EXCAVATIONS

AT

WHITEFRIARS STREET CAR PARK, NORWICH, 1979

by

Brian Ayers and Peter Murphy

ENVIRONMENTAL EVIDENCE

METHODS

MACROFOSSILS: Recovery and extraction

Large mammal bone and wood samples were collected by hand during excavation, but the remaining material was recovered from soil samples. Samples were taken from cleaned surfaces, wherever possible as intact blocks of sediment, and those destined for temporary storage were packed in two layers of polythene. Each sample was accompanied by a standard form in which were entered a description of the deposit, its archaeological context and the purpose for which the sample had been taken. Far more samples were taken than could possibly be examined; detailed documentation was therefore necessary to avoid confusion and to help in deciding which samples should be studied in detail. Two separate sample series were taken: one for the recovery of large biological remains, which were to be extracted from bulk samples on site, and a second for the extraction of smaller and more fragile material in the laboratory. The extraction methods used were essentially those of Kenward *et al* (1980), slightly adapted to suit local conditions.

The bulk samples (comprising up to eight bucketsful of soil) were processed in a 'bulk sieving tank', a modified version of the 'Siraf flotation tank' (Williams 1973). The flots and residues produced were dried and sorted in the laboratory, extracting fishbone and other small vertebrate remains, molluscs, fruitstones, nuts and large seeds as well as artefacts. Large numbers of smaller seeds were also present but have been disregarded for reasons outlined below.

In the laboratory, sub-samples (one to three kg. in weight) were taken from the second sample series for more detailed examination. Most of the samples were disaggregated by gentle manual agitation in hot water, but hydrogen peroxide treatment was found to be necessary for the complete disaggregation of more compacted samples. The disaggregated sediments were washed under running water in a 250 micron mesh sieve. Most deposits at the site included a relatively large mineral component (particularly the sand and gravel-based river sediments of Periods 1 and 2, and the dumped deposits of Period 3). The organic fraction of each sample was therefore separated by a 'wash-over' technique, collecting the organic material in a 250 micron mesh sieve, and this fraction was then sorted in a wet state under a binocular microscope at low magnification (x 10) extracting fruits, seeds, leaves, and mosses, as well as any freshwater and land molluscs which had floated off. The residue was washed over a 500 micron mesh sieve, dried, and sorted under the microscope, picking out molluscs, small vertebrate remains, and the few remaining plant macrofossils. Further samples, taken for the recovery of insect remains, have been sent in an unprocessed state to Dr. M. Girling.

MACROFOSSILS: identification, counts etc.,

Fishbone

Identifications were made by comparing the ancient material with modern reference skeletons in the collection of the Environmental Archaeology Unit, University of York. In addition to identifying the bones, an attempt has been made to size the fish represented in the deposits. Large individuals and rare specimens were sized by comparison with modern material. Common small fish, such as herring, are usually only caught in a rather restricted size range and therefore do not warrant sizing. Fish nomenclature follows Wheeler (1969).

Marine Mollusca

Shells and shell fragments recovered by bulk-sieving are listed in Table 8 (fiche). Counts were made of gastropod apices and bivalve hinges. As is usually the case in archaeological deposits, mussel valves were very fragmentary, and the counts of this species are based on intact hinges plus an estimate of minumum hinge numbers from fragments. Layer 82 consisted almost entirely of badly crushed mussel shell and periostraca. Microscopically the sediment included a high proportion of calcareous prisms from fragmented shells. Accurate counting was impossible, and the mussels from 82 have therefore not been included in the calculation of minimum numbers of individuals.

Freshwater and land mollusca

Shells were identified initially using Macan (1969) and identifications were confirmed by comparison with reference specimens in the Natural History Department, Norwich Castle Museum.

Mosses

These were identified by comparison with specimens in Norwich Castle Museum. Nomenclature follows Smith (1978).

Plant macrofossils

The 'flots' and 'residues' produced by the bulk sieving tank contained large numbers of smaller seeds, but these have not been examined, because this technique is thought to be relatively inefficient in extracting these smaller plant remains from waterlogged samples and may result in differential recovery rates for different categories of material. Moreover, adequate assemblages of small seeds had already been recovered from samples in the more controlled conditions of the laboratory.

Identifications were made using Bertsch (1941), Beijerinck (1947) Katz et al (1965) and Renfrew (1973) and were confirmed by comparison with modern reference specimens. Well-preserved specimens have not always been identified to species level where this would have been excessively time-consuming for the information gained. Thus for example Carex nutlets and Juncus seeds have not been specifically determined and grass caryopses have generally been identified only to family level. Other tentative or incomplete identifications refer to specimens with ill-defined or obscured morphology or result from a lack of modern reference specimens. Measurements have been made only where they were thought to be of direct relevance for the separation of taxa.

MICROFOSSILS

Diatoms

The samples were shaken vigorously with distilled water to dislodge fine particles and diatoms from aggregates, then poured into a beaker and organic matter in them oxidized with hot chromic acid. They were then shaken and allowed to stand for 15 seconds to allow sand grains to settle. The supernatant was centrifuged (3000g) for 5 minutes then washed with distilled water and recentrifuged. This was repeated three times. Aliquots of a suspension of the final residue were dried onto thin coverslips (thickness 0), dried and mounted in high refractive index mountant (Hyrax). They were examined using phase-contrast oil immersion microscopy (x 1000).

Results are given in Table 10 (fiche) and include an estimate in arbitrary units of abundance per unit, dry weight of sediment, and percentage contributions of particular species and genera to the total. Authorities for nomenclature are those quoted in Hustedt (1930).

Counts are based on all identifiable remains and indication is given of the degree, subjectively assessed, of fragmentation of the diatom frustules. (Diatom cell walls, which are of silica, comprise several parts, of which the valves, or frustules, are the larger. A species may be identified from the pattern of ornamentation on them. It is generally necessary to have at least the central and one terminal portion of the frustule for definite identification). Cysts, the silicious resting bodies of some members of another algal division, the Chrysophyta, were also recorded.

Pollen

Standard pollen extraction procedures were used to concentrate the sub-fossil pollen and spores present. Pollen taxonomy follows that given in the pollen key of Moore and Webb (1978). The pollen sum varied between 100 and 350 depending upon the absolute pollen frequencies present.

