Archaeological Watching Brief at Titchwell Marsh RSPB Reserve Norfolk

Archaeological Watching Brief Report

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Watching Brief

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Summary

Between July and October of 2009, Oxford Archaeology East conducted an archaeological watching brief and subsequent excavation at the Titchwell Marsh RSPB Reserve (TF 754 445). This work was undertaken on behalf of Lancaster Earthmoving Ltd., in advance of a development to realign the sea defences at the reserve.

The works entailed the stripping of a large borrow pit area in the south of the reserve ahead of the subsequent removal of natural boulder clay to use in order to widen and raise the Parrinder and West Bank sea defences further north in the reserve.

Finds included sixteen struck flints indicating activity from as early as the Mesolithic or Early Neolithic through to the later prehistoric periods. Further evidence for activity during the later prehistoric consisted of a single cremation and associated pit of Bronze Age date and a ditch and six heavily truncated pits dating to the Iron Age.

A background scatter of Roman pottery hinted at a continuation of activity during this period despite a lack of associated features.

Evidence of activity during the later historic and modern periods included nine ditches dating to the post-medieval period, various features associated with the Second World War (WWII) Armoured Fighting Vehicle (AFV) range and the sea defences themselves.

In August 2010 a section through the Western Sea Defence Bank was recorded during works to cut a new pipe and raise the bank height. This work showed the bank to be a multiphase structure from the post-medieval and modern periods. Plans to record a further bank section in Summer 2011 were cancelled as the groundworks were revised.

1 INTRODUCTION

1.1 Location and scope of work

1.1.1 An archaeological watching brief and subsequent excavation was conducted at Titchwell Marsh RSPB Reserve, Norfolk.

1.1.2 These archaeological investigations were undertaken in accordance with a Brief issued by David Robertson of Norfolk Landscape Archaeology (Planning Application 08/02567/FM), supplemented by a Specification prepared by OA East (formerly Cambridgeshire County Council's CAMARC).

1.1.3 The work was designed to assist in defining the character and extent of any archaeological remains within the proposed redevelopment area, in accordance with the guidelines set out in *Planning and Policy Guidance 16 - Archaeology and Planning* (Department of the Environment 1990). The results enable decisions to be made by the Norfolk Museums Service, on behalf of the Local Planning Authority, with regard to the treatment of any archaeological remains found.

1.1.4 The site archive is currently held by OA East and will be deposited with the appropriate county stores in due course.

1.2 Geology and topography

1.2.1 North-west Norfolk lies within a region of Upper Chalk, however Titchwell and the current development area lies on a coastal band of glacial till (approximately 1.5-2m depth of boulder clay overlying glacial sands and gravels). Further to the north into the old salt-marsh; this glacial till is overlain by peat, alluvium and fen silt (BGS Sheet 130).

1.2.2 The RSPB reserve includes a small area of higher ground (where the borrow pit field is located). The reserve proper consists of three low lying lagoons and an active salt-marsh to the east, which are all divided by a number of large banks. Within the borrow pit field itself topographic data showed that the highest ground was located at the south and centre of the site with the ground dropping to the north-east and west.

1.3 Archaeological and historical background

Prehistory

1.3.1 The early prehistoric period at Titchwell is represented by the discovery of a palaeolithic occupation site (NHER 15352) on the beach to the north of the site (see Fig. 1). During this period the site would have been a dry-land site with the sea far to the north and is likely to have been wooded - as indicated by the ancient wood remains seen at low tide along this section of coast.

1.3.2 The later prehistoric periods in comparison are very poorly represented with only a few spot finds of Neolithic axeheads (NHER 1307 and 1361) and a Neolithic blade (NHER 1356) discovered on the beach itself, presumably eroded from archaeological contexts off the shoreline (Fig. 1).

Roman and Saxon

1.3.3 The early historical periods are equally as poorly represented as the later prehistoric periods. A Roman cremation and urn (NHER 1311) was found to the south-west of the site just inside the parish of Thornham, and a number of cropmarks (NHER 26743,

26744 & 26745) thought to date to the Roman and Saxon periods have been identified to the east of the site (see Fig. 1).

Post-medieval

1.3.4 The vast majority of archaeological remains within the area of Titchwell are associated with the post-medieval period and World War Two. The post-medieval period saw large scale land reclamation projects with the creation of sea defences to the north, east and west of the site (NHER 26670, 26783, 26788, 26790, 26793 & 26794). The reclaimed land was then used for farming as indicated by the discovery of ridge and furrow systems within the area north of the site (NHER 26759 & 26786).

1.3.5 The Second World War witnessed dramatic change in this area with the creation of an Armoured Fighting Vehicle (AFV) Range. The remains of this period cover a wide area from the A149 at Titchwell all the way to the coastline to the north. The remains include a roadway and hard standings that run from the A149 along the western edge of the site (NHER 26789). As well as numerous pillboxes and bunkers found throughout the RSPB reserve (NHER 18070, 18071, 18072, 18074, 26711, 26785 & 32409), a minefield (NHER 26785), a range marker (NHER 26784) and beach defence scaffolding have also been found along the northern coastline (NHER 26713) (Fig. 1).

1.3.6 Most archaeological activity previously recorded in this area is from relatively modern periods whilst the majority of prehistoric archaeology is located on the sea shore itself or outside of the areas of land reclamation and the World War Two base. It is possible that the large scale land reclamation and the use of the area as a military base may in part be responsible for the lack of remains discovered in this area from earlier periods. The highly intrusive nature of these later activities within the archaeological record could easily have destroyed evidence of earlier periods of activity.

1.4 Acknowledgements

1.4.1 The author would like to thank Lancaster Earthmoving Ltd. as clients acting on behalf of the RSPB, and particularly Ian Markillie and his on-site staff for their patience and co-operation during the work. Paul Spoerry managed the project. The first author carried out work on site in the early stages of the project (LB), with particular focus on the WWII remains. Later excavations were conducted by John Diffey and Rachel Clarke surveyed the site. The illustrations were produced by Nick Gilmour and Louise Bush. The Brief for the archaeological works was issued by David Robertson of Norfolk Landscape Archaeology who also monitored the site.

2 Aims and Methodology

2.1 Aims

2.1.1 The objective of this project was to determine as far as reasonably possible the presence/absence, location, nature, extent, date, quality, condition and significance of any surviving archaeological deposits within the development area and to ensure their preservation by record through excavation where appropriate.

2.2 Methodology

2.2.1 The Brief required that all areas of below-ground disturbance, including excavations, quarrying, foundation trenches, service trenches, drains and soakaways be monitored, and where appropriate, all archaeological context and artefacts exposed be examined or excavated.

2.2.2 Machine excavation was carried out under constant archaeological supervision with a tracked machine excavator using a toothless ditching bucket.

2.2.3 Spoil, exposed surfaces and features were scanned for finds. All hand-collected finds were retained for inspection, other than those which were obviously modern. Modern finds deemed to be military in origin were, however, recorded and/or retained.

2.2.4 All archaeological features and deposits were recorded using OA East's *pro-forma* sheets. Trench locations, plans and sections were recorded at appropriate scales and colour and monochrome photographs were taken of all relevant features and deposits.

2.2.5 Six environmental samples were taken to investigate the possible survival of micro- and macro- botanical remains.

2.2.6 Work on the site was initially delayed so that the area could be scanned for unexploded ordnance. The site conditions were varied, the majority of site was dry although areas to the far west and far east suffered from severe water-logging.

3 RESULTS

3.1 Introduction

3.1.1 The archaeological watching brief and subsequent excavation at Titchwell Marsh RSPB Reserve revealed evidence for activity dating from the Mesolithic/Early Neolithic period through to modern. As a result, the features will be discussed by archaeological period, and within that, by feature type. A comprehensive listing of context data and descriptions can be found in Appendix A.

3.1.2 Archaeological features were quite dispersed across the site (Fig. 2). Natural geology was encountered *c.*0.35m below modern ground level. There was no subsoil, but in the north-west corner of site there was a layer of peat (67) *c.* 0.35m deep beneath the topsoil (01).

3.2 Period 1: Prehistoric

A.1.1 The Earlier prehistoric periods were represented by thirteen pieces of struck flint recovered from several features across the site. The discovery of these finds within the topsoil and contexts dated to later periods, combined with its often abraded condition and chronological mixing(see appendix C.2), suggest that this material is residual. Nonetheless, its very presence suggests activity was taking place in or around the area of investigation from as early as the Mesolithic or Early Neolithic periods.

3.3 Period 2: Bronze Age

Cremation

3.3.1 Located *c.*50m north of the southern extent of the site and 20m west of ditch **14** was cremation pit **10** (Fig. 3 and Plates 1&2). This feature was 0.26m wide and 0.26m deep with a U-shaped profile; it contained a single dark blue-grey clayey-silt fill (11). A concentration of cremated human bone was found within the lower half of this fill (see Appendix D) along with 13 sherds of pottery that are probably Bronze Age in date (Appendix C).

3.3.2 Post-excavation analysis of the cremated remains suggests that they represent a single adult (18+ years) individual of unknown sex. Analysis of fragmentation and bone colour and an absence of trabecular bone suggest a high pyre temperature in excess of 900°C, thus indicating that the population in this area had achieved good efficiency in the process of cremating their dead. Fracture patterns suggest that the remains represent an in-flesh cremation typical of British Bronze Age practices, while skeletal part representation analysis showed that in general skeletal elements from all parts of the body were represented (with the perhaps notable absence of teeth). Weight assessment of the remains showed that this cremation fell well below the average weight of an ancient adult cremation deposit. Results from the analysis have suggested that this low rate of skeletal element retrieval may be explained through collection procedures or through post-depositional processes.(See Appendix D)

3.3.3 Environmental analysis of the deposit found a single charred cereal grain, most likely a prehistoric hulled wheat, and a number of charred seeds representing common grassland species.(see Appendix D)

3.3.4 Analysis of the fabric of the pottery sherds found within the cremation deposit suggest that they probably sit squarely in the Middle Bronze Age 'Deverel-Rimbury' tradition. The sherds found represent only a small part of a vessel and it has been suggested

that the presence of only a small amount of cremated bone along with the partial vessel may indicate a rite involving selection of part of the cremation for deposition.(See Appendix C

Associated Pit

3.3.5 The cremation pit was truncated on its north-east side by pit **12** (see Plate 2). This feature was 1.25m long, 0.75m wide and 0.1m deep, with a flat base and moderately sloping sides. It contained a single fill (13) which consisted of a dark blue-grey clayey-silt and contained moderate charcoal and twenty seven fragments of burnt flint. It was originally thought that this fill may represent pyre material deposited at the same time as the cremated remains, however, analysis of a sample found no cremated bone within it and found that the nature of the charcoal differed from that found in the cremation deposit .(See Appendix D). The presence of burnt flint within this deposit although not unheard of in pyre material is much more commonly associated with cooking or craft activities (see appendix C). With the deposition of part of a cremation taking place as suggested above it is possible that the cremation itself took place elsewhere and this deposit may represent the remains of a ceremonial fire used for feasting at the time of the internment.

3.4 Period 3: Iron Age

Ditch

3.4.1 On the north-eastern side of the site was ditch **61**. The ditch was curvilinear; running south-east and turning in a south-south-westerly direction. It was 1.02m wide, 0.57m deep with a V-shaped profile (see Fig. 2). It contained a single mid yellow-grey sandy clay fill with frequent flint inclusions.(62). This fill contained charcoal, a number of struck flints dating to the prehistoric and later prehistoric periods and a single sherd of pottery dated to the Iron Age (see Appendix C). To the north-west, it was truncated by a post-medieval ditch **18** which was orientated north to south down the site.

Pits

3.4.2 Approximately 50m west of ditch **61** was a cluster of six possible pits (see Fig. 2). All of these features had been severely truncated by plough scars. Pit **49** was 1.4m long, 1.2m wide and 0.15m deep with an irregular U-shaped profile. The single fill (50) was a mid brown-grey silty sand and contained a single flint blade of Mesolithic or early Neolithic date (see Appendix C).

3.4.3 Pit **51** was 0.9m long, 0.9m wide and 0.08m. It contained a single fill (52) which was the same as fill 50, from which two small sherds of Iron Age pottery were recovered. The pit had a shallow U-shaped profile.

3.4.4 The largest pit **53**, was 2.3m long, 1.35m wide and 0.11m deep with a flat bottomed U-shaped profile. It contained one fill (54), which was the same as fill 50, but contained no finds.

3.4.5 Pit **55** contained a single mid brown-grey silty sand fill (56) (like the previous three pit fills). It was 0.9m long, 0.5m wide and 0.07m deep. The pit had a shallow U-shaped profile and contained no finds.

3.4.6 Pit **57** was 0.7m long, 0.75m wide and 0.05m deep with a shallow U-shaped profile. It had a single fill (58) which was the same as fill 50. There were no finds.

3.4.7 The smallest pit **59**, was 0.5m long, 0.33m wide and 0.05m deep with a shallow U-shaped profile. It had a single fill (60) which was also the same as fill 50. The feature contained no finds.

3.4.8 The shallow depth and irregular edges of many of these features, combined with the subsoil like fills and the small amount of finds associated with them may suggest a natural formation process for these features such as bioturbation. However, their close concentration and lack of similar features across the rest of site may suggest that these are heavily truncated pits from the Iron Age period although an interpretation of their function would be tentative at best

3.5 Period 3: Post-medieval

Ditches

3.5.1 Eight ditches were uncovered across the site that dated to the post-medieval period (see Figs. 2 and 4) plus one undated but thought to be of the same date due to its similar alignment. Of these, six were orientated north-south, while the others followed an east-west orientation. Due to uncertainty about the dating of some of these ditches, in the light of the existence of both Bronze Age and Iron Age remains close by and from the presence of possible prehistoric finds in their fills, waterlogged wood from two deposits, 33 in ditch **24** and 44 in ditch **26**, was subjected to Radiocarbon determinations by SUERC (Appendix E). The dates given (120+/- 45 BP and 65+/- BP respectively) clearly indicated a recent origin for these features.

3.5.2 In the north-west area of the site two ditches were uncovered (**65** & **68**) both orientated east-west approximately 40m apart (Fig.2). Ditch **65** (also recorded as ditch **63**) was 0.5m wide and 0.16m deep with a round-bottomed V profile. It contained a single fill (66), a dark brown peat which was the same as peat layer 67 above it. No finds were recovered from this ditch. Ditch **68** was 1.7m wide and 0.45m deep with a flat base and steep flat sides and was cut through both the peat layer (67) and the natural clay below. It contained two fills, 69 and 70. Fill 69 consisted of angular chalk pieces up to 70mm in diameter and contained modern CBM and pottery (not kept as identified as modern on site). At the base of the ditch was a layer of cut roundwoods up to 70mm in diameter and up to 1.2m in length. The cut marks on these roundwoods suggested a large (*c.*100mm wide) slightly convex bladed cutting tool was used to fell the pieces consistent with a modern axe blade. The upper fill (70) consisted of a soft mid bluish grey silty clay with occasional angular chalk rubble inclusions. This ditch has been interpreted as a land drain with the chalk fill (69) used to provide drainage and fill (70) a deliberate capping for the deposit below. A continuation of this ditch was found within the eastern area of the site just north of the group of iron age pits.

3.5.3 In the south-west corner of the site, an area that suffered heavily with waterlogging during the excavation, there were four parallel ditches running north to south between 6.5m and 9m apart. Ditch **4** (Fig. 4), was 2.6m wide, 0.46m deep, had an irregular profile and contained four fills. Fill 5 was a 0.05m thick mid grey-brown peat suggesting that the ditch remained open and wet for some period of time. Overlying this peat was fill 6, which consisted of a dark blue-grey silty clay, 0.17m deep and contained a piece of Iron Age pottery (see Appendix C), now known to be residual. Overlying fill 6 was fill 8, a 0.15m thick deposit comprised of a dark blue-grey clayey silt. The final tertiary fill of ditch **4** (07) was a mid grey-brown silty clay with a maximum thickness of 0.22m, which contained frequent large pieces of chalk, one sherd of post-medieval pottery and brick rubble and an oyster shell(see Appendix C).

