

ALSF2517. Report on archaeobotanical material (pollen and plant macrofossils) from Willington, Derbyshire. James Greig. 03/01/07

**Report on archaeobotanical material (pollen and plant macrofossils)  
from Willington, Derbyshire**

**James Greig**

report 06.06

## **Summary**

The pollen and plant macrofossils from seven profiles through palaeochannels and other organic layers were generally abundant and well-preserved. Some of the material seemed to be of early post-glacial date (lower 1, 7). The post-Neolithic material assessed (upper 1, 4, 5, 6) seemed to show clear signs of human activity in the vicinity, seen in both pollen and plant macrofossils, offering the prospect of an important new understanding of the development and settlement of this alluvial landscape. Full analysis has been made of three samples each of column 5 the deposits in a Bronze Age wood-lined trough, and column 6 the sediments of a silted channel adjacent to the wooden trough. These show a partly wooded landscape with some signs of local regrowth of woodland perhaps after the burnt mound became disused.

## **The Site**

Seven column samples (monoliths) and a number of separate bagged samples have been collected, of organic palaeochannel fills found and sampled when exposed as a result of gravel extraction at Willington quarry.

Column 1, possible prehistoric palaeochannel fill

Column 2, possible Roman palaeochannel fill (not assessed)

Column 3, possible prehistoric peat layers at edge of palaeochannel (not assessed)

Column 4, Roman/medieval palaeochannel near to burnt mound

Column 5, prehistoric Bronze Age fill of trough inside burnt mound

Column 6, prehistoric Bronze Age, silted channel beside trough, by burnt mound

Column 7, post-glacial to 2nd millennium B.C. ancient peat

## **Samples**

### *Macrofossil samples*

A selection of material has been analysed, either as part of the extraction and identification of material for radiocarbon dating, or simply for the botanical data.

Column 1 **0-10, 48-50, 73-75, 80-90 cm 96-98,**

Column 4 **248**

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Column 5 1998-46 255 top and 1998-46 255 bottom

Column 6 270 4466, 283 4487, 294 1998-46 top and 294 1998-46 bottom

### *Pollen samples*

These were taken from the monoliths using a cork borer, and stored in a refrigerator until preparation. The following samples were prepared for assessment, with counts of about 100 grains. Those in **bold** in Columns 5 and 6 have been counted to analysis level, roughly 200 land pollen grains and a scan per sample.

Willington 1: 0, 5, 50, 70 cm

Willington 4: 10, 70 cm

Willington 5: **5, 15, 25** cm

Willington 6: **0, 10, 20** cm

Willington 7: 0, 20, 40 cm

## **Laboratory work**

### *Plant macrofossils*

A subsample of 100 ml was measured out. It was broken down in water, and the lighter, organic, fraction washed over to separate it from the inorganic material, and caught in a 300 µm sieve. The washover was sorted in water under a x10 stereo microscope and the plant remains identified and checked with the writer's own reference collections. As this is an assessment, some identifications were not taken as far as possible. The results are listed in taxonomic order (Kent 1992) in Table 1.

### *Pollen analysis*

Pollen samples were processed using the standard method; about 1 cm<sup>3</sup> subsamples were dispersed in dilute NaOH and filtered through a 70µm mesh to remove coarser material, which was then scanned under a stereo microscope. The finer organic part of the sample was concentrated by swirl separation on a shallow dish. Fine material was removed by filtration on a 10µm mesh. The material was acetolysed to remove cellulose, stained with safranin and mounted on microscope slides in glycerol jelly. Counting was done with a Leitz Dialux microscope. Identification was using the writer's pollen reference collection, seen with a Leitz Lablux

microscope. Standard reference works were used, notably Fægri and Iversen (1989) and Andrew (1984). Counts of about 200 land pollen grains (not including *Alnus* and *Corylus*) per slide were made, followed by a quick scan for further taxa.

## Results

Both pollen and macrofossils are generally well-preserved and abundant in the material from Willington.

The pollen results are given in Tables 2, 4, and 6 and in Figs 1 and 2. The nomenclature and order of the taxa follow Bennett (1994) and Kent (1992) respectively. The macrofossil results are given in Tables 1, 3 and 5.

### *Willington 1 (Tables 1 and 2)*

The pollen sample from 5 cm looks early post-glacial, as it contains have much *Pinus* (pine) *Betula* (birch) and *Corylus* (hazel) among trees and shrubs. The herbs include some taxa such as *Thalictrum* (rue), *Artemisia* (mugwort), *Polemonium* (Jacob's ladder) and *Armeria* (thrift), a combination mainly known from Late-glacial/early Post-glacial contexts in which there was herbaceous vegetation as the landscape was only lightly wooded then. Wetland plants include Cyperaceae, and aquatics include *Myriophyllum* (millfoil). *Corylus* arrived on most of England between 9500 and 9000 BP and *Quercus* (oak), which was only found as a trace in this part of the core, somewhat after 9000 BP (Birks 1989), so the likely age of this lower part of the profile is somewhat more than 9000 years.