TABLE 2: CATEGORIES OF ANIMAL BONE TYPES

Number of category	bone types
1.	mandible, maxilla, tooth, skull
2.	humerus, femur, scapula, pelvis
3.	radius, ulna, tibia, fibula
4.	metacarpal, metatarsal, metapodial
5.	tarsals, carpals, patella
6.	phalanges

TABLE 3: TOTAL NUMBER OF IDENTIFIABLE ANIMAL BONE FRAGMENTS FROM SINGLE-PHASED LAYERS

	PIG	CAPRO-VINE	CATTLE	BIRD	HARE	DOG	CAT	HORSE	RED DEER	ROE DEER	IDENT
Period I											
No.	11	32	52	3	0	0	1	0	0	1	100
%	11	32	52	3	0	0	1	0	0	1	100
Period II											
No.	78	105	92	12	0	1	0	1	2	1	292
%	26.7	36	31.5	4.1	0	0.3	0	0.3	0.7	0.3	99.9
Period III											
No.	216	269	412	77	0	0	3	1	13	3	994
%	21.7	27.1	41.5	7.7	0	0	0.3	0.1	1.3	0.3	100
Period IV											
No.	37	57	59	20	2	1	0	0	0	0	176
%	21	32.4	33.5	11.4	1.1	0.6	0	0	0	0	100
TOTAL	342	463	615	112	2	2	4	2	15	5	1562
%	21.89	29.64	39.37	7.17	0.13	0.13	0.26	0.13	0.96	0.32	100

TABLE 4: PERCENTAGES OF THE MAIN MAMMALIAN SPECIES

i. <u>total number of fragments</u>

	PIG		CAPROVINE		CATTLE	
	No.	%	No.	%	No.	%
Period I	11	11.5	32	33.5	52	55
Period II	78	28.5	105	38	92	33.5
Period III	216	24	269	30	412	46
Period IV	37	24	57	37	59	39
TOTAL	342	24	463	32.5	615	43.5

ii. <u>epiphyses only</u>

	PIG		CAPROVINE		CATTLE	
	No.	%	No.	%	No.	%
Period I	6	13	20	43.5	20	43.5
Period II	22	19.1	51	44.4	42	36.5
Period III	108	28.7	126	33.5	142	37.8
Period IV	19	32.2	20	33.9	20	33.9
TOTAL	155	26	217	36.4	224	37.6

TABLE 5: DESCRIPTION OF MEASUREMENTS TAKEN FROM THE MMS BONES

HUMERUS	1.	maximum width of distal epiphysis
	2.	maximum thickness of distal epiphysis
	3.	maximum height of distal articulation
	4.	maximum width of barrel
RADIUS	1.	maximum width of proximal epiphysis
	L	length
METAPODIALS	1.	maximum width of proximal epiphysis
	2.	maximum thickness of proximal epiphysis
	3.	maximum width at distal fusion point
	4.	maximum thickness at distal fusion point
	5.	maximum width of distal epiphysis
	6.	maximum thickness of distal epiphysis
	7.	maximum thickness of medial condyle
	L	length
TIBIA	1.	maximum width of distal epiphysis
	2.	maximum thickness of distal epiphysis

TABLE 6: MEASUREMENTS OF THE MAIN MAMMALIAN SPECIES

LAYER	SPECIES	BONE TYPE	PF*	DF*	1	2	3	4	5	6	7	L
30	PIG	HUMERUS		DF	40.1	37.5	27.0	31.9				
51	"	"		DF	-	36.8	26.0	30.8				
74	"	"		DF	34.0	35.2	26.3	30.0				
86	"	"		DF	36.0	36.4	26.4	-				
96	"	"	PNF	DF	37.8	40.0	29.3	34.5				
27	"	RADIUS	PF		26.0							
30	"	"	PF	DNF	22.8							
51	"	"	PF		28.3							
51	"	"	PF		26.6							
75	"	"	PF		26.4							
74	"	"	PF		29.0							
88	"	"	PF	DNF	27.3							
30	"	TIBIA		DF	29.4	27.9						
30	"	"		DF	29.5	26.2						
46	"	"		DF	28.6	24.6						
46	"	"		DF	27.2	24.7						
50	"	"		DF	27.3	22.4						
52	"	"		DF	30.2	27.4						
55	"	"		DF	28.5	24.0						
68	"	"		DF	26.4	23.8						
75	"	"		DF	27.4	24.3						
74	"	"		DF	30.6							
102	"	"		DF	30.5	25.9						

* PF - proximal epiphysis fused DF - distal epiphysis fused

TABLE 6: (continued) (ii)

LAYER	SPECIES	BONE TYPE	PF	DF	1	2	3	4	5	6	7	L
4	CAPROVINE	RADIUS	PF	DF	28.9							
21	"	"	PF		30.6							
27	"	"	PF		23.0							
30	"	"	PF		31.0							
30	"	"	PF		30.0							
30	"	"	PF	DF	33.0							157.4
46	"	"	PF		28.3							
50	"	"	PF		31.1							
52	"	"	PF		31.2							
84	"	"	PF		32.0							
84	"	"	PF		29.7							
92	"	"	PF	DF								146.6
114	"	"	PF		29.8							
114	"	"	PF		31.6							
24	"	TIBIA		DF	26.2	19.8						
30	"	"		DF	28.6	21.7						
46	"	"		DF	26.4	20.6						
46	"	"		DF	28.1	21.2						
46	"	"		DF	26.9	19.5						
50	"	"		DF	26.6	18.6						
50	"	"		DF	27.7	21.3						
48	"	"		DF	29.0	21.2						
55	"	"		DF	25.0	18.9						
55	"	"		DF	27.7	20.5						
55	"	"		DF	28.2	21.6						

TABLE 6 (continued)

LAYER	SPECIES	BONE TYPE	PF	DF	1	2	3	4	5	6	7	L
55	CAPROVINE	TIBIA		DF	27.2	21.0						
55	"	"		DF	28.5	20.9						
52	"	"		DF	25.6	20.4						
52	"	"		DF	27.2	19.6						
52	"	"		DF	26.8	20.9						
52	"	"		DF	27.0	20.3						
82	"	"		DF	27.5	19.9						
102	"	"		DF	26.0	19.7						
24	"	METACARPAL	PF		20.2	15.5						
24	"	"	PF		23.8	17.5						
24	"	"	PF	DF	23.1	17.4	25.4	16.9				129.8
30	"	"	PF	DF	22.2							
30	"	"	PF	DF	22.0	16.0	25.5	13.5	25.0	15.5	11.0	122.9
30	"	"	PF		21.8	15.8						
30	"	"	PF		19.9	14.1						
30	"	"	PF		23.9	17.2						
46	"	"	PF	DF	21.2	15.5						115.9
46	"	"	PF	DF	23.0	18.2	24.2	13.1	24.6	16.2	11.4	129.3
46	"	"	PF		27.0	19.0						
50	"	"	PF		22.4	16.3						
50	"	"	PF	DNF	21.0	15.0						
55	"	"	PF	DF	23.5	17.0	25.9	23.0	26.2	16.3	11.4	128.4
52	"	"		DF					25.4	16.7	11.3	
60	"	"	PF	DF	23.2	16.6	25.7	12.7	25.5			117.8
84	"	"	PF		23.9	17.2						
86	"	"	PF	DF	23.7	17.7	26.7	14.0	26.6	16.5	12.0	122.0

