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Pollen analysis of the Walbrook stream channel underlying the Temple of Mithras, London.

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Samples were taken by Professor W. F. Grimes for the pollen analytical investigation of the River Walbrook deposits underlying the Temple of Mithras. The site of the temple was excavated in 1954 and has subsequently been published (Grimes 1968, 1971). Eleven samples were taken from the south face of cutting C.A. Two series of samples for pollen were taken from the peats, and peaty silts contained within the gravels underlying the Temple. The location of these is shown on section 1. Sealed glass tubes were used to contain the samples taken, thus preventing subsequent contamination by recent pollen.

Despite drying out in the sample tubes, pollen was abundant within the samples and in an acceptable state of preservation. Pollen counts of 400 grains were made at each level. Standard techniques were used for the extraction of the sub-fossil pollen and spores. This included Na Oh (10%) for defflocculation of the sediments and removal of humic colloids; digestion of silica by hydrofluoric acid and the removal of extraneous cellulose by Erdtmans acetolysis (1:9 H_2SO_4 and $(CH_3CO)_2O$) The remaining pollen and spores were stained with safranin and mounted in glycerol jelly on microscope slides. The results of the pollen count are given in Table 1 and Table 2. The pollen sum of 400 grains included dry land taxa plus those associate with marshy ground, that is the autochthonous component. This was carried out because of the problem of ecological separation of many types on the basis of their pollen morphological character. Pollen sums have been calculated as a percentage of the total pollen (TP). Spores are given as a percentage of total pollen plus spores. Percentages are given in brackets whilst the 'raw counts' are given first. Table 1 gives samples 1a-5 from 6'6" to 14' (sample 5). Samples 6-11 (Table 2) are from the base at c 15' to 10'6" taken from the eastern side of the section.

Interpretation

The pollen recorded shows a marked diversity of types. The problems of pollen morphological differentiation mean that the majority of those pollen taxa listed are only referable to broad pollen type categories or genera, and not in most cases to

species or even genus. These types are, however, indicative of a number of differen habitat types which are outlined below:

i) Aquatic/marginal aquatic:

Alisma type
Alnus
Caltha type
Cyperaceae
Filipendula
Gramineae
Hydrocotyle
Lychnis type
Lysimachia
Sphagnum

Other taxa in this group might include species of Ranunculaceae, papilionaceae, Galium, Umbelliferae Mentha type and compositae.

The low values of Alnus in these levels suggest that this was not a local constituent of the vegetation as this type is an extremely high pollen producer and, as an autochthonous component, usually give rise to high pollen frequencies. The remaining marginal plants are indicative of a fen type environment as opposed to a more acid peat forming community. The frequency of these taxa is, however, low especially that of Cyperaceae. This factor along with the large inorganic component of the samples/sediments analysed suggests that some at least of this pollen is derived from elsewhere. Such pollen might be carried downstream and incorporated into overbank deposition.

ii) Arboreal/shrub Element

Tree	Shrub
Betula	Corylus
Juglans	Hedera
Pinus	Ligustrum
Quercus	Sorbus type
Tilia	Thelycrania

These are present in only low frequencies and it may be inferred from this that extensive deforestation had taken place by the period represented here (1st - 3rd Century AD.). This is certainly the case in the area adjacent to the Walbrook, but the nature of the regional vegetation cover at this date is problematic. It seems likely, however, that higher values of Quercus, Betula and Corylus would be present if substantial areas of woodland or forest remained.

Juglans regia is an interesting pollen record from this site as this species is regarded as a Roman introduction to England (Godwin 1975) from the Mediterranean area. As the sample 1A lies well within the Roman temple levels this is not an unexpected find.

iii) Ruderals/weeds

This group contains those species which appear to be dominant in the vegetation present adjacent to the site. A great diversity of herbaceous taxa are present in the families listed below:

Ranunculaceae
Cruciferae
Caryophyllaceae
Chenopodiaceae
Malvaceae
Papilionaceae
Rosaceae
Umbelliferae
Polygonaceae
Scrophulariaceae
Plantaginaceae
Dipsacaceae
Compositae
Gramineae

These combine elements which are weeds of waste ground and weeds common to arable situations. The origin of the latter group which is similarly evidenced by the occurrence of cereal pollen is of some interest. It is difficult to ascertain the

nature of the area represented by the pollen incorporated into such sediments, and consequently any interpretation as to the extent of, or distance from any arable activity must remain enigmatic. One of the following situations may, however, apply:

i) Arable cropping outside the City's perimeter contributed to the records of cereal type pollen and associated cultigens.

ii) That the cereal pollen and weed pollen was transported from some distance away by the stream and subsequently deposited down stream at Mithras. It may be noted that the pollen of these particular elements did not show any appreciable degradation of the exines.

iii) Cereal pollen in urban sediments may be present due to secondary purely anthropogenic causes. Crop processing in the civinity of th site or upstream might be expected to contribute pollen to the sediments. Pollen can remain trapped in the bracts of cereal ears untilthreshing of the grain releases the contained pollen.

