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SCCAS-45-07

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By

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November 2007

Summary

Deposits of palaeoenvironmental potential were encountered during ground investigations at the former Priory Stadium, Sudbury, Suffolk. Pollen and beetle assessments were carried out on a sample core previously taken from the site, supported by radiocarbon dating to provide a chronology for the sequence. An initial phase of organic sedimentation was found to have occurred in a lagoonal floodplain setting of the River Stour c. 11000 BP, during the Windermere Interstadial. A shift to minerogenic floodplain sedimentation then occurred and is believed to have dominated depositional conditions until the Late Iron Age, c. 2100 BP, after which a return to organic sedimentation is recorded. Pollen and coleoptera (beetle) assessments suggest this second phase of in-situ organic accumulation occurred in response to the gradual infilling of an abandoned river channel (palaeochannel). The beetle record indicates the conditions during the accumulation of this peat. The pollen data shows that the environment around the sampling site has been largely open grassland since the Iron Age, with evidence for phases of both pastoral and arable cultivation. Pollen preservation is however poor in some parts of the sequence. The stratigraphic sequence therefore provides a valuable regional palaeoenvironmental archive. Due to an overall lack of palaeoenvironmental information for the Suffolk lowlands, the results of this study contribute significantly to the understanding the landscape evolution of the region during the Holocene.

KEYWORDS: Sudbury, Suffolk, pollen, beetles, radiocarbon dating

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1. INTRODUCTION

Deposits of palaeoenvironmental potential were identified during archaeological investigations at the site of the former Priory Stadium, Sudbury, located on the northern floodplain of the River Stour (TL 870 407).

Birmingham Archaeo-Environmental was subcontracted by Suffolk County Council Archaeological Service to undertake a palaeoenvironmental assessment of the site's stratigraphic archive (Hill & Jolliffe, 2007). Fieldwork involved sedimentary coring across the site, utilising the location of archaeological trenches to help avoid Made Ground (present across the site and varying in thickness from 0.65m to 1.55m). This work identified a stratigraphic sequence consisting of alluvial clays and silts with occasional layers of organic-rich silts, sands and peats. It was concluded that at least two phases of *in-situ* organic accumulation had occurred since sedimentation began at the site. Although a precise age for the development of the sedimentary sequence was unknown, a Mid-Holocene timescale (c. 4-5,000 yrs BP) was initially inferred.

A sample core considered to be most representative of the site's sedimentary archive was taken for palaeoenvironmental assessment (Core 2, refer to Figure 1 for trench and core locations). The core contained two organic-rich units interbedded with grey sands, silts and clays. It was suggested that two phases of organic accumulation occurred on the floodplain of the River Stour, separated by the accumulation of fine-grained alluvium through overbank sedimentation. Due to the relatively thin nature of the lower organic unit, it was suggested it may have derived from accumulation in a lagoonal floodplain setting, where stagnant water encouraged the colonisation and expansion of vegetation resulting in peat development. In contrast, the upper unit was much thicker (*c*. 1.92m of peat and organic-rich sands were encountered in Core 2) and was present across much of the central, southern and western sections of the site. It was consequently inferred that at least one relict channel (palaeochannel) of the River Stour may be present within the archive.

Taking into account the sequence of deposits encountered during ground investigations, Hill & Jolliffe (2007) recommended that a suite of assessments should be undertaken on the sample core in order to establish the potential for understanding the palaeoenvironmental history of the site. Pollen and beetle assessments were recommended, supported by radiocarbon dating on key organic horizons. A copy of the initial assessment report is provided in Appendix I. A summary of the sample core's stratigraphy is provided in Appendix II.

2. METHODS

2.1 Pollen Assessment

A total of 28 samples were assessed for pollen from Core 2. Pollen preparation followed standard techniques including potassium hydroxide (KOH) digestion, hydrofluoric acid (HF) treatment and acetylation (Moore et al., 1991). At least 125 total land pollen grains (TLP) excluding aquatics and spores were counted for each sample. However, pollen concentrations were very low in a number of samples and a full count was hence not possible (see below).

2.2 Beetle Assessment

A total of three samples were processed and assessed for Coleoptera (beetle) remains. The upper peat unit was split into three: 2.58-3.31m, 3.31-3.85m and 3.85-4.55m depths.

The samples were processed using the standard method of paraffin flotation outlined in Kenward *et al.* (1980) at the University of Birmingham. The insect remains were then sorted from the paraffin flot and the sclerites identified under a low power binocular microscope at x10 magnification. Where possible, the insect remains were identified by comparison with specimens in the Gorham and Girling collections housed at the University of Birmingham. The taxonomy used for the beetles follows that of Lucht (1987). A summary of the key beetle species encountered is provided in Table 1.

2.3 Radiocarbon Dating

A total of five samples (Table 2) were submitted for radiocarbon dating to Beta Analytic Inc., Florida, to investigate the chronology of sediment accumulation. Samples were taken from the basal organic unit at the lower and upper unit boundaries (at 5.72m and 5.65m depth). In addition, due to the thickness of the upper organic unit, samples were taken from the lower, middle and upper boundaries (at 4.55m, 3.85m and 2.58m depth respectively). Each sample underwent acid/alkali/acid treatment prior to dating. Radiocarbon dates were calibrated using Intcal04 (Reimer *et al*., 2004).

3. RESULTS

3.1 Pollen Results

Of the 28 samples submitted for pollen assessment, a total of 18 samples yielded pollen assemblages suitable for palaeoenvironmental assessment. These samples were: 2.58m, 2.66m, 2.74m, 2.82m, 3.14m, 3.22m, 4.12m, 5.65m, 5.69m and 5.72m depths. The results of the pollen assessment are provided in Figure 2. The stratigraphic column is also included for reference. All percentage figures are of total land pollen (TLP) unless otherwise specified. To facilitate discussion, the diagram has been divided into three local pollen assemblage zones with the site prefix 'PS'. Pollen nomenclature follows Moore *et al.* (1991) with the modifications suggested by Bennett *et al*. (1994).

PS-1: 4.55-3.90m, Poaceae-Cyperaceae-Apiaceae-*Plantago lanceolata*

The basal zone (PS-1) is dominated by herbaceous pollen (c.70-80%). The bulk of this consists of Poaceae (wild grasses) and Cyperaceae (sedges), but with high values for Apiaceae (carrot family) and *Plantago lanceolata* (ribwort plantain). A range of other herbs including Lactuceae undiff. (dandelions etc.), *Artemisia* (wormwood), Caryophyllaceae (pink family) and *Filipendula* (meadowsweet), *Galium*-type (bedstraw), *Rumex* spp. (docks), Ranunculaceae (buttercups) and *Centaurea cyanus* (cornflower) are well represented. Trees and shrubs are present at relatively low values, although *Betula* shows a low peak at the base. *Pteridium aquilinum* values also increase slightly, suggesting the presence of bracken on drier areas.

This zone reflects a predominantly open, grassy landscape dating to after 2110±40BP (2290-1990 Cal. BP, 340-40 Cal. BC), the Iron Age. At most, some birch scrub and scattered mixed woodland might have been present locally, or perhaps was more extensive at some distance from the sampling site. The low but consistent values for *Fraxinus* (ash) also imply some open, scrubby woodland.

The spectra of herb pollen indicate the presence of a range of habitats including damp bankside and open fen vegetation with sedges and tall herbs, of which members of the carrot family in particular, as well as meadowsweet and species of the pink family, were significant locally. Shallow open water is also indicated where *Typha latifolia* (reedmace) and *Potamogeton* (pond weeds) were growing.

The range of other herbs including ribwort plantain, wormwood, dandelions, bedstraw and fat hen reflect open habitats on the 'dryland' areas beyond the river and are strongly indicative of grassy meadow (plantains, docks, dandelions, buttercups) as well as disturbed ground and field edge 'weed' communities (cornflower, wormwood, fat hen). Low values for cereal type grains towards the top of the zone also imply the presence of arable plots.

PS-2: 3.90-3.58m, Poaceae-*Corylus*-*Salix*-Cyperaceae

The opening of this zone sees a marked change in the vegetation around the site. There is an increase in trees/shrubs in the form of a rise in *Corylus* (probably hazel) and *Salix* (willow). *Alnus* also displays a less pronounced rise in the upper half of the zone. Total tree and shrub percentages thus rise to 60% by the top of PS-2. Values for Poaceae and Cyperaceae fall slightly but of the other herbaceous taxa, *Plantago lanceolata* shows the most pronounced drop. Ranunculaceae (buttercups) display a pronounced peak mid-zone.

Willow is usually poorly represented palynologically; hence the values recorded in this zone suggest that this tree/shrub expanded to become dominant on the damper soils around the sampling site, whilst hazel was also expanding nearby presumably onto drier contexts. Such drier conditions might also be reflected in the fall in *Typha latifolia* at the opening of the zone.

Despite the evidence for an increased extent of woody vegetation locally, it is notable that with the exception of ribwort plantain, herbaceous taxa remain fairly well represented. This is probably partly a reflection of the fact that wetland vegetation of sedges and tall herbs near to and on the site remained fairly open at this time. The peak in Ranunculaceae presumably also reflects a localised expansion in buttercups on the damper open soils nearby.

Hence, the decrease in plantain suggests that hazel was expanding onto open grassy areas in the wider landscape. Alternatively, it may be hypothesised that rather than an actual areal decrease in ribwort plantain, the pollen signal of these open areas of dryland are partly being obscured by that of the local signal from willow. However, it would be anticipated that if such a taphonomic issue was at work, then this would have affected all the other low growing taxa, such as dandelions, and this is not observed.

PS-3: 2.90-3.58m, Cyperaceae-Poaceae-*Salix*

The vegetation in the final zone is initially similar to that of PS-2, with wetland vegetation in the form of willow and sedges persisting close to the site. A recovery in ribwort plantain is apparent and the curves for other herbs such as pink family, dandelions and Asteraceae (thistles etc.) remain present at low but consistent values. This suggests that open grassy areas with plantains had increased compared with the previous zone. Some scrub with hazel and ash is also implied.

There is evidence towards the top of the zone for increasingly open conditions around the sampling site (trees and shrub falling to c.10% TLP), with rising values for sedges and concomitant decreases in hazel and willow. This might suggest the effects of local waterlogging, leading to an expansion in sedges at the expense of the woody vegetation. Rises in the other herbs at this point might also indicate increased openness. The precise picture is somewhat unclear as pollen concentrations were too low above 2.90m to produce adequate counts.

3.2 Beetle Results

All three samples submitted for assessment from the upper peat unit provided relatively abundant and diverse beetle assemblages. The results of each sample assessment will be provided prior to the discussion of the inferred palaeoenvironment during the development of the upper organic sequence (refer to Table 1 for a summary of the key beetle species).

Sample 1: 3.85-4.55cm
The assemblage encountered within the basal sample had relatively restricted species diversity in comparison to the upper two samples. Hygrophilous (wetland) species are present whilst aquatic species are rare. The hydraenid *Hydraena testacea* was encountered and is typically found in stagnant standing waters, with rich floating vegetation composed of *Lemna* spp. (duckweed). Decaying organic material is suggested by the record of the staphylinid, *Oxytelus sculptus* (Tottenham 1954). These species are indicative of the peat-forming environment at the sampling site; there is less evidence of the vegetation growing on the drier soils further. However, the evidence points towards a damp, swampy meadow environment.

Sample 2: 3.31-3.85cm
Preservation of this sample was good. The palaeoenvironmental conditions indicated are similar to those of the previous sample. Whilst hygrophilous taxa persist, aquatic taxa are again restricted. Several species in this sample indicate damp, decaying organic material and possibly dung. The histerid *Onthiophilus striatus*, and the staphylinid *Tachinus rufipes,* are both associated with this type of foul material (Koch 1989, Tottenham 1954). Coprophagous taxa, such as the Scarabaeidae (dung beetles), which are unequivocal indicators of dung however, are absent. Once again, species associated with vegetation surrounding the feature are sparse. However, the Chrysomelidae, *Plateumaris*/*Donacia* spp. are associated with a variety of herbaceous wetland species including carices and taller reeds such as *Phragmites* spp. (common reed) and *Typha* spp. (bulrush) (Menzies and Cox 1996).

