NPP evidence relating to wetland environments in the shelly silt (Table 3). This includes abundant quantities of spores of marsh fen, and pollen of aquatic plants, including pondweed and bulrush (Fig 16), as well as the freshwater green algal-type *Spirogyra* (HdV-130; Fig 17), which has a known occurrence in shallow, possibly stagnant water (van Geel 1978). Interestingly, *Gloeotrichia* (HdV-146) was also recorded. These cyanobacteria are capable of nitrogen-fixing and are therefore considered pioneering species in pools and ponds that create suitable habitats for aquatic plants (*ibid*).

Above the shelly silt was a sealing layer of clay/silt and the diatoms from this (in samples D16 (at -10.68 m OD) and D17 (at -10.76 m OD)) were abundant and well-preserved (Table 6). Importantly, these include non-planktonic, particularly epiphytic, freshwater diatoms, which reflect shallow freshwater habitats with macrophyte growth and high nutrient levels, with no evidence of tidal influence. Wetland environments, represented by alder carr and freshwater marsh habitats, are also interpreted from the pollen derived from this deposit, with *Gloeotrichia* (HdV-146) also present, as in the underlying shelly silt. There is also slight evidence for possible proximity to marine conditions, based on the occurrence of pollen of the goosefoot (Amaranthacerae/Chenopodiaceae) family (Fig 16) and foram test linings (the latter assumed to be *in situ*), perhaps indicative of local saltmarsh environments.

Diatom type/conditions	**Diatom Taxon/Laboratory Number**	**Frequency**	
		(D18)	**(D19)**
Marine (Polyhalobous)	*Paralia sulcata*	2	2
	Rhaphoneis amphiceros	1	1
	Rhaphoneis sp	1	
Brackish water (Polyhalobous to Mesohalobous)	*Diploneis smithii*	1	
	Diploneis stroemii	1	
	Navicula (Petroneis) marina	1	
	Mesohalobous		
	Caloneis westii	1	
	Diploneis didyma	1	1
	Nitzschia punctata	2	1
	Nitzschia hungarica	1	
	Nitzschia navicularis	2	2
	Scoliopleura tumida	1	1
	Synedra tabulata		
Optimimum in freshwater but tolerant of slightly brackish water (Oligohalobous Indifferent)	*Epithemia* sp		1
	Fragilaria pinnata	1	
	Synedra ulna	1	
Unknown salinity group	*Diploneis* sp	1	
	Nitzschia sp		1
	Navicula sp	1	

Note: 1= present; 2= common

Table 5: Diatoms in samples D18 and D19

Diatom type/conditions	Diatom Taxon/Laboratory Number	Frequency		
		D15	D16	D17
Slightly brackish water (Oligohalobous Halophilous to Indifferent)	*Amphora veneta*	1		1
	Epithemia turgida	2	1	1
Oligohalobous Indifferent (optimum in freshwater)	*Amphora libyca*		1	2
	Aulacoseira sp.			1
	Aulacoseira granulata			
	Cocconeis placentula	1	3	3
	Cymbella affinis	1	1	
	Epithemia adnata	2	3	2
	Epithemia sp.	1		
	Fragilaria brevistriata	3	3	2
	Fragilaria construens			1
	Fragilaria construens v venter		1	1
	Fragilaria pinnata		1	2
	Gomphonema acuminatum v coronatum	2	1	
	Gomphonema angustatum			1
	Gomphonema augur			
	Navicula oblonga	1	2	1
	Navicula pupula		1	1
	Pinnularia major	1	1	
	Synedra capitata	1		
	Synedra acus			1
	Synedra ulna	1	1	1
Unknown salinity group	Indeterminate Naviculaceae	1		
	Chaetoceros sp		1	
	Cymbella sp	1		
	Fragilaria sp		2	
	Gomphonema sp			1
	Neidium sp			1
	Navicula sp	1		1
	Pinnularia sp	1		

Note: 1= present; 2= common; 3= very common

Table 6: Diatoms in sample D15-D17

Upper Peat: -10.66 m to -10.24 m OD (Late Mesolithic period)

At the very base of this peat deposit, in a similar way to underlying clay/silt (*p 39*), the NPP *Gloeotrichia* (HdV-146) was recorded (Fig 17), and the diatoms are also comparable (sample D15 (at -10.60 m OD); Table 6), being freshwater types that populate shallow water. Interestingly, the tree pollen throughout this deposit (Upper Peat; Fig 16), which formed during the early centuries of the seventh millennium cal BC (*p 29*), indicates that there was a decline in alder, with a corresponding increase and dominance of hazel-type woodland. It therefore seems likely that this fluctuation was related to changes in the water table, which lowered and facilitated the expansion of hazel-type species. Given the low pollen productivity of elm and lime, it is likely these trees also formed a significant component of the woodland mosaic at this time (Bradshaw and Webb 1985). Oak also continues to be important and alder may have contributed to the regional woodland, as well as occupying carr conditions in the wetland zone. A potentially lower water table also correlates with reduced freshwater indicators throughout this peat deposit, although the algal taxon *Pediastrum* (HdV-760) remains a common component of the assemblage (Fig 17). *Pediastrum* sp are typically indicative of freshwater habitats, but several species can also live in shallow brackish water conditions (Brenner 2005).

Marine transgression: -10.24 m to -4.7 m OD (Late Mesolithic period)
A transgressive contact is interpreted between the top of the Upper Peat (*p 40*) and the overlying alluvial deposits (Alluvium), indicating that marine sedimentation replaced peat accumulation. This marine transgression is evident through the presence of several key marine indicators. These include: the pollen from plants that are tolerant of coastal settings, such as the goosefoot family, daisy (Asteraceae) family, mugworts (*Artemisia*), and sea-milkwort (*Glaux maritima*; Fig 16; Table 3); dinoflagellate cysts; foram test linings; and diatoms. Regarding this latter element, between -10.10 m and -4.7 m OD, the diatoms comprise marine and brackish species, which, when compared with those from the underlying deposits, indicate a change to saline, shallow-water, tidal environments.

Although evidence for a marine transgression is apparent, its position/date could not be precisely determined, as the contact between the Upper Peat and marine alluvium was not visible in the core. Moreover, this marine transgression was also likely to have been an erosive event (supported by records of common reworking of Carboniferous age spores) and may have scoured/destroyed the original uppermost levels of the Upper Peat. With this in mind, the surviving uppermost level of this peat is dated to 6910-6650 cal BC (*p 29*) and this therefore provides a *terminus post quem* for the marine transgression. It is likely that this transgression dates to a later time in the Late Mesolithic period, particularly as pollen and diatom data from Union Dock (*p 23*) indicate a similar increase in sea level and marine deposition, with the start of marine influence being dated to 5640-5480 cal BC (6645±45 BP; SRR-4746; Long *et al* 1998), whilst a date from the Market Place, Kingston-Upon-Hull, indicates that another similar peat was overlain by estuarine transgressive silts and clays after 5980-5620 cal BC (6890±100 BP; IGS-C14/100, at -9.73 m OD; Van de Noort and Ellis 1995). Overall, this dating evidence seems to imply that this initial marine transgression started at some point in the mid-/late sixth millennium cal BC, and this broadly tallies with the palaeogeographic modelling of the marine inundation of the Humber in *c* 5000 cal BC (*p 23*), which envisages the accumulation of marine deposits (silts and clays from intertidal channels) and the development of saltmarsh environments on the edges of freshwater wetland systems (Metcalfe *et al* 2000). This transgression would also date to the period when some of the last remnants of Doggerland were submerged, which included the disappearance of Dogger Island and large portions of the Dogger Littoral, formerly east and south-east of the Humber (*p 23*).

Goxhill

Lower Peat: -11.32 m to -10.84 m OD (Late Mesolithic period)
Radiocarbon dates from the base and top of this peat indicate that it formed in the earlier half of the sixth millennium cal BC (*p 33*). Hence, it was later in date than the youngest of the peat deposits (Upper Peat) identified at Paull (*p 40*), allowing the overall sequence of environmental change in this part of the outer estuary to be pushed into the latter part of the Late Mesolithic period (and beyond).

The pollen data (Lower Peat; Fig 18; Table 7) suggests that a wetland environment existed at Goxhill, at this time, which was dominated by alder and willow (*Salix*) on damper soils, with hazel-type woodland or scrub and mixed woodlands, comprising mostly oak, with some elm, lime, pine, ash (*Fraxinus*), and ivy (*Hedera*), probably growing on the drier terraces, or higher areas. This peat deposit also produced relatively low pollen counts for herbs, with those present largely attributable to grasses and sedges, with some docks/sorrels, and with low, but relatively consistent, occurrences of pollen of the goosefoot family. Although members of the goosefoot family have a wide distribution, in this setting they are likely to represent salt-tolerant taxa, such as sea-blites (*Suaeda*), saltworts (*Salsola*), or glassworts (*Salicornia*), which suggest that the Goxhill area was subject to a marine influence (Long *et al* 1998).

The consistent occurrence of ivy pollen was also apparent and this may be indicative of the opportunistic presence of this species in more open woodland, or it could reflect an increased number of dead host trees (Garbett 1981). Perhaps telling is the abundance of fungal spores of *Coniochaeta xylariispora* (HdV-6) and *Kretzschmaria deusta* (HdV-44; Fig 19), which suggests the presence of damaged or diseased deciduous woodland (van Geel 1978; Innes *et al* 2006). Fungal spores of *Brachysporium* (HdV-159), found on decaying wood, and *Pleospora* (HdV-3B), known from dead plant remains (van Geel 1978), were also recorded. These therefore suggest some disturbance to the woodland, perhaps from animals using these areas for browsing (Innes *et al* 2006). Microcharcoal is also present throughout the pollen assemblage and, although in low quantities, provides evidence of low-level burning, which may indicate that Late Mesolithic hunter-gatherers were operating in the area.

Organic Clay: -10.68 m to -10.12 m OD (Late Mesolithic period)
Sealing the Lower Peat were minerogenic deposits (at -10.84 m to -10.68 m OD), indicating that the top

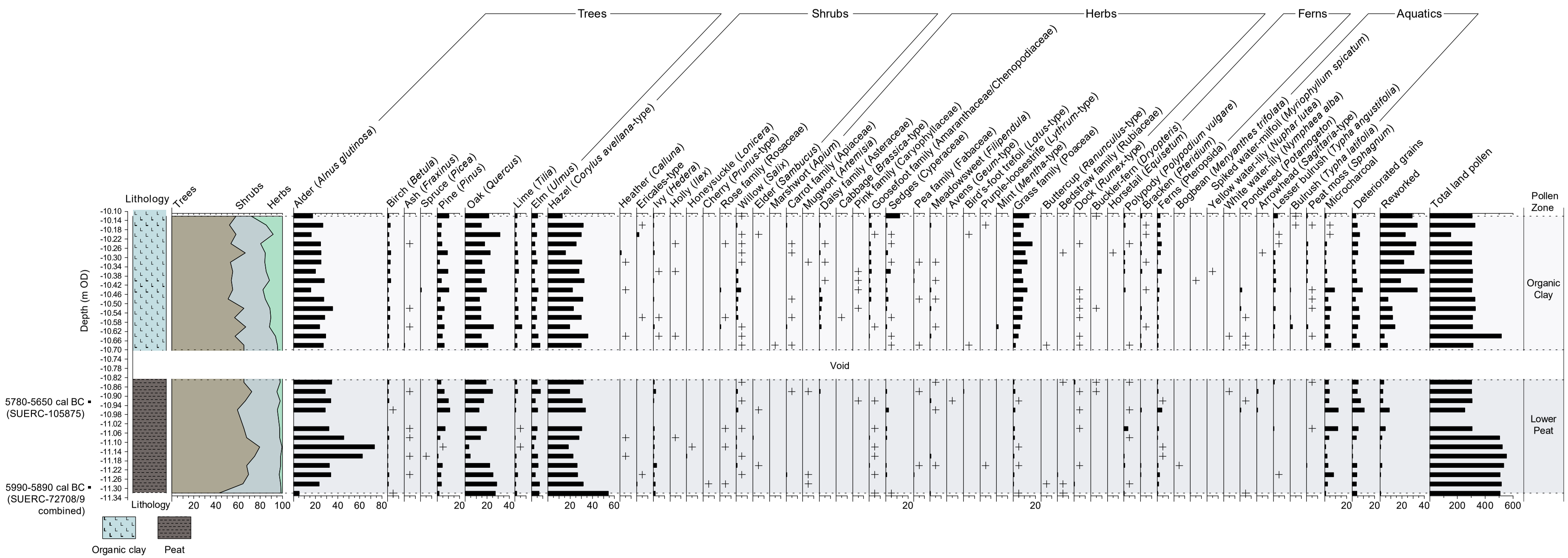


Figure 18: Pollen percentage diagram for the Lower Peat and overlying deposits in BH-11, Goxhill

Zone name	Altitude (m OD)	Assemblage characteristics
Lower Peat	-11.32 to- 10.84	Characterised by abundant tree and shrub pollen, notably hazel (*Corylus avellana*)-type and oak (*Quercus*), with lesser amounts of pine (*Pinus*), elm (*Ulmus*), and lime (*Tilia*). Ivy (*Hedera*) and willow (*Salix*) were also consistently recorded. The herb assemblage comprised sedges (Cyperaceae) and grasses (Poaceae), with fewer occurrences of docks/sorrels (*Rumex*-type), mugworts (*Artemisia*), bedstraws (Rubiaceae), meadowsweet (*Filipendula*), and the pollen of the goosefoot family (Amaranthacerae /Chenopodiaceae). The most frequent fungal spores included *K deusta* (HdV-44) and *C xylariispora* (HdV-6). Microcharcoal particles were present consistently, but in low numbers
	-10.84 to -10.68	Minerogenic deposits between 10.80-10.72m did not contain sufficient pollen for analysis. The subsample at 10.80m contained evidence of reworking of miospores of Carboniferous age as well as preservation of more robust spores (*eg Pteropsida* sp). These data, although sparse, is consistent with environmental change such as an erosive flooding event
Organic Clay	-10.68 to- 10.12	The pollen assemblages were from the lower part of an organic clay, which becomes more minerogenic towards the top of the unit. Tree pollen showed little change from the underlying lower peat. Pollen of grasses and aquatic plants (*eg* lesser bulrush (*Typha angustifolia*)) rose steadily throughout the zone, with pronounced, but lower, rises of pollen of sedges and the goosefoot family. The freshwater algal taxon *Pediastrum* (HdV-760) was present, and increased in frequency in the upper half of the unit. The NPP record showed increasing values for HdV-121 coincident with the increase in frequency of *Pediastrum* (HdV-760). Microcharcoal values were very low. There were rare occurrences of foraminiferal test linings and dinoflagellate cysts, some of which could be *in situ*. The dinocyst taxon *Operculodinium centrocarpum* is commonly recorded from Quaternary sediments from offshore areas, and does not range into sediments of Cretaceous or older age. Reworking of pollen of Cretaceous-Jurassic age was also identified (*eg* occurrences of long-ranging pollen of *Classopollis classoides* and *Cerebropollenites mesozoicus*, as well as long-ranging dinoflagellate cysts (*eg Pareodinia ceratophora*)). There was abundant reworking of miospores of Carboniferous age
	-10.12 to -8.48	No samples were analysed from this interval as the minerogenic deposit retained only poorly preserved, reworked, and sparse assemblages
Silty Clay I	-8.48 to -8.15	The pollen assemblage had a similar pollen profiles to those from the lower Organic Clay (at -10.68m to -10.12m OD). The pollen of grasses dominated the assemblage, but these decreased in frequency throughout the zone. The major tree types were all still well represented, including oak, hazel-type, alder, with lower frequency of pine, lime, birch (*Betula*), and elm. Pollen of the goosefoot and daisy family (Asteraceae) was well represented (and might include sea aster (*Aster tripolium*)). Pollen of sedges fluctuated in abundance, but were consistently recorded. Monolete ferns (Pteropsida), lesser bulrush, and the algal taxon *Pediastrum* (HdV-760) were all present. The most frequently occurring fungal spore was HdV-121. Reworked taxa remained significant, along with occurrences of foram test linings and rare dinoflagellate cysts. The dinocysts were all Quaternary types, including *Lingulodinium machaerophorum* and *O centrocarpum*. Microcharcoal values were very low
Upper Peat	-8.15 to -7.68	Slight fluctuations in the curves of the pollen of the various trees and shrubs occurred, but the overall components remained largely constant (*ie* oak, alder, hazel-type, with lower frequency of lime, elm, pine, and birch). Oak and hazel-type showed an increase towards the top of the zone. Grass pollen was well represented, but showed an overall decline throughout the zone. There were two distinct peaks in the pollen of sedges, at -8.04 m OD and again at -7.76 m OD. The lower peak was associated with occurrence of pollen of mints (*Mentha*-type), as well as purple loosestrife (*Lythrum salicaria*), water purslane (*Lythrum portula*), and pollen of the carrot family (Apiaceae, which contains many plants including marshworts, water dropworts, and sea hollies). A peak in pollen of the daisy family was noted at -7.92 m OD, and could include plants such as sea aster. This distinct peak in pollen of the daisy family occurred in association with pollen of the goosefoot family and thrift (*Armeria maritima*). The upper peak in sedge pollen was again coincident with slight increases in pollen of both the daisy and carrot families, as well as a relative peak occurrence of the freshwater algal type *Botryococcus* (HdV-761). Pollen of ribwort plantain (*Plantago lanceolata*) occurred within the top of the zone. The most commonly recorded fungal spores were *Glomus* (HdV-207), which occurred most abundantly either side of the rise in pollen of the daisy family. Occurrences of *Sordaria* (HdV-55A/B) and *Podospora* (HdV-368) were also recorded. There was very little evidence of reworking within the peat deposit
Silty Clay II	-7.68 to -7.50	Only two subsamples were analysed from this deposit. Pollen recovery was generally poor and there was evidence of significant reworking (of older, Carboniferous miospores). Tree pollen dominated the assemblages, in particular, pollen of oak, alder, and hazel-type. Grasses and pollen of the goosefoot family were the most frequent herbs, with occurrences also of mugworts, meadowsweet, docks/sorrels, and dandelion-type (*Taraxacum*). Foram test linings were present in the topmost sub-sample. No microcharcoal was recorded

Table 7: Pollen zonation and assemblage characteristics for BH-11, Goxhill

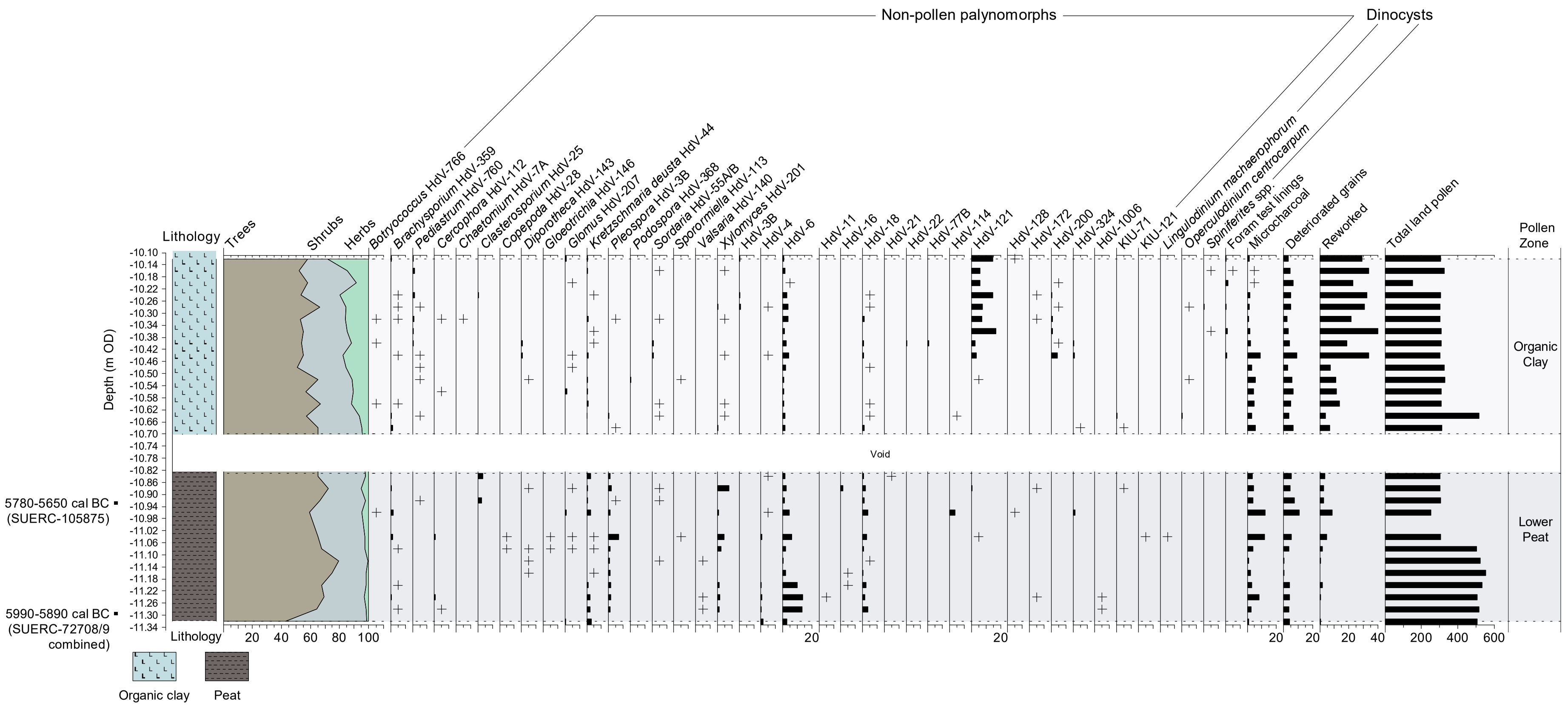


Figure 19: Non-pollen palynomorph percentage diagram for the Lower Peat and overlying deposits in BH-11, Goxhill

levels of this peat deposit had been eroded, most probably during a flood event. These deposits were then sealed by clay and the pollen assemblages from this suggest increasingly wet conditions (Organic Clay; Fig 18; Table 7). These may have comprised freshwater flooding or perhaps temporary lake development, as the pollen of aquatic plants, such as lesser bulrush (*Typha angustifoloa*) and pondweed, increase, together with increases in the freshwater algal taxon *Pediastrum* (HdV-760) and *Botryococcus* (HdV-766), and fungal spores of HdV-121 (Fig 19).

There is also evidence for marine conditions, demonstrated by the consistent presence of pollen of the goosefoot family and the daisy family (which could include taxa such as sea aster (*Tripolium pannonicum*)). Approximately halfway through this deposit the frequency of reworking of pre-Quaternary palynomorphs is evident (predominantly spores of Carboniferous age, but also some reworking of dinoflagellates of Cretaceous age from the underlying bedrock). Towards the top of the clay, probable *in situ* foram test linings and dinoflagellate cysts were also recorded, and these suggest marine input to the sedimentation. Poorly preserved diatom assemblages assessed from this clay (from -10.76 m to -10.20 m OD) are all of marine/brackish or brackish/marine affinity (OA North 2022), suggesting a transgressive event as sea level began to rise. Given the dating evidence from the underlying and overlying peats (*p 33*), it seems most likely that this event corresponds with the marine transgression noted at Paull (*p 41*) and the wider marine inundation of the Humber estuary dated to *c* 5000 cal BC (*p 23*).

Silty Clay I: -8.48 m to -8.15 m OD (Late Mesolithic period)

The pollen assemblage from this clay deposit (Silty Clay I; Fig 20; Table 7) is dominated by herbs, in particular grasses, and pollen grains of the goosefoot family are also consistently present, suggesting that probable saltmarsh conditions existed at, or close to, the site. Woodland pollen represents approximately 30-40% of the pollen count, with reduced alder (relative to that recorded in the Lower Peat assemblage; *p 41*) and higher frequencies of oak and mixed deciduous trees (with pine), probably derived from drier areas in the landscape.

There is also evidence for freshwater deposition, with commonly occurring pollen from aquatic plants, freshwater algae, and fungal spores of HdV-121 (which are known from lake sediments; van Geel 1978; Fig 21). The data are, however, hampered by high frequencies of reworked and deteriorated grains, but do confirm that environmental change was well underway and perhaps involved freshwater channels traversing areas of saltmarsh.

Upper Peat: -8.15 m to -7.68 m OD (Late Mesolithic to earlier Neolithic period)

The radiocarbon evidence indicates that the deposition of this Upper Peat started in the Late Mesolithic period and extended across the Final Mesolithic period and into the earlier Neolithic period (*p 34*), potentially spanning around 750 or 850 years. The pollen in this deposit (Fig 20; Table 7) reflects saltmarsh environments, as well as a more dominant sedge/fen peatland, with surrounding areas of woodland. The consistent occurrence of foram test linings throughout the peat testifies to marine conditions in its vicinity, whilst ribwort plantain (*Plantago lanceolata*; often an indicator of agricultural disturbance; *cf* Behre 1981) was also recorded in the top levels of the peat (dating to the thirty-ninth to thirty-eighth centuries cal BC). One possibility is that this reflects the presence of clearances/open ground used for pastoral farming by the first Neolithic groups in the region. Similarly, the peat also contained the fungal spore *Glomus* (HdV-207), which again points to some ground disturbance (Anderson *et al* 1984). Perhaps significantly, there is no clear evidence in the pollen data for cereals or indeed the Elm Decline (often coincident with first Neolithic experiments in agriculture; *p 21*), which could indicate that hunter-gather communities were still active in this area, in the initial centuries of the fourth millennium cal BC, when the peat was in its final stages of accumulation.

Silty Clay II: -7.68 m to -7.50 m OD (Earlier Neolithic period)

Overlying the Upper Peat was a deposit of silty clay (containing herbaceous and shelly debris; *p 34*) that, based on the radiocarbon dates from the underlying peat, was deposited at some stage after the mid-fourth millennium cal BC. Pollen preservation within this deposit was unfortunately poor (Silty Clay II; Fig 20; Table 7), and it also seems that this deposit had been subjected to some reworking, though the evidence that does exist points to a mixed broadleaf woodland interspersed with open areas. Some diatoms are also present and these all have a brackish/marine affinity; however, recovery and preservation of diatoms was too poor for full analysis (OA North 2022). This silty clay therefore seems to reflect further marine inundation in the Humber Estuary that occurred between *c* 4000 cal BC and *c* 3000 cal BC, with both Goxhill and Paull lying within an area of eutrophic wetlands, adjacent to intertidal environments, with consequent interplay between freshwater and marine deposition (Metcalfe *et al* 2000).

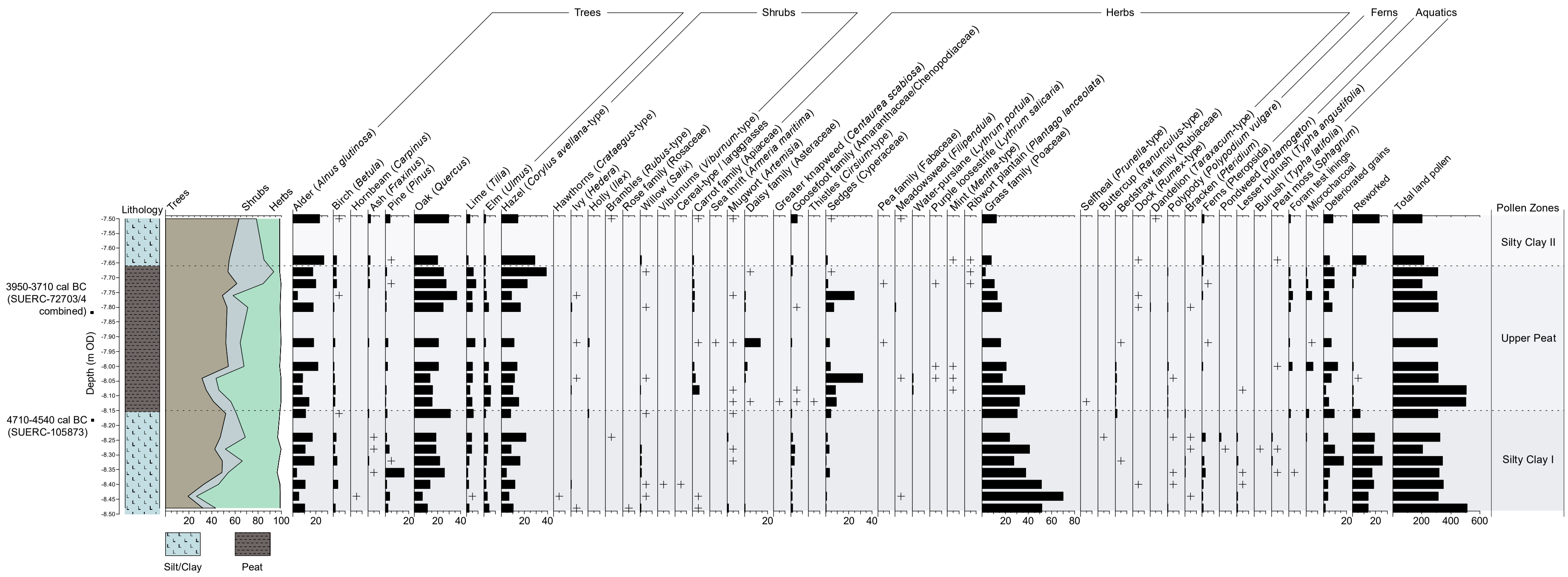


Figure 20: Pollen percentage diagram for the Upper Peat and surrounding deposits in BH-11, Goxhill

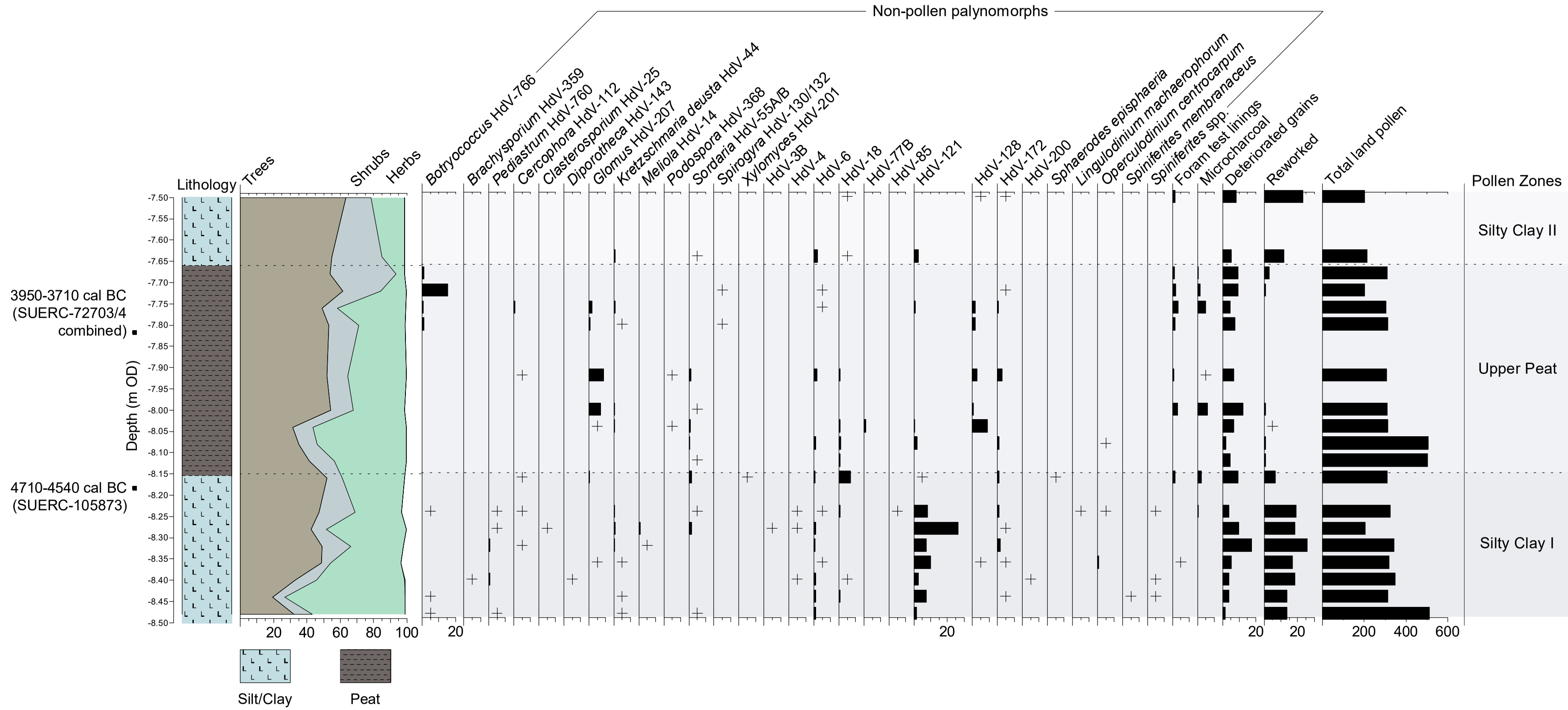


Figure 21: Non-pollen palynomorph percentage diagram for the Upper Peat and surrounding deposits in BH-11, Goxhill

Figure 22: Palaeochannel **6088** *and East Halton Beck*

3

PREHISTORIC ACTIVITY AND IRON AGE SETTLEMENT

R A Gregory and J Zant

The archaeological remains recorded during the project were all located in North Lincolnshire, on the southern side of the Humber Estuary, at Goxhill. Significantly, these comprised both stratigraphic and artefactual remains relating to prehistoric activity, the more conspicuous of which were present in one of the open-area excavations (Area C) in the main construction area (*Ch 1, p 8*). These formed elements of a later Iron Age settlement, which lay adjacent to a series of tidal creeks, extending across the scheme area and beyond, that would have strongly defined the character of this foreshore area. In addition, there was also some piecemeal evidence for prehistoric activity that occurred prior to the establishment of this settlement. This comprised several artefacts and features scattered across the scheme area, reflecting comparatively early activity at Goxhill, dating to the Late Neolithic period and Bronze Age, along with evidence, in another of the open-area excavation trenches (Area A; *p 8*), for stratified remains relating to earlier Iron Age division of the landscape.

The Prehistoric Creek and Changing Sea Levels

R A Gregory, M Rutherford (pollen), and N Cameron (diatoms)

During the excavations in both the main construction area and along the Soff Lane diversion, several substantial palaeochannels were identified. One (***6088***) was recorded during the watching brief along the road diversion and, although this was only partly examined, it was up to 20 m wide and contained a sequence of alluvial silts and charcoal (*p 54*). It was also orientated north-west/south-east and seems to have run towards the East Halton Beck, some 900 m to the east, possibly representing a former tributary of this watercourse (Fig 22).

Similar palaeochannels were present in Areas B and C, in the main construction area, though these were excavated and recorded in much more detail (Fig 23). They extended in a north-west/south-east direction and one (***3183***/***2650***) crossed both areas, where it had a maximum width of 11 m and was up to 0.45 m deep (Pl 12). Another palaeochannel (***2305***) lay to the east, traversing Area B, and this had a maximum width of 19 m and a depth of *c* 1 m.

Aside from these large palaeochannels, several smaller channels were also recorded in Area C, seemingly smaller tributaries. One (***3176***; Pl 13) flowed into the western edge of main palaeochannel ***3183***, from a south-westerly direction, whilst others were smaller in size and were found to the south-west. Of these, only ***3180*** connected with the wider channel system, with the others appearing as sinuous, isolated features, the full extent of which could not be determined.

Importantly, the course of the two major channels (***3183***/***2650*** and ***2305***) were also visible as cropmarks on aerial photographs, which demonstrate that they converged immediately south of Area B (Fig 23). Furthermore, in other parts of the main construction area, other similar large channels were evident as cropmarks and were also partially detected by the geophysical survey. These channels also split and formed several 'islands', with a large part of one of these lying between channels ***3183***/***2650*** and ***2305*** and hence covering the north-eastern end of Area C and the south-western end of Area B. Immediately north-east of this was a second larger island, with a smaller island located at its south-western corner, whilst a third island seemingly lay to the north-east. To the south and east the cropmark evidence also suggests the presence of comparable islands interspersed between the visible palaeochannels. Taken together, it therefore seems that all these substantial and more minor channels formed elements of an extensive tidal creek, which would have formed a prominent landscape feature in this foreshore area.

Both larger palaeochannels in Areas B and C also contained organic-rich deposits, relating to periods of channel stabilisation. Indeed, one of these deposits comprised a thin layer of peat in channel ***2305*** that had accumulated above a *c* 0.5 m-thick layer of silty clay, which sealed the base of this channel. It seems likely that this lower deposit was equivalent to, or

Figure 23: The prehistoric tidal creek in the main construction area

Plate 12: A section across palaeochannel **3183**, *looking south-east*

Plate 13: A section through palaeochannel **3176**, *looking approximately north-west*

more probably later than, a deposit of silty clay (Silty Clay II), recorded in a nearby borehole transect, that was deposited in the fourth millennium cal BC (*Ch 2, p 45*). This was confirmed, in some measure, through radiocarbon assays obtained from the humin and humic fractions in the overlying peat. Although these returned anomalous dates of 910-810 cal BC (2716±26 BP; SUERC-74735) and 2290-2040 cal BC (3760±29 BP; SUERC-74736), based on the humic-fraction date (SUERC-74735), which could potentially be more reliable (*Ch 2, p 28*), it is possible that the peat accumulated in the Late Bronze Age, in the early centuries of the first millennium cal BC, thus providing a date for this layer and a *terminus ante quem* for the underlying silty clay. This seems therefore to suggest that this channel, at least, and perhaps the wider tidal creek system, was initially active in the later Neolithic period and earlier part of the Bronze Age; however, it was inactive and was being subjected to terrestrialisation in the Late Bronze Age, though it presumably still formed a very wet environment.

Moreover, the peat contained some pollen and diatoms, with varying levels of preservation, which were assessed and provide some insights into the nature of the Late Bronze Age environment (OA North 2022). Specifically, the pollen data contained in three sub-samples was suggestive of a predominantly open, grassy landscape, as there were high counts for grass (Poaceae) pollen, along with the goosefoot (Amaranthacerae /Chenopodiaceae) family, sedges (Cyperaceae), dandelion-type (*Taraxacum*), and ribwort plantain (*Plantago lanceolata*), though it may be interpreted in a number of ways. Given the location of the palaeochannel in the foreshore area of the Humber, the grasses could, for instance, represent saltmarsh vegetation (as the goosefoot family may indicate saline-tolerant plants such as glassworts (*Salicornia*) or sea-blites (*Suaeda*)), or may be from plants growing on cultivated soils (*eg* fat-hen (*Chenopodium album*) or many-seeded goosefoot (*Lipandra polysperma*)). Cereal-type (*Cerealia*) pollen was also recorded in small numbers in each of the sub-samples, which could suggest that nearby arable cultivation was indeed occurring, although, these may alternatively reflect wild grasses, such as sweet-grasses (*Glyceria* sp), which grow in mud in wet areas, or in shallow water (Stace 2010). Rather interestingly, there was also a single record of eggs of the intestinal parasite whipworm, *Trichuris* (HdV-531), which suggests the possibility that the stabilised palaeochannel may have been used for human-waste disposal (although *Trichuris* species can infect other animals such as mice and pigs; Brinkkemper and van Haaster 2012).

It does seem, however, that this process of channel stabilisation/terrestrialisation was comparatively short-lived, with palaeochannel ***2305*** (and probably the others in the tidal creek system) becoming active once more, which resulted in the gradual accumulation of deposits of silty clay alluvium above the Bronze Age peat. Perhaps unsurprisingly, the diatoms from this alluvial deposit, although poorly preserved, include planktonic marine species, *Podosira stelligera*, and a benthic brackish water taxon, *Diploneis interrupta*, indicating that the channels contained saltwater (OA North 2022). Both brackish and marine diatoms were also recorded at the interface between the underlying peat and overlying alluvium, though these probably relate to the latter phase of saltwater inundation (Table 8). This level also contained freshwater, non-planktonic diatoms, though presumably these relate to the formation of the underlying Bronze Age peat, suggesting that freshwater pools were a feature of the terrestrialisation of the channel during that period (*above*).

Significantly, this process of alluvial deposition, stabilisation, and then later fluvial activity recorded in palaeochannel ***2305*** seems to accord with the broader evidence for sea-level change in the Humber Estuary (*cf* Van de Noort 2004, fig 9). It seems, for example, that across the later Neolithic period and earlier Bronze Age sea levels continued to rise, continuing the trend that was a prominent feature of the Mesolithic and earlier Neolithic periods (*Ch 2*). It is therefore likely that the initial deposit of silty clay in the channel reflects deposition connected with these rising sea levels, when the tidal creek was first active. It has also been postulated that this would have resulted in the development of saltmarsh environments in the foreshore areas, such as Goxhill (which would have surrounded the creek), with eutrophic wetlands creeping up the river valleys, which in around 3000 cal BC had reached a height of *c* -2.0 m OD, expanding to 1.5 m OD by 2000 cal BC (*op cit*, 27;

Diatoms	Diatom type/conditions
Navicula hungarica	Freshwater
Navicula capitata	
Cocconeis placentula	
Amphora libyca	
Rhoicosphaenia curvata	Halophilous (saltwater)
Navicula mutica	
Cyclotella meneghiniana	
Synedra tabulata	Mesohalobous (saltwater)
Synedra pulchella	
Rhopalodia gibberula	
Caloneis westii	
Bacillaria paradoxa	
Paralia sulcata	Coastal

Table 8: The diatoms recorded at the peat/alluvium interface in palaeochannel **2305**

Fig 24). It also has been further suggested that this era of rising sea levels was followed by a short period of marine regression, broadly estimated to date to the start of the Late Bronze Age, after which there was a return to a marine transgression, sometime after 1000 cal BC (*op cit*, 107-9). This sequence therefore might explain the accumulation of the Late Bronze Age peat in the palaeochannel at the beginning of the first millennium cal BC, associated with falling sea levels, which resulted in the tidal creeks at Goxhill becoming inactive. In turn, the later accumulation of alluvium in the palaeochannel seems to relate to the period when the creeks became active once more, perhaps at the start of the Iron Age, following the return of rapidly rising sea levels in the Humber Estuary.

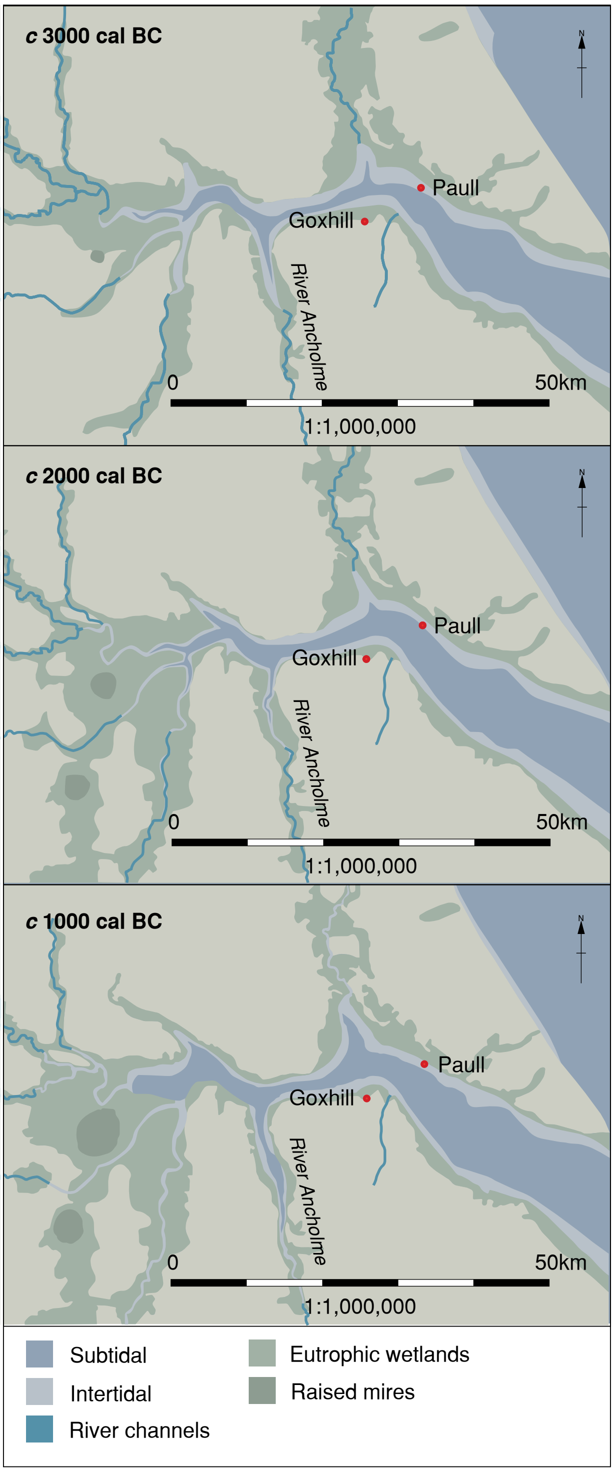


Figure 24: Palaeogeographical reconstructions for the Humber Estuary during the later Neolithic period and Bronze Age

Late Neolithic/ Bronze Age Activity at the Foreshore

A Dickson (lithics), D Druce, and J Meen (charcoal)

In Areas B and C, in addition to the palaeochannels, importantly, small collections of prehistoric worked flint and earlier prehistoric pottery were recovered during the archaeological excavations (Fig 25). The pottery comprises three sherds (with a total weight of 7 g), potentially dating to the Bronze Age (*Appendix 1*). Two were residual items in Iron Age gullies from Area C (***3454*** and ***3479***; *p 65*), whilst the third was a residual item in a Romano-British pit in Area B (***2618***; *Ch 4, p 113*), which was positioned on the island between palaeochannels ***3183/2650*** and ***2305***. These are all comparable, deriving from handmade vessels, with coarse moderate grog/clay-pellets and small quantities of sand-sized quartz inclusions in their fabrics.

Similarly, the flints are most likely to be Bronze Age in date, though some could be slightly earlier (*p 56*), and together with the pottery, seemingly reflect low-level activity involving individuals or small groups who visited the creek/foreshore area, possibly during hunting or fishing trips. Specifically, they comprise 13 items recovered as residual and unstratified items (Table 9). These include a small group concentrated within a 5 m area of Area C, comprising 11 of the flints (recovered as residual items from Romano-British ring-gully ***3242***; *Ch 4, p 81*), adjacent to the northern side of one of the minor palaeochannels (***3176***; *p 49*). It is therefore possible that these lithics originally formed contemporary elements associated with one of these suspected visits. Furthermore, two isolated flints were present on the opposite side of the channel, which again might relate to the same episode of activity.

In addition, several flints were recovered from the Soff Lane diversion (Fig 26). These include residual items from Area A (from medieval ditches ***1051*** and ***1159***; *Ch 5, p 146, p 150*) and a stratified item, though this was from palaeochannel ***6088*** (*p 49*), recorded during the watching brief. This flint could represent reworked material, which was originally derived from another area and was transported down the active channel by tidal waters; however, there is a good chance that it

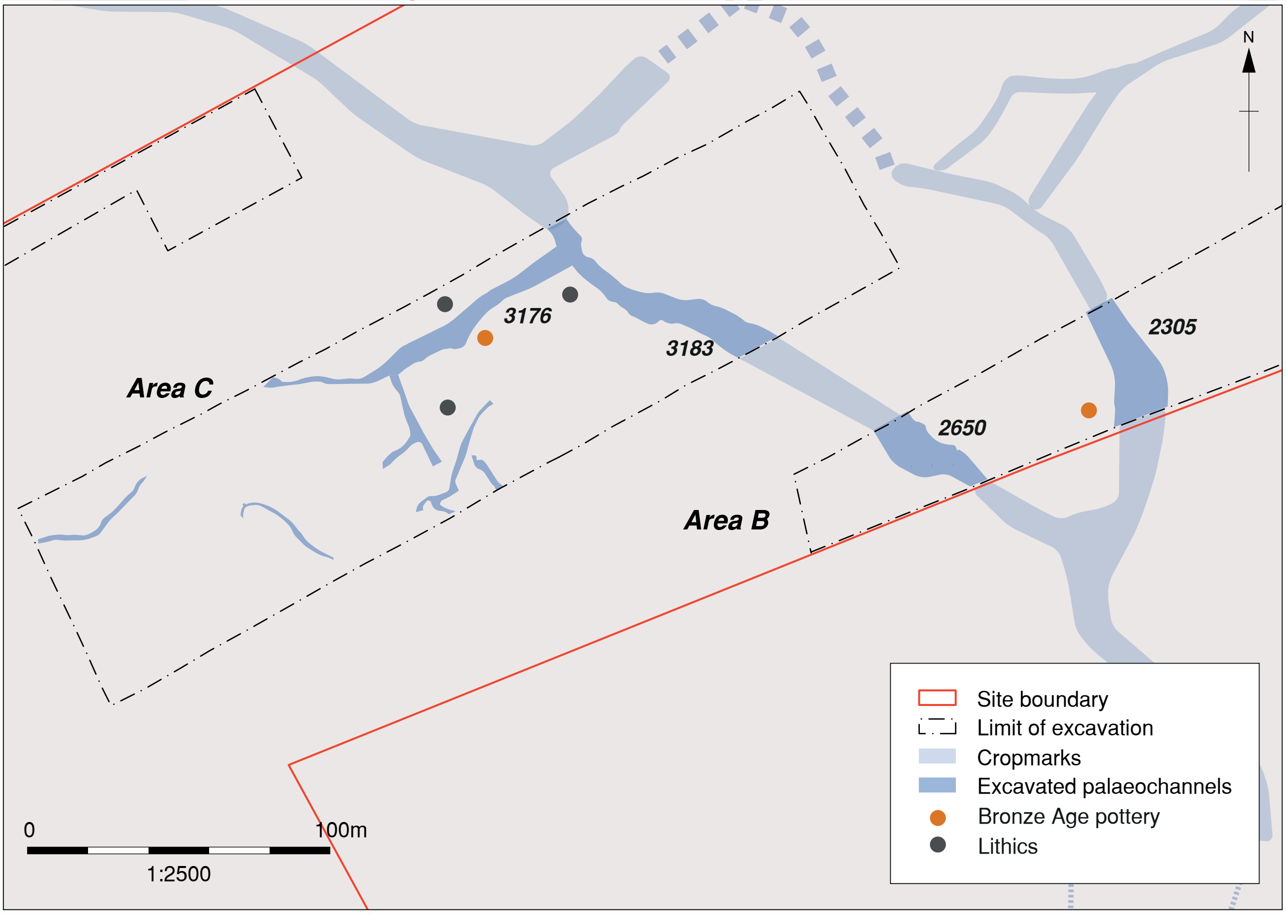


Figure 25: The palaeochannels in Areas B and C and distribution of artefacts associated with Late Neolithic and Bronze Age activity

Site	**Provenance**	**Awl**	**Flake**	**Indeterminate chunk**	**Miscellaneous retouch**	***Total***
Area A	Residual (isolated)	1	2			***3***
	Unstratified (isolated)		2			***2***
Area C	Residual (isolated)				1	***1***
	Residual (concentrated)		10	1		***11***
	Unstratified (isolated)		1			***1***
Soff Lane: watching brief	Palaeochannel *6088*		1			***1***
Total		***1***	***16***	***1***	***1***	***19***

Table 9: Worked flint by site, provenance, and type

was directly related to activity associated with the lithics found just to the north and that, perhaps, also included the digging of a prehistoric pit, some 20 m to the south. This pit (***6081***) was badly disturbed by a recent land drain and other modern features, which made it difficult to define and characterise, though it seems to have been *c* 1.85 m wide and 0.5 m deep, with a U-shaped profile. Once dug, it was left open and became gradually choked with silt (***6082/3***) that contained charcoal, with good preservation, including diffuse porous fragments that are probably from shorter-lived trees/shrubs, as well as indeterminate fragments from distorted or knotty wood. Importantly, this material was probably derived from a nearby campfire and reflects fuel sourced from nearby woodlands.

A comparable assemblage of charcoal was recovered from the adjacent palaeochannel (***6088***; *p 49*; from fill ***6087***, which also produced the flint), and this therefore seems to provide a direct link between these two features. Indeed, in both the pit and palaeochannel the charcoal is dominated by oak (*Quercus* sp) heartwood, together with alder/hazel (*Alnus glutinosa*/ *Corylus avellana*; Table 10). Positively identified hazel

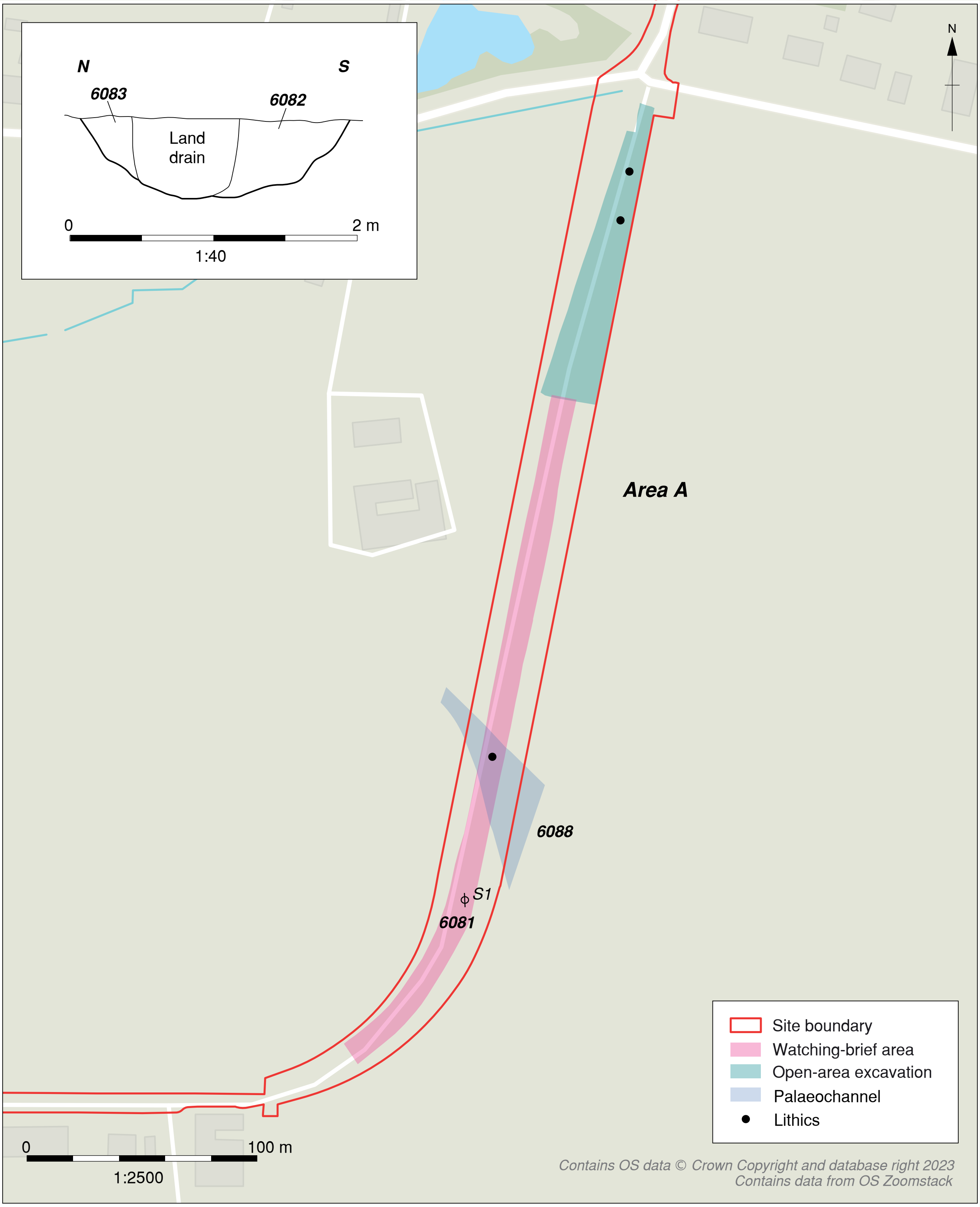


Figure 26: Pit **6081** *and the distribution of prehistoric lithics in Area A/Soff Lane diversion*

fragments were also recorded in both features, whereas alder was only identified in pit ***6081***. Other taxa, present in lower quantities or as rare types, include: hawthorn-type (Maloideae), which includes a wide range of trees/shrubs, including hawthorn (*Crategus*), apple (*Malus sylvestris*), and whitebeam (*Sorbus aria*); blackthorn-type (*Prunus*), which includes sloe/blackthorn (*Prunus spinosa*), wild cherry (*Prunus avium*), and bird cherry (*Prunus padus*); birch (Betulaceae); ash (*Fraxinus excelsior*); holly (*Ilex aquifolium*); and willow/poplar (*Salix/Populus*). A fragment of alder charcoal from pit ***6081*** was also subjected to radiocarbon assay,

Feature		**Pit *6081***		**Palaeochannel *6088***
Deposit		***6083***	***6082***	***6087***
Sample volume (L)		40	40	40
Flot volume (ml)		50	20	40
Taxa	***Common name***			
Prunus sp	blackthorn/cherry			1
Prunus/Maloideae	blackthorn/cherry/hawthorn	1		
Maloideae	hawthorn/apple/whitebeam		2	7 (r)
Quercus sp	oak	47 (h)	29 (h)	28 (h)
Betulaceae	birch family		3	
Corylus avellana L.	hazel	35	21	26 (r)
Alnus glutinosa (L) Gaertn.	alder		12	
Corylus/*Alnus*	hazel/alder	10	24	26
Fraxinus excelsior L	ash	4	1	2
Ilex aquifolium L	holly	1		
Salix/*Populus*	willow/poplar		1	
Diffuse Porous		2	3	8
Indeterminate			4	2
	Total fragment count	***100***	***100***	***100***

Notes: Actual counts are given. H=heartwood; R =roundwood

Table 10: Charcoal from the Early Bronze Age features on the Soff Lane diversion

returning a date of 2135-1945 cal BC (3647±19 BP; SUERC-104281). This therefore suggests that the charcoal in the pit dates to the Early Bronze Age and hence could be contemporary with the flint and charcoal in the nearby palaeochannel, with all of this material, and presumably also the pit, most probably reflecting sporadic, short-term visits to this locale.

Returning to the worked flints, all 19 items are very similar in that they were fashioned from poor-quality flint, probably locally sourced from superficial geological deposits (Henson 1985). The material also varies greatly in colour, texture, inclusion type, and opacity/translucence, though most of the items are in fine grained, brown/grey flint with inclusions varying from small speckles to large, greyish-white, coarse grains; however, no one type of flint is represented by more than one item, indicating that full (or even partial) reduction schemes are not represented within the assemblage. Most of the flint is also fairly fresh, with many pieces having some small, irregular scarring on their lateral edges and dorsal ridges. Recortication and/or patination is also insignificant within the assemblage, and many of the flakes have a patinated dorsal face, which could indicate reworking of older material, though it is more likely to represent the use of raw materials derived from glacial till.

Only two recognisable tools are present, a possible awl (Fig 27.1) and a blade-like flake (Fig 27.2) with miscellaneous retouch, both residual items from Areas A and C (Table 9). The awl was produced on a natural flake and has abrupt, irregular retouch on one edge, forming a spur, which is worn and damaged from use. This item probably represents the expedient manufacture of a tool, and as such, it could be representative of a Bronze Age (or later) technology (*cf* Humphrey and Young 1999). The retouched item is relatively thin and has patchy, semi-abrupt retouch along the left lateral edge. It also has a narrow platform, which is trimmed, a feature not found on any of the other flakes from the site; it also possesses probable brown patination. The potential patination and technological character of this piece could suggest a Neolithic (or even earlier) technology (*ibid*).

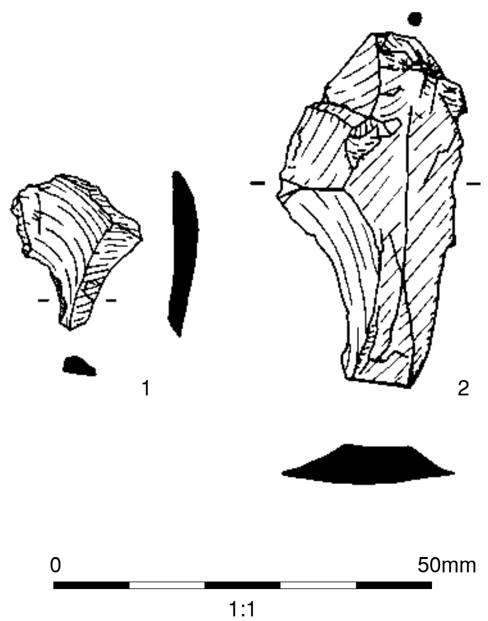


Figure 27: The flint awl from Area A and the retouched blade-like flake from Area C

With these exceptions, the assemblage consists entirely of flake debitage, with nine complete and seven broken examples. Most of the flakes have broad platforms, which often support a range of features (such as cones and fissures) associated with a hard-hammer technology. Several are very irregular in size and shape, and none show direct evidence for platform preparation prior to their removal. Some of the complete flakes are from the initial stages of production and several may also have been produced during setting up cores. These include those items struck from patinated nodules and one piece that was removed from a coarse flint pebble with a chalky cortex. In addition to the flakes, there is also a single piece of irregular, chunky, indeterminate debitage. The overall technological character of the debitage indicates that it was possibly the product of a later Neolithic and/or Bronze Age stone-working tradition (*ibid*).

Whilst this evidence is fairly limited, it is significant, as prior to the excavations at Goxhill, there were no other direct archaeological finds or sites dating to this period known from the scheme area. Several lithic scatters and individual finds of struck flints, broadly dated between the Mesolithic period and Early Bronze Age, as well as earlier prehistoric pottery, have been recorded, however, in the vicinity of the modern village and around North and South Killingholme, and Immingham (Cardwell *et al* 2000; Ellis *et al* 2001, 106-12; Archaeological Services WYAS 2005; 2007; LAS 2006; Allen Archaeology 2013; Hyder Consulting (UK) Limited 2015; Rowlandson and Fiske 2024; Fig 28).

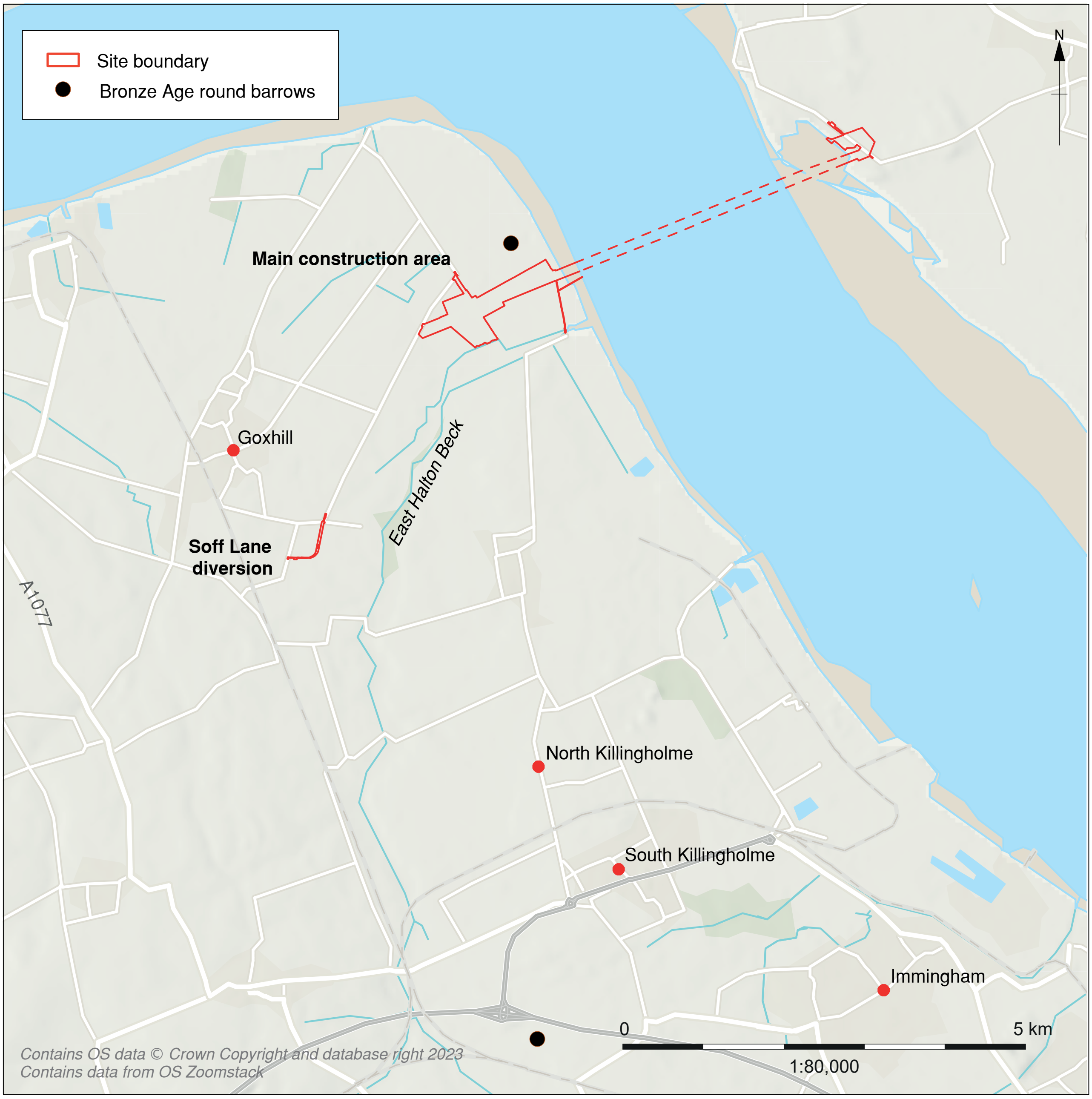


Figure 28: Earlier prehistoric lithic sites mentioned in the text

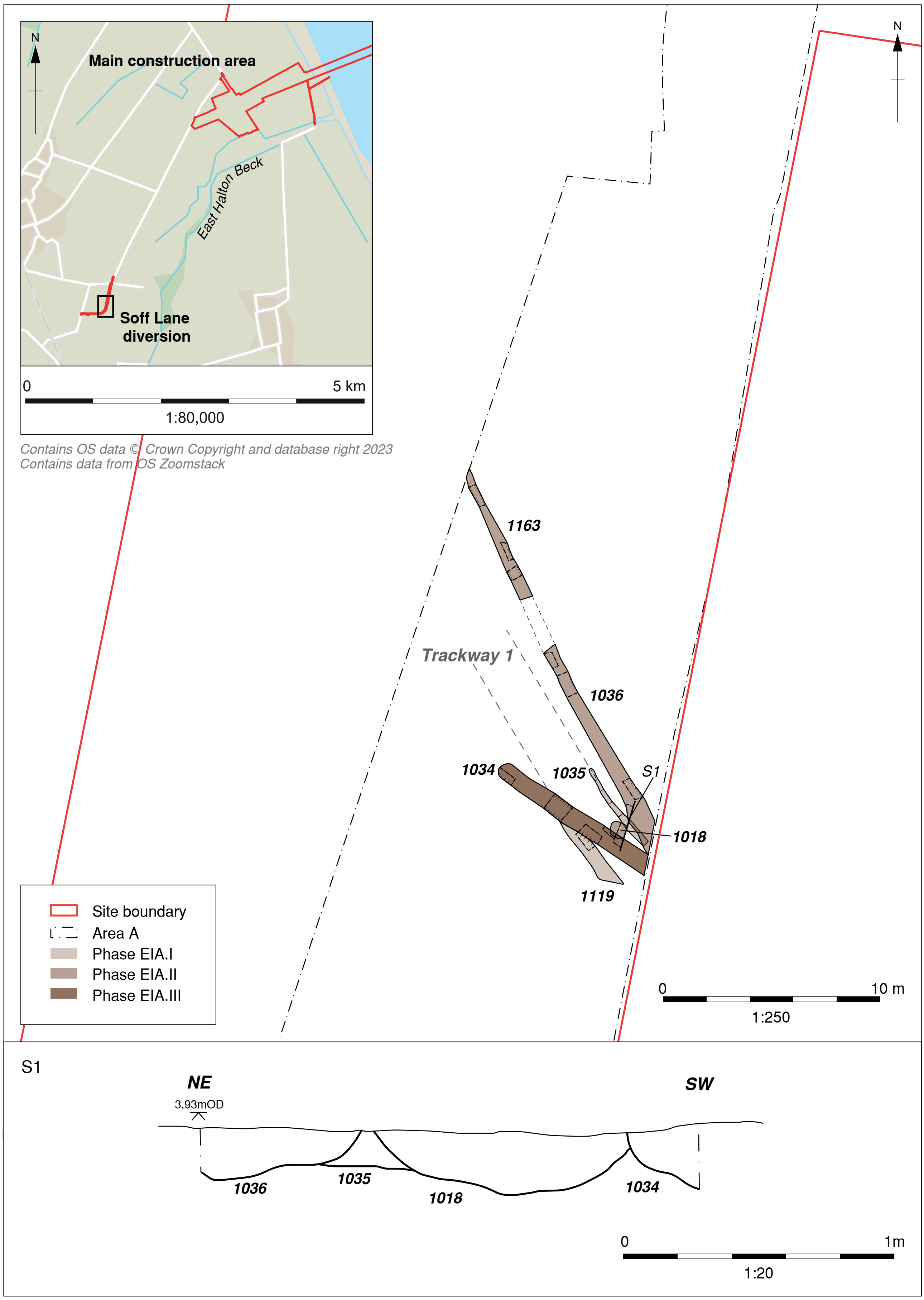


Figure 29: Earlier Iron Age features in Area A

It is probable that these, along with the finds and the pit present in the Goxhill excavations, reflect low-level activity focused on the exploitation of natural resources close to the Humber foreshore. In addition, the recovery of Neolithic axes from North Killingholme, and also from Immingham, might also point to woodland clearance in the wider area or, alternatively, to votive deposition in wetland environments (Van de Noort 2004; HFA 2010). The identification of Bronze Age settlement in the wider North Lincolnshire region has been very limited (Loughlin and Miller 1979; Willis 2022). Nevertheless, there is a suggestion that the foreshore area, close to Goxhill, formed an area that, in the earlier Bronze Age at least, was also used for other purposes, specifically the burial of the dead. Recent aerial mapping of the cropmark data has, for example, identified two large ring ditches *c* 600 m north of the main construction area that possibly denote the site of adjacent Bronze Age round barrows (Flemming and Royall 2019, 35), suggesting that the area was marked as a significant locale through the construction of burial monuments. Furthermore, the possible remains of another Bronze Age round barrow (defined by a ring ditch) have also been excavated at Brocklesby Interchange, close to Immingham, which, intriguingly, was seemingly associated with a pit alignment, that was perhaps designed to further emphasise this locale, or even divide the landscape (Cavanagh 2024, 11-12).

Dividing the Earlier Iron Age Landscape

In Area A, at the northern end of the Soff Lane diversion, a discrete group of intercutting ditches and a pit were present, which might potentially relate to an early division of the landscape at Goxhill (Fig 29). Moreover, this division seems to have occurred when the nearby creeks were active, following a short period in the Late Bronze Age when the channels were seemingly accumulating peat and were not receiving tidal waters (*p 52*).

The ditches were shallow, truncated features, with depths no greater than 0.2 m and with U-shaped profiles, and all had been left open and subsequently became silted. The earliest comprised ditches ***1119*** and ***1035*** (Phase EIA.I; Pl 14), *c* 0.7 m and *c* 0.25 m wide respectively, which ran parallel and defined a *c* 2 m-wide trackway (Trackway 1). This route was aligned north-west/south-east and it probably originally traversed the excavation area, although its north-western end had been lost through later truncation. Following silting, the north-eastern ditch (***1035***) was subsequently cut by a similarly oriented, though more substantial, *c* 0.65 m-wide ditch (***1036***/***1163***; Phase EIA.II), which extended the full width of the excavated area and probably formed a field or enclosure boundary, mimicking the course

Plate 14: Ditches **1119** *(left) and* **1034** *(right) partially excavated, looking north-west*

of the earlier trackway. A contemporary pit (***1018***) lay directly adjacent to this boundary, which also cut the earlier trackway ditch. Following infilling, both the ditch and pit were then cut by another, slightly more substantial, *c* 0.9 m-wide, ditch (***1034***; Phase EIA.III; Pl 14); however, this ran on a slightly different (more east to west) alignment than the earlier ditches, though it also seems to have formed a field/enclosure boundary, indicating that the boundaries in this area were actively maintained. This ditch also had a rounded terminal at its north-western end, possibly denoting an access point between two enclosures/fields. Significantly, it also produced a fragment of charcoal, which has been radiocarbon dated to 770-420 cal BC (2471±32 BP; SUERC-74726) implying that it, and by extension the preceding features, related to Early Iron Age enclosure of the landscape. Indeed, this suggestion of enclosure/landscape division at this time would not be entirely out of place, particularly as a large Early/Middle Iron Age boundary ditch has also been recorded to the north of South Killingholme, along with several smaller drainage or boundary features, relating to the wider division of the landscape (SKM 2010). Just to the north-west, a further Early-Middle Iron Age boundary ditch was recorded for *c* 400 m, parallel with Rosper Road, North Killingholme, with other small drainage or boundary features likely to have dated from the same period and related to agricultural use (APS 2006). The absence of pottery (if not a consequence of the period being largely aceramic), or other finds and ecofacts suggestive of domestic occupation, may also suggest that the boundaries in Area A lay some distance from any contemporary settlement, perhaps being located within their hinterlands.

Later Iron Age Settlement

The later Iron Age in North Lincolnshire

The main construction area (*Ch 1, p 8*) contained important evidence relating to Iron Age settlement,

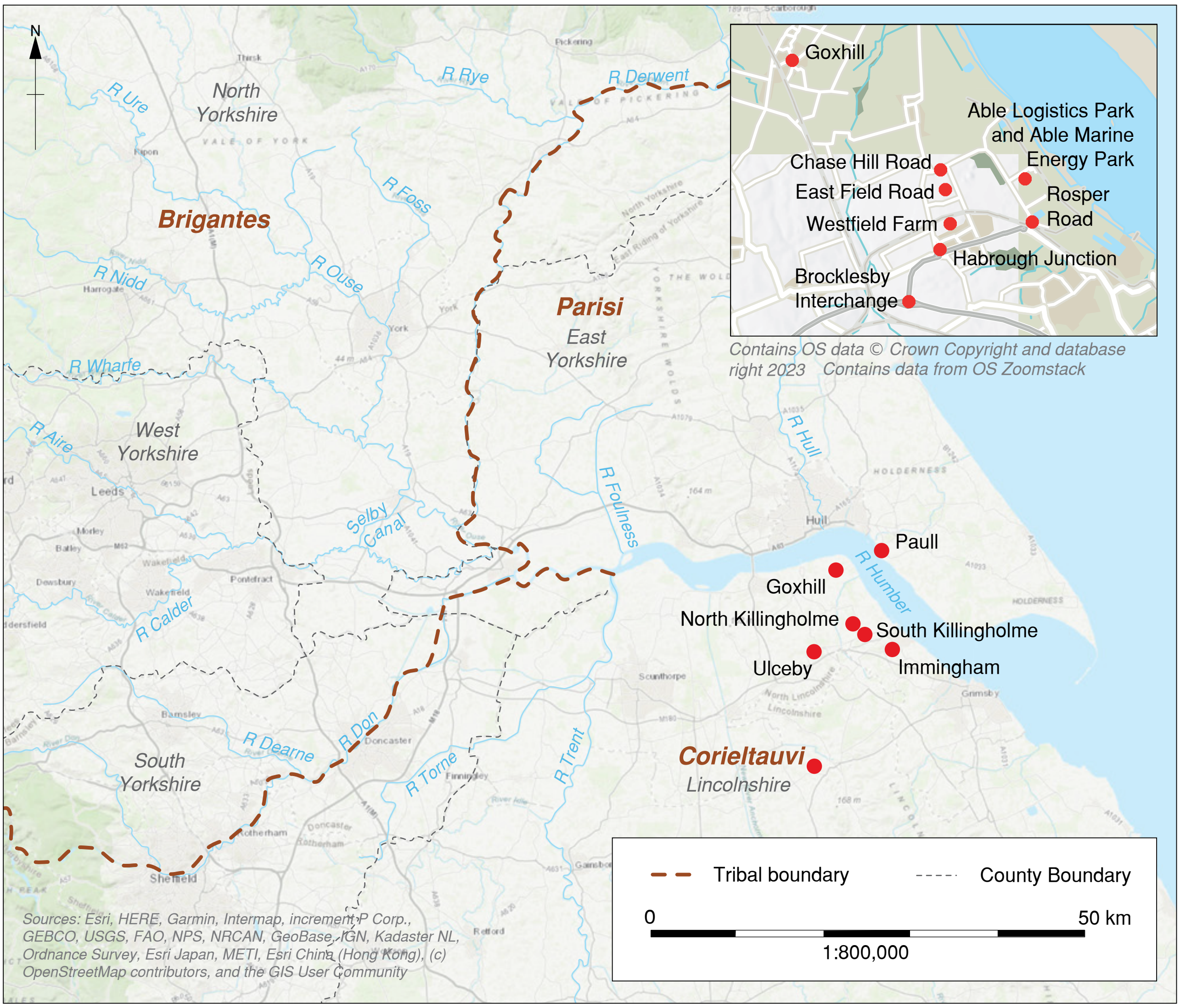


Figure 30: Potential late pre-Roman Iron Age 'tribal' territories surrounding the Humber Estuary, and Iron Age sites mentioned in the text

which was potentially established a century or so later than the trackway and boundaries in Area A (*p 59*), being occupied in the Middle and Late (Pre-Roman) Iron Ages (periods that have been grouped together as the 'later' Iron Age; *cf* Haselgrove and Moore 2007). This occupation was also concurrent with the period when the tidal creek was active, though its channels were gradually filling with silty clay (*p 52*).

On the evidence provided by later classical accounts, during this period the settlement at Goxhill, and also the wider area of North Lincolnshire, lay within the territory of the Corieltauvi (Fig 30), with Paull on the adjacent side of the Humber falling in the territory of the Parisi, whilst the area immediately to the east, bordering the head of the estuary, lay in the territory of the Brigantes (Jones and Mattingly 1990, 45; Gregory *et al* 2013, 237). In all these areas, however, these 'tribes' may have comprised a loose confederation of smaller semi-independent polities that were akin to the *pagus* in Gaul, as described by Julius Caesar in the mid-first century BC (Champion 1995, 86). Regarding the character of 'tribal' society, it is quite possible that these small social groups shared a common identity based on the geographical territories in which they dwelt, that may themselves have been bounded by watercourses and other prominent topographical features (*cf* Hartley and Fitts 1988; Cunliffe 2005), which in the case of Goxhill could have included the creek system and areas of adjacent saltmarsh.

Whilst identity may have been geographically specific, it does seem highly likely that all areas underwent similar historical trajectories. For instance, to the north of the Humber, archaeological investigations related to several pipeline schemes in Holderness clearly demonstrate that a marked expansion of settlement occurred, characterised by the establishment, on areas of slightly higher ground, of small agricultural settlements (with associated field/enclosure systems) practising a subsistence economy based on stock rearing and arable cultivation (*inter alia*; Glover *et al* 2016; Zant and Wegiel in prep). In northern and eastern England more generally, this intensification of settlement is reflected in the pollen evidence, which attests to widespread woodland clearance (van der Veen 1992, 12) and an intensification in arable agriculture (*op cit*, 158-9). This certainly seems a feature of the northern Humber region, as pollen evidence preserved in cores taken from close to Paull record a significant change in the vegetation record during the Late Iron Age, when tree pollen values fell and grass pollen rose, all suggestive of increased clearance and agriculture (Rackham *et al* 2011). Indeed, in the Humber region, Bronze Age and Iron Age woodland clearance and agricultural activity are even thought responsible for increased colluvial sedimentation within the estuary (Dinnin 1995; Long *et al* 1998).

Similarly, on the southern side of the Humber, archaeological investigation of Iron Age settlement in the vicinity of South Killingholme, south-east of Goxhill (Fig 30), indicated that settlement, as on the northern side of the Humber, was focused on areas of slightly higher ground (*ie* the Skitter Beck Ridge; *cf* HFA 2006; SKM 2010; AC Archaeology 2011; Tuck 2023; Cavanagh 2024). It also seems that, whilst some settlements appear to have been abandoned during the Late Iron Age, others were occupied into the Roman period (*Ch 4, p 78*; Willis 2022), as was also the case north of the Humber in Holderness (Zant and Wegiel in prep). Indeed, this is particularly evident from the extensive archaeological investigations carried out in North and South Killingholme, and Immingham, which indicate that much of the Humber foreshore was continuously occupied across both the later Iron Age and Roman periods (*cf* Allen Archaeology 2019; Willis 2022; Tuck 2023; Cavanagh 2024).

Morphological diversity is also a feature of the smaller, farmstead-type Iron Age settlements in the Humber region, with both 'open' and 'enclosed' sites attested, and variation is also evident in the form and layout of enclosures and field systems (Van de Noort 2004, 58). Indeed, the evidence from North and South Killingholme is consistent with this in suggesting the existence, throughout the Iron Age, of both open and enclosed settlements, though there appears to have been a gradual shift from open to enclosed sites, a phenomenon that is also attested more widely across northern Britain (*cf* Harding 2011). The enclosed settlements were bounded by ditches and, in both open and enclosed settlements, roundhouses formed the principal domestic structures, often associated with pits and other small timber structures. It also seems that interspersed within these agricultural settlements were potentially higher-status sites, with one such example being present at Ulceby, south-west of Goxhill (Fig 30), based on the discovery of large numbers of coins dating to the first century BC and a metalwork hoard containing bridal fittings, gold torcs, and a bracelet (Farley 2012).

Close to Goxhill, further insights into the character of later Iron Age settlement is also now coming to light, through archaeological excavations completed in advance of large-scale infrastructure schemes around South Killingholme and Immingham (Willis 2022). For instance, one of these excavations, at Chase Hill Road, carried out as part of the construction of the cable runs for the Hornsea Project One Offshore Wind Farm, identified an Iron Age square-shaped (*c* 50 x 50 m) enclosure that was defined by a ditch containing large amounts of Middle-Late Iron Age refuse, in the form of pottery, animal bone, metalworking slag, and fired clay. This enclosed settlement also contained three roundhouses, defined by curvilinear drainage gullies (Tuck 2023, 13-18). Moreover, further examples of roundhouse gullies, other settlement features, and associated ditch complexes, including those interpreted for livestock management, were uncovered further to the south (at East Field Road and Westfield Farm) as part of the same development works (*op cit*, 21-2, 26-8). In contrast, the remains at Westfield Farm seem to relate to an open roundhouse settlement.

Other significant developer-funded excavations undertaken in South Killingholme include those completed in advance of the construction of the Able Logistics Park and Able Marine Energy Park (AC Archaeology 2011; Allen Archaeology 2019). These works, again, uncovered later Iron Age remains, including a large sub-rectangular ditched enclosure containing several curvilinear gullies and other fragmentary structural elements. The main enclosure had several sub-enclosures appended to it and a short stretch of double-ditched trackway, with both the stratigraphic and artefactual datasets demonstrating several phases of activity dating from the Middle-Late Iron Age right through to the early second century AD (*ibid*).

Finally, the construction of the A160/A180 Port of Immingham Improvement Scheme resulted in the excavation of three areas of Iron Age settlement (Cavanagh 2024). One, at Rosper Road, was defined by a square enclosure, containing two roundhouses, evidenced by arcing gullies, and was therefore comparable to the enclosed settlement at the nearby site of Chase Hill Road (*p 61*). The second settlement, at Habrough Junction, was also enclosed, being defined by two ditched enclosures, although the main area of settlement was seemingly situated beyond the excavated area. Brocklesby Interchange formed the third area of Iron Age settlement and was typified by field boundaries, and an evolving system of conjoined enclosures, several of which contained roundhouses, once again, defined by arcing gullies.

One important feature of some of the Iron Age settlements in the Killingholme area was also their apparent association with small-scale industrial activity, including iron smithing (HFA 2006; SKM 2010) and possibly salt production, the latter largely evidenced by briquetage fragments (HFA 2006; AC Archaeology 2011; Tuck 2023; Cavanagh 2024). Regionally, salt production was a significant industry in the Lincolnshire marshes from at least the Late Bronze Age and into the post-medieval period (Ellis *et al* 2001; Lane and Morris 2001), with numerous later prehistoric sites known to the south of Goxhill, particularly within the coastal strip running between Grimsby and Skegness (*cf* Van de Noort 2004, fig 30, 73-7).

The form of settlement at Goxhill

The discovery of the Iron Age settlement at Goxhill was slightly surprising, particularly given that at the start of the project direct evidence for activity dating to this period was minimal. Indeed, this merely comprised of an Iron Age figurine in the form of a deer, with a pattern in relief, which was recovered by a metal detectorist on the Humber foreshore, close to the village (Hyder Consulting (UK) Limited 2015). That said, it was thought possible that some of the extensive cropmarks recorded within the scheme area (*Ch 1, p 4*; Amec 2007) might relate to Iron Age settlement, though without excavation this was difficult to substantiate. Furthermore, even following the preliminary evaluation trenching there was no evidence for Iron Age settlement, which perhaps highlights the benefit of undertaking open-area excavation within the scheme area.

Spatially, the remains associated with this settlement were solely confined to Area C, and they related to an unenclosed settlement that was positioned immediately west of one of the larger palaeochannels (***3183/2650***), and south of the larger of the tributary channels (***3176***) located to the west of the main channel (*p 49*). It was evident, however, through careful consideration of the stratigraphy, distribution of artefacts, and radiocarbon dating evidence, that these settlement remains were not all contemporary but could be split into two broad phases of activity, relating to an initial (founding) settlement and its later incarnation.

The founding Iron Age settlement

The earliest settlement (Phase LIA.I) was characterised by a group of ring gullies that defined six small timber roundhouses (Fig 31). These included three complete ring gullies (***3161***, ***3340***, and ***3353***: Pl 15) and two examples (***3350*** and ***3378***) that had been partially destroyed by the nearby palaeochannels (***3183*** and ***3176***), confirming that they were active when the settlement was in use (*p 64*). Of the remaining, sixth, ring gully (***3238***), only a segment of this was present in the excavation area.

All the gullies were of broadly similar character (roughly U-profiled, 0.4-0.8 m wide, and 0.1-0.3 m deep), with small diameters (under 6 m; Table 11), and they also contained similar deposits of silt. Based on gaps in the ring gullies, it seems that most of the roundhouses had entrances on their eastern sides, although one (***3161***) may have been accessed from the west; however, no postholes or other structural features survived within their interiors. Some patterning could also be discerned in terms of the spatial configuration of the ring gullies. Specifically, there was a suggestion that in two areas of the settlement, the larger roundhouses (***3340*** and ***3378***) were respectively paired with smaller

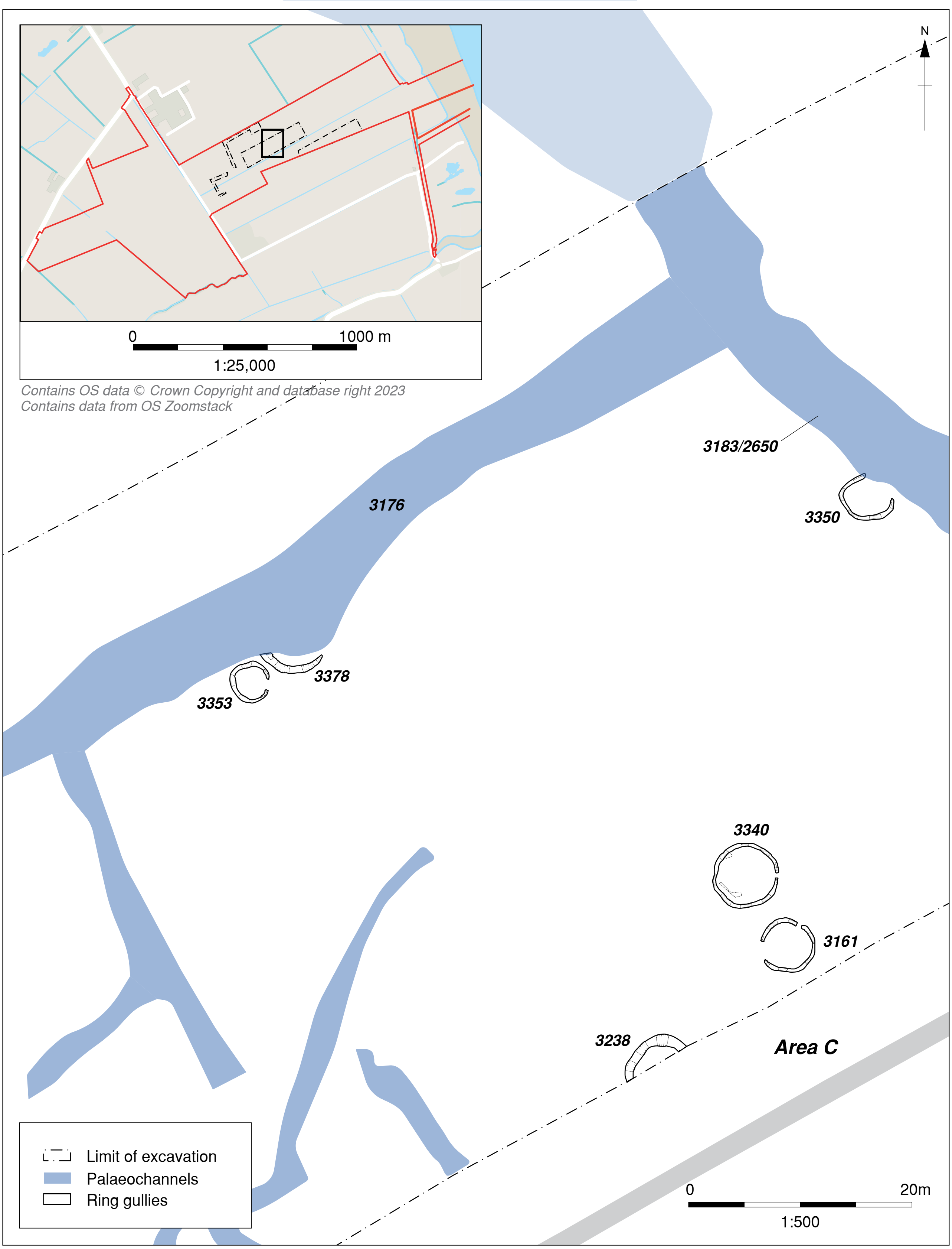


Figure 31: The initial (Phase LIA.I) Iron Age settlement

structures (*3161* and *3353*). This seems significant and, although the absence of interior features hampers interpretation, one possible explanation is that the larger roundhouse formed the primary domestic unit, which was associated with a smaller ancillary structure or dwelling.

Plate 15: Overhead view of ring-gully **3353**, *partially excavated*

Gully	Diameter	Width (maximum)	Depth (maximum)	Entrance position
3161	4.25 m	0.4 m	0.1 m	West
3238 (incomplete)	*c* 5.9 m (extrapolated)	0.8 m	0.3 m	Unknown
3340	5.8 m	0.4 m	0.15 m	East
3350 (incomplete)	4.45 m?	0.4 m	0.15 m	East?
3353	3.7 m	0.45 m	0.3 m	South-east
3378 (incomplete)	*c* 5 m (extrapolated)	0.7 m	0.1 m	Unknown

Table 11: The characteristics of the ring gullies from the early (Phase LIA.I) settlement

Artefacts and animal bone
Christine Howard-Davis and Ian Smith

One notable feature of the early settlement is the general absence of artefacts and ecofacts associated with the ring gullies, and it is perhaps noteworthy that none produced any pottery, suggesting that this phase of the settlement related to an early, aceramic phase of occupation. Indeed, the only artefact recovered was a coarse-stone tool (OR 1164), seemingly a pestle made from a hard, crystalline sandstone (Fig 32), in ring-gully ***3161***. This may suggest that the structure was involved in processing activities, which may, in turn, strengthen the case for this representing an ancillary structure, associated with an adjacent domestic dwelling (*p 63*).

The ecofacts comprised a small assemblage of animal bone (TNF 21) from ring-gully ***3340***, which may have formed a smaller ancillary structure associated with ring-gully ***3161*** (*p 63*). Although this material is scant and fragmentary, it comprises part of a cattle humerus, a loose maxillary horse tooth, and 19 large humerus fragments and other indeterminate fragments at the level of large mammal. All but one of these specimens are at either poor (Stage 4) or very poor (Stage 5) erosion stages, which suggests that the assemblage merely includes a few surviving robust elements.

Dating the early settlement
Due to the absence of pottery (*above*) or any other datable artefacts, it was recognised at an early stage that radiocarbon dating would be the most effective technique for establishing the date of the individual roundhouses. Indeed, an integral element of the excavation strategy was extracting and processing bulk soil samples from archaeological features, including all of the roundhouse gullies, partly as a way of recovering suitable single-entity charred plant remains or charcoal that could be subjected to

Figure 32: The coarse stone tool (OR 1164) from ring-gully **3161**

AMS dating (*Ch 1, p 18*). In addition, some of the archaeological features from the excavation areas also produced animal bone, and this material was also checked to established if there were any specimens that might be conducive to AMS dating. Following this assessment process it was evident, however, that nearly all of the roundhouse gullies contained a marked absence of organic material that might be suitable for dating. Indeed, it was only ring-gully ***3340*** (*p 62*) that produced a fragment of alder/hazel charcoal and a fragment of a cattle humerus, which were considered appropriate for radiocarbon assay, though AMS dating of the animal bone failed, as it was found to contain insufficient quantities of collagen. Therefore, only one assay, on the charcoal sample, was acquired, which returned a date of 350-50 cal BC (2135±30 BP; SUERC-74733). Whilst a single date must be treated with caution, it does seem to suggest that this roundhouse, at least, dates to this period.

Based on this date, it is therefore assumed that the other comparable roundhouses in the earlier settlement date to a similar period, which could potentially encompass a 300-year span. The major problem is that, whilst all the roundhouses could date to this period, it is unclear which, if any, were contemporary. Therefore, one possibility is that all the roundhouses were contemporary, forming a small hamlet-sized settlement that was only in existence for a comparatively short duration. The alternative is that only one or two houses were occupied at any one time and that the settlement had a much greater longevity. Given that occupation at the settlement also occurred at a much later period in the Iron Age (*below*), this latter suggestion may be more pertinent, with continuous occupation occurring across the middle and early parts of the Late Iron Age. If this was the case, presumably only one or two of the six roundhouses would have been occupied at any one time. Considering the spatial patterning of the roundhouses, this could have involved occupation of the two sets of paired (and probably contemporary) roundhouses (***3340*/*3161*** and ***3378*/*3353***; *p 62*) at different times, with the other two remaining roundhouses potential relating to earlier or later periods of occupation.

The later settlement

The area that contained the Middle-Late Iron Age settlement was also occupied across the terminal stages of the Iron Age (Phase LIA.II; Fig 33). This perhaps suggests that there was a largely unbroken sequence of middle to later Iron Age occupation at the settlement, running from the latter centuries of the first millennium cal BC right through to the period immediately prior to the Roman conquest of the region (*Ch 4, p 80*).

The remains associated with the later settlement principally comprised several circular and oval gullies. These were all broadly similar in character and size, *c* 0.55-1.1 m wide and 0.15-0.4 m deep, with U-shaped profiles, and they appear to mark the position of timber roundhouses and, perhaps, other ancillary structures. As with the gullies associated with the earlier (Phase LIA.I) settlement (*p 62*), no postholes, or other structural features, were present in the areas they encircled. In stark contrast to the earlier roundhouses, which were seemingly aceramic (*p 64*), most of these later roundhouse gullies did, however, yield (and were characterised by) small assemblages of very similar handmade pottery (*p 73*).

One of these gullies (***3312***; Pl 16) lay to the north of palaeochannel ***3176*** and had a 4.25 m diameter and a south-east-facing entrance, whilst the others were concentrated in the central part of Area C, on the southern edge of palaeochannel ***3176***. Moreover, within this area the gullies related to four separate roundhouses, successively built on the same spot (Pl 17; Fig 34). The primary roundhouse (Roundhouse I) was represented by gully ***3607*** and, although only a small portion of this survived, its diameter may have been *c* 7 m (Table 12). This was then rebuilt (as Roundhouse II), which was enclosed by ring-gully ***3479***. Although only the southern half of this latter gully survived, it had an internal diameter of 6.5 m.