The radiocarbon dates of 11405 ± 45 BP (SUERC-7350) from the top and 11780± 45 BP (SUERC-7351) from the bottom of the profile agree with this conclusion from the pollen that this material is Late-glacial in age.

Some of the assessment counts such as the top sample at 0 cm included some signs of thermophilous trees such as *Quercus*, *Tilia* and *Alnus*, which led to the idea in the assessment that part of the profile could be Post-glacial, but this could possibly be the result of some disturbance and mixing with later material.

The macrofossil samples from the lower part support this conclusion of mainly Late-glacial material, with *Betula* (birch) and some *Salix* (willow) remains, together with those of a range of herbs mainly from wetland and aquatic habitats. Some of the macrofossil samples from the upper 50 cm contained charcoal and charred *Rumex* (dock), and *Sambucus nigra* (elder) which suggests

that there was some human activity in this part, or mixing with later material bearing signs of human activity.

#### *Willington 4 (Tables 3 and 4)*

The two spectra (10 and 70 cm) are essentially similar, with a range of trees and shrubs making up 20-28% of the total pollen, including *Fagus* (beech). The herbs include records of cereal and plantain, together with a range of weed and grassland plants. An occupied farming landscape therefore seems to be represented.

This could easily represent Roman or medieval times, although *Centaurea cyanus* (cornflower), which might have been expected in such a landscape after about AD 1200, was not seen in the (small) counts, nor when the slides were scanned. Perhaps the material predates the high medieval period.

The macrofossils from 248 were quite abundant, and include a substantial element from the dry land, including a number of weeds such as *Atriplex* (orache), *Chenopodium* (goosefoot), *Stellaria* (chickweed), *Aphanes* (parsley piert) and two species of *Valerianella* (cornsalad). These suggest that cultivated land is well represented here. Probable grassland plants include *Cerastium* sp. (mouse-ear chickweed) and *Leontodon* sp. (hawkbit). Human activity is shown by charcoal. There is also a marshland part of the flora with *Ranunculus flammula* (lesser spearwort), and some aquatic plants as well, *Potamogeton* (pondweed) and *Glyceria* sp (sweet-grass).

#### *Willington 5 trough fill (Fig 1, Table 5)*

##### Trees and woodland

The pollen results from this short section of 25 cm sediment show about 22-40% tree and shrub pollen (excluding *Alnus* and *Corylus*). This shows that the general surroundings had some woodland with *Quercus* (oak), *Ulmus* (elm), *Fraxinus* (ash) and *Hedera* (ivy) with a trace of *Tilia* (lime). The small records of *Prunus* type (including sloe and cherry) and *Crataegus* (hawthorn) may represent woodland margins, scrub or hedgerows. They often occur in prehistoric sites such as this.

*Alnus* (alder) is the most abundant tree pollen type, and at least some of this is likely to have come from the immediate surroundings, since alder seeds and catkins, which are not usually

dispersed far from their parent trees, were present among the macrofossils. Alders probably grew along the stream channels together with *Salix* (willow) which is also present in the pollen record. Seeds of *Sambucus nigra* (elder) were found, but no pollen; elder often grows well in places where the soil has been enriched by human occupation.

Ericales (heather) pollen hints at some heathland, although probably not on the damp lands of the floodplain.

Possible crops, weeds, grassland etc.

A number of pollen records probably represent plants of bare soil, and ones such as Caryophyllaceae correspond with seeds of *Stellaria media* (chickweed), and Chenopodiaceae with those of *Chenopodium* (fat hen, etc.). Pollen of *Aster*, *Artemisia* (mugwort) and *Anthemis* type are likely to represent weeds. A slight Cerealia type pollen record hints that cereal crops were grown or processed nearby or that cereal products were present in some form. Charcoal, which was present in the lowermost macrofossil sample, provides some more evidence of low level human activity in the area.

Seeds of *Potentilla anserina* (silverweed) and pollen of *Ornithopus perpusillus* (birds foot) hint at sandy or gravelly areas, which would have been made by moving channels.

### Grasslands

There are several records of probable grassland plants such as *Ranunculus* (buttercup) together with seeds, *Plantago lanceolata* (ribwort plantain), *Sanguisorba minor* (lesser burnet), Lactuceae and Poaceae (grasses) although the latter can represent a whole range of habitats beside grassland. The signs of grassland correspond to dung beetles representing pasture.

