Surrey Archaeological Collections, **87**, 85–93, 2000

Pollen analysis of sediments from Moor Farm, Staines Moor, Surrey

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with an introduction by
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A peat deposit on Staines Moor was sampled for pollen analysis during the archaeological evaluation in order to provide an assessment of the vegetational history of the site (NGR TQ02700 72550). Two profiles through the peat were analysed and the results are described here in some detail. The elm decline, historically associated with the beginnings of the early Neolithic, is not marked by any major deforestation which suggests that the Neolithic culture had little impact in this vicinity. The major clearance of wood seems to have occurred well into the Bronze Age, a pattern noted elsewhere. Following this the local environment has been comparatively stable with minor fluctuations reflecting episodes of more and less intensive management of the floodplains.

Introduction

As a part of a flood defence programme in the Lower Colne valley, the Environment Agency (formerly the National Rivers Authority) commissioned an archaeological evaluation prior to the construction of a new bypass channel intended to alleviate flooding in Staines. Archaeologically, the site lies in an area of high potential, especially for earlier prehistory, with the Staines causewayed enclosure to the west (Robertson-Mackay 1987), Runnymede Bridge Neolithic and Bronze Age sites to the south-west (Needham 1985) and upper Palaeolithic and Bronze Age deposits at Church Lammas to the south-east (Hayman 1991). The evaluation failed to reveal any deposits of direct archaeological significance but did encounter a substantial thickness of peat and alluvium reflecting a complex hydrological sequence (Howell 1995). The bypass channel project in this area comprised embankment works with only superficial ground disturbance and the peat and alluvial deposits survive intact below ground. The opportunity was taken, therefore, to retrieve samples of deposits at the time of the evaluation to provide an assessment of the potential of the sedimentary sequence for reconstructing the vegetation history of the site and inform future researchers who may be interested in a detailed study of the wider palaeoenvironmental potential of this location.

The site lies in the delta formed by the confluence of the river Wraysbury, the river Colne and the Colne Brook, and the Thames. Locally, the sample points were taken from within a triangular shaped parcel of grassland flanked by the Staines by-pass (A30) to the south, Moor Lane and the river Wraysbury to the north, and Staines Moor to the west (TQ 02700 72550). The site lies at *c* 15m OD.

Description of the profiles

Two monoliths (vertical sections of sediments taken from the sides of trenches 7 and 18) were retrieved from Staines Moor, and these are referred to hereafter as Staines Moor 1 (tr 7), a monolith 195cm long and Staines Moor 2 (tr 18), 101cm long (fig 1). The sediments represent the infill of an abandoned river channel, overlain with alluvium.

The freshly collected monoliths were examined to establish the nature and colour of the sediments. Colour was recorded by matching with Munsell soil colour charts.