3.5.4 Ditch **24** was 2.75m wide and 0.45m deep with an irregular profile. It contained four fills (33, 35, 41 and 42). The basal fill (33) consisted of a silty peat up to 0.18m thick, similar to that in ditch **4** and contained a single Mesolithic or Early Neolithic flint flake now thought to be residual. Environmental analysis of this material found seeds from pond weed, buttercup and bramble along with insect fragments and egg cases (see Appendix D) again suggesting that the ditch contained standing water. Within the base of fill 33 was a single piece of unworked brushwood complete with its bark 25mm in diameter and 0.2m long. Carbon dating proved this brushwood to be of modern date (see Appendix E). Fill 35 overlay 33 and consisted of a mid greyish yellow silty clay up to 0.19m thick this in turn was overlain by fill 41 which consisted of a mid bluish grey clayey silt up to 0.11m thick. The latest fill (42) was made up of a mid brown-grey clayey silt up to 0.33m deep and contained an abundance of chalk rubble and frequent post-medieval ceramic building material (CBM).

3.5.5 Ditch **25** was 1.85m wide and 0.4m deep with an irregular profile. It contained two fills (47) and (48). The basal fill (47) consisted of a dark brown silty peat up to 0.14m deep containing occasional flint stones and some orange staining. At the very base of this fill a single layer made up of a number of pieces of brushwood was found. The brushwood was complete with bark and averaged 15mm in diameter and 0.2m in length and was laid with the line of the ditch. One piece had a worked end consisting of a chisel point with a 30° cut from a flat blade. This worked piece of brushwood was found pushed into the clay at the base of the ditch suggesting deliberate deposition. The upper fill (48) was made up of a mid blue-grey silty clay and contained frequent angular chalk pieces, CBM and a sherd of post-medieval pottery (see Appendix C).

3.5.6 Ditch **26** was 0.95m wide, 0.4m deep with an irregular U-shaped profile and had three fills. The basal fill (44) was a 0.23m thick dark brown-grey silty peat and contained three pieces of burnt flint. The largest of these burnt flint pieces was identified as a fragment of saddle quern thought to be of Bronze Age date although it is considered to be a residual find within this post-medieval context Environmental analysis of a sample of this fill found microscopic fragments of burnt clay and seeds from a species of sedge, a plant group most commonly associated with wetlands (see Appendix D). At the base of this fill a single layer of degraded unworked brushwood was found. The brushwood was laid along the line of the ditch and pieces averaged 15mm in diameter and up to 0.3m in length and some bark was still present despite the degradation. Carbon dating of a piece of this wood provided a modern date for this deposit. Overlying fill 44 was fill 45, a mid grey-yellow clay, 0.15m thick containing frequent large angular pieces of flint. The latest fill (46) comprised of a 0.1m thick mid blue-grey clayey silt and contained a struck flint piece thought to date from the later prehistoric but again now thought to be residual in origin.

3.5.7 In the eastern area of the site three ditches were found that are again thought to be from the post-medieval period. Ditch **18** was orientated north-south and ran for over 100m across the site. The ditch was 2.3m wide and 0.72m deep with a flat base and medium sloping sides. The ditch contained five fills (19,(20),(21),(22) and (23). Basal fill 19 consisted of a 0.24m thick deposit of dark bluish grey silty clay which contained occasional charcoal pieces and rounded flint stones. Also found within the base of this fill were pieces of a post-medieval ceramic land drain that was cut by the ditch suggesting a modern date for the cut. Overlying fill 19 but with its extent limited to the eastern side of the ditch was fill 20 thought to be a slump of natural material from the ditch sides. Overlying fill 20 was fill 21 consisting of a 0.21m thick layer of mid brownish grey silty clay which again contained pieces of the broken land drain. Fill 22, which overlay fill 21, was almost identical to 21 but slightly lighter and less humic most likely

as a result of the ditch drying out as it filled up with sediment. The final fill of ditch **18** (23) was very different to the lower fills being made up of a dark bluish grey clayey silt with a very loose consistency. This fill contained modern white porcelain pot, modern Iron finds and large amounts of charcoal and pieces of burnt wood. Rooting in the base of the ditch suggest it was heavily overgrown and this final fill may represent an episode of clearing and levelling.

3.5.8 Ditch **14** ran parallel to ditch **18** *c.3*m to the west. This ditch was 1.16m wide and 0.56m deep and contained three fills (15), (16) and (17). Basal fill 15 consisted of a 0.12m thick layer of mid greenish yellow clay. An environmental sample found humic plant material and preserved bramble seeds (see Appendix D). Fill 16 which overlay 15 was a 0.3m thick deposit of mid bluish grey anoxic alluvial clay. The uppermost fill of ditch 14 was a 0.23m thick deposit of mid reddish grey silty clay. No finds were attributed to any of the fills in ditch **14** however post-medieval CBM was found in fill 30 in ditch cut **28** which are equivalent to fill 16 and ditch cut **14** respectfully.

3.5.9 Ditch **14** appeared to cut a much smaller linear drainage channel (**27**) on its western side *c.*45m north of the southern extent of the site (ditch **14** recorded as ditch **28** at this intersection). This small drainage channel (**27**) was 0.4+m wide and 0.25m deep and ran east-west from the western edge of ditch **28**. it contained a sigle fill (29) of soft mid brownish grey clayey silt. Despite the section apparently showing ditch **28** cutting fill 29 the lack of a continuation on the eastern side of ditch **28** and the right angled intersection suggest that the two ditches are contemporary and the apparent relationship may instead be a result of the shallow depth of **27** leading to this channel silting up before the upper fills of **28** had formed. Ditch 28 contained three fills (32), (30), and (31) being equivalent to fills (15), (16) and (17) respectfully. As mentioned above, fill 30 contained CBM of post-medieval date while two residual flint flakes were identified from fill 32 (see Appendix C).

Second World War remains

3.5.10 A large amount of infrastructure features related to the site's use as an AFV Range during the Second World War period remained largely intact and i*n situ*. These remains included roadways, hard standings, pillboxes, bunkers and winch houses used for moving targets on the range. The majority of the Second World War remains were unaffected by the development of the site although the draining of the lagoons provided an excellent chance to see the current state of these remains.

3.5.11 The remains that were affected by the development included a line of metal and wooden posts which ran parallel to the Parrinder Bank and made up the base of a track used to carry moving targets for medium range target practice and what is thought to be the winch house that moved these targets which was situated at the end of the trackway at the western end of the Parrinder bank (see Plates 4, 5 & 6). Widening of the Parrinder Bank resulted in the burial and therefore preservation *in situ* of these remains.

3.5.12 In the borrow pit field evidence of this period was found in the form of a 'pig tail post' used in the construction of barbed wire fences. This was found in the topsoil (01) at the far eastern edge of site.

3.6 Finds Summary

3.6.1 A wide variety of finds were recovered dating from the Early Neolithic through to the modern period (see Appendix B).

3.6.2 Forty-nine lithics were retrieved from across the site, fourteen of which were worked flakes dating to the Late Neolithic and Early Bronze Age. There was also one core, a possible core fragment and a piece of flint quern. The remaining thirty-five pieces were an assortment of burnt and broken flint. Twenty-seven burnt flint pieces came from the fill of pit **12**, all the other flints were from ditch fills and believed to be residual.

3.6.3 The pottery assemblage consisted of thirty-three sherds, twenty of which are of probable prehistoric date, two are Roman and the remainder are post-medieval to modern. Thirteen prehistoric sherds came from a Bronze Age cremation, whilst seven were collected from four contexts, dating to the Iron Age.

3.6.4 A large proportion of the finds were dated to the post-medieval period. Nine sherds of post-medieval ceramic and thirty-two fragments of CBM were located during the excavation of features. All of the post-medieval finds were from ditch fills.

3.6.5 No animal bone was found on site, but cremation **10** contained human bone.

3.7 Environmental Summary

3.7.1 Six bulk samples were taken from features from across the investigation area (Appendix C). The results of the flotation of these samples revealed the remains of weeds and humic plant matter from the ditches, and an abundance of highly burnt human bone from the cremation pit.

4 Discussion and Conclusions

4.1 Prehistoric activity

4.1.1 The earliest evidence for prehistoric activity in the investigation area is represented by Mesolithic/Early Neolithic flint. No features however are dated to this period, the flint is residual. The earliest feature uncovered on site is a single cremation **10** dated to the Middle Bronze Age (possibly one of the earliest cremations found within the county of Norfolk to date). Interestingly the pottery analysis and the analysis of the cremation deposit itself both hint at the possibility of this representing only part of a cremation and its vessel.

4.1.2 The division of human remains *post mortem* is a common occurrence within the neolithic period where non-cremated remains were divided and deposited in different locations. The practice of dividing a cremation is not unheard of but is rare in the British Isles. In Scandinavia the practice is more common and Icelandic folklore in the form of Sagas tell that remains could sometimes be buried in several burial mounds in different locations and was believed to increase good fortune in agriculture (Wickholm A & Raninen S 2006). In the rare cases that have been identified in Britain interpretations suggested that distribution may occur among several mourners as a physical means of remembrance while broken artefacts and fragmented bodies may have been seen as a source of fertility and new life during the middle and late Bronze Age and may have been used in associated rituals (Rebay-Salisbury, K 2010 following Chapman & Gaydarska 2007). The same reference discusses the treatment of the urn suggesting that breaking the urn mirrors the fragmentation of the body during the cremation.

4.1.3 The cremation pit is truncated on its east side by pit **12**. It is likely that these two pits are contemporary with one another as clearly one was placed in relationship with the other, there being so few prehistoric features present so as to render a chance association highly unlikely. The fill (13) of pit **12** contained an abundance of burnt material however an absence of burnt bone and a difference in the type of charcoal found suggest that this material is not remnants from the pyre as was initially thought. Instead it is suggested that the burnt material may represent a ceremonial fire possibly used for feasting, as suggested by the presence of burnt flint. In other locations such features have been interpreted as being related to some form of fertility ritual, to ensure a good harvest from the surrounding land.

4.1.4 The two associated pit features (**10** and **12**) appear to be isolated, as no other Bronze Age archaeology has been identified close by, or anywhere else on site. In line with the interpretation given above, if part of a cremation was being used in a fertility rite then rather then being placed in a recognized cemetery it would be placed within the arable landscape that the rite was intending to fertilize

4.1.5 Topographic data from the site has shown that the cremation occupies a high point at c.4.4mOD with the ground dropping away to the north-east and the west. It appears that the cremation was positioned on the edge of a terrace above a relatively flat and marshy plain. In this position It was perhaps hoped that the power of the rite would not only fertilize the arable lands to the south but also the lower marshland leading towards the sea to the north.

4.1.6 In the north-eastern end of site is ditch **61**. This feature stands out because it is the only ditch on site that is not orientated north-south or east-west. It runs from the north-west in a curvilinear arc to the south-west. It is therefore likely that this feature is part of phase of activity on the site earlier than the other ditch digging. The pottery from the

fill (62) places it in the Iron Age; the flint flakes recovered from the fill reinforce it as being of prehistoric date. It is possible that this feature forms part of an enclosure ditch, the rest of which has been lost to post-medieval activity.

4.1.7 The presence of Iron Age activity on the site is also illustrated by the small cluster of six pits to the west of ditch **61**. The recovery of two sherds of Late Iron Age pottery from pit **51** shows that people were working and living in the vicinity during the Iron Age. Residual Iron Age pottery has been located in the fills of the post-medieval ditches and also as surface finds, further indicating that this area was occupied in this period.

4.2 Post-medieval activity

4.2.1 The majority of the features encountered on site are of post-medieval date. The four parallel ditches in the west of the site all contained post-medieval pottery and a large amount of CBM and, despite the presence also of possible prehistoric finds in their fills, they are all of recent date (Appendix E).

4.2.2 The four parallel ditches in the south west corner of the site all have similar fills, are of similar size and are relatively equally spaced across the area so are most likely to be contemporary in date and part of a single episode and/or system. As this area of the site still suffers greatly from waterlogging it is suggested that they form a drainage network to enable agricultural use of the land. As peaty deposits were found in the bases of all of these features and environmental analysis found pond weed and other wetland species it is suggested that these features started out as open drainage channels.

4.2.3 Previous work on Titchwell Marsh has identified a complex drainage network of parallel north-south and east-west drainage channels with shallow parallel depressions or grips intersecting larger field boundary ditches (Gardiner & Hartwell 2006). These can still be identified in aerial photos of the area north and east of the site and it is likely that most of the post-medieval ditches are related to this drainage network. The final chalk rubble fills in these ditches or grips suggest a change in the management of land drainage with a change to the use of rubble-filled land drains rather then open channels most likely as a result of more mechanized farming and the need for larger fields. This change is evident in the construction of feature **68** which was clearly dug and then backfilled with the chalk rubble.

4.2.4 The use of wood in the base of these features although consistent across many may also have changed over time. In the four parallel ditches which were initially open channels, the wood could have been used to line the ditches in order to prevent collapse in soft marshy ground. In ditch **68** however, where collapse was not a problem due to its immediate backfilling, the wood could have been used as a raft to prevent the chalk rubble from simply sinking into the soft ground.

4.2.5 Ditch **18** on the eastern side of the site was aligned in a north to south direction. It exactly lined up with the field boundary in the fields directly to the north and the south of the site. Therefore, it can be suggested that the investigation area was originally two fields, and at some point; this ditch was filled in and the fields combined. Ditch **14** runs parallel to this former boundary, *c.3*m to the west of it. South of the site along the line of these ditches there is a small track/droveway with ditches either side. Both ditches **14** and **18** are of similar dimensions; and aerial photographs of the site show a crop mark in the field directly to the north along the same alignment, suggesting a continuation of these two ditches, reinforcing this idea that they represent a post-medieval track or droveway.

4.3 Significance

4.3.1 The most intriguing find on the site is the Middle Bronze Age cremation or, in fact, partial cremation. Its broken urn and partial remains suggest that this was part of a whole cremation sub-divided and interred in this location, possibly as a fertility rite to ensure good harvests and/or fishing and hunting. The burnt material in the associated pit suggest an accompanying ceremony possibly involving feasting. This appears to be a rare find in the British isles and even rarer in Norfolk so adds considerably to our knowledge of cremation practices and funerary rites within the Middle Bronze Age and should encourage future cremated remains to be analysed with this evidence in mind.

4.3.2 The discovery of Iron Age features indicate a continuation of activity in this area within that period, as is also suggested by the few Roman pot sherds recovered from the site

4.3.3 The discovery of the post-medieval drainage system shows the practices used to drain the marshy expanses along this coastline and also show how these practices changed over time. With so much of Norfolk affected by the archaeology of land reclamation and drainage all discoveries of this type help us better understand the systems and procedures employed in this mammoth task.