### Wetland

The pollen and seed record of mainly wetland plants such as *Filipendula* (meadowsweet), and seeds of *Lychnis flos-cuculi* (ragged robin) suggest a transition from damp grassland to bog with *Persicaria hydropiper* (water-pepper) seeds and a corresponding record of *Persicaria maculosa* type pollen, Cyperaceae (sedge) pollen with corresponding macrofossils of various *Carex* species and of *Scirpus sylvaticus* (wood club-rush), together with pollen of *Sparganium/Typha* (bur reed/reedmace). Standing water is suggested by *Ranunculus* subgenus *Batrachium* (water crowfoot) seeds, as well as by some of the beetles studied by Mark Robinson. These remains probably represent the wetland plants which grew in and around the organic deposit as it formed

in the trough.

#### Change with time

The radiocarbon dates from the top and bottom of the profile (fig. 1) show that the results cover a time span from about 1200-1000 cal BC until about 1100-900 cal BC, that is, roughly a century.

A pollen diagram derived from only three samples can give only the barest indication of change, but there does appear to be an increase in tree pollen from the bottom to the top. This is mainly of *Quercus*, *Alnus* and *Corylus*, matched by a slight decline in Poaceae and Cyperaceae. There are also more macrofossil records of *Alnus* and *Sambucus* from the upper sample. These changes could be connected to an increase in woodland and a decrease in light demanding herbs as the site became overgrown after it had been abandoned. Or that part of the landscape may have been used less for occupation, and perhaps more for ceremonial purposes.

#### *Willington 6 palaeochannel fill*

The results from the palaeochannel are generally rather similar to those of the fill of the trough cut into it, Willington 5, although the Willington 6 results seem to cover a far longer time span, from about 2100-2000 to 1300-1100 Cal BC, according to the radiocarbon dates from the top and bottom of the profile.

#### Trees and shrubs

The main pollen types are *Quercus* (oak), *Alnus* (alder) and *Corylus* type (hazel). There are many smaller records, including *Fagus* (beech), which is thought to have arrived in the Bronze Age. The woodland edge, scrub or hedgerow indicators *Crataegus* (hawthorn), *Prunus* type (sloe or cherry) and *Rhamnus cathartica* (purging buckthorn) are present, and a trace of Ericales (heathers) which represents heathland. There is a similar proportion of tree and shrub pollen to that of Willington 5, around 25% excluding *Alnus* and *Corylus*, which suggests the presence of some woodland in the landscape. The presence of alder and elder seeds among the macrofossils shows that these grew on the spot.

#### Crops and weeds

There is a cereal type pollen record, as well as a number of weeds such as Chenopodiaceae

corresponding with *Chenopodium* seeds, *Spergula* (spurrey) which can grow as a cornfield weed on sandy soils, *Rumex* corresponding with *R. conglomeratus* (clustered dock) seeds and with *R. acetosella* (sheep's sorrel) seeds, and *Anthemis* type. Charcoal provides further evidence of human activity.

*Potentilla* type pollen and *P. anserina* (silverweed) seeds may reflect plants growing on sand and gravel banks.

#### Grassland plants

There are records of *Ranunculus* (buttercup) pollen and seeds, *Plantago lanceolata* (ribwort plantain), *P. major/media* (greater/hoary plantain), Lactuceae (a range of composites that includes many grassland taxa and Poaceae (grasses). *Filipendula* (meadowsweet) pollen and seeds, and pollen of Dipsacaceae (scabious) and *Carduus/Cirsium* (thistle) could represent damp grassland grading into swamp. The presence of beetles indicating grassland and dung (M. Robinson, this volume) provide further evidence for grassland and pasture.

#### Wetland and aquatic plants

wetland plants are represented by a 20% record of Cyperaceae and corresponding seeds of *Carex* (sedge), *Eleocharis* (spike-rush) and *Scirpus* (wood club-rush), all of which represent damp to wet conditions in the deposit as it formed. Some of the *Aster* type pollen could be from *Bidens* (bur marigold) and *Eupatorium cannabinum* (hemp agrimony). *Persicaria maculosa* type pollen corresponds with seeds of *P. hydropiper* (water-pepper) and of possible *P. maculosa* (persicaria), both of which grow on stream banks. *Sagittaria* (arrowhead), and *Sparganium/Typha angustifolia* (bur-reed or reedmace) pollen is also present, and pollen together with seeds of *Alisma* (water plantain). *Ranunculus* subgenus *Batrachium* (water crowfoot) seeds indicate standing water, at least some of the time. Part of the beetle fauna also suggests swamp conditions (M. Robinson, this volume).

