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A PALYNOLOGICAL STUDY OF ORGANIC SILTS FROM IRON AGE AND ROMAN CANTERBURY, KENT.

Patricia E. J. Wiltshire BSc.

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Summary

Exposed sections of organic silts from two closely adjacent areas were analysed. Sediments from Section 1 lay immediately beneath the foundations of Watling Street and were presumed to be of Iron Age and early Roman period. The peaty silts of Section 2 developed around a Roman, wooden drain, itself embedded within earlier and subsequent metallings at the edge of Watling Street. Pollen analysis showed that for the periods represented by both sets of sediments, the area was virtually treeless, and that both arable and pastoral husbandry were practised. Early in Section 1, the Iron Age cereal crops appeared to have been weed-ridden and, subsequently, a pastoral economy seems to have become more important. However, an episode which involved intense burning of local vegetation appeared to result in a drastic decline in cereal growing. Evidence is presented to indicate that soon after this event, the area might have been drained and cereal growing enhanced under a regime of more efficient husbandry. Remarkable evidence of the alternate use of bracken and graminaceous plants for possible domestic purposes is also given. The Roman deposits of Secton 2 reveal evidence of progressive intensification of both arable and pastoral farming.

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STOUR STREET - SS 'B' 86

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STOUR STREET - CANTERBURY (SS'B'86)

Introduction

The site was sampled for pollen analysis in summer 1986 by Dr. R. Scaife. During his first visit, he obtained individual samples of sediment from the faces of three exposed sections. The samples were taken at 4.0 cm intervals throughout. The first, and deepest section (Section 1) cut through deposits immediately underlying the foundations of Watling Street and was presumed to contain environmental evidence from Iron Age and early Roman times. Samples from Section 2 were taken from a lens of highly organic sediment which was intercalated between the original and subsequent metallings of Watling Street, and was surrounding the base of a wooden, Roman drain. It was presumed, therefore, that these sediments were of Roman origin. Samples from Section 3 were taken from sediments which were medieval in origin.

During the second site visit, a continuous core of sediments were obtained from Section 1. However, these deteriorated so badly in subsequent storage that they became useless for pollen analysis.

Preliminary examination of the sediments revealed that those from both Sections 1 and 2 contained adequate and well-preserved pollen but that there were virtually no microfossils present in the samples from Section 3. This report, therefore, presents results obtained from analysis of individual samples taken from Sections 1 and 2.

Methods

Approximately 2.0g of each sediment sample were treated by standard acetolysis and hydrofluoric acid treatment to remove the organic, silty matrix (Dimbleby 1985) and the resulting pellet suspended in 1.0 ml of glycerol jelly after staining with safranine. Slides were examined under phase-contrast microscopy at x400 magnification, and at x1000 magnification where necessary. Approximately 300 pollen grains were counted in each sample.

Initially, the counts for all taxa were expressed in terms of a percentage of total pollen (see Tables 1, 2 and 5). However, it was realised that to discern patterns in pollen frequencies the data needed a degree of manipulation. Therefore, some taxa were expressed as a percentage of total pollen minus certain other taxa. This was necessary since certain abundant palynomorphs have the effect of masking distribution patterns of less abundant ones. The relevant information is included on the appropriate tables and figures.

For Section 1, the percentage data set for the total number of palynomorphs was very difficult to interpret when plotted in full on a conventional pollen diagram. In an attempt to elucidate environmental changes it was decided, therefore, to plot only certain taxa, and also groups of taxa which might be ecologically or archaeologically meaningful. The palynomorphs included in the various groups are shown in Table 3. It was necessary to include some types in more than one group because it is not possible to determine some pollen beyond family or type. This means that species of varying ecological preference may represented by one palynomorph.

Section 2 had so few samples that plotting the data was deemed to be unnecessary and the results are presented in tabular form only.

Results

The results for both Sections 1 and 2 are presented in tabular form in Appendix I. Graphic representation of results for Section 1 are in Appendix II.

Section 1

Charcoal was found in every sample and was especially abundant in the sample at 24 cm below the foundation of the Roman road. This level is marked on each appropriate diagram in Appendix II. Fungal hyphae and spores were very abundant throughout, although they were very much less frequent at 24 cm where charcoal was so abundant. The great increase in charcoal is marked on all figures as "Burning +". Most fungal remains were of Deuteromycetes or Ascomycetes, and some *Eremascus*-type sporangia were found.

One egg case of a trichurid nematode worm was found in the sample at 44 cm, and black spherules were found at 40 cm and 72 cm. The nature of these spherules is the subject of current research but it has become obvious from repeated observations that they are usually found in deposits which have been totally saturated with water. It is possible that they represent metallic sulphides of microbial origin which are formed in anaerobic conditions.

Section 2

Abundant charcoal and spherules were found in every sample of Section 2. No nematode egg cases were found. Fungal remains were moderately abundant though not as frequent as in Section 1.

Discussion and Interpretation of Results (Section 1)

The General Picture

The Nature of the Sediments

Firstly, the fact that palynomorphs were, on the whole, well preserved and in highly organic sediments suggests that accretion occurred under conditions of low redox potential. Low redox usually implies various degrees of waterlogging and, in most situations where this occurs, the pollen spectrum indicates a large element of water/bog/marsh plants in the local vegetation.

