Chapter 4: Whitecross Farm: Environmental Evidence

ANIMAL BONE

by Adrienne Powell and Kate M Clark

Introduction

This report considers the animal bone recovered from the late Bronze Age contexts at Whitecross Farm. The small amount of bone from the earlier ditch and the later alluvium and ploughsoil has been excluded from the present analysis, although the assessment records and report on this small group may be found in the archive. Two pieces of worked bone were identified among the animal bone assemblage (see Powell and Clark, Chapter 3).

The assemblage was entirely hand-retrieved and totalled 1806 fragments, of which only 520 (29%) were identified to species (Table 4.1). Given the diverse natures of the source deposits, ranging from waterlogged palaeochannel fills to surface occupation spreads, differential survival is likely to have caused some spatial variation in the observed proportions of species and the degree of surface alterations to bones. Therefore these levels of the assemblage have been looked at separately. Most of the bone came from the wet midden and the occupation spread in the eyot; 'Other' includes bone from the postholes and the palisade trench. The incidence of gnawed, butchered and burnt bone was low overall (Table 4.2). However, when the levels are considered separately there is a marked tendency for the frequency of observed gnaw and butchery marks to decrease with increasing proximity to the surface and dryness of the deposit. This seems to have affected knife-cut marks to a greater degree than the heavier chop marks as their finer nature makes them more vulnerable to destruction. In addition to canid gnawing, the gnawed bone includes eight examples of rodent gnawing. The frequency of burning contrasts with the pattern for gnawed and butchered bone in that it increases between the wet midden and occupation levels, although the incidence is always low. The bone from the wet midden was often very darkly stained, which may have reduced the observed incidence of burning in this material.

Main species

Cattle, sheep/goat and pig comprised 93% of the total identified fraction of the assemblage.

Table 4.1 Number of identified specimens (NISP) from late Bronze Age features

Taxon	*Area*										*Total*	
	Palaeochannel		*Wet midden*		*Dry midden*		*Occupation*		*Other*			
	N	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*
Horse	-	-	-	-	1	3	1	0.4	-	-	2	0.4
Cattle	7	11	25	16	4	12	69	27	1	100	106	21
Sheep	7	11	11	7	1	3	14	5	-	-	33	6
Goat	2	3	3	2	1	3	1	0.4	-	-	7	1
Sheep/goat	22	34	51	32	10	30	81	31	-	-	164	32
Pig	20	31	60	38	13	39	78	30	-	-	171	33
Dog	1	2	1	1	-	-	1	0.4	-	-	3	1
Cervus elaphus	5	8	8	5	3	9	12	5	-	-	28	5
Capreolus capreolus	-	-	1	1	-	-	0	-	-	-	1	0.2
Vulpes vulpes	-	-	0	-	-	-	1	0.4	-	-	1	0.2
Felis silvestris	1	2	0	-	-	-	0	-	-	-	1	0.2
cf. *Anser anser*	-	-	0	-	-	-	1	-	-	-	1	-
Small duck	-	-	2	-	-	-	0	-	-	-	2	-
Bird nfi.	-	-	1	-	-	-	0	-	-	-	1	-
Sheep-sized mammal	36	-	105	-	34	-	204	-	-	-	379	-
Cattle-sized mammal	13	-	45	-	17	-	136	-	4	-	215	-
Unidentified	29	-	148	-	46	-	466	-	2	-	691	-
Total	143	-	461	-	130	-	1065	-	7	-	1806	-
% identified	45	-	35	-	25	-	24	-	-	-	29	-

nfi. = not further identifiable

Table 4.2 Incidence of gnawed, butchered and burnt bone in different areas (%)

Area	Gnawed	Chopped	Cut	Butchered	Worked	Burnt	Total (n)
Palaeochannel	18.2	2.1	6.3	8.4	-	1.4	143
Wet midden	11.1	2.0	9.3	11.3	0.7	2.8	461
Dry midden	9.2	1.5	3.8	5.4	-	0.8	130
Occupation	3.2	0.1	1.1	1.2	0.1	4.4	1065
Other	14.3	-	-	-	-	14.3	7
All	6.9	0.8	3.8	4.7	0.1	3.5	1806

Sheep/goat bones were the most numerous in all levels, although this decreased from the channel fills to the occupation spread. In less than a quarter of the material could the bones of sheep and goat be distinguished, using the criteria of Boessneck (1969) and Payne (1985). Most of these were sheep, with only a small number, mainly post-cranial bones, identified as goat. Bones from cattle are least frequent of the main species, but increased in frequency as sheep/goat decreased. This directional change in frequency is probably related to changing preservation, as discussed above, with the more robust cattle bones favoured in more adverse conditions. Pig is the second most frequently represented species in all levels, and although there is some variation in the frequency of pig bone, unlike the variation in cattle and sheep/goat it is not markedly directional (Figs 4.1–3).

Minimum number of elements (MNE) were calculated for these three species following the zone

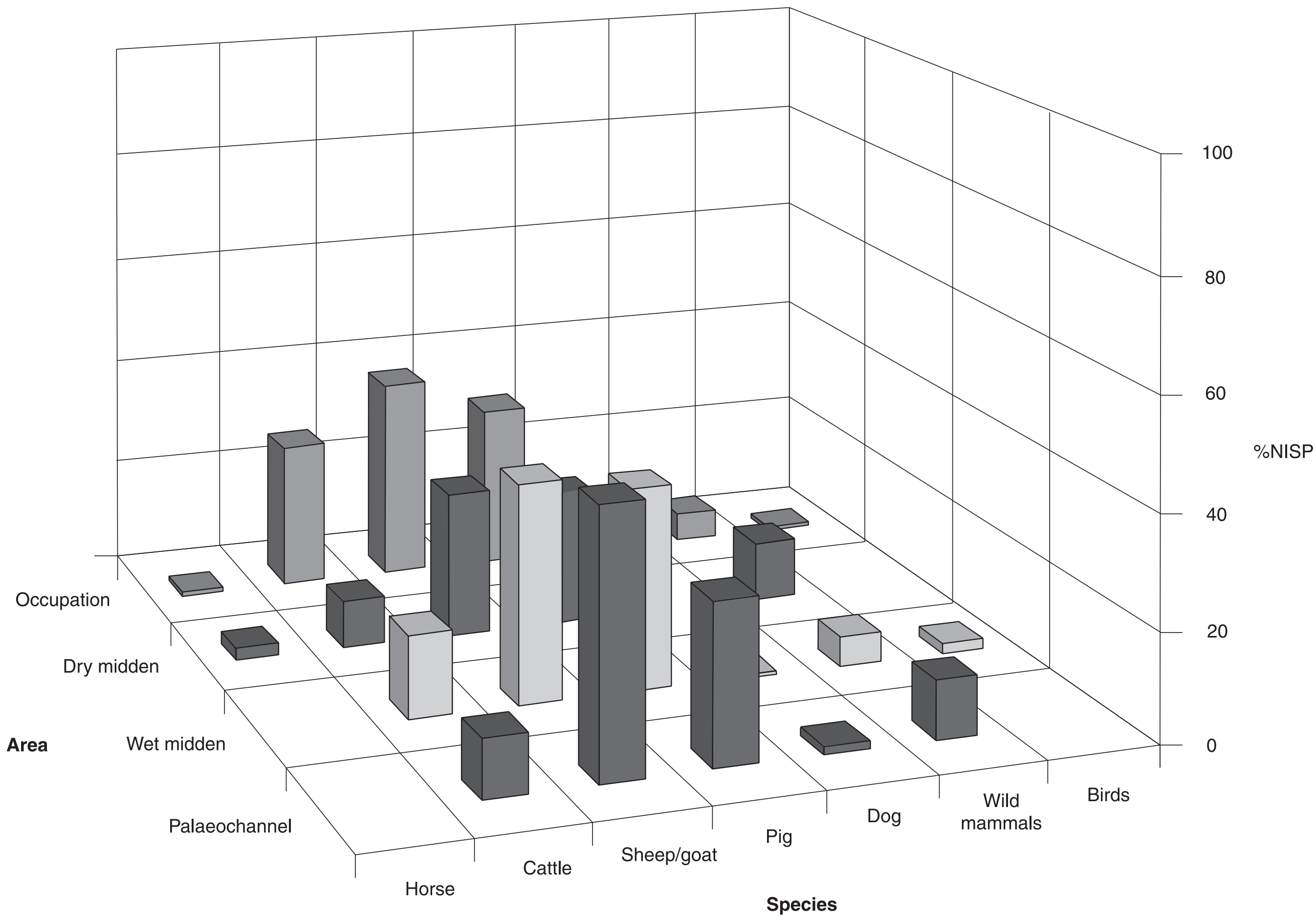


Figure 4.1 Distribution of species across all trenches at Whitecross Farm – %NISP

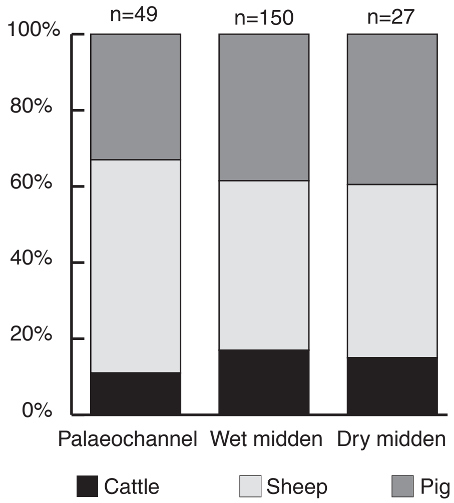


Figure 4.2 Relative proportions of cattle, sheep and pig – trench XXIV

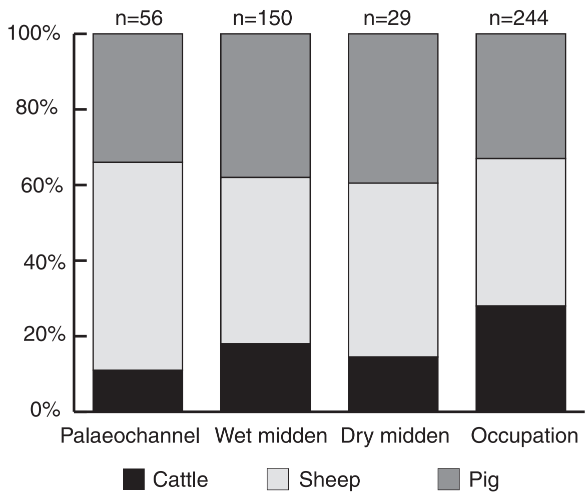


Figure 4.3 Relative proportions of cattle, sheep and pig – all trenches

method described by Serjeantson (1991), with loose maxillary teeth incorporated in the calculations for skulls where two or more teeth were demonstrably part of the same tooth row. The MNE figures for the assemblage as a whole, as well as the minimum number of individuals (MNI) derived from these, are given in Table 4.3. It may be seen that the rank order of the main species does not alter with the different methods of quantification, although the MNI figures increase the proportion of sheep/goat at the expense of cattle. The frequency of the mandible, since it is a robust element with a generally high rate of survival, has been used by Legge (1992) and Locker (2000) as another method of comparing relative proportions of species. From the figures in Table 4.3 this gives 24%, 44% and 32% respectively for cattle, sheep/goat and pig, confirming the presence of an unusually high amount of pig in this assemblage.

Table 4.3 Minimum number of elements (MNE)

Element	*Species* Cattle	Sheep	Pig	*Total*
Horn Core	-	1	-	1
Skull	2	2	3	7
Mandible	8	15	11	34
Atlas	-	1	1	2
Axis	1	1	1	3
Scapular	3	13	10	26
Humerus	5	6	13	24
Radius	3	24	5	32
Ulna	1	2	4	7
Pelvis	3	10	6	19
Sacrum	1	-	2	3
Femur	7	8	9	24
Tibia	5	18	8	31
Fibula	-	-	3	3
Patella	-	-	1	1
Astragalus	4	3	2	9
Calcaneus	2	-	5	7
Tarsals	2	-	1	3
Carpals	1	1	-	2
Metacarpal	1	17	3	21
Metatarsal	4	15	4	23
Lateral metapodial	-	-	6	6
Phalanx I	6	6	4	16
Phalanx II	2	-	2	4
Phalanx III	2	-	1	3
Total	63	143	105	311
% main domestics	20	46	34	
MNI	4	14	8	26
% MNI	15	54	31	

Differential preservation between levels is also likely to have affected body part frequencies. However, when each level was examined separately, sample sizes were small, particularly for cattle, so those results are not presented here. The presentation of cattle, sheep/goat and pig body parts suggests that whole carcasses were present on site originally.

Tooth eruption and wear have been recorded after Grant (1982), and Table 4.4 shows the results for cattle, sheep/goat and pig allocated to age groups after O'Connor (1988). Although the data are sparse, the presence of an elderly cattle M3 contrasts with the data for sheep/goat and pig, which are dominated by young and subadult examples. Figure 4.4 shows the sheep/goat jaws and teeth aged according to Payne (1973): 50% of the material came from animals slaughtered before the end of their first year, and 75% came from animals dead by the end of their second year. The epiphyseal fusion data (Table 4.5a–c) are consistent with the dental data, at least for sheep/goat and

Table 4.4 Tooth eruption and wear age groups

Age	Species Cattle	Sheep/goat	Pig	Total
Neonate	-	-	-	0
Juvenile	2	2	2	6
Immature	1	6	1	8
Subadult	-	4	4	8
Adult	2	4	1	7
Elderly	1	-	-	1
Total	6	16	8	30

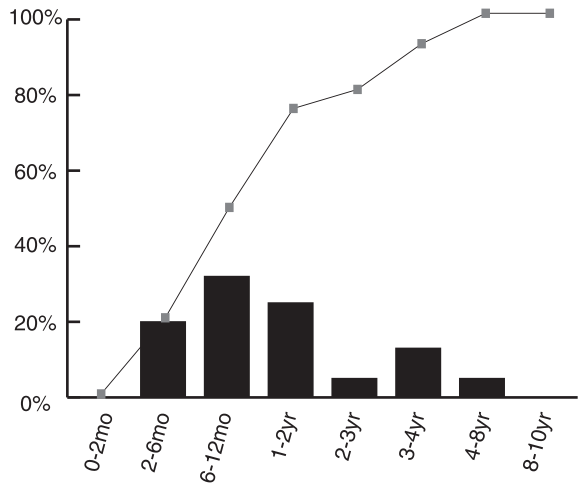


Figure 4.4 Sheep/goat mortality

pig, in suggesting that few animals survived beyond two years.

Sheep/goat were sexed on their pelves (Grigson 1982): 4 were female and 3 were male. Pigs were sexed on their canines (Schmid 1972) of which 7 examples occurred in this assemblage: 4 female and 3 male. The cattle bones yielded no sexable material.

Measurements were taken following Driesch (1976) and Payne and Bull (1988), and are listed in Appendix 3. Measurements on cattle bones are few: a right scapula with a GLP (greatest length of glenoid process) of 53.8 mm is within the range of cattle from Runnymede (Done 1980). Measurements on a distal humerus and three astragali are all within the range of the Potterne cattle (Locker 2000), although the humerus is relatively large. Sheep/goat withers heights were calculated on a sheep radius and a goat metacarpal using the factors of Teichert (Driesch and Boessneck 1974). The former gave a height of 0.591 m, within the range of both Runnymede and Potterne; the latter gave a height of 0.669 m, taller than any of the sheep from these sites. Other sheep/goat measurements from Whitecross Farm tend to be larger than the Runnymede animals, for example the proximal

Table 4.5a Cattle epiphyseal fusion

Age at fusion	Element	Fused	Unfused	Juvenile	Total
7–10 months	Scapula	2	-	-	2
"	Pelvis	1	-	-	1
12–15 months	Radius, p	1	1	-	2
15–18 months	Phalanx II	2	-	-	2
15–20 months	Humerus, d	2	-	-	2
20–24 months	Phalanx I	5	1	-	6
24–30 months	Tibia, d	3	-	-	3
"	Metapodial, d	-	2	1	3
36 months	Femur, p	-	2	2	4
42 months	Femur, d	-	1	2	3
42–48 months	Humerus, p	1	-	-	1
"	Radius, d	-	1	-	1
	Total	17	8	5	30

Table 4.5b Sheep/goat epiphyseal fusion

Age at fusion	Element	Fused	Unfused	Juvenile	Total
3–4 months	Humerus, d	2	-	1	3
"	Radius, p	8	5	-	13
5 months	Scapula	5	3	-	8
	Pelvis	11	-	-	11
7–10 months	Phalanx I	5	-	-	5
15–20 months	Tibia, d	2	7	1	10
20–24 months	Metapodial, d	5	8	1	14
36 months	Femur, p	-	3	-	3
42 months	Humerus, p	1	1	-	2
"	Radius, d	2	8	1	11
"	Femur, d	1	3	1	5
"	Tibia, p	-	3	2	5
	Total	42	41	7	90

Table 4.5c Pig epiphyseal fusion

Age at fusion	Element	Fused	Unfused	Juvenile	Neonatal	Total
12 months	Scapula	3	2	-	-	5
"	Humerus, d	6	3	-	-	9
"	Radius, p	3	1	-	-	4
"	Pelvis	4	-	-	-	4
"	Phalanx II	2	-	-	-	2
24 months	Phalanx I	1	4	-	-	5
"	Tibia, d	-	3	-	1	4
"	Metapodial, d	3	6	-	-	9
24–30 months	Calcaneus	-	4	-	-	4
36–42 months	Femur, p	-	4	2	-	6
"	Ulna, p	-	2	-	-	2
42 months	Humerus, p	-	3	-	-	3
"	Radius, d	-	1	-	-	1
"	Femur, d	-	3	2	-	5
"	Tibia, p	1	2	1	1	5
	Total	23	38	5	2	68

breadth (Bp) of the radius has a range of 24.3–28.8 mm, compared with 20–26 mm and a mean of 23 mm at Runnymede (Done 1980). However, when these figures are compared with the data in the animal Bone Metrical Archive (Centre for Human Ecology 1995) they both fall within the measurement range of 23.8–30.0 mm for the Bronze Age. Most of the measurements on pig bones are comparable with those of domestic animals from Runnymede and Potterne, but three bones are large enough to suggest the presence of wild boar (*Sus scrofa*). One is a large, but broken and unmeasurable, lower male canine; another is a similarly unmeasurable scapula; the third is a fused proximal tibia that has a proximal breadth of 60.8 mm. The same measurement in a modern female wild boar in the reference collection at the Department of Archaeology, University of Southampton, is 51.9 mm, or 85% of the bone from Whitecross Farm. Archaeological comparisons are rare since fused proximal tibiae rarely occur: the largest out of eight Bp measurements from the Neolithic domestic pigs at Durrington Walls is 52 mm (Harcourt 1971), while the ranges for domestic and wild pigs at the Iron Age German site of the Heuneberg are 41.5–49.5 mm and 52.5–70.5 mm, respectively (Willburger 1983). Thus, although male domestic pigs and female wild boar can overlap in size (Payne and Bull 1988), the tibia from Whitecross Farm is well outside the zone of overlap.

Dog

A femur recovered from the wet midden (2414) provided sufficient measurements to suggest that the animal was of similar height and build to a large modern labrador (length 177.3 mm, depth caput 19.19 mm, shaft diameter 14.5 mm, distal breadth 35.4 mm), with the estimated height at the shoulder being 0.544 m. From the organic deposit (2405) in the palaeochannel came a pelvic fragment, and again the breadth of the acetabulum suggests a dog of similar build although clearly the height of the animal cannot be predicted.

Other species

Of the other domestic species, horse is represented by only two bones: a left incisor (1803) and a right upper molar (2409).

In addition to the evidence for wild boar discussed above, at least six other species of wild animals are present, with red deer (*Cervus elaphus*) the most commonly occurring (contexts 1803, 2405, 2409, 2414, 2428, 2505 and 2605). Most of the red deer bones are from the post-cranial skeleton and include most of the longbones with the exception of the femur and metacarpal, as well as a pelvis (female) (2414) and three phalanges (2414 and 2505). A fragmentary, partial skull, consisting of left frontal, parietal, left and right petrous, occipital region and jugular process, came from the occupation spread. An atlas from the same context may articulate. Other cranial material consists of a fragment of mandible, one lower and two upper loose molars, a left zygomatic, a right temporal and six antlers. Most of these last are beam or tine fragments; however, two are shed antlers (2405) retaining the burr and one had the bes and tres tines, indicating an animal with a probable crown of ten points (Schmid 1972). Roe deer (*Capreolus capreolus*) is represented only by the shaft of a femur (2414). Wild carnivores present are fox (*Vulpes vulpes*) (2505), a single lower premolar, and wild cat (*Felis silvestris*) (2405), an unfused scapular indicating an animal less than 251 days old (after Curgy, in Amorosi 1989).

Four avian longbones were present (1807, 2414), of which three are identifiable: the distal shaft of a goose humerus, probably greylag goose (*Anser anser*), and a left humerus and ulna (GL=71.4 mm) of a duck or ducks smaller than a mallard (*Anas platyrhynchos*), about the size of a wigeon (*Anas penelope*).

Pathology

There were only two instances of pathological bone in the assemblage. A partially erupted pig M3 shows pitting in the enamel of the anterior cusps, which is unlikely to be the result of erosion since neither the other teeth in the row, nor the bone of the mandible itself, are affected. It is probably a hypoplastic condition, with unknown cause. The only other instance of pathology is a red deer first phalanx with two cavities on the medial side of the proximal metaphysis, which appear to be bone cysts.

Carcass utilisation

As mentioned above, butchery marks were observed on a few of the bones, amounting to 4.7% of the assemblage, including unidentified material (see Table 4.2), and were mainly in the form of knife cuts. Some evidence of skinning is present: in a pig mandible cut on the ventral surface of the symphysis, and a cattle metacarpal and sheep metatarsal with transverse cuts on the shafts. The remainder indicate both carcass dismemberment (including removal of the tongue in sheep and pig) and filleting. A right sheep/goat parietal with a longitudinal chop in the sagittal plane suggests splitting of the skull to extract the brain.