Sample 3: 2.85-3.31cm
This sample contained a well-preserved and readily interpretable assemblage. The majority of the recovered taxa were aquatic or hygrophilous species, with an increased representation of distinctly aquatic taxa. The carabid, *Dyschirius globosus*, and the genus Hydraenidae, are characteristic of damp, muddy conditions at the periphery of both standing and slow-moving waters and in more ephemeral, seasonal water bodies (Lindroth 1974, Hansen 1987). The Chrysomelidae *Prasocuris phellandrii* for example, is found amongst fine-leaved water dropwort (*Oenanthe aquatica*) (Koch 1992). This is an herbaceous taxa characteristic of standing or very slow moving water (Haslam *et al.* 1975). The dryopid *Esolus parallelipepidus*, part of the Elmidae or 'riffle beetle' family, is found at the muddy fringes of flowing waters (Holland 1972), which perhaps suggest an occasional input from a faster flowing water source. Indicators of the vegetation surrounding the sampling location are again limited.

3.3Radiocarbon Dating
A summary of the radiocarbon dates is provided in Table 2, whilst Radiocarbon Certificates are included in Appendix III. All samples contained sufficient carbon for reliable counting.

The onset of the first phase of organic deposition occurred at 10920±50BP (12940-12830 Cal. BP, 11,000-10880 Cal. BC). The upper unit boundary is dated to 11090 ± 60BP (13140-12880 Cal. BP, 11190-10930 Cal. BC). Although there is an overlap between the radiocarbon dates of the lower and upper organic unit boundaries, their similarity suggests a reliable approximate chronology has been obtained.

The second phase of organic accumulation commenced with the deposition of organic rich sands *c.* 2110±40BP (2290-1990 Cal. BP, 340-40 Cal. BC). A shift to the deposition of a red-brown well-humified peat is then dated to 2090±40BP (2150-1960 Cal. BP, 200-10 Cal. BC). Peat accumulation continued until 1280±40BP (1290-1140 Cal. BP, 660-810 Cal. AD), after which a shift to the deposition of dark grey clayey silts occurred.

4. DISCUSSION

There is an overall lack of information relating to landscape evolution of Suffolk lowlands during the Holocene, with an almost total absence of such data for Sudbury and the surrounding regions (Hill *et al*., 2007). This stratigraphic sequence dating back to the Late glacial – Holocene transition, therefore provides a valuable regional palaeoenvironmental archive.

The proximity of the core location to the contemporary River Stour, combined with the well-humified nature of the organics and the abundance of silt, would suggest that deposition initially occurred within a lagoonal swamp environment on the river's floodplain. The radiocarbon dating of this unit indicates that this period of lagoonal floodplain deposition occurred between 11090±60BP and 10920±50BP. This suggests that the phase of sedimentation occurred around the end of the warmer phase of the Windermere Interstadial and prior to the cold phase of the Loch Lomond Stadial.

A period of minerogenic accumulation then occurs, with the deposition of fine sands, silts and clays until c. 2110±40 BP. Deposition is likely to have taken place within a floodplain backswamp environment, with fine-grained alluvium accumulating during periods of increased discharge and flooding of the River Stour. However, considering only *c*. 1.0m of sediment accumulated over a period of *c*. 9000yrs, it is likely that hiatuses in sedimentation occurred. Phases of incision and aggradation on the floodplain are likely to have taken place throughout the Holocene in response to a range of factors including climatic change and the effects of human activity.

The transition from the deposition of floodplain alluvial sediments to organic-rich sands is dated to 2110±40 BP. As discussed above, as the upper boundary of these organic-rich sands is dated to 2090±40 BP, the radiocarbon dating of the period of accumulation of this deposit is unclear. A period of rapid accumulation may explain the results of the dating. Alternatively, one or both of the dates (obtained on bulk samples due to an absence of identifiable macrofossils) may be in error as a result of re-worked organic material or 'younging' due to rootlet penetration.

Despite this, it is clear from the corresponding pollen assemblages that a later Holocene context is appropriate. The pollen and beetle data indicate that during this period, the later Iron Age, the sampling site was open and swampy, perhaps a cutoff channel or backswamp, with wetland vegetation including sedges, and areas of standing water with reedmace and pondweeds. Tall herb communities are also indicated in the near vicinity. The beetle assemblages appear to be biased towards this onsite vegetation, but the pollen provides evidence of the wider environment.

The data shows that the vegetation on the drier soils was also open and had apparently been largely cleared of any substantial woodland cover prior to the beginning of the pollen record. There is good evidence that this open landscape was created and maintained by anthropogenic activity. Pastoral use of the damp meadows on the floodplain might be suggested on the basis of the range of herbaceous taxa but the presence of grains of cereal pollen and 'weeds' of arable fields such as cornflower and perhaps fat hen and wormwood also indicate disturbed soils and cultivation nearby.

The subsequent zone, PS-2, appears to portray some woodland regeneration or expansion locally. This is interpreted as relating to successional processes associated with the accumulation of peat beginning to outstrip the rising watertables, creating conditions suitable for willow and also hazel to grow nearer the sampling site. These slightly drier situations may also be suggested by beetle sample 2, which includes this pollen zone, and indicates an absence of aquatic conditions at this time. Despite the reduction in plantains, open, pastoral habitats seem to persist. These may have been maintained by grazing, although dung beetles are not recorded in the beetle samples.

Although inter-site comparisons are somewhat difficult due to the relative lack of palaeoenvironmental records for the region, some comparable data does exist. Palynological investigations of a palaeochannel sequence from Scole on the River Waveney also suggest weedy grassland during the Late Iron Age (Wiltshire, in prep) following substantial anthropogenic clearance during the later Bronze Age. A similar suite of herb species encountered through SP-2 and SP-3 at Sudbury were also recorded at Scole during the Late Iron Age and Romano-British periods (100 Cal. Yrs BC – 60 Cal. Yrs AD; Wiltshire, in prep), including plantains, dandelions, wormwood and cornflower. This was interpreted as evidence for agricultural activity proximal to the site, supporting the suggestion for human occupation and exploitation of the valley lowlands. The data therefore supports an emerging consensus that the East Anglian landscape had been largely cleared of its woodland cover by the Iron Age (Wiltshire and Murphy 1999).

The final pollen zone PS-3 corresponds to the lower half of beetle sample 2 (3.31-3.85m) and the upper half of beetle sample 3 (3.31-2.85m). The suggestion of substantially wetter conditions in the uppermost beetle assemblage is also indicated by the pollen data, with expansion of sedges and contraction of trees and shrubs apparent at the close of the diagram.

The various changes in the hydrological conditions at Sudbury could relate solely to localised factors associated with fluvial activity but may be connected in part at least to broader patterns of environmental change: increasing wetness during the later Iron Age is likely to be related to the effect of rising sea-levels causing rivers to 'back up' and hence raising local water tables and paludifying previously dry land. Similar effects, for example, have been recorded around this time in the Somerset Levels, *c*. 2624±45 ^{14}C years BP (SRR-914, 902-752 cal BC, Hibbert 1980). The presence of aquatic pollen including *Typha latifola* (reedmace) and *Potamogeton* (pondweeds) supported by the increase in abundance of aquatic beetle species at Sudbury does confirm an overall increase in wetness at the site. It is also possible that the wetter conditions indicated towards the close of the sequence are related to climatic fluctuations at the very beginning of the Medieval Warm Period. For example, in Suffolk, at West Stow, near Bury St. Edmonds, increasingly damp conditions may have led to the abandonment of a Saxon settlement in the *c*. 7th Century AD (Lamb 1982). Further study of sequences similar to that discussed in this report is required to provide support to these hypotheses and to elucidate any connections they might have with cultural changes.

Despite the absence in the beetle record of the Scarabaeidae family, obligate coprophages ('dung beetles'), the pollen strongly suggest that the landscape at Sudbury stadium was subject to grazing throughout much of the period of time represented by the pollen data. Cultivation is also indicated, although on the basis of the more sporadic record of cereal pollen, arable activity was probably not continuous. Although the chronology for part of the sequence is unclear, the evidence demonstrates that human communities have been exploiting the land around the river at the Sudbury stadium site since at least the Iron Age.

5. CONCLUSIONS

The palaeoenvironmental assessments undertaken at Priory Stadium provide a valuable contribution to understanding the landscape development of the area since the Late-glacial period. Few archives of this nature exist throughout the Suffolk lowlands and this is also the first site to cover such an extensive time period from Sudbury or the surrounding area. Both local and regional palaeoenvironmental signals have been provided through the application of pollen and beetle assessments to the sedimentary archive. It is suggested that work of a similar nature should be undertaken on similar sites from the region in order to develop a better spatial and temporal understanding of landscape evolution and associated human activity and its relation to archaeological sequences in the area.

ACKNOWLEDGEMENTS

The authors are grateful for the assistance of Keiron Heard, John Newman and colleagues at Suffolk County Council Arcaheological Services, for assistance during fieldwork and the subsequent post-excavation assessment. Beetle processing and sorting was undertaken by Christina Joliffe.

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Table 1: Summary of key beetle species encountered within the three organic samples from Priory Stadium, Sudbury.

Depth	2.85-3.31cm	3.31-3.85cm	3.85-4.55cm	Ecological preference	Host plants
Processed Weight	500ml	500ml	500ml		
Processed Volume	.5l	.5l	.5l		
COLEOPTERA					
Carabidae					
Dyschirius globosus (Hbst.)	**			Damp clay and sily substrates	
Pterostichus spp.		**			
Dytiscidae					
Hydroporus spp.	*				
Hydraenidae					
Hydaena testacea Curt.			**	Standing water	
Hydraena spp.	**	**			
Octhebius spp.	**				
Helophorus cf. *grandis*	*				
Hydrophilidae					
Cercyon spp.	*	**			
Laccobius spp.	*			slow moving and standing water	
Histeridae					
Onthophilus striatus (Forst.)		*		Dung and decaying organic material	
Orthoperidae					
Corylophus cassidoides (Marsh.)		*		Swampy meadows	*Phragmites australis*, *Carex* spp.
Staphylinidae					
Lesteva spp.		**			
Oxytelus rugosus (F.)	*			Dung and decaying organic material	
Oxytelus sculptus Grav.			**	Dung and decaying organic material	
Philonthus spp.		**			
Xantholinus spp.		**			
Tachyporus spp.		*			
Tachinus rufipes (Geer.)		*		Dung and decaying organic material	
Staphylinidae					
Aleocharinae gen. & spp. Indet.		***			
Dryopidae					
Dryops spp.			*		
Esolus parallelepipedus (Mull.)	*			Mud at the edges of running water	
Chrysomelidae					
Donacia spp.	*		*		
Plateumaris discolor/P. sericea		**		Swamps and bogs	*Carex* spp., *Iris pseudocorus*, *Nymphea alba*
Plateumaris spp.					
Plateumaris/Donacia spp.	**		**		
Prasocuris phellandrii (L.)	*				*Oenanthe aquatica*
Haltica spp.			*		
Chaetocnema concinna (Marsh.)			**		*Rumex* spp., *Polygonum* spp.
Curculionidae					
Limnobaris spp.		*			Brassicaceae, *Sisymbrium officinale*spp.

Table 2: Results of radiocarbon dates from Priory Stadium, Sudbury

Sample	Code	Depth (m)	Sample description	Sample pre-treatment	13C/12C Ratio	Conventional radiocarbon age	Calibrated range BC/AD (2 sigma - 95% confidence)
SUDBURY-2.58m	Beta-233960	2.58	peat	acid/alkali/acid	-28.7 o/oo	1280 +/- 40BP	660-810 Cal. AD
SUDBURY-3.85m	Beta-233961	3.85	peat	acid/alkali/acid	-29.3 o/oo	2090 +/- 40BP	200-10 Cal. BC
SUDBURY-4.55m	Beta-233962	4.55	peat	acid/alkali/acid	-29.3 o/oo	2110 +/- 40BP	340-320 Cal. BC, and 210-40 Cal. BC
SUDBURY-5.65m	Beta-233963	5.65	peat	acid/alkali/acid	-28.4 o/oo	11090 +/- 60BP	11190-10930 Cal. BC
SUDBURY-5.72m	Beta-233964	5.72	peat	acid/alkali/acid	-28.0 o/oo	10920 +/- 50BP	11000-10880 Cal. BC