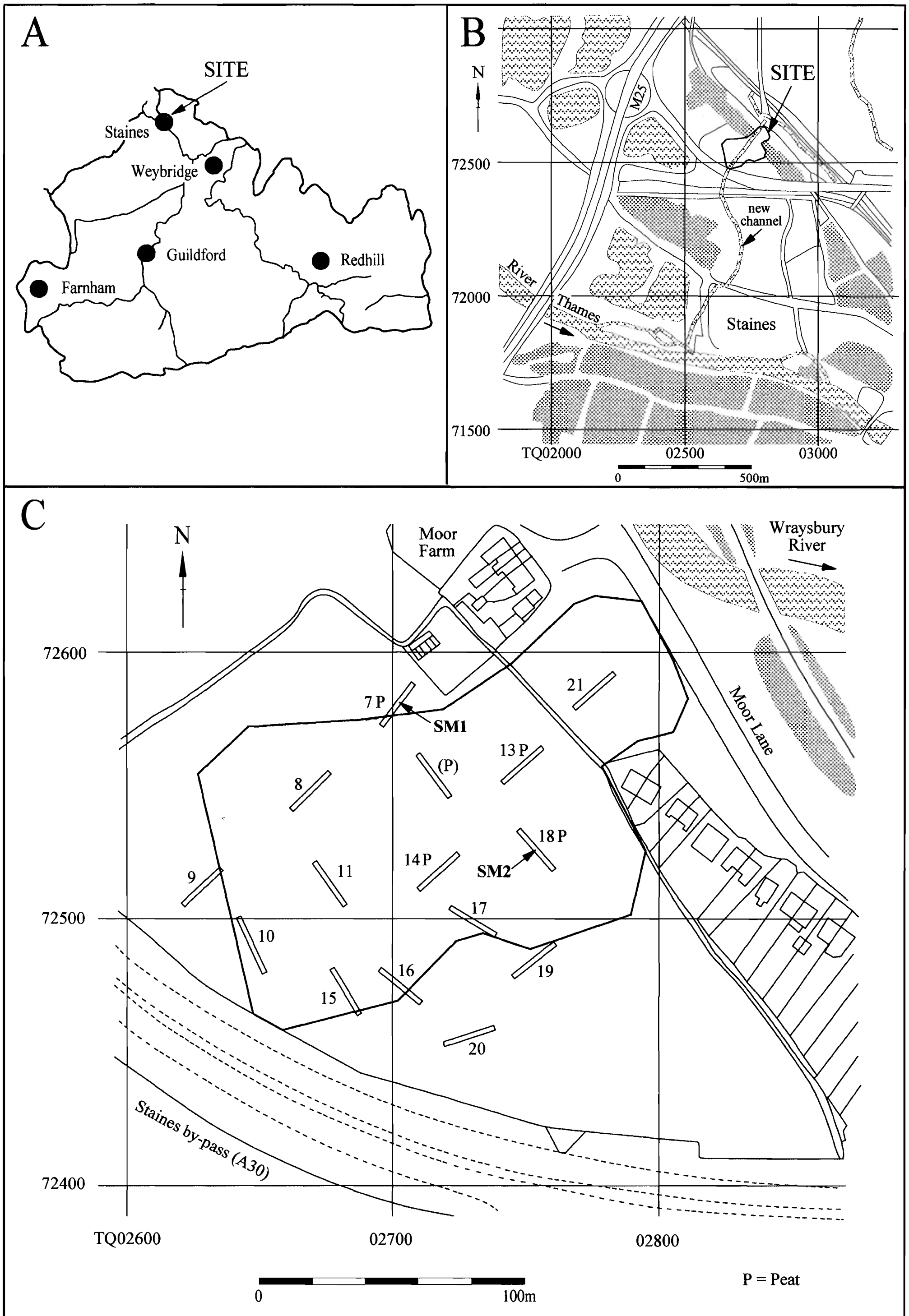

Fig 1 Staines Moor. Location of pollen samples from: A) within the county, B) within Staines and C) in relation to the evaluation trenches. (Reproduced by kind permission of the Ordnance Survey, © Crown copyright NC/00/1028)

STAINES MOOR 1

Depth (cm)	Description of sediment	Colour
0–10	Dark greyish brown alluvium	10 YR 4/2
10–26	Mottled gleyed alluvium with vertical red-brown roots and shells of *Planorbis*	10 YR 4/2 + 10 YR 4/6 to 10 YR 5/2
26–60	Very dark greyish brown alluvium with vertical red-brown root channels and many small shell fragments	10 YR 3/2
60–62	Narrow band of reworked tufa and charcoal with shells of *Limnaea*	
62–79	Black to very dark greyish brown organic mud mixed 50:50 with white tufa blocks	10 YR 2/1 to 10 YR 3/2 + 10 YR 8/2
79–82	Band of white tufa	10 YR 8/2
82–110	Very dark brown peat	10 YR 2/2
110–116	Dark brown peat with large branch of *Pinus*	10 YR 3/3
116–169	Very dark brown peat, *Carex* leaves at 140cm	10 YR 2/2
169–188	Dark brown gyttja, blackening on exposure to air	10 YR 3/3 to 10 YR 2/1
188–195	Dark grey silty clay	10 YR 4/1
195	Gravel base	

STAINES MOOR 2

Depth (cm)	Description of sediment	Colour
0–18	Dark greyish brown alluvium	10 YR 4/2
18–19	Band of white tufa	10 YR 8/2
19–35	Very dark brown silty organic mud	10 YR 2/2
35–45	Black amorphous peat	10 YR 2/1
45–56	Dark greyish brown alluvium	10 YR 4/2
56–69	Very dark greyish brown silty organic mud	10 YR 3/2
69–71	Dark brown sandy silt	10 YR 4/3
71–101	Very dark brown fibrous peat	10 YR 2/2