Axial splitting of vertebrae, suggesting division of carcasses into sides, was present at both Potterne (Locker 2000) and Runnymede (Done 1980), and was the most frequent sign of butchery at the latter. Evidence for this is less common at Whitecross Farm: out of 11 vertebrae with butchery evidence, a cattle axis and a lumbar vertebra from a sheep-sized mammal have been chopped axially, and a cattle-sized lumbar fragment has been chopped through lengthwise just off the sagittal plane. This bone and one other cattle-sized vertebra also show longitudinal chop marks on the internal surface of the neural arch, probably resulting from chops through the vertebral body. Vertical chop marks on the internal surface of a cattle-sized cervical vertebra fragment suggest that the spine was also chopped between the vertebrae into segments, either after or instead of splitting. Although axial splitting of vertebrae was practised at Whitecross Farm, it was not the sole technique used and the evidence is too sparse to indicate how prevalent it was on the whole. Whether it does represent division of carcasses into halves or only smaller-scale chopping of the spine into small joints or pot-sized portions is unclear.

Discussion

Earlier work at this site produced a small assemblage very similar to the one analysed here, although with a more restricted range of species (Wilson 1986). The Whitecross Farm assemblages show features in common with that from the similarly situated site of Runnymede (Done 1980; Serjeantson 1996). Both sites have unusually large proportions of pig, although at Runnymede the relative proportions of cattle, sheep/goat and pig vary according to which quantification method is used. Legge (1992) has shown that if the counts are based on identified mandibles, then different seasons of excavation at Runnymede give similar proportions: 27–28%, 45% and 27–29% respectively for cattle, sheep/goat and pig. These proportions are very similar to those at Whitecross Farm, although here pig is slightly better represented at the expense of cattle. The assemblage from Potterne also has similar proportions of the three main domestic species, if the large and small ungulate categories, which Locker (2000) includes with cattle and sheep, are excluded.

The high proportion of animals less than two years old in the pig and sheep/goat material is also seen at both Runnymede (Done 1980; Serjeantson 1996) and Whitecross Farm. This is a typical age profile for pigs since they do not yield any secondary products and it is most profitable in terms of meat yield for energy input to slaughter them before they are fully mature. The age profile for sheep/goat suggests that wool production did not play an important role in the economy of the inhabitants; however, the large numbers of sheep/goat bones suggest otherwise. It is possible that older, wool-producing animals, once they had outlived their usefulness, were generally not killed and eaten on the site. At Potterne, in contrast, both species have a greater number of older animals (Locker 2000).

The apparent similarity of the economy at Runnymede and Whitecross Farm may relate to their local environments. Pollen and plant macrofossil evidence from both sites suggests that in the late Bronze Age there were large cleared areas, with some secondary woodland (see Robinson below; Serjeantson 1996), and, as Serjeantson has argued, plants of the river edge such as waterlilies would also have been an important contribution to the diet of pigs. Done (1980) and Grigson (1986) have also suggested that high numbers of pig can indicate permanent settlement with a low element of pastoralism in the economy since pigs are difficult to herd. In addition, the presence of some woodland and scrub will have provided suitable habitats for the red deer, roe deer, wild boar and wild cat, and explain the presence of so many wild species in this small assemblage.

MACROSCOPIC PLANT AND INVERTEBRATE REMAINS

by Mark Robinson

Introduction

Extensive sampling was undertaken and the samples were analysed by the Environmental Archaeology Unit at the University Museum, Oxford. In addition subsamples of the waterlogged samples were analysed for pollen by F M Chambers (see below) and wood recovered by hand excavation was identified by R Gale and analysed by M Taylor (see below). Almost all the sediments on the site were sufficiently calcareous for the survival of mollusc shells. The bottom of the palaeochannel extended below the permanent water table resulting in the preservation of macroscopic plant and insect remains. In addition, high concentrations of charcoal were observed in some of the palaeochannel sediments.

Sampling strategy and the samples

A column of samples had already been analysed for molluscs through the island and the overlying sediments, including the late Bronze Age occupation deposit where it had been exposed by erosion in the bank of the Thames (Thomas *et al.* 1986). It was decided that the main effort would be concentrated on the sediments in the palaeochannel.

A column of waterlogged samples (column 1, samples 3 to 1) was analysed from the edge of the palaeochannel where it contained midden and possible destruction debris, in order to gain information on conditions and activities on the island (see Fig. 2.3). A waterlogged spot sample (sample 21) was also analysed from the edge of the palaeochannel further downstream. In order to provide a more regional environmental picture, a second column of waterlogged samples (column 4, samples 32 to 27) was analysed from the centre of the palaeochannel (see Fig. 2.3). This column was extended upwards through the inorganic sediments of the palaeochannel (column 4, samples 26 to 1) in order trace its later environmental sequence. Samples of inorganic sediments were also taken for molluscs from the pre-Bronze Age

Table 4.6 Sample details

Column	*Sample*	*Context*	*Sample category*	*Description*
1	1	2405	w	Black organic loam with some charred woody debris. Top sample in column
1	2	2405	w	Black highly organic silt with much shell and woody debris
1	3	2405	w	Black gravelly organic loam with some wood debris. Bottom sample in column
4	1	2402	m	Grey/buff clay. Top sample in column
4	2	2402	m	Grey/buff clay
4	3	2402	m	Grey/buff clay
4	4	2402	m	Grey/buff clay
4	5	2402	m	Grey clay
4	6	2402	m	Pale grey mottled silty clay with a little fine sand
4	7	2402	m	Pale grey mottled silty clay with a little fine sand
4	8	2402	m	Pale grey mottled silty clay with a little fine sand
4	9	2402	m	Pale grey mottled silty clay with a little fine sand
4	10	2402	m	Pale grey mottled silty clay with a little fine sand
4	11	2402	m	Pale grey mottled silty clay with a little fine sand
4	12	2402	m	Pale grey silty clay with a little fine sand
4	13	2402	m	Pale grey silty clay with a little fine sand
4	14	2402	m	Pale grey silty clay with a little fine sand
4	15	2402	m	Pale grey silty clay with a little fine sand
4	16	2402	m	Pale grey silty clay with a little fine sand
4	17	2404	m	Pale grey silty clay with a little fine sand
4	18	2404	m	Pale grey silty clay with a little fine sand
4	19	2404	m	Pale grey silty clay with a little fine sand
4	20	2404	m	Pale grey silty clay with a little fine sand
4	21	2404	m	Pale grey silty clay with a little fine sand
4	22	2404	m	Pale grey silty clay with a little fine sand
4	23	2404	m	Pale grey silty clay with a little fine sand
4	24	2404	m	Grey silty clay with a little fine sand
4	25	2404	m	Grey silty clay with a little fine sand
4	26	2404	m	Grey silty clay with a little fine sand
4	27	2404	w	Dark grey organic calcareous silt
4	28	2404	w	Dark grey organic calcareous silt
4	29	2405	w	Dark grey organic calcareous silt with many small shell fragments
4	30	2405	w	Black organic shelly sand
4	31	2405	w	Brown organic shelly silt with much woody debris
4	32	2405	w	Black organic sandy gravel. Bottom sample in column
-	5	2405	c	
-	6	gravel bar	m	Mottled pale grey/buff very sandy loam
-	7	gravel bar	m	Mottled pale grey/buff sandy gravel
-	8	2413/3	m	Grey sandy clay with some gravel and much iron panning
-	9	2413/4	m	Mottled grey fine sandy clay loam
-	10	2403/2	m	Grey/buff clay loam
-	11	2405/4	m	Dark grey clay loam
-	21	-	w	Black shelly organic
-	51	2405	c	
-	52	2505	c	
-	60	60	w	Brown peat with many fine roots
-	92	2505/2	c	
-	93	2505/3	c	
-	94	2505/4	c	
-	95	2505/3	c	

c = sample analysed for charred plant remains
m = sample analysed for molluscs
w = sample analysed for waterlogged macroscopic plant and insect remains in addition to charred plant remains and molluscs

sediments of the island (samples 6 and 7), a ditch on the island (samples 8 and 9) and the late Bronze Age occupation deposit (samples 10 and 11: see Fig. 2.3). Samples were floated for charred plant remains to obtain crop and charcoal evidence from the possible burnt destruction debris in the palaeochannel (samples 5 and 51) and also the occupation deposit on the island (samples 52, 92 to 95). Finally, a small sample of peat was analysed from a later deposit of fen peat (sample 60) which post-dated the other organic sediments in the palaeochannel, to obtain further information on the site after its abandonment. Sample details are given in Table 4.6.

Methods and results

Waterlogged samples (w in Table 4.6) were analysed for the full range of macroscopic plant and invertebrate remains: waterlogged seeds, wood, other waterlogged plant remains, charcoal, other charred plant remains, Coleoptera, other insect remains and Mollusca. Samples for charred plant remains (c) and molluscs (m) were just analysed for those categories.

The part of each sample which was to be analysed for macroscopic plant remains was weighed out and washed over on to a 0.2 mm aperture sieve in order to extract the organic fraction. This was graded through a stack of sieves and sorted in water with the aid of a binocular microscope at x12 magnification. Seeds and other potentially identifiable plant remains (both waterlogged and charred), along with insect fragments, were picked out. A subsample of the organic flot and a similar fraction of the inorganic residue were sorted down to 0.5 mm for the molluscs. An additional subsample from some of the samples was processed for insect remains alone. It was weighed out, washed over on to a 0.2 mm sieve, drained and subjected to paraffin flotation. The flot was washed in detergent then sorted as before. Both waterlogged plant and insect remains were stored in alcohol prior to identification whereas charred plant remains and mollusc shells were dried.

The molluscan samples were weighed, sieved down to 0.5 mm, dried and then sorted at x12 magnification. The samples for charred plant remains only were measured out and processed in a bulk flotation machine on to a 0.5 mm mesh. The flots were likewise dried and sorted at x12 magnification.

The weight or volume of each sample processed for each category of evidence is given at the start of each table of results (Tables 4.7–16). Specimens were identified with reference to the collections in the University Museum, Oxford at magnifications of up to x100 and the results have been given in Tables 4.7–16. The tables either record the minimum number of individuals represented by the fragments identified from a sample or show presence/absence. Nomenclature follows Clapham *et al.* (1987) for plants. The Royal Entomological Society's revised check lists of British insects (Kloet and Hincks 1964; 1977; 1978) have been used for the nomenclature of the entomological results. molluscan nomenclature follows Kerney (1976) for freshwater molluscs and Waldén (1976) for land snails.

Noteworthy species records

Papaver somniferum L. opium poppy

Waterlogged seeds of *P. somniferum* L. were found in column 4 samples 31 and 30, column 1 samples 3, 2 and 1 and sample 21. A total of 203 seeds were identified from sample 2 of column 1. A single charred seed of *P. somniferum* was identified from column 4 sample 31. They were easily separated from other species of *Papaver*, which were also present, by their size and their coarse reticulate surface cell pattern. This annual is generally regarded as an introduced weed (Clapham *et al.* 1987, 59), but the possibility that it was cultivated in Britain during the Bronze Age is also raised.

Drypta dentata (Ros.)

The front half of a left elytron of *D. dentata* was identified from column 1 sample 2. It could be recognised by its rounded shoulder, distinctively punctate surface and its iridescent green colour. It is now a rare beetle restricted in Britain to a few localities on the south coast (Lindroth 1974, 133) and this find probably represents the first archaeological record.

Aphodius varians Duft.

Part of a right elytron of *A. varians* was identified from column 4 sample 28. It was not possible to determine which colour variant it was from. This species of beetle has not been captured in Britain for over 150 years (Allen 1967, 222–3) although it is still widely distributed in France (Paulian 1959, 171). It has been identified from several other British prehistoric sites.

Analysis of the data

Coleoptera

The results for the Coleoptera from columns 1 and 4 are displayed in Figure 4.5; species groups are expressed as percentages of the minimum number of individuals of terrestrial Coleoptera. Aquatic Coleoptera have been excluded from the totals because the assemblages accumulated underwater and it enables some of the difference due to the environment of the deposit itself to be eliminated. The species groups used follow Robinson (1991, 278–81) and the members of each species group are

Table 4.7 Waterlogged seeds

		Number of seeds									
		Column 4						*Column 1*			
	Sample (all 1.0 kg)	*32*	*31*	*30*	*29*	*28*	*27*	*3*	*2*	*1*	*21*
RANUNCULACEAE											
Ranunculus cf. acris L.	meadow buttercup	1	-	1	2	3	-	-	1	1	-
R. cf. repens L.	creeping buttercup	10	17	16	16	14	1	3	12	15	8
R. cf. bulbosus L.	bulbous buttercup	1	2	-	1	1	-	1	1	-	-
R. flammula L.	lesser spearwort	-	-	-	1	-	-	-	-	-	-
R. cf. lingua L.	greater spearwort	-	-	2	1	-	-	-	-	-	-
R. sceleratus L.	celery-leaved spearwort	-	1	-	1	1	-	-	-	-	-
Ranunculus S. Batrachium sp.	water crowfoot	41	31	61	62	79	-	33	13	2	-
Thalictrum flavum L.	meadow rue	-	1	1	1	-	-	-	1	-	-
CERATOPHYLLACEAE											
Ceratophyllum submersum L.	hornwort	-	-	-	1	-	-	-	-	-	-
NYMPHAEACEAE											
Nymphaea alba L.	white water lily	1	-	-	1	1	-	-	-	-	-
Nuphar lutea (L.) Sm.	yellow water lily	-	2	2	1	3	1	1	1	-	-
PAPAVERACEAE											
Papaver rhoeas tp.	field poppy	-	5	-	-	-	-	-	52	-	7
P. argemone L.	long prickly headed poppy	1	2	-	-	-	-	-	8	1	1
P. somniferum L.	opium poppy	-	4	2	-	-	-	6	203	3	11
FUMARIACEAE											
Fumaria sp.	fumitory	-	1	-	1	-	-	-	-	-	1
CRUCIFERAE											
Brassica rapa L. ssp. *sylvestris* (L.) Jan.	wild turnip	3	2	1	1	-	-	1	3	-	-
Thlaspi arvense L.	field penny-cress	1	-	-	-	-	-	1	-	1	1
Capsella bursa-pastoris (L.) Med.	shepherd's purse	-	-	-	-	-	-	1	1	-	1
Barbarea vulgaris R. Br.	yellow rocket	1	1	-	1	-	-	1	2	1	-
Rorippa cf. amphibia (L.) Bes.	great yellow cress	6	4	2	-	9	-	41	11	-	16
Nasturtium microphyllum (Boen.) Reich.	watercress	-	-	-	-	-	-	-	-	-	1
Cruciferae indet.		-	-	1	-	-	-	-	-	-	-
VIOLACEAE											
Viola S. Viola sp.	violet	-	1	2	-	-	-	-	-	-	-
V. S. Melanium sp.	pansy	-	2	1	1	-	-	-	1	-	1
HYPERICACEAE											
Hypericum sp.	St John's wort	20	21	-	20	30	1	-	-	10	31
CARYOPHYLLACEAE											
Silene dioica (L.) Clairv.	red campion	-	2	1	-	-	-	-	-	-	-
S. cf. latifolia Poir.	white campion	-	-	-	-	-	-	-	-	-	1
Lychnis flos-cuculi L.	ragged robin	1	2	2	10	4	-	-	1	-	2
Cerastium cf. *fontanum* Baum.	mouse-ear chickweed	3	1	-	-	-	-	2	2	-	2
Myosoton aquaticum (L.) Moen.	water chickweed	7	36	7	5	9	1	5	20	22	42
Stellaria media gp	chickweed	3	10	4	6	1	-	2	19	6	121
S. cf. *neglecta* Weihe	greater chickweed	-	3	2	-	-	-	-	1	1	1
S. cf. *palustris* Retz.	marsh stitchwort	2	3	-	-	-	-	1	3	-	-
S. graminea L.	stitchwort	3	3	-	1	1	-	5	2	1	10
Moehringia trinervia (L.) Clairv.	three-nerved sandwort	-	-	1	1	-	-	-	1	-	-
Arenaria sp.	sandwort	31	20	-	-	10	-	-	12	-	12

Table 4.7 Waterlogged seeds (continued)

		Number of seeds									
		Column 4						*Column 1*			
	Sample (all 1.0 kg)	*32*	*31*	*30*	*29*	*28*	*27*	*3*	*2*	*1*	*21*
PORTULACACEAE											
Montia fontana L. ssp. chondrosperma (Fenz.) Walt.	blinks	-	2	-	-	-	-	-	-	-	-
CHENOPODIACEAE											
Chenopodium polyspermum L.	allseed	4	3	-	2	1	-	1	-	3	7
C. album L.	fat hen	12	15	16	8	1	-	46	182	18	80
C. ficifolium Sm.	fig-leaved goosefoot	-	-	-	-	-	-	-	-	-	4
C. cf. *rubrum* L.	red goosefoot	-	-	-	-	-	-	-	-	-	1
Atriplex sp.	orache	10	18	7	3	3	-	3	8	1	87
MALVACEAE											
Malva sylvestris L.	common mallow	-	-	-	-	-	-	-	-	-	1
LINACEAE											
Linum usitatissimum L.	flax	3	2	-	-	-	-	1	1	-	-
L. catharticum L.	fairy flax	4	3	11	8	2	-	2	3	-	4
ACERACEAE											
Acer campestre L.	field maple	-	-	2	1	-	-	-	-	-	-
RHAMNACEAE											
Rhamnus catharticus L.	purging buckthorn	-	1	-	-	-	-	-	1	-	-
ROSACEAE											
Filipendula ulmaria L.	meadowsweet	-	3	-	1	-	-	-	6	-	1
Rubus fruticosus agg.	blackberry	-	1	6	1	-	-	-	7	1	1
Potentilla anserina L.	silverweed	-	1	-	3	1	-	-	1	1	-
P. cf. *erecta* (L.) Räush.	tormentil	-	-	2	-	-	-	-	1	-	-
P. reptans L.	creeping cinquefoil	5	2	17	7	2	-	1	1	3	1
Aphanes arvensis L.	parsley piert	1	2	1	2	1	-	2	1	1	-
A. microcarpa (B. & R.) Roth.	parsley piert	1	1	1	1	-	-	1	2	1	2
Sanguisorba minor Scop.	salad burnet	1	1	4	-	-	-	-	1	-	2
Rosa sp.	rose	-	-	-	-	-	-	-	-	-	1
Crataegus cf. *monogyna* Jac.	hawthorn	5	9	4	4	1	-	6	10	-	-
Prunus spinosa L.	sloe	-	4	1	-	-	-	4	8	-	-
Prunus S. *Prunus* sp.	sloe or plum	-	1	-	-	-	-	-	-	-	-
LYTHRACEAE											
Lythrum salicaria L.	purple loosestrife	1	-	60	50	82	40	10	20	-	80
ONAGRACEAE											
Epilobium sp.	willowherb	5	2	2	1	-	-	-	-	-	2
HALORIGIDACEAE											
Myriophyllum sp.	water milfoil	3	-	3	1	-	-	-	-	-	-
HIPPURIDAE											
Hippuris vulgaris L.	mare's tail	1	-	-	2	-	-	-	-	-	1
CALLITRICHACEAE											
Callitriche sp.	starwort	-	-	-	1	-	-	-	-	-	-
CORNACEAE											
Cornus sanguinea L.	dogwood	-	-	3	-	1	-	-	2	-	-
UMBELLIFERAE											
Berula erecta (Huds.) Cov.	water parsnip	-	1	-	1	-	-	-	1	-	5
Oenanthe aquatica gp	water dropwort	2	4	9	5	7	5	13	18	4	4
Aethusa cynapium L.	fool's parsley	-	-	-	-	-	-	-	2	3	-
Conium maculatum L.	hemlock	-	-	-	-	-	-	-	1	1	-
Apium nodiflorum (L.) Lag.	fool's watercress	3	1	4	-	3	-	2	-	2	4
Torilis sp.	hedge parsley	-	-	-	-	1	-	-	-	-	2
Daucus carota L.	wild carrot	-	-	-	-	-	-	-	-	-	2

Table 4.7 Waterlogged seeds (continued)

		Number of seeds Column 4						Column 1			
	Sample (all 1.0 kg)	*32*	*31*	*30*	*29*	*28*	*27*	*3*	*2*	*1*	*21*
EUPHORBIACEAE											
Mercurialis perennis L.	dog's mercury	-	-	-	-	-	-	-	1	-	-
POLYGONACEAE											
Polygonum aviculare agg.	knotgrass	3	3	4	3	2	-	1	4	-	8
P. persicaria L.	red shank	6	22	1	1	1	-	6	22	12	18
P. lapathifolium L.	pale persicaria	-	1	1	-	-	-	-	12	-	4
P. hydropiper L.	water pepper	5	4	3	-	-	-	2	4	-	-
Fallopia convolvulus (L.) Löv.	black bindweed	-	-	-	-	-	-	3	4	-	1
Rumex acetosella agg.	sheep's sorrel	-	2	-	-	-	-	3	2	3	5
R. hydrolapathum Huds.	great water dock	-	-	-	-	-	-	-	-	-	1
R. conglomeratus Mur.	sharp dock	8	14	32	15	12	-	32	28	-	20
Rumex spp.	dock	9	8	34	13	5	-	38	17	1	21
URTICACEAE											
Urtica urens L.	small nettle	-	1	-	-	-	-	-	-	1	2
U. dioica L.	stinging nettle	32	97	33	29	28	3	15	78	522	156
BETULACEAE											
Alnus glutinosa (L.) Gaert.	alder	4	6	5	9	10	1	-	4	-	-
CORYLACEAE											
Corylus avellana L.	hazel	-	1	1	-	1	-	1	1	1	-
FAGACEAE											
Quercus robur L. or *petraea* (Mat.) Lieb.	oak	-	-	-	-	-	-	-	-	1	-
PRIMULACEAE											
Lysimachia vulgaris L.	yellow loosestrife	-	-	1	-	-	-	-	-	-	-
MENYANTHACEAE											
Menyanthes trifoliata L.	bogbean	-	-	-	-	1	-	-	-	-	-
BORAGINACEAE											
Myosotis sp.	forget-me-not	-	2	2	1	4	-	1	2	-	5
SOLANACEAE											
Hyoscyamus niger L.	henbane	-	-	1	-	-	-	-	-	-	5
Solanum dulcamara L.	woody nightshade	1	2	3	-	1	1	-	-	2	2
S. nigrum L.	black nightshade	3	-	-	-	-	-	1	-	-	1
SCROPHULARIACEAE											
Linaria vulgaris Mill.	common toadflax	-	1	-	-	-	-	-	-	-	-
Scrophularia sp.	figwort	3	-	-	-	-	-	1	1	-	2
Veronica Sect. *Beccabunga* sp.	water speedwell	20	10	30	70	10	-	80	-	10	190
Odontites verna (Bell.) Dum.	red bartsia	-	-	-	-	-	-	-	1	-	-
VERBENACEAE											
Verbena officinalis L.	vervain	-	-	1	-	-	-	-	-	-	1
LABIATAE											
Mentha cf. *aquatica* L.	water mint	14	39	69	29	41	96	10	21	36	43
Lycopus europaeus L.	gipsy wort	2	4	3	3	6	-	3	8	64	3
Prunella vulgaris L.	selfheal	4	-	1	2	1	-	3	1	-	1
Stachys palustris L.	marsh woundwort	-	1	1	1	-	-	1	1	-	2
Ballota nigra L.	black horehound	-	-	-	-	-	-	-	1	-	1
Lamium sp.	dead-nettle	-	-	-	-	1	-	-	-	-	1
Galeopsis tetrahit agg.	hemp-nettle	-	1	1	-	-	-	1	1	1	2
Glechoma hederacea L.	ground ivy	-	1	2	2	2	-	-	3	1	-
Ajuga reptans L.	bugle	-	-	6	-	-	-	-	-	-	-
PLANTAGINACEAE											
Plantago major L.	great plantain	6	2	13	4	3	-	3	1	-	2