Roundhouse II was, in turn, replaced by Roundhouse III. This was enclosed by gully ***3454***,

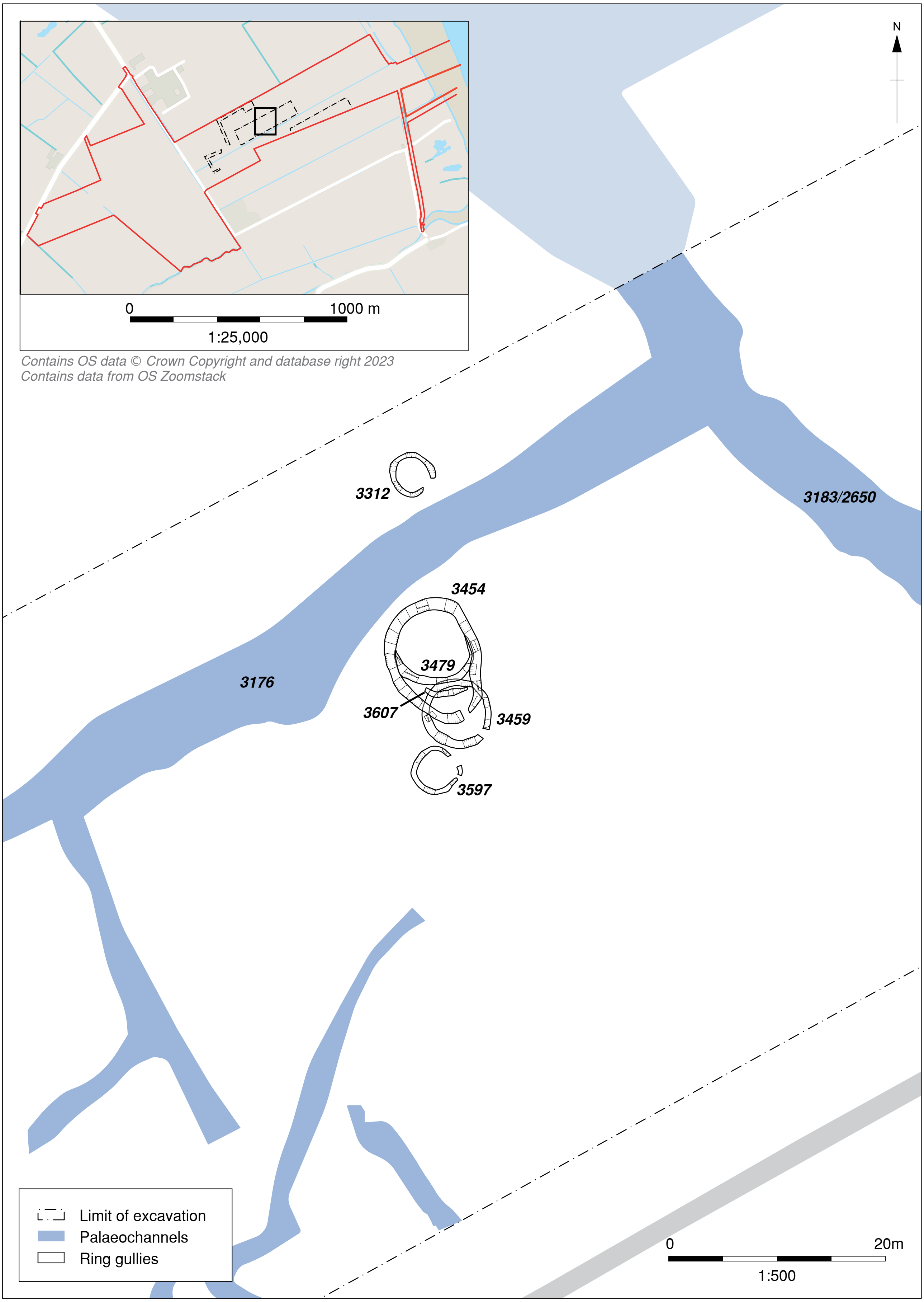


Figure 33: The later (Phase LIA.III) Iron Age settlement

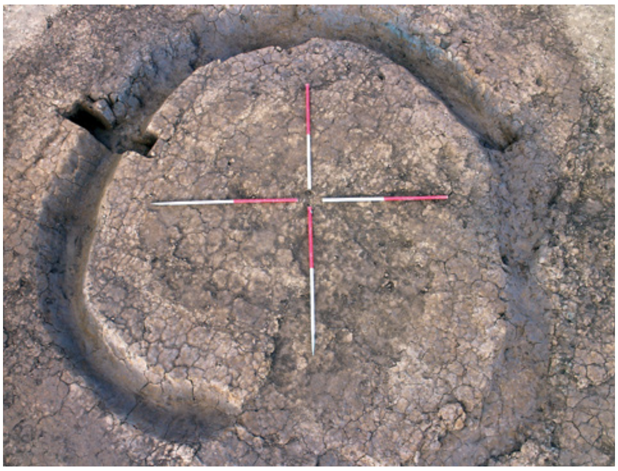


Plate 16: Roundhouse **3312**, *Area C, looking north*

which was rather more extensive, enclosing a 9.75 x 6.9 m oval-shaped area. It had a 0.8 m-wide entrance at its south-eastern end and it is also possible that its elongated from could have accommodated a porch, covering the doorway. This gully also appears to have been recut at some stage, indicative of maintenance/refurbishment (Fig 34).

Following the abandonment of Roundhouse III, a fourth and smaller roundhouse was then constructed across the southern part of the footprint of the earlier houses. Roundhouse IV was enclosed by gully ***3459***, which cut through all of the earlier gullies and enclosed an internal area with a diameter of 4.9 m. Immediately south of this was an even smaller roundhouse, enclosed by gully ***3597***, with a diameter of *c* 3.5 m; however, this had no stratigraphic relationship with the other ring gullies in this area (although it pre-dated a gully (***3606***) relating to a Romano-British sub-rectangular structure; *Ch 4, p 87*) and could therefore have formed a smaller ancillary structure that was contemporary with any of the larger roundhouses to the north. Perhaps significantly, this association (between a possible larger domestic unit and smaller ancillary structure) mirrored the pattern also observed in the earlier settlement (*p 62*).

Plate 17: The intercutting gullies for Roundhouses I-IV, Area C, looking north

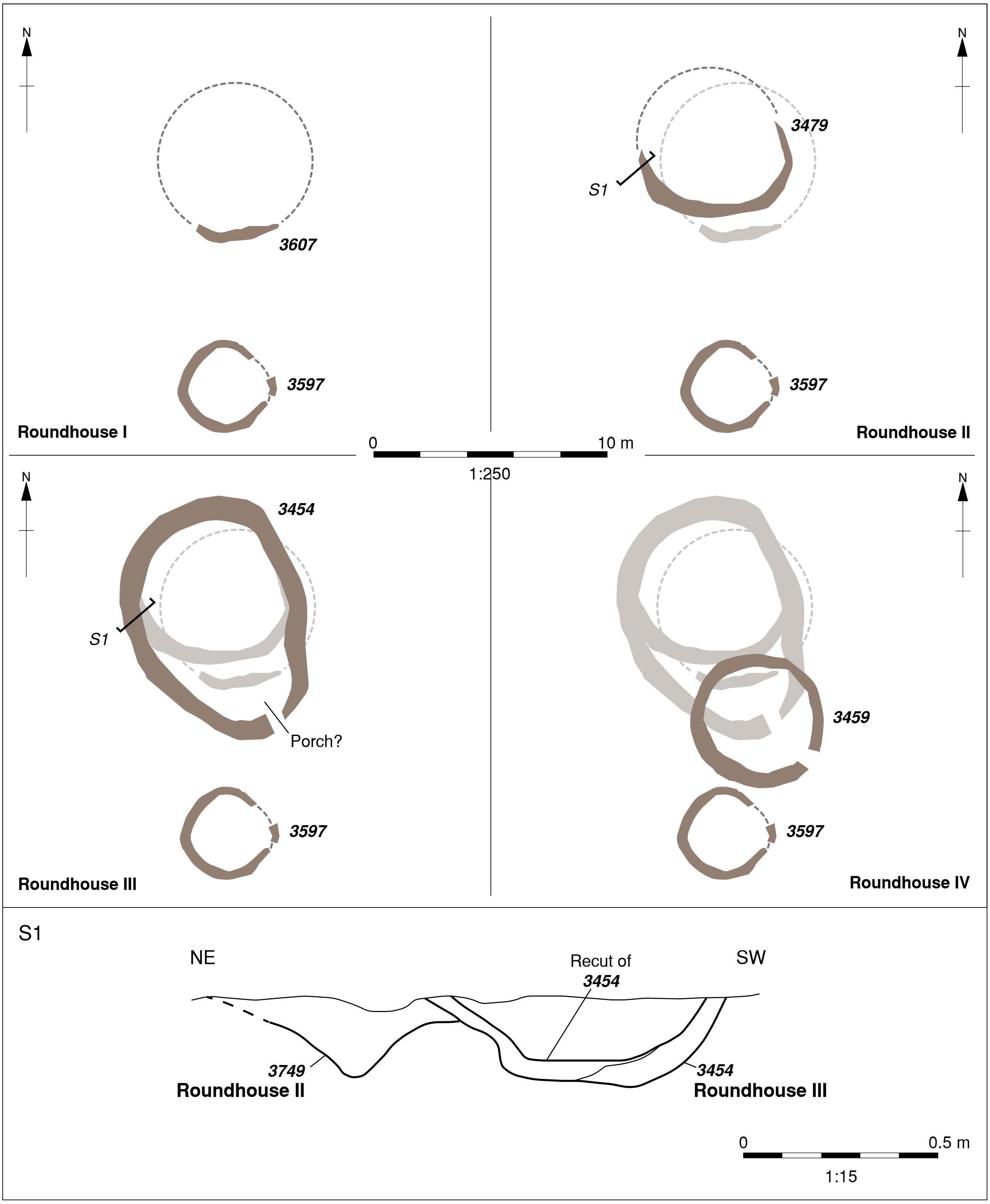


Figure 34: The sequence of roundhouses in the later settlement

Roundhouse	Gully	Diameter	Width (maximum)	Depth (maximum)	Entrance position
I	***3607*** (incomplete)	*c* 7 m	0.65 m	0.16 m	Unknown
II	***3479*** (incomplete)	*c* 6.5 m	0.85 m	0.3 m	South?
III	***3454***	9.75 x 6.9 m (oval)	1.1 m	0.4 m	South-east
IV	***3459***	4.9 m	1 m	0.4 m	Unknown
	3597	3.5 m	0.9 m	0.3 m	North-east?

Table 12: The characteristics of the ring gullies from the later (Phase LIA.II) settlement

The function of the roundhouse gullies

R I Macphail and C J Carey

During fieldwork the gullies associated with the roundhouses (both in the early and later settlement) were slightly perplexing, as it was not immediately clear if these functioned as structural features, containing timber uprights for perimeter walls, or were, instead, drainage gullies surrounding respective structures. Following detailed consideration of the stratigraphic evidence, it was deemed that the latter was probably the case, particularly as some of the gullies associated with the roundhouses of the later settlement (*p 65*) appeared to have been periodically cleared of silt. Therefore, to ascertain their function, detailed soil micromorphological and geochemical analysis was undertaken on the sediments contained within one of these gullies (***3454***) associated with a roundhouse (Roundhouse III; *p 65*).

This analysis indicated that the gully had been cut into the natural geology (***3003***), which in this area comprised late Glacial/early Holocene fluvioglacial coarse silts and coarse loamy silts (Pl 18). Small amounts of charcoal were also present in this natural deposit, which may be the result of activities associated with the digging of the ring gully (Pl 19). Above this, and within the gully, was a pale to dark brown clay (***3035***), with frequent fine silts, clearly indicating sluggish alluvial sedimentary infilling of the feature. The sediment also seems to have suffered from waterlogging, as leaching had affected the amounts of calcium, phosphorus, and manganese present (0.65% Ca; 0.06% P; 0.02% Mn), although secondary iron mottling had also occurred (1.97% Fe). Notably, the deposit only contained small amounts of anthropogenic materials, in the form of very fine charcoal and rare traces of fine charcoal/charred organic matter (2.89% LOI; Pl 20), and these probably derive from the management of nearby wetland areas for grazing, by fire.

Overall, the results indicated that this gully and probably the other roundhouse gullies, associated with both the earlier and later settlement, were not structural features, but instead functioned as drains, which also captured materials relating to the management of the landscape surrounding the settlement. The evidence also points to a site that was periodically flooded and waterlogged, and that probably formed a very wet environment, which, in turn, would have necessitated

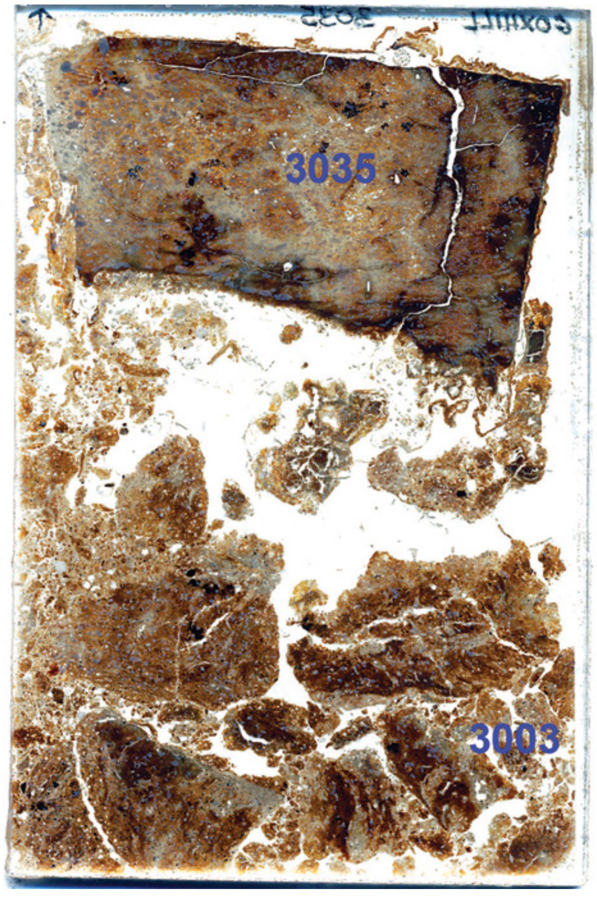


Plate 18: Photomicrograph of natural **3003** *and the overlying muddy brown clayey sediments (***3035***) in ring-gully* **3454***. PPL, frame height is ~90 mm*

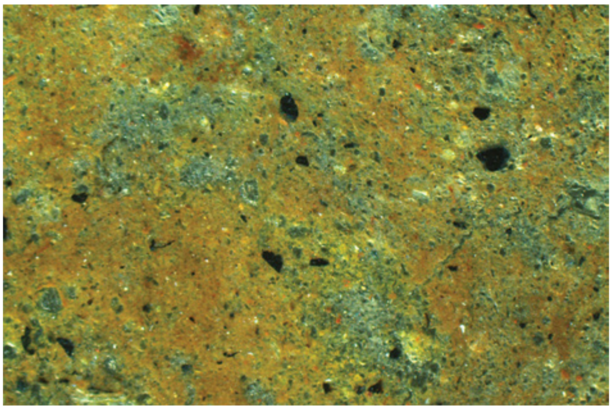


Plate 19: Photomicrograph of natural **3003***, under OIL, showing mixing and fine charcoal content. Frame width is ~4.62 mm*

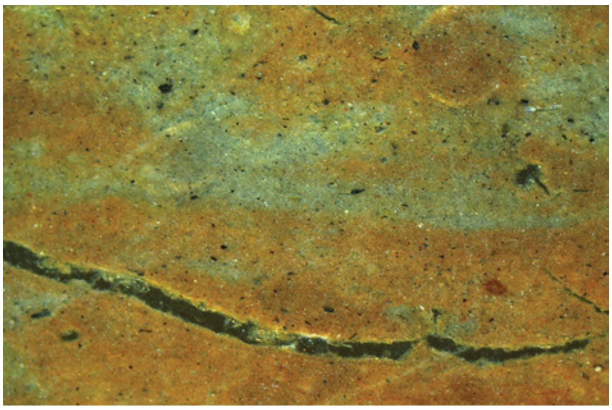


Plate 20: Photomicrograph of deposit **3035***, under OIL, showing layered fine alluviation, with a small and very fine charred organic matter content. Frame width is ~4.62 mm*

the construction of the drainage gullies. By implication, the use of the gullies as drains also indicates that the physical structures associated with the roundhouse ring gullies lay directly within the areas enclosed by the gullies. Notably though, no direct evidence for these structures was identified (*p 65*). Hence, it is possible that these structural remains had been destroyed by later agricultural activity, which may have been particularly the case if posts had, for instance, been set on post-pads, placed on the original ground surface, as opposed to being secured in earthfast settings (which may in any event have been intentionally avoided, given the wet-ground conditions (*below*) and associated issues connected with the rotting of timber posts). Another possibility, however, is that the materials used to construct any load-bearing perimeter walls for the roundhouses, comprised turf or clay blocks, which have left no *in situ* trace in the archaeological record (*cf* Harding 2009, 51-2).

The palaeochannels, plants, insects, and flooding
R I Macphail and C J Carey (sedimentology), D Druce (plant macrofossils), and E Allison (insects)

It is evident that during the occupation of the later settlement, the palaeochannels for the creek system were initially still active, though these were becoming gradually choked with alluvium. Details relating to this sedimentological process were examined by a combined study of soil micromorphology and bulk geochemistry on two monoliths from two of the smaller tributary channels (***3180*** and ***3198***) in Area C (*p 49*).

This study indicated that palaeochannel ***3198*** contained a layered and laminated alluvium (***3194***; Pl 21), containing low amounts of detrital organic matter, but a small concentration of (partially mineralised) organic soil clasts, the structure of which had suffered disturbance through wetland plant rooting and probable seasonal bio-working (burrows) (*cf* Vepraskas *et al* 2018). It was also apparent that following the deposition of the alluvium, water tables at the site fluctuated, which resulted in both iron-depletion and iron mottling. This seems to suggest that the site (and settlement area) was periodically flooded, which may also explain the alluvium's laminated characteristics. Higher up the monolith there was also a marked increase in zinc, a probable saltwater indicator (from 43.0 mg/kg to 74.2 mg/kg Zn), implying that this flooding/rise in water table was marine influenced. It also appears that there was a progressive increase in organic matter (from 1.94% LOI in the alluvium at the base of the channel to 3.34% LOI in the alluvium at the top), which indicates that the channel was also receiving eroded topsoil, perhaps having again entered the channel during flooding.

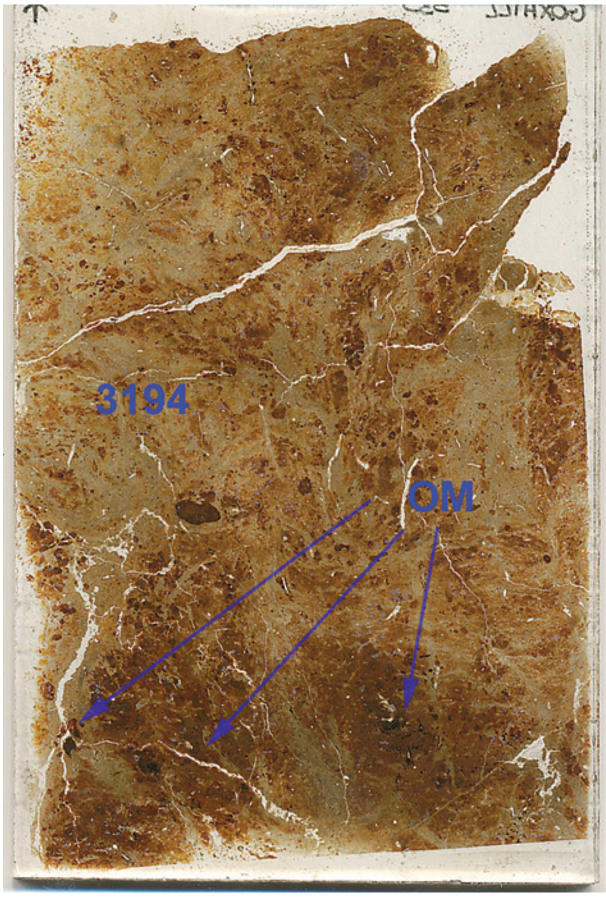


*Plate 21: Photomicrograph of the layered and laminated alluvium (***3194***) in palaeochannel* **3198**. *Organic soil clasts and iron staining (OM) are also visible PPL, frame height is ~90 mm*

In addition, palaeochannel ***3180*** produced similar evidence, in that it also contained layered and laminated weakly calcareous silty clays and clayey silts (deposit ***3179***; 1.96% Ca; 7.60% CO_3; Pl 22), with very fine blackened and charred organic matter (2.56% LOI), and calcitic microfossils (Pl 23). The weakly calcareous nature of some of the laminae is typical of marine alluvium, as is the presence of microfossils such as unidentified foraminifera (Pl 24). Furthermore, slaking of the sediments and semi-collapse of structures is probably a result of marine-water inundation (*cf* Macphail 1994; Boorman *et al* 2002; Macphail *et al* 2017). The deposit also had low phosphate levels (0.08% P), which is consistent with its suspected marine origin.

At the time when the later settlement was occupied, and the site was being periodically flooded, the larger palaeochannels also seem to have supported a selection of aquatic and semi-aquatic plants. This was clearly evidenced through the analysis of the waterlogged plant remains recovered from the alluvium in palaeochannel ***2650***, in Area B (Table 13). This indicated that in addition to taxa, most notably

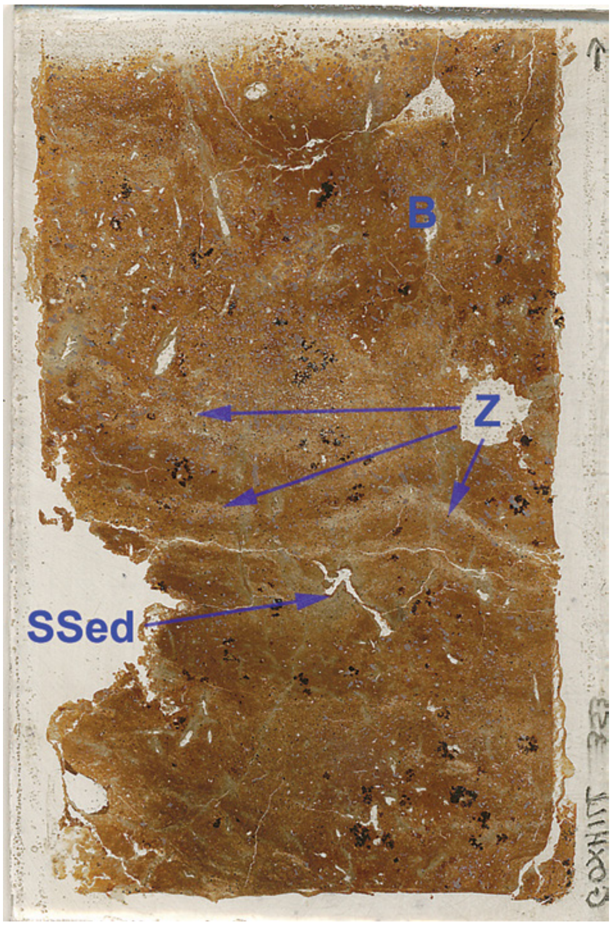


*Plate 22: Photomicrograph of the layered and laminated weakly silty clays (**3179**) in palaeochannel **3180**. Also visible are silt laminae that include fine calcareous matter (Z), calcitic microfossils and molluscs, a broad burrow (B), whilst the lower part of the image shows evidence of re-wetting and slaked sediments (SSed). PPL, frame height is ~90 mm*

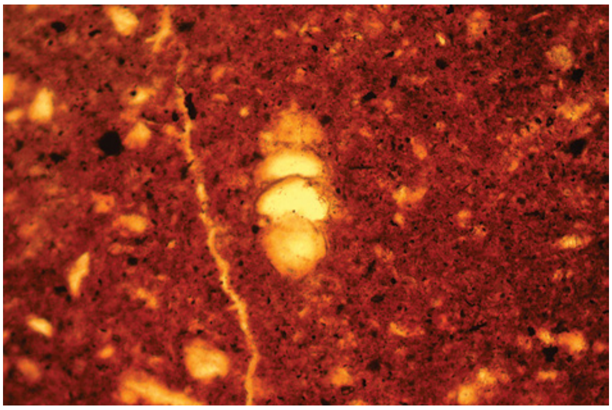


*Plate 23: Photomicrograph of a calcitic microfossil (a possible small gastropod) in alluvium **3179**, in palaeochannel **3180**. PPL, frame width is ~0.90 mm*

rushes (*Juncus*), that commonly grow in damp/waterlogged conditions, seeds from obligate aquatic/semi-aquatic plants are also present, which include duckweed (*Lemna* sp), water crowfoot (*Ranunculus*

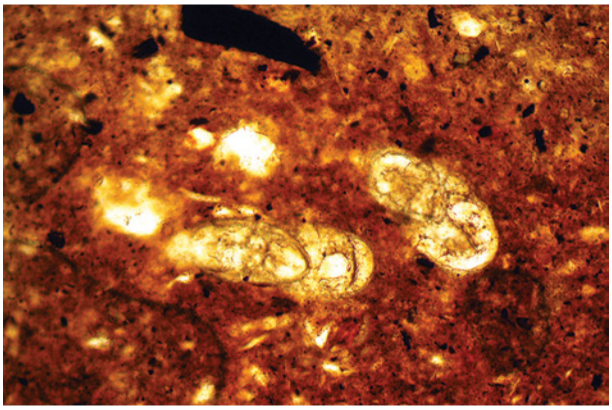


*Plate 24: Photomicrograph of the possible foraminifera in alluvium **3179**, in palaeochannel **3180**. PPL, frame width is ~0.90 mm*

aquatilis agg), water plantain (*Alisma plantago-aquatica*), possible pondweed (*Potamogeton*), and horned pondweed (*Zannichellia palustris*). Duckweed, water crowfoot, and water plantain are indicative of slow parts of rivers or streams, which is consistent with the water conditions that would have existed in the creek. Slight indications of brackish water conditions were also indicated by the recovery of possible wild celery (*Apium graveolens*) and sea club-rush (*Bolboschoenus* sp).

Abundant seeds of probable oraches (*Atriplex*) and goosefoot (*Chenopodium*) were also recovered; however, their poor preservation meant that very few could be positively identified, and both genera have a wide range of taxa that grow in a wide range of habitats. A more positive identification was that of possible spear-leaved orache (*Atriplex hastata*), which, perhaps significantly, is indicative of cultivated/waste ground in a coastal setting. Further evidence for cultivated/waste ground is indicated by the presence of smooth sow thistle (*Sonchus asper*) and small nettle (*Urtica urens*), whilst areas frequented by animals is indicated by common nettle (*Urtica dioica*). Given this, it seems possible that areas of cultivated land lay close to the Iron Age settlement, though it must be stressed that the evidence for these habitats is very slight.

Aside from the waterlogged plant remains, the alluvium in palaeochannel ***2650*** also contained an assemblage of 356 beetles and bugs, representing 159 different taxa of insects (*Appendix 3*), and these provide some valuable and complementary palaeoenvironmental data. Specifically, aquatic beetles account for almost a third of the assemblage (31%), indicating that water was present in the channel when the alluvium accumulated (Table 14). Moreover, *Ochthebius* species are particularly well represented, with *O marinus*, *O viridis* sl, and *O punctatus* providing clear indications for saltmarsh, brackish conditions, and a connection with the main estuary. *O dilatatus*, the most abundant beetle in the whole assemblage,

Sample volume (L)			10
Flot volume (ml)			400
Percentage analysed			50
Waterlogged plant remains			
Taxa	***Common name***	***Habitat (after Stace 2019)***	
		Cultivated/arable/ waste places	
cf Atriplex hastata	spear-leaved orache	often in coastal areas and saline habitats	+
Sonchus asper	smooth sow-thistle		+
Urtica urens	small nettle		+
		Mostly damp/waterlogged conditions	
cf Apium graveolens	*cf* wild celery	damp barish, usually brackish places near sea	+
Alisma plantago-aquatica	water-plantain	in or by ponds, ditches, and slow rivers	++
cf Bolboschoenus	sea club-rush	wet muddy places in estuaries or by sea	+
Juncus sp	rushes	mostly damp/wet ground	++++
Lemna sp	duckweeds	obligate aquatic in ponds, ditches, and slow parts of rivers and streams	++++
cf Potamogeton sp	*cf* pondweed	obligate aquatic in broad range of habitats	+
Ranunuculus aquatilis agg	water crowfoot	subaquatic in ponds, ditches, and slow rivers	+++
Ranunculus sceleratus	celery-leaved buttercup	in marshy fields, ditches, ponds and streamsides	++
Zannichellia palustris	horned pondweed	obligate aquatic in broad range of habitats	+
		Grow in a broad range of habitats	
Atriplex/Chenopodium	oraches/goosefoots		++++
Cirsium sp	thistles		+
Poaceae	grasses		+
Ranunculus acris/repens	meadow/creeping buttercup	especially damp soils	+
Urtica dioica	common nettle	especially where animals defecate	+
Other remains			
Charcoal fragments			+++
Daphnia ephippium resting eggs	water flea		++++
Charophytes	green algae		+

Remains are seeds/fruits unless stated otherwise. Remains are scored on a scale of + to ++++, where: + represents less than five items; ++ between six and 25; +++ between 26 and 100; and ++++ over 100 items

Table 13: Waterlogged plant remains from palaeochannel **2650**, *Area B*

is halobiotic in Scandinavia, but more euryoecious in Britain, occurring in and beside muddy fresh or brackish water, often in coastal locations (Hansen 1987, 39-40; Duff 2012, 326). *O minimus* is also very common and this is eurytopic, being found in still and slowly flowing fresh or brackish waters. Among the terrestrial fauna, the ground beetle *Pogonus chalceus* occurs in saltmarshes and under tidal litter (Luff 2007, 103).

Insects from damp ground and waterside habitats account for 11% of the terrestrial fauna, some of them providing details of emergent or marginal wetland vegetation. Adults and larvae of *Plateumaris bracata* (six individuals) are associated with common reed (*Phragmites australis*), although the larvae are also known from sedges, which are also the host plant of *Limnobaris* weevils. *Coccidula rufa*, a small member of the ladybird family, occurs on tall wetland vegetation such as reeds, rushes (*Juncus*) and reedmace (*Typha*) (Majerus 1994, 144).

Ground beetles (Carabidae) include *Pterostichus anthracinus*, a hygrophilous species that occurs near freshwater in marshes and fens (Luff 2007, 114), while the more eurytopic *Pterostichus vernalis* occurs in moss and litter in various damp or shaded lowland

Total beetle individuals	347
Total beetle taxa	150
AQUATICS (% of whole fauna)	31%
TERRESTRIAL BEETLES AND BUGS	
Decomposer component:	
Dry decomposers [rd]	7%
Foul decomposers [rf]	14%
Eurytopic decomposers [rt]	21%
Total decomposers [RT = rd+rf+rt]	42%
% rd/RT	17%
% rf/RT	33%
% rt/RT	50%
Other groups:	
Grain pests [g]	0%
Wood-associated taxa [l]	<1%
House fauna [h]	7%
Scarabaeoid dung beetles	12%
'Oxyteline association'	9%
Damp ground/waterside [d]	11%
Obligate saltmarsh taxa [c]	<1%
Plant-associated [p]	17%
Tree foliage [t]	0%
Total outdoor taxa	47%
SYNANTHROPES	
Strong synanthropes [ss]	0%
Typical synanthropes [st]	6%
Facultative synanthropes [sf]	19%
Total synanthropes [S = sf+st+ss]	25%
% ss/S	0%
% st/S	25%
% sf/S	75%

Table 14: Statistics for the analysed Coleoptera assemblage from palaeochannel **2650**, *Area B*

habitats, especially grasslands (*op cit*, 115; Duff 2012, 193). Other ground beetles are more typical of drier and, perhaps, relatively sparsely vegetated ground (*Bembidion obtusum, Curtonotus aulicus, Amara,* and *Paradromius linearis*). These may tie in with suggestions of disturbed ground and ruderal vegetation from phytophages such as *Chaetocnema concinna* or *picipes*, usually associated with Polygonaceae, especially knotweeds (*Polygonum*) and docks (*Rumex*), and *Phyllotreta nemorum* group and *Ceutorhynchus* spp, which feed on various wild and cultivated Brassicaeae. *Meligthes* larvae are also associated with Brassicaceae, but the adults forage for pollen on a wide range of plants. *Heterogaster urticae* and *Brachypterus* are indicative of nettles (*Urtica*) growing on nutrient-enriched ground.

Ground in the vicinity of the channel was probably rather open, with any shade provided mainly by long herbaceous vegetation rather than trees or shrubs. Various insects are indicative of rough grassland, both in damper places and on relatively dry ground, including the chafers *Phyllopertha horticola* and *Dascillus cervinus*, both of which have larvae that primarily feed at grass roots, and the planthopper *Anoscopus flavostriatus*, which occurs among grasses in damp areas. *Mecinus pyraster* associated with ribwort plantain, *Oxystoma* found on vetches (*Vicia* and *Lathyrus*), and *Sitona* species associated with various wild and cultivated leguminous plants (Fabaceae) are all commonly associated with grassland habitats.

A notable feature of the assemblage is the relative abundance of scarabaeid dung beetles, suggesting the use of local grassland for grazing domestic animals (*Nimbus contaminatus*, *Melinopterus* sp(p), *Colobopterus erraticus*, *Calamosternus granarius*, Aphodiinae spp, and *Onthophagus*; 12% of the terrestrial insect fauna). The size of this component suggests that grazing was occurring close to the channel. The most numerous of the dung beetles is *Nimbus contaminates,* which is active in the autumn months.

Decomposers other than scarabaeid dung beetles account for 30% of the terrestrial fauna and many of these are regarded as synanthropic to some degree. They include a characteristic 'house fauna' associated with relatively dry mouldering plant litter, in archaeological contexts typically occurring in buildings where plant materials were used structurally or stored (*Latridius minutus* group, *Cryptophagus* spp, *Atomaria*; 7% of the terrestrial fauna; Hall and Kenward 1990; Kenward and Hall 1995; Carrott and Kenward 2001). The presence of this component strongly suggests the disposal of litter from buildings in the channel, which seems to accord with the disposal of other refuse into the channel in the form of animal remains (*p 75*). A woodworm beetle (*Anobium punctatum*), which would have infested any wooden structure, may be associated with this group.

Iron Age pottery

One of the defining features of the later settlement was the presence of handmade Iron Age pottery (*Appendix 1*), which set this firmly apart from the earlier (aceramic) settlement. This represented a very small assemblage, merely comprising 70 sherds (0.101 kg; 0.14 RE) from a maximum of 12 vessels, recovered from the ring gullies defining the roundhouses (Table 15), which possibly related to the occupation of the roundhouses. The assemblage also includes one sherd recovered as a residual item in a probable Early Roman sub-rectangular gully (***3606***; *Ch 4, p 85*), although this truncated roundhouse ***3597*** (*p 67*) and, hence, was probably originally from the earlier

Ring gully	Pottery fabric	Number of sherds	Weight (g)	Number of vessels	*Total RE%*
3312	IASH3	6	14	1	***0.00***
3597 (includes residual sherds from a later, truncating, gully)	IASH3	7	7	2	***0.07***
3607 (Roundhouse I)	SHEL	32	14	1	***0.00***
3479 (Roundhouse II)	SHEL	2	5	1	***0.00***
	IASH3	2	6	1	***0.07***
3459 (Roundhouse IV)	SHEL	17	47	4	***0.00***
	CALGS	2	6	1	***0.00***
	MISC	2	2	1	***0.00***
Total		***70***	***101***	***12***	***0.14***

Table 15: The handmade (calcareous-gritted) pottery from the later (Phase LIA.II) settlement

roundhouse, particularly as its enclosing ring gully contained identical sherds of pottery.

Generally, this assemblage is in poor condition, largely due to soil conditions, and therefore has a low average sherd weight in comparison to other Iron Age pottery assemblages from North Lincolnshire, such as those recovered from North and South Killingholme, to the south-east of Goxhill (*cf* Rowlandson *et al* 2017; Rowlandson and Fiske 2023; 2024; *p 61*). Although the soil conditions at Goxhill may have hindered the preservation of the ceramic assemblage, it does seem to partly reflect the use of one specific type of Iron Age pottery, known from the wider region, classified as calcareous-gritted ware. From the suspected Iron Age features this ware is represented by fabric IASH3, which is a fine shell-gritted fabric with some quartz sand inclusions (*Appendix 1*). The vessel forms recorded in this fabric are almost all necked jars or bowls, which stylistically appear to be of Late La Tène II/III type (*ie* dating to the Middle-Late (Pre-Roman) Iron Age; *c* 200 cal BC-cal AD 43), though these did continue to be produced into the later first century AD (*cf* Knight 2002).

The existence of this shell-gritted fabric at Goxhill is also significant, as it is unlikely that the fossil shell used in the temper was naturally occurring in the glacial deposits found along this coastal zone (*Ch 1, p 4*). Indeed, fossil-shell-rich deposits are typically confined to Jurassic strata, which only outcrop to the west of the Cretaceous Lincolnshire Wold scarp (Wood and Smith 1978). Therefore, this type of shell-gritted pottery could have been produced in these areas (eg near Barnetby le Wold; *cf* Darling 2002; 2003), or perhaps the tempering material was itself transported to local production sites to be mixed with the local clays. Either option would require a well-established system of trade or exchange to be in existence in the Late Iron Age (perhaps via more significant nodal settlements such as Kirmington or South Ferriby; Van de Noort 2004, 89). This would also fit the pattern recognised by Peter Didsbury and Alan Vince (2011, 196-7) at contemporary sites on the north bank of the River Humber, where developed La Tène II/III type wares may also have been traded or redistributed from north-western Lincolnshire.

The pottery from the Iron Age features at Goxhill also include two sherds from a single vessel whose fabric possesses sparry mineral calcite inclusions (CALGS). Significantly, examples of Iron Age vessels with sparry mineral calcite in Lincolnshire are rare (*cf* Rowlandson 2012b), as most of these vessels were produced in the Vale of Pickering or the northern Yorkshire Wolds (*cf* Rowlandson 2012c). It also worth noting that there is a possibility that these sherds were intrusive, and actually dated to the Roman period *(Appendix 1*), although given that they possessed no diagnostic features it is difficult to determine their date with any degree of certainty.

The other fabrics from Iron Age features include tiny ceramic scraps (MISC; *Appendix 1*). Although these small sherds could not be dated with certainty, based on their stratigraphic provenance they are also possibly later Iron Age in date.

Use of the vessels

Sherds from two of the IASH3 jars from ring-gullies ***3479*** (*p 65*) and ***3597*** (*p 67*) were submitted for organic residue analysis (samples GOX029 and GOX030; *Appendix 2*) to determine their possible function. This clearly indicated that the vessel from ***3479*** was used to process dairy products, and the same also seems to be the case for the sherd from ***3597***, though at some stage it may also have been used for cooking meat. This therefore suggests that secondary dairy products, such as milk, butter, and cheese, formed an element of the later Iron Age diet, with the rearing of dairy animals (cattle and sheep/goats) perhaps forming an important element of the settlement's economy.

Animal bones and waste in the palaeochannels

I Smith

A small assemblage of animal bone (TNF 163) was recovered from the gullies surrounding the roundhouses in the later settlement (Table 16). As with the animal bone from the earlier settlement (*p 64*), most of this is in poor (Stage 4) or very poor (Stage 5) states of preservation (TNF 136; 84% of the total assemblage), with a smaller amount of bone that is moderately preserved (Stage 3; TNF 22; 13%), and five fragments with good preservation (Stage 2; 3%).

The identified species include cattle (TNF 17), which are the most frequent, followed by horse (TNF 6), dog (TNF 5), and sheep/goat (TNF 1). The cattle remains also include a mandible from ring-gully ***3479*** (Roundhouse II; *p 65*) with a deciduous fourth premolar, which has a surviving rear cusp only (of Grant's (1982) undetermined wear stage, but between stages f to m, and most probably at stage m), and with an M2 (at Grant's (*ibid*) stage f) and an M3 (unworn at Grant's (*ibid*) stage a). This suggests an animal of 18-30 months (Halstead 1985), or with a median age of 20 months (Jones and Sadler 2012, 22). A horse tooth, comprising a right-hand side deciduous premolar (dp2), was also recovered from ring-gully ***3459*** (Roundhouse IV; *p 67*) and the wear state of this specimen suggests it derives from an animal of less than 2.5 to 3.5 years old at death (*cf* Levine 1982; Hillson 2005, 240).

Beyond the identifiable species, the majority of the bones are only identified to unspecific levels of mammal. These are dominated by large mammal (TNF 112), with some medium mammal (TNF 4), as well as small fragments (TNF 18) identified only to the level of mammal.

In addition to the animal bone in the gullies, an assemblage of animal bone (TNF 105) was recovered from the adjacent palaeochannels, specifically ***3183/2650*** and ***3176*** (*p 49*; Table 17). Significantly, radiocarbon dating (*p 76*) suggests that some (if not all) of this material might be contemporary with that in the roundhouse gullies, and therefore it could represent waste generated in the settlement that was subsequently cast into the silting palaeochannels, along with other waste materials (as hinted at by the insects in the channel; *p 73*). In comparison to the material from the ring gullies (*above*), the animal bone from the channel is generally in a better state of preservation, with 35 fragments with good and moderate erosional stages (Stages 2 and 3; 33% of the assemblage), and 70 fragments with poor or very poor preservation (Stages 4 and 5; 67%).

These differences in preservation, between the palaeochannels and ring gullies, could be down to anthropogenic factors, specifically the selective disposal of primary and other butchery waste and cooked bones, though it is probably the case that such patterns are now obscured, particularly as the assemblages from both groups are dominated by the more durable parts of many bones and by teeth. Of course, it also possible that differences in the state of preservation relates to the microenvironments in which the bones were deposited (*cf* Lyman 1994, 354). For example, for the bone in the palaeochannels repeated wetting and drying would have been inimical to preservation, whilst submersion in waterlogged silt or clay-rich sediments may well have favoured bone preservation. In addition, bones buried quickly in the palaeochannels may have been protected from sub-aerial weathering (*op cit*, 360) and also gnawing and fragmentation by dogs, foxes, or pigs. The long-term condition of those bones may also reflect pH values (Behrensmeyer 1991, 310) and the lesser effects of roots, fungi, and other biota within the palaeochannels (Lyman 1994, 354, 396).

Ring gully	**Cattle**	**Horse**	**Sheep/goat**	**Dog**	**Large mammal**	**Medium mammal**	**Mammal**	***Total***
3479 (Roundhouse II)	4				14		9	***27***
3454 (Roundhouse III)	2	4			80			***86***
3459 (Roundhouse IV)	11	2	1	5	18	4	9	***50***
Total	***17***	***6***	***1***	***5***	***112***	***4***	***18***	***163***

Table 16: Animal bone (TNF) from the later (Phase LIA.II) settlement

Palaeochannel	**Cattle**	**Horse**	**Sheep/goat**	**Large mammal**	**Mammal**	***Total***
3183/2650	4	35	1	22	19	***81***
3176		1		23		***24***
Total	***4***	***36***	***1***	***45***	***19***	***105***

Table 17: Animal bone (TNF) from the palaeochannels adjacent to the later (Phase LIA.II) settlement

The identifiable species from the palaeochannels are dominated by horse (TNF 36; 34% of the assemblage), with smaller amounts of cattle (TNF 4) and sheep/goat (TNF 1), the remainder only being classifiable to the level of large mammal and mammal, represented by limb-bone shaft fragments. Notable specimens include a horse metatarsal from palaeochannel ***3183/2650*** (*p 49*), which suggests a withers height of 1.31 m (*cf* May 1985), whilst a sheep/goat pelvis from the same palaeochannel is represented by just less than half of the cranial portion of the acetabular articulation (zone 1 of Dobney and Rielly 1988, fig 11). In addition, this palaeochannel also produced cattle teeth, including a third and fourth permanent premolars and a first molar, all loose, but judged to be associated, with the permanent fourth at wear stage f and the first molar at wear stage k (Grant 1982). It is difficult to suggest an age for this specimen since cattle with the fourth permanent premolar and first molar at these wear stages span approximately 5 to 13 years of age (Jones and Sadler 2012, 16-18). Unfortunately, as loose teeth predominate amongst the mandibular and maxillary parts, there is too little age-related evidence to suggest cattle kill-off patterns.

It is also evident that the frequencies of domestic animals present in the palaeochannels contrasts with those recorded in the ring gullies, where cattle bones are more prevalent and horse only accounts for *c* 4% of the assemblage from these features; however, some of these differences could plausibly stem from greatly fragmented individual horse elements in the palaeochannels, which seems to be a factor at play with some of the later horse bones dumped into these features (*Ch 4, p 97*). In both the palaeochannels and ring gullies, very low quantities of sheep were also present, though it is unclear whether this is representative. It is possible, for instance, that taphonomic and other processes, including recovery, recording, and in the case of the palaeochannels, fluvial transport, have created a bias against sheep, as compared to cattle (Payne 1975; Behrensmeyer 1991, 313; Lyman 1994, 177).

Dating the later settlement

The chronology of the later settlement was established through radiocarbon dating, in conjunction with a consideration of the pottery recovered from the roundhouse gullies. As with the dating of the earlier settlement (*p 64*), it was considered that the chronology of the later roundhouses could only be fully established through radiocarbon dating, which, given that these houses were also within a stratigraphic sequence, could be enhanced through Bayesian modelling (*Ch 1, p 18*).

It was, however, evident following the processing of bulk soil samples from these gullies that all contained an absence of suitable charred plants and charcoal for radiocarbon assay. Therefore, in the absence of this material, three samples of animal bone from gullies ***3479*** (Roundhouse II), ***3454*** (Roundhouse III), and ***3459*** (Roundhouse IV; *pp 65-7*) were submitted for AMS dating. Two of the samples were subsequently discovered to contain insufficient carbon, and hence it was only the sample from ring-gully ***3459*** that was successfully assayed. This was a cattle metacarpal-shaft fragment, which returned a date of 40 cal BC-cal AD 120 (1971±24 BP; SUERC-104304), suggesting that the structure was either Late Pre-Roman Iron Age or Early Roman in date. However, based on the pottery from this ring gully (*p 73*), a Pre-Roman Iron Age is probably more appropriate, which may suggest that the animal bone (and by association the ring gully and pottery) dates somewhere between 40 cal BC and the middle decades of the first century cal AD. This radiocarbon date was also derived from the final roundhouse (Roundhouse IV) in the sequence, and therefore provides a *terminus ante quem* for the earlier houses that were built in this same location. These also contained comparable sherds of Iron Age calcareous-gritted pottery (*p 74*), suggesting that there was no great duration between the creation of each of the roundhouses, which might therefore reflect a continuous and unbroken sequence of occupation.

In addition to the dated animal bone from the roundhouse, a tibia-shaft fragment from a horse, present in palaeochannel ***3176*** (*p 49*), was also subjected to radiocarbon assay, returning a date of 45 cal BC-cal AD 110 (1995±24 BP; SUERC-104305). When this date is compared (using the chi-square test; *Ch 1, p 18*) with the date from the adjacent ring gully, they have good agreement (T′=0.37; T′(5%)=3.8; v=1; A_{comb}=106.2%(An= 50.0%)). Hence, they seem to relate to the same broad phase of activity, which seemingly involved the disposal of domestic waste into the palaeochannels.

4

ROMANO-BRITISH SETTLEMENT

R A Gregory and J Zant

At start of the mitigation works it was evident that the main construction area at Goxhill contained extensive evidence for Romano-British settlement. Specifically, a dense concentration of cropmarks and geophysical anomalies were recorded to the east of East Marsh Road, seemingly relating to the core of a Romano-British settlement (*Ch 1, p 6*), though these lay beyond the area that would be directly affected by the construction works, and hence no further large-scale excavations were required. During the mitigation works, excavation of Areas B and C to the south and south-west of the settlement core did, however, produce additional evidence for Romano-British activity, comprising a dense swathe of buried features, which was slightly surprising, as it was initially assumed that these areas lay at the periphery of the settlement. Moreover, it is now clear that these related to a continuous sequence of occupation, which started in the later Iron Age, with the establishment of an unenclosed settlement (*Ch 3*), and continued right through to the end of the Roman period. Furthermore, a reconsideration of the cropmark data, which was subjected to additional mapping following the completion of the fieldwork (Fleming and Royall 2019; *Ch 1, p 19*), indicates that some of these remains related to an extensive system of enclosures, which ran from the settlement core across a fairly large envelope, extending from the foreshore and across areas of landscape either side of East Marsh Road (*Ch 6, p 191*).

Roman Conquest and the Character of Romano-British Settlement

At the time of the Roman invasion of southern England in AD 43, and in the years that followed, the political position of the Corieltauvi tribe, who seemingly formed the main Pre-Roman Iron Age political entity in North Lincolnshire (*Ch 3, p 61*), is unclear. There is, however, no evidence that those associated with this polity were actively hostile towards Rome, and it is possible that after an initial period of neutrality, and with the collapse of organised resistance in the South East, there was local support for the invading Roman forces and administration (Clay 2010, 32).

The process of occupation across Lincolnshire was initially undertaken by the Roman military, who constructed forts and an extensive system of roads (*cf* Taylor 2006). Although the locations of the earliest Roman military depositions in northern Lincolnshire are uncertain, there is presently no evidence for any forts in the Goxhill area, with the closest possibly at Kirmington, *c* 10 km to the south on the Lincolnshire Wolds (Fig 35), although alternatively this might be an example of the later fortification of earlier settlement (Jones and Whitwell 1991). It is possible, however, that during the initial decades of the Roman period a military supply depot existed at Winteringham, on the southern bank of the Humber, *c* 17 km west of Goxhill, as this site has produced some evidence for an early phase of Roman military activity (Stead 1976). Rather significantly, Winteringham also lay at the far northern end of Ermine Street, which formed a major north/south route running through Lincolnshire, and indeed one of the most important national routes in the Early Roman period, linking London with Lincoln (Malone 2010, 3, fig 1). Following the initial military use of this site, in the mid-first century AD, its importance seems to have been retained and it developed into a Romano-British roadside settlement, which might represent an unwalled 'small town', functioning as an important trading post in the region for both land and seaborne goods (Whitwell 1995).

In addition to Ermine Street, a second major Roman road was located to the east. This was High Street, possibly a successor to a prehistoric routeway, extending approximately north/south along the Wolds, which in its northern section probably ran between Kirmington and South Ferriby, which lay *c* 12 km west of Goxhill, on the southern shores of the Humber (Malone 2010, 36). Perhaps unsurprisingly, a Romano-British settlement also lay at South Ferriby and, as with Winteringham (*above*), this roadside/riverside settlement may also have formed an important node in the local settlement hierarchy (Creighton 1990, 184; Van de Noort 2004, 123-4). Perhaps tellingly, during the second century, this settlement comprised a small stone-built farmstead, which also had an industrial focus, and was associated with an octagonal shrine/temple (Clay 2006), and therefore seems to be set apart

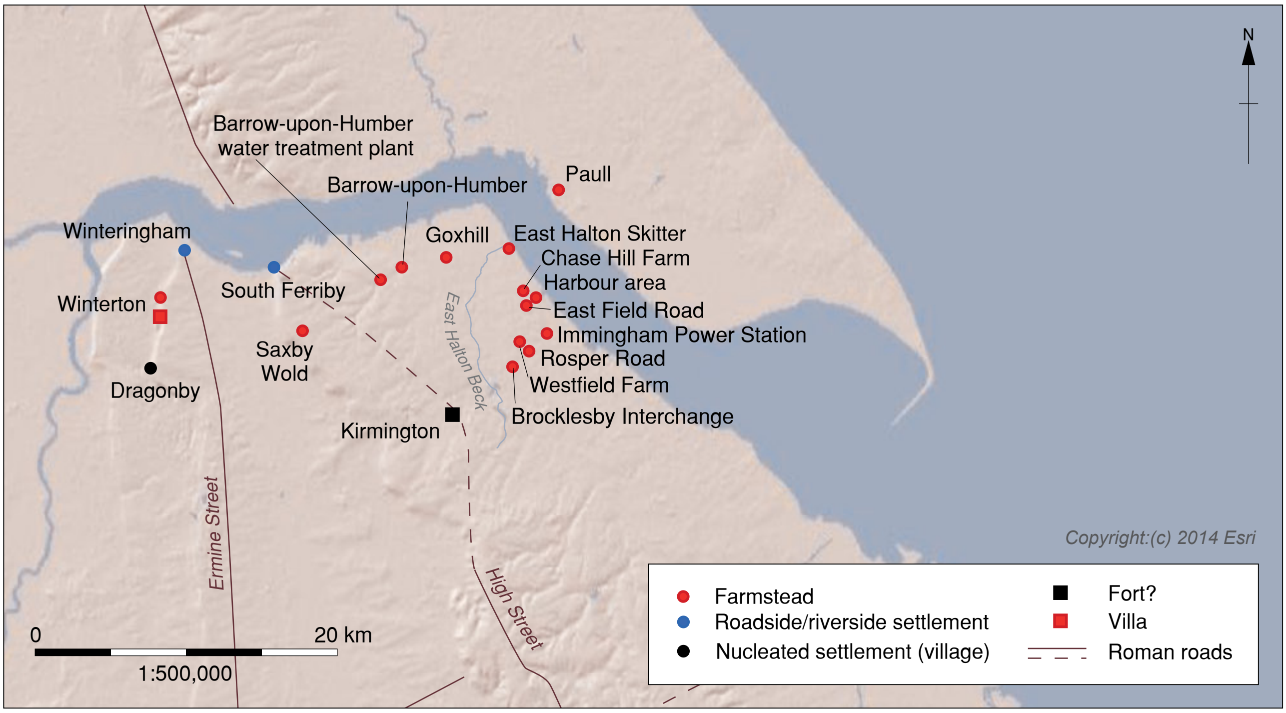


Figure 35: Roman military sites, roads, and rural settlements in North Lincolnshire mentioned in the text

from most of the other contemporary settlements in the region (*below*). It also appears that the trading post at Winteringham and the settlement at South Ferriby were directly linked by a short road, constructed in the Early Roman period, that ran along the foreshore of the Humber and that was built upon a raised causeway (Van de Noort 2004, 114-15).

In the landscape surrounding the Roman roads and riverside settlements at Winteringham and South Ferriby, rural settlement largely comprised small farmsteads associated with ditched agricultural enclosures/fields, some of which were also engaged in metalworking or salt production (*cf* Allen 2016). However, it is possible that, as the Humber formed an important communication and trading route during the Roman period, at least some of these settlements had better access to traded goods than other more inland settlements, particularly those that were set some distance from the major Roman roads (Millett 1999, 221). Although small farmsteads dominated the rural settlement pattern, there were several exceptions. These included larger nucleated settlements, which have been classified as 'villages' (*cf* Allen 2016), with one example being present at Dragonby to the east of Ermine Street and south of Winteringham. The origins of this settlement lay in the Iron Age, which, following a brief period of abandonment in the early decades of the Roman period (possibly following an attack by the Roman military), was reoccupied in the late first century AD. Subsequently, across the remainder of the Roman period, it became a flourishing high-status settlement, containing circular and aisled buildings, and was engaged in craftworking and trade (May 1996).

Roman villas formed another high-status rural settlement, with one substantial example being present at Winterton, sandwiched between Winteringham and Dragonby, and with a small farmstead also located just to its north (*cf* Allen 2016). By the end of the second century this villa settlement contained a series of structures, including bathhouses and other heated buildings, aisled buildings, and a workshop, which were arranged around a courtyard (Stead 1976).

Regarding the Romano-British settlements in the immediate environs of Goxhill, these mainly seem to represent examples of smaller farmsteads, associated with enclosures and field systems, with several being identified along the foreshore area extending southwards to Immingham (Fig 35). Some of these were catalogued as part of a major study of the Roman rural settlement of Britain (Allen *et al* 2016), whilst others have subsequently come to light during more recent developer-funded investigations associated with large-scale infrastructure projects. Moving south-eastwards from Goxhill, the first is at East Halton Skitter, on the southern side of the East Halton Beck, *c* 1 km distant of the Romano-British settlement at Goxhill. This settlement, recently classified as a 'complex farm' (*ibid*), has been investigated through geophysical survey and trial trenching, and at its core was a large, ditched enclosure, *c* 60 x 60 m in extent, with several satellite enclosures, all of which were bounded by a double-ditched track/droveway, and that on the basis of the pottery evidence seem to have been occupied from the mid-first to late second century AD (Cardwell *et al* 2000; Neal 2001; Van de Noort 2004, 122). This settlement core was also surrounded by a series of rectilinear enclosures and other track/droveways, though the pottery recovered from one of the enclosures suggests that these were established during a later phase of settlement activity, dating to the third to late fourth century (Cardwell *et al* 2000).

Travelling further southwards, the results of extensive investigations carried out in the Chase Hill area, North Killingholme, between 1999 and 2021, suggest that the whole of the Humber bank area was occupied and in use by the later Iron Age, with occupation continuing into the Roman period (*cf* Allen Archaeology 2019; Willis 2022; Tuck 2023). Of note is the substantial Romano-British settlement at Chase Hill Farm, which was subjected to geophysical survey, trial-trenching, and open-area excavation (Mason 2008; Allen Archaeology 2019). As with Goxhill, this settlement seems to have been established in the Iron Age, after which there was a potential break in occupation, with Romano-British settlement (based on pottery evidence) beginning in the late first/early second century AD, peaking in the third, and ending in the second half of the fourth century. This occupation was characterised by a series of rectilinear ditched enclosures and one of the enclosure ditches also contained a complete ceramic vessel (dating to the Antonine period; *ie* mid-/late second century AD) suggestive of deliberate (structured) deposition. More recently, in 2021, trial trenching carried out directly to the south and east revealed further evidence, in the form of probable agricultural enclosure ditches, consistent with the proximity of the Romano-British settlement at Chase Hill Farm, though no evidence of structural remains (*ie* postholes, hearths *etc*) was encountered (Headland Archaeology 2021).

Other Romano-British settlement remains have also been recorded close to Chase Hill Farm during development work. One of these sites, to the south, was at East Field Road, where Romano-British enclosures were identified dating to the first century (Tuck 2023, 22-4), whilst another site was located in the harbour area at North Killingholme, south-east of Haven Road (Archaeological Services WYAS 2007; Muldowney *et al* 2009). At this latter site, one of the excavated areas produced evidence for Iron Age enclosures, roundhouses, and pottery, which suggest that the settlement's genesis lay in the Middle-Late Iron Age, whilst in three other adjacent areas, the remains of a Romano-British rectilinear enclosure system were recorded, dating to the second-third centuries AD. This was defined by several superimposed ditches indicative of ditch maintenance and modification, with the enclosures probably functioning as fields or paddocks. Although no clear evidence for domestic structures was present, several pits and postholes were recorded, along with a few fragments of slag and briquetage, indicating the nearby presence of metalworking and possibly salt production. In addition to this settlement, a nearby and probably related settlement area has also been identified at North Killingholme, again in the harbour area, close to Rosper Road. In one area, this was defined by a sub-circular enclosure, dated to the first or second century AD, which was later supplanted by an extensive system of enclosures and trackways dating to the second-fourth centuries (Bartlett 2012; Allen Archaeology 2013; 2014; 2019), and in another area, at the southern end of Rosper Road, Romano-British settlement seems to have been focused on a pre-existing Iron Age enclosure (*Ch 3*, *p 62*), the ditches of which were partly recut (Cavanagh 2024, 35-6).

Other Romano-British settlements have also been identified further to the south, including one at Immingham Power Station. At this site, excavation revealed rectilinear enclosures, associated domestic structures, and other occupation features, with occupation extending across the Early Roman period to, at least, the late third century AD (HFA 2001; 2006). Moreover, close to this area, further archaeological evaluation in 2023 identified several areas of Iron Age/Romano-British occupation, probably representing a continuation of this settlement (Wilson 2023).

Slightly further west, in South Killingholme, at Westfield Farm, another Romano-British settlement was also excavated in advance of the development works for the Hornsea Project One Offshore Wind Farm (Tuck 2023, 29-36). This settlement had Iron Age origins (*Ch 3*, *p 62*), and was defined by a series of intercutting enclosures, which were in use right across the Roman period (first-fourth centuries). It also contained evidence for two roundhouses dating to the first/second century AD. One other settlement has also been located south-east of South Killingholme at the Brocklesby Interchange, which was examined by archaeological evaluation in 2010 and subsequent excavation in 2016, ahead of road construction for the A160/A180 Port of Immingham Improvement Scheme (Cavanagh 2024). These investigations indicate that this settlement had Iron Age antecedents (*Ch 3*, *p 62*) and was, again, defined by a complex sequence of enclosures, which were in use across the entirety of the Roman period. Significantly, though, this Romano-British settlement also produced coins and imported artefacts, notably brooches and a toilet set, as well as architectural materials (a stone column, roof tiles, and painted wall plaster) derived from a substantial Roman-style building (*op cit*, 42-5). Therefore, compared to the other Romano-British farmsteads in the environs of Goxhill, this settlement possessed a more elevated status, and, indeed, has more similarities with the high-status roadside/riverside settlements from the region, engaged in the regional trading of goods (*p 77*). Perhaps, tellingly, the settlement at Brocklesby Interchange was also positioned at the head of a former river channel, joining directly to the Humber (Cavanagh 2024, 42-5), which would have facilitated access to riverine traded goods and, perhaps, allowed the site to emerge as an important node in the local settlement hierarchy.

Further Romano-British settlements lay to the west, between Goxhill and South Ferriby, which include several that have been subjected to small-scale excavation (Allen *et al* 2016). These include one at Barrow-upon-Humber, probably occupied between the second and fourth centuries AD, which may have contained a stone building with a tiled roofed (Allen Archaeology 2010). A second, excavated at a water treatment plant, was positioned slightly further to the south-west and was defined by boundary ditches, an oven, and human burials (Williams 2001), whilst a third site, also associated with boundaries and burials, lay a few kilometres south of South Ferriby at Saxby Wold (Williams 2010). Therefore, these settlements seem comparable to those to the south-east of Goxhill and suggest that in the Roman period this entire foreshore area was largely characterised by small settlement units set within integrated systems of enclosures, fields, and trackways, indicating the presence of a managed agricultural landscape covering much of the area.

The presence of this open agricultural landscape is also evident from the pollen evidence, which continues the trend initiated in the later Iron Age (*Ch 3, p 61*). Indeed, regional pollen studies from profiles from the Bog at Roos and Sproatley Bog, on Holderness, on the opposite side of the Humber, suggest that, following the period of later Iron Age woodland clearance, there was no subsequent recovery of the woodland to significant levels during the Roman period (Tweddle 2000). It also seems that open grassland habitats were similarly used as pasture, with evidence of possible localised arable activity (*ibid*). In addition, it has been argued that, by the end of the Roman period, many areas of better soils in the Humber region would have been cleared of their tree cover for farming and pastoralism (Buckland 1973). Deforestation and agricultural intensification also seem to have contributed to Late Roman and post-Roman alluviation, with increased soil erosion leading to a significant influx of weathered sediment into the Humberhead levels during the later Roman period (*ibid*). This may also have been the result of a switch to winter wheat production, which would have made soils even more prone to erosion (*ibid*). Environmentally, this period also corresponds with fluctuating sea levels in the Humber, which might have influenced occupation across the estuary region. Specifically, for much of the Roman period, it seems that the estuary experienced a general trend towards falling sea levels (marine regression) or lower-amplitude tidal regimes, which, in some places, permitted expansion into areas that were previously too wet for settlement or farming (Metcalfe *et al* 2000). In contrast, some of the more marginal areas adjacent to the estuary appear to have been abandoned for settlement towards the end of the Roman period due to a rise in sea levels (Long *et al* 1998; Van de Noort 2004, 107).

Evolving Romano-British Settlement at Goxhill

During the later Iron Age, settlement in the main construction area appears to have been largely confined to Area C (*p 62*), being located immediately west of one of the main palaeochannels (***3183/2650***), which also defined the western side of an 'island', whose eastern side was bounded by another substantial palaeochannel (***2305***; *Ch 3, p 49*). Whilst Romano-British settlement initially seems to have continued in the same area, there appears to have been a gradual shift of focus eastwards over the course of the Roman period. This shift resulted in the eventual abandonment of the later Iron Age settlement, in Area C, which was converted to agricultural land, with occupation subsequently focusing on the 'island' in Area B and also, most probably, the area to its north-east where two earlier trial trenches (Trenches 35 and 36) had partially examined a dense area of cropmarks and geophysical anomalies suspected to relate to the settlement core (*Ch 1, p 6*; Fig 36).

In comparison to the later Iron Age settlement, the remains defining the Romano-British settlement were more plentiful and also exhibited a greater degree of stratigraphic complexity. Significantly, they included many inter-cutting features, which have allowed relative stratigraphic sequences to be discerned, and they also produced more finds, particularly pottery, which, along with a suite of radiocarbon assays (*p 132*), has been invaluable for dating activity across this area. Careful consideration of this stratigraphic and chronological evidence indicates that not all these remains were contemporary, but instead embodied three broad phases of settlement activity.

This comprised an initial phase of settlement (Phase RB.I; *p 81*), which, for all intent and purposes, was a continuation of the later Iron Age open settlement into the early stages of the Roman period; however, by this time settlement had also expanded out of the former Iron Age core and onto the adjacent 'island', though it seems the palaeochannels were still present but possibly no longer active. This was followed by

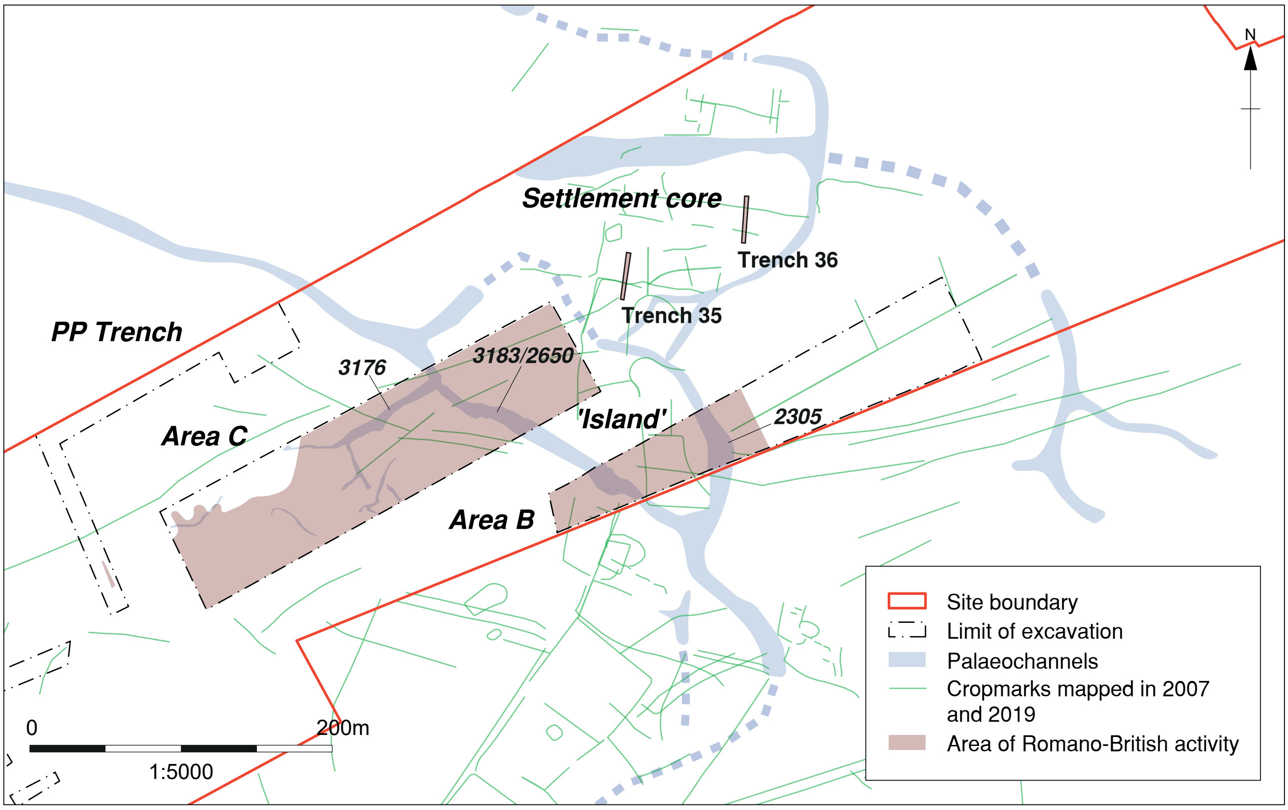


Figure 36: The extent of the Romano-British settlement in the main construction area

a period when circular, conjoined enclosures were established across the 'island' (Phase RB.II; *p 98*), some of which contained roundhouses, and then finally by the establishment of a rectilinear field/enclosure system (Phase RB.III; *p 106*), in the same area and beyond, which seems to have been contemporary with the core of the Romano-British settlement examined by the evaluation trenches (*p 80*), and also the wider cropmark evidence (*Ch 6, p 191*). Significantly, evidence for more buildings and industrial activity during this latter period was evident, with the buildings reflecting a shift in the vernacular architecture, from roundhouses to rectilinear structures. Furthermore, it is apparent that the palaeochannels had become completely silted prior to the establishment of the later Romano-British settlement and, therefore, no longer exerted any topographical constraints on the layout of the settlement's rectilinear enclosures.

The open settlement

Roundhouses

Within Area C, which witnessed occupation during the Late Iron Age (*Ch 3, p 65*), settlement continued, probably in an unbroken sequence, into the earliest part of the Roman period (Phase RB.I; Fig 37). As with its Iron Age precursor, this settlement was also characterised by unenclosed roundhouses defined by ring gullies. The largest of these was located at the junction of palaeochannels ***3176*** and ***3183***, which, as during the Late Iron Age, were progressively filling with alluvium. It was defined by two sequential, penannular ring gullies (***3227*** succeeded by ***3237***), enclosing an identical area, with a diameter of *c* 10.2 m (Fig 38). Both gullies were U-profiled, up to 0.75 m wide, and 0.3 m deep, with a gap, *c* 2.2 m wide, to the east, presumably marking the position of an entrance (Pl 25). Both also seem to have been periodically cleared of silt and they contained domestic refuse, suggesting that they remained open whilst the building was in use. They are therefore likely to have functioned as drains, rather than construction trenches, as seems the case with the gullies defining the roundhouses in the Iron Age settlement (*Ch 3, p 69*). The only feature within the interior was a short, L-shaped gully (***3262***; 0.7 x 1.3 m, overall, and 0.2 m wide), just to the south of the entrance, which possibly represented an internal division or perhaps another drain.

In addition to this large house, a smaller roundhouse (***3242***; Pl 26) was also present in Area C, on the northern side of palaeochannel ***3176*** (Figs 37 and 38). This had a 5.9 m diameter, a south-east-facing entrance, and its ring-gully (0.85 m wide and 0.2 m deep) produced occupation debris, which again suggests that this was a drain, rather than a construction trench; however, no surviving structural features, such as postholes, were recorded within its interior.

Whilst it is clear that occupation continued in Area C in the early part of the Roman period, it is also evident that

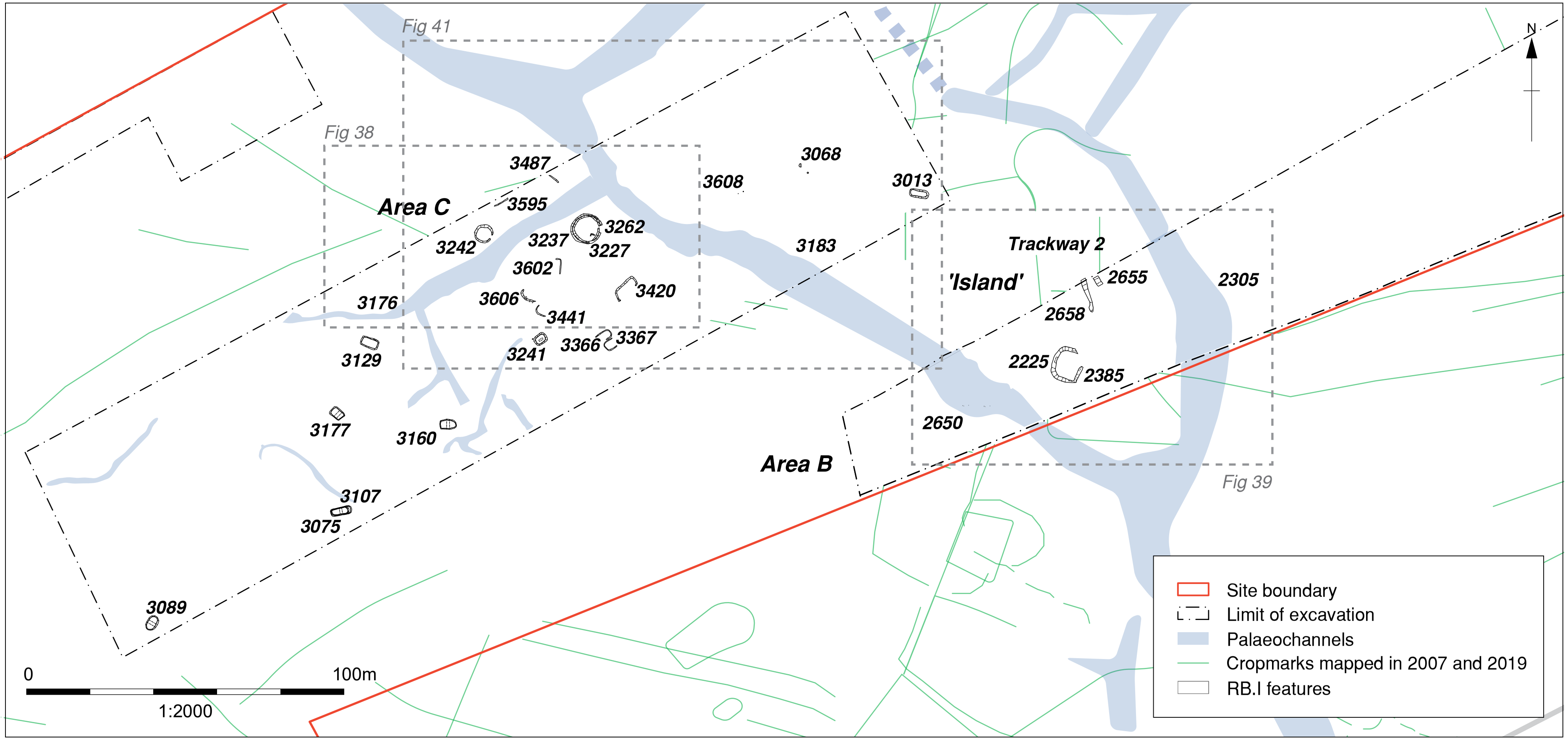


Figure 37: The Romano-British (Phase RB.I) open settlement

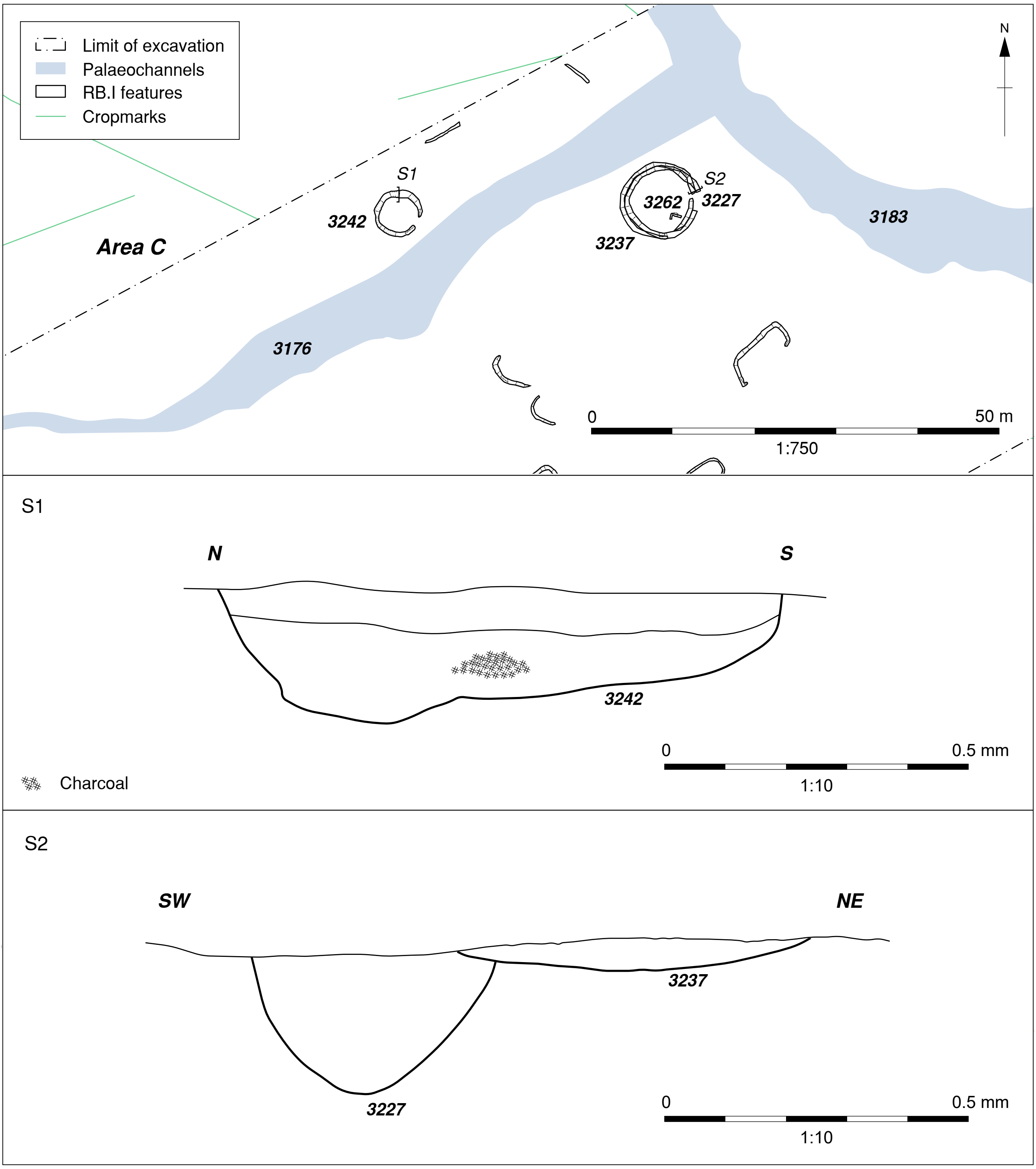


Figure 38: The Romano-British (Phase RB.I) roundhouses in Area C

Area B, on the 'island' to the east (*p* 80), formed an active part of this settlement (Fig 37). This was evidenced by the remains of a large roundhouse (***2225/2385***) situated in the area between palaeochannels ***2305*** and ***2650*** (Fig 39). It had a *c* 11.5 m diameter, being slightly bigger than its counterparts to the west in Area C, though it was similarly defined by a U-shaped gully, 1.2 m wide and 0.5 m deep, with a break on the north-eastern side denoting the position of an entrance/threshold (Pl 27). The gully also contained domestic refuse and, again, seems to have functioned as a drain surrounding the original footprint of the roundhouse, although no structural remains for this were present within the interior of the defined area.

Sub-rectangular structures

In addition to the roundhouses, a group of gullies or slots were present that all shared a broadly similar, sub-rectangular ground plan. In total, 14 examples were recorded in Area C, of which eight (***3013***, ***3075***,

*Plate 25: Roundhouse **3227**/**3237**, Area C, looking west*

*Plate 26: : Roundhouse **3242**, Area C, looking north-west*

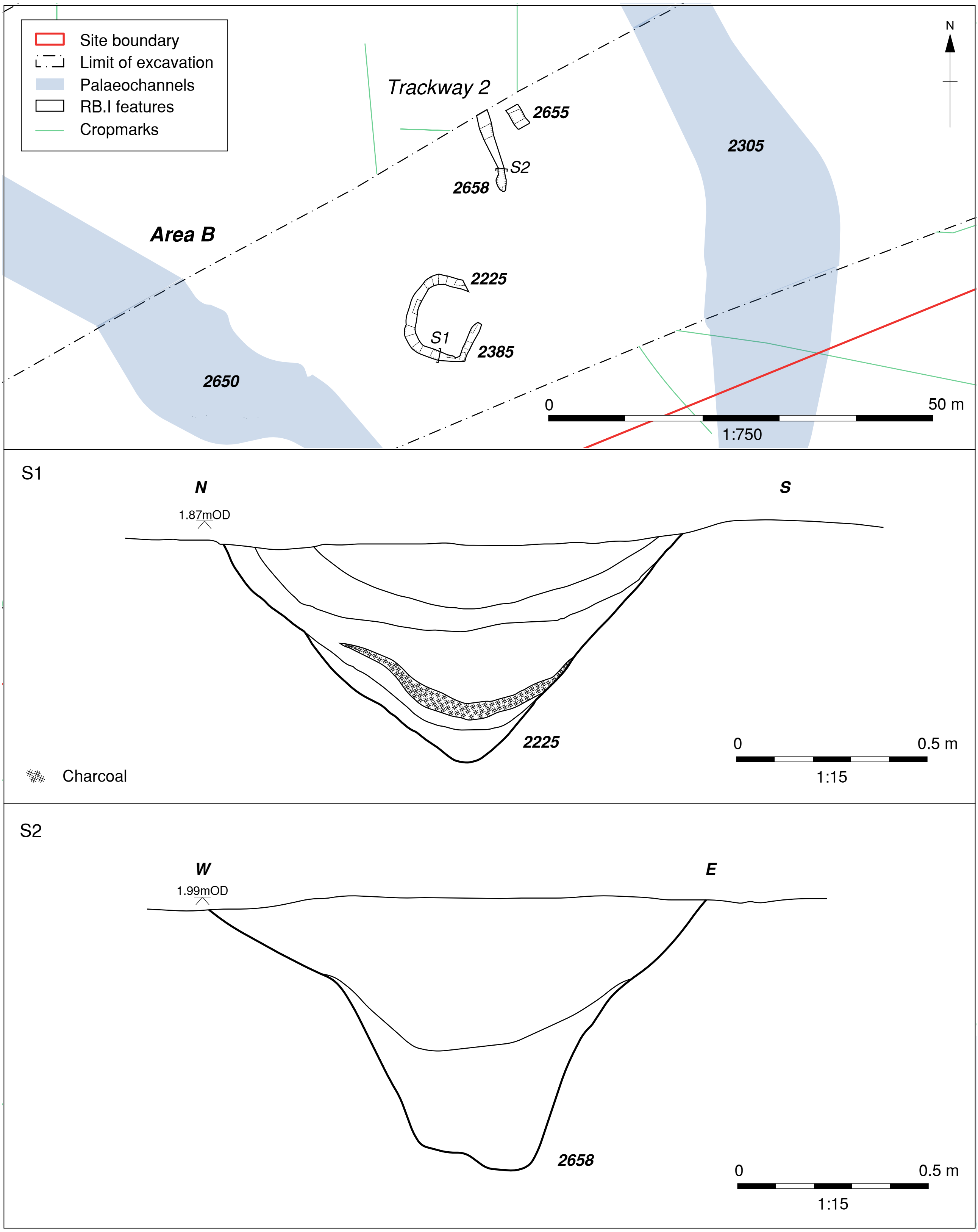


Figure 39: The Romano-British (Phase RB.I) roundhouse and trackway in Area B

3089, ***3107***, ***3129***, ***3160***, ***3177***, and ***3241***) were complete (Pl 28) and six (***3366***, ***3367***, ***3420***, ***3441***, ***3602***, and ***3606***), were more-or-less fragmentary (Figs 37 and 40). The majority were scattered across the former core area of the Iron Age settlement, to the west of palaeochannel ***3183***/***2650*** and south of palaeochannel ***3176***, which also contained roundhouse ***3227***/***3237*** (*p 81*), with just one example (***3013***) being present on the 'island', positioned to the north-west of roundhouse ***2225***/***2385*** (*p 83*; Fig 37).

Plate 27: Roundhouse **2225/2385***, Area B, looking north-east*

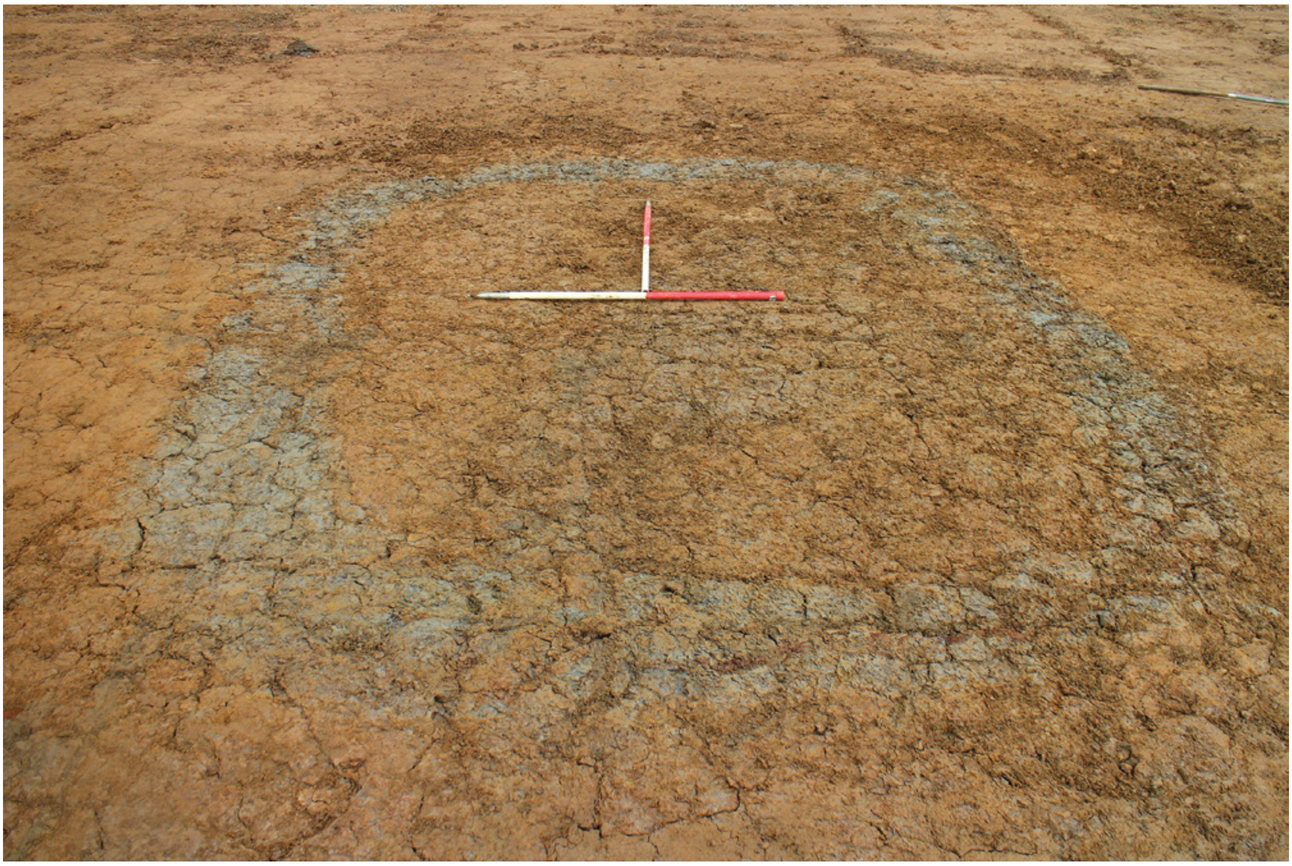


Plate 28: Sub-rectangular gully **3241** *before excavation, looking north-east*

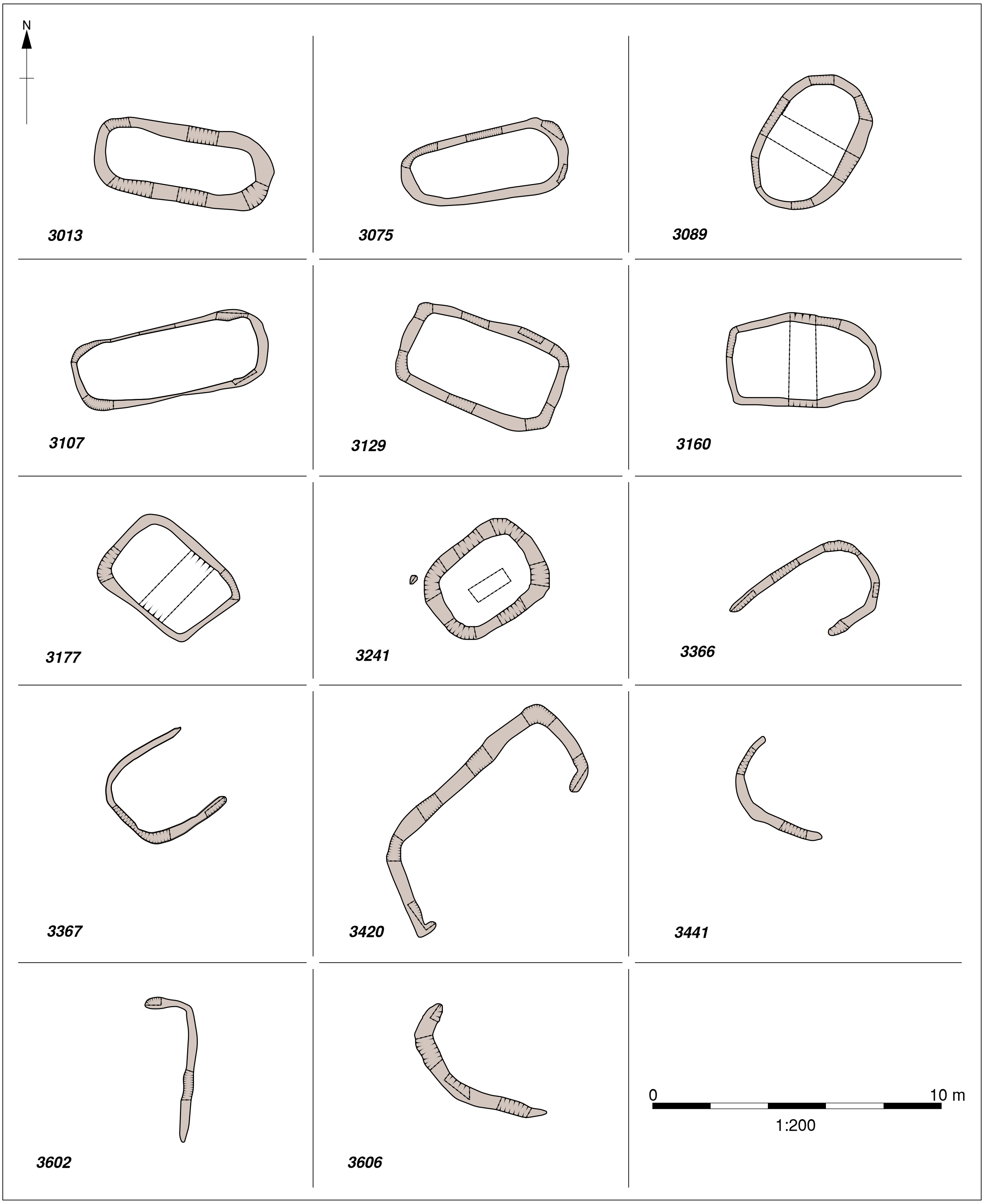


Figure 40: The sub-rectangular gullies associated with the open settlement (Phase RB.I)

Stratigraphically, some of these sub-rectangular gullies were clearly later than the roundhouses associated with the Iron Age settlement. Specifically, gullies ***3366*** and ***3367*** post-dated Iron Age roundhouse-gully ***3340*** (Pl 29), forming an element of the earliest Iron Age settlement (*Ch 3, p 62*), and gully ***3606*** was later than roundhouse-gully ***3597***, part of the later Iron Age settlement (*Ch 3, p 67*). One (***3441***) also contained Roman pottery (*p 92*) and this, together with the stratigraphic evidence, seems to suggest that some, if not all, of these sub-rectangular gullies were contemporary with the early (Phase RB.I) Romano-British roundhouses. Nevertheless, it is of course possible that a few of the isolated and

Plate 29: Sub-rectangular gullies **3366** *and* **3367***, cutting the gully (***3340***) for an earlier roundhouse, looking north-west*

artefactually barren examples might date to earlier or later periods.

The gullies defining these sub-rectangular features/ structures were of broadly similar size (Pl 30), with the majority in the range *c* 0.3-0.4 x 0.15-0.3 m (Table 18). Most had steep-sided, U-shaped profiles, with a few that were more V-shaped in form. One example also had some longevity, as it was represented by sequential gullies, with gully ***3107*** being a directly replacement for gully ***3075***.

Their internal areas varied from 12.65-19.38 m^2 for the complete examples, though most were *c* 13-17 m^2, and whilst the majority had rounded short ends, a few exhibited a more 'regular' rectangular plan (Fig 40).

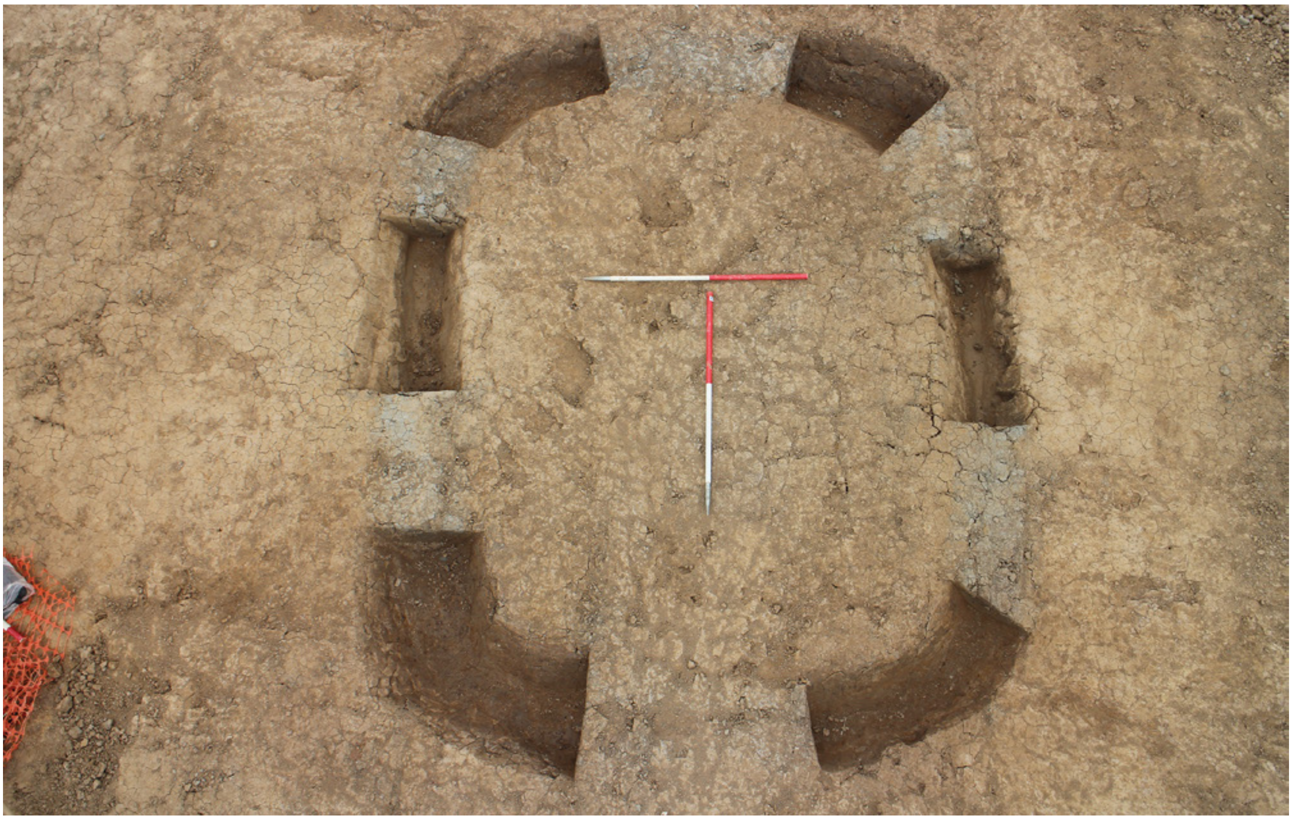


Plate 30: Sub-rectangular gully **3241** *partly excavated, overhead view*

Gully	Internal dimensions	Internal area (m^2)	Gully width (maximum)	Gully depth (maximum)
Complete				
3013	6.16 x 2.65 m	16.32	0.67 m	0.47 m
3075	5.75 x 2.2 m	12.65	0.33 m	0.16 m
3089	4.95 x 3.4 m	16.83	0.40 m	0.30 m
3107	6.7 x 2.5 m	16.75	0.34 m	0.35 m
3129	5.7 x 3.4 m	19.38	0.50 m	0.30 m
3160	5.46 x 3.26 m	17.80	0.35 m	0.30 m
3177	4.25 x 3.1 m	13.18	0.45 m	0.20 m
3241	4.2 x 3.2 m	13.44	0.64 m	0.42 m
Incomplete				
3420	7.4 x 2.75 m	20.35+	0.70 m	0.17 m
3441	5.6 x 2.75 m	15.40+	0.30 m	0.15 m
3366	4.5 x 2.9 m	13.05+	0.27 m	0.08 m
3367	3.6 x 3.3 m	11.88+	0.28 m	0.14 m
3602	4.5 x 1.5 m	6.75+	0.30 m	0.10 m
3606	5.4 x 2.8 m	15.12+	0.30 m	0.10 m

Table 18: The characteristics of the sub-rectangular gullies from the open settlement (Phase RB.I)

No internal features or deposits were recorded and the function of these features therefore remains elusive, although some suggestions can be made (*Ch 6, p 183*).