Appendix B. Context Inventory

Context	Cut	Category	Feature Type	Width(m)	Depth(m)	Finds	Date
1	-	-	surface finds	-	-	ceramic	post-medieval
2	-	layer	topsoil		0.35	ceramic, flint	post-medieval/BA
3	-	-	surface finds	-	-	pottery, flint	IA/BA
4	-	cut	ditch	2.6	0.46	-	-
5	-	cut	ditch	2.6	0.05	-	-
6	4	fill	ditch	1.15	0.17	pottery	IA
7	4	fill	ditch	2.2	0.36	pottery, shell, brick	post-medieval
8	4	fill	ditch	2.9	0.15	-	-
9			VOID				-
10	-	cut	pit	0.26	0.26	-	-
11	10	fill	pit	0.26	0.26	bone, pottery	Mid BA
12	-	cut	pit	0.75	0.1	-	-
13	12	fill	pit	0.7	0.1	Burnt flint	
14	-	cut	ditch	1.16	0.56	-	-
15	14	fill	ditch	0.6	0.12	-	-
16	14	fill	ditch	0.78	0.3	-	-
17	14	fill	ditch	1.16	0.23	-	-
18	-	cut	ditch	2.3	0.72	-	-
19	18	fill	ditch	0.8	0.24	Ceramic field drain pieces	post-medieval
20	18	fill	ditch	0.28	0.2	-	-
21	18	fill	ditch	1.3	0.21	Ceramic field drain pieces	post-medieval
22	18	fill	ditch	0.97	0.12	-	-
23	18	fill	ditch	2.3	0.27	Modern white ceramics	post-medieval
24	-	cut	ditch	2.75	0.45	-	-
25	-	cut	ditch	1.85	0.4	-	-
26	-	cut	ditch	0.95	0.4	-	-
27	-	cut	ditch	0.4	0.25	-	-
28	-	cut	ditch	0.95	0.56	-	-
29	27	fill	ditch	0.4	0.25	-	-
30	28	fill	ditch	0.55	0.25	CBM	post-medieval
31	28	fill	ditch	0.95	0.18	-	-
32	28	fill	ditch	0.95	0.18	flint	prehistoric
33	24	fill	ditch	2.54	0.18	flint	Meso/ENeo
34			VOID				
35	24	fill	ditch	1.88	0.19	-	-

Context	Cut	Category	Feature Type	Width(m)	Depth(m)	Finds	Date
36			VOID				
37			VOID				
38			VOID				
39			VOID				
40			VOID				
41	24	fill	ditch	2.45	0.11	-	-
42	40	fill	ditch	1.75	0.32	CBM	post-medieval
43			VOID				-
44	26	fill	ditch	0.8	0.23	flint	Latter Prehistoric
45	26	fill	ditch	0.85	0.44	-	-
46	26	fill	ditch	0.65	0.1	flint	Latter Prehistoric
47	25	fill	ditch	1.85	0.15	-	-
48	25	fill	ditch	1.1	0.3	CBM, ceramic	post-medieval
49	-	cut	pit	1.2	0.15	-	-
50	49	fill	pit	1.2	0.15	-	-
51	-	cut	pit	0.9	0.08	-	-
52	51	fill	pit	0.9	0.08	pottery	IA
53	-	cut	pit	1.35	0.11	-	-
54	53	fill	pit	1.35	0.11	-	-
55	-	cut	pit	0.5	0.07	-	-
56	55	fill	pit	0.5	0.07	-	-
57	-	cut	pit	0.75	0.05	-	-
58	57	fill	pit	0.75	0.05	-	-
59	-	cut	pit	0.33	0.05	-	-
60	59	fill	pit	0.33	0.05	-	-
61	-	cut	ditch	1.02	0.57	-	-
62	61	fill	ditch	1.02	0.57	flint, pottery	Latter Prehistoric/IA
63	-	cut	ditch	0.3	0.05	-	-
64	63	fill	ditch	0.3	0.05	-	-
65	-	cut	ditch	0.5	0.16	-	-
66	65	fill	ditch	0.5	0.16	-	-
67	-	layer	peat	-	0.35	-	-
68	-	cut	ditch	1.7	0.45	-	-
69	68	fill	drain	1.55	0.35	-	-
70	68	fill	drain	1.7	0.12	-	-
71		VOID					
72		VOID					
73		VOID					

APPENDIX C. FINDS REPORTS

C.1 Pottery

By Paul Spoerry

Introduction and methodology

C.1.1 A small group of pottery sherds of very variable date was recovered from the excavated features and land surface. This includes several fragile sherds found with the human cremation. The assemblage was not large enough to warrant significant work, however, the prehistoric sherds have been described in more detail for the archive. Hand-made sherd fabrics were studied using a low-power binocular microscope. Context groups were weighed and individual sherd numbers counted.

C.1.2 All sherds were either assigned a recognised ceramic fabric code, or in the case of hand-made prehistoric sherds, the fabrics were classified on the basis of key fabric inclusions. Brief description and data is tabulated below.

Results and Conclusions

C.1.3 The prehistoric pottery includes the thirteen small, fragile sherds from the cremation context 11. As they represent only a small part of the pot these are more probably from a vessel placed close to the pyre and are not part of a receptacle for the cremation or from a complete vessel placed in the ground alongside the remains. The small amount of cremated bone and partial vessel suggest a rite involving selection of part of the cremation only for deposition.

C.1.4 These sherds are too small to offer any real potential to reconstruct the vessel. The clay was probably naturally sandy, and very coarse crushed flint was added as a tempering agent. Bronze Age pottery from Norfolk is not yet widely published; the largest published groups being from as far away as Grimes Graves, where Middle Bronze Age vessels with a great variety of inclusion types including flint and quartz sand types were recorded (Longworth, Ellison and Rigby 1988). The vessel from context 11 probably sits squarely in this same Middle Bronze Age 'Deverel-Rimbury' tradition.

C.1.5 A number of small hand-made sherds of different fabric types were recovered from other contexts. These include grog, flint and quartz tempering and this diversity may imply widely differing dates for these vessels. None of these sherds can be very accurately dated, there is no data on the vessel shape other than the fact that one sherd in context 62 was much more thin-walled than the others. These sherds have mostly been identified as Iron Age in date, although one has inclusions, including large fragments of bronze mica, that are more usually seen in Middle Saxon pottery. The quartz sand temper and absence of any decoration or surface treatment might suggest a mature Middle Iron Age date on the basis of material from elsewhere in the County (Percival 1999), although this suggestion is evidently rather speculative with such a small, disparate and fragmentary group.

C.1.6 The presence of Romano-British greywares from surface finds hints at more activity of this period being close by.

C.1.7 The early-modern sherds probably accompany later 19th and 20th century land management that includes the cutting of drainage ditches and their lining with brushwood, as seen in those features at the western end of the site.

Context	No.	Code	Description	Date
1	2 (59g)	NVGW	Roman greyware jar rims' probably Nene valley (possibly later coarse Brampton product)	200-400
	1 (21g)	CREA	Creamware	1770-1900
	1 (48g)	TRANS	Transfer printed whitewares	1780-1900
2	4 (30g)	CREA	Creamware	1770-1900
	1 (6g)	RRED	Refined redware	1650-1780
	1 (3g)	ENGS	English stoneware bottle	1800-1900
3	1 (6g)	PRPOT	Reduced hand-made ware, with oxidised external surface; common medium quartz and occasional coarse grog inclusions	Iron Age
	1 (5g)	PRPOT	Reduced hand-made ware; abundant medium quartz inclusions, slightly smoothed ext. surface	Iron Age
6	1 (4g)	PRPOT	Reduced hand-made ware; abundant fine to coarse clear and white quartz inclusions	Iron Age
7	1 (70g)	PMR	Post-medieval redware; rolled rim from pancheon	1700-1900
11	13 (55g)	PRPOT	Reduced hand-made ware; common coarse and very coarse flint and occasional coarse quartz inclusions	Middle Bronze Age
42	1 (112g0	ENGS	English stoneware; base of large bottle	1850-1920
48	1 (82g)	CBM	Reduced grey roof pantile; sanded base	1500-1800
52	2 (3g)	PRPOT	Reduced hand-made ware; common fine-medium quartz inclusions, slightly smoothed ext. surface	Iron Age
	1 (3g)	PRPOT	Reduced hand-made ware; common medium-coarse quartz and occasional v. coarse gold mica flakes	Iron Age / Middle Saxon
62	1 (3g)	PRPOT	Reduced hand-made ware; abundant fine-medium quartz inclusions, thin-walled.	Iron Age

Table 1. Pottery identification and dating

C.2 Ceramic Building material (CBM)

By Paul Spoerry

Introduction and methodology

C.2.1 A small assemblage of fragments of brick, with a little roof tile, was examined by eye. Identification is based on fabric, form and technology. All samples unless stated otherwise are in an oxidised red earthenware fabric typical of brick and tile in the locale and county of Norfolk generally.

Result and Conclusions

C.2.2 Without a detailed local type series it is difficult to assign dates and provenance to bricks, which are notoriously hard to date anyway. Table 2 provides some approximate dates, based on 'rules of thumb' for technological development.

Context	No.	Description	Date
7	5	Later hand- made brick	1700-1850
	1	Hand-made narrow gauge brick	1500-1750
	1	Hand-made, poorly mixed brick	1600-1750
	5	Assorted roof tile	
42	3	Later hand- made brick	1700-1850
	1	Hand-made, poorly mixed brick	
	1	Roof tile	
30	2	Badly burnt hand-made brick	1500-1750
48	7	Later hand- made brick	1700-1850
	1	Hand-made, poorly mixed brick; Cambs fabric?	1700-1850
	5	Assorted roof tile	

Table 2. CBM identification

C.3 Flint

By Barry Bishop

Introduction and methodology

C.3.1 The archaeological investigations at Titchwell Marsh resulted in the recovery of 16 pieces of struck flint, a burnt fragment from a flint quern and a quantity of burnt flint (Tables 3 and 4). The assemblage is clearly chronologically mixed and demonstrates flintworking occurring at the site from at least the Early Neolithic period and also during the later Bronze Age or Iron Age.

Decortication Flake	Flake	Regular Blade	Irregular Blade	Blade-like flake	Core	Conchoidal Chunk	Notch	Scraper	Flint Quern Fragment	Burnt Flint (no.)	Burnt Flint (wt:g)
2	4	2	1	2	1	1	1	2	1	32	1289

Table 3. Quantification of lithic material

Struck Flint

Raw Materials

C.3.2 The raw materials used for the struck flint industries comprise a rather variable fine-grained flint that ranges in colour from semi-opaque grey to a mottled translucent brown/opaque yellow brown, sometimes stained a greenish or reddish brown. Where present, cortex is variably thick, hard and rough, and a number of pre-flaking thermal scars are also present. The raw materials are likely to have been obtained from local glacial tills or other glacially eroded deposits, that may have experienced some limited alluvial reworking.

Technology, Typology and Deposition

C.3.3 The struck flint was recovered from a variety of contexts. The largest quantity of stratified material came from ditch **61** (fill 62), which produced five pieces comprising three flakes, a blade and a side-scraper. With the possible exception of the blade (although this is quite thick and irregular and therefore does not necessarily need to be excluded) the flakes are relatively thick and short and have wide unmodified striking platforms. These, along with the rather undiagnostic scraper, would not be out of place within a later prehistoric assemblage dating to the later second or first millennium BC, and therefore may be at least broadly contemporary with the Iron Age date assigned to the feature from its contained pottery. However, they do not suggest in situ working and their condition would suggest that they had spent some time in an active environment between manufacture and deposition. The flake from Iron Age pit [49] (fill [50]) consists of the proximal end of a systematically produced blade that is unlikely to date to after the Early Neolithic.

C.3.4 The remainder of the material came from Post-medieval or unstratified contexts and is certainly residual. They include a blade and two blade-like flakes of Mesolithic or Early Neolithic date but mostly comprise thicker flakes along with a core, an end scraper and a notch that would perhaps be most characteristic of later prehistoric industries.

Discussion of the struck flint

C.3.5 Although only a small assemblage, the struck flint indicated activity at the site during both the Mesolithic/Early Neolithic and during the later prehistoric period. The earlier period is represented by the small quantity of blades and blade-like flakes. No cores or retouched pieces from these periods are present, however, and the material probably reflects the short term visiting of the site by mobile populations. The later prehistoric material can only be dated to the latter parts of the second or the first millennium BC but it could potentially be associated with the similarly dated activities represented by the field systems and cremation. Retouched pieces, comprising two scrapers and a notched flake, may imply a wider range of activities than seen previously, but the assemblage was still very small and can illuminate little in terms of the nature of these occupations.

Burnt Flint

C.3.6 Just over 1.2kg of otherwise unmodified burnt flint fragments were recovered from two contexts. By far the greatest quantities, comprising 28 large fragments weighing 1187g, came from pit **12**, associated with a cremation burial. This material had been systematically and intensively burnt, and the quantities present suggest deliberate burning. It may represent debris accruing from the cremation process, although deliberately burnt flint is more usually associated with cooking or craft/industrial activities. Nevertheless, it still may be connected to the practices surrounding the cremation and its interment, such as by indicating feasting or other associated activities.

Saddle Quern Fragment

C.3.7 The remaining burnt flint, consisting of three smaller fragments that weigh a total of 17g, were recovered from the primary fill of ditch **26** (fill 44). The largest piece, weighing 15g, is a fragment from a flint saddle quern and retained a small part of its battered and worn grinding surface.

C.3.8 The dating of flint saddle querns is far from clear. Few have been recovered from securely dateable contexts but those that have appear to be predominantly Bronze Age. Clark (1936, 44), for example, records a flint saddle quern that had been reused as a core from Early – Middle Bronze Age deposits at Mildenhall Fen, as well as mentioning other flint saddle querns in the Museum of Archaeology and Ethnology in Cambridge (*ibid*.). Nearer to Titchwell, flint querns have been recovered from excavations at Leziate and East Winch and these similarly had been burnt prior to deposition (Bishop 2009a and 2009b).

C.3.9 The fragment here is small and the circumstances surrounding its deposition are difficult to assess. Nevertheless, due to their transformative properties querns are often regarded as being charged with symbolic and metaphysical qualities (*e.g.* Hodder 1990; Lidström Holmberg 2004), and in the archaeological record often appear to have been disposed of with some formality. They are frequently recovered from significant points within settlements or arable systems and they are often considered to have been 'special' or 'placed' deposits, associated with both foundational and closing ceremonies (*e.g* Hill 1995). Frequently they appear to have been deliberately destroyed prior to

discard, which may have been deemed necessary in order for the material to be acceptable as an offering (Needham and Spence 1997, 86; Brück 1995, 262).

Context	Decortication Flake	Flake	Regular Blade	Irregular Blade	Blade-like flake	Core	Conchoidal Chunk	Notch	Scraper	RM	Condition	Suggested Date		Burnt Flint (No.)	Burnt Flint (wt:g)
02	1									Mottled Brown	Slightly Abraded	Prehistoric			
03									1	Mottled Brown	Slightly Abraded	Prehistoric	Partially cortical flake with a short stretch of moderately steep convex scalar retouch on its distal dorsal		
03						1				Mottled Brown	Slightly Abraded	Later Prehistoric	Rounded pebble with a series of flakes removed 'keel' style from one end and further flakes removed perpendicularly from the other. many incipient Hertzian cones. Weighs 98g		
03					1					Mottled Brown	Abraded	Meso/E Neo	Faceted platform, stained reddish brown		
03							1			Mottled Brown	Abraded	Prehistoric	Very battered		
03					1					Mottled Brown	Slightly Abraded	Meso/E Neo			
13													Heavily and uniformly burnt flint fragments	28	1187
32		1								Mottled Brown	Abraded	Prehistoric	Proximal Fragment. Stained red		
32		1								Mottled Brown	Slightly Abraded	Prehistoric	Stained red		
33			1							Mottled Brown	Abraded	Meso/E Neo			
44												Later Prehistoric	Flint quern fragment	3	17
46								1		Mottled Brown	Slightly Abraded	Later Prehistoric	Wide deep notch cut into right ventral of a partially cortical flake		
50			1							Mottled Brown	Good	Meso/E Neo	Proximal Fragment. Incipient recortication		
62				1						Mottled Brown	Abraded	Meso/E Neo			

Context	Decortication Flake	Flake	Regular Blade	Irregular Blade	Blade-like flake	Core	Conchoidal Chunk	Notch	Scraper	RM	Condition	Suggested Date		Burnt Flint (No.)	Burnt Flint (wt:g)
62									1	Mottled Brown	Slightly Abraded	later Prehistoric	Thick, partially cortical flake with a short stretch of moderately steep convex scalar retouch on its right lateral dorsal margin		
62	1									Translucent Brown	Slightly Abraded	Prehistoric	Distal Fragment		
62		1								Semi-opaque grey	Abraded	Prehistoric			
62		1								Semi-opaque grey	Good	Prehistoric			

Table 4. Lithic catalogue

Appendix D. Environmental Reports

D.1 Environmental samples

By Rachel Fosberry

Introduction and methodology

D.1.1 Six bulk samples were taken from features within the evaluated areas of the site in order to assess the quality of preservation of plant remains, bones and artefacts and their potential to provide useful data as part of further archaeological investigations.