In Section 1, the presence of black spherules at two depths does, indeed, suggest that the site had been waterlogged on occasion (possibly even flooded), but the amount of pollen from plants characteristic of wet soils was very low. Simply for the sake of showing a pattern, the data presented in Figure 3 were exaggerated by omitting abundant pollen taxa from the pollen sum.

This means that the graph does not reflect the true abundance of the wetland component; a better idea of the actual importance value of the wetland plants at this site is is gained from Tables 1 and 2, and the appropriate list of plants is given in Table 3. Bearing in mind the manipulation of the data, it is, nevertheless, reasonable to suggest that the histogram in Figure 3 shows that the site was wet early on, and that it gradually became drier; then that a period of flooding possibly occurred at a time represented by the sediments at 40 cm. The site than became drier again - quite markedly so above the depth of 24 cm, the level which contained so much charcoal.

It is also important to note that there was no evidence of sedges (Cyperaceae), nor of truly aquatic plants. Further impression of a relatively dry site is given by the large amount of fungal remains, and the lack of aquatic hyphomycetes amongst them.

The conditions under which the sediments were laid down are difficult to envisage. It is possible, of course, that the fossil record of the site represents mainly allochthonous material which was dumped on a perennially wet soil surface by the Iron Age inhabitants. The hypothesis of the area having been a dumping ground is supported by the nature of the artefacts found on the site (J. Rady - Pers. Comm). If the plant material being discarded were derived from land further from the river, an impression of a "dry land" flora (and microflora) might be obtained, whilst the wet conditions at the dump site would preserve the organic material. If this were the case, then observed patterns in the pollen spectrum through time might actually reflect local land management rather than changes in the natural vegetation.

<u>A Broad View of the Vegetation History</u>

It is very difficult to discern meaningful patterns in the pollen data when the whole percentage data set is examined (Tables 1 & 2) and palynomorphs such as Liguliflorae and *Bidens* type have been largely ignored in the interpretation since they include so many ecotypes that their abundance can only be taken to represent open, weedy conditions. However, certain important information is immediately obvious, expecially when viewed in conjunction with the pie chart (Figure 1), which shows the relative importance of plant groups throughout the sediments.

For the period of history represented, the site was clear of woodland and scrub, although willow was probably growing nearby for a considerable period. Willow is insect-pollinated and its pollen does not travel far so that a record of even a single pollen grain probably means that the plant was local. The other tree taxa, even though most are prolific pollen producers, are represented by very low counts. This probably means that there were no trees growing within a considerable distance of the site. Another obvious feature is the dominance of grass pollen. It is not possible to specify grasses from their pollen with any degree of confidence so it is not clear whether the pollen was derived from river-side and swamp grasses such as *Phragmites*, or whether the major contribution came from pasture and rough grassland. In a site so near to the river, it is tempting suggest that the former was more important, but the dilemma still remains. Bracken (*Pteridium*) seems to have been an important element, and cereals were grown continuously throughout the period under scrutiny. Furthermore, the diversity and abundance of herbs indicate that weeds formed an important component of the vegetation.

The Complex Details of the Local Vegetation History

Figure 2 is a scatter diagram of bracken and grass frequencies plotted against depth. The picture is a startling one - there is near perfect reciprocity between the two palynomorphs. This diametric relationship is exceedingly difficult to interpret and two possible scenarios must be considered.

Firstly, it was suggested earlier, that allochthonous material might have been dumped onto the site and it is possible that the patterns seen in bracken and grass might be a reflection of the degree to which they were used domestically. Both bracken and grasses such as *Phragmites* are known to have been used for thatching and bedding purposes. The trichurid egg found at 52 cm adds weight to this hypothesis. Its presence indicates that there was faecal contamination of the plant material, which would be the case if the plants had been used for animal bedding; but if human cess were also being dumped on the site, the parasite could have been of human origin. There may have been an attempt to use faecal-contaminated material for soil improvement (Dimbleby 1985).

As already stated, using pollen, it is virtually impossible to differentiate between reedbed grasses and those of pasture and rough grassland so, of course, it is possible that the grass pollen in question was derived from straw and hay - also suitable bedding materials. If this were the case, then the cereal-type pollen may also have been largely derived from straw. Greig (1982) showed that straw yielded a preponderance of grass and cereal pollen, although taxa such as stinging nettle (*Urtica*) and poppy (*Papaver*) were also represented in his samples. If straw were, indeed, the source of the grass and cereal pollen, then it would be reasonable to suppose that the cereal type grains would show a similar reciprocal relationship to bracken as grass. In fact, when Figures 5 (bracken) and 9 (cereal type) are compared, there does, indeed, seem to be a broadly diametric relationship between the two taxa. This is re-inforced by Figure 10 which shows that the segetal (crop weed) curve is broadly similar to that of cereal type. It is possible, therefore, that importance of bracken as bedding alternated with that of straw and hay and/or reeds. Overall, grass/straw was most important early on in the site's history, but it gave way to bracken, while after the event at 24 cm, which resulted in a large input of charcoal, grass became more important once more. It must be noted, however, that within these general trends, there seems to have been a regular alternation between grass and bracken input, and this might indicate a regular and planned strategy of resource utilisation.

