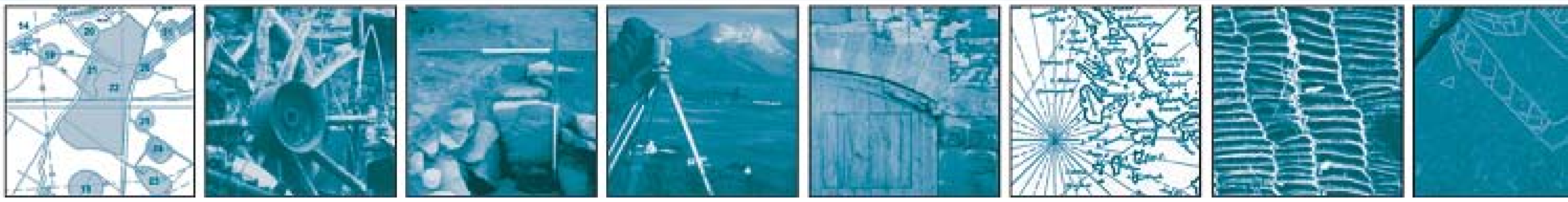

BUTLINS BOGNOR REGIS

Evaluation

for Butlins

18 February 2011

HEADLAND ARCHAEOLOGY Ltd

REGISTERED IFA ORGANISATION

BUTLINS BOGNOR REGIS

Evaluation

for Butlins

18 February 2011

HA Job no.: BUBR10
HAS no.: 863
NGR: SZ 944 992
Parish: Bognor Regis
Council: West Sussex

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ACKNOWLEDGEMENTS

Thanks to James Barron for providing borehole logs, to Martin Bates and Scott Tympany for the environmental assessments and Butlins for use of the accommodation.

Scale 1:25,000 @ A4

N

0 1km

Illus 1

Site location

BUTLINS BOGNOR REGIS

Evaluation

A new hotel and associated carparks lie to the west of the Holocene Aldingbourne Rife and straddle the edge of the earlier Pleistocene channel. Previous work within the channel has demonstrated that unlike some other water courses along the south coast, the Aldingbourne Rife became a marine environment very early in its life, other channels being fresh water. Desk-based work has identified a focus of past occupation along the edges of the channel including Bronze Age activity immediately to the south of the site of the current proposals.

Investigations for Hotel A targeted what was believed to be the edge of the Pleistocene channel. The work identified the bank edge of the Pagham Raised Beach. The sediment sequence associated with the bank is rare for the south coast as normally only the high energy deposits survive. In addition to this, the preservation of foraminifera is also rare and similarly supports high energy deposition. The samples from the peat showed that pollen was poorly preserved, but plant macrofossils had survived in good condition. The peat overlying the Holocene alluvial deposits that filled the channel may imply the area was a boggy wetland during the Medieval or Post-Medieval period.

1. INTRODUCTION/PLANNING BACKGROUND

In December 2010 Butlins submitted a planning application to construct a new hotel on the west side of their site at Bognor Regis. PPS5 introduced in 2010 states that the significance of Heritage Assets should be determined, and the impact of development on these should be assessed. The county structure plan 2001–2016 includes Policy CH11, which relates specifically to archaeology. The relevant extract states that 'Developments should not be permitted unless the archaeological heritage of West Sussex is protected and preserved and, where possible, opportunities are taken to promote the educational and amenity value of sites and areas (historic landscapes)' (West Sussex County Council, 67). An initial Desk Based Assessment was produced in support of the application and contains historical background information (Boucher 2010). This report covers the results of further archaeological fieldwork required.

The archaeological work tested the deposits for evidence of human activity and paleoenvironmental information, as previous work carried out immediately to the south of the site by Wessex Archaeology had identified evidence of potential Bronze Age activity along the channel edge, close to the present site. The site work carried out for the purposes of this report consisted of test pits, followed by targeted trenching.