Table 4.7 Waterlogged seeds (continued)

		Number of seeds									
		Column 4						*Column 1*			
	Sample (all 1.0 kg)	*32*	*31*	*30*	*29*	*28*	*27*	*3*	*2*	*1*	*21*
RUBIACEAE											
Galium aparine L.	goosegrass	3	3	1	-	-	-	-	2	-	-
Galium sp.	bedstraw	9	22	1	-	1	-	3	7	1	1
CAPRIFOLIACEAE											
Sambucus nigra L.	elder	8	3	17	7	3	-	2	5	2	1
VALERIANACEAE											
Valerianella carinata Lois.	corn salad	-	-	1	-	-	-	-	2	-	-
V. dentata (L.) Pol.	corn salad	-	1	-	-	-	-	-	5	2	2
Valeriana sp.	valerian	-	1	-	-	1	-	-	1	-	1
COMPOSITAE											
Bidens cernua L.	bur-marigold	-	-	-	1	-	-	-	-	-	3
Eupatorium cannabinum L.	hemp agrimony	1	-	-	-	-	-	-	-	-	-
Senecio cf. *aquaticus* Hill	marsh ragwort	-	-	-	1	1	-	-	-	-	-
Leucanthemum vulgare Lam.	ox-eye daisy	2	1	1	-	-	-	-	-	-	-
Carduus sp.	thistle	1	5	5	1	2	-	-	2	-	8
cf. *Cirsium* sp.	thistle	1	2	1	-	2	-	1	-	1	-
Lapsana communis L.	nipplewort	-	4	-	-	-	-	-	1	-	2
Leontodon sp.	hawkbit	1	1	-	-	-	-	-	1	-	-
Sonchus oleraceus L.	sowthistle	-	-	-	-	-	-	-	1	-	-
S. asper (L.) Hill	sowthistle	-	4	1	2	1	1	3	-	1	2
ALISMATACEAE											
Alisma sp.	water plantain	7	8	66	30	32	14	11	41	1	55
Sagittaria sagittifolia L.	arrowhead	-	2	-	1	3	-	1	2	-	-
POTAMOGETONACEAE											
Potamogeton sp.	pondweed	18	3	12	6	6	1	1	2	1	-
ZANNICHELLIACEAE											
Zannichellia palustris L.		88	4	-	1	2	2	3	4	1	2
JUNCACEAE											
Juncus effusus gp	tussock rush	30	111	-	10	30	60	90	60	40	80
J. bufonius gp	toad rush	31	10	10	50	60	30	20	-	-	20
J. articulatus gp	rush	50	-	20	40	40	10	30	-	10	40
Juncus spp.	rush	10	-	10	30	20	20	-	-	40	20
IRIDACEAE											
Iris pseudacorus L.	yellow flag	-	-	-	-	2	2	-	1	-	2
LEMNACEAE											
Lemna sp.	duckweed	-	-	-	-	-	-	-	1	-	-
TYPHACEAE											
Typha sp.	reedmace	-	-	-	-	-	-	-	10	-	10
CYPERACEAE											
Eleocharis palustris (L.) R. & S. or *uniglumis* (Lin.) Sch.	spike rush	4	3	5	4	7	5	2	2	4	1
Scirpus sylvaticus L.	wood clubrush	-	-	-	-	10	-	-	-	-	-
Schoenoplectus lacustris (L.) Pal.	bulrush	114	112	217	122	14	2	38	43	13	25
Carex spp.	sedge	5	14	24	8	8	1	9	13	6	9
GRAMINEAE											
Glyceria sp.	reed-grass	-	-	1	1	4	-	-	-	-	2
Bromus S. *Eubromus* sp.	brome grass	13	17	-	-	-	-	-	-	-	-
Triticum dicoccum Shubl. or *spelta* L.	emmer or spelt wheat	-	-	-	-	-	-	2	-	-	-
Triticum sp.	wheat	-	-	-	-	-	-	-	1	-	-
Gramineae indet.	grass	2	4	1	1	13	1	-	1	-	3
Total		715	811	904	735	663	299	617	1074	881	1348

Table 4.8 Other waterlogged plant remains (excluding wood)

	Sample (all 1.0 kg)		Number of items or presence Column 4 32	31	30	29	28	27	Column 1 3	2	1	21
Chara sp.	- oospore		2115	240	52	1351	30	60	90	21	10	200
Bryophyta indet.	- stem with leaves	moss	+	+	+	+	+	-	+	+	+	+
Pteridium aquilinum (L.) Kuhn	- frond fragment	bracken	3	3	-	-	-	-	8	5	-	2
Linum usitatissimum L.	- capsule	flax	1	1	-	-	-	-	-	5	-	1
Trifolium sp.	- flower	clover	1	-	-	-	-	-	-	-	-	-
Rubus sp.	- prickle	blackberry	-	-	-	-	-	-	1	-	-	-
Rosa sp.	- prickle	rose	-	-	-	-	-	-	-	1	-	-
Malus sp.	- endocarp fragment	apple	-	1	-	-	-	-	-	-	-	-
Prunus / Crataegus tp.	- thorn	sloe or hawthorn	3	9	2	-	-	-	17	6	-	1
Rumex sp.	- stem with peduncles	dock	-	-	1	-	-	-	-	2	-	-
Alnus glutinosa (L.) Gaert.	- female catkin	alder	-	-	4	2	-	-	-	4	-	-
A. glutinosa (L.) Gaert.	- female catkin scale	alder	-	3	-	-	-	-	-	-	-	-
A. glutinosa (L.) Gaert.	- bud scale	alder	-	2	-	-	1	-	1	-	-	3
A. glutinosa (L.) Gaert.	- mite gall	alder	-	-	-	-	2	-	-	-	-	-
Quercus sp.	- bud scale	oak	-	-	-	5	-	-	-	-	-	-
Triticum dicoccum Shubl.	- glume	emmer wheat	-	1	-	-	-	-	-	-	-	-
T. spelta L.	- glume	spelt wheat	-	-	-	-	-	-	1	2	-	2
T. dicoccum Shubl. or *spelta* L.	- glume	emmer or spelt wheat	1	1	-	-	-	-	-	5	-	-
Bud scale indet.			4	5	11	-	2	-	4	3	1	-
Leaf abscission pad			-	1	1	1	-	-	2	2	-	1
Deciduous leaf fragment			-	-	1	1	-	-	2	-	-	-

Table 4.9 Waterlogged wood

Sample (all 1.0 kg)		Presence Column 4 31	30	29	Column 1 3	2	1	21
Rhamnus catharticus L.	purging buckthorn	-	-	-	+	-	-	-
Prunus sp.	sloe etc.	+	-	-	+	-	-	-
Pomoideae indet.	hawthorn, apple etc.	-	-	-	+	+	-	-
Alnus glutinosa (L.) Gaert.	alder	+	-	-	+	+	-	-
Corylus avellana L.	hazel	+	-	-	+	-	+	-
Quercus sp.	oak	+	+	+	+	+	+	+

Table 4.10 Charred plant remains (excluding charcoal)

		Number of items												
		Column 4		*Column 1*										
	Sample	*31*	*30*	*3*	*2*	*1*	*21*	*5*	*51*	*94*	*93*	*95*	*92*	*52*
	Sample weight (kg)	*1.0*	*1.0*	*1.0*	*1.0*	*1.0*	*1.0*							
	or volume (litres)							*2.0*	*2.0*	*8.0*	*8.0*	*8.0*	*8.0*	*8.0*
Cereal grain														
Triticum dicoccum Shubl.	emmer wheat	-	-	-	-	2	-	5	-	-	-	-	-	-
T. spelta L.	spelt wheat	3	-	-	-	-	-	3	-	1	-	-	-	1
T. dicoccum Shubl. or *spelta* L.	emmer or spelt wheat	2	1	-	2	5	-	8	1	-	-	2	2	
Triticum sp. - short free-threshing grain	rivet or bread wheat	-	-	-	-	-	-	-	-	1	-	-	-	-
Triticum sp.	wheat	-	-	-	2	3	2	10	2	1	-	2	2	-
Hordeum vulgare L. - hulled lateral grain	six-row hulled barley	-	-	-	1	2	-	1	-	-	-	-	-	-
H. vulgare L. - lateral grain	six-row barley	-	-	-	1	-	-	1	-	-	-	1	-	1
Hordeum sp. - hulled median grain	hulled barley	-	-	-	1	3	-	2	1	-	-	-	-	1
Hordeum sp. - median grain	barley	-	-	-	-	-	-	1	1	-	-	-	-	-
Hordeum sp. - hulled grain	hulled barley	1	-	-	-	6	-	10	1	-	-	-	1	1
Hordeum sp.	barley	1	-	-	2	2	-	22	2	-	-	-	1	-
cereal indet.		1	1	1	4	10	2	56	9	3	2	10	8	3
Total cereal grain		8	2	1	13	33	4	119	17	6	2	15	14	7
Cereal chaff														
Triticum dicoccum Shubl. - glume base	emmer wheat	1	-	-	-	2	2	13	1	2	-	1	-	-
T. spelta L. - glume base	spelt wheat	11	1	-	6	17	-	29	9	-	-	-	-	-
T. dicoccum Shubl. or *spelta* L. - glume base	emmer or spelt wheat	9	3	-	1	21	13	35	8	-	-	-	-	-
Triticum sp. - awn fragment	wheat	4	-	-	5	-	-	1	5	-	-	-	-	-
Hordeum sp. - rachis	six-row barley	-	-	-	-	-	-	1	-	-	-	-	-	-
Hordeum sp.- rachis	barley	1	-	-	-	6	-	4	-	-	-	-	-	-
Secale or *Hordeum* sp. - rachis	rye or barley	-	-	-	-	-	-	2	-	-	-	-	-	-
Total chaff excluding awn fragments		22	4	0	7	46	15	84	18	2	0	1	0	0
Other food plant seeds / nuts														
Linum usitatissimum L.	flax	-	1	-	-	-	-	-	2	-	-	-	-	-
Corylus avellana L.	hazel	-	-	-	-	-	-	-	-	-	-	-	-	1
Weed seeds														
Ranunculus cf. *repens* L.	creeping buttercup	-	-	-	-	1	-	2	-	-	-	-	-	-
Papaver somniferum L.	opium poppy	1	-	-	-	-	-	-	-	-	-	-	-	-
Thlaspi arvense L.	field pennycress	-	-	-	-	-	-	1	-	-	-	-	-	-
Silene sp.	campion	-	-	-	-	-	-	1	-	-	-	-	-	-
Cerastium cf. *fontanum* Baum.	mouse-ear chickweed	1	-	-	-	-	-	-	-	-	-	-	-	-
Stellaria media gp	chickweed	-	-	-	-	-	-	2	-	-	-	-	-	-
S. graminea L.	stitchwort	-	-	-	-	-	-	4	1	-	-	-	-	-

Table 4.10 (continued) Charred plant remains (excluding charcoal)

		Number of items												
		Column 4		*Column 1*										
	Sample	*31*	*30*	*3*	*2*	*1*	*21*	*5*	*51*	*94*	*93*	*95*	*92*	*52*
	Sample weight (kg)	*1.0*	*1.0*	*1.0*	*1.0*	*1.0*	*1.0*							
	or volume (litres)							*2.0*	*2.0*	*8.0*	*8.0*	*8.0*	*8.0*	*8.0*
Chenopodium polyspermum L.	allseed	-	-	-	-	-	-	3	-	-	-	-	-	-
C. album L.	fat hen	-	-	-	1	2	-	21	2	1	-	-	-	3
Atriplex sp.	orache	-	-	-	-	-	-	2	-	-	-	-	-	-
Chenopodiaceae indet.		-	-	-	-	-	-	4	-	-	-	-	-	-
Linum catharticum L.	fairy flax	-	-	-	-	-	-	1	-	-	-	-	-	-
Vicia or *Lathyrus* sp.	vetch or tare	1	-	-	-	-	-	-	1	-	-	-	-	-
cf. *Medicago lupulina* L.	black medick	-	-	-	-	-	-	1	-	-	-	-	-	-
cf. *Trifolium* sp.	clover	-	-	-	-	3	-	13	-	-	-	-	-	-
Potentilla reptans L.	creeping cinquefoil	-	-	-	-	-	-	1	-	-	-	-	-	-
Crataegus cf. *monogyna* Jac.	hawthorn	-	-	-	-	1	-	-	-	-	-	-	-	-
Prunus spinosa L.	sloe	-	-	-	-	-	-	1	-	-	-	-	-	-
Polygonum aviculare agg.	knotgrass	-	-	-	-	-	-	1	-	-	-	-	-	-
Rumex acetosella agg.	sheep's sorrel	-	-	-	-	1	-	1	-	-	-	-	-	-
Odontites verna (Bell.) Dum.	red bartsia	1	-	-	-	-	-	-	-	-	-	-	-	-
Lycopus europaeus L.	gipsywort	-	-	-	-	1	-	-	-	-	-	-	-	-
Prunella vulgaris L.	selfheal	-	-	-	-	-	-	3	-	-	-	-	-	-
Plantago media L. or *lanceolata* L.	plantain	-	-	-	-	-	-	2	1	-	-	-	-	-
Valerianella dentata (L.) Pol.	corn salad	-	-	-	-	-	-	2	-	-	-	-	-	-
Sonchus asper (L.) Hill	sowthistle	1	-	-	-	-	-	-	-	-	-	-	-	-
Schoenoplectus lacustris (L.) Pal.	bulrush	-	-	-	-	-	-	1	-	-	-	-	-	-
Carex spp.	sedge	-	-	-	-	1	-	5	-	-	-	-	-	-
Bromus S. *Eubromus* sp.	brome grass	12	2	-	5	5	3	2	21	-	-	-	-	1
Gramineae indet.	grass	2	-	-	-	-	-	12	-	-	-	-	-	-
weed seeds indet.		5	-	-	1	2	2	26	7	-	-	-	-	-
Total weed seeds		24	2	0	7	17	5	112	35	1	0	0	0	4
Concentration of remains/litre or /kg (excluding awns)		54.0	9.0	1.0	27.0	96.0	24.0	157.5	35.0	1.1	0.3	2.0	1.8	1.5

Table 4.11 Charcoal

		Presence							
		Column 4			*Column 1*				
	Sample	*31*	*30*	*29*	*2*	*1*	*21*	*5*	*51*
	Sample weight (kg)	*1.0*	*1.0*	*1.0*	*1.0*	*1.0*	*1.0*		
	or volume (litres)							*2.0*	*2.0*
Pomoideae indet.	hawthorn, apple etc.	-	-	-	+	-	++	-	-
Corylus avellana L.	hazel	+++	++	-	+	+++	-	++++	++++
Quercus sp.	oak	-	-	+	-	-	-	-	+
Fraxinus excelsior L.	ash	-	-	+	-	+	+	-	-

+ present, ++ some, +++ much, ++++ very much

Table 4.12 Coleoptera

	Minimum no. of individuals										*Species group*
	Column 4						*Column 1*				
Sample	*32*	*31*	*30*	*29*	*28*	*27*	*3*	*2*	*1*	*21*	
Sample weight (kg)	*1.0*	*1.0*	*1.0*	*1.0*	*1.0*	*1.0*	*4.0*	*10.0*	*6.0*	*4.0*	
CARABIDAE											
Nebria brevicollis (F.)	-	-	-	-	-	1	-	1	-	-	
Dyschirius globosus (Hbst.)	-	1	-	-	1	-	-	-	-	-	
Clivina collaris (Hbst.) or *fossor* (L.)	1	-	-	-	-	-	1	1	1	-	
Patrobus atrorufus (Ström)	-	-	-	-	-	-	-	2	-	-	
Trechus obtusus Er. or *quadristriatus* (Schr.)	-	-	1	-	-	-	-	-	-	-	
T. secalis (Pk.)	-	-	-	-	-	-	-	1	-	-	
Bembidion lampros (Hbst.)	-	1	-	-	-	-	-	-	-	-	
B. tetracolum Say	-	-	-	-	-	-	2	1	1	-	
B. gilvipes Sturm	1	-	1	1	1	-	1	5	4	1	
B. assimile Gyl.	-	-	-	-	-	-	2	1	2	-	
B. biguttatum (F.)	-	-	-	-	-	-	1	2	1	-	
B. guttula (F.)	-	-	-	-	-	-	-	5	3	1	
Pterostichus cupreus (L.)	1	-	-	-	1	-	-	-	-	-	
P. gracilis (Dej.)	-	-	-	-	-	-	1	1	-	1	
P. melanarius (Ill.)	-	-	-	1	1	-	-	1	1	-	
P. cf. *minor* (Gyl.)	-	-	-	-	-	-	-	-	2	-	
P. nigrita (Pk.)	-	-	1	-	-	-	-	2	-	1	
P. strenuus (Pz.)	-	-	-	-	-	-	1	4	2	-	
P. vernalis (Pz.)	-	-	-	-	-	-	-	1	-	-	
P. cupreus (L.) or *versicolor* (Sturm)	-	-	1	-	-	-	-	1	-	-	
Calathus fuscipes (Gz.)	1	-	-	-	1	-	-	1	-	-	
Synuchus nivalis (Pz.)	-	1	1	-	-	-	-	-	-	-	
Agonum fuliginosum (Pz.)	-	-	-	-	-	-	1	2	-	-	
A. gracile Sturm	-	1	-	-	-	-	-	1	-	1	
A. marginatum (L.)	-	-	-	-	-	-	-	1	-	-	
A. muelleri (Hbst.)	-	-	-	-	-	-	1	1	-	-	
A. piceum (L.)	1	-	-	-	-	-	-	-	-	-	
Amara sp.	-	-	1	-	1	-	1	1	-	1	
Harpalus S. *Ophonus* sp.	-	-	-	-	-	-	-	1	-	-	
H. affinis (Schr.)	-	-	-	-	-	-	-	1	-	-	
H. rubripes (Duft.)	1	-	-	-	-	-	-	-	-	-	
Bradycellus sp.	-	1	-	-	-	-	-	-	-	-	
Badister bipustulatus (F.)	-	-	-	-	-	-	-	1	1	-	
Dromius linearis (Ol.)	-	-	-	-	-	-	-	1	-	-	
Drypta dentata (Ros.)	-	-	-	-	-	-	-	1	-	-	
HALIPLIDAE											
Haliplus sp.	-	-	-	-	-	-	-	1	-	-	1
DYTISCIDAE											
Hygrotus versicolor (Schal.)	-	-	-	-	-	-	-	1	-	-	1
Hydroporus sp.	-	-	-	-	-	-	-	1	-	-	1
Potamonectes depressus (F.)	-	-	-	-	-	-	-	1	-	-	1
Agabus bipustulatus (L.)	-	-	-	-	-	-	-	1	-	-	1
Agabus sp. (not *bipustulatus*)	-	-	-	1	-	-	1	-	1	-	1
Rhantus sp.	1	-	-	-	-	-	-	-	-	-	1
Colymbetes fuscus (L.)	-	-	-	-	-	-	1	1	-	-	1
GYRINIDAE											
Gyrinus sp.	-	-	-	-	1	-	1	1	-	-	1
Orectochilus villosus (Müll.)	-	-	-	1	1	-	1	1	-	-	1

Table 4.12 Coleoptera (continued)