Secondly, the inverse relationship may reflect true ecological changes in extra-local and regional vegetation, even though those changes may have been anthropogenic in origin. In other words, Iron Age peoples of the area might have been managing the territory in such a way that they were influencing the areal extent of bracken and grassland. For example, the frequencies of the palynomorphs of these plants are very much affected by grazing pressure so that their performance in a pollen diagram might be a reflection of stocking densities of domestic cattle. Bracken thrives under heavy grazing regimes because of its lack of palatability and its toxicity to stock, whereas, grasses and more palatable grassland weeds, often have little opportunity to flower under such circumstances (personal observation). Heavy grazing pressure could thus result in higher bracken and lower grass levels in the pollen record. However, it is difficult to explain the almost perfect negative relationship between bracken and grass in terms of heavy grazing. This precise pattern is not normally demonstrated in palaeoecological data.

When Figures 5 to 10 are examined, it can be seen that, very broadly, grass, segetals and cereal type were high at the base but that they declined in favour of bracken and ruderals. At 24 cm, some event (marked by an increase in charcoal), resulted in a drastic decrease in cereals and an enhancement of segetals. Subsequent to this event, bracken declined markedly, along with segetals. Ruderals decreased gradually, while cereals actually increased immediately after the event.

The relative fates of the various groups may seem rather complex but they may be explained in terms of a swing from arable to pastoral and then back to arable practices once more, the latter arable phase being one of more efficient management.

The high cereal and segetal values at the base suggest that the cereal crops were weed-ridden. The relatively high grass levels might mean that, although grazing might have been important, it was not intense enough to depress grass flowering. The subsequent fall in grass and the rise in bracken and ruderals might suggest that pastoral husbandry might have become increasingly important, although cereals continued to be grown. However, at 24 cm, the increase in burning seems to have affected cereal growing adversely. This suggests that cornfields became neglected allowing segetals to increase - hence the large rise in crop weeds at this level.

After the intense burning, cereal growing was enhanced while bracken, segetals and ruderals declined. This might indicate a more efficient management of the cornfields. Grass also increased which might mean that pasture was grazed less intensively, allowing the grasses to flower.

Another important point to note is that, after the burning episode, wetland plants declined markedly. It is possible that the ground became drier naturally, but it could also mean that the area was being drained, again indicating efficient land managment.

Alternative hypotheses have been offered to explain the inverse relationships of bracken and grass, and the relationship of grass to other groups. It must be remembered, however, that all the kinds of management suggested could have been carried out simultaneously so that their effects are superimposed in the pollen record. There may well have been a swing from pastoralism to arable farming and back again but, in itself, this does not preclude the possibility that bracken and hay/straw or reeds were being brought into the site and used alternately for domestic purposes. The results of all these practices would be reflected in the total pollen rain, and it has been necessary to resort to conjecture when confronted with such a complex spectrum.

Discussion and Interpretation of Results (Section 2)

The Nature of the Sediments

The definite trends in the pollen frequencies throughout the profile (Table 6) provide quite strong evidence that the sediments were deposited in situ. It is feasible that the organic matrix was built up from residues seeping out of the Roman drain. The organic silt certainly seems to have been laid down in standing water (indicated by the presence of black spherules throughout the profile), but the only plant characteristic of high water table (*Filipendula*) was represented by very low pollen frequencies. The pollen flora generally did not indicate that the surrounding environment was wet, and this may be further evidence to support the idea that the high water table was due to seepage from the drain, the pollen being washed into the sediments in the drainage water.

Vegetation History

Table 5 shows that the pollen flora was very mixed and contained ruderals, segetals, and pasture weeds, with bracken present but at very low levels. Table 6 shows the pollen taxa which showed trends in their frequencies throughout the profile. It can be seen that grass, and possible grassland weeds within the Liguliflorae and Umbelliferae, declined while cereal type, bracken, and possible pasture weeds and ruderals appeared to increase.

This picture is difficult to intepret but it would indicate that, throughout the time represented by the sediments, there was virtually no woodland in the vicinity and that grasses dominated the flora. Cereals were grown throughout the period. The very low levels of bracken could indicate that, either land management was effective at controlling the plant, or that it was used very little by the Romans for domestic use during the period under scrutiny.

The trend in pollen frequencies shown in Table 6 might indicate that there was a progressive intensification of both arable and pastoral husbandry throughout this period of Roman history at Canterbury.

Comparison of Sections 1 & 2

There is a striking similarity in the pollen record in both profiles. Both give a picture of mixed arable and pastoral economies being carried out in a virtually treeless landscape. The later, Roman, deposits showed that bracken was much less frequent than in the earlier Belgic ones. However, it must be noted that immediately beneath the base of Watling Street, bracken had been very much reduced, so Section 2 might be showing a continuing trend which had started at the top of Section 1.

Conclusion

There is no evidence of woodland in the vicinity or that either site had been a marsh or bog during accretion of the sediments. It would seem that the ground at the Section 1 site had been damp, and may have been flooded on at least two occasions, also that it might have been drained after some significant event (represented at 24 cm depth) which resulted in the input of a large amount of charcoal. The sediments of Section 2 were probably derived from organic materials and water seeping from the Roman drainage pipe.

The complex, reciprocal relationship between grass and bracken palynomorphs in Section 1 might have been due to a combination of changes in land management and alternating use of bracken and straw and/or reeds for domestic purposes. The pollen evidence also indicates (albeit tentatively) that cereal crops were weed-ridden early in the site's history and that a greater emphasis was subsequently given to pastoral land use. An episode which involved intense burning of local vegetation resulted in a drastic decline in cereal growing, with a resultant increase in crop weeds. Subsequently, cereal growing increased while bracken, segetals and ruderal decreased, indicating a more efficient husbandry.