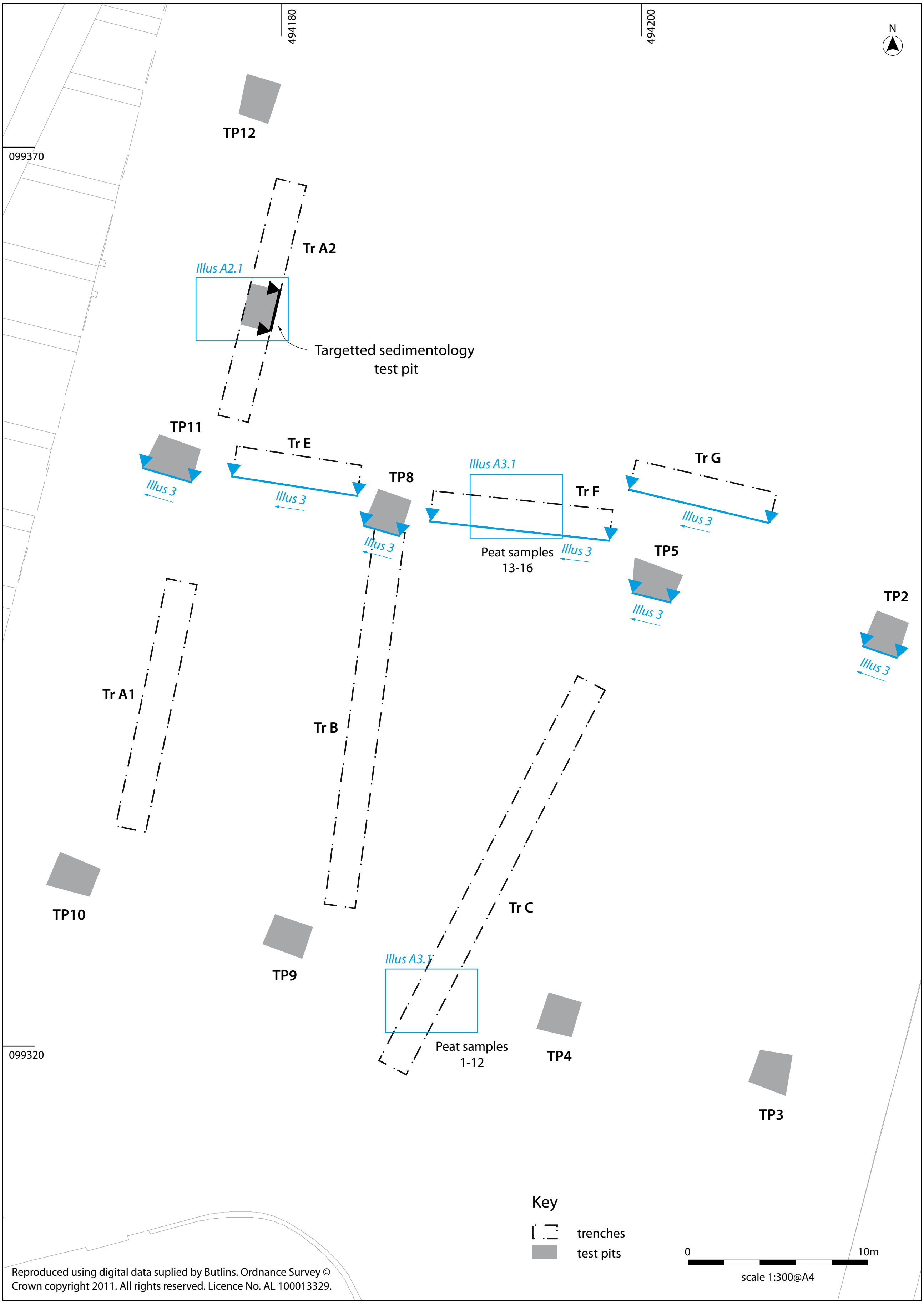
2. LOCATION

The site under investigation is located in Bognor Regis within the Butlins car park to the west side of a former Pleistocene channel that has been identified on local geological maps and from previous archaeological investigation. The site work that is the subject of this report was carried out in this area because the depth of deposits was shallow enough to be trenched safely. The deposits within the Pleistocene channel replaced the scoured out Pleistocene deposits and date to the mid Holocene (Mesolithic/Neolithic), with previous studies relating to them carried out in the nearby area by Wessex Archaeology (2003) and Martin Bates (2005), and in Chichester Harbour by John Mills (2007).

3. AIMS AND OBJECTIVES

The evaluation aimed to locate the channel edge and establish the likelihood of occupation on its shore line. The objective of the evaluation was to determine whether any archaeological remains were present within the area

2



Illus 2
Locations of test pits, trenches, peat sampling and composite cross section

of the proposed development, characterize them by date, extent, preservation and significance, produce a report and deposit the archive with a local repository.

4. METHOD

Initially eight test pits were dug using a JCB with a toothless bucket to test the deposits and depth of natural whilst looking for evidence of prehistoric human activity along the edge of the channel. The excavation area had to be reduced from what had been proposed so as not to dig up the tarmac car parking areas adjacent on the north and west sides. Services including two high power electric cables and a fibreoptic cable also limited the areas that could reasonably be excavated. Seven trenches were then excavated on the basis of the information from the test pits and with the agreement of John Mills (West Sussex archaeological planning advisor).

Peat deposits possibly containing evidence of prehistoric human activity were encountered close to the present ground level, these were examined, assessed and sampled by Scott Tympany, one of the projects environmental specialist. An assessment of the Pleistocene channel, and the nature of the Holocene deposits within it was carried out by Martin Bates, the projects sediments specialist.

Test Pit / Trench	Dimensions
1	NOT EXCAVATED
2	2m x 1.60m x 2m deep
3	NOT EXCAVATED
4	2m x 1.60m x 2m deep
5	2m x 1.60m x 2m deep
6	NOT EXCAVATED
7	NOT EXCAVATED
8	2m x 1.60m x 2m deep
9	2m x 1.60m x 2m deep
10	2m x 1.60m x 2m deep
11	2m x 1.60m x 2m deep
12	2m x 1.60m x 2m deep
A1	15m x 1.60m x 1.20m deep
A2	15m x 1.60m x 1.20m deep
B	20m x 1.60m x 1.20m deep
C	30m x 1.60m x 1.20m deep
D	NOT EXCAVATED
E	7.50m x 1.60m x 1.20m deep
F	5m x 1.60m x 1.20m deep
G	5m x 1.60m x 1.20m deep

Table 1
Trench register

5. RESULTS

5.1 Description of fieldwork

Test pits measuring 2m by 1.60m were set out in a rough grid pattern approximately fifteen meters apart. In most cases these pits were two meters deep or thereabouts.

The test pit positions were adjusted from the original layout so as to avoid damaging areas of tarmac. Trenches of varying lengths (see Table 1) were excavated based on the findings from the test pits (see Table 2). Underlying the car park make up in all of the trenches, grey alluvial sandy clay-silt was present. In two of the test pits (5 and 8) peat was also present near to the top, or at the top of the grey alluvial silt. Two possibly axe sharpened stakes were recovered from the peat deposit located in Trench C. It was clear from the test pits that the Pleistocene sand bank rose up towards the west side of the site and was not present in the pits and trenches excavated to the east. A north to south aligned sand bar was located close to the middle of the site and could, along with the overlying peat, imply the former presence of braided channels. A second peat deposit was located by borehole at approximately 7.4m below ground level. The alluvial silt (brick earth) exceeded two meters deep in the trenches and test pits to the eastern side of the site. Three boreholes were sunk in the same area as the trenches and test pits. The results of the boreholes showed that towards the west of the site (BH1), solid geology (Lambeth group Reading formation) was reached at 2.3m below ground level, to the north (BH2) it was reached at 2.5m, and to the east (BH3) the depth to solid geology was around 2.7m.

5.2 Assessment of the sediment sequence

The sequence of sediments was investigated in detail by the project's sediments specialist (Martin Bates) with collected samples being subsequently assessed by John Whittaker of the Department of palaeontology (natural History Museum). The following summarises the main findings of their work (Appendix 2).

The deposit sequence observed within the single trial pit excavated for that purpose comprised sandy flint gravels (1.3–2.2m below the surface) beneath sand (1.2–1.45m), sealed by brickearths (0.45–1.2m) and fine grained clay silts (0–0.45m). Microfossils only survived in the lower part of the sequence and only foraminifera were present (ostracods being notable by their absence). The species present are indicative of a 'fully temperate if not warm

Deposit	Description	Depth of Deposit	Within Trenches
10,000	Modern car park make up, scalpins, grey stone, demolition rubble, made ground. Sharp interface. Same as – 200, 400, 500, 800, 900, 1000, 1100, 1200, 3000, 4000, 5000, 6000, 7000	Ave 0.40m to 1m	All
10,001	Peat deposits, wooden artifacts present [axe cuts?]. Possibly Bronze Age based on findings of excavations in the near vicinity. Clear interface. Same as – 201, 401, 4006, 6003	Ave 0.10 to +0.70m	TP5/8, Trenches C and F
10,002	Reddish-brown sandy clay-silt. Alluvial [Holocene] deposit [brick earth]. Clear interface. Same as – 2001	Ave 0.15m to 0.20m	A2 only
10,003	Grey sandy clay-silt with occasional sub-angular flint clasts [5cm]. Alluvial [Holocene] deposit [brick earth]. Sharp interface. Same as – 202, 402, 502, 801, 901, 1001, 1101, 1201, 2001, 3001, 4003, 5001, 6001, 7001	Varies between 0.20m to over 2m	All
10,005	Mid brown to reddish brown very sandy clay-silt to silty-clay. Pliable and structureless. Sub vertical root canals [1–3mm] and occasional small sub-angular flint clasts [<0.5cm]. Holocene deposit [brick earth]. Sharp interface. Same as- 403, 503, 802, 902, 1002, 1102, 1202, 2002, 3002, 4004, 5002, 6002	Ave 0.50m to <1m.	TP 4,5 Trench C
10,006	Yellow-brown medium sand with occasional large [>5cm sub-rounded flint clasts. Apparantly structureless. Sharp/dipping interface. Also, yellow-brown becoming red/yellow sandy flint gravel. Flint clasts 2–10cm, sub-angular to rounded. Matrix supported with matrix of clayey-sand. Chalk clasts appear towards base of unit. Very loose and unconsolidated. [Pleistocene marine channel] Sharp interface. Same as – 803, 903, 1003, 1103, 1203, 2003, 3003, 4005, 6004	Ave 1m +	All but Trench G, T/Pits 2, 4 and 5
10,007	Red clay, reading beds.	Not excavated	Test pits 11 and 12