	Minimum no. of individuals										*Species group*
	Column 4						*Column 1*				
Sample	*32*	*31*	*30*	*29*	*28*	*27*	*3*	*2*	*1*	*21*	
Sample weight (kg)	*1.0*	*1.0*	*1.0*	*1.0*	*1.0*	*1.0*	*4.0*	*10.0*	*6.0*	*4.0*	
HYDROPHILIDAE											
Helophorus aquaticus (L.)	-	-	-	-	-	-	-	2	-	-	1
H. grandis Ill.	-	-	-	-	-	-	-	1	1	-	1
H. aquaticus (L.) or *grandis* Ill.	-	1	-	-	-	-	1	-	-	1	1
Helophorus spp. (*brevipalpis* size)	-	-	1	-	-	-	1	15	1	2	1
Coelostoma orbiculare (F.)	-	-	1	-	1	-	-	-	-	-	1
Sphaeridium bipustulatum F.	-	-	-	-	-	-	-	-	-	1	
Cercyon analis (Pk.)	-	1	-	-	-	-	1	22	9	-	7
C. atricapillus (Marsh.)	-	-	-	-	-	-	-	-	-	1	7
C. haemorrhoidalis (F.)	1	3	-	1	1	-	2	10	2	-	7
C. pygmaeus (Ill.)	-	-	-	-	-	-	-	-	1	-	7
C. cf. *sternalis* Sharp.	-	-	-	-	1	-	-	-	2	-	7
C. cf. tristis (Ill.)	-	-	-	1	-	-	-	1	-	-	7
C. unipunctatus (L.)	-	-	-	-	-	-	-	2	-	-	7
Cercyon sp.	-	-		-	-	-	1	-	-	1	7
Megasternum obscurum (Marsh.)	3	3	1	2	1	1	1	17	11	2	7
Cryptopleurum minutum (F.)	-	-	-	-	-	-	-	1	1	1	7
Hydrobius fuscipes (L.)	-	-	1	-	-	-	-	1	-	2	1
Anacaena bipustulata (Marsh.) or *limbata* (F.)	-	1	-	-	-	1	-	2	1	1	1
Laccobius sp.	-	-	1	-	-	-	-	1	-	-	1
Chaetarthria seminulum (Hbst.)	1	-	-	-	-	-	-	-	-	1	1
HISTERIDAE											
Hister bissexstriatus F.	-	-	-	-	-	-	-	2	-	-	
Histerinae indet.	-	-	-	-	-	-	-	1	-	-	
HYDRAENIDAE											
Ochthebius bicolon Germ.	-	-	-	-	-	-	-	3	-	-	1
O. cf. *bicolon* Germ.	-	-	-	-	-	-	2	16	2	1	1
O. minimus (F.)	-	-	1	-	-	-	1	12	-	2	1
O. cf. *minimus* (F.)	1	-	-	-	1	-	3	53	2	2	1
Hydraena pulchella Germ.	-	-	-	-	-	-	2	4	-	-	1
H. riparia Kug.	-	-	-	-	-	-	2	16	2	1	1
H. testacea Curt.	-	-	-	-	-	-	-	2	-	-	1
Hydraena sp.	1	1	-	-	-	-	-	-	-	-	1
Limnebius papposus Muls.	-	-	1	-	-	-	-	1	-	-	1
PTILIIDAE											
Ptenidium sp.	-	-	-	-	-	-	-	-	1	-	
Ptiliidae indet. (not *Ptenidium*)	-	1	-	2	2	-	-	1	2	-	
LEIODIDAE											
Choleva or *Catops* sp.	-	1	-	-	1	-	-	-	1	-	
SILPHIDAE											
Aclypea opaca (L.)	-	1	-	-	-	-	1	-	-	-	
Silpha atrata L.	-	-	1	-	-	-	1	1	1	-	
S. tristis Ill.	-	-	1	-	-	-	-	-	-	-	
SCYDMAENIDAE											
Scydmaenidae indet.	-	-	-	-	-	-	-	1	-	-	

Table 4.12 Coleoptera (continued)

	Minimum no. of individuals										*Species group*
	Column 4						*Column 1*				
Sample	*32*	*31*	*30*	*29*	*28*	*27*	*3*	*2*	*1*	*21*	
Sample weight (kg)	*1.0*	*1.0*	*1.0*	*1.0*	*1.0*	*1.0*	*4.0*	*10.0*	*6.0*	*4.0*	
STAPHYLINIDAE											
Micropeplus porcatus (Pk.)	-	-	-	-	-	-	-	1	-	-	
Metopsia retusa (Step.)	-	-	-	-	-	-	-	1	-	-	
Anthobium sp.	-	-	-	-	-	-	-	1	-	-	
Olophrum cf. *fuscum* (Grav.)	-	-	-	-	-	-	1	4	1	-	
O. cf. *piceum* (Gyl.)	1	3	-	-	-	-	-	-	2	-	
Acidota cruentata Man.	-	-	-	-	-	-	-	1	-	-	
Lesteva longoelytrata (Gz.)	1	2	-	-	-	-	-	-	-	-	
Bledius sp.	-	-	-	1	-	-	-	1	-	-	
Carpelimus bilineatus Step.	-	-	-	-	-	-	1	5	27	1	
C. cf. *corticinus* (Grav.)	-	-	-	-	-	-	-	1	4	1	
C. rivularis (Mots.)	-	-	-	-	-	-	-	3	1	-	
Platystethus arenarius (Fouc.)	-	2	-	-	-	-	-	1	1	-	7
P. cornutus gp	-	-	-	-	-	-	-	1	1	-	
Anotylus nitidulus (Grav.)	-	-	2	-	-	-	-	5	3	-	
A. rugosus (F.)	1	2	1	1	-	-	3	9	5	-	7
A. sculpturatus gp	-	1	-	-	-	-	-	1	-	-	7
Oxytelus sculptus Grav.	-	-	-	-	-	-	2	11	29	-	
Stenus bimaculatus Gyl.	-	-	-	-	-	-	1	-	-	-	
Stenus sp.	1	2	2	1	-	-	-	-	-	-	
Paederus littoralis Grav.	-	-	-	-	-	-	-	3	-	-	
Lathrobium longulum Grav.	-	-	-	-	-	-	-	-	1	-	
Lathrobium sp. (not *longulum*)	2	-	1	-	1	1	-	5	2	1	
Rugilus orbiculatus (Pk.)	-	-	-	-	-	-	-	-	-	1	
Othius laeviusculus Step.	-	-	-	-	-	-	1	-	-	-	
Leptacinus batychrus (Gyl.)	-	-	-	-	-	-	-	-	-	1	
L. pusillus (Step.)	-	-	-	-	-	-	-	-	1	-	
Gyrohypnus fracticornis (Müll.) or *punctulatus* (Pk.)	1	1	-	-	-	-	-	3	6	1	
Xantholinus linearis (Ol.)	-	-	-	-	2	-	-	2	-	-	
X. linearis (Ol.) or *longiventris* Heer	1	1	-	1	-	-	-	3	-	-	
Erichsonius cinerascens (Grav.)	-	-	-	-	-	-	-	2	-	-	
Philonthus spp.	1	3	2	-	-	-	1	4	4	1	
Creophilus maxillosus (L.)	-	-	-	-	-	-	-	1	-	-	
Mycetoporus sp.	1	-	-	-	-	-	-	-	-	-	
Tachyporus sp.	-	-	1	1	2	-	1	-	2	-	
Tachinus sp.	2	1	-	1	1	1	1	2	2	-	
Aleocharinae indet.	-	2	1	1	3	-	4	12	6	1	
PSELAPHIDAE											
Pselaphidae indet.	-	-	-	-	-	-	1	1	1	-	
GEOTRUPIDAE											
Geotrupes sp.	1	1	1	1	1	-	-	1	1	1	2
SCARABAEIDAE											
Colobopterus erraticus (L.)	-	-	-	-	-	-	2	1	-	-	2
Aphodius ater (Deg.)	-	-	-	-	-	-	1	1	-	-	2
A. contaminatus (Hbst.)	-	-	-	-	1	-	-	-	-	-	2
A. cf. *foetens* (F.)	-	-	-	-	-	-	-	1	-	-	2
A. granarius (L.)	-	-	-	-	-	-	2	-	1	-	2
A. luridus (F.)	1	1	-	-	-	-	-	1	-	-	2
A. pusillus (Hbst.)	1	-	-	1	1	-	1	5	-	-	2

Table 4.12 Coleoptera (continued)

	Minimum no. of individuals										*Species group*
	Column 4						*Column 1*				
Sample	*32*	*31*	*30*	*29*	*28*	*27*	*3*	*2*	*1*	*21*	
Sample weight (kg)	*1.0*	*1.0*	*1.0*	*1.0*	*1.0*	*1.0*	*4.0*	*10.0*	*6.0*	*4.0*	
A. rufipes (L.)	-	-	-	1	-	-	-	-	-	-	2
A. cf. *sphacelatus* (Pz.)	2	2	2	2	3	-	1	5	5	2	2
A. varians Duft.	-	-	-	-	1	-	-	-	-	-	2
Aphodius spp.	2	3	2	-	-	1	2	6	2	-	2
Onthophagus ovatus (L.)	2	1	1	3	-	-	-	2	2	-	2
Onthophagus sp. (not *ovatus*)	1	-	1	-	1	-	-	1	1	-	2
Amphimallon solstitialis (L.)	1	-	-	-	-	-	-	-	-	-	
Phyllopertha horticola (L.)	2	1	2	2	2	-	1	2	1	1	11
Cetonia aurata (L.)	-	-	-	-	-	-	-	1	-	1	
SCIRTIDAE											
cf. *Cyphon* sp.	-	-	-	-	-	-	-	2	-	-	
BYRRHIDAE											
Byrrhus sp.	-	-	-	1	-	-	-	-	-	-	
HETEROCERIDAE											
Heterocerus sp.	1	-	-	-	-	-	-	-	-	-	
DRYOPIDAE											
Helichus substriatus (Müll.)	-	-	-	1	-	-	1	-	-	-	1
Dryops sp.	-	-	2	1	1	-	-	2	1	-	1
ELMIDAE											
Elmis aenea (Müll.)	-	-	-	-	-	-	-	2	-	-	1
Esolus parallelepipedus (Müll.)	-	1	-	1	-	-	3	4	1	1	1
Limnius volckmari (Pz.)	-	1	-	-	-	-	2	2	1	-	1
Macronychus quadrituberculatus Müll.	-	-	-	-	-	-	-	1	-	-	1
Normandia nitens (Müll.)	2	-	-	-	-	-	2	1	1	1	1
Oulimnius sp.	2	1	3	-	4	-	12	31	9	2	1
Stenelmis canaliculata (Gyl.)	-	-	1	1	-	-	1	4	3	-	1
ELATERIDAE											
Agrypnus murinus (L.)	1	1	1	-	1	-	2	1	1	-	11
Athous hirtus (Hbst.)	1	-	-	-	-	-	-	1	-	-	11
Agriotes obscurus (L.)	-	-	1	-	-	-	-	-	-	-	11
A. sputator (L.)	-	-	-	-	-	-	-	1	-	-	11
Agriotes sp.	1	-	-	-	-	-	1	-	-	-	11
Synaptus filiformis (F.)	-	-	-	-	-	-	1	-	-	-	
CANTHARIDES											
Cantharis sp.	1	-	-	-	-	-	-	1	-	-	
ANOBIIDAE											
Grynobius planus (F.)	1	-	-	-	-	-	-	1	1	-	4
Anobium punctatum (F.)	-	-	-	-	-	-	1	-	-	-	10
NITIDULIDAE											
Brachypterus urticae (F.)	-	-	-	1	-	-	-	1	-	-	
Brachypterolus pulicarius (L.)	1	-	-	-	-	-	-	1	-	-	
Pria dulcamara (Scop.)	-	-	-	-	-	-	-	1	-	-	
Meligethes sp.	-	-	-	-	-	-	-	1	-	-	

Table 4.12 Coleoptera (continued)

	Minimum no. of individuals										*Species group*
	Column 4						*Column 1*				
Sample	*32*	*31*	*30*	*29*	*28*	*27*	*3*	*2*	*1*	*21*	
Sample weight (kg)	*1.0*	*1.0*	*1.0*	*1.0*	*1.0*	*1.0*	*4.0*	*10.0*	*6.0*	*4.0*	
RHIZOPHAGIDAE											
Monotoma sp.	-	-	-	-	-	-	-	1	2	-	
CRYPTOPHAGIDAE											
Cryptophagidae indet. (not *Atomaria*)	-	-	-	-	-	-	1	3	1	-	
Atomaria sp.	-	-	-	-	1	-	1	2	3	-	
CORYLOPHIDAE											
Corylophus cassidoides (Marsh.)	-	-	-	-	1	-	-	2	1	1	
Orthoperus sp.	-	1	-	-	-	-	-	1	-	-	
COCCINELLIDAE											
Anisosticta novemdecimpunctata (L.)	-	-	-	-	-	-	-	-	1	-	
Tytthaspsis sedecimpunctata (L.)	-	-	-	-	-	1	-	-	-	-	
LATHRIDIIDAE											
Lathridius minutus gp	-	-	-	-	-	-	-	2	7	-	8
Enicmus transversus (Ol.)	-	-	-	-	-	-	-	1	-	-	8
Corticaria punctulata Marsh.	-	-	-	-	-	-	2	1	-	-	8
Corticariinae indet.	-	-	-	1	-	-	1	7	2	1	8
CISIDAE											
Cis sp.	-	-	-	-	-	-	-	1	-	-	4
TENEBRIONIDAE											
Opatrum sabulosum (L.)	-	-	-	-	1	-	-	-	-	-	
ANTHICIDAE											
Anthicus formicarius (Gz.)	-	-	-	-	-	-	-	3	-	-	
BRUCHIDAE											
Bruchus or *Bruchidius* sp.	-	-	-	-	-	-	-	1	-	-	
CHRYSOMELIDAE											
Macroplea appendiculata (Pz.)	-	-	-	-	-	-	-	1	-	-	5
Donacia cinerea Hbst.	-	1	-	-	-	-	1	-	-	-	5
D. clavipes F.	-	-	-	1	-	-	-	1	1	-	5
D. dentata Hoppe	-	-	-	-	-	-	-	-	-	1	5
D. impressa Pk.	-	1	1	1	2	-	2	5	2	2	5
D. versicolorea (Brahm)	-	-	-	1	-	-	-	-	-	-	5
D. vulgaris Zsch.	-	-	-	-	-	-	-	1	-	-	5
Plateumaris affinis (Kunze)	-	-	-	-	-	-	1	1	1	-	5
Donacia or *Plateumaris* sp.	1	1	1	-	-	1	-	-	-	1	5
Chrysolina cf. *graminis* (L.)	-	-	-	-	-	-	-	1	-	-	
C. polita (L.)	-	-	-	-	-	-	-	1	-	1	
Gastrophysa polygoni (L.)	-	-	-	-	-	1	-	-	-	-	
G. viridula (Deg.)	-	-	-	-	-	-	-	1	-	-	
Phaedon sp. (not *tumidulus*)	-	-	-	-	-	-	1	1	-	-	
Prasocuris phellandrii (L.)	-	-	-	-	-	-	1	-	-	-	5
Galerucella calmariensis (L.)	-	-	-	-	-	-	-	1	-	-	5
Phyllotreta atra (F.)	-	-	-	-	-	-	-	1	-	-	
P. ochripes (Curt.)	-	-	-	-	-	-	-	1	-	-	
P. nemorum (L.) or *undulata* Kuts.	-	-	-	-	-	-	-	1	-	-	
P. vittula Redt.	1	-	-	1	1	-	1	1	-	-	
Aphthona nonstriata (Gz.)	-	1	-	-	-	-	-	5	1	1	5

Table 4.12 Coleoptera (continued)

	Minimum no. of individuals										Species group
	Column 4						*Column 1*				
Sample	*32*	*31*	*30*	*29*	*28*	*27*	*3*	*2*	*1*	*21*	
Sample weight (kg)	*1.0*	*1.0*	*1.0*	*1.0*	*1.0*	*1.0*	*4.0*	*10.0*	*6.0*	*4.0*	
Longitarsus spp.	2	1	-	2	1	-	-	8	-	-	
Altica sp.	1	-	-	-	-	-	2	2	-	-	
Crepidodera ferruginea (Scop.)	1	-	1	-	-	-	-	-	-	-	
Chalcoides sp.	-	-	-	-	-	-	-	-	1	-	4
Chaetocnema concinna (Marsh.)	1	1	1	-	-	-	2	4	1	-	
Chaetocnema sp. (not concinna)	-	-	1	1	-	-	-	3	-	-	
Psylliodes sp.	-	-	-	-	1	-	-	1	-	-	
APIONIDAE											
Apion aeneum (F.)	-	-	-	-	-	-	1	-	-	1	
Apion spp.	2	2	3	2	1	-	4	8	4	-	3
CURCULIONIDAE											
Otiorhynchus ligustici (L.)	-	-	-	-	-	-	1	-	-	1	
O. ovatus (L.)	-	-	-	-	-	-	-	-	-	1	
Phyllobius roboretanus Gred. or *viridiaeris* (Laich.)	-	-	-	-	-	-	1	-	-	1	
Phyllobius sp.	1	-	-	-	-	-	-	1	-	1	
Polydrusus sp.	-	-	-	-	-	-	-	1	1	-	4
Barypeithes araneiformis (Schr.)	1	-	-	-	-	-	-	1	-	-	
Sciaphilus asperatus (Bons.)	-	-	-	1	-	-	-	1	-	-	
Barynotus obscurus (F.)	-	-	2	-	1	-	-	-	1	1	
Sitona cf. *hispidulus* (F.)	1	-	-	-	-	-	-	1	-	-	3
Sitona sp.	1	-	-	1	1	-	-	-	1	-	3
Hypera punctata (F.)	-	-	1	1	1	-	1	1	-	-	
Hypera sp. (not *punctata*)	-	-	-	1	-	-	-	-	-	-	
Alophus triguttatus (F.)	1	-	-	-	1	1	-	1	1	1	
Tanysphyrus lemnae (Pk.)	-	-	-	-	-	-	1	-	-	-	5
Acalles turbatus Boh.	-	1	-	-	-	-	1	-	-	-	4
Bagous sp.	-	1	-	-	-	-	2	16	3	-	5
Notaris acridulus (L.)	-	-	-	-	1	-	-	1	1	-	5
N. bimaculatus (F.) or *scirpi* (F.)	-	-	-	-	-	-	-	-	1	-	5
Grypus equiseti (F.)	-	-	-	1	-	-	-	-	-	-	5
Cidnorhinus quadrimaculatus (L.)	-	-	-	-	-	-	-	-	1	-	
Ceuthorhynchidius troglodytes (F.)	-	1	-	1	-	-	-	-	-	-	
Ceutorhynchus cf. *angulosus* Boh.	-	-	-	-	-	-	-	1	-	-	
Ceuthorhynchinae indet.	-	-	1	-	-	-	5	1	4	-	
Anthonomus brunnipennis (Curt.)	-	-	-	-	-	-	-	1	-	-	
A. cf. *pedicularius* (L.)	-	-	-	-	-	-	-	1	-	-	4
A. cf. *rubi* (Hbst.)	-	-	-	-	-	1	-	-	-	-	
Curculio cf. *nucum* L.	-	-	-	-	-	-	-	1	-	-	4
Tychius sp.	-	-	-	1	1	-	1	2	1	-	
Miccotrogus picirostris (F.)	-	-	-	-	-	-	-	1	-	-	
Mecinus pyraster (Hbst.)	-	-	1	1	1	-	-	-	1	1	
Gymnetron labile (Hbst.)	-	1	-	-	-	-	1	1	1	-	
G. pascuorum (Gyl.)	1	-	-	-	-	-	-	1	-	-	
G. rostellum (Hbst.)	-	-	-	-	-	-	-	1	-	-	
G. veronicae (Germ.)	-	-	-	-	-	-	-	1	1	-	5
SCOLYTIDAE											
Scolytus intricatus (Ratz.)	-	-	-	-	1	-	-	-	-	-	4
Leperisinus varius (F.)	-	-	-	-	-	-	-	1	-	-	4
Total	65	64	55	51	59	10	123	517	235	58	

For Key to species groups see *Figure 4.5*

Table 4.13 Other insects

		Minimum no. of individuals or presence									
		Column 4						*Column 1*			
Sample		*32*	*31*	*30*	*29*	*28*	*27*	*3*	*2*	*1*	*21*
Sample weight (kg)		*1.0*	*1.0*	*1.0*	*1.0*	*1.0*	*1.0*	*4.0*	*10.0*	*6.0*	*4.0*
DERMAPTERA											
Labia minor (L.)		-	-	-	-		-	-	-	1	-
Forficula auricularia L.		-	-	-	-	-	-	-	1	-	-
HEMIPTERA											
Pentatoma rufipes (L.)		-	-	1	-	-	-	-	-	-	-
Heterogaster urticae (F.)		-	-	-	-	-	-	-	-	1	-
Drymus sylvaticus (F.)		-	-	-	-	-	-	-	1	-	-
Tingidae indet.		-	-	-	-	-	-	-	1	-	-
Anthocorinae indet.		-	-	-	-	-	-	-	1	-	-
Saldula S. *Saldula* sp.		-	-	-	-	1	-	1	2	-	-
Gerris sp.		-	-	-	-	-	-	1	5	-	-
Heteroptera indet.		-	-	1	-	-	-	-	-	1	-
Aphrodes bicinctus (Schr.)		1	-	2	-	1	-	3	1	1	-
A. flavostriatus (Don.)		-	1	-	-	-	-	-	1	1	-
Aphrodes sp.		-	-	1	2	-	-	-	1	-	-
Aphidoidea indet.		-	-	-	-	-	-	-	-	-	1
Homoptera indet.		-	-	-	-	-	1	-	-	-	-
TRICHOPTERA											
Ithytrichia lamellaris Eat. or *clavata* Mort	- larval case	31	46	78	144	203	15	30	109	10	48
Orthotrichia sp.	- larval case	14	3	8	17	35	-	-	4	3	10
Trichoptera indet.	- larva	5	3	3	2	-	-	16	5	1	-
Trichoptera indet.	- larval case	118	13	3	23	6	-	4	4	3	5
HYMENOPTERA											
Tetramorium caespitum (L.)	- female	-	-	-	-	-	-	-	1	-	-
Lasius flavus gp	- worker	1	-	2	1	-	-	1	-	-	-
L. niger gp	- worker	-	-	-	-	-	-	-	2	-	1
Hymenoptera indet.		1	1	-	-	-	-	9	11	4	3
DIPTERA											
Chironomidae indet.	- larva	-	+	+	+	+	-	+	+	+	+
Dilophus febrilis (L.) or *femoratus* Meig.	- adult	-	-	-	-	-	-	-	3	-	-
Musca cf. *domestica* (L.)	- puparium	-	-	-	-	-	-	1	1	1	1
Diptera indet.	- puparium	2	7	2	1	4	-	4	6	3	3
Diptera indet.	- adult	-	-	-	1	1	1	4	19	2	1

Table 4.14 Mollusca (column 4)