The diversity of herbs present does, however, indicate the presence of areas of waste ground on or adjacent to the area upon which the Temple of Mithras was built. This is evidenced by high totals of Gramineae pollen and the occurrence in lower frequenceies of other taxa such as plantago lanceolata, compositae spp. (including an unusually high total of Centaurea nigra type in sample 2) and Polygonace (Rumex and Polygonum). These and the other types listed are those which might be expected in urban waste-ground areas. It is possible that these areas were adjacent to the river and flood plain where peaty accumulation took place. This situation is analogous with fen peat accumulation of Later bronze age, to Iron Age date analysed from Willson's Wharfe, Southwark (Scaife in preparation). Here, predominantly herbaceous pollen reflects the openess of the vegetation with waste ground adjacent to the fen.

Conclusion

Pollen analysis of the samples obtained during the excavation of the Temple of Mithra in 1954 are interesting because of the diversity of pollen types found. From this analysis, it can be inferred that, as might be expected, the arboreal/woodland

component of the vegetation was negligible. The bulk of the pollen was derived from three principle environments; arable cultivation and associated weeds; weeds from open or waste ground and a marginal aquatic fen component. With the exception of Juglans regia (walnut) no introduced 'exotic' or garden plants are indicated from the pollen identified.

References

Godwin, H. (1975) The History of the British Flora Camb. Univ. Press.

Grimes, W.F. (1968) The Temple of Mithras and its surroundings. In The Excavation of Roman and Mediaeval London pp 92-115.

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TABLE 1

TREES AND SHRUBS	SAMPLE NUMBER 1A	1	2	3	4
Pinus				3 (.8)	1 (.3)
Quercus	1 (.3)	1 (.3)	7 (1.8)	4 (1.0)	3 (.8)
Tilia					1 (.3)
Alnus	2 (.5)			1 (.3)	9 (2.2)
Juglans	1 (.3)				
Thelycrania			1 (.3)		
Corylus	2 (.5)		2 (.5)	1 (.3)	12 (3.0)
Sorbus	1 (.3)				
Hedera					1 (.3)
HERBS					
RANUNCULACEAE			3 (.8)		
Caltha type			1 (.3)		
Ranunculus type	9 (2.3)	12 (3.0)	6 (1.5)	7 (1.8)	1 (.3)
Anemone type	1 (.3)				
Sinapis type	3 (.8)	1 (.3)		15 (3.8)	8 (2.0)
Hornungia type	1 (.3)			5 (1.3)	2 (.5)
Viola arvensis type	1 (.3)				
Lychnis type			1 (.3)		
Dianthus type	1 (.3)		2 (.5)		6 (1.5)
Spergula type			4 (1.0)		
Chenopodium type	2 (.5)			3 (.8)	14 (3.5)
MALVACEAE					1 (.3)
PAPILIONACEAE	1 (.3)	2 (.5)	1 (.3)	1 (.3)	3 (.8)
Ononis type	3 (.8)			1 (.3)	
Medicago type	1 (.3)	3 (.8)		4 (1.0)	1 (.3)
Trifolium type	5 (1.3)	6 (1.5)	2 (.5)	6 (1.5)	3 (.8)
Lotus type					
Astragalus type	2 (.5)		4 (1.0)		
Vicia cracca type	4 (1.0)				
Lathyrus type			2 (.5)	2 (.5)	
ROSACEAE		1 (.3)			1 (.3)
Filipendula	5 (1.3)		20 (5.0)	4 (1.0)	2 (.5)
CRASSULACEAE				1 (.3)	
Lythrum			1 (.3)		
UMBELLIFERAE	5 (1.3)	4 (1.0)	1 (.3)	8 (2.0)	7 (1.7)
Hydrocotyle		1 (.3)			
Polygonum aviculare type					3 (.8)
Rumex	2 (.5)		1 (.3)	2 (.5)	2 (.5)
R. obtusifolius type				1 (. .3)	
Calluna					1 (.3)
Lysimachia	1 (.3)				
Rhinanthus type	1 (.3)				
Mentha type					1 (.3)
Lamium type		1 (.3)			
Plantago Media/major	1 (.3)		2 (.5)		1 (.3)

TABLE 1 cont.

