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**A palaeoenvironmental evaluation
of deposits at the former Anchor
Hotel, Thetford, Norfolk**

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By

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Summary

This report describes stratigraphic recording of sediment samples recovered from boreholes excavated at the site of the former Anchor Hotel, Thetford, Norfolk. Two cores (9 and 10) have been identified as of possible palaeoenvironmental significance, consisting of deposits associated with a former course or courses of the Little Ouse river. The entire site is overlain by made ground, presumably reflecting the reclamation of the former floodplain of the river. The timing of environmental changes at the site is currently unknown, but assessment of sediment samples and radiocarbon dating of the organic horizons is recommended to elucidate the potential of the deposits to provide more detailed information on processes of Holocene environmental change.

KEYWORDS: Thetford, Norfolk, Borehole Survey, Geoarchaeology

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1. INTRODUCTION

In March 2010 Birmingham Archaeo-Environmental were commissioned to monitor a borehole survey of land at the former Anchor hotel, Thetford, Norfolk. The proposed development area includes the former hotel, open-air bus station and car park and lies in the heart of the known extent of the Late Saxon town (Hoggett, 2009). The Little Ouse River runs from south to north along the east edge of the site (Fig.1). The solid geology is Upper Cretaceous Chalk which is overlain by drift geology of river terrace gravels (Hoggett, 2009).

A series of boreholes were drilled using a windowless sampler to determine the depth and nature of the deposits and to assess their palaeoenvironmental potential. These data will be used in conjunction with trial trenching to be carried out by Suffolk County Council Archaeology Services to determine the extent and state of preservation of any archaeological remains. Two further cable percussive boreholes (Fig 1) were drilled inside the grounds of the former hotel but the results of these were not used for archaeological purposes and are not included in this report.

2. METHODS

2.1 Borehole Survey

The borehole survey was undertaken using a windowless sampler drilling rig operated by Harrison Group. 10

boreholes were drilled in a regular pattern across the site which was determined by Harrison Group (see Fig 1).

2.2 Stratigraphic Analysis

Core tubes were opened at Harrison Group's Norwich laboratory and the sediment stratigraphy recorded using the Troels-Smith (1955) system. A summary of the sedimentary and physical properties and the nomenclature used is provided in Appendix 1. A full stratigraphic description of the cores is provided in Appendix 2.

3. PRELIMINARY RESULTS OF FIELDWORK

3.1 The Stratigraphic sequence

The general stratigraphic sequence at the site consists of natural river terrace sands and gravels (~4.0-2.0 m thick), overlain by sandy silts and clays (2-1.0m) which were sealed by made ground consisting of brown earth often mixed with crushed bricks, mortar and chalk.

Cores 9 and 10 produced the most promising deposits in terms of palaeoenvironmental potential. Their locations (see Fig 1) are closest to the river and are likely to be representative of deposits associated with a former course or courses of the Little Ouse river.

Core 9 was characterised by yellow-orange coarse sands and rounded to

sub-angular gravels (3.10-2.45m) which were overlain by a sandy fine grained organic silt with rootlets and angular to sub-angular flint flints (2.45-2.05m, see Plate 1). A sharp transition was evident into dark brown sands with gravels, flints and chalk flecks (2.05-1.20 m) which were sealed by a medium brown silty sediment which contained abundant chalk (1.20-0.60m). This trended into a deposit consisting of a mixture of soil, sand and gravels containing brick and crushed mortar, which is the typical made ground recorded across the rest of the site.

The sequence would appear to represent a phase of fluvial deposition (the basal sands and gravels), followed by a period of more stable conditions, during which the organic sediment (2.45-2.05m) formed. The precise nature of this organic sediment is unclear, but it may represent a buried soil horizon (palaeosol). This unit is overlain by a sand and gravel dominated unit (2.05-1.20m) which has truncated the organic unit and reflects a further phase of fluvial activity. The overlying deposit of silty chalk rich sediment (1.20-0.60m) suggests the subsequent infilling of the channel by human and/or natural processes prior to the stabilisation of the surface by the deposition of made ground.

Core 10 stratigraphy was characterised by basal sands and rounded to sub-angular gravels (3.10-2.70m) with a sharp upper boundary into a thick grey clay layer (2.70-2.65m). The grey clay layer is sealed by peaty, silt-rich clay (2.65-2.50m, see Plate 2) which was in turn overlain by black fine to medium coarse sands (2.50-2.05m) and organic silts (2.05-1.62m). This trended into dark brown silty clay with flints and flecks of chalk (1.62-1.25m) which

was sealed by the topsoil and made ground (mainly tarmac).

