The Bronze Age landscape of the Greenwich Peninsula

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Introduction

The Greenwich Peninsula is an urban area currently going through significant regeneration, but today's landscape is very different from the wetland it used to be. Formerly the area was known as the Greenwich Marshes and Bugsby's Marshes after it was drained and reclaimed by Dutch engineers from the 15th century onwards but, prior to this, a network of channels crossed the peninsula, the legacy of the Late Pleistocene river.

For more than half a century archaeologists have attempted to map the channels and islands known to lie buried beneath the urban sprawl on the Thames floodplain.[1] Methods have changed and now use increasingly sophisticated GIS software, but the principles remain intact. However, knowledge of the prehistoric geography is patchy, and historically the north has received more attention than south of the river despite its remarkable buried terrain. The Greenwich Peninsula is one exception, with a MOLA deposit model identifying distinct deposit types and archaeological potential.[2] The modelling work continues, undertaken within commercial geoarchaeology, with the support of Historic England[3], to enhance understanding of the past landscape.[4]

In this article the Bronze Age landscape around Blackwall Lane and across the peninsula is reconstructed through deposit modelling and studying alluvial sediments retrieved from a small developer-funded construction project. It shows that even a modest amount of work can contribute significantly to our understanding of the local palaeotopography bringing the environment to life, highlighting zones of archaeological potential and setting the backdrop for nearby archaeology.

The site and its setting

The site lies on Blackwall Lane on the eastern bank of the modern tidal Thames, where it turns north towards Blackwall at the far end of the Greenwich Peninsula (Fig 1). Nine geoarchaeological boreholes were drilled across the site with a Terrier rig, and an evaluation trench excavated by MOLA in May and July 2012 respectively[5] (site code BLL12). The boreholes aimed to examine and sample the deep alluvial deposits known to exist on the site from previous geotechnical investigations. The trench investigated the zone between the floodplain and the gravel terrace edge, where evidence of prehistoric occupation could be expected.

The area is known to have potential for prehistoric remains as previous excavations nearby on Bellot Street uncovered evidence of a Bronze Age trackway,[6] and there was a possibility that this structure could continue on to the site. No trace of the trackway or associated archaeology was found, but further work on one of the boreholes enabled reconstruction of the environmental history. Borehole 3 (BH3) was chosen for detailed palaeoenvironmental study due to the thickness of the organic deposits, likely to preserve ecofacts. The work on the sediment and the accompanying sub-fossils build up a picture of prehistoric

