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Victoria Park, Stoke-on-Trent: a Palaeoenvironmental Assessment of Borehole Deposits

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By

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Summary

Deposits of palaeoenvironmental potential were encountered during borehole investigations at Victoria Park, Stoke, Stoke-on-Trent. Birmingham Archaeo-Environmental were subcontracted to undertake an assessment of the deposits, which included pollen and radiocarbon dating of selected organic-rich samples from the sedimentary sequence. Pollen was present in relative abundance within most samples assessed. The assemblages indicated that open grassland was established near to the site during the accumulation of the organic-rich silts. The presence of cereal pollen and associated cereal weeds within a number of the samples indicates pastoral and arable cultivation is likely to have been taking place in close proximity to the sampling location. The overall absence of tree species suggests at best isolated patchy woodland. Palynological interpretations suggest a sedimentary sequence dating to the late prehistoric period at the latest. Radiocarbon dating at the base of the organic-rich silt unit however indicated that sedimentation commenced c. 6440 ±35yrs BP. Contamination by ancient carbon is suggested as an explanation for the anomalous chronology.

KEYWORDS: Victoria Park, Stoke on Trent, pollen, radiocarbon dating

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1. INTRODUCTION

St Mowden Developments Ltd submitted an application for planning permission to Stoke City Council for the redevelopment of the former Victoria Ground, Stoke, Stoke-on-Trent (SJ 8792 4448). Stoke City Council (2008) requested an archaeological evaluation of the Victoria Ground, now referred to as Victoria Park, in order to assess the site for its archaeological and palaeoenvironmental potential. The work was undertaken in response to a condition of planning consent on the site. Historical maps identified a possible palaeochannel of the River Trent running through the site. It was postulated that deposits of palaeoenvironmental potential may have accumulated within the relict channel feature and might contain information relating to the landscape development of the site.

Birmingham Archaeo-Environmental (BA-E) was subcontracted by Halcrow Group Ltd to undertake a high-resolution coring survey across the site (Hill, 2008). The borehole survey identified a thin layer organic-rich silts within a number of the boreholes underlain by sands and gravels suggested to date to the Devensian glacial. Due to unknown age of the organic-rich deposits, combined with the relative absence of palaeoenvironmental records for the area, recommendations were made to undertake palynological assessments on the organic sequence. This was to be supported by radiocarbon dating to establish a chronology to the sequence. Samples were taken from WS03 (see Figure 1). The following assessment procedure was suggested:

- Pollen analysis of the organic-rich silt and underlying grey-brown silty sand in WS03 at 0.08m (6 samples in total),

- Radiocarbon dating of the base of the organic-rich silt at a depth of 6.32m to establish the timing of the onset of organic accumulation (1 sample in total).

This report therefore presents the results of the palaeoenvironmental assessments that were undertaken on the organic unit sampled during the phase of borehole investigations (pollen assessments and radiocarbon dating).

2. METHODS

2.1 Pollen Assessment

A total of six samples were taken at regular 0.08 m intervals throughout the organic sequence (6.00m, 6.08m, 6.16m, 6.24m, 6.32m and 6.40m). Five of these samples were taken from within the organic-rich silts, whilst the basal sample was taken from the underlying grey-brown silty sand unit. 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 abundance was relatively low within the basal samples, which prevented a full 125 TLP count being achieved.

2.2 Radiocarbon Dating

A single sample was submitted for radiocarbon dating to SUERC, East Kilbride for radiocarbon dating. The sample was taken from the base of the organic unit at 6.32m depth, where it was considered organic preservation provided

suitable amounts of organic carbon for dating purposes. 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 Assessments

Of the six samples submitted for pollen assessment, only two samples (6.00m and 6.08m depth) yielded pollen assemblages suitable for full palaeoenvironmental assessment. The remaining samples contained lower pollen concentrations, with an overall decrease in abundance with depth. The basal sample, taken from the underlying grey-brown silty sands, contained no identifiable pollen grains and hence is precluded from further discussions.

The results of the pollen assessment are provided in Figure 2 produced using TILIA and TILIA*GRAPH (Grimm 1991). The stratigraphic sequence is also included for reference. All percentage figures are of total land pollen (TLP) unless otherwise specified. Pollen nomenclature follows Moore *et al.* (1991) with modifications suggested by Bennett *et al*. (1994).