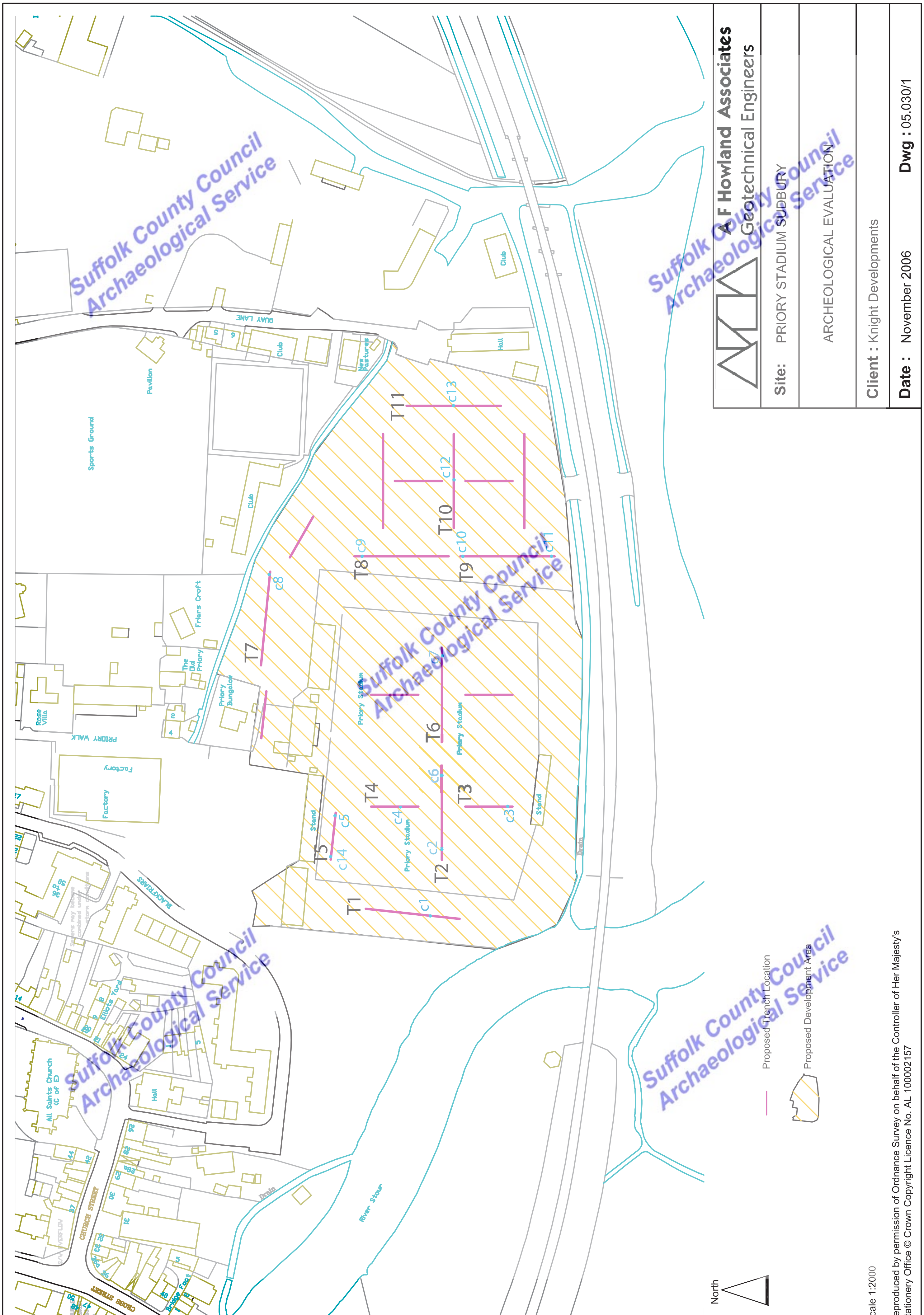

Figure 1: Priory Stadium, Sudbury. Site location, position of trenches (T1-T11) and core locations (c1-c14). Adapted from plan provided by SCCAS.

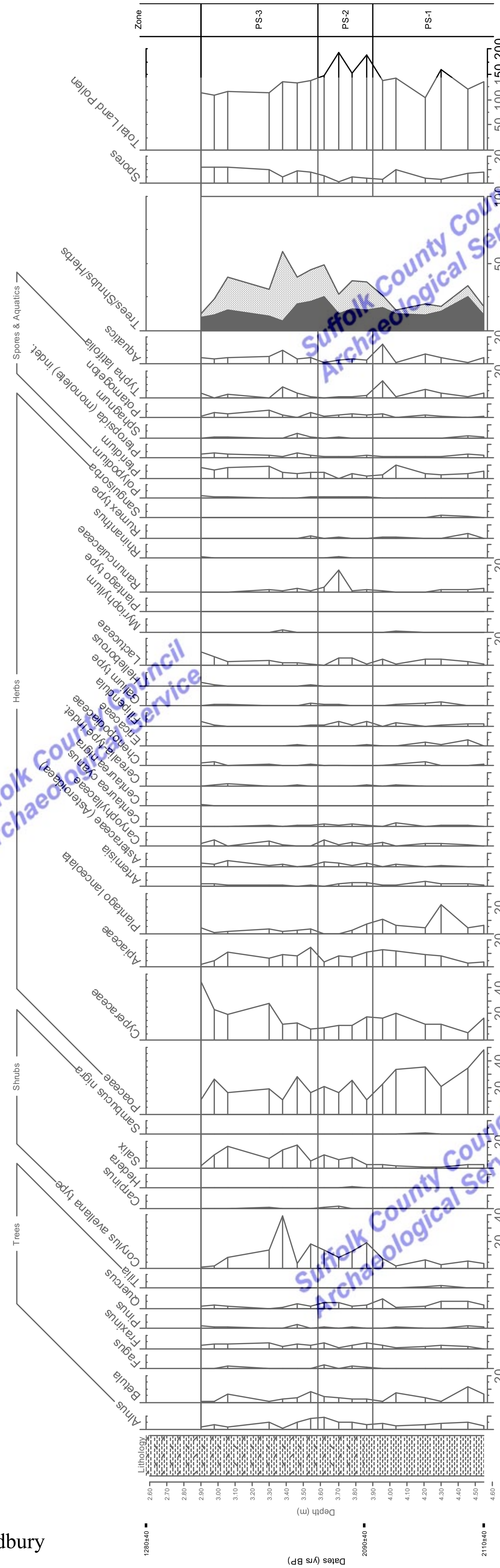

Figure 2: Pollen diagram for Priory Stadium, Sudbury

APPENDIX I

Priory Stadium, Sudbury: a palaeoenvironmental assessment of deposits encountered during ground investigations

By

Dr T. Hill & Miss C. Jolliffe

SCCAS-36-07

BIRMINGHAM ARCHAEO-ENVIRONMENTAL

BAE

Priory Stadium, Sudbury: a palaeoenvironmental assessment of deposits encountered during ground investigations

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SCCAS-36-07

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June 2007

Summary

Birmingham Archaeo-Environmental undertook sedimentary coring at Priory Stadium, Sudbury, to complement the archaeological excavations taking place at the site.

Fieldwork identified a stratigraphic archive consisting of alluvial clays and silts with occasional layers of organic-rich silts, sands and peats. Upon analysis of the spatial distribution of the organic deposits, it was concluded that at least two phases of in-situ organic accumulation have occurred since sedimentation began at the site. A palaeochannel may also be present within the deposits, and may reflect a former channel of the River Stour, which is located to the south. Although a precise timescale for the development of the sedimentary sequence is unknown, it is suggested that the deposits may date back to the Mid-Holocene (c. 4-5,000 yrs BP).

In order to fully understand the palaeoenvironmental history of the site, it is suggested that pollen and beetle assessments should be undertaken on the organic-rich deposits believed to represent the two phases of organic accumulation. AMS radiocarbon dating should also be undertaken on the top and base of each organic unit to establish the timing of the onset and cessation of organic deposition.

KEYWORDS: Priory Stadium, Sudbury, Suffolk, River Stour, peat, alluvium.

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Priory Stadium, Sudbury: a palaeoenvironmental assessment of deposits encountered during ground investigations

1. INTRODUCTION

Deposits of palaeoenvironmental potential were discovered during ground investigations at Priory Stadium, Sudbury (TL 870 407). The site is located on the northern floodplain of the River Stour. Residential housing and a sports ground are located immediately north of the site, and a car park present to the east (Figure 1). Prior to this phase of remediation, the site was the home to Sudbury Town Football Club, until its closure in 1999. Since then, the land has remained derelict, with the stadium and its terraces being removed in April and May 2007. It is proposed that the site is developed for residential housing.

In total, nineteen trenches were excavated by Suffolk County Council Archaeological Service (SCCAS) to an approximate depth of 1.20m. This was to enable archaeological assessments to be undertaken (see Figure 1 for approximate trench locations). Made Ground capped the site, typically to a depth of 0.80m. Previous borehole investigations however, indicated that the site was underlain by interbedded sequences of peat and alluvial clays and silts. The spatial and temporal extent of these deposits however, was poorly understood. Birmingham Archaeo-Environmental were consequently sub-contracted to undertake the coring and subsequent stratigraphic and palaeoenvironmental assessments across the site.

This report presents the results of palaeoenvironmental investigations (manual coring, recording, sampling and palaeoenvironmental assessment) associated with this scheme of work.

The aim of the work was threefold:

- To identify, record, characterise and sample organic deposits, encountered during previous geoarchaeological surveys.
- To assess this material for biological preservation (suitable for pollen and beetle assessments) and identify suitable samples for radiocarbon dating.
- To provide a detailed understanding of the subsurface stratigraphy of any organic-rich deposits and fine grained silts and clays, which might aid in the development of archaeological prospection strategies.

2. METHODS

2.1 Coring Survey

At the time of fieldwork, the site was derelict. All buildings (stadium terraces etc) had recently been removed to assist in the archaeological investigations being undertaken. A site visit was undertaken over a three-day period from 22nd-24th May 2007, during which sedimentary coring was undertaken within eleven of the nineteen excavated trenches (see Figure 1). Made Ground was found to overlie the natural strata and varied in thickness to between *c.* 0.65m and *c.* 1.55m. Inspection of the trench locations enabled the thick sequences of Made Ground to be avoided during coring. Core locations were chosen to ensure a clear spatial understanding of the stratigraphy across the site. This was achieved through the positioning of the cores to create two transects running approximately north-south and one transect running east-west.

Cores were extracted using a manual gauge 'Eijkelcamp' corer. Coring continued until bedrock or gravels were encountered. Samples were extracted in 1.0m length sections within the corer and selected cores were transferred into 1.0m lengths of plastic guttering for storage and transport.

2.2 Stratigraphic Analysis
Whilst an initial assessment of the sedimentary archive was made on-site, detailed stratigraphic analysis of selected cores was undertaken at the Birmingham Archaeo-Environmental laboratory at the University of Birmingham. Each 1.0m section of sample was carefully opened ensuring the enclosed stratigraphy remained intact prior to recording and sampling. Sediments were recorded using the Troels-Smith (1955) classification scheme. The scheme breaks down a sediment sample into four main components and allows the inclusion of extra components that are also present, but that are not dominant. Key physical properties of the sediment layers are also identified according to darkness (Da), stratification (St), elasticity (El), dryness of the sediment (Dr) and the sharpness of the upper sediment boundary (UB). A summary of the sedimentary and physical properties classified by Troels-Smith (1955) and the nomenclature used is provided in Table 1. A full stratigraphic breakdown of the cores is provided in Appendix I.

3. PRELIMINARY RESULTS OF FIELDWORK

A total of 14 cores were taken across the site (see Figure 1 for core locations relative to trial trenches, and Figure 2 and 3 for site photographs). There was considerable stratigraphic variation encountered during fieldwork. The depth at which gravels were encountered varied from 5.95m (Core 2) to 2.30m (Core 14), at which point coring was terminated due to the inability to penetrate the underlying sediments.

The general site stratigraphy was composed primarily of silts and clays within which occasional organic-rich units were present. Core transects running north-south (Figure 5) and east-west (Figure 6) are provided. The clays and silts were commonly orange-brown in colour towards the surface, becoming blue-grey and grey-brown with depth. The organic content of these deposits was generally low, with occasional herbaceous remains and organic mottling present. The minerogenic units become sand-rich prior to the basal gravels being encountered, which commonly resulted in sample extraction being difficult due to the saturated nature of the sediments (positioned below the local water table).

Organic-rich units were present in most of the cores, except cores 5, 10 and 14. When present, the organic deposits were either dark brown organic-rich sand and silt units or dark brown to red-brown herbaceous well-humified peat units. Although there was some spatial variation present between cores, it was common to encounter a peat unit at *c*. 2.80m depth in the central, southern and western area of the site. The thickness of this unit also varied considerably, from *c*. 0.30m to the west (Core 1), to *c*. 1.40m towards the centre of the site (Core 2). In contrast, to the east of the site (outside the stadium grounds), organic deposits were not encountered at the same depth. A second, deeper peat unit was however encountered at *c*. 5.60-5.70m in Core 2 and *c*. 4.90-5.20m in Core 12. There is therefore an earlier phase of peat accumulation evident across the site.