The stratigraphy of this sequence is slightly different to Core 9, but also indicates a phase of fluvial deposition in a relatively high energy environment (basal sands and gravels, 3.10-2.70m) followed by lower energy conditions during which the basal clay and organic (2.70-2.50m) formed. The overlying sands and silts (2.50-1.62m) reflect a further period of fluvial activity, either a flood event or the migration of a channel across the site, prior to infilling and stabilisation of the surface (silty clay and made ground).

3.2 Geoarchaeological implications

The borehole survey provides a context for the archaeological evaluation carried out on the site (Stirk, 2010). The three trenches indicate activity on the site from the Late Saxon to Medieval periods. There is evidence for buildings on the site for much of the medieval and post-medieval periods, other than in Trench 2 in the south-western corner of the site which contained evidence for tanning probably in the post-medieval period. The basal sands and gravels were also reached at a slightly greater depth (2.02m) compared to Trench 1 (1.82m) and Trench 3 (1.9m). The basal gravels were located at a depth of 2.10m in core 5.

Cores 9 and 10 are located some 10m to the east and indicate that the basal gravels are situated at c. 3.10m depth close to the river. This indicates the incised channel of the Little Ouse River and would suggest that Trenches 1 and 3 reflect occupation on the higher terrace gravels, with the ground surface falling away to the present river channel. The absence of clear evidence for human activity other than

tanning in Trench 2, would confirm the hypothesis that this area was a marginal, floodplain environment that was too wet to build on (Stirk, 2010: 60). This area was subsequently reclaimed, as the depth of made ground in Cores 9 and 10 demonstrate, but the date of this cannot be established on the basis of the current data. Further work is required to investigate the chronology of channel and floodplain evolution in this area.

4. CONCLUSIONS AND RECOMMENDATIONS

The deposits recorded in Cores 9 and 10 indicate the presence of a former course or courses of the Little Ouse on the site. The suite of deposits indicates deposition in fluvial and semi-terrestrial environments, representing the movement of the river over time relative to the coring sites. The timing and controlling processes behind these events are unclear but probably relate to 'natural' processes such as changes in relative sea level and perhaps also the effects of human activity.

Further analytical work has the potential to provide further information regarding the character of environmental changes on and around the site. Recent analysis of similar deposits in Suffolk has produced valuable data regarding the nature and timing of Holocene environmental change and its relation to human activity and the archaeological record. It is thus recommended that palynological assessment of the organic deposits is carried out. This should be accompanied by the provision of radiocarbon dating of selected samples of organic sediment. This will provide information regarding the timing of sediment

deposition and the preservation of associated palaeoenvironmental remains.

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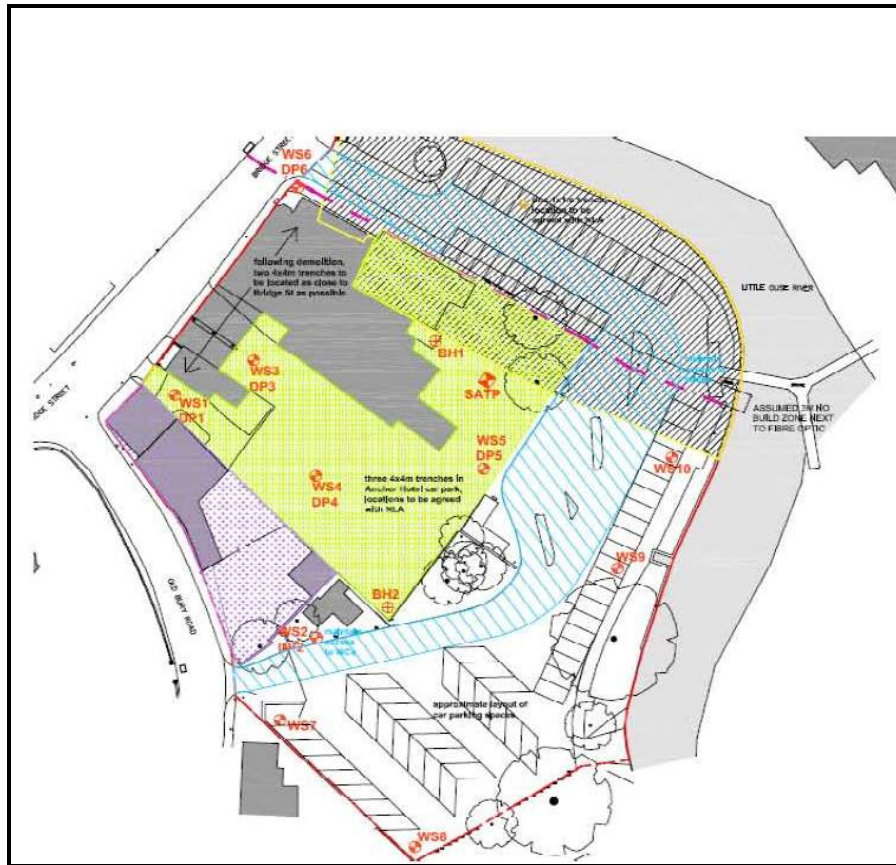