	Minimum no. of individuals																*Habitat*
	Column 4																
Sample (all 0.5 kg)	*32*	*31*	*30*	*29*	*28*	*27*	*26*	*25*	*24*	*23*	*22*	*21*	*20*	*19*	*18*	*17*	
GASTROPODA																	
Theodoxus fluviatilis (L.)	10	10	39	4	-	-	1	1	5	8	13	7	8	6	3	-	a
Valvata cristata Müll.	13	9	31	35	2	2	1	3	4	12	7	4	7	2	-	1	a
V. piscinalis (Müll.)	42	28	144	61	15	1	-	1	11	35	36	23	27	4	2	1	a
Bithynia tentaculata (L.)	41	24	112	17	1	2	1	1	12	16	15	10	9	2	1	2	a
B. leachii (Shep.)	14	11	65	2	2	-	-	1	2	8	10	11	7	2	-	-	a
Bithynia spp.	54	29	180	166	7	1	1	4	17	36	33	28	11	4	4	2	a
Carychium sp.	2	-	6	2	1	5	-	-	-	-	1	1	-	-	-	-	t
Physa fontinalis (L.)	-	-	2	-	-	-	-	1	-	-	-	-	-	-	-	-	a
Lymnaea truncatula (Müll.)	2	1	8	10	2	8	3	2	6	15	5	6	3	3	2	2	am
L. stagnalis (L.)	-	-	-	-	-	-	-	-	-	-	-	2	1	-	-	-	a
L. auricularia (L.)	-	1	7	-	-	-	-	-	-	1	-	1	-	-	-	-	a
L. peregra (Müll.)	2	1	5	4	-	-	1	1	2	1	1	-	-	1	-	-	a
Lymnaea sp.	-	-	4	1	-	-	1	1	2	-	1	-	-	-	-	-	a
Planorbis planorbis (L.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	a
P. carinatus (Müll.)	2	-	3	2	-	-	-	1	1	-	-	-	-	-	-	-	a
Anisus leucostoma (Mill.)	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	am
Bathyomphalus contortus (L.)	4	1	11	3	-	-	-	1	3	4	1	1	1	1	-	-	a
Gyraulus acronicus (Fér.)	1	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	a
G. albus (Müll.)	12	5	37	9	3	2	1	3	9	30	27	22	12	5	5	1	a
Armiger crista L.	3	6	23	19	2	3	-	3	7	17	19	14	9	3	2	-	a
Hippeutis complanatus (L.)	-	-	1	-	-	-	-	-	-	1	1	-	-	-	-	-	a
Ancylus fluviatilis Müll.	4	1	5	7	1	3	-	-	3	5	5	3	7	1	2	1	a
Acroloxus lacustris (L.)	-	1	-	-	-	1	-	-	-	1	-	-	-	-	-	-	a
Succinea or *Oxyloma* sp.	6	1	7	2	-	5	4	2	2	5	1	3	3	2	1	5	t
Cochlicopa sp.	2	-	1	1	-	-	-	-	-	-	-	1	1	1	-	1	t
Vertigo pusilla Müll.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	t
V. pygmaea (Drap.)	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	t
Pupilla muscorum (L.)	1	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-	d
Vallonia costata (Müll.)	-	-	1	-	1	-	-	-	1	-	-	-	-	-	-	-	d
V. pulchella (Müll.)	1	1	2	-	-	-	1	-	2	3	2	5	12	13	6	23	t
V. excentrica Sterki	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	d
Vallonia sp.	4	4	8	6	4	1	1	2	-	3	6	16	24	15	16	23	t
Punctum pygmaeum (Drap.)	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	t
Discus rotundatus (Müll.)	2	4	1	-	-	-	-	-	-	-	-	-	1	-	-	-	t
Vitrea sp.	-	-	1	-	1	-	-	-	-	1	-	-	-	-	-	-	t
Nesovitrea hammonis (Ström)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	t
Aegopinella nitidula (Drap.)	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	t
Zonitoides nitidus (Müll.)	-	-	1	-	1	-	2	-	-	-	-	-	-	-	-	-	t
Limax or *Deroceras* sp.	-	-	-	-	-	-	1	-	-	1	1	-	3	1	1	3	t
Clausilia bidentata (Ström)	-	-	2	-	-	-	-	-	-	-	-	-	-	1	-	-	t
Helicella itala (L.)	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	d
Trichia plebeia (Drap.) or *hispida* (L.)	3	4	6	4	2	3	1	6	1	2	2	1	8	2	1	5	t
Cepaea sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	t
BIVALVIA																	
Unionidae gen. et sp. indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	a
Sphaerium corneum (L.)	3	1	2	1	-	-	-	-	-	-	2	-	-	-	-	-	a
Sphaerium sp.	1	-	3	2	1	-	1	1	1	1	2	1	2	1	-	-	a
Pisidium amnicum (Müll.)	1	1	3	1	-	-	-	-	1	2	3	1	1	-	-	-	a
Pisidium spp.	15	9	73	79	13	12	4	10	27	30	23	24	11	6	5	3	a
Total	247	154	799	441	59	49	25	45	119	239	217	185	169	76	52	73	

d = dry ground, t = other terrestrial, am = amphibious, a = aquatic

Table 4.14 Mollusca (column 4) (continued)

	Minimum no. of individuals Column 4																*Habitat*
Sample (all 0.5 kg)	*16*	*15*	*14*	*13*	*12*	*11*	*10*	*9*	*8*	*7*	*6*	*5*	*4*	*3*	*2*	*1*	
GASTROPODA																	
Theodoxus fluviatilis (L.)	1	3	-	-	2	1	3	1	-	-	1	-	-	-	-	-	a
Valvata cristata Müll.	3	-	2	-	2	2	2	-	-	-	-	-	-	-	-	-	a
V. piscinalis (Müll.)	2	2	3	1	4	10	8	6	2	-	-	-	1	-	2	-	a
Bithynia tentaculata (L.)	-	1	1	-	-	1	2	1	-	-	-	-	-	-	-	-	a
B. leachii (Shep.)	1	1	-	-	1	-	1	2	-	-	-	-	-	-	-	-	a
Bithynia spp.	9	8	2	2	5	8	10	9	5	2	1	1	2	-	1	1	a
Carychium sp.	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	t
Physa fontinalis (L.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	a
Lymnaea truncatula (Müll.)	3	1	2	2	-	-	1	-	1	1	1	-	1	2	7	8	am
L. stagnalis (L.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	a
L. auricularia (L.)	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	a
L. peregra (Müll.)	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	a
Lymnaea sp.	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	a
Planorbis planorbis (L.)	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	a
P. carinatus (Müll.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	a
Anisus leucostoma (Mill.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	am
Bathyomphalus contortus (L.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	a
Gyraulus acronicus (Fér.)	1	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	a
G. albus (Müll.)	4	3	3	2	4	5	9	-	1	1	-	-	-	-	-	-	a
Armiger crista L.	1	1	-	1	13	1	3	3	-	-	-	-	-	-	-	-	a
Hippeutis complanatus (L.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	a
Ancylus fluviatilis Müll.	3	3	1	-	5	-	2	1	-	-	-	-	-	-	-	-	a
Acroloxus lacustris (L.)	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	a
Succinea or *Oxyloma* sp.	1	4	5	1	-	-	2	-	-	1	-	-	-	2	2	12	t
Cochlicopa sp.	2	1	3	7	1	2	3	6	2	1	2	1	2	-	2	-	t
Vertigo pusilla Müll.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	t
V. pygmaea (Drap.)	-	-	-	-	-	-	-	-	1	-	-	2	1	-	-	-	t
Pupilla muscorum (L.)	-	-	1	2	-	-	1	1	3	8	6	2	-	-	-	-	d
Vallonia costata (Müll.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	d
V. pulchella (Müll.)	28	6	11	14	5	13	16	30	25	21	28	33	28	7	5	7	t
V. excentrica Sterki	-	-	-	-	1	-	-	-	-	2	-	1	-	-	1	-	d
Vallonia sp.	20	16	33	34	9	17	25	26	27	24	18	26	47	9	16	14	t
Punctum pygmaeum (Drap.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	t
Discus rotundatus (Müll.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	t
Vitrea sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	t
Nesovitrea hammonis (Ström)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	t
Aegopinella nitidula (Drap.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	t
Zonitoides nitidus (Müll.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	t
Limax or *Deroceras* sp.	-	1	2	-	1	-	1	-	-	-	1	2	-	2	2	1	t
Clausilia bidentata (Ström)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	t
Helicella itala (L.)	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	d
Trichia plebeia (Drap.) or *hispida* (L.)	4	7	10	2	9	5	13	22	21	37	39	51	40	19	30	49	t
Cepaea sp.	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	t
BIVALVIA																	
Unionidae gen. et sp. indet.	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	a
Sphaerium corneum (L.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	a
Sphaerium sp.	-	-	1	1	3	1	1	1	-	-	-	-	-	-	-	-	a
Pisidium amnicum (Müll.)	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	a
Pisidium spp.	11	8	7	4	10	14	16	10	4	-	-	1	-	-	1	1	a
Total	96	68	89	74	78	81	121	121	92	99	97	120	122	41	71	94	

d = dry ground, t = other terrestrial, am = amphibious, a = aquatic

Table 4.15 Mollusca (other samples)

	Minimum no. of individuals										*Habitat*
	Column 1										
Sample (all 0.5 kg)	*3*	*2*	*1*	*21*	*7*	*6*	*9*	*8*	*11*	*10*	
GASTROPODA											
Theodoxus fluviatilis (L.)	-	3	2	-	2	2	-	2	-	-	a
Valvata cristata Müll.	7	23	-	17	22	32	6	4	-	2	a
V. piscinalis (Müll.)	5	31	7	46	95	86	11	13	-	-	a
Bithynia tentaculata (L.)	14	24	1	11	90	112	4	1	4	-	a
B. leachii (Shep.)	7	5	2	9	83	109	3	-	-	1	a
Bithynia spp.	24	109	3	26	59	179	5	10	7	2	a
Carychium sp.	7	4	1	2	1	3	3	1	-	-	t
Lymnaea truncatula (Müll.)	2	2	1	5	3	3	16	1	-	-	am
L. stagnalis (L.)	-	1	-	-	1	-	-	-	-	-	a
L. auricularia (L.)	-	2	-	1	10	8	-	-	-	-	a
L. peregra (Müll.)	3	1	-	2	3	2	-	-	-		a
Lymnaea spp.	1	1	1	1	1	3	-	-	-		a
Planorbis planorbis (L.)	-	-	-	-	-	-	1	-	-	-	a
P. carinatus (Müll.)	1	1	-	5	-	-	-	-	-	1	a
Anisus leucostoma (Mill.)	1	-	-	-	-	-	-	-	-	-	am
A. vortex (L.)	-	-	-	-	-	-	-	-	1	-	a
Bathyomphalus contortus (L.)	7	4	1	2	5	29	-	-	-	-	a
Gyraulus acronicus (Fér.)	-	-	-	-	2	-	-	-	-	-	a
G. albus (Müll.)	6	4	-	2	39	54	2	2	-	1	a
Armiger crista L.	6	9	-	5	28	33	4	8	-	-	a
Hippeutis complanatus (L.)	-	-	-	1	-	1	-	-	-	-	a
Ancylus fluviatilis Müll.	2	3	-	2	3	26	3	5	-	1	a
Acroloxus lacustris (L.)	2	-	-	-	-	1	-	-	-	-	a
Succinea or *Oxyloma* sp.	1	1	-	1	1	-	3	-	-	2	t
Cochlicopa sp.	2	4	-	-	2	1	7	8	-	3	t
Vertigo pygmaea (Drap.)	1	2	-	-	-	-	7	4	3	-	t
Vertigo sp.	1	-	-	-	-	-	-	-	-	-	t
Pupilla muscorum (L.)	1	4	-	-	-	-	2	-	6	3	d
Vallonia costata (Müll.)	-	1	-	-	1	-	12	7	1	-	d
V. pulchella (Müll.)	1	4	1	-	1	5	31	7	9	6	t
V. excentrica Sterki	1	3	1	-	1	-	-	-	5	2	d
Vallonia sp.	5	15	1	4	3	13	30	24	19	23	t
Punctum pygmaeum (Drap.)	1	-	-	-	-	-	-	-	-	-	t
Discus rotundatus (Müll.)	-	2	-	1	-	1	-	-	-	-	t
Vitrea sp.	1	1	-	-	-	-	-	-	-	-	t
Nesovitrea hammonis (Ström)	-	-	-	-	1	-	1	-	-	-	t
Aegopinella nitidula (Drap.)	-	2	-	-	-	-	1	-	-	-	t
Oxychilus cellarius (Müll.)	-	1	-	-	-	-	-	-	-	-	t
Zonitoides nitidus (Müll.)	1	1	-	1	-	-	-	-	1	-	t
Limax or *Deroceras* sp.	-	1	-	-	-	-	1	2	-	2	t
Cochlodina laminata (Mont.)	-	-	-	-	1	-	-	-	-	-	t
Clausilia bidentata (Ström)	-	-	-	-	-	1	-	-	-	-	t
Helicella itala (L.)	-	-	-	-	-	-	-	-	1	-	d
Trichia plebeia (Drap.) or *hispida* (L.)	8	10	1	1	2	9	40	11	11	39	t
Arianta arbustorum (L.)	-	-	-	-	-	-	-	-	-	-	t
Cepaea sp.	-	-	-	-	-	-	-	-	-	-	t
Arianta arbustorum (L.) or *Cepaea* sp.	1	-	-	-	-	-	-	-	-	-	t
BIVALVIA											
Unio sp.	-	-	-	-	-	-	-	-	-	-	a
Anodonta or *Pseudanodonta* sp.	-	-	-	-	-	-	-	-	-	-	a
Unionidae gen. et sp. indet.	-	-	-	-	-	-	-	-	-	1	a
Sphaerium corneum (L.)	2	1	-	-	-	-	-	-	-	-	a
Sphaerium sp.	-	3	-	1	1	1	-	-	-	-	a
Pisidium amnicum (Müll.)	1	2	2	4	1	1	1	-	-	-	a
Pisidium spp.	10	20	2	14	26	61	3	6	2	1	a
Total	133	305	27	164	488	776	197	116	70	90	

d = dry ground, t = other terrestrial, am = amphibious, a = aquatic

Table 4.16 Waterlogged seeds from sample 60

		Number of seeds
	Sample (0.25 kg)	*60*
Epilobium sp.	willowherb	10
Berula erecta (Huds.) Cov.	water parsnip	3
Pedicularis palustris L.	red rattle	1
Lycopus europaeus L.	gipsywort	1
Galium sp.	bedstraw	2
Carex spp.	sedge	6

indicated in Table 4.12. Not all the Coleoptera have been classified into categories. It was necessary to combine the results from column 4 samples 32 to 31 and column 4 samples 30 to 28 to give large enough totals of terrestrial Coleoptera.

Mollusca

The molluscan results from column 4 are displayed in Figure 4.6 according to habitat groups as indicated in Tables 4.14–15. They follow the groups used in Thomas *et al.* (1986, 179–81) with the addition of an amphibious group of *Lymnaea truncatula* and *Anisus leucostoma*. These two species were almost entirely absent from the original sequence and had been included in the aquatic group.

The taphonomy of the macroscopic plant and invertebrate remains

The waterlogged samples

The waterlogged sediments at the bottom of column 4 (samples 32 to 27), column 1 (samples 3 to 1) and sample 21 (trench XXIV contexts 2404/5–2405) all accumulated underwater in a palaeochannel of the

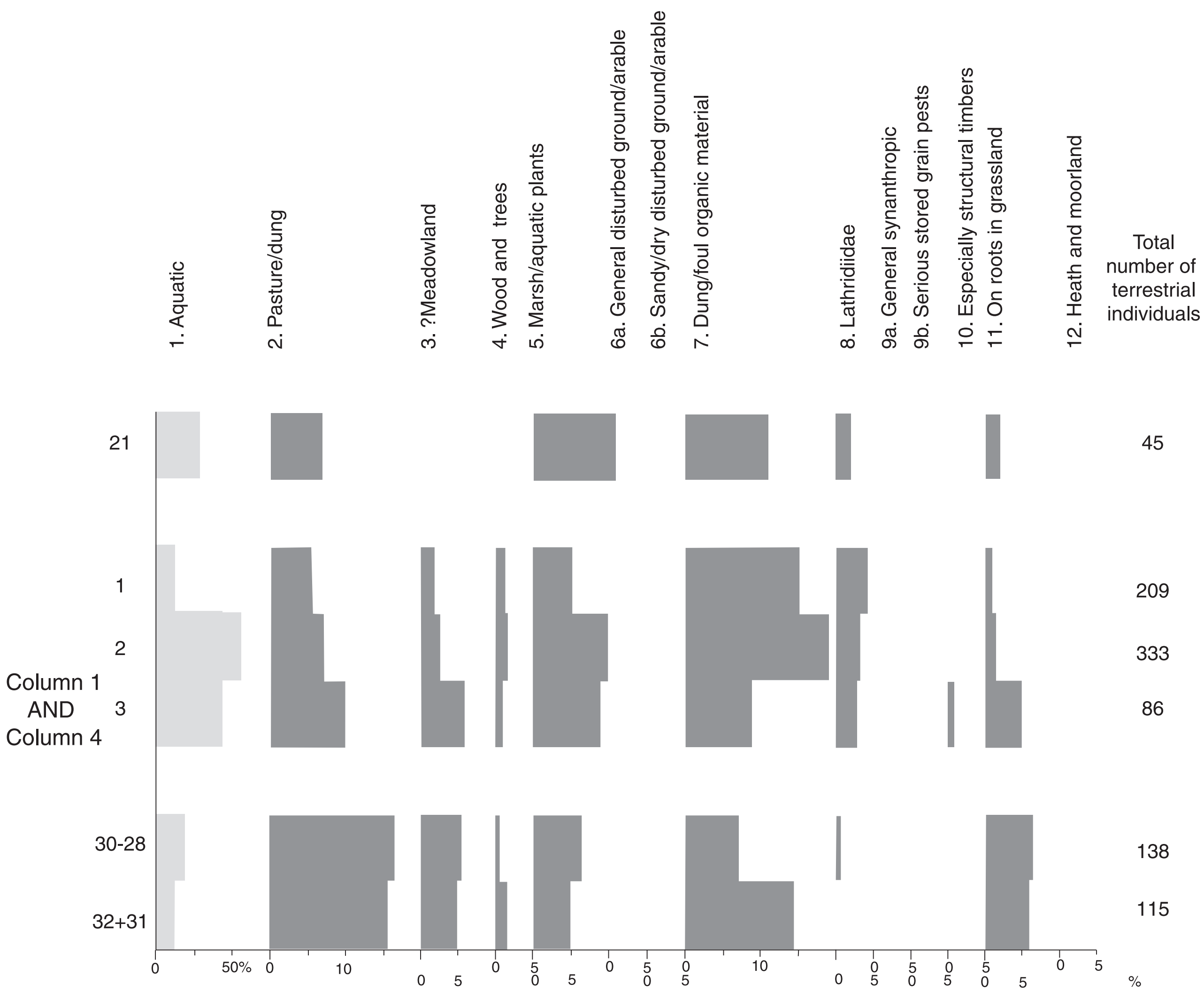


Figure 4.5 Species groups of Coleoptera from Whitecross Farm

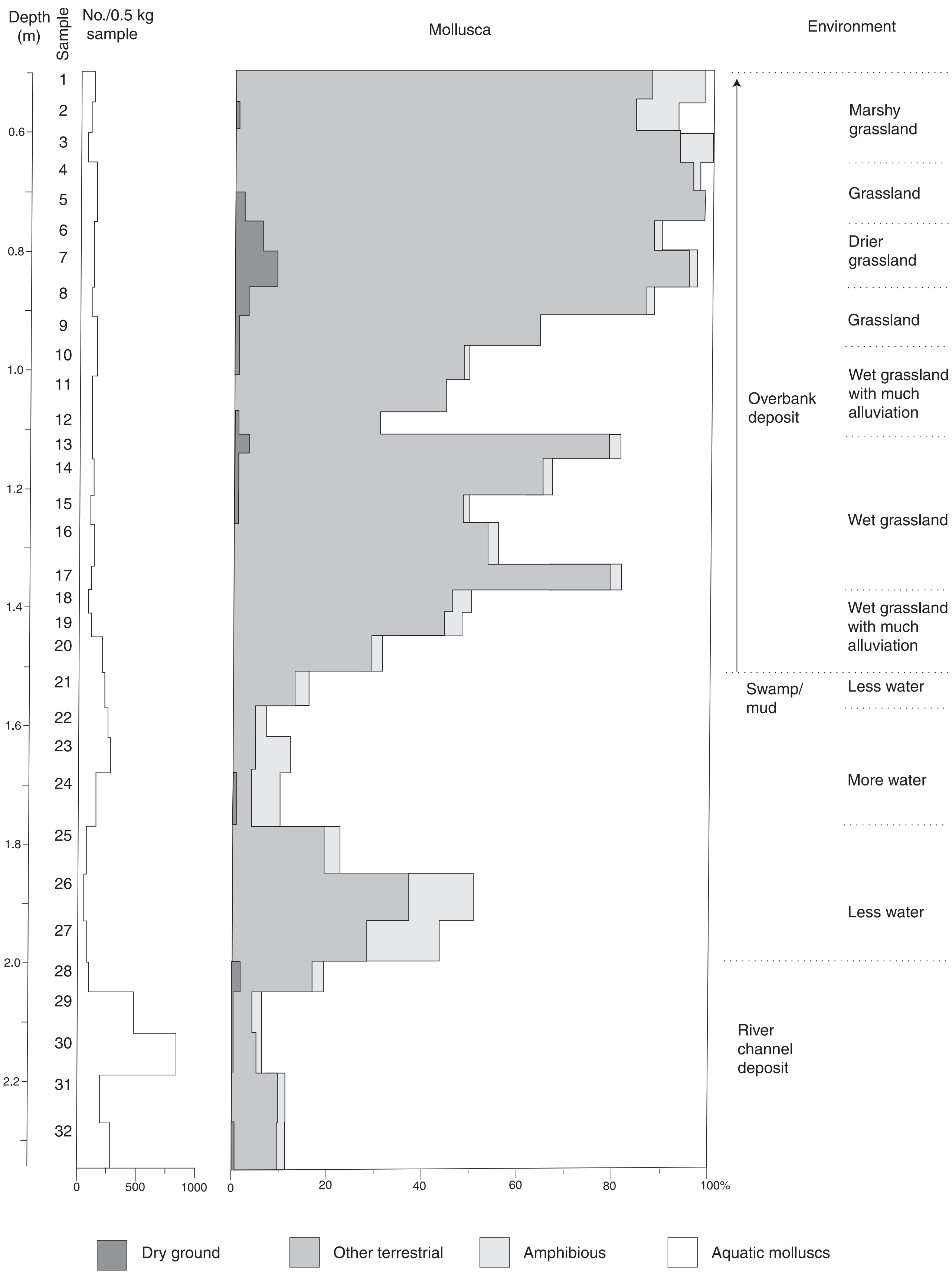


Figure 4.6 Molluscan sample column from trench XXIV and summary of results

Thames which at least seasonally carried a significant flow of water. Seeds of aquatic plants, fragments of aquatic insects and shells of aquatic molluscs occurred in all these samples. Although almost all of them could have come from organisms that lived in the channel at the place of deposition, presumably the majority had been carried some distance by the river before incorporation into the sediments.