The Roman deposits of Section 2 showed that there was a progressive intensification of both arable and pastoral husbandry and that, possibly, bracken was an insignificant feature of the local vegetation, or of domestic use.

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APPENDIX 1

Depth below Watling St	**0**	**4**	**12**	**16**	**20**	**24**	**28**	**32**	**36**	**40**	**44**	**48**	**52**	**60**	**68**	**72**
Silt	+															
Silts with Organic Lenses		+	+	+												
Organic Silt					+	+	+									
Highly Organic Silt								+	+	+						
Organic Matrix with Silt											+	+	+			
Silt with Molluscs														+		
Organic Matrix with Silt															+	+
Trees & Shrubs								**For Pollen + = 1.0% or Less**								
Pinus	+	+		+		+	+	+				+				
Betula							+	+	+	+	+	+		+		
Quercus	+		+			1.1	+	1.1	+	+		+	+	+	+	
Alnus	+			+	+	+	+	+					+		+	
Fraxinus								+			+					
Carpinus			+													
Corylus						+		1.1					+		+	
Genista type					+											1.1
Salix								+		+	+		+	+		
Sambucus	+		+					+								
Most Frequent Herbs																
Gramineae	73.4	66.7	70.5	59.1	70.3	58.2	54.5	63.6	46.7	57.3	55.4	63.7	50	52	61.2	64.6
Cereal type	2.9	2.7	1.6	4.5	5.2	+	3.5	3.3	1.9	2.2	+	5.2	3.3	3.4	3.3	9.5
Pteridium	4.6	13.3	11.7	14.1	5.6	19	24.3	13.1	28.6	22.2	25.8	10.4	22.3	22.9	11.1	7.3
Anthemis type						2.2	1.5			+	1.4	+	1.6	1.7	3.9	3.4
Bidens type	1.7	1.6	+	+	2.1		+	+	2.9	+	2.8	1.2	2.3	1.1	1.1	+
Liguliflorae	8.7	7.1	7.1	5.5	3.5	4.3	5	4	4.7	4	2.3	5.6	7.6	10.3	4.4	3.4
Polygonum aviculare			+		1.5	1.1	+	+	+	+	+	1.2				+
Plantago lanceolata	3.5	2	1.3	4	+	1.1	1.5	2.9	2.9	2.2	+	1.2	3.8	1.1	3.9	2.8
Rumex undiff	+	+	+	+	2.1	+	1.5	1.1	1.9	1.3		1.2	1.1		+	
Sinapis type			+	+	+	3.3	1.5	+	3.3	1.8	+	+		+		
Trifolium		1.2	+		3.5	1.1	+	+			+		+	+	1.7	
Umbelliferae	+	1.2	+		1.4	1.1	+		1.4		+	2	1.1			
Charcoal	+	+	+	+	+	++	+	+	+	+	+	+	+	+	+	+
Spherules										+						+

STOUR STREET - SECTION 1 (Expressed as Percentage Total Pollen Spores) - Table 1

Depth below Street (cm)	**0**	**4**	**12**	**16**	**20**	**24**	**28**	**32**	**36**	**40**	**44**	**48**	**52**	**60**	**68**	**72**
Less Frequent Herbs								**+ = 1.0% or less**								
Adonis							+								+	
Anagallis tenella type								+								
Apium										+						
Artemisia	+										+					
Aster Type											+					
Astragalus type											+					
Caltha type													+	1.1	1.1	1.1
Capsella type			+								2.8	+	2.2		+	
Caryophyllaceae				+		+			+	+		1.6			+	
Centaurea nigra type									+		+	+	+	+		
Chenopodiaceae		+	+									1.2			+	+
Chrysosplenium						+										
Filipendula						+				+	+	+			1.1	2.2
Galium type													+			+
Hypericum perforatum type		+			+	+										
Iris												+		+		
Lamium type	+		+				+			+				+	1.1	
Leguminosae		+		+	+		+	+		+		+			+	
Lotus type	+		+	+		2.2			+							+
Polygonum amphibium								+								
Polygonum bistorta type														+		
Polygonum convolvolus type								1.8	+						+	+
Potentilla type			+										+			+
Pulmonaria type c.f. Lithospermum													1.1			
Ranunculus type			+	+	+	+			+			+			+	
Rhinanthus type									+	+			+		+	+
Stachys type			+					+						+		
Trollius				+												
Urtica type				+			+		+	2.7					+	
Veronica type										+	+					
Trichuris egg													+			

STOUR STREET - SECTION (Expressed as Percentage Total Pollen Spores) Table 2

		POLLEN GROUP		
POLLEN TAXA	**Pasture**	**Wet Soils**	**Segetals**	**Ruderals**
Anthemis type	+		+	+
Plantago lanceolata	+			
Rumex undiff	+			+
Trifolium type	+			
Umbelliferae	+			+
Centaurea nigra type	+			
Hypericum perforatum type	+			
Galium type	+		+	
Lotus type	+			
Potentilla type	+			
Ranunculus type	+			+
Rhinanthus type	+			
Veronica type	+			
Salix		+		+
Trollius		+		
Chrysosplenium		+		
Filipendula		+		
Polygonum amphibium		+		
Polygonum bistorta type		+		
Anagallis tenella type		+		
Apium		+		
Caltha type		+		
Iris		+		
Pulmonaria type c.f. Lithospermum			+	
Polygonum aviculare			+	+
Polygonum convolvolus			+	
Sinapis type			+	+
Adonis			+	
Chenopodiaceae			+	+
Artemisia				+
Capsella type				+
Leguminosae				+
Urtica type				+