Geochronology of Staines Moor 1

Radiocarbon dates were obtained from the following levels:

Depth (cm)	Material	Chosen to date	Laboratory code	Uncalibrated date
89–91	Dark brown peat	Peak of *Corylus* before rise of *Alnus*	OXA-6470	8710+70
99–101	Dark brown peat	Decline of *Pinus*, just before peak of *Corylus*	OXA-6471	8460+65
179–181	Dark brown	Peak of Poaceae and herb	OXA-6469	9710+75

Preparation of samples

Samples for pollen analysis were taken at 10cm intervals down the profiles, except where a fracture in the column could have led to contamination, in which case the sample level was moved up or down by not more than 2cm. Each sample was of a vertical thickness of not more than 2cm.

The pollen was extracted by standard techniques involving sodium hydroxide to disperse the sediment, hydrofluoric acid to remove siliceous matter and acetolysis to remove cellulosic materials, as described in West (1968, 361–3).

The pollen was stained with safranin and mounted in glycerine jelly. A minimum of 300 pollen grains + spores was aimed at for the pollen count, but at several levels where the pollen was sparse (notably the lowest three levels in Staines Moor 1) this was not achieved, and only 50 grains were counted at the lowest level (195cm).

Results of pollen analysis (fig 2)

STAINES MOOR 1

Only a pollen diagram from Staines Moor 1 is presented here. Staines Moor 2 was essentially similar but did not include the basal sediments representing the early Flandrian period (post-glacial) up to the time of the rise in *Alnus*. The pollen frequencies of each species are plotted as

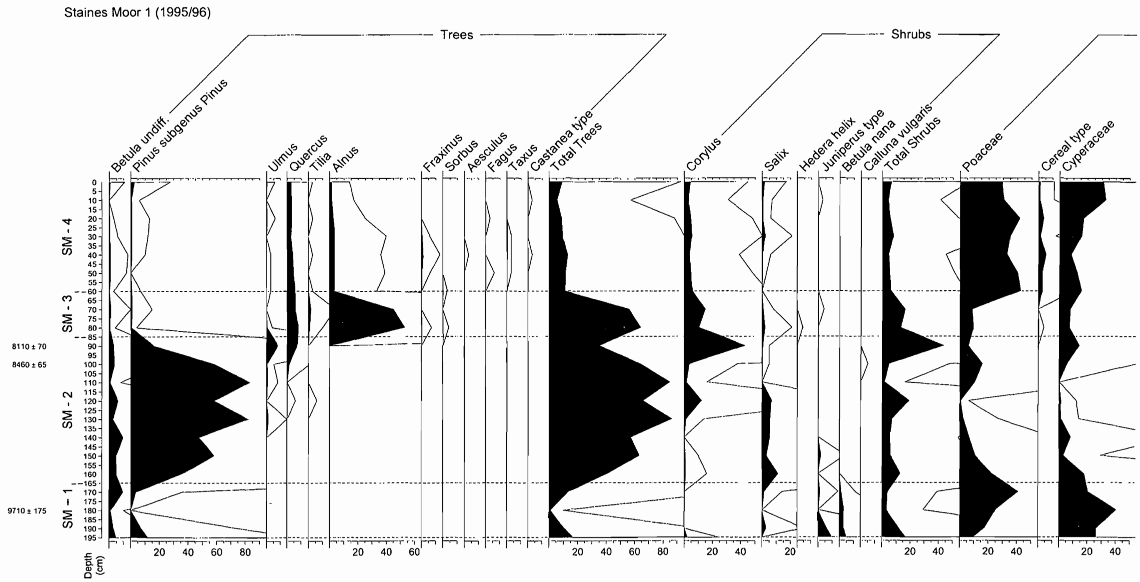

Fig 2 Staines Moor: pollen diagram — trees, shrubs and herbs (continues).

percentages of the total pollen of dry land plants for all the trees, shrubs and terrestrial herbs, as percentages of dry land plants + aquatics for aquatics, and as percentages of dry land plants + spores for spores.