Fig 1: site, trench and borehole location plan for BLL12 Sites 1, 2 and 3

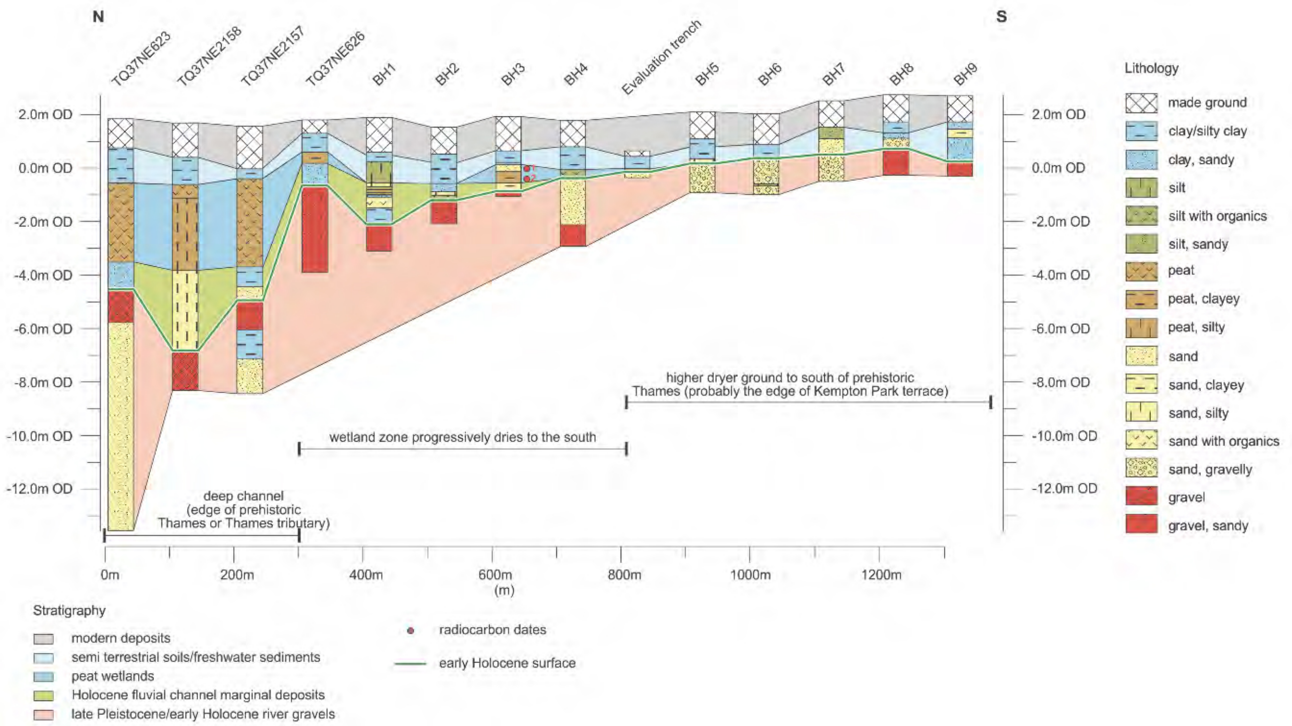

Fig 2: north-south cross-section through boreholes and trench sequence illustrating the sediment type and thickness, and summarising the environmental reconstruction (see Fig 3 for cross-section location plan)

and historic environmental change and land use. This information, in combination with information from boreholes across the Greenwich Peninsula, has enabled reconstruction of the Bronze Age landscape.

Reconstructing the Bronze Age environment and topography

This combination of methods recreates the surroundings in which prehistoric people lived. The often deeply buried stratigraphy holds evidence of relict landscape features that can be revealed by laterally linking sediment types representing distinct environments, as illustrated in Fig 2. The site spans an ecotonal zone between the floodplain and the terrace edge: in the deeper area to the north, fluvial channel sediments and thick wetland deposits are recorded and this contrasts with the drier ground in the south. The cross-section gives an idea of the difference between the flat urban setting of today and the archive of buried sediment, with the river margins at approximately 0m OD, and the channel at -4.5m OD.

A key marker horizon is the top of Late Pleistocene / Early Holocene gravel that represents the base of the Holocene sequence or 'Early Holocene surface'. The contours of the Early Holocene surface (relative to Ordnance Datum) modelled in Fig 3 are based on information available at the time of writing,[7] but models of the Peninsula continue to be refined as ongoing construction work across the area impacts the buried floodplain sediments.

To flesh out this picture and provide a dating framework, sub-fossils representing contemporary plant and animal communities were studied. Their preservation depends on the depositional environment, sediment type and succeeding circumstances. If laid down in an acidic wetland zone, for example, and continually saturated with water, organic preservation will be better than if the sediment is habitually exposed to the elements. Similarly, undisturbed deposits will have greater potential than those subjected to reworking.

Examining the borehole core

Ecofacts from carefully chosen sediment sub-samples were used to assess trends in ecology through time. Sub-samples were taken from each stratigraphic layer within BH3 to retrieve pollen, ostracods (bivalve crustacea), foraminifera (amoeboid protists), diatoms (siliceous algae) and material suitable for radiocarbon dating at key horizons (Table 1). The remainder of the core was cut into larger samples to recover plant macrofossils. Together, these sub-fossils were used to establish a picture of the local, on-site environment and also the ecology of the wider area. Thin samples (less than 50mm thick) were taken from the top and bottom of the peat layer to retrieve terrestrial plant macrofossils for dating the approximate onset and end of deposition.

The on-site sediments and their fossil content

Fossil preservation in BH3 was, in fact, relatively poor. Ostracods and diatoms were barely present which, given the ubiquity of ostracods and diatoms in natural water bodies, reflects unfavourable conditions for calcium carbonate and silica preservation. It is likely that the location at the edge of the wetland meant the site was susceptible to cycles of prolonged drying and rehydration that led to microfossil dissolution. The more robust organic remains, however, provide important information on the vegetation.