Table 2

Context register

interglacial'. Microfossils from higher up the sequence were indicative of a lower energy mud-flat environment. The sediments themselves are indicative of high energy deposits at the base of the sequence with lower energy deposits at the top of the sequence.

5.3 Assessment of pollen and plant macrofossils

Pollen and plant macro fossils were assessed by the project's environmental specialist (Scott Timpany of Headland Archaeology). The results of this work (Appendix 3) indicated that pollen present in the samples taken from the peat was poorly preserved. This was probably due to periodic flooding and reworking of the sediments they were deposited in. Plant macrofossils from the samples were better preserved and indicated open scrubland in a wetland environment.

5.4 Artefacts

Three wooden artefacts were recovered during the work on the site. All appear to be stakes that have been shaped and sharpened using metal edged tools. They do not exhibit any chronologically diagnostic characteristics (Apendix 4).

6. DISCUSSION/CONCLUSION

The excavation of test pits and trial trenches demonstrated that the Pagham Raised Beach was present towards the western edge of the site and that it dropped away towards the east. The area to the east of the sand bank had been filled by alluvial deposits. These deposits were probably flooding from the Rife channel, located further to the east. Occasional peat deposits near the top of the sequence probably date to the Medieval or Post-Medieval period and are likely to be related to braided channels. The underlying bedrock (Reading formation) also dropped in level from west to east.

Evidence from studying the sediments and macrofossils within them indicates that the high energy raised beach deposits are later replaced by a much lower energy, mud-flat, environment implying that they are 'perhaps associated with marine regression and a shift seawards of the beach face environments seen at the base of the sequence.'

The preservation of microfossils is rare in such deposits. Those present here display similarities to those found in other parts of the Pagham Raised Beach sequence where they have survived. The foraminifera from the later of the two samples implied low energy mud flats or possibly estuarine conditions. The sequence of sediments reflects this.

It is rare to find such a complete sequence of deposits and as such the sediments could contain valuable information of regional significance.

The pollen and plant macrofossil assemblage suggests that this area could have been a saltmarsh with grazing of animals possibly occurring alongside it. The evidence from the site shows no correlation between the peat from

Illus 3
Composite east-west section across the site

the site and Bronze Age peat previously found on the foreshore.

The peat deposit located at 7.4m in a bore hole to the east of the area of trenching was in fact a deposit of charcoal and may be lignite.

7. BIBLIOGRAPHY

Boucher, A, 2010a, *Butlins Hotel A, Bognor Regis, West Sussex, Desk Based Assessment*.

Boucher, A, 2010b, *Butlins Hotel A, Bognor Regis, Project Design for Archaeological Evaluation*.

8. APPENDICES

8.1 Appendix 1 – Site registers

Photographic register

Photo no.	B & W print	Colour slide	Digital	Direction Facing	Description
1	468/1	467/1	–	N/A	Photo register ID shot
2	468/2	467/2	0094/ 0095	NW-film N+W-digital	North and west sections of Test Pit 2
3	468/3	467/3	0096/ 0097	SE-film S+E-digital	South and east sections of Test Pit 2
4	468/4	467/4	0098/ 0099	NW-film N+W-digital	North and west sections of Test Pit 4
5	468/5	467/5	0100/ 0101	SE-film S+E-digital	South and east sections of Test Pit 4
6	468/6	467/6	0102/ 0103	NW-film N+W-digital	North and west sections of Test Pit 5, Alluvial [Holocene] deposits
7	468/7	467/7	0104/ 0105	SE-film-S+E-digital	South and east sections of Test Pit 5, Alluvial [Holocene] deposits
8	468/8	467/8	0106/ 0107	NW-film N+W-digital	North and west sections of Test Pit 8, Alluvial [Holocene] deposits
9	468/9	467/9	0108/ 0109	SE-film S+E-digital	South and east sections of Test Pit 8, Alluvial [Holocene] deposits
10	468/10	467/10	0110/ 0111	NW-film N+W-digital	North and west sections of Test Pit 9, Alluvial [Holocene] deposits
11	468/11	467/11	0112/ 0113	SE-film S+E-digital	South and east sections of Test Pit 9, Alluvial [Holocene] deposits
12	468/12	467/12	0114/ 0115	NW-film N+W-digital	North and west sections of Test Pit 10, Alluvial [Holocene] deposits
13	468/13	467/13	0116/ 0117	SE-film S+E-digital	South and east sections of Test Pit 10, Alluvial [Holocene] deposits
14	468/14	467/14	0118/ 0119	NW-film N-digital	North and west sections of Test Pit 11, Alluvial [Holocene] deposits
15	468/15	467/15	0120	SE-film NW-digital	South and east sections of Test Pit 11, Alluvial [Holocene] deposits. Digi/0120 – Test pit during excavation.
16	468/16	467/16	0121	NW	North and west sections of Test Pit 12, Alluvial [Holocene] deposits
17	468/17	467/17	–	SE	South and east sections of Test Pit 12, Alluvial [Holocene] deposits
18	468/18	467/18	–	S	South end of Trench C, Peat deposits overlying alluvial [Holocene] deposits
19	468/19	467/19	–	SW	Trench C, East facing section. Peat deposits overlying alluvial [Holocene] deposits
20	468/20	467/20	–	W	Trench C, East facing section. Peat deposits overlying alluvial [Holocene] deposits, moving north along section
21	468/21	467/21	–	W	Trench C, East facing section. Peat deposits overlying alluvial [Holocene] deposits, moving north along section
22	468/22	467/22	–	E	Trench C, West facing section. Peat deposits overlying alluvial [Holocene] deposits
23	468/23	467/23	–	E	Trench C, West facing section. Peat deposits overlying alluvial [Holocene] deposits, moving north along section
24	468/24	467/24	–	E	Trench C, West facing section. Peat deposits overlying alluvial [Holocene] deposits, location and spread of peat samples 1–12, poor photo?
25	468/25	467/25	–	E	Trench C, West facing section. Peat deposits overlying alluvial [Holocene] deposits, location and spread of peat samples 1–12, better photo
26	468/26	467/26 27 and 28	–	E	Trench C, West facing section. Peat deposits overlying alluvial [Holocene] deposits, location and spread of peat samples 1–12, better photo
27	468/27	N	–	S	Trench C, Peat deposits overlying alluvial [Holocene] deposits
28	468/28	N	–	E	Trench F, peat deposits overlying alluvial [Holocene] deposits and location and spread of peat samples 13–16. Rising Pleistocene sand bar