STOUR STREET - SECTION 1 - POLLEN TAXA INCLUDED IN VARIOUS VEGETATION TYPES- TABLE 3

Depth below Street (cm)	0	4	12	16	20	24	28	32	36	40	44	48	52	60	68	72
POLLEN GROUP																
Total Herbs	20.2	18.8	18.5	25.3	18.9	21.2	17.3	17.5	24.3	16.9	16	23.1	26.1	21.1	28.3	20.8
Grass (Gramineae)	73.4	66.7	70.5	59.1	70.3	58.2	54.5	63.6	46.7	57.3	55.4	63.7	50	52	61.2	64.6
Cereal Type	14.7	14.3	9.6	18.4	23.1	2.9	17.5	19.1	8.2	12.5	5.7	5.1	13.3	16.2	13.3	40.5
Pasture Weeds	35.3	40.8	30.8	46.9	49.2	37.1	25	31.9	46.9	27.5	37.1	25.9	35.6	18.9	33.3	23.8
Plants of Wet Soils				2	1.5	5.4		6		11.1	7.9	4.8	6.3	11.9	8.2	12.5
Bracken (Pteridium)	4.6	13.3	11.7	14.1	5.6	19	24.3	13.1	28.6	22.2	25.8	10.4	22.3	22.9	11.1	7.3
Segetals		2	11.5	6.1	9.2	34.3	22.5	23.4	18.4	15	17.1	13.8	13.3	16.2	22.2	33.3
Ruderals	17.6	24.5	30.8	28.6	35.4	45.7	42.5	23.4	49	45	62.9	32.8	26.7	16.2	33.3	23.8
Basis of Percentage Calculations																
Grass & Bracken = % of Total Pollen & Spores																
Plants of Wet Soils = % of All Herbs minus Grass & Bracken																
Other Groups = % of All Herbs minus Grass, Bracken & Plants of Wet Soil																

STOUR STREET - SECTION 1 - POLLEN TAXA INCLUDED IN VARIOUS GROUPS - Percentage Data - Table 4

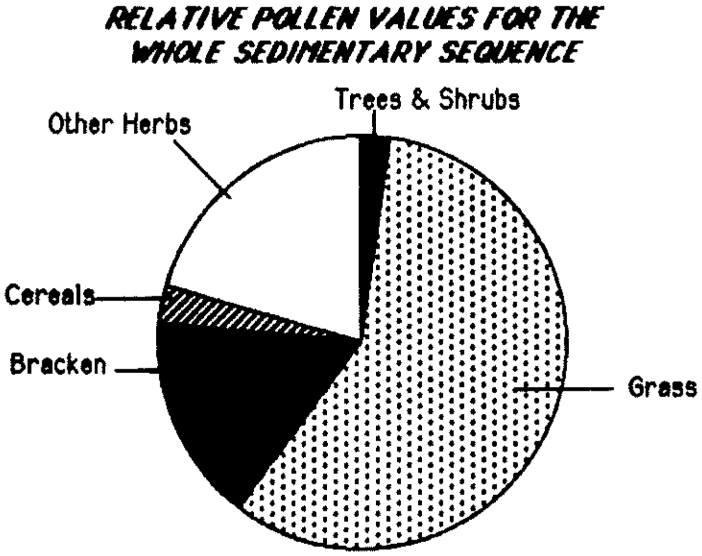
	Sample Number (5-Top)				
POLLEN TYPE	5	4	3	2	1
Trees & Shrubs					
Betula			+		+
Quercus	+		+	+	+
Alnus				+	
Corylus	+	+		+	+
Salix	+				
Ulex type	2.8	1.9		+	
Most Frequent Herbs					
Gramineae	63.8	72.2	71.9	74.5	85.2
Cereal type	6.6	4.2	2.1	2.6	1.5
Pteridium	2.8	+	1.8	1.8	+
Anthemis type	+	1.5	1.4	2.2	+
Bidens type	1.9	1.2	2.1	+	+
Leguminosae		2.3	2.1	2.2	1.2
Liguliflorae	1.4	1.9	3.2	1.8	2.4
Plantago lanceolata	3.8	1.2	1.1	1.1	1.2
Ranunculus type	2.3	+	1.1	+	+
Rumex undiff	2.3	1.9	1.4	1.1	+
Trifolium type	+	1.5	3.2	1.8	+
Umbelliferae	1.4	2.7	1.4	3.7	+
Less Frequent Herbs					
Adonis			+		
Artemisia	+	1.5	+	+	
Capsella type			+	+	
Caryophyllaceae	1.4		+	1.1	
Chenopodiaceae		+			
Cirsium			+		
Cruciferae			1.4		+
Filipendula	+		+	+	
Galium type		+		+	+
Hypericum perforatum type					+
Lamium type				1.1	
Linum bienne type			+		
Lotus type	2.3		+		
Ononis type					+
Papaver	+		+	+	
Polygonum aviculare		2.3			
Polygonum convolvolus type	+				
Potentilla type				+	
Rhinanthus type					+
Sinapis type		+			
Stachys type	+		1.4		+
Vicia cracca type	+				
Vicia sylvatica type					+
Spherules	+	+	+	+	+
Charcoal	+	+	+	+	+
+ = 1% or less					