Directly over the Thames gravels lay sterile, oxidised orange-grey silty clayey sands. These sediments are river-derived but the weathering suggests that a dry land soil developed within them, probably during the Mesolithic to

Neolithic periods. On top of this, a dark reddish brown peat indicated that the margins of the river became marshy and well-vegetated, with silt/clay sand lenses suggesting brief flooding or migration of the channel on the site. Wetland growth began in the Middle Bronze Age (Table 1), and the marsh deposits contain evidence for woodland at the fringes of the wetland zone. Pollen shows that this part of the floodplain was covered with plants such as reeds, ferns and rushes with stands of alder and small pools of water. On the drier slopes more open oak, lime and hazel woodland grew, typical of the late prehistoric period while human activity, perhaps woodland clearance and agriculture, close by was clearly indicated by barley grains and cereal-type pollen.

The peat was radiocarbon dated within the Middle to Late Bronze Age (Table 1), but a reversal of dates is seen, with the upper sample giving an older result than the base of the sequence. This reflects soil processes (the effects of worm and root action) and degradation within the peat layer, and also suggests a degree of poor stratigraphic integrity. The peat thinned southward and was different in character: friable and degraded with a high silt and sand content. On inspection a leeched lowermost layer was discerned likely to be a 'G' or gleyed horizon that can be a feature of shallow, poorly aerated organic soils (histic topsoils) at the interface between the wet- and dry-land.[8]

The Thames estuary is blanketed with silty clay alluvium, deposited from the Late Bronze or Iron Age onwards, and Blackwall Lane is no exception. Generally, microfossils within the upper alluvium in the lower Thames basin show the influence of brackish or saline water, reflecting tidal flooding, but at Blackwall Lane the absence of hardy agglutinating foraminifera (that would be expected to survive) shows that there is no evidence for saltmarsh, and the presence of earthworm granules and snails indicate dry conditions. The clays relate to a series of semi-terrestrial, immature soils and provide compelling evidence that the terrace bordering the peninsula was protected or cut off from the main Thames channel from the early historic period onwards. The products of local industry in the upper samples (slag and coal or charcoal) indicate historic sediment reworking.

Recreating the buried terrain

Much of the early work on the evolution of the Thames downstream of Westminster overlooked the influence of the underlying gravel contours, focusing instead on sea level change.[9] It is now understood that Pleistocene river dynamics created the setting for a complex mosaic of habitats and land forms that are central to understanding the surroundings in which prehistoric Londoners lived.

Deposit models can be created from hand-drawn sections or with software, and use information from archaeological projects and geotechnical boreholes to illustrate the undulating buried topography. In mapping the gravel surface, Fig 3 highlights the distinction between the areas of low lying and raised gravel across the peninsula. Based on this type of diagram, previous investigation characterised the past landscape and classified the area into zones of varying archaeological potential to produce an archaeological risk map.[10] In areas where the gravel surface lies above -2m OD, there is potential for Neolithic and earlier dry-land activity at the base of the peats (including waterlogged remains or structures). Bronze Age remains would be present in the upper peat horizons. Blackwall Lane lies above -1m OD but close to deep zones that may be inlets or tributaries from the main channel (recorded at Greenwich Wharf where a 12th-century tidal mill was discovered in 2007).[11] The channel appears to separate the terrace from a substantial floodplain eyot to the north-west of Blackwall Lane, locating the site at the interface between the terrace and the river: a zone of high prehistoric archaeological potential, as seen on the north bank of the Thames.[12]

During the Bronze Age, the deep channels infilled with peat and streams were forced to migrate, distancing Blackwall Lane from the active channels. This afforded some protection from tidal waters. The freshwater clays that cap the Blackwall Lane sequence accreted as river levels rose, but were probably fed by freshwater channels flowing off the terrace.