The non-aquatic component of the samples included items which had entered the river through various natural agencies from the surrounding landscape, for example insects which flew into the water and seeds which had been carried by the wind etc., as well as material which had been dumped in the channel by humans. The former category was a major part of all the samples. Dumped material was certainly present in column 4 samples 32–30, throughout column 1 and in sample 21. A little wood charcoal was also present in column 4 sample 29.

The terrestrial remains which entered the river through natural agencies would have been derived from a strip of land extending upstream on either side of the river. The samples of column 1 from the banks of the island would have had a higher proportion of remains from the island itself than column 4, which was further away from the bank. The same considerations made for the plant and invertebrate remains from the palaeochannel sediments at Runnymede (Evans 1991, 365) are probably also applicable to Whitecross Farm, Wallingford. They were that shells of land snails, seeds, remains of terrestrial insects and pollen had been derived from progressively larger catchments. Of the order of 50% of the terrestrial remains which reached the site at Runnymede by natural processes were seen as having had their origin in a zone extending, for some considerable distance in some instances, either side of the river and upstream (Table 4.17).

The dumped material included the remains of crops, which had been brought to the site for processing or consumption, wood brought for structural purposes and bracken. Some of this material was burnt before dumping while other material was left as accumulations of decaying plant debris before dumping, thereby gaining a decomposer fauna of insects.

Table 4.17 Runnymede Bridge: catchment areas for different types of environmental data

	Distance either side of the river	*Distance upstream*
Molluscs	2 m	0.2 km
Waterlogged seeds	10 m	0.5 km
Insects	50 m	0.5 km
Pollen	100 m	2 km

Sample 60 (context 60) was from a localised area of fen peat that had formed in the top of the palaeochannel beyond the main area of excavation after substantial sedimentation had already occurred in the channel. The organic material in it was dominated by remains of the fen vegetation itself.

The preservation of remains in most of the waterlogged samples was good for calcareous sediments, which was probably a reflection of rapid sedimentation and permanent waterlogging. Although some of the mollusc shells were fragile, there was not a high ratio of *Bithynia* opercula to shells, which occurs with severe leaching. Some organic remains that might have been expected to survive in column 4 sample 27 and sample 60 had, however, been lost. The absence of mollusc shells from sample 60 was also probably due to preservational conditions.

The non-waterlogged molluscan samples

The sediments of the upper part of column 4 (samples 26 to 1, context 2405/4), samples 11 and 10 (context 2403/1) all accumulated on swamp or floodplain surfaces which were experiencing alluviation from the Thames. These samples contained shells of flowing-water molluscs which had certainly been deposited with the alluvial sediment, shells of other aquatic molluscs which could either have been transported by the river or have been living *in situ* during episodes of submergence, and shells of terrestrial snails which mostly represented the *in situ* fauna when the surface was above water.

Samples 6 and 7 (see Fig. 2.3) were from the channel sediments which comprise the island itself. They were mostly aquatic species from the river with only a few terrestrial individuals which had fallen or been washed in. Samples 8 and 9 (context 2413) were from a ditch which cut the island (see Fig. 2.3). In addition to molluscs from the three categories described for the upper part of column 4, there also appeared to have been significant numbers of shells reworked from the sediments of the island.

The preservation of shells in these samples was mostly good other than that many shells of aquatic species had been fragmented.

The samples for charred plant remains from non-waterlogged sediments

Samples 5, 51, 52 and 92–5 were all from sediments which had accumulated at or just above the water level around the bank of the island. The charred plant remains in them represented material which had been brought to the island and then burnt. Subsequently the burnt debris was dumped at the edge of the channels. It is likely that chaff and small weed seeds were more vulnerable to complete combustion than the cereal grain and wood. This bias seems to have been exaggerated in all except samples 5 and 51 by the effects of repeated wetting and drying causing degradation. Samples 5 and 51 were from wetter deposits and the charred remains from them showed the same good preservation as those from the waterlogged samples.

The origin of the island

The mid-channel bar

When the initial work was undertaken on the alluvial sequence in the modern Thames bank at Wallingford (Thomas *et al.* 1986, 178–84), it was not realised that the site had been an island in the River Thames. It was assumed that the coarse basal sediments of the exposure were channel deposits of a side bar forming by lateral accretion. The current excavation showed these sediments to have been a mid-channel bar, with a palaeochannel to the west in addition to the modern navigation channel to the east (see Fig. 2.1). The bar sediments were sampled again in the cut-back section of feature 2413, a ditch in the centre of the island (see Fig. 2.3). Sample 7 was similar to the lowest sediments of the original column at 1.47–1.58 m, while sample 6 was perhaps the equivalent of 1.23–1.33 m in the original column. The sediments again showed fining upwards from sandy gravel to a sandy loam. The molluscan assemblages from them were likewise dominated by flowing-water aquatic species, particularly *Valvata piscinalis*, *Bithynia tentaculata*, *B. leachii* and *Gyraulus albus*. The last two species seem more characteristic of channel-bed deposits than overbank alluvial sediments, although they were by no means absent from the overbank sediments on the site. The occurrence of open-country species of terrestrial molluscs such as *Vallonia* sp. in combination with the woodland mollusc *Discus rotundatus* would suggest that the mid-channel bar was Neolithic or more recent in origin. *D. rotundatus* was absent from Britain in the very early Flandrian, when open habitats were still widespread, and during the mid Flandrian the catchment was largely wooded. The formation of the mid-channel bar would have occurred during a period of peak discharge by the river. High-energy events which caused major changes to the channel pattern of the Upper Thames seem to have been relatively rare during the Flandrian, when the usual regime of the river was one of low-energy channel silting and simplification (Robinson and Lambrick 1984).

Subsequently the bar received fine overbank alluviation of clay loam which raised the level of the island by about 0.25 m and upon which a soil developed (Thomas *et al.* 1986, 178–84). The duration of flood episodes then decreased allowing dry-ground open-country species of mollusc to become established. They comprised around 23% of the total shells from the late Bronze Age soil.

The early ditch

A ditch (feature 2413) which cut the sediments of the island was found beneath the late Bronze Age soil (see Fig. 2.3). The majority of the molluscs from it (samples 9 and 8) were terrestrial species, with about 6% of them being dry-ground open-country species, particularly *Vallonia costata*. While the proportion of dry-ground molluscs was not as high as from the late Bronze Age soil, this was probably the results of many of the shells being derived from the alluvial sediments cut by the ditch. These results suggested that relatively dry open conditions prevailed on the island before the late Bronze Age occupation.

The extent of the island in the late Bronze Age

The western edge of the island was defined by the palaeochannel with the late Bronze Age revetment trench along its bank. Recent erosion of the modern riverbank had truncated the eastern side of the island, but in one place where the erosion was less severe, an apparent soil horizon could be detected within the alluvial sediments sloping at about 30° down towards the river (see Fig. 2.2). Molluscan analysis of this soil (sample 11) showed that dry-ground open-country terrestrial species, particularly *Pupilla muscorum* and *Vallonia excentrica*, comprised 16% of the shells, with other terrestrial species making up a further 53% of the total. The only part of the original sequence investigated in the modern Thames bank to have such a high proportion of terrestrial snails (apart from the modern topsoil) was the late Bronze Age soil. It seems reasonable to assume that this horizon represented the eastern bank of the island. This would make the island about 18 m wide at its greatest extent. Trial trenching showed the island to have been about 170 m in length. Such dimensions are not atypical for the eyots of the River Thames.

The late Bronze Age aquatic and waterside environment

The fauna and flora of the palaeochannel

The aquatic insects and molluscs from the waterlogged late Bronze Age sediments of column 4 (samples 32 to 28), column 1 (samples 3 to 1) and sample 21 comprised a rich fauna of a well-oxygenated mesotrophic lowland river in all its aspects. These ranged from lengths with rapidly flowing water over a strong bed, and from areas of open water in the centre of the channel, through to densely vegetated marginal reedswamp. Around 90% of the shells were from aquatic molluscs. About a third of the Coleoptera (beetles) were water beetles, and the great majority of the other insect remains were the aquatic larvae of Trichoptera (caddis flies).

The molluscan assemblages comprised typical clean-water riverine faunas, with many specimens of *Theodoxus fluviatilis*, *Valvata piscinalis*, *Bithynia tentaculata*, *B. leachii* and *Gyraulus albus*. Species that can live in stagnant water were present, as is usual with flowing-water faunas, but there were not the large numbers of those Lymnaeidae and Planorbidae which would have flourished if the palaeochannel had been cut off from the river each summer. Variation within the habitats of the river was, for example, shown by the occurrence of both *Sphaerium corneum*, a bivalve which lives in a silt bed below clean water, and *Ancylus fluviatilis*, a freshwater limpet that lives attached to stones in quick-moving water where the turbulence of the current is sufficient to keep the stones clean (Boycott 1936, 141–2). Many of the gastropods from these samples cling to aquatic plants but *Armiger crista* is particularly well known from this habitat.

The aquatic molluscs were all species which can still be found in the modern channel of the Thames. The aquatic Coleoptera, in contrast, included some species from the family Elmidae which are now of very restricted distribution in the Thames or are entirely absent from the drainage basin. They require very clean well-oxygenated running water. They are well adapted to a strong current of the water, clinging to stones, submerged wood and aquatic plants. The smaller species such as *Esolus parallelepipedus* and *Oulimnius* sp. are now confined to weir outflows and the faster-flowing tributaries of the Thames. The two large species *Macronychus quadrituberculatus* and *Stenelmis canaliculata* are so fastidious in their need for large bodies of clean water that they can now only be found in Britain in the upper reaches of a few rivers and a single northern lake. Other water beetles from the site that no longer occur in the Thames include *Helichus substriatus*. All these species have been recorded from palaeochannel sediments of Neolithic date upstream at Buscot Lock (Robinson and Wilson 1987, 31) and downstream in Neolithic and Bronze Age sediments of the Middle Thames at Runnymede Bridge (Robinson 1991, 316–17) and Dorney (Robinson in prep. a). As was argued for Runnymede, such a fauna probably occurred throughout much of the length of the Thames while it remained in an unpolluted unmanaged state and its water only carried a low silt level.

The remaining aquatic Coleoptera mostly comprised a balanced riverine fauna of Dytiscidae, Gyrinidae, Hydrophilidae and Hydraenidae. Only sample 2 of the bankside samples of column 1 gave evidence for slower-moving shallower water than the samples from column 1 which was more distant from the bank. Sample 2 of column 1 had a higher proportion of Hydraenidae, particularly *Ochthebius minimus* than the other samples. *O. minimus* is a beetle which most usually occurs in stagnant water and marshes although it does occur in running water (Balfour-Browne 1958, 160). It is possible that it was associated with the refuse which had been dumped into the channel. The flowing-water caddis larva *Ithytrichia* sp., however, greatly outnumbered the stagnant- or slowly flowing-water caddis larva *Orthotrichia* sp., as it did in all the waterlogged samples.

Around 8.5% of the non-aquatic Coleoptera were species which feed on marsh and aquatic plants. Some of the more host-specific species included are summarised in Table 4.18.

Seeds of all these plants except *P. australis* were identified from the samples. The full range of seeds suggested a rich aquatic flora. The submerged flora included *Ranunculus* S. *Batrachium* sp. (water crowfoot), *Myriophyllum* sp. (water milfoil) and *Zannichellia palustris* (horned pondweed) along with the alga *Chara* sp. (stonewort). Both white and yellow water lilies (*Nymphaea alba* and *Nuphar lutea*) were members of the floating-leaved community along with *Potamogeton* spp. (pondweed). There was also a slight presence of *Lemna* sp. (duckweed). The occurrence of *N. alba* and *Lemna* sp. could imply lengths of the river or at least sheltered bays which experienced little current during the summer.

On the basis both of seed numbers and the evidence of the phytophagous Coleoptera, *Schoenoplectus lacustris* (bulrush) was the dominant plant of the reedswamp which fringed the river along with *Alisma* sp. (water plantain) and *Mentha* cf. *aquatica* (water mint) in shallow water alongside the bank. Among the *S. lacustris* probably grew *Veronica* Sect. *Beccabunga* sp. (water speedwell) and *Oenanthe aquatica* gp (water dropwort) with occasional clumps of *Rumex hydrolapathum* (great water dock) and *Iris pseudacorus* (yellow flag).

There were some chronological changes in the aquatic flora as shown by the seeds, for example a very substantial decline in *Zannichellia palustris* in column 4 above sample 32, but the reasons are unknown. There was a lower proportion of seeds of

Table 4.18 Non-aquatic host-specific Coleoptera

Macroplea appendiculata **on:**	*Potamogeton* (pondweed) and *Myriophyllum* (water milfoil) spp.
Donacia clavipes	*Phragmites australis* (common reed)
D. dentata	*Sagittaria sagittifolia* (arrowhead) and *Alisma* sp. (water plantain)
D. impressa	*Schoenoplectus lacustris* (bulrush)
D. versicolorea	*Potamogeton* spp. (pondweed)
Plateumaris affinis	*Carex spp.* (sedge)
Prasocuris phellandrii	aquatic Umbelliferae (water dropwort etc.)
Aphthona nonstriata	*Iris pseudacorus* (yellow flag)
Tanysphyrus lemnae	*Lemna* spp. (duckweed)

Schoenoplectus lacustris from column 1 than from column 4. It is possible that the tall reedswamp community was absent from the bank of the island in the vicinity of the timber structure.

The plant and insect evidence suggested a relatively abrupt transition from aquatic to terrestrial habitats without any extensive marsh in between. The Coleoptera included various Carabidae which are favoured by bankside habitats such as *Bembidion gilvipes*, *B. assimile* and *Agonum marginatum*. One of those beetles, *Drypta dentata*, is now only known in Britain from a few coastal localities but it occurs inland, for example on swampy banks and under *Phragmites* (reed) debris in central Europe (Koch 1989, 106; Lindroth 1974, 133). *Myosoton aquaticum* (water chickweed) seeds suggested this plant grew on areas of freshly exposed sediment. *Brassica rapa* ssp. *sylvestris* (wild turnip) probably colonised drier areas of eroding riverbank. There were seeds from a wide range of plants from the more permanent bankside vegetation and these have been summarised in Table 4.19.

The phytophagous beetle *Grypus equiseti* adds *Equisetum* sp. (horsetail) to the list. *Verbena officinalis* is of interest because archaeological records from prehistoric sites such as Runnymede (Greig 1991, 236) are beginning to suggest that riverbanks were formerly an important habitat for this plant. One of the samples from column 1 (sample 1) contained very high numbers of seeds of *U. dioica* and doubtless the activity on the island had favoured the colonisation of its bank by nettles.

The occurrence of a few seeds and driftwood fragments of *Alnus glutinosa* (alder) in most of the samples would suggest that this tree grew along the riverbank. However, given the prolific seed production of alder and the abundance with which its seeds occur in riverine sediments formed against a background of alder woodland, these results would be consistent with a few isolated trees surviving on the bank rather than the dense alder woodland of earlier periods. Some of the other remains of woody plants, for example small-diameter branch-wood of *Prunus* sp. (sloe etc.) and Pomoideae (hawthorn tp.) plus *Prunus/Crataegus* tp. thorns, were also probably from bankside vegetation. Some of the non-structural cut wood could have been derived from chopping back such scrub.

Coleoptera that feed on a wide range of foul organic material (species group 7) were present in all the waterlogged samples. These beetles, particularly from the genera *Cercyon*, *Megasternum* and *Anotylus*, mostly comprised between 7 and 15% of the terrestrial Coleoptera in the samples or groups of samples (see Table 4.12). This is the range of values that might be expected independently of human activity, from naturally occurring accumulations of decaying plant debris along the edge of the river (Robinson 1991, 280). Samples 2 and 1, however, both had values above 15% for species group 7. They also contained high numbers of another beetle, *Oxytelus sculptus*, which tends to be favoured by manure heaps (eg Kenward and Hall 1997, 669). Puparia of *Musca domestica* (housefly) were present. An indication that some of this refuse had been dumped on the riverbank and had begun to develop its own insect fauna as it became submerged was given by numerous examples of *Carpelimus bilineatus*, which occurs in very wet decaying organic material especially on bankside mud.

Sedimentation in the palaeochannel and the late Bronze Age hydrology

By analogy with the results emerging from a palaeochannel at Yarnton, Oxfordshire (Robinson in prep. b), the Wallingford palaeochannel need not necessarily have been continuously active since the creation of the island, but the biological evidence noted above shows it certainly to have been active during the late Bronze Age. The earliest sediments in the palaeochannel (column 4 sample 32 and column 1 sample 3) both contained flax and cereal remains which suggested that they post-dated the foundation of the settlement on the island. It is very likely that the construction of the timber waterfront structures initiated sedimentation, which continued under flowing channel conditions throughout the period of late Bronze Age activity on the site.

The preservation of the joint (notched end) at the top of one of the large oak uprights of the possible jetty for a horizontal timber (possibly facilitated by a slight post-Bronze Age rise in the permanent water table) would suggest a summer depth of water in the channel of no more than 0.25 m. It was difficult to establish whether the island suffered flooding during the period of its occupation (Thomas *et al.* 1986, 182–3). The dry-ground species of mollusc from the Bronze Age soil horizon on the island (0.75–0.86 m and sample 10) including *Pupilla muscorum*, *Vallonia costata*, *V. excentrica* and *Helicella itala* would not be able to tolerate long periods of submergence. However, the topography of the island was such that flood waters would drain immediately once the river level fell. It was noted

Table 4.19 Plants indicative of more permanent bankside vegetation

Thalictrum flavum (meadow rue)	*Solanum dulcamara* (woody nightshade)
Lychnis flos-cuculi (ragged robin)	*Verbena officinalis* (vervain)
Filipendula ulmaria (meadowsweet)	*Lycopus europaeus* (gipsy wort)
Urtica dioica (stinging nettle)	*Galium* sp. (bedstraw)

that there was some similarity between the faunas of the Bronze Age soil and the modern gravel surface adjacent to the riverbank, which occasionally experiences brief flooding. Alternatively, flooding could have ceased entirely during the period of occupation, the shells of aquatic molluscs in the soil being the result of Bronze Age reworking of earlier sediments.

The wider late Bronze Age terrestrial environment

Woodland and scrub

Wood- and tree-dependent beetles comprised 2% of the terrestrial Coleoptera from the waterlogged late Bronze Age sediments of column 4 (samples 32 to 28), column 1 (samples 3 to 1) and sample 21. This would suggest that the landscape of the catchment was largely open although there would have been some scrub, hedges or limited areas of woodland. In this aspect the insect results were very similar to those from the late Bronze Age phase at Runnymede. Some of the more host-specific species are summarised in Table 4.20.

The occurrence of remains of *Alnus glutinosa* (alder) has already been mentioned. Other trees and shrubs represented by seeds and in some cases also by wood are summarised in Table 4.21.

There were also a few seeds of woodland herbs including *Silene dioica* (red campion), *Moehringia trinervia* (three-nerved sandwort) and *Mercurialis perennis* (dog's mercury). Many of the terrestrial insects can occur in woodland but few are indicative of it. The pentatomid bug *Pentatoma rufipes* shows an association with trees, especially oak. However, the woodland carabid *Patrobus atrorufus* was perhaps living in cleared habitats as occurred at Runnymede during the late Bronze Age (Robinson 1991, 322).

While the insects and plants certainly did not include a full woodland fauna and flora, it is possible that some were relicts which had survived clearance of more extensive woodland. *M. perennis* tends to be regarded as an old woodland plant (Pollard 1973) and *Acer campestre* is not an early colonist of scrub (Jones 1944–5, 241–3). Any woodland that remained had perhaps been substantially modified by management. Some of the oak piles of the possible jetty were 30–35 years old at felling and had an average annual ring width of 2.8 mm (see Taylor *et al*., below). This would suggest rapid growth under well-illuminated conditions as occurs when trees regenerate after felling and grazing animals are excluded. Cut hazel rods from the palaeochannel (see Taylor *et al*., below) had perhaps been derived from coppice woodland. The woodland from which these structural timbers were obtained need not have been within the catchment of the remains, which reached the site through natural agencies, but there was also insect evidence for oak and hazel.

In addition, the remains suggested the occurrence of mixed thorn scrub. This could have been around the edge of any surviving areas of woodland, in the form of hedges, on undergrazed pasture and, as had already been suggested, in places along the riverbank. Species such as *Rhamnus catharticus* are able to withstand grazing pressure better than woodland trees and shrubs but are light-demanding so become shaded out if the scrub develops into woodland.

Grassland and the open landscape

The late Bronze Age landscape which comprised the catchment for the macroscopic plant and invertebrate remains was largely open. Chafer and elaterid beetles of species group 11, which have larvae that feed on roots in grassland, made up over 6% of the terrestrial Coleoptera from column 4. This would suggest a substantial presence of permanent grassland (Robinson 1991, 281). The most numerous of these was *Phyllopertha horticola*, but *Agrypnus murinus* was also well represented, which would suggest well-aerated rather than gleyed soil. This is in agreement with the evidence for a relatively sharp transition from riverine to terrestrial habitats along the riverbank.