4. CONCLUSIONS

The stratigraphic sequence encountered at Priory Stadium suggests considerable palaeoenvironmental variation exists within the depositional archive. It is concluded that the silt and clay deposits are alluvium derived from the River Stour, located immediately south of the site. As the site is situated on the floodplain of the River Stour, its low gradient relative to the river would have resulted in regular flooding and subsequent accumulation of fine silts and clays through overbank deposition. The variation in colour of the alluvium results from a) variations in organic content, b) variations in the provenance of the sediment supply and, c) the precipitation of iron oxides in the upper *c.* 2.0m through fluctuations in the level of the local water table.

The organic-rich deposits encountered across the site are interpreted as evidence for *in-situ* organic accumulation, possibly in a backwater lagoon or meander cut-off context within the floodplain of the River Stour. Although considerable spatial variation was evident, it is concluded that at least two periods of organic accumulation occurred on the Sudbury site. It is not possible at this stage to provide a date for the timescales involved for these periods of *in-situ* organic accumulation. However, when taking into account the thickness of the sedimentary sequences in question and the depths at which the organic-rich units are encountered, a Mid-Holocene timescale is likely. The considerable lack of palaeoenvironmental evidence from the Stour Valley region (Hill et al. 2007) suggests that dating the onset and cessation of organic deposition would significantly contribute to the local and regional understanding of landscape development.

The first phase of organic accumulation is only evident in Cores 2, 12 and possibly Core 13. Considering the isolated nature of these deposits and that the unit is never more than 0.30m thick, it is suggested that the unit derived from accumulation in a lagoonal floodplain setting, where stagnant water encouraged the colonisation and expansion of vegetation resulting in peat development. It cannot be discounted however that this unit originally covered much of the site and that subsequent erosion has removed the unit from the sedimentary archive. In contrast, considering the relative thickness of upper organic unit in Core 2 (where *c.* 1.92m of peat and organic-rich sands were encountered) and across much of the central, southern and western sections of the site, it is suggested that palaeochannel features may be present within the archive. Whether a single palaeochannel or multiple palaeochannels are present in this area of the site is unclear at this time. However, Made Ground deposits encountered in the southern face of Trench 5 (see Figure 4) indicate the potential infilling of a topographic hollow (K. Heard, SCCAS, *pers. comm.*). This may have occurred in an attempt to level the landsurface prior to development in the nineteenth or twentieth centuries. A palaeosol is indeed evident immediately above the fill deposits suggesting a later period of possible agricultural activity (Figure 4b). This infilling could be traced to the western edge of Trench 2, in which Core 2 was extracted (containing extensive organic deposits; Figure 3). It is possible therefore that a palaeochannel had previously developed, after which post-depositional decomposition and dessication of the organic deposits resulted in the lowering of the depositional landsurface. Such palaeochannel features would have created topographic hollows within the floodplain making any reclamation and development difficult. The evidence for the levelling of such features could possibly therefore be interpreted as indirect evidence for at least one palaeochannel feature within the Priory Stadium site. Coring at the western end of Trench 5 (where the infill feature was evident; Figure 4), however, was unsuccessful due to the abundance of gravel close to the trench surface.

5. RECOMMENDATIONS FOR FURTHER ANALYSIS

Taking into account the variation in stratigraphy encountered on the site, it is likely that palaeoenvironmental conditions have changed considerably over time. The accumulation of fine-grained alluvium through overbank sedimentation typified the depositional environment for much of the site's history. However, although the distribution of peat deposits varies spatially, it has been concluded that there were at least two phases of peat accumulation on the floodplain of the

River Stour. It is proposed that any palaeoenvironmental assessments undertaken should concentrate on Core 2, in which two peat units (believed to represent the two phases of organic accumulation) are present. Therefore, in order to obtain an understanding of the palaeoenvironmental conditions responsible for the development of the peat unit, the following assessment is suggested:

- Pollen assessment at the top, middle and bottom of the lower peat unit in order to assess the palaeoecological conditions present at the time of deposition. It is recommended that samples from within the lower peat unit at 5.65m, 5.69m and 5.72m depth are assessed.

- Pollen assessments should also be undertaken at regular 0.08m intervals through the well-humified peat and organic-rich sand unit (1.97m thick) in order to assess the palaeoecological conditions present during the second phase of *in-situ* organic accumulation. A total of 26 samples would require pollen assessment

- Due to the thickness of the upper organic-rich unit, the remaining deposits should be bulked into top, middle and lower samples, to be assessed for beetle remains (three samples in total). The red-brown, well-humified peat should be split into the upper and middle samples (2.58-3.31m, 3.31-3.85m depth), whilst the underlying organic-rich sand should be sub-sampled for the lower sample (3.85-4.55m depth).

- Radiocarbon dating is also suggested on suitable wood fragments or bulk organic samples from the top and base of the two peat units and at the transition from organic-rich sand into well humified peat within the upper peat unit (5 samples in total). This should be undertaken in order to establish the timing of the onset and cessation of peat deposition. Samples should be taken from *c*. 2.58m, 3.85m, 4.55m, 5.65m and 5.72m depth.

6. ARCHIVE

All cores sampled during fieldwork are currently stored by Birmingham Archaeo-Environmental, University of Birmingham, Edgbaston, Birmingham, B15 2TT. In addition, original core logs, site location plans, photographs and associated material are stored within Birmingham Archaeo-Environmental.

ACKNOWLEDGEMENTS

The authors are grateful to Kieron Heard and colleagues from Suffolk County Council Archaeological Service for their assistance during fieldwork.

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Troels-Smith, J. (1955). Karakterisering af lose jordater (characterisation of unconsolidated sediments). *Denmarks Geologiske Undersogelse*, Series IV/3, 10, 73.

Degree of Darkness	
nig.4	black
nig.3	
nig.2	
nig.1	
nig.0	white

Degree of Stratification	
strf.4	well stratified
strf.3	
strf.2	
strf.1	
strf.0	no stratification

Degree of Elasticity	
elas.4	very elastic
elas.3	
elas.2	
elas.1	
elas.0	no elasticity

Degree of Dryness	
sicc.4	very dry
sicc.3	
sicc.2	
sicc.1	
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

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

Table 1 Physical and sedimentary properties of deposits according to Troels-Smith (1955)

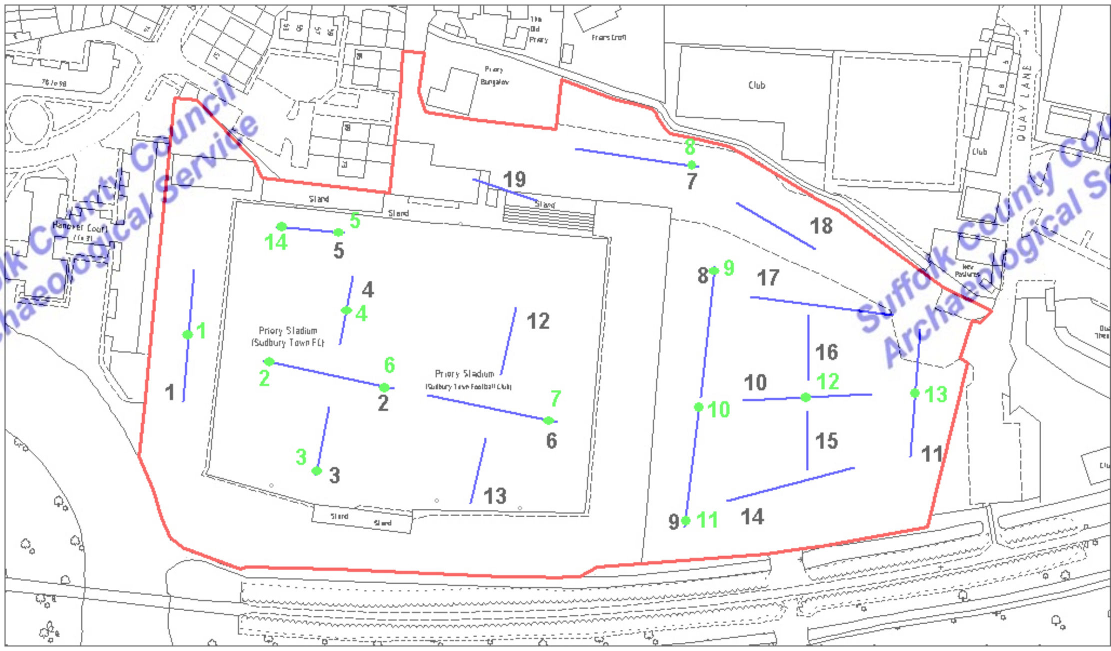


Figure 1: Plan showing core numbers and locations (green), archaeological trenches (blue) and trench numbers (black)

Figure 2: Priory Stadium, Sudbury, looking across the site to the east

Figure 3: Looking west along Trench 2, in which the two peat units being recommended for assessment were encountered during coring.

Figure 4 a) and b): Southern face of Trench 5. It is suggested that the artificial infilling of a topographic hollow is evidence for the location of a palaeochannel feature underlying the fill, running c. northwest-southeast across the site.

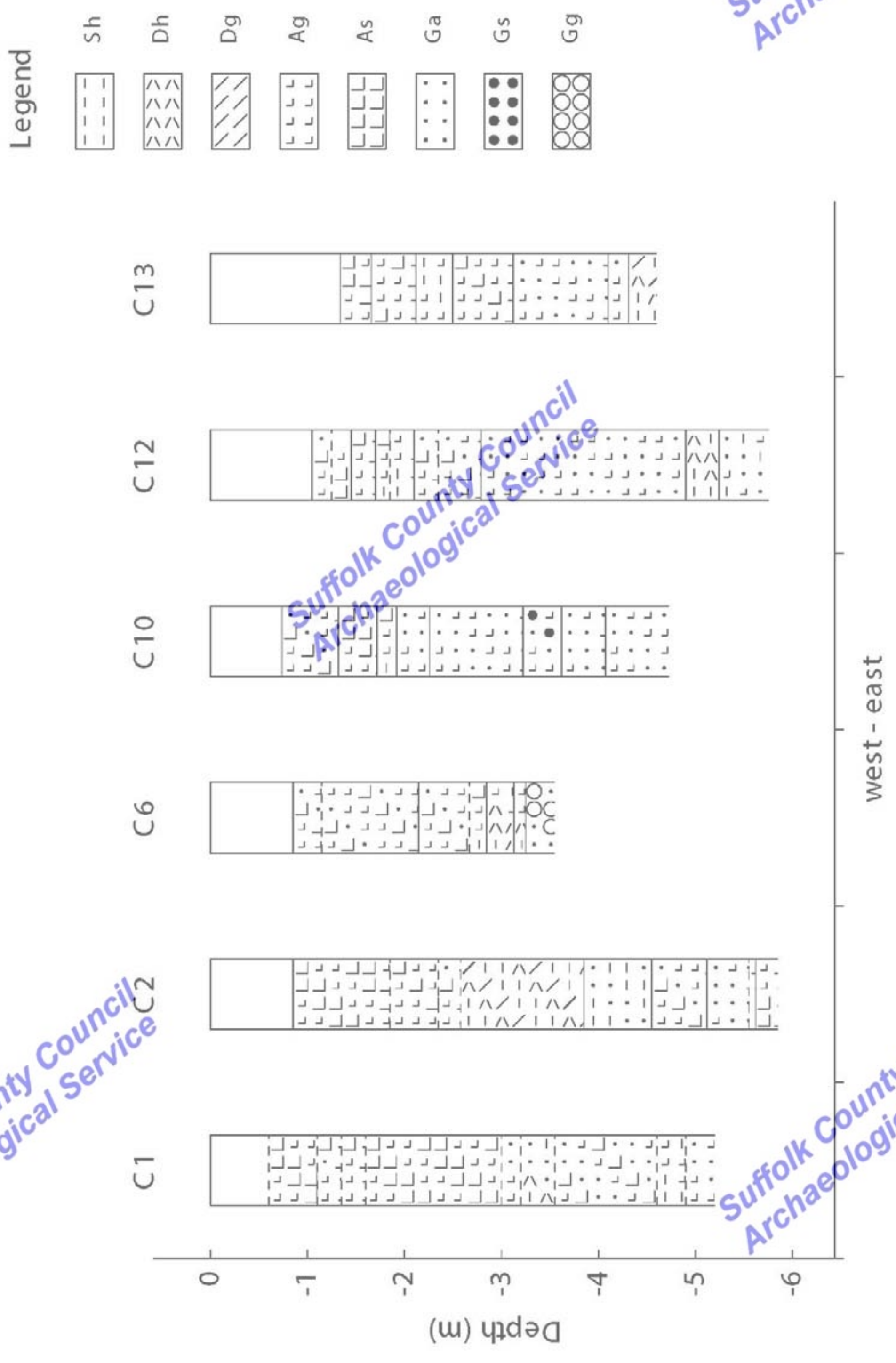


Figure 5: Core transect running east-west across the Priory Stadium site. Refer to Table 1 for stratigraphy