D.1.2 Features sampled included a cremation along with an associated pit, two of a series of four ditches that were later proved to be modern and two further ditches thought to be prehistoric.

D.1.3 Up to thirty litres of each sample were processed by tank flotation for the recovery of charred plant remains, dating evidence and any other artefactual evidence that might be present. The flot was collected in a 0.3mm nylon mesh and the residue was washed through a 0.5mm sieve. Both flot and residue were allowed to air dry. The dried residue was passed through 5mm and 2mm sieves and a magnet was dragged through each resulting fraction prior to sorting for artefacts. Any artefacts present were noted and reintegrated with the hand-excavated finds. The flot was examined under a binocular microscope at x16 magnification and the presence of any plant remains or other artefacts are noted on Table 5.

Results

Sample No.	Context No.	Cut No.	Contents
1	11	10	Cremated human bone, pottery, charred grain, charred weed seeds:plantain, goosefoot, knotgrass,
2	13	12	Charcoal
3	15	18	Humic plant matter and bramble seeds
4	33	24	Pond weed, buttercup and bramble seeds, egg cases and insect fragments
5	44	26	Sedge seeds, microscopic burnt clay fragments
6	62	61	Charcoal

Table 5. Environmental results

Preservation

D.1.4 Samples 1, 2 and 6 contain plant remains preserved by carbonisation.

D.1.5 Samples 3, 4 and 5 are preserved by waterlogging (survival due to anioxic conditions)

Plant Remains

Cereals

D.1.6 A single charred cereal grain is present in Sample 1, fill 11 of cremation pit **10**. It is likely to be a prehistoric hulled wheat grain, either emmer or spelt wheat (*Triticum dicoccum/spelta*) although identification is tentative due to the poor preservation of the grain. No chaff elements occur.

Weed seeds

D.1.7 Charred seeds occur as single specimens in Sample 1 and include plantain (Plantago lanceolata), goosefoot (Chemopodium sp.), knotgrass (Polygonum sp.).

D.1.8 Samples 3, 4 and 5 contain moderate quantities of seeds preserved by waterlogging including bramble (*Rubus* sp), buttercup (*Ranunculus* sp.), nettle (*Urtica* sp.) and sedges (*Carex* sp.).

Ecofacts and Artefacts

D.1.9 Sample 1 contained several fragments of prehistoric pottery along with a substantial quantity of cremated human bone.

Contamination

D.1.10 Modern roots were present in large quantities in all of the samples.

Discussion

D.1.11 The cremation and its associated pit have yielded interesting samples that prove that the cremation is human; the associated pit contains charcoal. The cremation sample also contains a considerable amount of charcoal suggesting that the bone elements were deposited along with some pyre material. The single grain may be an accidental inclusion, but an offering of grain at the original pyre site is possible. The weed seeds of plantain, goosefoot and knotweed are all grassland seeds that were probably included in the pyre fuel.

D.1.12 The associated pit contained a similar amount of charcoal to the cremation sample but the nature of the charcoal differs. The cremation contains larger pieces of charcoal whereas the charcoal in the fill of the associated pit is comprised of fine flecks. There is no evidence of burning *in-situ*. Unfortunately the analysis of the bulk samples from these features cannot verify their association.

D.1.13 Sample 3, fill 15 was taken from the basal fill of ditch **18**. The presence of numerous waterlogged bramble seeds and humic matter indicates that the ditch remained wet after construction and that the surrounding area was shrubland.

D.1.14 Sample 6, fill 62 of an undated ditch in the north-east corner of the site contained modern roots and sparse charcoal. The presence of the charcoal indicates a burning event but the quality of the charcoal would not be suitable for radiocarbon dating and so this feature remains undated.

D.1.15 Radiocarbon dating of samples from ditches **24** and **26** indicate that were modern.

Statement of Research Potential

D.1.16 The samples have limited research potential other than the cremation and its' associated pit. Radiocarbon dating of these features would not only provide a date but could also verify the association of these features.

Further Work and Methods Statement

D.1.17 No further work is required on these samples.

D.2 Human Remains

By Róisín McCarthy

Archaeological Background

D.2.1 Cremated bone was identified in a small pit (**10**) at the eastern end of the site which appeared to represent the remains of an unurned cremation deposit (Fill 11). The feature was truncated on its north-east side by a contemporary pit (**12**), of longer and shallower dimensions than pit **10**, which was filled with moderate charcoal (13) and dark blue-grey clayey silt (Bush 2009; Uí Choileáin 2009).

D.2.2 The deposit containing the cremated bone was half-sectioned and all of the soil recovered was wet sieved and the residue passed through 10mm and 5mm sieves. All bone measuring greater than 5mm was extracted for osteological analysis (Uí Choileáin 2009).

Bronze Age Cremation Technology

D.2.3 McKinley (1997b) highlights the important distinction between the terms 'cremation' and 'cremation burial'; the former describes the purposeful ritualised act of burning a corpse, whilst the latter refers to the cremation deposit within a vessel and in turn burial pit. Cremated remains therefore represent the total of non-combustive elements that constitute the human body (Lange *et. al* 1987, p. 11).

D.2.4 Cremation burials, both urned and unurned, are the most typical mode of ritualised deposition of cremated human remains (McKinley 2004), the latter form being in evidence at Titchwell Marsh. Other forms of cremation deposits include the *bustum*-type burial and pyre-sites where cremated bone is recovered in direct association with the site of burning.

D.2.5 The Bronze Age cremation rite constituted a series of time-consuming and often labour-intensive operations. These included the preparation of the body, construction of the pyre, and occasionally the sacrifice of animals and preparation of food and other gift offerings to be placed on the pyre, the cremation itself and the task of collecting the cremated remains for later burial (Williams 2004). Certainly the tasks preceding burial would have needed to be carried out under a limited time scale since osteological evidence points towards cremation soon after death as the most common timing of mortuary events in the Bronze Age period.

Pyre Construction

D.2.6 Pyre design and construction would have been pivotal to a successful cremation and must have taken into account the length and weight of the body and adequate air-flow to facilitate oxygen supply to the fire. There would appear to be a universal format for pyre construction; specifically layers of timber crossing in alternating long-axes set in a rectangle with gaps in-filled with brushwood, occasionally built over a shallow pit to facilitate an under-draft and increase air circulation (McKinley 1993). Open-air experimental pyres of this construction have been recorded as reaching temperatures in excess of 1200°C (McKinley 1994a) with much of the timbers having burned down to wood ash after approximately two hours (although the corpse may continue to burn in its own fat for several hours following this; McKinley 2008). Important factors affecting the temperatures achieved and length of time of heat exposure include the amount of fuel, adequate oxygen supply and weather conditions (i.e. the negative affects of strong winds and heavy rain). Oak wood has been found to be the most common fuel for

cremations dating to all periods in Britain (McKinley 2008). Alternative wood species such as ash, *Pomoidaea* and *Prunus* spp. have also been identified from ancient pyre sites in Britain (Murphy 1994).

D.2.7 The corpse was most commonly positioned extended and supine (fully clothed with artefacts laid on and around the body) on top of the pyre construction. This supposition is generally supported by evidence of the burnt remnants of glass and metal pyre goods adhering to bones in various positions indicating a supine position on the pyre (McKinley 1997a). This type of evidence was not present on bones from the Titchwell Marsh cremation deposit however.

Process of Cremation

D.2.8 The cremation process rapidly dehydrates and oxidises the organic components of the body. Three principal prerequisites of complete oxidisation are an appropriate length of time, amount of temperature and supply of oxygen (McKinley 2006; Roberts 2009). If any one of these conditions are lacking, a successful cremation is not possible. The cremation process has been divided into four principal stages of incineration as follows (Devlin 2008, 110).

1. Dehydration: the breaking of hydroxyl bonds resulting in the release of water
2. Decomposition: the loss of organic components occurring at temperatures of between 500°C and 800°C
3. Inversion: the loss of carbonates occurring at temperatures between 700°C and 1100°C
4. Fusion: the melting of bone crystals, visible microscopically and occurring at temperatures in excess of 1600°C

D.2.9 Experimental cremations have shown that the incineration of the body tissues, to the point where the bones are revealed takes approximately one hour at temperatures ranging from 670°C to 810°C (*Bohnert* et al. 1998). In a modern crematorium setting, complete oxidisation of a corpse takes, on average, one and a half hours where temperature is closely regulated and controlled via gas-jet burner technology. Common macroscopic changes observable in bones that have undergone the cremation process are changes in colour, fragmentation and fissuring, warping and shrinkage. All of these changes will be discussed in more detail below with respect to the Titchwell Marsh cremation deposit.

Methods

Analysis Aims and Procedure

D.2.10 The aims of the present analysis were to compile a detailed inventory of all identifiable bone fragments, recording, wherever possible, osteological data relating to the demographic and pathological profile of each of the cremation deposits, as well as evidence of pyre technology and ritualised activities. The following section describes the general osteological methodologies employed as part of standard analysis procedure. More detailed method statements relating to specific aspects of analysis are discussed in the relevant sections of this report.

D.2.11 Analysis methodology followed McKinley's standard procedure (McKinley 1997b; Brickley & McKinley 2004). The cremation deposits were each passed through a stack of three sieves at 10mm, 5mm and 2mm fractions taking care to remove any non-bone material (e.g. stone inclusions). Each of the sieve fractions were then weighed and their percentage from the total deposit weight calculated in order to assess the degree of fragmentation. Measurements of the maximum length of cranial and longbone fragments were also taken at this stage. A pro-forma cremation recording sheet was used to standardise the recording of bone fraction weights as well as general observations relating to colour, warping, fissuring and shrinkage, the presence of animal bone and/or pyre goods, age and biological sex, minimum number of individuals (MNI) and palaeopathological observations.

D.2.12 Analysis proceeded with the identification of bone fragments, firstly according to species (i.e. human from non-human) based on gross appearance, surface texture and density (Whyte 2001), followed by a more detailed division of identifiable human bone fragments according to their anatomical location via a pro-forma 'bone sorting' grid-sheet. Bone fragments were assigned one of four anatomical categories as follows: skull, axial, upper limb and lower limb. Only bone fragments that could be confidently assigned to a single bone (e.g. femur, occipital, clavicle) or bone type (e.g. metacarpal, rib, hand phalanx) were considered 'identifiable'. Longbone shaft fragments as well as indistinguishable phalanges and vertebrae were grouped and quantified as such, but not considered further in the analysis. Anatomical terminology was informed by Schwartz (1995).

D.2.13 Bones considered useful for the determination of the biological sex and age-at-death were set aside at this stage for further assessment. The methodologies employed for the assessment of age-at-death and biological sex, as well as the palaeopathological observation strategies employed during analysis, are described below (see Results).

Results

Osteological Analysis

D.2.14 High levels of fragmentation limited the quantities of identifiable bone most useful in the assessment of biological sex and age-at-death. Close to 75% of the cremation deposit consisted of undiagnostic bone fragments, whilst a further 18% of bone fragments were classified as unidentifiable longbone fragments and therefore of little analytical value.

Minimum Number of Individuals (MNI)

D.2.15 The MNI total is calculated on a simple premise: each individual can have only one left femur, one left humerus and so forth. A true MNI count for a bone assemblage considers the bone element, side, age, sex, articulation (i.e. the joint or point at which two or more bones meet) -or occlusion in the case of sided teeth (i.e. the surface of the tooth which meets the tooth above)- and metrically corresponding bones (i.e. bones which appear to belong to the same individual based on size) in order to calculate the total. In cases of cremated bone assemblages most osteoarchaeologists will simplify the process by identifying the most recurrent bone within a specified context, for example an urn, the total number of which will equal the absolute maximum MNI. An MNI of one individual was calculated for the Titchwell Marsh cremation deposit.

D.2.16 Morphological changes associated with the cremation process further complicate the identification of recurring bones in a single cremation deposit and caution must be exercised when applying an interpretation of bone duplication as an example of a dual or multiple burial. Only in cases where two or more sets of the same bones,

morphologically distinct and with obvious disparities in age-related development (i.e. adult versus non-adult bone), are present within a single cremation deposit with little evidence of external disturbance can the conclusion of dual or multiple burial be drawn (McKinley 1997a).

D.2.17 No intrusive bones were recovered from the Titchwell Marsh cremation deposit, however, despite truncation by pit 12. This latter feature, filled with primarily charcoal and burnt flints (13), was considered contemporary with the cremation deposit at the time of excavation and may represent a final deposition of pyre material immediately following the cremation burial (Pit **10**) (Uí Choileáin 2009, p.20). The notable absence of bone in fill 13 is significant in relation to possible bone collection procedures and cremation ritual, however, and will be discussed in further detail below.

Biological Sex Assessment

D.2.18 As mentioned previously, the fragmentary nature of cremated bone severely limits the quantity and quality of bone that may be used in the assessment of biological sex. Sexually dimorphic traits of the skull and pelvis are most commonly employed as indicators of biological sex in skeletal remains, however special care must be taken in the identification of specific skeletal regions. Merbs (1967) notes, for example, that marginal fragments from up to six other parts of the skeleton may be confused with the sciatic notch of the pelvis alone.

D.2.19 As the pelvis reflects skeletal adaptation to child-bearing in females it is considered the most reliable indicator of biological sex (Roberts 2009), however in the case of the Titchwell Marsh cremation deposit, no sexually dimorphic pelvic fragments were present. Cranial morphology may also indicate biological sex in skeletal remains, but is subject to a greater degree of variation between males and females than the pelvic region. As a result, biological sex assessments in adult cremated bone are quite commonly uncertain and range from 'possible' to 'probable'. Positive sex assessments of 'male' or 'female' for cremation burials are rare and were not possible for the Titchwell Marsh cremation deposit.

D.2.20 A single fragment of right supraorbital ridge of the frontal bone was identified, however the fragment was too small too assess for male and/or female morphology. No other sexually dimorphic skeletal features were identified on bones from the deposit. A final sex assessment of 'unknown sex' was therefore assigned.

Age-at-death Assessment

D.2.21 In general, adult age estimates are gleaned from observations of age-related morphological changes to the skeleton where observable (i.e. pubic symphyseal face (Todd 1920) auricular surface (Lovejoy *et. al* 1985) endocranial suture closure (Buikstra & Ubelaker 1994) and levels of degenerative joint disease (DJD). Non-adult age assessments are derived from observations of dental development, ossification of growth centres and the degree of synostosis of various epiphyses known to occur at specific age-ranges during childhood and adolescence (Scheuer and Black 2000). As the unerupted tooth crowns of immature individuals are generally well-protected within the tooth crypts they commonly survive the cremation process and are a particularly useful indicator of age-at-death in immature cremated remains. Non-adult age assessment is intrinsically more accurate than adult age assessment due to the well-understood stages of growth prior to adulthood. Following synostosis of the sternal end of the clavicle (c. 25- 30 years), age-related changes in the adult skeleton are highly variable between individuals and populations.