Trackway and other features

Several other contemporary elements of the settlement were also present on the 'island' between the palaeochannels (in Areas B and C), and in the area to the west (in Area C). On the 'island', in Area B, these included a trackway (Trackway 2; Fig 39), just to the north-east of roundhouse ***2225/2385*** (*p 83*). It entered Area B from the north, on a north-west/south-east alignment, and was traced south-eastwards for *c* 10 m, before petering out. The trackway was 3.4 m wide and defined by a pair of roughly parallel ditches (***2655*** and ***2658***), 1.35-1.75 m wide and 0.6-0.7 m deep, with U-shaped profiles. In a similar way to the adjacent roundhouse, it was truncated by features associated with later phases of Romano-British occupation.

Other possibly contemporary features on the 'island' lay to the north (in Area C; Fig 41), in the vicinity

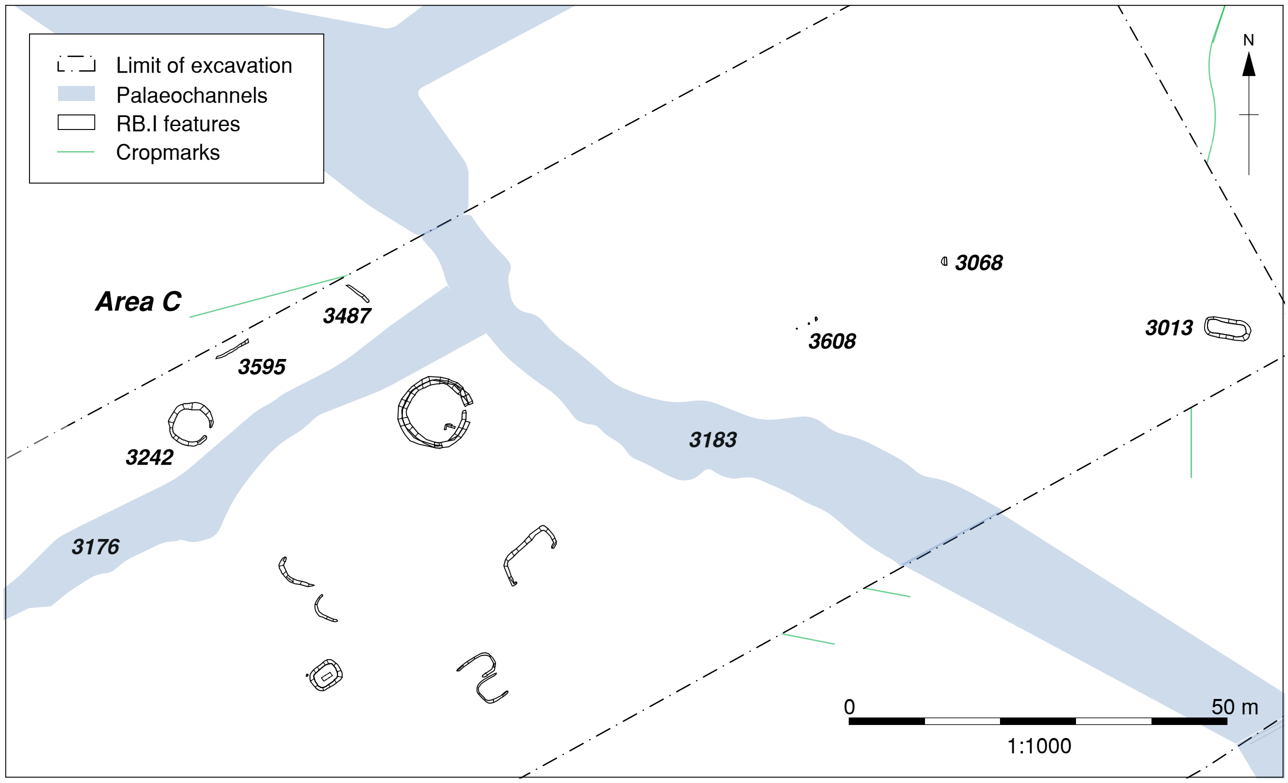


Figure 41: Settlement features (Phase RB.I) on the 'island' and in the area to the west

of sub-rectangular structure ***3013*** (*p 83*). These included a north-east/south-west-aligned row of three small, shallow pits or hollows (***3608***) to the east of palaeochannel ***3183***. They contained small quantities of charcoal and other burnt material, and moderate amounts of animal bone (*p 97*), suggesting they may have formed rubbish pits. Approximately 21 m to the north-east, another pit (***3068***) was also identified.

In the area to the west, to the north-east of roundhouse ***3242*** (*p 81*) were two isolated gullies (***3487*** and ***3595***) on the northern edge of Area C. These were both 0.4 m wide, the former being 3.5 m long, whilst the latter extended for 4.8 m; they continued outside the excavation area, making them difficult to interpret. They are presumed to be contemporary with the roundhouse, although the possibility that they were associated with the earlier settlement cannot be entirely ruled out.

The sediments in the gullies and trackway ditch
R I Macphail and C J Carey

As with the gullies surrounding the Iron Age roundhouses (*Ch 3, p 69*), initially, it was slightly unclear whether the roundhouse and sub-rectangular gullies represented drains or structural features, which may have secured timber uprights. Detailed soil micromorphological and geochemical analysis on the sediments in one of the sub-rectangular gullies (***3606***; *p 85*), and also those in a roundhouse gully (***2225/2385***; *p 83*), was therefore undertaken in an attempt to clarify their function and also to see if they contained any pertinent data relevant to activity in the settlement, more generally.

It was evident from this analysis that sub-rectangular gully ***3606*** had been cut into the natural fluvioglacial geology (***3003***) and it contained coarse silts and loamy coarse silt sediments (***3603***) that included very fine and fine sand (Pl 31). This suggests that once created the gully remained open and then rapidly filled with waterborne deposits, probably transported during the flooding of Area C. Although this sediment had been subjected to very broad and broad-burrow mixing, notably it contained concentrations of charred plant remains and charcoal (Pl 32), including monocotyledonous plants (2.55% LOI), which seem to point to the local management of the landscape by fire. Moreover, it is possible that charred coastal wetland plants may have contributed to the small concentrations of potassium and zinc (0.16% K; 0.007% Zn) recorded in the sediments. These sediments also contained eroded organic deposits/topsoil, whilst the geochemical evidence indicates that it was affected by groundwater leaching (0.48% Ca; 0.07% P; 0.06% Mn; very low magnetic susceptibility enhancement) and post-depositional

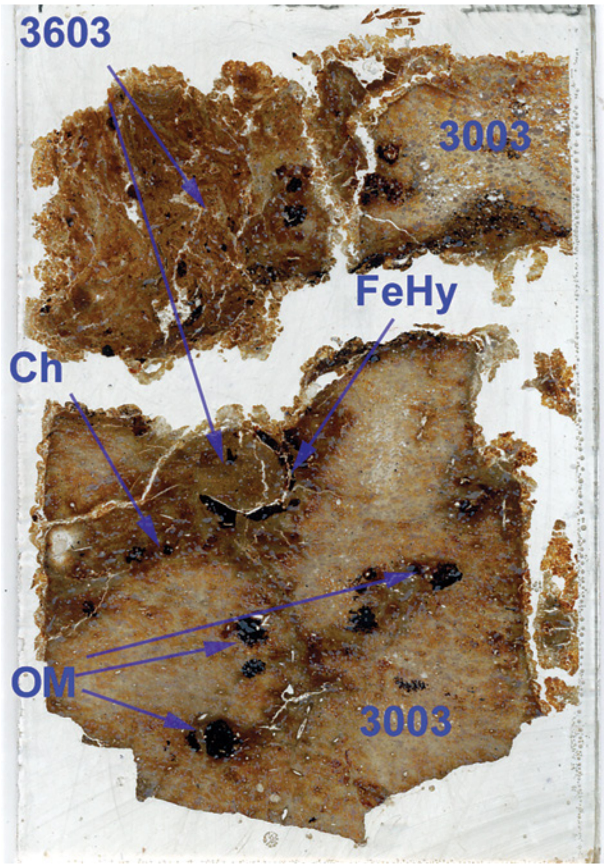


*Plate 31: Photomicrograph of the natural (***3003***) and overlying coarse silts and loamy coarse silt sediments (***3603***), in gully* ***3606***, *with broadly burrowed down very fine charcoal-rich silty clays (Ch) and locally eroded soil clasts (OM). Post-depositional rooting led to the formation of a 10 mm-wide iron channel hypocoating (FeHY). PPL, frame height is ~90 mm*

iron mottling (1.56% Fe; Crowther 2003; Vepraskas *et al* 2018).

Similarly, the basal sediments (***2311***) in roundhouse-gully ***2225/2385*** comprised layered and laminated silty clays, typical of those found on estuarine mud flats (Reineck and Singh 1986). This seems to reflect silting associated with brackish water (Pl 33), indicating that the 'island' (in Area B) was also subjected to flooding. It appears that during silting, charcoal and burnt materials were washed into the gully, which were perhaps derived from domestic activity within or close to the roundhouse. Above this deposit was sediment ***2312***, which was rich in sub-horizontally oriented monocotyledonous charcoal (15.2% LOI), fine fragments of burnt clay, and both burnt and leached bone fragments, probably representing charred waste from a hearth that had been dumped into the gully. This was also confirmed by the high magnetic susceptibility enhancement of the deposit and also by the high amounts of mobilised clay, which could be due to the ash from a hearth; specifically, ash releases potassium (K), which is known to actively

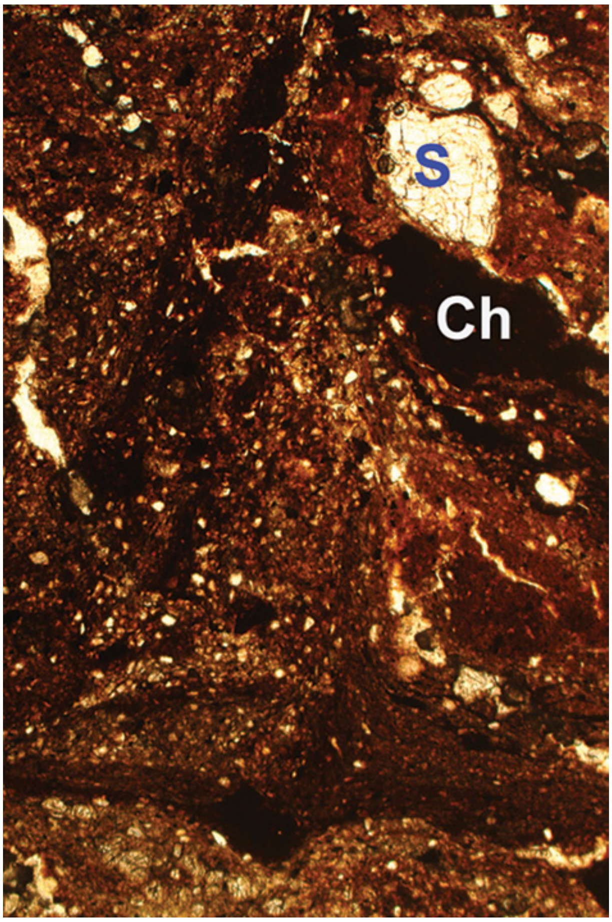


Plate 32: Photomicrograph of deposit **3603***, in gully* **3606***, showing charcoal (Ch), below a fine-grained sand (S). PPL, frame width is ~4.62 mm*

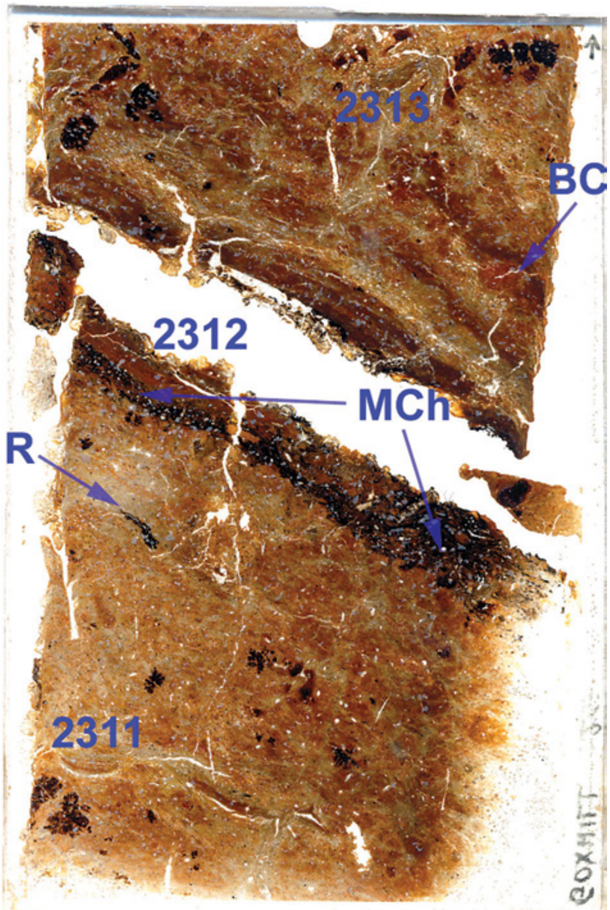


Plate 33: Photomicrograph of basal deposit **2311***, in gully* **2235/2385***, with relict roots (R), very fine charcoal, clayey panning, and probable gypsum in root channels. This is below deposit* **2312***, which is characterised by sub-horizontally oriented monocotyledonous charcoal (MCh) and fine bone fragments. Upper deposit* **2313** *is much less charcoal-rich, but includes a burnt soil-sediment clast (BC). PPL, frame height is ~90 mm*

mobilise clays in fire settings (Courty and Fedoroff 1982). Moreover, these findings are consistent with the bulk sample data for deposits ***2311/2312*** (*ie* 36.6% CO_3; 2.22% Fe, 1.01% Ca, 0.19% K; and 0.12% P) and presumably this hearth was associated with the occupation of the roundhouse. This deposit was then sealed by a third and final deposit (***2313***), which only included traces of occupation activity. It represented a laminated iron-depleted sediment, comparable to the basal deposit (***2311***), testifying to the final silting of the gully with brackish water, probably during the flooding of the site.

The evidence therefore seems to suggest that the sub-rectangular gully (***3606***) and roundhouse gully (***2225/2385***), and presumably the other similar gullies from the settlement, functioned as drains, as opposed to construction trenches, that were needed due to the wet conditions that existed across the settlement. It also appears that the source of this brackish water was from the nearby palaeochannels, associated with the tidal creek, which at certain times may have overflowed, resulting in the flooding of the settlement. Regarding the function of the structures, charred waste, including fragments of animal bones, entered the roundhouse gully (***2225/2385***), implying that it enclosed a domestic structure. Charred materials were also present in the sub-rectangular gully (***3606***), though these could represent 'background' evidence for burning around the settlement area.

Perhaps significantly, as suggested for the Iron Age roundhouses (*Ch 3, p 70*), any associated structures within the areas defined by both, rather different, gullies have either been destroyed, or the materials that were used have left no archaeological trace. With this in mind, tellingly, the presence of eroded organic deposits/topsoil in sub-rectangular gully ***3606*** (*p 90*; Pl 34) might tentatively suggest that these were derived from a turf wall set on the inner edge of the drain surrounding the sub-rectangular structure.

In addition to the sediments in the gullies, those from one of the ditches (***2658***) defining Trackway 2 (*p 89*) were also subjected to detailed analysis to determine if

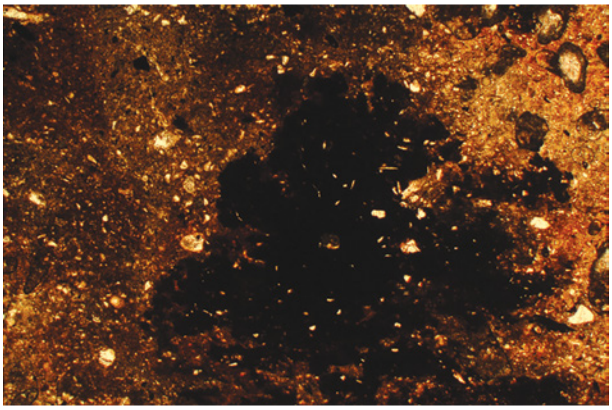


Plate 34: Photomicrograph of deposit **3603**, *in gully* **3606**, *under OIL, showing iron and probable manganese stained organic soil. PPL, frame width is ~4.62 mm*

this feature had captured any evidence for surrounding activity. Analysis indicated that the lower muddy fill (***2512***) contained good evidence for burning, which probably derived from activity in the nearby settlement (Pl 35). This comprises abundant levels of fine charcoal, as well as coarse charcoal, which includes wood charcoal and iron-stained charcoal, together with burnt silt, possible burnt topsoil, and charred bone, consistent

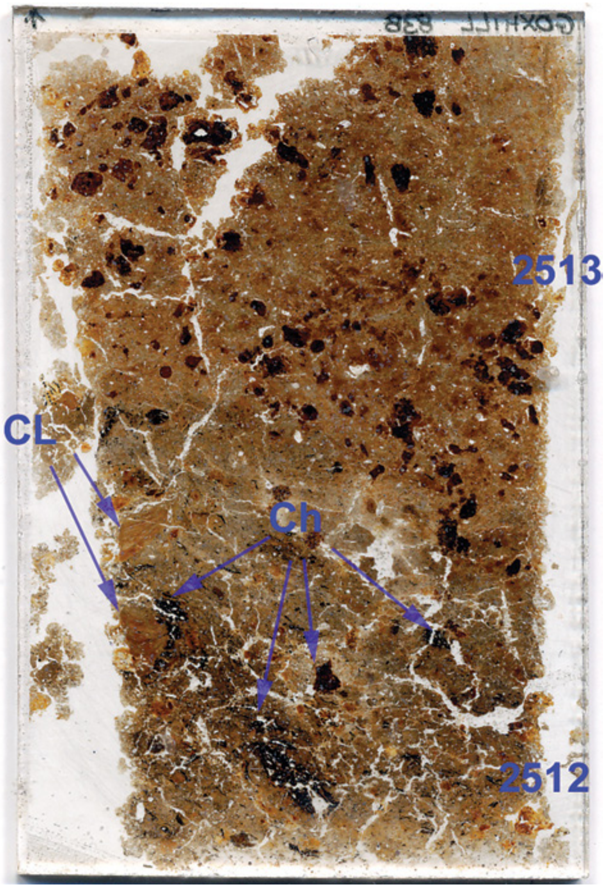


Plate 35: Photomicrograph of charcoal-rich (Ch) deposit **2512**, *in ditch* **2658**, *with microlaminated inwash clays (CL), overlain by silty clay* **2513**, *characterised by iron mottling. PPL, frame height is ~90 mm*

with a moderate organic-matter content (6.01% LOI). Some of the charcoal is also coated with iron-clays that may relate to sediment slaking in fire installations, due to ashes releasing potassium (*p 90*), as well as much phosphate (0.22% K; 0.44%P; 1.30 Ca; Courty and Fedoroff 1982). Of additional interest is the small concentration of heavy metals/pollutants, specifically copper, zinc, and arsenic (46 mg/kg Cu; 96 mg/kg Zn; 14 mg/kg As), indicating probable use of non-ferrous metal tools and utensils.

As with the gullies surrounding the sub-rectangular structure and roundhouse, the trackway ditch also produced additional evidence for wet conditions, as its upper deposit (***2513***) exhibited microlaminations typical of flooding and alluviation (Pl 36). Moreover, this deposit had experienced iron mottling and contained depleted sediments suggestive of fluctuating water tables, following its accumulation (Pl 35).

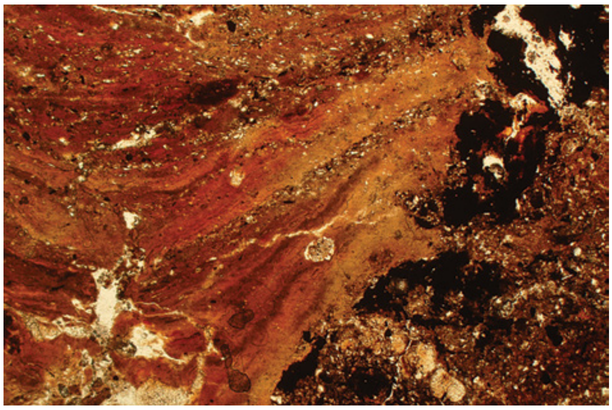


Plate 36: Photomicrograph of microlaminated clayey infill in ditch **2658**. *PPL, frame width is ~4.62 mm*

Artefacts

Coarse-stone tools

C Howard-Davis

Two coarse-stone tools were recovered from the early roundhouses in Area C (Fig 42). These comprise a hand 'rubber' (OR 1149; used in association with a saddle quern to grind a range of substances, amongst them grain) from the terminus of ring-gully ***3227*** (*p 81*), whilst a fine white (?crystalline) stone object (OR 1125) from ring-gully ***3242*** (*p 81*) appears to have been modified by use, creating an irregularly faceted surface. Burnt stone, presumably related to domestic occupation, was also present in ring-gully **2225**/***2385*** in Area B (*p 83*).

Pottery

The gullies for both the roundhouses and sub-rectangular structures, and one of the ditches (***2658***) for Trackway 2, produced a very small assemblage of pottery (*Appendix 1*). This comprises 138 sherds (0.803 kg; 0.19 RE) from a maximum of 24 vessels produced in several different fabrics (Table 19).

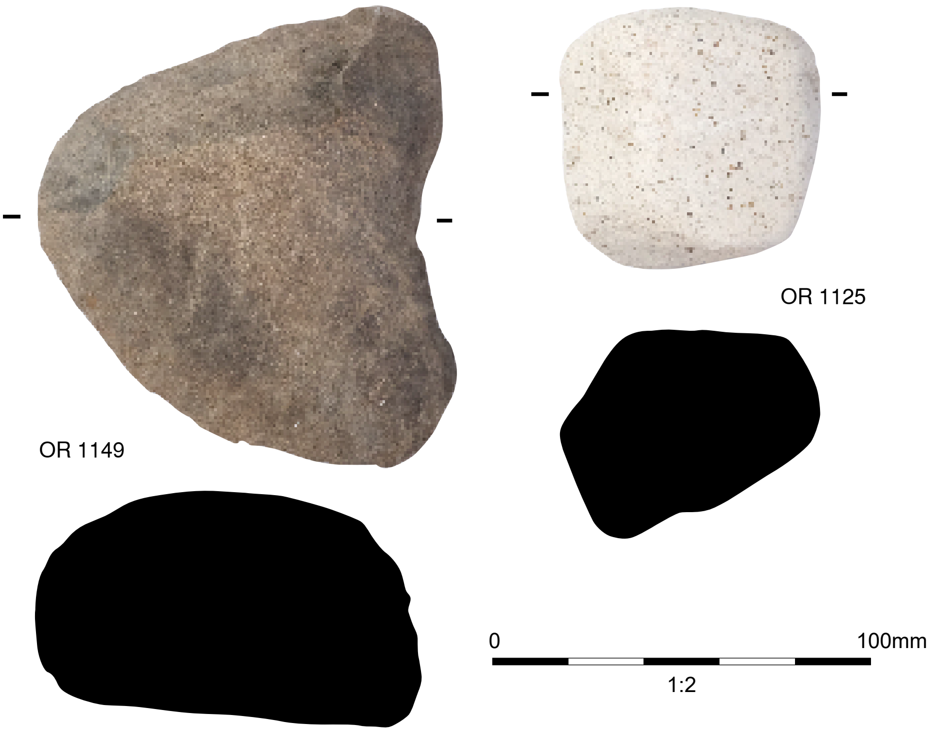


Figure 42: The coarse-stone tools from ring-gullies **3227** *(OR 1149) and* **3242** *(OR 1125)*

Feature	Pottery group	Fabric type	Number of sherds	Weight (g)	Number of vessels	*Total RE%*
Ring-gully ***3227***	Calcareous	IASH7	31	350	2	
		SHEL	18	16	1	
		VESIC	5	2	1	
		DWSHT?	6	54	1	
	Reduced	GREY3	3	5	1	
Ring-gully ***3237***	Calcareous	IASH3	12	24	1	***0.02***
	Reduced	GREY3	4	7	1	
		IAGR2	2	30	1	
Ring-gully ***3242***	Calcareous	IASH3	29	57	2	
	Reduced	GREY1	2	13	1	
		IAGR2	8	23	1	
Ring-gully ***2225/2385***	Reduced	GREY1	2	53	2	***0.06***
		NWLGR	1	3	1	
		SFGR	1	12	1	
		IAGR1	1	25	1	
		IAGR2	5	58	3	***0.07***
		IAGR	1	6	1	
Sub-rectangular gully ***3441***	Reduced	IAGR2	1	4	1	***0.02***
Trackway 2	Reduced	IAGR2	6	61	1	***0.02***
Total			***138***	***803***	***24***	***0.19***

Note: this excludes residual Iron Age sherds (IASH3) from gully ***3606*** (*Ch* 3, *p* 73)

Table 19: Stratified pottery from the open settlement (Phase RB.I)

Many of the sherds represent calcareous gritted-wares, which include vessels in fabrics IASH3 and IASH7 from ring-gullies ***3227***, ***3237***, and ***3242*** (*p 81*). Of these, IASH3 is a relatively fine fabric and also the principal type represented in the pottery assemblage from the (Pre-Roman) Iron Age settlement in Area C (*Ch 3*, *p 74*). In contrast, IASH7 is a coarser handmade shell- and grog-gritted fabric, and all the vessels in this fabric were concentrated in ring-gully ***3227***, with most deriving from a single very abraded jar base, although a single body sherd from a large jar or bowl was also present. It is possible that this type of (Pre-Roman Iron Age) pottery continued to be available in the mid-/late first century AD. The other calcareous gritted-wares were, again, all from ring-gully ***3227*** and include those in SHEL and VESIC fabrics, with the former relating to otherwise uncategorised and largely handmade shell-gritted wares, and the latter to those sherds with a vesicular fabric, probably caused by the shell temper leaching from the fabric.

In addition to the calcareous gritted-wares, ring-gullies ***3227***, ***3237***, and ***3242*** also contained reduced grey wares, as did ring-gully ***2225/2385*** (*p 83*). Several different fabric types are represented (Table 20), which comprise GREY1, from gullies ***3242*** and ***2225/2385***, and includes a bowl or dish from the latter (Fig 43.1), GREY3 from gullies ***3227*** and ***3237***, and NWLGR and SFGR, both from gully ***2225/2385***. It seems likely that many of these wares were locally produced. It is possible, for instance, that GREY1 was produced in kilns at Barnetby Top, and other kilns in the north-eastern Lincolnshire area including Market Rasen (Samuels 1979; 1983; Darling 2005a; 2007; nd: Rowlandson 2022), whilst it is notable that GREY3 includes typically earlier Roman forms similar to the repertoire and firing colours seen from elsewhere in Lincolnshire (Rowlandson *et al* 2011). Indeed, some vessels from

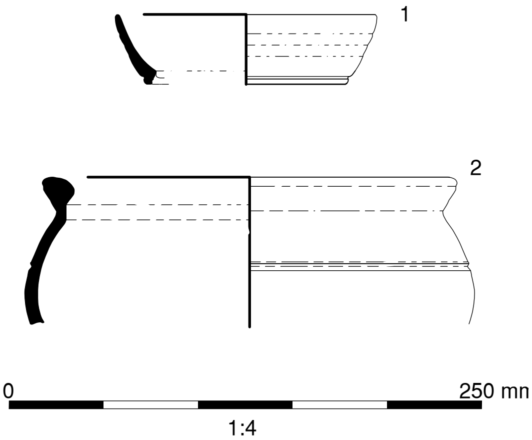


Figure 43: A grey ware (GREY1) bowl or dish (1) and a transitional ware (IAGR1) jar (2) from the open (Phase RB.I) settlement

the Market Rasen kiln have similar firing and quartz-gritted fabrics, although other more local kilns were also probably active in the Early to Mid-Roman period. The NWLGR is 'blue-grey ware', representing wheel-thrown pottery that was most likely produced in the Dragonby area (Gregory 1996). Many of the vessels reported on from Melton, East Yorkshire, would also fit comfortably with this fabric type (Precious *et al* 2011). SFGR is probably also another locally produced ware and the range of forms would suggest production in the later first to second century AD (*cf* Dudley 1949; Darling 2005b; Firth *et al* 2010).

The final pottery type recovered from the open settlement comprises transitional coarse gritted wares, including shell-, grog-, and coarse quartz-tempered fabrics. These represent another reduced ware that was developed in the Conquest period and suspected to be produced until sometime in the second half of the second century AD (Leary 2013; Darling and Precious 2014;

Fabric type	**Description**
GREY1	Grey ware reduced fabric 1: mid-green-grey occasionally with dark grey core, wheel-made pottery. Quartz moderate to common sub-rounded with some glassy grains, 0.2-0.8 mm. Ferrous inclusions sparse, sub-rounded, 0.25-0.5 mm. Some sherds have rare, angular grey flint up to 2.5 mm. No mica evident
GREY 3	Grey ware reduced fabric 2: mid- to dark grey surfaces often with oxidised (orange margins). Common to abundant sub-rounded and angular quartz 0.2-0.5 mm, common red or black angular or sub-rounded ferrous rich grains 0.2-0.8 mm, with no mica is evident
NWLGR	North-west Lincolnshire grey ware: dark grey to mid-grey core with a slightly hackley fracture. Common sub-angular translucent (some clear) quartz 0.25-0.5 mm; occasional sub-rounded dark inclusions ?Fe >1 mm; sparse fine silver mica; some sherds have rare rounded white ?limestone 0.3 mm
SFGR	South Ferriby grey ware: pale grey core with mid-grey surfaces, slightly concoidal break. Pitted surfaces due to the calcareous parent clay, often with voids left by the surfaces. Occasional to moderate sub-rounded clear quartz *c* 0.5 mm; sparse fine silver mica 0.1-0.25 mm visible on the surfaces and often in the break. Many of the small bowls and dishes are burnished to a blue- grey sheen. Surfaces are often pitted where red ?chalk may have leached out. Variants in the fabric are evident, some coarser variants have surviving flecks of red ?chalk

Table 20: The grey ware pottery fabrics associated with the open settlement (Phase RB.I)

Rowlandson *et al* 2017; Rowlandson and Fiske 2024). The transitional wares were harder fired than their Iron Age precursors, with more consistent surface colours, suggesting a more controlled kiln environment, and they also show greater evidence for wheel finishing or wheel throwing. The range of forms produced in transitional fabrics include jars and large bowls with wedge-shaped rims, as well as jars with everted rims or hooked everted rims (*cf* Rigby and Stead 1976, fig 64.4).

Across the entire assemblage of transitional wares recovered from Areas B and C, five different fabrics are present, though just three of these are reflected in sherds from the open settlement (Table 21). These include IAGR1 and, although only one sherd in this fabric was recovered from the open settlement (in ring-gully ***2225/2385***; *p 83*), it seems from the larger assemblage that it was mostly utilised for: large bowls, some with wedge-shaped rims; jars with hooked everted rims; lug-handled jars; and large-necked storage jars. More common is IAGR2 (from ring-gullies ***3237***, ***3242*** (*p 81*), and ***2225/2385***, sub-rectangular gully ***3441*** (*p 85*), and Trackway 2; *p 89*), which was probably produced in locations where there was access to Jurassic strata, although there is also evidence that at least some was produced in the vicinity of South Ferriby (Firth *et al* 2010). This was used to produce wheel-thrown or wheel-finished vessels, with the range of vessel types probably being very similar to that of IAGR1, including a shell-gritted jar with the typical wedge-shaped rim from ring-gully ***2225/2385*** (Fig 43.2). The other fabric type, IAGR, resembles the transitional wares but could not be assigned to a specific fabric type.

The function and use of the ceramic vessels

A sherd from a shell-gritted jar with a wedge-shaped rim (*above*; Fig 43.2), found in roundhouse ring-gully ***2225/2385*** (*p 83*), was subjected to organic residue analysis (sample GOX024A/B) to determine its contents (*Appendix 2*). This indicated that it contained ruminant adipose fats, implying it was solely used to process animal carcasses from cattle, sheep, or goat. Moreover, the lipids were mainly found in the rim area, suggesting that the vessel was used to boil these carcasses and hence probably functioned as a 'stewpot'.

Another sherd from ring-gully ***3237*** (*p 81*) was similarly subjected to organic residue analysis. This sherd (sample GOX031; *Appendix 2*) is from an IASH3 vessel (a type also present in the later Iron Age settlement; *Ch 3*, *p 74*), and although it contained a mix of ruminant and adipose fats, it seems primarily to have been used to process dairy products. This was also the case with the IASH3 sherds subjected to analysis from the later Iron Age settlement (*Ch 3*, *p 74*).

Plants and animals

D Druce and J Meen (charred plant remains) and I Smith (animal bone)

Following assessment (*Ch 1*, *p 14*), two bulk samples from roundhouse ring-gully ***2225/2385*** (*p 83*) were identified as containing charred plant remains. These were therefore subjected to detailed analysis and, importantly, they provide information on the potential economy of the open settlement (Table 22). Specifically, the samples indicate that cereals and arable farming were a feature of the settlement, as they contained low quantities of cereal grains and chaff. Although some are indeterminate, they do include hulled barley (*Hordeum distichon/vulgare*), oats (*Avena* sp), and wheat (*Triticum* sp), together with one plump grain similar in appearance to a free-threshing variety such as bread wheat (*Triticum aestivum*), though the morphological overlap of cereal grains from wheat species, combined with a lack of diagnostic chaff, means bread wheat's presence is very tentative (Hillman *et al* 1996). In addition, common ruderals indicative of cultivated or waste/rough ground are present, such as common chickweed (*Stellaria media*), fat-hen (*Chenopodium album*), brome (*Bromus* sp), and mayweed (*Tripleurospermum*), the latter more commonly recorded in later Roman and medieval assemblages from Britain (Greig 1991; Hall and Huntley 2007). A single cultivated flax (*Linum usitatissimum*) seed was also recovered, as well as a large pea (Fabaceae/*Pisum sativum*?), which could represent a cultivated variety, although it was lacking the diagnostic hilum to confirm this. Gathered food remains were represented by apple/pear (*Malus*/*Pyrus*) seeds.

Other notable remains comprise possible common mallow (*Malva sylvestris*) seeds, which, once considered native, is now classed as an archaeophyte, given it has been rarely recorded in Britain prior to

Fabric type	Description
IAGR1	Iron Age tradition 'Gritty' fabric 1: grog-gritted fabric, often with patchy surface colours
IAGR2	Iron Age tradition 'Gritty' fabric 2: shell- and sand- gritted fabric with some vessels including sparse grog. This fabric, typically with even dark grey to black surface colours and commonly showing evidence of being wheel thrown or wheel finished, appears to have taken over from the IASH type fabrics. The vessels also include smaller quantities of quartz sand and grog
IAGR/IAGR?	Miscellaneous fabrics broadly resembling the transitional wares

Table 21: The transitional ware pottery fabrics associated with the open settlement (Phase RB.I)

Taxa	*Common name*		
Cereals			
Avena sativa/fatua	wild/cultivated oat		3
Hordeum distichon/vulgare Spelzgerste	hulled barley		2
cf Triticum aestivum sl	bread wheat		1
Triticum sp	wheat		1
Cerealia indet	indeterminate cereals		13
		Total cereal grains	**20**
Cereal chaff			
Hordeum distichon/vulgare	cultivated barley rachis segment		1
Cerealia indet	indeterminate cereal culm node		2
		Total cereal chaff	**3**
Avena sativa/fatua	wild/cultivated oat awn fragments		+
Cerealia indet	indeterminate cereal awn fragments		+
Cerealia indet	indeterminate cereal culm fragments		+
Other cultivars			
Linum usitatissimum	flax		1
Cultivated/wild food sources			
Malus/Pyrus	apple/pear		93
Lathyrus/Pisum/Vicia	tare/vetch/pea seed fragments		1
Wild taxa		***Habitat (after Stace 2019)***	
		Cultivated/arable/ waste places	
Aphanes sp	parsley-pierts		1
Chenopodium album	fat-hen		4
Stellaria media	common chickweed	also open ground	2
Tripleurospermum	mayweeds	also coasts	2
		Waste/rough ground	
cf Malva sylvestris	common mallow		4
		Grassland and waste/rough ground	
Bromus Type	bromes	also arable	8
Melilotus/Medicago/Trifolium	melilot/medick/clover		2
		Mostly damp/waterlogged ground	
Carex sp	sedges		36
Eleocharis palustris agg	common spike-rush		1
Juncus sp	rushes		114
Juncus sp	rush seed head fragments		1
Montia fontana	blinks		1
Schoenoplectus sp	club-rush	also in tidal muds and shallow water of lakes, ponds, slow rivers, and dykes	1*cf*
		Grow in a broad range of habitats	
cf Lamium sp	dead-nettles		1
Vicia/Lathyrus	vetch/tare		10
Galium sp	bedstraws		3

Table 22: Charred plant remains from ring-gully **2225/2385** *(data from two flots, 5 ml and 2 ml in size; fraction >0.25 mm)*

Taxa	*Common name*		
Poaceae >4 mm	grasses		7
Poaceae 2-4 mm	grasses		14
Poaceae <2 mm	grasses		231
Avena/Poaceae	oat/grass glume fragments		+
Poaceae	grass stem/culm fragments		++++
Polygonum aviculare agg	knotgrass		3
Ranunculus acris/repens	meadow/creeping buttercup	especially damp soils	2
Rumex sp	docks		4
Urtica sp	nettles		17
Indeterminate seeds/fruits			34
Indeterminate stem/root fragments			++

Remains are seeds/fruits unless stated otherwise. Actual counts are given otherwise remains are scored on a scale of + to ++++, where: + represents less than five items; ++ between six and 25; +++ between 26 and 100; and ++++ over 100 items

Table 22: Charred plant remains from ring-gully **2225/2385** *(data from two flots, 5 ml and 2 ml in size; fraction >0.25 mm) (cont'd)*

the sixteenth century (Stace 2019). Although common mallow's status as a native plant is unclear, some regions see a clear rise in its occurrence during the Roman period (Carruthers and Hunter Dowse 2019, 157). It is therefore of interest that a radiocarbon date of 40 cal BC-cal AD 120 (1978±24 BP; SUERC-104284; *p 135*) was provided by one of the charred mallow seeds. Early classical writers describe all mallows as being used as food and documents suggest that the Romans often used it as a vegetable (Grieve 1973). Perhaps then, it is also significant that apple/pear pips are present in the assemblage from the ring gully (*p 95*), which could indicate that the mallow seeds also represent the remains of consumed food.

Several seeds from plants that grow in a broad variety of habitats were also recorded; however, by far the largest component of the assemblage comprises the seeds and stem/culm fragments of grasses (Poaceae). In addition, the ring gully also contained abundant seeds and occasional seed heads of wet-ground taxa, such as rushes (*Juncus* sp) and sedges (*Carex* sp). Rare seeds of club-rush (*Schoenoplectus* sp) were also recovered, which commonly grows in tidal muds and the margins of lakes, ponds, slow rivers, and dykes (Stace 2019).

In addition to the plant remains, an assemblage of animal bone (TNF 212) was recovered from palaeochannel ***2305***, and there is a suggestion from the radiocarbon dating evidence (*p 135*), together with the channel's spatial proximity to Trackway 2 and roundhouse ***2225/2385***, that this was cast into the silting channel during the occupation of the open settlement. If this was the case, it therefore mirrored the earlier disposal practices identified at the later Iron Age settlement, which seemingly involved the dumping of animal bones/carcases, and other domestic waste, into the nearby silting palaeochannels (*Ch 3, p 75*). The state of preservation of this material is also similar, with 89 fragments with good and moderate (Stages 2 and 3; *c* 42% of the assemblage) erosional stages, and 123 fragments with poor preservation (Stage 4 and 5; *c* 58% assemblage), suggesting similar taphonomic factors were at play.

The range of identifiable species, however, was much more restricted, with only horse being recognised, the remainder of the bones being only identifiable as large mammal and mammal (Table 23). It may be significant that horse was also the most identifiable species in the palaeochannel assemblages suspected to date to the later Iron Age (*Ch 3, p 76*). It seems, however, that fragmentation could be a factor leading to the higher numbers in palaeochannel ***2305***. Specifically, these remains include 13 loose mandibular teeth, though these were clearly associated and probably derive from the same animal (NISP 1). They comprise matching pairs (right and left) of second to fourth deciduous premolars (dp2, dp3, and dp4), and right and left permanent second premolars (P2). In addition, there are four incisors and a developing canine, as well as many fragmented parts of the associated mandible. This animal is estimated to have been less than 2.5 to 3.5 years old at death (Levine 1982; Hillson 2005, 240) since the deciduous dp2 had apparently not been displaced and the permanent P2 is unworn and must have been in the 'crypt'. The remains from the palaeochannel also include a group of unfused large mammal cervical and fragmented thoracic vertebrae and fragments of rib, and it is therefore possible that these derive from the neck and thorax of the same young horse.

A slightly smaller quantity of animal bone (TNF 190) was also present in several of the gullies for

Feature	Cattle	Horse	Sheep/goat	Large mammal	Medium mammal	Mammal	*Total*
Palaeochannel ***2305***		41		159		12	***212***
Ring-gully ***2225/2385***	9			39			***48***
Ring-gully ***3227***				2			***2***
Ring-gully ***3237***					2		***2***
Ring-gully ***3242***				3		58	***61***
Sub-rectangular gully ***3420***		4		15			***19***
Sub-rectangular gully ***3602***	1		1	2	2		***6***
Sub-rectangular gully ***3606***				4			***4***
Trackway 2						18	***18***
Pit group ***3608***						30	***30***
Total	***10***	***45***	***1***	***224***	***4***	***118***	***402***

Table 23: Animal bone (TNF) from the palaeochannel **2305** *and the open settlement (Phase RB.I)*

the roundhouses and sub-rectangular structures, and other settlement features (Table 23). This material is more poorly preserved than that from the palaeochannel, most with poor (Stage 4) or very poor (Stage 5) erosional stages (TNF 137; *c* 72% of the assemblage), whilst much of the remaining material has moderate (Stage 3) preservation, albeit one bone is in a good (Stage 2) state. In a similar fashion to the bone from features associated with the later Iron Age settlement (*Ch 3, p 75*), cattle were the most frequent of the identifiable species (TNF 10), followed by horse (TNF 4), with one fragment from a sheep/goat. The remaining material is only identifiable to large mammal (TNF 65), medium mammal (TNF 4), and mammal (TNF 63), with the latter material including 30 fragments from pit group ***3608*** (*p 90*).

Of the notable specimens, sub-rectangular gully ***3602*** (*p 85*) produced one *in situ* cattle third mandibular molar (with a much-reduced hypoconulid) at wear stage g (Grant 1982). This suggests the animal died at the 'adult' stage (*cf* Halstead 1985) or medial age 4 years 8 months (*cf* Jones and Sadler 2012, 22). A group of horse teeth was also recovered from sub-rectangular gully ***3420*** (*p 85*), comprising right-hand side deciduous premolars (dp2, dp3, and dp4) and an unerupted, unworn left-hand side permanent second premolar (P2). It is plausible that these teeth were associated with a horse that was less than 2.5 to 3.5 years old at death (*cf* Levine 1982; Hillson 2005, 240).

The enclosed settlement

The area to the west of the major palaeochannels in Area C was eventually abandoned, with Romano-British settlement shifting (in Phase RB.II) and concentrating to the east, directly on the 'island', in Area B (between channels ***2305*** and ***2605***; *p 80*). The character of settlement also changed as the former open settlement was replaced by a series of circular enclosures, one of which demonstrably contained roundhouses (Fig 44). One of these enclosures (Enclosure 1) was defined by a U-shaped ditch (***2073/2231***), 1.4 m wide and 0.5 m deep, which contained silt (Pl 37). The enclosure was probably roughly circular in form, although only its southern part lay within Area B, where it was *c* 17 m, east to west, and in excess of 8.5 m, north to south. It also had a 2.4 m-wide entrance on its south-west side, allowing access into its interior; however, no features were recorded within this internal area.

Immediately to the east of Enclosure 1 was a conjoined pair of curvilinear ditched enclosures (Enclosures 2 and 3) aligned broadly north-west/south-east, which had been partially created across the footprint of a roundhouse associated with the earlier open settlement (***2225/2385***; *p 83*). Enclosure 2, defined by a ditch (***2427***), up to 2 m wide and 0.8 m deep, was roughly oval, enclosing an area in excess of 138 m^2 (as it extended north of the excavation area). The east side of the boundary ditch was partially recut (as ***2464***), and both the original ditch and its later redefinition contained domestic waste, principally pottery (*p 101*), and some burnt stone, that had probably been cast into ditch when it was filling with silt. Most of this material was concentrated in the enclosure's western ditch (***2427***), suggesting that this side of the enclosure was favoured for refuse disposal.

To the south, Enclosure 3 was of similar form, being either sub-oval or sub-rectangular in plan, with a U-profiled perimeter ditch (***2194/2432*** to the west and ***2357*** to the east), up to 2.05 m wide and 0.95 m deep, which yielded further domestic waste, again mainly pottery; however, in contrast to Enclosure 2 (*above*), this material was more evenly distributed in the eastern and western enclosure ditches. Within the investigated area, the enclosure had an internal area of *c* 450 m^2, but it extended south of Area B. A *c* 3.5 m-wide gap in the western ditch may have marked the position of a south-westerly entrance.

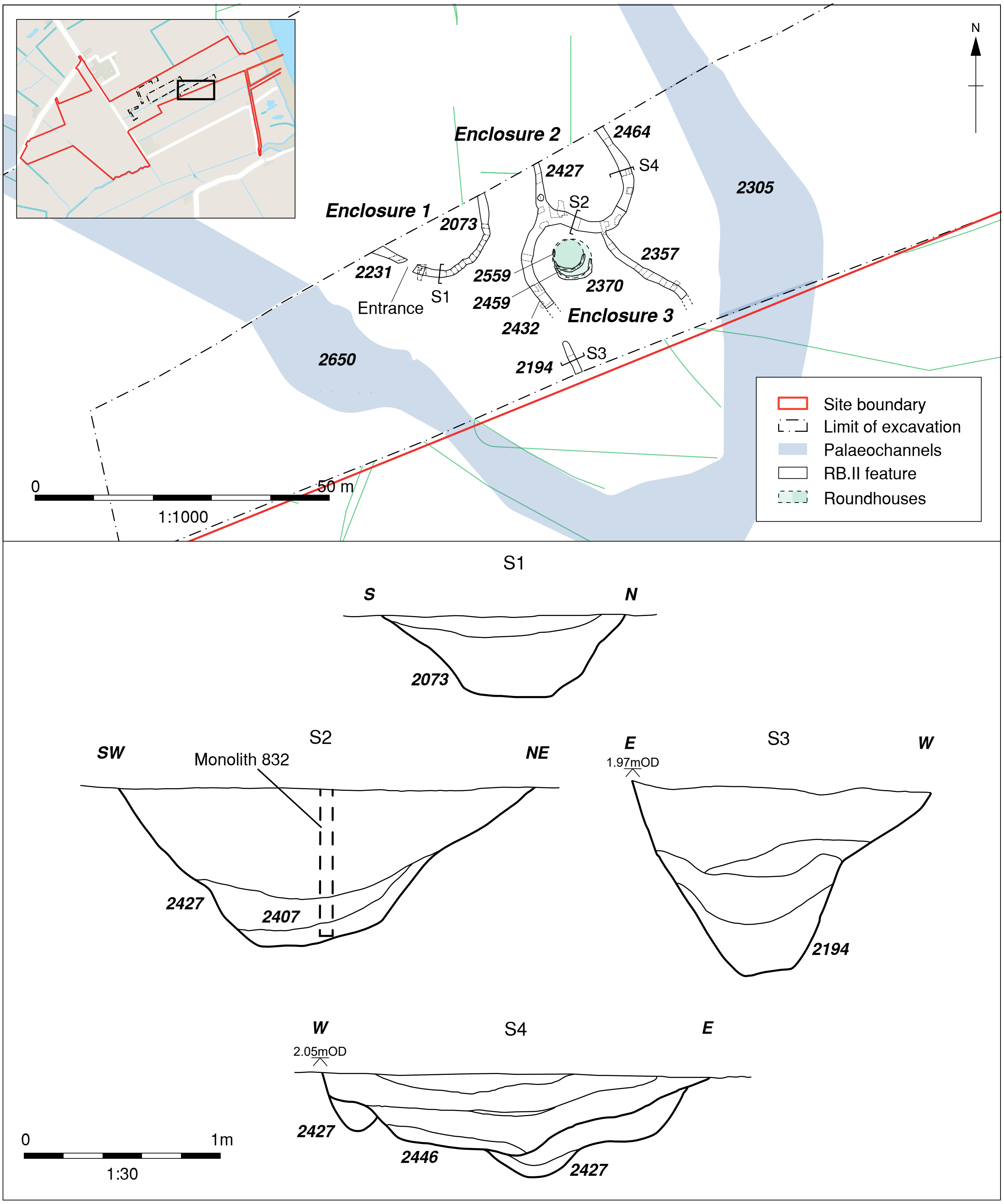


Figure 44: The enclosed settlement (Phase RB.II) in Area B

Within Enclosure 3 two fragmentary, roughly concentric ring gullies (***2370*** and ***2459/2559***), 0.55-0.75 m wide and 0.2-0.32 m deep, probably represented the remains of a small roundhouse, *c* 6.5 m in diameter, which may have been reconstructed at least once (Pl 38). Although the two gullies had no direct stratigraphic relationship, it is likely that **2370** was the primary feature, which, in contrast to the later gully, produced some Roman pottery. Too little of either gully survived for the position of an entrance to be determined, though a gap in the putative later feature might possibly have marked a west-facing entrance. With the exception of the roundhouse, no other occupation features were recorded and none were present within the roundhouse itself.

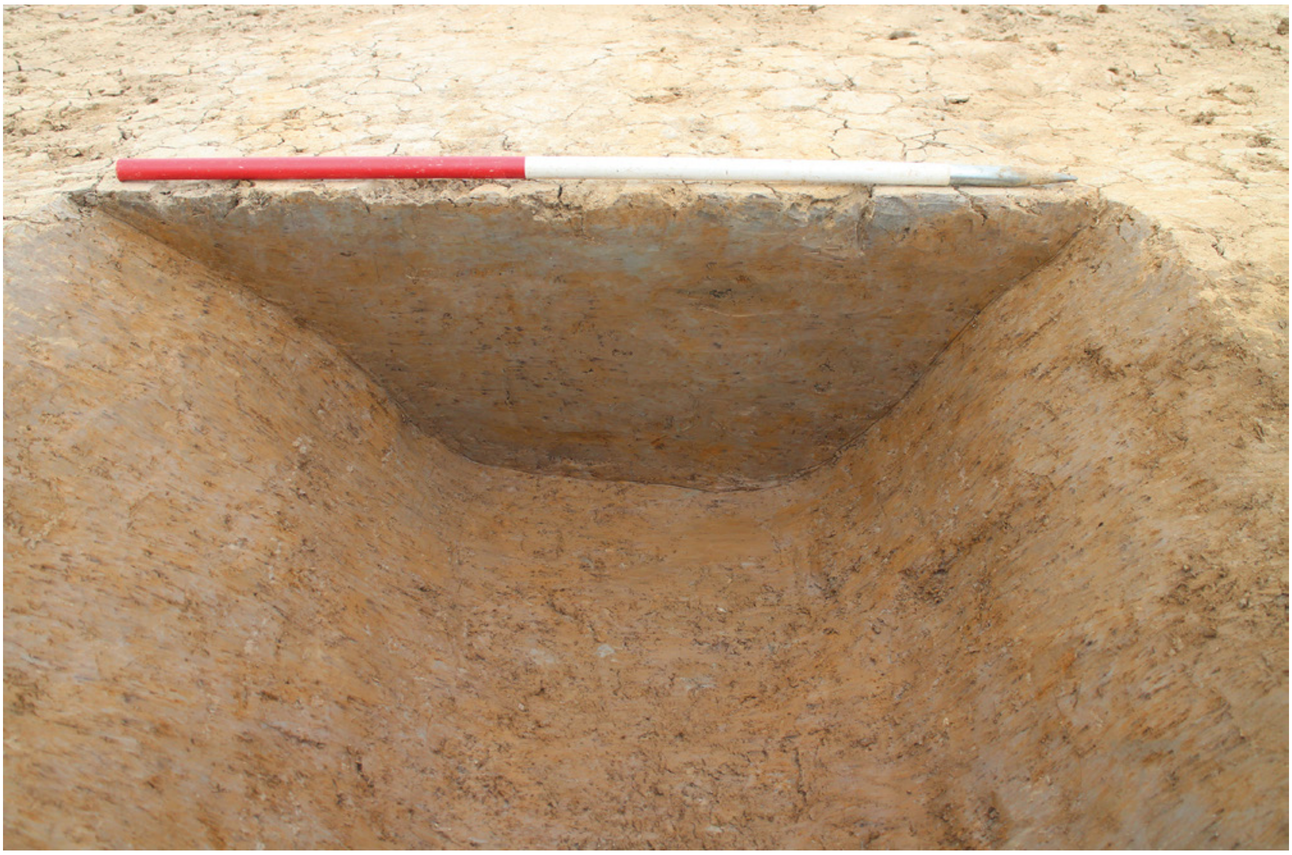


Plate 37: A section across ditch **2073**, *looking north-west*

Plate 38: Roundhouse gullies **2370** *and* **2459**/**2559**, *looking north-east*

Pottery

Apart from small quantities of highly fragmented fired clay, or daub (346 g), in ring-gully **2370** (*p 99*), all of the artefactual material from the enclosed settlement comprises Roman pottery (Table 24; *Appendix 1*). Most of this seems to have been contemporary with the filling of the ditches of Enclosures 1-3 and ring-gully **2370**, though a very small group of Late Roman pottery

Feature	Pottery group	Fabric type	Number of sherds	Weight (g)	Number of vessels	*Total RE%*
Enclosure 1 (ditch **2073**)	Reduced	GREY3	1	54	1	***0.44***
Enclosure 2 (ditch **2427**)	Calcareous	IASA?	1	20	1	
		SHEL	8	26	3	
	Reduced	GREY1	5	94	4	
		GREY4	5	60	3	***0.41***
		SFGR	3	6	1	***0.02***
		GREY	1	5	1	
		IAGR1	7	101	5	***0.19***
		IAGR2	26	305	14	***0.24***
		IAGR4	19	655	14	***0.18***
		IAGR	4	71	2	
		IAGR?	6	31	6	***0.06***
	Rock tempered	ETW4	1	9	1	***0.02***
Enclosure 2 (ditch **2464**)	Reduced	GREY1	23	455	3	
		IAGR1	1	152	1	***0.11***
		IAGR2	8	321	3	***0.29***
		IAGR	1	69	1	***0.09***
Enclosure 3 (ditch **2432**)	Fine ware	GFIN	1	6	1	
	Reduced	GREY1	7	118	4	***0.14***
		GREY3	1	5	1	
		GREY4	1	20	1	***0.14***
		IAGR1	7	54	1	***0.10***
		IAGR2	1	13	1	***0.12***
		IAGR?	2	17	1	
Enclosure 3 (ditch **2357**)	Calcareous	IASH3	1	8	1	
	Reduced	GREY1	3	61	1	
		GREY	1	21	1	
		IAGR1	5	120	2	***0.15***
		IAGR4	2	89	2	
Ring-gully ***2370***	Reduced	GREY1	5	129	3	***0.32***
		GREY4	1	49	1	***0.07***
		SFGR	1	116	1	***0.37***
		GREY	1	12	1	
		IAGR1	19	1131	3	***0.22***
		IAGR3	2	14	1	
	Rock tempered	ETW4	1	19	1	
Total			***182***	***4436***	***92***	***3.68***

Note: excludes sherd of intrusive DWSHT (*p 119*) from ditches **2427** (one sherd) **2432** (nine sherds), and **2357** (12 sherds) and GREYB from ditches **2474** (one sherd) and **2432** (one sherd); fabric types recorded in the unenclosed later Iron Age and early Roman period settlements are highlighted

Table 24: Stratified Roman pottery from the enclosed settlement (Phase RB.II)

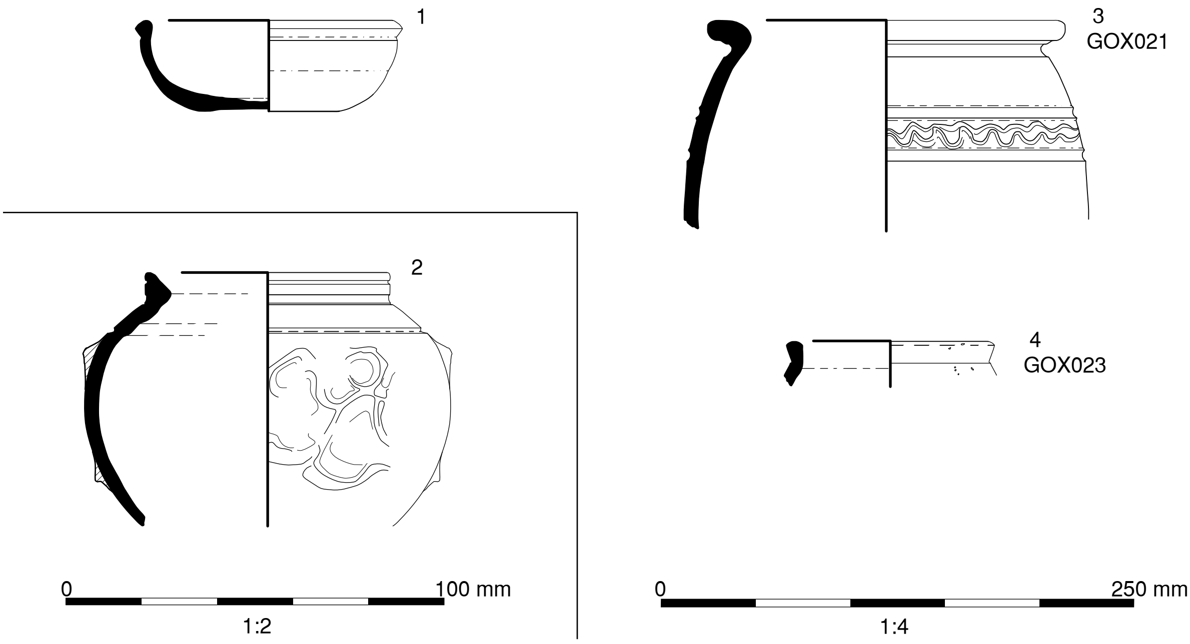


Figure 45: A grey ware (SFGR) bowl (1) and (GREY3) jar (2), and transitional ware jars (3 and 4) from the enclosed settlement

sherds was also present in the ditches of Enclosures 2 and 3, which almost certainly derive from a later phase of activity (*p 106*). Therefore, setting these intrusive sherds aside, the pottery assemblage from the enclosed settlement is small, merely comprising 182 sherds (4.436 kg; 3.68 RE) from a maximum of 92 vessels.

This assemblage includes Roman pottery fabrics that had previously been recorded in the open Roman settlement (Phase RB.I), which were perhaps also produced during the period when the enclosed settlement was active (or were residual items). These comprise several types of reduced grey ware (GREY1, GREY3, and SFGR; *p 94*), which include a grooved rim SFGR bowl with burnished wavy-line decoration (Fig 45.1) from ring-gully ***2370*** (*p 99*) and a GREY3 jar with coarse web rusticated surfaces (Fig 45.2) from ditch ***2073*** of Enclosure 1 (*p 98*), as well as two specific types of transitional ware (IAGR1 and IAGR2; *p 95*), along with similar material (IAGR/IAGR?), which could not be assigned to a specific transitional ware fabric type. Noteworthy vessels in these transitional fabrics include a (IAGR1) jar, with a hooked everted rim and wavy line decoration (Fig 45.3), from ring-gully ***2370***, and a shell-gritted jar (Fig 45.4) from ditch ***2432*** of Enclosure 3 (*p 98*). The assemblage also comprises small quantities of handmade calcareous gritted wares (IASH3; SHEL; *p 94*). Although these, together with a single sherd of possible Iron Age sandy ware (IASA?), could represent residual items, they could feasibly date to the second century AD (*Appendix 1*).

In addition, a small number of Roman fabric types are present that had not been recorded in the open settlement (Table 25). These include one type of grey ware (GREY4) from Enclosures 2 and 3, and ring-gully ***2370***. Although, superficially, this is very similar to the fabrics produced at Market Rasen in the later second to third centuries, and several kilns in the vicinity, such as Legsby (Darling 2005a; 2007; nd), it was more likely to

Fabric type	Description
GFIN	Miscellaneous fine grey ware
GREY4	Grey ware reduced fabric 4: wheel thrown. Commonly light grey surfaces with dark grey core, although some examples are fired to a dark grey throughout. Quartz moderate sub-rounded with some glassy grains, 0.2-0.8 mm. Typically more consistently fired than GREY1 (Table 20) with sparser quartz
IAGR3	Iron Age tradition 'Gritty' fabric 3: coarse quartz-gritted fabric
IAGR4	Iron Age tradition 'Gritty' fabric 3: similar to fabric IAGR2 (Table 21) with the addition of grog or clay-pellet inclusions. Most vessels being wheel made with a fairly well-controlled firing
ETW4	A fine variant of rock-tempered ware, containing coarse fragments of (glacial) erratic pebbles broken up as temper

Table 25: The Roman pottery fabrics first appearing in the enclosed settlement (Phase RB.II)

have originated from a similar source to GREY1 (*p 94*), which may also include Market Rasen area products. A much finer grey ware (GFIN) is also present, which is a type often found in rural settlements in northern Lincolnshire broadly dating to the second to fourth centuries (Rowlandson and Fiske 2023; 2024).

Apart from the grey wares, two transitional ware fabrics (IAGR3 and IAGR4) were found in the same enclosures and ring gully, which had not been seen in the transitional ware assemblage from the open settlement (*p 95*). Only two sherds of IAGR3 are present (and only six across the entire assemblage), indicating that this was a comparatively rare fabric type. Although the vessel forms are difficult to establish, elsewhere in northern Lincolnshire this fabric was often used to make Roxby 'A' type lid-seated jars (J105). The other fabric (IAGR4) is more common and this is comparable to one of the transitional fabrics associated with the open settlement (IAGR2; *p 95*). As with its counterpart (IAGR2), this fabric was primarily used to produce wheel-made vessels and the majority of forms created were large jars and/or bowls. Moreover, vessels in IAGR3 and IAGR4 are largely similar to some of the coarse gritted wares illustrated from Market Rasen and probably represent local products dating to the second century (Darling 2007).

One final type of pottery fabric, used to produce some of the handmade vessels from the enclosed settlement, utilised non-soluble (igneous and sandstone-type) rock as a temper, which was probably derived from Devensian Till (*Ch 1*, *p 4*) along the eastern Lincolnshire coast. Similar handmade pottery, classified as rock-tempered ware (ETW fabric group), is known from the wider region and it seems to have developed in the Early-Middle Iron Age (Knight 1994; 2002; Rowlandson 2012d); however, based on evidence from East Yorkshire, it continued to be used, particularly on rural sites, throughout much of the Roman period (Precious *et al* 2011; Rowlandson 2012c). Two sherds in a fine variant of this fabric (ETW4) were recovered from Enclosure 2 and ring-gully ***2370*** (*p 99*), and it is possible that these were contemporary with these features, relating to rock-tempered wares that were produced, in this instance, after the Roman conquest. In addition to the rock-tempered ware recovered from settlement features, fragments from a jar, with an externally bevelled rim, produced in a coarser variant of this fabric (ETW2; Fig 46) were present in the adjacent palaeochannel ***2305*** (*p 98*). On spatial grounds, and given that rock-tempered wares were not recorded in the earlier open settlement, this might be contemporary with the enclosed settlement, although, as examples of this form are known from several Late Iron Age to Early Roman sites in eastern Yorkshire (*cf* Rowlandson

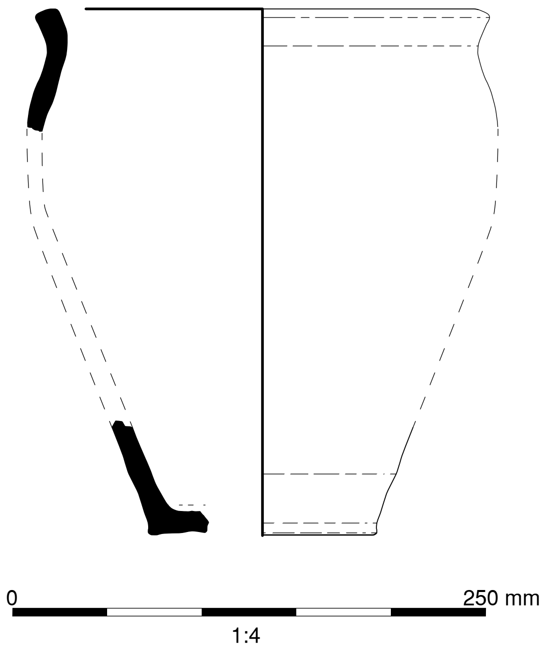


Figure 46: A rock-tempered ware (ETW2) jar from palaeochannel **2305**

2012c, figs 31.15 and 32.27), it is possible that it relates to the earlier period of occupation.

Vessel use

Four of the transitional ware jars recovered from the enclosed settlement (samples GOX017, GOX018, GOX020, GOX021 (Fig 45.3), GOX023 (Fig 45.4), and GOX025), as well as the rock-tempered jar from the palaeochannel (sample GOX015; Fig 46), were subjected to organic residue analysis (*Appendix 2*). This indicated that the transitional ware jars were used for cooking meat, as well as for processing dairy products, whilst the rock-tempered jar contained ruminant dairy fats, suggesting that it was used to contain/process secondary dairy products, such as milk, butter, and cheese. It was also apparent that the lipids in the rock-tempered jar were concentrated in the base of the vessel, suggesting it was used to heat milk, possibly to convert it into one of the secondary dairy products.

The local environment and activities in the enclosed settlement

M Rutherford (pollen), R I Macphail and C J Carey (soil micromorphology and geochemistry), and I Smith (animal bone)

As part of the excavations in Area B, a pollen monolith (832) was extracted from ditch ***2427***, defining Enclosure 2 (*p 98*). This was subjected to assessment, which indicated that the ditch's secondary fill (***2407***; Fig 44), a natural accumulation of organic silty clay, contained pollen suitable for analysis (OA North 2022). Three sequential sub-samples from this deposit were therefore analysed, using identical methods to those

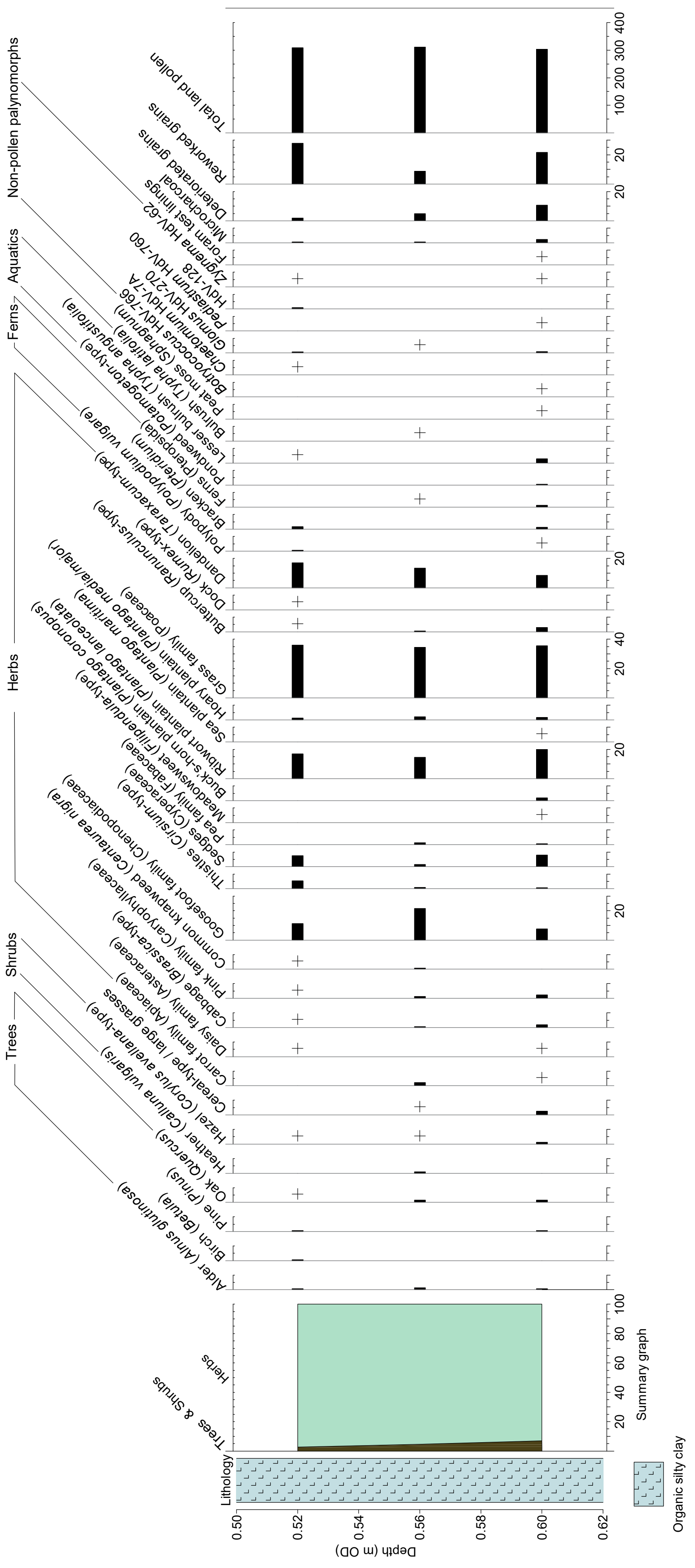


Figure 47: Pollen diagram for deposit **2407** *in ditch* **2427**

employed on the borehole cores from Goxhill and Paull (*Ch 2*, *p 26*), and these provide some evidence relating to the local environment surrounding the enclosed settlement.

Although pollen preservation is generally mixed and pollen from pre-Quaternary sediments is common, all sub-samples contain very similar pollen assemblages (Fig 47). These are characterised by herbs, in particular, grasses, ribwort plantain (*Plantago lanceolata*), dandelion-type (*Taraxacum*-type), and pollen of the goosefoot family (Chenopodiaceae (Amaranthaceae)), which forms a large group including taxa found on waste ground, such as fat-hen, as well as coastal zones, such as glassworts (*Salicornia*) and sea-blites (*Suaeda*). Pollen of sedges (Cyperaceae), pink family (Caryophyllaceae), cabbage family (Brassicaceae), thistles (*Cirsium*-type), and daisy family (Asteraceae) are also present, with the latter forming another large family that could include sea daisy (*A tripolium*), as well as daisy (*Bellis perennis*). There are also occurrences of several different species of plantains, including hoary/greater plantain (*P media/major*), as well sea plantain (*P maritima*), and buck's-horn plantain (*P coronopus*).

Cereal-type pollen was more commonly recorded in the deepest sub-sample, the dimensions suggesting possible occurrence of wheat/oats, as well as barley. Tree and shrub pollen is represented by rare occurrences of alder (*Alnus*), pine (*Pinus*), birch (*Betula*), oak (*Quercus*), hazel-type (*Corylus avellana*-type, including bog-myrtle (*Myrica gale*)) and heather (*Calluna vulgaris*), suggesting that woodland in the area had largely been cleared, with only small stands remaining. There are few records of fern spores and pollen of aquatic plants is represented by bulrush (*Typha latifolia*) and greater bulrush (*T angustifolia*). Freshwater algal indicators include occurrences of *Pediastrum* (HdV-760) and *Botryococcus* (HdV-766). Microcharcoal counts are low.

It therefore seems from this evidence that the local vegetation in the vicinity of Enclosure 2 was principally grassland, which was possibly also used for some small-scale arable cultivation. The presence of ribwort plantain and sedges is indicative of wet meadows and pastures (Behre 1981), whilst the common occurrence of pollen of the goosefoot family and sea plantain may, in this setting, be interpreted to infer possible saltmarsh conditions (Taylor 1995; Long *et al* 1998).

In addition to the pollen, evidence for the activities associated with the enclosed settlement was also provided by a monolith from ditch ***2357*** of Enclosure 3 (*p 98*) that was subjected to detailed soil micromorphological analysis. This indicated that the silty sediment in this ditch contained many blackened/charred organic silt clasts (~3 mm in size; eroded topsoil), with one example of an embedded probable small mammal tooth (~1 mm; Pl 39) and another 10 mm-size anthropogenic soil clast (hence moderately low concentrations of organic matter: 3.79% LOI and phosphate; 0.13% P). These may provide evidence of disturbance/charring of the natural turf soils, the natural fauna, and impacts of occupation/land management employing fire.

Finally, a small assemblage (TNF 82) of animal bone was recovered from the boundaries of Enclosures 1-3 and ring-gully ***2370*** (Table 26), providing some limited

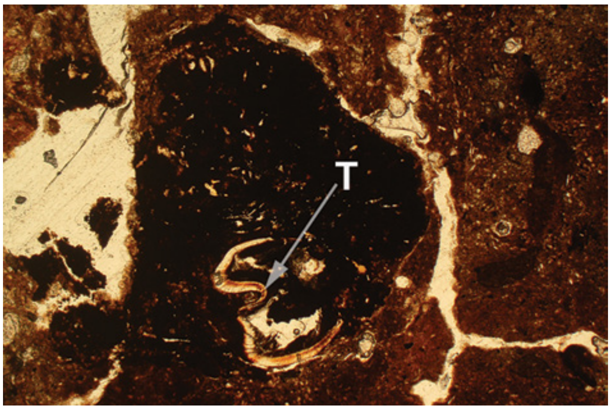


Plate 39: Photomicrograph of eroded blackened organic soil in ditch **2357**, *with embedded small mammal tooth (T). PPL, frame width is ~4.62 mm*

Feature	Cattle	Horse	Sheep/ goat	Dog	Large mammal	Medium mammal	Mammal	Bird (?)	Unidentified	*Total*
Enclosure 1 (ditch ***2073***)					4				2	***6***
Enclosure 2 (ditches ***2427*** and ***2464***)		8	4	2	14	4	9	1		***42***
Enclosure 3 (ditches ***2432/2357***)	3	5	2		18		5			***33***
Ring-gully ***2370***	1									***1***
Total	***4***	***13***	***6***	***2***	***36***	***4***	***14***	***1***	***2***	***82***

Table 26: Animal bone (TNF) from the enclosed settlement (Phase RB.II)

insights into the economy of the settlement. This assemblage is much better preserved than the animal bone recovered from the earlier open settlement (*p 98*), mirroring more so the preservation recorded for the animal bones dumped into palaeochannel ***2305*** (*p 97*), with 34 fragments with good and moderate preservation (Stages 2 and 3; *c* 41% of the assemblage), and the remainder with poor (Stage 4) erosional stages.

The domesticated species comprise cattle (TNF 3), horse (TNF 13), sheep/goat (TNF 6), and dog (TNF 2), all from Enclosures 2 and 3, with a single cattle maxillary tooth from ring-gully ***2370*** (*p 99*). The horse remains from Enclosure 2 (ditch ***2427***; *p 98*) include an astragalus, calcaneus, and scaphoid, all left-hand side and probably associated. Dog is represented by a mandibular tooth row (zones 1, 2, and most of zone 6 of Dobney and Rielly 1988). The cattle specimens also comprise a metacarpal (represented by half of the proximal articulation) and third phalanx, whilst a sheep/goat radius, metacarpal, femur, patella, and tibia were recorded. The sheep/goat tibia produced two diagnostic zones, but this is the maximum number of zones from sheep/goat and is judged to indicate the high degree of fragmentation and poor rate of bone survival. However, the majority (TNF 54) of animal bone is identified to non-specific levels of mammal and includes limb-bone shafts and vertebrae amongst the large mammal remains. There is also a fragment of possible bird bone from Enclosure 2.

Overall, this group is interpreted as domestic waste and plausibly represents the results of secondary and primary butchery (Rixson 1989) of beef and mutton. It also seems that the remains of a dead horse, at least one dog, and a bird were serendipitously incorporated, or deliberately cast, into the enclosure ditches.

The later Romano-British settlement

During the later stages of the Roman period, the character of settlement at Goxhill once again changed (in Phase RB.III). Indeed, it adopted a rather different form to that previously recorded, being characterised by an extensive and more 'regular' system of conjoined rectilinear enclosures visible as cropmarks and geophysical anomalies (Fig 48). These occupied much of Area B, and also the eastern end of Area C, covering the settlement features associated with the earlier enclosed settlement that lay on the 'island' between the palaeochannels (*p 98*). It is evident, however, that by this stage these, by then, ancient channels had largely filled with silt.

Activity to the west of the former island was less intense, but in contrast to the north-east, the aerial photographic and geophysical evidence suggests that denser elements of the rectilinear enclosure system are present. This suggestion was confirmed through the excavation of evaluation Trenches 35 and 36, targeted on the north-east area, which indicated that the remains there did indeed form elements of a later enclosure system. Although no further archaeological work was required across

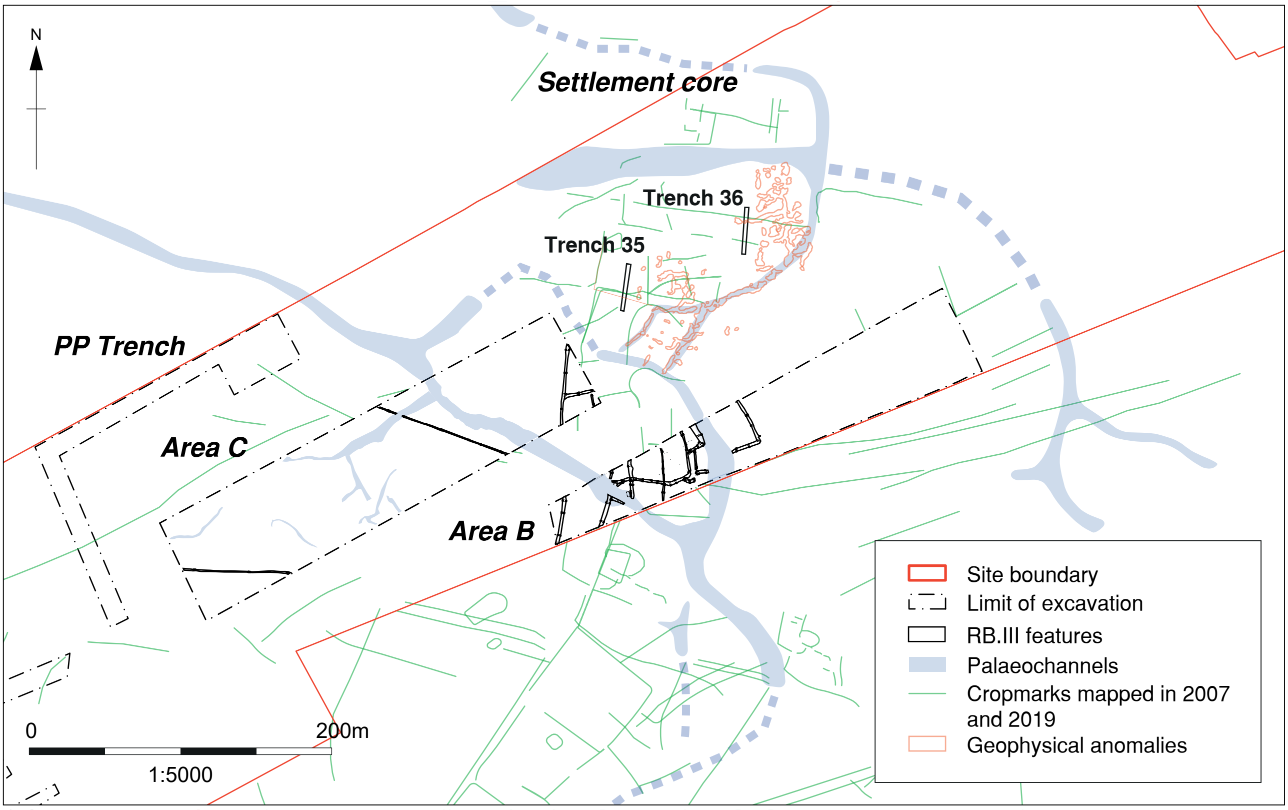


Figure 48: The extent of the excavated later (Phase RB.III) rectilinear enclosure system and settlement

this north-eastern area following the evaluation (*p 77*), it was evident that the features in these comparatively small interventions may have been situated at the very heart of the settlement, particularly as they produced moderately high quantities of Late Roman pottery (*p 115*), suggestive of intense domestic occupation.

In Trench 35 the principal features were two U-profiled ditches forming elements of the later rectilinear enclosure system (Fig 49). The larger ditch (***3505***) was aligned north-east/south-west and was 3.2 m wide and 1.2 m deep, whilst the smaller one (***3512***) was 1 m wide and 0.6 m deep, and was located to the north, being aligned broadly perpendicular to its counterpart (the junction of the two lay outside the trench). The position of ditch ***3505*** corresponded with a cropmark, but ditch ***3512*** was not previously detected. A small gully (***3510***), at a right angle to ditch

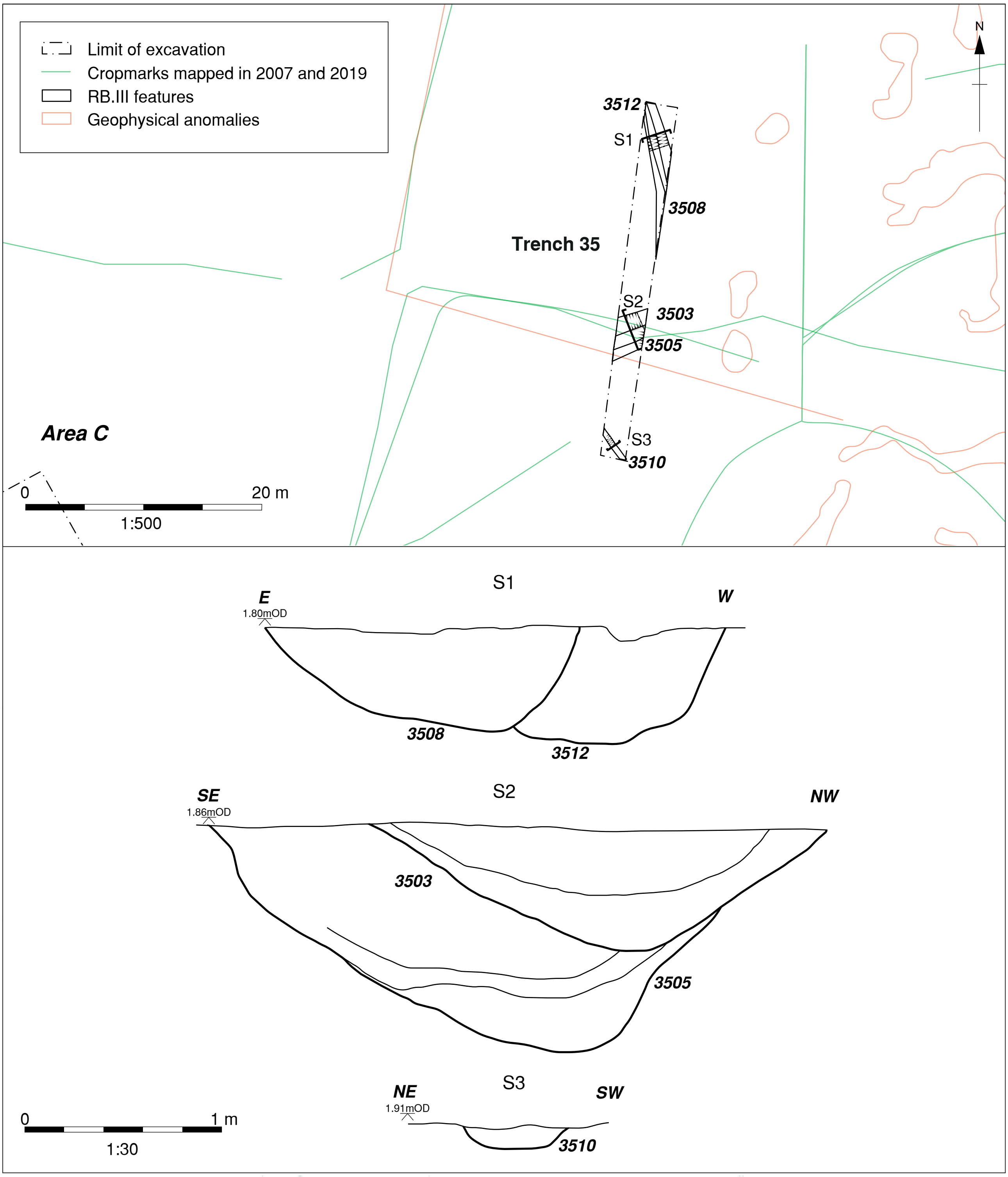


Figure 49: Plan of Trench 35 and the sections across the two (Phase RB.III) enclosure ditches and gully

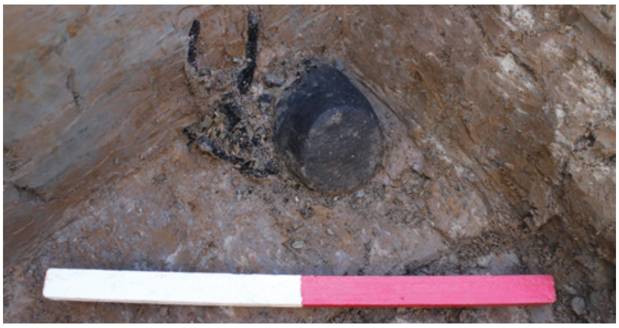


Plate 40: Cremation burial in ditch **3505**

3505, was the only other feature present, this being at the southern end of the trench. Following silting, both ditches ***3505*** and ***3512*** were recut (as ***3503*** and ***3508*** respectively) and, significantly, prior to the recutting of ditch ***3505***, an urned Romano-British cremation burial (Pl 40) had been interred into the top of this silted-filled boundary (*p 119*).

Trench 36 contained more diverse remains, some of which, again, constituted ditches for rectilinear enclosures, with others seemingly relating to three

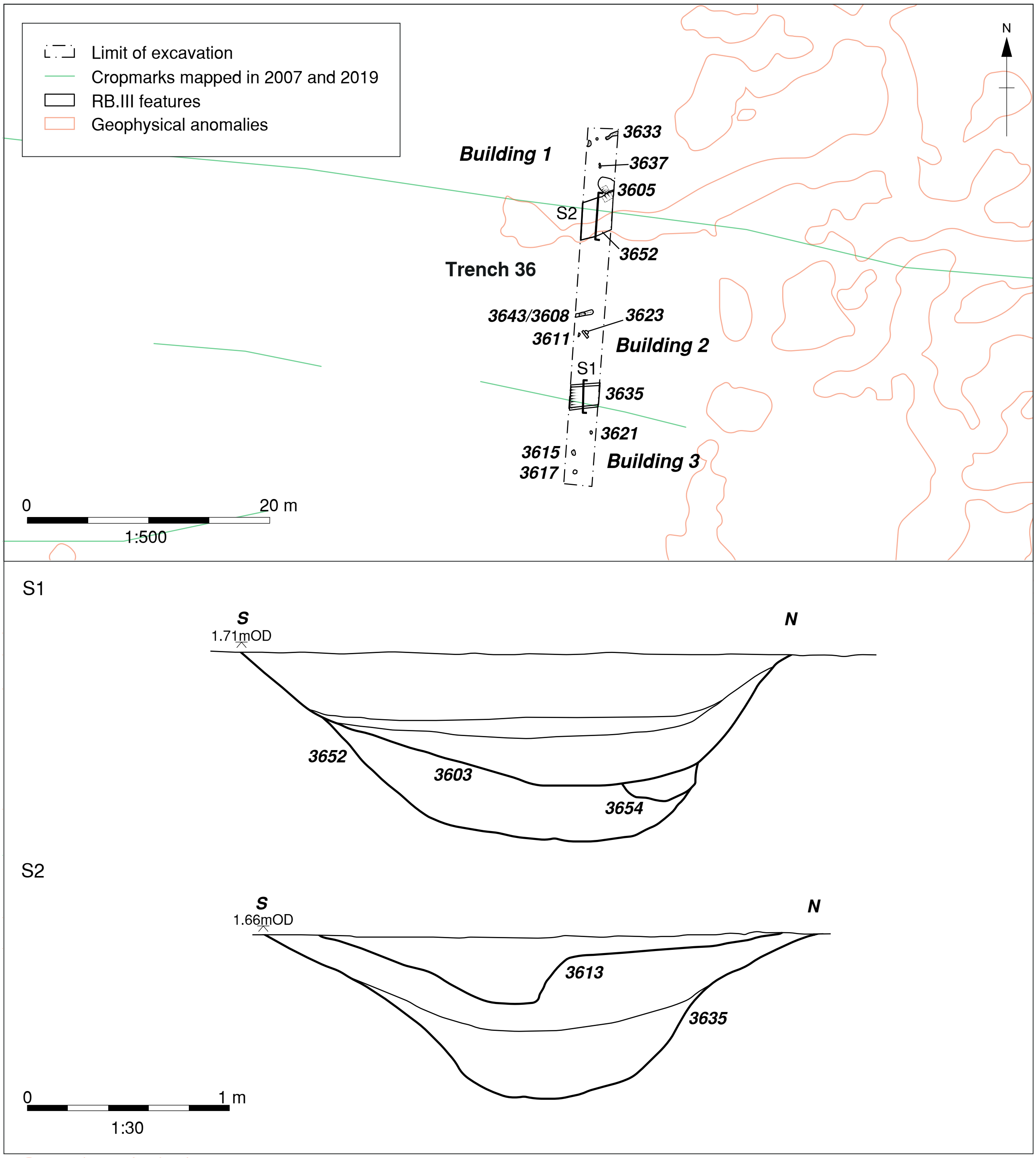


Figure 50: Plan of Trench 36 and the sections across the two (Phase RB.III) enclosure ditches

timber buildings, suggesting that this area may have represented a central/densely occupied part of the settlement (Fig 50). Two north-east/south-west enclosure ditches were present (***3652*** to the north and ***3635*** to the south), both corresponding with cropmarks. Following silting, in a similar way to the ditches in Trench 35 (*p 108*), both had been recut (as ***3603*** and ***3613*** respectively). Prior to recutting, a small pit (***3654***; seen in section only) had also been dug into the fills of ditch ***3652***. Given the evidence for the cremation burial cut into the ditch (***3505***) in the adjacent trench, which had also been interred prior to recutting (*p 108*), it is possible that this pit also held a similar burial; however, if this was the case, it had been destroyed/removed when the ditch was reconfigured.

The remains of the timber buildings were positioned either side of these boundaries, indicating that they were situated within the rectilinear enclosures. Although the size of the evaluation trench meant that only their partial remains were recorded, and hence their scale and morphology is uncertain, it is possible that these were rectilinear in plan. One (Building 1) was positioned immediately north of ditch ***3652*** and was defined by an L-shaped configuration of four postholes (grouped as ***3657***) and a construction trench (***3633***) that may have formed its corner. These also suggest that the building was in excess of 2.5 x 2.35 m, and its greater part may have lay north-east of the trench. Cutting the northern lip of ditch ***3652*** was also a pit (***3605***), 1.2 m in diameter and 0.4 m deep, which may have been contemporary with the building.

The remains of a second building (Building 2) lay to the south, in the area between ditches ***3652*** and ***3635***, and sharing their alignment. This was defined by a construction trench (***3643***; Pl 41), 0.3 m wide and 0.3 m deep, which extended into Trench 36 from the west. This trench was also later recut (as ***3608***) to a similar size, suggesting the building was refurbished/rebuilt. Two postholes (***3611*** and ***3623***) were positioned to the south of the trench, forming additional elements of the building. All the features associated with this building contained high amounts of burnt debris, suggesting that it may have burnt down, which may also explain the apparent need to rebuild/refurbish it following this destructive event. The third building (Building 3) was positioned to the south of ditch ***3655***. It was defined by three postholes (***3615***, ***3617***, and ***3621***), possibly forming a right-angled alignment and hence the possible corner of a rectilinear building.

To the south-west and west of the presumed settlement core, further elements of this later Roman (Phase RB.III) settlement were recorded in Areas B and C. In Area B, these included parts of at least 11 enclosures (Enclosures 5-15), with the remains of a further two (Enclosures 4 and 16) evident in the eastern part of Area C (Fig 51). These enclosures were defined by ditched boundaries, containing quantities of later Roman pottery (*p 115*), and were created following the complete silting of the palaeochannels that crossed these areas (*Ch 3, p 49*). This was particularly evident in the case of enclosure ditch ***2049***, which crossed an infilled palaeochannel (***3183/2650***) and then continued northwards as ditch ***2147***, indicating that by this stage the tidal creek was no longer in existence. The upper silts of the palaeochannels also produced later Roman pottery, providing further confirmation that they had completely silted by this period. Rather interestingly, this material includes a near-complete vessel (*p 119*) that had seemingly been deliberated buried into the more easterly of the silt-filled palaeochannels (***2605***) in Area B.