The pollen assemblages encountered throughout the organic-rich silt unit are very similar in species abundance and diversity. Herbs are well represented; Poaceae (wild grasses) almost wholly dominates the spectra and typically contributes 70-80%TLP within each sample. Additional herbaceous taxa include *Plantago lanceolata* (ribwort plantain), *Rumex* (sorrels) Apiaceae (Carrott Family), Cyperaceae (sedges), Ranunculaceae (Buttercups) and Lactuceae undiff. (Dandelions etc) also contribute. Grains of Cereal-type indet. (cereals) pollen are also recorded in a number of the samples, with an overall increase in relative abundance towards the top of the diagram (up to c. 7% TLP). Tree species rarely contribute more than *c*. 10% TLP and are restricted to occasional grains of *Alnus* (alder), *Betula* (birch), *Pinus sylvestris* (Scots' pine), *Quercus* (oak) and *Ulmus* (elm). Shrubs including *Corylus avellana*-type (hazel, but may include sweetgale), *Ilex* (Holly) and *Salix* (willow) are also present, but again rarely contribute more than 5% TLP.

The level of grain corrosion, breakage and crumpling was high within a number of the samples, especially those towards the base of the organic-rich silt unit. In addition, the abundance of pre-Quaternary spores was found to increase with depth.

3.2 Radiocarbon Dating

A single sample of bulk organic-rich silt was submitted from the base of the organic-rich silt at 6.32m depth to SUERC. The bulk organic-rich silt sample provided a date of 6440 ± 35yrs BP (5480-5340 Cal. yrs BP; SUERC 19780). Further details are provided in Table 1 and Appendix I.

4. DISCUSSION

Herbaceous taxa dominate the pollen samples. Certain herbs, including a component of the Poaceae (grasses) and Cyperaceae (sedges) are likely to reflect on-site reedswamp vegetation growing at the fringes of the river. It is also likely that the wider landscape was open, with the presence of other herb taxa including *Rumex*, *Plantago lanceolata*, Apiaceae and Lactuceae suggesting meadow-like environments in close proximity to the sampling site. It is probable that such vegetation communities were created and maintained by pastoral farming activities. The presence of occasional grains of cereal-type pollen may reflect the presence of arable land in the pollen catchment, although this pollen type can include non-cultivated grasses *Glyceria* sp. (sweet vernal grasses).

The overall absence of tree and shrub species from the pollen profile (collectively rarely contributing more than 10% TLP) indicates that woodland in the near vicinity was sparse. It is possible that

isolated pockets of woodland prevailed near to the sampling site. Alternatively, due to the evidence for agricultural activity within the pollen sequence, the arboreal pollen may have been restricted to individual trees within field boundaries in the study area.

The overall similarity in pollen assemblages indicates little detectable change in the local environment during sediment accumulation, although it is probable that the archive accumulated within a relatively short period of time. The pollen spectra is suggestive of a later Holocene landscape, perhaps dating to the later prehistoric period at the earliest. The overall abundance of herbaceous species indicates open grassland with little woodland.

Although there is some variation, the wider picture is that the landscape of lowland England had been cleared of its original tree cover for settlement and farming by the Iron Age and open environments were common in most lowland river valleys by the Medieval period. However, radiocarbon dating of the organic unit suggests that the onset of sedimentation dates to 6440 ± 35yrs BP (5480-5340 Cal. yrs BP; SUERC 19780), or during the Neolithic. At *c*. 5-6000 Cal. yrs BP, much of the Midland lowlands were covered in dense woodland with at best limited openings. This is thus in significant contrast to the associated pollen evidence at this site.

Whilst it is possible that open environments were present at the Victoria Ground site from the Neolithic, it is more likely that the radiocarbon date is in error and that the pollen record reflects a much later phase of landscape development. It was previously suggested that contamination by ancient carbon may be a possible factor when undertaking radiocarbon dating of the sedimentary sequence at Victoria Park (Hill, 2008). Unfortunately, it seems likely that old carbon was incorporated into the sedimentary archive during aggradation of the River Trent floodplain. Such contamination would have affected the subsequent dating of organic carbon that accumulated *in-situ* during the development of the sedimentary sequence.

5. RECOMMENDATIONS FOR FURTHER ANALYSIS

Based on the relatively limited variation in abundance and diversity encountered within the pollen samples, in addition to the dating issues encountered within the organic sequence, no further palaeoenvironmental work is recommended.

6. ARCHIVE

The borehole deposits and associated proxy samples will be retained at Birmingham Archaeo-Environmental until the client approves the disposal of the material.