The peats predating the trough from 4466 270 which may be comparable to Column 6 contained very abundant macrofossils. Evidence of trees and shrubs was provided by records of *Betula* (birch), *Alnus* (alder), *Crataegus* (hawthorn) and numerous buds, and the material seemed to consist of the remains of leaves, probably of trees. *Urtica dioica* (nettle) could be growing in damp woodland. Dry land herb communities may be represented by *Ranunculus* sect *Ranunculus* (buttercup) and *Rumex conglomeratus* (clustered dock), and the presence of charcoal showed



some sign of human activity, perhaps connected with the burnt mound. As is usual with wetland deposits, most of the macrofossil flora was from marshy habitats with taxa such as *Lychnis flos-cuculi* (ragged robin), *Persicaria hydropiper* (water-pepper), *Eupatorium cannabinum* (hemp agrimony) and *Carex* sp. (sedge). Aquatic plants included *Ranunculus* subg. *Batrachium* (water crowfoot), *Oenanthe* sp (water dropwort) and *Glyceria* (sweet-grass).

Sample 4487 283 was an ashy material with relatively few macrofossils, most of which were aquatic and marshland taxa, such as *Ranunculus* subg. *Batrachium* (water crowfoot), *Eleocharis* sp. (spike-rush) and *Carex* (sedge).

The evidence of wet woodland could be quite local, showing conditions along the palaeochannel in which the evidence was preserved, or it could show that this was not a cleared and occupied place, but it was used for a burnt mound for some particular reason. There is no evidence of seasonal activity.

#### *Willington 7*

The three pollen spectra are dominated by herbs, including *Thalictrum* (meadow or alpine rue), *Limonium* (sea lavender) and *Artemisia* (mugwort). The few trees and shrubs are mainly *Betula* (birch), *Corylus* (hazel), *Salix* (willow) and *Pinus* (pine) with a little *Alnus* (alder) in the top sample.

*Pinus* (pine) arrives about 9000 BP, and *Alnus* (alder) after 8000 BP (Birks 1989), which provides some indication of the likely date for this sequence. This looks like an early post-glacial succession with herb-rich communities and developing woodland mainly of birch and willow.

#### *Comparison with other sites*

Our understanding of the development of the cultural landscape of the Trent valley comes from short sequences covering various time periods and from a range of sites which have been studied. Palaeochannel fills can be of very varying ages.

The assessment results from Willington 1 and 7 seem to show a phase with pioneer woodland and herb vegetation being established in the early Post-glacial. Unpublished results from Shardlow quarry show a somewhat later stage of woodland development with elm and pine.

The start of prehistoric clearance of the wildwood of lime, elm and oak in the late Neolithic and early Bronze Age and the first stage in the opening up of the river valleys to occupation is shown

by the results from the site of Wellington (Herefordshire) in the Lugg valley (Greig 2004a). A similar sequence of events probably happened in the Trent valley.

The results from the deposits above the second logboat at Shardlow SQB 04, 18 km down the Trent (Greig 2006), begin at around 1500 cal BC, when there was more tree pollen with *Quercus* (oak) and *Tilia* (lime), suggesting that some wildwood still existed at the start of the sequence there (or closer to the site), which had become reduced in the upper part of the profile to more like the Willington results, in which there is *Quercus*, but only very little *Tilia*. At the same time *Fagus* (beech) and Ericales (heathers) appear, indicating secondary woodland and heathland, respectively, as at Willington.

Sites set in landscapes with more evidence of occupation (or more intense or more local occupation) such as Beckford and Bidford (Greig 2005) in the vale of Evesham. Another Thames site under investigation is Yarnton (Oxfordshire), where the evolution and use of the Thames valley landscape from the Neolithic to the Saxon period is being investigated (Allen, Hey and Miles 1997). Bronze Age pollen results from Yarnton (Greig 2004b) show far less signs of woodland, with around 10% tree pollen at this stage, than the sites in the Trent valley. These results may reflect open landscapes either just around the settlements or perhaps more plausibly in the landscapes of the Vale of Evesham or the Thames valley generally, where grazing and occupation prevented trees from becoming established there after clearance of the woodland. Thus the Trent valley seems to have had more remaining woods as the result of less dense occupation in the prehistoric period, or the investigated sites may possibly have missed the centres of occupation.

The potential of buried sites in valleys both from the sedimentology (Howard and Macklin 1999) and palynology (Brown 1999) is very great.

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### **Figures and tables**

Table 1. Macrofossils from Column 1

Table 2. Pollen and spores from Column 1

Table 3. Macrofossils from Column 4

Table 4. Pollen and spores from Column 4

Table 5. Macrofossils from Columns 5 and 6 and associated samples

Table 6. Pollen and spores from Column 7

Fig 1. Pollen diagram of Willington Column 5

Fig 2. Pollen diagram of Willington Column 6

**Table 1**

Macrofossils in radiocarbon dating material from Willington (south Derbyshire), Column 1. Seeds in brackets are of aquatic plants or charred, with asterisks, and were not included in radiocarbon sample.