All of the ditches extended beyond the areas investigated, in one direction or another, so the

Plate 41: Construction trench **3643/3608***, prior to excavation, looking south-west*

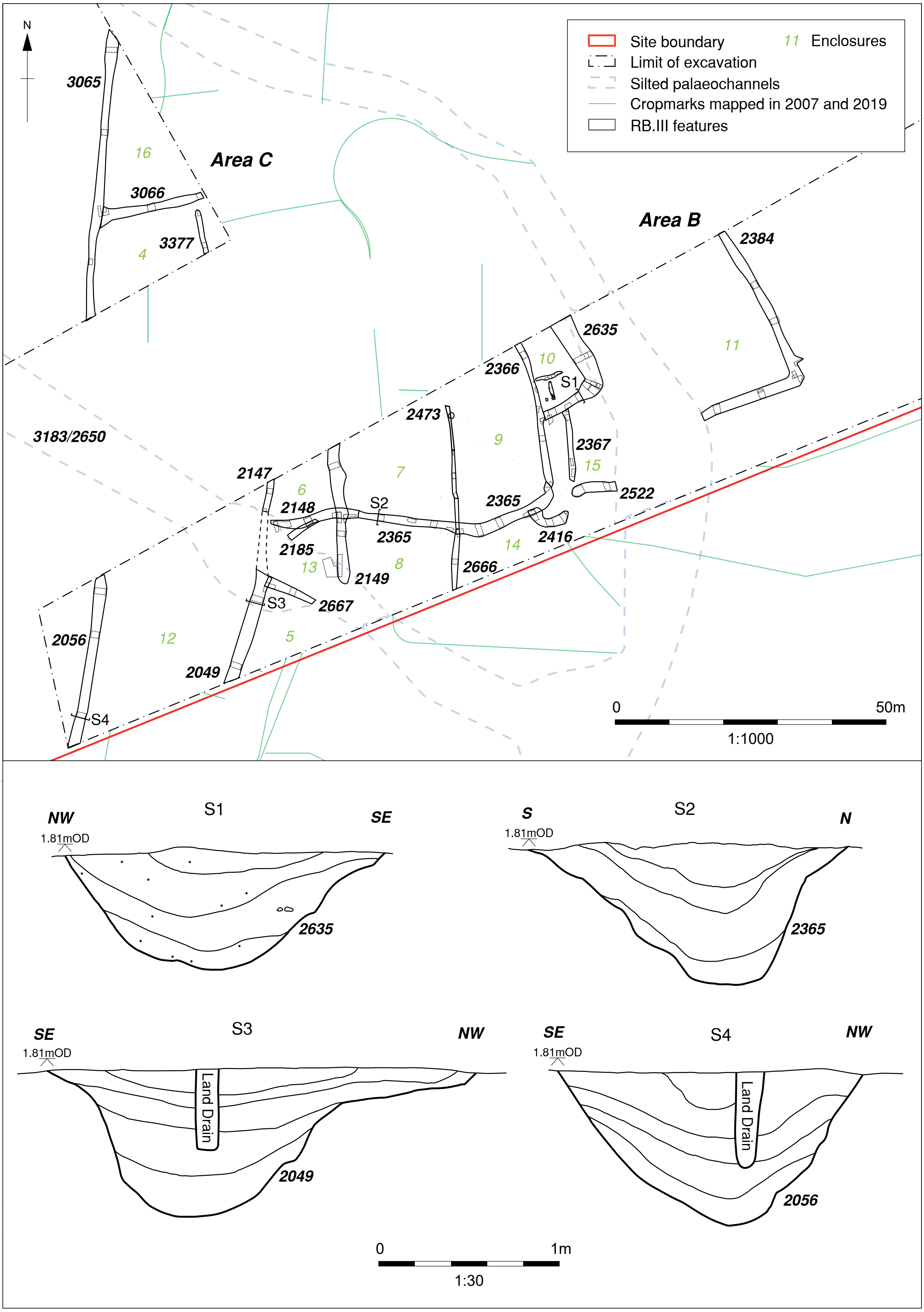


Figure 51: The later (Phase RB.III) rectilinear enclosures in Areas B and C

full dimensions of the associated enclosures could not be established, but they were probably mostly rectangular, with their long axes aligned broadly north/south, and may have varied considerably in size (Table 27). Following the initial silting of one of the ditches (*2635*) forming the boundary between Enclosures 10 and 15, and probably also Enclosures 10 and 11, its north-west/south-east aligned section had been recut and reconfigured. At the north-east corner of Enclosure 4, a putative entrance was marked by a 1.85 m-wide gap in the perimeter ditch. A more elaborate arrangement appears to have existed at the south-west corner of Enclosure 15 (Fig 52). There, the west side of the enclosure (defined by ditch

Enclosure	Length (north/south)	Width (east/west)	Area (m^2)
4	17.85 m+	20.7 m	369+
5	10.7 m+	10.7 m	114+
6	10.7 m+	12.1 m	129+
7	26.4 m+	20 m	528+
8	21.4 m+	20 m	428+
9	29.2 m+	18 m	525+
10	13.7 m+	9 m	123+
11	30 m+	22 m+	660+
12	52.8 m+	25.7 m	1357+
13	18.5 m+	17.8 m+	329+
14	9.3 m+	29.2 m	271+
15	15 m	13.6 m+	204
16	30 m+	17.8 m+	534+

Table 27: Summary of the later (Phase RB.III) rectilinear enclosures in Areas B and C

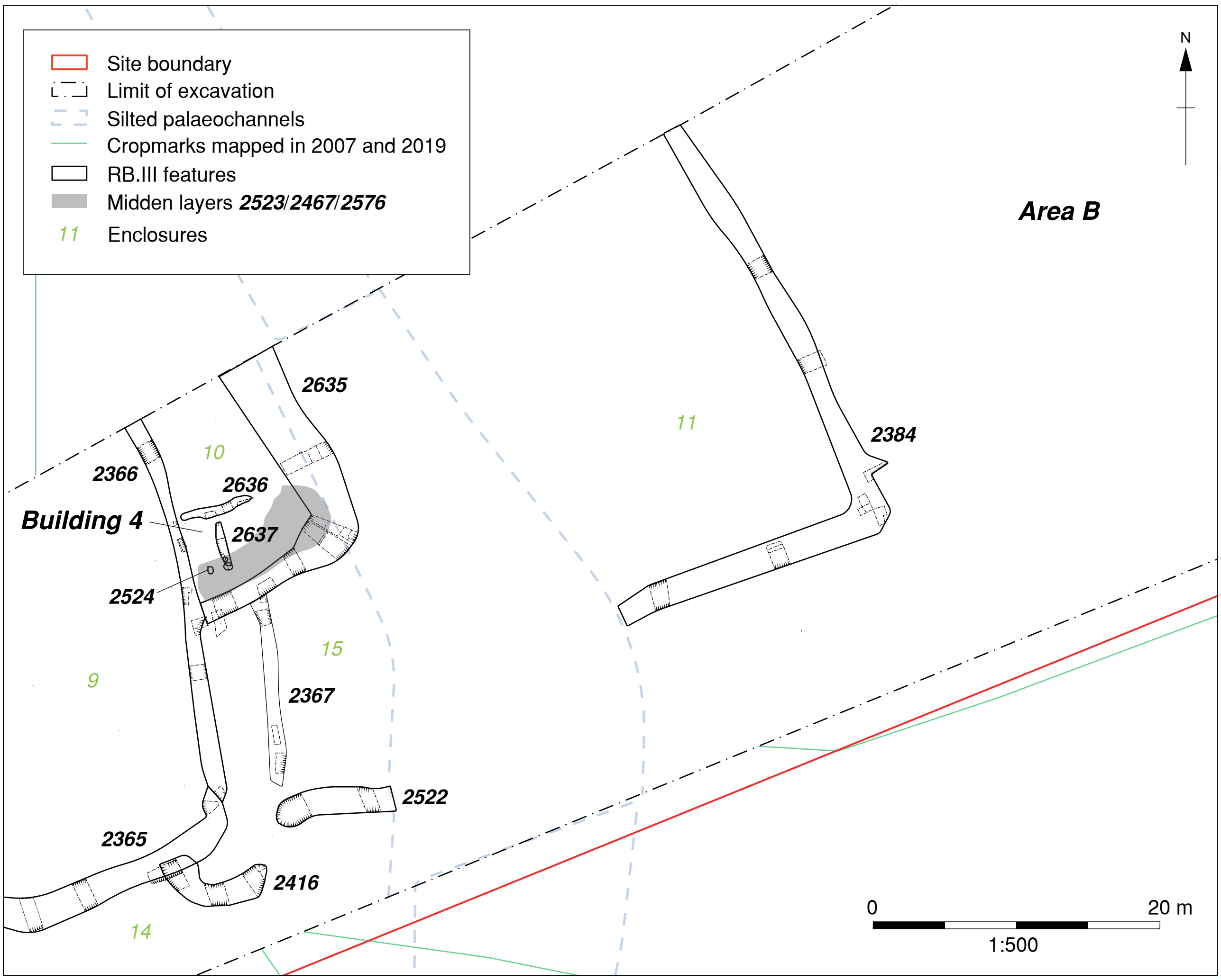


Figure 52: The entrance for Enclosure 15 and Building 4

2366; 3.7 m wide east to west) appears to have been almost completely separated from the rest by a north/south ditch (**2367**), 0.9 m wide and 0.45 m deep, that terminated just short of the enclosure's southern boundary ditch (**2522**). The latter also terminated at this locale, creating a possible entrance, *c* 3.6 m wide, at the south-west corner of the enclosure. Immediately outside (*ie* south) of this, on the north side of Enclosure 14, was a curving gully (**2416**), 1.65 m wide and 0.5 m deep, that partly enclosed the entrance. The precise significance of this arrangement is unclear, but it may represent a 'funnel' intended to direct livestock from Enclosure 14 into the western part of Enclosure 15 (and/or *vice versa*).

Although the ditches defining the enclosures varied considerably in size (Table 28), the majority were roughly U-shaped in profile, measuring *c* 1.5-2.3 m wide and *c* 0.5-1 m deep (Fig 51). In addition to the evidence for silting and, in places, inputs of domestic refuse, some of the ditches also contained layers of dark organic soil, probably representing periods of stability when vegetation was able to become established. Within Areas B and C, the western side of the enclosure system was marked by a substantial north/south ditch (**2056**/**3065**), up to 2.3 m wide and 0.9 m deep. This also represented the western boundary of Enclosures 4 and 16 in Area C and Enclosure 12 in Area B, and it seems likely that one or two other enclosures lay in the unexcavated area in between. The eastern side of the enclosure system was defined, within Area B, by ditch **2384** (the eastern and southern sides of Enclosure 11), which was 1.85 m wide but only 0.4 m deep (and recut at least once).

Few internal features were recorded in any of the enclosures, indicating that they were not a focus for intensive domestic activity, which instead seems to have been focused to the north-east in the area sampled by Trenches 35 and 36 (*p 106*). Rather, they may have served as fields and/or stock enclosures, as is also suggested by the possible stock funnel at the south-west corner of Enclosure 15 (*above*); however, the presence of domestic refuse in many of the enclosure ditches indicates the proximity of occupied areas, and it may be that these materials also derived, in large part, from the core settlement area.

The best evidence for activity within the enclosures, in this 'periphery' area, came from Enclosure 10 (Fig 52) and comprised the remains of a small rectangular timber structure (Building 4) in its south-western corner, which abutted enclosure ditch **2366**. This is very similar to the buildings recorded in the settlement core (in evaluation Trench 36; *p 108*) and was represented by two shallow construction trenches (**2636** and **2637**), 0.5 m wide, arranged in a T-shaped formation. One of these trenches (**2637**) also had two postholes at its southern end, indicative of post-in-trench construction. If trench **2636**, the east/west feature, is taken to be the north wall, with trench **2637** being an internal partition, Building 4 would have been in excess of 5.7 m long, east to west, and at least 3.9 m wide, north to south.

Associated with Building 4 was a small pit (**2524**), 0.4 m in diameter and 0.12 m deep, adjacent to the southern end of construction trench **2637**, both of which were sealed by a spread of compacted, orange-brown sandy

Ditch	Width (maximum)	Depth (maximum)	Part of
2049	2.35 m	0.8 m	East boundary of Enclosure **12**
2056	2.3 m	0.9 m	West boundary of Enclosure **12**
2147	2.35 m	0.8 m	West boundary of Enclosure **6**
2148	2.55 m	1 m	Boundary between Enclosures **6** and **13**
2149	1.75 m	0.8 m	Boundary between Enclosures **8** and **13**
2365	2.55 m	1 m	Boundary between Enclosures **7** and **8** and Enclosures **9** and **14**
2366	1 m	0.5 m	Boundary between Enclosures **9**, **10**, **14** and **15**
2384	1.85 m	0.4 m	Southern and eastern boundary of Enclosure **11**
2473	0.75 m	0.2 m	Boundary between Enclosures **7** and **9**
2522	1.6 m	0.65 m	South boundary of Enclosure **15**
2635	1.5 m	0.7 m	Boundary between Enclosures **10** and **15** (and probably Enclosures **10** and **11)**
2666	0.75 m	0.2 m	Boundary between Enclosures **8** and **14**
2667	1.4 m	0.6 m	Boundary between Enclosures **5** and **13**
3065	2.3 m	0.9 m	Western boundary of Enclosures **4** and **16**
3066	1.9 m	1.1 m	Boundary between Enclosures **4** and **16**
3377	0.9 m	0.5 m	East boundary of Enclosure **4**

Table 28: The dimensions of the ditches defining the later (Phase RB.III) rectilinear enclosures

clay (***2523***), up to 0.1 m thick and covering an area of *c* 5 x 4 m. A similar deposit (***2467***), up to 2.8 x 1 m in area and 0.12 m thick, was also present to the east of the building and more of this material had been dumped into the upper part of the eastern perimeter ditch (***2635***) of Enclosure 10 (Pl 42), a few metres further east still. Indeed, once this ditch was almost completely infilled, it was partly overlain by a further accumulation of burnt material (***2576***), 0.3 m thick, covering an area of *c* 2.6 x 2.75 m, which contained a sizeable assemblage of Late Roman pottery (*p 115*). One possibility is that these layers form the vestiges of middens that accumulated around Building 4, being contemporary with its use, and were eventually shunted over the ditches of the Enclosure 10 following the abandonment of the settlement. It may also be significant that a relatively large assemblage of pottery was recovered from the eastern end of ditch ***2365***, where it formed the boundary between Enclosure 9, to the north, and Enclosure 14, to the south, suggesting the possible proximity to activity areas in this part of the site.

Elsewhere within the enclosure system, internal features were limited to three small pits (Fig 53). One (***2233***) in Enclosure 6 was oval shaped, 1.05 x 0.5 m and 0.2 m deep, whilst the other two were circular, with one (***2428***) measuring *c* 1 m in diameter and 0.5 m deep, adjacent to (and partially cutting) the western boundary of Enclosure 9, and the other representing a large pit (***2618***), 2.3 m in diameter and 0.6 m deep, in the north-west corner of Enclosure 15.

In addition to the enclosures and associated features on the former 'island', two extensive ditches were also present in the central and western parts of Area C. Whilst morphologically similar to the enclosure ditches, they did not share a common alignment and had no stratigraphic relationship with them (Fig 54). These were also isolated features, in the sense that they had no associated ditches running off them, and they probably represent ditched field boundaries crossing the area formerly settled in the later Iron Age (*Ch 3*, *p 62*, *p 65*) and earlier Roman period (*p 81*), which by this stage had been abandoned and converted into agricultural land. One of the boundaries (***3067***), 0.85 m wide and 0.25 m deep, was aligned north-west to south-east, whilst the other (***3115***), 1.2 m wide and 0.6 m deep, was located further to the south-west and was aligned east to west (this was also recorded in the PP Trench as ***5010***). There was also a suggestion that the land investigated by Area A, in the Soff Lane diversion site to the south-west of Goxhill village, also formed an element of the landscape that was farmed during this period. Although no direct stratigraphic evidence for Roman features was present in this area, four sherds of Roman pottery were recovered as residual items in medieval features (*Ch 5*, *p 150*, *p 153*).

*Plate 42: The eastern perimeter ditch (**2635**) of Enclosure 10, looking south-east, showing burnt clay and other charred materials in its upper fill*

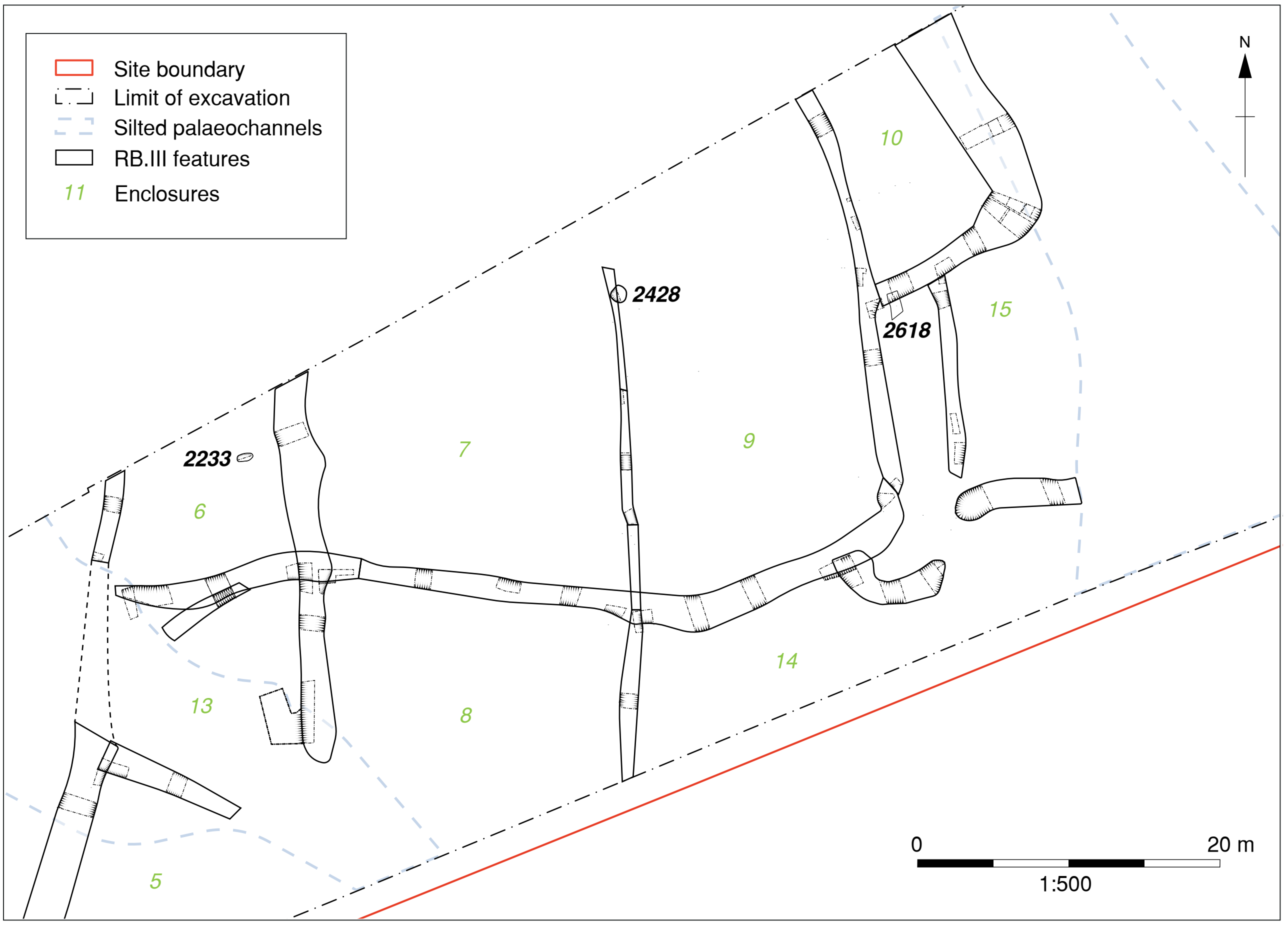


Figure 53: The pits in Enclosures 6, 9, and 15

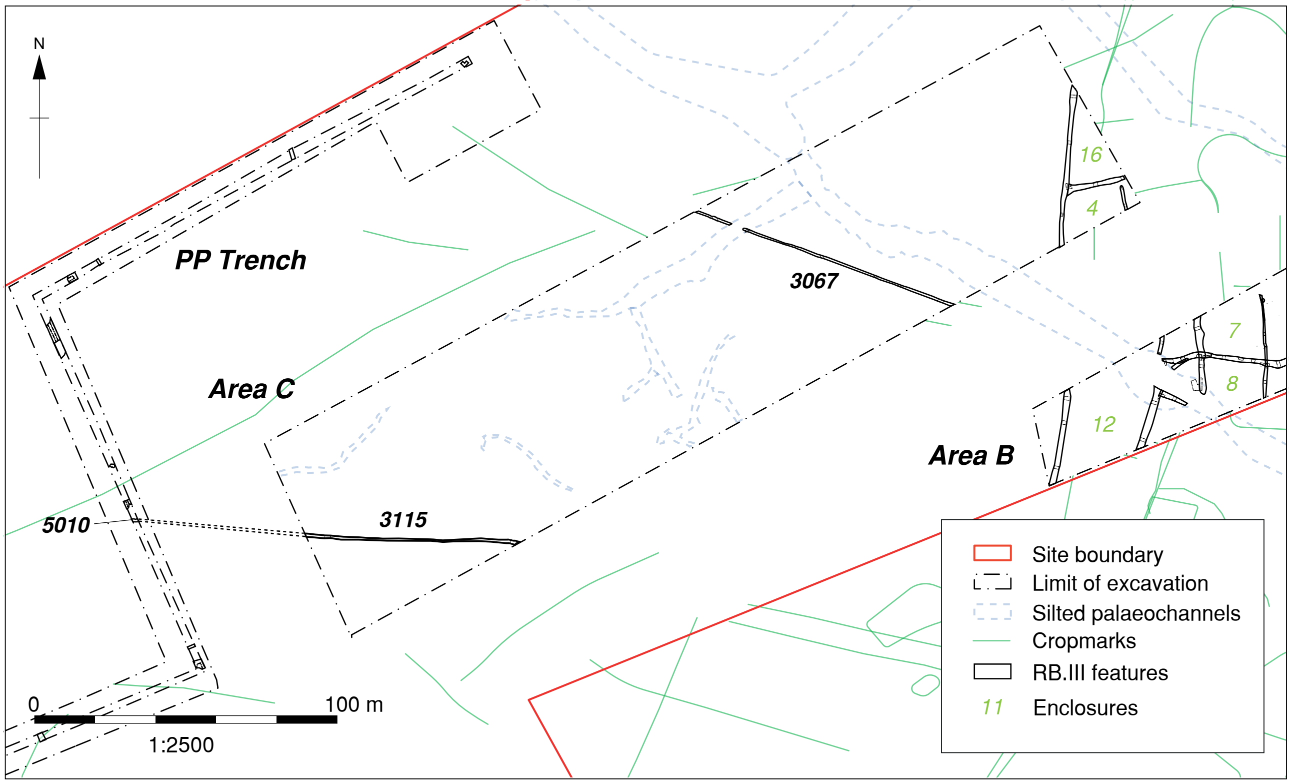


Figure 54: The Romano-British (Phase RB.III) field boundaries in Area C and the PP Trench

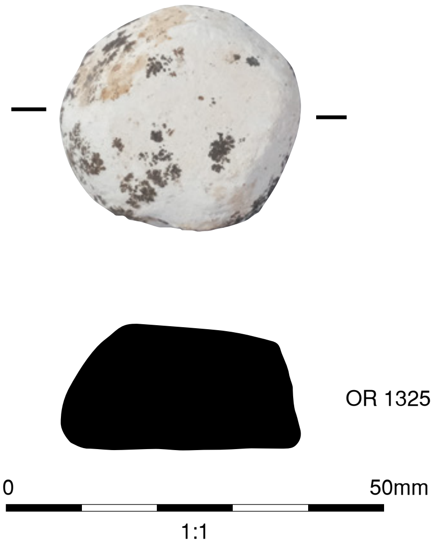


Figure 55: The chalk disc from the later Romano-British settlement (Phase RB.III)

Stone artefacts and iron nails
C Howard-Davis

A very small collection of worked/modified stone was recovered from the rectilinear enclosures, consisting of three separate items. One item, an elongated stone with smooth sides, was from ditch ***2149***, which separated Enclosures 8 and 13 (*p 112*). This seems to have been partly used as a rubber/smoother; however, it also has pecked ends, and the distribution of the pecking suggests that one end could have been used as an anvil, whilst the other might have been used as a hammer. Pit ***2618*** (*p 113*) produced a small chalk disc (OR 1325; Fig 55), which is clearly a man-made item, possibly intended as a lid or stopper of some kind. The third item (OR 1490) is a worn stone, possibly building material, from one of the construction trenches (***2636***) for Building 4 (*p 112*). In addition to these, the ditches of the enclosure system produced six badly corroded iron nails, with five being present in ditch ***2384*** (*p 112*) and one in ditch ***2365***.

Pottery
As with the earlier phases of Romano-British settlement, the bulk of the artefactual material comprises Roman pottery (*Appendix 1*), recovered from features within the settlement core (evaluation Trenches 35 and 36), and the ditched enclosures and associated features and palaeochannels in Areas B and C. In contrast to the earlier assemblages (*p 92*, *p 101*), this stratified assemblage is markedly different, in that it is much more sizeable, comprising 948 sherds (17.792 *kg;* 9.01 RE) from a maximum of 437 vessels, and also includes a much greater range of fabric types (Table 29). Many of these fabrics had, however, been recorded in the assemblages recovered from the earlier Romano-British settlement, comprising specific types of grey ware (GREY 1, GREY 3, GREY4, and SFGR; *p 94*, *p 102*) and transitional ware (IAGR1, IAGR2, and IAGR4, *p 95*, *p 102*), together with fabrics from both of these reduced ware groups that could not be assigned to a specific fabric type (IAGR and GREY?). Although some of this grey ware was probably also produced during the period when this later Romano-British settlement was occupied, a proportion of this material may have been residual. Similarly, it is quite probable that the transitional wares also represent residual material and, perhaps significantly, a large proportion was derived from the enclosure ditches in Area B, which could in theory represent material that was ultimately derived from the earlier (Phase RB.II) enclosed settlement (*p 98*). Notable vessels in this latter material include a jar, in fabric IAGR4, with a channelled or lid-seated rim (Fig 56.1) from enclosure ditch ***2635*** (*p 111*). In addition, an oversized bowl (Fig 56.2), in fabric IAGR2, with internal burnished lattice decoration (*cf* Darling and Precious 2014, no 841) was also recovered as an unstratified item in the subsoil sealing this ditch.

There are also several pottery fabrics that had not previously been recorded in the earlier Roman pottery assemblages. Notably, pottery from Continental sources is present for the first time in the form of samian ware and amphora (*Appendix 1*). Specifically, samian ware from plain vessels, produced in both Central and East Gaul (SAMCG and SAMEG) in the second half of the second century AD, was recovered from both the settlement core (Trench 36) and the enclosures in Area B. The Central Gaulish material was from Les Martres-de-Veyre (one sherd) and Lezoux (nine sherds), with that from the settlement core comprising a Dragendorff (Dr) 31 vessel and a body sherd, both from ditch ***3603***, and the rim from a bowl from ditch ***3613*** (*p 109*). The Central Gaulish sherds from Area B derived from ditches ***2365***, ***2635***, and ***2366*** (*p 112*), and include dish and bowl forms Dr 18/31, 31, and 31R. The East Gaulish material is more limited (three sherds) and include a Dr 31R vessel from Area B and a Dr 33 cup from the settlement core, possibly produced in Layoye. It is also worth noting that one sherd of South Gaulish ware came from Area B; however, this was unstratified and probably relates to occupation (if it was not a curated vessel) associated with the earlier enclosed settlement, as it is a Dr 29 decorated bowl that is likely to be Flavian (late first century AD) in date.

The second 'exotic' ceramic item is an amphora, with two sherds from this vessel being present in ditch ***3603*** in the settlement core (*p 109*). As with the samian ware (*above*), this vessel was from Gaul and it holds some significance as amphorae are very rarely recovered from Romano-British farmsteads in Lincolnshire

Pottery group	Fabric type	Settlement core (evaluation Trenches 35 and 36)				Palaeochannels				Enclosures and associated features (Area B and C)			
		Number of sherds	Weight (g)	Number of vessels	*Total RE%*	Number of sherds	Weight (g)	Number of vessels	*Total RE%*	Number of sherds	Weight (g)	Number of vessels	*Total RE%*
Samian	SAMCG	3	8	3	***0.06***					7	61	7	***0.14***
	SAMEG	1	2	1						2	28	2	
Amphora	GAU	2	51	1									
Mortaria	MOMH2	2	28	1									
Fine ware	CC1	1	6	1									
	GFIN									3	32	3	***0.11***
Oxidised	OX	3	27	1						3	15	2	***0.08***
Calcareous	IASA?									1	9	1	
	DWSHT	193	3404	12	***0.82***	23	1159	6	***0.58***	169	2131	50	***1.09***
	DWSHT?	3	6	1						2	20	1	
	SHEL	3	39	2						17	135	10	***0.02***
Reduced	BB1									1	16	1	
	BB2									1	7	1	***0.06***
	GREY1	52	941	43	***0.99***	3	160	6	***0.05***	114	2025	75	***1.88***
	GREY3	5	26	2	***0.09***					6	35	3	***0.08***
	GREY4									16	378	11	
	GREY8									6	70	3	
	GREYB									30	854	21	***0.73***
	GREY?									1	11	1	
	SFGR	9	133	4		2	11	1		16	509	12	***0.43***
	SFGR?									1	7	1	
	CRGR					1	84	1	***0.16***				
	GREY	11	240	7	***0.07***	4	66	3	***0.08***	46	663	34	***0.23***
	GROG									1	15	1	
	LCOA									1	25	1	
	LCQU									2	29	2	
	IAGR1									12	728	8	
	IAGR2	4	39	4	***0.11***					51	732	26	***0.5***
	IAGR4					1	65	1	***0.08***	86	2235	44	***0.35***
	IAGR	1	4	1						12	116	9	***0.15***
Rock tempered	ETW2	2	40	1		8	323	1	***0.07***				
	ETW4									2	11	2	
	ETW4G									2	33	1	
Total		***295***	***4994***	***85***	***2.14***	***42***	***1868***	***19***	***1.02***	***611***	***10930***	***333***	***5.85***

Note: Fabric types recorded in the late Iron Age and earlier Roman period settlements are highlighted

Table 29: Stratified Roman pottery from the later (Phase RB.III) Romano-British settlement

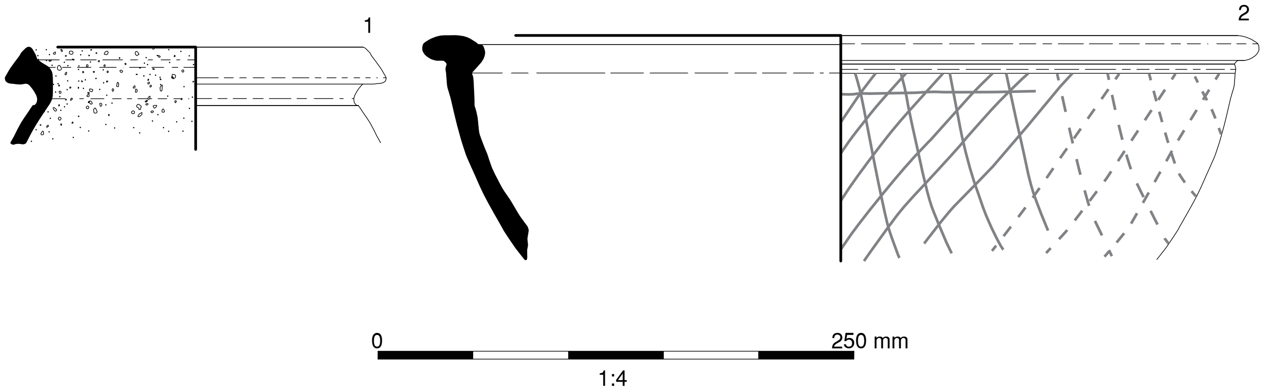


Figure 56: A transitional ware (IAGR4) jar (1) and oversized (IAGR2) bowl (2)

(I Rowlandson *pers obs*). It also has traces of pitch on its internal surface, which would have rendered it unsuitable for transporting oil or oily foodstuffs. This could suggest that its primary function was to transport pitch, though another possibility is that it was reused, and filled with pitch, after the original contents had been emptied (*cf* Peňa 2007, 69-71). Given that Gauloise amphorae were used principally to transport wine, the latter hypothesis seems more likely (Peacock and Williams 1986).

Beyond these Continental wares, other Romano-British pottery types include several types of fine, oxidised, reduced, rock-tempered, and calcareous wares (Table 30). The fine ware is represented by a single stratified sherd of colour-coated ware (CC1) from posthole ***3611*** of Building 2 (*p 109*) in the settlement core. This is from a beaker with rouletted decoration, and another CC1 beaker fragment, with barbotine strip decoration, was present in Area B, though it was unstratified.

Three stratified sherds of oxidised ware were also present in enclosure ditches ***3065*** and ***3377*** in Area C (*p 112*). These are in a miscellaneous oxidised fabric and relate to two identifiable vessels: a jar with bead rim and high shoulder; and a bowl with an everted rim. In addition, a small collection of unstratified oxidised wares were found in topsoil and subsoil deposits in Area B. These comprise four sherds of cream ware (CR) from a very abraded flagon handle, the foot-ring base from a flagon or jar, possibly not local in origin, and a single rim and flange sherd from a copy of a samian form Dr 38 bowl. This latter vessel was produced in a smooth-surfaced, oxidised fabric (OX1, inclusions as GREY1; *p 94*), which dates to the late third-fourth century AD, and, although similar to Swanpool types, it could be a product of the kilns at Linwood Warren, or

Fabric type	**Description**
CC1	Colour-coated fabric 1: the fabric is similar to the colour-coated fabrics from the Nene Valley (LNV CC; *cf* Tomber and Dore 1998)
OX	Oxidised ware: miscellaneous fabrics
BB1 and BB2	Black-burnished ware: fabric types BB1 and BB2 (*cf* Tomber and Dore 1998)
CRGR	Crambeck grey ware (*cf* Tomber and Dore 1998)
GREY8	Grey ware reduced fabric 8: mid-grey fabric with sparse to moderate fine quartz inclusions, rare fine black inclusions, smooth surfaces, sometimes with traces of burnish
GREYB	Burnished grey ware: mid-grey, hard and highly fired, wheel made, burnished externally and internally on open vessels. Quartz moderate sub-rounded with some glassy grains, 0.1-0.8 mm. Ferrous inclusions sparse, sub-rounded, 0.25-0.5 mm
LCOA	Coarse quartz-gritted ware, typically used for the production of double lid-seated jars (Darling and Precious 2014)
LCQU	Quartz-gritted ware broadly as GREY1 (*p 94*), with the addition of sparse to moderate glassy rounded quartz grains, with low sphericity typically seen in local Greensand outcrops. The forms are typically wheel-made jars, including Dales-type derivatives, double lid-seated jars, and Huntcliff jars
GROG	Miscellaneous grog-gritted wares, mostly as GREY1 (*p 94*), with grog/clay-pellet inclusions
ETW4G	As ETW4 (*p 103*), but with additional grog or clay-pellet tempering
DWSHT	Shell-gritted Dales ware (*cf* Tomber and Dore 1998, DAL SH)

Table 30: The Roman pottery fabrics first appearing in the later (Phase RB.III) Romano-British settlement

perhaps Kirmington, or other local sites (Rowlandson *et al* 2014; Rowlandson and Fiske 2019; 2020a). Overall, even taking the unstratified sherds into account, oxidised ware is therefore infrequently represented, although the low levels are typical of assemblages from this part of Lincolnshire (I Rowlandson *pers obs*).

Turning to the reduced wares, stratified sherds of Black-burnished ware are recorded for the first time. These include a sherd of Black-burnished ware 1 (BB1) from midden layer ***2576***, though this could not be attributed to a form type, and a rim sherd from a bowl or dish of Black-burnished ware 2 (BB2) in midden layer ***2467*** (*p 113*). An unstratified sherd of BB2 was also recovered from the subsoil in Area B, presumably relating to the same phase of activity; it is from a BG225 bowl (rounded, as Gillam 1970, no 225). Hence, as with fine and oxidised wares, it appears that only small quantities of Black-burnished ware reached this rural site, with the source of the BB1 vessel probably being Dorset, whilst the BB2 vessels were most likely produced in Essex or Kent (Tomber and Dore 1998).

The other stratified reduced wares present, but not recorded in the earlier assemblages, comprise three different types of grey ware, two types of quartz-gritted ware, and grog-gritted ware. One of the grey wares (CRGR; *ibid*) was produced near Crambeck, Yorkshire (Wilson 1989), with one stratified sherd, a fragment from a Crambeck Type 4 large wide-mouthed bowl (Fig 57.1; *cf* Corder 1928, pl VI.145), recovered from the surface of palaeochannel ***2650/3183***, which by this stage had completely filled with alluvium (*p 106*). The appearance of this fabric south of the Humber was probably due to coastal trade towards the end of the Roman period, with several other Late Roman sites from the region also producing small amounts of Crambeck ware (*cf* Rowlandson 2011; Rowlandson *et al* 2014; 2017; Rowlandson and Fiske 2023; 2024). The second grey ware (GREYB) is a distinctive type of hard, highly fired, and burnished later Roman grey ware that was probably produced locally, in a similar area to GREY1 (*p 94*). Although no notable vessels were identified in the stratified assemblage, several unstratified GREYB sherds formed part of a wide-mouthed jar (Fig 57.2). The other grey ware (GREY8) might again have been produced locally at those later Roman kilns that were also producing the GREYB pottery (Rowlandson *et al* 2017). There are also sherds of miscellaneous grey ware, which include several from a carinated jar or beaker, with burnished wavy-line decoration (Fig 57.3), from enclosure ditch ***2635*** (*p 112*).

The two quartz-gritted wares, both dated to the Late Roman period, comprise fabric types LCOA and LCQU, the former represented by a single sherd from enclosure ditch ***2635*** (*p 112*) and the latter by two sherds from enclosure ditch ***2365*** (*p 113*). LCOA was probably produced in Lincoln, whilst LCQU was a local equivalent produced at sites such as Linwood Warren and Market Rasen (Samuels 1983; Vince 2002; Wilson and Wilson 2007; Spoerry 2008; Allan *et al* 2010). It is also worth noting that the LCOA fabric has typically been found in final Roman or later deposits in the *colonia* and acts as a good indicator for the last period of Roman pottery production in the county (Darling 1977; Darling and Precious 2014). Similarly, fabric LCQU, is considered to have a similar date range (Darling and Precious 2014). A final reduced ware, not previously recorded in the earlier assemblages, comprises a miscellaneous grog-gritted ware (GROG),

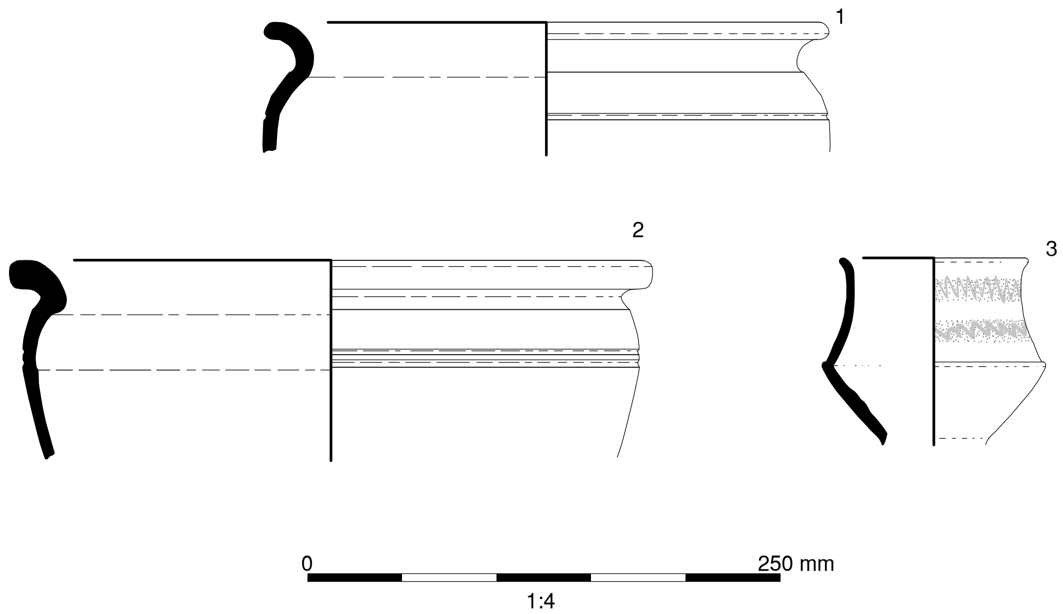


Figure 57: A Crambeck grey ware (CRGR) wide-mouthed bowl (1), a burnished grey ware (GREYB) wide-mouthed jar (2), and a miscellaneous grey ware (GREY) carinated jar or beaker (3)

with one sherd from a large storage jar recovered from ditch ***2635***. Small amounts of rock-tempered wares are also present, with one fabric type represented (ETW4G) that had not been previously recorded, though this might represent residual material from earlier phases of occupation (*Appendix 1*).

In addition to these wares, two sherds from a very abraded Mancetter-Hartshill mortarium, with grey fired clay trituration grits, were recovered from ditch ***3603*** in the settlement core (*p 109*). This was produced in Warwickshire and the fact that only a single mortarium is represented in the assemblage suggests that there was a limited uptake of the use of these specialist Roman food-preparation vessels (Cool 2006).

One major feature of the pottery assemblage from the later Romano-British settlement was the appearance of shell-gritted Dales ware (DWSHT). Indeed, this type of calcareous pottery dominates, forming *c* 40% by sherd count and *c* 38% by weight of the total stratified pottery assemblage from the Phase RB.III settlement, representing a maximum of 68 vessels (2.49 RE). These vessels are almost exclusively the typical lid-seated Dales ware jar forms, handmade with wheel-finished rims, which were produced in north-western Lincolnshire between the first half of the third century and middle of the fourth (Loughlin 1977; Swan 2002; Darling and Precious 2014). Within this assemblage is also a near complete vessel (Fig 58) that had been deliberately inserted into the top of one of the infilled palaeochannels (***2605***; *p 109*). Pottery in the DWSHT fabric also includes a couple of 'proto-Dales ware' jars, handmade throughout with externally bevelled rims, which may have been produced in the late second to third century, again in north-western Lincolnshire (Darling and Precious 2014).

Use of the shell-gritted Dales ware jars

Seven of the DWSHT vessels (samples GOX01-GOX04 (Fig 58), GOX07-GOX10/11, and GOX013) were subjected to organic residue analysis (*Appendix 2*) in an attempt at establishing the function of these vessels. Rather interestingly, this demonstrated that the jars were associated with high levels of ruminant carcass fats, suggesting that the jars in these fabrics may have formed specialised vessels used for cooking meat. Moreover, most of the vessels seem to have acted as 'stewpots' involved in the boiling of meat, though one (GOX013) was used to roast meat. Two transitional ware vessels from the later Roman settlement were similarly subject to lipid analysis (GOX027 and GOX28), and these again seem to represent 'stewpots'. Indeed, there was no evidence for the processing of dairy products (as had been noted in the sherds analysed from the earlier phases of settlement). This may suggest that there was a move towards a greater dependence on rearing animals for meat, fats, hides, and sinews during the later Roman period, rather than the production of cheese and other dairy products. The lipid in one of the samples (GOX007) also predominated in the rim, suggesting that this vessel, at least, was used for boiling foodstuffs.

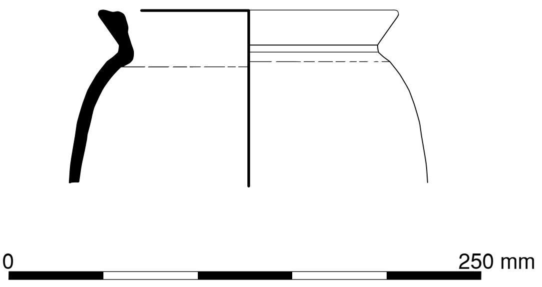


Figure 58: A shell-gritted Dales wear (DWSHT) lid-seated jar

The Roman cremation burial

V Jamieson (cremated human bone)

A cremation burial in Trench 35, in the presumed heart of the settlement, had been inserted into ditch ***3505*** (*p 108*) and was contained within a ceramic vessel. This vessel is a 'proto-Dales ware' jar (*Appendix 1*) and it probably dates to the late second to third century AD (Fig 59). Contained within this jar was a small assemblage of cremated human bone, comprising 169 fragments, weighing 29 g. All the cremated bone is white with patches of light blue and light grey, suggesting a pyre temperature of 645-940°C. Fissuring and transverse cracking is present on most of the pieces, indicating that soft tissue was present at the time of the cremation. The fragments are mostly 5-10 mm in size, with the largest (part of the right tibia) measuring

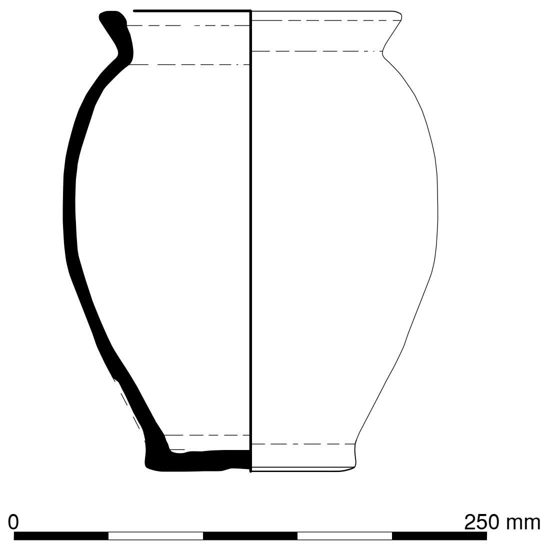


Figure 59: The shell-gritted 'proto Dales ware' jar used as a cremation urn

56 mm in its longest dimension. The remains represent a single individual of indeterminate sex, probably an adult, given the size of the skull fragments present. The large tibia fragment shows evidence of active periostitis at the time of death.

Animal remains

I Smith

Many of the enclosure ditches in Areas B and C (*p 112*), as well as Building 4 (*p 112*), and pits ***2428*** and ***2618*** (*p 113*) in Area B, produced small quantities of animal bone (Table 31). A total of 260 fragments were retrieved, most of which (TNF 241) represents bone that had entered the enclosure ditches, probably as domestic waste generated in the nearby settlement area, though the material from ditches ***2635*** and ***2636*** (TNF 34) may have derived from Building 4 and the associated middens (*p 113*). Just over half of this material (*c* 54%) exhibits good and moderate preservation (Stages 2 and 3).

Cattle- and horse-bone fragments dominate the identifiable domesticates. The horse remains comprise many loose teeth, and the occlusal surface on one of these, a mandibular tooth from field boundary ***3067*** (*p 113*), has a deep ectoflexid that could suggest it is from a horse (*Equus caballus*) rather than a donkey (*Equus asinus*; Eisenmann 1986, 76). There is also a slightly damaged horse radius from ditch ***2056*** (*p 112*) that indicates a pony-sized animal with a withers height of approximately 1.28 m (or 12.5 hands; *cf* May 1985).

Turning to the other identifiable domesticates, there is a smaller quantity of sheep bones and, perhaps significantly, also a single pig bone (a cranial fragment) in ditch ***2635*** (*p 112*) that represents a species that had not been recorded in the assemblages from the earlier Romano-British settlements (Phase RB.I (*p 97*) and RB.II (*p 105*)), or indeed those from the later Iron Age settlements (*Ch 3, p 64, p 75*). Red deer also makes its first appearance, evidenced by a single distal humerus fragment that again was present in enclosure ditch ***2365***. Moreover, this exhibits good evidence for butchery, in the form of fine cut marks just proximally of the coronoid fossa, corresponding with Binford's (1981) code Hd-2 and to Lauwerier's (1988, 196) code 24, which undoubtedly indicates dismemberment. The presence, therefore, of this meat-bearing and butchered limb bone appears to suggest that the hunting of red deer, and consumption of venison, formed an element of the rural economy at the later Romano-British settlement.

Feature	Cattle	Horse	Sheep/ goat	Pig	Red deer	Large mammal	Medium mammal	Mammal	Unidentified mammal	*Total*
Enclosure ditch ***2049***						10				***10***
Enclosure ditch ***2056***		3								***3***
Enclosure ditch ***2147***	13									***13***
Enclosure ditch ***2148***	5					70				***75***
Enclosure ditch ***2149***	12		1					1		***14***
Enclosure ditch ***2365***	7	1	2		1	11	3			***25***
Enclosure ditch ***2366***		1				4		4		***9***
Enclosure ditch ***2384***		1				7	1			***9***
Enclosure ditch ***2522***	3	1								***4***
Enclosure ditch ***2635***		33	4	1		2			2	***42***
Enclosure ditch ***2667***	4									***4***
Enclosure ditch ***3065***	1		1			5				***7***
Enclosure ditch ***3066***	1					12		5		***18***
Enclosure ditch ***3377***	1						3	2	2	***8***
Enclosures total	47	40	8	1	1	121	7	12	4	***241***
Pit ***2428***	1		1						2	***4***
Pit ***2618***	4									***4***
Building 4: construction trenches ***2636*** and ***2637***						1	2		7	***10***
Field boundary ***3067***		1								***1***
Overall Total	***49***	***41***	***9***	***1***	***1***	***122***	***9***	***12***	***13***	***260***

Table 31: Animal bone (TNF) from the later Romano-British settlement (Phase RB.III)

Oysters and other molluscs
C Howard-Davis

Apart from animal bones, two of the enclosure ditches (***3652*** and ***2365***: *p 109*, *p 113*) and one of the pits (***2618***; *p 113*) associated with the later Romano-British settlement also produced oyster shells and other terrestrial molluscs (*cf* OA North 2022). In total, this assemblage includes 47 shell fragments from the native oyster (*Ostrea edulis*) and one terrestrial snail shell. The oyster shells clearly indicate that wild food was gathered from the foreshore area.

Charred plant remains from midden layer *2467* and pit *2428*
D Druce and J Meen

Two samples from Area B, containing charred plant remains, were subjected to detailed analysis (Table 32). One was from a pit (***2428***; *p 113*) and the other from a layer (***2467***) that may have formed part of a midden associated with Building 4 (*p 113*). In many respects, the charred plant remains are comparable to those recorded from the earlier (Phase RB.I) open settlement (*p 95*), reflecting the same broad range of cereals. One major difference, however, is the presence of spelt wheat (*cf Triticum spelta*), possibly suggesting that this was first cultivated at Goxhill during the later Roman period. In addition, there are slighter higher quantities of possible bread wheat, although as with the earlier assemblage, the identification of this is tentative. It is also worth noting that when the later Romano-British settlement, and the earlier Roman settlements, were occupied, sea level was in a regressive phase (*p 80*), so that land previously exposed to full tidal inundation might, perhaps, have then been used for cereal cultivation. Experiments on crop growth on unprotected saltmarshes in the Netherlands have, however, shown that wheat will not grow directly in areas where the influence of the sea prevails (Bottema *et al* 1980), although it is possible to cultivate other cereal types, including barley and oats, on such exposed coastal land (*ibid*). Given this, wheat was more probably grown in sheltered areas, directly adjacent to the settlement, whilst other cereal types could have been grown on nearby saltmarshes, which seem to have been present in the wider landscape, based on the pollen evidence (*p 124*). Regarding other foodstuffs, as with the earlier assemblage (*p 95*), a possible cultivated pea fragment was recorded, but

			Spread *2467*	**Pit *2428***
Sample volume (L)			40	20
Flot volume (ml)			100	5
Fraction (mm)			>0.25	>0.25
Taxa	***Common name***			
Cereals				
Hordeum distichon/vulgare Spelzgerste	hulled barley		4	
cf Triticum aestivum sl	bread wheat		3	2
Triticum sp	wheat		1	9
*cf Triticum spelt*a	spelt wheat			3
Cerealia indet	indeterminate cereals		2	4
		Total cereal grains	***10***	***18***
Cerealia indet	indeterminate cereal fragments			+
Cereal chaff				
Cerealia indet	indeterminate cereal culm node		1	
		Total cereal chaff	***1***	***0***
Other cultivars				
Lathyrus/Pisum/Vicia	tare/vetch/pea		1	
Wild taxa		***Habitat (after Stace 2019)***		
		Grassland and waste/rough ground		
Melilotus/Medicago/Trifolium	melilot/medick/ clover			8

Table 32: Charred plant remains from layer **2467** *and pit* **2428**

			Spread *2467*	Pit *2428*
Sample volume (L)			40	20
Flot volume (ml)			100	5
Fraction (mm)			>0.25	>0.25
Taxa	***Common name***			
Plantago lanceolata	ribwort plantain		1	
		Mostly damp/waterlogged ground		
Carex sp	sedges		19	
Cyperaceae	sedge family		1	
Eleocharis palustris agg	common spike-rush			1
Juncus sp	rushes		87	33
Juncus sp	rush seed head fragments		2	
Montia fontana	blinks		1	
Schoenoplectus sp	club-rush	also in tidal muds and shallow water of lakes, ponds, slow rivers, and dykes	4	
		Grow in a broad range of habitats		
Euphrasia/Odontites	eyebright/bartsia		3	
Poaceae 2-4 mm	grasses			2
Poaceae <2 mm	grasses		14	9
Avena/Poaceae	oat/grass glume fragments			
Poaceae	grass stem/culm fragments		++	++
Potentilla sp	cinquefoils			1
Rumex sp	docks		6	
Indeterminate seeds/fruits			9	7
Indeterminate stem/root fragments			++	

Remains are seeds/fruits unless stated otherwise. Actual counts are given otherwise remains are scored on a scale of + to ++++, where: + represents less than five items; ++ between six and 25; +++ between 26 and 100; and ++++ over 100 items

Table 32: Charred plant remains from layer **2467** *and pit* **2428** *(cont'd)*

in contrast there is a notable absence of apple/pear seeds and common mallow, which could suggest a decline in gathered foods. Plants that grow in a broad variety of habitats are also present and these are again broadly comparable to those recorded in the earlier assemblage (*p 95*).

Pollen, plants, and insects in the enclosure ditches

M Rutherford (pollen), D Druce (waterlogged and charred plant remains), and E Allison (insects)

Complementary palaeoenvironmental evidence, in the form of pollen, waterlogged and charred plants, and insects, was recovered from the ditches defining some of the later Romano-British enclosures. Turning first to the pollen evidence, monoliths were extracted from two of the enclosure ditches and the survival of pollen in these was sufficient to warrant analysis, which followed the methodology used for the other pollen cores considered during the project (*Ch 2, p 26*). One of these ditches (***2049***) was in Area B, separating Enclosures 5 and 12 (*p 112*), whilst the other (***3066***) lay in Area C, forming the east/west division between Enclosures 4 and 16 (*p 112*). The pollen in the monolith from ditch ***2049*** could be separated into two pollen assemblage zones: one (2049 (a)) related to pollen in the ditch's lower sediments and the other (2049 (b)) related to pollen in its upper fills (Fig 60; Table 33). In contrast, the pollen in the sediments from ditch ***3066*** formed a single pollen assemblage zone (Fig 61; Table 33).

It is evident from both pollen monoliths that the local vegetation surrounding the later Roman settlement was principally grassland, as the data is typified by abundant, but fluctuating, grass pollen. In this respect,

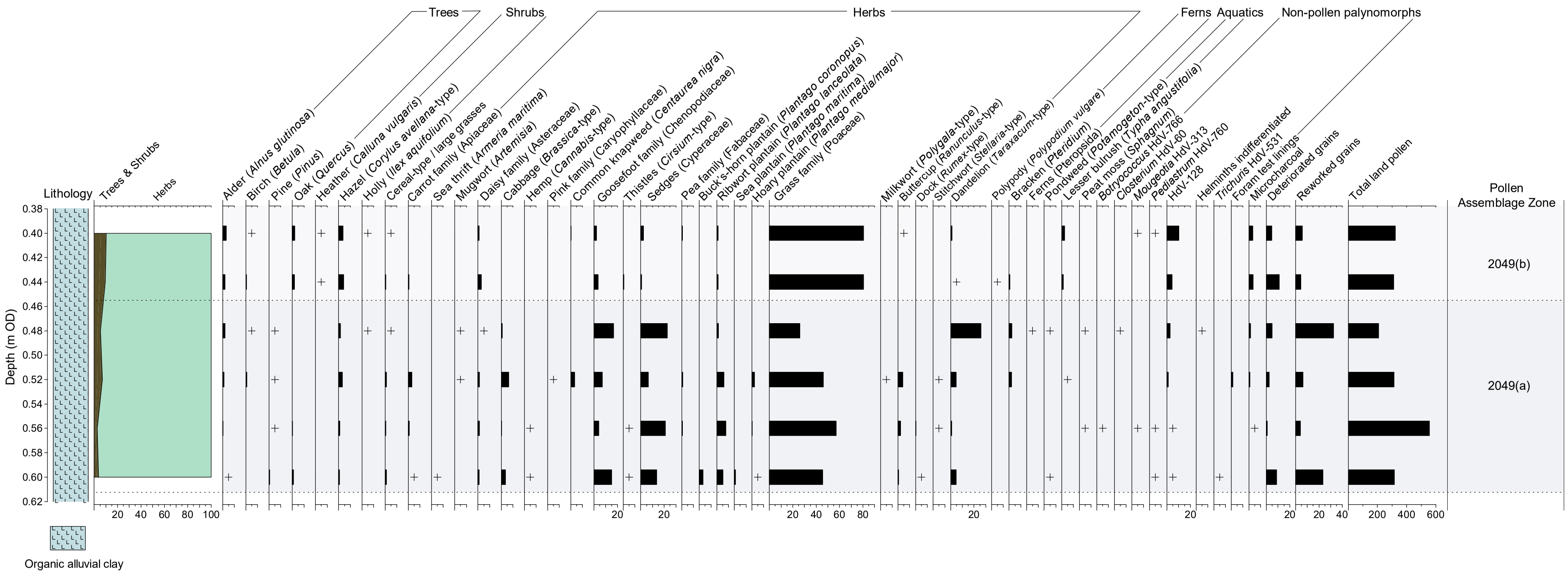


Figure 60: Pollen diagram for enclosure ditch **2049**

Ditch	Zone and depth	Assemblage characteristics
2049	2049 (a): 0.61-0.45 m	This zone is characterised by pollen of herbs similar to that recorded from ditch ***2427***, associated with the Phase RB.II settlement (*p 105*). In addition, the occurrence of thrift (*Armeria maritima*) is recorded in the deepest sub-sample. Tree and shrub pollen is very reduced, with hazel (*Corylus avellana*)-type and alder (*Alnus*) the most commonly recorded. Low frequency of cereal-type pollen is present and rare occurrence of hemp/hops (*Cannabis*-type) is recorded. There are occurrences of several algal types, including *Closterium* (HdV-60) and *Mougeotia* (HdV-313). Eggs of the intestinal parasite, *Trichuris* (HdV-531), were recorded. Foraminiferal test linings are present, and the incidence of pre-Quaternary pollen is high in two sub-samples. Microcharcoal counts are low. Pollen was variably preserved, being abundant at 0.56 m, but poorly preserved and less abundant at 0.48 m
	2049 (b): 0.45-0.38 m	Abundance of pollen of grasses (Poaceae) distinguish this pollen assemblage zone from the underlying zone, 2049 (a). The data also support a slight, but clear, increase in tree and shrub pollen (in particular, alder, oak (*Quercus*), and hazel-type). Although pollen of sedges (Cyperaceae) is much reduced relative to the underlying zone, pollen of aquatics including lesser bulrush (*Typha angustifolia*), are relatively common. Microfossil HdV-128 is also commonly present. The dimensions of low incidence of cereal-type pollen overlap with those of sweet-grasses such as *Glyceria* sp. Low quantities of microcharcoal are recorded
3066	Unzoned: 0.54-0.22 m	This pollen assemblage is characterised by abundant, but fluctuating, grass pollen, with an overall increase in frequency of pollen of the goosefoot family (Amaranthacerae /Chenopodiaceae) between the bottom and top of the zone, and variable occurrences of other herbs such as plantains (*Plantago*), dandelion-types (*Taraxacum*-types), cabbage family (Brassicaceae), pink family (Caryophyllaceae), thistles (*Cirsium*-type), sedges, common knapweed (*Centaurea nigra*), and, in the deepest sub-sample, a relative high frequency of pollen of the carrot family, Apiaceae, a large group including taxa such as marshworts (*Apium*) and rock samphire (*Crithmum maritimum*). Cereal-type pollen is present consistently, with rare occurrences of pollen of hemp/hops. Tree and shrub pollen appear to become slightly more diverse towards the top of the zone (including alder, birch (*Betula*), oak, elm (*Ulmus*), hazel-type, and heather (*Calluna vulgaris*)). Fern spores of bracken (*Pteridium aquilinum*) are consistently present. Sporadic occurrences of pollen from aquatic plants includes low frequency of water-milfoils (*Myriophyllum* sp), lesser bulrush, and pondweed (*Potamogeton*-type). Freshwater algal types include relatively consistent presence of microfossil type HdV-128. There are rare appearances of eggs of intestinal parasites, including *Trichuris* (HdV-531). Rare occurrences of the (marine) dinoflagellate cyst *Operculodinium centrocarpum* may be *in situ* or could be reworked, as there is evidence of pre-Quaternary reworking throughout the section. Microcharcoal is recorded in low quantities only. Pollen preservation is mixed with deteriorated grains present throughout

Table 33: Pollen assemblages from the later Roman enclosure ditches **2049** *and* **3066**

it seems that the landscape was essentially identical to that surrounding the earlier enclosed settlement (*p 105*).

The pollen data from ditches ***2049*** and ***3066*** also suggest the presence of wet meadows, or pasture, in the vicinity of the settlement, which, given the presence of some salt-tolerant taxa, may have been exposed to saline inundation. This was again noted in the pollen from the earlier enclosure ditch (*p 122*) and is also consistent with the wider evidence from the Humber Estuary (Long *et al* 1998). Specifically, an increase in saltmarsh vegetation is interpreted from increased frequency of pollen of the goosefoot family, cabbage family, plantains (*Plantago*), and mugworts (*Artemisia*) in the lower pollen zone in ditch ***2049*** and the upper part of ditch ***3066***. In coastal locations, pollen of the goosefoot family may include oraches (*Atriplex*), sea-blites, and glassworts, all of which are commonly found on muddy saltmarshes, though the family also includes taxa such as fat-hen, which is often abundant on disturbed ground (Stace 2019). Plantains, including those tolerant of coastal habitats (*eg* sea plantain and buck's-horn plantain), are also common in the samples from ditches ***2049*** and ***3066***. Furthermore, pollen of the halophyte, thrift (*Armeria maritima*), was recorded from ditch ***2049***, providing confirmatory evidence for saltmarsh conditions, whilst the consistent occurrence of pollen of the cabbage family, also from this same ditch, may be indicative of a community of plants such as scurvy grass (*Cochlearia officinalis*), which grows on

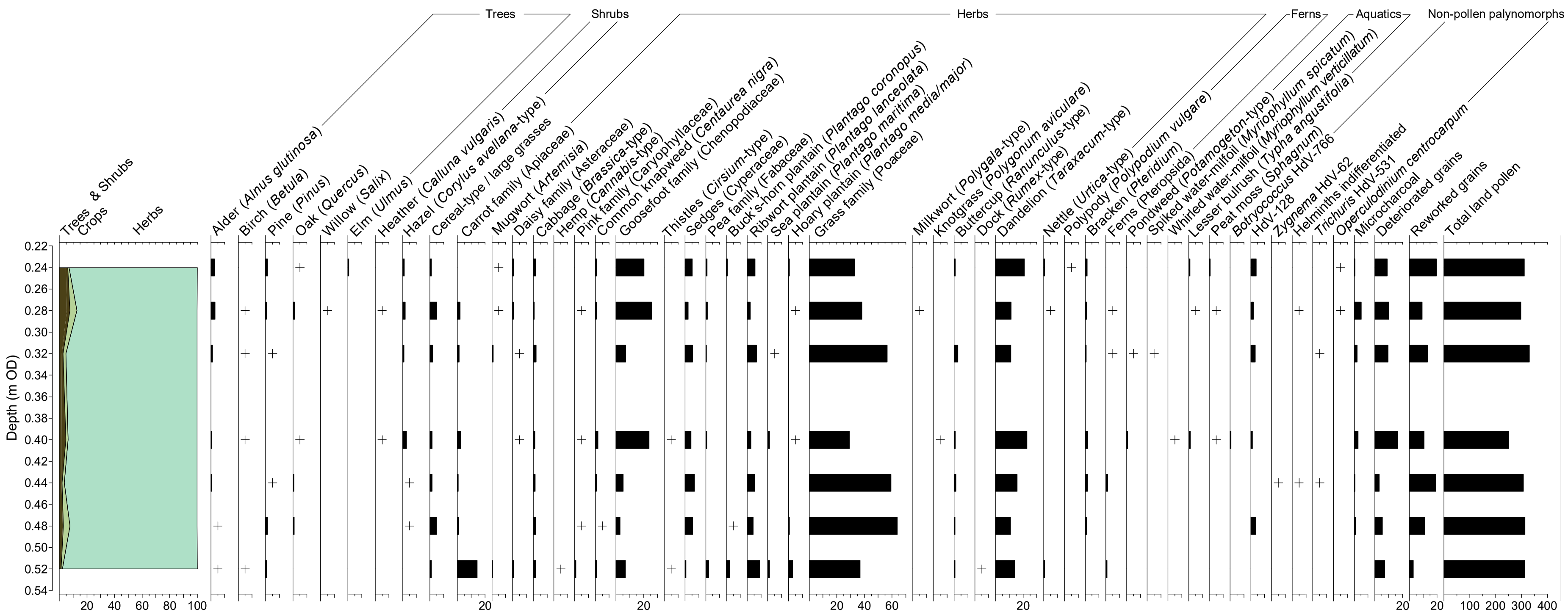


Figure 61: Pollen diagram for enclosure ditch **3066**

saltmarshes and muddy shores, or sea kale (*Crambe maritima*), which is also a coastal plant (Stace 2019). A range of pollen from aquatic plants was also recorded and this includes pollen from bulrushes (*Typha angustifolia*), which are often amongst the first plants to colonise areas of newly exposed, wet mud (*ibid*).

As with the pollen data from the earlier enclosed settlement (*p 105*), small quantities of cereal-type pollen are indicative of minor cultivation, and the pollen from ditch ***3066*** also includes rare pollen of weeds associated with cultivated fields, such as knotgrass (*Polygonum aviculare*; Behre 1981), as well as dandelion-type weeds, which are particularly abundant. The significant amounts of dandelion-type pollen may, therefore, also be indicative of disturbed, cultivated, or waste ground (Nayling and Caseldine 1997), although this might also be down to differential preservation. Specifically, this type of pollen grain is highly resistant to microbial attack and oxidation (Wilmshurst and McGlone 2005), particularly following a period when conditions were unsuitable for pollen preservation (Bottema 1975), which could result in over-representation in the pollen assemblage.

Tree and shrub pollen was generally scarce in the monoliths, which is consistent with the suggestion that woodland clearance was already well advanced by the Iron Age (Beckett 1981; Tweddle 2000; *Ch 3, p 61*) and that it had largely been cleared during the period when the earlier enclosed Romano-British settlement was occupied (in Phase RB.II; *p 98*). Nevertheless, there is evidence for some (probable) regional stands of woodland, comprising oaks with pine, birch, hazel-type, rare elm (*Ulmus*), and holly (*Ilex aquifolium*), with alder and rare willow (*Salix*) in wetter areas. The presence of hazel-type suggests the presence of small areas of hazel scrub or woodland, or perhaps hedgerows; however, the pollen may represent bog-myrtle, which frequents wet moorland, heathland, bogs, and fen habitats (Stace 2019).

The NPP assemblage is fairly diverse and comprises rare occurrences of freshwater algae, *Botryococcus* (HdV-766) and *Pediastrum* (HdV-760), variants of the blue/green alga *Zygnema* HdV-62, and the slightly more consistent presence of microfossil HdV-128, all from shallow, stagnant freshwater habitats (van Geel 1978). There are also infrequent occurrences of the eggs of intestinal parasites, notably *Trichuris* (HdV-531), in both ditches. This suggests the presence of faecal material, which could be of animal or human origin (Jones 1982). More specifically, the size of these eggs measure 42-36 μm and these fall within the ranges measured for *T trichiura* and *T suis*, with the former known to parasite humans and the latter to infect pigs (*cf* Sondak 1948; Beer 1976; Hall *et al* 1983).

The basal sediments in ditch ***3066***, as well as the joining enclosure ditch (***3065***; *p 112*) that defined the western side of Enclosures 4 and 16, contained numerous seeds preserved under waterlogged/anaerobic conditions (Table 34). Both ditches contained abundant rush seeds, whilst ditch ***3065*** also contained abundant water crowfoot (*Ranunculus aquatilis* agg), which along with possible pondweed (*Potamogeton* sp) and horned pondweed (*Zannichellia palustris*) represent aquatic or sub-aquatic plants. These species commonly grow in ponds, ditches, and slow rivers, and they supplement and confirm the pollen evidence from ditches ***3066*** and ***2049***, which also represent a range of aquatic plants (*above*).

A slight marine influence is indicated in the material from ditch ***3065*** due to the presence of frequent foraminifera; however, other than rare possible orache seeds, much of the evidence from the enclosure ditch primarily relates to a freshwater environment, which is probably to be expected given that by this stage the tidal creek seems to have no longer existed (*p 106*). Although rare water crowfoot seeds were also recorded in ditch ***3066***, evidence for the presence of standing water within this feature is less evident. Rather, it seems that the ditch was being infilled with organic matter, evident by the presence of abundant wood and leaf fragments.

In comparison to ditch ***3065***, ditch ***3066*** also included more evidence for cultivated land and waste places. Notably these include common hemlock (*Conium maculatum*) seeds, which, although preferring damp/wet conditions, also grow in waste ground, often alongside tracks or roads. The higher quantity of charred plant remains, including rare cereal grains, weed seeds, and small grass culm fragments, and also charcoal in ditch ***3066***, suggests the feature was in receipt of more settlement waste than ditch ***3065***.

In addition to the pollen and waterlogged plant remain, insects were present in the recut (***3503***) of an enclosure ditch recorded in Trench 35, in the settlement core (*p 108*), providing additional details on the later Roman environment and the economy of the settlement. This assemblage contains 357 beetles and bugs of 142 taxa (Table 35; *Appendix 3*). Aquatic beetles are abundant, with the 25 taxa identified, accounting for around a third of the whole assemblage (34%), indicating that the ditch held water for much of the time when the silts accumulated. *Ochthebius* species are particularly well represented, all typically associated with mud, both in and beside water (*O marinus*, *O viridis* sl, *O dilatatus*, *O minimus*, and *O ?bicolon*). Both *O marinus* and *O viridi s*l are halobiontic, indicating saltmarsh and brackish conditions, although the former can tolerate very low salinities. Saltmarsh conditions are also indicated by a few terrestrial taxa, including *Bembidion iricolor* and a horned *Bledius* species. *O bicolon*, only tentatively identified, is usually associated with running freshwater; however, other water beetles in the assemblage are eurytopic and some are tolerant of

Taxa	**Common name**	***Habitat (after Stace 2019)***	**Ditch *3065* (10 l sample; 150 ml flot)**	**Ditch *3066* (10 l sample; 10 ml flot)**
Sample volume (L)			10	10
Flot volume (ml)			150	10
Percentage analysed			100	100
		Cultivated/arable/ waste places		
Chenopodium album	fat-hen			++
Sonchus asper	smooth sow-thistle			*cf*+
Stellaria media	common chickweed			+
Urtica urens	small nettle			+
		Woods/hedges/scrub		
Betula sp	birch family	mostly damp/waterlogged conditions	+	
cf Apium nodiflorum	*cf* fool's water cress	ditches, marshes and by lakes and rivers		+
Carex sp	sedges	mostly damp/wet ground	++	
Conium maculatum	hemlock	damp ground, ditches, roadsides, waste ground		+++
Juncus sp	rushes	mostly damp/wet ground	++++	++++
cf Potamogeton sp	*cf* pondweed	obligate aquatic in broad range of habitats	+	
Ranunculus aquatilis agg	water crowfoot	subaquatic in ponds, ditches, and slow rivers	++++	+
Zannichellia palustris	horned pondweed	obligate aquatic in broad range of habitats	+	
		Grow in a broad range of habitats		
cf Atriplex sp	oraches	mostly in coastal areas, saline habitats, and saltmarshes		+
Cirsium sp	thistles		+	
Poaceae	grasses		++	+
Potentilla sp	cinquefoils		+	+
Pteropsida trilete spore	ferns		++	
Solanum dulcamara	bittersweet			++
Charred plant remains				
Cerealia indet	indeterminate cereals			+
cf Galeopsis sp	hemp-nettle	broad range of habitats including arable and waste ground		+
Melilotus/Medicago/ Trifolium	melilot/medick/ clover	broad range of habitats including grassland and waste/rough ground		++
Poaceae stem/culm fragments	grasses			++
Vicia/Lathyrus	vetch/tare			+
Indeterminate stem/ root fragments				++

Table 34: Waterlogged plants, and other remains, from the later Romano-British enclosure ditches, Area C

Taxa	**Common name**	***Habitat (after Stace 2010)***	**Ditch *3065* (10 l sample; 150 ml flot)**	**Ditch *3066* (10 l sample; 10 ml flot)**
Sample volume (L)			10	10
Flot volume (ml)			150	10
Percentage analysed			100	100
Charcoal fragments			++	++++
Other remains				
Wood fragments				++++
Leaf fragments				++++
Daphnia ephippium resting eggs	water flea		++	
Foraminifera			++	

Remains are seeds/fruits unless stated otherwise, which are scored on a scale of + to ++++, where: + represents less than five items; ++ between six and 25; +++ between 26 and 100; and ++++ over 100 items

Table 34: Waterlogged plants, and other remains, from the later Romano-British enclosure ditches, Area C (cont'd)

Total beetle individuals	***355***
Total beetle taxa	***142***
AQUATICS (% of whole fauna)	33%
TERRESTRIAL BEETLES AND BUGS	
Decomposer component:	
Dry decomposers [rd]	4%
Foul decomposers [rf]	18%
Eurytopic decomposers [rt]	14%
Total decomposers [RT = rd+rf+rt]	36%
% rd/RT	12%
% rf/RT	50%
% rt/RT	38%
Other groups:	
Grain pests [g]	0%
Wood-associated taxa [l]	0%
House fauna [h]	4%
Scarabaeoid dung beetles	16%
'Oxyteline association'	7%
Damp ground/waterside [d]	12%
Obligate saltmarsh taxa [c]	2%
Plant-associated [p]	20%
Tree foliage [t]	0%
Total outdoor taxa	50%
SYNANTHROPES	
Strong synanthropes [ss]	0%
Typical synanthropes [st]	3%
Facultative synanthropes [sf]	12%
Total synanthropes [S = sf+st+ss]	15%
% ss/S	0%
% st/S	18%
% sf/S	82%

Table 35: Statistics for the analysed Coleoptera assemblage from ditch recut **3503***, Trench 35*

brackish waters to some degree. All *Ochthebius* species *Bagous*, represented by several individuals, are aquatic weevils that live among submerged vegetation. *Acidota cruentata* and *Lesteva longoelytrata* are typically associated with moss and litter in marginal wetland situations.

Various taxa indicate that wet, exposed mud existed in the ditch (*Carpelimus* spp, *Bledius*, *Augyles*/*Heterocerus*, *Dryops*, and *Bembidion ?lunulatum*), and a terrestrial *Helophorus* (*Empleurus*) species suggests the presence of adjacent cultivated or disturbed ground for which there are also hints from *Ceutorhynchus*, *Meligethes*, and perhaps *Psylliodes*, which are all associated with the wild and cultivated cabbage family (Brassicaceae). Other phytophages provide evidence for vegetation on both damp and drier ground. The host plants of *Agramma laetum* (a lace bug) and *Chaetocnema arida* group include sedges and rushes, while *Notaris acridulus* occurs on reed-sweet-grass (*Glyceria maxima*) and probably other semi-aquatic grasses (Morris 2002, 38). *Prasocuris* (*Hydrothassa*) species are usually associated with the buttercup family (Ranunculaceae), and *Donacia* and *Plateumaris* species with wetland vegetation, but the remains are too fragmentary to determine the host plants. Nettles (Urticaceae) growing on nutrient-enriched ground were indicated by *Heterogaster urticae* and *Brachypterus*. Drier ground, perhaps further from the ditch, is indicated by the ground beetles *Calathus fuscipes*, *Amara*, and *Ophonus*, and several taxa are indicative of grassland, including *Phyllopertha horticola*, *Mecinus labilis*, found on ribwort plantain, and *Sitona* species associated with pea family (Fabaeceae).

Scarabaeid dung beetles are proportionally very well represented, suggesting that grazing animals were a common presence locally (five species; 16% of the terrestrial beetle assemblage), with *Nimbus contaminatus* the most numerous species. Two of the other dung beetles recorded, *Melinopterus prodromus*, or *sphacelatus*, and *Calamosternus granarius*, are attracted to foul settlement waste in addition to fresh dung deposited in open grassland. A small but characteristic house fauna was recorded (*Latridus minutus* group, *Cryptophagus*, *Atomaria* spp; 3%), in combination with a group of beetles associated with foul organic matter (*Cercyon ?haemorrhoidalis*, *C nigriceps* or *pygmaeus*, *Cryptopleurum minutum*, *Anotylus sculpturatus* group, *Platystethus aenarius*, and *Aleochara*), suggesting the disposal of foul litter from buildings, possibly including stable manure. Alternatively, if cultivated ground was present, manuring may have been occurring on adjacent ground. The presence of occasional fragmentary sheep ked (*Melophagus ovinus*) puparia in association with a house fauna is probably significant. The puparia are firmly attached to sheep wool by a secretion produced by the female keds and they are difficult to dislodge from the fleece. In archaeological contexts they chiefly occur in deposits associated with wool cleaning and discarded floor litter from buildings where wool cleaning was taking place, rather than indicating the presence of living sheep. It seems most likely in this case that the ked puparia arrived in the ditch with occupation waste, pointing to the cleaning and processing of wool in the settlement.

Sediments in the enclosure ditches and the evidence for salt working
R I Macphail and C J Carey

During fieldwork, several soil monoliths were taken from enclosure ditches ***2056***, ***2148***, ***2149***, and ***2635***, in Area B, and ditches ***3066*** and ***3377***, in Area C. These were then subjected to detailed analysis to determine the character of the deposits and also to see if they contained pedological evidence for activity associated with the later Romano-British settlement.

Considering first the monoliths from Area B, that from ditch ***2056*** (*p 112*) was extracted from three sequential deposits of grey silty clay in the lower part of this feature (***2038***, ***2039***, and ***2040***, first to last; Fig 62). All contained sub-horizontally oriented monocotyledonous plant

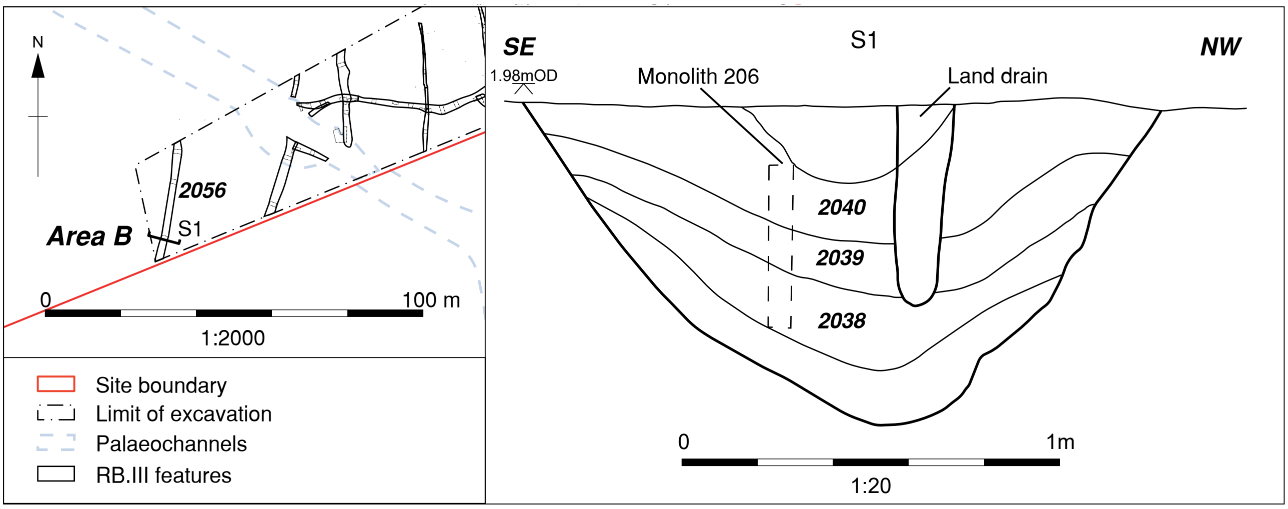


Figure 62: Section across ditch ***2056****, showing the position of the analysed soil monolith*

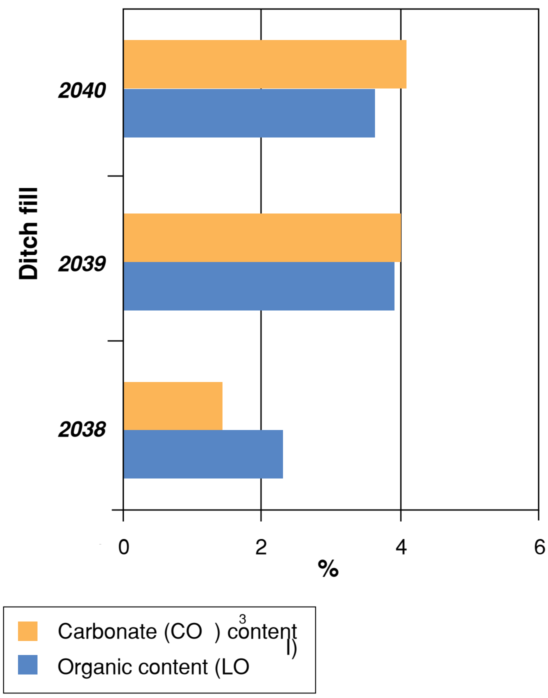


Figure 63: The organic content (LOI) and CO_3 data (%) for deposits **2038**, **2039**, *and* **2040**, *in ditch* **2056**

fragments and abundant very fine charred/blackened organic matter (max 3.92% LOI; Fig 63), which were most concentrated in deposit ***2039*** (Pl 43). This seems to suggest the intentional burning of the local wetland, possibly as part of the management of land used for grazing livestock (*cf* Wilkinson and Murphy 1986; 1995; Bell *et al* 2000; Wilkinson *et al* 2012). Following the deposition of deposit ***2040***, the partially infilled ditch was subjected to waterlogging, which resulted in iron mottling and increased iron content (max 2.52% Fe; Fig 64) in this upper deposit, as well as peaks in manganese (0.013% Mn) and very low magnetic susceptibility values (Crowther and Barker 1995; Crowther 2003; Vepraskas *et al* 2018). Secondary iron also seems to be 'fixing' small amounts of phosphate (0.022-0.039% P).

Similarly, the monolith from ditch ***2148*** (*p 112*) also produced evidence for the management of the local wetland by fire. This sampled a deposit of silt (***2179***) at the base of the ditch and contained abundant very fine charcoal and concentrations of sub-horizontally oriented charcoal, including probable monocotyledonous material (2.89% LOI; Pl 44). The ditch was initially waterlogged, as deposit ***2179*** was originally iron-depleted, but it later became 'drier', which resulted in iron mottling (1.39% Fe). Waterlogged leaching was also responsible for the low phosphate levels (0.05% P) and very low magnetic susceptibility (Crowther and Barker 1995; Crowther 2003).

The monolith from ditch ***2149*** (*p 112*), again, sampled a basal fill (***2227***), which comprised a brown silty clay. In contrast to ditches ***2056*** and ***2148***, there were no clear

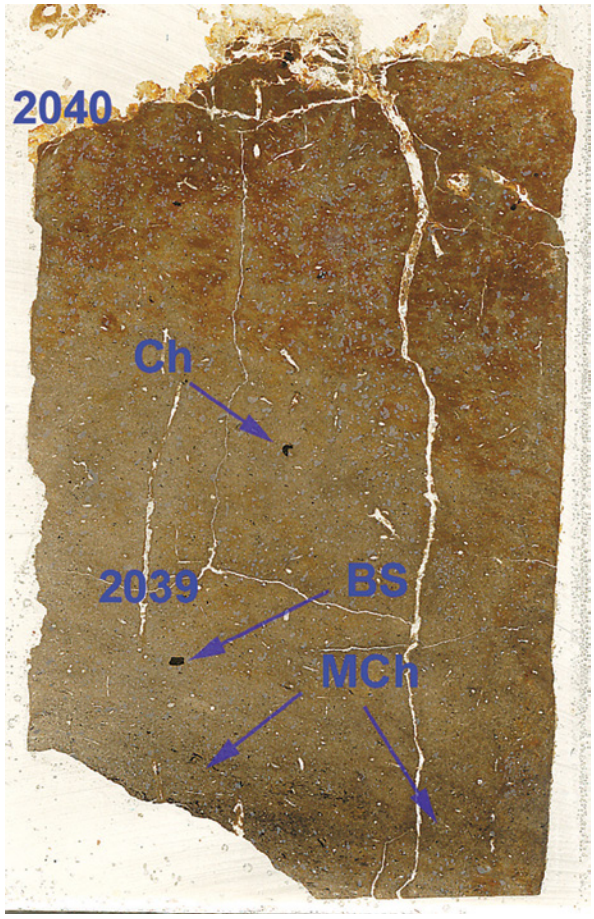


Plate 43: Photomicrograph of the silty clay deposits in ditch **2056**, *with concentrations of monocotyledonous charcoal (MCh) in deposit* **2039**, *which include a blackened/charred organic soil fragment (BS). Upwards, deposit* **2040** *is characterised by iron mottling. Frame height is ~90 mm*

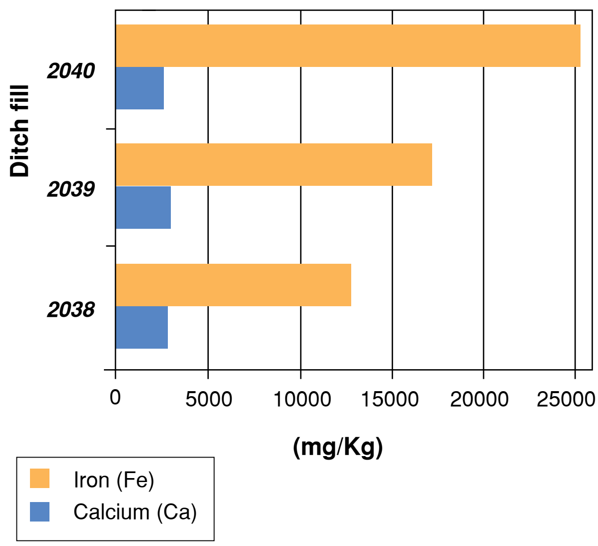


Figure 64: The iron (Fe) and calcium (Ca) data (mg/k) for deposits **2038**, **2039**, *and* **2040** *in ditch* **2056**

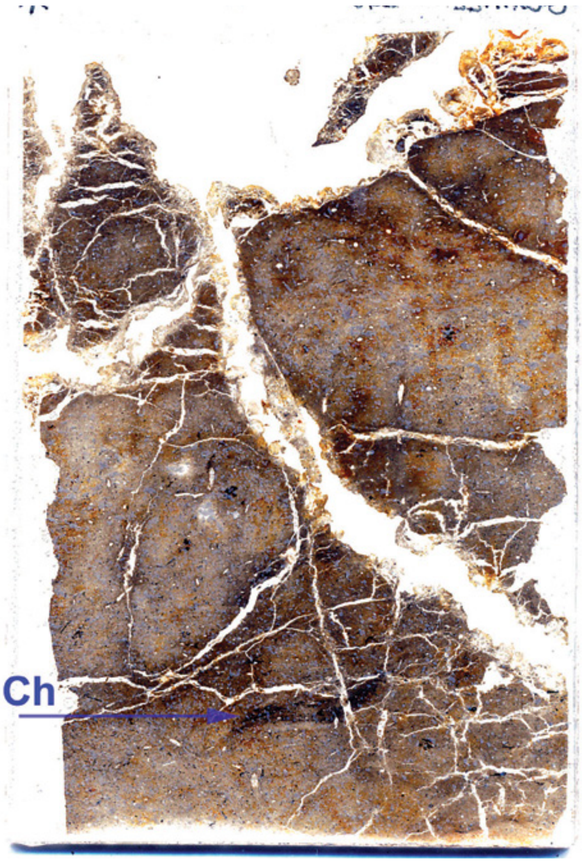


Plate 44: Photomicrograph of the silty clay deposits in ditch **2148***, showing general iron depletion with later iron mottling. The deposit contains very fine charcoal with minor matrix pan-associated charcoal concentration, including likely monocotyledonous charcoal (Ch). Frame height is ~90 mm*

anthropogenic signals in this sediment, although it did include some very fine organic matter (2.92% LOI).

Two monoliths (870 and 873) from ditch ***2635*** are, however, much more informative. Following an initial period of silting, this ditch had been recut (*p 111*), and both of the monoliths sampled the upper fill (*2577*) of the recut ditch and, importantly, an overlying layer (*2576*), which probably represents a midden deposit originally associated with Building 4, that had been shunted into the top of the partially infilled ditch following the abandonment of the settlement (*p 113*; Fig 65). One of the monoliths (873) also sampled the upper fill (*2582*) contained in the initial incarnation of this boundary (Fig 65).

Both monoliths indicated that the midden layer (*2576*) represented a finely fragmented burnt sediment, which had previously been rooted, with roots that were blackened, darkened, and rubified (Pl 45). Its red colour also suggests that it related to processes that involved heating materials to moderate temperatures (400-500°C), which was also consistent with enhanced magnetic susceptibility values (Tite and Mullins 1971; Dammers and Joergensen 1996; Röpke and Dietl 2017) and the rare instances of siliceous plant materials being partially melted into nodules. Of further note are suggested dicotyledonous plant rooting into this midden, which have been found in coastal soils affected by brackish groundwater (Macphail *et al* 2010).

In monolith 870 the geochemistry revealed that midden layer **2576** was much more organic when compared

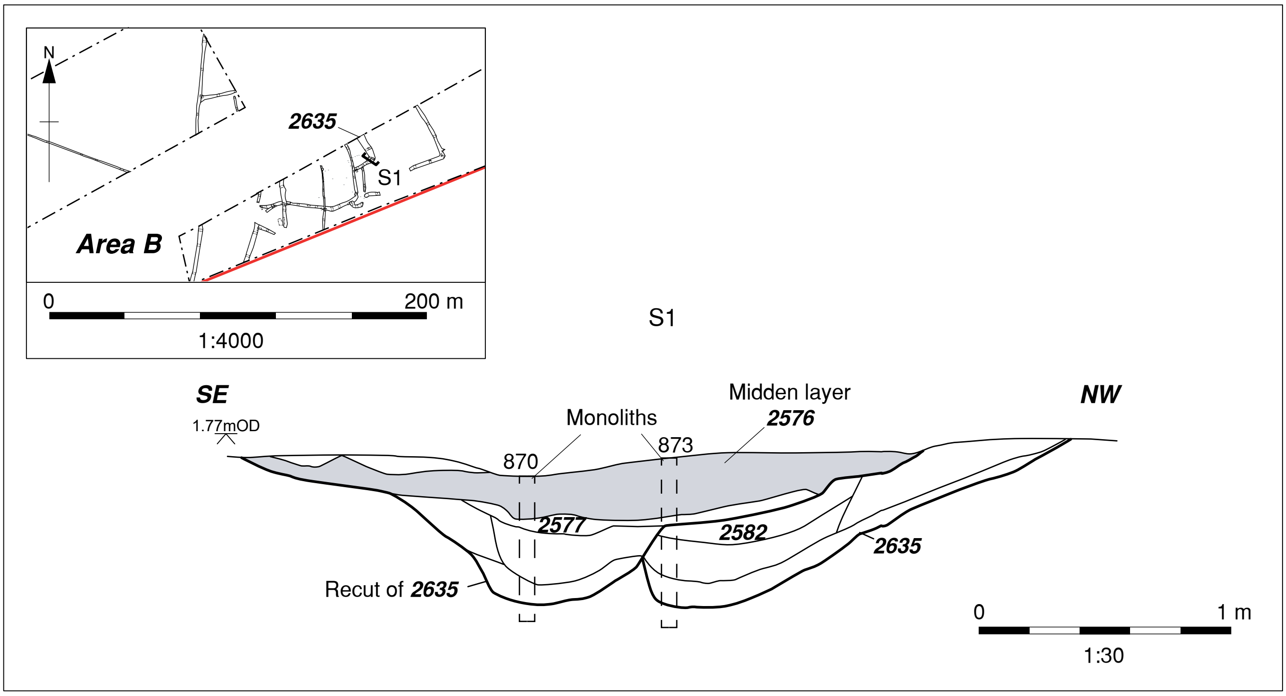


Figure 65: Section across ditch **2635***, and its recut, and midden layer* **2576** *(Phase RB.III), showing the position of the analysed soil monoliths*

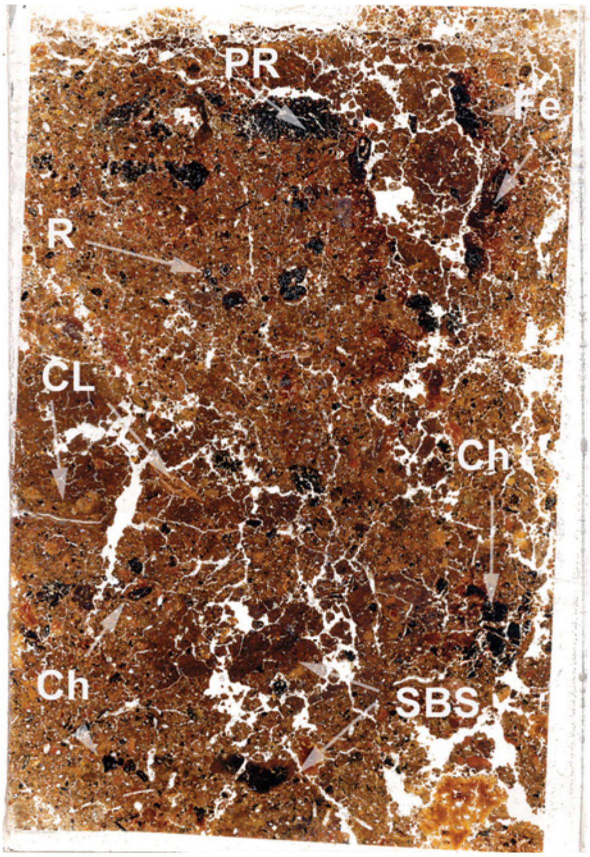


Plate 45: Photomicrograph of midden layer **2576** *(monolith 870). The reddish colours record the presence of ubiquitous burnt sediment clasts, with opaque more strongly burnt examples (SBS), iron-stained examples (Fe), charcoal, charred plant remains (PR) and charred amorphous organic matter and partially melted siliceous plant remains. Later rooting included probable dicotyledonous plants (R). Frame height is ~90 mm*

to the underlying ditch fill, ***2577*** (7.77% LOI; 2.80% LOI, respectively; Fig 66). Ash residues may also have contributed to concentrations of potassium and phosphate (0.033% K, 0.39% P; Fig 67), while contamination by copper, especially (37.5 mg/kg Cu), as well as zinc, arsenic, and lead, are indicative of industrial processes and use of alloys (tools, utensils), such as bronze (Fig 68). Trace amounts of silver (0.13 mg/kg Ag) were also recorded, which could relate to the use of lead vessels. The geochemistry of monolith 873 was also revealing as this indicated markedly enhanced levels of sodium (1890-1161 over 763 mg/kg Na), phosphorus (3572-3047 over 653 mg/kg P), copper (32-26 over 12 mg/kg Cu), zinc (103-90 over 63 mg/kg Zn), tin (1.26-0.81 over 0.54 mg/kg Sn), and organic matter (7.00-3.97 over 3.28% LOI). In addition, magnetic susceptibility enhancement of deposit ***2576*** was the highest recorded in all of the soil monoliths analysed in Areas B and C.

Overall, given the amount of charcoal and ubiquity of burnt-mineral material, it was therefore evident that midden layer ***2576*** contained debris from fire installations and industrial activity. It was also evident that this debris was not composed of burnt daub and clay, often associated with ovens and furnaces, but was instead composed of once-vegetated (coastal) wetland soil sediments. Elsewhere, such reddened, burnt accumulations have been linked to salt working and are termed 'red hills' (Biddulph *et al* 2012; Macphail *et al* 2012). The unusually high concentrations of sodium (0.16% Na) are also consistent with this deposit being linked with salt working, with the geochemistry also indicating the likely use of bronze utensils and lead vessels, with the latter possibly being used for boiling brine (*cf* Biddulph *et al* 2012).