Fig 1: Borehole Locations

WS = Windowless Samples; BH = Cable percussive boreholes

WS	Samples	Sediment
1	1.70m	Silty soil with monocots
	1.82m	Silty soil with monocots
3	1.35m	Piece of wood (C14)
5	0.95m	Medium brown soil
	1.10m	Dark brown silty clay
9	2.30m	Organic silt
	2.09m	Organic silt
	2.38m	Organic silt
	2.44m	Organic silt
10	1.30m	Silty clay
	1.50m	Silty clay
	1.70m	Sandy organic silt
	1.90m	Sandy organic silt
	2.65m	Peaty clay with organics
	2.59m	Peaty clay with organics
	2.52m	Peaty clay with organics

Table 1: Samples collected from Thetford



Plate 1: Core 9: Sandy organic silt overlying sands and gravels

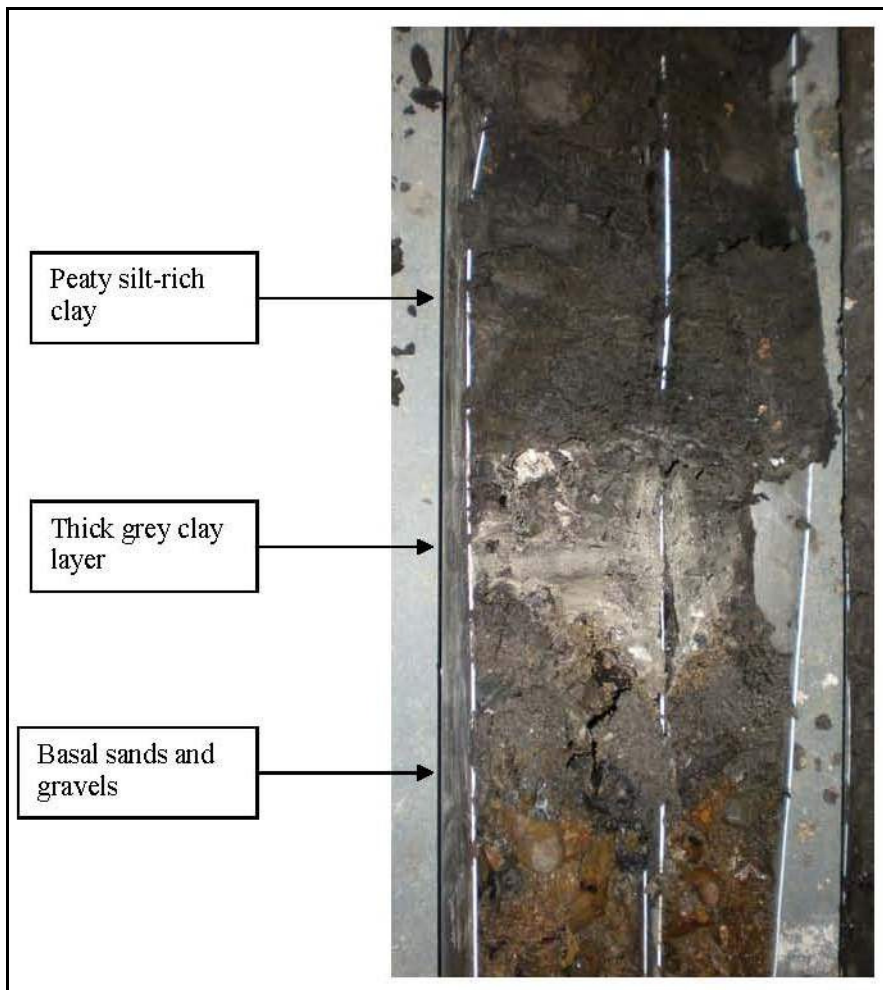


Plate 2: Core 10

APPENDIX 1 - TROELS-SMITH CLASSIFICATION

Troels-Smith (1955) classification scheme of sediments used for borehole assessment, a summary of which is provided below:

Degree of Darkness	Degree of Stratification	Degree of Elasticity	Degree of Dryness
nig.4 black	strf.4 well stratified	elas.4 very elastic	sicc.4 very dry
nig.3	strf.3	elas.3	sicc.3
nig.2	strf.2	elas.2	sicc.2
nig.1	strf.1	elas.1	sicc.1
nig.0 white	strf.0 no stratification	elas.0 no elasticity	sicc.0 water

	Sharpness of Upper Boundary
lim.4	< 0.5mm
lim.3	< 1.0 & > 0.5mm
lim.2	< 2.0 & > 1.0mm
lim.1	< 10.0 & > 2.0mm
lim.0	> 10.0mm

	<i>Sh</i>	<i>Substantia humosa</i>	Humous substance, homogeneous microscopic structure
<i>I Turfa</i>	<i>Tb</i>	<i>T. bryophytica</i>	Mosses +/- humous substance
	<i>Tl</i>	<i>T. lignosa</i>	Stumps, roots, intertwined rootlets, of ligneous plants
	<i>Th</i>	<i>T. herbacea</i>	Roots, intertwined rootlets, rhizomes of herbaceous plants
<i>II Detritus</i>	<i>DI</i>	<i>D. lignosus</i>	Fragments of ligneous plants >2mm
	<i>Dh</i>	<i>D. herbosus</i>	Fragments of herbaceous plants >2mm
	<i>Dg</i>	<i>D. granosus</i>	Fragments of ligneous and herbaceous plants <2mm >0.1mm
<i>III Limus</i>	<i>Lf</i>	<i>L. ferrugineus</i>	Rust, non-hardened. Particles <0.1mm
<i>IV Argilla</i>	<i>As</i>	<i>A. steatodes</i>	Particles of clay
	<i>Ag</i>	<i>A. granosa</i>	Particles of silt
<i>V Grana</i>	<i>Ga</i>	<i>G. arenosa</i>	Mineral particles 0.6 to 0.2mm
	<i>Gs</i>	<i>G. saburralia</i>	Mineral particles 2.0 to 0.6mm
	<i>Gg(min)</i>	<i>G. glareosa minora</i>	Mineral particles 6.0 to 2.0mm
	<i>Gg(maj)</i>	<i>G. glareosa majora</i>	Mineral particles 20.0 to 6.0mm
	<i>Ptm</i>	<i>Particulae testae molloscorum</i>	Fragments of calcareous shells

APPENDIX 2 - BOREHOLE LOGS**WS1**

0.00-0.50m	Hand recovered, made ground				
0.50-1.00m	Da	St	El	Dr	UB
	1	0	0	3	1
	As3 Gmin1				
	Light brown, sandy clay with flecks of chalk and crushed mortar				
1.00-1.62m	Da	St	El	Dr	UB
	2	0	1	2	4
	Ag3 Gmin1 Gmaj++				
	Sandy silts with flecks of mortar and large flints, becoming increasingly darker and wetter with depth				
1.62-2.05m	Da	St	El	Dr	UB
	4	0	1	1	1
	Ag2 Sc2 Dh++				
	Silty soil with monocots, becoming sandier with depth				
2.05-3.10m	Da	St	El	Dr	UB
	1	0	0	2	4
	Gmin2 Gmaj2				
	Orange sand and river terrace gravels				

WS2

Made ground and top soil.
Drilling ceased due to thick brick layer

WS3

0.00-0.55m	Hand recovered, made ground				
0.55-0.89m	Made ground, chalk and fill from industry				
0.89-1.05m	Da	St	El	Dr	UB
	1	0	0	3	4
	As3 Gmin1				
	Light brown, sandy clay with chalk				
1.05-1.70m	Da	St	El	Dr	UB
	3	0	0	2	2
	Gmin2 Ag2 Gmaj++				
	Dark silty sand with flints, chalk and large pebbles and gravels				
1.70-1.80m	Sand				
	Gmin4				
1.80-2.00m	Very light sand				
	Gmin4				

WS4

0.00-0.60m	Hand recovered, Made ground				
0.60-0.80m	Medium brown soil with flecks of chalk and mortar				
0.80-1.30m	Da	St	El	Dr	UB
	2	1	1	2	0
	As2 Sc2 Gmin+ Gmaj+				
	Clayey soil with pebbles and sand lenses				
1.30-1.42m	Da	St	El	Dr	UB
	2	0	1	2	1
	As3 Gmin1 Ag++				
	Medium brown slightly silty, sandy clay with large pieces of chalk				
1.42-2.00m	Da	St	El	Dr	UB