Table 4.20 Wood- and tree-dependent host-specific Coleoptera

Anthonomus cf. pedicularius **on:**	*Crataegus* sp. (hawthorn) leaves
Curculio cf. *nucum*	*Corylus avellana* (hazel) nuts
Scolytus intricatus	mainly *Quercus* sp. (oak) under bark
Leperisinus varius	mainly *Fraxinus excelsior* (ash) under bark

Table 4.21 Summary of trees and shrubs represented by seeds or wood

Cornus sanguinea (dogwood)	*Rhamnus catharticus* (purging buckthorn)
Corylus avellana (hazel)	*Crataegus* cf. *monogyna* (hawthorn)
Quercus sp. (oak)	*Prunus spinosa* (sloe)
Acer campestre (field maple)	*Sambucus nigra* (elder)

Scarabaeoid dung beetles of species group 2, which feed on the droppings of larger herbivores under pastureland conditions, comprised over 16% of the terrestrial Coleoptera from column 4. This is sufficient to imply that much of this grassland was being grazed by domestic animals (Robinson 1991, 271). The most numerous species were *Aphodius* cf. *sphacelatus* followed by *Onthophagus ovatus*. There was, however, a single example of *A. varians*, a dung beetle now extinct in Britain. *A. varians* was also identified from the late Bronze Age deposits at Runnymede and has been recorded from a few other prehistoric sites (Robinson 1991, 323; unpubl. info.).

Clover- and vetch-feeding weevils of the genera *Apion* and *Sitona* (species group 3) comprised 6% of the terrestrial Coleoptera. This value is rather high for pastureland (Robinson 1991, 280) and was possibly a reflection of the vegetation being ungrazed on the steeper parts of the riverbank. Both the phytophagous Coleoptera and the seeds suggested the grassland to have been very herb-rich. There were several species of weevil associated with grassland herbs whose seeds rarely survive in waterlogged deposits including *Ceuthorhynchidius troglodytes*, *Mecinus pyraster*, *Gymnetron labile* and *G. pascuorum,* which feed on *Plantago lanceolata* (ribwort plantain), and in one instance *P. media* (hoary plantain) as well.

Seeds of potential grassland plants are summarised in Table 4.22. Taken together, they would make up a community of relatively well-drained circumneutral to calcareous soil. *Sanguisorba minor*, the most calcicolous of these plants, was present in three of the five late Bronze Age samples from column 4. It is now best known in the Upper Thames Valley from chalk and limestone soils but is also present in some of the few fields of unimproved pasture that survive on the First Gravel Terrace of the Thames. *Rumex conglomeratus*, which was well represented in all these samples, tends to be favoured by grazing but is also a woodland-edge and hedgerow plant. The occurrence of seeds of *Leucanthemum vulgare* in three of the samples emphasises the insect evidence that some of the grassland was only lightly grazed. It is a plant which is most typical of hay meadows. However, a full hay-meadow flora was absent.

A large proportion of the remaining terrestrial insects were species common to grassland habitats. The bugs *Aphrodes* sp. including *A. bicinctus* feed on grasses. The small chrysomelid beetles *Longitarsus* spp. include many species which feed on grassland herbs. Carabid beetles such as *Calathus fuscipes* and some of the staphylinid beetles such as *Xantholinus linearis* or *longiventris* readily occur in grassland. The terrestrial molluscs from the waterlogged samples of column 4 were mostly open-country species which would be appropriate to grassland.

Arable and disturbed grassland

Insects are not very reliable for the detection of arable land within the catchment. However, the carabid beetles of species groups 6a and 6b, which tend to be favoured by arable and other disturbed-ground habitats, were entirely absent from column 4. Some of the phytophagous Coleoptera can feed on arable weeds, for example *Chaetocnema concinna* on *Polygonum aviculare* (knotgrass), but none is exclusive to arable weeds. Weevils of the subfamily Ceuthorhynchinae which tend to feed on cruciferous weeds were rare. The waterlogged seeds from column 4 included some from plants that can grow as arable weeds, but they could also have been derived from the settlement and naturally occurring bankside habitats.

Both the charred and the waterlogged plants included arable crop remains that had been brought to the site. The charred seeds were probably mostly from weeds which had been growing among the crops. The most numerous of these were the seeds of the annual weeds *Chenopodium album* (fat hen) and *Bromus* S. *Eubromus* sp. (brome grass). The former is a nitrophilous weed; the latter is a subgenus of large seeded grasses, one species of which, *B. secalinus* (chess), was once a common arable weed because it was difficult to clean its seeds from seedcorn. The charred weed seeds do not give sufficient evidence of soil type to enable the location of the arable fields to be determined, but they would be appropriate to the circumneutral soils of the gravel terraces of the Upper Thames. The occurrence of a significant number of seeds of grassland plants in sample 5 – including *Linum catharticum* (fairy flax), cf. *Trifolium* sp. (clover), *Prunella vulgaris* (selfheal) and *Plantago media* or *lanceolata* – might suggest that arable agriculture was impinging on grassland.

Waterlogged seeds of plants of various wayside and ruderal habitats such as *Rumex* spp. (dock) and *Urtica dioica* (stinging nettle) were present in column 4 along with annual weeds of more frequently disturbed ground such as *Stellaria media* gp (chickweed), *Chenopodium album* (fat hen) and

Table 4.22 Seeds of potential grassland plants

Ranunculus cf. *acris* (meadow buttercup)	*Potentilla reptans* (creeping cinquefoil)
R. cf. *repens* (creeping buttercup)	*Sanguisorba minor* (salad burnet)
R. cf. *bulbosus* (bulbous buttercup)	*Rumex conglomeratus* (sharp dock)
Stellaria graminea (stitchwort)	*Leucanthemum vulgare* (ox-eye daisy)
Linum catharticum (fairy flax)	*Leontodon* sp. (hawkbit)

Atriplex sp. (orache). They probably had their origin in the bankside habitats already mentioned, at the edge of scrub and from the settlement itself.

Other aspects of the landscape

The only other major aspect of the late Bronze Age landscape for which there was evidence was bracken-covered light acidic soil, as indicated by the frond fragments of *Pteridium aquilinum* (bracken) which had been imported to the settlement. The lack of a significant presence of other species characteristic of acid ground would suggest that the source of the bracken was beyond the catchment of the remains that did not experience human transport.

Conditions and activities on the island in the late Bronze Age

The vegetation of the island

The molluscan evidence from the late Bronze Age occupation horizon suggests that the island supported dry short-turfed grassland with bare patches created by trampling (Thomas *et al.* 1986, 182). Those Coleoptera that have larvae that feed on the roots of grassland plants (species group 11) and the scarabaeoid dung beetles of pastureland (species group 2) were less than half as abundant from the waterlogged samples from the edge of the island (column 1 samples 3 to 2, sample 21) as from column 4 (see Fig. 4.5). This tends to suggest that the grazed grassland was mostly an aspect of the surrounding landscape rather than of the island itself.

The waterlogged samples from the edge of the island, however, had a higher proportion of seeds from plants of disturbed and waste ground than the samples from column 4. They presumably reflected the weeds growing on the less heavily trampled parts of the island. Seeds of the nitrophile *Chenopodium album* (fat hen) were particularly abundant although seeds of two other plants of middens, *Hyoscyamus niger* (henbane) and *Solanum nigrum* (black nightshade), were not nearly so numerous. Other seeds of annual weeds included *Stellaria media* gp (chickweed), *Polygonum persicaria* (red shank) and *P. lapathifolium* (pale persicaria). Taken together the seeds suggest a community of the Polygono-Chenopodietalia, an order of weeds of root crops, spring-sown cereals and nitrogen-rich disturbed ground that occur around settlements (Silverside 1977, 240–1).

On the parts of the island that experienced less disturbance, the vegetation probably graded into a community dominated by *Urtica dioica* (stinging nettle) and other tall-growing coarse herbs. Interestingly, there were also a couple of early records of *Conium maculatum* (hemlock), which does not become widespread in the region until the Roman period. Phytophagous insects of such vegetation from column 1 and sample 21 are summarised in Table 4.23.

Seeds of *Alnus glutinosa* (alder) were almost absent from the samples from the edge of the island. There were, however, remains of *Rubus fruticosus* agg. (blackberry), *Crataegus* cf. *monogyna* (hawthorn) and *Prunus spinosa* (sloe), so it is possible there was some thorny scrub on the island and around its edge.

Decaying organic material and buildings

As has already been noted, the insect evidence suggested that foul organic refuse had been dumped on the riverbank of the island. This could have included manure, debris from animal byres and crop-processing waste. Beetles from the family Lathridiidae such as *Lathridius minutus* gp and *Corticaria punctulata* (species group 8) were better represented in the samples from the edge of the island than from column 4. These beetles are mould-feeders which are favoured by old damp hay, thatch and stable litter.

The insects gave plenty of evidence for accumulations of organic debris as commonly occur around settlements, but they gave no evidence for the presence of buildings. General synanthropic beetles – which tend to live in indoor habitats (species group 9a), such as members of the Ptinidae – were entirely absent. There was only a single specimen of *Anobium punctatum* (woodworm beetle). This beetle, which is the most important member of species group 10, proliferates in structural timber. It seems likely that the organic refuse did not have its origin inside buildings, and any houses on the island were situated some little distance beyond the excavated area, perhaps on the northern part.

Crops and crop-processing

Several of the waterlogged samples contained a few glumes of hulled wheat including both *Triticum dicoccum* (emmer wheat) and *T. spelta* (spelt wheat). Much higher concentrations of charred cereal

Table 4.23 Phytophagous insects of perennial waste ground vegetation from column 1 and sample 21

Pria dulcamara **on:**	*Solanum dulcamara* (woody nightshade)
Apion aeneum	*Malvaceae* (mallows)
Brachypterus urticae	*Urtica dioica* (stinging nettle)
Cidnorhinus quadrimaculatus	*Urtica dioica* (stinging nettle)
Heterogaster urticae	*Urtica dioica* (stinging nettle)

remains were found in one of the waterlogged samples from the edge of the island (column 1 sample 1), and an associated deposit of charcoal on the bank of the palaeochannel (sample 5). Although the charcoal deposit appeared to represent burnt structural timber, the charred cereal remains from both samples had the character of crop-processing debris rather than a stored crop. There was slightly less chaff than grain and a similar quantity of weed seeds to chaff. Barley, including hulled *Hordeum vulgare* (hulled six-row barley), outnumbered wheat among the identified grain from these samples. In contrast, glumes of emmer and spelt wheat greatly outnumbered rachis internodes of barley. Excluding species unlikely to have grown as arable weeds, for example *Prunus spinosa* (sloe), the charred weed seeds ranged in size from not much smaller than small cereal grains (*Bromus* S. *Eubromus* sp.) to very small (cf. *Trifolium* sp.).

If the ratios between grain, chaff and weed seeds had not been seriously distorted by differential combustion (and preservation was good), the charred crop-processing remains could be classed as 'tail grain', the by-product from the final sieving of a de-husked crop after the majority of the chaff has been removed by winnowing. Such material would probably be fed to domestic animals rather than deliberately burnt as waste. However, it could have been among the structural timbers when they were burnt. It is also possible that much chaff had been lost though differential combustion and that the remains represented de-husking waste.

Even allowing that a single six-row barley rachis can support three grains whereas a pair of emmer or spelt glumes only encloses two or three grains, barley chaff was still under-represented in comparison with wheat chaff. This was perhaps because the wheat had been stored within its glumes in spikelet form whereas the barley ears had been broken up and some of the rachis lost. It is uncertain whether the wheat and barley had been processed separately or mixed. Some late Bronze Age bread found at Lavendon, Buckinghamshire contained both wheat and barley grain (Robinson unpubl. info.).

The other charred assemblages were smaller and tended to contain the same range of remains. Sample 30 of column 4 and sample 41, however, also contained seeds of *Linum usitatissimum* (flax), a crop which is rarely found charred because, unlike cereals, fire was not part of its processing. Some of the samples from columns 1 and 4 contained waterlogged seeds and capsule fragments of flax. It is likely that flax was being rippled (threshed) on the site to extract its edible, oily seeds. It is also possible that flax was being retted in the palaeochannel to extract its fibres, although the concentration of remains was insufficient to confirm this activity.

Emmer wheat, spelt wheat, six-row hulled barley and flax are all well known as late Bronze Age crops, while the status of another plant from the site, *Papaver somniferum* (opium poppy), is much less certain. A single charred seed of *P. somniferum* was identified from column 4 sample 31, and waterlogged seeds of *P. somniferum* were present in most of the waterlogged samples. Column 1 sample 2, however, contained 203 seeds of it. Seeds of *P. somniferum* have already been recorded from a Bronze Age context in Britain at the Wilsford Shaft, Wiltshire (Robinson 1989, 83) and they form a common minor component of Iron Age assemblages of charred arable weeds from sites on the Hampshire Chalk (G Campbell pers. comm.).

P. somniferum now has the status in Britain of a semi-tolerated garden plant and a weed of waste places, especially refuse tips. The frequent occurrence of double-flowered varieties and a range of flower colours shows that most of these populations had their origins as escapes from cultivation of ornamental garden flowers. In central Europe it is also a member of arable weed communities, while in various parts of the world it is cultivated as an oil crop for its edible seeds and as a medicinal/drug plant.

A check on the subsample analysed for insects from column 1 sample 2 also revealed many seeds of *P. somniferum* so the result seems unlikely to have arisen through the chance inclusion of a single poppy capsule in the subsample analysed for macroscopic plant remains. The sample contained few waterlogged cereal remains in relation to poppy seeds so it is unlikely that the seeds represented cereal cleaning waste. It is possible that a stand of opium poppy grew on the island close to the deposit, either cultivated or wild. Poppy seed imported to the site could have been accidentally spilt or discarded among refuse into the channel. Finds of *P. somniferum* have been made from some Neolithic and Bronze Age sites in Germany, Switzerland and the Netherlands in contexts which suggested it was being cultivated (Renfrew 1973, 161–2; Waterbolk and van Zeist 1966, 575–6), and there seems no reason why it should not also have been cultivated in late Bronze Age Britain. Whatever the explanation for the Wallingford opium poppy, the occurrence of seeds of at least two other species of poppy in the sample, *Papaver rhoeas* tp. (field poppy) and *P. argemone* (long prickly headed poppy), in higher concentrations than in any of the other samples, was probably related.

No remains of other cultivated plants were found. A single charred hazelnut fragment provided the only evidence for collected wild food plant resources. Charred seeds of *Crataegus* cf. *monogyna* (hawthorn) and *Prunus spinosa* (sloe) were more likely to have been imported on branches used for fuel than collected for consumption. The discovery of a waterlogged endocarp (core) fragment of *Malus* sp. (apple) from the palaeochannel merely shows that this fruit was available in the locality.

Other imported plant remains

Wood was imported to the site for structural purposes and as fuel. Almost all the structural wood was *Quercus* sp. (oak) and *Corylus avellana* (hazel) which contrasted with the wider range of species among the waterlogged 'driftwood' (see Taylor *et al*., below). Relatively small quantities of Pomoideae indet. (hawthorn, apple etc.), *C. avellana* and *Fraxinus excelsior* (ash) charcoal from column 1 sample 2 and sample 21 probably represented wood burnt as fuel. The much larger quantities of *C. avellana* charcoal from column 1 sample 1, sample 5 and sample 51, however, were probably destruction debris. About half of all the hazel rods were charred (see Taylor *et al*., below).

About half the waterlogged samples contained frond fragments of *Pteridium aquilinum* (bracken), which was perhaps brought for use as animal bedding.

The post-abandonment environmental sequence

The silting of the palaeochannel and floodplain alluviation

The organic remains in column 4 sample 27 probably accumulated after the abandonment of the settlement on the island. Crop remains and charcoal were absent. The invertebrate remains suggest that the channel remained at least seasonally active, while the macroscopic plant remains suggest a landscape that was perhaps more open than earlier. The rise in the proportion of the amphibious mollusc *Lymnaea truncatula* from 2% to 11% of the total molluscs (see Fig. 4.6), however, probably reflected the increasing areas of seasonally exposed mud as the channel silted. These conditions of swamp and mud seem to have persisted until column 4 sample 20 when the proportion of terrestrial molluscs rose from 13% to 28% of the total. Thereafter the regime was one of overbank alluviation on a grassy floodplain.

The assemblages from column 4 sample 20 up to sample 4 comprised aquatic species from the river plus an open-country fauna of land snails, particularly *Vallonia pulchella*, *Trichia hispida* gp and, in some instances, *Cochlicopa* sp. There were few shells of amphibious species. They probably correspond to Evans *et al.* (1992, 69) taxocene 1 with the addition of allochthonous aquatic species. Evans interprets it as a taxocene of relatively dry meadow or pasture with occasional winter flooding. The assemblages did not contain the higher proportion of amphibious species Succineidae and *Carychium* sp. which occur in the alluvial floodmeadow faunas of the Upper Thames Valley (Robinson 1988). This was probably a reflection of the site being better drained and flood waters not standing so long as on some of the broad expanses of Thames floodplain.

An increase in the percentage of aquatic molluscs in column 4 between sample 12 and sample 9 was perhaps due to an increase in the rate of alluviation. It possibly corresponded to the period of rapid alluviation in the riverbank section between 0.64 m and 0.44 m (Thomas *et al.* 1986, 183). In samples 7 and 6 of column 4 there was a significant presence of dry-ground snails, particularly *Pupilla muscorum*. This level in column 4 corresponded to a horizon of disturbance of the Bronze Age occupation layer on the former island. It is suggested that this represented an episode of cultivation on the island and although the molluscan assemblages of these two samples were not characteristic of cultivation, it is possible that this occurred on the island itself during a dry phase. It could have been Roman or later in date.

An increase in amphibious species such as *Lymnaea truncatula* in the top three samples of column 4, reaching 9% in sample 1, suggests conditions became wetter. A rise in *Succinea* or *Oxyloma* sp. might suggest that the vegetation also became taller.

Fen vegetation in the top of the palaeochannel

The fen peat which had formed in the top of the palaeochannel beyond the main area of excavation (sample 60) contained relatively few seeds. They were all from species likely to have been growing in the localised fen itself including *Epilobium* sp. (willowherb), *Berula erecta* (water parsnip), *Pedicularis palustris* (red rattle) and *Carex* spp. (sedge).

The wider implications of the results

The environmental remains from the late Bronze Age site at Wallingford are remarkably similar to the late Bronze Age waterfront site at Runnymede Bridge, in the Middle Thames (Needham 1991), and it is the obvious site with which comparisons can be made. Both sites were settlements situated on what were islands in the River Thames and were the foci of high-status activity which resulted in the deposition of metalwork. Substantial timber structures were found in waterlogged palaeochannel sediments along one side of the islands, and midden material had been dumped in the palaeochannels. However, there was little evidence from insects for the proximity of buildings. Not least, very detailed studies have been made of the environmental archaeology of both sites, using a wide range of lines of evidence.

The environmental archaeology of the Upper Thames gravels during the late Bronze Age was reviewed briefly in the light of the results from excavations at Eight Acre Field, Radley (Robinson 1995, 49) and also as part of the project on the neighbouring site of Barrow Hills, Radley (Robinson 1999). An earlier review covered the Middle as well as the Upper Thames (Robinson 1992a, 54–5). The picture that emerged from several sites was of an open landscape of lightly grazed grassland, that is grassland not so heavily grazed as completely to prevent the flowering of taller grassland herbs and a local presence of mixed thorn scrub. Wallingford and Runnymede both fall into this pattern. Woodland was not entirely absent and the pollen from Wallingford (see Chambers and Botterill, below) might suggest a somewhat greater background presence of trees than on some of the gravel terrace sites. Likewise, the occurrence of seeds of some woodland herbs at Wallingford was possibly a reflection of large-scale clearance being more recent or the presence of more woodland around the edge of the catchment than on some of the other sites. The products of arable agriculture were found on most of the Thames Valley sites that were considered, although at Wallingford and Runnymede the cultivated fields were perhaps on higher ground at some distance from the settlements.

Both the Wallingford and Runnymede sites had areas of nutrient-rich disturbed ground which supported such weeds as *Chenopodium album* (fat hen) and *Urtica dioica* (stinging nettle) as might be expected for settlements of this date. In addition, seeds of *Conium maculatum* (hemlock) were present. It is a weed of riverbanks and damp waste ground, especially where refuse has been dumped. *C. maculatum* was a common weed on Roman sites in the Thames Valley (Robinson 1980, 93) but, with the exception of Wallingford and Runnymede, has not been found on earlier sites in the region. Trade along the River Thames would have provided a means by which this plant could spread into the region, perhaps from a Bronze Age introduction to the British Isles. These riverbank settlements were evidently suitable habitats where it could flourish. However, not until the Roman period did conditions enable a general colonisation of settlements. Various lines of evidence suggest that the intensity of activity on settlements was greater in the Roman period than in later prehistory (Robinson and Wilson 1987, 54) and it might be that these high-status late Bronze Age sites showed more similarity to settlements of a later period.

Although both Runnymede and Wallingford had waterlogged midden deposits which contained numerous remains of insects that feed on foul organic material, few woodworm beetles (*Anobium punctatum*) or other synanthropic insects of indoor habitats were found on either site. This fauna was certainly present in Britain before the late Bronze Age (Robinson 1992b). Such a result was somewhat surprising but was presumably because the middens largely comprised dung and crop-processing waste rather than debris from inside houses.

Wallingford joins Runnymede in a select group of late Bronze Age sites in southern Britain where both emmer (*Triticum dicoccum*) and spelt (*T. spelta*) wheat were being used. They date back to about 3000 BP and were mostly of high status (Greig 1991, 259). Spelt wheat was also identified from a late Bronze Age waterhole at Eight Acre Field, Radley, but further late Bronze Age sites in the Upper and Middle Thames Valley have so far only yielded emmer wheat (Robinson 1995, 48–50). Evidence is now emerging for a presence of spelt wheat in Britain during the middle Bronze Age with possible records from Godmanchester, Cambridgeshire (P Murphy pers. comm.) and Yarnton, Oxfordshire (Robinson in prep. b). By the early Iron Age, spelt became the main wheat cultivated over much of Britain and in the Upper Thames Valley; emmer wheat was reduced to only a trace in charred cereal assemblages as, for example, at the Ashville Trading Estate, Abingdon, Oxfordshire (Jones 1978, 94, 108).

