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THE STANSTED AIRPORT PROJECT, ESSEX, PART 3. THE BRITISH RAIL SECTIONS (BRS)

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Summary

During the construction of a culvert, carrying the diverted Stansted Brook beneath the new rail link, sections through river channel deposits were exposed. These were recorded and sampled for pollen, macrofossils and radiocarbon dating. From the characteristics of the sediments and the plant macrofossils which they contained the following plant sequence is suggested: 1. An isolated channel with little active stream flow gradually silted up during seasonal flooding. Vegetation comprised mainly aquatic, reedswamp, marsh and grassland taxa. Charcoal and occasional charred cereal remains were present indicating some agriculture in the vicinity. 2. The topmost channel fills included slightly more organic sediment, and a rise in frequency of Typha implies development of reedswamp. These wetter conditions may perhaps be related to increased deforestation with the catchment. 3. The channel fills are overlain by c.1m of oxidised mineral alluvium probably deposited by overbank flooding from the main river channel.

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The Stansted Project. Part 3. The British Rail Sections (BRS)

As part of the construction work for the new rail link serving Stansted Airport the Stansted Brook was diverted through a culvert under the railway. Excavations for this culvert in April-May 1988 revealed sections through alluvial sediments, and data on the underlying deposits were provided by Borehole Logs recorded by Ground Engineering during preliminary site investigation work. The position of the site in relation to the relief and drainage of the area and the detailed positions of the sections and boreholes are shown in Fig. 1.

Section 1 (TL 52317 25040)

This section was limited in depth and extent but it was possible to record the topmost 160cm of sediments and to obtain samples for pollen and macrofossil analysis and dating. The section was as follows (all depths approximate since the section face was battered at an angle of c. 45°).

0-80cm. Yellowish brown to brown silty clay; well-developed subangular blocky peds above, very weak ped development below; prominent fine grey mottling towards base; virtually stoneless; fairly sharp boundary.

80-100cm Dark greyish-brown silty clay; traces of plant

detritus; very rare small flint pebbles; sharp boundary.

100-108cm Dark grey silty clay; slightly organic with plant detritus (leaves, stems etc.); sharp boundary.

108-160cm+ Dark greyish-brown silty clay; traces of plant detritus; occasional bands of paler silty clay.

The topsoil had been stripped at this site prior to construction work. Similar, but somewhat deeper sections were seen elsewhere in the excavation, but these were not safely accessible due to flooding.

Bulk samples for macrofossil analysis and dating were taken at 100-108, 108-115, 115-125, 125-135 and 135-145cm. A monolith for pollen analysis was collected by Pat Wiltshire using a peat corer; the top of the monolith was at c. 90cm.

Section 2 (TL 52312 25018)

This showed deposits similar to those previously seen over a 10m. length of section about 150cm deep. At one point, however, a section some 250cm deep was visible. It showed the following deposits (topsoil stripped):

0-100cm Yellowish brown to brown silty clay; well developed subangular blocky peds above, very

	weak ped development below; fine brown and grey mottling towards base; stoneless; merging boundary.
100-117cm	Grey silty clay; irregular dark grey zone of mottling at 107cm; sharp boundary.
117-121cm	Dark grey silty clay; slightly organic, traces of plant detritus; sharp boundary.
121-123cm	Mid grey silty clay; sharp boundary.
123-200cm	Grey silty clay, becoming gradually darker greyish-brown with depth; large yellowish-brown mottles at 150-170cm; organic streaks towards base; traces of grey sand at 180cm; virtually stoneless but one 3cm rounded flint pebble at 170cm; sharp boundary.
200-205cm	Very dark greyish-brown organic silty clay; some wood fragments; sharp boundary.
205-216cm	Greyish-brown silty clay; becoming more organic towards base with wood fragments; sharp boundary.
216-218cm	Very dark greyish-brown organic silty clay; wood fragments; sharp boundary.

218-250cm Dark greyish-brown slightly organic silty clay; degraded wood fragments and woody roots/twigs fairly common.