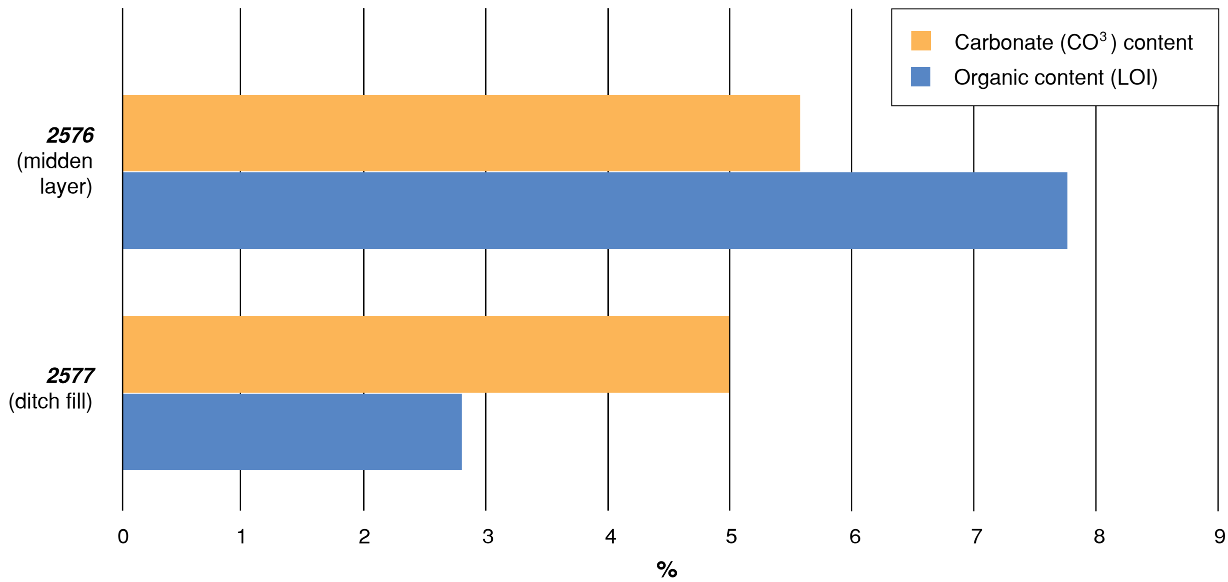


Figure 66: The organic content (LOI) and CO_3 data (%; monolith 870) for deposits **2577** *and* **2576***, associated with ditch* **2635**

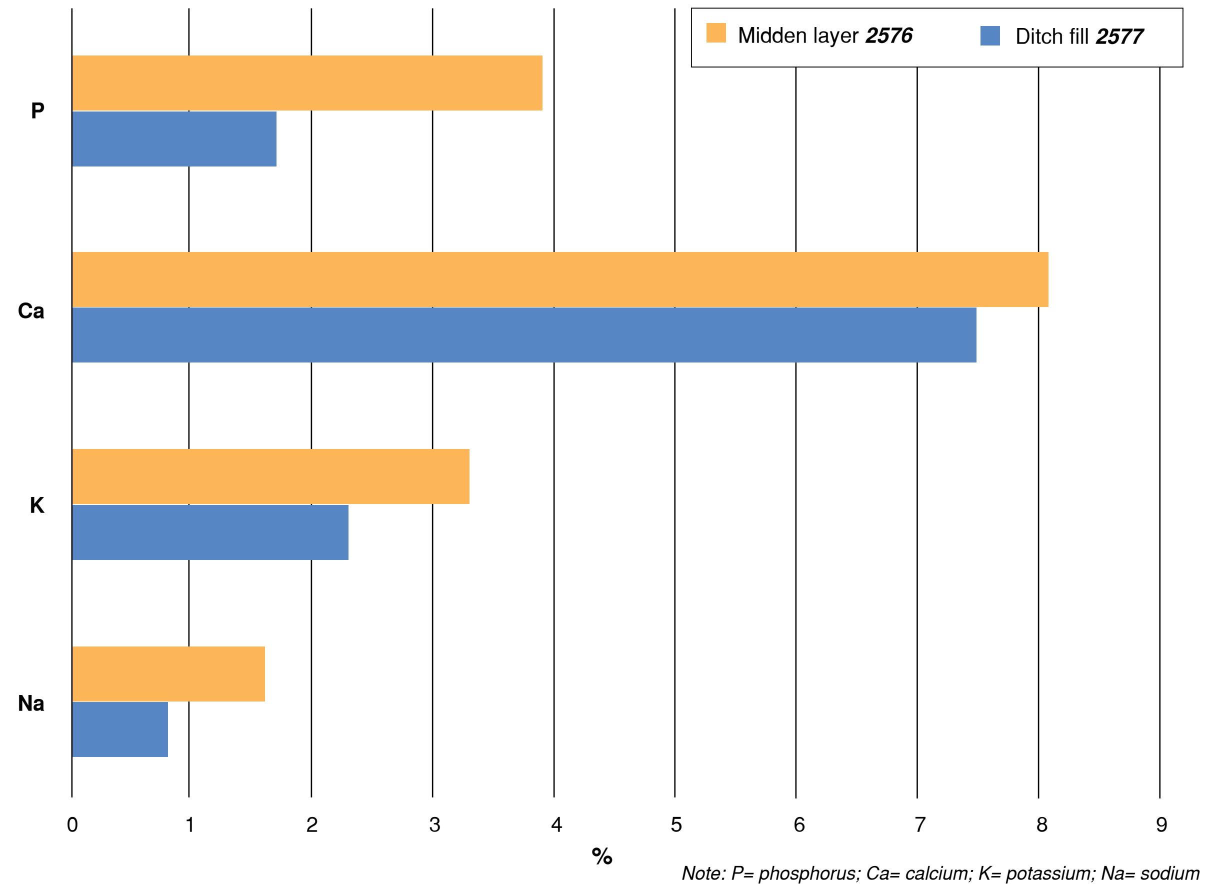


Figure 67: The calcium (Ca), potassium (K), sodium (Na), phosphorous (P) data (%) for deposits **2577** *and* **2576**, *associated with ditch* **2635**

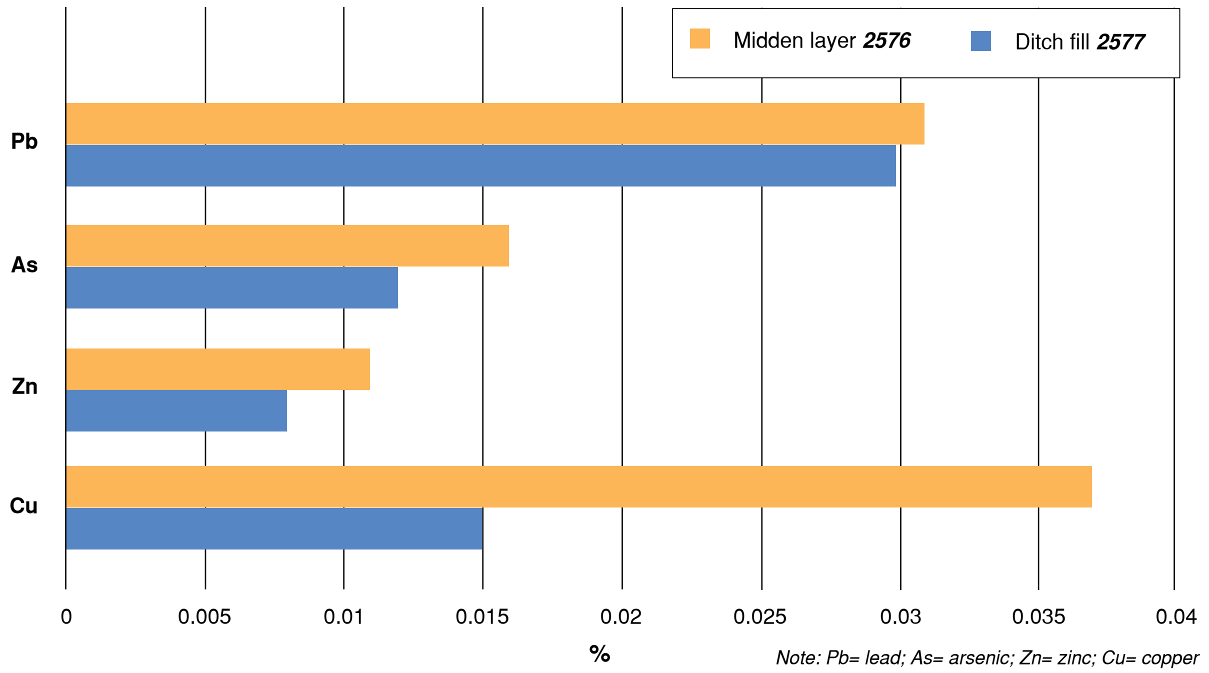


Figure 68: The lead (Pb), arsenic (As), zinc (Zn), and copper (Cu) data (%) for deposits **2577** *and* **2576**, *associated with ditch* **2635**

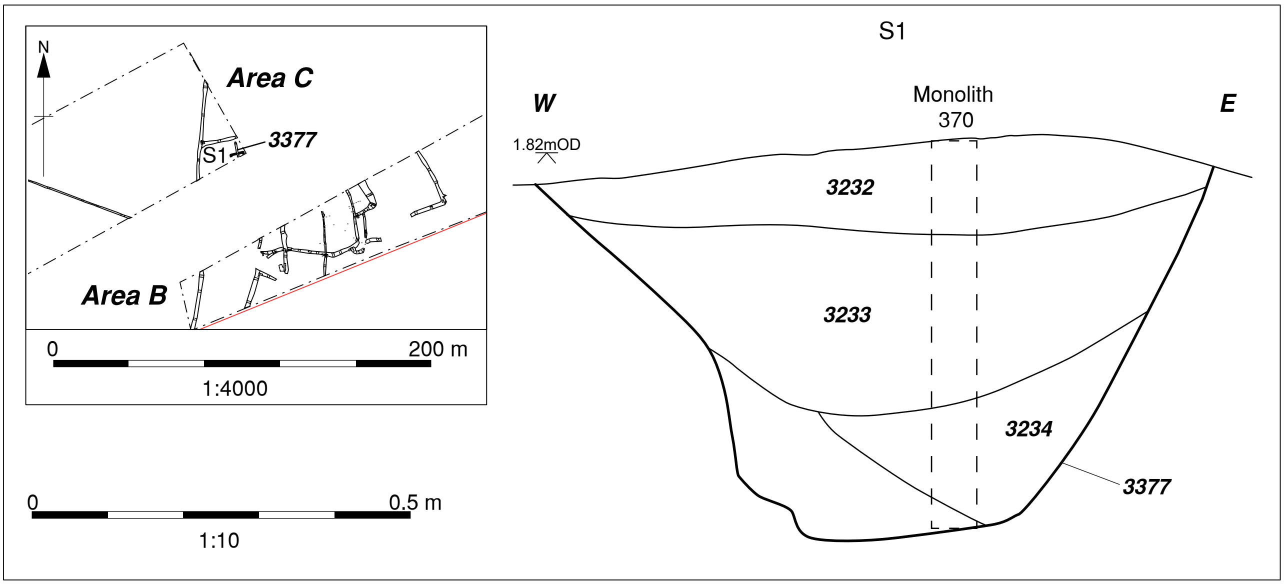


Figure 69: Section across ditch **3377**, *showing the position of the analysed soil monolith*

From Area C the monoliths were extracted from enclosure ditches *3066* and *3377* (*p 112*), and one of these proved to be particularly informative. This was taken from three sequential deposits of silty clay (*3234*, *3233*, and *3232*, first to last; Fig 69) that filled boundary *3777*. This indicated that the lower silt (*3234*) was only associated with a moderate amount of very fine charcoal, relating to background burning in the area. In contrast, deposit *3233* represented a fine charcoal-rich dump of burnt muddy sediments, which also contained a 6mm-size cluster of bone fragments (max 3 mm), possibly butchery discard (Pl 46). These fragmented reddish sediments contained possible plant pseudomorphs structures, which represent marine plant rooting features, and burning is reflected in an enhanced magnetic susceptibility, with charcoal (max 2 mm) and charred organic matter contributing to a moderately high 5.28% LOI. Heavy-metal combinations and pollutants (Cu, Ni, As, and Pb) indicate the use of alloy utensils. The relatively high amount of zinc (88 mg/kg Zn) may have been concentrated by the use of marine sediments (Macphail and Goldberg 2018, 287-9). Significantly, all these pedological features and geochemistry point to a salt-working origin for this deposit (Biddulph *et al* 2012; Macphail *et al* 2012).

It was clear from upper deposit *3232* that the dumping of burnt material into this boundary was not continuous, as the base of this deposit was characterised by silty clay that had washed into the ditch, above which were burnt sediments associated with fire installations (Pl 47). These included diatomaceous sediments (variously burnt) and embedded, moderately strongly heated vesicular siliceous nodules (possibly of plant/silt origin). Also present were fragments of humic anthropogenic sediments, which, although enigmatic, were probably water-laid in the vicinity of the fire installation. It is also notable that deposit *3232* had a very similar geochemical signature to deposit *3233* (*above*), though with slightly more organic matter (6.34% LOI), again, a signal

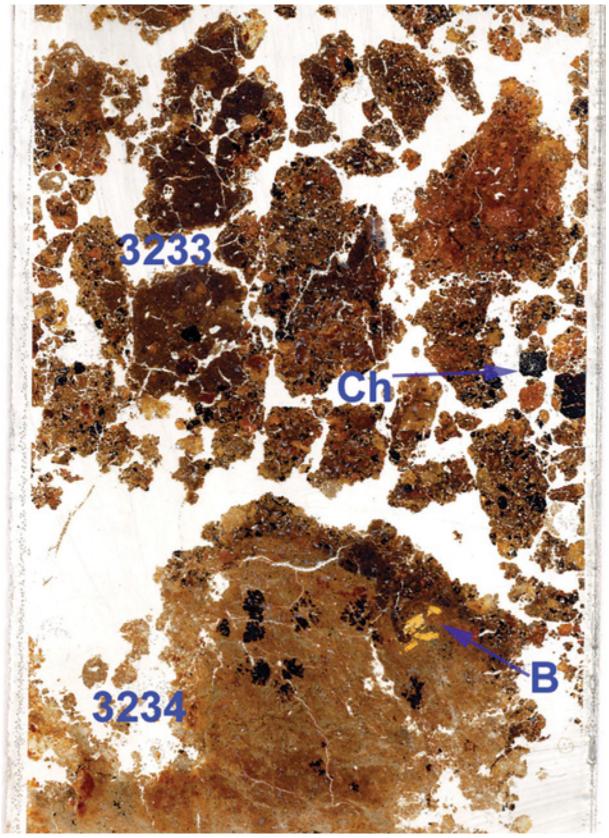


Plate 46: Photomicrograph of deposits **3234** *and* **3233** *in ditch* **3377**. *Waterlain layered and laminated clayey silts and silty clays make up layer* **3234**. *Overlying deposit* **3233** *is composed of charred organic matter and fine charcoal (Ch), burnt probable mudflat sediments showing relict marine plant rooting structures and probable semi-melted siliceous plant remains. This also is burrow mixed into* **3234**, *and there is a bone cluster (B) at its base. Frame height is ~90 mm*

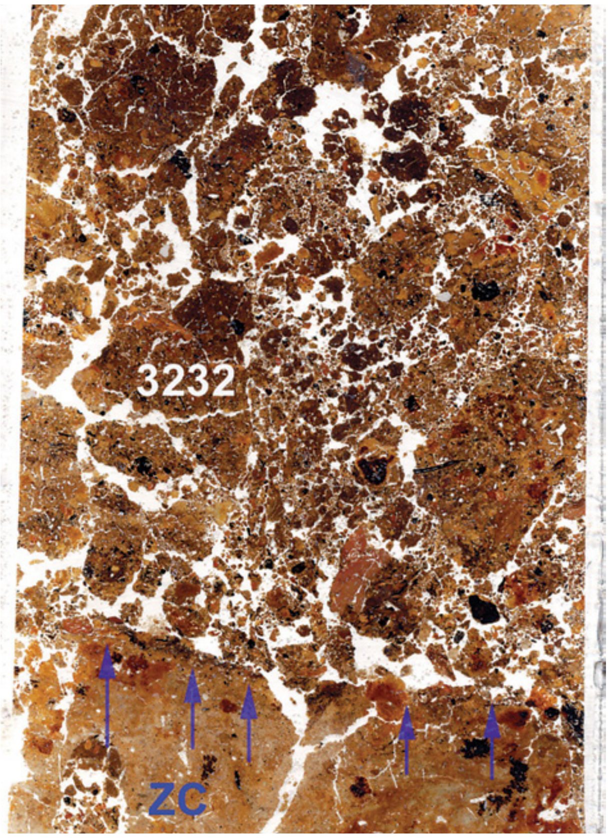


Plate 47: Photomicrograph of deposit **3233** *in ditch* **3377**. *The lower layer is a massive silty clay deposit that shows upward fining to a 'surface' (ZC). Upwards deposit* **3232** *is composed of fragmented mainly burnt muddy sediments relict of fire installation use. Frame height is ~90 mm*

of salt working, where non-ferrous metal-alloy utensils were used. The geochemical signatures of both deposits ***3233*** and ***3233***, however, is slightly different from midden layer ***2576***, which was also debris from salt working (*p 131*) and includes more strongly burnt sediment fragments (higher magnetic susceptibility) and is richer in sodium (Na).

The other monolith from Area C was extracted from the upper silty clay fill in ditch ***3066*** (*p 112*), which was deposited at a time when the ditch was waterlogged, as it was iron depleted (1.21% Fe) and strongly manganese and phosphate depleted (0.007% Mn, 0.003% P). It also contained very fine and fine charcoal (3.38% LOI), including likely charred monocotyledonous plant remains, that probably reflect the management of wetland vegetation by fire.

Radiocarbon dating

An integral element of the post-excavation analysis was an extensive programme of radiocarbon dating (*Ch 1, p 18*). Although all the features associated with the open (Phase RB.I), enclosed (Phase RB.II), and later (Phase RB.III) incarnations of the Romano-British settlement were associated with Roman pottery, and some could be placed within a relative sequence based on stratigraphy, radiocarbon dating focused on a selection of features from these different phases. It was designed to provide independent chronological information and to assist in the dating of the less chronologically sensitive Roman pottery types.

In total, 21 samples were submitted for AMS dating, comprising charred plant remains (cereals, other seeds, stems, and a culm node; 14 samples), short-lived charcoal (four samples), and animal bone (three samples). In terms of provenance, one sample (SUERC-104287) was from a ditch (***2658***) that defined Trackway 2, forming an element of the earliest (Phase RB.I) open settlement on the 'island' between the palaeochannels in Area B (*p 89*). When calibrated this produced a later Iron Age/ Early Roman period date (Table 36), though the ditch also contained transitional ware pottery (IAGR2; *p 93*), implying that it dated to the period following the Roman conquest. Based on the presence of this pottery and the calibrated range of the dated sample, it seems that the trackway ditch was open and receiving organic material in the mid-first century AD and that transitional ware fabric type IAG2 was also, by extension, being produced in this period. Apart from this sample, a fragment of horse bone from the adjacent palaeochannel (***2305***), to the east, was assayed, and the resultant date was statistically consistent with the dated material in the trackway ditch (T'=0.57; $T'(5\%)$=3.8; v=1; A_{comb}= 102.4%(An= 50.0%)). Although, in radiocarbon terms, this animal bone might also relate to later Iron Age activity, it is notable that the palaeochannel lay well beyond the identified area of later Iron Age settlement (*Ch 3, p 63, p 65*), but was

Feature/context	**Laboratory code**	**Material**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Calibrated date range (95% confidence)**
Palaeochannel ***2305***	SUERC-104311	Animal bone: horse/ donkey/mule (*Equus* sp) mandible fragment	1984±24	-22.6	45 cal BC-cal AD 115
Ditch ***2658***; Trackway 2	SUERC-104287	Charcoal: *Salix/Populus* sp	2013±24	-25.0	55 cal BC-cal AD 75
Ring-gully ***2225/2385***	SUERC-74731	Charred seed: *Malus/ Pyrus* sp	1898±29	-25.0	cal AD 60-230
	SUERC-104283	Charred seed: *Avena* sp	1928±24	-23.9	cal AD 25-205
	SUERC-104284	Charred seed: *Malva* sp	1978±24	-25.0	40 cal BC-cal AD 120

Table 36: The radiocarbon dates from the open settlement (Phase RB.I)

directly adjacent to elements of the Romano-British open settlement, and so the horse bone most likely derived from this later phase of settlement.

Several other samples from the open settlement were also dated. These comprised three samples from roundhouse ring-gully **2225/2385** (*p 83*). When subjected to the chi-square test, these assays are statistically consistent (T′=3.79; T′(5%)=5.99; *v*=2), though one assay (SUERC-74731) has slightly poor agreement (A_{comb}=56.7%(An= 60.0%)), being later in date, and therefore could indicate intrusive material. It may also be significant that this ring gully contained the same type of transitional ware pottery (IAGR2) to that in Trackway 2, along with another transitional ware fabric (IAGR1) and several types of grey ware (GREY1, NWLGR, and SFGR; *p 93*), indicating that these were also produced when the roundhouse was in use.

A collection of samples from the features associated with the succeeding (Phase RB.II) enclosed settlement were also subjected to radiocarbon assay (Table 37). Four of these were from ditch **2427/2464**, which defined Enclosure 2 (*p 98*), with two (SUERC-104285 and SUERC-104286) from successive ditch fills in the western side of the enclosure (*ie* ditch **2427**). The other two were also from sequential ditch fills, one (SUERC-104275) from the fill of the primary ditch and the other (SUERC-104303) from a fill in a ditch recut, both on the eastern side of the enclosure (*ie* ditch **2464**). These dates form sequences that broadly span the mid-first century cal BC to the first decade of the third century cal AD.

A contemporary ditch (**2357**) that ran off Enclosure 2 formed an element of Enclosure 3 (*p 98*), and two samples from this were subjected to radiocarbon assay. One (SUERC-104271), however, was modern, whilst the other (SUERC-104273) produced a date spanning the mid-second to mid-third century cal AD. A final feature associated with the enclosed settlement was ring-gully **2370** (*p 99*). Three assays were gained from this, though when combined these failed the chi-square test, having poor agreement (T′=8.69; T′(5%)=6.0; *v*=2; A_{comb}=18.1%(An= 40.8%)), indicating the presence of residual/intrusive material. It seems likely, however, that SUERC-104291 dates intrusive material, particularly as the other two assays from the ring gully (SUERC-104293 and SUERC-104306) are statistically consistent, with good agreement (T′=1.74; T′(5%)=3.84; *v*=1; A_{comb}=67.4%(An= 50.0%)).

It is also worth noting that Enclosure 2 partially cut Trackway 2, associated with the open settlement (*p 134*), whilst Enclosure 3 also truncated ring-gully **2225/2385**, again associated with the open settlement (*p 135*). Therefore, the respective assays from the earlier features are effectively constrained by those from Enclosure 2, and *vice versa*.

Finally, a group of assays were obtained from features associated with the later Romano-British settlement (Phase RB.III; Table 38). Stratigraphically, four of these were from ditches (*p 112*) associated with the rectilinear enclosure system that, in Area B, overlaid features associated with the earlier phases of Romano-British settlement. One of these assays (SUERC-104277) was from the secondary fill of ditch **3066** and it calibrates to the mid-second to early fourth century cal AD. The second (SUERC-104276) was from the secondary fill of an adjacent ditch (**3777**), spanning the mid-second to mid-fourth century cal AD. The third (SUERC-104292)

Feature/context	Laboratory code	Material	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (95% confidence)
Ditch **2427** (secondary fill); Enclosure 2	SUERC-104285	Charcoal: *Alnus glutinosa*	1960±24	-25.3	35 cal BC-cal AD 125
Ditch **2427** (tertiary fill); Enclosure 2	SUERC-104286	Charred seed: *Triticum* sp	1923±20	-22.1	cal AD 30-205
Ditch **2464** (secondary fill of primary ditch); Enclosure 2	SUERC-104275	Charcoal: *Corylus avellana*	1965±18	-24.5	25 cal BC-cal AD 125
Ditch **2464** (secondary fill of recut ditch); Enclosure 2	SUERC-104303	Charcoal: *Corylus avellana*	1945±24	-25.2	25 cal BC-cal AD205
Ditch **2357**; Enclosure 3	SUERC-104271	Charred seed: *Hordeum vulgare*	Modern	-27.0	Modern
	SUERC-104273	Charred seed: *Hordeum vulgare*	1846±24	-23.1	cal AD 125-245
Ring-gully **2370**	SUERC-104291	Charred seed: *cf Pisum sativum*	1832±24	-26.0	cal AD 125-315
	SUERC-104293	Charred seed: *Triticum* sp	1889±24	-24.4	cal AD 80-225
	SUERC-104306	Animal bone: cattle (*Bos taurus*) tooth (maxillary)	1935±17	-21.8	cal AD 20-155

Table 37: The radiocarbon dates from the enclosed settlement (Phase RB.II)

was from the tertiary fill of ditch ***2635***, calibrating to the late first to early third century cal AD. The fourth (SUERC-104272), from the secondary fill of ditch ***2384*** (*p 112*), spans the mid-second to mid-third century cal AD. Significantly, when the three assays (SUERC-104272, SUERC-104276, and SUERC-104277) from the secondary ditch fills are combined and subjected to the chi-square test, they are statistically consistent, with good agreement (T′=1.03; T′(5%)=5.99; v=2; A_{comb}=161.8%(An=40.8%)), suggesting that the ditches of the enclosure system were open, though partially filled, during a similar period. This, in turn, seems to imply that the early date (SUERC-104292) from the tertiary fill of ditch ***2635*** was from residual material. It is also worth noting that ditches ***2384*** and ***2635*** also produced pottery (including shell-gritted Dales ware; DWSHT), indicating that these ditches were open and receiving material across the third and also potentially the early fourth centuries (*p 119*).

Of the remaining dates samples from the later Romano-British settlement, one (SUERC-104307) was from a construction trench (***2636***) for Building 4 (*p 112*). This produced a date spanning the mid-second to early fourth century cal AD. The second assay (SUERC-104274) dated midden layer ***2467*** in Enclosure 10 (*p 113*), which was possibly also associated with the use of Building 4. This suggests that material was entering the midden during the mid-second to mid-third century cal AD. The third assay (SUERC-104282) was from pit ***2428*** (*p 113*), which again dates to the mid-second to mid-third century cal AD.

Bayesian modelling

Sequences and phases

Bayesian chronological modelling was undertaken to refine the dating of the Romano-British remains, which, importantly, had good stratigraphic interplay, and hence provided the required *a priori* archaeological information (*Ch 1, p 19*). Therefore, this information could be used to create a site-specific prior information model (Griffiths 2022, 163), with the radiocarbon dates being placed within three OxCal phases that were set within an OxCal sequence (*'Romano-British activity'*).

The earliest phase in this sequence (*'Phase RB.I. Open settlement'*) contained dated features that probably related to the same phase of activity but had no direct stratigraphic relationships. These were therefore situated within two separate sub-phases. One of the sub-phases (*'Trackway 2'*) contained the single radiocarbon date (SUERC-104287) from ditch ***2658*** (*p 135*), whilst the other (*'Ring-gully 2225/2385'*) contained the combined date from the two statistically consistent assays (SUERC-104283/104284) from this gully (*p 135*), which were included as a 'Prior'. The third date from this feature (SUERC-74731), which seemed to date intrusive material, was also included, though it was set as an outlier (?), meaning it was excluded from the model as an active likelihood.

Significantly, both the trackway and ring gully were cut by the features associated with the Romano-British enclosed settlement (*p 98*), and hence the radiocarbon evidence associated with this subsequent settlement formed the next OxCal phase (*'Phase RB.II. Enclosed settlement'*) in the sequence. This phase contained the sub-phase *'Enclosure 2'*, with the two sets of sequential radiocarbon dates from the ditches defining the eastern and western sides of this enclosure being modelled as two separate sequences (*'Ditch 2427'* and *'Ditch 2464'*). The single date (SUERC-104273) from the upper fill of Enclosure 3 was also included as a sub-phase (*'Ditch 2357 upper fill'*). Similarly, the radiocarbon dates from ring-gully ***2370*** (*p 136*), which lay within Enclosure 3, were also included as a sub-phase (*'Ring-gully 2370'*). This sub-phase contained the combined date from SUERC-104293/104306, forming a 'Prior', which seems to date this feature. In addition, another date (SUERC-104291) was placed in this sub-phase, though as it has poor agreement with the other two dates, it was set as an outlier (?).

The last OxCal phase in the sequence was '*Phase RB.III. Later Romano-British settlement*' and within this the radiocarbon dates were contained in four OxCal sub-phases. One (*'Partially open ditches'*) contained a 'Prior' from the combined dates for the secondary ditch fills in certain parts of the enclosure system, all of which were statistically consistent (*above*). This sub-phase also contained another date (SUERC-104292); however, it is

Feature/context	Laboratory code	Material	Radiocarbon age (BP)	δ^{13}C (‰)	Calibrated date range (95% confidence)
Ditch ***3066*** (secondary fill)	SUERC-104277	Charred seed: *Conium maculatum*	1835±22	-25.0	cal AD 125-305
Ditch ***3377*** (secondary fill)	SUERC-104276	Charred stem fragments: *Dicotyledon*	1808±24	-26.2	cal AD 165-335
Ditch ***2635*** (tertiary fill)	SUERC-104292	Charred seed: *Hordeum vulgare*	1897±24	-25.0	cal AD 75-220
Ditch ***2384*** (secondary fill)	SUERC-104272	Charred seed: *Hordeum vulgare*	1845±24	-21.9	cal AD 125-245
Construction trench ***2636***; Building 4	SUERC-104307	Animal bone: *Mammalia* humerus shaft fragment	1832±19	-21.5	cal AD 130-310
Midden layer ***2467***	SUERC-104274	Charred culm node: Poaceae	1851±24	-24.2	cal AD 125-240
Pit ***2428***	SUERC-104282	Charred seed: *Triticum* sp	1846±24	-24.0	cal AD 125-245

Table 38: The radiocarbon dates from the later Romano-British settlement (Phase RB.III)

suspected to derive from residual material (*p 137*) and therefore provides a *terminus post-quem* for the deposit (expressed as 'After' in the OxCal model). The other three sub-phases related to dated features contained within the enclosure system and included *'Building 4'*, *'Midden layer 2467'*, and *'Pit 2428'*.

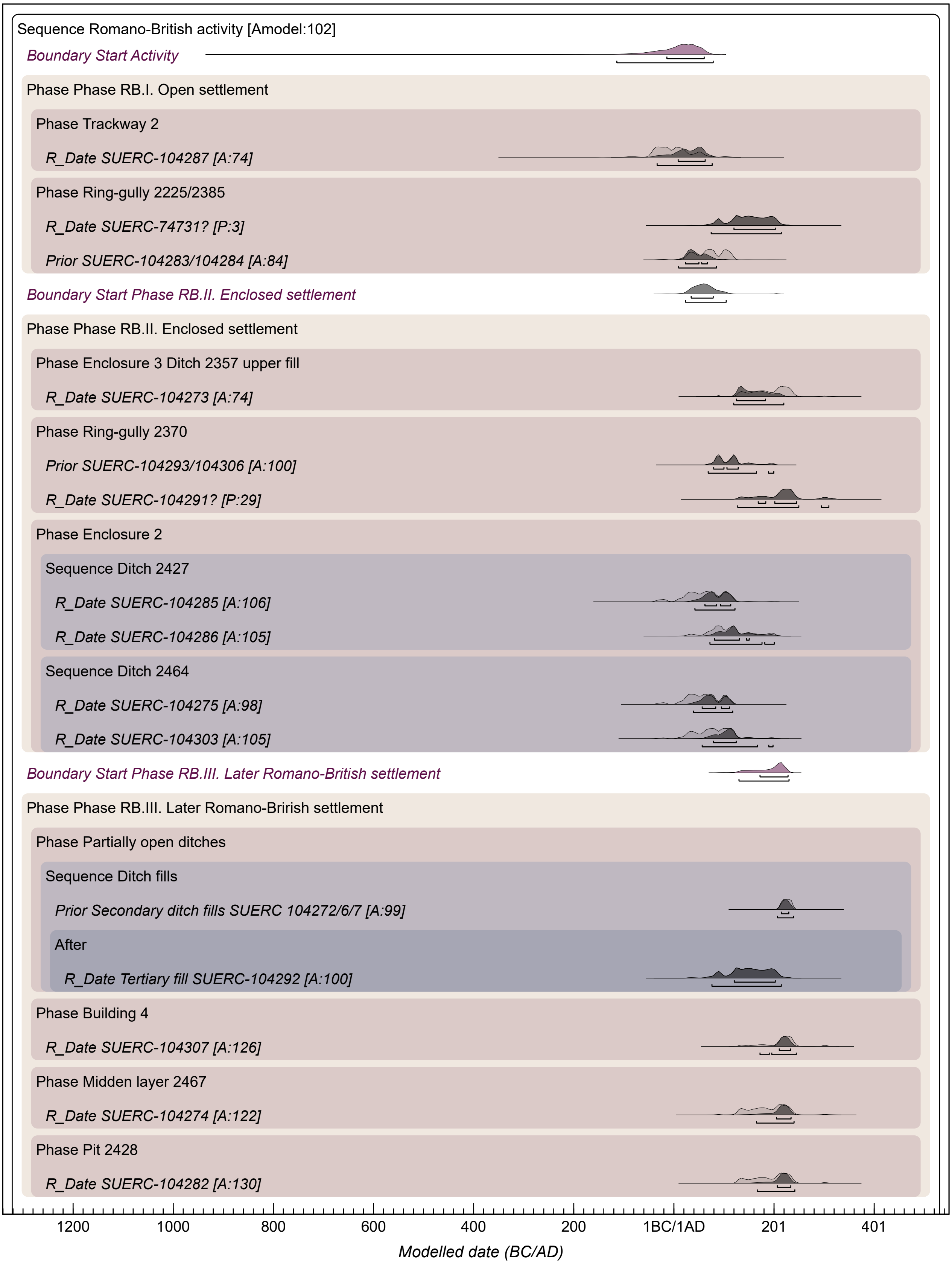


Figure 70: The posterior-density estimates for Romano-British settlement

Results

The model has good agreement (Amodel=102) and provides modelled dates (priors) for the three phases of Romano-British settlement (Fig 70; Table 39). Specifically, the model indicates that the start of '*Phase RB.I. Open settlement*' occurred in *120 cal BC-cal AD 80*, whilst the ditch of Trackway 2 was filling in *40 cal BC-cal AD 80*, and ring-gully ***2225/2385*** contained material dating to *cal AD 10-90*; however, based on the pottery evidence (which dates after the Roman conquest), it is likely that both features, and the open settlement more generally, dated to the mid-/late first century AD.

The model estimates that the succeeding enclosures, associated with the enclosed settlement, were created in *cal AD 20-110* (*Start Phase RB.II. Enclosed settlement*). Moreover, it seems that the upper fill within the ditch of Enclosure 3 ('*Ditch 2357 upper fill*') formed in *cal AD 120-220*, whilst the modelled dates from Enclosure 2 suggest that its ditches were open and filling across the period *c cal AD 40-210*.

The model estimates that the enclosures associated with the later Romano-British settlement were created in the period *cal AD 130-240* (*Start Phase RB.III. Later Romano-British settlement*); however, the secondary ditch fills entered this enclosure system in the period *cal AD 200-240*. Hence, the enclosure ditches must have been created prior to this, with the modelled dates providing a *terminus ante quem* for the cutting of the ditches, perhaps in the early decades of the third century cal AD (*ie* in the intervening period between the filling of the Phase RB.II enclosures and the partial filling of the Phase RB.III enclosures). The features contained within the Phase RB.III enclosures (Building 4, midden layer ***2467***, and pit ***2428***) all date to the same broad period, *c cal AD 160-250*, indicating that the enclosures were in use in the late second/early third century AD. Whilst the chronology of the pottery also seems to largely confirm this, as the assemblage is predominantly second- to third-century in date, it does include several sherds dating to the third to fourth centuries, and even material dating to the later fourth century (*p 118*). This may suggest that there was a main floruit of occupation activity in the late second/third century, followed by much reduced activity in the end stages of the Roman period, with the areas of settlement being largely abandoned, which included a lack of maintenance of the rectilinear enclosures that had originally formed such an important element of the later Romano-British settlement.

Modelled OxCal phase/event	**Modelled dates**	**Posterior density estimate (68% confidence)**	**Posterior density estimate (95% confidence)**
Start Activity	-	*20 cal BC-cal AD 60*	*120 cal BC-cal AD 80*
'*Phase RB.I. Open settlement*' phase; '*Trackway 2*' sub-phase	*SUERC-104287*	*cal AD 10-70*	*40 cal BC-cal AD 80*
'*Phase RB.I. Open settlement*' phase; '*Ring-gully 2225/2385*' sub-phase	*SUERC-104283/104284*	*cal AD 20-70*	*cal AD 10-90*
Boundary *'Start Phase RB.II. Enclosed settlement'*	-	*cal AD 30-80*	*cal AD 20-110*
'*Phase RB.II. Enclosed settlement*' phase; '*Enclosure 3*' sub-phase; '*Ditch 2357 upper fill*' sub-phase	*SUERC-104273*	*cal AD 120-190*	*cal AD 120-220*
'*Phase RB.II. Enclosed settlement*' phase; '*Ring-gully 2370*' sub-phase	*SUERC-104293/104306*	*cal AD 80-130*	*cal AD 60-200*
'*Phase RB.II. Enclosed settlement s*' phase; '*Enclosure 2*' sub-phase; sequence '*Ditch 2427*'	*SUERC-104285*	*cal AD 60-120*	*cal AD 40-130*
	SUERC-104286	*cal AD 80-160*	*cal AD 70-210*
'*Phase RB.II. Enclosed settlement*' phase; '*Enclosure 2*' sub-phase; sequence '*Ditch 2464*'	*SUERC-104275*	*cal AD 50-120*	*cal AD 30-120*
	SUERC-104303	*cal AD 70-130*	*cal AD 50-200*
Boundary *'Start Phase RB.III. Later Romano-British settlement'*	-	*cal AD 170-230*	*cal AD 130-240*
'*Phase RB.III. Later Romano-British settlement*'; '*Partially open ditches*' sub-phase; sequence '*Ditch fills*'	*SUERC-104272/104276/104277 (Secondary ditch fills)*	*cal AD 210-240*	*cal AD 200-240*
	SUERC-104292 (Tertiary fill; terminus post quem)	*cal AD 120-210*	*cal AD 70-220*
'*Phase RB.III. Later Romano-British settlement*'; '*Building 1*' sub-phase	*SUERC-104307*	*cal AD 210-240*	*cal AD 170-250*
'*Phase RB.III. Later Romano-British settlement*'; '*Midden layer 2467*' sub-phase	*SUERC-104274*	*cal AD 200-240*	*cal AD 160-250*
'*Phase RB.III. Later Romano-British settlement*'; '*Pit 2428*' sub-phase	*SUERC-104282*	*cal AD 200-240*	*cal AD 160-240*

Table 39: Posterior-density estimates for key parameters in the chronological model for Romano-British settlement

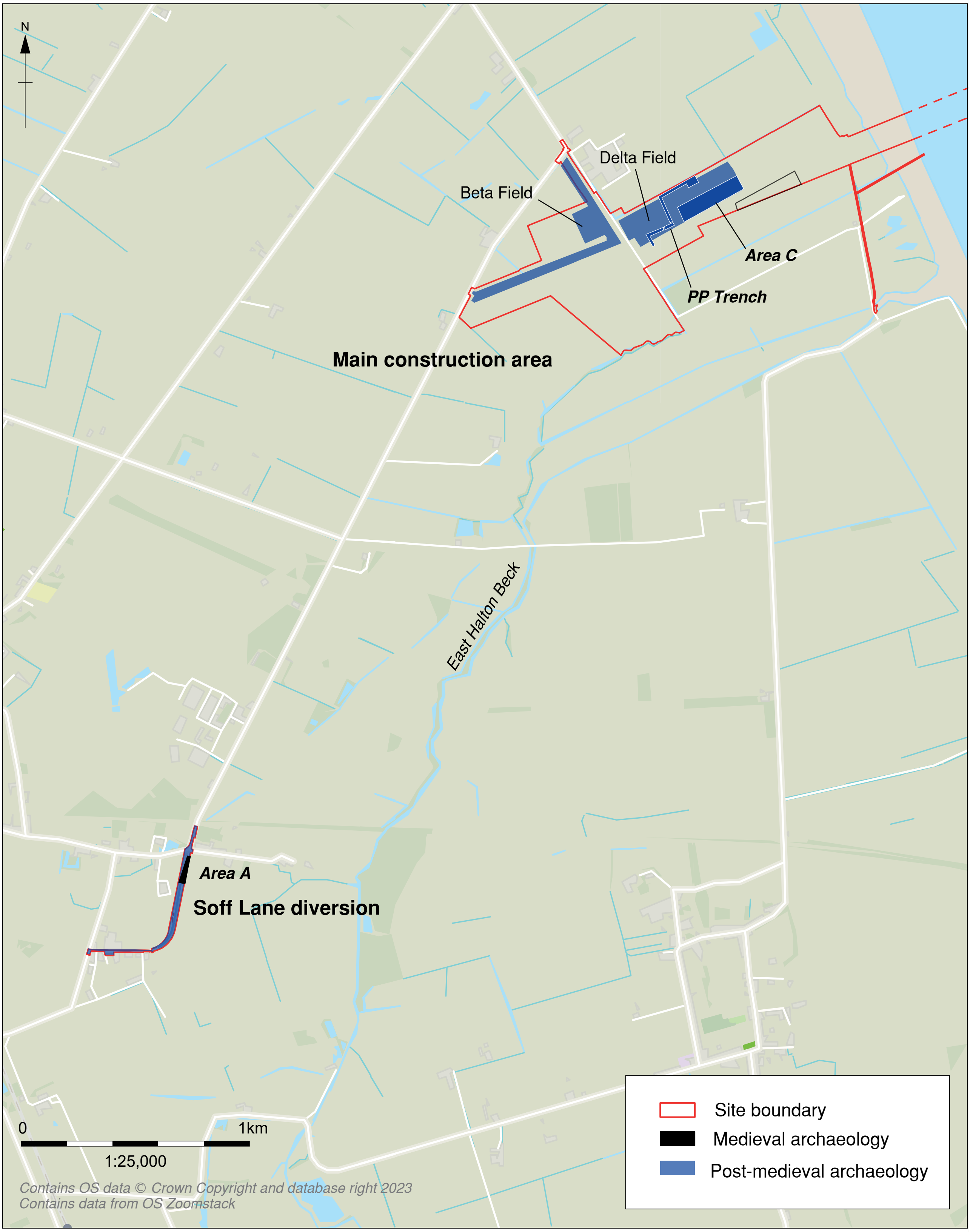


Figure 71: The areas containing medieval and post-medieval remains at Goxhill

5

MEDIEVAL AND POST-MEDIEVAL LANDSCAPES

R A Gregory and J Zant

At the start of the mitigation works, one area on the southern side of the Humber was suspected to contain significant evidence for medieval activity. This was close to Goxhill village, at the northern end of the Soff Lane diversion, where four trial trenches, excavated as part of the preliminary phase of works, had revealed ditched boundaries associated with medieval pottery (Fig 71; *Ch 1, p 6*). This part of the diversion was therefore earmarked for more detailed investigation, comprising open-area excavation (Area A) that was designed to expose and record more of these features, and also any other associated archaeological remains. This certainly proved worthwhile, as this excavation revealed the form and stratigraphic relationships of these boundaries, along with several more boundaries, pits, and possible structures. In addition to these remains, during the course of the watching brief along the diversion, south of Area A, and in two areas in the main construction area (Beta and Delta Fields; *Ch 1, p 12*), as well as in Area C and the PP Trench (*Ch 1, p 8*), several features were recorded that provide some minor details on the form of the post-medieval agricultural landscape.

The Medieval Landscape at Goxhill

R A Gregory, C L Howsam, and J Zant

The rise in sea level that began towards the end of the Roman period (*Ch 4, p 80*) continued for several centuries before levels began to fall again, towards the end of the first millennium AD (Long *et al* 1998; Van de Noort 2004, 107). Consequently, for much of the early medieval period (*c* fifth to mid-eleventh centuries), the Lincolnshire marshes, and in particular the Outmarsh (*Ch 1, p 2*), were probably susceptible to regular flooding, which is likely to have resulted in the abandonment of some of the more marginal areas and the establishment of settlements further inland (Van de Noort 2000). Archaeological and pollen evidence also suggests that both rural and urban populations in Lincolnshire declined dramatically during this period, resulting in the large-scale abandonment of settlements, both on the coast and inland (*op cit*, 129). Historically, the earlier part of this period equates with the arrival of Anglo-Saxon settlers from the Continent that, in northern Lincolnshire, initially led to the formation of the minor kingdom of Lindsey, which was eventually absorbed into the larger Anglo-Saxon kingdom of Mercia in the seventh century, following the Battle of the Trent in 679 (Leahy 2008, 7).

Subsequently, between the late ninth and mid-eleventh centuries most of eastern England, including northern Lincolnshire, and in turn Lindsey, formed part of Danelaw, an area ruled by the Danish Vikings who administratively divided the East Midlands into the Five Broughs, one of which was centred on Lincoln (Van de Noort 2004, 131). Within Lincolnshire, Lindsey was further divided into three ridings, North, South, and West, in a similar fashion to Yorkshire, with Goxhill lying in the North Riding (Vellacott 1906, 248; Gietel-Basten 2020, 2). The ridings were also subdivided into smaller units, termed wapentakes, that broadly corresponded with the Anglo-Saxon hundreds, but probably with rather more unique particularities (Ramsay 1898, 155-7; Vellacott 1906, 248; Gietel-Basten 2020, 2), with Goxhill forming part of the Yarborough wapentake. As with the hundreds, wapentakes were also formed of smaller townships and/or parishes, and Goxhill, and all areas on the southern side of the Humber subjected to archaeological investigation, were within the parish of Goxhill. This formed one of 36 ancient parishes in the Yarborough wapentake and it was bounded by the parishes of Barrow-upon-Humber to the west, Thornton Curtis to the south, and East Halton to the east (Cameron 1996, 5). Significantly, no smaller (township) divisions were present within the Goxhill parish, which suggests that it was probably based on a pre-existing civil delimitation, with the parish boundary mirroring a single (most likely earlier) single, and fairly large, township.

Prior to the current project, evidence for early medieval (Anglo-Saxon/Viking) settlement in the immediate environs of Goxhill was scarce, being largely confined to scatters of pottery, including Stamford ware and

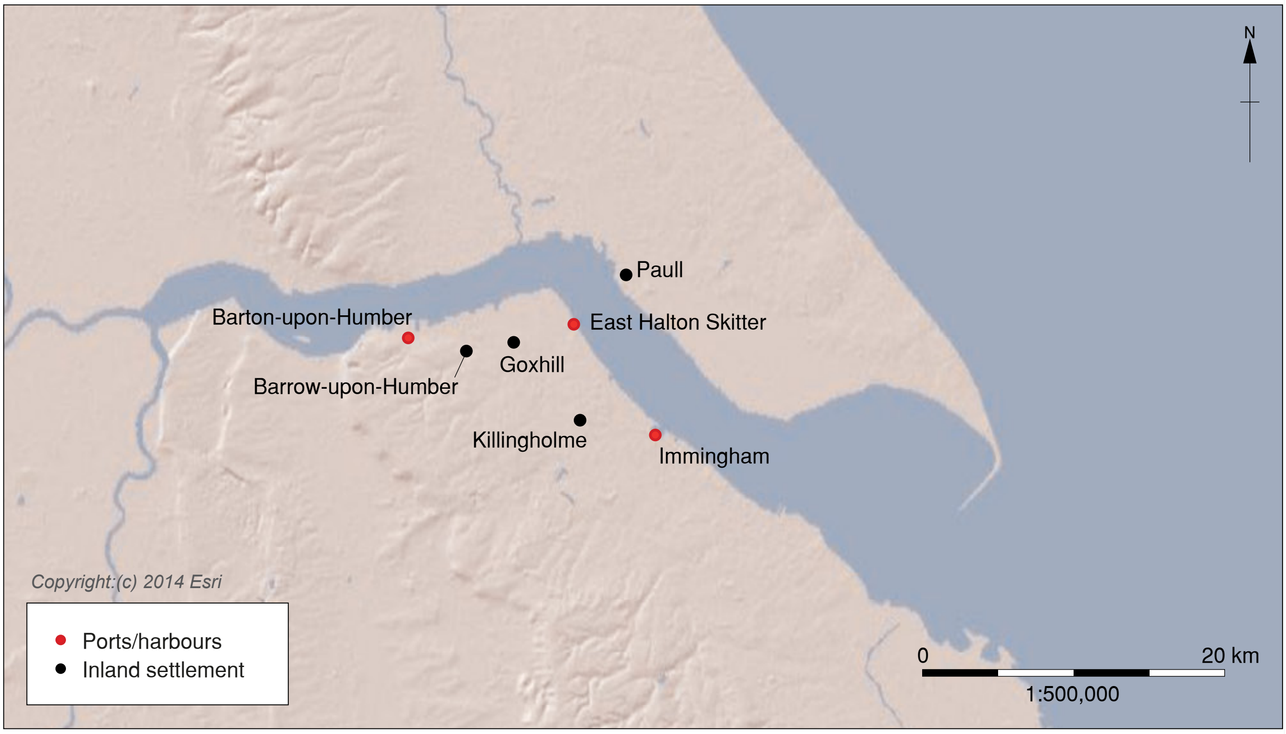


Figure 72: Medieval sites mentioned in the text

Late Saxon gritty ware from sites close to the coast (in the Salt Marsh area; *p 144*; Loughlin and Miller 1979; Ellis *et al* 2001). A small quantity of Frankish pottery, dating to the Middle Saxon period, has also been recovered from the East Halton Skitter (HFA 2010) and had been imported into the area from the Low Countries or northern Germany. This indicates that maritime trade still formed an important feature and it seems likely that several small ports or harbours were established on inlets along the North Lincolnshire coast, and probably included the East Halton Skitter, as well as Immingham, to the south, and Barton-upon-Humber, much further to the west (Fig 72). Indeed, archaeological evidence suggests that Barton-upon-Humber was a major trading centre as early as the sixth/seventh century, with access to a range of exotic goods from the Continent (Waldron 2007; Rodwell and Atkins 2011). Based on place-name evidence, it also seems likely that other more inland settlements existed in the area, including Goxhill (given that its place-name is of Old Norse origin; Cameron and Insley 1998, 52), together with Killingholme and Barrow-upon-Humber (Ellis *et al* 2001; AC Archaeology 2011). Furthermore, of these, Barrow-upon-Humber may equate with the settlement of *Ad Barwe*, which was founded in the seventh century (Van de Noort 2004, 131).

During the later medieval period (mid-eleventh to mid-sixteenth centuries), the continued fall in sea levels, which had begun towards the end of the first millennium AD (*p 141*), led to the silting of many of the inlets that had influenced the siting of coastal settlements in the preceding centuries (*op cit*, 133). This marine regression did, however, allow increased exploitation of the North Lincolnshire wetlands, a process aided by increased political stability in the decades following the Norman Conquest in 1066, which went hand-in-hand with growing economic prosperity, agricultural intensification, and land reclamation, the latter facilitated by advances in drainage techniques and the construction of sea defences (*ibid*).

The settlement and manor of Goxhill formed one element of this medieval landscape, and is listed in Domesday Book, compiled in 1086, as *Golse/Golsa* (Cameron and Insley 1998, 52). It is also clear that at this time five individuals held land at the settlement, including the Bishop of Lincoln, and the village appears to have comprised a total of 92 families (*ibid*). Subsequently, during the twelfth century, the area was held by the Counts of Aumale, who effectively ruled a large portion of northern England, including parts of Lincolnshire and most of Yorkshire (Oswald *et al* 2010, 8, fig 1). Across the thirteenth to the late fifteenth/sixteenth centuries, Goxhill was held by a succession of families, during which time it was granted a market charter, probably in the thirteenth or fourteenth century (Ellis *et al* 2001). Significantly, during the earlier part of this period, William le Gros, one of the Counts of Aumale, also founded Thornton Priory in 1139. The site is situated *c* 3 km south-east of Goxhill village in the adjacent parish of Thornton Curtis (*p 141*) and, following its elevation to the status of an abbey in 1148, rose to become one of the richest Augustinian houses in the country (Page 1906, 163;

Plate 48: The fourteenth-century gatehouse at Thornton Abbey

Ellis *et al* 2001; Van de Noort 2004, 140). The abbey was certainly an imposing feature in the medieval landscape and even today still forms a spectacular site, particularly given that its late fourteenth-century gatehouse is still extant (Pl 48), representing one of the largest and most elaborate monastic gatehouses in England, and also forming one of the first medieval buildings to incorporate brick into its design (Pevsner and John 1964, 251; Oswald *et al* 2010). Excavation and survey at the abbey, which is now a scheduled monument (NHLE 1011198; Historic England 2023a), has mapped and uncovered a range of other monastic buildings (Oswald *et al* 2010; Willmott and Townend 2011; 2012). In addition, recent excavation has uncovered a previously unknown cemetery that also contained a plague pit with the remains of at least 48 men, women, and children, which graphically highlight the devastating effects of the Black Death on mid-fourteenth-century communities in the Goxhill area (Willmott *et al* 2020).

In terms of the wider later medieval landscape, the Goxhill parish seems to have been divided into several distinct zones (Fig 73), which can be reconstructed through examination of later enclosure maps, aerial photographs, and documentary sources (Russell and Russell 1987; Russell 1995; Fleming and Royall 2019). From these sources, it is clear that Goxhill village, North End and South End (the latter including the northern end of the Soff Lane diversion), contained a series of 'old' enclosures, potentially medieval in date, that may have demarcated areas of domestic settlement. The landscape surrounding these enclosures formed open medieval fields, which were probably in the main used to grow crops. On the late eighteenth-century enclosure maps, these open fields also equated with four contiguous areas: The Mill Field, west of the village and also North End; Hallands Field, south of the village, which also covered South End; Horse Gate Field, immediately north-east of Goxhill village and east of North End; and Chapel Field, slightly further to the east, which ran close to the East Halton/Skitter Beck. It therefore seems possible that these four divisions were retained from the medieval period (Russell and Russell 1987). Within the area of open fields, beyond Goxhill village, were other medieval sites. One, east of the village, was Goxhill Grange, in origin a monastic farm that most likely belonged to the nearby Thornton Abbey (*p 142*; Hyder Consulting (UK) Limited 2014). Perhaps tellingly, this was in the Chapel Field and what remained of the site survived into the early twentieth century, before being swept away by the construction of an airfield (*p 172*).

Another medieval site is Goxhill Hall, located south-east of the village (at South End in Hallands Field; *above*)

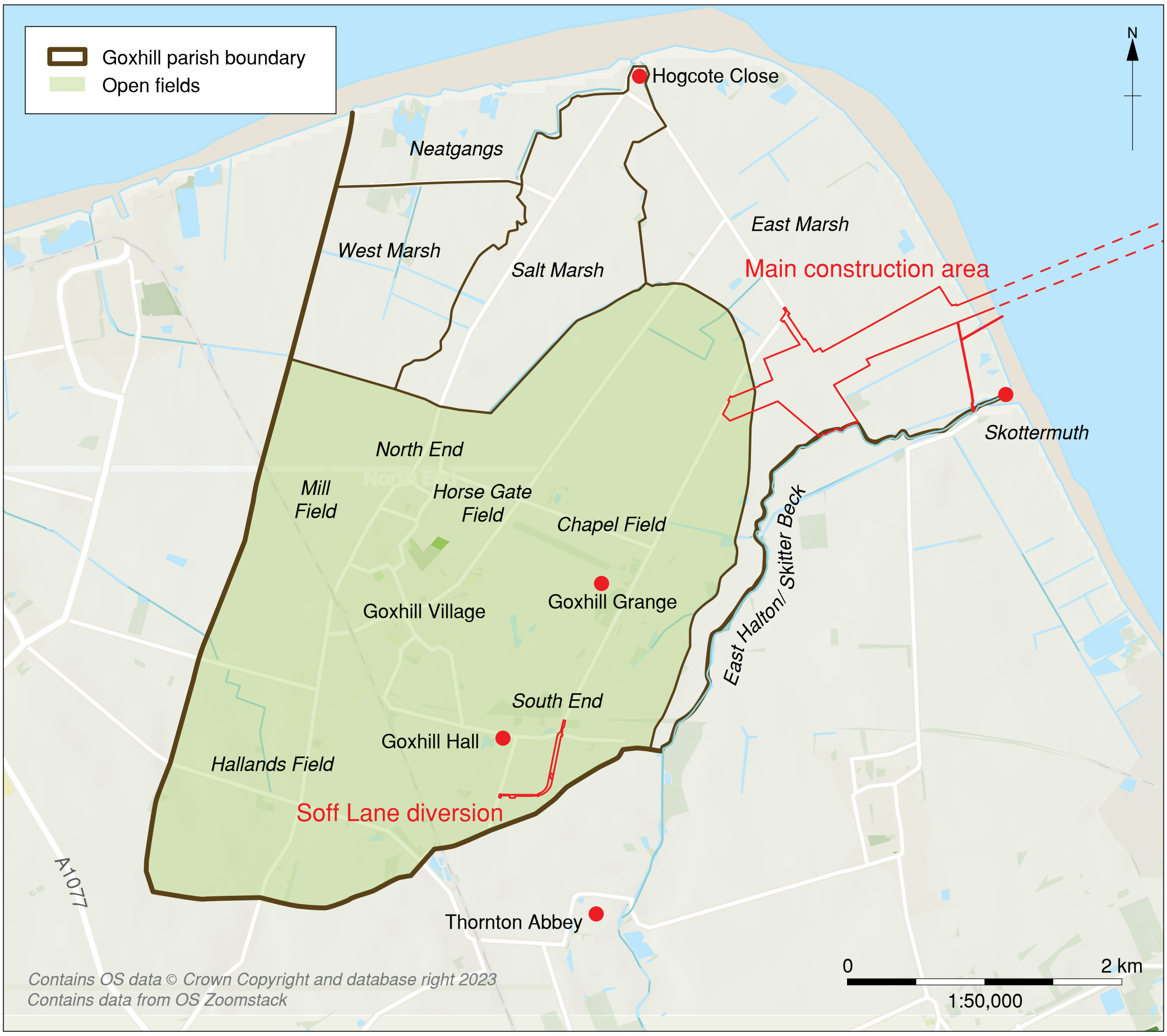


Figure 73: The organisation of the medieval landscape in the Goxhill parish

and immediately west of the Soff Lane diversion. This site now contains an extant late seventeenth-century (Grade II* listed) house, constructed by the Hildyard family between 1690 and 1701, and, rather unusually, an earlier medieval hall, standing at the north-east corner of the moated enclosure (Historic England 2023b). This Grade I listed building is probably mid-fourteenth-century in date and was the home of the Despenser family of Gloucestershire, who inherited the Goxhill estates at the beginning of the fourteenth century (Pevsner and John 1964, 251; Emery 2000, 250-1; Historic England 2023c). Architecturally, it represents a rectangular two-storeyed block resembling a two-storeyed chapel (Pl 49), comparable with the Prior's Chapel at Ely, and was consequently labelled as a 'priory' on post-medieval mapping (Armstrong 1779; OS 1886a); however, there is no evidence that the building had an ecclesiastical use and it is probably a chamber block, originally linked at first-floor level to a now vanished hall (Emery 2000, 250-1; Historic England 2023c). Beyond these two buildings, the remains of fishponds, drainage ditches, and an associated field system are also present, indicating that the hall formed one element of a much larger complex (Loughlin and Miller 1979, 199; Historic England 2023c). It also seems highly likely that this moated site was established at an earlier date than the extant fourteenth-century hall, particularly as documentary evidence suggests the presence of a fortified house at the site, erected by Peter of Goxhill in the twelfth century (Emery 2000, 250-1).

The landscape to the north of the open medieval fields was of a much different character. Consideration of the historic mapping and place-name evidence indicates that this was a wet area containing pasture and meadow land. As with the area of open fields (*p 143*), the late eighteenth-century enclosure maps demonstrate that this was also divided into four areas, known as Neatgangs, West Marsh, Salt Marsh, and East Marsh,

Plate 49: The medieval two-storeyed building (left) at Goxhill Hall

the latter covering the main construction area at Goxhill, and these probably reflect medieval division of this area (Fig 73; Russell and Russell 1987, 31). Indeed, the etymology of these places names indicates that 'marsh' refers to meadowland near water and 'neatgangs' refers to cow pasture, which appears to confirm that these areas were used for grazing livestock in the medieval period (Clarke 2016). This area of meadow/pastureland also contained some medieval settlement. There are, for example, documentary references to a small port, known as Skottermuth (probably at the mouth of the Skitter/East Halton Beck at East Halton Skitter), with a ferry and a watermill (Ellis *et al* 2001). Given that early medieval pottery has been recovered from this area, it seems possible that this port was in use across the entire medieval period. Further around the coast to the north-west, in the Salt Marsh, there was also a moated site at Hogcote Close, Goxhill Haven, which was occupied from the thirteenth to sixteenth centuries (Loughlin and Miller 1979). The site was also associated with a series of large extensive man-made ditches, visible as cropmarks, which could relate to medieval (or post-medieval) land reclamation across this wet area (Fleming and Royall 2019, 48). It also seems that part of this area was endowed to Thornton Abbey, at some stage between 1139 and 1221, and was used as a source of clay for building/brickmaking (Oswald *et al* 2010, 9, fig 4). Another medieval industry that may have occurred in the Goxhill parish was salt making. For instance, there is a thirteenth-century reference to the payment of tithes to Thornton Abbey to produce salt and, although this may relate to a site on the south side of the East Halton Beck, where there are later documentary references to salterns (*cf* Ellis *et al* 2001), it is feasible that salterns were also present in the Goxhill parish.

Post-Roman activity at Goxhill
J Young (pottery)

The very earliest evidence for post-Roman activity came from Area B, in the main construction area, and Area A, on the Soff Lane diversion (*Ch 1, p 8*), in the form of pottery. This includes three sherds from fifth- to seventh-century Anglo-Saxon-type handmade vessels. The vessels are in fine quartz sand-tempered fabrics (ESAXLOC) that are presumed to be of local origin. One sherd from Area B is from a small necked jar (or bowl) with pressed dimples around the neck (Fig 74.1), whilst the other two sherds from Area A are from a single miniature jar with a simple out-turned rim (Fig 74.2). Neither of the vessels

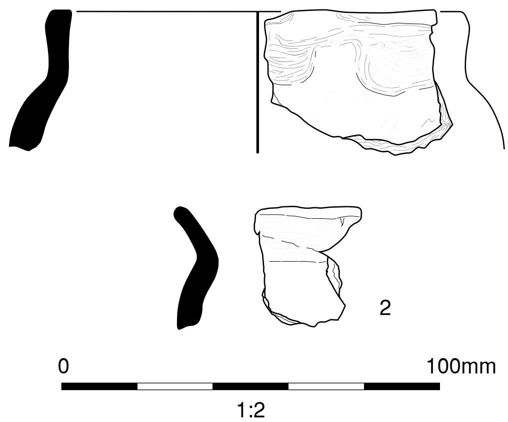


Figure 74: Anglo-Saxon vessels from Areas A and B

can be exactly paralleled amongst other assemblages from northern Lincolnshire, but similar fine quartz fabrics have been noted in the wider region (Young and Vince 2009, 348).

These sherds were recovered as unstratified items from topsoil/subsoil deposits and no other evidence for contemporary activity was recorded. Therefore, they essentially form 'background evidence' for activity in the centuries following the collapse of Roman rule. The sherd from Area B, however, does imply that there was continued occupation/activity in the area of the later Romano-British settlement (*Ch4, p 117*), in turn suggesting a degree of settlement continuity. It may also be significant that the sherds from Area A were found within an area that produced good evidence for later medieval activity, indicating that this area was utilised in some manner from the early stages of the medieval period.

Medieval activity on the Soff Lane diversion

Beyond the three sherds of Anglo-Saxon pottery (*p 145*), it is notable that all stratigraphic remains dating to the medieval period were confined to Area A (*Ch 1*, *p 8*), at the northern end of the Soff Lane diversion, where inter-cutting ditches, pits, and the remains of possible timber structures were recorded; Pl 50). On the evidence of the stratigraphic relationships, together with the associated pottery (*p 157*) and radiocarbon-dating evidence (*p 167*), three sub-phases of activity (Phases M.I, M.II, and M.III) could be identified, dating between the early tenth and late twelfth/early thirteenth centuries (Fig 75).

Early trackways and enclosures

The earliest (Phase M.I) medieval remains in Area A comprised several ditches, mostly aligned east/west and probably forming elements of two trackways and adjacent enclosures (Fig 76); all had gradually silted and some also contained medieval pottery (*p 157*). The possible east/west trackways (Trackway 3 to the south and Trackway 4 to the north), 6 m and 4.5 m wide respectively, were set *c* 20 m apart. They were defined by pairs of parallel ditches (***1038***/***1051*** and ***1301***/***1341***, respectively), measuring *c* 0.8-1.5 m wide and 0.55-0.7 m deep, with both U-shaped and V-shaped profiles. The eastern end of ditch ***1341*** (the southern ditch of Trackway 4) also contained slumped deposits, suggesting that there might once have been a bank on its south side; however, no other trace of this survived, presumably having been completely removed by later ploughing. The northern ditch (***1301***) also differed from the others in having clearly been recut (as ***1343***, 0.7 m wide and 0.28 m deep).

The area between the trackways was seemingly occupied by an enclosure (Enclosure 17), *c* 14 m wide, north to south, the sides of which were defined by ditches (***1037*** to the south and ***1166*** to the north) aligned parallel with the trackways. These were quite different in size and shape, the former being V-shaped, 0.7 m wide and 0.5 m deep, the latter U-profiled and considerably wider at 2 m wide and 0.55 m deep.

Within the area of Enclosure 17, available for investigation (*c* 200 m^2), three ditches (***1161***, ***1162***, and ***1167***) were recorded, 0.3-0.7 m wide and 0.3-0.6 m deep. These defined two sides of a small 'sub-enclosure' or 'pen', with ditch ***1167*** to the north and ditch ***1161*** to the west, which was later replaced by ditch ***1162***. This sub-enclosure measured *c* 10.6 m north to south and more than 10.3 m east/west, possibly with an entrance

Plate 50: Medieval features in Area A, prior to excavation, looking west

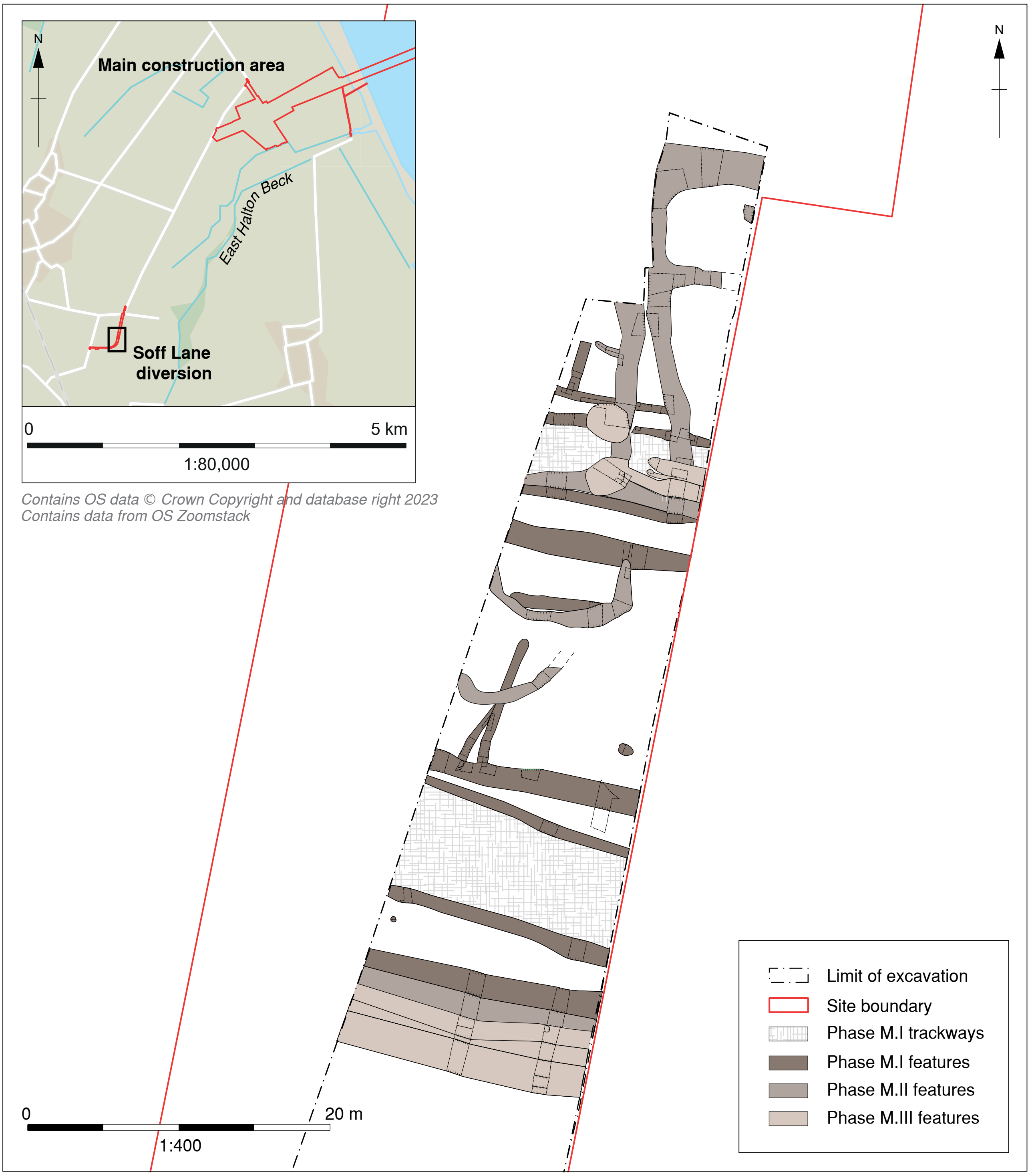


Figure 75: Medieval archaeology in Area A

at the north-west corner, defined by a gap, *c* 2.8 m wide, between ditch ***1167*** and the north terminal of ditch ***1162***. Within its interior was an oval-shaped pit (***1018***; 1.05 x 0.7 m and 0.3 m deep), whilst slumped deposits identified within ditch ***1167*** hint at the former existence of a bank on its north side.

Another comparable enclosure/pen seems to have existed to the north of Trackway 4 (Enclosure 18), again being defined by a ditch (***1342***; up to 0.7 m wide and 0.45 m deep) aligned parallel with the trackway. The northern boundary of Enclosure 18 was not recorded, however, and internal features were limited to a single ditch (***1344***; up to 0.75 m wide, 0.3 m deep, and 3.5 m long) extending northwards from ditch ***1342***.

A ditched boundary (***1349***; 1.6 m wide and 0.45 m deep) was also present to the south of Trackway 3. Slumped deposits recorded in this feature suggest the former existence of a bank on the north side of the ditch.

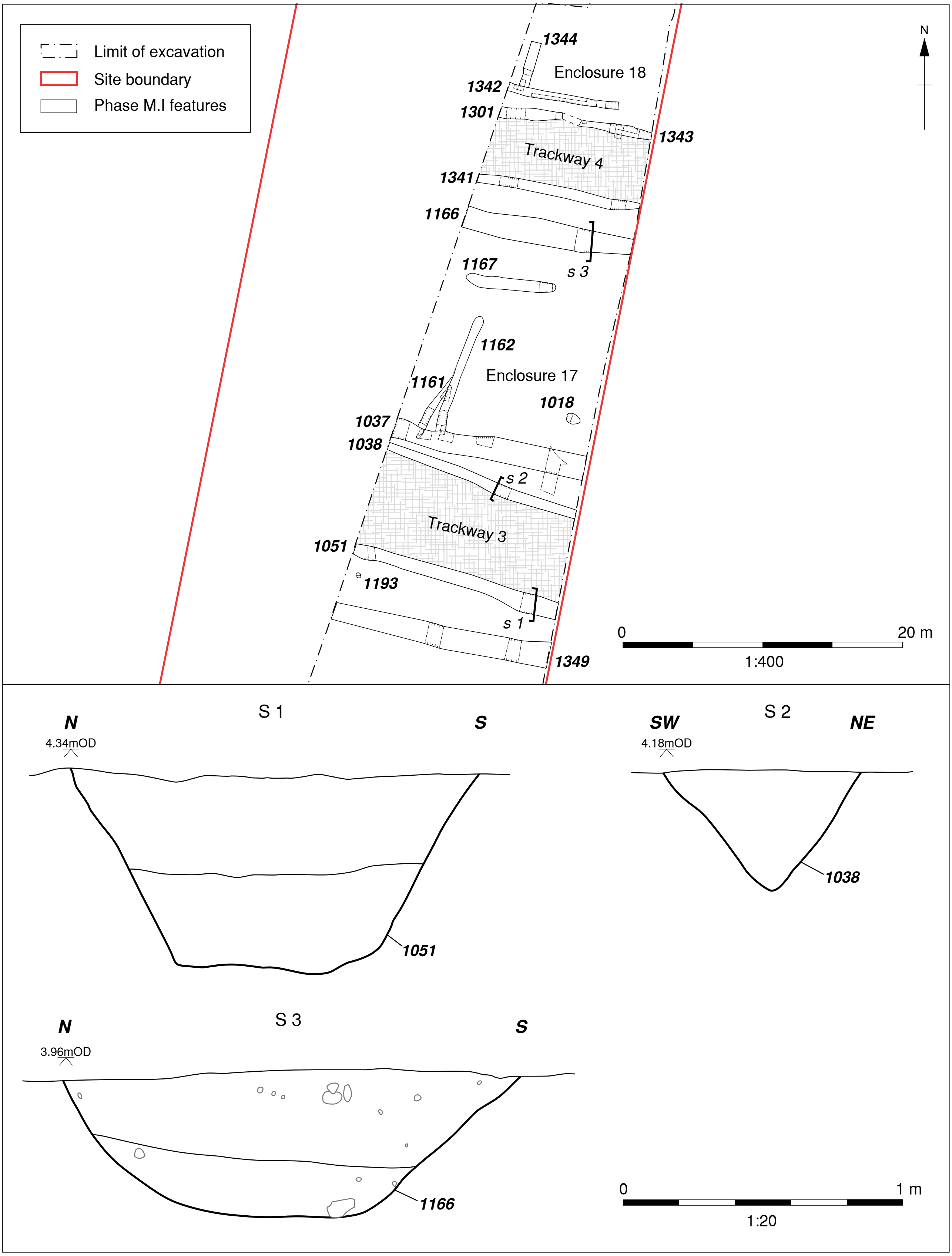


Figure 76: The medieval (Phase M.I) trackways and enclosures

Although all 'above ground' traces of this bank had been destroyed, it is possible that an adjacent posthole (***1193***) may have been associated with this, perhaps, forming elements of a revetment or bracing. Together the presence of a ditch and bank may suggest that this denoted the limit of medieval enclosure in this area.

Conjoined enclosures and structures

Following the silting of the ditches for the early trackways and enclosures, a series of conjoined (or partly conjoined) rectilinear ditched enclosures were established (in Phase M.II), of which three (Enclosures 19-21) lay partially within Area A (Fig 77). The south side of these enclosures was marked by an east/west-aligned, U-profiled ditch (***1350***), 1.05 m wide and 0.7 m deep, which, following silting, had been recut. This lay immediately to the north of the southern ditch

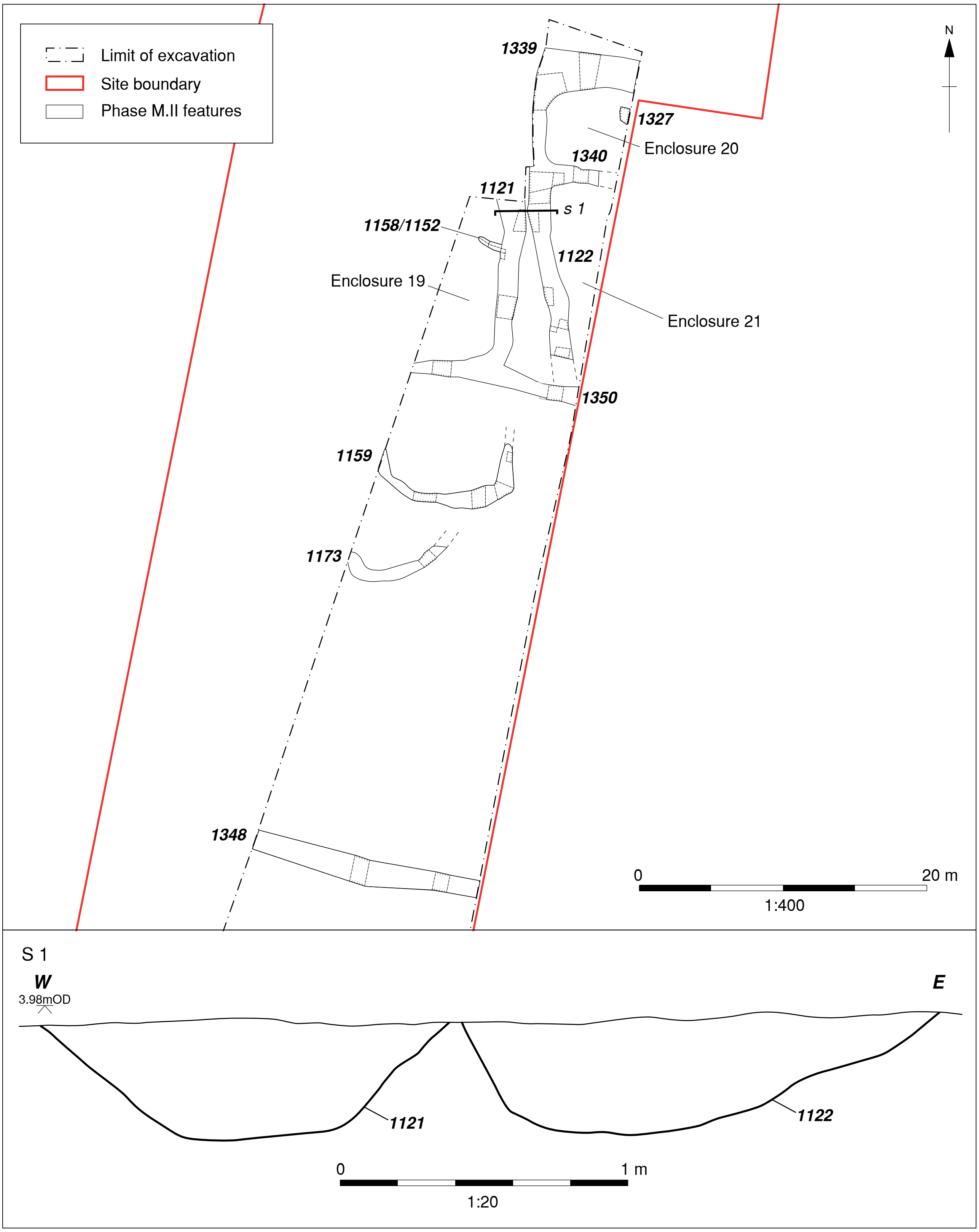


Figure 77: The reconfigured (Phase M.II) medieval enclosures and associated structures

Plate 51: Section across enclosure ditches **1121** *(left) and* **1122** *(right), looking north*

(***1341***) of Trackway 4 (*p 146*), suggesting that this may have continued to be a significant landscape feature, though in the investigated area the trackway itself had clearly fallen from use and been lost, with ditch ***1350***, in certain places, truncating this infilled feature.

Extending north-north-west from ditch ***1350*** were two further U-shaped ditches (***1121*** and ***1122***; Pl 51) that had a converging alignment (from south to north). The former, which was up to 2 m wide and 0.4 m deep, represented the eastern side of Enclosure 19, whilst the latter (0.9 m wide and 0.3 m deep) formed the western boundary of two conjoined enclosures (Enclosures 20 and 21). Interestingly, both ditches produced sherds of residual Roman pottery (DWSHT and GREY4; *Ch 4*, *p 102*, *p 119*), suggestive of some later Roman activity in this area. To the west, only the south-east corner of Enclosure 19, measuring *c* 12.5 x 6.5 m at its greatest extent, was available for investigation and internal features were limited to a small gully (***1158***/***1152***) extending westwards from perimeter ditch ***1121***. Enclosure 20, the northernmost of the two eastern enclosures, was small (though it extended to the east of the site), measuring *c* 5.7 m north to south, internally, and over 5 m east to west. Its western extent was bounded by ditch ***1122*** (which also defined the western side of Enclosure 21 to the south), whilst its northern side was defined by an east/west ditch (***1339***), 2.5 m wide and 0.3 m deep, representing an eastward return of ditch ***1122*** at its northern end. Ditch ***1339*** also produced a sherd of residual Roman (GREY1) pottery (*Ch 4*, *p 94*). The southern side of the enclosure was marked by another east/west ditch (***1340***), 1 m wide and 0.4 m deep, extending to the east from ditch ***1122*** and separating it from Enclosure 21. Only the western edge of the latter lay within Area A, but it was *c* 14 m north to south and over 5 m east to west. No internal features were recorded within it and the only feature in Enclosure 20 was a shallow pit (***1327***).

In addition to the creation of 'new' enclosures, one of the pre-existing boundaries (***1349***; *p 147*) was retained, with its original ditch being recut (as ***1348***). Stratigraphically, this occurred after elements of the bank on the northern side of the earlier ditch had weathered and slumped into it, as ditch ***1348*** cut through these deposits. The redefined boundary ditch had a U-shaped profile, 1.5 m wide and 0.5 m deep, and yielded a small medieval bell (*p 157*).

Sandwiched between boundary ***1348***, to the south, and Enclosures 19-21, to the north, within what was formerly Enclosure 17 (*p 146*), were two curvilinear gullies (***1159*** and ***1173***). Both had dark charcoal-rich fills (Pl 52) containing organic materials and burnt stone, with gully ***1159*** also containing animal and fish bone (*p 160*), suggesting that they were associated with domestic activity. Indeed, it is conceivable that these were drainage gullies, containing detritus and perhaps cess, associated with otherwise vanished wooden structures. The best preserved of the two (***1159*** to the north) was 1.35 m wide and 0.67 m deep and may have enclosed an area measuring 7.8 m east to west and at least 4 m north to south. After a period of initial silting, this gully also seems to have been deliberately backfilled with refuse. A third near-identical gully (***1017***) was also recorded much further to the south (Fig 78). Based on its obvious similarities to gullies ***1159*** and ***1173***, it was possibly contemporary, perhaps representing the site of another timber structure, located slightly beyond the main area of medieval activity.

Pit digging and the later boundary

Following the silting of the ditches of the conjoined enclosures in the northern part of Area A (Enclosures

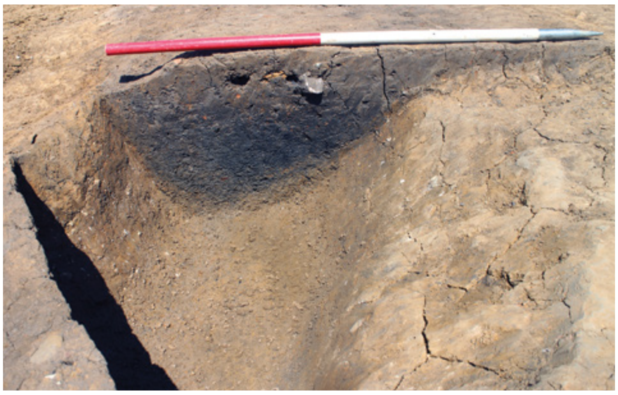


Plate 52: Section across gully **1159**, *looking east, showing its dark, charcoal-rich fill*

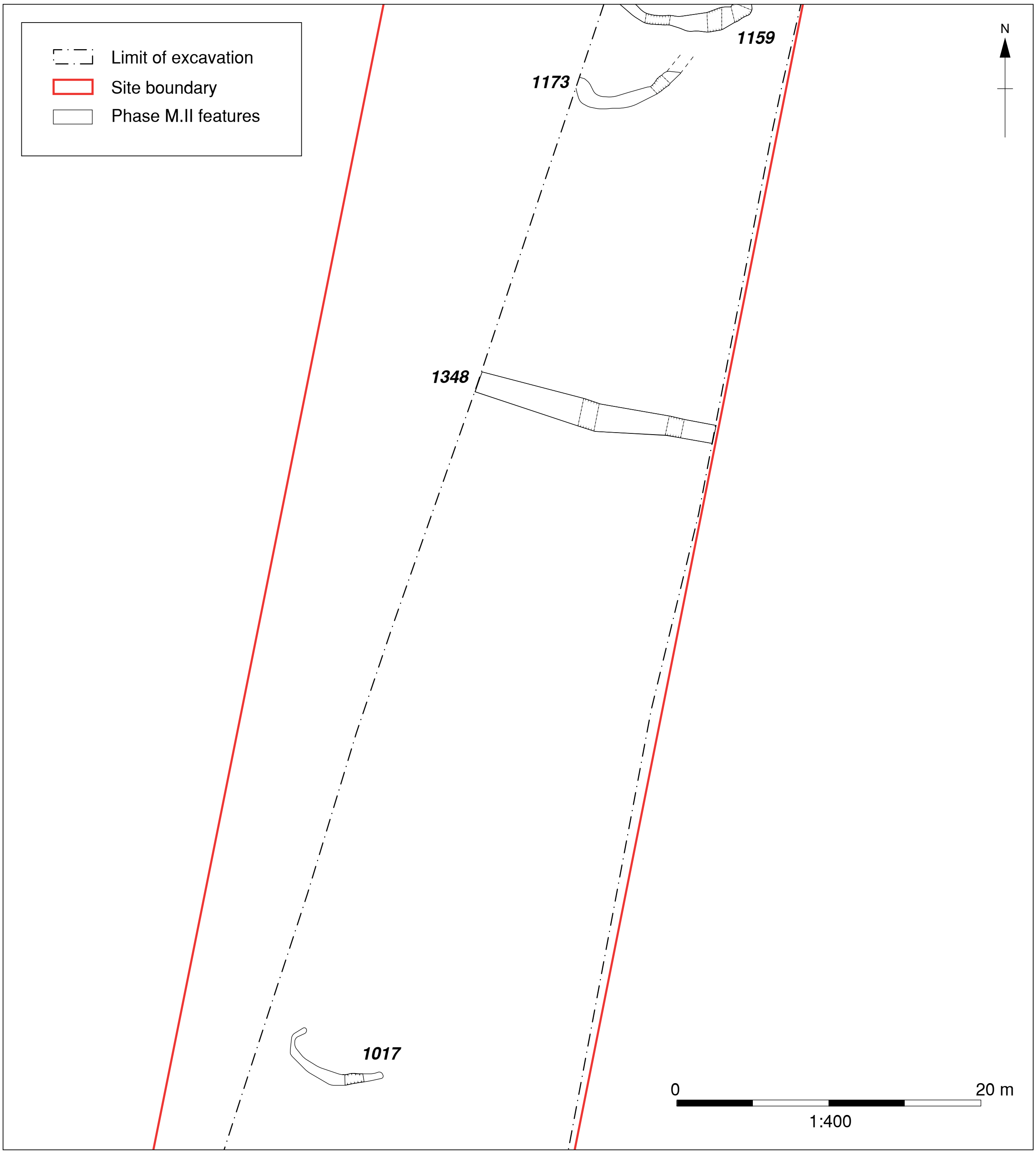


Figure 78: Gully **1017**

19-21; *p 151*), several pits and other features were then dug through these defunct features, during a final phase (M.III) of medieval activity at the site (Fig 79). These comprised a group (***1320***) of three inter-cutting, elongated pits (from earliest to latest, ***1238***, ***1236***, and ***1234***), with maximum depths of 0.35 m and all filled with domestic waste. Immediately to the west, and also forming part of the group, was a shallower pit (***1183***; 0.13 m deep), which again contained domestic waste. Following the filling of the latest pit in the sequence, a short east/west-aligned gully (***1321***) was then cut across this area.

Two larger pits (***1129*** and ***1322***) were located further to the west and were spaced only a few metres apart. Both were sub-circular in plan, measuring *c* 3 m in diameter but only 0.3-0.4 m deep. The southernmost pit (***1129***; Pl 53) had initially silted, after which the upper part of the feature was deliberately backfilled with earth and domestic refuse. In contrast, pit ***1322***, which appears to have been broadly contemporary, had no lower silt layer, being used as a rubbish pit from the outset, with an emphasis on the disposal of animal remains (*p 160*).

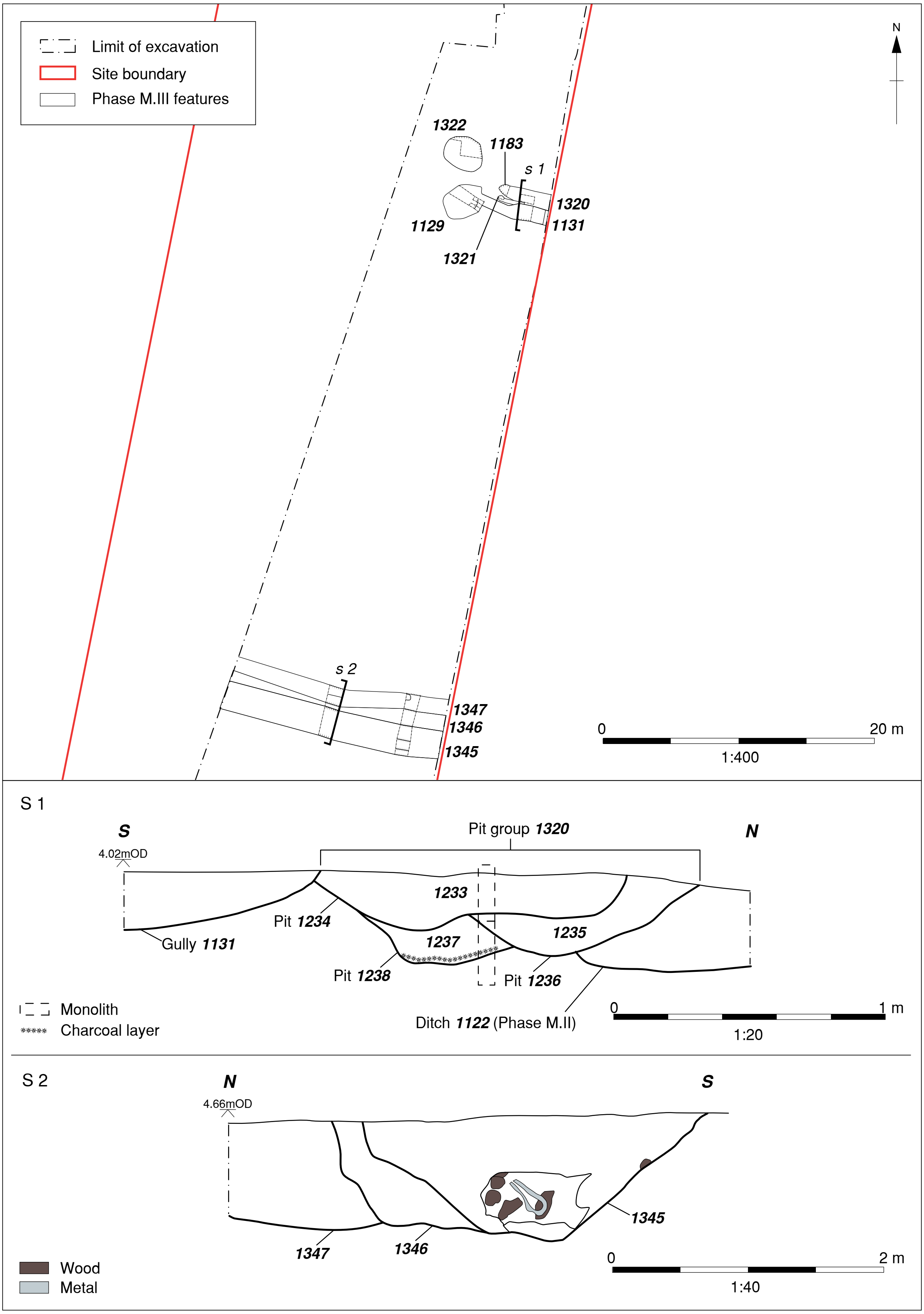


Figure 79: The medieval (Phase M.III) pits and the recut boundary for Enclosure 19

Plate 53: Pit **1129** *(Phase M.III) cutting enclosure ditch* **1121** *(Phase M.II), looking north-east*

Extending east from pit ***1129***, and seemingly associated with it, was a shallow ditch or gully (***1131***), 1.2 m wide and 0.2 m deep, which also extended eastwards beyond the excavation trench. This may have been dug to channel water into the pit, which might explain the presence of silt at its base. In a similar fashion to pit ***1129***, the ditch/gully also eventually became filled with domestic refuse. Significantly, it also cut gully ***1321*** and pit ***1234*** (*p 153*), demonstrating that it, together with pit ***1129*** and (possibly) pit ***1322***, were slightly later features.

At the southern end of Area A, an earlier boundary (***1348*** in Phase M.II; *p 152*) was also retained and recut during acts of maintenance, indicating that it remained a significant feature that perhaps demarcated the main area of medieval activity that lay to its north. Initially the ditch was recut as ***1347***, which eventually filled with silt. The ditch was then recut again as ditch ***1346***, which also silted (and contained a residual sherd of Roman (GREY1) pottery; *Ch 4, p 94*), and was finally recut as ditch ***1345***. A notable feature of these ditches is the presence of quite large fragments of charred wood (particularly in the final incarnation of this boundary), amongst small assemblages of pottery and other finds, suggestive of nearby domestic occupation (Pl 54).

Plate 54: Section across ditch **1345**, *looking east, showing charred wood fragments and other organic materials in the lower fills*

Stone and metal artefacts

A Parsons (Norse bell) and C Howard-Davis (other finds)

Many of the features in Area A produced medieval artefacts, principally pottery (*p 157*), along with a few coarse-stone tools and metal objects. The small collection of coarse stone tools includes two unstratified items (OR 1048 (Fig 80) and OR 1180), presumably medieval in date, which, due to the presence of one heavily worn face, were probably rubbers used in conjunction with saddle querns. This implies that at Goxhill such items, which are usually considered to be prehistoric or Roman in date (Buckley and Major 1990), were also used during the medieval period. There is also a single, very worn fragment of millstone (OR 1099; Fig 80) from pit ***1129*** (Phase M.III; *p 153*). Its thinness and the pecked 'harping' on one side suggest a Roman or later date; however, given that it came from a medieval pit, it is most likely to date to that period (*ibid*). Pit ***1129*** also contained two other stone items. One has an obviously worn face and might have been used as flooring (OR 1098), whilst another probably represents building material (OR 1059; Fig 80).

In addition to the stone items, several items of metalwork were recovered from Area A, which might be medieval in date, particularly as they were all from a ditched boundary (***1349***; *p 147*) that seems to

Figure 80: Stone objects from medieval features in Area A

have been retained (and recut) across the medieval period. Two of these are iron nails from its initial recut (***1348***; Phase M.II; *p 152*), whilst a fragment of copper alloy, probably also part of a nail, and two horseshoes were from two later recuts (***1345*** and ***1346***; Phase M.III; *p 155*). Of greater significance is a small copper-alloy bell (Fig 81; Pl 55), from ditch recut ***1348***. This is a typical example of a 'Norse bell' dating to the period (late ninth to mid-eleventh centuries) when the region formed part of Danelaw (*p 141*). It has a type I flared suspension loop, with a fluted concave bell of hexagonal cross-section and rectangular, crenelation-like, projections at the corners of the bell faces. There is also a small raised fillet between the body and the suspension loop, as seen on many of the previously recorded examples (*cf* Schoenfelder and Richards 2011, 152). The main body has been crushed, but the remains of the top of the clapper and solder holding its suspension loop in place have been preserved inside.

