Landscape Evolution in the Middle Thames Valley
Heathrow Terminal 5 Excavations Volume 2

Pollen

(Section 16)

by Sylvia Peglar, Denise Druce and Elizabeth Huckerby

SECTION 16

POLLEN ANALYSES

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Introduction

More than 70 monoliths (samples) were assessed by Elizabeth Huckerby, Denise Druce, Sylvia Peglar and Pat Wiltshire for their suitability and potential for full pollen analysis, to provide an understanding of the environmental, vegetational, and land-use changes which have occurred on the Heathrow site. Unfortunately, many samples proved unsuitable, having poor pollen preservation and/or very sparse pollen. Finally, 23 samples from 18 archaeological features were selected for full analysis. They were chosen to cover, as far as possible, all temporal periods represented archaeologically from the Neolithic to post-Medieval times, and with as broad a spatial spread across the site as feasible. As it was only possible to make full analyses from one Neolithic feature a second Neolithic feature was assessed to provide as much evidence as possible of the vegetation and human impact on the site during Neolithic times. As well as these samples, analyses have been made on 2 samples from a palaeochannel crossing the western side of the site to provide a background to the land-use changes on the site, and extend the temporal representation back to Mesolithic times. A further sample has been analysed from a pit, thought to have been used for retting hemp in the post-Medieval period, which had been dug into the palaeochannel. These samples are listed in Table 1 below.

Sample no.	Feature no.	Feature description	Feature date	Area	Figure
17094	527200	Pit	Neolithic	49	1
29129 #	836047	Pit	E/M Neolithic	P2A2	Tab2
17010	527069	Pit	E/M Bronze Age	49	2
16512/16511*	557034/557027	Pits	M Bronze Age recut of a previous MBA pit	49	3, 4
16048	510047	Waterhole	M Bronze Age	77	5
27315	708014	Waterhole	M Bronze Age	91	6
29054/29055 *	815041	Waterhole	M Bronze Age	P2A4	7
29133	823181	Waterhole	MBronze Age	P2A5	8
17146/17133 *	611100/611107	Waterhole	M or L Bronze Age	61	9,10
27091	685032	Waterhole	M or L Bronze Age	91	11
18145	509174	Waterhole	L Bronze Age	100	12
18363/18364*	593207	Well	L Iron Age	61	13,14
24004	649010	Waterhole	L Iron Age/ E Romano-British	61	15
18236	527374	Waterhole	E-M Romano-British	61	16
18269	527388	Waterhole	M Romano-British	61	17
17518	529139	Waterhole	Medieval	49	18
18154		Palaeochannel	Mesolithic - Medieval	17	19
19019		Palaeochannel	Mesolithic - Medieval	20	20
18426	546437	Retting pit?	Post – Medieval	17	21

Table 1. Monoliths chosen for full pollen analysis. (# assessed only,* overlapping monoliths)

There are many problems in interpreting pollen data, including the different amounts of pollen produced by any one taxon, vast amounts being produced by wind-pollinated plants such as most trees, and small amounts by those plants, mainly herbs, which are pollinated by insects. The amount of pollen produced by one taxon may vary depending on its location: for example, whether it is growing in an open or closed (e.g. woodland) situation.Some plants are very rarely preserved as their pollen may be very fragile, for example, the rushes (*Juncus* species). Also many plants produce pollen that is not distinctive and cannot be easily separated from other species of the same genus, or even family (e.g. the grasses (Poaceae).Thus within one taxon, plants occurring in several different habitats may be represented and are indistinguishable.

Problems in interpretation are found especially in pollen data from archaeological contexts and palaeochannels where there is a limited choice of samples as good pollen preservation is limited. Only under conditions from which oxygen has been excluded,

i.e. anaerobic conditions, will pollen and spores be well preserved. Most archaeological samples are obtained from sediment within pits and waterholes, which have often had variable water depths, have often dried out, or consist of dry material dumped into these features. This means that the pollen assemblage identified will often be distorted by differential pollen preservation, which means those pollen types with distinctive and robust identification characteristics are identifiable, whilst those grains which are more fragile and less distinctive are effectively 'lost'. This will result in a skewed data set, and must be taken into account when interpreting the results obtained. It is important that unidentifiable grains are quantified so that the state of pollen preservation is known and allowed for in interpretations. In addition, the contexts from which pollen may be identified may have entered into the features being examined in different ways: the sediments may be naturally laid down *in situ*, or have been brought in from further away via flowing water, or may have been dumped into the feature, and may include, for example, waste from cereal processing, other 'industrial' waste, general domestic waste, faecal material which may include pollen derived from non-local foods, or pollen brought in with dumped bedding. There may also be 'reworked' pollen from older sediments which may have become incorporated into the contexts.

In archaeological contexts, there are often hiatuses or temporal gaps in sedimentation which may be difficult to identify, so that sediments representing short or long periods of time may be absent. However, with experience and care, and with other evidence from other analyses such as macrofossils, insects, soil micromorphology, fungal spores and algae remains, attempts may be made to interpret the sediments and the pollen data obtained from them, and to provide some indications of the vegetation and land-use around the site during specific phases of use and habitation.

Methods

As three different palynologists were analysing the material from T5, it was felt necessary to set up protocols for preparation, analysis, and reporting of the different samples, to provide quality control and allow all results to be directly comparable.

Pollen preparation

All samples were prepared for pollen analysis using a standard chemical procedure (method B of Berglund & Ralska – Jasiewiczowa (1986), using HCl, NaOH, sieving, HF, and Erdtman's acetolysis, to remove carbonates, humic acids, particles > 170 microns, silicates, and cellulose, respectively. The samples were then stained with safranin, dehydrated in tertiary butyl alcohol, and the residues mounted in 2000 cs silicone oil. Slides were examined at a magnification of 400x (1000x for critical examination) by equally-spaced traverses across at least two slides to reduce the possible effects of differential dispersal on the slide (Brooks & Thomas 1967). The aim was to obtain a pollen count of at least 500 land pollen and spores, but a time limit of seven hours was set for each level counted, and a count of 300 was more realistic in many samples. Tablets with a known concentration of *Lycopodium* spores (Stockmarr 1971) were added to a known volume of sediment at the beginning of the preparation so that pollen concentrations could be calculated. Pollen identification was made using the keys of Moore *et al*. (1991), Faegri & Iversen (1989), and small modern pollen reference collections held by Oxford Archaeology North and Sylvia Peglar. Andersen (1979) was followed for identification of cereal-type grains. Indeterminable grains were also recorded as an indication of the state of the pollen preservation. Plant nomenclature follows Stace, 1997.

Calculations and presentation of results

Calculations were made and pollen diagrams drawn using the spreadsheet TILIA and TILIA.GRAPH in TILIA.View 2.0.2 (Grimm 1990). The results are presented as pollen diagrams of pollen and spore taxa as percentages of the total land pollen sum, SumP (trees + shrubs + cultivated plants + herbs + ferns & fern allies). Obligate aquatics, indeterminable and unknown grains and fern and fern allies spores, other spores, and microcharcoal particles > 5 microns are presented as percentages of the SumP + the sum of the particular category. All percentages < 1% are shown as +. The contexts sampled are given on the righthandside of each diagram.

A short description of the results of the analyses of the samples are given below in temporal order, and interpreted, as far as possible, in terms of the local vegetation and land-use, and any changes in these, over the time periods they represent.

Results and interpretation

Neolithic

Two samples <17094> and <29129> were identified as having the potential for full pollen analytical studies.. However, only very low counts were obtained from sample <29129> due to poor preservation and sparsity of pollen.

Sample <17094> , Area 49, feature 527200, a Neolithic pit truncated by the eastern cursus ditch of the Stanwell Cursus (Figure 1)

This monolith was taken through the fills of a Neolithic pit truncated by the Stanwell cursus ditch. It contains early Neolithic pottery and it should therefore provide a glimpse of the landscape of the site during the early Neolithic period before the Stanwell C1 cursus was constructed. A few odd grains of obligate aquatics were found (duckweed (*Lemna*)), and pondweed (*Potamogeton*)), showing that there was standing water in the pit during the time of fill. An interesting find is a spore of hornwort (*Anthoceros*), a liverwort-like taxon found growing on damp soils probably around the edge of the pit. There is no evidence of faecal material within the sediments suggesting that this pit may have been used for the disposal of domestic debris.

Eight sub-samples were analysed from this sample, 5 from the lowest context (527206), and 3 from the overlying context (527191) . The pollen grains and spores from this sample were poorly preserved, with indeterminable pollen values mostly over 25%, and the results may therefore be skewed to some extent.. Taxa remaining identifiable even when badly preserved (including alder (*Alnus*), lime (*Tilia*), grasses (Poaceae), composites (*Anthemis*-type, *Aster*-type, *Taraxacum*-type), ferns (Pteropsida (monolete), etc.) may possibly be over-represented in the pollen assemblages, which may indicate differential preservation. Pollen concentrations are low, suggesting quite rapid accumulation of the sediments particularly those of the lowest context (527206). This context also contained a number of fungal spores including those of *Glomus*, a taxon found in soils and may thus be evidence of the inclusion of reworked sediment. The presence of fungal spores, the poor preservation of grains which may indicate they have been subjected to aerobic conditions, and the

rapid accumulation rate, suggest that this fill was perhaps 'dumped' into the pit. The problems of taphonomy of the pollen record of such deposits are discussed above.

The diagram shows that at the time the contexts were being deposited or dumped, the area around the sample site was very open, with herbs dominating the pollen percentages. Some woodland was still extant in the area on the drier ground. This woodland contained very little elm (*Ulmus*), suggesting that the sample is post 'Elm decline' (dated to *c.*3700 BC). However, the woodland was made up of deciduous tree and shrub taxa, of oak (*Quercus*), hazel (*Corylus*) and in particular lime (*Tilia*). Lime trees, even though insect pollinated, produce quite large amounts of pollen, which is heavy and falls close to the trees that produced it instead of being whisked up into the air. Lime is thus under-represented in the 'pollen rain'. Therefore, although lime percentages appear low in this fill, the tree probably formed a large component of the woodland on drier ground nearby. The so-called '*Tilia* decline', associated with anthropogenic forest clearance, occurred at different times at different sites, but has been shown to occur about 3000-3700 years BP in this area (West Heath Spa, Hampstead Heath (Greig, 1991), Tilbury (Devoy, 1979).This suggests that the fills were laid down between *c*. 5000 and 3000 yrs BP and that they therefore confirm a Neolithic age for these contexts. Alder and willow (*Salix*) were probably growing on wetter ground. Although a few grains of pine (*Pinus*) were found, it is unlikely that pine, other than the odd tree, was growing in the vicinity as pines produce copious amounts of pollen and would have much larger percentages if locally present. It was probably growing on the sandier soils north of the area . There is some slight evidence for an increase in trees and shrubs towards the top of the sequence, with other shrub taxa characteristic of somewhat open woodland or scrub, including holly (*Ilex*), buckthorn (*Rhamnus cathartica*) and guelder rose (*Viburnum opulus*), appearing. This could imply increased grazing within the woodland, opening the woodland further, so that taxa characteristic of woodland glades and edges, such as holly, buckthorn and guelder rose, either increased or flowered more profusely. The decrease in fern spores and increase in bracken (*Pteridium aquilinum*) seen at the same time could support this hypothesis. A few grains of dwarf ericaceous shrubs (heather and heaths -*Calluna* and undifferentiated Ericales) also appear towards the top of the diagram but were probably not growing close to the site but on sandier soils to the north.

The herbaceous taxa are dominated by grasses and many taxa associated with arable fields and pastures. Quite high percentages of cereal pollen types including the oats and/or wheat taxon (*Avena/Triticum*) suggest that cereals were being grown very close to the site as these grains are large and do not travel far, although some grains may have been incorporated into the pit as waste cereal processing material (Robinson & Hubbard, 1977). Taxa characteristic of arable fields include many members of the Asteraceaefor example dandelions, brassicas (Brassicaceae), chickweeds (Caryophyllaceae undiff. , *Cerastium*-type), black bindweed (*Fallopia convolvulus*) and knotgrass (*Polygonum aviculare*-type). However, many of these taxa are also characteristic of ruderal communities, disturbed ground and footpaths. Other taxa may be associated with pastures and meadows such as grasses, ribwort plantain (*Plantago lanceolata*), greater and hoary plantains (*Plantago major/. media*), clover (*Trifolium*-type), buttercups (*Ranunculus*-type), sedges (Cyperaceae), cow parsley family (Apiaceae), composites (daisy-type, dandelion-type, thistles (*Cirsium/Carduus*)), yellow rattle-type (*Rhinanthus*-type), bedstraws (Rubiaceae), sorrels (*Rumex acetosa*-type) and selfheal-type (*Prunella*-type). Monolete fern spores are quite abundant, particularly in the lower part of the diagram, which may be due in part to differential preservation as fern spores are very resistant and are recognisable even when pollen is badly preserved. Nevertheless there must have been quite a number of ferns growing quite close by, perhaps around the pit and also in the woodland which may have been quite open and subjected to grazing.

All subsamples from this feature contained many micro-charcoal particles, and the material sieved off during pollen preparation also contained larger pieces of charcoal, which is more conclusive evidence of local fires. The sievings also contained several rush (*Juncus)* seeds, particularly from levels 0.79 and 0.81 m (context (527191). Pollen of rushes are very rarely preserved, and these seeds show that rushes were growing in and around the site at this time, suggesting that the pit was perhaps no longer in use and that context (527191) represents a natural infilling of the pit. The higher pollen concentrations in this context, suggesting a lower sedimentation rate, are perhaps further proof of this.

Sample <29129>, Area TEC05 (Area P2A2), feature 836047, an Early/Middle Neolithic pit/waterhole (Table 2)

The sample number in this instance represents a series of incremental samples taken at 0.04 m intervals directly from the secondary fill of an Early/Middle Neolithic pit on the eastern side of the site. It was not possible to make full pollen analyses from this sample, but a table (Table 2) of the low counts obtained from the sample is given to add as much information as possible to the Neolithic interpretation.

Only a couple of obligate aquatic grains, (duckweed) were found from 1 subsample (0.24 m) suggesting standing water in the pit at this time. Other grains and spores show that the area was quite open during the time of infilling with over 50% herbaceous pollen. The pollen taxa are characteristic of grassland/pasture growing locally with some (open?) woodland or scrub growing within the area. There is no evidence of cereal growth or of any characteristic herbaceous taxa associated with arable fields, but this is a very restricted analysis and their absence may not be a true reflection of the environment at that time.

Depth (cm)	**4**	**8**	**12**	**16**	**20**	**24**	**28**	**32**
Trees & Shrubs								
Alnus glutinosa			1		2	5	2	1
Betula						1		
Corylus avellana		1	1	1	2	1	2	2
Quercus	1							
Tilia					1		1	
Rosaceae undiff.					1			
Calluna vulgaris						1		
Total	**1**	**1**	**2**	**1**	**6**	**8**	**5**	**3**
Herbs								
Poaceae undiff.	3	5	4	5	6	5	6	9
Cyperaceae					1			
Aster-type		1				1		
Taraxacum-type	3		1			1		
Caryophyllaceae								1
Chenopodiaceae	1							
Filipendula			1			1		
Potentilla-type					1			
Plantago lanceolata	2				1	2		1
Ranunculus			2		2	7	2	
Total	**9**	**6**	**8**	**5**	**11**	**17**	**8**	**11**
Ferns & fern allies								
Pteropsida undiff. (monolete)		2	2		1	3		1
Polypodium vulgare						1		
Pteridium aquilinum						1		
Total		**2**	**2**		**1**	**5**		**1**
Total land pollen & spores	**10**	**9**	**12**	**6**	**17**	**30**	**13**	**15**
Aquatics								
Lemna						**2**		
Total						**2**		
Indeterminable pollen & spores	**5**	**4**	**4**	**4**	**8**	**12**	**4**	**12**

Table 2: Pollen assessment of series 29129 of feature 836047: an Early/Middle Neolithic pit

Early /Middle Bronze Age

Sample <17010>, Area 49, feature 527069, an Early/Middle Bronze Age pit (Figure 2)

Five sub-samples were analysed from this sample: one from context (527076), three from context (527085), and one from context (527071). The pollen from this sample was well preserved (with low indeterminable pollen values) but very sparse due to the matrix in which it was contained having very large amounts of charcoal and wood. Microcharcoal was not counted from this sample as it was so abundant in all five levels. Pollen concentration is quite high in context (527071), lower in 'peaty' context (527085), and low in context (527076). This suggests not very rapid accumulation in context (527071), more rapid accumulation in (527085) and high accumulation above. The pollen assemblages show that the area was very open at the time of infilling, with very little woodland in the area and with no lime (except a couple of grains in the basal sample). The pollen analyses suggest that open grassland prevailed with some arable agriculture close by. Cereal pollen values are quite high and include wheat (some of which was spelt and/or emmer), possible oats, barley, but no rye (*Secale*). Many weeds associated with arable fields are also present including: probable parsley-piert (*Aphanes*), various composites, goosefoots (Chenopodiaceae), chickweeds (*Cerastium*-type), members of the cabbage family (Brassicaceae), black bindweed, knotgrass, redshank *(Persicaria maculosa*-type)**,** St John's wort (*Hypericum perforatum*-type), prickly poppy (*Papaver argemone*-type), black nightshade (*Solanum nigrum*-type), and nettle (*Urtica*). Many of these taxa are also characteristic of ruderal and footpath communities. Nettle, black nightshade and goosefoots are characteristic of nitrogen or phosphate-enriched soils and are probably indicative of grazing animals. Many of the herbaceous taxa present are associated with pastures; these included grasses, composites (including daisy-type, dandelion-type), bird's-foot trefoil (*Lotus*-type**),** ribwort plantain, greater and hoary plantains, cinquefoil (*Potentilla*-type), selfheal-type, buttercups, sorrels, and speedwells (*Veronica*-type). Several taxa are also characteristic of damp/wet grasslandsuch as: sedges, ragged robin (*Lychnis flos-cuculi*), meadowsweet (*Filipendula*) and loosestrife (*Lysimachia vulgaris*-type). Fern spores are sparse, but bracken spores (and also dandelion-type pollen) increase upwards in the sequence, perhaps representing increased grazing pressure.

Middle Bronze Age

Seven samples were analysed from Middle Bronze Age (MBA) features: two from area 49, one from area 77, one from area 91, and three from TEC05 (areas P2 A4 and A5). It was hoped that some spatial interpretation could be gained from these analyses to differentiate what was happening in the different areas across the site during this period.

Samples <16512> and <16511>, Area 49, features 557034 and 557027, Middle Bronze Age pits. (Figures 3 & 4)

Samples <16511> and <16512> are overlapping monoliths taken from a MBA pit, feature 557034, which is a recut of a previous MBA pit 557027 in Area 49. This is an area containing settlement dated to the MBA. Sample <16511>, taken through the pit recut, contains 4 contexts from 557034 going down into 1 context from 557027. Sample 16512 was taken through 2 contexts from the original pit 557027. The pollen results from these features are discussed in sedimentary/chronological order ie from the base of MBA pit 557027 upwards through MBA pit, feature 557034, a recut of the first pit.