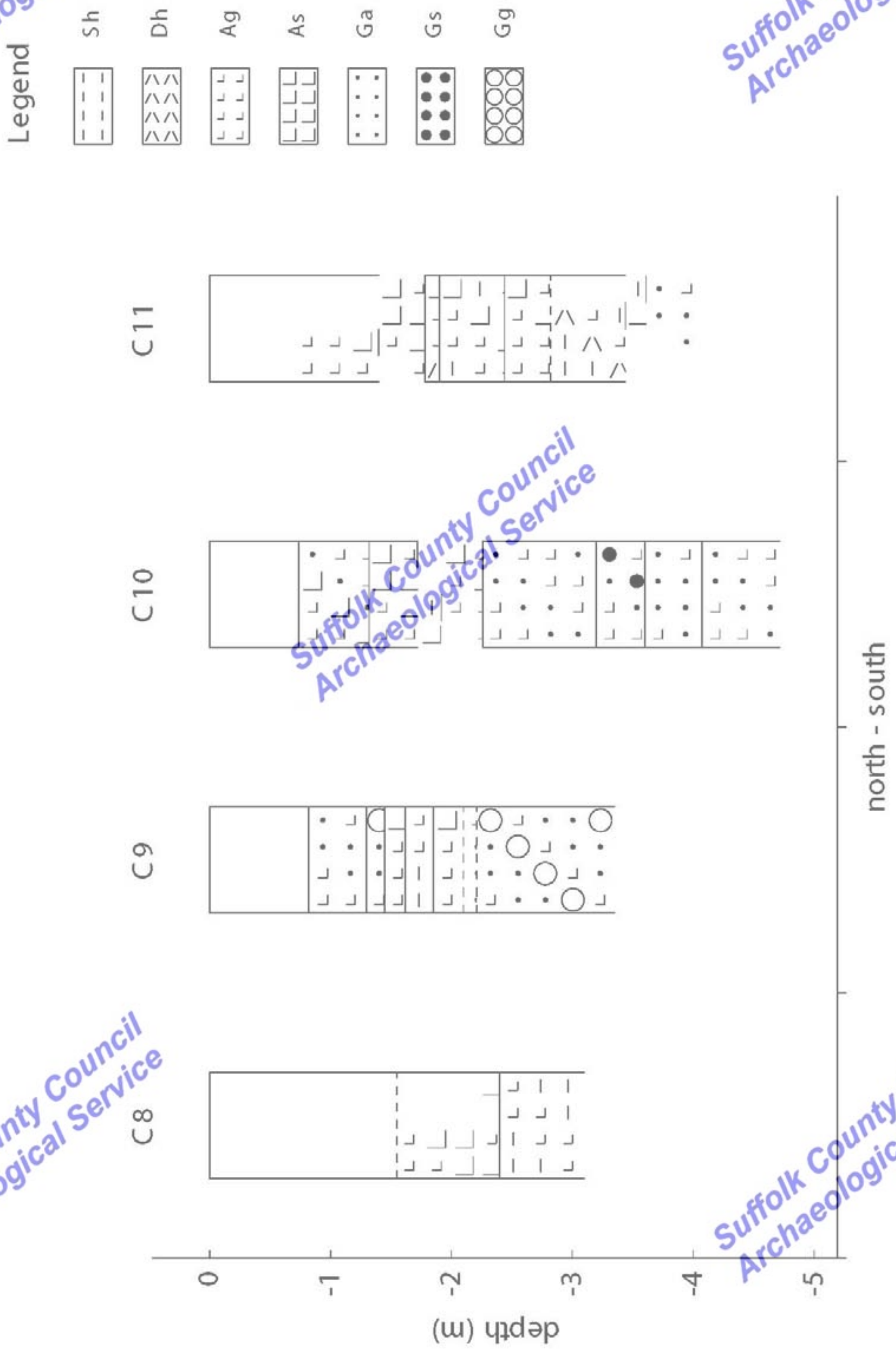


Figure 6: Core transec running north-south across the Priory Stadium site. Refer Table 1 for stratigraphy

APPENDIX I

Core Stratigraphy

Refer to Table 1 for summary of sedimentary classification scheme of Troels-Smith (1955)

Core 1 (Trench 1; TL86944 BNG40828)

0.00-0.60m Made Ground

0.60-1.10m

Da	St	El	Dr	UB
2	0	0	2	-

Ag2, As2, Lf+, Sh+, Ptm+
Light grey/brown clayey silt with iron mottling

1.10-1.35m

Da	St	El	Dr	UB
2+	0	0	2	1

Ag2, As1, Ga1, Lf+, Ptm+
Light brown slightly sandy clayey silt

1.35-1.60

Da	St	El	Dr	UB
2	0	0	2	2

As3, Ag1, Ga+
Light grey silty clay

1.60-3.00m

Da	St	El	Dr	UB
2+	0	0	2	1

Ag2, As1, Ga+, Sh+
Medium grey organic mottled silty clay
**increasing sand content with depth*

3.00-3.20m

Da	St	El	Dr	UB
2+	0	0	2	1

Ga2, Ag2, As+, Ptm+, Sh+
Light brown silty sand

3.20-3.55m

Da	St	El	Dr	UB
3	0	1	2	1

Ga2, Sh1, Dh1, Ag+, Dg+
Dark brown organic-rich sand

3.55-4.60m

Da	St	El	Dr	UB
2	0	0	2	2

Ga2, Ag1, As1
Light grey silty sand (occasional silt-rich horizons within)

4.60-4.90m

Da	St	El	Dr	UB
3	0	1	2	2

Sh2, Ag2, As+, Ag+
Medium brown organic-rich sand

4.90-5.20m

Da	St	El	Dr	UB
3	0	0	2	2

Ga2, Ag2, Sh+, Ptm+
Dark grey sandy silt

Core terminated within sands and gravels at a depth of 5.30m

Core 2 (Trench 2; TL86970 BNG40821)

0.00-0.85m Made Ground

0.85-1.30m

Da	St	El	Dr	UB
2+	0	0	2	-

Ag2, As2, Ga+, GgMaj+
Light grey-brown clayey silt with occasional gravel

1.30-1.85m

Da	St	El	Dr	UB
2+	0	0	2+	1

Ag2, As2, Ga+, Lf+
Orange-brown clayey silt with iron mottling

1.85-2.35m

Da	St	El	Dr	UB
2	0	0	2	1

Ag3, As1, Sh+
Light grey clayey silt with occasional organic mottling

2.35-2.40

Da	St	El	Dr	UB
3	0	0	2	2

Ga4, Ag+
Dark grey sand horizon

2.40-2.58m

Da	St	El	Dr	UB
3	0	0	2	2

Ag2, As1, Ga1
Dark grey slightly sandy clayey silt

2.58-3.85m

Da	St	El	Dr	UB
3	1	2	2	2

Sh2, Dg1, Dh1, Ag+
Red-brown well humified peat
**shell-rich horizon 3.31-3.37m*

3.85-4.55m

Da	St	El	Dr	UB
2	0	0	2	1

Ga2, Sh2, Dh+, Dg+, Ptm+, Ag+
Light grey-brown organic sand

4.55-5.12m

Da	St	El	Dr	UB
1+	0	0	2	2

Ag2, As1, Ga1, Sh+, Dh+
Light grey clayey silt with occasional organic mottling

5.12-5.65m

Da	St	El	Dr	UB
3	0	0	2	1

Ga3, Ag1, Sh1
Dark grey-brown silty sand

5.65-5.72m

Da	St	El	Dr	UB
3	0	1	2	1

Sh2, Ag1, As1
Red-brown silty peat

5.72-5.95m

Da	St	El	Dr	UB
2	0	0	2	2

Ag2, As2, Ga+
Light grey-brown clayey silt

Core terminated within sands and gravels at 5.95m depth

Core 3 (Trench 3; TL86982 BNG40790)

0.00-0.65m Made Ground

0.65-1.25m

Da	St	El	Dr	UB
2+	0	0	2	-

Ag2, As2, Lf+, Ag+
Orange-brown mottled clayey silt

1.25-1.57m

Da	St	El	Dr	UB
2+	0	0	2	1

Ag2, As1, Ga1, Ptm+, Lf+
Orange-brown mottled sandy silt

1.57-1.63m

Da	St	El	Dr	UB
2+	0	0	2+	2

Ag2, Ga1, Ptm1, As+, Lf+
Orange-brown mottled shell-rich silt horizon

1.63-3.13m

Da	St	El	Dr	UB
3	0	2	2+	2

Sh1, Dh1, Ag1, Ga1, Ptm+, Dl+
Dark brown silty well humified peat
** charcoal fragments c. 0.42m depth*

3.13-3.30m

Da	St	El	Dr	UB
3	0	0	2	2

Ga2, Gs1, Ggmin1
Dark grey coarse sand horizon

3.30-3.45m

Da	St	El	Dr	UB
2	0	0	2	2

Ga2 As1, Ag1
Light grey silty sand horizon

3.45-3.90m

Da	St	El	Dr	UB
2+	0	0	2	1

Ga2, Ag2, Ptm+, Dl+, As+
Grey-brown organic silty sand

3.90-4.00m

Da	St	El	Dr	UB
2	0	0	2	1

Ga2, Ag1, Ptm1
Light grey shell-rich sand horizon

4.00-4.50m

Da	St	El	Dr	UB
2+	0	1	2	2

Sh2, Ag2, Ga+, Ptm+
Light brown well-humified silty peat

4.50-4.78m

Da	St	El	Dr	UB
2+	0	0	2	1

Ga2, Ag2, As+, Dh+
Grey-brown silty sand

Core terminated in coarse sands at 4.78m depth

Core 4 (Trench 4; TL86922 BNG 40829)

0.00-0.75m Made Ground

0.75-1.93m

Da	St	El	Dr	UB
2+	0	0	2	-

Ag2, As2, Ga+, Lt+, Th+, Ggmaj+
Orange-brown mottled clayey silt

1.93-2.25m

Da	St	El	Dr	UB
2	0	0	2	1

Ag3, As1, Lf+, Sh+
Light grey clayey silt with occasional organic and iron mottling

2.25-2.65m

Da	St	El	Dr	UB
2+	0	0	2	1

Ga2, Ag1, As1, Dh+, Sh+
Grey-brown silty sand

2.65-2.82m

Da	St	El	Dr	UB
2	0	0	2	2

Ag2, As1, Ga1, Sh+
Light grey clayey silt

2.82-3.05m

Da	St	El	Dr	UB
2+	0	0	2+	2

Ag2, As1, Sh1, Th+, Dh+
Grey-brown organic clayey silt

3.05-3.22m

Da	St	El	Dr	UB
2	0	0	2	1

Ag2, As1, Ga1, Dh+, Dl+
Light grey clayey silt

3.22-3.40m

Da	St	El	Dr	UB
2+	0	0	2	2

Ag2, Ga1, Ggmin1, Dl+
Yellow-grey sandy silt with occasional flint gravel

3.40-3.50m

Da	St	El	Dr	UB
3+	1	2	2	2

Dh2, Ag1, Ga1, Sh+
Dark brown sand-rich peat

Core abandoned within sands and graves at 3.50m depth

Core 5 (Trench 5; TL 86991 BNG 40859)

0.00-0.78m	Made Ground				
0.78-1.69m	Da	St	El	Dr	UB
	2	0	0	2	-
	Ag2, Ga1, As1				
	Light grey-brown clayey silt				
1.69-2.20m	Da	St	El	Dr	UB
	2+	0	0	2	2
	Ag3, As1, Lf+, Ga+				
	Light grey iron mottled clayey silt				
2.20-2.49m	Da	St	El	Dr	UB
	2+	0	0	2	1
	Ag3, As1 Sh+				
	Grey clayey silt with organic mottling				
2.49-2.75m	Da	St	El	Dr	UB
	Ga4, Ag+, Ggmin+				
	Yellow-brown sands				
2.75-3.65m	No sediment extracted, coarse sands encountered				

Core abandoned within coarse sands and gravel at 3.65m depth

Core 6 (Trench 2; TL 87002 BNG40815)