<i>Depth in Column 1 monolith</i>	<i>194 col 1, 1-10 cm</i>	<i>23-25 cm</i>	<i>48-50cm</i>	<i>73-75</i>	<i>80-90 cm</i>	<i>96-98cm</i>
<i>Ranunculus</i> sect. <i>Ranunculus</i>	3		1			
<i>Ranunculus flammula</i> L.			1		1	
<i>Ranunculus</i> subg <i>Batrachium</i>	(1)	present	(13)		25	(1)
<i>Betula</i> sp. seeds			17	77	52	15
<i>Betula</i> sp. catkin scale			1		32	1
<i>Alnus glutinosa</i> L. catkin			1			
<i>Corylus avellana</i> L.	1					
<i>Persicaria lapathifolia</i> (L.) Gray	2					
* <i>Rumex acetosella</i>		present	(1)			
* <i>Rumex</i> sp.			(1)			
<i>Rumex</i> sp.	1					
<i>Populus</i> sp. bud scales			9	3		
<i>Salix</i> sp. seed capsule				2	1	
cf. <i>Rorippa</i>			(1)			
<i>Filipendula ulmaria</i>			4	2	11	3
cf. <i>Potentilla palustris</i> (L.) Scop				4		
<i>Myriophyllum verticillatum</i>			(20)	9		(1)
<i>Myriophyllum</i> sp.			(1)			
Apiaceae			1			1
<i>Prunella vulgaris</i> L.	2					

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<i>Sambucus nigra</i> L.	1 fr					
<i>Valerianella dentata</i> (L.) Pollich					4	
<i>Valeriana officinalis</i> L.					2	
<i>Potamogeton</i> sp.			(16)	18	2	
cf. <i>Eriophorum</i> sp.					1	
<i>Eleocharis</i> sp.						1
<i>Schoenoplectus</i> sp.						1
<i>Carex</i> subg. <i>Vignea</i>			1			
<i>Carex</i> subg. <i>Carex</i>	3		153	95	61	15
* <i>Carex</i> subg. <i>Carex</i>			(1)			
<i>Glyceria</i> sp.					1	
Poaceae				present		
<i>Chara</i> sp.			(5)	present		
charcoal	present		burnt			trace

**Table 2 pollen and spores Willington 1**

sample	0	5	50	70	
spores					
Filicales	1	2	-	-	bracken
pollen					
<i>Pinus</i>	3	61	+	-	pine
<i>Ranunculus</i> -tp.	14	11	-	-	buttercup, crowfoot
<i>Thalictrum</i>	-	10	-	-	meadow rue
<i>Ulmus</i>	-	2	-	-	elm
<i>Quercus</i>	7	1	-	-	oak
<i>Betula</i>	8	61	62	38	birch
<i>Alnus</i>	7	1	2	-	alder
<i>Corylus</i>	13	34	9	6	hazel
Caryophyllaceae	+	15	-	-	stitchwort family
<i>Persicaria</i>					
<i>bistorta</i> -tp.	-	-	-	+	bistort etc.
<i>Rumex</i> -tp.	2	-	-	1	docks and sorrels
<i>Armeria</i>	-	1	-	-	thrift
<i>Tilia</i>	1	1	-	-	lime
<i>Salix</i>	-	1	4	6	willow
Ericaceae	-	4	-	-	heathers
Brassicaceae	-	1	-	-	cabbage family
<i>Filipendula</i>	-	2	6	13	meadowsweet
<i>Potentilla</i> -tp.	-	2	1	1	tormentil, cinquefoil
<i>Sanguisorba minor</i>	-	-	-	+	lesser burnet
<i>Myriophyllum</i>					
<i>verticillatum</i> type	4	32	-	-	millfoil
<i>Myriophyllum</i>					
<i>spicatum</i> type	2	1	-	-	millfoil
Apiaceae	-	-	1	1	umbellifers
<i>Polemonium</i>	-	1	1	-	Jacob's ladder
<i>Plantago lanceolata</i>	1	-	-	-	ribwort plantain
<i>Plantago media/major</i>	-	1	-	-	
<i>Fraxinus</i>	1	-	-	-	ash
Rubiaceae	1	1	-	+	bedstraws
Dipsacaceae	-	-	+	-	scabiouses
<i>Cirsium</i> -tp	-	1	-	-	thistle
<i>Centaurea nigra</i>	1	-	-	-	knapweed
<i>Aster</i> -tp	-	8	1	-	daisies etc
<i>Artemisia</i>	4	-	-	1	mugwort
Lactuceae	-	1	-	-	
cf. Potamogetonaceae	-	-	2	16	? pondweed

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Cyperaceae	33	137	19	41	sedges
Poaceae	33	49	4	16	grasses
Cerealia-tp.	-	-	-	?	cereals
<b>total pollen</b>		<b>132</b>	<b>476</b>	<b>112</b>	<b>140</b>



**Table 3**

Plant macrofossil list, column 4 248, from 100 ml sediment, names and order according to Kent (1992).