Category	*Age Range (yrs)*
Adult	18+
Young Adult	18-25
Prime Adult	26-35
Mature Adult	36-45
Older Adult	45+
Adolescent	13-17
Older Child	6-12
Young Child	2-5
Infant	1mth-2yrs
Neonate	<1mth

Table 6: Age categories employed in present analysis

D.2.22 For this reason only broad age categories, if any, may be assigned with confidence and are often grouped together, for example, young-to-prime adult or mature-to-old adult. In cases where age-related morphological traits of the skeleton are unobservable the gross appearance (i.e. size and density) of the bones may be taken as an indicator of maturation, but with caution. The age categories employed for the purposes of this analysis are outlined in Table 6 above.

D.2.23 An age-at-death assessment was possible, within limits, for the individual represented by the Titchwell Marsh cremation deposit. The deposit had a limited number of diagnostic bone fragments available for age estimation. The presence of a number of permanent lower molar roots exhibiting a closed apices (and therefore fully-erupted at the time of death) indicated an age-at-death of at least 9 years. Fused intermediate and distal hand phalanges were also identified, and increased the age-at-death estimate to 18-25+ years. The remaining bone fragments were consistent in size and morphology with an adult individual. An overall age-at-death estimate of 'adult; 18+ years' was therefore assigned.

Fragmentation

D.2.24 The level of fragmentation in a cremated bone assemblage is an important factor affecting the ease with which bone fragments may be identified. The maximum fragment size recorded for the Titchwell Marsh cremation deposit was 34mm and was derived from a fragment ulna shaft. This measurement falls well below the range of maximum fragment sizes recorded from modern crematorium where longbone fragments averaged at between 68 and 195mm in length (Gibson 2007) prior to cremulation (i.e. purposeful crushing to dust).

D.2.25 The Titchwell Marsh cremation deposit exhibited a high level of fragmentation, in that bone fragments less than 5mm in size accounted for over half of the deposits' total weight. Over 50% of the overall weight of the cremation deposit was retrieved from the 5mm sieve fraction, whilst a further 35% came from the 2mm fraction. Only 9% (32.5g) of the cremation deposit consisted of 10mm+ fragments. This latter figure falls considerably short of percentage volume figures from cremations recovered from contemporary Bronze Age sites, for example at Norwich Road, Norfolk (Geber 2000) where close to 50% of bone fragments were greater than 10mm in size. This deposit however was recovered from an urned cremation burial. The high level of fragmentation

seen at Titchwell Marsh may be explained partly by the unurned nature of the deposit, thereby affording the bones less protection from external disturbance than in the case of an urned burial context.

Context	Total (g)	>10mm (g)	>10mm (%)	>5mm (g)	>5mm (%)	>2mm (g)	>2mm (%)
11	**345**	32.5	9	190.9	55	121.6	35

*Note: 1% of Context 11 cremation deposit total was accounted for by <2mm bone dust an/or pea-grit.

Table 7: Degree of fragmentation within the Titchwell Marsh cremation deposit

D.2.26 Aside from the inherent friability of cremated bone, a variety of factors have been recognised as contributing to the overall level of fragmentation of cremated bone assemblages. Experiments by Stiner *et al*. (1995) illustrated that bones exposed to fire are significantly more fragile than those which are not. In particular, the bones of individuals with underlying weakening pathological conditions such as osteoporosis have also been shown to suffer preferential fragmentation during and after the cremation process (Ubelaker 2007) and in general denser bones will demonstrate less fragmentation. Weathering and burial environments -particularly in regions with high water content, acidic soil and regular episodes of freezing- will also further fragment cremated bone. Post-cremation collection processes such as the possible raking-over of bones have been interpreted from levels of fragmentation in cremated bone assemblages (McKinley 1997a). Similarly, activities such as tending to the pyre by stoking and moving body parts to the central heat source (Reinhard 1994), (a practice employed in modern Hindu cremations; Downes 1999), may also have contributed greatly to the levels of fragmentation.

D.2.27 Purposeful post-cremation breakage or 'pounding' of cremated bone to facilitate deposition in a cinerary vessel has been reported elsewhere where fragment size has appeared uniformly small (Gejvall 1967; White 1982), however in general purposeful breaking of bones is seldom interpretable from cremated assemblages (McKinley 1994b). As assessment of longbone fragment edges in the Titchwell Marsh cremation deposit showed that the vast majority occurred along the lines of previously existing dehydration fissures from the cremation process and were therefore not the result of purposeful breakage prior to deposition.

Evidence of Collection and Deposition Procedure

D.2.28 Collection biases offer one explanation as to the low rate of skeletal element retrieval at Titchwell Marsh. In the Bronze Age period, the recovery of cremated remains from the pyre site was most likely carried out by hand, or possibly in some cases by winnowing or raking over the bones (McKinley 2008). As with modern ethnographic examples, it is likely that the cremation pyre would have been left overnight to cool (McKinley 1997a). McKinley (1997a) estimates that the collection of cremated remains may have taken anything up to four hours per person in order to achieve full recovery. Even aside from the inevitable 30% loss of skeletal material reduced to bone dust after the cremation process, complete recovery of cremated remains is rarely, if ever, reported in archaeological cremated bone deposits. Experimental cremation studies (McKinley 1997a; Bohnert 1998) have shown that cremated bone often remains in anatomical order by the end of the cremation process on the hot ash bed and is easily distinguishable in colour from the remains of pyre debris. Significant biases in terms of

the quantities of identifiable skeletal elements according to specific bone types in cremation deposits may be a function of the ease with which certain bones are identifiable in comparison to others.

Bone Weights

D.2.29 An assessment of the weight of cremated bone deposits can be a useful indicator of the collection practices employed after cremation and burial environment conditions. The weight of an unburned dry skeleton will normally equal that of a cremated skeleton (McKinley 1997a), however more often than not ancient cremation deposits fall considerably short of the expected weight of the average adult cremation. Studies of cremated adult remains that have been exposed to temperatures of between 800°C and 1200°C in modern crematorium settings, have reported post-cremation bone weights of between 1 to 2.5kg (McKinley 1997a; Bohnert 1998; Wahl 2008). Of these weights McKinley (1997a) has estimated that approximately 30% would be irretrievable bone dust. She has recorded cremation burial weights of anywhere between 57g to 3000g from approximately five-thousand British multi-period sites (McKinley 2006). It is also important to note that ancient cremation deposits can contain considerable amounts of pea-grit and other sediments often less than 2mm in size, which should be accounted for as much as possible in an assessment of the true bone weight of such deposits. On average ancient adult cremation deposits contain approximately 40-60% of the expected bone weights reported from modern studies (i.e. 1650g; McKinley 2000).

D.2.30 The total weight of the cremation deposit was 345g, or approximately 21% of the average expected weight of an adult cremation.

Skeletal Part Representation

D.2.31 Cranial fragments are perhaps the most distinctive bone fragment in any cremated bone deposit, and often account for the vast majority of identified bone fragments in cremation burials. A paucity of trabecular bone may also reflect its poor survival once passed through the cremation process (McKinley 1997a).

D.2.32 Close to 26% (88.3g) of the total weight of the cremation deposit consisted of identifiable bone fragments, 70% of which were classified as ‘longbone only’ thereby proving the most frequently identifiable skeletal element (see Table 8). The next most frequently identified bone fragments were derived from the skull region, accounting for 21.7% (19.2g) of the weight of identifiable bone fragments. The remaining skeletal regions were notably less frequent. Fragments of bones from the axial region of the skeleton, bones from the upper limbs and bones from the lower limbs accounted for 1.4% (1.2g), 6.1% (5.4g) and 0.3% (0.3g) of all identifiable bone fragments respectively. Although upper and lower limb bones are almost certainly represented in the category of ‘longbone only’, the absence of vertebral and rib fragments indicates a very poor survival rate of trabecular bone. This is perhaps to be expected considering the high level of efficiency of this particular cremation (see Efficiency of Cremation below). In general skeletal elements from all parts of the skeleton were represented with the perhaps notable exception of the teeth. Even some of the smallest bones of a typical adult skeleton such as hand phalanges and the odontoid process of the second cervical vertebra were recovered.

Context	Skull (%)	Axial (%)	Upper Limb (%)	Lower Limb (%)	Unidentifiable (%)
11	21.7	1.4	6.1	0.3	74.4

Table 8: Skeletal representation by element expressed as a percentage of identifiable bone

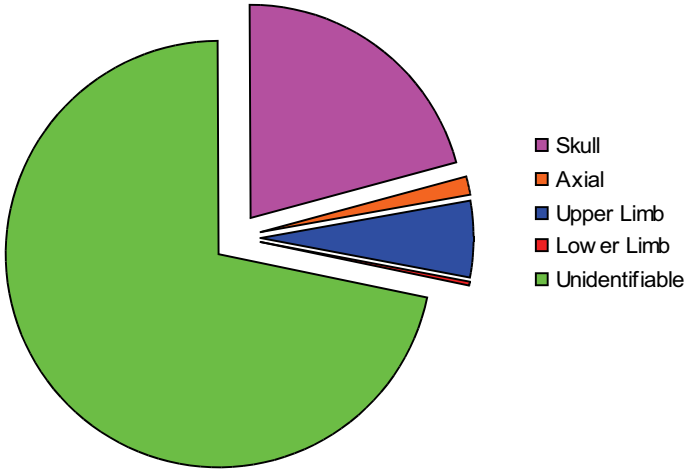

Table 9: Skeletal representation by element expressed as a percentage of identifiable bone

Evidence of Pyre Technology

Efficiency of Cremation

D.2.33 Interpretation of the overall efficiency of the cremation process is generally informed by an assessment of colour variations observable in cremated bone. Colour reflects the on-going chemical changes that compose the cremation process (Fairgrieve 2008). Although not conclusively reliable, the colour of cremated bone may be taken as a rough indication of the pyre temperature and the duration of the fire (Shipman *et al.* 1984). A well-ventilated and sufficiently fuelled fire may rapidly reduce a body to calcined bone and ash, whilst excessive draft and lack of fuel may result in partially oxidised and in some cases unburned bone.

D.2.34 Qualitative studies on the effects of fire on human remains have illustrated the various colour stages that may be exhibited on cremated bones (Shipman *et. al* 1984). Shipman et al. (1984) note that for assessment of pyre and bone temperatures during cremation, colour alone is an imprecise indicator owing to intra-observer differences in colour perception and the staining effects of the burial environment in which burned bones had been deposited. Variations in fuel load, oxygen availability and contact with metal artefacts both during the cremation process and once buried, can also account for the range of colours observed on cremated bone. In addition, the chemical composition of the skeleton and amount of organic matter in the bones themselves may also affect the efficiency of incineration (Worley 2008).

D.2.35 Cremated bone can vary in colour from black (charred) to blue/grey and eventually progressing to white when full oxidisation of the organic component of the bone has been achieved. In general bone exposed to fire will turn from the normal tan/ off-white colour of unburned bone, initially to dark brown or black to blue-grey and eventually

white at temperatures of 800°C or more (Walker *et al* 2008). Similar colour changes occur in incinerated teeth (Fairgrieve 2008; Schmidt 2008). The various stages of colour in the Titchwell Marsh cremation deposit was assessed according to the Shipman *et al.* (1984, p. 307-325) method (see Table 4 below), which equates each colour stage to a range of likely temperatures.

Colour Stage	**Bone Temperature**	**Bone Colour**
1	20°C -<285°C	Normal surface; neutral white/ pale yellow/ yellow
2	295°C -<525°C	Reddish-brown/ Very dark grey-brown/ Neutral dark-grey/ Reddish-yellow
3	525°C -<645°C	Neutral black (with medium blue and some reddish-yellow appearing)
4	645°C -940°C	Predominantly neutral white with light blue-grey and light grey present
5	940+°C	Neutral white with some medium-grey and reddish-yellow)

Table 10: Bone colour stages (after Shipman et al. 1984)

D.2.36 The vast majority of bones from the Titchwell Marsh cremation deposit were classified as Shipman *et. al.* Stage 5 firing. Occasionally colour variation between the various layers of a single bone was observed, most often in the cortices of long bone shaft fragments and between the inner and outer table of cranial vault fragments which had broken post-mortem. In these cases the outer layer of bone had the appearance of Stage 5 firing whilst the internal surfaces had remained at Stage 2-3 (i.e. dark brown-dark grey). This two-tone or 'sandwich' effect was also noted on cremated bones from the Anglo-Saxon cemetery at Spong Hill (McKinley 2008) and may be an indication of the duration of the fire. Poor firing of trabecular bone has been attributed previously to its greater level of blood vessel infiltration in comparison to cortical bone making it more difficult to oxidise (McKinley 2008). If bones had appeared calcined according to their external appearance, for example, this may have been considered sufficiently burned for burial.

D.2.37 McKinley (2004) advises that bone colour variations should be described in detail noting the skeletal elements affected, the side of the body from which the bone came and also the parts of the bone affected. Details such as these will inform interpretations of the distance of various body parts from the central heat source in the pyre as well as the susceptibility of certain bones (e.g. those with less tissue cover) to direct heat exposure for longer (McKinley 2004; 2008; Fairgrieve 2008). From observations of the overall colour variations across the skeletal elements of the cremation deposit it would appear that skeletal elements from all regions of the skeleton had equal levels of exposure to heat during the cremation process.

Bone Fissuring Patterns

D.2.38 The pattern and appearance of fissures in cremated bone may indicate the condition of the body prior to cremation (i.e. in-flesh or skeletonised). Bone anatomy also has a part to play in the way in which bone fractures and fissures once exposed to fire (Fairgrieve 2008). Early studies of fissuring patterns in cremated bone (Baby 1954; Buikstra 1989), primarily focused on patterns of fissuring in the diaphyses of longbones. Several forms

of fissure morphology in cremated bone have been identified and are summarised in Table 11 below.

Fissure Pattern	Description
Curvilinear (or curved transverse)	Usually found to occur across the diaphyses of longbones
Transverse	Appear as cracks or splits perpendicular to the long-axis of longbones and can sometimes result in complete transaction of the bone shaft
Longitudinal	Cracks which follow the long-axis of longbones and can sometimes penetrate to the medullary cavity
Delaminate	Peeling effect where areas of cortical bone appear to flake away from underlying trabecular bone for example at longbone epiphyses
Patina	Referred to as a superficial 'cracked earth' pattern typically observable on flat bones of the cranium and sometimes on the outer surfaces of longbones

Table 11: Types of fissuring patterns in cremated bone (after Herrmann & Bennett, 1999, p. 461-469)

D.2.39 Although variations have been reported, the general consensus of these studies is that bone cremated in flesh will display patterns of deep transverse cracking with some degree of warping, whilst bones which have been cremated without flesh will have far less severe and superficial cracking and no warping (Binford 1963; Buikstra 1989). For the purposes of the present analysis, bone fissuring patterns in the Tichwell Marsh cremation deposit were assessed according to a combination of experimental cremation study results (Thurman and Wilmore 1981; Binford 1963; Whyte 2001), outlined in Table 12 below.