0.00-0.85m	Made Ground				
0.85-1.15m	Da	St	El	Dr	UB
	2+	0	0	2	-
	As2, Ag1, Ga1, Lf+, Th+				
	Orange-brown iron mottled silty clay				
1.15-2.15m	Da	St	El	Dr	UB
	2+	0	0	2	1
	Ag2, As1, Ga1, Lf+				
	Orange-brown iron mottled clayey silt				
2.15-2.77m	Da	St	El	Dr	UB
	2	0	0	2	2
	Ag2, As1, Ga1, Dh+, Sh+				
	Light grey clayey silt with occasional organic remains				
2.77-2.95m	Da	St	El	Dr	UB
	2+	0	0	2	1
	Ag2, As1, Sh1				
	Light brown organic rich silt				
2.95-3.23m	Da	St	El	Dr	UB
	3	1	2	2	2
	Dh2, Sh1, Ag1, Ggmin+, Dl+				
	Red-brown silty peat with occasional gravel				
3.23-3.35m	Da	St	El	Dr	UB
	3	0	2	2	1
	Ag2, Sh1, Dh1, As+				
	Dark grey-brown organic-rich silt				
3.35-3.65m	Da	St	El	Dr	UB
	2	0	0	2	1
	Ga2, Ggmin1, Ggmaj1, Ag+, Dl+				
	Light grey gravely sand with occasional organic remains				

Core abandoned in sands and gravels at 3.75m depth

Core 7 (Trench 6; TL 87054 BNG40802)

0.00-0.78m Made Ground

0.78-1.58m

Da	St	El	Dr	UB
2+	0	0	2	-

Ag3, As1, Lf+, Ga+
Orange-brown clayey silt with iron mottling

1.58-1.75m

Da	St	El	Dr	UB
2	0	0	2	2

Ag4, As+, Sh+
Light grey silt with occasional organic mottling

1.75-2.02m

Da	St	El	Dr	UB
2+	0	0	2	-

Ag3, As1, Lf+, Ga+
Orange-brown clayey silt with iron mottling

2.02-2.82m

Da	St	El	Dr	UB
2	0	0	2	2

Ag4, As+, Sh+
Light grey silt with occasional organic mottling

2.83-3.84m

Da	St	El	Dr	UB
3	1	2	2	2

Dh2, Sh2, Th+, Dg+, Ag+
Red-brown herbaceous well humified peat
** silt content increases with depth*

3.84-4.26m

Da	St	El	Dr	UB
2	0	0	2	1

Ga2, Ag2, As+, Ggmin+, Dh+
Light grey silty sand

4.26-4.46m

Da	St	El	Dr	UB
2	0	0	2	2

Ag3, Ga1, As+
Light grey sandy silt

4.46-4.65m

Da	St	El	Dr	UB
2	0	0	2	1

Ga2, Ag1, Ggmin1, Sh+, Dh+
Light yellow-grey sand with occasional gravel

Core abandoned in sands and gravels at 4.65m depth

Core 8 (Trench 7; TL 87098 BNG 40878)

0.00-1.55m Made Ground

1.55-2.40m

Da	St	El	Dr	UB
2+	0	0	2	-

Ag2, As2, Sh+, Ga+
Blue-grey silty clay with occasional organic mottling

2.40-3.10m

Da	St	El	Dr	UB
3	1	2	2	2

Sh2, Ag2, Dh+, As+, Dg+
Light brown silt-rich peat

3.10-3.30m no sediment extracted, coarse sands and gravels encountered

Core abandoned in coarse sands and graves at 3.30m depth

Core 9 (Trench 8; TL 87103 BNG 40845)

0.00-0.82m Made Ground

0.82-1.30m

Da	St	El	Dr	UB
2+	0	0	2	-

Ga2, Ag2, Ggmin+, Ptm+, Lf+
Grey-brown iron mottled sandy silt

1.30-1.45m

Da	St	El	Dr	UB
2+	0	0	2	1

Ga2, Ag1, Ggmin1
Light yellow-brown gravely sand

1.45-1.62m

Da	St	El	Dr	UB
2+	0	0	2	1

Ag3, As1, Sh+, Ga+
Blue-grey organic clayey silt

1.62-1.85m

Da	St	El	Dr	UB
2+	0	1	2	2

Sh2, Ag2, As+, Dh+
Light brown silt-rich peat

1.85-2.10m

Da	St	El	Dr	UB
2+	0	0	2	2

Ag3, As1, Sh+
Grey-brown clayey silt with occasional organic mottling

2.10-2.21m

Da	St	El	Dr	UB
2+	0	0	2	2

Ga3, Ag1, As+
Yellow-brown silty sand

2.21-3.35m

Da	St	El	Dr	UB
2+	0	0	2	1

Ga2, Ag1, Ggmin1, Ggmaj+
Yellow brown gravely sand

Core abandoned in sands and gravels at 3.35m depth

Core 10 (Trench 9; TL 87097 BNG 40808)

0.00-0.74m Made Ground

Depth	Da	St	El	Dr	UB
0.74-1.32m	2	0	0	2	-
	Ag2, As1, Ga1, Ptm+, Lf+, Sh+				
	Light grey-brown sandy silt				
1.32-1.72m	2+	0	0	2	1
	Ag2, As2, Sh+, Ga+				
	Glue-grey organic clayey silt				
1.72-1.92m	2+	0	0	2	1
	Ag2, As1, Sh1, Dh+				
	Grey-brown organic-rich clayey silt				
1.92-2.26m	2+	0	0	2	2
	Ag3. As1, Sh+, Dh+				
	Blue-grey clayey silt				
2.26-3.22m	2	0	0	2	1
	Ag2, Ga2, As+				
	Light grey silty sand				
	** unsampled from 2.32-3.02m*				
3.22-3.62m	1	0	0	2	2
	Ag2, Ga1, Gs1				
	White silty sand				
3.62-4.07m	3	0	0	2	1
	Ga3, Ag1, As+, Dh+				
	Dark grey silty sand				
4.07-4.72	2+	0	0	2	1
	Ga2, Ag2, As+				
	Dark grey silty sand				

Core abandoned in sands and gravels at 4.72m depth

Core 11 (Trench 9; TL 87105 BNG 40776)

Depth					
0.00-0.70m	Made Ground				
0.70-1.40m	Da	St	El	Dr	UB
	2+	0	0	2	-
	Ag3, As1, Ga+, Ggmin+, Lf+				
	Orange-brown iron mottled clayey silt				
1.40-1.78m	Da	St	El	Dr	UB
	2+	0	0	2	2
	Ag2, As2, Sh+				
	Grey clayey silt with organic mottling				
1.78-2.00m	Da	St	El	Dr	UB
	3	0	0	2	1
	Ag2, As1, Dh1, Sh+				
	Dark grey organic-rich silt				
2.00-2.54m	Da	St	El	Dr	UB
	3+	0	1	2	2
	Ag2, As1, Sh1, Dh+, Ptm+				
	Dark grey-black organic clayey silt				
2.54-2.92m	Da	St	El	Dr	UB
	2	0	0	2	1
	Ag3, As1, Sh+				
	Light grey clayey silt				
2.92-2.98m	Da	St	El	Dr	UB
	2+	0	2	2	1
	Sh2, Ag2, As+				
	Grey-brown organic silt				
2.98-3.53m	Da	St	El	Dr	UB
	3	1	2	2	2
	Sh2, Dh1, Ag1, As+				
	Red-brown humified peat				
3.53-3.70m	Da	St	El	Dr	UB
	2	0	0	2	1
	Ag2, As1, Sh1, Dh+				
	Light grey-brown organic clayey silt				
3.70-4.00m	Da	St	El	Dr	UB
	1	0	0	2	1
	Ga2, Ag2, As+				
	Pale white silty sand				

Core abandoned in sands and gravels at 4.00m depth

Core 12 (Trench 10; TL 87132 BNG 40812)

0.00-1.05m Made Ground

1.05-1.25m

Da	St	El	Dr	UB
2+	0	0	2	-

Ag2, As1, Ga1, Lf+, Ggmin+
Orange-brown iron mottled clayey silt

1.23-1.45m

Da	St	El	Dr	UB
2	0	0	2	1

Ag2, As2, Lf+, Ptm+, Ga+
Light grey iron mottled clayey silt

1.45-1.70m

Da	St	El	Dr	UB
2+	0	0	2	2

Ag3, As1, Sh+, Lf+
Blue-grey iron mottled clayey silt

1.70-1.85m

Da	St	El	Dr	UB
2+	0	0	2	1

Ag2, As1, Sh1, Dh+
Grey-brown organic-rich clayey silt

1.85-2.10m

Da	St	El	Dr	UB
3	1	2	2	1

Sh2, Ag2, As+, Dh+
Red-brown organic –rich silt

2.10-2.35m

Da	St	El	Dr	UB
2	0	0	2	1

Ag2, As1, Ga1, Sh+, Dh+
Blue-grey clayey silt

2.35-2.79m

Da	St	El	`Dr	UB
2+	0	0	2	2

Ag2, As1, Ga1
Grey-brown silty sand

2.79-4.13m

Da	St	El	Dr	UB
1	0	0	2	1

Ag2, Ga2, As+, Lf+
Pale white sands and silts

4.13-4.90m

Da	St	El	Dr	UB
2+	0	0	2	2

Ga2, Ag2, As+, Sh+, Dh+
Grey-brown silty sand with occasional organic remains

4.90-4.95m

Da	St	El	Dr	UB
3	0	2	2	2

Ag2, Sh2, Dh+, As+
Dark brown peaty silt

4.95-5.24m

Da	St	El	Dr	UB
3	2	2	2	2

Dh2, Sh2, Dg+
Red-brown herbaceous well humified peat

5.24-5.75m	Da	St	El	Dr	UB
	2+	0	0	2	2
	Ga2, Ag1, Sh1, Ptm+				
	Grey-brown organic-rich silty sand				

Core terminated in sands and gravels at 5.75m depth

Core 13 (Trench 11; TL 87164 BNG 40808)

0.00-1.34m	Made Ground				
1.34-1.66m	Da	St	El	Dr	UB
	2+	0	0	2	-
	Ag2, As2, Sh+, Ptm+, Lf+				
	Blue-grey clayey silt with occasional organic mottling				
1.66-2.12m	Da	St	El	Dr	UB
	2+	0	0	2	2
	Ag3, As1, Sh+				
	Blue-grey clayey silt				
2.12-2.50m	Da	St	El	Dr	UB
	2+	0	0	2	1
	Ag2, Sh2, As+, Ptm+				
	Grey-brown peaty silt				
2.50-3.12m	Da	St	El	Dr	UB
	2+	0	0	2	2
	Ag3, As1, Sh+				
	Blue-grey clayey silt with occasional organic mottling				
3.12-4.10m	Da	St	El	Dr	UB
	1	0	0	2	1
	Ga2, Ag2				
	Pale white silty sand				
4.10-4.31m	Da	St	El	Dr	UB
	2	0	0	2	2
	Ag3, Ga1, As+, Sh+				
	Light grey sandy silt				
4.31-4.50m	Da	St	El	Dr	UB
	3	1	2	2	2
	Sh2, Dg1, Dh1, Ag+				
	Red-brown herbaceous well humified peat				
4.50-4.60m	Da	St	El	Dr	UB
	3+	1	2	2	1
	Sh2, Dh1, Ag1, Ga+				
	Dark brown silt-rich well humified peat				

Core abandoned in sands and gravels at 4.60m depth

Core 14 (Trench 5; TL 86976 BNG 40861)

0.00-1.20m	Made Ground				
1.20-1.74m	Da	St	El	Dr	UB
	2+	0	0	2	-
	Ag2, As1, Sh1, Dh+, Ptm+				
	Grey clayey silt with organic mottling				
1.74-2.30m	Da	St	El	Dr	UB
	2+	0	0	2	2
	Ga2, Ag1, Ggmin1, As+, Sh+, Ggmaj+				
	Grey gravely sand				

Core abandoned in sands and gravels at 2.30m depth

APPENDIX II

Core Stratigraphy

Core 2 (Trench 2, TL86970 BNG40821)

Refer to initial assessment report (Appendix I) for summary of sedimentary classification scheme of Troels-Smith (1955)

0.00-0.85m Made Ground

0.85-1.30m	Da	St	El	Dr	UB
	2+	0	0	2	-

Ag2, As2, Ga+, GgMaj+
Light grey-brown clayey silt with occasional gravel

1.30-1.85m	Da	St	El	Dr	UB
	2+	0	0	2+	1

Ag2, As2, Ga+, Lf+
Orange-brown clayey silt with iron mottling

1.85-2.35m	Da	St	El	Dr	UB
	2	0	0	2	1

Ag3, As1, Sh+
Light grey clayey silt with occasional organic mottling

2.35-2.40	Da	St	El	Dr	UB
	3	0	0	2	2

Ga4, Ag+
Dark grey sand horizon

2.40-2.58m	Da	St	El	Dr	UB
	3	0	0	2	2

Ag2, As1, Ga1
Dark grey slightly sandy clayey silt

2.58-3.85m	Da	St	El	Dr	UB
	3	1	2	2	2

Sh2, Dg1, Dh1, Ag+
Red-brown well humified peat
**shell-rich horizon 3.31-3.37m*

3.85-4.55m	Da	St	El	Dr	UB
	2	0	0	2	1

Ga2, Sh2, Dh+, Dg+, Ptm+, Ag+
Light grey-brown organic sand

4.55-5.12m	Da	St	El	Dr	UB
	1+	0	0	2	2

Ag2, As1, Ga1, Sh+, Dh+
Light grey clayey silt with occasional organic mottling

5.12-5.65m	Da	St	El	Dr	UB
	3	0	0	2	1

Ga3, Ag1, Sh1
Dark grey-brown silty sand

5.65-5.72m	Da	St	El	Dr	UB
	3	0	1	2	1

Sh2, Ag1, As1
Red-brown silty peat

5.72-5.95m	Da	St	El	Dr	UB
	2	0	0	2	2
	Ag2, As2, Ga+				
	Light grey-brown clayey silt				

Core terminated within sands and gravels at 5.95m depth

APPENDIX III

AMS Radiocarbon Date Certificates

FROM: Darden Hood, Director (mailto:mailto:dhood@radiocarbon.com)
(This is a copy of the letter being mailed. Invoices/receipts follow only by mail.)
September 17, 2007

Mr. Thomas Hill
University of Birmingham
Birmingham Archaeology
Edgbaston
Birmingham B15 2TT, UK

RE: Radiocarbon Dating Results For Samples SUDBURY-2.58m, SUDBURY-3.85m, SUDBURY-4.55m, SUDBURY-5.65m, SUDBURY-5.72m

Dear Dr. Hill:

Enclosed are the radiocarbon dating results for five samples recently sent to us. They each provided plenty of carbon for accurate measurements and all the analyses proceeded normally. As usual, the method of analysis is listed on the report with the results and calibration data is provided where applicable.