Sample <16512>

Context (557029) (Figure 3)

This, the lowest context sampled in the original pit, is, according to the Framework Archaeology Freeviewer, a black peaty layer. Pollen of the obligate aquatics duckweed and pondweed, and water plantain (*Alisma*-type) which grows at the edge of water, show that the pit was water-filled at the time of deposition.

The pollen from this context was well preserved with very low indeterminable values, probably due to the sediments being waterlain under anaerobic conditions. Assemblages from the context are dominated by herbaceous pollen, particularly grasses and ribwort plantain, together with many other taxa characteristic of damp meadows and pastures, including sedges, buttercups, sorrels, dandelion-type, and cow parsley family. There is also evidence for some arable cultivation nearby, with the pollen of various cereals, including oats/wheat, barley-type, and other undifferentiated cereals (Cerealia-type undiff.), and a single grain of flax (*Linum usitattisimum*

(included in *L. bienne*-type). Alternatively this may represent the dumping of crop processing waste in the pit. The macroscopic plant remains corroborate the latter interpretation and Carruthers (*CD Section 14*) has suggested that possible waste fodder was deposited in the pit, since barley rachis fragments were more common than wheat chaff fragments, barley being used as animal fodder rather than for human consumption. Tetlow (*CD Section 17*) has also analysed material from context (557027) and found indicators for the surrounding vegetation being disturbed ground and damp pasture, with the occurrence of insect taxa living on dead nettle (*Lamium*), hemp nettle (*Galeopsis*), buttercups and cuckoo flower (*Cardamine*). Pollen of taxa associated with arable fields are also present: e.g. mugwort (*Artemisia*), *Anthemis*-type (chamomile-type) which also includes mayweed (*Matricaria/Tripleurospermum*), dandelion-type (*Taraxacum*-type also including sow thistle (*Sonchus*)), nettles, goosefoots and oraches (Chenopodiaceae, *Chenopodium/Atriplex*) and members of the knotweed family (Polygonaceae) including knotweed, black bindweed, and redshank. However, many of these taxa may also be associated with trackways and open ground, as found around habitations. The very small amounts of pollen of trees and shrubs present are mainly of taxa that may be associated with hedgerows or scrub (as were the seeds found by Carruthers) such as rosaceous taxa (Rosaceae undiff.), cherries/sloe (*Prunus*-type), brambles (*Rubus fruticosus*-type), elder (*Sambucus nigra*-type) and willow. Alder and willow are also trees of damp places and their pollen may have originated from the banks of a stream (now a palaeochannel) which crossed the area and those of the river Colne which flows to the west.

The microcharcoal in this context, which was abundant and therefore uncounted, possibly provides evidence of local fires and the dumping of domestic waste.

Context (557039)

It is suggested in the stratigraphic description of the waterhole that this context is a deliberate backfill of pit 557027. Several grains of obligate aquatics were found, suggesting that the pit contained standing water at the time of deposition. The pollen assemblages are very similar to those of context (557029). Tree and shrub pollen is slightly higher, but this is mainly due to an increase in elder which is often associated with nitrogen or phosphate-enriched waste or rough ground. Values of other herb pollen types characteristic of open rough ground (such as dandelion-type, goosefoots

and buttercups) are also slightly higher, possibly suggesting a slight increase in waste, rough ground. There is some evidence for hedges and/or scrub, howevergrasses and ribwort plantain, characteristic of meadows and pastures, still dominate the assemblages. There is, however, still evidence for the growth of cereals, and one grain of hemp/hops (*Cannabis/Humulus*) was found. Unfortunately the grain was not well enough preserved to be able to distinguish between hemp and hops, and as only a single grain was found it is unlikely that this represents hemp being grown as a crop; rather it is much more likely to be from hops, a native plant of hedgerows and scrub.

Several eggs of the parasitic intestinal nematode *Trichuris* were found in the subsample taken at 0.14m. These suggest that faeces of either animals or humans were incorporated into the sediments at the time of deposition. The presence of a few grains of obligate aquatics suggest that the pit still contained standing water and had been left open long enough for aquatic taxa to colonise the pit. The faecal material may therefore have been dumped into the pit, or may have become incorporated naturally as the pit functioned as a a waterhole for animals.

Sample <16511> (Figure 4)

Microcharcoal particles were abundant throughout this sample and were not quantified. Pollen concentrations were also very high increasing upwards indicating a slowing sedimentation rate. Evidence of standing water in the pit at this time is indicated by the presence of several obligate aquatic taxa.

Context (557039)

The basal two subsamples from this monolith are from the same context as that from the top section of sample <16512> (see above), and the pollen assemblages are very similar, being characteristic of a pastoral landscape with some crop growth, hedgerows, and open waste ground.

Context (557031)

The pollen assemblages from this context, the basal backfill of the recut pit 557034, possibly represents the use of pit as a refuse receptacle for local settlements. It is, again, dominated by taxa associated with pastures. However, values of cereals are slightly higher, with an increased number of weed taxa. Although these values are low, cereals produce small quantities of large, heavy pollen which are not dispersed very far compared with other taxa. Hence a small increase could represent quite a big

increase in cultivation, or maybe represent waste material from cereal processing which was added to the pit. There are also records of leguminous plants (Fabaceae undiff.), vetches/peas (*Vicia/Lathyrus*) in this fill, which may represent crops although there is no evidence of cultivated peas or beans. A few spores of the fungus *Glomus* occur in the sediments from this fill, evidence of soils being incorporated into the sediments.

Context (557033)

This context has been interpreted as being a natural infilling of the recut pit with sediments being derived from the surrounding ground surfaces and the sides of the pit. Obligate aquatic taxa present suggest the pit was waterfilled during the period of infilling. However, pollen was uncountable above 0.24m and from context (557035), suggesting that the pit was dry during this period of infilling.

The pollen assemblages are similar to those of the preceding context but with some reduction in ribwort plantain and other taxa characteristic of pastures together with a concomitant small increase in taxa of open waste/rough ground (including dandelion-type) and trees and shrubs. An increase in bracken may suggest a decrease in grazing pressure.

Context (557032)

There is a gap in the subsamples analysed between contexts (557033) and (557032) and thus an unrepresented period of time. The sediments of context (557032) include lots of burnt flint, possibly some worked flint, and some MBA pottery. The context is interpreted as a backfill of household debris. The occurrence of obligate aquatic pollens suggest that the pit was still waterfilled at this time.

The pollen assemblages from context (557032) are dominated by dandelion-type, characteristic of open, waste land, trackways and ruderal communities. Evidence of pastures (including grasses, ribwort plantain, buttercups and sorrel) and crops is less than in previous contexts and the biodiversity has decreased. This suggests that although some pasture and arable fields were still in the area, they may have been further away or fewer than in the time of previous contexts. Higher spore values of ferns and bracken may be further evidence of increased dereliction. However, the changes in the pollen assemblages may be attributed tothe fill probably representing

household detritus coming from open, waste ground around habitations, this may account for the change in pollen assemblages.

The two samples <16511> and <16512> suggest that at the time of sedimentation or deposition/dumping the landscape was very open with very few trees and dominated by pastures and grassland, with some growth of cereals and possibly other crops, some hedgerows, and much open and waste ground and trackways.

Sample <16048>, Area 77, feature 510047, a Middle Bronze Age waterhole (Figure 5)

This Middle Bronze Age sample is located in Area 77, on the eastern side of the excavated area. The monolith was taken through a single natural context (562038) from the slow silting-up of a waterhole, feature 510047. The deposits are thus wind and waterlain. Only a few grains of obligate aquatic taxa (duckweed, pondweed and probably horned pondweed (cf.*Zannichellia*)) were found, suggesting that the waterhole was quite open with little aquatic vegetation. Carruthers (plant remains report) found no aquatic macrofossils from this waterhole, and suggests that either the waterhole was managed to keep it open, or the level of disturbance was too great for aquatic vegetation to become established. She also notes that there was an absence of nettle seeds, although several pollen grains of nettle were found, suggesting there was deliberate removal or repeated cutting of vegetation around the waterhole to provide easy access. Several spores of hornwort, a taxon growing on bare damp soil, were found, probably growing around the sides of the waterhole.

Microcharcoal particles were very abundant in all subsamples and were not quantified. Pollen concentrations were not very high suggesting that the pit filled quite quickly. The pollen was quite well preserved with only 10-15% indeterminable grains.

The pollen assemblages are dominated by herbaceous pollen, particularly grasses, but with 20-30% tree and shrub pollen. Besides grasses, there is ca. 5-10% ribwort plantain and other taxa characteristic of pastures. A wide suite of taxa associated with pastures and meadows were found. Taxa of tall herbs including yellow rattle, meadowsweet, St John's wort, hogweed/parsnip (*Heracleum/Pastinaca*) and salad burnet (*Sanguisorba minor* ssp. *minor*) suggest that herb-rich meadows were close by. Some cereals, including emmer/spelt wheat (*Triticum*), barley, and possibly oats, were found together with taxa associated with arable fields. An odd grain of flax was also

present, probably from a crop of flax. It produces very little pollen and is unlikely to have travelled very far. The 20-30% of tree and shrub pollen suggest that there was some woodland, including lime, oak, alder, and hazel growing nearby, probably to the east of the site. This woodland may have been quite open and grazed, evidenced by the presence of taxa such as cow-wheat (*Melampyrum*), bracken, cow parsley family, clovers, and dandelion-type (Behre, 1986). Taxa of trees and shrubs such as hazel, ash (*Fraxinus excelsior*), willow, elder, rosaceous shrubs, hawthorn-type (*Crataegus*-type), cherry/sloes, rose (*Rosa*), bramble, and ivy (*Hedera helix*) are evidence of either open woodland glades, woodland edges or hedgerows.

There is not much variation throughout the sequence, except for a small increase in vetches/peas and dandelion-type towards the top. These may represent a crop being grown nearby but they could also represent an increase in herb-rich meadows. A few grains of heather and heath were found in the top two samples. This suggests that heath was developing within the region, but probably at some distance from the site.

As in other Middle Bronze Age sequences from the current phase of work at Heathrow, the pollen suggests an open pastoral landscape with some woodland, possibly grazed, to the east, with pastures, meadows, hedgerows and some arable fields.

Sample <27315>, Area 91, feature 708014, a Middle Bronze Age waterhole (Figure 6)

Fifteen samples were analysed from context (708023), an organic deposit from a Middle Bronze Age waterhole, feature 708014, from area 91 on the eastern side of the excavated area. Odd grains of duckweed provide evidence for standing water.

The lower part of the fill (from ca. 0.17 m downwards), which was characterised by very good pollen preservation and consequently low indeterminable pollen, is dominated by grass and nettle pollen, including clumps of the pollen of these taxa indicative of their growth immediately around the waterhole. These subsamples also contain many fungal spores and *Trichuris* eggs, characteristic of the inclusion of faecal material into the sediment, probably from the use of the waterhole by animals. The high nettle pollen values, a taxon indicative of nutrient-enriched soils such as those on which animals defaecate, concur with this suggestion. Some cereals were possibly being grown nearby, including oats/wheat, barley and emmer/spelt. In

addition a couple of grains of rye were found and two grains of hemp/hops were identified. This is the earliest evidence for the growth of rye from this site. Many other taxa found are characteristic weeds of arable fields, grassland, and waste and rough ground and trackways. There is increasing evidence of woodland.

The upper part of the fill has increasing amounts of tree and shrub pollen, especially of lime and hazel, and fern spores, particularly those of polypody (*Polypodium vulgare*). There is a concomitant decrease in herbaceous taxa especially, grasses. Charcoal values are higher and then decrease. These assemblages suggest that there is woodland regeneration very close to the sample site, or that trees and bushes of lime and hazel, which had previously been pollarded or coppiced so that they ceased to flower, had been abandoned and had begun to flower profusely again. Pollen of taxa characteristic of hedgerows decrease as tree and shrub pollen increases. Perhaps the hedgerows, which may have originated as assarts from the woodland, were no longer being maintained and were being reabsorbed into the woodland, which was closing in. Fungal spores and *Trichuris* eggs disappear and nettle pollen values drop, suggesting that there was abandonment of the waterhole. Pollen preservation is much worse, and there may be differential preservation and skewed results with taxa easily being recognised even when in poor condition being favoured. However, grass pollen values (a taxon easily recognised even when poorly preserved) definitely decrease showing that there was a major change in the vegetation around the site. The sediments may have periodically dried out so that conditions became aerobic and grains were oxidised. There were still some arable fields around, although perhaps further away, and there is still evidence of rough and waste ground.

Samples <29054> and <29055>, TEC05,(Area P2A4), feature 815041, a Middle Bronze Age waterhole (Figure 7)

A series of 3 overlapping monoliths were taken through the fill of a Middle Bronze Age waterhole, feature 815041. situated on the eastern side of the excavated area. The upper monolith (29053), and the top of the second monolith (29054) did not contain pollen of sufficient preservation or concentration for analysis. The basal half of 29054 (from 0.22 m from the top of the monolith to its base) and the whole of 29055 were analysed. The subsamples are from 2 contexts, 827110 down to 0.38m from the top of 29054 (5 subsamples analysed) and 827096 from 0.38 m downwards in 29054 and throughout 29055 (12 subsamples).

Context (827096)

The pollen assemblages throughout this lower fill are dominated by herbaceous taxa. Grass (Poaceae) pollen makes up 50-60% of the total pollen sum together with c. 15% ribwort plantain (*Plantago lanceolata*), c. 5% dandelion-type (*Taraxacum*-type) and many other taxa characteristic of meadows and pastures. Clumps of grass pollen probably came from grasses growing very close to the waterhole. Some common reed (*Phragmites australis*) was present but in small quantities and not as clumps. Some cereal grains, including emmer and/or spelt (*Triticum*), barley-type (*Hordeum*-type), and oats and/or wheat (*Avena/Triticum*-type) were found together with taxa indicative of arable cultivation and waste places such as composites (Asteraceae family), poppy (*Papaver rhoeas*-type), black bindweed-type (*Fallopia convolvulus*-type), knotgrass-type (*Polygonum aviculare*-type), goosefoots (Chenopodiaceae), black nightshade-type (*Solanum nigrum*-type) and nettles (*Urtica*). Pollen of trees and shrubs only average 15% in the fill, mostly of alder (*Alnus*), oak (*Quercus*) and hazel (*Corylus*), but also with maple (*Acer*) and rosaceous shrubs (Rosaceae undiff., hawthorn-type (*Crataegus*-type), cherries/sloes (*Prunus*-type), roses (*Rosa*-type) and brambles (*Rubus fruticosus*-type)), all taxa which could be found in hedgerows. Charcoal particles were abundant throughout the sequence and have not been quantified. Tree and shrub pollen begins to increase towards the top of the fill, particularly willow (*Salix*).

These assemblages suggest that the area around the waterhole had been cleared of woodland and that the landscape was very open, mainly with very herb-rich grasslands, but probably with some cereal cultivation nearby. A few grains of obligate aquatic taxa, including duckweed (*Lemna)* and possibly horned pondweed (cf. *Zannichellia*) were found indicating that there was open water in the waterhole at the time of sedimentation of fill 827096, and that it was probably kept mainly free from aquatic vegetation. The presence of sedges (Cyperaceae), grasses including common reed, lesser bulrush/bur-reed (*Typha angustifolia/Sparganium*) and iris (Iris spp) are evidence for these taxa growing on damp soil around the waterhole. There is no evidence for cess or the use of the waterhole by animals.

Context (827110)

The samples from fill 827110 differ in their pollen content from those of the fill below. Tree and shrub pollen increases, particularly that of willow which averages c. 10% total pollen and spores, a very high value for willow which produces only relatively small amounts of pollen. It suggests that willow trees may have grown up around the waterhole. Further evidence for this comes from the presence of clumps of willow pollen Other tree and shrub pollen values, particularly oak, hazel, alder and ash (*Fraxinus*) also increase somewhat, and there is a concomitant decrease in many herb taxa including grass, ribwort plantain, clovers (*Trifolium*-type), buttercups (*Ranunculus*-type) and sorrels (*Rumex* spp.). However, there is still a very rich herbaceous flora. Other herb taxa which may be indicative of waste ground and/or arable cultivation increase – dandelion-type and goosefoots together with bracken spores (*Pteridium aquilinum*). Cereal grains are still present suggesting that wheat and/or oats and barley were being grown. However, there is no evidence for the growth of emmer and/or spelt during this period, *Triticum* grains only being found during the basal half of fill 827096. Duckweed values are slightly higher in this fill, and the green alga *Botryococcus* is present possibly indicating that the waterhole was not being kept so free of vegetation.

The assemblages from waterhole 815041 suggest that the landscape was very open, mainly with herb-rich grasslands, but with some cereal cultivation. There is some evidence for hedgerows. Towards the top of the sequence, tree and shrub pollen increases particularly that of willow which probably grew up around the waterhole. There are suggestions that there was some diminution in grazing and meadow use, possibly with some secondary woodland development within the area perhaps following abandonment of some of the grasslands and/or less management of the hedgerows which then flowered more profusely. This could have been concomitant with a decreased use of the waterhole.

Sample 29133, Area TEC05 (Area P2A5), feature 823181, a Middle Bronze Age waterhole (Figure 8)

18 samples were taken from the lowest 0.68m of the fill from four contexts (823192, 823191, 823190 and 823184). The feature also contained the remains of a wooden ladder.

10 samples were chosen for full analysis. However, due to the poor condition of many of the pollen grains in two of the samples, only eight were suitable for full analysis. The concentration of pollen in the uppermost sample was low and a count of less than 300 grains obtained. Therefore, although it gives some indication of landscape changes higher up the profile, the relatively low count and high number of indeterminate grains (>40% TLP) means that the assemblage at this level may be skewed.

Context (823192)

The lowest two fills (contexts 823192 and 823191) were very organic; context 823192 consisting of a very humified organic deposit. This is somewhat supported by the presence of ascospores (Type 17/19 and 55) at these levels, which van Geel (1987) has identifed in the upper levels of a peat bog in Holland. The number of indeterminable grains in the lowest four samples is relatively low (<20% TLP), which may be consistent with wetter conditions and better preservation, however, the number of aquatic taxa (lesser bulrush/bur-reed and bulrush) is low, which suggests that the surface of the waterhole was quite open with little aquatic vegetation. Hornwort, horsetails and, possibly, mint (*Mentha*-type) were likely to have been growing on the damp muddy soils surrounding the waterhole. Several other taxa characteristic of damp/wet grassland are also recorded, including sedges and meadowsweet. Ivy-leaved Bellflower (*Wahlenbergia hederacea,* included in *Jasione montana*-type) also prefers damp conditions. although sheep's-bit (*Jasione montana*, which is also included in this taxon) along with the few grains of heather pollen, may originate from these species growing on sandier soils further away from the site. Alternatively, they may originate from material brought onto the site, which was subsequently dumped into the waterhole.