	3	1	1	1	1
	Gmin2 As2				
	Clayey sand, becoming wetter, darker and sandier with depth				
2.00-2.20m	Da	St	El	Dr	UB
	3	0	0	1	1
	Gmin4				
	Medium brown sand				
2.20-2.90m	Light brown orange sand with large flints				
2.90-3.10m	Fine brown orange sands				

WS5

0.00-0.55m	Hand recovered, made ground				
0.55-0.83m	Chalk with some brown soil				
0.83-1.00m	Medium brown soil with chalk				
1.00-1.75m	Da	St	El	Dr	UB
	3	0	1	2	2
	As3 Ag1 Gmin++ Gmaj+				
	Dark brown silty clay with flecks of chalk and flints, becoming sandier with depth				
1.75-2.10m	Da	St	El	Dr	UB
	4	0	0	1	2
	Gmin3 Gmaj1				
	Black sand with pebbles and stones				
2.10-3.10m	Very coarse sands trending into large flints and gravels				

WS6

0.00-0.80m	Hand recovered, made ground with sand, gravel and clay				
0.80-1.40m	Gravelly clay				
1.40-2.20m	Da	St	El	Dr	UB
	3	0	0	2	1
	As3 Ag1 Gmin++				
	Dark brown, slightly sandy silty clay with flints				
2.20-3.20m	Da	St	El	Dr	UB
	2	0	0	2	1
	Gmin 2 Gmaj1 Ag1				
	Grey brown silty gravelly sand with flint and HC odours (diesel)				
3.20-4.10m	Da	St	El	Dr	UB
	3	0	0	2	1
	Gmin3 Ag1				
	Dark grey and black silty sand and flints				

WS7

0.00-2.75m	Made ground, Imported sand fill				
2.75-3.10m	Grading into natural sands and gravels with flint				

WS8

0.00-0.30m	Hand recovered, made ground				
0.30-0.88m	Made ground				
0.88-1.18m	Gmin4				
	Brown sand				
1.18-3.10m	Flint and natural sands and river terrace gravels				

WS9

0.00-0.60m	Hand recovered, made ground and gravelly sands				
0.60-0.73m	Medium brown topsoil with lots of chalk				
0.73-1.20m	Da	St	El	Dr	UB
	3	0	0	3	1
	Ag2 Sc2 Gmin++				
	Medium brown silty soil, flecks of chalk, sandier with depth				
1.20-2.05m	Da	St	El	Dr	UB
	4	0	0	2	2
	Gmin3 Gmaj1				
	Very dark brown sand with gravels, flints and chalk				
2.05-2.10m	Da	St	El	Dr	UB
	2	0	0	2	1
	Sh2 Ag2 Gmin++ Th++				
	Organic sandy silt with flints and rootlets				
2.10-2.30m	Missing				
2.30-2.45m	Da	St	El	Dr	UB
	2	0	0	2	1
	Sh2 Ag2 Gmin++ Th++				
	Organic sandy silt and sandy with flints and rootlets				
2.45-3.10m	Da	St	El	Dr	UB
	2	0	0	2	4
	Gmin2 Gmaj2				
	Very coarse sands and gravels				

WS10

0.00-0.80m	Hand recovered, made ground				
0.80-1.10m	Brown soil with lots of crushed mortar, brick and chalk				
1.10-1.25m	Missing				
1.25-1.62m	Da	St	El	Dr	UB
	3	0	1	2	0
	As3 Ag1 Gmaj+				
	Dark brown silty clay with flecks of chalk and flints				
1.62-2.05m	Da	St	El	Dr	UB
	2	0	1	2	1
	Sh2 Ag2 As++ Gmaj++ Gmin+				
	Organic clayey silt, large flints at 1.92m and becoming sandier with depth				
2.05-2.50m	Da	St	El	Dr	UB
	4	0	0	2	1
	Gmin4 As+ Ag+				
	Black sands becoming clayey and silty with depth				
2.50-2.65m	Da	St	El	Dr	UB
	2	0	1	2	1
	As2 Sh2 Ag++ Dh++ Th+				
	Peaty clay with silt, plant remains and rootlets				
2.65-2.70m	Da	St	El	Dr	UB
	1	0	1	3	4
	As4				
	Thick grey clay layer				
2.70-3.10m	Da	St	El	Dr	UB
	1	0	0	3	4
	Gmin2 Gmaj2				
	Sands and Gravels				