Photo no.	B & W print	Colour slide	Digital	Direction Facing	Description
29	468/29	467/29	–	E	Trench F, peat deposits overlying alluvial [Holocene] deposits, location and spread of peat samples 13–16. Rising Pleistocene sand bar
30	N	467/30	–	–	Trench F, peat deposits in section overlying alluvial [Holocene] deposits and rising Pleistocene sand bar

Drawing register

Drawing no.	Scale	Plan or Section	Description
1	1:20	section	North facing section of Test pit 2
2	1:20	section	North facing section of Test pit 5
3	1:20	section	North facing section of Test pit 8
4	1:20	section	North facing section of Test pit 8
5	1:50	section	West facing section of Trench B
6	1:50	Plan	Plan of Trench B
7	1:50	section	West facing section of Trench C
8	1:50	section	West facing section of Trench A1
9	1:50	section	East facing section of Trench A2
10	1:50	section	South facing section of Trench E
11	1:50	section	South facing section of Trench G
12	1:50	section	South facing section of Trench F
13	1:50	section	South facing section of Trench B
14	1:20	section	North facing section of Test pit 11
15	1:20	section	North facing section of Trench F
16	1:20	section	North facing section of pit dug in Trench A2 for sedimentology and to collect forams and ostracods

8.2 Appendix 2 – A rapid assessment of sediments from a test pit at Butlins, Bognor

By Martin Bates & John Whittaker

Introduction

The site was visited by one of the authors on 12th January 2011. The purpose of the visit was to provide advice on the nature of the sediments present at the site and where appropriate on relevant sampling strategies. As a result of the visit a single test pit was excavated under geoarchaeological supervision by MRB and 5 samples were taken for assessment.

Lithology

A detailed log of the lithology observed in the test pit is presented in Table A2.1.

Sample S5 taken from adjacent section where sand unit above gravel thickened considerably.

The sequence present forms a relatively simple sequence of made ground (0.00–0.45m) above fine grained clay-silts (brickearths) (0.45–1.20m). Beneath this was a sand unit (1.201.30/1.45m) that laterally thickened towards the east above a thick sequence of sandy flint gravels (1.30/1.45–2.20m). The bedrock was reached at 2.20m.This sequence is strongly reminiscent of the typical sequences described elsewhere in the lower coastal plain as belonging to the Pagham Raised Beach (Bates *et al.* 2010).

Microfossil assessment

Five samples were submitted for assessment in order to determine whether or not any microfossils (foraminifera and/or ostracods) occurred in the samples. If present a preliminary examination of the samples was to be undertaken in order to ascertain information on the environment of deposition of the sediments.

Approximately 200g of each of the samples was processed. The samples were placed in bowls and dried in an oven. Once dry, a little sodium carbonate was added (to remove any clay fraction and aid breakdown) and hot water poured over them. After soaking for some time each was then washed through a 75 micron sieve and the residue decanted back into the bowls for final drying in an oven. Once dry they were put into labelled plastic bags. Examination was under a binocular microscope, each

Depth below ground surface (m)	**Lithology**	**Samples**
0.00 – 0.45	Made ground.	–
–	---sharp contact---	–
0.45 – 0.60	Reddish-brown sandy clay-silt. Very compact and firm. Structureless.	–
–	---graded contact---	–
0.60 – 0.70	Grey sandy clay-silt with occasional sub-angular flint clasts (<5cm). Structureless and massive.	–
–	---abrupt contact---	–
0.70 – 1.20	Mid brown to reddish-brown very sandy clay-silt to silty-clay. Pliable and structureless. Many sub-vertical root canals (1-3mm) and occasional small sub-angular flint clasts (<0.5cm).	–
–	---sharp contact---	–
1.20 – 1.30/1.45	Yellow brown medium sand with occasional large (>5cm) sub-rounded flint clasts. Apparently structureless.	S1 (1.25m) S5*
S2 (1.30m) OSL 1	–	–
–	---sharp/dipping contact---	–
1.30/1.45 – 2.20	Yellow-brown becoming red/yellow sandy flint gravel. Clasts 2-10cm, sub-angular to rounded. Matrix supported with matrix of clayey-sand. Chalk clasts appear towards base of unit. Very loose and unconsolidated.	S3 (1.50m)
S4 (2.10m)	–	–
	---sharp contact---	–
2.20 – 2.40	Red clay.	–
–	---base of test pit---	–

Table A2.1

Lithology and sampling positions of samples

	S (1)	S (2)	S (3)	S (4)	S (5)
Ammonia batavus (Type I – robust and ornate)	B	B	B	x	x
Ammonia batavus (Type II – flat with small boss)	A	A	A	x	xx
Elphidium crispum	R	R	R	x	–
Elphidium excavatum	R	R	R	x	xx
Elphidium williamsoni	E	E	E	–	xx
Haynesina germanica	N	N	N	–	x
	sand (weathered)		*gravelly sand*		

Table A2.2

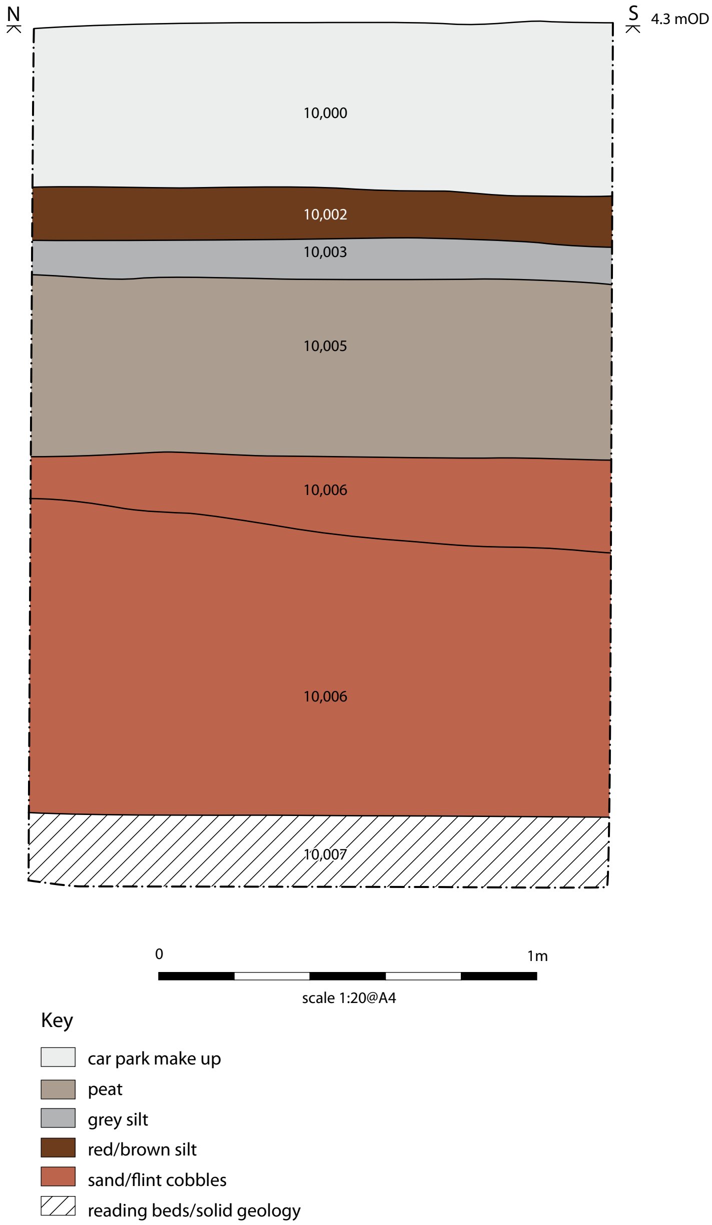
Microfossil samples from test pit
X – present (several speciments); xx – common