Staines Moor 1 appears to represent a Flandrian sequence, though possibly discontinuous as there is some evidence for a hiatus in deposition. The pollen diagram can be divided into four broad local pollen assemblage zones, SM1 to SM4:

SM1 195–165cm

The base of the profile is probably just before the last 10,000 years (post-glacial). Many shrubs of the late Devensian Lateglacial persist, such as Juniper (*Juniperus communis*) and Dwarf Birch (*Betula nana*) along with typical herbs such as *Centaurea*, *Anthemis* type, *Serratula* type, *Gentiana verna* type, *Thalictrum*, *Sanguisorba*, *Rumex acetosa* type, *Cryptogramma* and *Selaginella*. Following the Lateglacial Interstadial, gravel accumulation occurred in the Thames and its tributaries from about 11,500–10,250BP during the Late Devensian Lateglacial Stadial (Loch Lomond/Younger Dryas Stadial) much as in the Kennet Valley (Collins *et al* 1996). During this phase a tundra-flora existed, as can be seen a the top of the Wasing Sand Bed, Woolhampton, sequence (*ibid*). This flora persisted through the Late Devensian Lateglacial Stadial to the beginning of the Holocene (Flandrian/post-glacial) as at the base of the Midgham Member, Woolhampton, with very little change. The landscape was open with high frequencies of the pollen of grasses (Poaceae) and sedges (Cyperaceae).

A radiocarbon date of 9710 + 75BP (uncalibrated) (OXA-6469) was obtained for the depth 179–81 cm. The peak of herb pollen before the rise of *Betula* and *Pinus* in the Flandrian occurs at 180cm. This date is not inconsistent with the time-scale proposed here.

Locally the river channel was open water and the dark brown gyttja represents a freshwater deposit, with freshwater algae such as *Pediastrum*, *Botryococcus*, *Spirogyra* and *Mougeotia* present up to 180cm. At 180cm and above, *Carex rostrata* nutlets and *Betula* wood and fruits were found. The frequencies of *Betula* pollen are surprisingly low however. The local presence of *Carex rostrata* explains the high Cyperaceae pollen counts in this zone. Peaking just before the Cyperaceae, *Equisetum* spores must represent *Equisetum fluviatile* in the same environment.

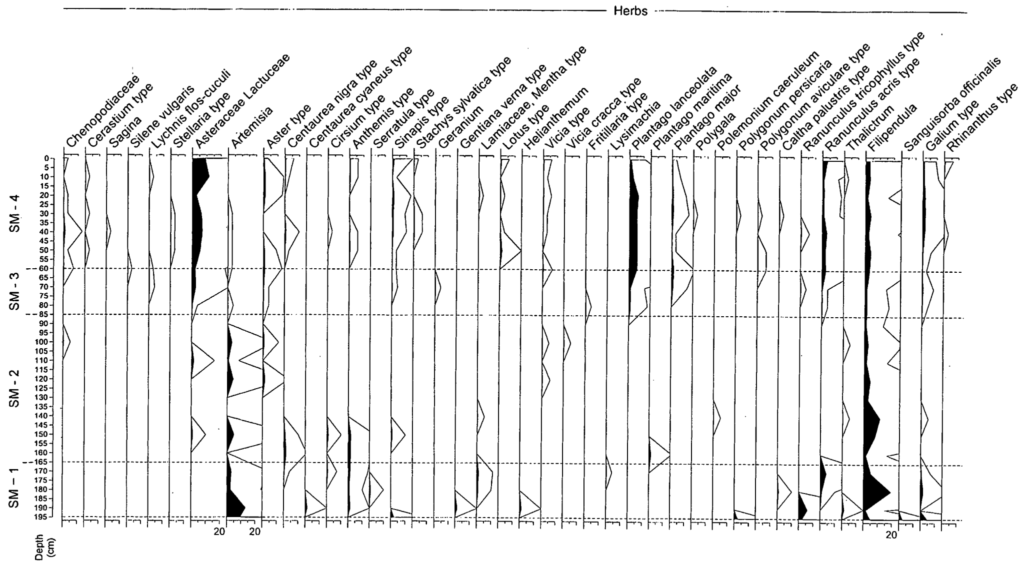

Fig 2 (continued) Staines Moor: pollen diagram — herbs (continues). For radiocarbon dates see part 1 of the diagram.