The evidence shows that the area around the waterhole consisted of fairly open woodland during its initial stages of infilling (tree & shrub pollen representing 60% TLP) and that this woodland was dominated by oak with little alder and hazel scrub. Other tree and shrub pollen was also recorded but their low values suggest they were poorly represented in the woodland flora. Grasses dominate the herbaceous assemblage, which, alongside fairly abundant ribwort plantain pollen, and the presence of common sorrel, buttercups, sedge, members of the cow parsley family, composites (daisy family and dandelion type) salad burnet and bedstraws, indicate the

presence of pastures and meadows. The occurrence of nettle, which grows in nitrogen-enriched soil, plus bracken (spores), which is common in grazed woodland, may indicate the presence of livestock.

The nearby cultivation of oats/wheat and barley is indicated, as is the possible cultivation of hemp/hops; although the latter may originate from native hops growing in nearby hedgerows or scrub. Other taxa indicative of arable land are also recorded, including black bindweed, knotgrass and goosefoot. However, some of these taxa are also frequent on disturbed ground and around habitation sites.

Context (823191)

A change is recorded at 0.57m (the top of context 823192), which shows a marked decline in oak pollen and a corresponding rise in alder, hazel, and rosaceous taxa (hawthorn, cherries, whitebeams), which, common at woodland borders, may indicate the opening up of the oak woodland around the waterhole, or, alternatively, the expansion of hedgerows nearby. This change in the woodland flora is accompanied by a marked rise in grass pollen, a very slight increase in cereal pollen, and a slight increase in the number and diversity of arable weeds including a slight rise in mugwort and goosefoot, and the first appearance of pollen from the cabbage family, St John's wort, and black nightshade. Herbaceous taxa indicative of pasture are also recorded, including bird's-foot trefoil, ribwort plantain, greater and hoary plantain, cinquefoils and buttercups. The pollen record appears to signify a period of increased management of the landscape with designated areas of arable and pastoral land with possible boundary hedges where oak woodland persisted perhaps further away. The marked rise in horsetail at this level is difficult to interpret, however, it could mean that denser vegetation was being left to grow immediately around the waterhole, perhaps as a result of less trampling by livestock. The appearance of pondweed at this level may corroborate this, and suggests that aquatic vegetation was now growing on the surface of the water.

Regeneration in oak woodland, with the persistence of some hedgerow species is indicated at 0.45m. At the same time cereal pollen declines alongside a reduction in the associated arable and pastoral weed flora described above.

Context (823184)

Although the two samples above 0.45m depth were poor in pollen, the very top sample from 0.27m suggests that there was a temporary recovery in woodland, and by the final stages of infilling, that the area was very open with little hazel/oak woodland. The assemblage wasdominated by herbaceous taxa indicative of pasture, such as grass, daisy-type, dandelion-type, ribwort plantain, greater and hoary plantain and buttercups.

Changes in the charcoal values more or less mirror the oak curve, and indicate that decreased burning activity was taking place during the period of increased landscape management. It is possible that burning activity, be it for clearance or domestic fires, was taking place further away from the areas of farmed land.

The Middle Bronze Age pollen analyses described from the above feature suggest that the landscape was very open during the Middle Bronze Age with more grassland than in the Neolithic. Pasture seems to have predominated, often with evidence of herb-rich meadows, hedgerows, and with some cereal growth. There is also tentative evidence for possibly other crop cultivation, including flax.

Middle or Late Bronze Age

Three samples dated to the Middle or Late Bronze Age were analysed, two from Area 61 and one from Area 91 on the eastern side of the site.

Samples <17146> and <17133>, Area 61, features 611100 and 611107, a Middle Bronze Age pit recut by a Middle or Late Bronze Age waterhole (Figures 9 & 10)

These 2 samples are overlapping monoliths from a waterhole, feature 611107, a recut of a former pit, feature 611100. The original pit (611100) has been dated to the MBA whereas the recut waterhole (611107) is dated to the Middle or Late Bronze Age (M/LBA). Monolith <17146> is the lower most sample, overlapping with the base of <17133>. It was taken through the basal context of the original pit and the 2 basal contexts of the recut waterhole. Monolith <17133> was taken through 4 contexts of the recut waterhole, including the 2 basal contexts represented in sample <17146>. The waterhole is in area 61, towards the northern part of the excavated site.

Seven samples from <17146> and 12 from <17133> were analysed. Preservation and concentration of pollen was very variable in both samples. Microcharcoal particles were very abundant throughout both samples and were not quantified.

Context (611116)

This context, in sample <17146>, is recorded as being a gravel deposit from the collapse and erosion of the original pit's sides. If so, it may contain pollen from earlier times preserved within the original walls of the pit. The pollen preservation was quite good and at a reasonable concentration. Only a couple of obligate aquatic grains were identified, those of lesser bulrush (*Typha angustifolia*) or bur-reed (*Sparganium*) (*Typha angustifolia*-type), taxa which grow in shallow water or mud.

The pollen assemblage is dominated by grasses, with many herbs of grassland, although ribwort plantain has a rather low value suggesting that grazed grassland was limited or at a distance. Quite high values of cereal crops, including emmer/spelt, barley and possibly oats, together with the weeds associated with arable fields, suggest that cereals were being grown nearby. Taxa which are characteristic of hedgerows are also well represented.with the occurrence of the pollen of many rosaceous taxa, ivy (*Hedera*), ash (*Fraxinus*) and maple (*Acer*). There is also 5% oak pollen which may represent oaks growing as standards in the hedgerows, from woodland further away, or could be from older material which has eroded from the sides of the pit. Hazel and alder pollen are also present.

Several fungal spores were also found including *Glomus* spores suggesting the inclusion of soil into the fill.

Context (611101)

Pollen from this context, the basal fill of the recut (present in both <17146> and <17133>), was very variable, some poor, at rather low concentrations, suggesting that the context accumulated rather rapidly and that the pollen had been under aerobic conditions. However, duckweed pollen was quite common, suggesting that the pit had standing water at the time of its deposition which was perhaps not being kept clear of vegetation. Grass pollen (but not that of common reed (*Phragmites*)) was dominant, and several clumps of grass pollen were found. This suggests that either grass was hanging over the pit, or that grass was being introduced into the pit. *Glomus* spores were also common in all levels, and eggs of the parasitic intestinal nematode

Trichuris, found in both animal and human faeces, were also present. Nettle values were also quite high, a plant of nitrogen-enriched soils often linked to areas with defaecation. It is tempting to suggest that this pit was used as a cesspit with grass being used as 'wipes' or that turves contaminated with faeces were being put into the pit. Perhaps more likely, was that it was a 'wallow' and waterhole for animals. Again, as in the context below (611116), taxa associated with arable fields (cereal cultivation), pastures and meadows, and open waste and disturbed ground were present, and hedgerow taxa were common.

Context (611105)

Biodiversity was very high in this context, the base being represented by the top subsample of <17146> and with the whole context in <17133>, with many herbs characteristic of cereal crops and arable fields, trackways and waste and open ground. There is some evidence for reduced pasture, with characteristic taxa having only low values or being absent (e.g. ribwort plantain, buttercups, sorrel, and greater/hoary plantain), and with a slight increase in pollen from cereals.

The basal three subsamples from this context in sample 17133 contain high values of bracken, which may be associated with a drop in grazing pressure, or may have been dumped into the pit as household waste, possibly used as bedding. There are also slight increases in some other taxa which may be associated with derelict or open ground (e.g. goosefoots, dandelion-type, and possibly cleavers (*Galium aparine*) (Rubiaceae). Plants associated with hedgerows or scrub are also at lower values. As in context (611101), *Glomus* spores and *Trichuris* eggs are common. Duckweed pollen is absent suggesting that either the pit was more or less dry at this time, or that it was being cleared and kept open.

The upper two subsamples from this context have high values of duckweed pollen and spores of the green alga *Spirogyra* are also present, suggesting that the pit then had standing water, was not being cleared and possibly was no longer in use. No parasitic eggs were found suggesting it was no longer being used as a cesspit or animal waterhole. Taxa characteristic of hedgerows or scrub are particularly well represented and could represent a cessation of hedgerow maintainance allowing increased flowering or the development of scrub on abandoned land. Bracken spore

values are much lower in these upper subsamples. Certainly there seems to have been some local change in landuse.

This context is difficult to interpret. There appear to be different stages, with less pasture and more open, derelict ground around the site during the earlier phase, and increased hedgerow flowering or scrub development and decreased open ground area later. There is evidence of some woodland being extant in the area, although not close by, during the time of its deposition.

Contexts (611104) and (611103)

The pollen assemblages from these contexts are similar to those from context (611105).

The analyses from these two samples give a picture of an open landscape, perhaps with some woodland at some distance, with arable fields, pastures and meadows, hedgerows and much waste and open rough ground. The waterhole was probably used for animals rather than for collecting water for human use, or alternatively may have been a cesspit.

Sample <27091>, Area 91, feature 685032, a Middle or Late Bronze Age waterhole (Figure 11)

A total of eight pollen samples were analysed from this feature on the eastern side of the site, all from a single context (685035), which represented the first of a series of silty contexts, which accumulated naturally in a low energy depositional environment. The deposit contained much organic matter including the remains of vegetation growing in and around the waterhole.

The pollen record from this deposit, which had accumulated to a thickness of c. 0.35m, showed that the environment surrounding the feature during its accumulation remained essentially the same and was dominated by herbaceous pollen of, primarily grass, with a wide range of ruderals such as dandelion-type, plantain, and buttercups. Some cereal-type pollen was also present, including positively identified oats/wheat, emmer/spelt, and possible barley. Very little tree/shrub pollen was recorded in the sequence, amounting to no more than 20% TLP throughout the diagram. Alder and hazel pollen dominated what little tree/shrub pollen was present. However, similar values of rosaceous pollen, including hawthorn-type, which is insect-pollinated and

therefore produces only small amounts of pollen at the lower levels (especially 0.24 and 0.28m), suggests the growth of hedgerows and/or scrub close by.

The occasional presence of pondweed pollen in the feature suggests that, at times, conditions in the waterhole remained relatively wet during its infilling.

The pollen evidence from the basal fill of the waterhole indicates that during its initial infilling the landscape surrounding the feature consisted of open/rough grassland with some areas under cultivation and probably hedgerows. Occasional stands of scrubby woodland were also present. Essentially however, the landscape remained very open in the area during the Middle or Late Bronze Age.

Late Bronze Age

Sample <18145>, Area 100, feature 509174, a Late Bronze Age waterhole (Figure 12)

This monolith was taken through the secondary fills of a Late Bronze Age waterhole, in area 100 on the northeastern edge of the excavated area. Ten samples were analysed from four contexts.

There are no records of obligate aquatic taxa from this sample and pollen was not very well preserved with quite high percentages of indeterminable pollen, suggesting that this was a rather dry pit without standing water. There were also no records of parasitic eggs and very few fungal spores. The waterhole therefore does not seem to have been used as a cess pit. Clumps of grass pollen were found at many levels suggesting that the pit was overhung with grass, and was not surrounded by bare earth as it probably would have been if used by animals. These clumps of pollen may also have come from material dumped into the pit.

Context (524265)

The basal context has ca. 40% tree pollen of alder, oak, and hazel but only odd grains of lime, suggesting that lime was not such a large component of the woodland on this side of the site, the soils being less suitable, possibly wetter, as alder and willow pollen values (two trees which grow in wetter places) are reasonably high. Alternatively it may be that lime had been cleared from the woodland, or that nearly all the lime trees within the area had been pollarded so that they did not flower. The

evidence suggests that there was a lot of woodland within the area, fairly close to the waterhole and it may be that the waterhole was actually in a clearing in woodland, perhaps without lime in the immediate vicinity. The presence of rosaceous shrubs and other taxa associated with woodland edges, glades, or hedges may add further evidence for this hypothesis. No cereal grains or other unequivocal evidence of arable fields were found in this context but many taxa associated with grassland were present. Charcoal values are low suggesting that this waterhole was some distance from habitations.

Context (524263)

Hazel, maple and rosaceous values decrease throughout this context, while there are small but increasing values of cereals including indeterminate wheat, emmer and/or spelt wheat, and possibly oats, together with possible weeds of arable fields. There are also small increases in fern and bracken spores which may be due to more opening of the woodland. This may suggest the development of some cereal growth possible at some distance from the pit and some decrease in grazing. There is also a large increase in dandelion-type and goosegrass/orache pollen upwards, two taxa particularly indicative of ruderal communites as found on waste or derelict ground and along trackways or around habitations. Charcoal particles also increase upwards in the sequence. It may be that there was increasing activity quite close to the waterhole or opening up of the woodland during this period of infilling.

Contexts (524251) and (524249)

These contexts continue the trends seen in the context below, with decreasing evidence of woodland and increasing values of taxa characteristic of waste and disturbed land. Charcoal particles further increase possibly suggesting increased activity nearby or increased burning.

The pollen record from sample 18145 suggests that the landscape was quite open around the site during the Late Bronze Age, but that there was some woodland close to the eastern side of the site as shown by the higher values of tree pollen, (Figure 10) compared with the Middle Bronze Age.. There was grassland around, with some cereal growth, but the evidence for hedgerows, seen in the MBA diagrams, seems to diminish. There is also increasing evidence for open waste, disturbed ground and

ruderal communities And an increase in microcharcoal particles upwards, possibly evidencing increasing aactivity nearby.

Late Iron Age

Two samples, from area 61, were analysed from a Late Iron Age well.

Samples <18363> and <18364>, Area 61, feature 593207, a Late Iron Age well (Figures 13 & 14)

Two overlapping monoliths, <18363> and <18364> were taken through the three basal contexts of a Late Iron Age/Early Romano-British well. Four subsamples were analysed from <18363> the lower part of context (593201), and twelve from <18364>: nine from the same context (593201), one from (593202) and two from (593182). Pollen was quite well preserved in all contexts. Charcoal values were very high in all subsamples and were not quantified. Odd grains of obligate aquatic taxa were found in the lower two contexts but not in the upper context suggesting that there was standing water during the time of deposition of contexts (593201) and (593202) but that the well was possibly dry during context (593182). However, this is poor negative evidence, and the values of indeterminable pollen were low: if the sediments were dry these values would be expected to be higher. It may be that the well contained standing water but was more thoroughly cleared of aquatic vegetation during the deposition of the upper context (593182).

Three contexts are dominated by grasses and many other taxa characteristic of grassland and waste and disturbed ground. Tree and shrub pollen values are very low (<10%) suggesting that the landscape was very open around the waterhole perhaps with some extant woodland or copses at some distance. There is evidence of cereal cultivation together with many weeds of arable fields. The picture is one of a preponderance of grassland, including some herb-rich meadows, with some cereal cultivation, possibly some way off, and a lot of open waste, disturbed ground as found along trackways, habitations, etc. During the deposition of context (593201) there is some increase in grasses and ribwort plantain with a concomitant decrease in dandelion-type, and then a return to their former values. This could represent a period of increased grassland (or less grazing) around the site. A few grains of ling (*Calluna*) suggest that heath was becoming established in the wider area. This is

further confirmed by the presence of ericaceous seeds, including those of ling, in this context (Carruthers, plant remains report). During the deposition of contexts (593202) and (593182) there is evidence of the increased spread of open disturbed ground and little evidence of cereal growth.

No parasitic eggs were identified from the pollen preparations which suggests that it is unlikely that faecal material was introduced into the feature and that this was a clean waterhole for the collection of water for human use.

Late Iron Age/early Romano-British

Sample <24004>, Area 61, feature 649010, a Late Iron Age/Early Romano-British waterhole (Figure 15)

Eight pollen samples were analysed from waterhole 649010, all from the same context (649011), consisting of 0.45m of deposit, believed to represent the initial erosion of the feature sides. If this is the case, then the pollen results need to be treated with caution due to their uncertain taphonomy, as it is possible that the pollen may have originated from the sediments in which the waterhole was dug as well as the contemporary environment. However, the pollen assemblages are very similar to those from samples <18363> and <18364> (see above) suggesting that the pollen analysis is reliable and reflects the contemporaneous vegetation.

The pollen record shows very little in the way of marked changes (assuming that the deposit was laid down sequentially). The pollen diagram (Figure 15) shows low tree and shrub pollen values (+/<5%) TLP. A very slight increase in tree/shrub pollen of, primarily, alder and hazel, occurs at 0.81m, but the increase is not on a scale to suggest any form of regeneration in the area at this time. Grass dominates the herbaceous pollen assemblage, accompanied by the pollen of common ruderals such as dandelion-type, daisy-type, plantain, and buttercups. All subsamples include pollen of knotgrass, which is native to all types of open ground, plus occasional cereal-type pollen, with oats/wheat and emmer/spelt present in the lowermost six samples (0.65-0.93m).

Values of microscopic charcoal are fairly high in the basal sample, then fall slightly and subsequently rise again up the profile. The very high amounts in the top 0.15m of deposit suggest that increased burning was possibly taking place in the area during the

final deposition of this primary fill. However, like the pollen record from this feature, the charcoal record needs to be treated with caution as some may originate from the sediment lining the feature sides. The same may be said for the very high indeterminable pollen values of all pollen samples.

Assuming that the pollen from this feature is contemporary with the initial infilling of the waterhole, the environment surrounding the feature during the Late Iron Age/Early Romano-British period consisted of very open grassland, possibly pasture, with very little evidence for trees or shrubs. Limited cereal cultivation was also taking place in the area, especially during the earlier phase of infilling. This is a very similar picture to that obtained from samples <18363> and <18364> (Late Iron Age).

Early-middle Romano-British

Sample <18236>, Area 61, feature 527374, an Early-Middle Romano-British waterhole (Figure 16)

This sample was taken through two secondary contexts of a waterhole containing LIA/ERB pottery. The pollen preservation was quite good although somewhat degraded. Charcoal particle values were very high and were not quantified. There is very little evidence of standing water in the hole, but all levels contained high amounts of parasitic eggs indicative of the incorporation of faecal material, and fungi spores, suggesting that this was a waterhole for animals rather than for collecting water.

The pollen assemblages from both contexts are dominated by grass pollen, clumps of which were found at most levels, together with many taxa indicative of grasslands, including tall herb-rich meadows with grasses, sedges, knapweed (C*entaurea nigra*-type), thistles (*Cirsium/Carduus*), vetches/peas (*Vicia/Lathyrus*), meadowsweet (*Filipendula*), buttercups, yellow rattle/ eyebrights (*Rhinanthus*-type) and devil's-bit scabious (*Succisa*), much open disturbed and waste ground, and some cereal growth (emmer/spelt, barley, wheat and/or oats). No other crops were identified. The arable weeds present include cornflower (*Centaurea cyanus*) and field bindweed (*Convolvulus arvensis*). There is little evidence of woodland, tree and shrub pollen values being less than 8% throughout. Hornwort probably grew on damp soils around

the waterhole together with sedges, rushes (Juncaceae), meadowsweet, horsetails (*Equisetum)* and mint and/or gypsywort (*Lycopus*) both in the *Mentha*-type.