Condition of Body	Fracture Pattern
In-Flesh	Deep checking, curved/ diagonal-transverse fracturing, warping, irregular longitudinal splitting, no checking
Fleshed (Green Bone)	Serrated fractures near epiphyses, parallel fractures along checking lines, less-pronounced warping
Dry Bone	Superficial checking, longitudinal striae and splintering/ cracking, no warping

Table 12: Categories of fissuring patterns (after Baby 1954; Thurman and Wilmore 1981; Binford 1963; Whyte 2001)

D.2.40 The Titchwell Marsh cremation deposit displayed fissuring patterns typical of that expected for an in-flesh cremation; *i.e.* deep transverse cracking at the longbone shafts and occasional concentric cracking on a number of longbone articular surfaces. Patina-type fissuring was also noted on several cranial vault fragments, again typical of in-flesh cremation. Warping was not observed on bone fragments from the deposit however, but this is more likely as a function of small fragment size making this type of morphological change unobservable.

Summary of Main Findings

D.2.41 In summary, the Titchwell Marsh cremation deposit represents the remains of an adult individual of unknown sex and at least 18 years of age at the time of death.

D.2.42 The morphology of the bone fragments was of in-flesh cremation, typical to the Bronze Age period in Britain. Skeletal part representation reflected the probable manual random collection of the bones from the pyre site before being deposited into the pit for burial. There was a notable absence of trabecular bone overall, which is indicative of a high level of efficiency of cremation.

D.2.43 The quantity and quality of data retrieved from the deposit was typical of cremation burials that have been truncated and it is possible that a considerable volume of the original cremation deposit had been lost due to later disturbance.

D.2.44 The presence of animal bone was discounted via an assessment of the external texture and density of the bone fragments.

Evidence of Efficiency of Cremation

D.2.45 The majority of bone fragments in the Titchwell Marsh cremation deposit were buff white in colour, classified as Stage 5 according to the Shipman *et. al.* (1984) method indicating full oxidisation (McKinley 2008) and that pyre temperatures reached and were sustained at temperatures in excess of 900°C. This evidence suggests that the population of Titchwell Marsh had achieved good efficiency in the process of cremating their dead.

Evidence of Cremation Ritual

D.2.46 Evidence of the cremation ritual practices at Titchwell Marsh was limited. Bone fissuring patterns observed on the bones support the conclusion that the body was in-flesh and likely to have been cremated soon after death. There was no evidence to suggest purposeful manipulation of the bones, for example breaking, prior to burial.

Evidence of Collection Procedure

D.2.47 Weight assessment of the Titchwell Marsh cremation deposit revealed a poorer recovery rate than that of the contemporary Middle Bronze Age burial site at Beacon Hill, Somerset where the cremation burial was approximately 32% of average expected weights (McKinley 2008). In interpreting cremation burial weights due consideration should be given, however, to the level of disturbance on site. McKinley (1997a) advises that only cremation burials from undisturbed contexts may be considered as possibly containing the quantities of bone that were originally deposited.

D.2.48 The Titchwell Marsh cremation deposit was truncated by a contemporary shallow pit feature (Pit **12**) with a charcoal fill. There was no evidence of burning in the vicinity of the burial, suggesting that the fill of Pit **12** was the remains of pyre debris transported from the original pyre site and deposited in Pit **12** immediately after burial of the cremation deposit in Pit **10**. The complete absence of bone from the fill of Pit **12** however is significant, and indicates that if indeed this material represents pyre material contemporary with the cremation deposit, that particular care was taken in the recovery of bone fragments from the pyre site. An absence of intrusive bone fragments also suggests that the pyre site may have been built specifically for the individual from the associated cremation deposit and not on a site previously used for cremation. If particular care was taken in the recovery of the bone from the pyre site then the low weight of the Titchwell Marsh cremation deposit could be accounted for by a number of factors. These include (i) selective deposition of a particular portion of the original cremation, (ii) bone fragments were lost post-burial due to truncation and/or (iii) an adverse burial environment leading to poor survival of the bone.

Summary of Results

Context 11

Condition/ Context	Context 11: Disturbed Unurned Burial in Pit
Description	
MNI	1
Sex	Unknown
Age	Adult; 18+ years
Total Weight	345g
	Stage 5 firing *(Ref: Shipman et. al 1984)*: very well fired overall. Dehydration fissuring pattern is deep transverse cracking and concentric, longitudinal cracking primarily of the longbone shafts; patina fissuring is observable on a number of cranial vault fragments: overall fissuring pattern is consistent with an *in-flesh* cremation.
ID Cranial	42 vault fragments; 2 fragments of frontal (1x mid-line, 1x right supraorbital ridge); 1 fragment of parietal (adjacent to saggital suture); 18 tooth root fragments (1 lower molar root, 3 unidentified molar roots, 1 incisor root)
ID Axial	1 fragment of cervical vertebra facet; 2 thoracic vertebrae facets; 1 fragment of unidentified vertebra neural arch; 1 fragment of unidentified vertebral body
ID Upper Limb	1 fragment of unsided ulna shaft; 1 metacarpal shaft; 1 proximal hand phalanx shaft; 3 fragments of unnumbered intermediate hand phalanges, 1 fragment of distal hand phalanx (base)
ID Lower Limb	1 head of unnumbered metatarsal; 2 fragments of unidentified foot phalanges (1 shaft and 1 head fragment)
Pathology/ Non-Metric	None present
Finds or Animal Bone	None present

**KEY:*

ID= Identifiable

APPENDIX E. RADIOCARBON DATES

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30 October 2009

Laboratory Code	SUERC-26105 (GU-20137)
Submitter	Rachel Fosberry Oxford Archaeology East 15 Trafalgar Way Bar Hill Cambridgeshire CB23 8SQ
Site Reference	Titchwell RSPB Reserve
Sample Reference	XNF TMR09 [24] (33)
Material	Wood : Unidentified
$\delta^{13}C$ relative to VPDB	-27.4 ‰
Radiocarbon Age BP	120 ± 45

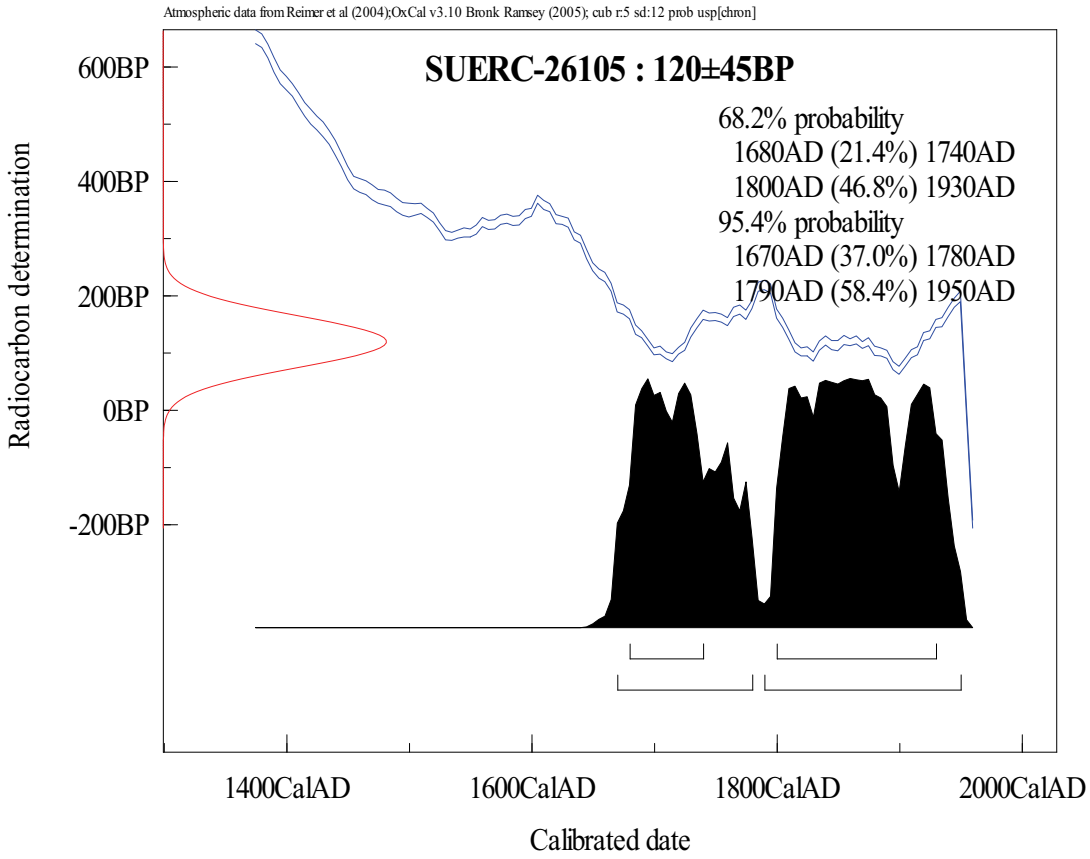
N.B.

1. The above ^{14}C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

2. The calibrated age ranges are determined from the University of Oxford Radiocarbon Accelerator Unit calibration program (OxCal3).

3. Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after the SUERC code. The contact details for the laboratory are email g.cook@suerc.gla.ac.uk or Telephone 01355 270136 direct line.

Calibration Plot



Scottish Universities Environmental Research Centre
Director: Professor A B MacKenzie Director of Research: Professor R M Ellam
Rankine Avenue, Scottish Enterprise Technology Park,
East Kilbride, Glasgow G75 0QF, Scotland, UK
Tel: +44 (0)1355 223332 Fax: +44 (0)1355 229898 www.glasgow.ac.uk/suerc

30 October 2009

Laboratory Code	SUERC-26106 (GU-20138)
Submitter	Rachel Fosberry Oxford Archaeology East 15 Trafalgar Way Bar Hill Cambridgeshire CB23 8SQ
Site Reference	Titchwell RSPB Reserve
Sample Reference	XNF TMR09 [26] (44)
Material	Wood : Unidentified
$\delta^{13}C$ relative to VPDB	-28.2 ‰
Radiocarbon Age BP	65 ± 45

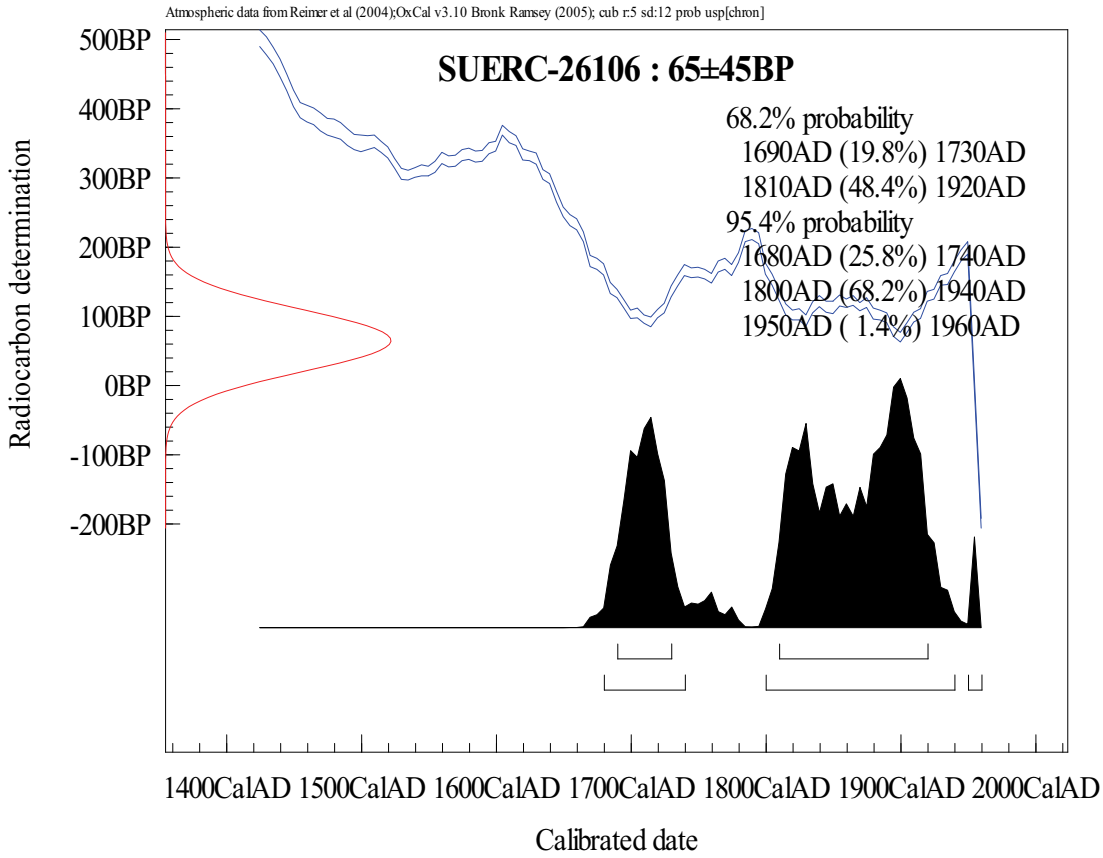
N.B.

1. The above ^{14}C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

2. The calibrated age ranges are determined from the University of Oxford Radiocarbon Accelerator Unit calibration program (OxCal3).

3. Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after the SUERC code. The contact details for the laboratory are email g.cook@suerc.gla.ac.uk or Telephone 01355 270136 direct line.

Calibration Plot



APPENDIX F. 2010 RECORDING OF THE WESTERN BANK

By John Diffey and Paul Spoerry

Description of observation and recording

F.1.1 During August 2010 two visits were made to the site to record works to strengthen the western sea defence bank, that lies about 200m west of the excavated area and runs for circa 1.1km northwards. The southern section of bank works was observed, around location TF749 4389.

F.1.2 The western sea bank at Titchwell Marsh was recorded in 2001 during the NMP programme (NHER 26790). It is believed to be that bank recorded on Faden's 1797 Map and Bryant's 1826 Map and it is believed to be associated with 18th century drainage and reclamation. It is known that the sea defences were breached in the 1953 North Sea surge and the entire area was flooded. When the land was purchased in 1974 by the RSPB considerable work was done to the existing northern and western embankments while a new embankment was created on the western side of the reserve (Gardiner M & Hartwell B).

F.1.3 The new works involved the cutting of a section through the bank for a large outflow pipe to be laid, and the addition of a mid-orange brown clay layer about 0.4m thick to the top of the existing bank (recorded as context 505, Figure 6). The former work enabled a section of the existing bank to be recorded. It was recorded as 15.5m wide at the base, 2.35m high with a flattish top around 3.5m across. It sat on a buried ground surface of light bluish-green clay. The bank make-up consisted of two layers. The lowest layer 503 was up to 1.3m thick and composed of redeposited natural clay of mixed blue-green and red-brown colour containing small sub-angular flint stones. The uppermost bank layer was 504, a mix of dark brown and light yellow sand and gravel, and silty clay, with frequent small sub-angular flints and occasional pieces of chalk. This fill also contained modern metal rods and cables and modern brick and tile This deposit was up to 1.25m thick and flattened at the top where is formed the previously exposed bank top. It also included lenses of topsoil and this, with the chalk lumps, suggest that it was created from a mix of material, at least some of which was imported from a distance further south.

F.1.4 The elements that make up this structure appear consistent with its previous interpretation as a post-medieval sea defence bank. The two main deposits clearly represent the two phases of works recorded previously the lower deposit representing the original 18th century construction while the upper layer represents the work of the RSPB in the late 70's and early 80's The former deposits suggest that the bank was constructed using the local clay formed in the salt-marshes that were being drained. The work by the RSPB was apparently carried out in the same fashion, with material drawn from either side of the bank by to raise it. Therefore the unlikely mix of material in the bank's top layers must be due to foreign material being deposited either side of the bank during the time of military use. This was subsequently re-deposited onto the bank during the first phase of its re-construction, explaining the amount of brick rubble and metalwork within the material.

Appendix G. Bibliography

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APPENDIX H. OASIS REPORT FORM

All fields are required unless they are not applicable.