STOUR STREET - SECTION 2 (Expressed as Percentage Total Pollen) - Table 5

	Sample Number (5=Top)				
	5	4	3	2	1
POLLEN TYPE					
Downward Trend					
Gramineae	63.8	72.2	71.9	74.5	85.2
Liguliflorae	1.4	1.9	3.2	1.8	2.4
Umbelliferae	1.4	2.7	1.4	3.7	+
Upward Trend					
Cereal type	6.6	4.2	2.1	2.6	1.5
Pteridium	2.8	+	1.8	1.8	+
Bidens type	1.9	1.2	2.1	+	+
Plantago lanceolata	3.8	1.2	1.1	1.1	1.2
Rumex undiff	2.3	1.9	1.4	1.1	+

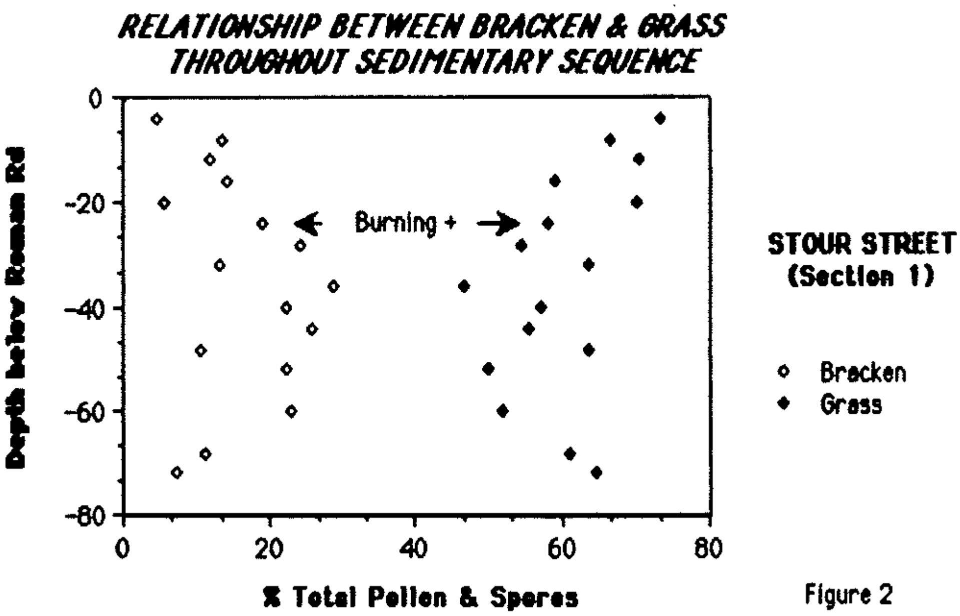
STOUR STREET - SECTION 2 - Trends in Important Pollen Taxa - Table 6

APPENDIX 11



STOUR STREET
(Section 1)

Figure 1



STOUR STREET
(Section 1)