The landscape appears to have been very open and pastoral in character while this waterhole was in use, with very little extant woodland, some cereal growth, much grassland and meadows, and a lot of open, disturbed ground, trackways and habitation sites.

Middle Romano-British

Sample <18269>, Area 61, feature 527388, Middle Romano-British waterhole (Figure 17)

This sample from Area 61 was taken through two contexts of a Middle Romano-British waterhole. There is little difference between the two contexts (527380) and (527347). Pollen preservation was quite good, and microcharcoal particles very high in all subsamples. The sediments contained numbers of parasitic eggs suggesting that faecal material was incorporated into the contexts, suggesting that this was an animal watering hole rather than for the collection of water for human use.

The pollen assemblages are very similar to those from sample <18236> (see above), indicative of a pastoral landscape with meadows, pastures, and some arable fields with cereal crops. One grain of hemp/hops (*Cannabis/Humulus*) was found, but whether this is from a crop of hemp or from wild hops cannot be determined. However, tree and shrub pollen values were somewhat higher than in sample <18236>, especially from the lower context (527380) with particularly hazel and elm. It is possible that these taxa were growing in a hedge close to this waterhole.

Medieval

Sample <17518>, Area 49, feature 529139, Medieval waterhole (Figure 18)

Nine pollen subsamples were analysed from this sample, which was taken from the lower half of a Medieval waterhole and contained eight different filling episodes. The lowest four contexts have been interpreted as representing early slumping episodes of material from the feature sides, and it is therefore possible that the assemblages from these depths contain a combination of both older and contemporary pollen. The

uppermost four contexts, however, represent various phases of natural silting and accumulation and the pollen from these contexts is therefore more likely to show a more accurate picture of the environment surrounding the pit during its infilling.

The pollen assemblages are dominated by herbaceous taxa, primarily grass pollen, with a relatively wide range of ruderals and species associated with open/rough ground, such as daisy-type, dandelion-type, plantain including buck's-horn plantain (*Plantago coronopus*), and docks (*Rumex* undiff). The relatively high values of ribwort plantain, which may be associated with trampling by animals, suggest that some areas also carried livestock. A number of herbaceous taxa typically, although not exclusively, associated with cultivated land are also present, including goosefoots, plus members of the pea family (Fabaceae) such as bird's-foot-trefoil, clovers, and vetches/peas. Cereal-type pollen is well represented and includes oats/wheat and barley in all subsamples, and is better represented in the uppermost four levels.

Tree and shrub pollen values are quite high, from 15% to over 20% TLP, with a peak at 0.22m. The dominant tree pollen throughout is oak, which is responsible for the peak in tree pollen, together with some ash and a relatively wide range of shrubs, including holly, honeysuckle (*Lonicera periclymenum*), rose family (including hawthorn-type), and elder. This assemblage could be indicative of hedgerows with standards of oak and ash. After the peak in tree/shrub pollen at 0.22m, levels fall once again in the top of the diagram, concomitant with the increase in cereal-type and goosefoot pollen.

Although the lower contexts were described as being derived from natural slumping, the pollen record does not appear to show any abrupt changes in pollen assemblages. The sequence, therefore, is likely to reflect the environmental conditions around the pit during the whole of this phase of infilling. The results show that the environment surrounding the site was one of open grassland and rough ground, with evidence of both pastoralism and cereal cultivation, the latter perhaps becoming more important later on. Unlike some of the earlier periods at Heathrow, the landscape in this area of the site during the Medieval period was slightly more wooded with oak and ash, and also contained areas of shrubs, or hedging. Ash is often indicative of secondary woodland. The pollen assemblages may, in part, represent parkland with grazed grassland and standard oaks.

The Palaeochannel

Two monoliths cut through sediments of a buried palaeochannel, running approximately North-South on the western side of the excavated area, were analysed to hopefully provide some information on the vegetation growing on the floodplain to the west of the excavated area, to compare with that of the higher ground of the settlement. It was hoped that the results could also augment the Mesolithic and Neolithic periods which are poorly represented in the pollen analyses from archaeological features.

Sample <18154>, Area 17, (Figure 19)

Fifteen subsamples were analysed from sample <18154>. However, three of these, at 0.46, 0.50 and 0.70m, contained very little pollen and were therefore not included on the pollen diagram. Monolith sample <18154> was 0.90m long and was taken through a number of contexts which had accumulated in the palaeochannel. Sequentially, these included parts of the channel fills assigned to the Mesolithic/Neolithic by the excavators; a Romano-British tufa layer, which had been reworked; a Medieval flood deposit; and an uppermost context of Made Ground (see Figure 19).

The lowermost analysed subsample containing sufficient pollen for analysis, at 0.66m, from the Mesolithic/ Neolithic contexts, was dominated by tree pollen of primarily hazel, with limited pine, oak, willow, and elm, and occasional grains of alder. This suggests that ediments at this level accumulated just before the spread of alder in this part of Britain ca. 8000 BP (Birks, 1989). About 20% of the pollen assemblage is herbaceous, consisting primarily of grass and sedge pollen.

At 0.62m, tree pollen values drop significantly (from c. 75% to less than 10%) and are replaced by very high levels of fern spores, which are maintained at very high values at 0.58m and 0.54m. These high values suppress all the other percentage values, and tree and shrub pollen probably remained more or less at the same concentrations with alder having migrated into the area. The lack of any pollen of aquatic taxa actually growing in water during this phase of infilling suggest that there was no (or very little) standing water in the channel at this time, but that it was filled by marsh/fen. The high fern spore values could possibly be attributed to the marsh fern (*Thelypteris palustris*) growing within the channel together with sedges, lesser bulrush/bur-reeds, and horsetails. Although levels of charcoal fall during the initial rise in fern spores, they

rise significantly during the deposition of the remaining Mesolithic/Neolithic fill, which suggests relatively intensive local fires during this time. The upper two pollen samples from the Mesolithic/Neolithic contexts contained very little pollen, which may be a consequence of environmental conditions not being conducive to pollen preservation possibly caused by drying out of the sediments. There is probably an hiatus in the pollen record before the overlying Romano-British deposit.

At 0.42m, the lowermost sample taken from the Romano-British tufa deposit, values of fern spores are significantly reduced, tree pollen falls very slightly, and herbaceous pollen increases in both quantity and diversity. As in previous levels, the herbaceous pollen is dominated by grass and sedge pollen. However, taxa of disturbed and open soils, including those of the cow parsley family (Apiaceae), the cabbage family (Brassicaceae), plus ribwort plantain, are also represented. The presence of sedges, meadowsweet, and bulrush/bur-reeds, suggest that conditions in the channel were wet. In addition, this level contains the first records of heather and cereal-type pollen, including positively identified *Avena/Triticum*-type (oats/wheat). Other cereal types positively identified from the Romano British tufa layer include barley-type, which could include the wild sweet-grass *Glyceria*, and rye, which suggests that a wide range of cereal crops were being grown on the site during this period. Charcoal values remain very high during the initial deposition of the tufa, but fall at 0.38m (see below).

Tree pollen increases very slightly at 0.38m, primarily as a result of a slight rise in alder and beech (*Fagus sylvatica*) pollen. However, this is a temporary rise, and at 0.30m levels of tree pollen decline and continue to decrease during the deposition of the subsequent Medieval fill. This decline is matched by a steady increase in charcoal particle values during this period of infilling. Herbaceous pollen continues to dominate the record during this time, and includes taxa typical of open/rough grassland and/or cultivated ground, such as knapweed (*Centaurea nigra*-type), dandelion-type, goosefoots and knotgrass.

An increase in fern and bracken spores in the Made Ground, coupled with an increase in dandelion-type pollen (which is easy to recognise even when degraded) may be the result of differential preservation rather than a change in the actual pollen record during the dumping of this deposit. However, pollen preservation does not appear to be too bad, as indeterminable pollen values are quite low (<20%).

The pollen assemblages during the deposition of the Mesolithic/Neolithic fills indicate a wooded landscape dominated by hazel with limited stands of pine, oak, elm and later alder. The absence of alder pollen in the lowermost deposits (below 0.58m) suggests they accumulated prior to the alder expansion in this part of Britain, dated to c. 8000 BP, which suggests that these deposits are Mesolithic in age. The grass and sedge pollen present at this depth may represent species growing in and on the borders of the channel, or as components of marsh/fen growing in the channel at that time. Significant levels of microscopic charcoal were present at this level, which may suggest that significant burning activity was taking place during this time. There is a marked change in the pollen record at 0.62m which may either suggest the development of marsh/fen at this time, and/or the high fern spore values are masking the true pollen record. `There is certainly evidence that a significant change had occurred either in or around the channel.

By the Romano-British period, the more regional landscape as recorded in the pollen record from the paloaeochannel, was very open and dominated by taxa characteristic of open/rough grassland and cultivated land. The presence of a number of cereal taxa suggests that a wide range of cereals was being grown fairly close by. In addition, the range of obligate aquatic taxa present suggest that the channel remained open. A very similar agricultural landscape was recorded in the later medieval flood deposit.

Sample <19019>, Area 20, (Figure 12)

Thirteen pollen subsamples were analysed from a second sample <19019> from the Palaeochannel. The basal nine subsamples were taken from the clay channel, while the upper four samples were taken from the rejuvenated channel. The pollen preservation was very variable throughout the sequence.

The pollen assemblages from the basal three subsamples are dominated by tree and shrub pollen evidence for a wooded landscape dominated by oak, with hazel, some pine and elm. Willow is also well represented probably growing on the damp soils of the channel banks. Only odd grains of alder were found, suggesting that these subsamples are pre-alder expansion in date, i.e. before ca. 8000 B.P (Birks, 1989), of Mesolithic age. Interestingly, charcoal values were high during this period although there is no evidence of human activity in the pollen spectra. It is possible that the charcoal came from natural fires caused by lightning, but Rackham (1980) suggests

that this is unlikely as British wildwood would not burn, and the charcoal is therefore more likely to have come from local man-made fires.

There is no pollen of floating or immersed aquatic taxa, although odd grains of horsetail (*Equisetum*) and bur-reed/bulrush (*Typha angustifolia*-type) are found, suggesting that the channel may have been very shallow or only a damp marshy hollow at this time. Several taxa associated with damp grassland, such as meadowsweet, sedges and cow parsley family including marshwort (*Apium*-type) are present.

The subsample at 0.38m seems to be intermediate between the basal samples and those above. It may be that there are hiatuses in the sequence, either when the channel dried up, or when water currents were sufficiently strong to carry away previously deposited sediment and prevent sedimentation. The first cereal-type pollen grain occurs at this level, although this could be from sweetgrass, a native wild grass growing along the edges of the watercourse. However, it is accompanied by a small rise in grasses, dandelion-type, and other taxa indicative of grassland, and may suggest some opening of the woodland. A rise in charcoal particles, and increases in ferns and bracken lend further credence to this hypothesis.

The subsample at 0.34m shows a large change in the pollen assemblages, with nearly 80% alder pollen, including clumps of alder pollen. The alder appears to have replaced the willow as the tree of wet soils after its migration into the area. There may well be an hiatus between samples 0.38 and 0.34m. Elm pollen is very sparse, suggesting that the subsample is younger than ca. 5000 B.P., the approximate date of the 'elm decline', and therefore probably of Neolithic age. Several obligate aquatic taxa are present including duckweed, bulrushes /bur-reed and pennywort (*Hydrocotyle*). This suggests that this was a flowing stream at this time, fringed with alder growing on the marshy ground along the stream banks, its pollen falling directly into the water.

The remaining subsamples from the clay channel sediments show decreasing values of tree and shrub pollen particularly alder, and increasing values of ferns, grasses and other taxa characteristic of grasslands and rough open ground, suggesting the increasing clearance of woodland in the area, but could also indicate the gradual drying-out of the channel. However, the presence of duckweed pollen shows that

there was some open water in the channel at this time with taxa of wet soils and damp grassland present. A few cereal-type grains are found and could be indicative of some cereal growth nearby, but again, these could be from sweetgrass.

The upper four subsamples come from the rejuvenated channel. The pollen assemblages are dominated by herb taxa, particularly grasses and bracken spores, with only small amounts of tree and shrub pollen, indicating that most of the woodland around the site had been cleared by the time these sediments were laid down. Cereal grains (including emmer/spelt) and taxa characteristic of arable fields and rough disturbed ground are present, suggesting cereal growth nearby. Charcoal particle values are quite high. Towards the top of the sequence, there is some indication of an increase in grazed grassland and meadows, with increases in the pollen of grasses, sedges, dandelion-type, ribwort plantain, and bedstraws, and also of hedgerows or scrub (rosaceous shrubs). It is difficult to date these sediments, but, because of the woodland clearance, and the limited number of taxa, compared with the results from other samples above, they were possibly laid down during the Bronze Age.

Sample <18426>, Area 17, feature 546437, retting tank (Figure 21)

Eleven pollen subsamples were analysed from sample <18426> taken through the fills of a pit, thought to be a retting tank, cut into the palaeochannel. The pollen preservation was very good from the organic deposits, with very low indeterminable values. The pollen assemblages are indicative of a largely cleared landscape with a mixture of pastures, arable fields with cereals including possibly barley, emmer/spelt and rye, and probably hemp (*Cannabis*), rough open ground, and damp/wet grassland. The biodiversity of the area is very high with many taxa. Obligate aquatic species are represented, and taxa of shallow water or marshy ground including flowering rush (*Butomus*), common reed (*Phragmites*), bulrushes/bur-reeds, and sedges, are present, indicating that the palaeochannel into which the pit was dug was still a damp course with a high water table, and that the pit would have filled with water to enable hemp or flax to be retted. Surprisingly, the hemp pollen values are quite low, and the pit itself is quite small in area. It may be that the male plants were harvested and put into the retting pit before they were fully ripe and producing their pollen. It is also possible that the pit was used just for collecting water and not as a retting pit, and that the hemp pollen is indicative of the growth of hemp close by Carruthers (plant remains)

did not find any macrofossils of flax from this feature, but did find possible hemp macrofossils.

The upper half of the sequence shows increasing tree and shrub pollen values particularly of ash, a tree often associated with secondary woodland growth on former cleared land, and oak. This may indicate some decrease in farming with the development of secondary woodland in the area.

Conclusions

Mesolithic

Three levels that could be referred to the Mesolithic were analysed from each of the Palaeochannel sequences. They showed that woodland, particularly of oak and hazel but with some elm and pine was widespread across the landscape with willow growing on the damper soils around the palaeochannel to the west of the excavated site. These results are similar to those obtained from Runnymede Bridge (Scaife, 2000). There is no unequivocal evidence at this time for any anthropogenic effect in the area, although microcharcoal particles are abundant, suggesting the possible local presence of man-made fires.

Neolithic

Sample <17094> from feature 527200, a pit truncated by a pre-cursus ditch situated in the SW corner of the site, provides evidence of a very open Neolithic landscape locally, cleared by humans, with grasslands, and quite a lot of cereal cultivation nearby, and a lot of ruderal communities such as those connected to open, disturbed ground, trackways and habitations site in the Neolithic. Some woodland was extant at this time, but at some distance from the pit, mostly of lime, oak, and hazel, and probably dominated by lime, at least on the drier soils. The absence of elm suggests that the sediments are post ‘Elm Decline’ and therefore younger than ca. 3000 BC.

Limited analyses from sample <29129>, taken from Early/Middle Neolithic pit 836047, on the far eastern side of the site, concur with the evidence for an open landscape with grasslands. There is no evidence for cereal production on this eastern

side, but this may be an unreliable interpretation as it is based on negative evidence from very sparse pollen analyses.

Early/Middle Bronze Age

Analyses from a pit (527069), sample <17010>, from area 49, probably close to a Middle Bronze Age settlement suggest that there was a very open landscape with very little woodland during the period the sediments were laid down. Biodiversity was increasing suggesting that many different plant communities were present with the development of weed floras. There was little woodland around and lime seems to have been absent, either cleared, or possibly pollarded so heavily that it did not flower. Open grassland prevailed with lots of cereal cultivation close to the pit. Damp grasslands and meadows which were probably grazed, were also present together with much open, disturbed ground of trackways and habitations. The pit may have been used for the collection of water for human use as there appeared to be no bare ground around the feature as one would have expected if cattle were using it.

Middle Bronze Age

Samples <16512> and <16511>, overlapping samples from a pit in area 49, the same SW corner of the site as <17010> (see above), show a very similar picture to that given by <17010>. Evidence for cereal cultivation is somewhat less than in <17010> and again there is little evidence of woodland. However, there are much higher values of ribwort plantain suggesting that, at this time, grazed grassland and meadows were more widespread in the area than fields under cereal production. Pollen from plants characteristic of open disturbed ground such as trackways and habitation sites was also present. Other pollen taxa suggest the development of hedges nearby. These results corroborate the evidence from the sediments of <16511/2> were indeed later than those of <17010>, showing that grazed grassland and meadows became more important than cereal production later on, with the development of hedges to prevent animals straying in this part of the site.

Sample <16048> is from a waterhole (510047) in area 77, on the eastern side of the site. It provides evidence of much more woodland on this eastern side than on the western side during the Middle Bronze Age. This woodland was probably grazed and

therefore quite open. There is also less evidence of cereals being grown with a preponderance of grassland and herb-rich meadows, and hedges. If these sediments are contemporaneous with those of <16511> and <16512> then this eastern side nearer woodland was being used for grazing as opposed to the western side which was being used more for cereal cultivation although grazing appears to become more important later on. Although taxa indicative of open and disturbed ground are present, they appear to be of less extent than on the western side, suggesting that perhaps habitations were on the western side of the site.

Sample <27315>, a sample from a Middle Bronze Age waterhole again from the eastern side of the site (area 91) also provides evidence for the presence of more woodland to the east, and appears to show the development of secondary woodland, including lots of lime. However, this may be from one tree (or clone) growing very close to the waterhole, which could have been previously heavily pollarded. The waterhole may actually have been in a clearing or glade within the woodland. It contained much faecal material and nettle pollen values are high suggesting that it was probably used by animals or was a cesspit rather than for the collection of water for human use. The sequence shows a decrease in cereals and taxa indicative of hedgerows upwards, suggesting an abandonment of the area (and waterhole) possibly with the reabsorption of the hedgerows into the woodland from which they were first assarted. It is possible that this sample is later in date than samples <16511/2> and <16048>.

Samples <29054> and<29055>, from waterhole 815041, from the extreme eastern side of the site, provide evidence of herb-rich grasslands during the time of fill of this waterhole. The assemblages are similar to those of the topmost part of the <27315> diagram, with evidence for increasing woodland nearby, but without the high nettle pollen values found in the basal half of <27315>.

Sample <29133> from waterhole 823181 also from the far eastern side of the site suggests fairly open woodland with grasslands. Some cereal cultivation probably took place nearby as well as quite a lot of woodland is also indicated.