Project Details

OASIS Number	Oxfordar3-67166		
Project Name	Archaeological Watching Brief at Titchwell Marsh RSPB Reserve		
Project Dates (fieldwork) Start	27-07-2009	Finish	01-10-2009
Previous Work (by OA East)	No	Future Work	No

Project Reference Codes

Site Code	XNFTMR09	Planning App. No.	08/02567/FM
HER No.	ENF123412	Related HER/OASIS No.	N/A

Type of Project/Techniques Used

Prompt: Conservation Area Consent

Please select all techniques used:

☒ Field Observation (periodic visits)	☒ Part Excavation	☐ Salvage Record
☐ Full Excavation (100%)	☒ Part Survey	☐ Systematic Field Walking
☐ Full Survey	☐ Recorded Observation	☐ Systematic Metal Detector Survey
☐ Geophysical Survey	☐ Remote Operated Vehicle Survey	☐ Test Pit Survey
☐ Open-Area Excavation	☐ Salvage Excavation	☒ Watching Brief

Monument Types/Significant Finds & Their Periods

List feature types using the NMR Monument Type Thesaurus and significant finds using the MDA Object type Thesaurus together with their respective periods. If no features/finds were found, please state "none".

Monument	Period	Object	Period
Cremation	Neolithic -4k to -2k	HSR, Pottery	Neolithic -4k to -2k
Ditch	Modern 1901 to Present	Flint	Bronze Age -2.5k to -700
Ditch	Modern 1901 to Present	CMB, ceramic	Modern 1901 to Present

Project Location

County	Norfolk	Site Address (including postcode if possible)	
District	Kings Lynn & West Norfolk	Titchwell Marsh RSPB Reserve Main Road Titchwell, King's Lynn, PE31 8BB	
Parish	Titchwell		
HER	Norfolk		
Study Area	13,750sqm	National Grid Reference	TF 754 445

Project Originators

Organisation	OA EAST
Project Brief Originator	David Robertson (Norfolk Landscape Archaeology)
Project Design Originator	Paul Spoerry
Project Manager	Paul Spoerry
Supervisor	Louise Bush and John Diffy

Project Archives

Physical Archive	Digital Archive	Paper Archive
Norfolk Museum Service	OA East	Norfolk Museum Service
ENF123412	XNFTMR09	ENF123412

Archive Contents/Media

	Physical Contents	Digital Contents	Paper Contents
Animal Bones	☐	☐	☐
Ceramics	☒	☐	☐
Environmental	☐	☐	☐
Glass	☒	☐	☐
Human Bones	☐	☐	☐
Industrial	☐	☐	☐
Leather	☐	☐	☐
Metal	☐	☐	☐
Stratigraphic		☐	☐
Survey		☒	☐
Textiles	☐	☐	☐
Wood	☒	☐	☐
Worked Bone	☐	☐	☐
Worked Stone/Lithic	☒	☐	☐
None	☐	☐	☒
Other	☐	☐	☐

Digital Media	Paper Media
☒ Database	☐ Aerial Photos
☐ GIS	☒ Context Sheet
☐ Geophysics	☐ Correspondence
☒ Images	☒ Diary
☒ Illustrations	☐ Drawing
☐ Moving Image	☐ Manuscript
☐ Spreadsheets	☐ Map
☒ Survey	☐ Matrices
☒ Text	☐ Microfilm
☐ Virtual Reality	☐ Misc.
	☐ Research/Notes
	☒ Photos
	☐ Plans
	☒ Report
	☒ Sections
	☐ Survey

Notes:

Plans

Limit of Excavation

Intrusion/Truncation

Illustrated Section S.14

Archaeological Deposit

Excavated Slot

Modern Deposit

Cut Number 118

Sections

Cut

Deposit Horizon

Intrusion/Truncation

Top Surface/Top of Natural

Cut Number 18

Deposit Number 17

Ordnance Datum 18.45m OD

Stone

Flint

Clay

Brick BR

Charcoal

Wood

Convention Key

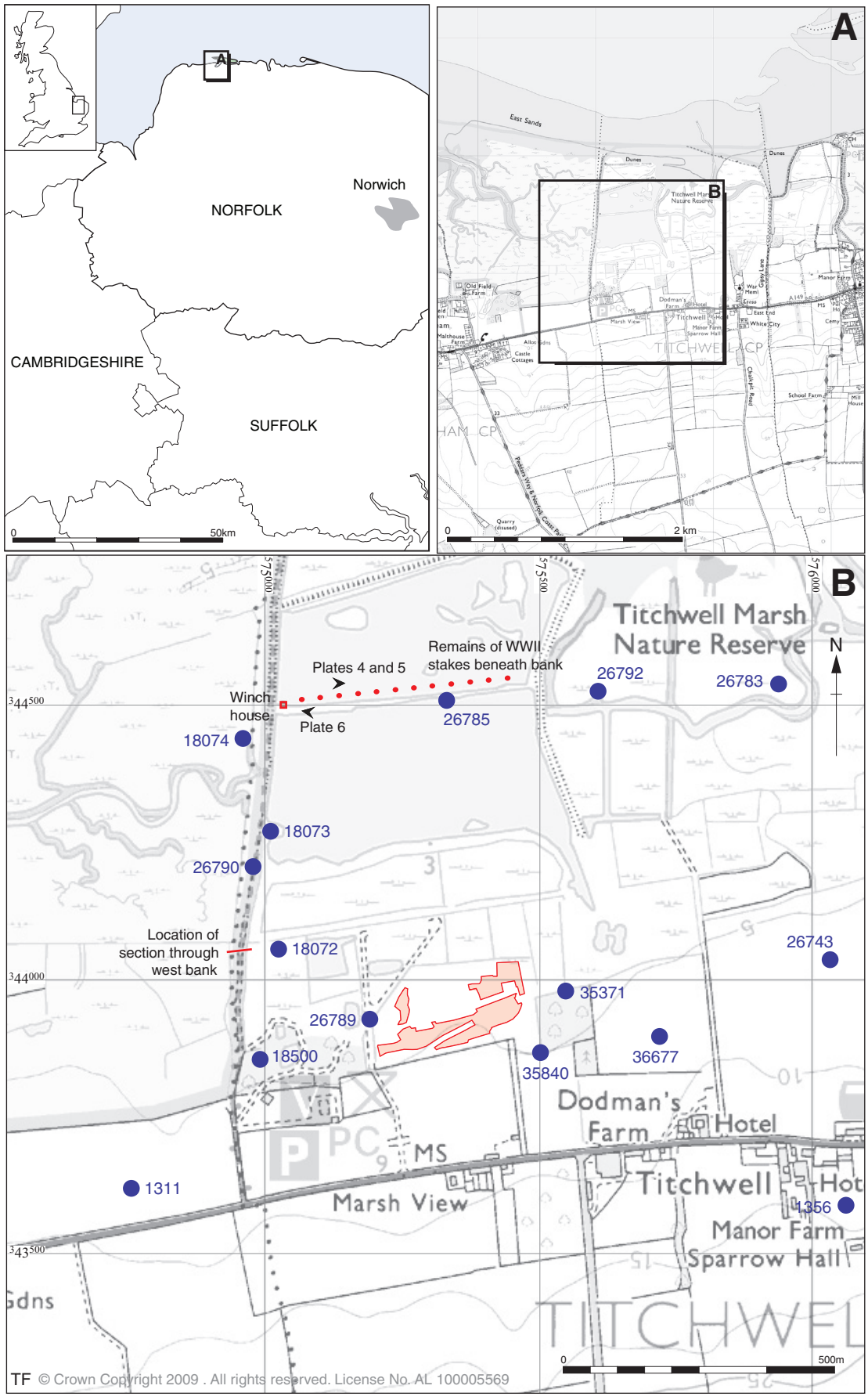


Figure 1: Site location showing archaeological works (red) and HER plot (blue)