Figure 2

PLANTS OF WET SOILS

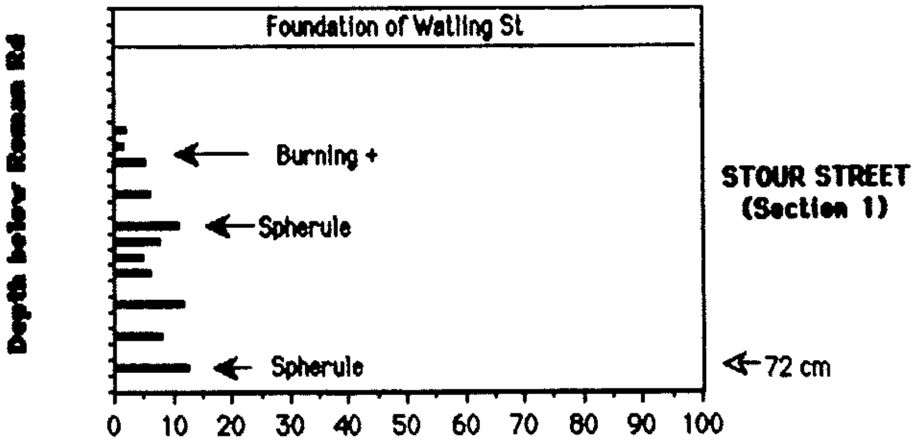


Figure 3

ALL HERBS

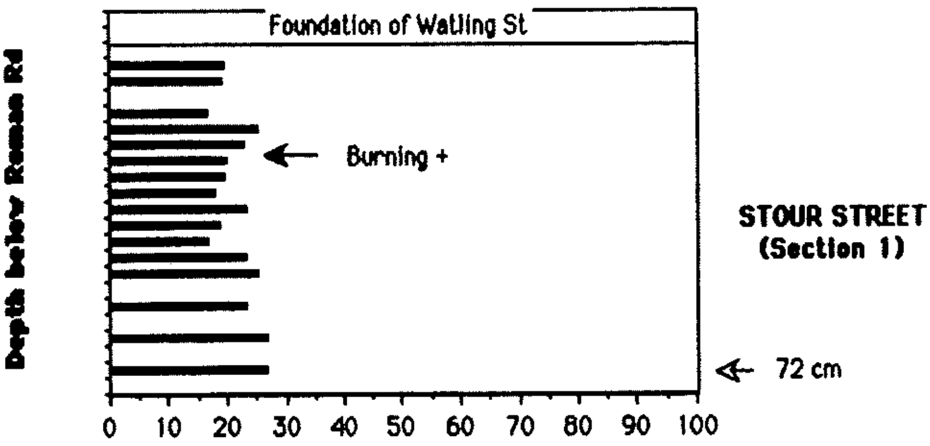


Figure 4

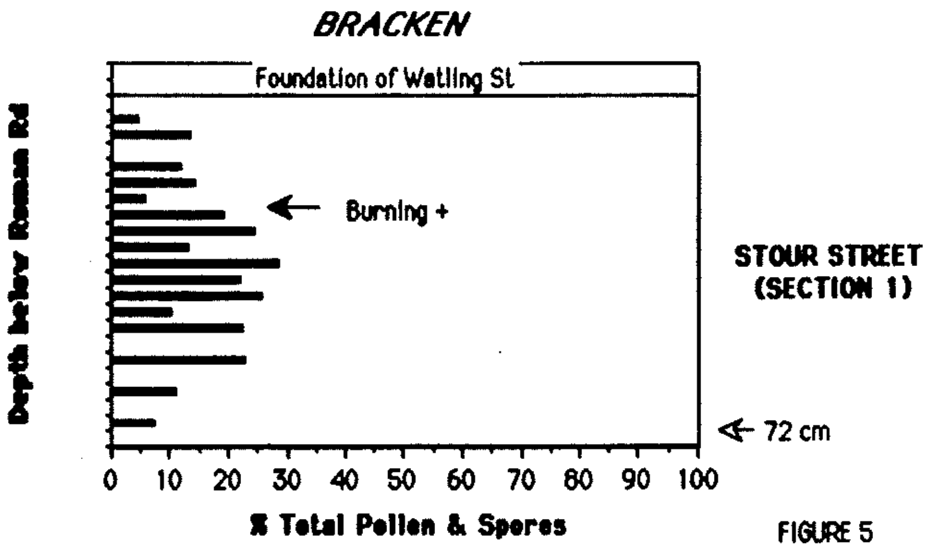


FIGURE 5

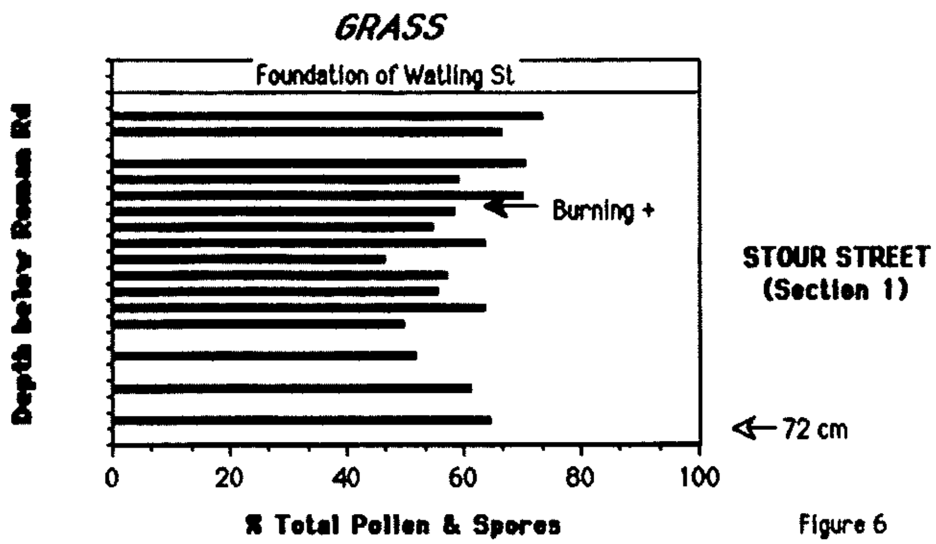