<i>Ranunculus</i>		
sect <i>Ranunculus</i>	1	buttercups
<i>Ranunculus flammula</i> L.	1	lesser spearwort
<i>Chenopodium</i> sp.	1	fat hen
<i>Atriplex</i> sp.	2	orache
<i>Stellaria</i>		
<i>media</i> (L.) Villars	1	chickweed
<i>Cerastium</i> sp.	1	mouse-ear chickweed
cf. <i>Polygonum aviculare</i> L.	1	knotgrass
<i>Aphanes arvensis</i> L.	1	parsley piert
<i>Myosotis</i> sp.	2	forget-me-not
<i>Valerianella</i>		
<i>rimosa</i> Bast.	1	broad-fruited cornsalad
<i>Lapsana communis</i> L.	1	nipplewort
<i>Leontodon</i> sp.	1	hawkbit
<i>Potamogeton</i> sp.	1	pondweed
<i>Carex</i> subg. <i>Carex</i>	2	sedges
<i>Glyceria</i> sp.	2	flote-grass
other remains		
<i>Chara oogonia</i>	++	brittlewort
charcoal fragments	+	
tree buds and bud scales	+	
leaf galls	+	
insect remains	+	
number of dishes sorted	2	

**Table 4 pollen and spores Willington 4**

sample	10	70	
spores			
<i>Pteridium</i>	2	2	bracken
<i>Polypodium</i>	3	2	polypody
pollen			
<i>Pinus</i>	+	2	pine
<i>Ranunculus</i> -tp.	2	1	buttercup, crowfoot
<i>Fagus</i>	+	-	beech
<i>Quercus</i>	4	8	oak
<i>Betula</i>	2	-	birch
<i>Alnus</i>	12	7	alder
<i>Corylus</i>	8	5	hazel
Chenopodiaceae	-	1	goosefoot
Caryophyllaceae	1	-	stitchwort family
<i>Persicaria bistorta</i> -tp.	-	2	bistort etc.
<i>Rumex</i> -tp.	+	-	docks and sorrels
Brassicaceae	-	2	brassicas
Ericales	1	1	heathers
<i>Filipendula</i>	1	-	meadowsweet
<i>Plantago lanceolata</i>	10	5	ribwort plantain
<i>Fraxinus</i>	-	1	ash
Lactuceae	13	20	a group of composites
<i>Anthemis</i> -tp.	1	-	mayweeds etc.
Alismataceae	+	-	water-plantains
cf. Potamogetonaceae	-	16	pondweeds
Cyperaceae	4	10	sedges
Poaceae	34	34	grasses
Cerealial-tp.	+	1	cereals
<i>Sparganium</i> type	1	-	spike-rush
<b>total pollen</b>	<b>89</b>	<b>115</b>	

Table 5. Seeds from Willington Columns 5 and 6. (in brackets) aquatic taxa present

<b>Willington Columns 5 and 6 seeds in radiocarbon samples</b>	<i>Col 5, 0-1cm top</i>	<i>Col 5 24-25cm bottom</i>	<i>Col 6, 0-1cm top</i>	<i>Col 6, 24-25cm bottom</i>	<i>4466 270</i>	<i>4487 283</i>
<i>Ranunculus</i> sect. <i>Ranunculus</i>	1	2		20	4	
<i>Ranunculus</i> subg. <i>Batrachium</i>	(present)	(present)		(present)	24	11
<i>Urtica dioica</i> L.	1		1	1	35	
<i>Urtica urens</i> L.					1	
<i>Betula pendula</i> Roth. seed					1	
<i>Alnus glutinosa</i> L. catkin	1				3	
<i>Alnus glutinosa</i> L. seeds	1	2	2	3	15	
<i>Chenopodium</i> sp.	1			2	1	
<i>Atriplex</i> sp.					2	
<i>Montia</i> sp.				present		
<i>Stellaria media</i> (L.) Villars	4				5	
<i>Stellaria uliginosa</i> Murray					1	
<i>Cerastium fontanum</i> Baumg.					1	
<i>Cerastium</i> sp.					1	
<i>Lychnis flos-cuculi</i> L.	2			4	20	
Caryophyllaceae nfi					6	
<i>Persicaria</i> cf. <i>maculosa</i> Gray			1	3		
<i>Persicaria hydropiper</i> (L.) Spach		3	8	8	6	
<i>Rumex acetosella</i>				3		
<i>Rumex conglomeratus</i> Murray					2	
<i>Rumex</i> sp.		1		2	4	
cf. <i>Rorippa</i> sp.					1	
<i>Filipendula ulmaria</i>	1	3		4	4	
<i>Rubus idaeus</i> L.					1	
<i>Potentilla anserina</i> L.		1				
<i>Potentilla</i> sp.						1