Middle or Late Bronze Age

Two overlapping samples (<17146> and <17133>) were taken from a waterhole in area 61 in the centre of the excavated site. This waterhole was either used by animals or as a cesspit as it contained many eggs of parasitic nematodes indicative of the inclusion of faecal material in the sediments. The waterhole is close to a known LBA settlement, and possibly a MBA settlement. Evidence for a lot of open disturbed ground such as found by trackways and around habitations would appear to support this. There was some cereal cultivation, but it was either less than earlier in the Bronze Age or at a greater distance. However, pastures and meadows predominated. There is much evidence of hedges, suggesting that animals were being kept in enclosed fields with hedge boundaries close to this waterhole. The waterhole may have been actually within such an enclosure.

Sample <27091> was taken from a Middle Bronze Age waterhole in area 91 on the eastern side of the site. It showed evidence of little woodland with a very open landscape with mainly pastures and meadows at this time, but with some cereal cultivation and open and disturbed ground.

Late Bronze Age

Sample <18145> was also taken from a waterhole on the eastern side of the site from area 100 slightly north of <27091>. It provides evidence for more woodland than was present while the sediments of <27091> were being deposited. Evidence for grazing and hedge growth seems to decrease upwards, together with a concomitant increase in evidence for cereal cultivation, and also of ruderal communities of open and disturbed ground. It could be that the habitation sites were changing, coming closer to the eastern side of the site, together with cereal fields, by the time the uppermost sediments were being laid down. There is also evidence for further opening of the woodland on this side. The above samples suggest that there may have been abandonment and the development of secondary woodland at the end of the Bronze Age

The spatial differences in the Bronze Age ecology that are demonstrated by the pollen analysis from the waterholes and pits at Perry Oaks (Wiltshire 2006) and the Terminal 5, Heathrow are discussed later in this report.

Late Iron Age

Two samples from area 61, central to the site, were analysed from a well. This well was probably used for collecting water for human use as it did not contain any evidence of faecal contamination. The two overlapping samples <18363> and <18364> provided evidence of grasslands, pastures and meadows predominating during this period. There appears to have been a little cereal production, and the hedgerows, which seem to have been so characteristic of the Bronze Age had more or less disappeared. The landscape was very open with very little evidence of trees and shrubs.

Late Iron Age/early Romano-British

Sample <24004> from area 61 was analysed. The results were very similar to those from <18363> and <18364> (Late Iron Age).

Early –Middle Romano-British

One sample <18236> from a waterhole in area 61, central to the site was analysed. The waterhole was probably used by animals and contained faecal material. The pollen assemblages are similar to those of <18363/4> from earlier within the same area, but with evidence of even less woodland being extant. Grasslands, pastures and meadows dominate the landscape but with much open disturbed ground, possible evidence of increased trackways and habitations in the area and further woodland clearance.

Middle Romano-British

A sample <18269> from a waterhole in area 61 was analysed. The resulting pollen assemblages are very similar to those of <18236> indicative of a pastoral landscape with meadows and pasture and some cereal cultivation.

Medieval

One sample, (<17518>, from a Medieval pit in area 49, on the SW corner of the site was analysed, and provided evidence for pastures and meadows, and some cereal cultivation, which increases upwards. Quite high values of tree and shrub pollen, particularly ash, suggest that there may have been the development of some secondary woodland.. However, the high oak values may represent parkland, with areas of grazed grassland within which there are large standard trees, which were often oaks.

A summary and comparison of the palynological analysis from Perry Oaks and Terminal 5 Heathrow

During the excavations at both the Perry Oaks sludge works and those carried out between 2002 and 2005 in advance of the building of Terminal 5 at Heathrow, a comprehensive palynological sampling strategy was employed and a very large number of subsamples from these samples were assessed as to their potential for palynological analysis. Patricia Wiltshire in her earlier report (Wiltshire 2006) states that this has allowed a "comprehensive mosaic of pictures" to be produced that is unusual from archaeological projects and this has now been extended to a wider area of the site. The results of this more recent work are described earlier in this report.

As the Perry Oaks sludge works are part of the broader Heathrow picture the archaeologists requested that the results from the earlier site should be incorporated along with those from the excavations of 2002 to 2005.

The direct comparison between the pollen data from Perry Oaks and the present phase of excavation is made more difficult by the different approaches employed by Wiltshire and the present authors. The latter have perhaps interpreted their data too cautiously but they felt that the taphonomic problems associated with analysing pollen from archaeological features (which are discussed more fully earlier in this report) justificatied for this caution. A further difference is that Wiltshire defined the Perry Oaks pollen diagrams using local pollen assemblage zones whilst the present authors made the decision to describe the present ones by archaeological contexts. However, despite the differing approaches, the comparison of the two phases of palynological

work contributes to a greater understanding of the ecology of the archaeological sites at Heathrow.

The Mesolithic vegetation at Perry Oaks and Terminal 5, Heathrow

Unfortunately the taphonomic conditions of the deposits from Perry Oaks that are dated to the Mesolithic were not suitable for good pollen preservation, consequently there is only very fragmentary palynological evidence from the few sub samples assessed from this period to place the flints, that are diagnostically dated to the Mesolithic, in the context of the Heathrow landscape. The flints have provided thermoluminescence dates suggesting that there was activity in the middle of the 7th millenium BC at Heathrow. The Perry Oak pollen data, although sparse, may be indicative of pine woods, that are thought to be extensive in Southern England at this time although this present phase of work, where the deposits from two palaeochannels (sample 19019, Area 20 and sample 18154 Area 17) were analysed suggested a woodland of oak and hazel with some pine and elm similar to that recorded at Runnymede Bridge (Scaife 2000). At two sites in close proximity to Oxford and each other, Cothill Fen and Sidlings Copse, show a variation in the representation of pine with it being more important at Cothill and less so at Sidlings Copse, where hazel and oak were the dominant trees (Day 1991). Lime, together with alder, expanded at both these sites at c 6790BP and at Sidlings Copse it has the highest representation in the British Isles (ibid.). Unfortunately the palaeochannel samples from Heathrow are undated and so cannot be related directly to the earlier work at Perry Oaks. However if these natural deposits are more recent than those from the features assessed at Perry Oaks the pollen record, although patchy, is beginning to hint at a succession from pine woods to ones of oak and hazel with some pine and elm at Heathrow in the Mesolithic, at a time when there is artefactual evidence for an anthropogenic presence.

Neolithic at at Perry Oaks and Terminal 5, Heathrow

The Neolithic palynological record in the wider context of Heathrow, like that from the Mesolithic, is fragmentary but does suggest there may have been some possible

spatial diversity in the changing landscape. This supposition is based on the somewhat conflicting evidence from Perry Oaks and that from Areas 49 and P2A2.

At Perry Oaks the pollen assessment of some Early Neolithic features indicates a cleared landscape in the early Neolithic, although Wiltshire (2006) does suggest that the pollen assemblages may be too impoverished to allow any conclusions to be drawn or may "reflect a period when Neolithic people had indeed created extensive clearings" in the woodland. This is in contrast to the Late Neolithic where tree pollen dominated the pollen diagram from Feature 150011, a pit which cuts the basal fills of the Stanwell Cursus. The Neolithic landscape at Heathrow when these fills were accumulating was probably that of woodland dominated by oak and hazel (Wiltshire, 2006). Although there does appear to have been some arable cultivation taking place locally perhaps even in woodland glades.

In contrast the pollen recorded from pit 527200 in Area 49which is cut through by the pre-cursus ditch, suggests a cleared landscape in the western part of the site before the construction of the ditch although there is some evidence for woodland recovery in the upper fills. An assessment of a single incremental sample from early/middle Neolithic pit 836047 in Area P2A2 from the East of the site also suggests an open landscape in the Early/Middle Neolithic. There was no evidence of cereal cultivation or herbaceous taxa associated with cultivation recorded in this sample. The pollen assemblages from Area 49 are characteristic of arable cultivation with open disturbed ground and ruderal communities in the early and middle Neolithic.

It is possible that the pollen analyses of the fills from the two features pit 5272000 in Area 49 and pit 150011 from Perry Oaks are recording Early Neolithic clearance, its subsequent collapse, followed by the recovery of woodland. This recovery is hinted at in the upper fills from pit 52700 and recorded in pit 150011. Wiltshire (2006) cites the pollen evidence from a Neolithic long barrow site at Redlands Farm, Northamptonshire, which is thought to have been constructed when the area was cleared and as it fell into disuse woodland recovered colonising the clearing. She cites the analysis of deposits from a palaeochannel of the river Nene by Brown and Keough (1992) where they showed that woodland dominated the landscape in the later Neolithic. Closer to Heathrow, and nearb to the archaeological sites at Runnymede, Scaife (2000) analysed the pollen from a series of natural deposits and his evidence

suggests that the Neolithic vegetation in that part of the Thames Valley was that of woodland.

An alternative hypothesis is that the pollen records from the three Neolithic features from Area 49, Area P2A2 and Perry Oaks (the subsample assessed from an Earlier Neolithic feature) represent very localised clearances of the woodland at Heathrow, which were fringed by woodland. In area 49 this clearing becoming invaded by trees as the pre-cursus ditch fell into disuse. If this is indeed what happened and the pre cursus ditch was in a clearing you would expect there to be higher frequency of tree pollen in the total pollen count than 10% rising to a brief maximum of 40%.

Early, Middle and Late Bronze Age Features analysed at Perry Oaks and Terminal 5, Heathrow

The deposits from a total of thirteen features (6 from Perry Oaks and 9 from Terminal 5) dated to the Bronze Age were analysed for pollen. They were features 12400, 135071, 156031, 17818, 155144 and 15243 from Perry Oaks and 17010, 557034 and 555027 in Area 49, 510047 in Area 77, 708014 in Area 91, 611100 and 611107 in Area 61, 815041 in Area P2A4 and 823181 Area P2A5. These features were all dated to the Middle Bronze Age to Late Bronze Age except pit 17010, which was Early/Middle Bronze Age. The high number of deposits that were analysed has allowed a spatial picture of what the landscape may have been like during the Middle Bronze Age at Heathrow. A number of other features were also assessed as to their suitability for pollen preservation but were not taken to further analysis either on archaeological criteria or because pollen was absent or poorly preserved within them.

The pollen assemblages recorded in the features from all areas of Heathrow are characterised by evidence for extensive clearance, arable cultivation and pastoral regimes. However there are differences between the individual deposits perhaps related to their geographic position or individual chronologies.

Framework (2006, 102) and Wiltshire (2006) placed considerable emphasis on the the likely occurrence of hedgerows during the Bronze Age at Perry Oaks. This supposition is based primarily on the pollen evidence and the location of the waterholes close to ditches and banks, where hedgerows may have developed. Considerable credence is placed on the pollen evidence to suggest the presence of

well established and managed hedgerows in the Perry Oaks landscape in the Bronze Age. It is concluded from palynological records that hedgerows were well established before 1600 BC. The diversity of pollen from woody plants and the presence of pollen from field maple is interpreted as representing hedges that were at least 500 years old (Framework, 2006, 104). This statement was probably based on hedgerow studies in the late twentieth century by Hooper (1974), which are discussed by Rackham (1986, 191-204) and trace comparisons back to the Saxon period. Hooper and others found that the greater species diversity was, the older the hedge, but there are exceptions to this rule if the hedges were planted. The modern comparisons have not been extended back to the Roman hedges and therefore to extrapolate the pollen signals record even further back to the Bronze Age at perry Oaks should be viewed with caution. The authors of Perry Oaks also make the assumption that the presence of banks and ditches precludes assarting of the woodland but this statement is unsubstantiated (Framework, 2006, 102). The rich assemblage of pollen from herbaceous taxa is also used to support the existence of hedgerows, although Wiltshire (in Framework Archaeology 2006, 157) does suggest that some of the taxa may also have been found growing in ditches, grassland, ploughed fields or disturbed ground.

The current palynological study from T5 has placed less emphasis on the presence of hedgerows, although not excluding them, and have also considered other habitats where trees and shrub might have been growing especially pasture woodland.

At Perry Oaks the pollen from six Bronze Age features (Framework 2006, figure 3.8) were clustered in two groups with the first (124100 and 155144) in Landholding 5 to the east of the other (157243, 17108, 135071, and 156031) in Landholding 3. The pollen from lower fills of the Middle Bronze Age waterhole 124100, in the eastern cluster, lay close to a species rich hedgerow, which would have provided a local source of food, construction materials, fuel, medicines, and other commodities (Wiltshire 2006). Cereals were being grown nearby and the pollen from herbaceous taxa recorded suggest that weeds were growing in or around the ploughed fields, along pathways, hedge-banks and in grazed pasture (ibid.). There then followed a phase when it is possible that the waterhole was less used and water levels fluctuated. Arable cultivation appears to have declined although flax (*Linum usitatissimum*) pollen was recorded and there is a slight increase in the representation of pollen from oak and other woody taxa perhaps suggesting less management of local trees (ibid.).

Arable cultivation appears to increase again and it was thought that hedgerow management increased based on a reduction in Rosaceae pollen probably from brambles. Wiltshire (ibid.) goes on to say that the changes in th pollen may reflect grazing pressure as sheep nibble young bramble and flowering heads so reducing the production of pollen. A change in grazing regimes are also used to explain the increase in bracken spores, as unlike cattle, sheep do not trample bracken. Wiltshire (2006) suggested that because the waterhole was drying out it was favouring sheep over cattle, because they need less water than cattle.

The pollen from the large waterhole 155144 also in this eastern cluster, which is dated to the Late Bronze Age, suggests that it lay within a farmed landscape with few trees and no evidence for hedgerows (Wiltshire 2006). There was clear evidence that cultivation was being practised when the lower fills were accumulating with grazing briefly becoming more important. An increase in the representation of herb pollen may be indicative that an area of ground around the waterhole was allowed to remain fallow. Wiltshire suggests that cultivation became less intensive as the waterhole dried up, although the immediate landscape remained very open. Wiltshire suggests that the changes recorded in the pollen assemblages during the use of waterhole 155144 do not exhibit major alterations in the local landscape but reflect minor changes in husbandry and land management.

The other cluster of four waterholes (157243, 178108, 135071, and 156031) at Perry Oaks were located some distance to the west of the two mentioned above. Three waterholes, (178108, 135071, and 156031) lay close together in a straight line with 135071 being place centrally. The other waterhole (157243) in this group lay a short distance to the south east of 178108 (Framework 2006, figure 3.8).

Waterhole 135071

The pollen data from this waterhole provides clear evidence of a hedgerow in close proximity to the feature, which would have been a source of many commodities including food sources, medicinal plants and constructional timber. Throughout the lifetime of the waterhole cereal cultivation was taking place nearby and there were areas of herb rich pasture.

Waterhole 156031

This waterhole was close to 135071 and the pollen data, again, suggests the proximity of an old hedgerow nearby. Early in the life of this waterhole the levels of tree and shrub pollen were quite high, which Wiltshire interpreted as fairly "lax management" of the hedge allowing the trees and shrubs to flower more readily. She also suggested that grazing was likely to have been light because the high values and variety of pollen from grasses and other herbaceous plants was characteristic of a species rich sward. A modern analogy for this can be found today on the limestone in the Yorkshire Dales near Austwick where there is a very marked increase in the diversity and number of herbaceous plants on the other side of a fence if sheep and cattle are excluded (Huckerby pers com). Undoubtedly cereals were being grown and/or processed near the feature during its lifetime and trees and shrubs are likely to have been heavily exploited. It is suggested that the quality of the grazing declined later in the life of the feature. There was little or no evidence of standing water during the lifetime of this feature. The obvious changes in the pollen diagram may only reflect small changes in the local land management (Wiltshire 2006).

Waterhole 178108

The third waterhole in this cluster was *178108* and the pollen evidence suggests that, again, there was no standing water in it during its lifetime. Although Framework (2006) suggests that this may be indicative of the waterhole being kept clear of weeds. The pollen record from this feature was unusual with unusually high values of *Sambucus nigra* (elder) pollen which were interpreted as a tree or trees overhanging the feature, or very close by in a hedgerow with other taxa such as maple and rosaceous shrubs. Wiltshire considered that because only low levels of pollen from grass, some ruderals and pasture herbs were recorded, grazing pressure was fairly high. However, arable cultivation was likely to have been important. Subsequent changes in the pollen spectra, often associated with increases in the representation of charcoal particles, are thought to represent changes in landuse around the feature.

Waterhole 157243

This waterhole lay within 50 m south of the previous one and is separated from the other three in this western cluster. Chronologically it was thought to be more recent although there is likely to have been an overlap. Again, there is thought to be strong

evidence of hedgerows nearby and arable cultivation. Wiltshire interpreted the changes in the pollen spectra as variations in the intensity of the grazing and cultivation activities around the settlement in the Middle/Late Bronze Age.

The Bronze Age features analysed from Areas 49, 61, 77, 91 100, P2A4 and P2A5 were sampled during the 2002 to 2005 excavation programme.

As described above, a single pit sample dated to the Early/Middle Bronze Age, in Area 49, was analysed, four of Middle Bronze Age (one each from Areas 49, Areas 77, P2A4 and P2A5, two of Middle to Late Bronze Age (one each from Areas 61 and 91) and two dated to the Late Bronze Age (one each from Area 91 and 1 from Area 100). The results are described earlier in this report but it is perhaps of relevance to comment here on the spatial diversity in land-use on the Heathrow site in the Middle and Late Bronze Age that has been demonstrated by Patricia Wiltshire's work at Perry Oaks and the more recent work reported here by Peglar *et al*.

Areas 91 and 77 (lying in the south east of the site)

The pollen records from the fills of three waterholes, (waterhole 510047 in Area 77 and waterholes 708014 and 685032 in Area 91) from the eastern edge of the 2002-2005 excavation suggest that there was a much greater representation of woodland to the east in the Middle and Late Bronze Age. This woodland was probably of a quite open character and likely to have been grazed. The appearance of secondary woodland in the later history of these two features, together with a reduction in pollen from cereals and taxa indicative of hedgerows, has been interpreted by the authors as possible abandonment of the area in the Late Bronze Age. The increases in arboreal pollen may represent an actual spread of secondary woodland or that the level of hedgerow and woodland management declined allowing the trees and shrubs to flower more profusely. The possible abandonment of these areas in the Late Bronze Age is also corroborated by the decrease in the values of nettle pollen and *Trichuris* eggs (see section) in Waterhole 708014 , Area 91.

Area 49 (close to the Stanwell Cursus near settlement 7)

The analysis of the fills from three features dated to the Early/Middle Bronze Age in area 49 confirmed the very open nature of the landscape during these periods. The landscape was dominated by pasture and grassland, but the cultivation or processing of cereals and other crops such as flax was taking place. There was little woodland in

this area of the site but the settlement may have had some hedgerows. The pollen record from the two overlapping monoliths from pit 557034 also suggest that this pit lay within an area of the site with much disturbed ground and ruderal communities as would be expected around habitation and trackways. Some of the pollen types recorded are characteristic of nitrogen and phosphate enriched soils supporting the evidence for grazing animals and pasture.

Area 61 (to the east of the site near Bronze Age Trackway 2)

The analyses of the fills from two interrelated features dating to the Middle-Late Bronze Age in Area 61 demonstrated the openness of the vegetation in these periods, perhaps with hedgerows bordering the nearby arable fields and species rich grassland. Initially grazing pressure is likely to have been low or at some distance from the features. Later, the areas of pasture became more heavily grazed although the high values of nettle pollen and *Trichuris* eggs in the fills may be indicative of cess being deposited in the feature.