TABLE 6. (continued) (iv)

LAYER	SPECIES	BONE TYPE	PF	DF	1	2	3	4	5	6	7	L
82	CAPROVINE	METACARPAL		DF			25.8	13.2	26.3	16.0	11.4	
82	"	"	PF	DF			29.7					118.5
88	"	"	PF	DF	28.3	19.4	30.8	14.6	30.9	17.6	10.5	124.9
88	"	"	PF		24.3	17.3						
88	"	"	PF	DNF	25.8	17.9						
93	"	"	PF		24.4	17.4						
93	"	"		DF			24.4	12.4	25.0	15.9	11.0	
98	"	"	PF		22.5	15.5						
113	"	"	PF	DF	22.5	17.5	25.7	13.1	26.0	15.7	11.0	127.2
30	"	Metatarsal	PF		20.6	20.2						
30	"	"	PF		20.7	19.6						
46	"	"	PF		20.4	20.3						
46	"	"	PF		20.0	20.0						
46	"	"	PF	DF	18.3	20.0			23.4	15.6		131.6
46	"	"	PF		21.0	21.3						
46	"	"	PF		20.5	22.0						
50	"	"	PF	DNF	20.4	20.6						
50	"	"	PF		22.8	22.1						
55	"	"	PF	DF	19.6	20.0			23.2			133.2
52	"	"	PF	DF	20.0	21.0			24.7	15.6		135.0
52	"	"		DF					22.8	15.9		
52	"	"		DF					23.7	16.2		
52	"	"		DF					24.4	15.7		
60	"	"	PF		20.6	21.5						
73	"	"	PF		20.3	20.9						
75	"	"	PF	DF	19.9	20.6			23.0	16.0		

TABLE 6. (continued) (v)

LAYER	SPECIES	BONE TYPE	PF	DF	1	2	3	4	5	6	7	L
82	CAPROVINE	METATARSAL		DF					25.0	16.2		
82	"	"	PF		19.6	19.9						
88	"	"	PF	DNF	20.4	21.0						
88	"	"							24.3	15.8		
100	"	"		DF					24.2			
91	"	"			22.7	22.3			25.0	16.9		145.0
114	"	"	PF	DF	23.5	22.0			27.3	17.5		134.1
102	"	"	PF		20.4	21.2						
102	"	"		DF					22.8	15.0		
102	"	"	PF	DF	20.9	22.5			24.5	16.8		

TABLE 6. (continued) (vi)

LAYER	SPECIES	BONE TYPE	PF	DF	1	2	3	4	5	6	7	L
75	CATTLE	RADIUS	PF		68.8							
86	"	"	PF		71.7							
68	"	"	PF		71.4							
92	"	"	PF		84.3							
114	"	"	PF	DF	84.4							302.0
30	"	TIBIA		DF	56.4	40.7						
46	"	"		DF	58.0							
51	"	"		DF	48.8	37.5						
51	"	"		DF	57.0	43.0						
51	"	"		DF	63.[illegible]	44.7						
51	"	"		DF	54.4	39.8						
51	"	"		DF	57.4	42.0						
55	"	"		DF	52.5	39.2						
55	"	"		DF	64.4	45.7						
75	"	"		DF	59.5	42.3						
91	"	"		DF	63.4	45.2						

TABLE 6. (continued)

LAYER	SPECIES	BONE TYPE	PF	DF	1	2	3	4	5	6	7	L
46	CATTLE	METACARPAL	PF		59.0							
46	"	"	PF	DF	56.1	35.4	54.2	27.4	60.5	31.8		191.0
51	"	"	PF	DF	48.0	29.3	46.5	24.9	50.6	29.7		176.0
51	"	"	PF	DF	54.6	36.7	53.8	25.0	59.6	31.2		184.5
51	"	"		DF					51.7			
51	"	"	PF		57.7	35.2						
55	"	"	PF		47.0	29.0						
52	"	"	PF	DF	47.0	28.6	45.7	26.2	46.4	26.5		175.0
52	"	"	PF		55.0	34.3						
75	"	"	PF		50.7	32.6						
88	"	"	PF	DF			45.2					184.0
90	"	"	PF		43.4	41.4						
91	"	"		DF			51.5	27.5	55.1	29.6		
114	"	"	PF	DF	60.0	37.7	59.3	28.6	65.0	33.3		208.0
113	"	"	PF		48.4	29.1						
113	"	"	PF	DF	51.4	31.7	46.0	25.3	51.6	28.9		188.0

TABLE 6. (continued)

LAYER	SPECIES	BONE TYPE	PF	DF	1	2	3	4	5	6	7	L
5	CATTLE	METACARPAL		DF			46.5		51.3	30.0		
30	"	"		DF			50.6		53.8	29.2		
30	"	"		DF			45.3		47.1			
30	"	"		DF					54.6			
46	"	"	PF		44.7	42.8						
48	"	"	PF		45.5	45.0						
50	"	"		DF			52.6	29.2	56.9	30.3		
51	"	"		DF			43.0	25.7	45.9	27.0		
51	"	"	PF	DF	52.8	51.1	53.7	32.2	57.7	32.3		221.5
51	"	"	PF		39.4	37.9						
52	"	"	PF		43.8	42.3						
52	"	"		DF								
55	"	"		DF			55.0	25.3	60.0	31.7		
60	"	"	PF		49.6							
60	"	"		DF					50.7			
74	"	"	PF		47.8	46.7						
84	"	"		DF			46.8	28.7	49.0	29.7		
86	"	"	PF	DF			46.3	26.1	49.8	28.9		209.0
114	"	"	PF	DF	50.0	49.0	57.6	29.9	60.1	32.5		237.0

TABLE 7: THE DISTRIBUTION OF IDENTIFIED FISH BONES IN THE THREE MAIN PERIODS OF THE SITE (Bracketed numbers, e.g. (12) are the number of vertebral centra per taxon per period. Unbracketed numbers are the number of other identified bones per taxon per period.)