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<i>Prunus spinosa</i> L.					1	
<i>Prunus/Crataegus</i> thorn					1	
<i>Crataegus</i> sp.					1	
cf. <i>Euphorbia helioscopia</i> L.				1 fr		
<i>Berula erecta</i> (Hudson) Cov					1	
<i>Oenanthe aquatica</i> (L.) Poiret					4	
cf. <i>Oenanthe</i> sp.					13	
<i>Apium inundatum</i> (L.) H.G. Reichb.					1	
<i>Solanum dulcamara</i> L.					1	
<i>Solanum</i> sp.					1	
<i>Lycopus europaeus</i> L.		1			1	
<i>Mentha</i> sp.					3	
Lamiaceae					4	
<i>Sambucus nigra</i> L.	2			1	1	
<i>Valeriana officinalis</i> L.					2	
cf. <i>Carduus</i> sp.					1	
<i>Cirsium</i> cf. <i>vulgare</i> (Savi) Ten.					1	
<i>Bidens</i> sp.			1			
<i>Eupatorium cannabinum</i> L.			1		45	
Alismataceae		(present)	7	2	6	
<i>Juncus</i> sp.			(present)		2	
<i>Eleocharis</i> sp.			1	3	4	2
<i>Scirpus sylvaticus</i> L.		4	5		2	
<i>Schoenoplectus lacustris</i> (L.) Palla					1	
<i>Carex</i> subg. <i>Vignea</i>	3		2			
<i>Carex</i> subg. <i>Carex</i>	2	6	29	19	23	24
<i>Glyceria</i> sp.				present		
Poaceae nfi					2	
<i>Sparganium</i> sp.					1	

**Table 6 pollen and spores Willington 7**

sample	0	20	40	
pollen				
<i>Pinus</i>	1	2	1	pine
<i>Caltha</i>	-	1	-	kingcup
<i>Ranunculus</i> -tp.	8	6	-	buttercup, crowfoot
<i>Thalictrum</i>	3	1	-	meadow rue
<i>Quercus</i>	?	-	?	oak
<i>Betula</i>	4	2	7	birch
<i>Alnus</i>	1	-	-	alder
<i>Corylus</i>	3	4	-	hazel
Chenopodiaceae	1	-	-	goosefoot
Caryophyllaceae	+	1	2	stitchwort family
<i>Limonium</i> sp.	1	-	-	sea lavender
<i>Salix</i>	1	7	3	willow
Brassicaceae	-	1	-	brassicas
<i>Filipendula</i>	3	9	7	meadowsweet
<i>Potentilla</i> -tp.	2	-	5	tormentil, cinquefoil
<i>Myriophyllum</i> <i>verticillatum</i> tp.	1	2	-	water millfoil
Apiaceae	2	-	1	umbellifers
Rubiaceae	-	1	-	bedstraws
<i>Valeriana</i>	-	-	1	valerian
Lactuceae	-	1	-	a group of composites
<i>Aster</i> -tp	-	1	-	daisies etc
<i>Artemisia</i>	6	2	1	mugwort
Cyperaceae	32	49	69	sedges
Poaceae	22	26	25	grasses
<i>Sparganium</i>	-	-	1	spike-rush
<b>total pollen</b>	<b>91</b>	<b>116</b>	<b>122</b>	