ACKNOWLEDGEMENTS

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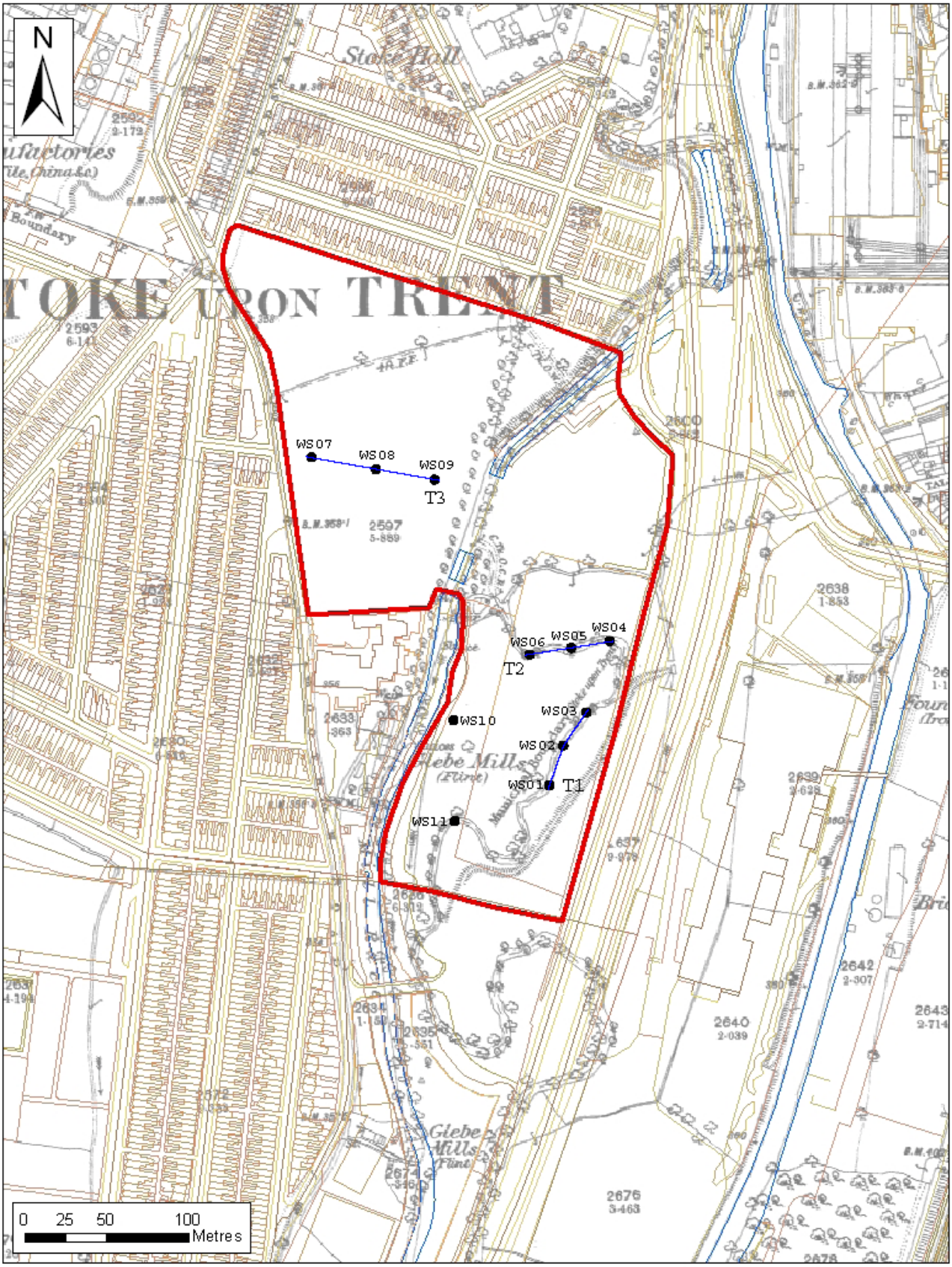

Figure 1: Victoria Park site plan and 1882 historical map, with the location of each window sample borehole and transect indicated. Boreholes locations are approximations, GPS coordinates for each are provided in Appendix I. Ordnance Survey Mapping used with permission HMSO Crown Copyright License No. 100021029