sample having been put through a nest of small sieves and a fraction at a time sprinkled onto a picking tray. Representatives of the foraminifera, which were found in two of the samples, were picked out into a 3in x 1in faunal slide, the numbers of each species being assessed semi-quantitatively by eye, as either present or common (see Table A2.2).

The top three samples, S1/S2/S3, were all barren. Samples S1 and S2, in particular, contained iron minerals and were apparently weathered and are thus decalcified. Samples S4 and S5, however, did contain foraminifera, but no ostracods (or molluscs). Those in S4 are not very common and were only found after a careful and time-consuming examination. They comprise two types of Ammonia batavus (a robust and very ornate form and somewhat flatter and less ornate form), together with Elphidium crispum and Elphidium excavatum. They are typical of high energy sandy beaches, and indeed are the most robust of foraminifera. They would have lived clinging or otherwise attached to seaweed in a shallow marine environment. Two of the species, the robust and ornate Ammonia batavus and Elphidium crispum, indicate a fully temperate if not warm interglacial. Although these faunas are similar to those found in other Pagham Raised Beach sites (Bates *et al.* 2010), most notably Pagham Water Treatment Works, they completely lack ostracods. The lack of ostracods is probably a result of partial decalcification which occurs even in the lowest samples where only the most robust foraminifera are present. The high energy environment of deposition might also have contributed to their absence.

It is also noticeable that the cold/cool microfossil indicators invariably found elsewhere in this beach are totally absent in these samples.

Sample S5 contained the best fauna, but it was still rather restricted with only five species of foraminifera present,



Illus A2.1

Test pit for rapid assessment of sediments

three of them common (Table A2.2), with two of them not found in sample S4. The stratigraphic position of this sample within the sands overlying the beach gravel suggests a later phase of deposition and given the presence of E.williamsoni and H.germanica (both species commonly found on mudflats in estuaries) a change in environment of deposition from high to low energy perhaps associated with marine regression and a shift seawards of the beach face environments seen at the base of the sequence.

Discussion and significance

The Pleistocene sediments sampled in the test pit at the site have been demonstrated to document high sea level conditions associated with marine gravels and overlying sands (1.20–2.20m depth) beneath a cover of brickearth. This is a well known lithological succession beneath the West Sussex Coastal Plain. The presence of microfossils (foraminifera) in these sediments is however, less common. In many instances (particularly from the lowermost sequence of marine deposits known as the Pagham Raised Beach) sequences are decalcified and barren of contained fossil evidence. Here at Bognor not only are foraminifera preserved but they appear to be subtly different to previous assemblages ascribed by Bates *et al.* (2010) to this beach. Not only that but a sequence of events from high to low energy is also preserved in the one test pit investigated. This too is unusual in West Sussex for deposits of this age. We can therefore conclude that:

The sediments contain important indicators of past environments and climate.

At present we are uncertain how they relate to the other parts of the Pagham Raised Beach.

The sediments are potentially rare (in the context of the coastal plain due to their preservation of microfossils and also the range of environmental changes they document).

Consequently, given their proximity to the surface and the fact that these deposits are certainly of regional/national significance, further investigation should take place to sample these sequences. Ideally this should take the form of a series of sampled test pits along two transects running north/south and east/west across the site. Sampling and analysis of contained microfossils should be undertaken in conjunction with a dating program using Optically Stimulated Luminescence dating (for which a framework already exists in West Sussex).

References

Bates, M R, Briant, R M, Rhodes, E J, Schwenninger, J L & Whittaker, J E, 2010, 'A new chronological framework for Middle and Upper Pleistocene landscape evolution in the Sussex/Hampshire Coastal Corridor', *Proceedings of the Geologists' Association* 121.

8.3 Appendix 3 – Palaeoenvironmental Assessment Report

By Scott Timpany

Introduction

The site of the new hotel being constructed at Butlins, Bognor Regis lies on an area of wetland close to the palaeochannel complex of the Aldingbourne Rife. The Rife has gone through many stages in its lifetime from a large Pleistocene channel to a series of smaller channels during the Holocene. As such it has been the subject of both archaeological and paleoenvironmental interest in terms of former landscape reconstruction and peoples who may have inhabited this area from the Palaeolithic onwards (*e.g.* Bates *et al.* 2010).

A site visit on 12th January 2011 showed that the area of the hotel was located some distance from the main Holocene channel that runs further east of the site. However, the stratigraphy of the site did reveal a sequence of probable flood deposits, present as green-grey silt, which overlay possible Pleistocene sediments (Appendix 2) and underlay made ground. At two locations on the eastern side of the site, within Trench C and Test Pit (TP) 5 a peat layer was observed lying stratigraphically within the flood deposits. Tree roots and abundant wood fragments were present within the peat (see Illus A3.1) and a worked wooden stake was also retrieved from this layer within Trench C. A possible thin organic band was seen in Trench F in the middle of the site, where a tree root was present within this layer.