SM2 165–85cm

Pinus subgenus *Pinus* (presumably *Pinus sylvestris*) pollen dominates this zone in the pollen diagram. *Corylus avellana* pollen levels rise, but until 85cm remain well below the percentages of pine pollen. The herbs generally decline though *Artemisia*, *Aster* type, *Vicia* type, *Thalictrum* and *Filipendula* persist, along with *Thelypteris palustris*, probably largely as fenland species cohabiting with *Salix*, which reaches exceptionally high levels during this zone. Towards the end of the zone, pollen of the mixed oak forest elements, *Ulmus*, *Quercus* and *Tilia* starts. Fern spores are very abundant throughout the zone.

An uncalibrated radiocarbon date of 8460 + 65BP (OXA-6474) was obtained for 99–101cm. This level marks the beginning of the decline in *Pinus* pollen as *Quercus* rises to peak percentages, and is just before the major peak in *Corylus* pollen. Again this date is not inconsistent with the proposed time-scale.

Another radiocarbon date was obtained from 10cm above the last at 89–91 cm (OXA-6470). This produced a somewhat anomalous date of 8710 + 70BP, or, in other words, older than the date 10cm below. It marks the peak of *Corylus*, before *Alnus* expands to a peak at 80cm (Birks 1989). There may be some truncation of the sediments in Staines Moor 1 above this level (see later), but the sample was chosen from a level where contamination with ^{14}C-free carbon (hard water error) was unlikely, so a date closer to 8000BP might be expected. This would be closer to the date when *Alnus* usually increases (*ibid*), not that the date of *Alnus* expansion is necessarily predictable (Bennett & Birks 1990).

Thus regionally, the pollen diagram suggests almost complete tree cover, dominated initially by pine, but this gradually being replaced by the broadleaf trees. Locally a willow carr existed.

SM3 85–60cm

Alnus (*glutinosa*) pollen percentages increase and then decline rapidly at 60cm. *Corylus avellana* and *Tilia* reach their highest percentages in this zone. Although indicators of human disturbance appear (Behre 1986) — cereal type, *Plantago lanceolata*, *Ranunculus* type, *Rumex acetosa* type — herb frequencies generally remain low in this zone, and there is virtually no wood ash in the preparations at 80cm suggesting little forest clearance by fire, but the levels rise dramatically at

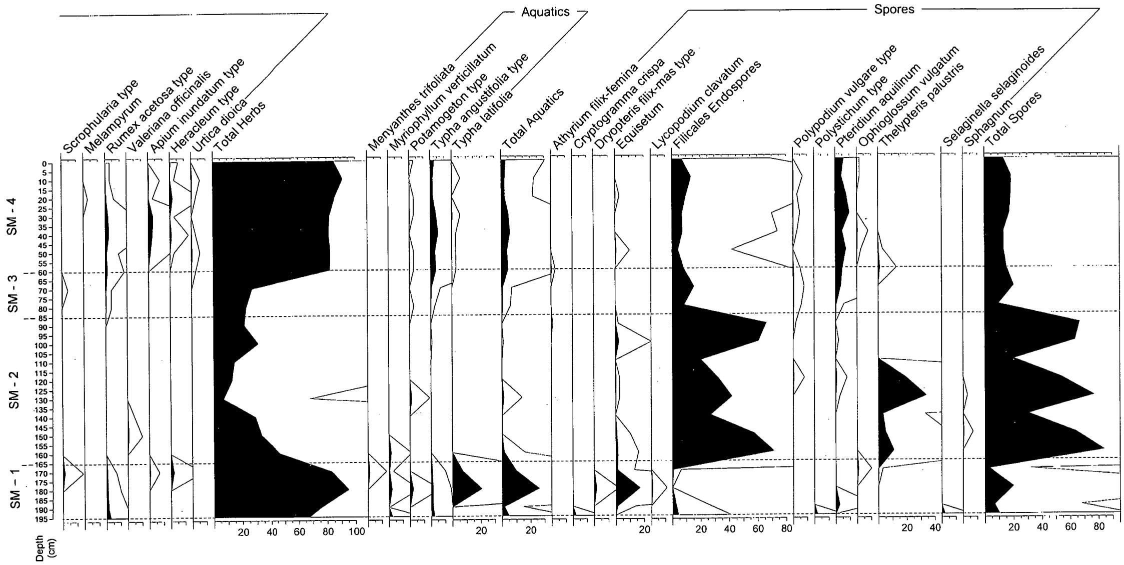

Fig 2 (continued) Staines Moor: pollen diagram — herbs, aquatics and spores. For radiocarbon dates see part 1 of the diagram.