Figure 6

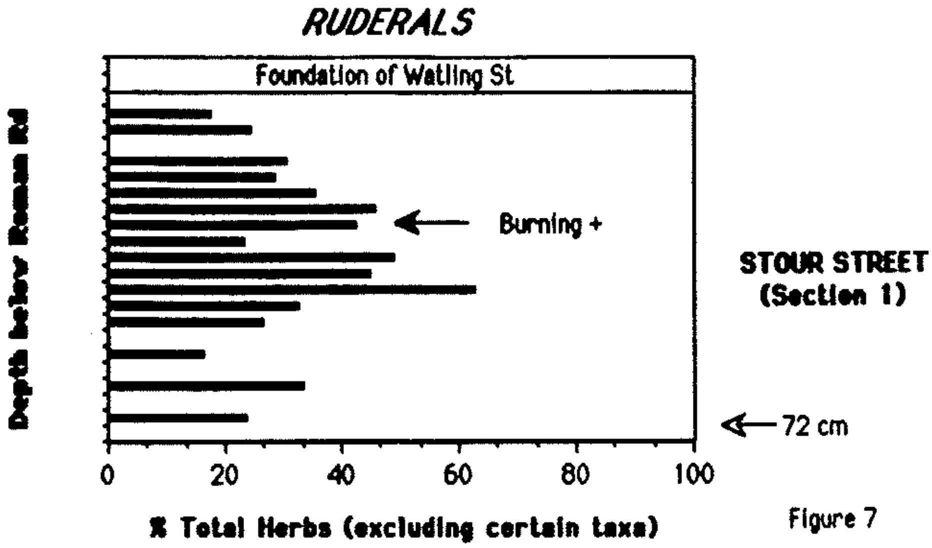


Figure 7

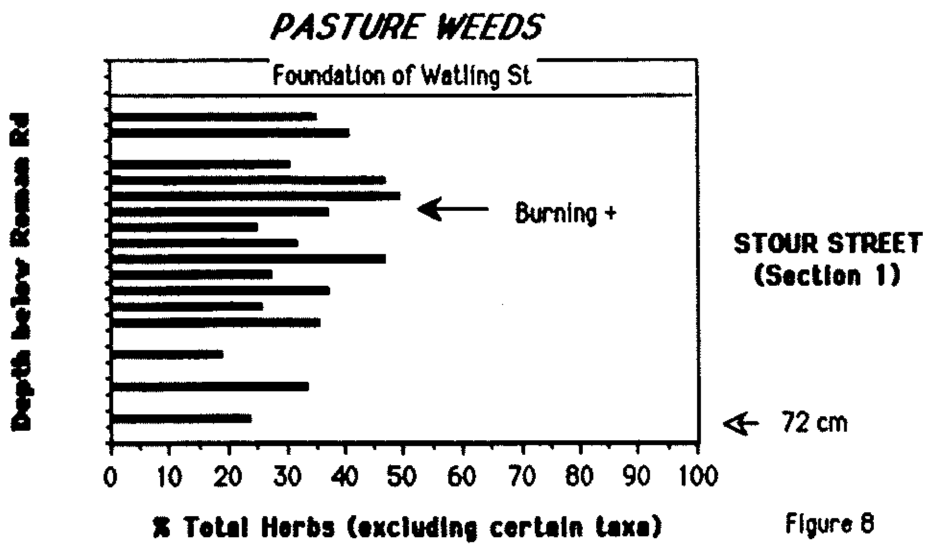


Figure 8

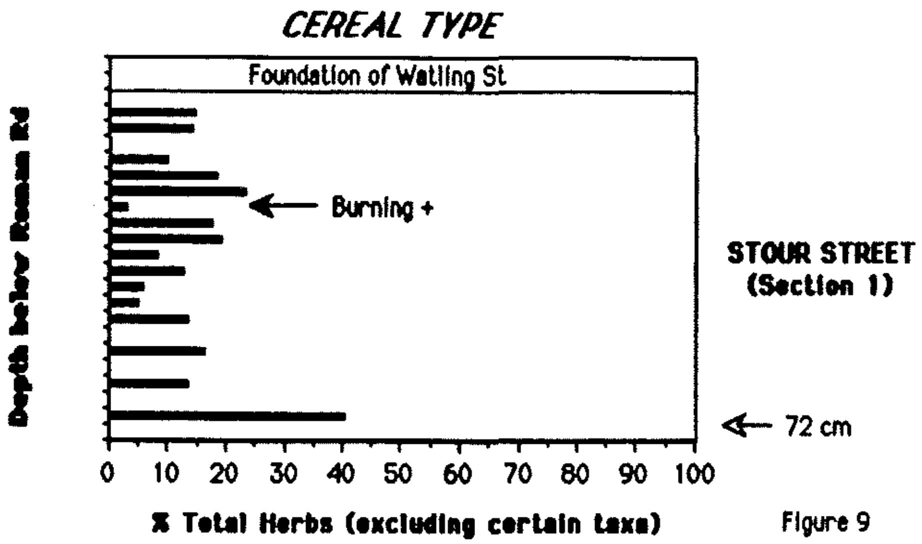


Figure 9

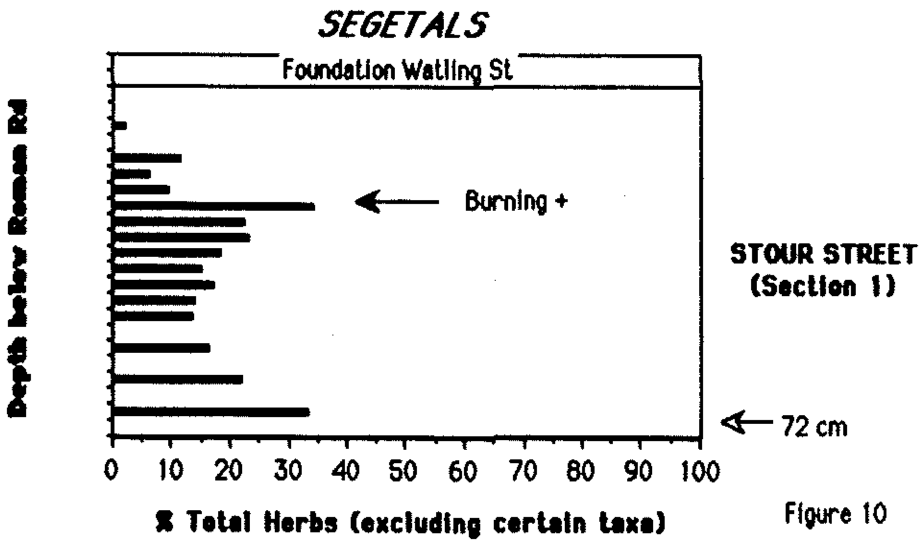


Figure 10