The presence of large tree remains within the peat was of palaeoenvironmental interest given the presence of submerged forest on the foreshore at Bognor, to the south of the site. Trees from this submerged forest have been investigated and found to lie within a thin peat layer and date to the Bronze Age period (Allen *et al.* 2004). The presence of a worked stake within the peat also made it of archaeological interest. It was therefore decided to investigate the peat and possible organic bands within the flood deposits to see if they contained botanical remains (pollen and plant macrofossils) together with the wood, which could be used to provide palaeoenvironmental data for the site and whether they were similar to the

Sample	***Context***	***Pollen Present***	***Abundance***	***Preservation***	***Observed taxa***
S1 68cm	Flood deposit	Yes	High	Good to poor	*Lactuceae*, Type 7A, *Poaceae*, *Plantago lanceolata*, *Cyperaceae*, *Pinus*.
S1 75cm	Flood deposit	Yes	High	Good to poor	*Pinus, Pteropsida, Poaceae, Cyperaceae, Taxus.*
S1 85cm	Peat	Yes	Low	Poor	*Poaceae, Crataegus, Crassula, Cyperaceae, Quercus, Pteridium.*
S1 87cm	Peat	Yes	Low	Poor	*Quercus, Pinus, Poaceae.*
S1 89cm	Peat	Yes	High	Good to poor	*Pinus, Cyperaceae, Poaceae, Apiaceae, Aster, Crataegus.*
S1 91cm	Peat	Yes	Low	Good to poor	*Pinus, Cyperaceae, Betula, Poaceae*, Type 207.
S1 93cm	Peat	Yes	Low	Good to poor	*Pinus, Poaceaea, Crataegus, Salix, Plantgo maritima, Aster, Chnopodium.*
S1 95cm	Peat	Yes	Low	Poor	*Pinus, Pteropsida, Crataegus, Cyperaceae, Poaceae, Pteridium.*
S1 97cm	Peat	Yes	High	Poor	Type 263, *Poaceae, Apiaceae, Pinus, Lactuceae*, Type 7A.
S1 99cm	Peat	Yes	High	Good to poor	*Salix, Cyperaceae, Poaceae, Pinus, Lactuceae.*
S1 101cm	Peat	Yes	High	Poor	*Pinus, Poaceae, Aster, Cyperaceae*, Type 263.
S1 103cm	Peat	Yes	Low	Poor	*Lactuceae, Taxus, Pteridium*
S1 105cm	Peat	Yes	Low	Poor	*Pinus, Lactuceae, Pteridium, Poaceae, Aster.*
S2 56cm	Possible organic band	Yes	High	Good to poor	*Poaceae, Fraxinus excelsior, Corylus avellana, Lactuceae, Cyperaceae*, Type 112.
S2 62cm	Flood deposit	Yes	Low	Good to poor	*Poaceae, Aster, Cyperaceae, Lactuceae.*
S2 68cm	Flood deposit	Yes	Low	Poor	*Aster, Lactuceae, Poaceae, Cyperaceae.*

Table A3.1

Pollen Assessment Results

		Context	***Spoil of TP***	***Section 1***	***Section 1***	***Spoil near trench***	***Borehole***
		Sample depth	**–**	***85-95cm***	***95-105cm***	**–**	***7m***
		Orig. vol (litres)	***3***	***2***	***2***	***3***	***0.5***
		% of sample assessed	***30***	***30***	***30***	***30***	***50***
Latin Name	***Plant Part***	***Common Name***					
Taxus baccata	wood	yew	–	+	+	+	–
Taxus baccata	seed	yew	+	–	–	+	–
Corylus avellana L.	nutshell	hazel	+	–	–	–	–
Salix sp.	wood	willow	+	+	–	–	–
Maloideae	wood	hawthorn/apple/pear	–	+	–	–	–
cf. Crataegus sp.	buds	hawthorn	+	+	+	+	–
Crataegus sp.	fruit	hawthorn	++++	++++	++	+++	–
Crataegus sp.	thorn	hawthorn	+	–	–	–	–
Fraxinus excelsior	wood	ash	+	–	+	+	–
Sambucus nigra	fruit	elder	–	+	–	–	–
cf. Ranunculus sp.	achene	buttercups	+	–	+	+	–
Urtica dioica	fruit	common nettle	–	+	–	–	–
Polygonum aviculare	achene	knotgrass	+	–	–	–	–
Rumex sp.	achene	dock	++	+	–	+	–
Rubus sp.	thorn	brambles	++	–	–	–	–
Rubus sp.	fruit	brambles	++	+	++	+	–
Hyocyamus niger L.	charred seed	henbane	+	–	–	–	–
Carex sp. indet.	nutlet	sedge	–	+	–	–	–
Indeterminate	seed	indeterminate	–	–	–	+	–
Indeterminate	buds	indeterminate	–	++	–	–	–
Possible cone fragments	cone	indeterminate	–	+++	–	+++	-
Wood fragments	wood	indeterminate	++++	++++	++++	++++	–
Moss fragments	leaves	mosses indet.	+	+	–	+	–
Insect fragments	wing cases	insects indet.	+	+	–	+	–
Charcoal fragments >1cm	charcoal	charcoal indet.	+	–	–	++	+++

Table A3.1
Plant Macrofossil Assessment Results

submerged forest and buried peats on the foreshore.

Methods

Fieldwork

Samples were taken in the field using kubiena tins for pollen samples and bulk sampling for plant macrofossils. A sequence of kubiena tins were taken from two sections; one from within Trench C (see Illus A3.2) and a second from within Trench F (see Illus A3.3). The kubiena samples overlapped each other by approximately 1cm in order to make sure that a complete sequence was taken from the layers of interest (peats) within each section.

Bulk samples were taken from the peats for plant macrofossil assessment; with samples taken from peat within Section 1, a peat layer within TP 5 and peat from the spoil of Trench C where the worked stake was found. A bulk sample was also taken from a possible peat layer found 7m below the surface from one of the Boreholes placed at the site as part of the geo-technical investigations.

Laboratory work

Pollen

Pollen preparation was undertaken using a floatation method (Nakagawa *et al.* 1998) due to the sediments being largely silts. This enabled the pollen within these low organic sediments to be condensed so as to increase the potential of these levels for any future pollen analysis. The pollen samples were then scanned using a stereo microscope to look for the presence/absence of pollen, non-pollen palynomorphs (NPPs), such as fungal spores and microscopic charcoal.

Plant macrofotssils

Samples were washed through a small stack of sieves with 1mm and 250μm meshes. The remains were sorted and identified using a binocular microscope at magnification of x10, and x40 where greater magnification was needed for identification. Identifications were confirmed using modern reference material and seed atlases including Berggren (1969) and Cappers *et al.* (2006).

Wood identification

For identification wood samples were thin sliced along the radial, tangential and transverse sections using a razor blade and then bleached before being mounted on a slide in glycerol and examined under a microscope at x100 and x400 when required. Wood sections were identified using features described by Schweingruber (1978, 1990) and IAWA (1989).

Results/Discussion

The results are presented in Tables A3.1 and A3.2.

Preservation

Pollen

Pollen grains were found to be present in all levels prepped for assessment. The preservation of the grains is generally quite poor throughout the two sequences, with many grains, observed to be degraded on the slides. The higher percentage of degraded pollen is to be expected in silt sediments, where pollen is likely to held in suspension longer thus increasing the risk of biochemical deterioration from bacterial/fungal attack (Tipping, 2000; Dark and Allen, 2005).