The deeper areas across the peninsula generally have good environmental preservation. Between -2m and -4m OD the gravels are often covered in a thin layer of clay and these zones may have been crossed by Iron Age or Roman tidal creeks with some potential for the remains of boats and cargoes in the lower part of the alluvium. In areas where the gravel surface lies below -4m OD there is the potential for even older Mesolithic assemblages, provided these have not been eroded away. Evidence of historic remains such as river walls and sluices

MOLA ref	Lab No.	Height (m OD)	Sample type	∂13C (‰)	Uncalibrated date (BP)	Calibrated date cal BC (95.4% probability)
BLL12_<1>_BH3_-0.05	UBA-22908	*c.* -0.05	Rubus seeds	-26	3034±44	1420–120
BLL12_<2>_BH3_-0.80	UBA-21667	*c.* -0.80	?Alder twigs	-37	2859±36	1130–920

Table 1: radiocarbon dating results. Conventional radiocarbon ages[23] are quoted in accordance with the international standard known as the Trondheim convention.[24] Dates in this table and in the text have been calibrated using the datasets published by Reimer *et al*[25] and the computer program OxCal v4.2.[26] The calibrated date ranges have been calculated according to the maximum intercept method[27] and are quoted in the form recommended by Mook[28] with the end points rounded outward to 10 years (for errors greater than 25 years).

Fig 3: Early Holocene surface around the Blackwall Lane site (at the terrace edge in the south). A river inlet or channel is seen to the west, perhaps forded by the Bellot Street trackway. To the north, on what is now the Greenwich Peninsula, lay a network of channels interspersed with gravel islands.

of medieval and later date may be recovered from the deepest zones, while historic droveways are likely on the higher gravel areas.

Despite reworking, erosion and human manipulation of the gravel (such as terracing and landscaping from the Roman period onwards, Victorian and later basement excavation, river scour, channel clearance and dredging) that can impact the reliability of the modelling, the benefits outweigh the limitations both in terms of the predictive capacity and its contribution to understanding the landscape and archaeological interpretations. Recent projects demonstrate the potential of deposit models to provide meaningful information on many issues regarding past landscapes[13] and heritage resource management to a range of users including archaeologists, curators and the general public.[14]

Using the Early Holocene surface as a base map, the Bronze Age landscape is visualised at the time when the peat at Blackwall Lane was accreting (Fig 4). Looking out across the peninsula from the vantage point of the terrace edge, people would have seen a series of channels and islands or eyots. In the prehistoric period the eyots would have appeared pronounced, gradually becoming inundated and submerged through time. This process was precipitated by the expansion of the Thames estuary due to rising river levels. However, because the rate of sea-level rise actually appears to decrease during the Bronze Age,[15] it is thought that alternative processes such as slowed peat accumulation and compaction are likely to be at work alongside the rising river level trend.[16]

Bronze Age archaeology in the surroundings

During the Bronze Age the Thames wetlands were extensively exploited. A network of wooden trackways was laid to cross the marshes and to take advantage of good fishing, hunting and fowling.[17] These trackways are generally made from alder with some use of oak, ash, hazel and yew. Of particular note are two Bronze Age alder timber structures excavated at sites in Bellot Street (approximately 100m to the north-west) at the edge of the peat-filled Greenwich Wharf channel. The waterlogged and preserved organic remains of a trackway were found during excavations in 1992 sealed by thick silts (BSG93).[18] The track (found around -0.5m OD and at least 3m wide at one point, diminishing rapidly to the south-east) comprised a concentrated mass of wooden branches with at least one sharpened post suggesting that this was a man-made structure. Radiocarbon dating assigned Early to Middle Bronze Age dates to the wood and surrounding peat. In 2005 another corduroy-style wooden trackway or platform made of a single layer of horizontally laid logs (at *c.* -0.2m OD) was discovered close by on Bellot Street (GBL05)[19] (see Fig 1). Dating of the peat above (1950–1700 cal BC) and below (1880–1610 cal BC) the platform suggests Early Bronze Age deposition. So, although unrelated, the structures represent phases of Bronze Age marshland use. The onset of peat growth at Bellot Street is notably earlier than at Blackwall Lane (*c.* 300 to 800 years before). This is because Bellot Street lies within the tributary channel where the wetland would have encroached earlier than at the terrace edge. Interestingly, both timber structures appear to be broadly positioned north-west/south-east. This speculative projected alignment is shown on Figs 3 and 4 continuing well beyond the Bellot Street sites.