70cm, staying high thereafter. Although it is possible that the microscopic charred particles could represent the result of natural, catastrophic, burning of vegetation, their presence at this level, linked with the pollen of species reflecting anthrogenic clearance, strongly suggests a human influence. Day (1991) concluded that charcoal particles in the Sidlings Copse, Oxfordshire, sequence reflected not so much the burning of the woodland, but subsequent activities. The same could be the case at this site.

Regionally oak–lime woodlands existed with a little clearance for arable and pastoral farming. The indicators of pastoral farming include the species mentioned above as reflecting human disturbance. Locally the sediment is dominated by tufa deposition, suggesting a flooding of the surface and increased algal photosynthesis at high temperatures, conditions which favour tufa formation. Aquatics such as *Potamogeton* and *Typha* reappear, supporting this concept. Beside this re-used channel, alder-willow carr contributed to the local (or more strictly extra-local) pollen. *Thelypteris palustris* eventually colonized the infilling channel at 60cm.

SM4 60–0cm

All the trees decline or remain at low frequencies in this zone. *Corylus* and *Salix* however maintain more constant frequencies, suggesting the survival of some damp woodland in this vicinity.

The main feature of this zone is the expansion of the grasses, cereals, and all the weeds of arable land, pasture and haymeadow. High values of non-cereal grass pollen are more likely to reflect haymeadow than pasture, where flowering stems are commonly eaten off by the grazing animals (Behre 1986). *Centaurea nigra*, *Rhinanthus* and *Heracleum* would indicate tall herb communities, with, in wetter parts, *Caltha palustris* and *Lychnis flos-cuculi*, and all of these peak in this zone, adding support for the local presence of meadow. A major stratigraphic boundary occurs at 60cm, above which the sediment is all alluvial in origin, most probably linked to the destabilization of soils by arable farming followed by erosion by rain storms. Those herbs with particularly high frequencies (Poaceae, Asteraceae, Lactuceae, *Sinapis* type, *Lotus* type, *Vicia* type, *Plantago lanceolata*, *Ranunculus* type, *Rumex acetosa* type, and the umbellifers (*Apium nodosum* type and *Heracleum* type) probably represent components of local haymeadows. Channels in the meadows would have held *Caltha* and nearby deeper channels held *Potamogeton* and *Typha*. Some of the species typically associated with flood meadows at the present day are found such as *Ophioglossum vulgatum*, *Centaurea nigra* type, *Rhinanthus* type suggesting the dual usage (spring grazing, summer hay) associated with management of flood meadows (Rodwell *et al* 1992). These species are typical of flood meadows (Duffey *et al* 1974) and correspond to National Vegetation Classification type MG5 (Rodwell *et al* 1992) — 'the typical grassland of grazed haymeadows treated in the traditional fashion on circumneutral brown soils throughout the lowlands of Britain'.

Regionally, arable land (cereals, Chenopodiaceae, etc) rough grazing/heath (*Pteridium aquilinum*) and pasture (many of the same plants as in the local vegetation) seem to have dominated — woodland was scarce, except that there is evidence of some *Quercus*/*Corylus* woods at some distance from the site.

STAINES MOOR 2

This sequence corresponds only with the upper horizons (SM3 and SM4) of the Staines Moor 1 profile, but had a higher rate of sediment accumulation and therefore occupies a greater vertical extent, meaning that there is a somewhat finer degree of resolution of the changes in the earlier part of SM3 when sampled at a similar 10cm interval.

SM3 100–55cm

Alnus dominates, with high *Corylus* and *Tilia*, as in Staines Moor 1. The elm decline is at 80cm, also as in Staines Moor 1, and above this level the two profiles are very similar.

The main difference between Staines Moor 2 and Staines Moor 1 lies in the part of the profile before the elm decline. Staines Moor 2 has consistently lower frequencies of *Alnus* and higher *Corylus* and it appears that the whole sequence from 100–70cm in Staines Moor 2 occupies the equivalent of the space between 90 and 80cm in Staines Moor 1.