The degradation within the peat layers indicates that the peat may also have gone through alternate periods of wetting and drying. Fluctuations in the watertable and/or sea-level, together with periodic in-washing of material can cause some mixing of sediments, thus increasing the risk of oxidation and microbial attack (Brown, 1997; Tipping, 2000).

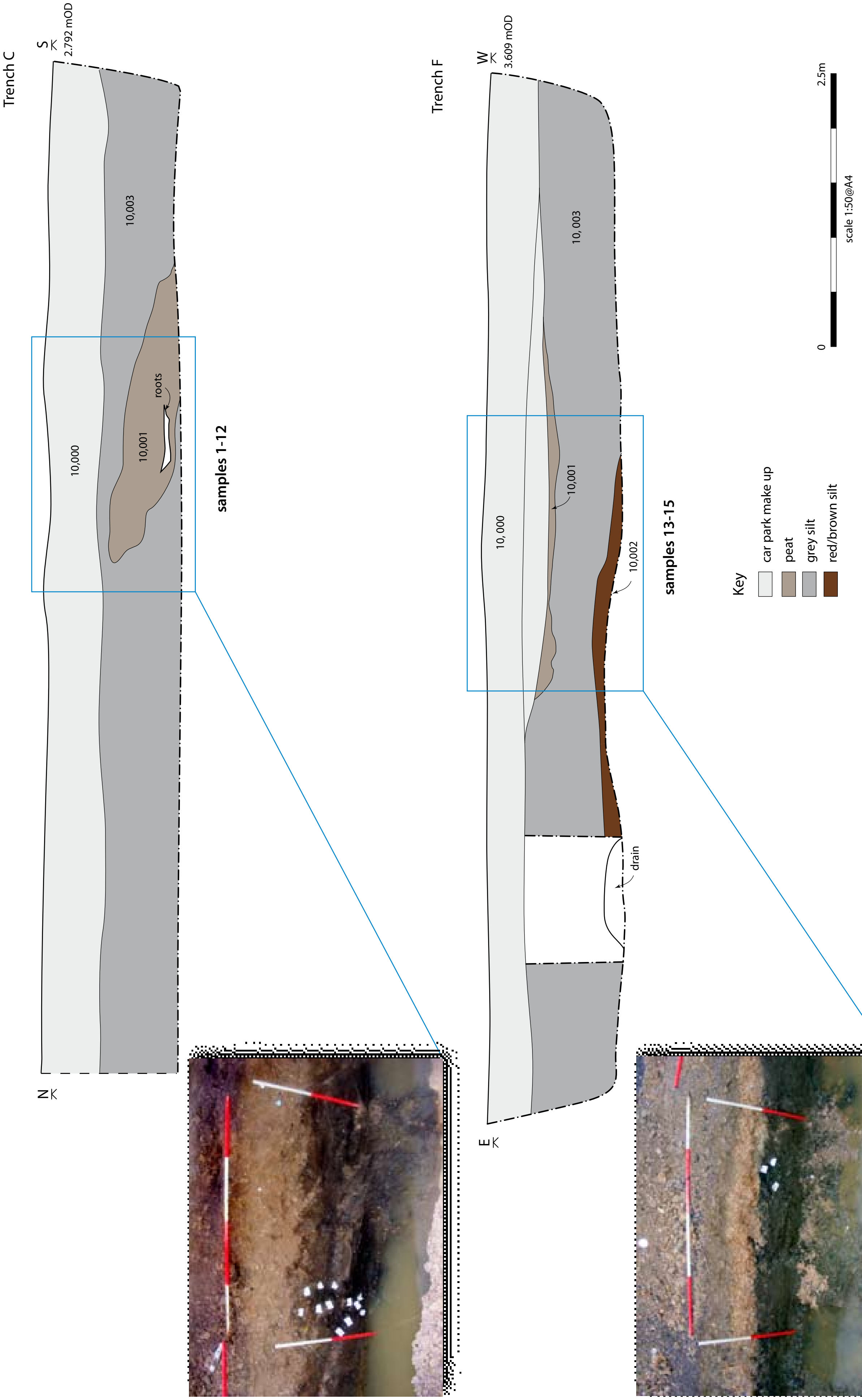
Grains were also noted as being crumpled and broken on slides, which is likely to represent mechanical damage to the pollen from being held in suspension within the silt sediments together with potential re-working of the materials (Delcourt and Delcourt, 1980; Jones *et al.* 2007). This is especially likely to have occurred within the flood deposits with frequent flooding events and in-washing of materials, causing some reworking of sediments. Abundance of pollen was mixed with levels showing high and low concentrations of pollen; however abundance of NPPs was generally good in all levels with high numbers of fungal spores noted on the pollen slides.

Plant macrofossils

In contrast to the pollen grains the plant macrofossils showed excellent preservation from the bulk samples. Abundance was also found to be good within the plant macrofossil assemblage with samples containing a large number of seeds and fruits etc. Diversity of plant remains within the assemblage is also good in the samples, with all except the sample from the BH (7m) containing a range of plant macrofossils. The BH sample was found to contain only charcoal fragments and given its depth may represent a lignite deposit.

Vegetational information

The quick scan of the pollen and plant macrofossils, together with the wood identifications enables some tentative observations of the vegetational sequence present through the sediments. The peat layers seen across the western part of the site within Trench C and TP 5 were all found to contain similar plant macrofossil assemblages suggesting they correlate to the same period. The local environment indicated by the plant macrofossil assemblage, from the peats and thin organic band (Section



Illus A3.1
Peat sampling locations

Illus A3.2
Location of kubiena tin samples from section 1

2) is one of open scrub woodland in an area of wetland. The presence of trees such as hawthorn (*Crataegus* sp.) evident at the site from fruits stones, thorns and buds, together with pollen and probable wood fragments (*Maloideae* sp.), with ash (*Fraxinus excelsior*), elder (*Sambucus nigra*), yew (*Taxus baccata*) and hazel (*Corylus avellana*) also represented, indicate the presence of scrub woodland across the site (Clapham *et al.* 1962). Ground flora within the assemblages such as sedges (*Cyperaceae* and *Carex* sp.), brambles (*Rubus* sp.), bracken (Pteridium) and docks (*Rumex* sp) suggest wet, boggy ground (Clapham *et al.* 1962; Stace, 1997).

The pollen record also suggests that these areas of peatland were subject to periodic flooding from coastal waters with the presence of coastal plants such as sea plantain (*Plantago maritima*), Aster-type (michaelmas daisies) and lettuce family (*Lactuceae* sp.), together with goosefoots (*Chenopodium* sp.). The occurrence of Type 207 (*Glomus cf.* fasciculatum), within the peats, which has been linked to increases in inwashed minerogenic sediments (van Geel *et al.* 1989) also indicates periodic flooding of this boggy woodland scrub. These flooding events are likely to have been from the Holocene channel to the east, which would have been tidally active (Allen *et al.* 2004). These flooding episodes are likely to be the cause for the poor preservation of the pollen within the peats from being subjected to reworking and mechanical damage.