Period	II		III		IV	
Kind of Fish						
Elasmobranchii	(2)	-	(4)	2	(3)	-
Rajidae	-	1	-	4	-	-
Raja clavata	-	2	-	3	-	-
Clupea harengus	(46)	4	(201)	31	(5)	-
Salmonidae	-	-	(1)	-	-	-
Esox lucius	(1)	-	(2)	-	-	-
Cyprinidae	(3)	1	-	-	-	-
Anguilla anguilla	(18)	1	(20)	3	(1)	-
Gadidae	-	-	(3)	-	-	-
Merlangius merlangus	(15)	-	(27)	3	(1)	-
Gadus morhua	(10)	-	(24)	3	(1)	-
Dicentrarchus labrax	(1)	-	-	1	-	-
Trachurus trachurus	-	-	(3)	-	(1)	-
Scomber scombrus	(2)	-	(2)	-	(1)	-
Pleuronectidae	(9)	-	(31)	1	(1)	-
Pleuronectes platessa	-	-	-	1	-	-
Platichthys flesus	-	-	-	2	-	-

TABLE 8: MARINE MOLLUSCA

Sample No.	1	2+3	4	5+6	7+8	9+10	11	12+13	14	15	15	15	16	Total MNI (excl.82)
Context	60	55	67	68	52	75	84	86	74	82	92	93	113	
Ostrea edulis UV	2	4	4	1	6	1	1	4	3	1	1	-	1	40
LV	1	10	1	3	2	1	-	3	3	2	1	2	1	
Mytilus edulis	4	16	3	7	1	1	28	141	(1)	*	18	11	-	116
Cerastoderma sp.	-	-	(1)	-	-	-	-	-	-	-	-	-	-	1
Buccinum undataum	-	(1)	-	-	-	-	-	-	-	-	-	-	-	1
Littorina littorea	1	-	-	1	1	-	-	-	-	-	-	-	-	3

* - abundant - not counted

(1) - indicates non-hinge or non-apical fragment

82 and 92 are sub-divisions of 93

TABLE 9: FRESHWATER AND LAND MOLLUSCA from context (114) (sample 58); 1kg sample

Valvata piscinalis (Müller)	142
Valvata cristata (Müller)	18
Valvata sp.*	170
Bithynia tentaculata (Linné)	34
Lymnaea peregra (Müller)	20
Bithynia/Lymnaea*	180
Planorbis planorbis (Linné)	10
Anisus leucostoma (Millet)	1
Gyraulus albus (Müller)	43
Bathyomphalus contortus (Linné)	19
Planorbis sp. (sensu lato) *	53
Helicella sp.*	1
Discus rotundatus (Müller)	+
Pisidium spp. (individuals with paired valves)	18
Pisidium spp. (separated valves)	306
Ostrea edulis (Linné)	+
Cerastoderma sp.	+

+ indicates non-apical or non-hinge fragments

* small fragments, including nepionic whorls

Notes:

1. The Pisidium spp. include a large proportion of immature specimens. No attempt has been made to identify these bivalves to species.
2. Since the sediment was coarse many of the shells are very fragmentary and some are abraded. This has led to difficulties in the separation of several taxa and to a high proportion of approximate identifications. These do not, it is thought, invalidate the overall ecological interpretation of the assemblage.
3. The sieved fraction also contained fragments of arenaceous caddis-fly larval cases.

TABLE 10: DIATOMS AND OTHER ALGAL REMAINS. (Percentages given for individual taxa are those of the total count of diatoms and chrysophytan cysts combined. The degree of intactness of the diatoms is indicated by the number of + signs.)

Context	24	27	30(1)	30(2)	30(2)	41(1)	46(2)	51(1)	51(2)	52(1)	52(2)	58	74	82(2)	83
Code for sample	A	B	C	D	E	F	G	H	I	J	K				
Absolute abundance	10	15	19	9	11	24	5	21	9	4	5	35	37	29	49
Intactness	-	-	-	-	-	±	-	-	-	-	-	+++	+	+++	+++
Coscinodiscus						4.2				25					2
Chrysophytan cysts	30	46.7	26.3	22.2	27.3	41.7	0	9.5	0	25					
Achnanthes minutissima	10							4.8					2.7		2
A. lanceolata												17.1		3.4	16
A. l. rostrata													5.4		8
A. sp.														3.4	
Cocconeis placentula	10	6.7	0	11.1	0	4.2	0	4.8	0	25	40	37.1	37.8	17.2	16
C. scutellum			5.3			4.2									
C. sp.												2.9			
Fragilaria sp.			15.8									11.4	2.7		4
F. construens			5.3											20.7	
F. brevistriata			10.5					4.8						3.4	
Synedra sp.			5.3			4.2			22.2					3.4	2
Diatoma elongatum				11.1	9.1										
Epithemia zebra	10				27.3		40								
Rhopalodia gibba					9.1			4.8							2
Cymbella brehmi									22.2			5.7	2.7		
Cymbella sp.													5.4		
Rhoicosphenia curvata															2
Amphora ovalis var *pediculus*													5.4		
Amphora sp.													2.7		

... continued ...

TABLE 10: (continued)

Context	24	27	30(1)	30(2)	30(2)	41(1)	46(2)	51(1)	51(2)	52(1)	52(2)	58	74	82(2)	83
Code for sample	A	B	C	D	E	F	G	H	I	J	K				
Gomphonema sp.													2.7		
Pinnularia sp. 1	10	6.7						4.8		25					
P. sp. 2	10														
Nitzschia sp.	10		21.1	22,2		8.4	40	19	33.3				18.9	20.7	
N. palea														3.4	2
Navicula sp. 1	10	13.3	10.5	22.2	18.2	29.2	20	23.8	33.3	25		25.7	8.1	24.1	30.6
N. tuscula		26.7			9.1			4.8	11.1						
N. sp. 2															6.0
N. hungarica var. *capitata*															2
N. schonfeldi								4.8					5.4		2
Hantzschia sp.			5.3			4.2									
Campylodiscus noricus								4.8							
Navicula bacillum								4.8							
Diploneis ovalis								4.8							

TABLE 11: MOSSES

Context number	52	74	75	86	88	92	93	100	113	114
? Bracythecium rutabulum B. and S.	-	-	+	-	-	-	-	-	-	-
Eurynchium confertum Milde or)) Bracythecium velutiunum B. and S)	-	-	-	-	-	-	-	+	-	+
? Amblystegium riparium	-	-	-	-	-	+	-	-	-	-
Thamnobryum alopecurum B. and S.	-	-	-	-	-	-	+	-	-	-
Thuidium tamariscinum (Hedw) BS. and G.	+	-	+	-	-	-	-	-	+	-
Unidentified	-	+	-	*	-	+	-	-	-	-