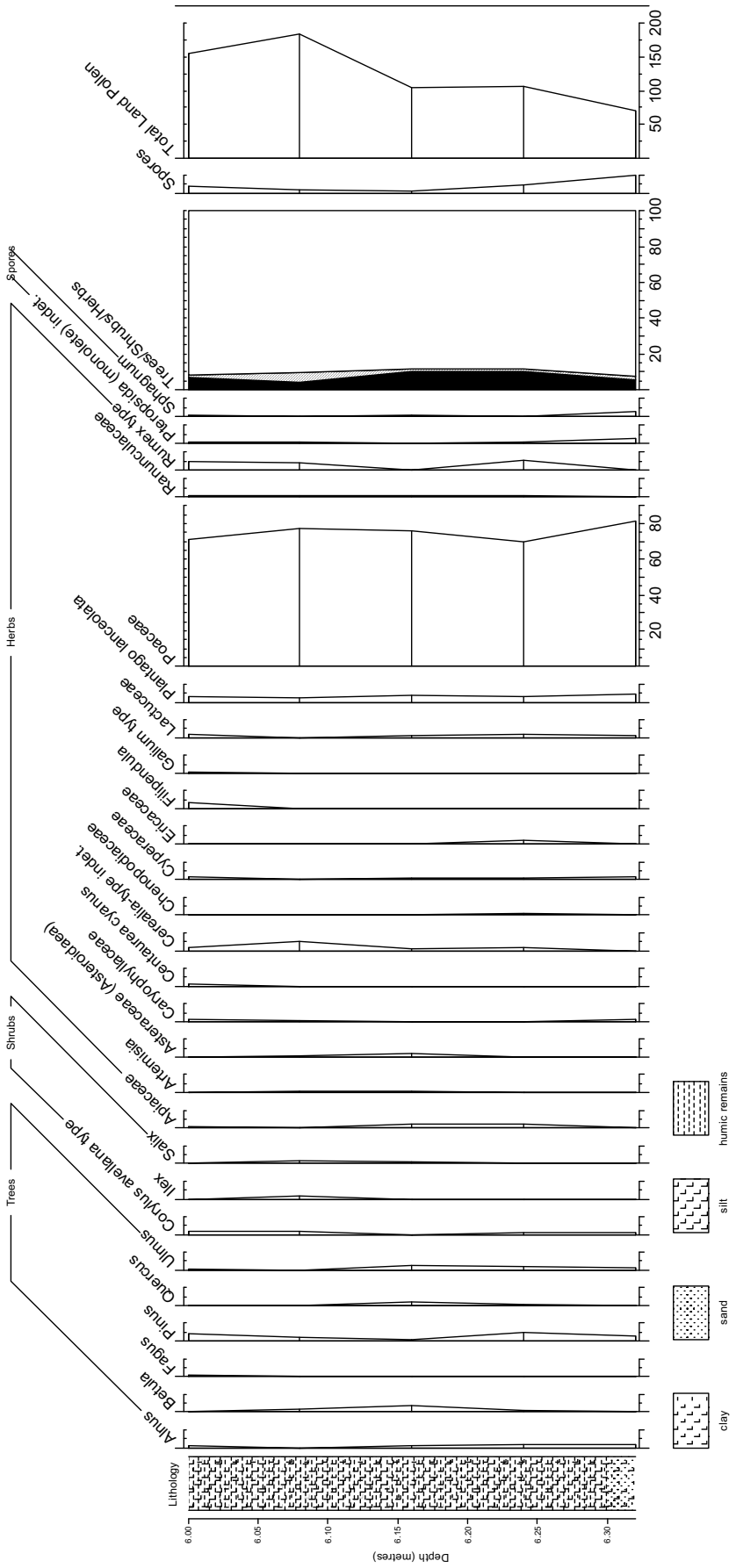

Figure 2: Pollen diagram for WS3 from Victoria Park, Stoke.

Sample/ Depth (m)	Lab Code	Material	δ13C o/oo	Radiocarbon Age BP	Calibrated Range 2σ
WS03-7.32m	SUERC-19780	Bulk organic-rich silt	-24.6	6440+35	5480-5340 BC

Table 1: Summary of AMS radiocarbon dating result obtained from the Victoria Park palaeoenvironmental assessment.

APPENDIX I

RADIOCARBON DATING CERTIFICATE

Director: *Professor A B MacKenzie*

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RADIOCARBON DATING CERTIFICATE

12 August 2008

Laboratory Code	SUERC-19780 (GU-17026)
Submitter	Dr. Tom Hill Birmingham Archaeology University of Birmingham Edgbaston Birmingham B15 2TT
Site Reference	Victoria Park, Stoke, Stoke on Trent
Sample Reference	WS03-7.32m
Material	Organic rich silt : Humic Acid
$\delta^{13}C$ relative to VPDB	-24.6 ‰
Radiocarbon Age BP	6440 ± 35

N.B.

1. The above ^{14}C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.
2. The calibrated age ranges are determined from the University of Oxford Radiocarbon Accelerator Unit calibration program (OxCal3).
3. Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after the SUERC code.

Conventional age and calibration age ranges calculated by :- Date :-

Checked and signed off by :- Date :-

Calibration Plot