Samples were collected for macrofossil analysis and dating from almost the entire sequence (between 90 and 230cm) and a core for pollen analysis, c.45cm long with its top at c.180cm. was also taken (the upper sediments had previously been sampled in section 1 for pollen analysis). It was not possible to sample the lowest deposits because the excavation flooded as a result of seepage and torrential rain, which occurred between recording and sampling.

Borehole 1

This deep borehole has been sunk by Ground Engineering for British Rail, prior to construction work. It was adjacent to the Stansted Brook culvert and very close to Section 2. The bore log records the following sediments (ground level at 66.25m OD):

0-0.35m Soft brown friable clayey topsoil with many roots and lenses of dark orange brown fine silty sand.

0.35-1.10m Very soft to soft orange brown silty clay with small lenses of dark brown fine silty sand; partings of brown orange and blue grey silty clay in lowest 15cm.

1.10-1.90m Very soft grey very silty clay with soft brown silty peat including roots and decayed vegetation.

1.90-2.50m Very soft brown and black pseudo-fibrous friable peat.

2.50-5.85m Similar peat with intact pieces of wood and occasional shell fragments.

5.85-7.55m Very soft grey-green and black highly organic very clayey sandy silt with traces of small shell fragments; below 6.55m becoming dark grey and black with much decayed vegetation and pockets of black, pseudo-fibrous peat.

7.55-9.55m Very soft black amorphous silty peat with many small intact shells (highly organic silt?); becoming dark green at base.

9.55-11.40m Very soft dark green highly organic clay.

11.40-12.55m Soft grey and green very silty clay becoming slightly sandy.

12.75-14.45m Medium dense grey fine to coarse angular to rounded predominantly flint gravel, with some medium to coarse, slightly clayey sand and

occasional small pockets of soft grey silty clay; below 13.90m becoming a brown grey and white fine to medium angular to rounded sandy clay-bound gravel.

14.45-15.20m Firm to stiff light brown and grey green friable silt; with laminations of dark brown silty clay below 14.95m.

15.20-16.30m Medium dense, fine to coarse angular to sub-rounded clayey gravel with some medium to coarse sand (claybound gravel).

16.30-17.45m Firm to stiff brown grey friable silt (redeposited putty chalk).

17.45-17.95m Soft grey silty clay.

17.95-18.20 Stiff black friable laminated, highly organic silt (amorphous silty peat ?).

18.20m + Glacial Till? Stiff light grey silt with abundant sand and gravel-sized rounded chalk nodules with occasional coarse angular flint gravel (becoming more clayey below).

Unfortunately it was not possible to examine samples from this borehole. However, allowing for differences in the terminology used in this bore log and the lesser degree of

precision in sediment descriptions necessary for this purpose it is clear that the top 2.50m of this borehole records identical sediments to those in section 2.

Organic sediments are recorded to a depth of 11.40m. It seems improbable that these are all Holocene sediments: even in the valley of the Chelmer, a much more important river than the Stansted Brook, organic channel fills overlying Pleistocene gravels do not extend for more than 4m below the present surface, and the contact between organic/fine-textured alluvium and sub-alluvial gravel is generally between 1.0 and 2.8m below the surface (Murphy and Wilkinson, forthcoming). It therefore appears that at this site a Holocene channel is incised into a Pleistocene channel, cut into the chalky Till and filled with organic deposits, fine-textured (sometimes laminated) sediments, gravels and possible colluvial sediments.

Dating

Samples for radiocarbon dating have been submitted from Section 2. These comprise a sample of the organic sediment at 117-121cm, and woody roots and twigs from 228-238cm.

Plant macrofossils

Small samples were disaggregated by prolonged soaking in NaOH solution and then graded into size fractions in a rack of sieves. Macrofossils were extracted from these fractions by sorting under a binocular microscope at low power, though the fraction under 0.5mm was only scanned in each case. The organic fractions retained in the sieves were always small: the samples consisted predominantly of fine mineral sediment. The macrofossils extracted are almost all very poorly preserved, hence the high proportion of unidentified or incompletely identified specimens (Table 1). In view of the rarity and poor preservation of plant remains, no doubt resulting in the complete loss of macrofossils of some taxa, the samples were not though to merit very detailed or extensive study.