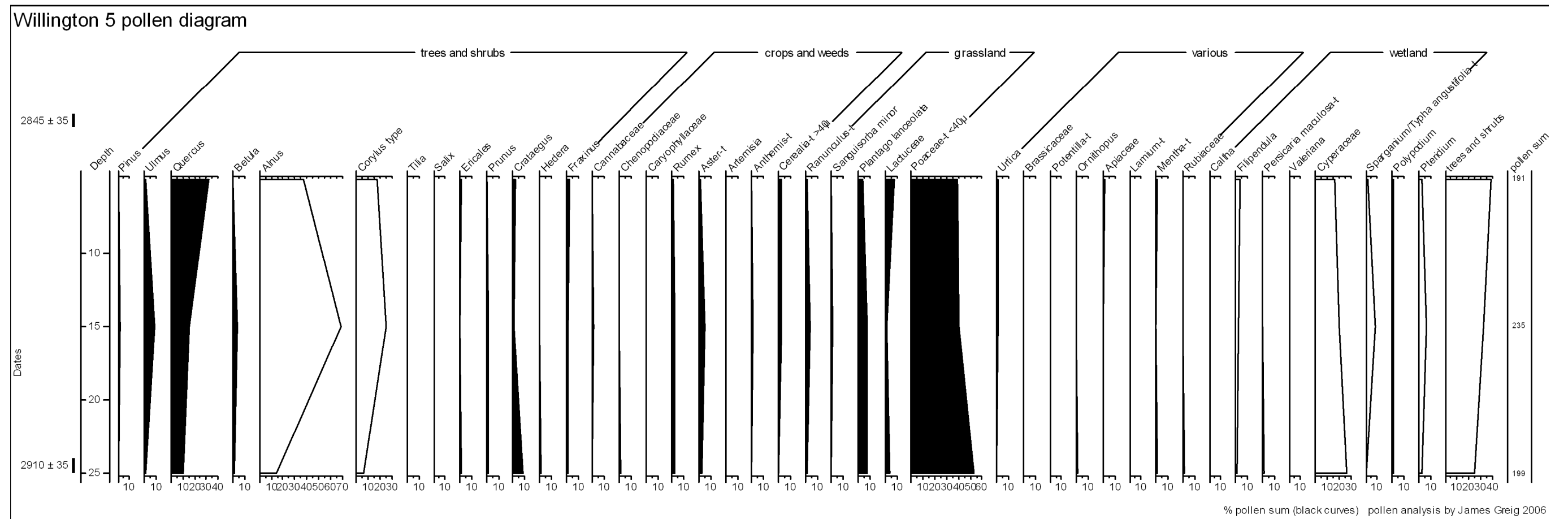


Fig 1. Pollen diagram of Willington Column 5

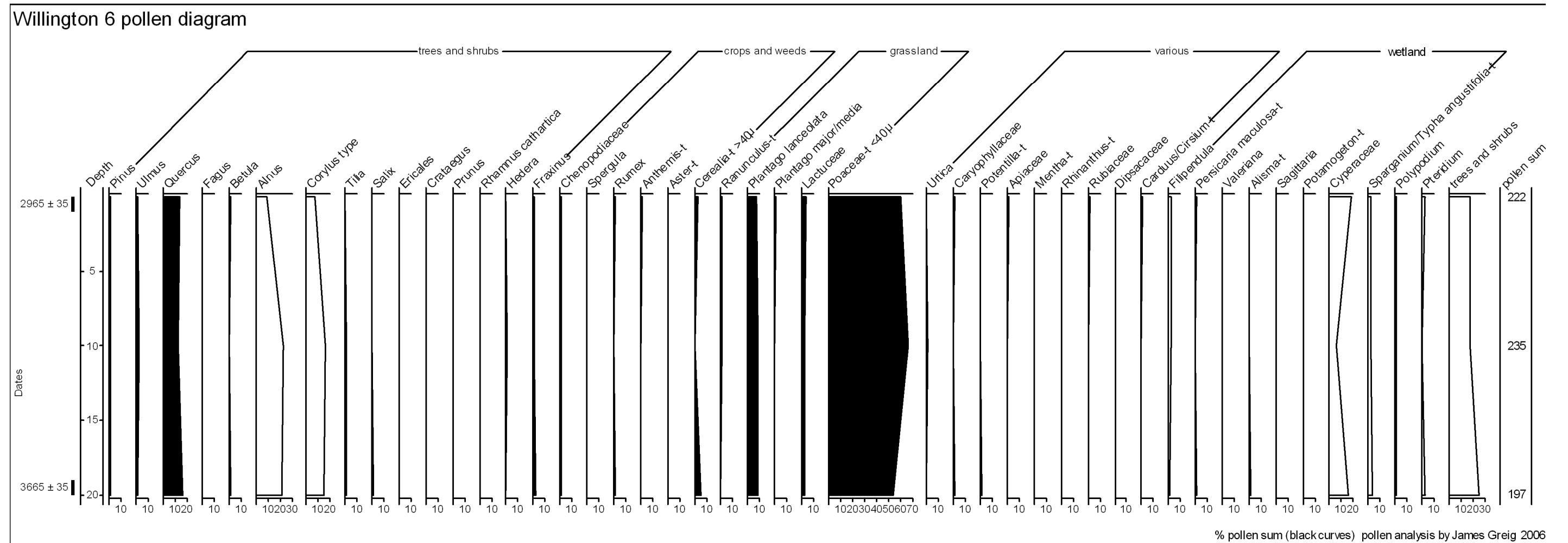


Fig 2. Pollen diagram of Willington Column 6