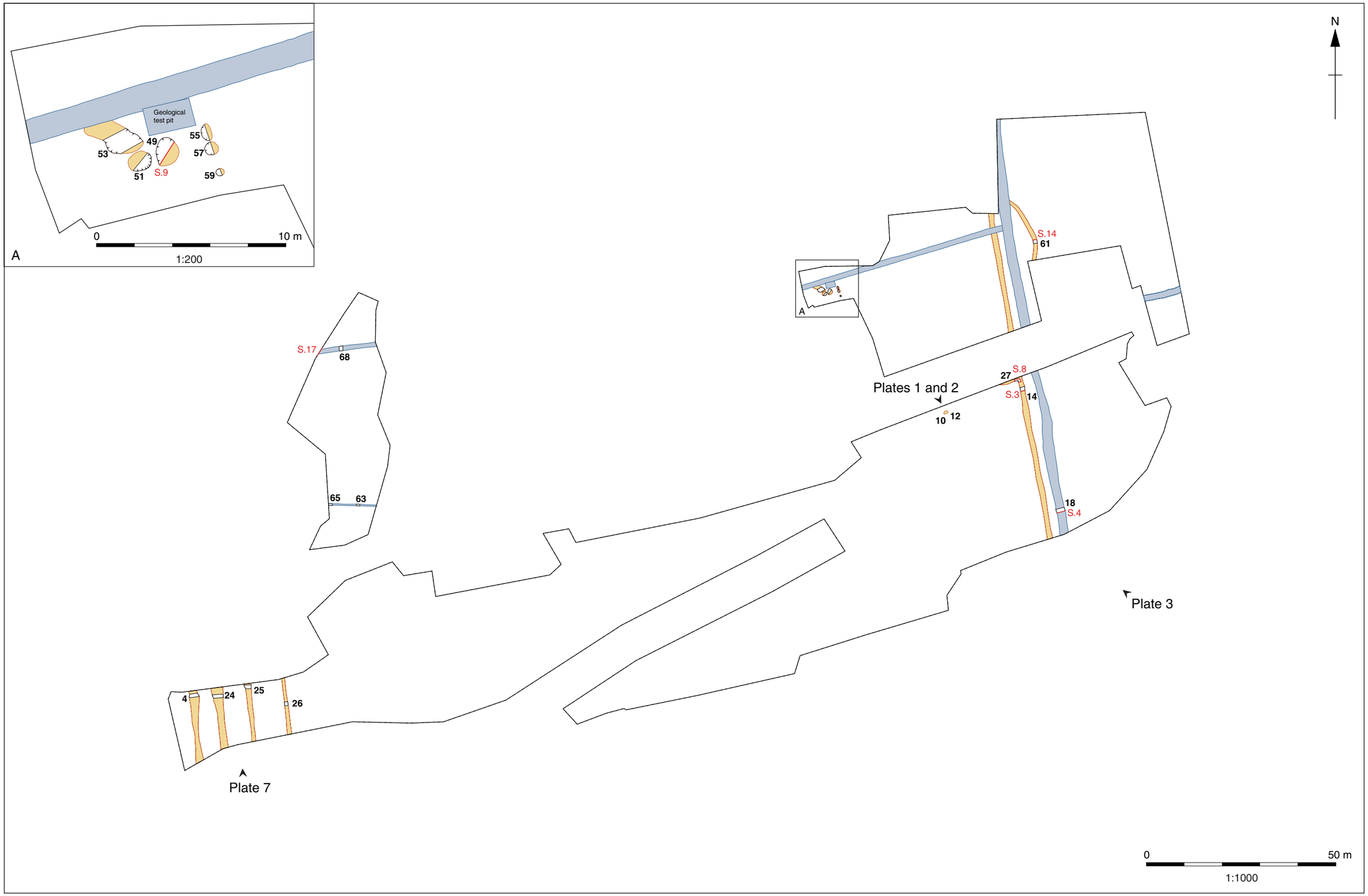


Figure 2: Overall site plan

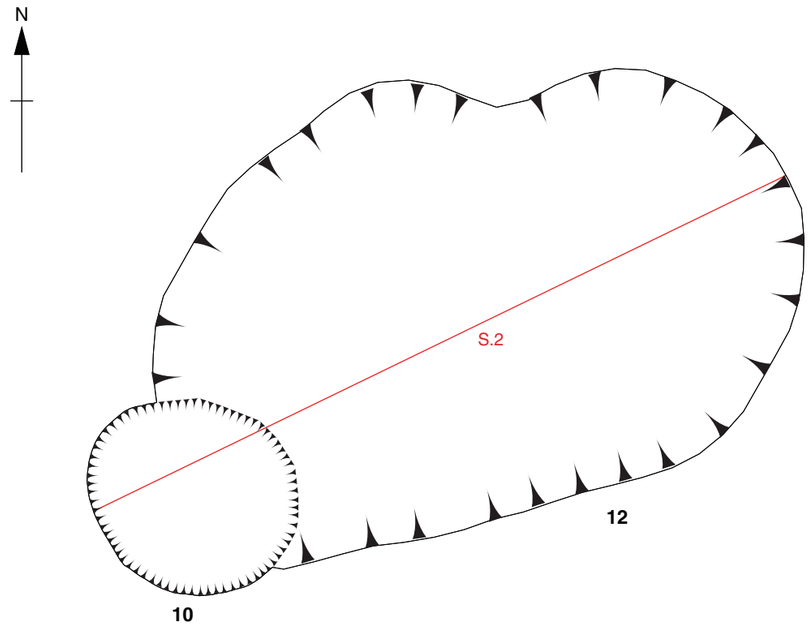


*Plate 1: Cremation **10**, looking south-south-east*

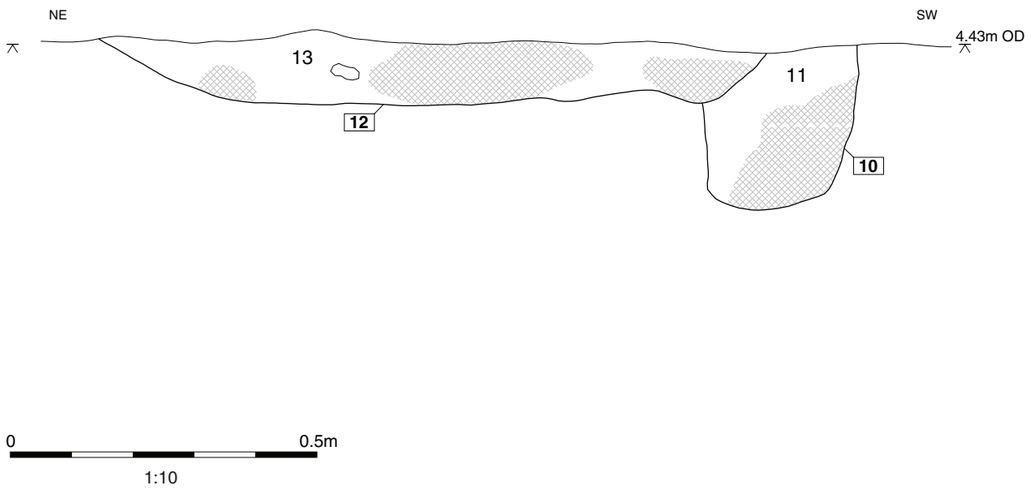
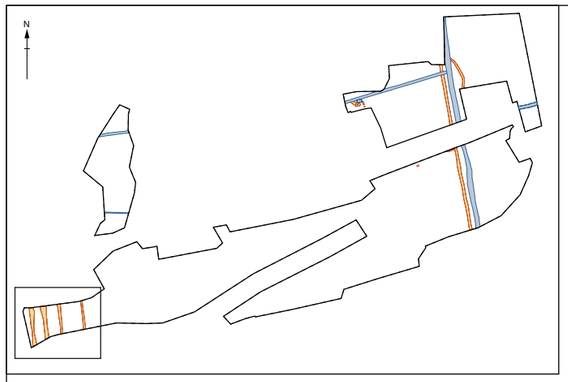
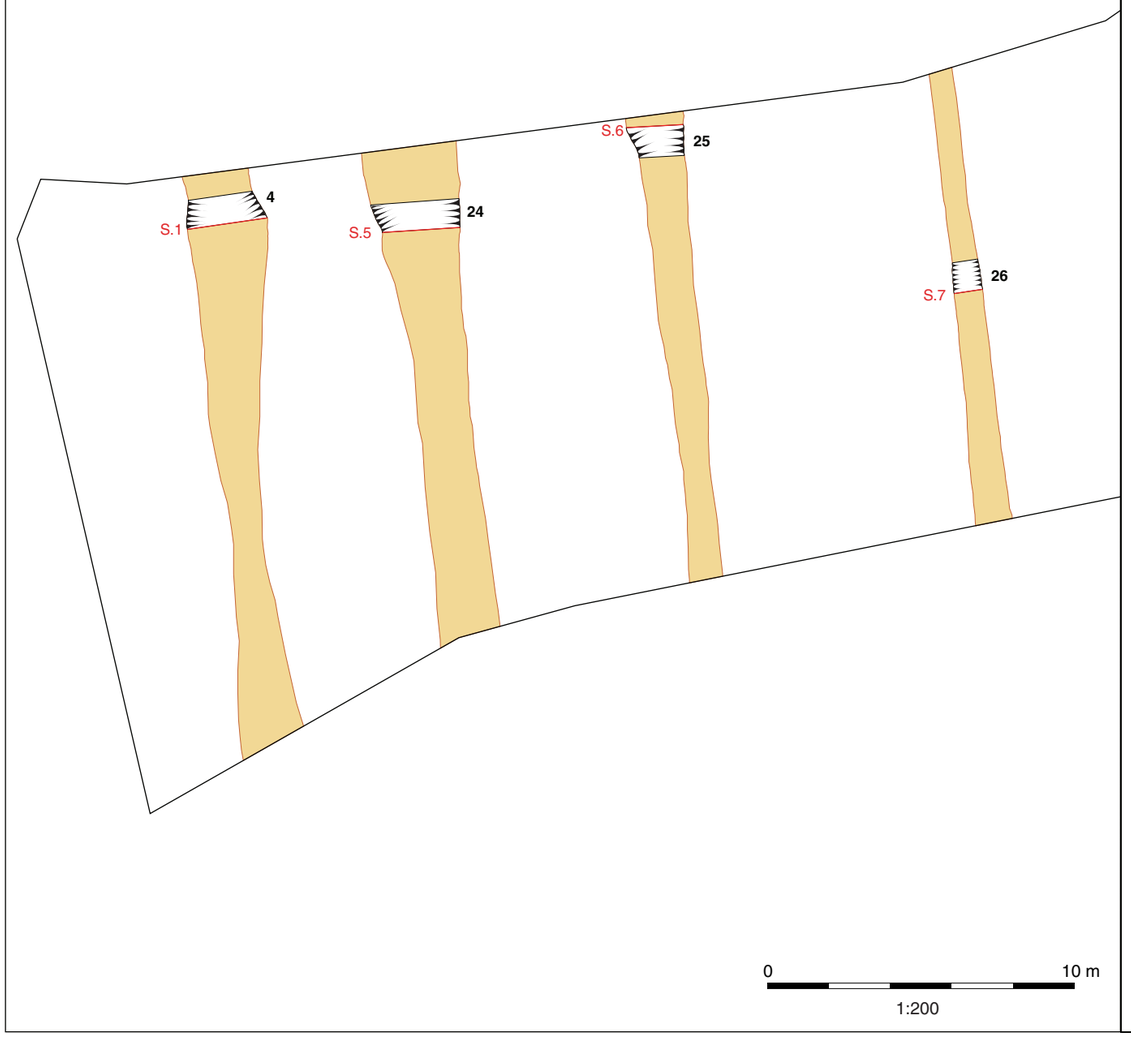


*Figure 3: Cremation **10***

Plate 2: Cremation after excavation, looking south-south-east





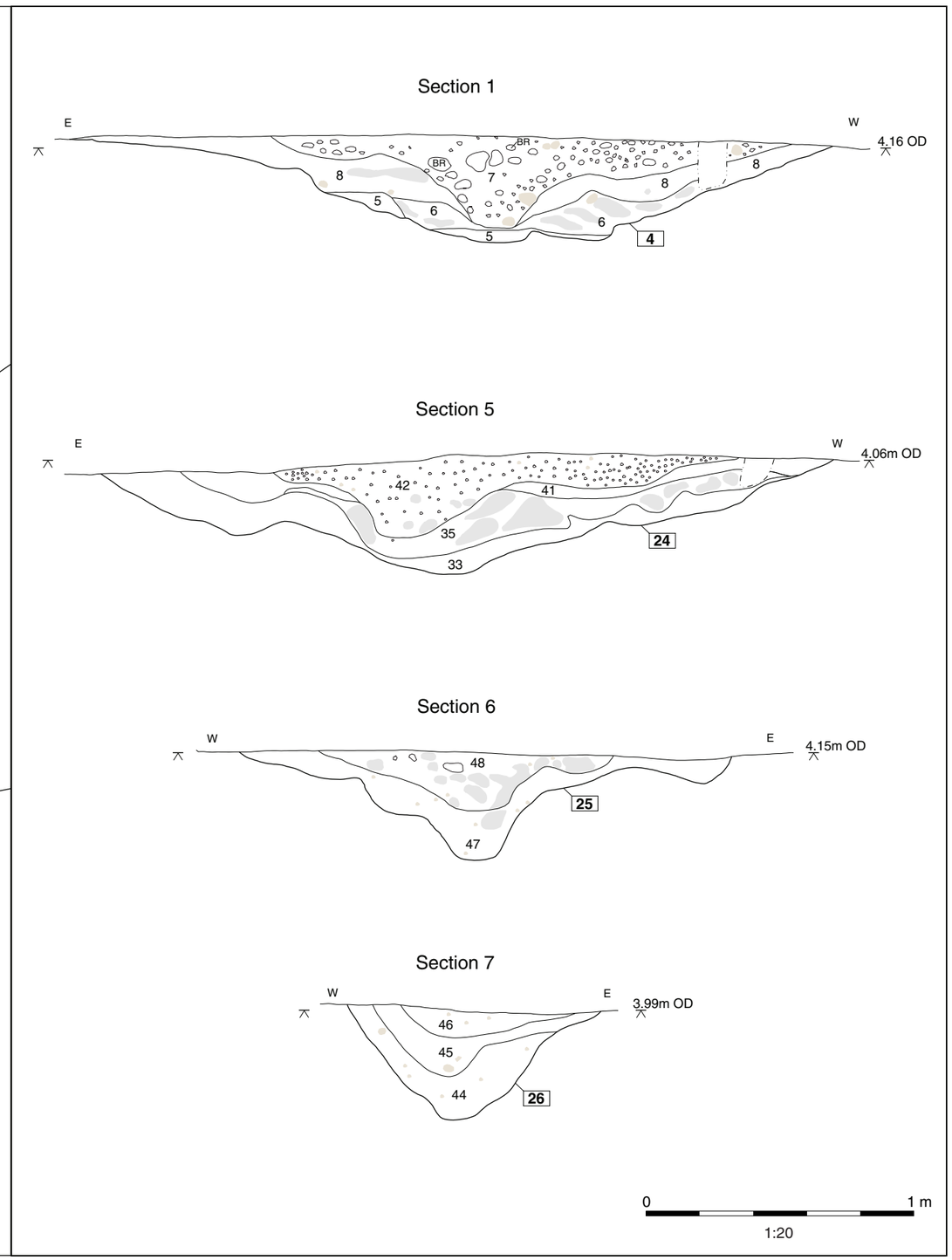


*Figure 4: Plan and sections of ditches **4**, **9**, **24**, **25** and **26***

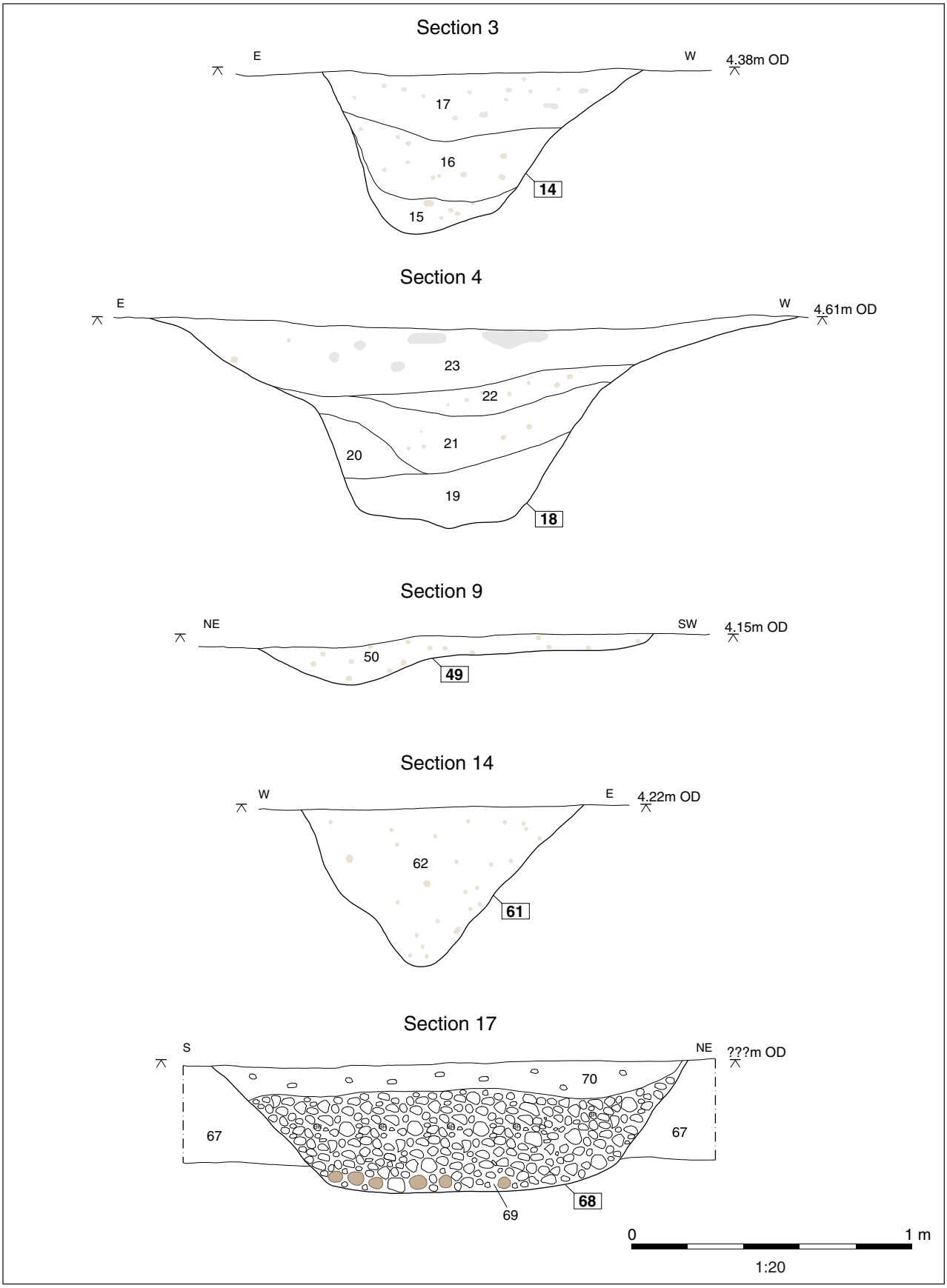


Figure 5: Additional sections (see Fig. 2 for locations)

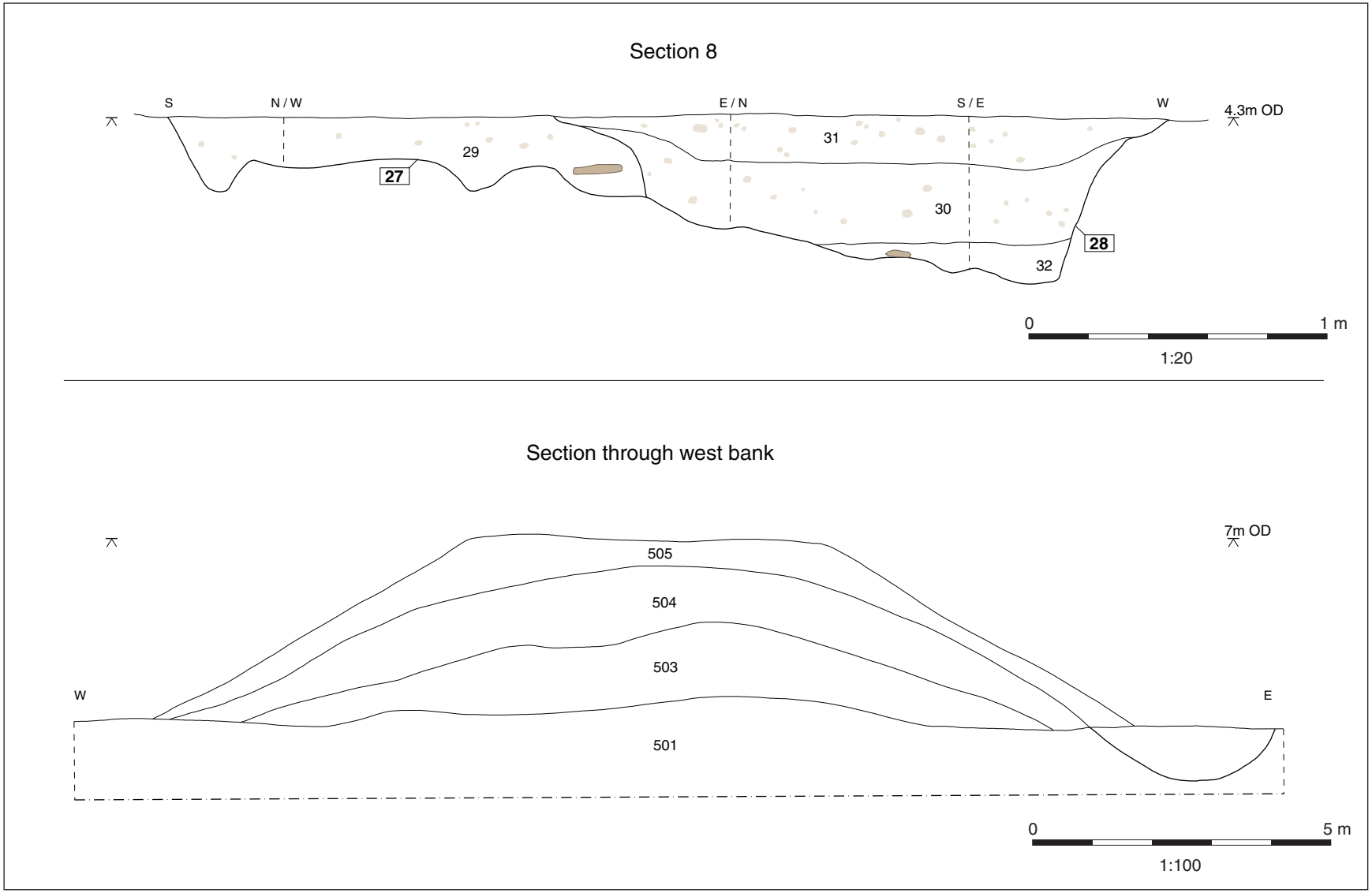


Figure 6: Additional sections

Plate 3: Overview of site looking north-west

Plate 4: Line of WWII track stakes looking east

Plate 5: Close-up of WWII track stake, looking east

Plate 6: Winch house and track line, looking west

Plate 7: General shot showing site conditions, looking north

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