Section 1

Five samples from depths between 100 and 145cm were examined. The lowest two samples contained very few macrofossils preserved by waterlogging, and it seems probable that the sediments below 125cm dried out periodically with consequent humification of organic material. The sample from 115-125cm produced a sparse assemblage dominated by Ranunculus acris/repens/bulbosus, Mentha cf. aquatica, and Eleocharis sp. This seems to indicate wet grassland conditions. Above this, Ranunculus and Eleocharis decline in frequency, whilst Mentha cf. aquatica and Typha sp(p) increase, implying increasingly wet

conditions and the local development of Typha reedswamp, beneath which the slightly organic dark grey silty clay at 100 -108cm appears to have formed. Charcoal fragments were present in all samples, and some abraded fragments of fired clay came from the sample at 135-145cm.

Section 2

Alternate samples from the sample column collected were examined. Most samples, however, contained very few macrofossils and for this reason only three relatively 'rich' samples were studied in any detail. Samples from below 216cm contained some woody roots and twigs with occasional fruits and seeds of Mentha cf. aquatica, Ajuga reptans, Urtica dioica, Sambucus nigra and charcoal fragments. The sample from the very dark greyish-brown organic silty clay at 200-205cm produced a poor assemblage in which the main component was badly degraded nutlets of Urtica dioica. At 180-190cm, however, a rather richer flora is represented, including a slightly higher proportion of aquatic plants (Characeae, Ranunculus sceleratus, R. subg. Batrachium, Alismataceae, Zannichellia palustris, and Lemna sp) together with marsh and marginal species and some scrub taxa (Rubus fruticosus, Sambucus nigra). This slightly more diverse flora is related to coarser, sandy sediment at this level indicating increased current flow. Mottling in the sediments between 150 and 170cm, and extreme rarity of macrofossils in samples from this level, imply periodic desiccation and humification. The sample from 123-130cm

produced a mixture of aquatic, reedswamp, marginal, marsh and grassland taxa. Samples above this contained sparse assemblages. Charcoal was present throughout the sequence and carbonised glume bases of Triticum cf. spelta came from samples at 123-130 and 140-150cm.

Conclusions

The existence of a deep channel at this point in the valley is of considerable interest, and the deposits infilling it would undoubtedly repay further study. However, most of these deposits are likely to be of Pleistocene date and are thus of no relevance to the Holocene landscape history of this area. The sediments seen in section all contain charcoal, and are thus probably contemporary with human activity within the river catchment, which includes the northern part of the Stansted Project survey area and areas further to the north east (Fig. 1).

The Holocene sediments, as yet undated, have produced disappointingly sparse and restricted macrofossil assemblages compared to those from comparable river valley sections in the Chelmer system (Murphy and Wilkinson, forthcoming). Nevertheless, combining the few data obtained from macrofossils, with information from the sediments an outline sequence of events and provisional chronology can be suggested. The deposits seen in sections 1 and 2 are channel fills. The generally fine texture of the sediments implies that there was little or no stream flow (apart from

the sandy deposits at 180cm in section 2): the channel seems to have been isolated from the main course of the river, and to have silted up mainly as a result of sediment deposition during flooding episodes. Throughout the sequence local vegetation seems to have been predominantly herbaceous: surprisingly, no remains of Alnus or Salix were present in the samples, and wood fragments were generally rare. The low organic content of the sediments, the rarity of plant macrofossils at most levels, and the mottling at various horizons within the sections all indicate that the sediments dried out, presumably seasonally. Vegetation on the dried mud surfaces may have consisted largely of Urtica dioica, though at some levels a more diverse flora of aquatics, reedswamp and marsh plants is indicated. The topmost channel fills in section 1 contain a sequence of macrofossils implying increasingly wet conditions: below 125cm there was virtually no organic preservation, at 115-125cm, wet grassland vegetation seems to be indicated but by 100-108cm the assemblage appears to represent local development of Typha reedswamp. A trend of this type could be interpreted as indicating increased run-off following extensive deforestation. The presence of carbonised cereal remains down to a depth of 150cm, however, shows that there was some agriculture in the area before this postulated phase of wetter conditions. The crop present - probably spelt (Triticum cf. spelta) - was most widely cultivated in the Iron Age and Roman periods. The final phase of sedimentation - the yellowish-brown to brown silty clay above 100cm is thought to have been deposited by overbank

flooding from a main river channel, once minor channels had been completely choked with sediment. In view of evidence from survey for extensive medieval settlement in the area it may be suggested provisionally that this latest phase of sedimentation occurred in the middle ages. The radiocarbon dates will confirm or refute this.