As always, no students or intern researchers who would necessarily be distracted with other obligations and priorities were used in the analyses. We analyzed them with the combined attention of our entire professional staff.

If you have specific questions about the analyses, please contact us. We are always available to answer your questions.

The cost of the analysis was charged to the VISA card provided. A receipt is enclosed. Thank you. As always, if you have any questions or would like to discuss the results, don't hesitate to contact me.

Sincerely,

Darden Hood

Mr. Thomas Hill

University of Birmingham

Report Date: 9/17/2007

Material Received: 8/21/2007

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 233960	1340 +/- 40 BP	-28.7 o/oo	1280 +/- 40 BP

SAMPLE : SUDBURY-2.58m
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (peat): acid/alkali/acid
2 SIGMA CALIBRATION : Cal AD 660 to 810 (Cal BP 1290 to 1140)

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 233961	2160 +/- 40 BP	-29.3 o/oo	2090 +/- 40 BP

SAMPLE : SUDBURY-3.85m
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (peat): acid/alkali/acid
2 SIGMA CALIBRATION : Cal BC 200 to 10 (Cal BP 2150 to 1960)

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 233962	2180 +/- 40 BP	-29.3 o/oo	2110 +/- 40 BP

SAMPLE : SUDBURY-4.55m
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (peat): acid/alkali/acid
2 SIGMA CALIBRATION : Cal BC 340 to 320 (Cal BP 2290 to 2270) AND Cal BC 210 to 40 (Cal BP 2160 to 1990)

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 233963	11150 +/- 60 BP	-28.4 o/oo	11090 +/- 60 BP

SAMPLE : SUDBURY-5.65m
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (peat): acid/alkali/acid
2 SIGMA CALIBRATION : Cal BC 11190 to 10930 (Cal BP 13140 to 12880)

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 233964	10970 +/- 50 BP	-28.0 o/oo	10920 +/- 50 BP

SAMPLE : SUDBURY-5.72m
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (peat): acid/alkali/acid
2 SIGMA CALIBRATION : Cal BC 11000 to 10880 (Cal BP 12940 to 12830)

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-28.7:lab. mult=1)

Laboratory number: **Beta-233960**

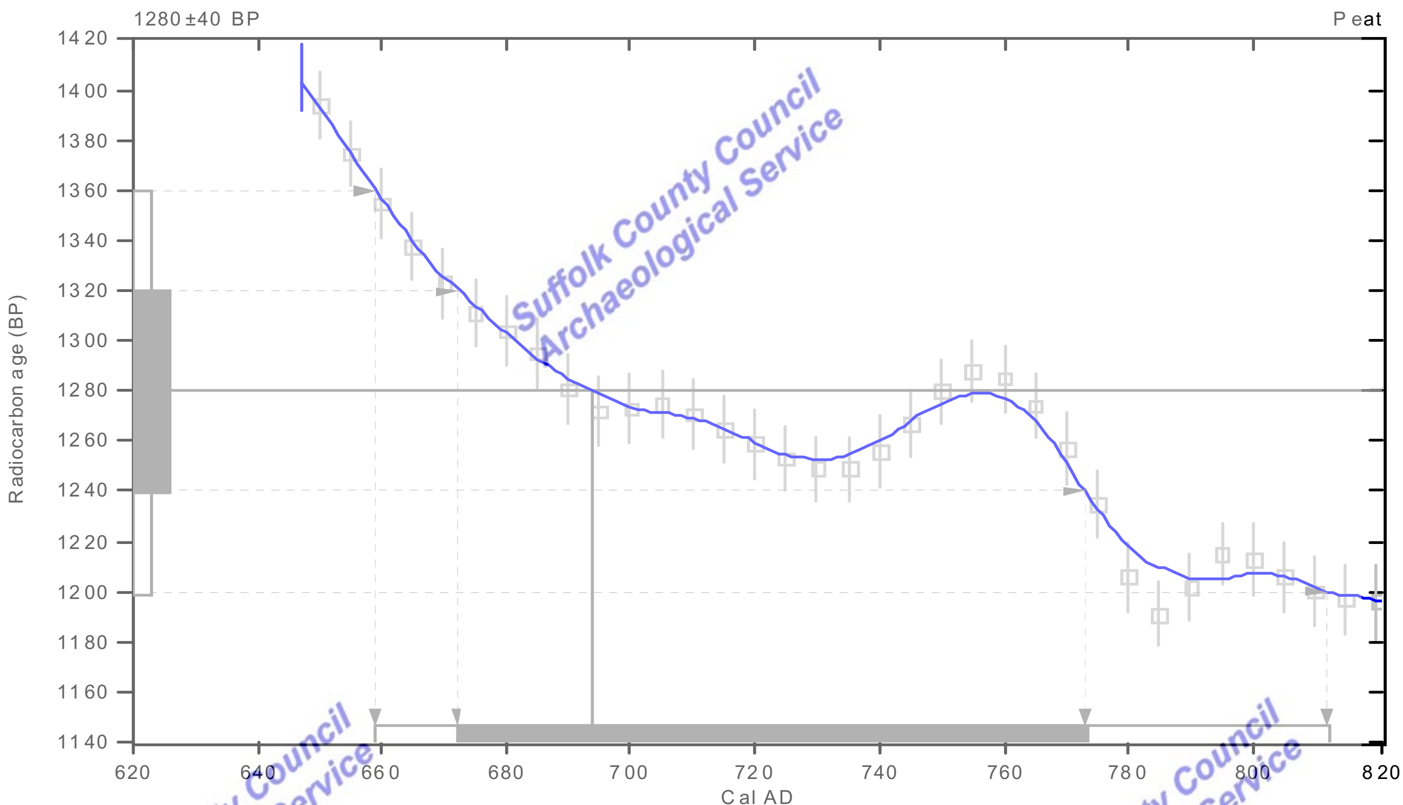
Conventional radiocarbon age: **1280±40 BP**

2 Sigma calibrated result: (95% probability) **Cal AD 660 to 810 (Cal BP 1290 to 1140)**

Intercept data

Intercept of radiocarbon age with calibration curve: Cal AD 690 (Cal BP 1260)

1 Sigma calibrated result: (68% probability) Cal AD 670 to 770 (Cal BP 1280 to 1180)



References:

Database used
INTCAL04
Calibration Database
INTCAL04 Radiocarbon Age Calibration
IntCal04: Calibration Issue of Radiocarbon (Volume 46, nr 3, 2004).
Mathematics
A Simplified Approach to Calibrating C14 Dates
Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

Beta Analytic Radiocarbon Dating Laboratory

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-29.3:lab. mult=1)

Laboratory number: **Beta-233961**

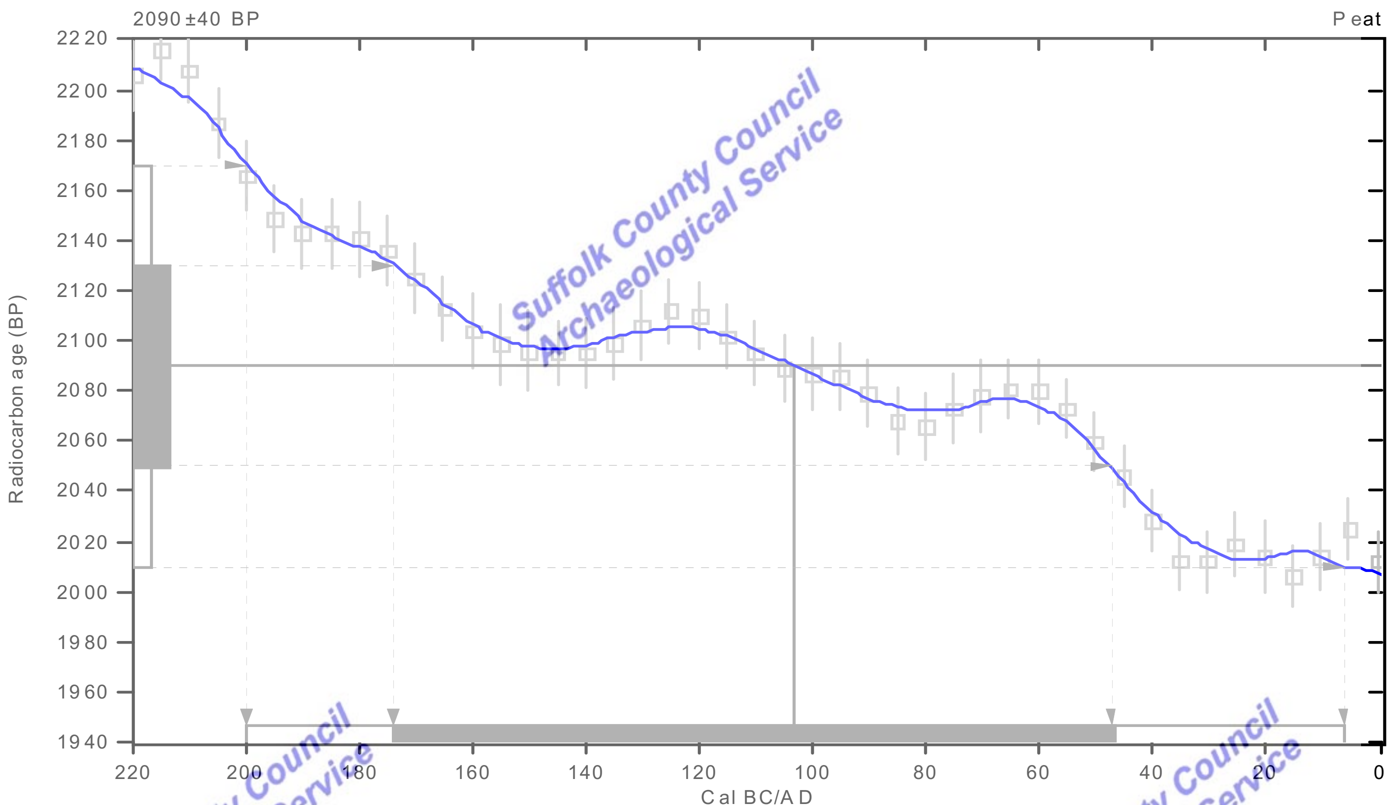
Conventional radiocarbon age: **2090±40 BP**

2 Sigma calibrated result: (95% probability) **Cal BC 200 to 10 (Cal BP 2150 to 1960)**

Intercept data

Intercept of radiocarbon age with calibration curve: Cal BC 100 (Cal BP 2050)

1 Sigma calibrated result: (68% probability) Cal BC 170 to 50 (Cal BP 2120 to 2000)



References:

Database used

INTCAL04

Calibration Database

INTCAL04 Radiocarbon Age Calibration

IntCal04: Calibration Issue of Radiocarbon (Volume 46, nr 3, 2004).