TABLE 12: POLLEN COUNTS calculated as a percentage of total pollen

SAMPLE	1	2	3	4
Betula	0.3		1.3	
Pinus			1.0	1.0
Quercus	9.4	12.5	7.0	2.0
Tilia	0.3			
Alnus	2.3	1.3	2.7	
Fraxinus		0.7		
Fagus	0.6	0.7		
Corylus type	8.5	7.2	7.7	
Salix	1.7	3.3	3.3	
Ranunculus type	0.3	0.7	0.7	
Sinapis type	1.4	2.6	3.3	7.0
Hornungia type	0.6		1.0	
Caryophyllaceae undiff.				1.0
Dianthus type			0.7	
Chenopodium type	0.3		0.7	1.0
Papilionaceae undiff.	0.9	0.7	1.3	1.0
Ononis type	0.6			
Medicago type	1.1			
Trifolium type	1.7	0.7	0.3	
Lotus type		0.7		
Lathyrus type			0.7	
Rosaceae Undiff.	1.7		0.3	1.0
Filipendula	3.4	2.0	0.7	
Potentilla type	0.3		0.3	
Umbelliferae	0.9	0.7	1.3	
Hydrocotyle			0.7	
Cannabis type	0.3	0.7		
Rumex	1.1	1.3	3.7	
Urtica type	0.6	0.7		
Erica	0.3			
Calluna	1.1	2.0		1.0

... continued ...

TABLE 12: (continued)

SAMPLE	1	2	3	4
Solanum nigrum	0.6			
cf. Digitalis type			0.7	
Melampyrum		0.7	0.7	
Mentha type	1.4		1.3	
Lamium type	0.6			
Plantago lanceolata	4.6	4.6	5.3	3.0
Campanula type	1.1	0.7		
Galium type		1.3	0.7	
Bidens type	1.1		0.7	
Aster type			0.7	
Anthemis type	0.3			
Centaurea nigra type	0.6	0.7		1.0
C. scabiosa type			0.7	
C. cyanus				4.0
Taraxacum type	6.8	3.9	7.7	30.0
Gramineae	38.2	42.1	32.3	31.0
Cereal type	6.8	3.9	6.7	1.0
Typha angustifolia type		0.7		
Cyperaceae	3.1	3.3	7.7	10.0
Unidentified	0.3			3.0
Pteridium	2.4		4.3	4.7
Dryopteris type	1.9	10.6	1.6	1.9
Polypodium	0.3		0.3	
Trichuris eggs		1	6	6
Pollen Sum	351	152	300	100
Spore total	17	18	20	7

TABLE 13: PLANT MACROFOSSILS RECOVERED FROM SAMPLES IN THE LABORATORY.
(All taxa represented by fruits or seeds unless otherwise indicated)

* not completely sorted + present ++ abundant (c) charred fr - fragments.

Context No.	46	55	74	82	84	88	92*	98	100	102*	113*	114
Sample No.	3	14	23	29	17	30	38	32	54	52	55	58
Chara sp. (oogonia)	-	-	-	-	-	-	-	-	-	-	+	+
Ranunculus c.f. repens L.	-	-	1	-	-	-	-	1	1	-	-	-
Ranunculus c.f. flammula L.	-	-	-	-	-	1	1	-	10	-	2	-
Ranunculus sceleratus L.	-	-	-	-	-	-	-	1	-	-	-	-
Ranunculus subgenus Batrachium	-	-	-	-	-	-	-	2	-	-	-	31
Ranunculus sp.	1	-	2	1	-	-	2	2	1	2	2	24
Papaver argemone L.	-	-	-	-	-	-	-	-	-	1	2	-
Papaver somniferum L.	-	-	-	-	-	-	-	-	-	26	32	-
Brassica sp.	-	-	1	-	1	-	-	-	2	1	-	-
Raphanus raphanistrum L. (siliqua frag.)	-	-	-	-	-	1	-	-	-	-	-	-
Thlaspi arvense L.	-	-	1	-	-	-	-	1	-	-	1	-
Reseda lutea L.	-	-	-	-	-	-	-	-	-	2	-	-
Reseda sp.	-	1	-	-	1	-	-	-	-	-	-	1
Hypericum c.f. tetrapterum Fries	-	-	-	-	-	1	-	-	-	-	-	-
Hypericum sp.	-	-	-	-	-	-	-	-	-	-	1	-
Silene c.f. alba (Miller) Krause	-	-	10	-	-	-	-	-	1	-	-	-
Agrostemma githago L.	-	-	c.f.2	-	-	-	-	-	7(fr)	2+fr	2+fr	1+fr
Dianthus c.f. armeria L.	-	-	-	-	-	-	-	-	-	-	2	-
Cerastium sp.	-	-	-	-	-	-	1	-	-	1	3	-
Stellaria media (L) Vill	-	-	-	1	1	2	5	13	8	42	49	-
Stellaria holostea L.	-	1	-	-	-	-	-	-	-	-	-	-
Stellaria c.f. graminea L.	-	-	1	-	-	1	1	-	-	5	-	-
Stellaria sp.	-	-	-	-	2	-	-	-	-	-	-	-

TABLE 13: (continued)

Context No.	46	55	74	82	84	88	92*	98	100	102*	113*	114
Sample No.	3	14	23	29	17	30	38	32	54	52	55	58
Spergula arvensis L.	-	-	-	-	-	-	-	-	-	1	-	1
Caryophyllaceae indet.	-	-	1	-	-	1	-	-	5	-	4	-
Montia fontana subsp. chondrosperma	-	-	1	-	-	1	-	-	-	-	-	-
Chenopodium album L.	11	6	29	2	2	10	3	31	10	40	15	40
Atriplex patula/hastata	-	1	1	-	6	-	3	-	3	10	7	4
Suaeda maritima (L) Dumort	-	-	-	-	-	-	-	-	-	-	-	1
Chenopodiaceae indet.	-	3	4	-	3	6	-	2	2	3	1	3
Malva sylvestris L.	-	-	1	-	-	-	-	-	-	-	-	-
Linum usitatissimum L.	-	-	-	1	-	1(fr)	-	5(fr)	-	-	1	1
c.f. Geranium sp.	-	-	-	-	-	-	-	-	25	-	-	-
Ilex aquifolium L.	-	-	-	-	-	-	-	-	5	-	-	-
Ilex aquifolium L. (leaves)	-	-	-	-	-	-	-	-	+(fr)	-	-	-
Vicia sp. (c)	-	-	-	-	1	-	-	-	-	-	-	-
Filipendula ulmaria (L) Maxim.	-	-	-	1	-	1	2	-	-	-	2	-
Rubus fruticosus agg.	-	8	1	-	2	2	-	-	210	62	17	25
Rubus c.f. idaeus L.	-	-	-	-	-	-	-	-	-	-	-	1
Rubus sp.	-	1(c)	-	-	-	1	-	1	-	-	-	-
Potentilla sp.	-	-	-	-	-	-	1	-	-	-	-	12
Fragaria vesca L.	-	-	-	-	c.f.2	1	-	2	31	85	6	-
Aphanes arvensis L.	-	-	-	1	-	-	-	-	-	-	-	-
Aphanes c.f. microcarpa	-	-	2	-	-	-	-	-	-	-	1	12
Prunus spinosa L.	-	-	-	-	-	-	-	-	1	1	-	-
Prunus domestica L. subsp. domestica	-	-	-	-	-	-	-	-	2	1	-	-
Prunus domestica L. subsp. institia	-	-	-	-	-	-	-	-	6	-	-	2
Crataegus monogyna Jacq.	-	-	-	-	-	-	-	-	-	1	-	-
Malus sylvestris Miller	-	-	-	-	-	-	-	-	-	-	1	-