It is interesting that there is no tufa deposition at this stage in Staines Moor 2, suggesting it was not flooded to the same extent as Staines Moor 1. It is also possible that when water flowed again in the Staines Moor 1 channel, it truncated the sediments to a certain extent, and this is why this phase is better represented in Staines Moor 2. Siltation starts at 71cm in Staines Moor 2 at the time that tufa deposition was occurring in Staines Moor 1.

SM4 55–0cm

There are no significant differences between this pollen assemblage zone in Staines Moor 2 and Staines Moor 1, except that *Quercus*, *Corylus* and *Alnus* frequencies are consistently slightly higher, suggesting that Staines Moor 2 may have been a little closer to a surviving fragment of woodland. As these differences persist to the present day the location of the monoliths in relation to the nearest woodland can be checked.

There is also rather more *Typha angustifolia* type pollen in Staines Moor 2, implying closer proximity to a river channel.

Discussion

Abandoned river channel sediments sealed by alluviation represent some of the best sites available for long pollen sequences in south-east England (Scaife & Burrin 1992). Similar deposits have been located at Thames Valley Park, Reading (Keith-Lucas 1997) and at Dorney Reach and Cippenham (Keith-Lucas unpublished) in relation to the Thames Flood Relief Scheme as well as comparable sites on the tributaries of the Thames such as the rivers Pang and Kennet. These, being essentially small basins, reveal as much about local conditions as about the wider landscape.

The Staines Moor pollen diagrams give a valuable insight into the history of the vegetation which has today been much modified by human influence.

The basal pollen zone (SM1) reflects the last part of the Devensian late-glacial and the early Flandrian — or pre-Boreal in Blytt and Sernander terminology (Godwin zones III and IV). It reveals a rich tundra flora in the late-glacial and comparatively little *Betula* in the pre-Boreal. In this respect it is very similar to the pollen diagram of the Dorney Reach sediments which the author has prepared recently.

The high frequencies of *Pinus* pollen relative to *Corylus* in SM2 are typical of south-east England during the early Boreal. Perhaps more striking is the persistence of many of the herbs of open habitats after the expansion of pine. Although some are waterside species, others, such as *Artemisia*, are more typical of unstable habitats. These probably persisted on the floodplain gravels which were not buried under alluvium until considerably later.

At the time of the Boreal-Atlantic transition at 85cm, there was a closed woodland with abundant elm and lime (SM3). The Elm Decline of the early Neolithic is not marked by any major deforestation, and one is forced to conclude that the Neolithic culture had comparatively little impact in this vicinity. That the elm decline was not a direct consequence of woodland clearance but more likely represented a epidemic such as of Dutch Elm disease, is now generally accepted, so deforestation at this level would not necessarily be expected (Perry & Moore 1987). By the time that major clearance of woodland occurs at 60cm (SM4) we are probably well into the Bronze Age. At Runnymede Bridge, Greig (1991) also noted that the major drop in tree pollen occurred between the middle Neolithic and the late Bronze Age, though exactly when was uncertain. From this time on the local environment has been comparatively stable — there are minor fluctuations in amounts of *Salix* pollen alternating with *Aster* type, for example, indicating cycles of more and less intensive management of the floodplains. *Salix* scrub would tend to increase at times of relaxation of cutting and grazing. High amounts of *Aster*-type pollen, along with other herbs, would indicate a shorter turf, and hence probably more intensive cutting and grazing. Finer resolution pollen analysis combined with dating of the sediments would be necessary to establish the duration and causes of these changes, as was done on the very similar alluvium at Runnymede (Greig 1991).

The good correlation of the pollen with the lithostratigraphy, as found in the Ouse Valley in Sussex (Scaife & Burrin 1983), suggests that this site is undisturbed, apart from the possible hiatus in deposition or even a truncation of the sediments between 90 and 80cm in Staines Moor 1. This is at the Mesolithic/Neolithic boundary, exactly where Scaife and Burrin (1983) also noted a hiatus in deposition. The significance of this hiatus is that very little deposition, or possibly even some erosion, occurred at a time when the tree cover was maximal (so soil erosion minimal), that is particularly when *Alnus* dominated the floodplain, and flow rates in rivers were increasing as a result of climatic changes in the early Atlantic period.

ACKNOWLEDGEMENTS

We are extremely grateful to Andy Pepper of the Environment Agency for the grant aid provided to cover the cost of the ^{14}C determinations. Thanks also go the students of the Reading University botany class for their help with the identifications.

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