Mathematics

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-29.3:lab. mult=1)

Laboratory number: **Beta-233962**

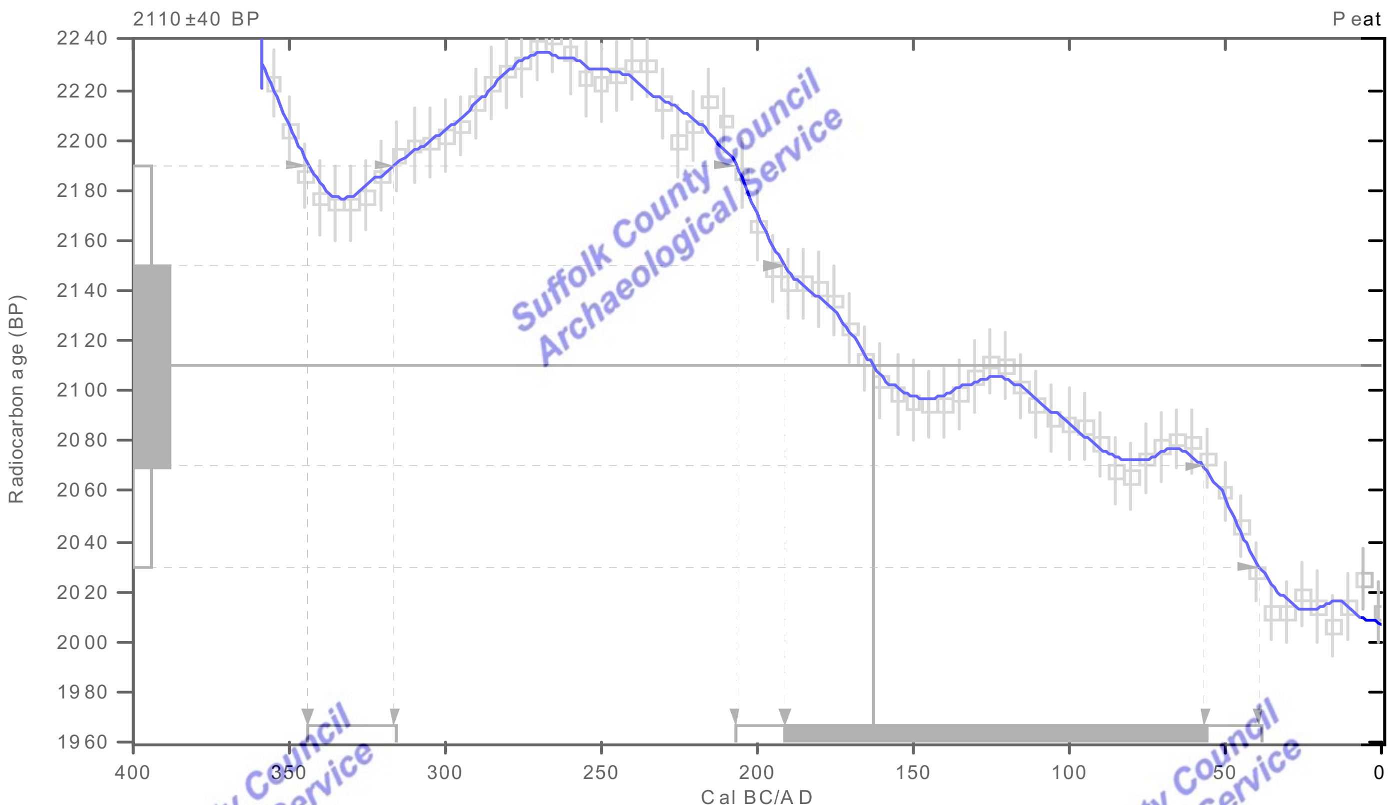
Conventional radiocarbon age: **2110±40 BP**

2 Sigma calibrated results: (95% probability) **Cal BC 340 to 320 (Cal BP 2290 to 2270) and Cal BC 210 to 40 (Cal BP 2160 to 1990)**

Intercept data

Intercept of radiocarbon age with calibration curve: Cal BC 160 (Cal BP 2110)

1 Sigma calibrated result: (68% probability) Cal BC 190 to 60 (Cal BP 2140 to 2010)



References:

Database used
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Calibration Database
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IntCal04: Calibration Issue of Radiocarbon (Volume 46, nr 3, 2004).
Mathematics
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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-28.4:lab. mult=1)

Laboratory number: **Beta-233963**

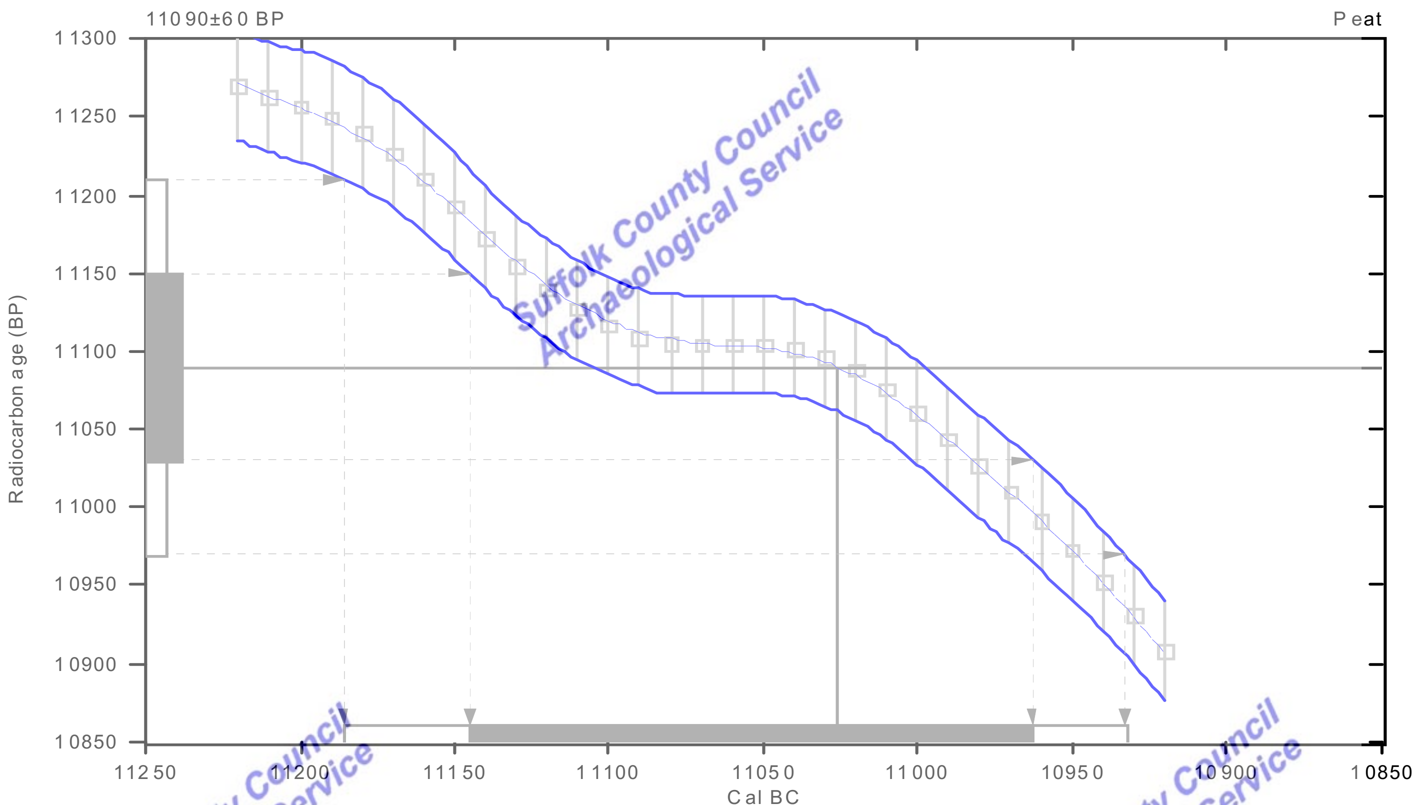
Conventional radiocarbon age: **11090±60 BP**

2 Sigma calibrated result: **Cal BC 11190 to 10930 (Cal BP 13140 to 12880)**
(95% probability)

Intercept data

Intercept of radiocarbon age with calibration curve: Cal BC 11030 (Cal BP 12980)

1 Sigma calibrated result: Cal BC 11140 to 10960 (Cal BP 13100 to 12910)
(68% probability)



References:
Database used
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Calibration Database
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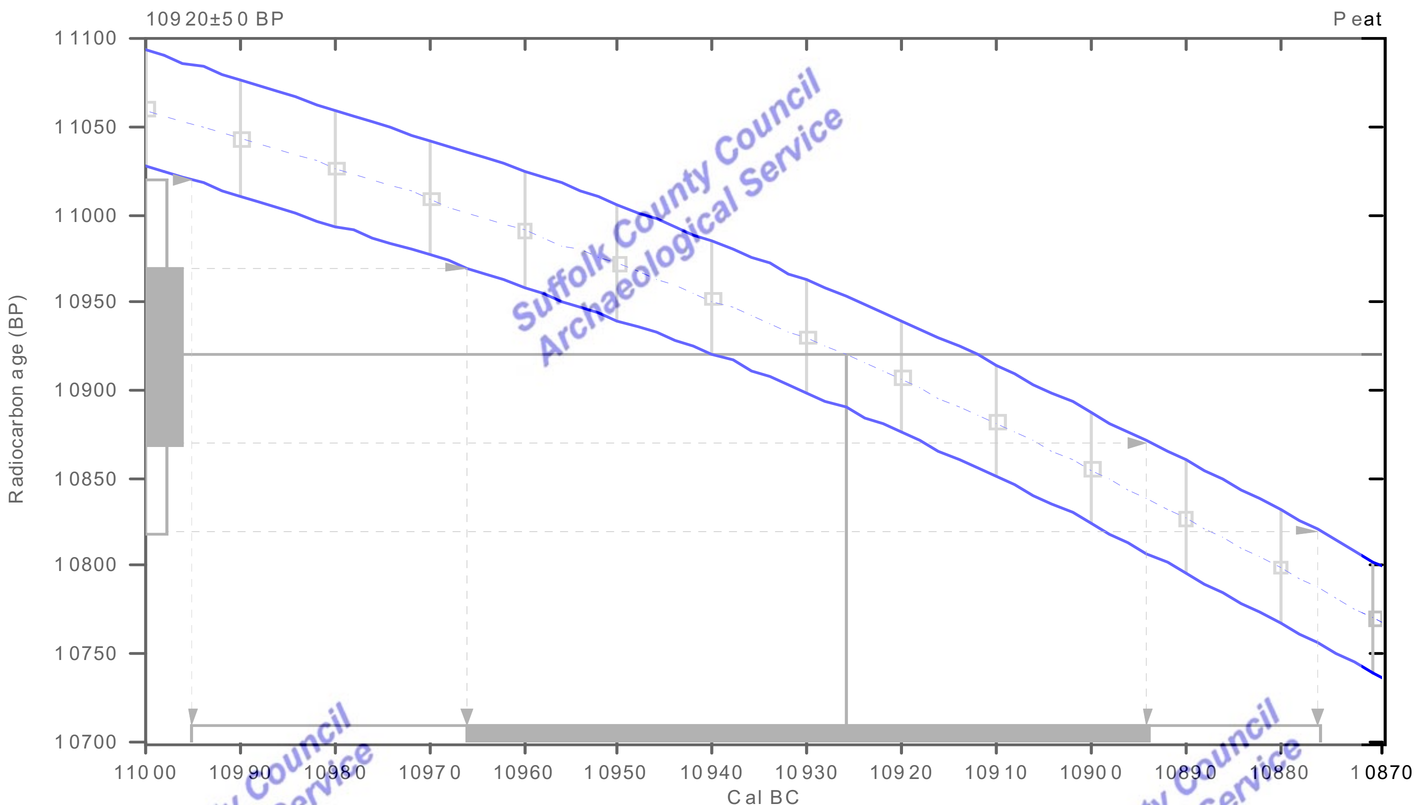
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-28:lab. mult=1)

Laboratory number:	**Beta-233964**
Conventional radiocarbon age:	**10920±50 BP**
2 Sigma calibrated result: (95% probability)	**Cal BC 11000 to 10880 (Cal BP 12940 to 12830)**

Intercept data

Intercept of radiocarbon age with calibration curve:	Cal BC 10930 (Cal BP 12880)
1 Sigma calibrated result: (68% probability)	Cal BC 10970 to 10890 (Cal BP 12920 to 12840)



References:

Database used

INTCAL04

Calibration Database

INTCAL04 Radiocarbon Age Calibration

IntCal04: Calibration Issue of Radiocarbon (Volume 46, nr 3, 2004).

Mathematics

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