On drier ground field systems were established in the Bronze Age, and although the Thames valley has shown notable survival of these,[20] the only direct evidence for cultivation nearby comes from ard marks on the eyots from Westminster to Bermondsey[21]. The field systems that emerged and developed over the Middle and Late Bronze Age indicate a managed farming landscape and a pastoral economy on a scale that may have supported an increasingly hierarchical society,[22] and it may just be a matter of time before such evidence is found in Greenwich.

Fig 4: Bronze Age landscape looking down from the terrace northwards towards where the site would have been located. This reconstruction is based on the map of the Early Holocene surface (Fig 3). The conjectured line of the Bellot Street trackway can be seen linking the terrace edge to one of the floodplain eyots (Faith Vardy).

Conclusions

This small-scale study has generated a snapshot of the Greenwich Peninsula in the Bronze Age that sheds light on the history of the area. The sediment recovered from the borehole core provided the archive of landscape change from the prehistoric period onwards and combined with information from the surroundings, the wider environs are pictured. The investigation provides a clearer understanding of the nature of the prehistoric landscape, demonstrating the presence of a tributary channel or inlet to the west and the archipelago of eyots to the north, as well as the freshwater status of the southern part of the peninsula as it became cut off from the Thames. Despite relatively poor sub-fossil preservation, the local conditions and environmental changes have also been reconstructed. The poor preservation, in fact, confirms the site's position at the terrace margins, a location that would have experienced cycles of wetting and drying.

Prehistoric Londoners certainly exploited the marsh using trackways that linked the drier terrace and floodplain islands and this geoarchaeological study provides insight into the location and purpose of the archaeology. Mapping the buried gravel contours identifies zones of archaeological and environmental potential by delimiting the extent of the wet and dry land, and this has great value in informing future work.

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Mary Nicholls is a Senior Geoarchaeologist at MOLA with a great interest in reconstructing past environments. Dr Rob Scaife, a Reader in Palaeoecology within Geography and Environment at the University of Southampton, analysed the pollen. The diatom analysis was carried out by Dr Nigel Cameron, Honorary Senior Research Fellow at the UCL Environmental Change Research Centre. Dr John Whittaker, a member of the Natural History Museum palaeoecology team, worked on the ostracods and foraminifera and Karen Stewart, Senior Archaeobotanist at MOLA, studied the plant material.

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6. PCA, BSG93 and PCA, GBL05.

7. Logged sedimentary information held in a geoarchaeological database (Rockworks 15) is used to create inverse distance weighted surface plots, using ArcGIS 10.1 spatial analyst tool, of the base of the Holocene sedimentary sequence. The resulting Digital Elevation Model shows heights relative to Ordnance Datum (OD).

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Letter

I was interested in Tim Tatton-Brown's article in the last LA on Kentish Rag (**14** (10) 261-4). However, the evidence from Kennington Palace shows that the demise of Reigate stone as a facing course was, at least, a little later than the early 14th century posited there (*ibid.*, 262).

Henry VIII's masons were brutally efficient in removing the walls of the Palace in 1531 including even the foundations. They seem to have started at the north-east corner of the Hall/Chamber block and worked south-westwards, but by the time they reached the south-west corner they seemed to have extracted all the stone they needed so here they left substantial parts of foundations and, in one very small part, a little of the superstructure (in structure E1); these show that the walls were of chalk except for the Reigate stone facing which probably dates to 1353–4 (*The Black Prince's Palace at Kennington, Surrey* BAR 26 (1976) 49).

The rubble infill of the robber trenches shows that this applied more generally in the palace for they produced 109 faced blocks of Reigate stone (*ibid.*, 67) but only 14 examples of Rag of which only 4 were faced (*ibid.*, 77 & 92).

This is significant since it is a royal site which should be in the height of fashion and the Black Prince employed leading craftsmen of the day, such as Henry Yevele, the mason, and Hugh Herland, the carpenter (famous as the carpenter of Westminster Hall roof). Little major work was done at Kennington after *c.* 1360 so it does not provide evidence for when Reigate facing was abandoned, but merely a *terminus post-quem.*

Graham Dawson
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Detail of the Kentish ragstone ashlar quoin and face on the north-west side of the Jewel Tower, Westminster.
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