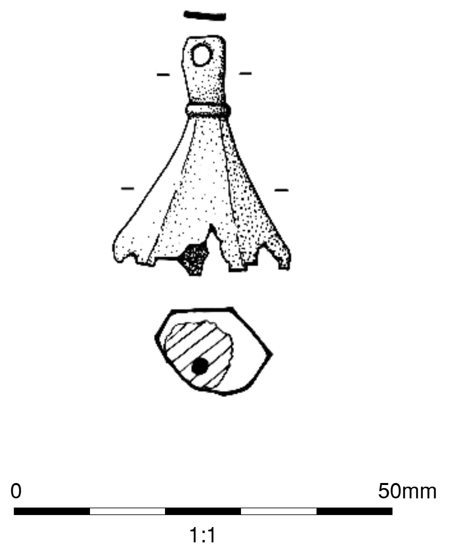


Figure 81: The Norse bell

Plate 55: The Norse bell

Norse bells appear in graves, urban and rural settlement sites, and as stray finds, with many of the latter examples being recorded by the Portable Antiquities Scheme (*op cit*, 152-6). They are mostly known from Britain (particularly in areas of Danelaw) and Ireland, although two examples have also been discovered in Iceland (*ibid*). Various suggestions for their use have been proposed, ranging from horse-harness accessories, hawking, funerary goods, and clothing accessories (*op cit*, 157-8), though another tentative possibility is that they functioned as good-luck charms used during travel, perhaps akin to the 'luck/gremlin/guardian' bells used in modern-day motorcycle culture (*cf* Cannon 2023; M Loydall *pers comm*).

Medieval pottery
J Young

Medieval pottery forms the bulk of the artefacts recovered from Area A. Setting aside the unstratified sherds of handmade Anglo-Saxon pottery (*p 145*), the assemblage comprises 114 sherds (1.020 kg) from a maximum of 69 vessels, and hence is somewhat small. It does, however, contain a range of different fabric types (Table 40).

Late Saxon-type wares
The Late Saxon assemblage is entirely composed of quartz-tempered ware types, used to produce 17 wheel-thrown vessels. Whilst there is the potential for some vessels to date to the earlier part of the tenth century, a late tenth- to mid-eleventh-century date is more probable, as it is within this period that quartz-tempered fabrics became more common in North Lincolnshire (Young *et al* 2005).

One of these quartz-tempered fabrics is Torksey ware (TORK), with nine jars or bowls being present. These include vessels represented by undiagnostic body sherds, broadly dating to the late ninth to mid-eleventh centuries; however, a small jar rim from ditch ***1349*** (Phase M.I; *p 147*) dates no later than the early eleventh century, whilst an in-turned rim bowl with kiln flashing from a contemporary (Phase M.I) posthole (***1193***; *p 150*) is of early/mid-tenth- to early/mid-eleventh-century date. In addition, nine sherds, from two jars and another in-turned rim bowl also with kiln flashing, are of Torksey-type (TORKT), but they are in slightly unusual fabrics.

Five other quartz-tempered sherds are from two jars, an in-turned rim bowl, and a jar or bowl in North Lincolnshire Late Saxon Grey ware fabrics (NLLSG; Fig 82.1). At St Peter's Church, Barton-upon-Humber, this generic grouping has been classified into two main

Fabric group	Fabric code	Fabric name	Total sherds	Total vessels	Total weight (g)	Date range (AD)
Late Saxon-type wares	TORK	Torksey ware	10	9	96	850-1100
	TORKT	Torksey-type ware	9	3	44	
	NLLSG	North Lincolnshire Late Saxon Grey ware	5	4	134	
	ELLSLLG	East Lindsey Late Saxon Lincoln-type Light Firing Greyware	3	1	185	
	LSAXX	Late Saxon non-local fabrics	3	1	185	
Saxo-Norman wares	NLSTCW	North Lincolnshire Sand-tempered Coarse ware	17	4	41	1030-1150
	NLGTCW	North Lincolnshire Grit-tempered Coarse ware	21	13	124	
	NLQS	North Lincolnshire Quartz and Shell Fabrics	8	6	47	950-1220
	NLQC	North Lincolnshire Quartz and Chalk-tempered ware	18	10	71	1050-1220
	ST	Stamford Ware	5	3	60	970-1220
'Early medieval' wares	BEVO1T	Beverley Orange-type ware Fabric 1	1	1	19	1100-1230
	HEMGG	Humber Early Medieval Glazed Gritty ware	1	1	33	1180-1230
'Medieval' wares	BEVO2	Beverley Orange ware Fabric 2	11	10	107	1230-1350
	BEVO2T	Beverley Orange-type ware Fabric 2	1	1	30	1230-1350
	HUM	Humberware	4	3	29	1250-1550
	Total		***114***	***69***	***1020***	

Table 40: The medieval pottery fabric types from Area A

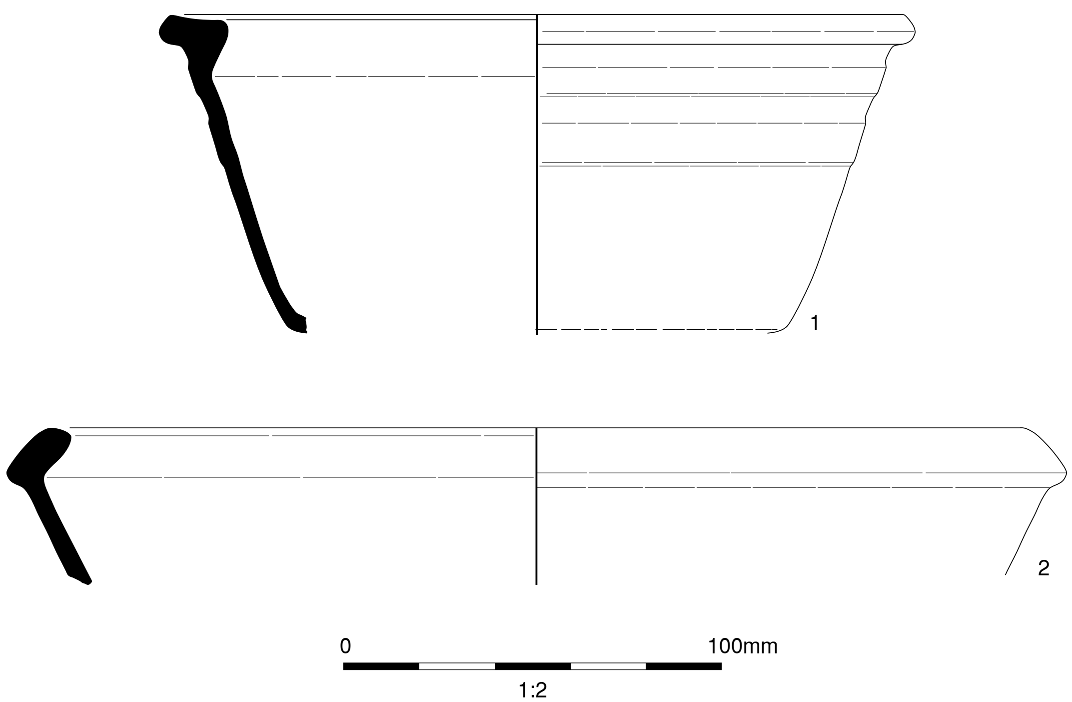


Figure 82: The Late Saxon-type wares from Area A

fabric groups (Boyle *et al* 2011), with all the vessels from Goxhill falling into the earlier (Fabric 1) grouping. The recovered vessels are all competently wheel-thrown and most broadly date between the tenth and mid-eleventh centuries. The exception is an unstratified bowl from the topsoil/subsoil that is of early/mid-tenth- to early/mid-eleventh-century date.

Three quartz-tempered sherds (ELLSLLG) are from a single large wheel-thrown bowl (Fig 82.2) of late tenth- to mid-eleventh-century form. The light firing reduced fabric and form suggest that it is an atypical regional import from Lincoln. Whilst the pale reduced fabric and off-white external surfaces are not typical of later Lincoln vessels (SNLS), the bowl does have the typical spaced side-pressed finger impressions commonly found around everted rim SNLS bowls of late tenth- to mid-eleventh-century date (Young *et al* 2005, fig 71, 450, and 452-3). Recently, further vessels have been recovered in the parish of Mumby in East Lindsey and the type is now classified as East Lindsey Late Saxon Lincoln-type Light Firing Greyware (J Young *pers obs*).

Saxo-Norman wares

The pottery assemblage also contains 36 vessels (represented by 69 sherds), in five different fabrics, that are almost all coarsewares of Saxo-Norman type. Two of the five fabrics are very similar, comprising coarsewares tempered with either sand (NLSTCW) or grit (NLGTCW). A total of 17 vessels in these fabrics were recorded and are wheel-thrown, but not as competently as the Late Saxon types, with harsher surface textures. Of these, two small jars and two jars or bowls are in the sand-tempered fabric, whilst the remaining 13 vessels, in the coarser grit-tempered fabric, consist of a range of miniature, small, and medium-sized jars. Most of these also have soot residues suggesting that their primary use was as cooking pots. In terms of chronology, these two fabric types, which visually are almost indistinguishable from local Roman reduced sandy fabrics, were first identified at Barrow Road, Barton-upon-Humber, where they were dated between the mid-eleventh and mid-twelfth centuries (Didsbury 1999; Young 2000). They have rarely been noted elsewhere and, until a large chronologically well-stratified group is discovered, dating must remain tentative, although associated wares do seem to suggest a date range spanning the mid-/late eleventh to early/mid-twelfth centuries.

A third Saxo-Norman fabric is a shell-tempered (NLQS) type, being represented by six handmade vessels. These comprise four jars or bowls, and two identifiable jars of potential mid-tenth- to twelfth-century date.

Ten vessels (nine jars and a jar or bowl) are in North Lincolnshire Quartz and Chalk-tempered fabrics (NLQC). This handmade ware belongs to a widespread tradition, probably originating in the later eleventh or earlier twelfth century, and covers a large area extending from East Anglia to East Yorkshire. It is also the main Saxo-Norman coarseware in most of North and North-East Lincolnshire, and is usually associated with assemblages of potential late eleventh- to early/mid-thirteenth-century date, but it is most common in twelfth-century assemblages (Boyle *et al* 2011). Eight of the vessels from Area A fall in the earlier part of this chronological range, probably dating between the late eleventh and mid-twelfth centuries. Elsewhere in Lincolnshire, most of vessels in this fabric seem to be of medium or large size (*ibid*), which makes those from Area A rather unusual, as this group includes three miniature jars and five small-sized jars.

Three Saxo-Norman-type Stamford ware (ST), unglazed, jars were also recovered from Area A, with one (in ST Fabric C) from ditch ***1339***, defining one of the conjoined enclosures (Phase M.II; *p 152*), dating to the to the mid-/late twelfth century. The other two jars were present in later (Phase M.III) pits, with one (in ST Fabric A/G), from pit ***1129*** (*p 153*), dating between the early/mid-eleventh and mid-twelfth centuries, whilst the other (in Fabric A/B), from pit ***1322*** (*p 153*), dates between the mid-/late eleventh and mid-twelfth centuries.

Twelfth- to thirteenth-century 'early medieval' wares

Only two glazed jug sherds of 'early medieval' type ware are present in the assemblage and were produced in East Yorkshire or North Lincolnshire. One, with a decayed suspension glaze, is of Beverley 1-type (BEVO1T) and dates between the late twelfth and mid-thirteenth centuries. Although visually the sherd is similar to Beverley 1 ware (*cf* Watkins 1991; Didsbury and Watkins 1992), the fabric does not exactly match and hence it may be a product of different kilns. The other is from the base of a large jug or jar, with spots of a splashed-type glaze on the internal wall. This is an example of Humber-type Early Medieval Glazed Gritty ware (HEMGG) and dates between the mid-/late twelfth and early/mid-thirteenth centuries. One notable feature is that no 'early medieval' type coarsewares were recovered; however, this may be because in this area the Saxo-Norman North Lincolnshire quartz- and chalk-tempered fabrics (*above*) fulfilled this function.

Thirteenth- to sixteenth-century 'medieval' wares

A total of 16 sherds, from 14 vessels, are of 'medieval' type, with 11 of the sherds coming from ten very abraded Beverley 2 (BEVO2) vessels. Within these, it is only possible to identify five jugs with any certainty, with the other sherds potentially coming from jugs, jars, or, in the case of an internally glazed base, from a bowl. The vessels are of generic thirteenth- to early/mid-fourteenth-century type. A further highly abraded basal sherd from a jug, jar, or bowl is of Beverley 2-type (BEVO2T). This vessel may have been produced within East Yorkshire or Lincolnshire between the thirteenth and mid-fourteenth centuries. Four sherds are also from two Humberware (HUM) jugs and a jug (or jar) of variable late thirteenth- to mid-sixteenth century date.

Animals and fish

I Smith

The medieval features in Area A produced a small assemblage of faunal and palaeobotanical remains. Regarding the faunal remains, 233 fragments of bone were recovered from features associated with the three successive phases of activity (Table 41). Approximately a third of this material exhibits good preservation (Stage 2), with most (*c* 22% of the entire assemblage) deriving from the pits (***1129*** and ***1320***) and a gully (***1131***), associated with the final phase of medieval activity (*p 152*). This seems to suggest that this material entered these features shortly after the death of the respective animals and had not been subjected to weathering, or other attritional taphonomic processes. The remainder of the material is either moderately or poorly preserved (Stage 3 and 4) and therefore some of this may have been present at the site for some time (perhaps within middens), prior to it entering particular features.

The assemblage from Phase M.I, associated with the early trackways and enclosures (*p 146*), comprises (TNF 10) cattle and large mammal (TNF 36), and fragments (TNF 6) only classifiable to the level of mammal. The cattle remains include some possibly associated horncore fragments (TNF 9) and the supra-condyloid fossa area of a femur (TNF 1; Dobney and Rielly 1988, diagnostic zone 7), all from ditch ***1166***. The ditches (***1122*** and ***1339***) of the conjoined enclosures, dating to Phase M.II (*p 151*), only produced very small amounts of bone from sheep/goat (TNF 5) and a large mammal (TNF 1); however, drainage gully ***1159***, also dating to this period, is more significant, as it produced small quantities of unidentifiable fish bone (TNF 2), along with unidentified mammal bone (TNF 13), which presumably derived from activity associated with the structure that the gully enclosed. The material from the pits (***1129*** and ***1320***), gully ***1131***, and ditch (***1346***) associated with the last phase of medieval activity (Phase M.III; *p 152*) includes large mammal (TNF 39), with small quantities of cattle (TNF 30), medium-sized mammal (TNF 11), and sheep/goat (TNF 6). A single pig distal humerus was also retrieved from ditch ***1346*** and bears probable evidence for dismemberment in the form of fine cut marks on the medial distal epicondyle (corresponding with Binford (1981) 'Hd-3'). The pits (***1320***) also produced a small quantity of fish bone (TNF 2), comprising herring-size vertebra fragments.

Cereals and other plants

D Druce

Several bulk samples, from features associated with the three phases of medieval activity, also contained abundant charred plant remains. Specifically, these were collected from ditch ***1166*** (Phase M.I; *p 146*), drainage gully ***1159*** (Phase M.II; *p 152*), and pits ***1183*** and ***1234***, and gully ***1131*** (Phase M.III; *p 153*), all of which seem to have received domestic waste. These samples were therefore subjected to analysis, which produced some details on the range of medieval crops under cultivation, together with the nature of the local agricultural environment.

The assemblage is overwhelmingly dominated by cereal grains and chaff (Table 42), which, in the case of ditch ***1166*** (Phase M.I), amounts to over 2300 grains.

Phase	Feature	Cattle	Sheep/ goat	Pig	Large mammal	Medium mammal	Mammal	Unidentified mammal	Fish	*Total*
M.I	Ditch ***1162***							1		***1***
	Ditch ***1166***	10			22		6	30		***68***
	Ditch ***1167***				14					***14***
Total		***10***			***36***		***6***	***31***		***83***
M.II	Ditch ***1122***		5							***5***
	Drainage gully ***1159***							*13*	2	***15***
	Ditch ***1339***				1					***1***
Total			***5***		***1***			***13***	***2***	***21***
M.III	Pit ***1129***	18	3		25	2	3			***51***
	Gully ***1131***	8	1		3		8			***20***
	Pit group ***1320***		2		2	3		29	2	***38***
	Ditch ***1346***	4		1	9	6				***20***
Total		***30***	***6***	***1***	***14***	***11***	***11***	***29***	***2***	***104***

Table 41: Animal bone (TNF) from medieval features in Area A

Although the effects of heavy charring meant that many of the cereals could not be identified to type, the evidence suggests that barley (*Hordeum vulgare*), free-threshing wheat (*Triticum aestivum/durum/turgidum*), oats (*Avena* sp), and rye (*Secale cereale*) were under cultivation. The number of rye grains, however, is relatively low compared to the other cereal types. If the quantities of oat/large grasses are considered, then there is a slight indication that oat and barley were the dominant crops, with free-threshing wheat perhaps becoming more important during later periods. This is tentative, however, given the high quantities of indeterminate cereal grains, and oat and large wild grasses being more recognisable even when heavily charred.

Several of the features contained common to abundant oat awn fragments and abundant oat/grass lemma bases. Although both could come from wild grasses, such remains are often common in cereal assemblages containing cultivated oats (Druce 2018, 167). Diagnostic cereal chaff is relatively rare, the better-preserved fragments confirming the presence of six-row barley (*Hordeum vulgare* 6-zeilig) and bread wheat (*Triticum aestivum*). Several spelt (*Triticum spelta*) wheat glume bases were also recovered from ditch ***1166*** (Phase M.I; *p 146*); however, the lack of cereal grains with characteristics consistent with this variety of wheat suggests spelt was not a prominent crop during the medieval period at Goxhill. Rather, it is possible the remains come from a relict crop.

Several other common medieval crops (Table 43) were also recorded, including flax (*Linum usitatissium*), field bean (*Vicia faba*), and pea (*Pisum sativum*), which may represent other kitchen waste or residual plants growing amongst the cereals. Several cabbage/mustard (*Brassica/Sinapis*) seeds were also recorded in the assemblages,

Phase		**M.I**	**M.II**	**M.III**		
Feature		Ditch ***1166***	Drainage gully ***1159***	Pit ***1183***	Pit ***1234***	Gully ***1131***
Sample volume (L)		80	80	40	40	40
Flot volume (ml)		225	140	150	100	50
Fraction (mm)		>0.25	>0.25	>0.25	>0.25	>0.25
Taxa/common name	**Plant Part**					
Cereals						
Avena sativa/fatua (wild/cultivated oat)	seed/fruit	86	24		29	7
Hordeum distichon/vulgare Spelzgerste (hulled barley)	seed/fruit	630	333	86	159	181
Secale cereale (rye)	seed/fruit	17	1		8	10
cf Triticum aestivum sl (bread wheat)	seed/fruit	101	251	142	291	230
Cerealia (indeterminate cereals)	seed/fruit	1543	628	127	200	106
Total cereal grains		***2377***	***1237***	***355***	***687***	***534***
Cerealia (indeterminate cereals)	seed/fruit fragments	++++	++++	++++	++++	++++
Poaceae >4 mm (large grasses)	seed/fruit	631	313	107	212	143
Cereal chaff						
Hordeum distichon/vulgare (barley)	rachis segment	8	10	3	4	
Hordeum vulgare 6-zeilig (six-rowed barley)	rachis segment	18				
Hordeum/Secale (barley/rye)	rachis segment	4			5	6
Secale cereale (rye)	rachis segment			5	5	
Triticum aestivum (bread wheat)	rachis segment	3				
Triticum aestivum sl */durum/turgidum* (bread/durum/rivet wheat)	rachis segment	6	31	13	24	5
Triticum spelta (spelt wheat)	glume base	8				
Cerealia (indeterminate cereals)	culm node	35	6	7	17	9
Total cereal chaff		***83***	***47***	***28***	***55***	***20***
Avena sativa/fatua (wild/cultivated oat)	awn fragment	+++	+	+++	++++	+++
Avena/Poaceae (oat/grass)	lemma base	70	56	11	64	17
Cerealia (indeterminate cereals)	embryo/sprout	+	++		+	+

Note: Actual counts are given, otherwise remains are scored on a scale of + to ++++, where: + represents less than five items; ++ between six and 25 items; +++ between 26 and 100 items; and ++++ over 100 items

Table 42: Cereal grains and chaff from medieval features in Area A

Phase		M.I	M.II	M.III		
Feature		Ditch ***1166***	Drainage gully ***1159***	Pit ***1183***	Pit ***1234***	Gully ***1131***
Sample volume (L)		80	80	40	40	40
Flot volume (ml)		225	140	150	100	50
Fraction (mm)		>0.25	>0.25	>0.25	>0.25	>0.25
Taxa/common name	**Plant Part**					
Other cultivars						
Linum usitatissimum (flax)	seed/fruit	8		2		
Pisum sativum (pea)	seed/fruit					1
cf Vicia faba (field bean)	seed/fruit	2	5	4		4
Possible cultivars						
Lathyrus/Pisum/Vicia (tare/vetch/pea)	seed/fruit	23	19	14	32	24
Lathyrus/Pisum/Vicia (tare/vetch/pea)	seed/fruit fragments	28	61	48	105	39
Brassica/Sinapis (cabbages/mustards)		7	3		2	2

Table 43: Additional medieval cultivars from features in Area A

and, although this group includes several introduced/cultivated crops, there are many wild native varieties that grow in a range of environments, including on sea-cliffs, riverbanks, and on waste/rough ground (Stace 2019).

The samples also contained the seeds from a suite of weeds commonly found in cereal assemblages from archaeological sites (Table 44), the most notable being stinking chamomile (*Anthemis cotula*), the ubiquitous weed of cultivated land. Other common/abundant seeds, which can grow in a wide variety of habitats, but often accompany cereal assemblages, include brome (*Bromus* type), vetch/tare (*Vicia/Lathyrus*), medium to small grasses (Poaceae), and docks (*Rumex* sp). All the samples contained seeds of oraches/goosefoot (*Atriplex/Chenopodium*), and although this group includes several taxa, such as spear-leaved orache (*Atriplex prostrata*) and fat-hen (*Chenopodium album*),

Phase			M.I	M.II	M.III		
Feature			Ditch ***1166***	Drainage gully ***1159***	Pit ***1183***	Pit ***1234***	Gully ***1131***
Sample volume (L)			80	80	40	40	40
Flot volume (ml)			225	140	150	100	50
Fraction (mm)			>0.25	>0.25	>0.25	>0.25	>0.25
Taxa/ common name	**Habitat (after Stace 2019)**	**Plant Part**					
Cultivated/arable/ waste places							
cf Anagallis arvensis (*cf* scarlet pimpernel)		seed/fruit				1	
Agrostemma githago (corncockle)		seed/fruit		1		1	
Anthemis cotula (stinking chamomile)	on heavy clay soils	seed/fruit	397	116	94	175	135
		seed head fragment	1	9			
Chenopodium album (fat-hen)		seed/fruit		4			
Lepidium sp (pepperwort)	also grassland/open ground	seed/fruit				1	3
Plantago major sl (greater plantain)	also grassland/open/ rough ground	seed/fruit	1			4	2
Polygonum convolvulus (black-bindweed)		seed/fruit	2	3	1		1

Table 44: Weed seeds from medieval features in Area A

Phase			M.I	M.II	M.III		
Feature			Ditch ***1166***	Drainage gully ***1159***	Pit ***1183***	Pit ***1234***	Gully ***1131***
Sample volume (L)			80	80	40	40	40
Flot volume (ml)			225	140	150	100	50
Fraction (mm)			>0.25	>0.25	>0.25	>0.25	>0.25
Taxa/ common name	**Habitat (after Stace 2019)**	**Plant Part**					
Polygonum lapathifolium agg (pale persicaria)	especially damp soils	seed/fruit	56	10		3	
Raphanus raphanistrum (wild radishes)	also coasts	seed/fruit	1				
		capsule	5	9	3	4	5
Sherardia arvensis (field madder)	also thin grassland	seed/fruit				2	
Spergula arvensis (corn-spurrey)	calcifuge-cult/coast/ especially sandy	seed/fruit	1			1	3
Stellaria media (common chickweed)	also open ground	seed/fruit	4				
Tripleurospermum (mayweeds)	also coasts	seed/fruit	11			1	3
Valerianella dentata (narrow-fruited cornsalad)	also rough ground	seed/fruit			3	3	1
Waste/rough ground							
Hyoscyamus niger (henbane)	especially manured by rabbits or cattle. Also maritime sand and shingle	seed/fruit				1	
Grassland and waste/rough ground							
Bromus Type (bromes)	also arable	seed/fruit	33	2		4	
Centaurea sp (knapweed)	also arable and waysides	seed/fruit				2	
Melilotus/Medicago/ Trifolium (melilot/ medick/clover)		seed/fruit		3			
Trifolium sp (clover)		seed head					1
Plantago lanceolata (ribwort plantain)		seed/fruit		1			
Woods/hedges/scrub							
Corylus (hazel)		seed/fruit	1			1	
Sambucus nigra (elder)	also waste places	seed/fruit	2		3	1	1
Mostly damp/waterlogged ground							
Carex sp (sedges)		seed/fruit	42	18	27	45	22
Cyperaceae (sedge family)		seed/fruit			12		
Eleocharis palustris agg (common spike-rush)		seed/fruit	46	6	1	13	3
Isolepis setacea (bristle club rush)		seed/fruit	2	1			
Juncus sp (rushes)		seed/fruit				20	76
Juncus sp (rushes)		seed head fragments		67			

Table 44: Weed seeds from medieval features in Area A (cont'd)

Phase			M.I	M.II	M.III		
Feature			Ditch ***1166***	Drainage gully ***1159***	Pit ***1183***	Pit ***1234***	Gully ***1131***
Sample volume (L)			80	80	40	40	40
Flot volume (ml)			225	140	150	100	50
Fraction (mm)			>0.25	>0.25	>0.25	>0.25	>0.25
Taxa/ common name	**Habitat (after Stace 2019)**	**Plant Part**					
cf Potamogeton sp (*cf* pondweed)	obligate aquatic	seed/fruit				1	
Schoenoplectus sp (club-rush)	also in tidal muds and margins of lakes, ponds, slow rivers and dykes	seed/fruit			21	44	16
Grow in a broad range of habitats							
Asteraceae (daisy family)		seed/fruit	2				
Atriplex/Chenopodium (oraches/goosefoots)		seed/fruit	92	58	25	30	14
Cirsium/Carduus (thistles)		seed/fruit	5				
Euphrasia/Odontites (eyebright/bartsia)		seed/fruit	2	3	1	3	4
Galium sp (bedstraws)		seed/fruit	3			1	
Persicaria (knotweed)		seed/fruit	8	23	12	16	20
Poaceae 2-4 mm (grasses)		seed/fruit	270	264	30	159	209
Poaceae <2 mm (grasses)		seed/fruit	65	165	40	120	120
Poaceae (grasses)		stem/culm fragments	+++	++		+++	++
Polygonum aviculare agg (knotgrass)		seed/fruit	7	1		1	
Potentilla sp (cinquefoils)		seed/fruit	1				
cf Primulaceae (*cf* primrose family)		seed/fruit	2				
Ranunculus acris/repens (meadow/creeping buttercup)	especially damp soils	seed/fruit	7			2	1
Ranunculus sp (buttercups)		seed/fruit	19				
Rumex sp (docks)		seed/fruit	75	61	8	37	44
Stellaria sp (stitchwort)		seed/fruit			5	3	3
Urtica sp (nettles)		seed/fruit	1			1	
Vicia/Lathyrus (vetch/tare)		seed/fruit	143	84	130	210	109
		seed/fruit fragments	++	++			
Indeterminate		seed/fruit	38	11	4	1	
		plant stem/root fragments		++	++++	+++	++

Note: Actual counts are given, otherwise remains are scored on a scale of + to ++++, where: + represents less than five items; ++ between six and 25 items; +++ between 26 and 100 items; and ++++ over 100 items

Table 44: Weed seeds from medieval features in Area A (cont'd)

which grow in cultivated/waste ground, many grow in coastal areas and saltmarshes (Stace 2019).

The seeds of pale persicaria (*Polygonum lapathifolium*) were also recorded, which, along with sedge (*Carex* sp) and common spike-rush (*Eleocharis palustris*), prefer damp/wet soils. Other indicators of wet conditions include: rush (*Juncus* sp), seed-head fragments found in drainage gully ***1159*** (Phase M.II; *p 152*); rush seeds from pit ***1234*** and gully ***1131*** (Phase M.III; *p 153*); and club-rush (*Schoenoplectus* sp) seeds present in all three of the Phase M.III features. A single pondweed (*Potamogeton* sp) seed was also recovered from pit ***1234*** (*p 153*). Sedges and rushes may have been growing at the margins of the cultivation plots, perhaps where they bordered drainage ditches. Alternatively, the remains may represent other settlement debris, such as flooring, bedding, or thatch.

The sedimentary evidence for livestock and cereal processing

R I Macphail and C J Carey

Soil monoliths were extracted from several medieval features in Area A. Following post-excavation assessment (*Ch 1, p 14*), four of these, from enclosure ditch ***1121*** (Phase M.II; *p 152*), pit ***1129***, and pit group ***1320*** (Phase M.III; *p 153*), were then subjected to detailed analysis, involving soil micromorphology and geochemistry, to see if the sediments contained any information relating to activities in this area.

The monolith from ditch ***1121*** indicates that its sandy loam fills (***1291*** and ***1289***) contained an abundance of matrix intercalations and associated matrix void coatings (Pl 56), which point to both muddy and probable trampled conditions in the ditch (Lewis *et al* 2010; Macphail and Crowther 2010; Rentzel *et al* 2017). The soil sediments were also burrowed, with deposit ***1291*** particularly characterised by iron (Fe-Mn?) staining (2.08-2.50% Fe; 0.062-0.080% Mn), which probably relates to small concentrations of organic matter (2.34-2.50% LOI) and associated phosphate (0.03-0.23% P), and topsoil biological working (Goldberg *et al* 2022). Based on these microfeatures and geochemical traits, it therefore seems that this ditch was trampled by livestock (*cf* Macphail and Goldberg 2018, fig 11.18). This may suggest that the conjoined enclosures functioned as stock enclosures and, at times, animals perhaps wandered along the enclosure boundaries when they were in the process of being corralled.

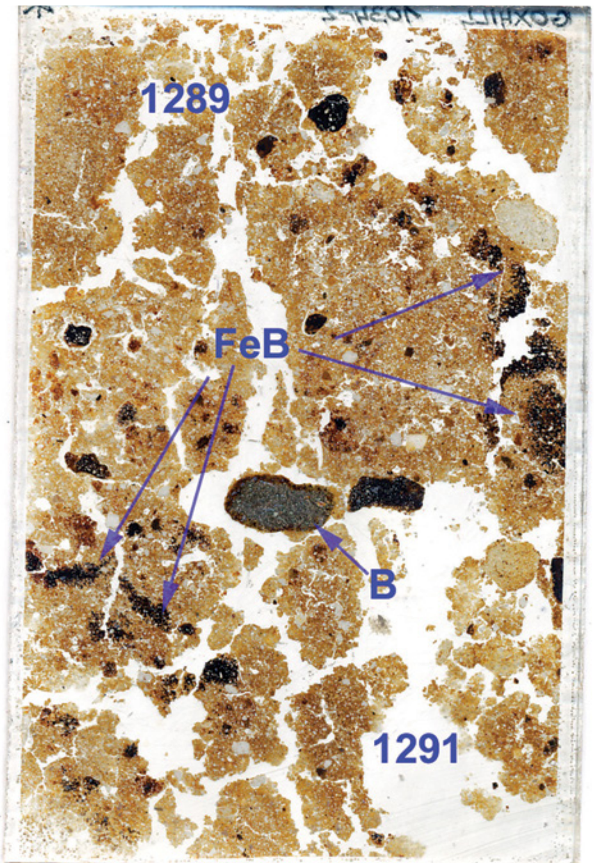


Plate 56: Photomicrograph of deposits **1291** *and* **1289** *in ditch* **1121***. Deposit* **1291** *is a fine sandy loam, which includes gravel, including a basalt clast (B), whilst* **1289** *is a medium sandy loam. Matrix intercalations and void coatings are abundant throughout, along with broad burrows, which in* **1291** *are preferentially iron stained (FeB). Frame height is ~90 mm*

The monolith from pit ***1129*** is also informative, regarding the types of medieval activities occurring close to the excavated area. It indicates that the pit contained a heterogeneous broadly burrowed moderately weakly humic (3.57% LOI) sandy silt loam fill (***1128***), moderately rich in very fine, fine, and coarse charcoal, with examples of burnt sands and gravel (Pl 57). Moreover, the charcoal

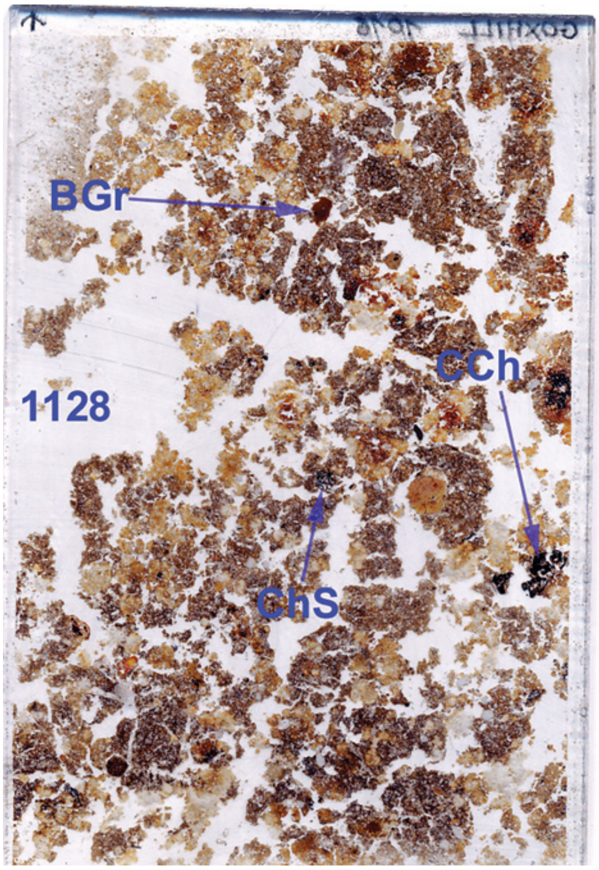


Plate 57: Photomicrograph of deposit **1128** *in pit* **1129***. This deposit is a fragmented prismatic sandy silt loan, with very fine charcoal, probable burnt gravel (BGr), possible charred seed fragments (ChS) and coarse charcoal (CCh). Frame height is ~90 mm*

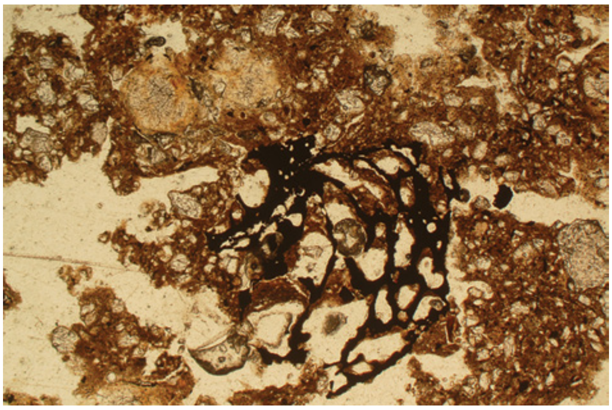


Plate 58: Photomicrograph of charred ('popcorned') cereal in pit **1129***. PPL, frame width is ~4.62 mm*

includes possible seed ('popcorned' cereal) fragments (Pl 58) and examples of iron-clay staining, as well as ash, which resulted in the release of potassium and phosphate (0.05% K; 0.09% P; Courty and Fedoroff 1982). This seems to suggest that the pit contained debris from a corn-dryer (*cf* Macphail and Goldberg 2018, 468). The presence of matrix intercalations and void coatings also suggests some backfilling of soil into the pit, whilst secondary iron mottling was noted (2.01% Fe), as well as a later inwash of silty clay.

The third and fourth monoliths sampled the deposits contained in three inter-cutting pits (***1238***, ***1236***, and ***1234***) forming pit group ***1320*** (*p 153*). Again, these proved informative, producing very similar evidence to that encountered in adjacent pit ***1129*** (*p 165*).

One of the monoliths was from deposits (***1237*** and ***1235***) contained in the first and second pits in the sequence (***1238*** and ***1236*** respectively; Fig 79). Deposit ***1237***, within the earlier pit, comprised a charcoal-rich fine sandy silt loam, with semi-continuous layered and laminated clasts, and also contained sub-horizontally oriented fine charcoal, with burnt clay clasts and ash residues (Pl 59). These appear to be burnt dumps of soil that included frequent (sometimes monocotyledonous) charred detrital organic matter. The deposit (***1235***) in the secondary pit was a mixture of a diffusely layered charcoal-rich, reddish brown, clayey silt loam that contained very fine charcoal. Both deposits were still relatively humic (4.96% LOI/5.44% LOI) and exhibited a moderately strongly enhanced magnetic susceptibility, and ash was also present (reflected by 0.07% K and 0.11% P/0.14% P). They also contained frequent inclusions of strongly rubefied and indurated sediments, which are likely fragments (max 14 mm) from a heated clay structure (Pl 60). In addition, fragments of charred seeds, interpreted as 'popcorned' cereal grains, were recorded. Together this evidence suggests that both fills were waste derived from corn-dryers constructed from sediment-based 'daub'. Moreover, the lack of wood charcoal and complete dominance of burnt sediments, containing relict detrital organic matter, indicate they were also composed of fuel remains produced during the burning of upper saltmarsh sediments (Reineck and Singh 1986; Macphail *et al* 2010). This in turn suggests the use of a saltmarsh 'turves' for fuel (*cf* Carter 1998; Adderley *et al* 2006).

Similar evidence was also recorded in the other monolith. This again sampled deposit ***1235*** in pit ***1236*** and produced evidence for the dumping of burnt saltmarsh 'turves' (fuel-ash waste), along with small amounts of wood charcoal and charred cereal grain. This monolith also sampled deposit ***1233*** contained within the final pit (***1234***) in the sequence (Fig 79). This was much richer in charred cereal-processing waste, with both charred cereal-grain fragments and charred stem sections possibly representing burnt straw (Pl 61; 4.61% LOI). Burnt gravel-size sediments were also observed, probably representing daub from a burnt structure, and occurred alongside 'popcorned' cereal grains, suggesting that much of this deposit was composed

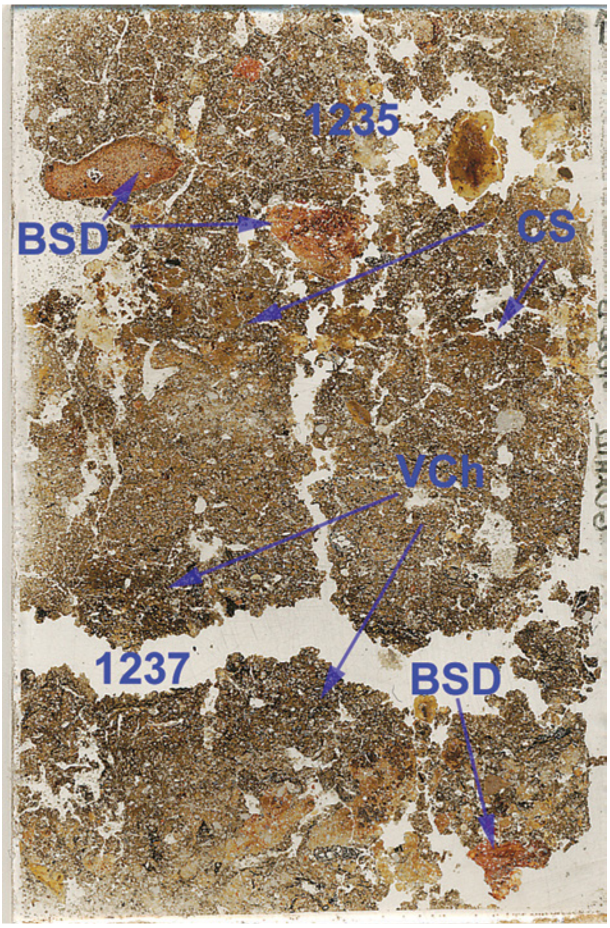


Plate 59: Photomicrograph of deposits **1237***, in pit* **1238***, and* **1235***, in pit* **1236***. This deposit is a very fine charcoal-rich fine sandy silt loam, diffusely layered with concentrations of gravel-size burnt sediment/daub (BSD). Overlying dposit* **1235** *is a more clayey sediment (CS) with evidence of faunal remains, and charred seed remains. Frame width is ~90 mm*

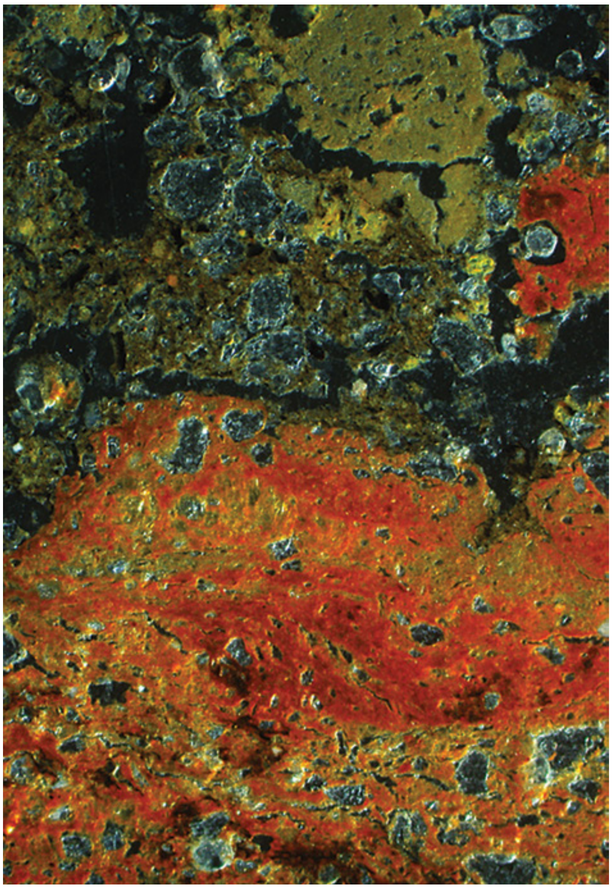


Plate 60: *Photomicrograph of deposit* **1237** *in pit* **1238***, showing red, strongly reubefied burnt fragment of sediment, used as daub, and overlying charred and uncharred estuarine/saltmarsh sediments. PPL, frame height is ~4.62 mm*

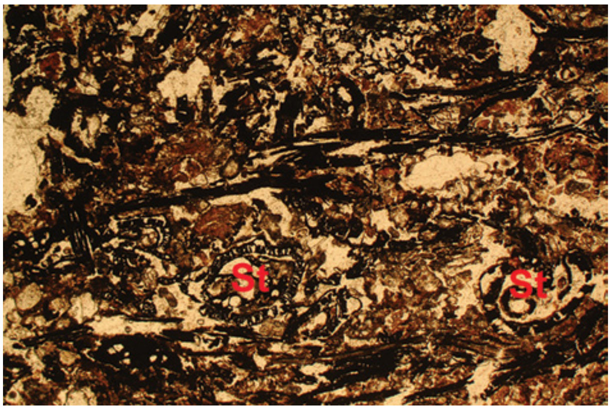


Plate 61: Photomicrograph of deposit **1233** *in pit* **1234***. This is probable corn-dryer rake-out containing charred cereal-processing waste, including likely stems/straw (St). PPL, frame width is ~4.62 mm*

of rake-out material from a corn-dryer (*cf* Macphail *et al* 2017, fig 21).

Dating the medieval activity: radiocarbon dating and pottery chronologies
R A Gregory and J Young

The chronology of medieval activity in Area A was partly established through radiocarbon dating and the recovered pottery. In total, eight charred cereals deriving from several features associated with the three separate phases of activity (Phases M.I-III) were subjected to radiocarbon assay. Specifically, two of the samples were from Phase M.I features, whilst three sets of assays were from Phase M.II and M.III features.

Of the assays from Phase M.I features, one (SUERC-104297) from posthole ***1193*** (Phase M.I; *p 150*) dates to the late eighth to late tenth century cal AD (Table 45). Significantly, this posthole also produced pottery (Torksey ware) dating between the early/mid-tenth and early-mid eleventh centuries (*p 157*), and hence it is likely that the seed, posthole, and pottery date to the latter part of the calibrated range (*ie* tenth century cal AD). Indeed, within the 95% calibrated range, there is a 90.8% probability that the seed actually dates to cal AD 875-995, which seems to confirm this suggestion.

This tenth-century date range might also be applicable to the other sherds of stratified Torksey ware from Phase M.I features (Table 46), particularly as the absence of any Late Saxon Lincoln, or Lincoln-type, shell-tempered vessels in the assemblage suggests that activity is unlikely to have started before the mid-/late tenth century. During this period, the main market for Torksey ware appears to have been York, whilst in Lincoln it was not until the collapse of the shell-tempered industries that Torksey ware became more dominant, as suggested by an increase in sherds recovered from archaeological sites (Mainman 1990). It is also worth noting that Torksey ware has been recovered from other medieval sites in the Goxhill region, though it is possible that this is slightly later in date. A case in point is St Peter's Church, Barton-upon-Humber, where the few chronologically significant Torksey-type sherds recovered are of post-late tenth-century type and most of the vessels

Feature	Laboratory code	Material	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (95% confidence)
Posthole ***1193***	SUERC-104297	Charred seed: *Hordeum vulgare*	1135±24	-25.3	cal AD 770-995
Ditch ***1166*** (secondary fill); Enclosure 17	SUERC-104295	Charred seed: *Avena* sp	919±24	-22.6	cal AD 1035-1210

Table 45: Radiocarbon dates from Phase M.I features in Area A

Feature	Pottery type	Total sherds (weight)	*Total vessels*	Date range
Ditch ***1051***	North Lincolnshire Late Saxon Grey ware (NLLSG)	2 (15g)	***1***	Tenth to mid-eleventh century
Ditch ***1161***	East Lindsey Late Saxon Lincoln-type Light Firing Greyware (ELLSLLG)	3 (185g)	***1***	Late tenth to mid-eleventh century
	North Lincolnshire Grit-tempered Coarse ware (NLSTCW)	10 (13g)	***2***	Mid-eleventh to mid-twelfth century
Ditch ***1166***	Beverley Orange ware Fabric 2 (BEVO2)	1 (1g)	***1***	Thirteenth to early/mid-fourteenth century (intrusive item?)
Ditch ***1301***	North Lincolnshire Quartz and Shell Fabrics (NLQC)	1 (7g)	***1***	Late eleventh to mid-twelfth century
	Torksey ware (TORK)	1 (1g)	***1***	Tenth to mid-eleventh century
Ditch ***1349***	Torksey ware (TORK)	5 (55g)	***5***	Tenth to early eleventh century (includes at least one tenth-century jar)
	Torksey-type ware (TORKT)	6 (30g)	***2***	Tenth to mid-eleventh century
Total number of vessels			***14***	

Table 46: Stratified medieval pottery from Phase M.I features in Area A

were from deposits dating between 50 and 100 years after the type ceased production (Boyle *et al* 2011).

The other Phase M.I radiocarbon assay (SUERC-104295) was from the secondary fill of ditch ***1166*** (part of Enclosure 17; *p 146*) and this spans the mid-eleventh to first decade of the thirteenth century cal AD (Table 45). The ditch also contained a sherd of Beverley 2 ware (*p 159*), though given its thirteenth- to early/mid-fourteenth-century date range, the sherd is likely to represent an intrusive item (Table 46). Several of the other Phase M.I ditches, although not subjected to radiocarbon dating, also produced pottery with a broad chronological range spanning the tenth to mid-twelfth centuries, and this chronological range is confirmed, in some measure, by Bayesian modelling of the radiocarbon date from ditch ***1166***. Importantly, this ditch was stratigraphically earlier than a Phase M.II gully (***1159***; *p 152*), which also produced radiocarbon dates (*p 169*), and when this dating evidence is placed within an OxCal sequence, it suggests that ditch ***1166*** had been established (perhaps in the mid-/late tenth century), had partially filled, and was falling out of use in *cal AD 1030-1160* (Fig 83). Therefore, the radiocarbon dating evidence, together

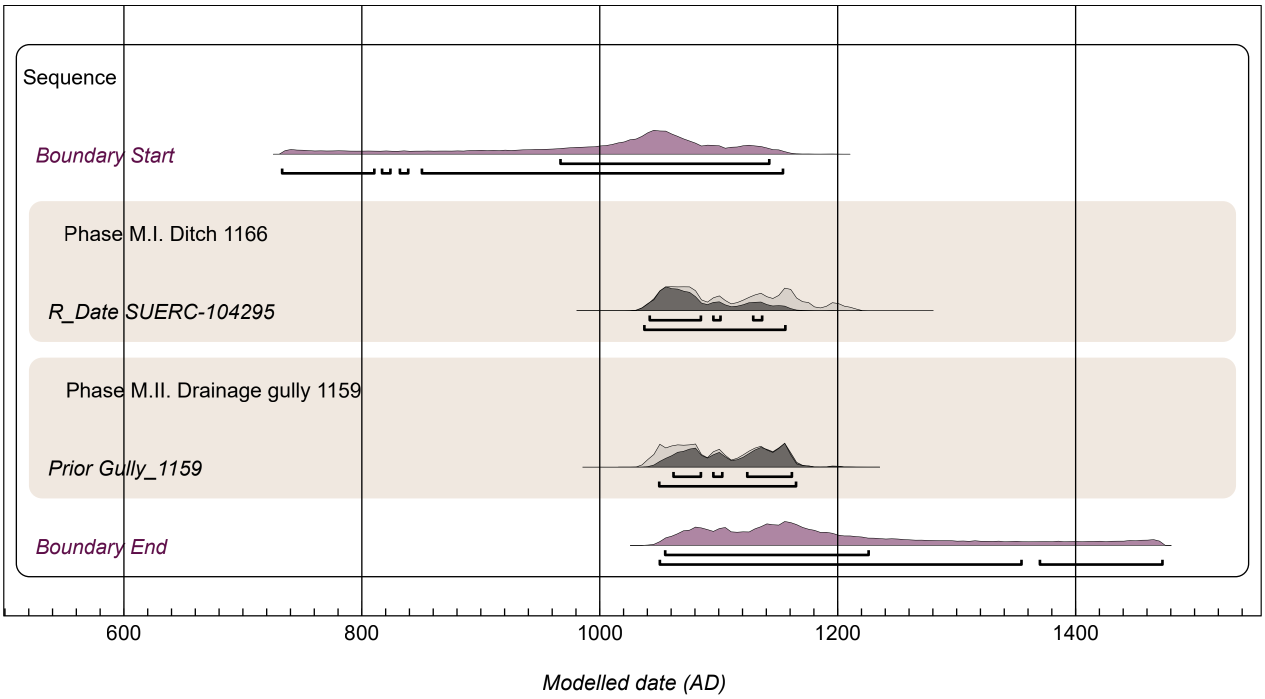


Figure 83: The posterior-density estimates for ditch **1166** *(Phase M.I) and gully* **1159** *(Phase M.II)*

Feature	Laboratory code	Material	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (95% confidence)
Gully ***1159***	SUERC-74725	Charred seed: *Hordeum* sp	963±29	-23.4	cal AD 1020-1160
	SUERC-104294	Charred seed: *Avena* sp	905±24	-25.7	cal AD 1040-1220
Ditch ***1121***	SUERC-74724	Charred seeds: *Triticum* sp	908±28	-24.1	cal AD 1040-1220

Table 47: Radiocarbon dates from Phase M.II features in Area A

with the associated pottery from Phase M.I features, indicates that activity spanned a lengthy period, broadly extending across 200 years, between the mid-/late tenth and mid-twelfth centuries, and also covering both the pre- and post-Norman Conquest periods; however, when considered in relation to the dating evidence from the succeeding phase, it is likely that this activity was actually constrained to the earlier part of this period (*below*).

The Phase M.II radiocarbon assays include two (SUERC-74725 and SUERC-104294; Table 47) from drainage gully ***1159*** (*p 152*). When subjected to the chi-square test, these are statistically consistent, with good agreement (T'=2.08; T'(5%)=3.84; *v*=1; A_{comb}=77.2%(An= 50.0%)), and hence provide a secure date for this gully spanning the mid-eleventh to early thirteenth centuries. Significantly, this gully also partially truncated infilled ditch ***1166*** (*p 168*), and when the combined (Prior) dates from this and the gully are modelled in an OxCal sequence, they suggest the drainage gully ***1159*** dates to *cal AD 1040-1170*, indicating that it was established immediately following the final filling of the earlier ditch (Fig 83). The other Phase M.II assay (SUERC-74724) was from ditch ***1121*** (*p 152*) and this similarly spans the mid-eleventh to early thirteenth centuries. Again, it suggests that the ditch, which defined Enclosure 19, was established shortly after the demise of the Phase M.I features.

The stratified pottery from the Phase M.II features paints a similar chronological picture (Table 48). This represents a small assemblage from ditches ***1339*** and ***1350***, which formed elements of conjoined Enclosures 19 and 20 (*p 151*). One the sherds, from a Beverley 2 ware (*p 159*) vessel, is likely to have been intrusive in ditch ***1339***, whilst the other sherds suggest activity dated between the late eleventh and mid-/late twelfth centuries, which falls within the radiocarbon date range. Indeed, this could indicate that activity during Phase M.II explicitly dated to this period, with an end date perhaps pushing more towards the mid-twelfth century (based on the dating evidence from Phase M.III; *below*). This in turn would also imply that the earlier Phase M.I activity dated more succinctly between the mid-/late tenth and late eleventh centuries.

The remaining radiocarbon assays from Area A were from Phase M.III features, specifically two pits, ***1234*** (SUERC-104302) and ***1183*** (SUERC-104296), both part of pit group ***1320*** (*p 153*), and gully ***1131*** (SUERC-104301; Table 49). Stratigraphically, although

Feature	Pottery type	Total sherds (weight)	Total vessels	Date range
Ditch ***1339***	Beverley Orange ware Fabric 2 (BEVO2)	1 (3g)	1	Thirteenth to early/mid-fourteenth century (intrusive item?)
	Stamford Ware (ST)	2 (7g)	1	Mid- to late twelfth century
Ditch ***1350***	North Lincolnshire Quartz and Shell Fabrics (NLQC)	4 (9g)	2	Late eleventh to mid-twelfth century
Total number of vessels			**4**	

Table 48: Stratified medieval pottery from Phase M.II features in Area A

Feature	Laboratory code	Material	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (95% confidence)
Pit ***1234***; pit group ***1320***	SUERC-104302	Charred seed: *Triticum cf aestivum*	973±24	-22.8	cal AD 1020-1160
Pit ***1183***; pit group ***1320***	SUERC-104296	Charred seed: *Hordeum vulgare*	938±24	-25.7	cal AD 1030-1165
Ditch ***1131***	SUERC-104301	Charred seed: *Secale cereale*	943±24	-21.8	cal AD 1030-1160

Table 49: Radiocarbon dates from Phase M.III features in Area A

pits ***1234*** and ***1183*** represent the earlier features, followed by gully ***1131*** (*p 153*), all three radiocarbon dates are statistically consistent, with good agreement (T'=1.06; T'(5%)=5.99; v=2; A_{comb}=105.0%(An=40.8%)), providing a combined date of cal AD 1040-1160. This therefore implies that the pits were dug and filled rapidly (for waste disposal), closely followed by the creation of the gully, probably shortly after the Phase M.II activity, perhaps in the mid-twelfth century based on the dating evidence from this earlier phase (*p 169*). The date range of the stratified pottery also correlates with this suggestion. Some of the material was from three pits (***1129***, ***1238***, and ***1322***) that seem to have been rapidly backfilled with rubbish (*p 153*), and terminal dates for this assemblage fall in the mid-twelfth century (Table 50). This might therefore provide a date for backfilling, although a small proportion of the pottery could represent material from the earlier phases of activity. Similarly, the terminal dates for some of the pottery from the radiocarbon dated gully (***1131***) fall in the mid-twelfth century. The gully also produced a sherd of Humberware, dating to the late thirteenth to fifteenth century, though this was probably intrusive, at least in this feature, whilst a sherd in the North Lincolnshire Quartz and Shell fabric (NLQS) might represent a residual item found within the gully. It does, however, seem that some features associated with Phase M.III were receiving material during the later date range (even though the pits and gully had almost certainly been backfilled by this stage). Specifically, the silt in boundary ditch ***1347*** produced pottery dating to the thirteenth to early/mid-fourteenth century, which also acts as a *terminus post quem* for the two latter reiterations of this boundary (*p 155*).

The Post-Medieval Landscape at Goxhill

Following its suppression in 1539, Thornton Abbey, by far the most significant medieval establishment in the area (*p 142*), initially became a college for the training of priests for the newly formed Church of England, though this too was dissolved by Edward VI in 1547 (Oswald *et al* 2010). Thereafter, the site was owned by several notable families until it was bought by Vincent (later Sir Vincent) Skinner in 1602. Skinner, who had connections to William Cecil, chief advisor to Elizabeth I, was a staunch Puritan and was responsible for the demolition of most of the abbey buildings to facilitate the construction of his new house, though

Feature	Pottery type	Total sherds (weight)	Total vessels	Date range
Pit ***1129***	Beverley Orange-type ware Fabric 1 (BEVO1T)	1 (19g)	1	Late twelfth to mid-thirteenth century
	North Lincolnshire Grit-tempered Coarse ware (NLGTCW)	11 (72g)	5	Mid-eleventh to mid-twelfth century
	North Lincolnshire Quartz and Chalk-tempered ware (NLQC)	3 (16g)	3	Mid-eleventh to early/mid-thirteenth
	North Lincolnshire Quartz and Shell Fabrics (NLQS)	2 (9g)	2	Mid-tenth to twelfth century
	Stamford Ware (ST)	1 (13g)	1	Eleventh to mid-twelfth century
Pit ***1238***; pit group ***1320***	North Lincolnshire Grit-tempered Coarse ware (NLGTCW)	1(2g)	1	Eleventh to mid-twelfth century
Pit ***1322***	North Lincolnshire Grit-tempered Coarse ware (NLGTCW)	1 (5g)	1	Eleventh to mid-twelfth century
	Stamford Ware (ST)	2 (40g)	1	Mid-/late eleventh to mid-twelfth century
Gully ***1131***	Humberware (HUM)	2 (17g)	1	Late thirteenth to fifteenth century
	North Lincolnshire Grit-tempered Coarse ware (NLGTCW)	8 (45g)	6	Mid-eleventh to mid-twelfth century
	North Lincolnshire Quartz and Chalk-tempered ware (NLQC)	8 (57g)	3	Mid-eleventh to mid-twelfth century
	North Lincolnshire Quartz and Shell Fabrics (NLQS)	6 (38g)	4	Mid-tenth to twelfth century
Ditch ***1347***	Beverley Orange ware Fabric 2 (BEVO2)	2 (18g)	2	Thirteenth to early/mid-fourteenth century
Total number of vessels			***31***	

Table 50: Stratified medieval pottery from Phase M.III features in Area A

the gatehouse (*p 143*) was retained (*ibid*). The house itself was probably never completed and may have been demolished within a few years to pay Skinner's debts (he died in High Holborn debtors' prison in 1616). Members of the Vincent family continued to occupy a more modest house (known today as Abbot's Lodge) into the eighteenth century, but in 1816 the site was purchased by the 1st Baron Yarborough, who took steps to preserve what remained of the abbey. Thereafter the site was cared for by the Earls of Yarborough until 1938, when it was placed in state guardianship (*ibid*).

At Goxhill itself, much of the present-day landscape within the parish is a product of changes in land-use dating from the post-medieval and modern periods (mid-sixteenth to twentieth centuries). Outside of the village, and North and South End, there are several residential buildings and farmhouses of this date (such as Chapel Farm), most of which are depicted on late nineteenth-century OS mapping (Fig 84). Many of these buildings, along with the modern roads, field boundaries, and drainage channels, were also probably established during the period of enclosure, which in the Goxhill parish dated to 1773-5 (Russell and Russell 1987, 31); however, it is clear that some of these field boundaries were removed during the twentieth century to create larger fields. At the close of the nineteenth century, some small-scale industry was also present, in the form of brickworks along the coast, such as that at Goxhill Haven, which lay within an area that had been important for medieval clay extraction (*p 145*). Aerial photography has also identified extensive groups of small rectangular pits running for over 4 km along the coastline at Goxhill and these have been interpreted as post-medieval peat extraction pits (Fleming and Royall 2019, 43), though given the presence of nearby brickworks, they could instead relate to clay extraction. The coastline, and that at Paull, also contains several linear mounds, jutting out into the estuary and forming post-medieval groins, as well as the sites of beacons to aid maritime navigation within the estuary (*ibid*).

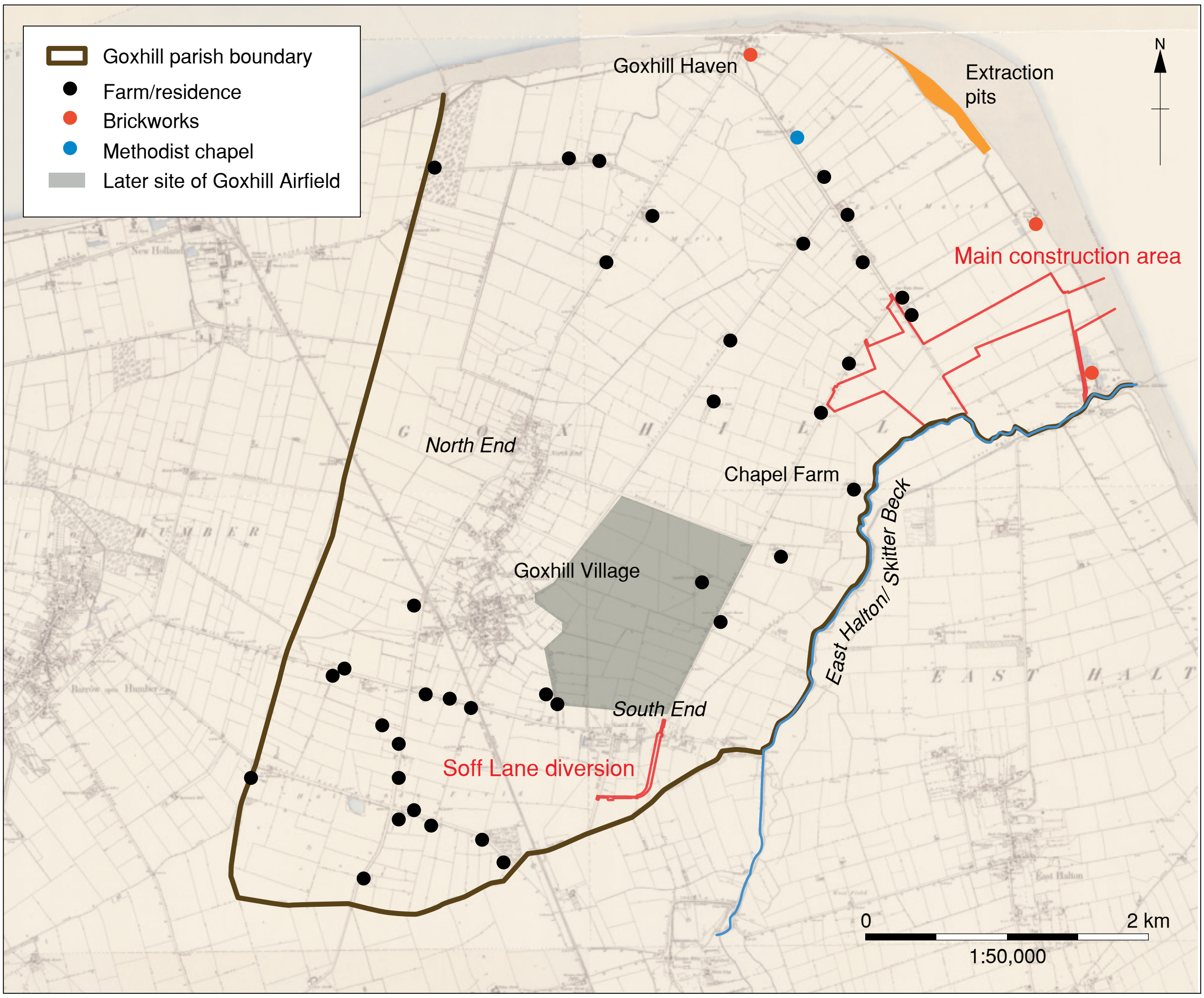


Figure 84: The post-medieval landscape in the Goxhill parish, as depicted on nineteenth-century mapping (OS 1886a; 1886b; 1886c; 1886d; mapping reproduced with the permission of the National Library of Scotland)

Probably the most significant modern site in the Goxhill area is the (disused) airfield to the north-west of Soff Lane. This was established during World War I and was further developed and enlarged during World War II, initially as a base for RAF Bomber Command and later for Fighter Command. Later still it was used as a training base by the United States Army Air Force (Dixon and Parker 1994). Several other military sites, constructed during World War II, are also present and include searchlight batteries and gun emplacements at East Marsh Farm, which are now visible as cropmarks (Fleming and Royall 2019, 124), as well as a bombing decoy site (Scheduled Monument: List Entry No 1431904), immediately south of the main construction

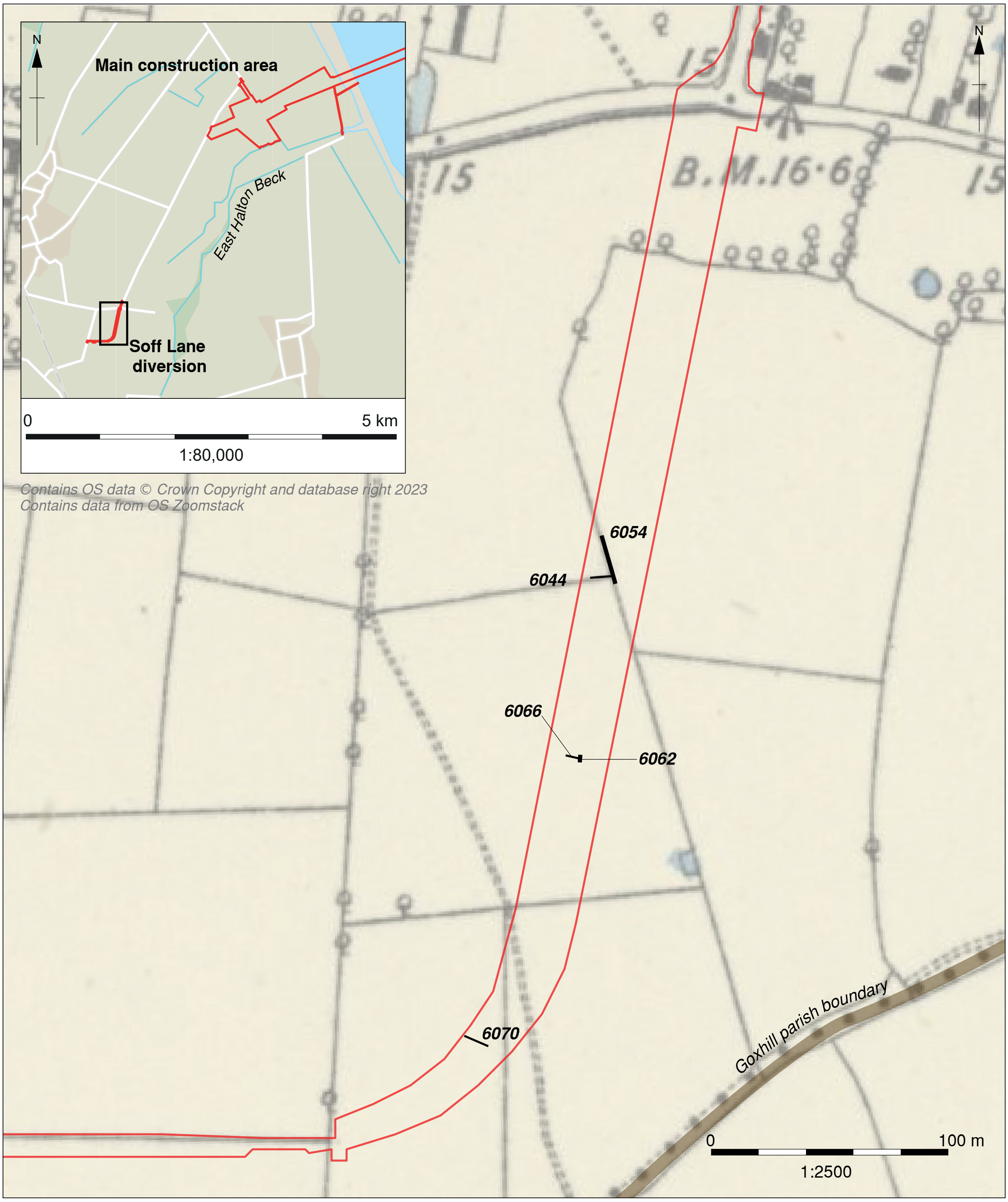


Figure 85: The post-medieval field boundaries along the Soff Lane diversion, superimposed on the First Edition OS mapping (1886a; mapping reproduced with the permission of the National Library of Scotland)

area, designed to draw off Luftwaffe bombing raids aimed at oil installations at North Killingholme.

Post-medieval activity at Goxhill

J Zant, D Druce (plant remains), E Allison (insects), and I Smith (animal bones)

With the exception of modern field drains and plough furrows, post-medieval features in Area A were limited to the remains of ploughed-out field boundaries, represented by ditches recorded during the watching brief along the Soff Lane diversion (Fig 85). These features, which corresponded with field boundaries depicted on the First Edition OS mapping (OS 1888a), comprised a T-shaped arrangement of two ditches (**6044** and **6054**), up to 1.9 m wide and 0.5 m deep, and two east/west ditches located further to the south: **6066** (0.9 m wide and 0.5 m deep), *c* 72 m to the south; and **6070** (*c* **0.8** m wide and 0.25 m deep), some 18 m further south still.

Another former field ditch (**3337**) was recorded in Area C, in the main construction area, and was also observed further to the north during the watching brief in Delta Field (*Ch 1*, *p 12*) where, it was recorded as **6053** (Fig 86). It was aligned north-west/south-east, measuring *c* 2.3 m wide and 0.55 m deep, correlated with a boundary depicted on nineteenth-century

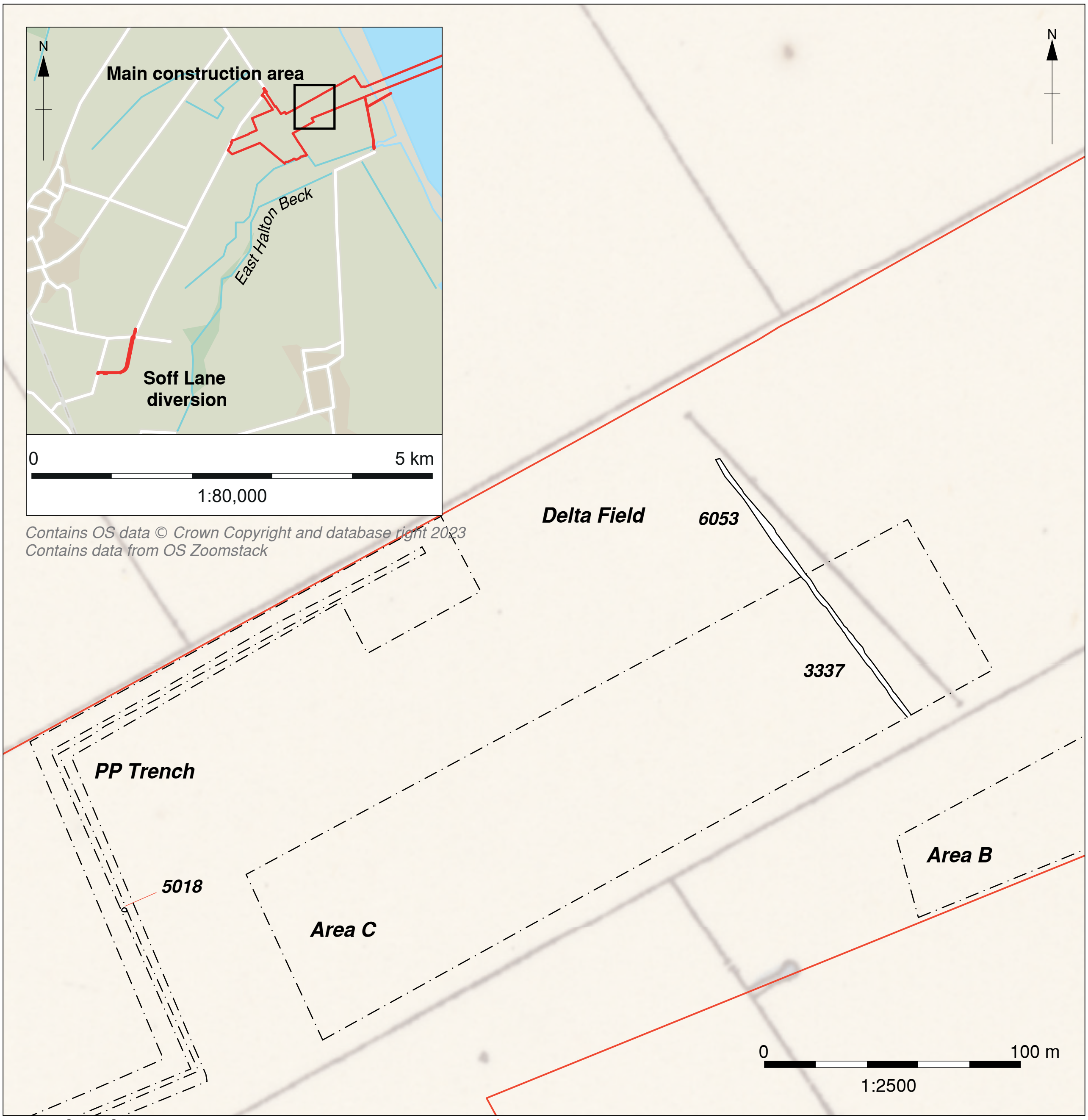


Figure 86: The post-medieval ditch and pit in Area C and the PP Trench, superimposed on the First Edition OS mapping (1886b; mapping reproduced with the permission of the National Library of Scotland)

mapping (1886b), and yielded early/mid-nineteenth-century pottery, as well as waterlogged seeds and insects. The seeds were dominated by sub-aquatic taxa, such as water crowfoot (*Ranunculus aquatilis*) and water-plantain (*Alisma plantago-aquatica*), which grow at the margins of ponds, ditches, and slow rivers, suggesting that it was probably a water-filled drainage feature. Further evidence for an aquatic environment is indicated by the presence of duckweed (*Lemna* sp) and frequent ostracod bivalves. Rare sedge seeds were also recovered, as were thistle (*Cirsium* sp) seeds, which can inhabit a wide range of environments, including waste/rough and arable ground (Stace 2019).

The insects presented a similar picture (*Appendix 1*), in that aquatic species account for 29% of the whole assemblage, suggesting that the ditch held water when its fill accumulated. The identified species include *Ochthebius bicolon*, usually associated with fresh running water, but others of the identified water beetles are eurytopic and some are also tolerant of brackish conditions. Ground around the ditch may also have been relatively dry since taxa associated with damp ground and marginal habitats are rather poorly represented (3%). Single individuals of *Atomaria* and *Dienerella*, often members of a house fauna, hint at the disposal of occupation waste, but this is unclear due to the limited size of the assemblage and since both genera also occur in natural situations. Poor-quality grassland in agricultural use was indicated by *Phyllopertha horticola* and aphodiine dung beetles. The latter are proportionally very well represented (20% of the terrestrial fauna), the majority being the autumn-active *Nimbus contaminatus*. *Acrolocha sulcula*, a small omaliine rove beetle, was also identified and usually occurs in dung but also sometimes more generally among decaying vegetation, including sedge and

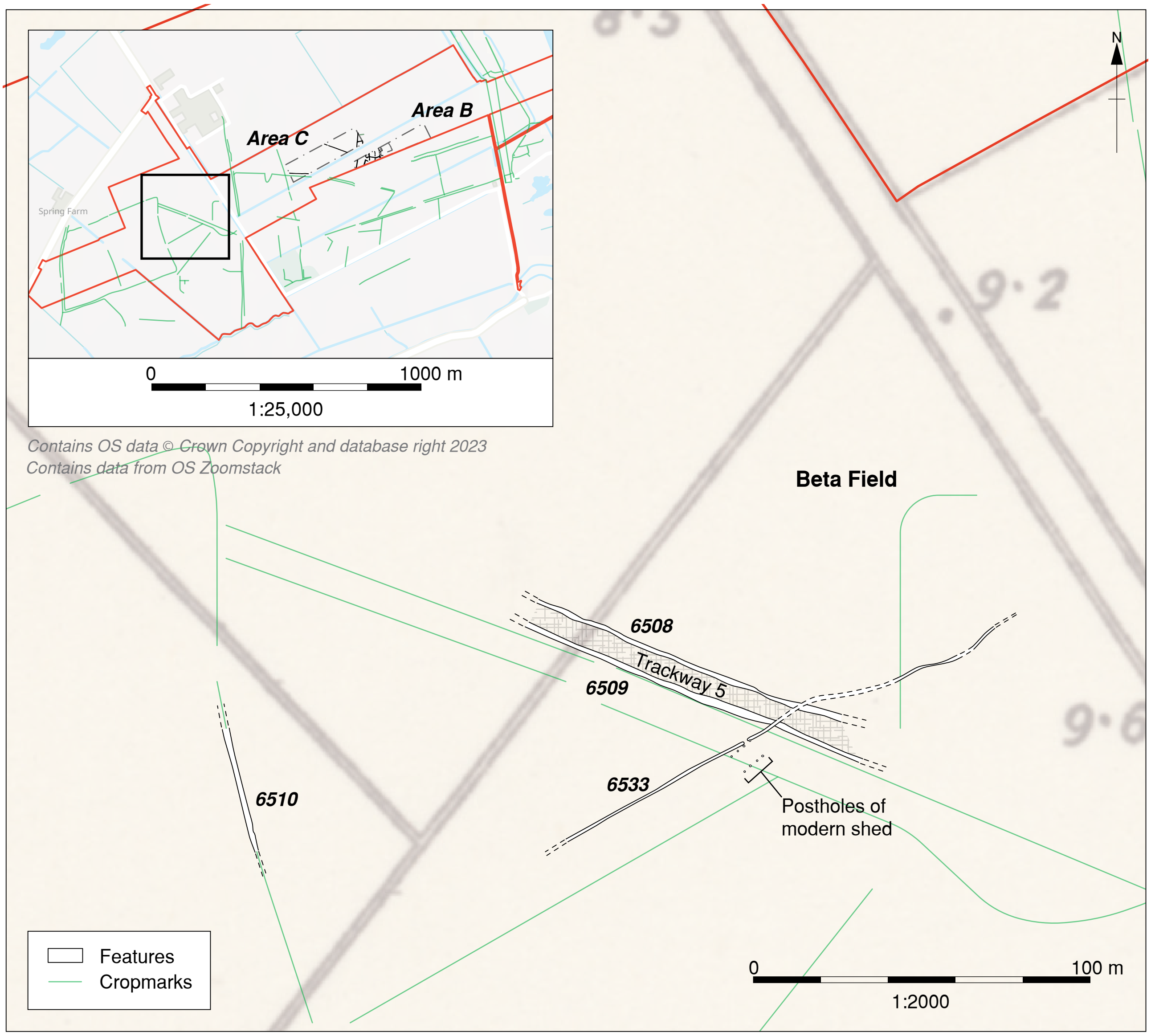


Figure 87: The post-medieval trackway and boundaries in Beta Field, superimposed on the First Edition OS mapping (1886b; mapping reproduced with the permission of the National Library of Scotland), and associated cropmark evidence

reed (*Phragmites*) litter (UK Beetles nd). Finally, *Pterostichus melanarius* is also present and, although an almost ubiquitous ground beetle in Britain, it is especially typical of agricultural grassland.

One other feature recorded during the open-area excavations was a post-medieval or modern pit (***5018***; Fig 86). This was uncovered in the PP Trench, south-west of Area C, and it contained a dump of cattle bone comprising an isolated mandibular tooth and a metacarpal, and adjoining fragments of a humerus; both the metacarpal and humerus are represented by single diagnostic zones.

Outside the core areas of archaeological investigation represented by Areas B and C, a ditched trackway (Trackway 5) and other probable boundary ditches were recorded during the watching brief in Beta Field (*Ch 1, p 12*) located several hundred metres further west (Fig 87). Trackway 5 was defined by a pair of parallel ditches (***6508*** and ***6509***), each 2 m wide and 0.3-0.4 m deep and set 6 m apart, and were traced north-west to south-east for 107 m. Cutting across the southern recorded end of the track on a north-east/south-west alignment was a later boundary ditch (***6533***), 0.9 m wide and 0.3 m deep, which was traced for 142 m. Further west another ditch (***6510***), 2 m wide and 0.3 m deep, entered the field from the north and was traced southwards for *c* 35 m; this had been recut on at least one occasion.

Although none of these features could be independently dated and none had any stratigraphical or spatial relationship with other archaeological remains, their fills appeared relatively modern and hence they most likely dated to the post-medieval period. Importantly, further details of these features and the wider system of contemporary enclosure were visible from the cropmark evidence. It indicates that Trackway 5 formed an extensive feature running north-westward off another north/south-aligned trackway, which was perhaps a precursor of East Marsh Road. A scatter of linear cropmarks to the east of this latter trackway also seem to define associated post-medieval fields running towards the banks of the Humber. Furthermore, it is also evident that the north-western end of Trackway 5 linked with a sizeable rectangular field/enclosure, the eastern boundary of which was defined by ditch ***6510***. A third and fourth trackway lay respectively on the western and southern sides of this enclosure, with additional field systems and enclosures to the south. Spatially, however, all of the excavated elements, and the majority of the cropmarks, clearly pre-date the field boundaries depicted on late nineteenth-century mapping (OS 1886b), and they therefore seemingly relate to an early phase of post-medieval enclosure.

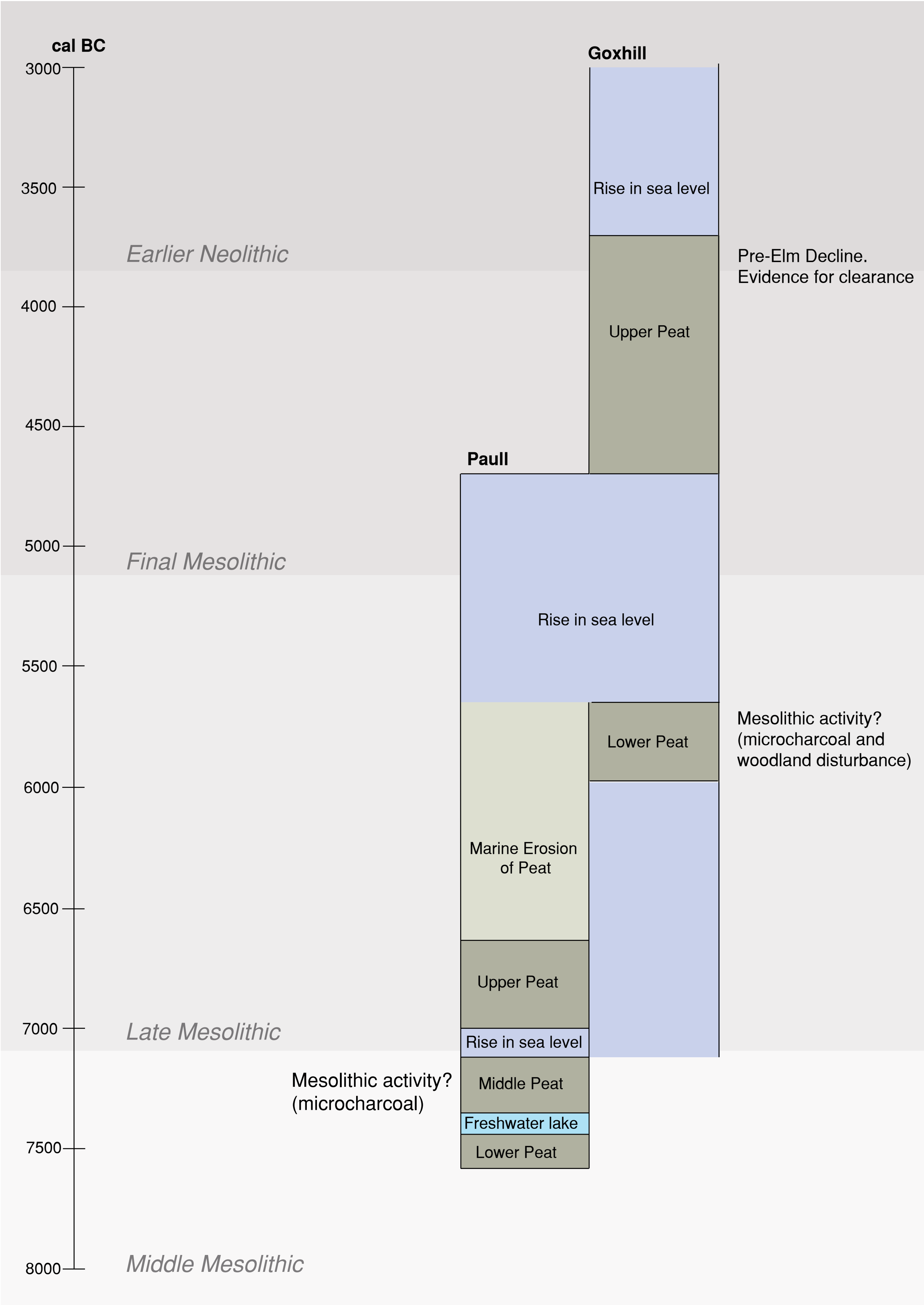


Figure 88: The chronology and character of the estuarine landscapes at Paull and Goxhill

6

CHANGING LANDSCAPES AND SETTLEMENT ON THE BANKS OF THE HUMBER

R A Gregory, M Rutherford, J Zant, and D Druce

The archaeological and palaeoenvironmental investigations, undertaken as part of the Number 9 Feeder Gas Transmission Pipeline project, provided a valuable opportunity to investigate landscape development across a protracted period in the Humber Estuary. The palaeoenvironmental work (*Ch 2*) proved particularly successful, as this identified natural sediments at both Paull, East Yorkshire, and Goxhill, North Lincolnshire, that allowed excellent insights into the evolving Mesolithic and Neolithic estuarine landscape, either side of the Humber. Similarly, archaeological investigation, focusing on two landscape areas to the north-east and south-east of Goxhill village successfully recorded a suite of buried remains relating to the prehistoric and historic use of a 'marginal' environment in the North Lincolnshire marshes. Indeed, across these investigated areas, archaeological excavation, artefact, and palaeoenvironmental analyses have allowed for a much clearer understanding of prehistoric (*Ch 3*), Romano-British (*Ch 4*), and medieval settlement and later land-use (*Ch 5*), which adds to, and complements, the emerging evidence recovered by other archaeological projects undertaken in the wider Goxhill area (*inter alia*; Tuck 2023; Cavanagh 2024).

Early Estuarine Landscapes

The evidence relating to Mesolithic and Neolithic landscapes at Goxhill and Paull is geoarchaeological and palaeoenvironmental in form. Specifically, this was obtained through the borehole coring of natural deposits that accumulated in the outer estuary, which proved to be suitable for lithological, pollen, and diatom analyses, deposit modelling, and radiocarbon dating (*Ch 2*). When combined, these techniques allowed both the terrestrial environment and changes in sea level to be discerned across the earlier and middle phases of the Holocene. Perhaps importantly, these palaeoenvironmental reconstructions also equate to the period when Britain was in the process of separating from the Continent, and transforming into an island, as rising sea levels gradually submerged Doggerland, the former land bridge joining these two landmasses (*Ch 2, p 22*). Indeed, in terms of the pollen data from Goxhill and Paull, it is also highly significant that this followed a logical stratigraphical order when compared against regional woodland pollen trends. It suggests that the analysed peats (and the surrounding deposits), although in places truncated by transgressive events (*p 177*), were *in situ* and had not been redeposited/reworked from elsewhere. This therefore allows for accurate insights into the character of the ancient landscape and comparison with comparable *in situ* natural sediments from other parts of the outer estuary that have also been subjected to detailed analysis, particularly those from Union Dock (Long *et al* 1998) and Market Place, Kingston-Upon-Hull (Van de Noort and Ellis 2000; *Ch 2, p 23*).

Chronologically, the palaeoenvironmental and geoarchaeological data span some 3700 years, based on dates obtained from the Lower Peat at Paull, in BH-H, dated 7580-7480 cal BC (*Ch 2, p 28*), and the Upper Peat at Goxhill, dated 3950-3710 cal BC, in BH-11 (*Ch 2, p 34*). In archaeological terms, this covers a period extending between the Middle Mesolithic and earlier Neolithic periods. At Paull, in addition to the Lower Peat, a Middle Peat, and an Upper Peat also formed, respectively, in the mid-/late eighth millennium cal BC (at the end of the Middle Mesolithic period) and early centuries of the seventh millennium cal BC (at the start of the Late Mesolithic period). Similarly, at Goxhill, beneath the earlier Neolithic upper peat was a lower peat that accumulated in the earlier part of the sixth millennium cal BC (during the Late Mesolithic period; Fig 88).

Significantly, the pollen data reflects a rapidly changing palaeoenvironment across this period that was subject to fluctuating sea-level changes. Specifically, the vegetational history inferred from the pollen counts from the Lower Peat at Paull suggests that hazel (*Corylus avellana*)-type pollen was prevalent during the later stages of the Middle Mesolithic period, when eastern Britain was still attached to Continental Europe (prior to the main inundation of Doggerland; *Ch 2, p 22*), with Paull (and probably also Goxhill) situated beyond estuarine subtidal to intertidal influences. Although hazel produces large amounts of pollen that are easily transported, and it is therefore possible that the pollen derives from both a local and regional source area, the evidence does seem to indicate that this part of the estuary was covered with hazel scrub/woodland (Pl 62). One other significant point is that the date for the inception of peat at Paull (7580-7480 cal BC; *Ch 2*, *p 28*) is slightly older than previous records for peat inception in the outer estuary, such as Union Dock where it is dated to 7330-7050 cal BC (8170±45 BP; 9250-8981 cal BP; SRR-4747; Long *et al* 1998). This therefore suggests that Middle Mesolithic woodland, primarily of hazel, was well established across the estuary area, well above the tidal limit, at least from the mid-eighth millennium cal BC, if not slightly earlier. Notably, this hazel woodland could have also formed a significant location for Mesolithic communities operating in the area, as it would have provided a reliable food source, in the form of hazelnuts. Regionally, mixed woodland of elm (*Ulmus*), oak (*Quercus*), pine (*Pinus*), and birch (*Betula*) (but without alder; *Alnus*) was present, and these arboreal areas could also have been used for hunting and gathering food. That said, there was very little evidence within the analysed cores that could be related to Mesolithic people in the immediate area. In palaeoenvironmental terms, the presence of people is often evident through microcharcoal, produced by fires used in woodland clearance or in settlements/encampments, and it was perhaps notable that counts for microcharcoal particles in the Lower Peat are low, suggesting limited exploitation of this environment.

Plate 62: Hazel woodland, which may have been similar to that surrounding Paull in the Mesolithic period

At Paull, following the accumulation of the Lower Peat, a silty clay was subsequently deposited, and the diatom evidence suggests that it relates to a large body of freshwater (*Ch 2*, *p 34*). It therefore indicates that a freshwater lake existed at this location, which may also have formed an attractive environment for Mesolithic communities. It appears, however, that this lake was then subjected to paludification, resulting in the formation of a freshwater peat bog, which is represented by the middle deposit of peat identified in the borehole cores. Significantly, pollen from within the Middle Peat suggests the development of wetland environments, including alder carr and freshwater marshes; however, these areas could still have been an important source for freshwater and were possibly also utilised for watering and grazing by animals, which may have attracted human communities to this area during hunting trips. Increasing values of microcharcoal were recorded in this peat, which might reflect such activities. Given the low levels of microcharcoal in the earlier peat (*above*), it may well be that this relates to a period when the area was more extensively visited/exploited/settled by Mesolithic groups.

Evidence from pollen indicators within the top of the Middle Peat and diatoms within overlying silty deposits also point to a later period of possible marine influence, most likely relating to rises in sea levels in the late eighth/early seventh millennium cal BC, which was eventually followed by a return to a freshwater habitat, though one that was perhaps surrounded by saltmarshes (*Ch 2, p 38*). Indeed, this could suggest that rises in sea level during this period resulted in ponding up of freshwater at Paull. The Upper Peat recorded at Paull therefore accumulated within this freshwater environment, and it also seems that during its formation the water table gradually lowered. This corresponded with, and probably also facilitated, a decline in alder and a corresponding rise in hazel woodland, which once again may have been an attractive environment for Mesolithic communities, providing food and an area that was suitable for coppicing and acquiring other woodland resources (*cf* Conneller 2022, 175-6; Brown *et al* 2023).

Rather significantly, sealing the upper peat was a thick deposit of marine alluvium, reflecting rising sea levels that, based on the dating evidence from Goxhill (*below*), probably occurred at some point during the mid-/late sixth millennium cal BC, when the last remnants of Doggerland were being submerged (*Ch 2, pp 21-2*). Based on the dating evidence from this upper peat, and other estuarine sites where similar deposits of peat have been dated to a slightly later period, it appears that this transgression was a highly erosive event. Indeed, the evidence from Paull may point to the meandering of the main channel of the Humber, or one of its sub-channels, which scoured away the peat more deeply at this location than at other sites in the outer estuary (specifically Union Dock and Market Place, Kingston-Upon-Hull; *Ch 2, p 23*). Indeed, it is likely that the marine sediments at Paull were deposited in a possible palaeochannel or depression, allowing development of a relatively thick intercalated sequence over a shorter time interval. Pollen and diatoms associated with the alluvium also include several key marine indicators that suggest the development of saltmarsh environments, which would have probably formed on the edges of freshwater wetland systems. It seems possible then that this transgression resulted in a fairly rapid change to the character of the estuarine landscape, as vegetated areas became inundated and freshwater wetlands transitioned to saltmarsh habitats, which may have influenced Mesolithic settlement and life in the estuary, leading to different forms of engagement and perceptions with the changing landscape (*cf* Moore 2003; Chapman and Lillie 2004; Leary 2009; 2011; 2015).

Palaeoenvironmental data from the peat deposits at Goxhill also provide evidence of freshwater wetlands and saltmarsh areas, as well as rising sea levels, across the later Mesolithic and earlier Neolithic periods. Specifically, the Lower (earlier sixth millennium cal BC) Peat in BH-11 at Goxhill seems to have formed within a large former channel, which was initially filled with alluvium (*Ch 2, p 31*). Given the date of the peat (which acts as a *terminus ante quem*), this alluvium may well have been deposited during the rise in sea levels that followed the deposition of the Middle Peat at Paull, dated to the late eighth/early seventh millennium cal BC (*p 176*). At Goxhill, however, there was no clear evidence for a comparable layer of peat, dating to this period, and this perhaps points to differences in intertidal deposition and conditions on the opposites sides of the Humber.

The Lower Peat at Goxhill was dominated by woodland pollen (with alder and willow (*Salix*) on damper ground and mixed woodland in drier areas; *Ch 2, p 41*) and also provided some evidence of minor woodland disturbance, based on the occurrence of fungal spores such as *Kretzschmaria deusta* (HdV-44) and *Coniochaeta xylariispora* (HdV-6). These spores are associated with dead or diseased trees and may have resulted from, for example, the activities of browsing animals (van Geel 1978; Innes *et al* 2006), which could in turn have attracted Mesolithic communities to this area. Indeed, slightly elevated frequencies of microcharcoal within this lower peat may provide evidence for local or regional burning of the woodland by hunter-gatherers or indicate the existence of small encampments in this part of the Humber Estuary.