Also of interest within the pollen assemblage is the presence of NPP's such as *Cercophera* sp. (Type 112) and *Chaetomium* sp. (Type 7A) fungal spore values, which are linked to animal dung (Kuhry, 1985; van Geel *et al.* 2003). The presence of these within the peats indicates there may have been animals grazing in the area of the site. However, given the presence of these within the flood deposits as well as the peats (see Table A3.1), it is possible grazing was taking place near to the coast with these NPP's incorporated into the peats from the inwashed flood waters.

The pollen assemblages from the flood deposits were observed to be dominated by herbaceous pollen and in particular grass (*Poaceae*) pollen. The coastal plant community indicators present in the peats are more clearly associated with those deposits that have more frequent inclusions of michaelmas daisies and lettuce family pollen. The assemblage from these deposits is suggestive of possible saltmarsh, whilst the presence of coprophilous fungi also indicates these areas were used for grazing.

The finding of a worked stake, identified as ash, within the peat from Trench C is evidence of anthropogenic activity at the site. However, with the exception of possible grazing activity there is little evidence for the presence of people in the palaeoenvironmental assessment. Charcoal fragments were present in two of the peat samples (see Table A3.2), which may represent burning activity. However, these fragments could also represent reworked lignite and thus would need further identification to reveal whether they are from trees identified during the assessment and thus may represent local burning.

The palaeoenvironmental information from the assessment can be compared to previous work done in the area by Allen *et al.* (2004). The pollen assemblage with indicators of saltmarsh and coastal plants and limited

Illus A3.3
Location of kubiena tin samples from section 2

numbers of tree pollen would tie into the upper sequences of the pollen profile from the Holocene channel fill. The identification of wood remains from the peats such as ash, yew, willow (*Salix* sp.) and probable hawthorn (*Maloideae*) differs from the Bronze Age submerged forest where the trees were largely oak (*Quercus* sp.) with some yew, alder (*Alnus glutinosa*), lime (*Tilia* sp.) and hawthorn/apple/pear (*Maloideae*) (Gale, in Allen *et al.* 2004). This would suggest the sequence at the site is not related to that of the foreshore. Indeed pollen from the foreshore results revealed an alder carr-woodland existed, whereas alder pollen was not noted on the slides during this assessment.

Conclusions

Archaeobotanical remains were present in all of the sediments assessed although preservation differed between the pollen and plant macrofossils with pollen showing evidence of mechanical and biological damage probably as a result of in-washing and reworking of sediments.

The peats assessed showed scrubby woodland was present on wet boggy ground, consisting largely of hawthorn, ash, yew, willow and hazel, together with elder. The assemblage differed from the Bronze Age sequence found on the foreshore and the two are suggested to be unrelated.

The probable flood deposits contained pollen dominated by *herbaceous taxa* in particular grasses and is likely to represent coastal saltmarsh vegetation, together with tentative evidence for animal grazing.

Assessment of potential

The poor preservation of the pollen together with the probable reworking and inwashed component from the river catchment indicates that further work is unlikely to provide an interpretable sequence for the site. Any local changes to vegetation that could point to anthropogenic activity may be masked by the regional (in-washed) pollen and thus would be difficult to observe. Therefore it is suggested that no further pollen work is required.

There is material available for radiocarbon dating from the plant macrofossil assemblage, together with the worked stake and it is recommended this material is used should any dates be required for the site. Therefore it is recommended that material from the plant macrofossil assemblage is used for any radiocarbon dating for the site.

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8.4 Appendix 4 – *Finds Assessment Report*

By Scott Timpany

Introduction

Three pieces of worked wood were recovered on the site and this report aims to present the results of the assessment of these pieces. A probable stake with a worked end was found in the spoil from Trench C with peat that had been removed during trenching. Two further wooden objects of unknown function were found within the peat layer [10,001], in section within Trench C. The wooden objects were wrapped and labelled on site and then sealed in sample bags containing water prior to assessment.

Method

Wood identification

For identification wood samples were thin sliced along the radial, tangential and transverse sections using a razor blade and then bleached before being mounted on a slide in glycerol and examined under a microscope at x100 and x400 when required. Wood sections were identified using features described by Schweingruber (1978, 1990) and IAWA (1989).

Tool marks

The worked tips were simply examined under a raking light which would enhance features such as signature marks on the axe facets (*cf.* Sands 1997).

Results/Discussion

The wood assessment results are presented in Table A4.1

Find 001

Facets were noted on the worked end of the ash stake, which displayed a single jam curve that suggested a flat-blade axe had been used to strike the wood. The presence of a single jam curve suggests that the wood was struck only a couple of times to make the sharpened end. The shallow facets and single jam curve suggest the use of a metal axe, in that they can cut through wood more efficiently (Sands 1997). The strongly curved rings together with the pith and bark still being present on the stake indicate it was made from branchwood, possibly chosen due to its straight growth. Tree remains of ash were found within the peat suggesting that local resources were used to make the stake. The presence of bark still on the stake and the speed with which it may have been cut (a couple of strikes) it would appear little effort went into the making of this object.

Find 002

This object appeared to have been worked at both ends; however, only one end displayed any evidence of working as the other had been poorly preserved. The visibly worked end showed evidence of facets but only one jam curve, again the curve showed a flat edged blade had been used to strike the wood and appeared comparable to that of the ash stake (see above) indicating the use of a similar metal axe. The wood also appeared to have been split and effectively halved. The object was identified as being made from birch, though unfortunately no rings were visible or bark present. The absence of birch macrofossils in the peat layer (see Environmental report) suggests that unlike the ash stake this wood may have been brought to site from elsewhere.

Find 003

No clear facets could be observed for this object, which as with Find 002 had been split. This small split timber may represent waste material from the construction of split objects such as Find 002. Find 003 was also identified as being made from birch wood.

Conclusions

Three worked wood objects were recovered from the site: a stake made from ash, an unknown split wooden object with two worked ends made from birch and a possible discarded piece of split birch waste material.

The ash stake and birch object were probably struck with the same type of flat bladed metal axe.

It is likely the ash stake was made from locally available ash branchwood. The birch objects may have been constructed from woof d brought to the site.

Finds no.	***Context no.***	***Taxon***	***Ring count***	***Ring curvature***	***Tool identification***
001	Unstrat.	*Fraxinus excelsior* (ash)	8	Strongly curved	Metal axe
002	10,001	*Betula* sp. (birch)	–	–	Metal axe
003	10,001	*Betula* sp.	–	–	–
(birch)	–	–	–	–	–

Table A4.1
Wood Assessment Results

Recommendations

The wooden objects could be radiocarbon dated in order to clarify what period of activity they represent. Therefore it is recommended at least one of Finds 001 or 002 is radiocarbon dated.

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