Area 100 (to the north of the site)

.The analysis of the pollen from a single Late Bronze Age waterhole (593207) from Area100 demonstrated that. the landscape continued to be very open, with grassland and suggests cereal growth continuing to be recorded. However, the hedgerows of the earlier Bronze Age seem to have decreased and there appears to have been an increase in open waste, disturbed ground and ruderal communities.

Areas P2A4 and Area P2A5 (from the east of the site near Bronze Age Trackway 6)

The pollen record from both these waterholes suggest that the Middle Bronze Age landscape was open with herb rich grasslands and some cereal cultivation. However pasture may have been more prevalent close to the Bronze Age Trackway 6. There is some evidence to suggest that some regeneration of woodland was taking place towards the upper part of the sequences.

Late Bronze Age/ Early Iron Age Transition at Perry Oaks and Terminal 5, Heathrow

The only pollen evidence for this period at Perry Oaks comes from the assessment of the fills of pit 146048 and although palynomorphs were very sparse in these deposits

the assemblage does suggest that the Perry Oaks area continued to be very open (Wiltshire 2006). No features dating to the Bronze /Iron Age transition were analysed from the Terminal 5.

The Middle Iron Age at Perry Oaks and Terminal 5, Heathrow

The number of deposits dated to the Middle Iron Age suitable for pollen analysis was low, with none in the more recent excavations. At Perry Oaks the deposits from two features (137114 and178015) were assessed but only one of them (178015) was judged as having the potential for further palynological analysis (Wiltshire 2006). Although the frequency of palynomorphs recorded during the assessment of the fills of 137114 was very low, the pollen record does suggest that weedy grassland and ruderal weeds dominated the local landscape with some cereal cultivation nearby. There were some trees growing in the pollen catchment but there was no evidence of hedgerows. The detailed pollen analysis of the fills of Feature 178015 confirms the presence of a very cleared landscape at Perry Oaks in the Middle Iron Age. It is possible that there were some trees near the settlement area but these are likely to have been pollarded and/or coppiced so preventing flowering, causing them to be under-represented or absent in the pollen record. Again the importance of hedgerows, a major feature of the Bronze Age landscape, seems to have been reduced by the Middle Iron Age at Perry Oaks. Wiltshire (ibid.) suggests that grassy earth banks replaced the hedgerows as field boundaries. Initially, although the values of pollen from grasses were low, the pollen record suggests a species rich grassland with grassy banks between the fields, where some of the herbs may have grown. It is possible that grazing pressure was high and that the remaining herbs were unpalatable to the animals. Subsequent changes in the pollen record, when the values of pollen from grasses and ribwort plantain increase, charcoal particles decrease and only low numbers of cereal pollen were identified, were interpreted by Wiltshire as representing a reduction in grazing pressure and a relaxation of land management. Towards the upper part of the sequence there were changes in the pollen record, which included a marked rise in pollen from grasses. Wiltshire (2006) thought that these changes may have been associated with a reduction in grazing pressure or are perhaps indicative of Iron Age hay making when the crop was harvested after the grasses had flowered but before the other herbs had.

Late Iron Age/Early Romano-British Period at Perry Oaks and Terminal 5, Heathrow

There were no features from this period at Perry Oaks and the only suitable sequences from the 2002 to 2005 excavations were two waterholes (593207 and 649010) from Area 61. Waterhole 593207 is dated to the Late Iron Age and 649010 to the Late Iron Age Early Romano British period. The pollen records from both of these features are very similar and demonstrate a continuation of the open nature of the landscape at Heathrow through the Late Iron Age to the Romano- British Period. Grassland and herb rich meadows probably represent the major types in Area 61 at this time but there continued to be some cereal cultivation and there were areas of waste, disturbed ground around the habitations and the trackways. A characteristic of this period is the absence or very sparse nature of hedgerows and woodland as Wiltshire observed at Perry Oaks in the middle Iron Age (Wiltshire 2006).

Romano-British Period at Perry Oaks and Terminal 5, Heathrow

This was represented by a single feature, a waterhole/pit (135087) to the west of the main settlement (Framework, 2006, 227). The palynological analysis of the fills from this feature suggests that when they were accumulating the Roman landscape in the late 4th and early 5th centuries was virtually cleared of trees and hedgerows. However the pollen evidence suggests that some ancient hedgerows, probably quite open in character, may have still been present. Wiltshire interpreted some of the changes in the pollen record to modifications of management regimes in the area. Initially weedy grassland and ruderal weeds dominated the landscape, although the presence of cereal and arable weed pollen is indicative of cultivation or processing close to the feature. The reciprocal fluctuations in the high values of both grass and Lactucaceae pollen through the sequence was interpreted as representing changes in the grazing intensity at Perry Oaks. It was suggested that very high values of Lactucaceae (dandelion-type plants) pollen were indicative of more intense grazing because their basal rosettes are able to withstand grazing unlike many other plants. However, higher values of grass pollen were thought to be representative of a reduction in grazing pressure. The absence or very low values of cereal pollen during the later phases of the feature suggest that arable cultivation in the immediate area decreased after an earlier period

when cereals were being grown or processed close to the waterhole. The proportion of pollen from woody taxa increases in the central part of the diagram before falling again. Wiltshire (2006) comments that this rise is unexpected in a cleared landscape but could possibly be explained by a relaxation in the management of the hedgerows so allowing the trees and other plants to recover as a source of valuable commodities such as constructional timber and food. In her summary of the Romano-British period at Perry Oaks Wiltshire describes the landscape as being characterised by pasture and "waste ground" with occasional trees and shrubs and some cultivation.

Romano-British features from the 2002-2005 excavations.

The pollen from two waterholes (527374 and 527388) from Area 61 was analysed during the later investigations and, broadly speaking, supports the evidence from Perry Oaks. Area 61 appears to have been very open and pastoral in character with some cereal growth. There were very significant areas of grassland and meadows and a lot of disturbed ground, trackways and habitation sites. However the values of hazel and elm pollen in the lower samples from waterhole 527374 suggest a possible hedgerow close to this feature.

Medieval and Post-Medieval at Perry Oaks and Terminal 5, Heathrow

There is no pollen record dating to the Medieval and Post-Medieval periods from Perry Oaks and the only information about the nature of the landscape and vegetation comes from pit 529139 in Area 49 and a possible post Medieval retting tank (546437) cut into the palaeochannel in Area 17. In contrast to the earlier periods of settlement at Heathrow there was a greater representation of pollen from trees and therefore of woodland, probably of a secondary nature. By the Medieval, parkland with grazed grassland and standard oaks was present in Area 49. Disturbed or waste ground continued to be important in this part of the site but grazing and arable cultivation was being practised. In Area 17, near to the palaeochannel, the biodiversity was high in the pollen record and included obligate aquatic species and plants from shallow water or damp ground suggesting that the palaeochannel in which the tank was cut was still a damp course during the Medieval period. The landscape was largely cleared along the channel banks with a mosaic of pasture, arable fields, open ground and damp/wet

grassland. A suite of cereal types were being cultivated and hemp was either being grown nearby or being retted in the tank cut into the palaeochannel.

In conclusion the summary of the pollen data from Perry Oaks together with that from the more recent excavations (2002-2005) has demonstrated that the comprehensive sampling strategy for palynological assessment and analysis undertaken at Heathrow has indeed enabled a spatial and temporal picture of the landscape to be formulated. This picture, although incomplete and sketchy in parts, does place the archaeological record of the various areas and periods within a landscape setting.

The major limitation to any palynological investigations from archaeological sites is that of the identification of suitable deposits in which pollen has been preserved. The problems of interpreting the data from archaeological features are discussed in the introduction. Ideally the pollen record from individual features can be best interpreted by comparison with that from well dated natural deposits closely associated with a site but this has only been possible to a very limited extent at Heathrow. The only natural pollen records are from the palaeochannel deposits, which remain undated, but by comparison with published pollen diagrams from two sites near to Oxford (Day 1991) and Runnymede (Scaife, 2000) it has been possible to surmise the nature of the Mesolithic woodland at Heathrow. The final outcome of this palynological work is of considerable significance in our understanding of the archaeological record at Heathrow.

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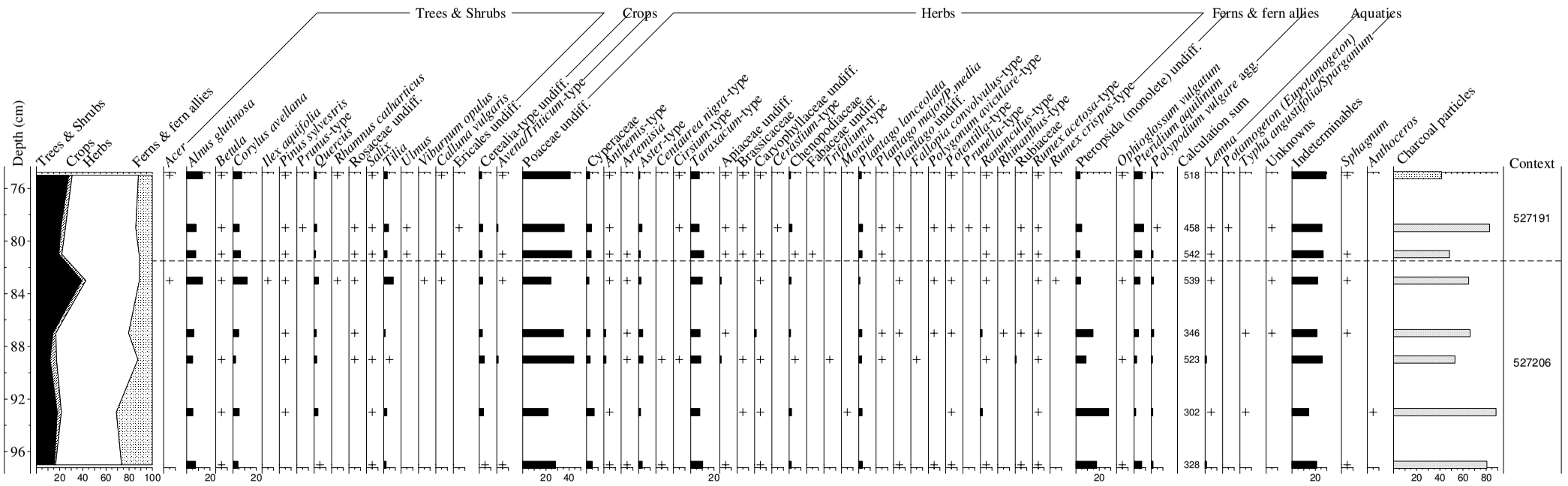
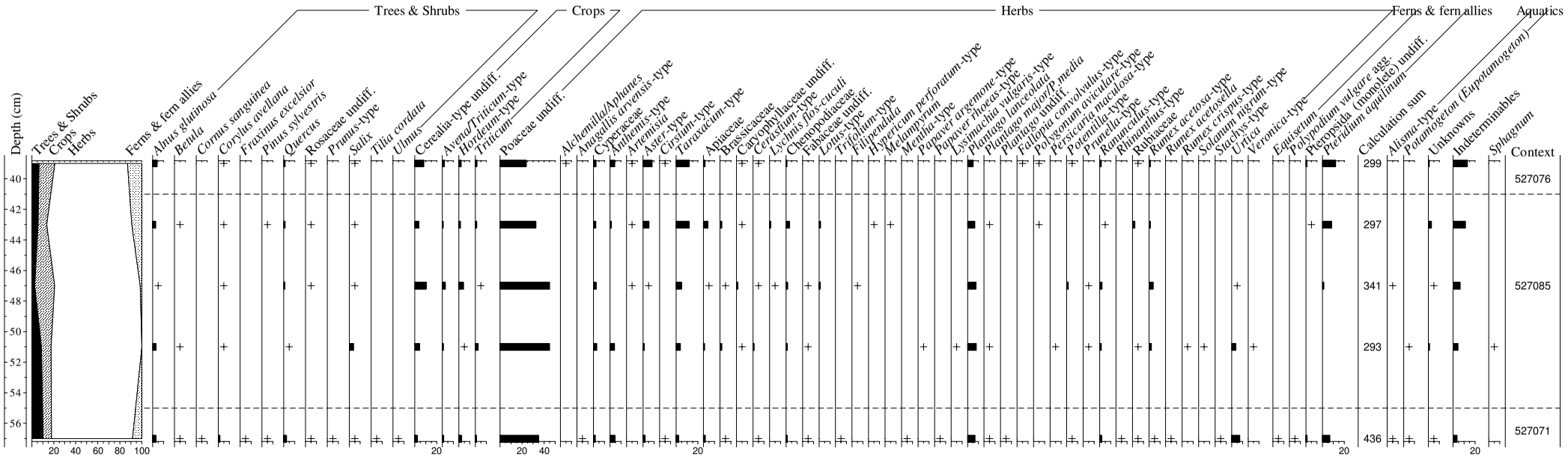
HEATHROW T5 - Figure 1
Sample 17094, the fill of Neolithic pit 527200
Pollen percentage diagram



Summary pollen diagram

S.Peglar, 2006

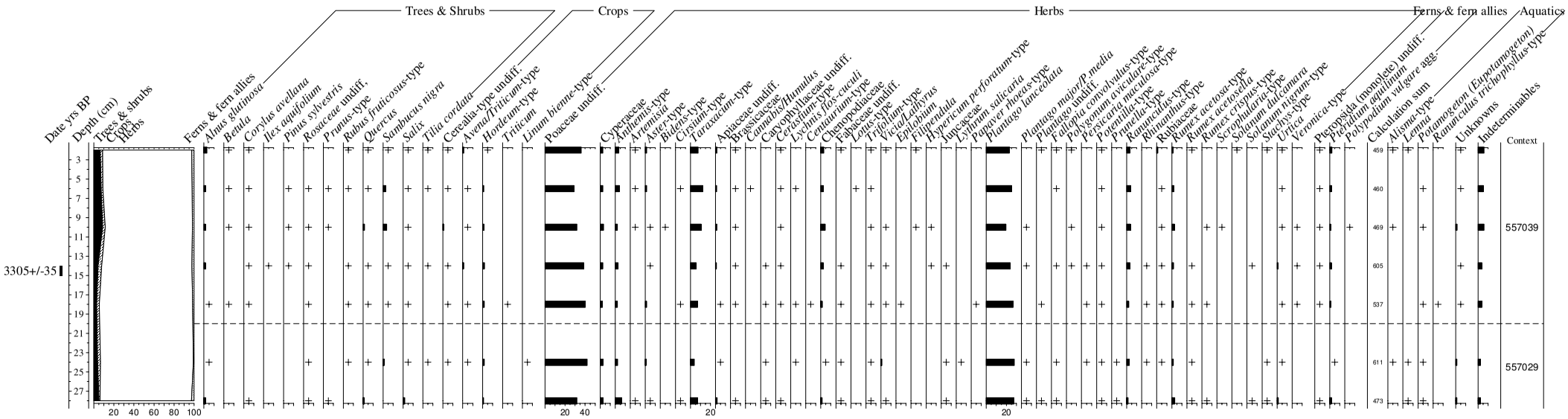
HEATHROW T5 - Figure 2
Sample 17010, the fill of Early/Middle Bronze Age pit 527069
Pollen percentage diagram



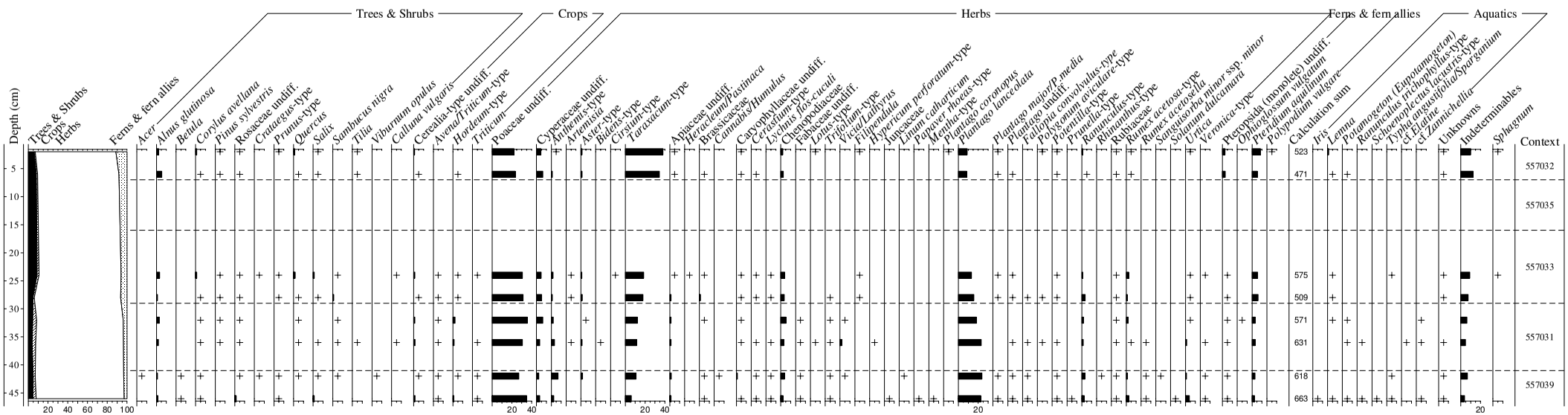
Summary pollen diagram

S.Peglar, 2006

HEATHROW T5 - Figure 3
Sample 16512, the fill of Middle Bronze Age pit 557034 which
is a recut of a previous Middle Bronze Age pit 557027
Pollen percentage diagram



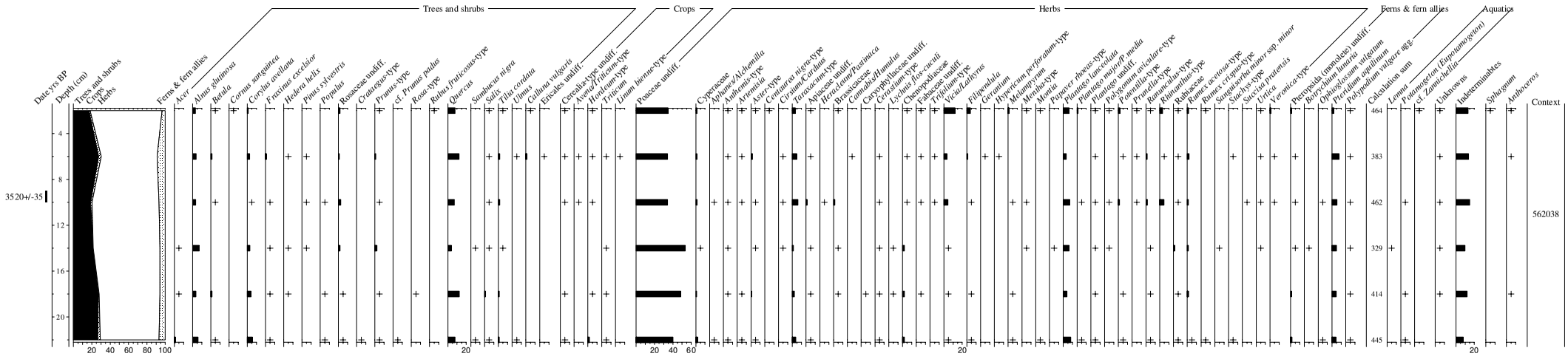
HEATHROW T5 - Figure 4
Sample 16511, the fill of Middle Bronze Age pit 557034 which
is a recut of a previous Middle Bronze Age pit 557027
Pollen percentage diagram