Sealing the Goxhill Lower Peat was a marine clay, indicating a transgressive event associated with rising sea levels that occurred at some point between the earlier sixth and mid-fifth millennia cal BC, which would have resulted in the creation of intertidal environments across previously eutrophic wetlands, with areas of saltmarsh perhaps being traversed by freshwater channels or containing temporary freshwater lakes (*Ch 2, p 41*). Moreover, this transgressive event almost certainly corresponds with that recorded at Paull (*above*), which the dating evidence from Goxhill indicates commenced in the mid-/late sixth millennium cal BC (*Ch 2, p 33*).

The pollen data from the Upper Peat at Goxhill suggest that this transgressive event had ended by the mid-fifth millennium cal BC, after which freshwater sedge (Cyperaceae) fen/coastal reed (*Phragmites*) swamp and saltmarsh began to appear, surrounded by areas of woodland (*Ch 2, p 45*). Perhaps significantly, elm pollen was still consistently recorded in the upper peat, indicating that the pollen assemblage pre-dates the Elm Decline, which has recently been argued to be asynchronous, or at least comprising multiple elm declines occurring over an extended period between the later Mesolithic and Middle Neolithic periods. Dating evidence from the top of this upper peat seems to therefore indicate that the Elm Decline in the Goxhill area post-dates 3950-3710 cal BC (*Ch 2, p 33*), possibly, based on its timing in other parts of the British Isles and Ireland, dating to the middle centuries of the fourth millennium cal BC (*cf* Grosvenor *et al* 2017; Kearney and Gearey 2020). In addition, there is a slight possibility, based on the presence of ribwort plantain (*Plantago lanceolata*) pollen and fungal spores associated with clearances/agricultural disturbance in the top of the Upper Peat, that in the early centuries of the fourth millennium cal BC, Neolithic groups engaged in pastoral farming were present in the Goxhill area; however, without more definitive evidence for agricultural (*ie* cereal pollen), this is difficult to substantiate, and it is therefore possible that hunter-gatherers were still present during this period and facilitated small-scale, and localised, woodland clearance.

Lying directly above the Upper Peat at Goxhill was a marine alluvium, containing some limited palaeoenvironmental evidence for nearby saltmarsh habitats and shallow brackish pools/channels, which therefore relates to another transgressive event. The dating evidence indicates that this occurred at some point after the mid-fourth millennium cal BC, most probably *c* 4000-3000 cal BC (based on palaeogeographic reconstructions from the wider estuary), when there was a greater incidence of intertidal deposition (Metcalfe *et al* 2000, fig 6).

It does seem, however, that even after the rise in sea level during the Neolithic period, sea levels continued to rise across the third and second millennia cal BC (Van de Noort 2004, fig 9). Significantly, across this period an extensive tidal creek traversed large parts of the estuarine landscape at Goxhill, with several of its channels being mapped from aerial photographs (*Ch 3*, *p 49*). Moreover, one of the channels was subjected to excavation and this indicates that it was active during the period when sea levels were consistently rising during the Bronze Age (*Ch 3*, *p 52*). Importantly, this landscape was not anthropogenically barren, as it was certainly visited by later prehistoric groups, with direct evidence for this being recovered by the archaeological excavations, in the form of Bronze Age pottery and worked flints, as well as an Early Bronze Age pit containing charcoal from a nearby campfire (*Ch 3*, *p 53*). Overall, this evidence, although somewhat sparse, appears to point to transitory activity by partly nomadic groups visiting the area, perhaps for the seasonal exploitation of wetland resources (*cf op cit*, 43).

At the start of the first millennium cal BC, in the Late Bronze Age, there was then a potential fall in sea level. This was evidenced by a deposit of peat recorded in one of the excavated palaeochannels (*Ch 3*, *p 52*), suggesting that the tidal creek was inactive during this period and was being subjected to terrestrialisation. Moreover, there is a slight possibility that during this period the ‘drier’ foreshore area was being utilised for cereal cultivation, with some of the terrestrialised channels perhaps also being used for the disposal of human waste. This period of falling sea levels, however, was comparatively short lived, with a return to the trend of rising sea levels shortly after the accumulation of peat in the palaeochannel, perhaps at the start of the Iron Age. This resulted in the ‘reactivation’ of the tidal creek, which remained an important feature of the landscape probably well into the later Iron Age and the initial decades of the Roman period. After this, it seems, from the wider regional evidence in the outer estuary (*op cit*, fig 9), that sea levels began to fall across the remainder of the Roman period, resulting in the tidal creek once more becoming inactive, filling with silt and alluvium, and eventually disappearing. This was followed in the early medieval period by an initial rise in sea level, which once again began to fall at the end of the first millennium AD, after which sea levels began to progressively rise once more (*ibid*).

Iron Age and Romano-British Settlement at Goxhill

Early Iron Age settlement

Although Goxhill had certainly been visited in the earlier prehistoric period (*above*), it is possible that the first permanent form of settlement appeared in the early part of the Iron Age, when sea levels were rising, and the tidal creek system was active (*above*). Evidence for this was present in the Soff Lane diversion where the remains of a ditched trackway and boundaries were recorded which, based on a single radiocarbon assay, dated somewhere between the mid-eighth and late fifth centuries cal BC (*Ch 3*, *p 59*). This evidence points to the existence of earlier Iron Age settlement at Goxhill and, given the general paucity of regional evidence for settlement dating to this period, is of some interest (Knight *et al* 2012, 58). Although the evidence is somewhat limited, it is quite likely that the trackway functioned as a droveway (Applebaum 1966, 100), designed to facilitate and regulate the movement of livestock around the landscape, to prevent over-grazing, and to discourage stock from straying (Van de Noort 2004, 58). The other boundaries potentially delineated fields or stock enclosures, and it also possible that these relate to the first concerted attempts to divide and manage the landscape in this part of North Lincolnshire. Notably, there is a hint that this process may have been more widespread, with other areas, just beyond Goxhill, also being divided and used for settlement across this period. Specifically, the possible terminal of an earlier Iron Age ditch was recorded at Westfield Farm, South Killingholme, which also contained Iron Age pottery and a fragment from a quern that was perhaps intentionally placed into this early boundary (Tuck 2022, 26).

Iron Age and Romano-British open settlements

More definitive evidence for Iron Age settlement was evident in Area C, in the main construction area. This initially comprised the remains of an unenclosed roundhouse settlement established in the latter centuries of the first millennium cal BC (Phase LIA.I), adjacent to an ‘island’ that lay between two of the channels forming elements of the tidal creek (Fig 89; *Ch 3*, *p 62*). In its earliest incarnation the settlement was aceramic and contained six roundhouses, though the presence of these structures is hardly surprising since roundhouses represent the archetypal architectural form for living and farming accommodation from the Bronze Age, right through into the Iron Age,

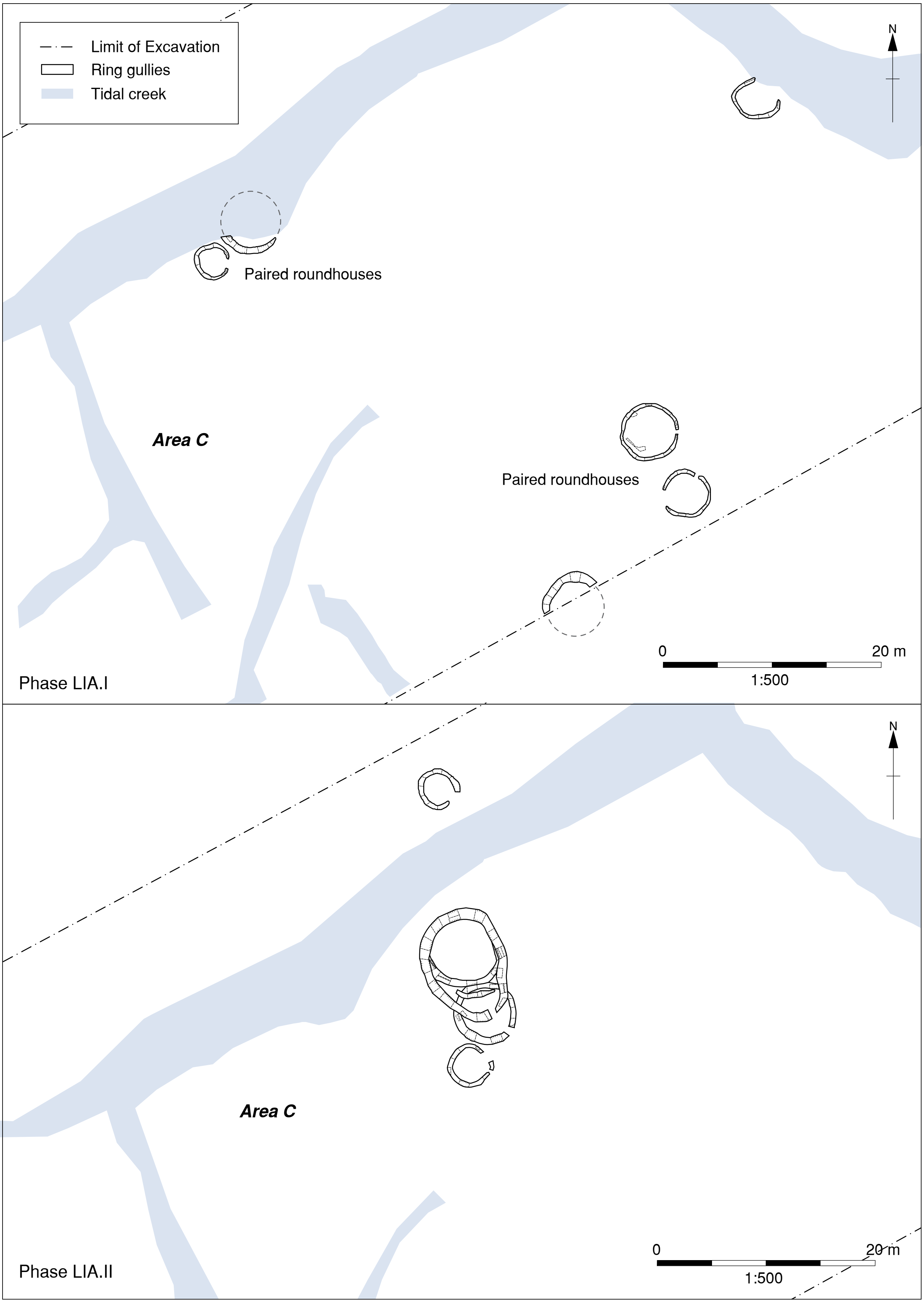


Figure 89: The Iron Age open settlements at Goxhill

*Plate 63: A ring gully defining a roundhouse (***3242***; Phase RB.I), looking north-west*

and in some areas beyond (*cf* Harding 2009; Pope 2015). Moreover, roundhouses seem to have been more-or-less ubiquitous on Iron Age settlement sites across the country, only declining in popularity in some areas during the early first millennium AD, during the earlier Romano-British period (Harding 1974, 37-53).

These roundhouses (and also all of the subsequent roundhouses) were defined by ring gullies (Pl 63) that, based on detailed microscopic examination of the fills from some of the later roundhouses (*Ch 3, p 69*), appear to have functioned as drainage gullies, as opposed to construction trenches, designed to secure the timber walls of the house. Moreover, drainage gullies enclosing these buildings were certainly needed given that the area selected for settlement seems to have formed a very wet environment that was periodically flooded. Rather curiously, all the excavated roundhouses, from all phases of Iron Age and Romano-British settlement, contained a surprising absence of internal structural features, such as postholes and post-rings. Whilst this could be down to later truncation, it is also possible that the load-bearing walls were constructed of archaeologically invisible materials such as turf or clay (*cf* Harding 2009, 51-2), or that any posts were set directly on pads (which were subsequently removed), perhaps to prevent the rotting of timber uprights in this damp environment. Moreover, several other Iron Age roundhouses recorded from the immediate area (*eg* at Chase Hill Road, Westfield Farm, Brocklesby Interchange, and Rosper Road; Tuck 2023; Cavanagh 2024) were also largely defined by arcing drainage/drip gullies, with a complete absence of internal features, or only a very few present with no apparent spatial integrity, suggesting a degree of commonality in either the survival of the remains, or local Iron Age architectural traditions (Fig 90).

As the dating evidence from the Goxhill roundhouses associated with the 'founding' (Phase LIA.I) aceramic settlement is rather limited, it is quite possible that not all were contemporary (forming a small hamlet-sized settlement), but they were instead progressively established over an extended period, which, given that all the houses were stratigraphically isolated, could have involved periods of settlement, followed by abandonment, and then later reoccupation, as part of a dynamic and shifting pattern of settlement. Of course, another alternative is that this settlement was semi-permanent being seasonally occupied, perhaps when livestock were moved to the foreshore area for summer grazing. Although the houses were stratigraphically isolated, spatially there was a suggestion that on two occasions a larger roundhouse was paired with a smaller one. It is therefore possible that the larger represented the domestic unit, whilst the smaller formed an ancillary building that served a different, complementary function. Indeed, despite the generic term 'roundhouse', it is unlikely that all prehistoric and Roman-period circular structures were, in fact, houses; some could have served as

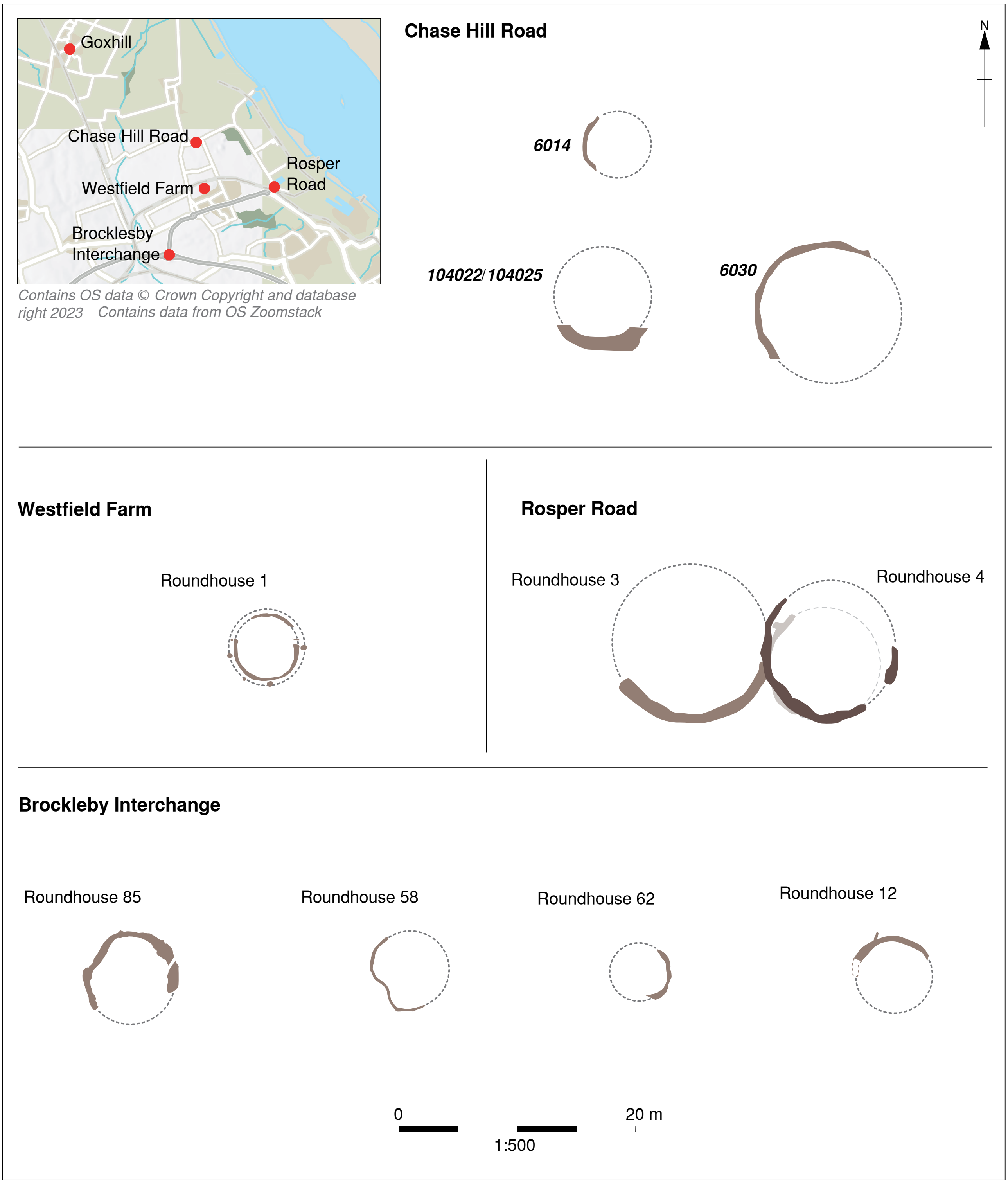


Figure 90: Excavated Iron Age roundhouses from North and South Killingholme, and Immingham

industrial buildings, 'kitchens', animal pens, or even byres, whilst others may have had a storage function (*cf* Haselgrove 1982, 81; Hingley 1989, 31; Gregory and Brown 2025). In the case of the Goxhill houses, tellingly a stone pestle was recovered from one of the smaller ancillary structures, suggesting that this may have been connected with processing activities. Beyond this object and the physical remains of the houses themselves (which were also comparatively limited; *p 182*), little other evidence was recovered beyond a few fragments of animal bone, including cattle and horse remains, which seem to indicate that its inhabitants were engaged in livestock farming.

Iron Age settlement at this location also continued (perhaps as part of an unbroken sequence of occupation) into the terminal stages of the Iron Age, just prior to the Roman conquest (Phase LIA.II; *Ch 3, p 65*). Again, the settlement was unenclosed being defined by several roundhouses, hugging the active channels of the tidal creek, though in this instance most were constructed successively at the same location, with one house replacing another, as part of a programme of (probable continual) rebuilding/refurbishment. This suggests that there was a greater investment in the settlement and a greater degree of conservatism in locating the houses, implying, in turn, that the settlement was occupied on a permanent basis, as opposed to a seasonal one, which may have been the case with the earlier settlement (*p 180*). Significantly, this settlement also produced much more artefactual and palaeoenvironmental evidence than its predecessor, again suggesting more sustained, permanent occupation. Notably Iron Age pottery appeared for the first time, traded from west of the Lincolnshire Wolds, from sites such as Barnetby le Wold or South Ferriby, as well as the Vale of Pickering, or the northern Yorkshire Wolds (Fig 91). This suggests that by this period an extensive system of trade or exchange was well established, with material produced in more distant areas perhaps being distributed from larger trading settlements in the region, such as Kirmington or South Ferriby, which formed trading nodes in at least the Early Roman period (*Ch 4, p 78*), and possibly also earlier.

The palaeoenvironmental evidence (*Ch 3, p 70*) from the later Iron Age settlement at Goxhill comprises plant remains from one of the channels of the tidal creek and

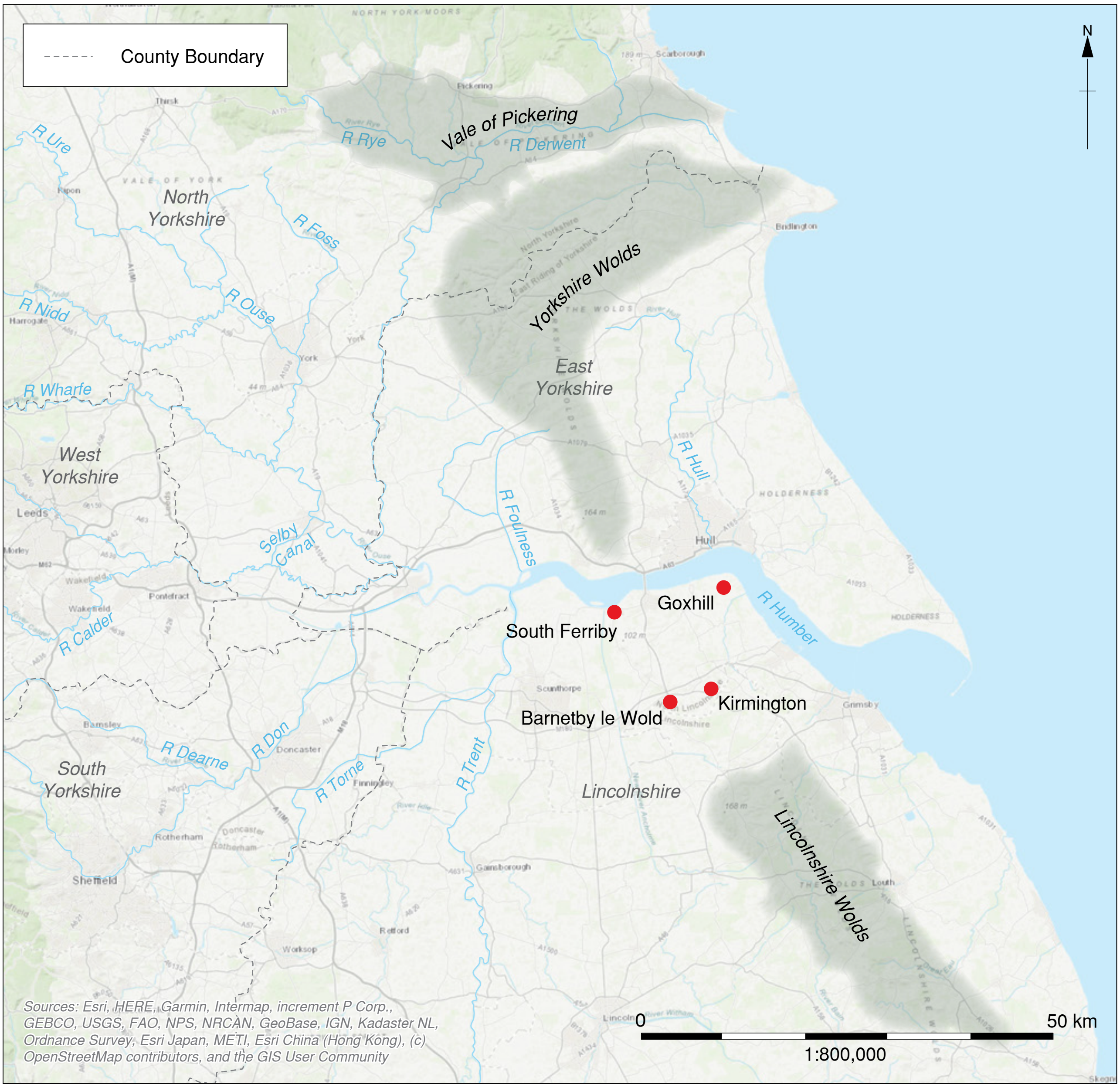


Figure 91: Possible source areas of Iron Age imported pottery (or tempering materials) identified at Goxhill, and possible trading settlements

includes some that may suggest that cultivated land lay close to the settlement, though this is tentative at best, as these plants also grow on rough ground. Indeed, the presence of rough grassland surrounding the settlement was confirmed by the insects recovered from the same channel, which also include scarabaeid dung beetles indicating that animals were grazing close to the settlement. It also seems from soil micromorphological analysis of the sediments in one of the roundhouse gullies that these areas of grassland were actively managed though periodic burning.

Given the presence of managed grassland, used for grazing, it therefore appears doubly significant that animal bone from a range of domesticates was also recovered from the channels of the tidal creek (*Ch 3, p 75*), constituting waste material that had been cast into these features during the occupation of the settlement. Indeed, the channels would have formed convenient places to dump such detritus, along with other domestic waste that, based on the recovered insects, seems to have included organic litter from the roundhouses. It is possible therefore that the roundhouses were subjected to periodic 'cleaning', which entailed the removal of domestic debris that was then dumped into the nearby watercourses. Returning to the animal bones, these include horse, cattle, and sheep/goat, and it is quite possible that livestock farming formed the main economic focus for this settlement, focusing on cattle and sheep/goats, given there was no clear evidence for arable cultivation. Moreover, this seems to have been confirmed through the analysis of the organic residues surviving on some of the sherds of Iron Age pottery, which indicated that the processing of dairy products occurred and that milk/butter/cheese (from cattle and sheep/goats) formed one, and perhaps a major, element of the diet for those living in the later Iron Age settlement (*Ch 3*, *p 74*; *Appendix 2*). Perhaps, unsurprisingly, the economies of other nearby later Iron Age settlements, around Immingham, also seems to have been focused on the exploitation of cattle and sheep/goats, as well as the breeding of horses (Cavanagh 2024, 43).

In the decades immediately following the Roman conquest, life at the settlement continued, probably much as it had done before, in that an open settlement (Phase RB.I; Fig 92; *Ch 4*, *p 81*) was present during the mid-/late first century AD, containing several roundhouses that, for all intent and purpose, were identical to those associated with the earlier phases of settlement. It is clear, however, that whilst two of these roundhouses were constructed in the area that had previously been occupied, there was an expansion in settlement eastwards onto the adjacent 'island', bounded by two of the creek channels, which were perhaps no longer active during this period (*p 178*). In this area, a roundhouse, a track/droveway, and a few pits and postholes formed additional components of the earlier Romano-British settlement (*Ch 4*, *p 89*). Sedimentary analysis also suggests that this area formed a particularly wet environment, perhaps subjected to periodic flooding that seems to have been a feature with the earlier phases of settlement (*Ch 4, p 90*).

One major difference, however, was the artefactual evidence, as, perhaps unsurprisingly, locally produced Romano-British style pottery was adopted, alongside the continued use of 'traditional' Iron Age wares (*Ch 4, p 92*; *Appendix 1*). The new styles of pottery included transitional wares, which had developed from the local Iron Age wares, and wheel-made 'Roman' grey wares. These grey wares were produced at local sites to the east of the River Ancholme, such as the known kiln sites from Barnetby Top, South Ferriby, and the multitude of sites in the Market Rasen area, and from west of Ancholme at Dragonby (Fig 93).

In addition to these features, and the roundhouses, a collection of other structures seem to form part of this phase of settlement. These were all defined by sub-rectangular gullies (Pl 64; *Ch 4*, *p 83*), which contained sediments indicating that they functioned as drains (*Ch 4*, *p 90*). In terms of their function, initially during the post-excavation assessment (*Ch 1*, *p 14*) it was posited that the structures may relate to salt production, due to their superficial resemblance to structures recorded at other coastal salt-production sites (*cf* Biddulph *et al* 2012, 122, fig 6.20, 127-31); however, following more detailed analysis, it was clear that there was no definitive evidence for this type of use. Indeed, there was no evidence from the open settlements for any diagnostic salt-production features, such as brine tanks and evaporation hearths (Hathaway 2013, 180-211), or other characteristic deposits and artefacts (*eg* 'red-hill' waste (*p 189*), briquetage, and hearth furniture; *cf* Biddulph *et al* 2012).

Given the lack of evidence for a connection with salt-making, an alternative suggestion is that the sub-rectangular drainage gullies marked the positions of hayricks. Perhaps tellingly, very similar sub-rectangular drainage gullies defining Iron Age hayricks are know from eastern England (*cf* OA East 2012), and near-identical sub-rectangular features, interpreted as hayricks, have also been identified during aerial-photographic mapping close to Goxhill, though these are argued to be post-medieval in date (Fleming and Royall 2019, 44). It is of course possible that in this area the simple design has a very extended history, being first used in Iron Age/early Romano-British settlements, such as those at Goxhill, and continuing as a feature of the agricultural landscape right across the succeeding millennia.

The presence of hayricks would also imply that livestock farming formed a major economic focus, as it seems to have done previously (*above*). There was some supporting evidence for this from one of the pottery

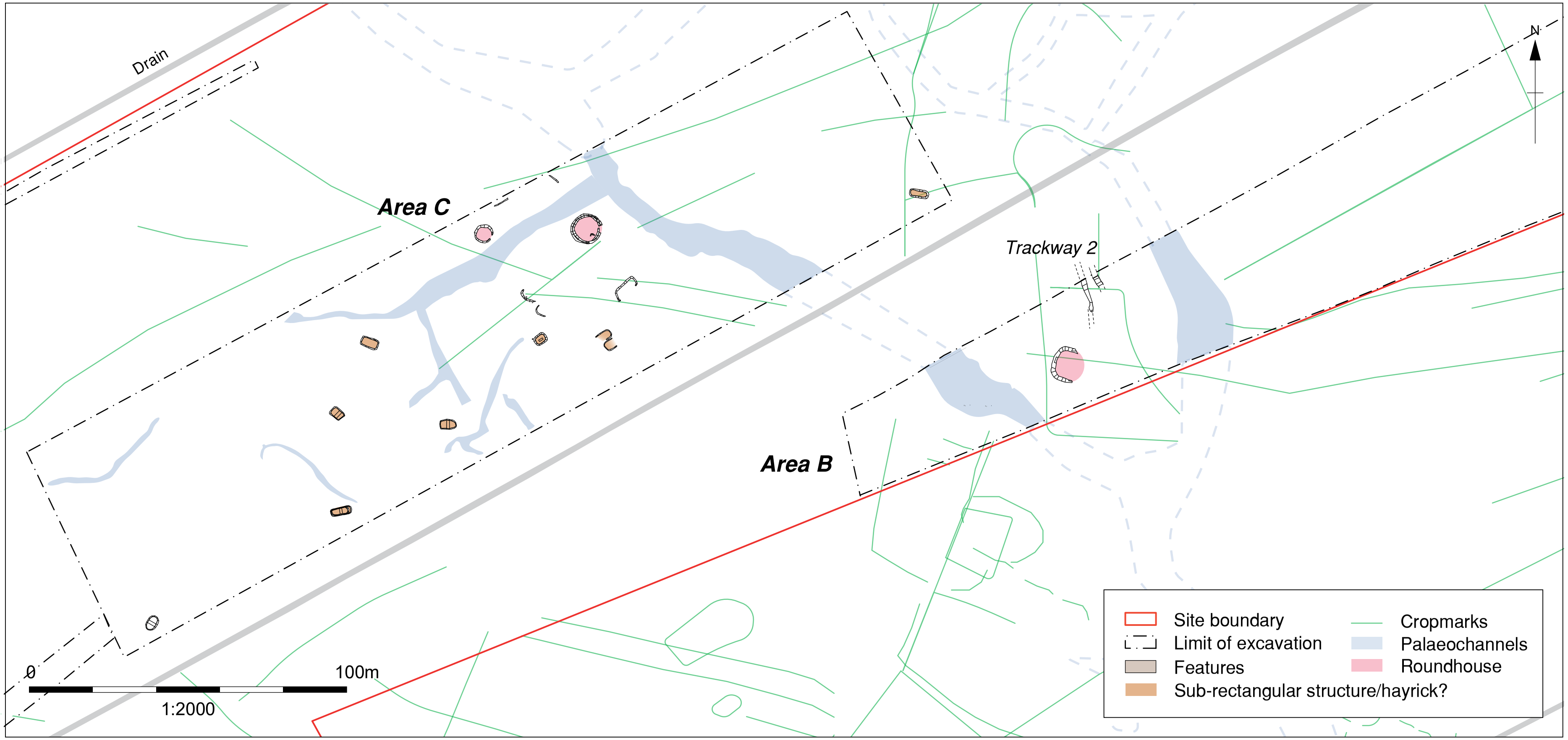


Figure 92: The Romano-British open settlement (Phase RB.I)

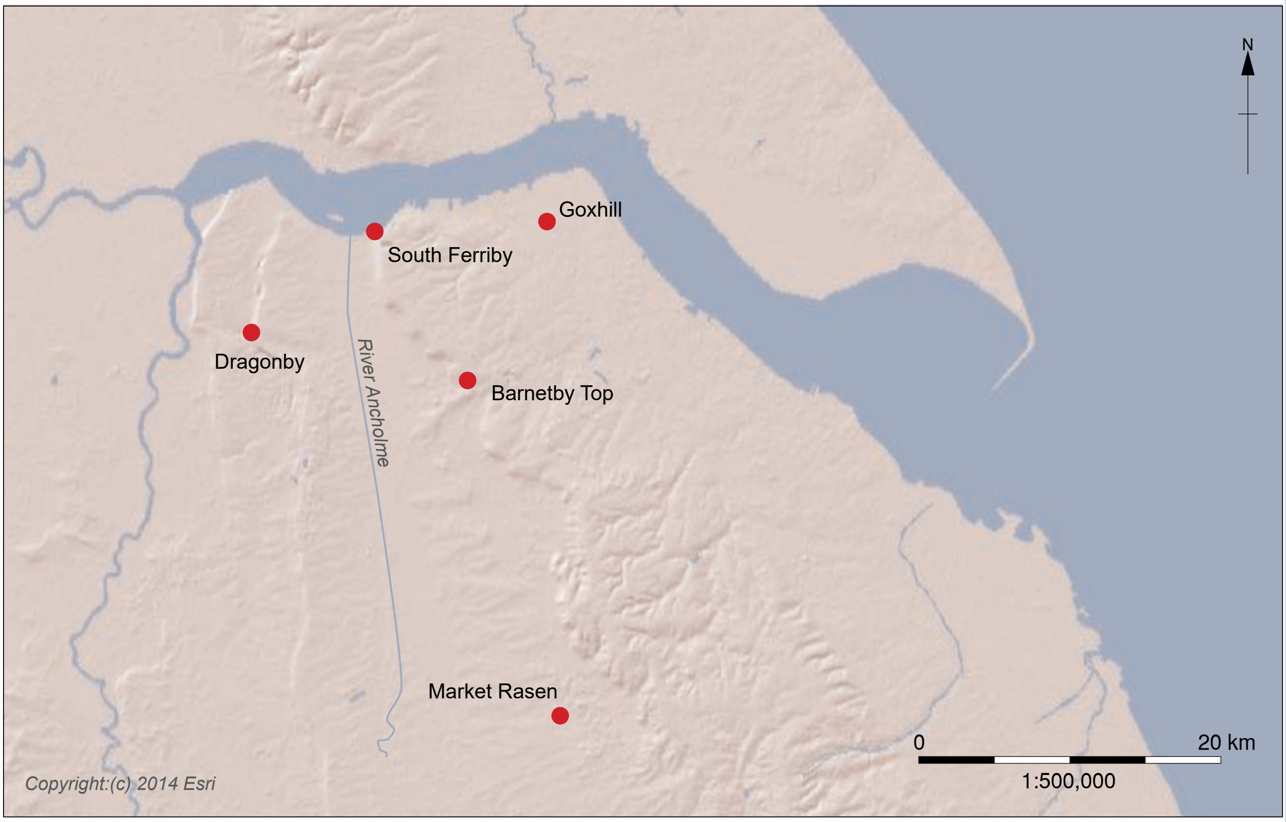


Figure 93: Possible source areas of Romano-British pottery used in the Romano-British open settlement

vessels from the settlement, which based on analysed residues, was used to process animal carcasses from cattle, sheep, or goat (*Ch 4, p 95*; *Appendix 2*). As indicated by the analysis of the lipids in another sherd, the consumption of dairy products also seems to have occurred, continuing a trend evident in the later Iron Age settlement (*p 183*). Indeed, it may be the case that dairy products were contained within specialised vessels. Animal bones and carcasses also continued to be dumped into the adjacent (though silting) palaeochannels and these remains, along with fragments from the roundhouse gullies, indicate that

*Plate 64: A sub-rectangular gully (***3241***) in the Romano-British open settlement (Phase RB.I), looking north-east*

cattle, sheep/goat, and horse formed elements of the pastoral economy. Again, the exploitation of these three principal domesticated animals fits comfortably with the evidence from other early Roman sites in the immediate area (*cf* Cavanagh 2024, 43).

Perhaps importantly though, it seems that the economy of this settlement expanded to include arable cultivation. This was evidenced through the recovery of charred cereals and chaff from one of the roundhouses located on the island, pointing to the cultivation of hulled barley (*Hordeum distichon/vulgare*), oats (*Avena* sp), and wheat (*Triticum* sp), which includes a possible free-threshing variety of bread wheat (*Triticum aestivum*; *Ch 4, p 95*). Although the identification of bread wheat by its caryopses alone is not without its problems, bread wheat has also been recorded at an increasing number of Late Iron Age/Roman-period sites in the region. Except for a few sites, however, including those in South Shields, Tyne and Wear, and Catcote, Durham, quantities are small, and bread wheat appears to have remained secondary to spelt wheat (*cf Triticum spelta*) until the Late Roman or early medieval periods (van der Veen 1992, 74; 2022a, 136; 2022b, 304; Hall and Huntley 2007). Similarly, the identification of oats is also slightly problematic, as this crop is more commonly associated with medieval and post-medieval assemblages (*cf* Campbell 1994; Carruthers 2010). This may suggest that intrusive cereal grains formed part of the analysed assemblages, though cultivated oats have been recorded in Roman-period contexts at several sites, for example at Melton, near North Ferriby, where charred bread wheat and oat grains were recovered from a third-century kiln (Jaques *et al* 2011, 290). In addition to the cereals, the charred plant remains also suggest that flax (*Linum usitatissimum*) and peas (Fabaceae/*Pisum sativum*?) may have been cultivated, with the inhabitants' diets being supplemented by gathered foods, specifically apples/pears (*Malus/Pyrus*) and common mallow (*Malva sylvestris*), with the latter possibly used as a vegetable (Grieve 1973).

Romano-British enclosed settlements

At some stage, most probably in the early second century AD, the area that had been a focus for settlement for many centuries (in Area C) was abandoned, with settlement subsequently shifting eastwards. The character of settlement also changed, with the settlement transforming from one that was open to one that was enclosed (Phase RB.II; *Ch 4, p 98*). On a section of the former island (in Area B), this settlement was defined by a series of circular and conjoined enclosures, which presumably continued across the entirety of this area and beyond, perhaps in a cellular pattern (Fig 94). However, although enclosure now held sway, the traditional (Iron Age) vernacular architecture was still employed, as roundhouses continued to be built within some of the circular enclosures, again defined by the 'usual' circular drainage gullies. Material culture and the agricultural economy also seem to have largely mirrored that typifying the earlier Romano-British open settlement (*p 183*). Similar styles of Romano-British pottery were used (*ie* grey and transitional wares, some produced in the Market Rasen area), although in a wider range of fabric types, with some evidence for the continued use of traditional Iron Age wares (*ie* rock-tempered ware; *Ch 4, p 101*; *Appendix 1*).

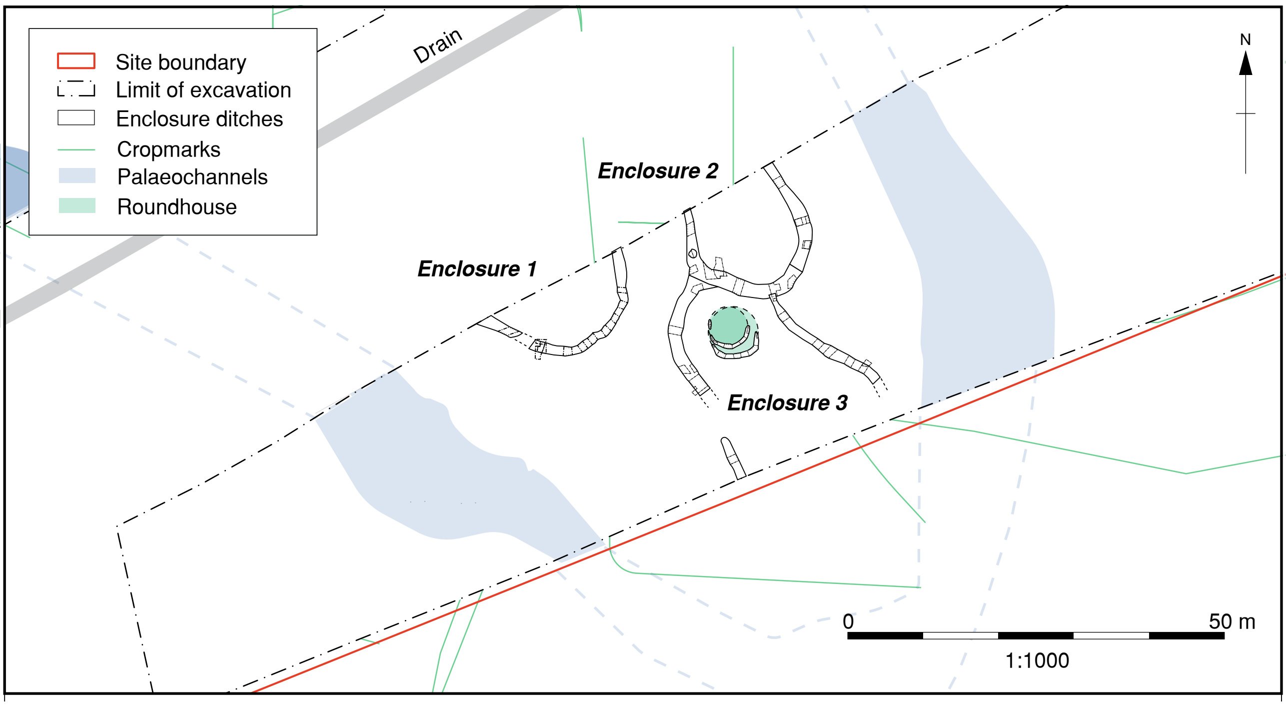


Figure 94: The Romano-British enclosed settlement (Phase RB.II)

It also appears that some of these vessels were used to contain/process secondary dairy products, such as milk, butter, and cheese, whilst others were used for cooking meat (*Ch 4*, *p 103*; *Appendix 2*). Based on this, pastoralism was certainly still an important feature of the settlement's economy, continuing an economic trend that had seemingly held sway for hundreds of years, with animals reared for both meat and milk. Indeed, this is supported by the palaeoenvironmental data (*Ch 4*, *p 103*). The pollen evidence, for instance, indicates the presence of grassland surrounding the settlement that was almost certainly used for grazing and, based on microscopic examination of the sediments in one of the enclosure ditches, was probably managed through burning. The recovered animal bone suggests that cattle, horse, and sheep/goat formed the principal domesticates that grazed these grasslands, which tallies with the evidence from other Romano-British settlements in the immediate area (*cf* Cavanagh 2024, 43-4). The pollen evidence also suggests the presence of saltmarsh and small stands of woodland in the vicinity, as well as agricultural plots used to cultivate wheat and barley, again, continuing a trend established in the initial phase of Romano-British settlement (*p 186*).

During the later Roman period, probably in the late second/early third century (*Ch 4*, *p 106*), the settlement at Goxhill transformed once more, though in a slightly more radical fashion (Phase RB.III; Fig 95). During this period, the core of the settlement probably lay to the north-east of the open-area excavations (Areas B and C) in the main construction area, being identified from aerial photographs, geophysical survey, and evaluation trenching, and emanating from its southern side was a series of regular rectilinear enclosures, suggestive of a highly managed agricultural landscape. To the west, other contemporary linear boundaries were also created, which may relate to a field system, running across the area that had formerly been the site of the later Iron Age settlement.

In terms of the later Roman vernacular architecture, there seems to have been a notable shift from the use of 'traditional' roundhouses to the adoption of rectilinear timber buildings, with elements from three of these (Buildings 1-3) being present in one of the evaluation trenches, excavated across the settlement core (*Ch 4*, *p 108*). Given their location in the settlement core, they probably formed domestic dwellings, which by this date had adopted a more 'Romanised' style, and this is confirmed, in some measure, by the insect remains from this core area, which include a characteristic house fauna (*Latridus minutus* group, *Cryptophagus*, *Atomaria* spp; *Ch 4*, *p 129*). Indeed, it seems that rectilinear buildings became the dominant form of domestic architecture across many areas of Roman Britain by the second to third centuries (Smith 2016, 50), so their appearance in the later Romano-British settlement at Goxhill seems to follow this broad trend.

This core area was also significant in other ways, as it was permissible to bury the (cremated) dead within the enclosure ditches in this part of the settlement, with one definitive example contained in a ceramic vessel being recorded (*Ch 4*, *p 119*), though there was also the suggestion of a second similar burial (*Ch 4*, *p 109*). The definitive example, based on the cremation vessel, was buried in the late second to third century, and this date range seems to accord with the evidence from other Romano-British sites in the immediate vicinity. Specifically, a cremation burial at the nearby Romano-British settlement at Brocklesby Interchange, Immingham (*Ch 4*, *p 119*), has been radiocarbon dated to cal AD 120-320 (1837±30 BP; SUERC-88517; Cavanagh 2024, 177) and, within this (95%) calibrated range, there is a *c* 89% probability that it dates to cal AD 120-260, suggesting that it could be broadly contemporary with the Goxhill burial. Rather interestingly these two separate burials also date to the period when cremation burial (prevalent during the earlier Roman period) was falling out of favour, as the preferred burial rite in north-eastern England, and was in the process of being replaced by inhumation burial, which became the preferred method of burial across the third and fourth centuries (Smith 2018, 211, 220).

Beyond the dating evidence, the practice of placing the dead in ditched boundaries, as was the case at Goxhill, is not particularly uncommon and has been noted at other Romano-British settlements in north-eastern England (*cf* Gregory *et al* 2013, 265-7). Furthermore, isolated burials, especially those placed in boundaries, are not infrequently found at Roman-period rural settlements in the Humber region. For example, on the southern side of the Humber, close to Goxhill, these have been recorded at Immingham Power Station (*Ch 4*, *p 79*), where an inhumation was placed within an Early Roman-period ditched enclosure (HFA 2006, 260), and at Brocklesby Interchange, where two Late Roman inhumations, as well as disarticulated human remains, were also deposited in enclosure ditches (Cavanagh 2024, 45). Similarly, on the northern side of the Humber, in Holderness, Roman cremation and inhumation burials were focused on the boundaries of a ladder settlement at Easington (Richardson 2011), and similarly, near Partington Haven, again in Holderness, several inhumation burials lay within a complex of later Roman ditched enclosures (Zant and Wegiel in prep). It also seems likely that the genesis of this style of burial lay in the Iron Age, as several inhumation burials, as well as disarticulated human remains, are known to have been placed in Iron Age boundary ditches in both North Lincolnshire and Yorkshire (*cf* Chadwick 2009, 125; Cavanagh 2024, 42),

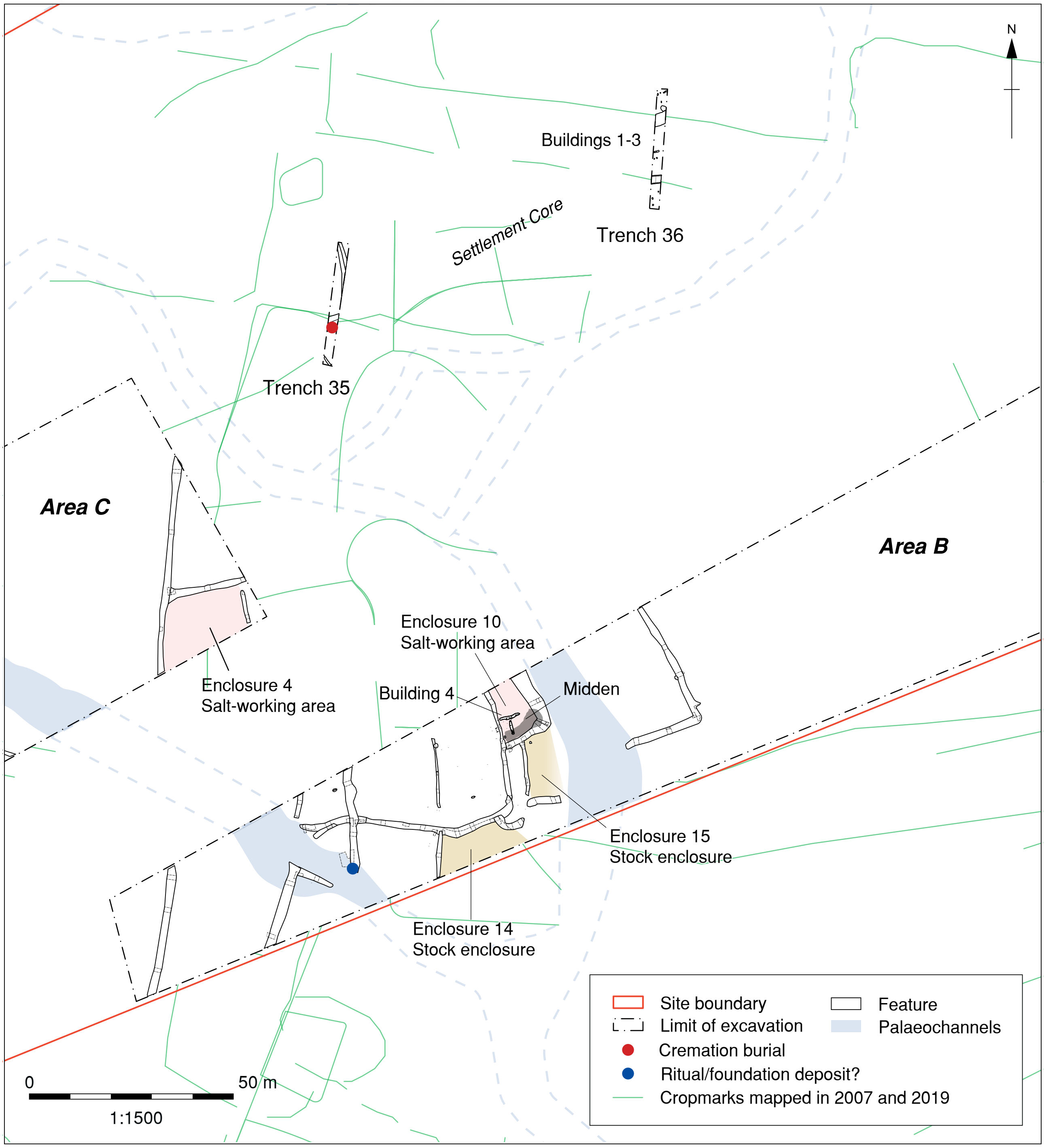


Figure 95: The later Romano-British settlement (Phase RB.III)

and hence the practice seen at Goxhill clearly formed a continuation of a pre-Roman burial tradition.

More detailed examination of the rectilinear enclosures surrounding the settlement core was possible in the open-area excavations, where the enclosures had been established across the former island (*p 178*). Although by this stage the channels of the creek had silted, the area still formed a very wet environment, as the enclosure ditches were prone to waterlogging (and at times probably held standing water), based on the analysis of their sediments (*Ch 4, p 129*), and waterlogged plant and insect remains (*Ch 4, p 122*). There may also have been a memory of the former creek that bounded the areas of earlier Romano-British settlement. It seems, for instance, that one of the silted channels was 'marked' through the deliberate deposition of a near-complete ceramic vessel (*Ch 4, p 109*), suggesting it was still viewed as a significant feature. This might also conceivably represent a deliberate foundation offering, made when the enclosures were first created, which mirrors the wider practice of depositing complete Roman vessels, and other items, into boundaries and other features (*cf* Fulford 2001). For example, this was noted at the nearby site at Chase Hill Farm, North Killingholme (*Ch 4*, *p 79*), where a complete mid-/late second-century vessel had been deliberately placed within an enclosure ditch (Allen Archaeology 2019), whilst at Brocklesby Interchange it seems that animal remains may have been deliberately placed in enclosure ditches, as foundational offerings (Cavanagh 2024, 20-1).

Most of the enclosures at Goxhill were devoid of evidence for occupation and there is a suggestion that at least some functioned as stock enclosures, particularly as the arrangement of gullies and ditches in one area seems to represent the remains of a funnel intended to direct livestock between two of the enclosures (Enclosures 14 and 15; *Ch 4*, *p 111*). Others, however, seem to have been used for different purposes (Fig 95). Specifically, one of the enclosures (Enclosure 10) contained a small rectangular building (Building 4), which was surrounded by a midden (*Ch 4*, *p 112*).

Analysis of the midden deposits (which at a later date had been shunted into the ditches of Enclosure 10) was highly informative, as it indicates that they contained burnt soils, with enhanced magnetic susceptibility and high levels of sodium, clearly indicative of salt working (*Ch 4*, *p 129*). These burnt soils are therefore akin to the so-called 'red-hill' waste, which is found extensively in other ancient salt-working areas, for instance, along the Essex coast in association with Roman-period salt production (Biddulph *et al* 2012). Moreover, the midden soils from Goxhill appear to indicate the use of coastal plants as low temperature fuels and coastal (mudflat) sediments as a source of brine (the 'sleaching' method of salt working; *cf ibid*; Macphail *et al* 2012). Significantly, the geochemistry of the midden deposits also indicates the use of bronze utensils and lead vessels that were most likely related to salt working within the enclosure, with the timber building perhaps forming a shed associated with this activity. Further evidence for salt working was also recovered from another ditched boundary (associated with Enclosure 4), which contained similar 'red hill' deposits (*Ch 4*, *p 132*), implying that salt working also occurred in this area.

In terms of the overall settlement evidence, the identification of salt working is highly significant. Indeed, it represents the first clear evidence for this type of activity at Goxhill, which probably formed an important part of the later Romano-British settlement's economy, only occurring once the landscape had been systematically divided into a regular system of enclosures. The evidence also adds to a corpus of salt-working sites of prehistoric and Roman date known from the Lincolnshire Marsh and that occupy low-lying areas similar to that at Goxhill (Lane 2005, 49). Based on the recovery of small amounts of briquetage, including hearth furniture, from Iron Age enclosure ditches and pits at Killingholme (HFA 2006, 256-7), it also seems that salt working in the immediate area had occurred for some considerable time, perhaps therefore forming a 'traditional' industry, which was only finally adopted at Goxhill in the later Roman period.

The enclosure ditches were also important in other ways, as they 'captured' artefactual and palaeoenvironmental data that allow additional insights into the later Roman settlement, with some of this material probably forming refuse, generated in the settlement core, that had been intentionally dumped into the enclosure ditches. The artefactual evidence largely comprises locally produced pottery, with some either being recorded in the earlier assemblages or being variations of these earlier wares (*Ch 4*, *p 115*; *Appendix 1*), though some novel types did appear for the first time. This was particularly the case with shell-gritted Dales ware, produced in north-western Lincolnshire, which suddenly makes an appearance and is well represented in the assemblage from the later Roman settlement. This represents a 'practical' handmade vessel, with a wheel-thrown rim (*Appendix 1*), essentially similar to an Iron Age jar, but with an improved rim, indicating that the ceramic vessels utilised in the later Roman period were essentially comparable to the earlier vessels used at the settlement.

Significantly, the later Roman pottery assemblage also includes small quantities of imported material, either from elsewhere in the Roman Empire or from other more distant parts of Britain. This includes samian ware, produced in Central and East Gaul (Webster 1996; *Ch 4*, *p 115*), and fragments from an amphora, also produced in Gaul (Peacock and Williams 1986), that may indicate that imported wine was consumed (*Ch 4*, *p 115*; *Appendix 1*). Wares that reached the site from production centres elsewhere in Britain (*Ch 4*, *p 117*) include Black-burnished ware produced in Dorset and Essex/Kent; a Mancetter-Hartshill mortarium from Warwickshire, East Yorkshire Crambeck greyware; and a few sherds of cream ware and colour-coated fine wares that were probably not made locally (*Appendix 1*), but are of uncertain origin (Tomber and Dore 1998). Most of these wares were traded widely from the second century onwards (though the Crambeck ware dates to the fourth century) and are found in some quantity at 'Romanised' sites such as towns, forts, and extramural settlements, with smaller amounts also reaching many of the region's rural settlements (*Appendix 1*). Indeed, for the most part, the types and quantities of these traded wares at Goxhill are typical of those from Romano-British rural settlements elsewhere in North Lincolnshire (Rowlandson and Fiske 2020a; 2023; 2024). Exactly how the inhabitants of these settlements obtained such pottery is a matter for speculation, though Goxhill itself is located no great distance from the Roman 'small town' at Winteringham, at the end of Ermine Street, as well the substantial trading settlements of South Ferriby, Kirmington, and, more pertinently, that seemingly located a short distance to the south, at Brocklesby Interchange (*Ch 4, p 79*), and was presumably well placed to take advantage of coastal trade into the Humber Estuary. Of course, it is also conceivable that some pottery and other goods reached rural settlements through itinerant traders.

The palaeoenvironmental remains from the ditches are more varied, comprising faunal remains, charred plant remains, pollen, and insects (*Ch 4, p 122*), supplemented by faunal remains and charred plant remains (*Ch 4, p 121*) from midden deposits within one of the enclosures (*p 189*). The faunal remains indicate that pastoral farming continued to form an important feature of the later Roman rural economy. Although the assemblage is dominated by cattle and horse, suggesting that these may have formed the principal stock animals, it might also be a product of taphonomy (Payne 1975). Sheep bones are also present, whilst pig was recorded for the first time, which could suggest that a greater range of domesticates were reared than had previously been the case in the Iron Age and earlier Romano-British settlements.

There was also some additional evidence for the presence of sheep and pigs at the settlement. Specifically, it seems that faecal matter had entered the fills of two of the enclosure ditches, which contained the eggs of the parasite *Trichuris* (*Ch 4, p 126*). This may therefore provide further confirmation for pig farming at the settlement, as *Trichuris suis* parasites pigs, though it is also possible that it represents the human parasite *Trichuris triciura* (Sondak 1948; Beer 1976). The insect assemblage from the settlement core (*Ch 4, p 126*) similarly provides additional evidence for sheep farming, as it includes occasional fragmentary sheep ked (*Melophagus ovinus*) puparia, which attached to sheep wool, suggesting that the cleaning and processing of wool occurred within the settlement. Other insects are similarly informative, particularly given that scarabaeid dung beetles are well represented, providing further evidence for grazing animals, and may even point to manure being removed from stables and then being cast into the ditches, or at least the use of manure on adjacent farmland.

There was also one further strand of important evidence relating to the use of the stock animals. This derived from the analysis of the lipids contained in several of the later Roman ceramic vessels (*Ch 4, p 119*). It seems to indicate that there was a move towards a greater dependence on rearing animals for meat, fats, hides, and sinews during the later Roman period, rather than the production of cheese and other dairy products, which was seemingly a more important feature within the later Iron Age (Phase LIA.II; *p 185*) and earlier Romano-British settlements (Phase RB.I; *p 187*; and Phase RB.II; *p 189*).

Apart from husbandry of domestic species, the animal-bone assemblage includes the distal humerus from a red deer, with good evidence for butchery, indicating that deer hunting occurred and that venison formed one element of the later Roman diet (*Ch 4, p 120*). Other wild foods were also exploited, evident through the recovery of native oyster shells from the enclosure ditches and a pit (*Ch 4, p 121*). Increased exploitation of shellfish, particularly oysters, during the Romano-British period is a phenomenon that has been noted elsewhere in the region, for example at Dragonby (Alvey 1996), and at a site near Easington, in Holderness, where three-quarters of the oyster shells recovered came from a single Roman-period ditch (Burgess and Daniel 2018). The Romans themselves consumed oysters with enthusiasm and classical texts suggest that British oysters were exported to Rome (McKeown 2010, 161), perhaps being sealed in barrels of brine (King 1990, 105). The deposition of oyster shells in Roman-period deposits at Goxhill may therefore indicate a 'Romanising' influence. Today, the Humber Estuary is effectively devoid of oysters, though they were doubtless far more common during the Roman period and would have been easily collected from the shallow tidal waters. Indeed, further down the coast, Cleethorpes was home to extensive oyster beds as late as the early twentieth century, and oysters are still occasionally collected offshore (Walmsley and Pawson 2007).

The plant remains and pollen (*Ch 4, p 122*) provide further details on the landscape surrounding the later Romano-British settlement, its use, and the rural economy. Specifically, these indicate that grassland used for grazing probably dominated the landscape, though this was interspersed with smaller agricultural plots used to cultivate a range of cereal crops, which formed another element of the later Roman diet. Many of the cereals (wheat and barley) had been previously cultivated, though these seem to have been supplemented by spelt wheat, which was possibly first cultivated at Goxhill during the later Roman period (*Ch 4, p 121*). However, the cultivation of all of these types of cereals during this period is probably to be expected, given that both barley and spelt wheat are considered the main crops of the Roman period (Greig 1991, 309; Lodwick 2017, 11), and in north-eastern Britain spelt seems to have been more common in the southern part of the region, with barley being more dominant further to the north (Campbell *et al* 2011, 18).

A microcosm of early settlement in North Lincolnshire?

It is clear that the archaeological investigations at Goxhill produced a good range of complementary evidence allowing the pattern and development of Iron Age and

Romano-British settlement to be discerned in some detail. In very broad terms, it indicates an initial phase of potential Early Iron Age settlement, followed by two phases of later Iron Age open settlement (Phases LIA.I and LIA.II), perhaps reflecting an unbroken sequence of occupation extending across the latter centuries of the first millennium cal BC and into the early decades of the first millennium cal AD. It was immediately followed by the continuation of open settlement in the initial decades of the earlier Roman period (Phase RB.I), then, most probably in the early second century, earlier areas of settlement were abandoned and an enclosed (although undefended) settlement (Phase RB.II), was established, defined by a cellular arrangement of conjoined curvilinear enclosures. Finally, probably in the later second/early third century, when the tidal creek had largely disappeared, settlement (Phase RB.III) was reorganised into a core area of occupation, linked to a series of rectilinear enclosures.

Significantly, it also now apparent that many of the cropmarks plotted from aerial photographs (Fleming and Royall 2019) probably relate to this final phase of Romano-British settlement. Moreover, from this evidence it is clear that the excavated remains formed the northerly elements of an extensive system of rectilinear enclosures, running from Areas B and C in the main construction area at Goxhill in a south-westerly direction, with the possibility of a second settlement core being present just south of the excavation areas and a third settlement core being located at the far south-eastern end of this enclosure system (Fig 96). It also seems that additional boundaries ran westwards from these enclosures (with one being excavated in Area C; *Ch 4, p 113*). Therefore, it is clear that the rural landscape was highly managed during the later Roman period, consisting of a series of small farmsteads and their associated land holdings, which probably covered most of the modern rural landscape.

Significantly, many of the enclosures at Goxhill were also aligned along a principal north-east/south-west boundary. In this respect, the system therefore shows some similarities with so-called Romano-British 'ladder' settlements, characterised by a linear aggregation of rectilinear enclosures flanking one or both sides of an axial road or trackway (*cf* Stoertz 1997). Moreover, such settlements were seemingly commonplace in the wider Humber region, with examples known at Whitton, on the southern bank

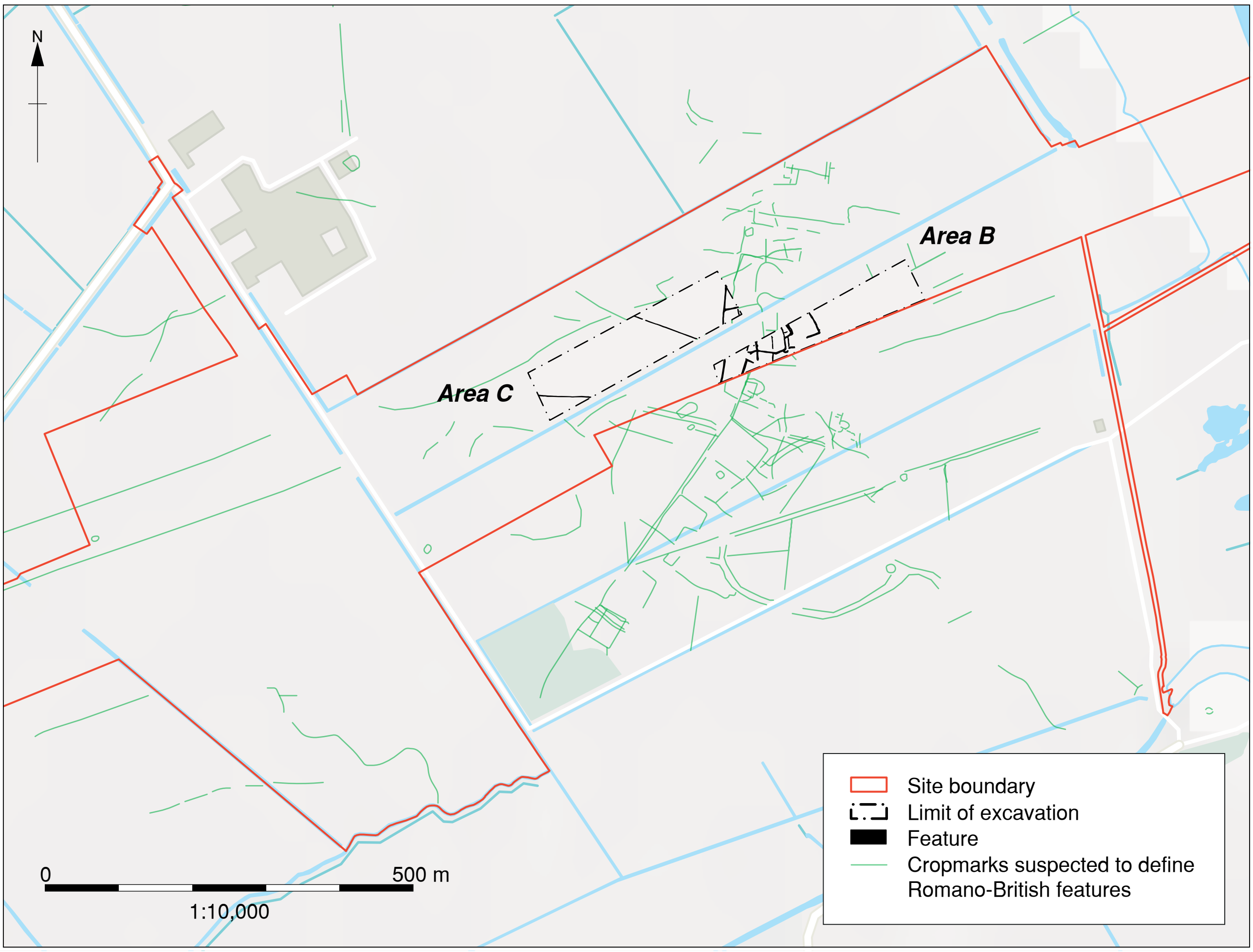


Figure 96: The extent of later Romano-British settlement at Goxhill

of the Humber, north of Scunthorpe (Van de Noort 2004, 119-20, fig 55), and at Melton, near North Ferriby, north of the river (Fenton-Thomas 2011). Closer to Goxhill, the settlement at Ulceby was also probably of a similar form, being defined by a series of rectangular enclosures arranged around a principal trackway (*cf* Jones 1998).

The excavated remains from Goxhill also indicate that roundhouses represented the main form of rural building up until the later Roman period, when these were replaced by rectilinear timber buildings, suggesting the adoption of a more 'Romanised' way of life. Tellingly, this also corresponds with the period when trade seems to have increased, with a handful of exotic Roman goods arriving at the settlement, which could, along with the adoption of a different form of vernacular architecture, and perhaps also changes in diet (*ie* the consumption of oysters; *p 192*), suggest that the rural population at Goxhill was more willing or able to 'buy into' the Roman cultural package. Indeed, the presence of some imported pottery, including what were presumably relatively expensive samian table wares and at least one amphora, does suggest, however, that there was no cultural 'bar' to the use of such goods and that at least some of the inhabitants were sufficiently well off to afford them. Prior to this, during the earlier Roman period, when roundhouses were still used and there was a notable absence of exotic goods, there was perhaps a degree of cultural conservatism (Hingley 1989, 34-5) at Goxhill that resulted in a slow 'take-up' of Roman material culture, with the inhabitants simply having no desire to obtain such goods. It may also have been linked to different expressions of wealth and social status, which instead may have been based on the ownership of livestock (Nevell and Roberts 2005, 115, 118), or the control of a group of followers or retainers (Hingley 1989, 146-7).

The rural economies of the different phases of later Iron Age and Romano-British settlement at Goxhill can also be determined to some degree. It seems that rearing and husbandry of livestock was a major focus for all these settlements, though there was a possible shift in emphasis over time. Based on the, admittedly, limited evidence gained from the analysis of lipid residues in a small selection of the pottery vessels (*Appendix 2*), it seems that dairy farming was important during the later Iron Age (Phase LIA. II), with a shift in the initial phases of Romano-British settlement (Phase RB.I) to a focus on rearing animals for meat, fats, hides, and sinews. There was then a possible return to dairy farming when the first Romano-British enclosed settlement was established (Phase RB.II), followed by a switch back to a non-dairy focused pastoral economy in the later Roman period (Phase RB.III). It also seems that during this latter period, a wider range of domestics were exploited and that the processing and cleaning of wool occurred, perhaps indicating that sheep had become an important economic focus, even though it has been argued that, nationally, the importance of cattle dramatically increased in the later Roman period (King 1984).

Significantly, comparable lipid studies have been completed on other assemblages of Iron Age and Romano-British pottery from the immediate area. One focused on the pottery recovered from the A1680/A180 Port of Immingham Improvement Scheme (*Ch 4, p 79*), and, in contrast to Goxhill, this suggested that most vessels, across both the Iron Age and Roman period, were used to process ruminant carcase products, with minor levels of diary processing in the later Roman period (Dunne and Evershed 2024, 189). It was also noted that the vessels had been subjected to sustained use in the processing of commodities with a high-lipid content, and that stainer vessels were used in activities relating to the rendering of fat (*ibid*). Similarly, several Roman vessels from Westfield Farm, on the Hornsea Project One Offshore cable route, were also associated with the processing of ruminant carcasses (Dunne 2023, 196). This therefore suggests that, in relation to livestock, not all settlements in the area were engaged in the same activities, with some specialising more on dairy production, whilst others focused on carcass processing, and that at some sites these specialisms were embedded and static, whilst at others they were more dynamic, with the emphasis changing over time.

Some arable farming also occurred at Goxhill, though this may have formed a more minor economic concern. Clear evidence for arable farming first appears in the earlier Roman period (*p 186*) and by the later Roman period, when the landscape was more systematically organised, there may have been a wider range of cereals cultivated in the area (*p 190*). Evidence for other rural industries was absent from the later Iron Age and earlier Romano-British settlements, though salt making was almost certainly a feature of the later Romano-British settlement (*p 189*). It is quite possible that this, along with agricultural surpluses, helped to generate the wealth required to obtain some of the exotic goods that appeared during this period (*p 189*), all of which facilitated the conversion to a more 'Romanised' way of life.

The sequence of settlement at Goxhill seems therefore to follow a fairly logical order and development, which is also apparent at several other sites in the immediate area, particularly around North and South Killingholme, and Immingham (*ie* Chase Hill Road, East Field Road, Westfield Farm, Rosper Road, Habrough Junction, and Brocklesby Interchange; *Ch 4, p 79*; Tuck 2023; Cavanagh 2024), which together provide a microcosm of early settlement across North Lincolnshire's Outmarsh and Middlemarsh. Indeed, this combined evidence suggests that the first major divisions of this landscape date to the earlier Iron Age (evidenced at Goxhill and perhaps Westfield Farm), which was followed in the later Iron Age by the establishment of both open settlements, containing one or more unenclosed roundhouses (*eg* Goxhill, Westfield Farm, and Brocklesby Interchange), and more substantial enclosed settlements (*eg* Rosper Road and Chase Hill Road), typified by roundhouses contained within sub-rectangular enclosures. Between these settlements extensive ditched boundaries were created to divide and define discrete parcels of agricultural land, with good examples of these being recorded at Brocklesby Interchange and East Field Road (*ibid*). At certain locations, including these latter two sites, together with Westfield Farm and Goxhill, settlement then continued into the earlier Roman period. This was essentially similar in form to later Iron Age settlement, being typified by both open roundhouse settlements and roundhouses contained in dedicated domestic enclosures (with both settlement types evident at Goxhill), with one particularly well-defined example recorded at Brocklesby Interchange, defined by a comparatively large rectangular ditched enclosure, subdivided into various compartments, which seems to have been associated with a high-status building (Cavanagh 2024, 20-2).

At some sites, such as Goxhill, Westfield Farm (Tuck 2023, 31-4), and Brocklesby Interchange (Cavanagh 2024, 22-6), the creation of enclosure/boundary ditches then intensified during the later Roman period, suggestive of a corresponding intensification in settlement and agriculture, and also a concerted attempt to create more regular (rectilinear) systems of enclosure, some containing domestic structures, others (such as those at Goxhill) being given over to industry, whilst many functioned as stock corals. At a small number of sites (*eg* Brocklesby Interchange; *op cit*, 27-31) there was also evidence for the continuation of settlement during the terminal stages of the Roman period (mid-fourth to fifth century), following the silting of the later Roman enclosures, which was once again characterised by ditched enclosures, though, in comparison to their immediate predecessors, these were smaller and more irregular, having a much more 'organic' morphology.

The Medieval and Later Landscape at Goxhill

The pottery evidence (*Appendix 1*) suggests that the later Romano-British settlement in the main construction area flourished during the late second and third centuries, which was perhaps followed by less intense occupation in the fourth century, at the end of the Roman period (*Ch 4*, *p 117*). After this, although there is no firm evidence for immediate post-Roman occupation, in the form of stratigraphic remains, it does appear that the Goxhill area still remained important for early medieval settlement. This is not particularly unexpected, given that the Humber Estuary, which has, throughout its history, served as an obvious 'gateway' to the interior of Britain for traders, settlers, and invaders, has yielded some of England's earliest 'Anglo-Saxon' material culture (Loveluck 1999). The evidence for post-Roman activity at Goxhill, however, is meagre and includes a single unstratified sherd of fifth- to seventh-century pottery from the main construction area (*Ch 5*, *p 145*). This does at least indicate that there was some activity at the former Romano-British settlement during the post-Roman period, though what this may have entailed is not clear. Similarly, two unstratified sherds of identical pottery were recovered from the Soff Lane diversion, indicating that this area also witnessed some form of activity in the fifth to seventh centuries. There is a slight suggestion that this may have been a more important area for settlement during this period, given that it witnessed later medieval occupation (*below*). Therefore, one tentative suggestion is that occupation shifted from the core areas of Romano-British settlement (such as that identified in the main construction area) to Goxhill village (or its immediate environs) in the post-Roman period. Indeed, this may have been required due to rises in sea level during the initial phases of the medieval period (*Ch 5*, *p 141*).

All the stratigraphic evidence for medieval activity was confined to Area A, on the Soff Lane diversion, and related to three broad phases of activity (Phases M.I-M.III). Importantly, the features associated with this activity produced medieval pottery and other artefacts (most notably a 'Norse' bell; *Ch 5*, *p 155*), along with some palaeoenvironmental remains, allowing some insights into the medieval environment and agriculture. Significantly, analysis of later mapping and aerial photographs indicates that this area lay within a broader zone of medieval open fields (known later as Hallands Field, in the area of Soff Lane), with areas of pasture/meadowland to the north, adjacent to the foreshore area (*Ch 5*, *p 143*). Furthermore, the excavations lay within an area of ancient enclosure, depicted on the late nineteenth-century enclosure maps (Fig 97), running south and north of Church Side (most probably a medieval routeway), in the vicinity of South End and Goxhill Hall (*Ch 5*, *p 143*). Based on this, it seems highly likely that the recorded features, and artefactual and palaeoenvironmental remains, in Area A relate to the 'ancient' enclosures running to the south of the road. Indeed, one boundary (***1349***; *Ch 5*, *p 147*) was present and was retained across all three phases of activity. Given this, it probably formed the southernmost boundary defining this area

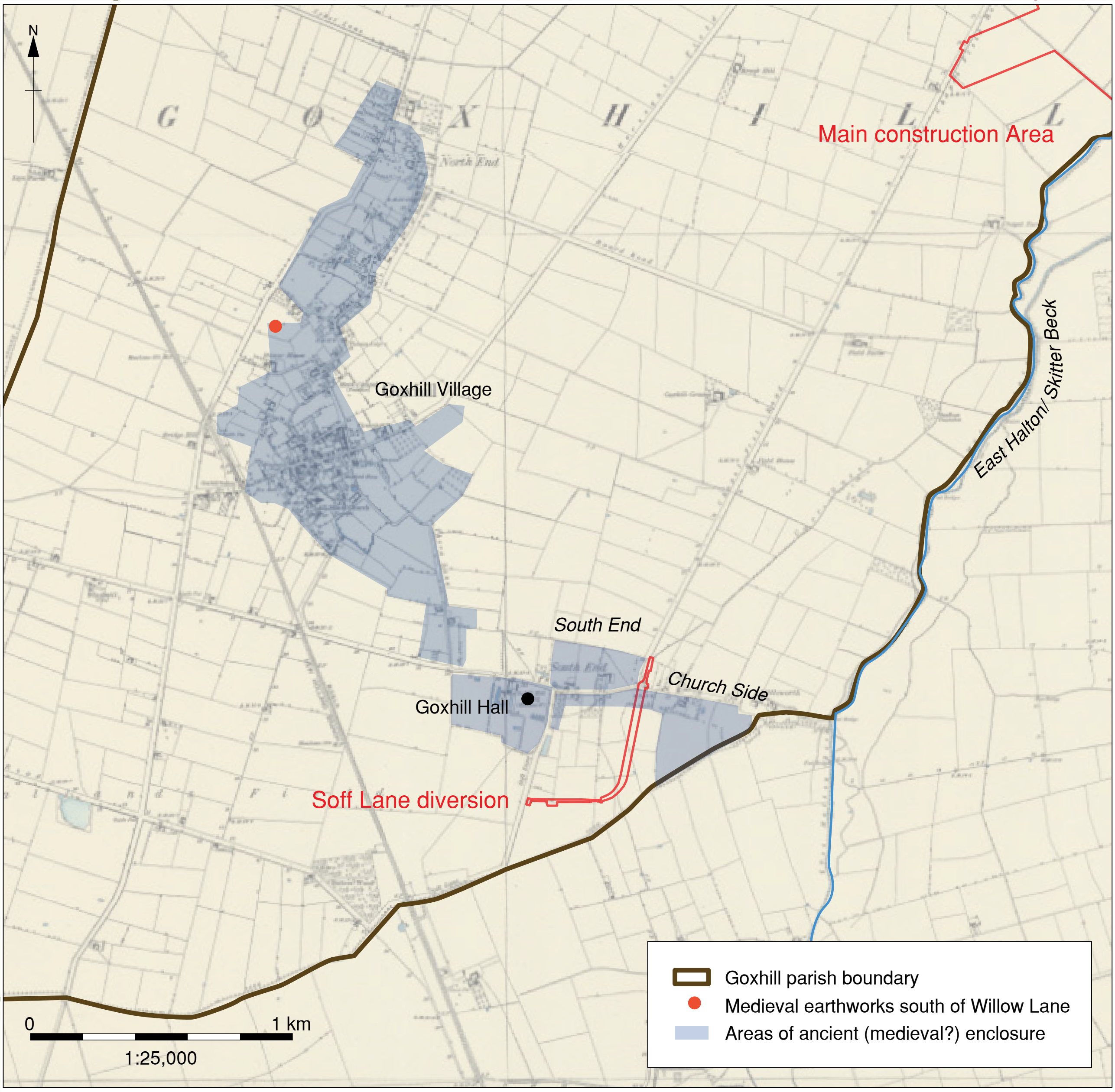


Figure 97: Areas of ancient (medieval) enclosure at Goxhill, superimposed on the First Edition OS mapping (OS 1886a; 1886b; 1886c; 1886d; mapping reproduced with the permission of the National Library of Scotland)

of medieval enclosure, with the land given over to enclosure being constant across the entire period. It can be further argued that the enclosures demarcated areas of potential settlement, with any building remains being closer to the frontage of Church Side. If this was the case, the recorded remains would therefore have been to the rear of any principal domestic dwellings, which seems consistent with the excavated evidence.

The pottery and radiocarbon dating evidence suggest that the main phase of medieval settlement (Phase M.I; Fig 98) in Area A began in the tenth century (*Ch 5, p 146, p 165*). The remains relating to this phase of activity comprised a boundary (***1349***), defining the southern limits of medieval enclosure (*above*). In conjunction with the dating evidence, it implies that the enclosures running off Church Side were established prior to the Norman Conquest, when the area lay within Danelaw (*Ch 5, p 141*). Other remains associated with this pre-Conquest activity included two trackways and adjacent ditched enclosures, and possible animal pens that are again highly suggestive of activity to the rear of any early dwellings along Church Side. Indeed, these remains also appear broadly analogous to others recorded by excavation and survey elsewhere in Goxhill village. For example, to the south of Willow Lane (Fig 97), an earthwork survey identified a complex of well-preserved earthworks, including a sunken trackway

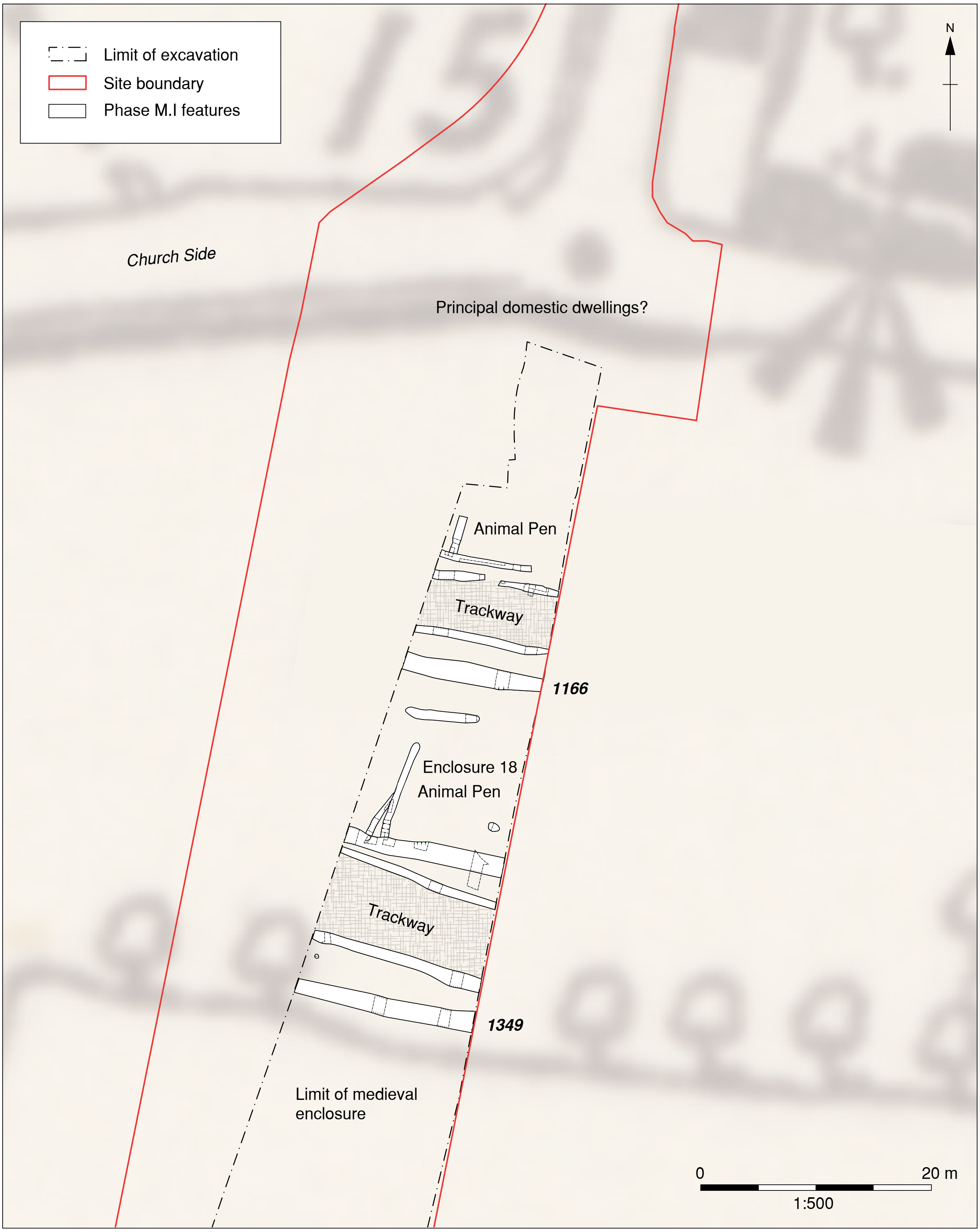


Figure 98: The tenth-century activity (Phase M.I) in the Soff Lane diversion, superimposed on the First Edition OS mapping (1886a; mapping reproduced with the permission of the National Library of Scotland)

associated with ridge-and-furrow cultivation and two rectangular enclosures, probably crofts, one of which contained a building platform (North Lincolnshire Historic Environment Record (HER) 1580).

The Phase M.I feature in Area A also produced small amounts of pottery, including Torksey ware, along with local wares produced in North Lincolnshire (*Ch 5, p 155*). Animal bone was also present, suggesting that there may have been a focus on the rearing of cattle in this enclosed area. Perhaps significantly, much of the animal bone was recovered from a ditch (***1166***) defining the southern side of an enclosure (Enclosure 18), which would have lain closer to any potential dwellings on Church Side, suggesting that it may have formed a convenient feature for the disposal of domestic refuse. Furthermore, this ditch produced a large assemblage of charred cereal grain and chaff (*Ch 5, p 158*), again constituting probable dumped refuse/kitchen waste. These remains indicate that all four of the principal medieval cereal crops were under cultivation, namely barley, free-threshing wheat, oats, and rye (*Secale cereale*). The ditch also contained flax, field bean (*Vicia faba*), pea, and cabbage/mustard (*Brassica/Sinapis*) seeds, which may represent other kitchen waste (or perhaps residual plants growing amongst the cereals). Therefore, it seems from these plant remains and the animal bone that a mixed agricultural economy was in operation. Other plant remains from the ditch included weeds commonly associated with cultivated land, as well as plants that favour damp/wet soils.

Probably in the immediate post-Conquest period, more specifically between the mid-/late tenth and late eleventh centuries (based on the pottery and radiocarbon dating evidence; *Ch 5, p 167*), several changes occurred in this area (Phase M.II; Fig 99). They included the creation of a series of conjoined enclosures (*Ch 5, p 149*), which would have been positioned immediately to the rear of any dwellings on the Church Side frontage. It is possible that these functioned as stock enclosures, as analysis of the sediments within the ditches suggests that the area had been trampled by animals (*Ch 5, p 163*). In contrast to the earlier ditches in this area, which seem to have been used to dispose of animal remains, these features were comparatively devoid of bone; however, the fragments that could be confidently identified to species include sheep/goat, which may hint that these animals were penned in the enclosures.

South of these enclosures, the boundary (***1349***) that had been established during the first phase of settlement activity (*p 194*), demarcating the main area of medieval enclosure/settlement, was retained (being recut as ***1348***; *Ch 5, p 150*), and significantly two probable structures were present in the intervening area. These were defined by arcing drainage gullies and, although no structural remains survived, it is possible that they defined two small medieval hovels (*c* 7.8 x 7 m in plan) positioned to the rear of any principal dwellings on Church Side (Fig 100). Indeed, they appear to have been associated with domestic activity, as one of the gullies contained domestic waste/cess. This material comprises bone, from both mammals and fish (*Ch 5, p 158*), and charred cereals from the four main medieval cereal crops recorded in the earlier assemblages (*above*), as well as a selection of weeds that occur on cultivated land (*Ch 5, p 158*). The gully also produced rush (*Juncus* sp) seeds, which could reflect debris from flooring, bedding, or thatch and may confirm it demarcated a domestic structure (*Ch 5, pp 162-3*). Another comparable structure/hovel was also identified, although, interestingly, this lay beyond and to the south of the main area of medieval enclosure (Fig 100).

The third phase of medieval activity (Phase M.III; Fig 101) probably began in the mid-twelfth century (*Ch 5, p 150, p 168*), occurring not long after the ditches of the conjoined (Phase M.II) enclosures had silted (*above*). It was characterised by the digging of pits and a gully, all of which contained domestic refuse, again, most probably derived from any dwellings on the Church Side frontage. This material includes relatively large amounts of pottery (with sherds from 31 vessels being recorded; *Ch 5, p 168*), as well as plant and faunal remains. The faunal remains point to rearing/consumption of cattle, sheep/goat, and pig, and some fish bones are also present, indicating that herring-size fish formed part of the later medieval diet (*Ch 5, p 158*). The charred plant remains are comparable to the earlier assemblages, indicating the cultivation of a similar range of crops during this period (*Ch 5, p 158*). It is also evident through detailed analysis of the sediments within the pits that these contained burnt debris representing rake-out material from corn-dryers, which would have been located somewhere in the near vicinity (*Ch 5, p 163*). The boundary ditch (***1349/1348***; *above*) demarcating the area of medieval enclosure was again maintained through repeated recutting, and this redefined boundary also contained pottery dating between the thirteenth and early/mid-fourteenth centuries, which probably relates to the last period of domestic settlement in this area. This therefore indicates that the site had certainly been abandoned by the mid-fourteenth century.

In addition to the medieval remains, the project also recovered some limited evidence for post-medieval activity. This included ditched field boundaries (one of which had originally been filled with water, functioning as a drainage ditch; *Ch 5, p 171*), a pit, plough furrows, and a trackway. Most of these features are likely to have been created during the period of Parliamentary enclosure in the later eighteenth- and early nineteenth centuries.

A microcosm of later settlement in North Lincolnshire?

As with the remains from the main construction area dating to the Iron Age and Roman periods (*p 190*), it also seems plausible that the medieval remains from the Soff Lane diversion reflect a microcosm of medieval settlement development

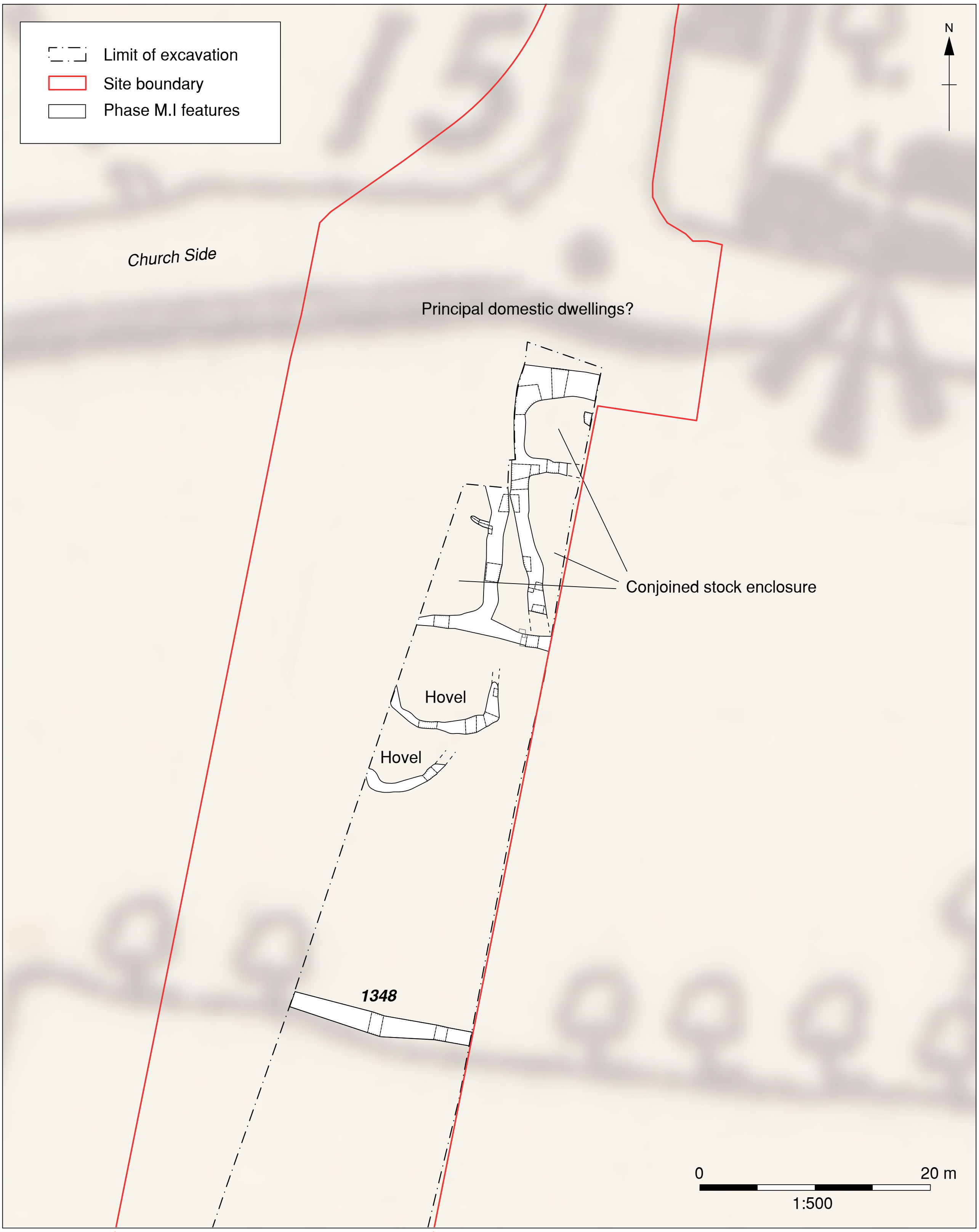


Figure 99: Mid-late tenth- to eleventh-century activity (Phase M.II) in the Soff Lane diversion, superimposed on the First Edition OS mapping (1886a; mapping reproduced with the permission of the National Library of Scotland)

in Goxhill and perhaps also the wider region. It can be assumed that there was activity at Goxhill in the immediate post-Roman period, though this may have been fairly low-level in character. It was followed by a more concerted phase of settlement in the Late Saxon period, which could conceivably correspond with the start date for the establishment of the medieval village at Goxhill (recorded in

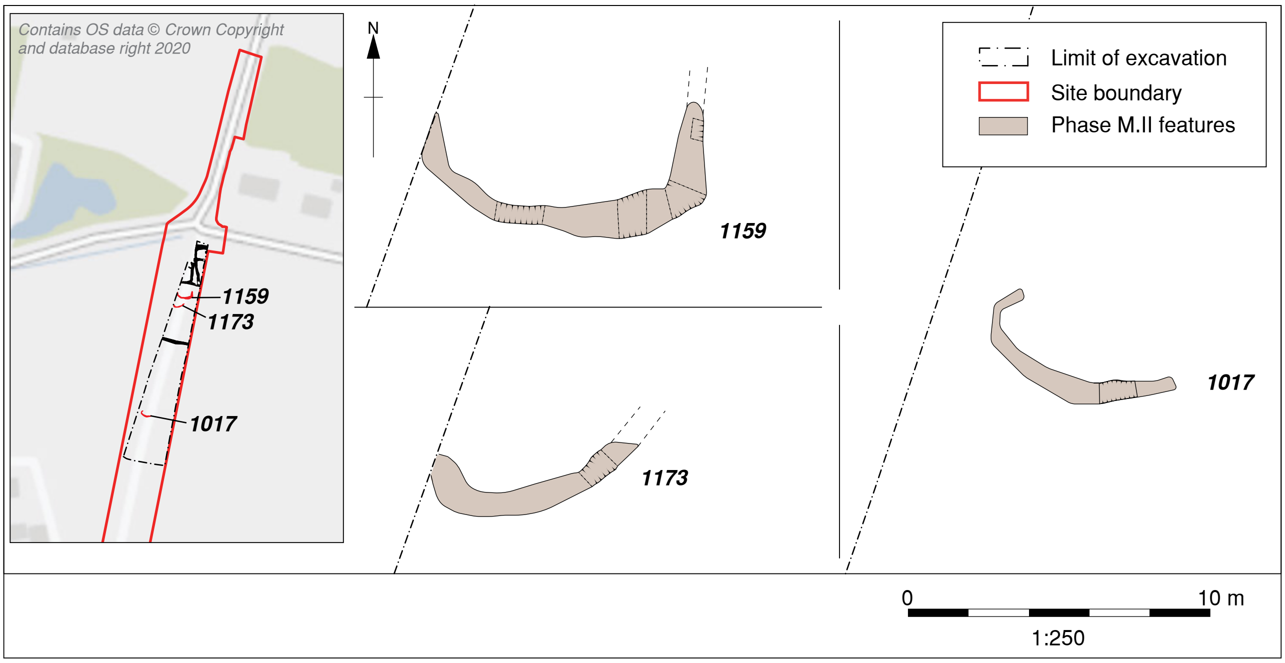


Figure 100: The drainage gullies defining the possible medieval hovels in the Soff Lane diversion

the Domesday survey; *Ch 5, p 142*) and hence the origins of the present-day settlement. In Area A, domestic activity then continued for 200 years, or so, following the Norman Conquest, which corresponds with a period of steadily increasing prosperity and population growth across the region, resulting from political stability, an ameliorating climate, and, in low-lying areas such as the Lincolnshire Marsh, marine regression (Van de Noort 2004, 133). Furthermore, based on the cartographic evidence for ancient enclosure, it is possible that the village was much larger in extent than is presently the case, with domestic occupation extending to the south-east of the present settlement, in a continuous swathe towards South End, where the Soff Lane diversion is located.