Reference

Murphy, P. and Wilkinson, T.J. (forthcoming) 'Valley Sediments of the Chelmer and Sandon Brook', in Buckley, D.G. and Hedges, J.G. (forthcoming) 'Excavations at Springfield, Chelmsford'.

Section no.	1	1	1	1	1	2	2	2
Depth (cm)	100-108	108-115	115-125	125-135	135-145	123-130	180-190	200-205
Characeae indet (a)	-	-	-	-	-	-	+	+
Ranunculus acris/repens/bulbosus	-	5	41	-	-	4	7	-
Ranunculus sceleratus L	-	-	-	-	-	-	18	-
Ranunculus subg Batrachium	-	-	-	-	-	-	4	1
Rorippa islandica (Oeder) Borbas	-	-	-	-	-	-	3	-
Rubus fruticosus agg	-	-	-	-	-	-	1	-
Apium cf. nodiflorum (L) Lag.	-	2	1	-	-	52	-	-
Oenanthe sp.	-	1	cf2	-	-	cf2	-	-
Umbelliferae indet (b)	1	23	3	-	-	-	-	-
Polygonum lapathifolium L.	-	-	-	-	-	1	-	-
Polygonum sp.	-	-	-	-	-	5	-	-
Polygonaceae indet.	-	-	3	-	-	fr	-	-
Urtica dioica L.	-	-	1	-	-	2	28	56
Mentha cf. aquatica L.	61	53	26	2	-	128	24	8
Lycopus europaeus L.	5	3	-	-	-	6	-	-
Prunella vulgaris L.	-	-	1	-	-	-	-	-
Stachys sp.	-	-	-	-	-	-	1	-
Ajuga reptans L.	-	-	-	-	-	-	1	1
Sambucus nigra L.	-	-	-	-	-	-	fr	-
Bidens sp.	-	-	2	-	-	1	-	-
Eupatorium cannabinum L.	-	-	-	-	-	-	3	-
Alismataceae indet (c)	-	-	-	-	-	1	2	3
Zannichellia palustris L.	-	-	-	-	-	-	13	-
Juncus spp.	+	+	+	-	-	-	+	+
Lemna spp.	-	-	-	-	-	-	2	-
Sparganium sp(p) (d)	4	6	1fr	-	-	57	4	-
Typha sp(p)	72	5	-	-	-	19	-	-
Eleocharis palustris/uniglumis-type	-	6	39	-	-	3	-	-
Carex spp (e)	4	7	3	-	-	172	-	-
Cyperaceae indet (f)	-	-	-	4	-	fr	2fr	-
Triticum cf spelta L (g)	-	-	-	-	-	2	-	-
Gramineae indet	-	2	4	-	-	4	1	-
Monocot stem frags etc.	+	+	+	+	+	+	+	+
Wood/twigs	+	-	+	-	-	-	-	+
Charcoal	+	+	+	+	++	+	+	+
Indet. seeds etc.	1	21	25	-	-	12	19	-
Insect remains	+	+	+	+	+	+	+	+
Mollusc shell fragments	-	-	-	-	+	-	-	-
Fired clay fragments	-	-	-	-	+	-	-	-
Sample wt (kg)	0.1	0.25	0.5	0.5	0.5	0.5	0.5	0.5

Table 1 : Macrofossils from selected samples

Taxa are represented by fruits or seeds except where indicated

fr = fragments

Notes: (a) Oogonia; (b) Badly degraded Apium/Berula size; (c) Embryos only; (d) Includes specimens lacking outer ribbed fruit tissue; (e) Mainly small trigonous forms; (f) Mostly fragments; (g) Carbonised glume base