Context No.	46	55	74	82	84	88	92*	98	100	102*	113*	114
Sample No.	3	14	23	29	17	30	38	32	54	52	55	58
Epilobium sp. (hirsutum-type)	-	-	-	-	-	-	1	-	-	2	3+c.f.1	-
c.f. Myriophyllum sp.	-	-	-	-	-	-	-	-	-	-	-	1
Hydrocotyle vulgaris L.	-	-	-	-	-	-	-	-	-	-	1	-
Anthriscus sylvestris (L) Hoffm.	-	-	-	-	-	-	-	-	-	-	c.f.2	-
Conium maculatum L.	9	1	-	-	-	-	-	-	-	-	-	-
Apium graveolens L.	-	-	-	-	-	-	-	-	31	84	32	2
Oenanthe sp.	-	-	-	-	-	-	1	-	-	-	-	-
Aethusa cynapium L.	-	-	-	-	-	-	-	1	-	-	-	-
c.f. Pastinaca sativa L.	-	-	-		-	-	-	-	c.f.2	-	-	-
c.f. Anethum graveolens L.	-	-	-	2	-	-	-	-	1	-	-	1
Umbelliferae indet.	-	-	-	-	-	-	-	2	1	2	4	13
Euphorbia helioscopia L.	-	1	-	-	3	-	-	-	-	-	-	-
Polygonum aviculare agg.	-	-	-	-	-	2	10	2	-	2	-	11
Polygonum lapathifolium L. (+ perianth)	-	-	-	-	-	-	-	-	-	1	-	1
Polygonum lapathifolium/persicaria	-	-	-	-	-	1	3	2	22	11	1	-
Polygonum hydropiper L. (+ perianth)	-	-	-	-	-	-	-	-	130	-	1	-
Polygonum convolvulus L.	-	-	13	-	-	1(fr)	-	2	1	3	-	3
Polygonum sp.	-	-	-	-	1	-	-	3	-	3	9	1
Rumex acetosella agg.	-	-	9	-	-	1	8	5	2	5	9	9
Rumex sp.	-	1	6	2	-	5	-	12	2	6	8	16
Polygonaceae indet.	-	-	6	-	2	1	-	1	-	6	2	4
Urtica urens L.	-	4	2	-	19	5	1	3	20	534	11	2
Urtica dioica L.	84	7	180	17	14	116	11	107	5	65	59	45
Humulus lupulus L.	-	1	-	1	2	-	-	3	-	8	12	1
Juglans regia L. (frags)	-	-	+	-	-	-	-	-	-	-	-	-

TABLE 13: (continued)

Context No.	46	55	74	82	84	88	92*	98	100	102*	113*	114
Sample No.	3	14	23	29	17	30	38	32	54	52	55	58
Betula sp.	-	-	-	-	-	-	-	-	1	-	-	-
Corylus avellana L. (frags)	+(c)	+(c)	+	+	+(c)	+	-	+	+	+	-	+
Calluna vulgaris (L) Hull (shoot tip)	-	-	-	-	-	-	+	-	-	-	-	-
Armeria/Limonium sp. (calyx)	-	-	-	-	-	-	-	-	-	-	-	1
c.f. Anagallis arvensis L.	-	-	-	-	-	-	-	-	-	3	-	-
Menyanthes trifoliata L.	-	-	-	-	c.f.2	-	-	-	1	-	-	-
Hyoscyamus niger L.	-	1	-	-	1	1	-	6	-	-	-	13
Solanum nigrum L.	-	2	-	-	5	-	-	-	-	-	-	-
Mentha sp.	-	-	-	-	-	1	-	1	-	-	-	-
Prunella vulgaris L.	-	-	-	-	-	-	1	-	3	4	2	-
Galeopsis tetrahit/speciosa	-	-	-	-	-	1	1	1	2	2	1	2
Teucrium c.f. scordium L.	-	-	-	-	-	-	1	-	-	-	-	-
Labiatae indet	1	1	-	-	-	-	1	5	-	8	6	-
c.f. Plantago major L.	-	-	-	-	-	-	2	-	-	-	-	-
Galium sp.	-	-	-	-	-	-	-	-	1	-	-	-
Sambucus nigra. L.	48	7	-	1	4	7	1	12	1	2	-	56
Valerianella c.f. dentata (L) Poll.	-	-	-	-	-	-	-	-	-	1	-	-
Bidens cernua L.	-	-	-	-	-	-	-	-	10	-	-	-
Bidens tripartita L.	-	-	-	-	-	-	-	-	-	-	1	-
Senecio sp.	-	-	-	-	-	-	1	-	-	-	1	-
Anthemis cotula L.	-	-	-	-	-	2	39	-	25	38	12	54
Achillea millefolium L.	-	-	-	-	-	-	-	-	-	-	2	-
Arctium sp.	-	-	-	-	-	-	1	-	-	-	-	-
Cirsium sp.	-	-	-	-	-	-	-	-	1	-	2	-
c.f. Onopordum acanthium L.	-	-	-	-	-	-	-	-	-	-	-	1
Centaurea cyanus L.	-	-	-	-	-	-	5	-	-	-	-	-

TABLE 13: (continued)