Medieval activity in the Soff Lane diversion then seems to abruptly end, perhaps in the early/mid-fourteenth century, which could be down to several factors. Climate change could have been one factor, as between the mid-fourteenth and mid-sixteenth centuries, the climate progressively deteriorated, typified by wetter, cooler conditions (Goudie 1983, 132-7). This may therefore have reduced the viability of arable farming in some areas and led to many of the principal landowners buying up and enclosing large tracts of land for conversion to pasture (Moorhouse 2003, 181), both for cattle and sheep, the latter being of particular value in the context of the burgeoning medieval wool trade (Van de Noort 2004, 155-7).

Another factor may have been disease, specifically the Black Death in the mid-fourteenth century. As across much of England, this would have resulted in the shrinkage (and, in some cases, the abandonment) of some medieval settlements, unemployment and rural depopulation, and the shift towards the less labour-intensive strategy of stock rearing (Allison 1976, 99-100). Indeed, at Goxhill, this could well have been the principal reason for the cessation of activity in Area A, with any potential dwellings being abandoned along Church Side. Certainly, the Black Death seems to have been catastrophic for medieval communities in this area, as evidenced by the plague pit identified at Thornton Abbey (*Ch 5, p 143*). A reduced population may have led to the apparent contraction in settlement, from its potentially greatest medieval extent (*above*), shrinking to an area now defined by the present-day village. If this was the case, it seems that the only area in the former south-eastern extent of the settlement that continued to be occupied was Goxhill Hall, particularly given that it contains a mid-fourteenth-century building (*Ch 5, p 143*).

Following this period of abandonment, the wider landscape surrounding Goxhill largely retained its medieval rural qualities right up until the late eighteenth century, although it may well have been the case that the medieval and early post-medieval landowners in this area also strove to increase productivity through the implementation of drainage schemes (Van de Noort 2004, 157). During the late eighteenth century, the landscape in the Goxhill parish was subjected to Parliamentary enclosure (*Ch 5, p 169*). This movement, stimulated by the development of improved agricultural practices, including the introduction of new crops and rotation systems and animal husbandry regimes, resulted in far-reaching changes, including the instigation of increasingly

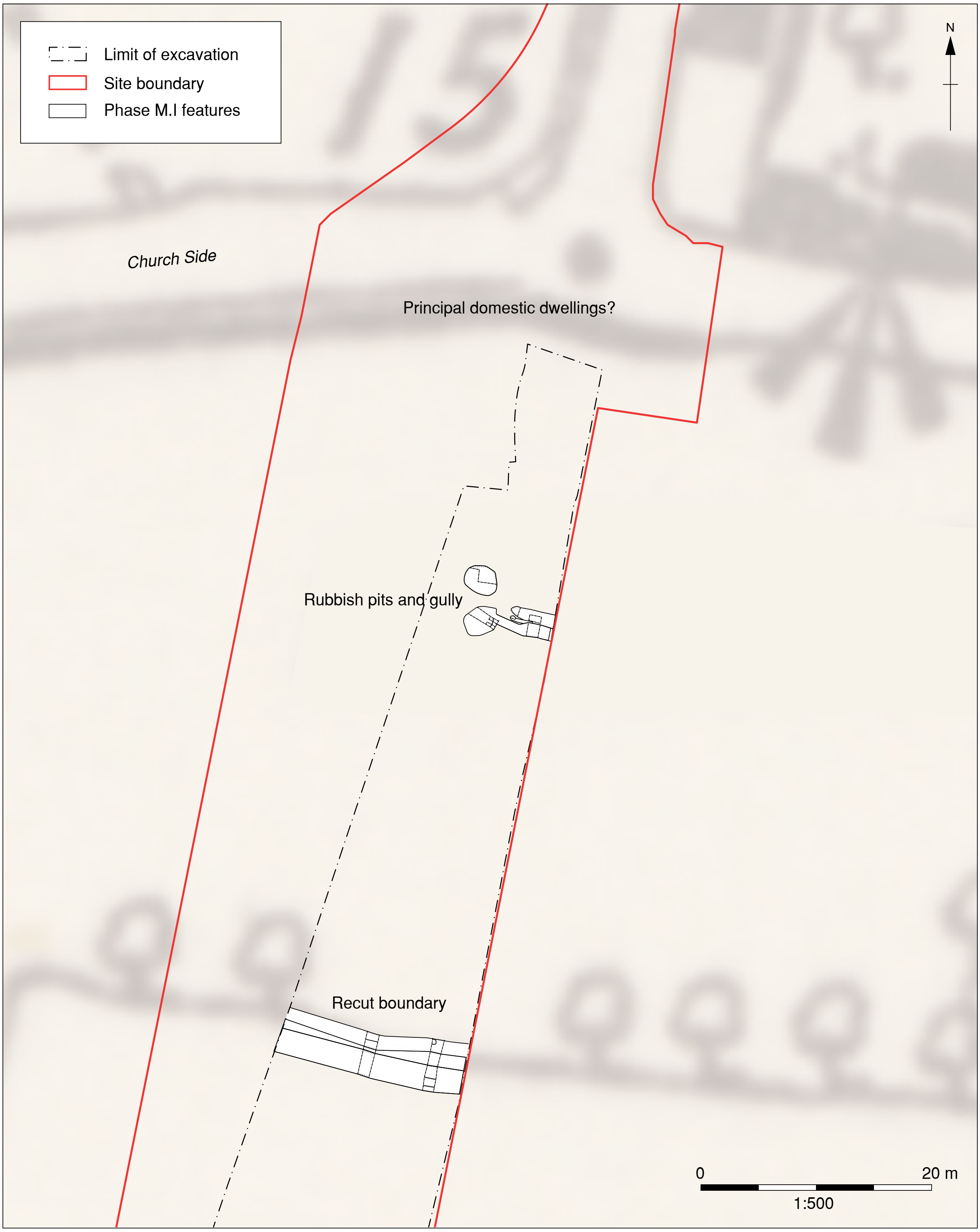


Figure 101: Mid-twelfth- to fourteenth-century activity (Phase M.III) in the Soff Lane diversion, superimposed on the First Edition OS mapping (1886a; mapping reproduced with the permission of the National Library of Scotland)

ambitious drainage schemes (*cf* Allison 1976, 148-9). Indeed, by the mid-nineteenth century, this enclosure, accompanied by the construction of improved field-drainage systems from the 1850s onwards, resulted in the development of the pattern of settlement that is evident over much of the region today, characterised by large fields and dispersed farms (Van de Noort 2004, 162).

Conclusion

The archaeological and palaeoenvironmental investigations connected with the replacement of the Number 9 Feeder Gas Transmission Pipeline have proved extremely rewarding for comprehending the nature of two landscapes either side of the Humber Estuary, at Paull, East Yorkshire, and Goxhill, North Lincolnshire, and also the character and development of prehistoric, Romano-British, and medieval settlement on the southern side of the estuary at Goxhill. Moreover, the project highlights the relative success of the combined use of archaeological excavation and post-excavation analysis, together with borehole sampling, deposit modelling, and the analysis of a range of palaeoenvironmental data, to gain a fuller understanding of early landscape development. It is anticipated that this work, whilst being directly relevant to the areas investigated at Paull and Goxhill, will form a valuable adjunct to the emerging regional evidence, which will ultimately result in a much deep understanding of estuarine landscapes of the Humber Estuary.

BIBLIOGRAPHY

Cartographic Sources

Armstrong, A, 1779 *A map of Lincolnshire* [Online] Available at: https://www.britishmuseum.org/collection/object/P_Ee-6-66 (accessed 14 September 2023)

Ordnance Survey (OS), 1886a 6″:1 mile, First Edition Lincolnshire Sheet VIII.SW, surveyed 1886

Ordnance Survey (OS), 1886b 6″:1 mile, First Edition Lincolnshire Sheet VII.NW, surveyed 1886

Ordnance Survey (OS), 1886c 6″:1 mile, First Edition Lincolnshire Sheet VII.SE, surveyed 1886

Ordnance Survey (OS), 1886d 6″:1 mile, First Edition Lincolnshire Sheet VII.NE, surveyed 1886

Secondary Sources

AC Archaeology, 2011 *Able Marine Energy Park, North and South Killingholme, North Lincolnshire: archaeology and cultural heritage assessment*, Unpubl rep

Adderley, W P, Simpson, I A, and Davidson, D, 2006 Historic landscape management: a validation of quantitative soil thin-section analyses, *J Archaeol Sci*, **33**, 320-34

Allan, J, Hughes, M J, and Taylor, R T, 2010 Saxo-Norman pottery in Somerset: some recent research, *Somerset Archaeol Natur Hist*, **154**, 165-84

Allen Archaeology, 2010 *Trial trenching on land off Palmer Lane, Barrow-upon-Humber, North Lincolnshire*, Unpubl rep [Online] Available at: https://doi.org/10.5284/1006713 (accessed 14 July 2023)

Allen Archaeology, 2013 *Archaeological evaluation report: trial trenching on land at Able Marine Energy Park, North Killingholme, North Lincolnshire*, Unpubl rep

Allen Archaeology, 2014 *Interim archaeological report: AMEP Area 6 trial trenching*, Unpubl rep

Allen Archaeology, 2019 *Archaeological assessment report and updated project design: Able Humber Port, East Halton, South Killingholme and North Killingholme, North Lincolnshire*, Unpubl rep

Allen, M, 2016 The North-East, in A Smith, M Allen, T Brindle, and M Fulford, *New visions of the countryside of Roman Britain. Volume* ***1****: the rural settlement of Roman Britain*, Britannia Monog Ser, **29**, London, 242-81

Allen, M, Blick, N, Brindle, T, Evans, T, Fulford, M, Holbrook, N, Richards, J D, and Smith, A, 2016 *The rural settlement of Roman Britain: an online resource* [Online] Available at: https://archaeologydataservice.ac.uk/archives/view/romangl/map.html (accessed 13 July 2023)

Allison, K J, 1976 *The East Riding of Yorkshire landscape*, Howden

Alvey, R C, 1996 Marine molluscs, in May 1996, 171

Amec, 2007 *Paull to Goxhill pipeline: desk-based assessment and field reconnaissance survey: archaeology*, Unpubl rep

Anderson, R C, Liberta, A E, and Dickman, L A, 1984 Interaction of vascular plants and vesicular-arbuscular mycorrhizal fungi across a soil moisture-nutrient gradient, *Oecologia*, **64**(1), 111-17

Applebaum, S, 1966 Peasant economy and types of agriculture, in C Thomas (ed), *Rural settlement in Roman Britain*, CBA Res Rep, **7**, London, 99-107

Arcadis, 2016 *River Humber gas pipeline replacement project: archaeological mitigation strategy and written scheme of investigation*, Unpubl doc

Archaeological Project Services (APS), 2006 *Archaeological evaluation on land at Ropser Road, North Killingholme, North Lincolnshire*, Unpubl rep

Archaeological Services, West Yorkshire Archaeology Service (WYAS), 2005 *Clough Road realignment, North Killingholme, North Lincolnshire: archaeological trial trenching*, Unpubl rep

Archaeological Services, West Yorkshire Archaeology Service (WYAS), 2007 *Clough Road realignment, North Killingholme: archaeological strip, map, and record*, Unpubl rep [Online] Available at: https://doi.org/10.5284/1033906 (accessed 13 July 2023)

Archaeological Services, West Yorkshire Archaeology Service (WYAS), 2014 *Feeder No 9 River Humber pipeline replacement project, Paull, East Yorkshire: geophysical survey*, Unpubl rep

Ashmore, P J, 1999 Radiocarbon dating: avoiding errors by avoiding mixed samples, *Antiquity*, **73**, 124-30

Association of Local Government Archaeological Officers (ALGAO), 2015 *Advice note for post-excavation assessment* [Online] Available at: https://www.algao.org.uk/sites/default/files/documents/ALGAO_UK_PXA_Advice_Note.pdf (accessed 16 January 2023)

Bantock, T, and Botting, J, 2018 *British bugs* [Online] Available at: https://www.britishbugs.org.uk/ (accessed 18 September 2023)

Barber, D C, Dyke, A, Hillaire-Marcel, C, Jennings, A E, Andrews, J T, Kerwin, M W, Bilodeau, G, McNeely, R, Southon, J, Morehead, M D, and Gagna, J M, 1999 Forcing of the cold event of 8200 years ago by catastrophic drainage of Laurentide lakes, *Nature*, **400**, 344-8

Bartlett, A D H, 2012 *Proposed Able UK Ltd Marine Energy Park, North Killingholme, North Lincolnshire: report on archaeological geophysical survey 2012*, Unpubl rep [Online] Available at: https://doi.org/10.5284/1056911 (accessed 13 July 2023)

Bartlett, A D H, 2014 *Feeder No 9 River Humber pipeline replacement project: Goxhill AGI archaeological geophysical survey*, Unpubl rep

Bateman, M D, Buckland, P C, Frederick, C D, and Whitehouse, N J, 2001 (eds) *The Quaternary of East Yorkshire and North Lincolnshire*, London

Bateman, M D, Evans, D J A, Buckland, P C, Connell, E R, Friend, R J, Hartmann, D, Moxon, H, Fairburn, W A, Panagiotakopulu, E, and Ashurst, R A, 2015 Last glacial dynamics of the Vale of York and North Sea lobes of the British and Irish Ice Sheet, *Proc Geol Assoc*, **126**, 712-30

Bateman, M D, Evans, D J A, Roberts, D H, Medialdea, A, Ely, J, and Clark, C D, 2018 The timing and consequences of the blockage of the Humber Gap by the last British-Irish ice sheet, *Boreas*, **47**, 41-61

Battarbee, R W, Jones, V J, Flower, R J, Cameron, N G, Bennion, H B, Carvalho, L, and Juggins, S, 2001 Diatoms, in J P Smol and H J B Birks (eds), *Tracking environmental change using lake sediments. Volume 3: terrestrial, algal, and siliceous indicators*, Dordrecht, 155-202

Bayliss, A, and Marshall, P, 2022 *Radiocarbon dating and chronological modelling: guidelines and best practice*, London

Beckett, S C, 1975 *The Late Quaternary vegetational history of Holderness, Yorkshire*, Unpubl PhD thesis, Univ Hull

Beckett, S C, 1981 Pollen diagrams from Holderness, North Humberside, *J Biogeog*, **8**, 177-98

Beer, R J, 1976 The relationship between *Trichuris trichiura* (Linnaeus 1758) of man and *Trichuris suis* (Schrank 1788) of the pig, *Res Veterinary Sci*, **20**(1), 47-54

Berglund, B E, and Ralska-Jasiewiczowa M, 1986 Pollen analysis and pollen diagrams, in B E Berglund (ed), *Handbook of Holocene palaeoecology and palaeohydrology*, Chichester, 455-84

Behre, K E, 1981 The interpretation of anthropogenic indicators in pollen diagrams, *Pollen et Spores*, **23**, 225-45

Behrensmeyer, A K, 1978 Taphonomic and ecologic information from bone weathering, *Paleobiol*, **4**(2), 150-62

Behrensmeyer, A, K, 1991 Terrestrial vertebrate accumulations, in P Allison and D E G Briggs (eds), *Taphonomy: releasing the data locked in the fossil record*, Topics Geobiol, **9**, London, 291-335

Bell, M, Caseldine, A, and Neumann, H, 2000 *Prehistoric intertidal archaeology in the Welsh Severn Estuary*, CBA Res Rep, **120**, York

Berstan, R, Stott, A W, Minnitt, S, Ramsey, C B, Hedges, R E M, and Evershed, R P, 2008 Direct dating of pottery from its organic residues: new precision using compound-specific carbon isotopes, *Antiquity*, **82**(317), 702-13

Biddulph, E, Foreman, S, Stafford, E, Stansbie, D, and Nicholson, R, 2012 *London Gateway. Iron Age and Roman salt making in the Thames Estuary: excavations at Stanford Wharf Nature Reserve, Essex*, Oxford Archaeol Monog, **18**, Oxford

Bidwell, P, and Croom, A, 2010 The supply and use of pottery on Hadrian's Wall in the 4th century AD, in R Collins and L Allason-Jones (eds), *Finds from the frontier: material culture in the 4th-5th centuries,* CBA Res Rep, **162**, York, 20-36

Binford, L R, 1981 *Bones: ancient men and modern myths*, New York

Bird-David, N, 1992 Beyond 'the hunting and gathering mode of subsistence': culture-sensitive observations on the Nayaka and other modern hunter-gatherers, *Man*, New Ser, **27**, 19-44

Blackford, J J, and Innes, J B, 2006 Linking current environments and processes to fungal spore assemblages: surface NPM data from woodland environments, *Rev Palaeobot Palynol*, **141**, 179-87

Bondevik, S, Sormo, S K, and Skjerdal, G, 2012 Green mosses date the Storegga tsunami to the chilliest decades of the 8.2 ka cold event, *Quat Sci Rev*, **45**, 1-6

Boorman, L, Hazelden, J, and Boorman, M, 2002 New salt marshes for old: salt marsh creation and management, in Eurocoast (ed), *Littoral 2002: the changing coast*, Porto, 35-45

Bottema, S, 1975 The interpretation of pollen spectra from prehistoric settlements (with special attention to Liguliflorae), *Palaeohistoria,* **17**, 17-35

Bottema, S, van Hoorn, T C, Woldring, H, and Gremmen, W H E, 1980 An agricultural experiment in the unprotected saltmarsh, part II, *Palaeohistoria* **22**, 127-40

Boyle, A, Didsbury, P, Vince, A, and Young, J, 2011 The medieval pottery, in H E M Cool and M Bell, *Excavations at St Peters Church, Barton upon Humber*, London, 1038-66

Bradley, R J, 2019 *The prehistory of Britain and Ireland*, 2nd edn, Cambridge

Bradshaw, R H W, and Webb, T, 1985 Relationships between contemporary pollen and vegetation data from Wisconsin and Michigan, USA, *Ecol*, **66**(3), 721-37

Brenner, W W 2005 Holocene environmental history of the Gotland Basin (Baltic Sea): a micropalaeontological model, *Palaeogeog Palaeoclimatol Palaeoecol*, **220**, 227-41

Brickley, M, and McKinley, J, 2004 *Guidelines to the standards for recording human remains*, IfA Pap, **7**, Reading

Brinkkemper, O, and van Haaster, H, 2012 Eggs of the intestinal parasites whipworm (*Trichuris*) and maw worm (*Ascaris*): non-pollen palynomorphs in archaeological samples, *Rev Palaeobot Palynol*, **186**, 16-21

Brock, F, Lee, S, Housley, R A, and Bronk Ramsey, C, 2011 Variation in the radiocarbon age of different fractions of peat: a case study from Ahrenshöft, northern Germany, *Quat Geochronol*, **6**(6), 550-5

Bronk Ramsey, C, 2009 Bayesian analysis of radiocarbon dates, *Radiocarbon*, **51**, 337-60

Bronk Ramsey, C, and Lee, S, 2013 Recent and planned developments of the program OxCal, *Radiocarbon*, **55**, 720-30

Brooks, D, and Thomas, K W, 1967 The distribution of pollen grains on microscope slides. The non-randomness of the distribution, *Pollen et Spores*, **9**, 621-9

Brown, D, 2011 *Archaeological archives: a guide to best practice in creation, transfer, and curation*, 2nd edn, Reading

Brown, F, Clark, P, Dickson, A, Gregory, R A, and Zant, J, 2023 *From an ancient Eden to a new frontier: an archaeological journey along the Carlisle Northern Development Route*, Lancaster Imprints, **31**, Lancaster

Brown, T, 2013 Divisions of floodplain space and sites on riverine 'islands': function, ritual, social or liminal places?, *J Wetland Archaeol*, **3**, 3-15

Buckland, P C, 1973 Environment and archaeology in the Vale of York, *S Yorkshire Stud Archaeol Natur Hist*, **1**, 6-16

Buckland, P I, Bateman, M D, Bennike, O, Buckland, P C, Chase, B M, Frederick, C, Greenwood, M, Murton, J, Murton, D, and Panagiotakopulu, E, 2019 Mid-Devensian climate and landscape in England: new data from Finningly, South Yorkshire, *Roy Soc Open Sci*, **6**(7) [Online] Available at: https://royalsocietypublishing.org/doi/full/10.1098/rsos.190577 (accessed 6 June 2022)

Buckley, D G, and Major, H, 1990 Quernstones, in S Wrathmell and A Nicholson (eds), *Dalton Parlours: Iron Age settlement and Roman villa*, Yorkshire Archaeol, **3**, Wakefield, 105-20

Bullock, P, Fedoroff, N, Jongerius, A, Stoops, G, and Tursina, T, 1985 *Handbook for soil thin section description*, Wolverhampton

Burgess, A, and Daniel, P, 2018 Easington to Salt End: the archaeology of the Humber Gateway onshore cable route, *East Riding Archaeol*, **17**, 1-113

Cameron, K, 1996 The Scandinavian element in minor names and field-names in North-East Lincolnshire, *Nomina*, **19**, 5-27

Cameron, K, and Insley, J, 1998 *A dictionary of Lincolnshire place-names*, London

Campbell, G, 1994 The preliminary archaeobotanical results from Anglo-Saxon West Cotton and Raunds, in J Rackham (ed), *Environment and economy in Anglo-Saxon England*, CBA Res Rep, **89**, York, 65-82

Campbell, G, Moffett, L, and Straker, V, 2011 *Environmental archaeology: a guide to the theory and practice of methods, from sampling recovery to post-excavation*, 2nd edn, London

Cannon, K, 2023, *Why motorcycles have bells: the history and the legends* [Online] Available at: https://motorcyclehabit.com/why-motorcycles-have-bells-the-history-the-legends/ (accessed 19 April 2023)

Cappers, R T J, Bekker, R M, and Jans, J E A, 2006 *Digitalezadenatlas van Nederland*, Groningen

Cardwell, P, Neal, P, and Parry, J, 2000 *Humber Link Pipeline Project – Site 26 East Halton Skitter, North Lincolnshire: archaeological evaluation interim report*, Unpubl rep [Online] Available at: https://doi.org/10.5284/1023704 (accessed 13 July 2023)

Carrott, J, and Kenward, H K, 2001 Species associations among insect remains from urban archaeological deposits and their significance in reconstructing the past human environment, *J Archaeol Sci*, **28**, 887-905

Carruthers, W, 2010 The plant remains, in C Harding, E Marlow-Mann, and S Wrathmell (eds), *Wharram: a study of settlement on the Yorkshire Wolds, XII. The post-medieval farm and vicarage sites*, York Univ Archaeol Publ, **14**, York, 287-313

Carruthers, W J, and Hunter Dowse, K L, 2019 *A review of macroscopic plant remains from the Midland counties*, Hist Engl Res Rep Ser, **47/2019**, London

Carter, S, 1998 The use of peat and other organic sediments as fuel in northern Scotland: identifications derived from soil thin sections, in C M M Coles (ed), *Life on the edge: human settlement and marginality*, Oxbow Monog, **100**, Oxford, 99-104

Catt, J A, 1990 Geology and relief, in S Ellis and D R Crowther (eds), *Humber perspectives: a region through the ages*, Hull, 13-28

Cavanagh, N A, 2024 *Becoming Roman in North East Lincolnshire: excavation and survey along the A160/A180 Port of Immingham Improvement Scheme*, BAR Brit Ser, **685**, Oxford

Chadwick, A M, 2009 *West Yorkshire Archaeology Advisory Service research agenda: the Iron Age and Romano-British periods in West Yorkshire*, Wakefield

Champion, T, 1995 Power, politics, and status, in M J Green (ed), *The Celtic world*, London and New York, 85-94

Chapman, H, and Lillie, M 2004 Investigating Doggerland through analogy: the example at Holderness, East Yorkshire, UK, in N C Fleming (ed), *Submarine prehistoric archaeology of the North Sea: research priorities and collaboration with industry*, CBA Res Rep, **141,** York, 65-9

Chartered Institute for Archaeologists (CIfA), 2014 *Standard and guidance for archaeological excavation*, Reading

Chartered Institute for Archaeologists (CIfA), 2020 *Standard and guidance for the creation, compilation, transfer, and deposition of archaeological archives*, rev edn, Reading

Charters, S, 1996 *Chemical investigation of absorbed lipids and laboratory simulation experiments to interpret archaeological pottery vessel contents and use*, Unpubl PhD thesis, Univ Bristol

Charters, S, Evershed, R P, Goad, L J, Heron, C, and Blinkhorn, P, 1993 Identification of an adhesive used to repair a Roman jar, *Archaeometry*, **35**, 91-101

Clarke, R, 2016 *The south Humber coastal lowlands: a landscape interpretation*, Unpubl rep [Online] Available at: http://www.richardclarkelandscapehistorian.co.uk/wp-content/uploads/2016/03/South-Humber-coastal-lowlands.pdf (accessed 28 September 2023)

Clay, C, 2006 *Archaeological excavation report: land off Horkstow Road, South Ferriby, North Lincolnshire. Volume* **1***: text, illustrations, and photographs*, Unpubl rep

Clay, C, 2010 Roman forts in Lincolnshire, in S Malone and M Williams (eds), *'Rumours of Roman finds': recent work on Roman Lincolnshire*, Heckington, 30-42

Cohen, A, and Serjeantson, D, 1996 *A manual for the identification of bird bones from archaeological sites*, London

Coles, B J, 1998 Doggerland: a speculative survey, *Proc Prehist Soc*, **64**, 45-81

Collyer, W, 2018 *An updated fabric type series for post-Roman pottery from North Lincolnshire (fifth to sixteenth centuries)*, Unpubl rep

Conneller, C, 2022 *The Mesolithic in Britain: landscape and society in times of change*, London

Cool, H E M, 2006 *Eating and drinking in Roman Britain*, Cambridge

Copley, M S, Berstan, R, Dudd, S N, Docherty, G, Mukherjee, A J, Straker, V, Payne, S, and Evershed, R P, 2003 Direct chemical evidence for widespread dairying in prehistoric Britain, *Proc Nat Acad Sci USA*, **100**(4), 1524-9

Corder, P, 1928 *The Roman Pottery at Crambeck, Castle Howard*, Roman Malton District Rep, **1**, York

Corder, P, and Kirk, J L, 1932 *A Roman Villa at Langton, near Malton E Yorkshire*, Roman Malton and District Rep, **4**, York

Correa-Ascencio, M, and Evershed, R P, 2014 High throughput screening of organic residues in archaeological potsherds using direct acidified methanol extraction, *Analytic Method*, **6**(5), 1330-40

Courty, M A, 2001 Microfacies analysis assisting archaeological stratigraphy, in P Goldberg, V T Holliday, and C R Ferring (eds), *Earth sciences and archaeology*, New York, 205-39

Courty, M A, and Fedoroff, N, 1982 Micromorphology of a Holocene dwelling, *Proc Nordic Archaeometry*, **7**, 257-77

Courty, M A, Goldberg, P, and Macphail, R I, 1989 *Soils and micromorphology in archaeology*, 1st edn, Cambridge

Cox, M L, 2007 *Atlas of the seed and leaf beetles of Britain and Ireland*, Newbury

Creighton, J, 1990 The Humber frontier in the first century AD, in S Ellis and D R Crowther (eds), *Humber perspectives: a region through the ages*, Hull, 182-98

Crowther, J, 2003 Potential magnetic susceptibility and fractional conversion studies of archaeological soils and sediments, *Archaeometry*, **45**(4), 685-701

Crowther, J, and Barker, P, 1995 Magnetic susceptibility: distinguishing anthropogenic effects from the natural, *Archaeol Prospect*, **2**, 207-15

Cumberpatch, C C, 2018 Late prehistoric and Romano-British hand-made pottery, in Burgess and Daniel 2018, 38-63

Cummings, V, 2017 *The Neolithic of Britain and Ireland*, Abingdon

Cunliffe, B, 2005 *Iron Age communities in Britain*, 4th edn, London

Dammers, K, and Joergensen, R G, 1996, Progressive loss of carbon and nitrogen from simulated daub on heating, *J Archaeol Sci*, **23**, 639-48

Darling, M J, 1977 *A group of Late Roman pottery from Lincoln*, Archaeol Lincoln, **16/1**, Lincoln

Darling, M J, 1989 Nice fabric pity about the form, *J Roman Pottery Stud*, **2**, 98-101

Darling, M J, 2000 *Report 74 on the pottery from land off St Barnabas Road, Barnetby le Wold, BBAC,* Unpubl rep

Darling, M J, 2001, Roman Pottery, in Lane and Morris 2001, 202-17

Darling, M J, 2002 *Report 108 on pottery from Barnetby le Wold, BBAD*, Unpubl rep

Darling, M J, 2003 *Report 111 on pottery from the Bridles, Barnetby le Wold, BBAF*, Unpubl rep

Darling, M J, 2004 Guidelines for the archiving of Roman pottery, *J Roman Pottery Stud*, **11**, 67-74

Darling, M J, 2005a *Report 63 on the pottery from Linwood Road, Market Rasen, Lincolnshire*, Unpubl rep

Darling, M J, 2005b *Report 184 on pottery from land off Horkstow Road, South Ferriby, Lincolnshire*, SFAG04, Unpubl rep

Darling, M J, 2006 *Report 217 on pottery from evaluation on land at vehicle redistribution and storage facility, North Killingholme, N Lincolnshire, NKE05*, Unpubl rep

Darling, M J, 2007 *Report 215 on pottery from excavations to the east of Linwood Road, Market Rasen, Lincolnshire*, Unpubl rep

Darling, M J, 2008 *Report 272 on pottery from evaluation on land at vehicle redistribution and storage facility, North Killingholme, North Lincolnshire, NKE07*, Unpubl rep

Darling, M J, 2009 Pottery and other fired clay items, in P Boyer, J Proctor, and R Taylor-Wilson, *On the boundaries of occupation: excavations at Burringham Road, Scunthorpe, and Baldwin Avenue, Bottesford, North Lincolnshire*, PCA Monog, **9**, Saxilby, 37-55

Darling, M J, nd *Market Rasen report*, Unpubl rep

Darling, M J, and Field, N, 2003 The Roman pottery, in N Field and M Parker-Pearson, *Fiskerton: an Iron Age timber causeway with Iron Age and Roman votive offerings*, Oxford, 115-7

Darling, M J, and Precious, B J, 2014 *A corpus of Roman pottery from Lincoln*, Lincoln Archaeol Stud, **6**, Oxford

Deegan, A, 2014 *Air photo and LiDAR mapping and interpretation: Feeder No 9 River Humber pipeline replacement project (Paull), East Riding*, Unpubl rep

Dickinson, B, 1996 Samian pottery, in May 1996, 591-7

Didsbury, P, 1999 *The pottery from Barrow Road, Barton on Humber (BOH99)*, Unpubl rep

Didsbury, P, and Vince, A, 2011 First millennium BC pottery, in Fenton-Thomas 2011, 184-97

Didsbury, P, and Watkins, J G, 1992 The pottery, in D H Evans and D G Tomlinson (eds), *Excavations at 33-35 Eastgate, Beverley*, Sheffield Excav Rep, **3**, Sheffield, 81-121

Dinnin, M, 1995 Introduction to the palaeoenvironmental survey, in Van de Noort and Ellis 1995, 27-48

Dixon, L, and Parker, R, 1994 *Goxhill at war: USAAF fighter training base No 345*, Lincoln

Dobney, K J, and Rielly, K, 1988 A method for recording archaeological animal bones: the use of diagnostic zones, *Circaea*, **5**(2), 79-96

Druce, D, 2018 The charred plant remains, in J Bradley and C Howard-Davis, *From Mesolithic encampment to medieval estate: the archaeology of the Bay Gateway*, Lancaster Imprints 24, Lancaster, 162-7

Dudd, S N, and Evershed, R P, 1998 Direct demonstration of milk as an element of archaeological economies, *Science*, **282**(5393), 1478-81

Dudley, H, 1949 *Early days in north-west Lincolnshire: a regional archaeology*, Scunthorpe

Duff, A G, 2012 *Beetles of Britain and Ireland. Volume **1**: Sphaeriusidae to Silphidae*, Iver

Duff, A G, 2016 *Beetles of Britain and Ireland. Volume **4**: Cerambycidae to Curculionidae*, Iver

Duff, A G (ed), 2018 *Checklist of beetles of the British Isles*, 3rd edn, Iver

Duff, A G, 2020 *Beetles of Britain and Ireland. Volume **3**: Geotrupidae to Scraptiidae*, Iver

Dunbar, E, Cook, G T, Naysmith, P, Tripney, B G, and Xu, S, 2016 AMS 14C dating at the Scottish Universities Environmental Research Centre (SUERC) radiocarbon dating laboratory, *Radiocarbon*, **58**(1), 9-23

Dunne, J, 2023 Organic residue analysis, in Tuck 2023, 192-206

Dunne, J, and Evershed, R P, 2024 Lipid analysis, in Cavanagh 2024, 178-91

Dunne, J, Evershed, R P, Salque, M, Cramp, L, Bruni, S, Ryan, K, Biagetti, S, and di Lernia, S, 2012 First dairying in green Saharan Africa in the fifth millennium BC, *Nature*, **486**(7403), 390-4

East Midlands Historic Environment Research Framework (EMHERF), 2021 *East Midlands Historic Environment Research Framework* [Online] Available at: https://researchframeworks.org/emherf/ (accessed 10 February 2023)

Eisenmann, V, 1986 Comparative osteology of modern and fossil horses, half-assess, and asses, in R H Meadow and H-P Uerpmann (eds), *Equids in the ancient world*, Wiesbaden, 67-116

Ellis, S, 1995 Physical background to Holderness, in Van de Noort and Ellis 1995, 9-17

Ellis, S, Fenwick, H, Lillie, M, and Van de Noort, R (eds), 2001 *Wetland heritage of the Lincolnshire Marsh: an archaeological survey*, Hull

Elsdon, S M, 1996 *Iron Age pottery in the East Midlands: a handbook*, Nottingham

Elsdon, S M, and Knight, D, 2003 The Iron Age pottery, in N Field and M Parker-Pearson, *Fiskerton: an Iron Age timber causeway with Iron Age and Roman votive offerings*, Oxford, 87-92

Emery, A, 2000 *Greater medieval houses of England and Wales, 1300-1500. Volume **II**: East Anglia, Central England, and Wales*, Cambridge

English Heritage, 2007 *Geoarchaeology: using earth sciences to understand the archaeological record*, London

Evershed, R P, 1993 Biomolecular archaeology and lipids, *World Archaeol*, **25**(1), 74-93

Evershed, R P, 2008a Organic residue analysis in archaeology: the archaeological biomarker revolution, *Archaeometry*, **50**(6), 895-924

Evershed, R P, 2008b Experimental approaches to the interpretation of absorbed organic residues in archaeological ceramics, *World Archaeol*, **40**(1), 26-47

Evershed, R P, Mottram, H R, Dudd, S N, Charters, S, Stott, A W, Lawrence, G J, Gibson, A M, Conner, A, Blinkhorn, P W, and Reeves, V, 1997 New criteria for the identification of animal fats preserved in archaeological pottery, *Naturwissenschaften*, **84**(9), 402-6

Evershed, R P, Stott, A W, Raven, A, Dudd, S N, Charters, S, and Leyden, A, 1995 Formation of long-chain ketones in ancient pottery vessels by pyrolysis of acyl lipids, *Tetrahedron Let*, **36**(48), 8875-8

Faegri, K, Iversen, J, Kaland, P E, and Krzywinski, K, 1989 *Textbook of pollen analysis*, 4th edn, Chichester

Farley, J, 2012 *At the edge of empire: Iron Age and Early Roman metalwork in the East Midlands*, Unpubl PhD thesis, Univ Leicester

Farquhar, G D, Ehleringer, J R, and Hubick, K T, 1989 Carbon isotope discrimination and photosynthesis, *Annu Rev Plant Physiol Plant Mol Biol*, **40**(1), 503-37

Fenton-Thomas, C, 2011 *'Where sky and Yorkshire and water meet': the story of the Melton landscape from prehistory to the present*, On-Site Archaeol Monog, **2**, York

Firth, S, Fry, H, Rowlandson, I M, and West, H, 2010 *An appraisal of the Roman pottery from the South Ferriby brickyard, North Lincolnshire*, Unpubl rep

Fleming, F, and Royall, C, 2019 The inner Humber Estuary rapid coastal zone assessment: aerial investigation and mapping project, Hist Engl Res Rep Ser, **86-2019**, Portsmouth

Flenley, J R, 1987 The meres of Holderness, in S Ellis (ed), *East Yorkshire field guide*, Cambridge, 73-81

Foster, G N, Bilton, D T, and Friday, L E, 2014 *Keys to the adults of the water beetles of Britain and Ireland (Part 2)*, Handbooks for the identification of British insects, **4**(5b), Telford

Foster, G N, Bilton, D T, Hammond, M, and Nelson, B H, 2020 *Atlas of water beetles of Britain and Ireland: smaller families of Polyphaga*, Telford

Fulford, M, 2001 Links with the past: pervasive 'ritual' behaviour in Roman Britain, *Britannia*, **32**, 199-218

Garbett, G G, 1981 The Elm Decline: the depletion of a resource, *New Phytol*, **88**, 573-85

Gearey, B R, Hopla, E J, Boomer, I, Smith, D, Marshall, P, Fitch, S, Griffiths, S, and Tapping, D R, 2017 Multi-proxy palaeoecological approaches to submerged landscapes: a case from 'Doggerland', in the southern North Sea, in M Williams, T Hill, I Boomer, and I P Wilkinson (eds), *The archaeological and forensic applications of microfossils: a deeper understanding of human history*, London, 35-53

Gietel-Basten, S, 2020 Circular visualisation of historical migration in England in the long eighteenth-century, *Heliyon*, **6** [Online] Available at: https://doi.org/10.1016/j.heliyon.2020.e05490 (accessed 08 September 2023)

Gillam, J P, 1970 *Types of coarse Roman pottery vessels found in northern Britain*, 3rd edn, Newcastle upon Tyne

Glover, G, Flintoft, P, and Moore, R (eds), 2016 *'A mersshy contree called Holdernesse'. Excavations on the route of a National Grid pipeline in Holderness, East Yorkshire*, Oxford

Goldberg, P, Macphail, R I, Carey, C, and Zhuang, Y, 2022 *Practical and theoretical geoarchaeology*, 2nd edn, Chichester

Goudie, A, 1983 *Environmental change*, 2nd edn, Oxford

Grant, A, 1982 The use of tooth wear as a guide to the age of domestic ungulates, in B Wilson, C Grigson, and S Payne (eds), *Ageing and sexing animal bones from archaeological sites*, BAR Brit Ser, **109**, Oxford, 91-108

Gregg, M W, Banning, E B, Gibbs, K, and Slater, G F, 2009 Subsistence practices and pottery use in Neolithic Jordan: molecular and isotopic evidence, *J Archaeol Sci*, **36**(4), 937-46

Gregory, A K, 1996 Romano-British pottery, in May 1996, 513-65

Gregory, R A, and Brown, F, 2025 *Pioneers, settlers, villagers, and warriors: excavations at Ronaldsway Airport, Isle of Man*, Lancaster Imprints, **34**, Lancaster

Gregory, R A, Daniel, P, and Brown, F, 2013 *Early landscapes of West and North Yorkshire: archaeological investigation along the Asselby to Pannal natural gas pipeline 2007-8*, Lancaster Imprints, **21**, Lancaster

Greig, J, 1991 The British Isles, in W van Zeist, K Wasylikowa, and K-E Behre (eds), *Progress in Old World palaeoethnobotany: a retrospective view on the occasion of 20 years of the International Work Group for Palaeoethnobotany*, Rotterdam, 299-334

Grieve, M, 1973 *A modern herbal*, rev edn, West Molesey

Griffiths, S (ed), 2022 *Scientific dating in archaeology*, Stud Sci Archaeol, **5**, Oxford

Grimm, E C, 1991-2011 *Tilia, Tilia-Graph, and TG-View*, Springfield

Grosvenor, M J, Jones, R T, Turney, C S M, Charman, D J, Hogg, A, Coward, D, and Wilson, R, 2017 Human activity was a major driver of the mid-Holocene vegetation change in southern Cumbria: implications for the Elm Decline in the British Isles, *J Quat Sci*, **32**(7), 934-45

Hall, A R, and Huntley, J P, 2007 *A review of the evidence for macrofossil plant remains from archaeological deposits in northern England*, Engl Heritage Res Dept Rep Ser, **87**, London

Hall, A R, Jones, A K, and Kenward, H K, 1983 Cereal bran and human faecal remains from archaeological deposits: some preliminary observations, in B Proudfoot (ed), *Site, environment, and economy*, BAR Int Ser, **173**, 85-104

Hall, A R, and Kenward, H K, 1990 *Environmental evidence from the Colonia: General Accident and Rougier Street*, The Archaeology of York: the past environment of York, **14**(6), London, 289-434

Halmemies-Beauchet-Filleau, A, Vanhatalo, A, Toivonen, V, Heikkilä, T, Lee, M, and Shingfield, K, 2013 Effect of replacing grass silage with red clover silage on ruminal lipid metabolism in lactating cows fed diets containing a 60:40 forage-to-concentrate ratio, *J Dairy Sci*, **96**(9), 5882-900

Halmemies-Beauchet-Filleau, A, Vanhatalo, A, Toivonen, V, Heikkilä, T, Lee, M, and Shingfield, K, 2014 Effect of replacing grass silage with red clover silage on nutrient digestion, nitrogen metabolism, and milk fat composition in lactating cows fed diets containing a 60:40 forage-to-concentrate ratio, *J Dairy Sci*, **97**(6), 3761-76

Halstead, P, 1985 A study of the mandibular teeth from Romano-British contexts at Maxey, in F Pryor and C French (eds), *Archaeology and environment of the Lower Welland Valley*, The Fenland Project, **1**, East Anglian Archaeology, **27**, Cambridge, 219-82

Halstead, P, and Collins, P, 1995 *Sheffield animal bone tutorial*: *taxonomic identification of the principal limb bones of common European farmyard animals and deer: a multimedia tutorial*, Archaeology Consortium, TL TP, Univ Glasgow

Hamilton, D, and Kinnaird, T, 2022 Building chronologies for Europe's lost frontiers: radiocarbon dating and age-depth modelling, in V Gaffney and S Fitch (eds), *Europe's lost frontiers. Volume* **1***: context and methodology*, Oxford, 181-9

Hansen, M, 1987 *The Hydrophiloidea (Coleoptera) of Fennoscandia and Denmark*, Fauna Entomologica Scandinavica, **18**, Leiden

Harding, D W, 1974 *The Iron Age in lowland Britain*, London

Harding, D W, 2009 *The Iron Age roundhouse: later prehistoric buildings in Britain and beyond*, Oxford

Harding, D W, 2011 *The Iron Age in northern Britain: Celts and Romans, natives and invaders*, 2nd edn, Abingdon and New York

Hartley, B, Barber, H G, Carter, J R, and Sims, P A, 1996 *An atlas of British diatoms*, Bristol

Hartley, B R, and Fitts, R L, 1988 *The Brigantes*, Gloucester

Haslegrove, C C, 1982 Indigenous settlement patterns in the Tyne-Tees lowlands, in P A G Clark and C C Haselgrove (eds), *Rural settlement in the Roman North*, Durham, 57-104

Haselgrove, C, and Moore, T, 2007 New narratives of the later Iron Age, in C Haselgrove and T Moore (eds), *The later Iron Age in Britain and beyond*, Oxford, 1-15

Hathaway, S J E, 2013 *Making the invisible visible: Iron Age and Roman salt production in southern Britain*, Unpubl PhD thesis, Univ Bournemouth [Online] Available at: https://eprints.bournemouth.ac.uk/21381/ (accessed 17 February 2023)

Hather, J G, 2000 *The identification of the northern European woods: a guide for archaeologists and conservators*, London

Headland Archaeology, 2021 *North Killingholme, North Lincolnshire: archaeological evaluation (trial trenching)*, Unpubl rep [Online] Available at: https://doi.org/10.5284/1095749 (accessed 13 September 2023)

Hendey, N I, 1964 *An introductory account of the smaller algae of British coastal waters. Part V: Bacillariophyceae (Diatoms)*, Ministry Agricult Fisheries Food, **4**, London

Henson, D, 1985 The flint resources of Yorkshire and the East Midlands, *Lithics*, **6**, 2-9

Hill, J D, 1995 *Ritual and rubbish in the Iron Age of Wessex: a study of the formation of a specific archaeological record*, BAR Brit Ser, **242**, Oxford

Hillman, G C, Mason, S, de Moulins, D, and Nesbitt, M, 1996 Identification of archaeological remains of wheat: the 1992 London workshop, *Circaea*, **12**(2), 195-209

Hillson, S, 2005 *Teeth*, 2nd edn, Cambridge

Hingley, R, 1989 *Rural settlement in Roman Britain*, London

Historic England, 2015 *Management of research projects in the historic environment: the MoRPHE project manager's guide*, London

Historic England, 2023a *Thornton Abbey Augustinian monastery: gatehouse, precinct, medieval road and bridge, moat, fishponds, post-Dissolution college and school, and house* [Online] Available at: https://historicengland.org.uk/listing/the-list/list-entry/1011198 (accessed 12 September 2023)

Historic England, 2023b *Goxhill Hall, South End* [Online] Available at: https://historicengland.org.uk/listing/the-list/list-entry/1346831 (accessed 12 September 2023)

Historic England, 2023c *Goxhill Hall moated site, associated drainage system, fishponds, and field system* [Online] Available at: https://historicengland.org.uk/listing/the-list/list-entry/1007820 (accessed 12 September 2023)

Houk, V, Klee, R, and Tanaka, H, 2010 Atlas of freshwater centric diatoms with a brief key and descriptions. Part III: Stephanodiscaceae A, *Cyclotella Tertiarius Discostella, Fottea*, **10**, 1-498

Hu, F S, Slawinski, D, Wright Jr, H E, Ito, E, Johnson, R G, Kelt, K R, McEwan, R F, and Boedigheimeer, A, 1999 Abrupt changes in North American climates during early Holocene times, *Nature*, **400**, 437-40

Humber Field Archaeology (HFA), 2001 *Interim report on the archaeology of the Immingham combined heat and power site, Killlingholme, North Lincolnshire*, Unpubl rep

Humber Field Archaeology (HFA), 2006 *Archaeological excavations on land at Immingham combined heat and power plant, Killingholme, North Lincolnshire*, Unpubl rep

Humber Field Archaeology (HFA), 2010 *South Humber channel marine studies: archaeology and cultural heritage desk study*, Unpubl rep

Humber Field Archaeology (HFA), 2015 *Archaeological monitoring of site investigations: Feeder 9 River Humber gas pipeline replacement project, Goxhill, North Lincolnshire and Paull, East Riding of Yorkshire*, Unpubl rep

Humphrey, J, and Young, R, 1999 Flint use in later Bronze Age and Iron Age England – still a fiction?, *Lithics*, **20**, 57-61

Hustedt, F, 1953 Die systematik der diatomeen in ihren beziehungen zur geologie und ekologie nebst einer revision des halobien-systems, *Svensk Bot Tidskr*, **47**, 509-19

Hustedt, F, 1957 Die diatomeenflora des fluss-systems der Weser im gebiet der Hansestadt Bremen, *Ab Naturw Ver Bremen*, **34**, 181-440

Hyder Consulting (UK) Limited, 2014 *National Grid River Humber pipeline replacement project: environmental impact assessment*, Unpubl rep

Hyder Consulting (UK) Limited, 2015 *National Grid River Humber pipeline replacement project, Appendix 6.1: desk-based assessment*, Unpubl rep

Innes, J B, Blackford, J J, and Chambers, F M, 2006 *Kretzschmaria deusta* and the north-west European mid-Holocene *Ulmus* decline at Moey y Gerdii, North Wales, UK, *Palynol*, **30**(1), 121-32

Innes, J B, Blackford, J J, and Simmons, I G, 2011 Mesolithic environments at Star Carr, the eastern Vale of Pickering and environs: local and regional contexts, *J Wetland Archaeol*, **1**, 85-108

Jaques, D, Schmidl, A, and Carrott, J, 2011 Plant, invertebrate, and vertebrate remains, in Fenton-Thomas 2011, 289-319

Jones, A K G, 1982 Human parasite remains: prospects for a quantitative approach, in A R Hall and H K Kenward (eds), *Environmental archaeology in the urban context*, CBA Res Rep, **43**, London, 66-70

Jones, B, and Mattingly, D, 1990 *An atlas of Roman Britain*, Oxford

Jones, D, 1998 Romano-British settlements on the Lincolnshire Wolds, in R H Bewley, *Lincolnshire's archaeology from the air*, Occ Pap Lincolnshire Hist Archaeol, **11**, Lincoln

Jones, D, and Whitwell, J B, 1991 Survey of the Roman fort and multi-period settlement complex at Kirmington on the Lincolnshire Wolds: a non-destructive approach, *Lincolnshire Hist Archaeol*, **26**, 57-62

Jones, G G, and Sadler, P, 2012 Age at death in cattle: methods, older cattle, and known-age reference material, *Envir Archaeol*, **17**(1), 11-28

Kearney, K, and Gearey, B R, 2020 The Elm Decline is dead! Long live declines in elm: revisiting the chronology of the Elm Decline in Ireland and its association with the Mesolithic/Neolithic transition, *Envir Archaeol* [Online] Available at: https://doi.org/10.1080/14614103.2020.1721694 (accessed 4 October 2023)

Kenward, H K, 1997 Synanthropic decomposer insects and the size, remoteness, and longevity of archaeological occupation sites: applying concepts from biogeography to past 'islands' of human occupation, in A C Ashworth, P C Buckland, and J T Sadler (eds), *Studies in Quaternary entomology: an inordinate fondness for insects*, London, 135-52

Kenward, H K, and Hall, A R, 1995 *Biological evidence from Anglo-Scandinavian deposits at 16-22 Coppergate*, Archaeology of York: Past Environment of York, **14**(7), 435-797

Kenward, H K, Hall, A R, and Jones, A K G, 1980 A tested set of techniques for the extraction of plant and animal macrofossils from waterlogged archaeological deposits, *Sci Archaeol*, **22**, 3-15

Kenward, H K, Hall, A R, and Jones, A K G, 1986 *Environmental evidence from a Roman well and Anglian pits in the legionary fortress*, The Archaeology of York: the past environment of York, **14**(5), London

King, A, 1984 Animal bones and the dietary identity of military and civilian groups in Roman Britain, Germany, and Gaul, in T Blagg and A King (eds), *Military and civilian in Roman Britain*, BAR Brit Ser, **136**, Oxford, 187-217

King, A, 1990 *Roman Gaul and Germany*, London

Knight, D, 1994, *Late Bronze Age/Early Iron Age pottery from Tetney*, Unpubl rep

Knight, D, 1998, *Guidelines for the recording of later prehistoric pottery from the East Midlands*, Unpubl rep

Knight, D, 2002 A regional ceramic sequence: pottery of the first millennium BC between the Humber and the Nene, in A Woodward and J D Hill (eds), *Prehistoric Britain: the ceramic basis*, Oxford, 118-42

Knight, D, Vyner, B, and Allen, C, 2012 *East Midlands heritage: an updated research agenda and strategy for the historic environment of the East Midlands*, Nottingham Archaeol Monog, **6**, Nottingham

Krammer, K, and Lange-Bertalot, H, 1986 Bacillariophyceae 1. Teil: Naviculaceae, in H Ettl, J Gerloff, H Heynig, and D Mollenhauer (eds), *Süsswasserflora von Mitteleuropa, Band* **2/1**, Stuttgart and New York, 876

Krammer, K, and Lange-Bertalot, H, 1988 Bacillariophyceae 2. Teil: Bacillariaceae, Epithemiaceae, Surirellaceae, in H Ettl, J Gerloff, H Heynig, and D Mollenhauer (eds), *Süsswasserflora von Mitteleuropa, Band* **2/2**, Jena, 596

Krammer, K, and Lange-Bertalot, H, 1991a Bacillariophycea 3. Teil: Centrales, Fragilariaceae, Eunotiaceae, in H Ettl, J Gerloff, H Heynig, and D Mollenhauer (eds), *Süsswasserflora von Mitteleuropa, Band* **2/3**, Stuttgart and Jena, 576

Krammer, K, and Lange-Bertalot, H, 1991b Bacillariophyceae 4. Teil: Achnanthaceae, Kritische Ergänzungen zu Navicula (Lineolatae) und Gomphonema, Gesamtliteraturverzeichnis Teil 1-4, in H Ettl, J Gerloff, H Heynig, and D Mollenhauer (eds), *Süsswasserflora von Mitteleuropa, Band* **2/4**, Stuttgart and Jena, 437

Lane, T, 2005 The wider context of the Cheshire salt industry: Iron Age and Roman salt production around the Wash, in M Nevell and A P Fielding (eds), *Brine in Britannia: recent archaeological work on the Roman salt industry in Cheshire*, Archaeol North West, **7**, Manchester, 47-54

Lane, T, 2018 *Mineral from the marshes: coastal salt-making in Lincolnshire*, Lincolnshire Hist Archaeol Heritage Rep Ser, **12**, Heckington

Lane, T, and Morris, E M A (eds), 2001 *Millennium of saltmaking: prehistoric and Romano-British salt production in the Fenland*, Lincolnshire Archaeol Heritage Rep Ser, **4**, Heckington

Lane, T, and Trimble, D, 2010 *Fluid landscapes and human adaption: excavations on prehistoric sites on the Lincolnshire Fen edge 1991-1994*, Lincolnshire Archaeol Heritage Rep Ser, **9**, Heckington

Lauwerier, R, 1988 *Animals in Roman times in the Dutch eastern river area*, Amersfoort

Leahy, K, 2008 *The Anglo-Saxon kingdom of Lindsey: the archaeology of an Anglo-Saxon kingdom*, Stroud

Leary, J, 2009 Perceptions of and responses to the Holocene flooding of the North Sea lowlands, *Oxford J Archaeol*, **28**, 227-37

Leary, J, 2011 Experiencing change on the prehistoric shores of Northsealand: an anthropological perspective on early Holocene sea-level rise, in J Benjamin, C Bonsall, C Pickard, and A Fischer (eds), *Submerged prehistory*, Oxford, 75-84

Leary, J, 2015 *The remembered land: surviving sea-level rise after the last Ice Age. Debates in archaeology*, London

Leary, R S, 2013 The Late Iron Age and Romano-British pottery, in Willis 2013, 183-245

Levine, M, 1982 The use of crown height measurements and eruption sequences to age horse teeth, in B Wilson, C Grigson, and S Payne (eds), *Ageing and sexing animal bones from archaeological sites*, BAR Bri Ser, **109**, Oxford, 223-50

Lewis, J, Leivers, M, Brown, L, Smith, A, Cramp, K, Mepham, L, and Phillpotts, C, 2010 *Landscape evolution in the Middle Thames Valley. Heathrow Terminal 5 excavations. Volume* **2**, Framework Archaeol Monog, **13**, Oxford and Salisbury

Lillie, M, 1997 The palaeoenvironmental survey of the Rivers Aire, Went, former Turnbridge Dike (Don North Branch) and the Hampole Beck, in R Van de Noort and S Ellis (eds), *Wetland heritage of the Humberhead Levels: an archaeological survey*, Hull, 47-78

Lindsey Archaeological Services (LAS), 2006 *Vehicle redistribution and storage facility, North Killingholme, N Lincs: archaeological evaluation trenches (Area E)*, Unpubl rep

Lodwick, L, 2017 Arable farming, plant foods, and resources, in M Allen, L Lodwick, T Brindle, M Fulford, and A Smith, *New visions of the countryside of Roman Britain. Volume* **2***: the rural economy of Roman Britain*, Britannia Monog Ser, **30**, London, 11-84

Long, A J, Innes, J B, Kirby, J, Lloyd, J M, Rutherford, M M, Shennan, I, and Tooley, M J, 1998 Holocene sea-level change and coastal evolution in the Humber Estuary, eastern England: an assessment of rapid coastal change, *Holocene*, **8**, 229-47

Lott, D A, 2009 *The Staphylinidae (rove beetles) of Britain and Ireland. Part 5: Scaphidiinae, Piestinae, Oxytelinae*, Handbooks for the identification of British insects, **12**(5), Shrewsbury

Lott, D A, and Anderson, R, 2011 *The Staphylinidae (rove beetles) of Britain and Ireland. Parts 7 and 8: Oxyporinae, Steninae, Euaesthetinae, Pseudopsinae, Paederinae, Staphylininae*, Handbooks for the identification of British insects, **12**(7 and 8), Shrewsbury

Loughlin, N, 1977 Dales ware: a contribution to the study of Roman coarse pottery, in D P S Peacock (ed), *Pottery and early commerce: characterisation and trade in Roman and later ceramics*, London, 35-84

Loughlin, N, and Miller, K R, 1979 *A survey of archaeological sites in Humberside*, Hull

Loveluck, C, 1999 Archaeological expression of the transition from the Late Roman to Early Anglo-Saxon period in lowland East Yorkshire, in P Halkon and M Millet (eds), *Rural settlement and industry: studies in the Iron Age and Roman archaeology of lowland East Yorkshire*, Yorkshire Archaeol Rep, **4**, Leeds, 228-36

Luff, M L, 2007 *The Carabidae (ground beetles) of Britain and Ireland*, Handbooks for the identification of British insects, **4**(2), 2nd edn, Shrewsbury

Lyman, R L, 1994 *Vertebrate taphonomy*, Cambridge

McKeown, J C, 2010 *A cabinet of Roman curiosities: strange tales and surprising facts from the world's greatest empire*, Cambridge

McKinley, J I, 2004 Compiling a skeletal inventory: cremated human bone, in Brickley and McKinley 2004, 9-13

Macphail, R I, 1994 Soil micromorphological investigations in archaeology, with special reference to drowned coastal sites in Essex, *SEESOIL*, **10**, 13-28

Macphail, R I, Allen, M J, Crowther, J, Cruise, G M, and Whittaker, J E, 2010 Marine inundation: effects on archaeological features, materials, sediments, and soils, *Quat Int*, **214**, 44-55

Macphail, R I, Bill, J, Crowther, J, Haită, C, Linderholm, J, Popovici, D, and Rødsrud, C L, 2017 European ancient settlements. A guide to their composition and morphology based on soil micromorphology and associated geoarchaeological techniques: introducing the contrasting sites of Chalcolithic Borduşani-Popină, Borcea River, Romania, and the Viking Age Heimdaljordet, Vestfold, Norway, *Quat Int*, **460**, 30-47

Macphail, R I, and Crowther, J, 2010 *Landscape evolution in the Middle Thames Valley. Heathrow Terminal 5 excavations Volume* **2***, Section 19: soil micromorphology, chemistry, magnetic susceptibility, and particle size analyses*, Framework Archaeol Monog, **13**, Oxford and Salisbury, [Online] Available at: https://framearch.co.uk/t5/wp-content/docs/T5_Volume_2_SpecialistReports.zip (acccessed 10 May 2023)

Macphail, R I, Crowther, J, and Berna, F, 2012 Soil micromorphology, microchemistry, chemistry, magnetic susceptibility and FTIR, in Biddulph *et al* 2012, 193

Macphail, R I, and Cruise, G M, 2001 The soil micromorphologist as team player: a multianalytical approach to the study of European microstratigraphy, in P Goldberg, V T Holliday, and C Ferring (eds), *Earth sciences and archaeology*, New York, 241-67

Macphail, R I, and Goldberg, P, 2018 *Applied soils and micromorphology in archaeology*, Cambridge

Mainman, A, 1990 A*nglo-Scandinavian pottery from Coppergate.* The Archaeology of York: the pottery, **16/5**, London

Majerus, M E N, 1994 *Ladybirds*, London

Malone, S, 2010 Rumours of Roman finds: updating Roman Lincolnshire, in S Malone and M Williams (eds), *'Rumours of Roman finds': recent work on Roman Lincolnshire*, Heckington, 1-14

Maltby, M, 2006 Salt and animal products: linking production and use in Iron Age Britain, in M Maltby (ed), *Integrating zooarchaeology*, Oxford, 117-22

Mason, P, 2008 *Archaeological trial excavation and topographic survey of land at East Halton, Lincolnshire*, Unpubl rep [Online] Available at: https://doi.org/10.5284/1008563 (accessed 13 July 2023)

May, E, 1985 Widerristhöhe und Langenknochenmaße bei Pferden: Ein immer noch aktuelles Problem, *Zeitschrift Säugetierkunde*, **50**, 368-82

May, J, 1996 *Dragonby: report on excavations at an Iron Age and Romano-British settlement in North Lincolnshire*, Oxbow Monog, **61**, Oxford

Medieval Pottery Research Group (MPRG), 1998 *A guide to the classification of medieval ceramic forms*, Medieval Pottery Res Group Occas Pap, **1**, London

Metcalfe, S E, Ellis, S, Horton, B P, Innes, J B, McArthur, J, Mitlehner, A, Parkes, A, Pethick, J S, Rees, J, Ridgway, J, Rutherford, M M, Shennan, I, and Tooley, M J, 2000 The Holocene evolution of the Humber Estuary: reconstructing change in a dynamic environment, in I Shennan and J Andrews (eds), *Holocene land-ocean interaction and environmental change around the North Sea*, Geol Soc London Spec Publ, **166**, London, 97-118

Millett, M, 1999 New perspectives on the *civitas Parisorum*, in P Halkon and M Millett (eds), *Rural settlement and industry: studies in the Iron Age and Roman archaeology of lowland East Yorkshire*, Yorkshire Archaeol Rep, **4**, Leeds, 221-7

Monaghan, J, 1997, *Roman pottery from York*, The Archaeology of York: the pottery, **16**(8), London

Monaghan, J, 2000 The pottery, in P Ottaway, Excavations on the site of the Roman signal station at Carr Naze, Filey, 1993-94, *Archaeol J*, **157**, 140-7

Mook, W G, 1986 Business meeting: recommendations/resolutions adopted by the Twelfth International Radiocarbon Conference, *Radiocarbon*, **28**, 799

Moore, J, 2003 Beyond hazelnuts and into the forest, in L Bevan and J Moore (eds), *Peopling the Mesolithic in a northern environment*, BAR Int Ser, **1157**, Oxford, 53-8

Moore, P D, Webb, J A, and Collinson, M E, 1991 *Pollen analysis*, 2nd edn, Oxford

Moorhouse, S, 2003 Medieval Yorkshire, a rural landscape for the future, in T G Manby, S Moorhouse, and P Ottaway (eds), 2003 *The archaeology of Yorkshire, an assessment at the beginning of the 21st century*, Yorkshire Archaeol Soc Occas Pap, **3**, Leeds, 181-214

Morales, E A, Guerrero, J M, Wetzel, C E, Sala, S, and Ector, L, 2013 Unravelling the identity of *Fragilaria pinnata* Ehrenberg and *Staurosira pinnata* Ehrenberg: research in progress on a convoluted story, *Cryotogamie Algologie*, **34**, 89-102

Morris, M G, 2002 *True weevils (Part 1), Coleoptera Curculionoidea (Subfamilies Raymondionyminae to Smicronychinae)*, Handbooks for the identification of British insects, **5**(17b), London

Mukherjee, A J, Copley, M S, Berstan, R, Clark, K A, and Evershed, R P, 2005 Interpretation of $\delta^{13}C$ values of fatty acids in relation to animal husbandry, food processing, and consumption in prehistory, in J Mulville and A Outram (eds), *The zooarchaeology of milk and fats,* Oxford, 77-93

Muldowney, L, Weston, P, and Wylie, J, 2009 *Vehicle redistribution and storage facility, Areas D3, D5, and D7, Killingholme, North Lincolnshire*, Unpubl rep [Online] Available at: https://doi.org/10.5284/1033905 (accessed 13 July 2023)

Nayling, N, and Caseldine, A, 1997 *Excavations at Caldicot, Gwent: Bronze Age palaeochannels in the lower Nedern Valley,* CBA Res Rep, **8**, York

Neal, P, 2001 Romano-British settlement, East Halton Skitter, North Lincolnshire, *Annu Rep Humber Wetlands Survey*, **6**, 11-15

Nevell, M, and Roberts, J, 2005 Towards an understanding of the rural economy and society of the Iron Age and Romano-British landscape of the Mersey basin and the southern Pennines, in M Nevell and N Redhead (eds), *Mellor: living on the edge. A regional study of an Iron Age and Romano-British settlement*, Manchester Archaeol Monog, **1**, Manchester, 107-18

Oswald, A J, Goodall, J, Payne, A, and Sutcliffe, T J, 2010 *Thornton Abbey, North Lincolnshire: historical, archaeological, and architectural investigations*, Engl Heritage Res Dept Rep Ser, **100-2010**, Swindon

Outram, A K, Stear, N A, Bendrey, R, Olsen, S, Kasparov, A, Zaibert, V, Thorpe, N, and Evershed, R P, 2009 The earliest horse harnessing and milking, *Science*, **323**(5919), 1332-5

Oxford Archaeology (OA) East, 2012 *An Iron Age settlement and Romano-British villa complex at Itter Crescent, Peterborough: post-excavation assessment*, Unpubl rep

Oxford Archaeology (OA) North, 2016a *Feeder No 9 River Humber pipeline replacement, Goxhill, North Lincolnshire: archaeological evaluation report*, Unpubl rep

Oxford Archaeology (OA) North, 2016b *Feeder No 9 River Humber pipeline replacement, Goxhill, North Lincolnshire: project design for archaeological mitigation*, Unpubl rep

Oxford Archaeology (OA) North, 2021 *River Humber gas pipeline replacement project, Paull, East Yorkshire: archaeological trial trench, watching brief, and palaeoenvironmental coring report*, Unpubl rep

Oxford Archaeology (OA) North, 2022 *Feeder No 9 River Humber pipeline replacement, Goxhill, North Lincolnshire: post-excavation assessment report*, Unpubl rep

Page, W (ed), 1906 *The Victoria history of the county of Lincoln*, **2**, London

Parker, A G, Goudie, A S, Anderson, D E, Robinson, M A, and Bonsall, C, 2002 A review of the mid-Holocene Elm Decline in the British Isles, *Progr Phys Geogr*, **26**(1), 1-45

Payne, S, 1975 Partial recovery and sample bias, in A T Clason (ed), *Archaeozoological studies*, Oxford, 7-17

Peacock, D P S, 1982 *Pottery in the Roman world: an ethnoarchaeological approach*, London

Peacock, D P S, and Williams, D F, 1986 *Amphorae and the Roman economy*, London

Peeters, J H M, Amkreutz, L W S W, Cohen, K M, and Hijma, M P, 2019 *North Sea Prehistory Research and Management Framework (NSPRMF) 2019: retuning the research and management agenda for prehistoric landscapes and archaeology in the Dutch sector of the continental shelf*, Nederlandse Archeologische Rapporten, **63**, Amersfoort

Peňa, J T, 2007 *Roman pottery in the archaeological record*, Cambridge

Pethick, J S, 1990 The Humber Estuary, in S Ellis and D R Crowther (eds), *Humber perspectives: a region through the ages*, Hull, 54-70

Pevsner, N, and John, H, 1964 *The buildings of England: Lincolnshire*, London

Pollard, R J, 1990 Quantification: towards a standard practice, *J Roman Pottery Stud*, **3**, 75-9

Pope, R, 2015 Bronze Age architectural traditions: dates and landscapes, in F Hunter and I B M Ralston (eds), *Scotland in late prehistoric Europe*, Edinburgh, 159-84

Precious, B, 1993 *Market Deeping (MAD91): Roman pottery assessment*, Unpubl rep

Precious, B, Vince, A, Steane, K, Hartley, K, and Rowlandson, I, 2011 Roman and Romano-British pottery in Fenton-Thomas 2011, 213-25

Prehistoric Ceramics Research Group (PCRG), Study Group for Roman Pottery (SGRP), and Medieval Pottery Research Group (MPRG), 2016 *A standard for pottery studies in archaeology*, London

Rackham, J, Giorgi, J, and Scaife, R, 2011 *Palaeoenvironmental study of the sediments at 14/9, Paull Holme and 15/1, Cow Hill, Easington to Paull natural gas pipeline*, Unpubl rep

Ramsay, J H, 1898 *The foundations of England, or twelve centuries of British history (BC 55-AD 1154)*, London

Raven, A M, van Bergen, P F, Stott, A W, Dudd, S N, and Evershed, R P, 1997 Formation of long-chain ketones in archaeological pottery vessels by pyrolysis of acyl lipids, *J Anal Appl Pyrol*, **40-41**, 267-85

Reimer, P, Austin, W, Bard, E, Bayliss, A, Blackwell, P, Bronk Ramsey, C, Butzin, M, Cheng, H, Edwards, R, Friedrich, M, Grootes, P, Guilderson, T, Hajdas, I, Heaton, T, Hogg, A, Hughen, K, Kromer, B, Manning, S, Muscheler, R, Palmer, J, Pearson, C, van der Plicht, J, Reimer, R, Richards, D, Scott, E, Southon, J, Turney, C, Wacker, L, Adolphi, F, Büntgen, U, Capano, M, Fahrni, S, Fogtmann-Schulz, A, Friedrich, R, Köhler, P, Kudsk, S, Miyake, F, Olsen, J, Reinig, F, Sakamoto, M, Sookdeo, A, and Talamo, S, 2020 The IntCal20 Northern Hemisphere radiocarbon age calibration curve (0-55 cal kBP), *Radiocarbon*, **62**, *1-33*

Reineck, H E, and Singh, I B, 1986 *Depositional sedimentary environments*, Berlin

Rentzel, P, Nicosia, C, Gebhardt, A, Brönnimann, D, Pümpin, C, and Ismail-Meyer, K, 2017 Trampling, poaching, and the effects of traffic, in C Nicosia and G Stoops (eds), *Archaeological soil and sediment micromorphology*, Chichester, 281-98

Richardson, J, 2011 Bronze Age cremations, Iron Age and Roman settlement and early medieval inhumations at the Langeled Receiving Facilities, Easington, East Riding of Yorskshire, *Yorkshire Archaeol J*, **83**, 59-100

Ridgway, J, Andrews, J E, Ellis, S, Horton, B P, Innes, J B, Knox, R W O B, McArthur, J J, Maher, B A, Metcalfe, S E, Mitlehner, A, Parkes, A, Rees, J G, Samways, G M, and Shennan, I, 2000 Analysis and interpretation of Holocene sedimentary sequences in the Humber Estuary, in I Shennan and J Andrews (eds), *Holocene land-ocean interaction and environmental change around the North Sea*, Geol Soc Spec Publ, **166**, London, 9-39

Rigby, V, 2004 Pots in pits: the British Museum East Yorkshire Settlements Project 1988-1992, *East Riding Archaeol*, **11**, 1-224

Rigby, V, and Stead, I M, 1976 Coarse pottery, in Stead 1976, 136-90

Rixson, D, 1989 Butchery evidence on animal bones, *Circaea*, **6**(1), 49-62

Rodwell, W, and Atkins, C, 2011 *St Peter's, Barton-upon-Humber, Lincolnshire: a parish church and its community. Volume **1**: history, archaeology, and architecture*, Oxford

Roffet-Salque, M, Dunne, J, Altoft, D T, Casanova, E, Cramp, L J E, Smyth, J, Whelton, H, and Evershed, R P, 2017 From the inside out: upscaling organic residue analyses of archaeological ceramics, *J Archaeol Sci Rep*, **16**, 627-40

Röpke, A, and Dietl, C, 2017 Burnt soils and sediments, in C Nicosia and G Stoops (eds), *Archaeological soil and sediment micromorphology*, Chichester, 173-9

Rowlandson, I M, 2011 The Roman pottery, in N Field and M McDaid, *Biomass generating station, Hobson Way, Stallingborough, North-East Lincolnshire: archaeological excavation*, Unpubl rep

Rowlandson, I M, 2012a *An assessment of the prehistoric and Roman ceramics from the Hornsea Wind Farm Cable Route evaluation, HWFE12, NLM Acc NCAC*, Unpubl rep

Rowlandson, I M, 2012b *An assessment of the pottery from Hall Farm, Middlegate Lane, Bonby, North Lincolnshire (BYAN, TA 0161 1693)*, Unpubl rep

Rowlandson, I M, 2012c Later prehistoric and Roman pottery, in J Richardson, *Iron Age and Roman settlement at Newbridge Quarry, Pickering, North Yorkshire*, Archaeol Serv WYAS Publ, **12**, Wakefield, 40-50

Rowlandson, I M, 2012d *The prehistoric and Roman ceramics from excavations at land off Falkland Way, Barton-upon-Humber (BAFW09/BAFW10)*, Unpubl rep

Rowlandson, I M, 2013a *A report on the Roman pottery from field walking on the site of the Able Marine Energy Park, North Killingholme, North Lincolnshire, NKAM12*, Unpubl rep

Rowlandson, I M, 2013b *A report on the Roman pottery from an evaluation on the site of the Able Marine Energy Park, North Killingholme, North Lincolnshire, NKAM12*, Unpubl rep

Rowlandson, I M, 2014 *A report on the ceramics from Scouts Lane, New Waltham, North-East Lincolnshire NWAS14*, Unpubl rep

Rowlandson, I M, 2022 *A rapid assessment of the pottery from the Elsham to Lincoln scheme (E2L)*, Unpubl rep

Rowlandson, I M, Darling M J, and Monteil, G, 2011 The Roman pottery, in C Palmer-Brown and J Rylatt, *How times change: Navenby unearthed*, PreConstruct Archaeol Services Monog, **2**, Saxilby, 73-101

Rowlandson, I M, and Fiske, H G, 2018 The wheel-made Romano-British pottery, in Burgess and Daniel 2018, 63-5

Rowlandson, I M, and Fiske, H G, 2019 *Willow Farm, Hibaldstow, North Lincolnshire (HIWI17, NGR SE 9805 0247): prehistoric and Roman pottery assessment*, Unpubl rep

Rowlandson, I M, and Fiske, H G, 2020a The pottery from Hatcliffe Top, in Willis 2020, 20-30

Rowlandson, I M, and Fiske, H G, 2020b *The Roman pottery from Hornsea Offshore Wind Farm, Onshore Electrical Connection, Project Two, Lincolnshire*, Unpubl rep

Rowlandson, I M, and Fiske, H G, 2021 *Hornsea Windfarm Project 2, Lincolnshire (HOW15): Iron Age and Roman pottery assessment*, Unpubl rep

Rowlandson, I M, and Fiske, H G, 2023 Iron Age and Romano-British pottery, in Tuck 2023, 127-92

Rowlandson, I M, and Fiske, H G, 2024 Prehistoric and Romano-British pottery, in Cavanagh 2024, 47-100

Rowlandson, I M, Fiske, H G, Hartley, K F, Mills, J M, Bird, J, and Williams, D, 2021 The Roman pottery, in J Phillips and P Wilson, *Life, death, and rubbish disposal in Roman Norton, North Yorkshire: excavations at Brooklyn House 2015-16,* Oxford, 78-142

Rowlandson, I M, Fiske, H G, and Monteil, G, 2017 *An assessment of the prehistoric and Roman pottery from the Able Marine Energy Park scheme, North Killingholme, North Lincolnshire (NKAM13)*, Unpubl rep

Rowlandson, I M, Hartley, K F, and Monteil, G, 2014 *The prehistoric and Roman pottery from archaeological monitoring during the construction of a search and rescue facility at Humberside International Airport, Kirmington, North Lincolnshire, KMAP (TA 100 101)*, Unpubl rep

Russell, E, and Russell, R, 1987 *Parliamentary enclosure and new Lincolnshire landscapes*, Lincoln

Russell, R, 1995 *The logic of open field systems*, London

Salque, M, 2012 *Regional and chronological trends in milk use in prehistoric Europe traced through molecular and stable isotope signatures of fatty acyl lipids preserved in pottery vessels*, Unpubl PhD thesis, Univ Bristol

Samuels, J, 1979 The excavation of two Romano-British pottery kilns at Barnetby Top, South Humberside, *Lincolnshire Hist Archaeol*, **14**, 11-22

Samuels, J, 1983 *The production of Roman pottery in the East Midlands*, Unpubl PhD thesis, Univ Nottingham

Schmid, E, 1972 *Atlas of animal bones for prehistorians, archaeologists, and Quaternary geologists*, London

Schoenfelder, M, and Richards, J D, 2011 Norse bells: a Scandinavian colonial artefact, in H Hamerow (ed), *Anglo-Saxon studies in archaeology and history*, Oxford, 151-68

Schweingruber, F H, 1990 *Microscopic wood anatomy*, 3rd edn, Birmensdorf

Shennan, I, Lambeck, K, Flather, R, Horton, B P, Innes, J B, McArthur, J, Lloyd, J, Rutherford, M M, and Wingfield, R, 2000a Modelling western North Sea palaeogeographies and tidal changes during the Holocene, in I Shennan and J E Andrews (eds), *Holocene land-ocean interaction and environmental change around the North Sea,* Geol Soc Spec Publ, **166**, 299-319

Shennan, I, Lambeck, K, Horton, B P, Innes, J, B, McArthur, J, Lloyd, J, and Rutherford, M M, 2000b Holocene isostasy and relative sea-level changes on the east coast of England, in I Shennan and J E Andrews (eds), *Holocene land-ocean interaction and environmental change around the North Sea,* Geol Soc Spec Publ, **166**, London, 275-98

Sills, J A, and Kinsley, G, 1978 Grimsby, Weelsby Avenue, *Lincolnshire Hist Archaeol,* **13**, 77-8

Sinclair Knight Merz (SKM), 2010 *Heron renewable energy plant: archaeological trial trenching*, Unpubl rep

Sisson, S, and Grossman, J D, 1938 *The anatomy of the domestic animals*, Philadelphia and London

Slowikowski, A M, Nenk, B, and Pearce, J, 2001 *Minimum standards for the processing, recording, analysis, and publication of post-Roman ceramics*, Medieval Pottery Res Group Occas Pap, **2**, London

Smith, A, 2016 Buildings in the countryside, in A Smith, M Allen, T Brindle, and M Fulford, *New visions of the countryside of Roman Britain. Volume **1**: the rural settlement of Roman Britain*, Britannia Monog Ser, **29**, London, 44-74

Smith, A, 2018 Death in the countryside: rural burial practice, in A Smith, M Allen, T Brindle, M Fulford, L Lodwick, and A Rohnbogner, *New visions of the countryside of Roman Britain. Volume **3**: life and death in the countryside of Roman Britain*, Britannia Monog Ser, **31**, London, 205-80

Smith, D, Hill, G, Kenward, H K, and Allison, E, 2020 Development of synanthropic beetle faunas over the last 9000 years in the British Isles, *J Archaeol Sci*, **115**(105075) [Online] Available at: https://doi.org/10.1016/j.jas.2020.105075 (accessed 25 September 2023)

Sondak, V, 1948 The specificity of the species of *Trichuris* of man and pig, *Parazitologicheski Sbornik*, **10**, 197-204

Southwood, T R E, and Leston, D, 1959 *Land and water bugs of the British Isles*, London

Spangenberg, J E, Jacomet, S, and Schibler, J, 2006 Chemical analyses of organic residues in archaeological pottery from Arbon Bleiche 3, Switzerland – evidence for dairying in the late Neolithic, *J Archaeol Sci*, **33**(1), 1-13

Spoerry, P, 2008 *Ely wares*, East Anglian Archaeol Rep, **122**, Cambridge

Stace, C, 2019 *New flora of the British Isles*, 4th edn, Cambridge

Stead, I M, 1976 *Excavations at Winterton Roman villa and other Roman sites in North Lincolnshire, 1958-1967*, London

Sterry, P, 2008 *Collins complete guide to British trees: a photographic guide to every common species*, London

Stoertz, C, 1997 *Ancient landscapes of the Yorkshire Wolds*, Swindon

Stoops, G, 2003 *Guidelines for analysis and description of soil and regolith thin sections*, Madison

Stoops, G, Marcelino, V, and Mees, F, 2018 *Interpretation of micromorphological features of soils and regoliths*, 2nd edn, Amsterdam

Stuiver, M, and Kra, R S, 1986 Editorial comment, *Radiocarbon*, **28**(2B), ii

Stuiver, M, and Polach, H A, 1977 Reporting of ^{14}C data, *Radiocarbon*, **19**, 355-63

Stuiver, M, and Reimer, P J, 1986 A computer program for radiocarbon age calculation, *Radiocarbon*, **28**, 1022-30

Sturt, F, Garrow, D, and Bradley, S, 2013 New models of north-west European Holocene palaeogeography and inundation, *J Archaeol Sci*, **40**, 3963-76

Swan, V G, 2002 The Roman pottery of Yorkshire in its wider historical context, in P Wilson and J Price (eds), *Aspects of industry in Roman Yorkshire and the North*, Oxford, 35-79

Taylor, D, 1995 New pollen data from the Keyingham valley, southern Holderness, in Van de Noort and Ellis 1995, 121-7

Taylor, J, 2006 The Roman period, in N Cooper (ed), *Archaeology of the East Midlands: an archaeological resource*, Leicester Archaeol Monog, **13**, Leicester 137-60

Tite, M S, and Mullins, C E, 1971, Enhancement of magnetic susceptibility of soils on archaeological sites, *Archaeometry*, **13**, 209-19

Tomber, R, and Dore, J, 1998 *The national Roman fabric reference collection: a handbook*, MoLAS Monog, **2**, London

Tuck, A, 2023 *The archaeology of the Hornsea Project One Offshore Windfarm cable route: agriculture, settlement, moats and saltworking in the Lincolnshire marshes*, Wessex Archaeol Monog, **41**, Salisbury

Tweddle, J C, 2000 *A high resolution palynological study of the Holocene vegetational development of central Holderness, Eastern Yorkshire, with particular emphasis on the detection of prehistoric human activity*, Unpubl PhD thesis, Univ Sheffield

UK Beetles, nd, *UK beetles: home, families, species, updates, and articles* [Online] Available at: https://www.ukbeetles.co.uk/acrolocha-sulcula (accessed 19 September 2023)

Van de Noort, R, 2000 Where are Yorkshire's 'Terps'? Wetland exploitation in the early medieval period, in H Geake and J Kenny (eds), *Early Deira: archaeological studies of the East Riding in the fourth to ninth centuries AD*, Oxford, 121-31

Van de Noort, R, 2004 *The Humber wetlands: the archaeology of a dynamic landscape*, Macclesfield

Van de Noort, R, and Davies, P, 1993 *Wetland heritage: an archaeological assessment of the Humber Wetlands*, Hull

Van de Noort, R, and Ellis, S (eds), 1995 *Wetland heritage of Holderness: an archaeological survey,* Hull

Van de Noort, R, and Ellis, S (eds), 2000 W*etland heritage of the Hull Valley: an archaeological survey*, Hull

van der Veen, M, 1992 Crop husbandry regimes: an archaeological study of farming in northern England 1000 BC-AD 500, Sheffield

van der Veen, M, 2022a Crop prevalence and surplus production in Roman and medieval northeast England, in N Hodgson and B Griffiths (eds), *Roman frontier archaeology in Britain and beyond*, Oxford, 136-49

van der Veen, M, 2022b All change on the land? Wheat and the Roman to early medieval transition in England, *Medieval Archaeol*, **66**(2), 304-42

van Geel, B, 1978 A palaeoecological study of Holocene peat bog sections in Germany and the Netherlands based on the analysis of pollen, spores, and macro- and microscopic remains of fungi, algae, cormophytes, and animals, *Rev Palaeobot Palynol*, **25**, 1-120

van Geel, B, and Aptroot, A, 2006 Fossil ascomycetes in Quaternary deposits, *Nova Hedwig*, **82**(3-4), 313-29

Vellacott, C H, 1906 Political history, in Page 1906, 245-92

Vepraskas, M J, Lindbo, D L, and Stolt, M H, 2018 Redoximorphic features, in G Stoops, V Marcelino, and F Mees (eds), *Interpretation of micromorphological features of soils and regoliths*, Amsterdam, 425-45

von den Driesch, A, 1976 *A guide to the measurement of animal bones from archaeological sites*, Peabody Mus Bull, **1**, Cambridge MA

Vince, A, 2002, *Petrological analysis of Roman pottery from Market Rasen*, Unpubl rep [Online] Available at: https://archaeologydataservice.ac.uk/archiveDS/archiveDownload?t=arch-1000-1/dissemination/pdf/AVAC_reports/2002/avac2002016.pdf (accessed 30 June 2023)

Waddington, C, 2015 A case for secondary Mesolithic colonisation of Britain following rapid inundation of the North Sea plain, in N Ashton and C Harris (eds), *No stone unturned: papers in honour of Roger Jacobi*, London, 221-32

Waldron, T, 2007 *St Peter's, Barton-upon-Humber, Lincolnshire: a parish church and its community. Volume* **2***: the human remains*, Oxford

Walker, J, Gaffney, V, Fitch, S, Harding, R, Fraser, A, Muru, M, and Tingle, M, 2022 The archaeological context of Doggerland during the final Palaeolithic and Mesolithic, in V Gaffney and S Fitch (eds), *Europe's lost frontiers. Volume* ***1****: context and methodology*, Oxford, 63-88

Walker, K, 1990 *Guidelines for the preparation of excavation archives for long-term storage*, London

Walmsley, S A, and Pawson, M G, 2007 *The coastal fisheries of England and Wales, Part V: a review of their status 2005-6*, Sci Ser Tech Rep, **140**, Lowestoft

Ward, G K, and Wilson, S R, 1978 Procedures for comparing and combining radiocarbon age determinations: a critique, *Archaeometry*, **20**, 19-31

Watkins, G, 1991 The pottery, in P Armstrong, D Tomlinson, and D H Evans, *Excavations at Lurk Lane, Beverley, 1979-82*, Sheffield Excav Rep, **1**, Sheffield, 61-103

Webster, P, 1996 *Roman samian pottery in Britain*, CBA Practical Handbook Archaeol, **13**, York

Wenban Smith, F, 2002 *Palaeolithic and Mesolithic archaeology on the sea-bed: marine aggregate dredging and the historic environment*, Salisbury

Whitehouse, N J, Schulting, R J, McClatchie, M, Barratt, P, Rowan McLaughlin, T, Boggard, A, Colledge, S, Marchant, R, Gaffrey, J, and Bunting, M J, 2014 Neolithic agriculture on the European western frontier: the boom and bust of early farming in Ireland, *J Archaeol Sci*, **51**, 181-205

Whitwell, B, 1995 Roman small towns in North Lincolnshire and South Humberside, in A E Brown (ed), *Roman small towns in eastern England and beyond*, Oxbow Monog, **52**, Oxford, 95-102

Wicks, K, and Mithen, S, 2014 The impact of the 8.2 ka cold event on the Mesolithic population of western Scotland: a Bayesian chronological analysis using 'activity events' as a population proxy, *J Archaeol Sci*, **45**, 240-69

Williams, D, 2010 *Saxby Wold Windfarm, Lincolnshire: archaeological evaluation interim statement*, Unpubl rep [Online] Available at: https://doi.org/10.5284/1023712 (accessed 14 July 2023)

Williams, M, 2001 *Barrow-upon-Humber Water Treatment Works: archaeological excavations*, Unpubl rep [Online] Available at: https://doi.org/10.5284/1023711 (accessed 14 July 2023)

Willis, S H, 2005 Samian pottery. A resource for the study of Roman Britain and beyond: the results of the English Heritage funded Samian Project. An E-monograph, *Internet Archaeology*, **17** [Online] Available at: http://intarch.ac.uk/journal/issue17/willis_toc.html (accessed 20 April 2020)

Willis, S H, 2013 *The Roman roadside settlement and multi-period ritual complex at Nettleton and Rothwell, Lincolnshire*, Central Lincolnshire Wolds Res Project, **1**, Canterbury

Willis, S H, 2020 *The Waithe Valley through time 1: the archaeology of the valley and excavation and survey in the Hatcliffe area*, Central Lincolnshire Wolds Res Project, **2**, Canterbury

Willis, S H, 2022 *East Midlands Historic Environment Research Framework: updated period resource assessment for the later Bronze Age and Iron Age* [Online] Available at: https://researchframeworks.org/emherf/updated-period-resource-assessment-the-later-bronze-age-and-iron-age/ (accessed 14 September 2023)

Willmott, H, and Townend, P, 2011 *Thornton Abbey Project, 1st interim report*, Unpubl rep [Online] Available at: https://www.academia.edu/1992402/Thornton_Abbey_Excavation_2011_Interim_Report (accessed 12 September 2023)

Willmott, H, and Townend, P, 2012 *Thornton Abbey Project, 2nd interim report*, Unpubl rep [Online] Available at: https://www.academia.edu/3765171/Thornton_Abbey_Excavation_2012_Interim_Report (accessed 12 September 2023)

Willmott, H, Townend, P, Mahoney Swales, D, Poinar, H, Eaton, K, and Klunk, J, 2020 A Black Death mass grave at Thornton Abbey: the discovery and examination of a fourteenth-century rural catastrophe, *Antiquity*, **94**(373), 179-96

Wilkinson, T J, and Murphy, P, 1986 Archaeological survey of an intertidal zone: the submerged landscape of the Essex coast, England, *J Field Archaeol*, **13**, 177-94

Wilkinson, T J, and Murphy, P L, 1995 *The archaeology of the Essex coast. Volume **I**: The Hullbridge Survey*, East Anglian Archaeol Rep, **71**, Chelmsford

Wilkinson, T J, Murphy, P L, Brown, N, and Heppell, E, 2012 *The archaeology of the Essex Coast. Volume **II**. excavations at the prehistoric site of The Stumble*, East Anglian Archaeol, **142**, Chelmsford

Wilmshurst, J M, and McGlone, M S, 2005 Corroded pollen and spores as indicators of changing lake sediment sources and catchment disturbance, *J Paleolimnol*, **34**, 503-17

Wilson, C, and Wilson, P, 2007 Linwood Warren: a journey of discovery, in D Start and J Howard (eds), *All things Lincolnshire: a collection of papers and tributes to celebrate the 80th birthday of David N Robinson OBE MSc*, Lincoln, 211-40

Wilson, P R (ed), 1989 *Crambeck Roman pottery industry*, Leeds

Wilson, R, 2023 *VPI Immingham, Humber Zero Project, North Lincolnshire: archaeological evaluation report*, Unpubl rep

Witkowski, A, Lange-Bertalot, H, and Metzeltin, D, 2000 *Diatom flora of marine coasts I*, Iconographia diatomologica, Annotated Diatom Micrographs, **7**, Königstein

Wood, C J, and Smith, E G, 1978 Lithostratigraphical classification of the chalk in North Yorkshire, Humberside, and Lincolnshire, *Proc Yorkshire Geol Soc*, **42**, 263-87

Woodbridge, J, Fyfe, R M, Roberts, N, Downey, S, Edinborough, K, and Shennan, S, 2014 The impact of the Neolithic agricultural transition in Britain: a comparison of pollen-based land-cover and archaeological ^{14}C date-inferred population change, *J Archaeol Sci*, **51**, 216-24

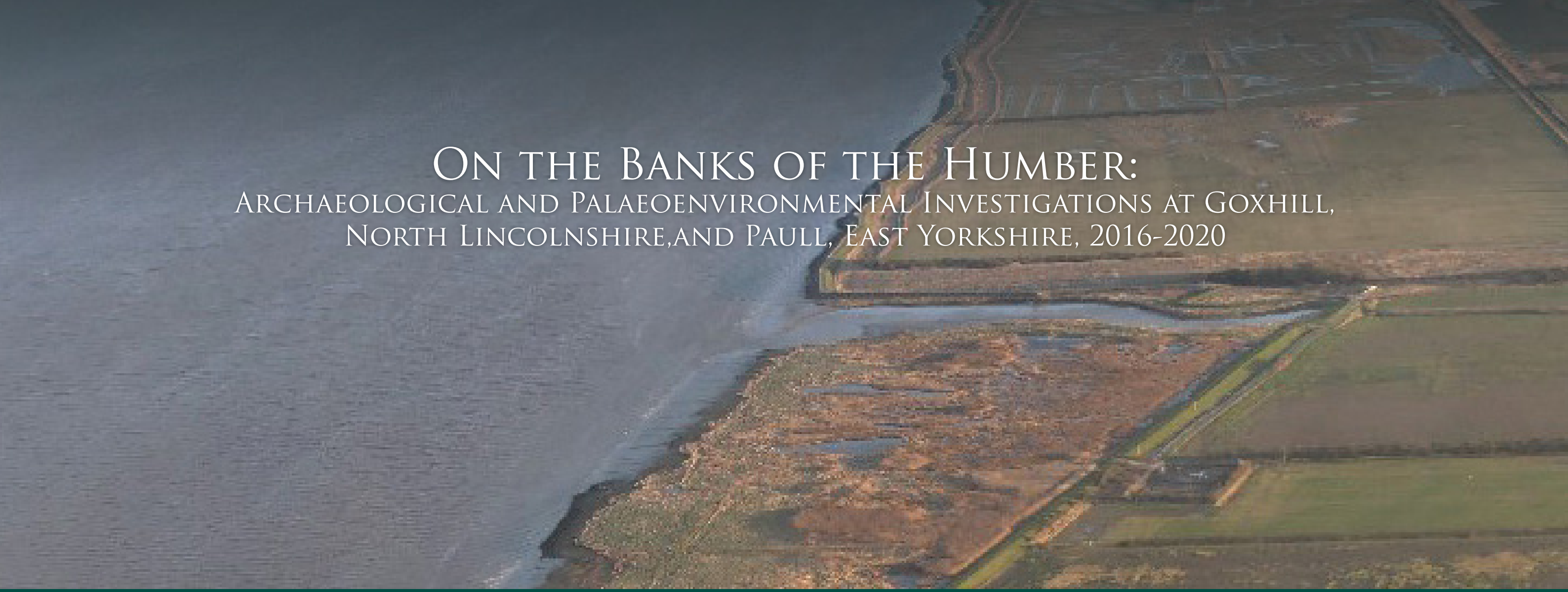
Young, J, 2000 *The pottery from Barrow Road, Barton on Humber (BOH00)*, Unpubl rep

Young, J, and Vince A, 2009 The Anglo-Saxon pottery, in D H Evans and C Loveluck, *Life and economy at early medieval Flixborough, c AD 600-1000: the artefact evidence. Excavations at Flixborough Volume* **2**, Oxford, 339-401

Young, J, Vince, A, and Nailor, V, 2005 *A corpus of Anglo-Saxon and medieval pottery from Lincoln*, Lincoln Archaeol Stud, **7**, Oxford

Zant, J, and Wegiel, R, in prep *The archaeology of the Easington to Paull gas pipeline, Holderness, East Yorkshire*, Lancaster Imprints, Lancaster

INDEX



On the Banks of the Humber:
Archaeological and Palaeoenvironmental Investigations at Goxhill, North Lincolnshire,and Paull, East Yorkshire, 2016-2020

The replacement of the Number 9 Feeder Gas Transmission Pipeline has provided an important opportunity to investigate early landscapes and settlement either side of the Humber Estuary. A combination of techniques has been employed over an eight-year period by Oxford Archaeology in order to explore the geoarchaeology and archaeology within two landscape areas, at Paull, East Yorkshire, and Goxhill, North Lincolnshire.

Geoarchaeological investigations at both Paull and Goxhill included borehole coring, lithological, pollen, and diatom analyses, deposit modelling, and radiocarbon dating, the results of which provide details of the evolving early prehistoric coastal landscape that was present in the Mesolithic and earlier Neolithic periods. All of the archaeological remains investigated by the project were confined to Goxhill, and evaluation trenching, open-area excavation, and archaeological monitoring, together with detailed post-excavation analysis, have greatly enhanced understanding of prehistoric and historic settlement in this area. Within this landscape, limited evidence for Bronze Age and post-medieval activity was recovered, with the vast majority of the excavated remains dating to the Iron Age, Roman, and medieval periods, relating to progressive phases of open and enclosed settlement.

This synthetic volume arises from a multi-disciplinary approach to geoarchaeology and archaeology, with an emphasis on interpreting the evidence in terms of landscape development. It includes the work of a range authors drawn from Oxford Archaeology and several external specialists.

PORR nationalgrid SKANSKA a.hak ARCADIS oxford archaeology

Archaeopress Archaeology
www.archaeopress.com