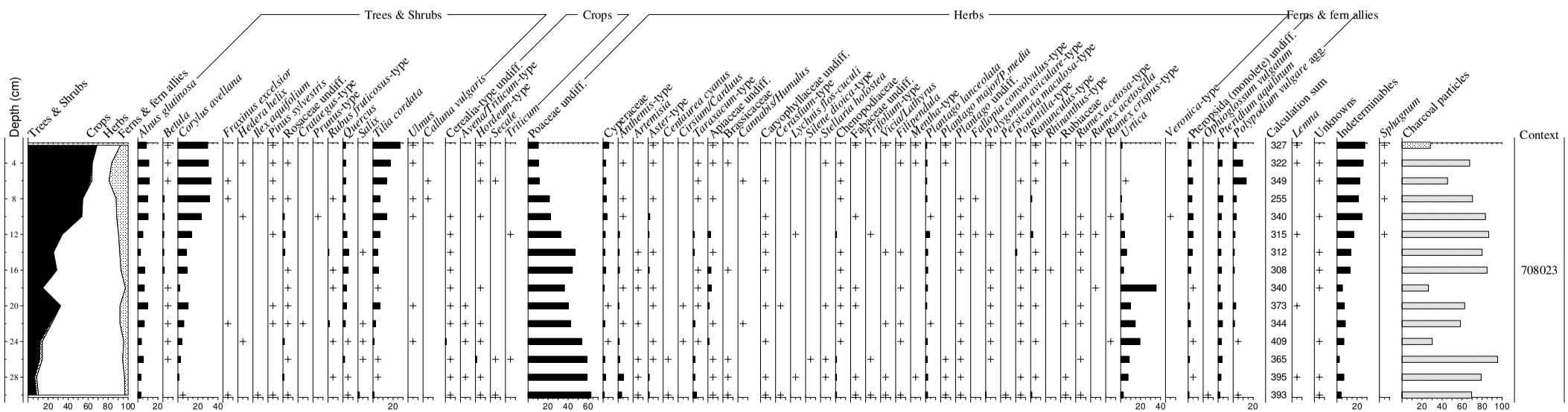
Summary pollen diagram

S.Peglar, 2006

HEATHROW T5 - Figure 5
Sample 16048, the fill of Middle Bronze Age waterhole 510047
Pollen percentage diagram



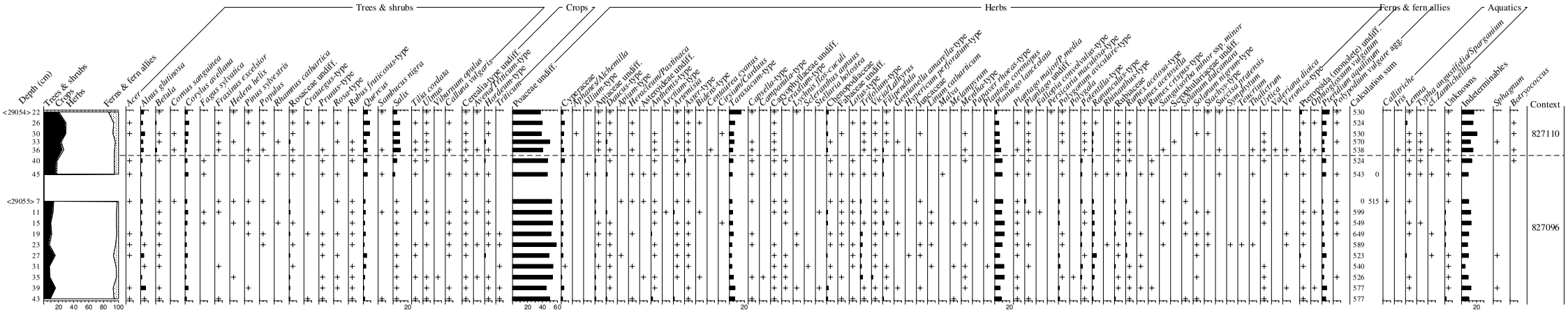
HEATHROW T5 - Figure 6
Sample 27315, the fill of Middle Bronze Age waterhole 708014
Pollen percentage diagram



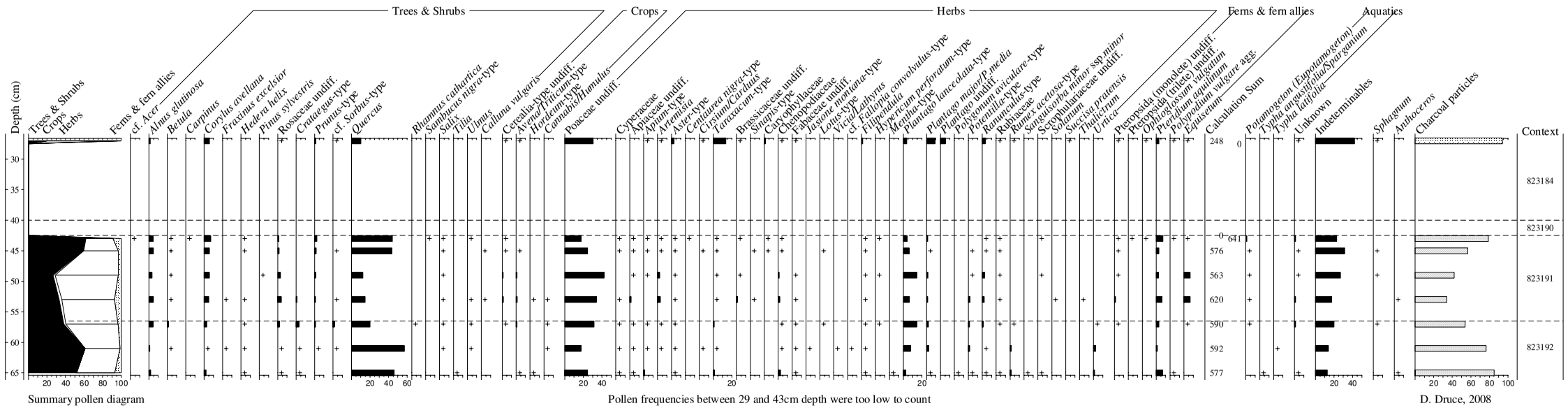
Summary pollen diagram

S.Peglar, 2006

HEATHROW T5 - Figure 7
Samples 29054 & 29055, fills of Middle Bronze Age waterhole 815041
Pollen percentage diagram



T5 HEATHROW - Figure 8
Sample 29133, fill of Middle waterhole 823181
Pollen percentage diagram



Summary pollen diagram

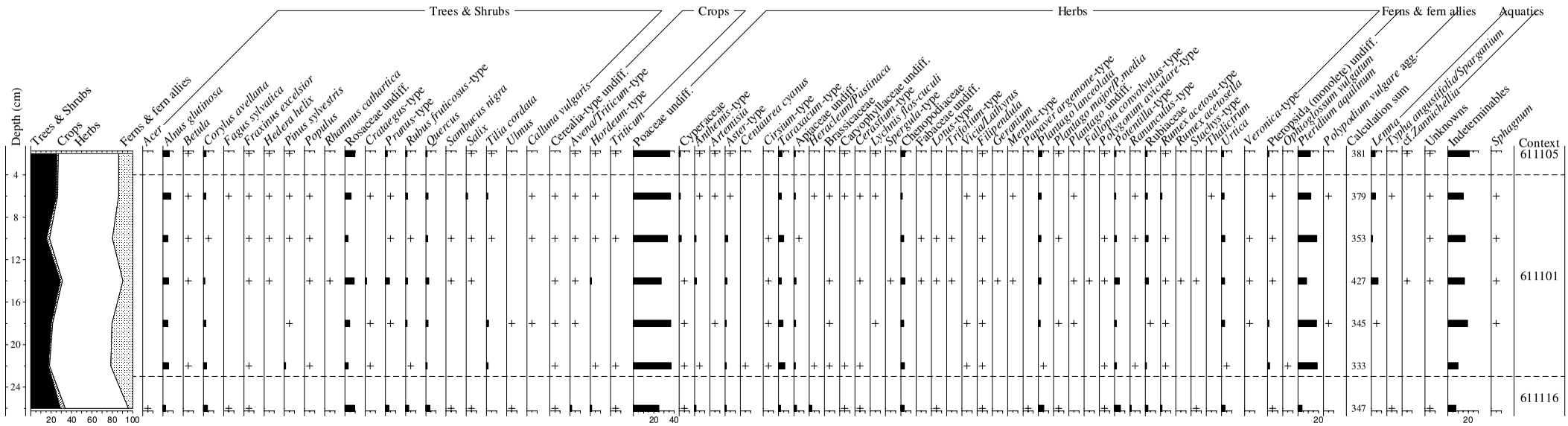
Pollen frequencies between 29 and 43cm depth were too low to count

D. Druce, 2008

HEATHROW T5 - Figure 9

Sample 17146, the fill of Middle/Late Bronze Age waterhole 611107,
which is a recut of a previous Middle Bronze Age pit 611100

Pollen percentage diagram



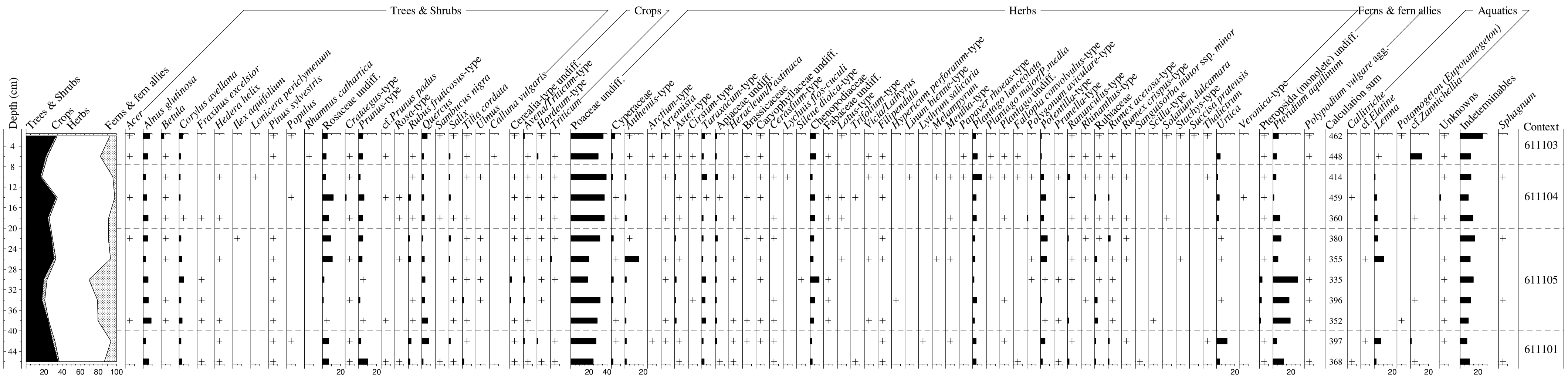
Summary pollen diagram

S.Peglar, 2006

HEATHROW T5 - Figure 10

Sample 17133, the fill of Middle/Late Bronze Age waterhole 611107, which is a recut of a previous Middle Bronze Age pit 611100

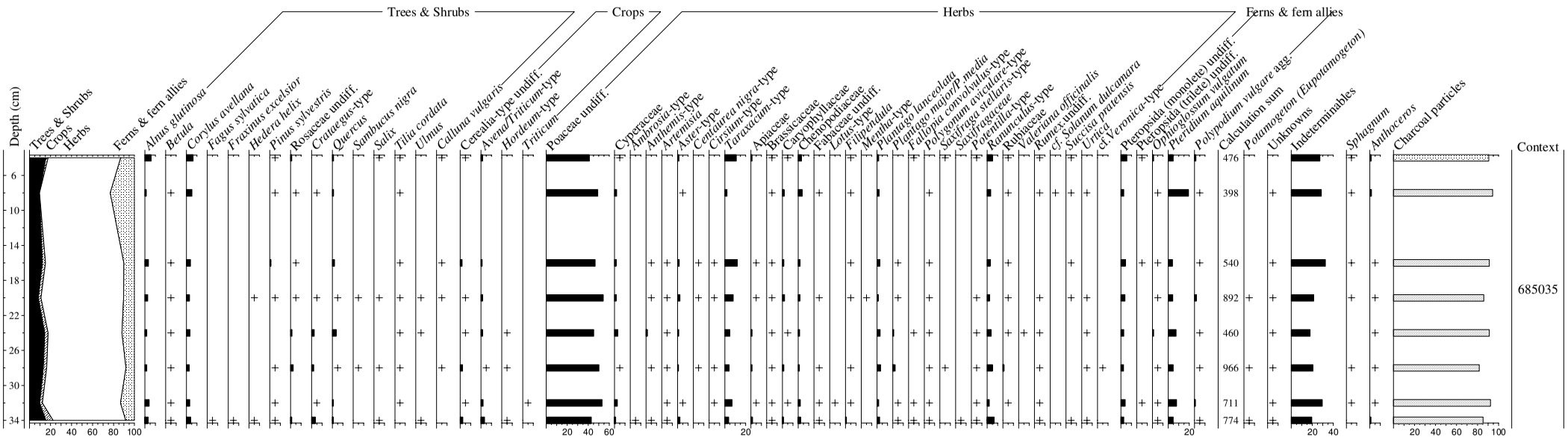
Pollen percentage diagram



HEATHROW T5 - Figure 11

Sample 27091, the fill of a Middle or Late Bronze Age/Early Iron Age waterhole 685032

Pollen percentage diagram



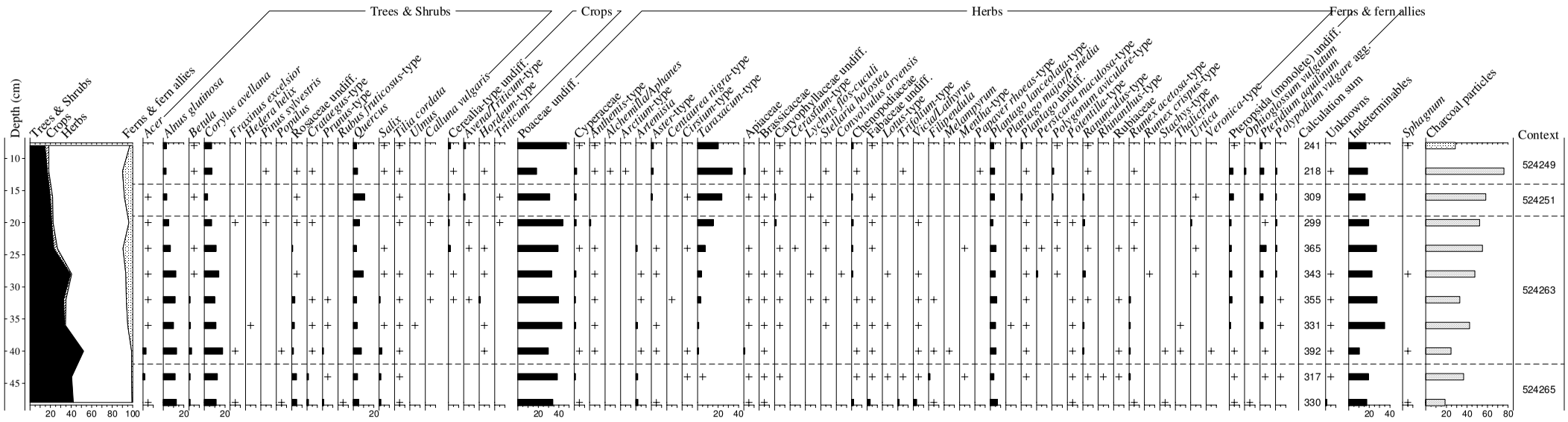
Summary pollen diagram

D.Druce, 2006

HEATHROW T5 - Figure 12

Sample 18145, the fill of Late Bronze Age/Early Iron Age waterhole 509174

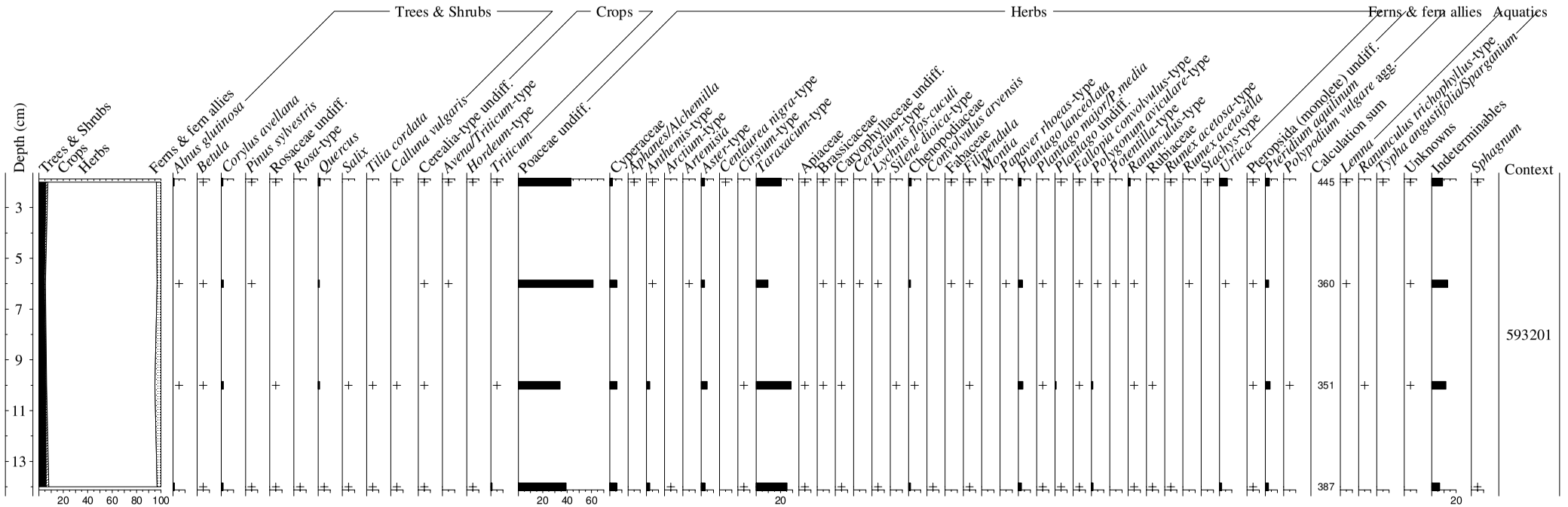
Pollen percentage diagram



Summary pollen diagram

S.Peglar, 2006

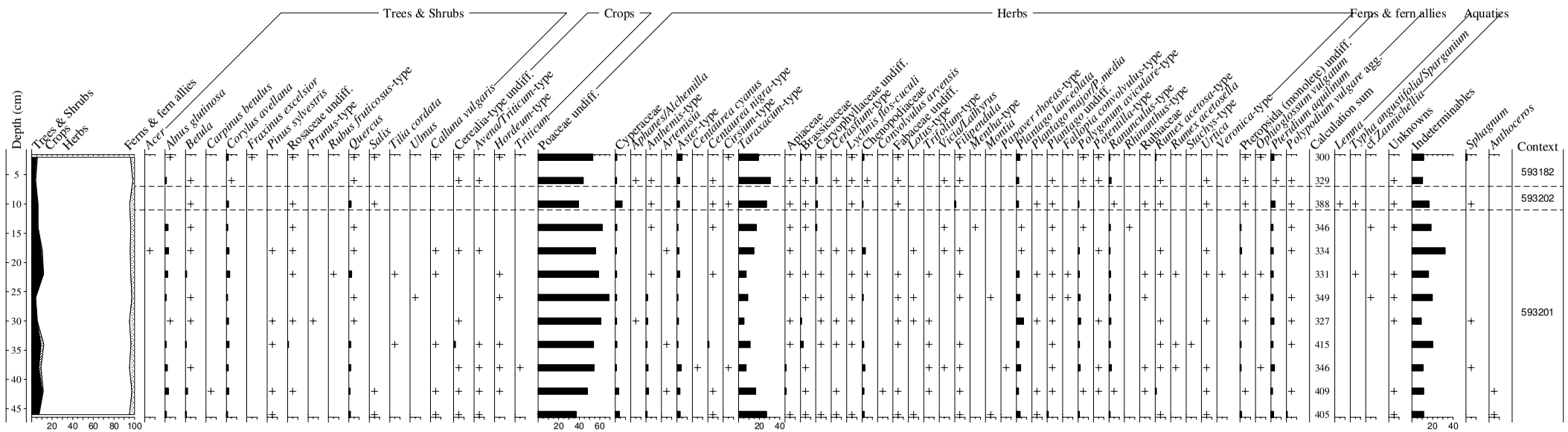
HEATHROW T5 - Figure 13
Sample 18363, the fill of Late Iron Age/Early Romano-British waterhole 593207
Pollen percentage diagram