Context No.	46	55	74	82	84	88	92*	98	100	102*	113*	114
Sample No.	3	14	23	29	17	30	38	32	54	52	55	58
Lapsana communis L.	-	c.f.1	-	-	-	-	-	-	1	2	5	-
Sonchus arvensis L.	-	-	-	-	-	-	2	-	-	-	c.f.1	-
Sonchus oleraceus L.	-	-	-	-	-	-	-	-	1	-	2	-
Sonchus asper (L) HIll	-	-	-	-	-	-	-	-	-	-	2	-
c.f. Hieracium sp.	-	-	-	-	-	-	-	-	6	-	-	-
Compositae indet.	-	-	-	-	-	-	-	3	-	4	3	2
Alismataceae indet.	-	-	-	-	-	-	-	-	1	-	2	2
Triglochin maritima L.	-	-	-	-	-	-	1	-	1	-	2	1
Potamogeton c.f. perfoliatus L.	-	-	-	-	-	1	-	-	-	-	4	34
Potamogeton sp.	-	-	-	-	-	-	-	-	1	-	-	1
Zannichellia palustris L.	-	-	-	-	-	1	-	3	5	3	34	34
Juncus spp.	+	+	+	-	-	+	+	+	+	+	+	+
Iris pseudacorus L.	-	-	-	-	-	-	1	-	-	-	-	-
Typha sp.	-	-	-	-	-	-	-	-	-	3	3	-
Eleocharis sp.	-	1	-	-	38	-	29	3	13	6	3	12
Carex spp.	-	5	4	1	10	12	23	18	30	11	3	14
Scirpus sp.	-	-	-	-	3	-	-	-	-	-	1	-
Cyperaceae indet.	-	1	-	-	-	-	1	-	-	-	1	-
Cereal indet. (c)	1	2	-	-	-	-	-	-	-	-	-	-
Triticum aestivum s.l. (c)	-	-	-	-	-	-	-	1	-	-	-	-
Hordeum sp. (c)	14	-	-	-	1	-	-	-	1	-	-	-
Avena sp. (c)	2	-	-	-	1	-	-	-	-	-	-	-
Secale cereale (c)	-	1	-	-	-	-	-	-	-	-	-	-
c.f. Secale cereale (rachis frags)	-	-	-	-	-	-	-	-	-	-	1	-
Avena sp.	-	-	-	-	-	-	4+c.f.3	-	-	-	-	-
Gramineae indet.	1(c)	-	-	-	2(c)	3	78	-	31	16	25	-

TABLE 13 (continued)

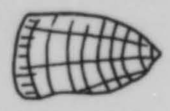
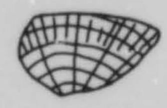
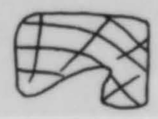
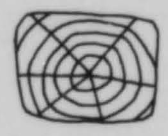
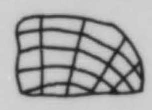
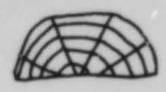
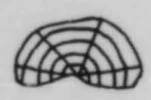
Context No.	46	55	74	82	84	88	92*	98	100	102*	113*	114
Sample No.	3	14	23	29	17	30	38	32	54	52	55	58
Gramineae indet. (culm frags)	-	-	-	-	-	+	++	-	+	-	-	+
<u>Vitis</u> <u>vinifera</u> L.	-	1(c)	1	-	-	-	-	-	-	-	-	-
Indet.	4	2(c) +2	9	4	15	8	9	8	29	15	15	15
Sample weight (Kg.)	2	1	1	1	1	1	1	2	3	1	1	3

TABLE 14: FRUITS AND SEEDS RECOVERED BY MACHINE FLOTATION

fr - fragments
germn - germinated

	Context No.	60	55	67	68	52	52	75	75	84	86	86	74	82	92	93	113
	Machine flotation sample no.	1	2	4	5+6	7	8	9	10	11	12	13	14	15	15	15	16
Cereals	<u>Triticum</u> <u>aestivum</u> s.l.	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
	<u>Hordeum</u> sp.	1	1(median)	3(median)	-	-	2(median)	-	-	1(lateral)	-	1	1(germn.)	-	1(germn.)	-	-
	<u>Avena</u> <u>sativa</u>	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
	<u>Avena</u> sp.	-	1	-	-	-	-	-	-	2	1	-	-	-	1	1	-
Bean	<u>Vicia</u> <u>faba</u> var <u>minor</u>	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Succulent fruits	<u>Prunus</u> <u>avium</u>-type	-	-	-	-	1	-	-	1	1	-	3	-	-	6	1	-
	<u>Prunus</u> <u>spinosa</u>	1	1	1	-	) -	7+fr	3+fr	)	)	)	)	-	-	)	)	)
	<u>Prunus</u> <u>domestica</u> s.l.	-	1	-	-	) 15	-	1	) 14+fr	) 577+fr	) 249 +fr	) 305 +fr	-	-	) 946 +fr	) 23	) 70
	<u>Prunus</u> sp.	-	-	2	5+fr	)	-	-	)	)	)	)	-	-	)	)	)
	<u>Crataegus</u> <u>monogyna</u>	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
	<u>Rubus</u> <u>fruticosus</u>	5	9	12	8	-	-	2	13	67	54	88	-	-	205	22	48
	<u>Rubus</u> c.f. <u>idaeus</u>	-	-	-	-	-	-	-	3	12	-	7	-	-	-	6	5
	<u>Sambucus</u> <u>nigra</u>	3	-	1	-	-	-	-	8	-	3	-	-	-	2	-	1
Nuts	<u>Corylus</u> <u>avellana</u>	-	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+
	<u>Juglans</u> <u>regia</u>	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-
Hemp	<u>Cannabis</u> <u>sativa</u>	-	-	3	-	-	-	-	-	-	1	-	-	-	3	-	-
Hop	<u>Humulus</u> <u>lupulus</u>	1	-	-	-	-	-	-	1	-	-	6	-	-	-	-	1
Marigold	<u>Calendula</u> <u>officinalis</u>	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Parsnip	<u>Pastinaca</u> <u>sativa</u>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1

TABLE 15: DESCRIPTION OF TIMBERS - all oak (<u>Quercus</u> sp.)

No.	No. of rings	Sapwood	Average width (mm)	Sketch not to scale	Dimensions (cm)
*99A	79+	19+	1.48		13 x 3-7
*78B	49+	bark	0.76		12 x 9 radius 8-9
53	-	-	-		33 x 25
*49	244	-	0.92		33 x 30
34A	15	-	-		11 x 8
34B	12	-	-		13 x 6-5
34C	29	13	-		radius 8-13
34D	9	-	-		12 x 4-7
30 △3	37	12	-		23-26 x 7-8

* - samples of which the ring widths were measured. The complete complete ring sequence of 49 was measured. 99A had <u>c</u>.20 very narrow rings which could not be measured accurately and 76B had another <u>c</u>.88 (average width 0.2-0.3mm). Bark was present on both 99 and 78. 53 was very knotty, which obscured the ring sequence.