	SAMPLE NUMBER				
	1A	1	2	3	4
HERBS					
P. lanceolata	15 (3.8)	65 (16.3)	35 (8.7)	14 (3.5)	7 (1.7)
P. Coronopus		2 (.5)		1 (.3)	
Galium type				2 (.5)	
Scabiosa	3 (.8)	2 (.5)	7 (1.8)		
Bidens type	1 (.3)	10 (2.5)			
Artemisia					1 (.3)
Anthemis type	6 (1.5)	1 (.3)	2 (.5)	6 (1.5)	8 (1.9)
Centaurea nigra type	4 (1.0)	1 (.3)	70 (17.4)	5 (1.3)	8 (1.9)
Taraxacum type	11 (1.8)	14 (3.5)	8 (2.0)	8 (2.0)	13 (3.2)
Alisma type	1 (.3)	1 (.3)			
CYPERACEAE	4 (1.0)	5 (1.3)	12 (3.0)	6 (1.5)	2 (.5)
GRAMINEAE	277 (69.3)	259 (64.8)	196 (48.8)	281 (70.3)	284 (71.0)
Cereal type	12 (3.0)	5 (1.3)	5 (1.3)	6 (1.5)	7 (1.7)
SPORES					
Equisetum					1 (.2)
Pteridium			6 (1.5)	1 (.3)	
Dryopteris type			1 (.2)		2 (.5)
Polypodium				3 (.7)	
Sphagnum					
Anthoceras			1 (.2)		
PARASITES					
Trichuris					1

TABLE 2

TREES AND SHRUBS	6	7	8	9	10	11
Betula	1 (.3)					1 (.3)
Pinus		3 (.8)				
Quercus	2 (.5)	3 (.8)				
Alnus	3 (.8)			1 (.3)		
Corylus	4 (1.0)	5 (1.3)	1 (.3)		2 (.5)	
Ligustrum			1 (.3)			
HERBS						
RANUNCULACEAE						1 (.3)
Ranunculus type	7 (1.8)	8 (2.0)	12 (4.0)	11 (2.7)	6 (1.5)	4 (.5)
Sinapis type	4 (1.0)	3 (.8)	3 (.8)		1 (.3)	1 (.3)
Hornungia type	2 (.5)					
Dianthus type	3 (.8)	3 (.8)			1 (.3)	1 (.3)
Stellaria type	1 (.3)	6 (1.5)				
Chenopodium type	1 (.3)		3 (.8)	2 (.5)		1 (.3)
PAPILIONACEAE	2 (.5)		1 (.3)	1 (.3)		1 (.3)
Ononis type		1 (.3)		6 (1.5)		1 (.3)
Medicago type		4 (1.0)	1 (.3)	3 (.8)		
Trifolium type	1 (.3)	4 (1.0)	5 (1.3)	9 (2.3)	3 (.8)	2 (.5)
Lotus type	4 (1.0)					1 (.3)
Vicia cracca type			2 (.5)	4 (1.0)	1 (.3)	
Lathyrus type		1 (.3)	1 (.3)			
ROSACEAE	3 (.8)			2 (.5)	3 (.8)	2 (.5)
Filipendula	2 (.5)	3 (0.8)	9 (2.3)	1 (.3)		3 (.8)
Geum					1 (.3)	
UMBELLIFERAE	7 (1.3)	6 (1.5)	3 (.8)	2 (.5)	7 (1.8)	3 (.8)
Polygonum persicaria type	1 (.3)					
P. aviculare type	1 (.3)					
Rumex	2 (.5)	6 (1.5)	1 (.3)			
SCROPHULARIACEAE					1 (.3)	
Rhinanthus type		1 (.3)	1 (.3)			
Odontites type	1 (.3)					
Stachys type	1 (.3)	1 (.3)				
Plantago lanceolata	17 (4.2)	18 (4.5)	1 (.3)	16 (4.0)	7 (1.8)	9 (2.3)
P. Coronopus				2 (.5)		
Campanula			1 (.3)			
Scabiosa type						2 (.5)
Bidens type	9 (2.3)	2 (.5)	1 (.3)		1 (.3)	
Aster type	1 (.3)					
Anthemis type	6 (1.5)	10 (2.5)	6 (1.5)	2 (.5)	2 (.5)	5 (1.3)
Centaurea nigra type	1 (.3)	4 (1.0)	5 (1.3)		4 (1.0)	13 (3.3)
Taraxacum type	8 (2.0)	12 (4.0)	17 (4.3)	2 (.5)	5 (1.3)	5 (1.3)
Alisma type		1 (.3)				
CYPERACEAE	5 (1.3)	2 (.5)	4 (1.0)	3 (.8)		3 (.8)
GRAMINEAE	288 (71.8)	278 (69.2)	315 (78.8)	335 (82.3)	352 (88.0)	345 (86.3)
Cereal type	13 (3.3)	12 (4.0)	7 (1.8)		2 (.5)	5 (1.3)

TABLE 2 cont.

SPORES	6	7	8	9	10	11
Dryopteris type	1 (.3)					2 (.5)
Pteridium	2 (.5)	2 (.5)				
Anthoceras			1 (.3)		1 (.3)	1 (.3)