Summary pollen diagram

S.Peglar, 2006

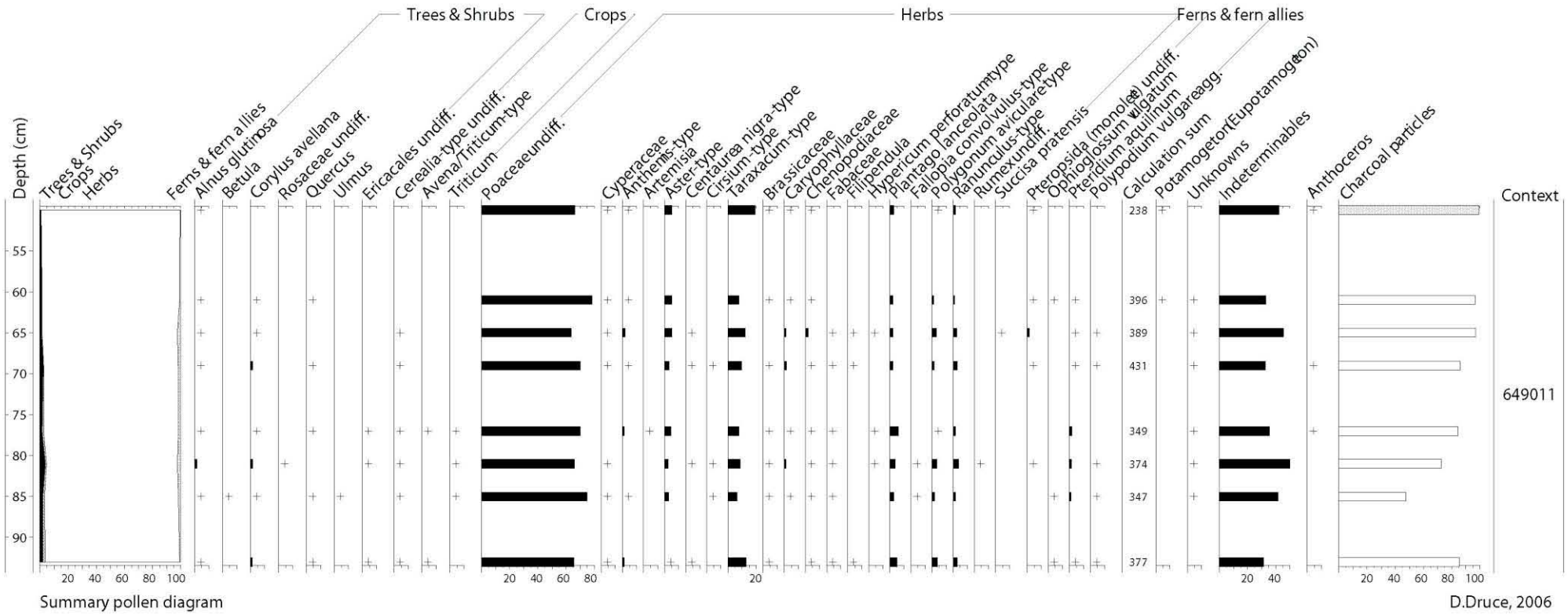
HEATHROW T5 - Figure 14
Sample 18364, the fill of Late Iron Age/Early Romano-British waterhole 593207
Pollen percentage diagram



Summary pollen diagram

S.Peglar, 2006

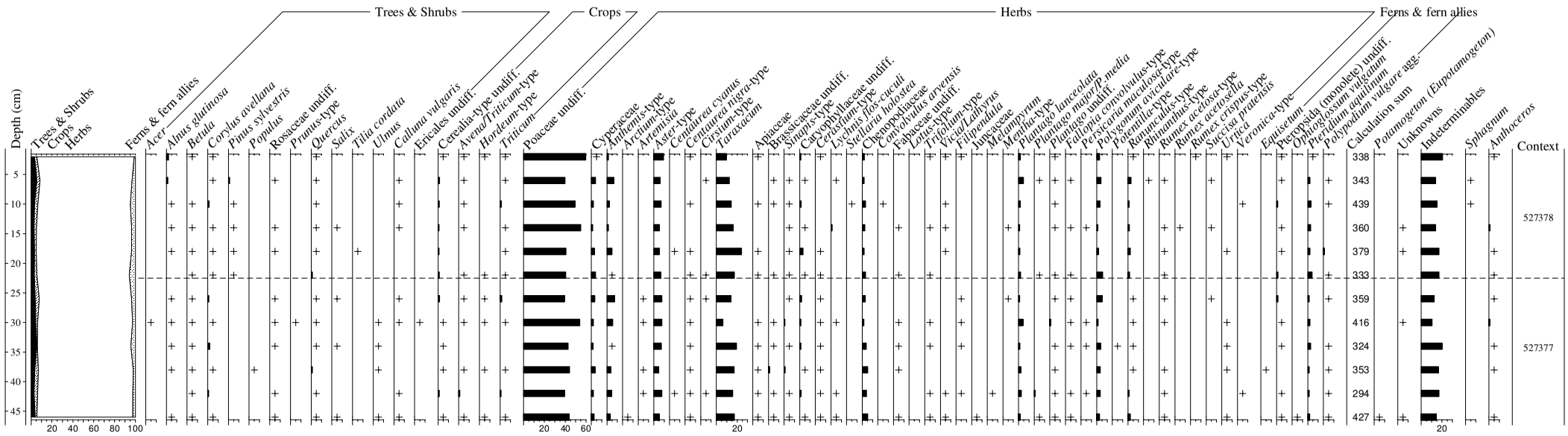
HEATHROW T5 - Figure 15



HEATHROW T5 - Figure 16

Sample 18236, a fill of Early-Middle Romano-British waterhole 627374

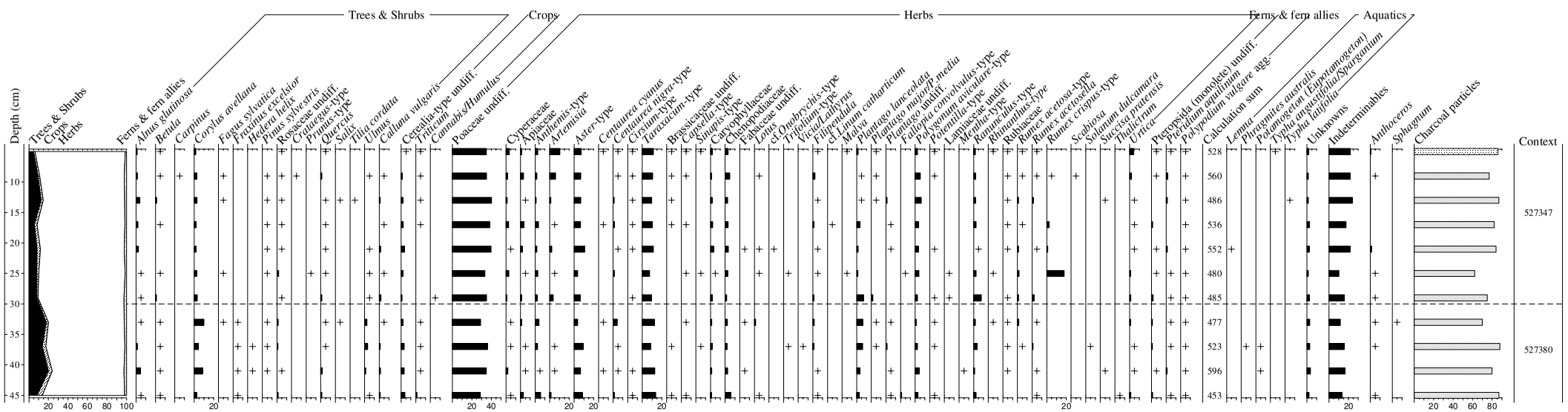
Pollen percentage diagram



Summary pollen diagram

S.Peglar, 2006

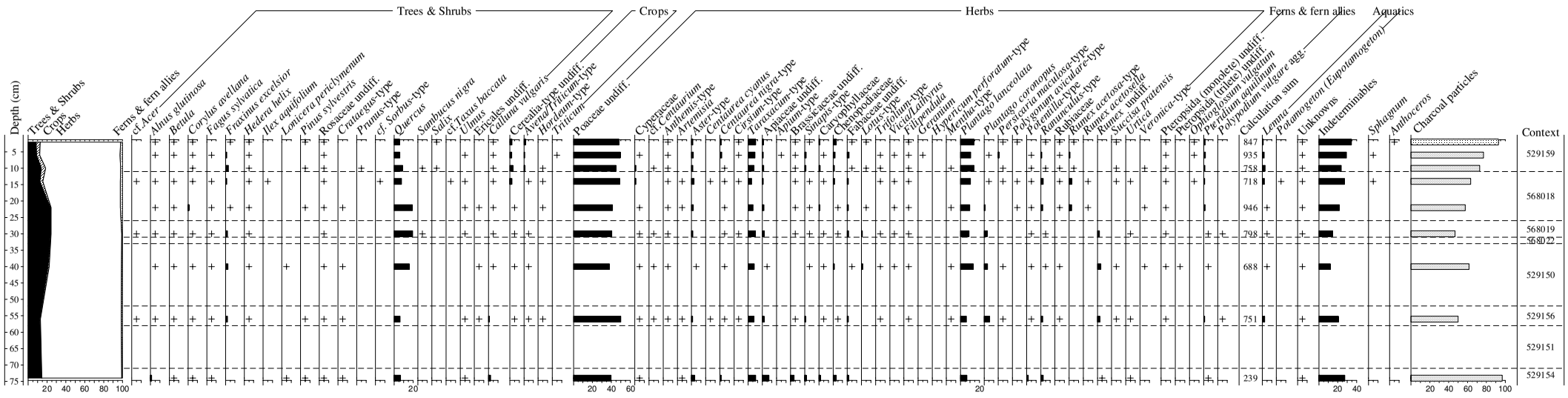
HEATHROW T5 - Figure 17
Sample 18269, a fill of Middle Romano-British waterhole 527388
Pollen percentage diagram



HEATHROW T5 - Figure 18

Sample 17518, a fill of Medieval waterhole 529139

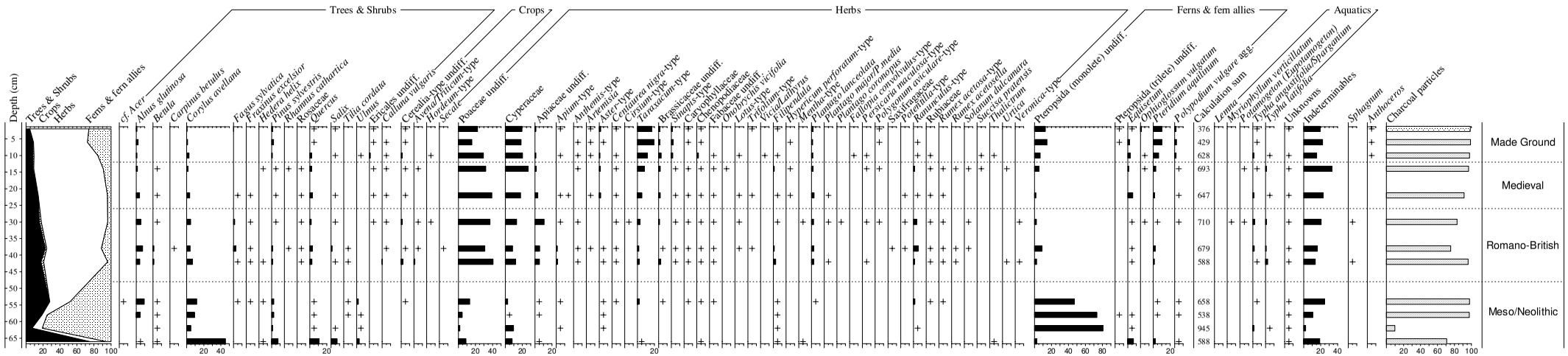
Pollen percentage diagram



Summary pollen diagram

D.Druce, 2006

HEATHROW T5 - Figure 19
Sample 18154 from the Palaeochannel
Pollen percentage diagram

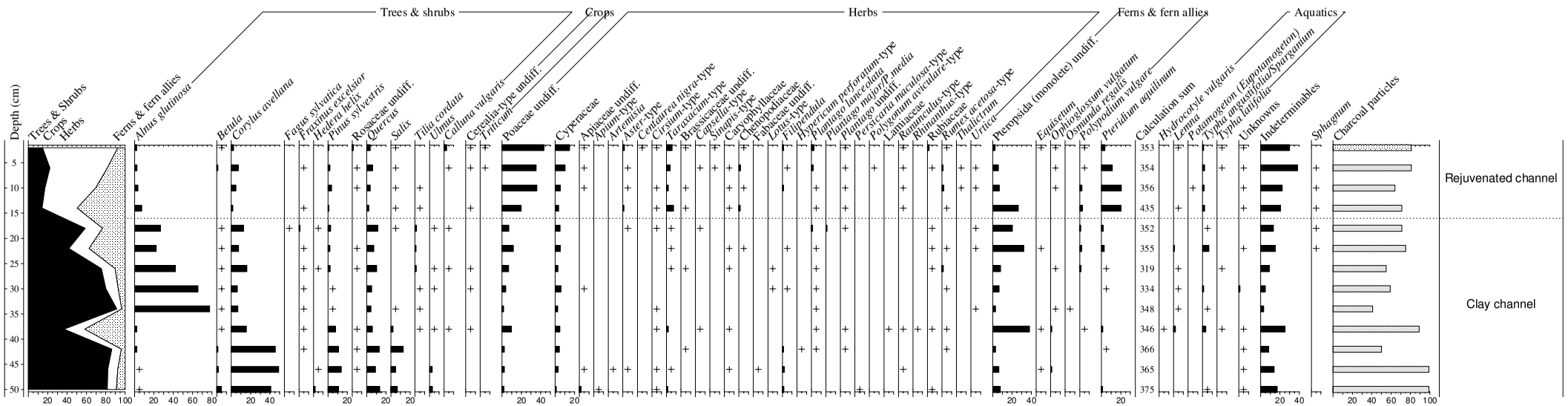


Summary pollen diagram

Very low pollen frequency between 45 and 53 cm
suggests an hiatus in the sediments

D.Druce, 2006

HEATHROW T5 - Figure 20
Sample 19019 from the Palaeochannel
Pollen percentage diagram



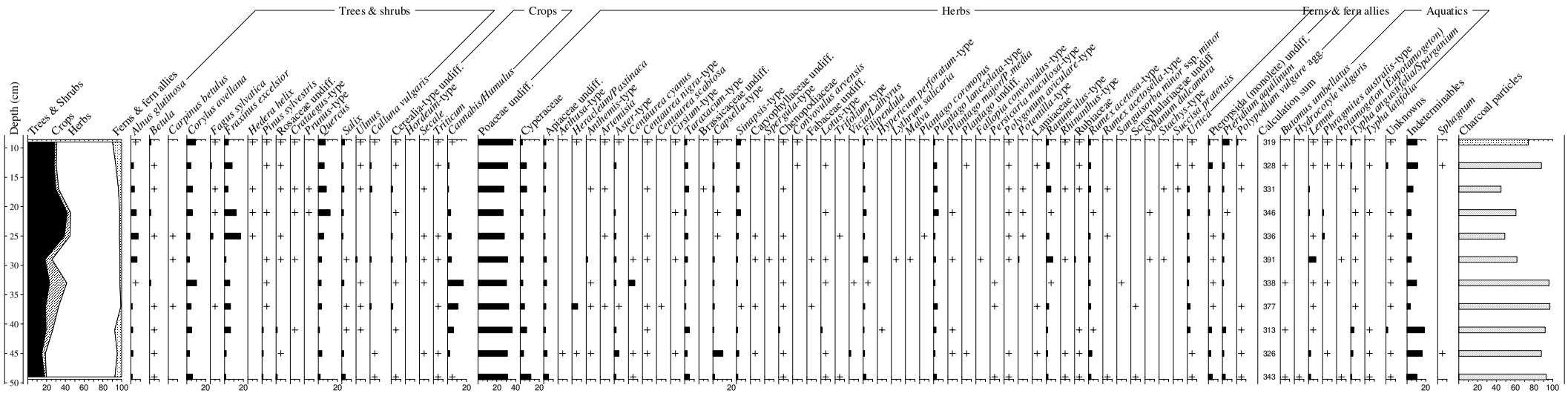
Summary pollen diagram

E.Huckerby & D.Druce, 2006

HEATHROW T5 - Figure 21

Post-Medieval sample 18426, the fill of a 'retting tank' cut inhto the Palaeochannel

Pollen percentage diagram



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