TABLE 16: IDENTIFIED TIMBERS

Context	Taxon	Timber/Young Wood	Diameter (Young wood only)
30	Indet. diffuse porous	Y	3.3cm
51	Quercus sp.	T	-
54	Quercus sp.	T	-
62	Quercus sp.	T	-
63	Quercus sp.	T	-
66WA	Indet. d.p.	Y	frag.
66WC	Indet. d.p.	Y	frag.
66WD	Salix/Populus sp.	Y	11cm
66 24	Prunus sp.	Y (branched)	2-3cm
69	Quercus sp.	T	-
78A	Quercus sp.	T	-
85A	Corylus sp.	Y	2.5cm
85B	Fraxinus sp.	Y	3cm
85C	Indet. d.p.	Y	2.5cm
85D	Salix/Populus sp.		frag.
85E	Salix sp.	Y	2.5cm
85F	Indet. d.p.	Y	3.5cm
85G	Indet. d.p.	Y	6cm
85H	Salix sp.	Y	5cm
90	Quercus sp.	T	-
94	Quercus sp.	T	-
97	Quercus sp.	T	-
99BCDE	Quercus sp.	T	-
101A	Salix/Populus sp.	Y (branched)	5x1.7cm (flattened)
101B	Corylus sp.	Y	2.5x1cm (flattened)
101D	Salix sp. (?)	Y	4x1.5cm (flattened)
103	Quercus sp.	T	-
105a	Ilex sp.	Y	3cm
105b	Corylus sp.	Y	3cm
107	Quercus sp.	Y	3.5cm
113	Quercus sp.	T	-

TABLE 17: SOIL ANALYTICAL DATA

Layer	pH	Alk. Sol. Humus	% Organic Carbon	% Loss on Ignition
27	6.8	88.0	-	8.5
30	6.8	105.0	2.85	6.9
46	6.8	202.0	-	7.6
51	6.8	152.0	-	6.9

N.B. Alk. Sol. Humus mgms. per 100 gms. air dry soil

SOIL MICROMORPHOLOGY (level 30)

The fabric is mainly agglomeroplasmic, porphyroshelic in part, unorientated, with rather diffuse boundaries, and contains well developed fine channels and metavughs, without cutans. Skeletal material is very diverse, and comprises mainly sub-rounded silts and fine and medium quartz sand, with feldspar and oolites also common. Coarse sand to fine gravel-sized aragonite (shell) fragments are present. Non-mineral skeletal material includes charcoal fragments and more commonly recognisable plant remains (See Percentage Fabric Analysis below). Plant material is generally black under Plane Polarised Light (PPL), but may be dark reddish brown. It is non-birefringent, and black under Reflected Light (R.L.). In many cases cell material is visible. One coarse dendriform rod phytolith is present.

Amorphous organic matter is also present, and may be included within peds or act as a loose void-fill. This material is pale brown (PPL) with a finely granular texture under high power. In one slide amorphous organic matter is associated with crystal filaments, which are thin, pleochroic (pale blue to colourless - PPL), with strong birefringence and parallel extinction. This is likely to be the phosphate mineral, vivianite, as noted by the excavators in the underlying level 46.

The fine fabric of the peds is generally dark brown to black (PPL), non-birefringent (i.e. opaque under Crossed Polarised light), and dark grey to black (R.L.). This suggests fines, clay and fine silt are complexed with high amounts of organic material, as described above. Also the high proportions of charcoal present in washed samples is also indicative of this material also being important in the peds. These large quantities of organic matter, including fine charcoal, are likely to give these deposits their dark colour - a suggestion already proposed for the "Dark Earth" of dry urban sites (Macphail 1980).

The deposit contains very few glaebules; ferri-manganic bodies, and as soil ignition indicated very low iron content, this may well relate to a waterlogged history. A high organic content would also sustain anaerobic conditions, again preserving the organic matter itself. In this sense evidence of soil fauna is not surprisingly missing.

<u>Percentage Fabric Analysis</u> (Semi-Quantitative)

Pore Space	31%
Mineral Grain	35%
Amorphous Organic Matter /Soil Complex	32%
Charcoal	0.5%
Amorphous Organic Matter	2%
Plant Material	13%

Whitefriars, Norwich, 1979

Tree-ring data

49 - 244 annual rings

year	width (0.1mm)									
	0	1	2	3	4	5	6	7	8	9
0		17	18	16	15	15	13	14	15	19
10	18	17	10	8	7	9	6	8	10	16
20	13	16	21	21	16	14	17	17	10	14
30	12	17	12	20	13	12	9	16	14	16
40	13	20	9	6	5	10	13	10	8	7
50	8	7	7	10	9	8	6	10	5	7
60	4	4	5	6	7	5	7	6	6	5
70	8	6	7	8	10	10	11	11	12	14
80	11	16	12	12	11	9	13	17	21	15
90	12	15	14	14	11	8	10	9	9	10
100	14	8	7	11	12	6	7	12	8	7
110	5	10	7	6	7	10	8	7	6	5
120	7	7	7	5	8	8	6	8	7	6
130	5	7	8	8	10	9	7	9	6	7
140	6	7	7	9	8	7	7	6	7	8
150	8	9	8	7	5	6	6	10	6	7
160	10	11	8	5	6	7	5	6	7	9
170	7	7	5	7	6	6	4	6	6	8
180	5	5	4	6	6	8	5	8	6	8
190	7	6	7	7	6	9	10	13	6	11
200	11	7	10	13	10	9	8	10	10	13
210	10	8	10	11	10	7	6	9	8	11
220	11	10	13	9	8	4	4	5	9	13
230	7	8	11	13	7	6	9	6	5	9
240	6	7	8	11	7					

(no sapwood rings)

continued ....

Tree-ring data (continued)

78 B - 49 measured annual rings

year	width (0.1mm)									
	0	1	2	3	4	5	6	7	8	9
0		9	7	7	10	12	10	18	11	10
10	11	9	10	6	6	8	8	11	10	6
20	6	4	13	14	12	11	9	8	6	6
30	5	8	4	4	3	4	5	6	6	6
40	6	4	7	6	5	3	6	4	5	9

plus c.88 rings, too narrow to measure accurately; bark present.

99 A - 79 measured annual rings

year	width (0.1mm)									
	0	1	2	3	4	5	6	7	8	9
0		13	17	18	20	19	17	16	19	16
10	15	11	10	10	9	11	12	13	15	13
20	20	16	15	22	14	13	15	22	19	16
30	17	26	23	20	16	14	14	17	18	14
40	17	22	20	18	20	22	12	14	18	30
50	36	21	18	11	10	14	11	10	8	10
60	8	14*	6	8	9	7	9	15	18	14
70	12	10	5	5	8	13	16	13	9	5

* - first sapwood ring; there were a further c.20 very narrow rings to the bark - these could not be measured accurately.