The other certain crops from Wallingford – six-row hulled barley (*Hordeum vulgare*) and flax (*Linum usitatissimum*) – have a record of cultivation in Britain that goes back to the Neolithic and continues up to the present day. They were again found from the late Bronze Age phase at Runnymede (Greig 1991, 259). The discovery of a large quantity of seeds of opium poppy (*Papaver somniferum*) serves to illustrate the difficulty of determining whether a plant which certainly grew as a weed in prehistoric Britain was also a cultivated crop. Given the evidence for its cultivation in continental Europe, there seems no reason why it should not also have been cultivated in Britain.

The importation of fronds of bracken (*Pteridium aquilinum*) from an area of light acidic soil some distance from the site, perhaps for animal bedding, was a forerunner of a trend that became widespread on sites in the Upper Thames Valley during the Iron Age (Allen and Robinson 1993, 117). Bracken was likewise found in the midden at Runnymede (Robinson 1991, 325). It shows that the settlements were not dependent just upon their immediate environs for their subsistence activities.

Overall, the results from Wallingford present a picture of the landscape of the Upper Thames Valley during the agricultural intensification of the late Bronze Age. Clearance had been sufficiently extensive that structural timbers were being obtained from managed or at least secondary woodland. The floodplain was being used for pasture, and arable land was perhaps situated on the gravel terraces. The woodland relicts among the waterlogged seeds, and the seeds of grassland plants among the charred arable crop remains, emphasise that this change was ongoing. The silting of the palaeochannel and sedimentation over the island were reflections of the longer-term hydrological consequences as the agricultural intensification in the Upper Thames Basin continued into the Iron Age and Roman periods, consequences considered in more detail elsewhere (Robinson 1992c). At the more local level, the results here complement the other archaeological evidence for site conditions and activities on a rather unusual high-status site and have brought out further similarities with the only close parallel at Runnymede Bridge.

POLLEN ANALYSIS

by Frank Chambers and E W Botterill

Introduction

Ten samples from the excavations were submitted to the Environmental Research Unit, University of Keele for pollen analysis. The samples (subsamples of those taken for other environmental analyses, see Robinson above) derived from an alluvium-filled channel containing piles of a late Bronze Age waterfront structure. Samples 1–3 were from a sequence through the late Bronze Age sediments in trench XXIV, containing timber debris and charcoal (context 2405). Six of the other samples derived from a column sample (column 4), also taken from the palaeochannel fill in trench XXIV. These samples, 4.27–4.32, were taken at 0.1 m intervals from the portion of this column sample which cut through the organic layer 2405 and the base of the immediately overlying alluvial layer (2404, see Fig. 2.3). Sample 21 was taken separately from an organic deposit at the base of the channel further downstream, but still containing archaeological debris.

Laboratory methods

Samples were prepared for pollen analysis after the method of Barber (1976), employing hydrofluoric acid digestion, and using silicone oil as mounting medium. Pollen counts were then conducted, using a total land pollen (TLP) sum, excluding spores. Trees and major shrubs comprise arboreal pollen (AP); other pollen types comprise the non-arboreal pollen (NAP).

Results and discussion

Pollen was found in all samples, but the abundance and state of preservation varied considerably. Pollen was very sparse, or sparse in some, and in rather poor condition generally, with the exception of sample 21, in which the condition was excellent. The results are listed in Table 4.24, in which an attempt has been made to separate the non-arboreal pollen taxa into broad ecological groups. These should not be seen as definitive, as there is inevitable overlap between them, and some taxa could be placed in several of the groups.

The relatively low AP/NAP ratios in all the samples confirm an open local environment. Sample 21 had significantly lower arboreal pollen percentages (9.2%) than all the others; while sample 4.29, close to the middle of the vertical sequence of six samples, had the highest (33.8%). Of the arboreal taxa, *Quercus* (oak), *Alnus* (alder) and *Corylus* (hazel) were the principal types. The presence of *Fraxinus* (ash) and of *Sambucus* (elder) in some samples is suggestive of secondary woodland.

Gramineae (grass) pollen dominate all the pollen spectra, which together with the number of other taxa is suggestive of pastoralism (Dimbleby 1985), but could also be indicative of non-agricultural disturbed ground, or indeed of arable agriculture (Behre 1986).

Cereal-type pollen was recorded from all samples, although owing to difficulties of identification, *Glyceria* (an aquatic grass with a similar pollen size) may be included in these. The sample with the largest percentage of cereal-type pollen (sample 21) also included one grain of *Centaurea cyanus* (cornflower) – a notable arable weed (Behre 1986).

The proximity of the sampling sites to open water is testified by pollen records of a number of aquatic fringe and open-water taxa, including *Potamogeton* (pondweed) and *Nymphaea* (white water lily), and by the presence of pollen from certain marsh or wetland taxa (see Table 4.24).

WATERLOGGED WOOD

by Maisie Taylor, Rowena Gale and George Lambrick

Introduction

The catalogue of waterlogged wood presented below was compiled from the site records, report and draft descriptive/analytical catalogue created by George Lambrick during and soon after excavation. Rowena Gale undertook all species identifications. This earlier work was very thorough and of great value in the consideration of more detailed analysis of the woodworking. Some of George Lambrick's and Rowena Gale's comments have been incorporated into the text, and this has been acknowledged as far as possible. Some of the material was still available for examination when this more detailed phase of the analysis began, and some had been conserved. The quality of the conservation was extremely high and it was possible to add more data, including some information on surface detail, to the catalogue after further consideration of the surviving material.

Wood

Ninety-eight pieces of wood were recorded in detail in the field. They included *in situ* verticals and a variety of horizontal wood. Most of the wood was worked (51 pieces) and much was charred (46 pieces). Some were both worked and charred and in these cases the charring sometimes 'blurred' the woodworking detail. A high proportion of the material was retained and was therefore available for later examination. Thirteen pieces were conserved by freeze-drying.

Dimensions

Where the dimensions of some pieces examined in storage were different from those recorded in the

Table 4.24 Pollen spectra in samples analysed

Sample no.	*1*	*2*	*3*	*4.27*	*4.28*	*4.29*	*4.30*	*4.31*	*4.32*	*21*
Arboreal pollen										
Betula	-	-	0.2	0.4	0.4	0.2	0.4	1.0	0.3	0.2
Pinus	1.1	1.4	0.2	2.0	0.4	1.2	1.2	0.8	0.6	0.2
Ulmus	-	0.3	0.7	-	-	0.6	-	0.8	0.6	0.2
Quercus	4.4	8.5	7.0	6.0	9.1	11.8	5.0	3.3	5.2	2.0
Alnus	1.1	5.4	5.4	6.5	4.6	8.0	3.6	4.1	6.6	2.2
Tilia	-	-	-	0.8	0.4	0.2	0.9	-	0.9	-
Fraxinus	-	1.4	0.2	0.4	2.0	2.0	1.4	1.7	1.1	1.0
Ilex	-	-	-	-	-	0.2	-	-	-	-
Hedera	-	-	-	-	-	-	-	-	0.3	-
Fagus	-	-	-	-	-	0.2	-	-	-	-
Corylus	6.7	3.1	6.3	6.5	4.0	8.4	5.9	4.6	4.9	3.0
Salix	-	0.3	1.2	-	0.8	0.8	1.4	-	1.1	0.2
Sambucus	-	0.3	-	-	-	0.2	-	0.4	-	-
Rhamnus	-	-	-	-	-	-	-	-	-	0.2
Herbs										
(a) Woodland and woodland fringe										
(Polypodium)	-	-	0.2	0.4	-	0.2	-	-	0.3	-
(Filicales)	1.1	1.0	0.2	3.6	0.8	1.0	0.9	-	2.0	0.2
(Pteridium)	-	2.4	0.7	0.4	0.8	1.0	0.9	0.4	1.7	0.4
Solanum dulcamara	-	0.3	0.2	-	-	-	-	-	-	-
Umbelliferae	1.1	2.4	2.6	0.8	1.2	0.8	1.4	0.4	0.9	1.4
Liliaceae	-	-	0.2	-	0.4	0.6	-	0.4	-	-
Centaura cf. *nigra*	-	-	-	-	-	0.4	-	-	0.3	-
Stellaria	-	-	-	-	-	-	0.9	-	-	-
(b) Ruderal and grassland										
Caryophyllaceae	2.2	1.7	0.7	1.2	0.4	1.2	0.9	-	-	1.4
Labiatae	2.2	-	0.7	2.0	0.4	0.2	0.4	-	0.9	0.2
Artemisia	-	-	-	-	0.4	-	0.4	0.4	-	0.4
Compositae Tub.	-	1.4	0.2	0.8	0.4	0.8	0.9	1.2	0.9	1.4
Compositae Lig.	5.5	2.0	1.6	2.4	2.5	1.2	1.8	1.6	1.1	1.8
Chenopodiaceae	-	0.7	0.2	0.8	0.4	0.4	-	-	0.6	2.4
Rumex	-	1.0	1.2	0.4	0.8	0.4	0.4	1.2	0.3	0.6
Plantago lanc.	3.3	2.4	3.5	0.8	5.0	4.0	5.0	8.3	4.9	6.4
Papilionaceae	3.3	3.1	0.5	0.8	1.2	1.4	2.3	5.4	0.9	4.4
Gramineae	51.0	45.6	53.9	43.1	50.6	44.8	48.4	52.7	48.6	48.4
Poterium	-	1.0	0.7	-	-	-	-	-	-	1.4
Potentilla-type	2.2	0.7	-	-	0.4	0.2	-	-	0.6	0.8
Malvaceae	-	-	0.2	-	-	-	-	-	-	-
Campanulaceae	-	-	-	-		-	-	-	-	0.2
(c) Arable										
Cereal-type	4.4	1.4	1.4	2.0	0.8	2.0	4.5	2.9	4.0	7.8
Cannabiaceae	1.1	1.0	0.7	0.8	-	-	-	-	-	-
Centaurea cyanus	-	-	-	-	-	-	-	-	-	0.2
Cruciferae	-	2.0	0.7	1.2	-	-	-	-	0.9	-
Anagallis	-	-	0.2	-	-	-	-	-	-	-
(d) Marsh, fen and heath										
Ranunulaceae	4.4	2.0	3.1	1.2	4.1	2.6	2.7	4.1	0.6	3.0
(Lycopodium)	-	-	0.2	-	-	-	-	-	-	-
Mentha-type	-	-	0.2	-	-	0.2	-	0.4	-	0.4
Thalictrum	-	-	-	-	-	0.2	-	-	-	-
Succisa	-	0.3	-	-	-	-	0.4	-	-	-

Table 4.24 Pollen spectra in samples analysed (continued)

Sample no.	*1*	*2*	*3*	*4.27*	*4.28*	*4.29*	*4.30*	*4.31*	*4.32*	*21*
Filipendula	-	2.0	-	0.4	0.4	1.0	5.0	1.2	1.1	1.0
Cyperaceae	4.4	5.4	5.6	14.5	5.8	1.2	3.2	0.8	10.9	6.0
Ericaceae	1.1	-	0.5	-	0.8	0.2	-	0.4	-	-
Vaccinium	-	-	-	0.4	-	-	-	-	-	-
(e) Aquatic fringe and open water										
Typha-type	-	0.7	0.2	1.2	1.7	1.8	-	-	-	0.4
Sparganium-type	-	0.7	0.9	1.2	0.4	0.8	0.4	0.8	-	0.6
Potamogeton	-	0.3	-	0.8	-	-	0.4	0.4	-	-
Nymphaea	-	-	-	0.4	-	-	0.4	-	-	0.8
Summary										
Arboreal pollen (%)	13.3	20.7	21.2	22.6	21.7	33.8	19.8	16.7	21.6	9.2
Total land pollen (TLP)	90	294	426	248	241	500	221	241	348	500

Note: Taxa in parentheses are excluded from the total land pollen (TLP) sum

field, it was assumed that the field measurements were more accurate. Even slight drying out in storage can distort certain measurements, such as diameters, disproportionately. The lengths of some pieces were not recorded in the field, although they are evident from the plans.

Species identified

Species identification indicated that there were six species or groups of species.

Quercus sp. – oak

Thirty-four pieces were identified as oak. Of these, 27 were either timber, for example Wood 58 (Fig. 4.7.4) and Wood 49 (Fig. 4.8.6), or debris from timberworking, for example Wood 54 (Fig. 4.7.1), 28 (Fig. 4.7.2), 31 (Fig. 4.7.3), 10 (Fig. 4.8.7), 17 (Fig. 4.8.5), 81 (Fig. 4.8.8), 64 (Fig. 4.9.10) and 75 (Fig. 4.9.11). Another four were roundwood, for example Wood 96 (Fig. 4.9.9), but were large structural verticals. Eighteen pieces of timber and debris were charred, together with two pieces of smaller roundwood. One piece showed clear evidence for coppicing: Wood 93 (Fig. 4.11.16). All the oak was worked.

Corylus avellana – hazel

Twenty-eight pieces were identified as hazel, all of which were roundwood, many of which were trimmed (eg Fig. 4.10.12–13). Twenty-one pieces were charred, and on some occasions the charred ends may also have been trimmed. There were few definite signs of coppicing although many pieces had straight and, sometimes, quite long stems. Wood 57 also had a slight curve at the base of the stem.

Pomoideae – *apple, hawthorn etc.*

Sixteen pieces were identified as Pomoideae; of these, seven were trimmed in some way and two were charred. Some showed signs of being taken from a coppice (eg Fig. 4.11.15) or hedge (eg Wood 26). The different genera are impossible to separate microscopically, which leaves us with the likelihood that this wood comes from wild apple or pear, hawthorn or service.

Prunus sp. – *sloe, cherry etc.*

Five pieces were identified as *Prunus*. Because there are many difficulties in separating the different types of *Prunus*, this was not attempted. The wood is most likely to come from wild cherry or blackthorn. Wood 4 is roundwood, and was recorded in the field as trimmed, Wood 20 and 85 were also roundwood, while Wood 89 (Fig. 4.10.14) was a fork, trimmed at one end but still with side shoots.

Alnus glutinosa – alder

Two pieces were identified as alder. Wood 22 is a large woodchip, while Wood 86 was recorded in the field as a 'split log'.

Fraxinus excelsior – ash

One piece was identified as ash.

Roundwood

Sixty pieces of roundwood were retrieved from the excavation; much of it was trimmed, some of it was charred, and some of it was trimmed and charred which made analysis of the woodworking difficult. The diameters of the roundwood ranged from 5 mm on a twig of Pomoideae (Wood 79) upwards. The

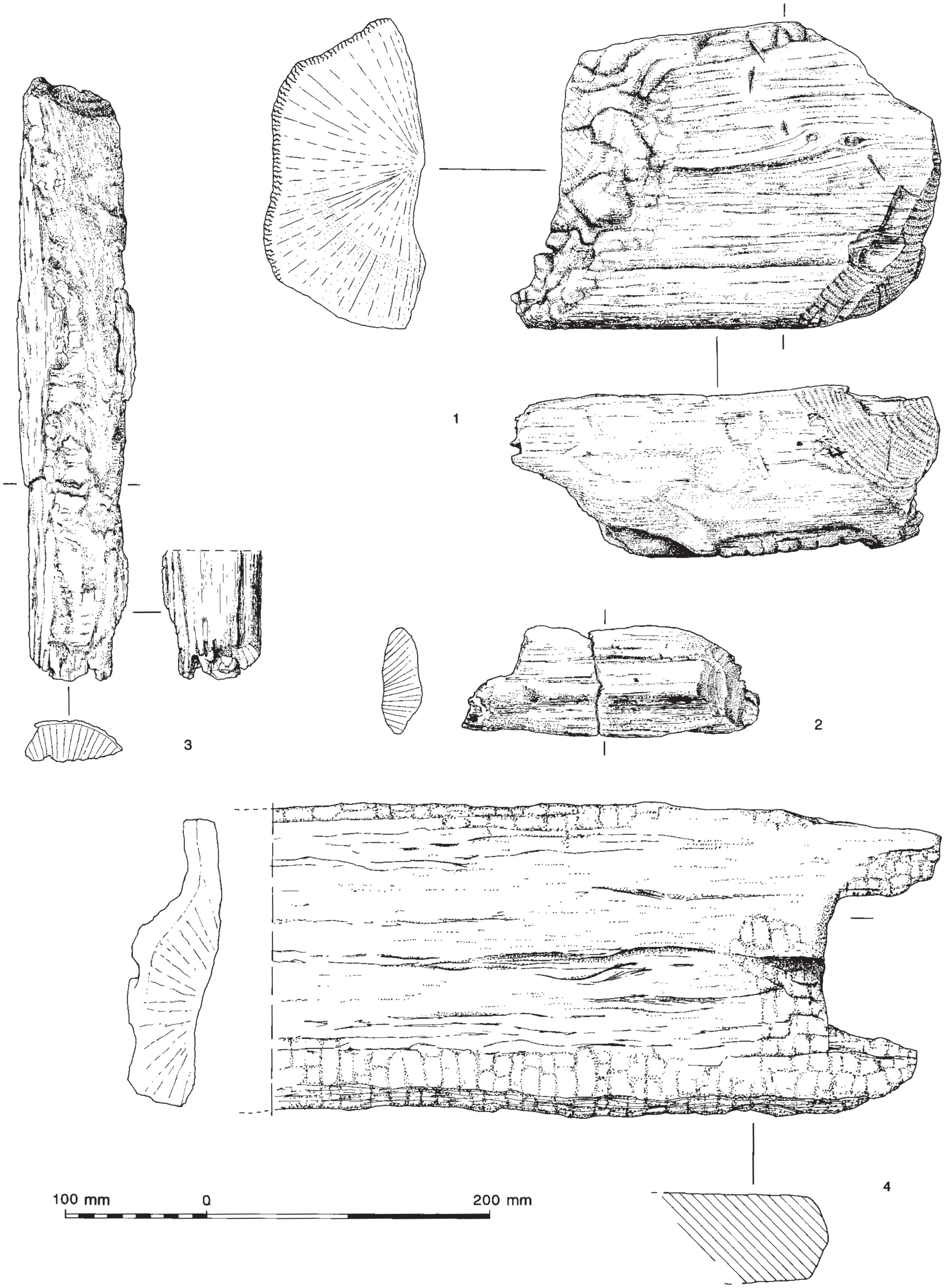


Figure 4.7 Worked oak (catalogue nos 54, 28, 31 and 58)

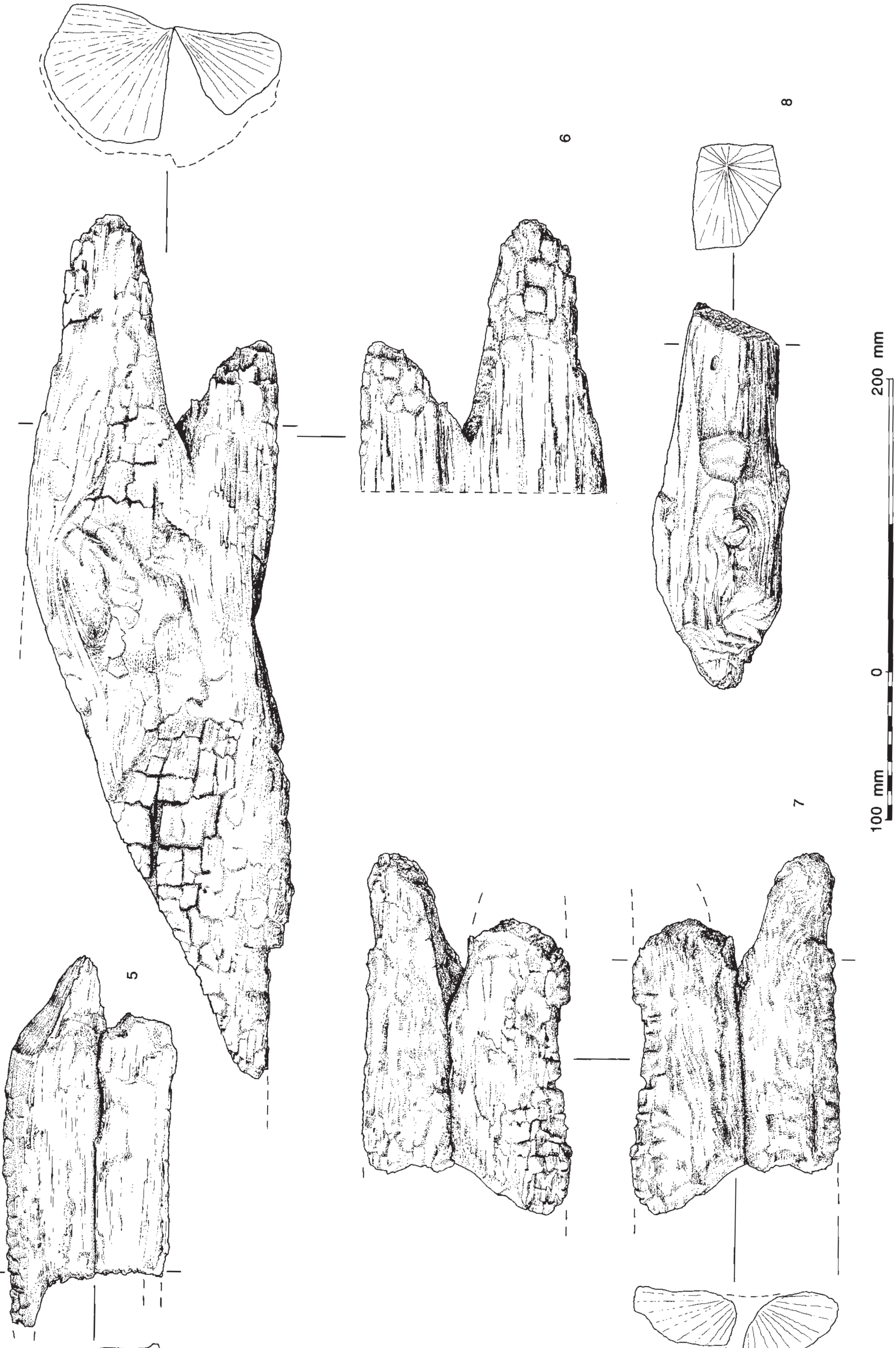


Figure 4.8 Worked oak (catalogue nos 17, 49, 10 and 81)

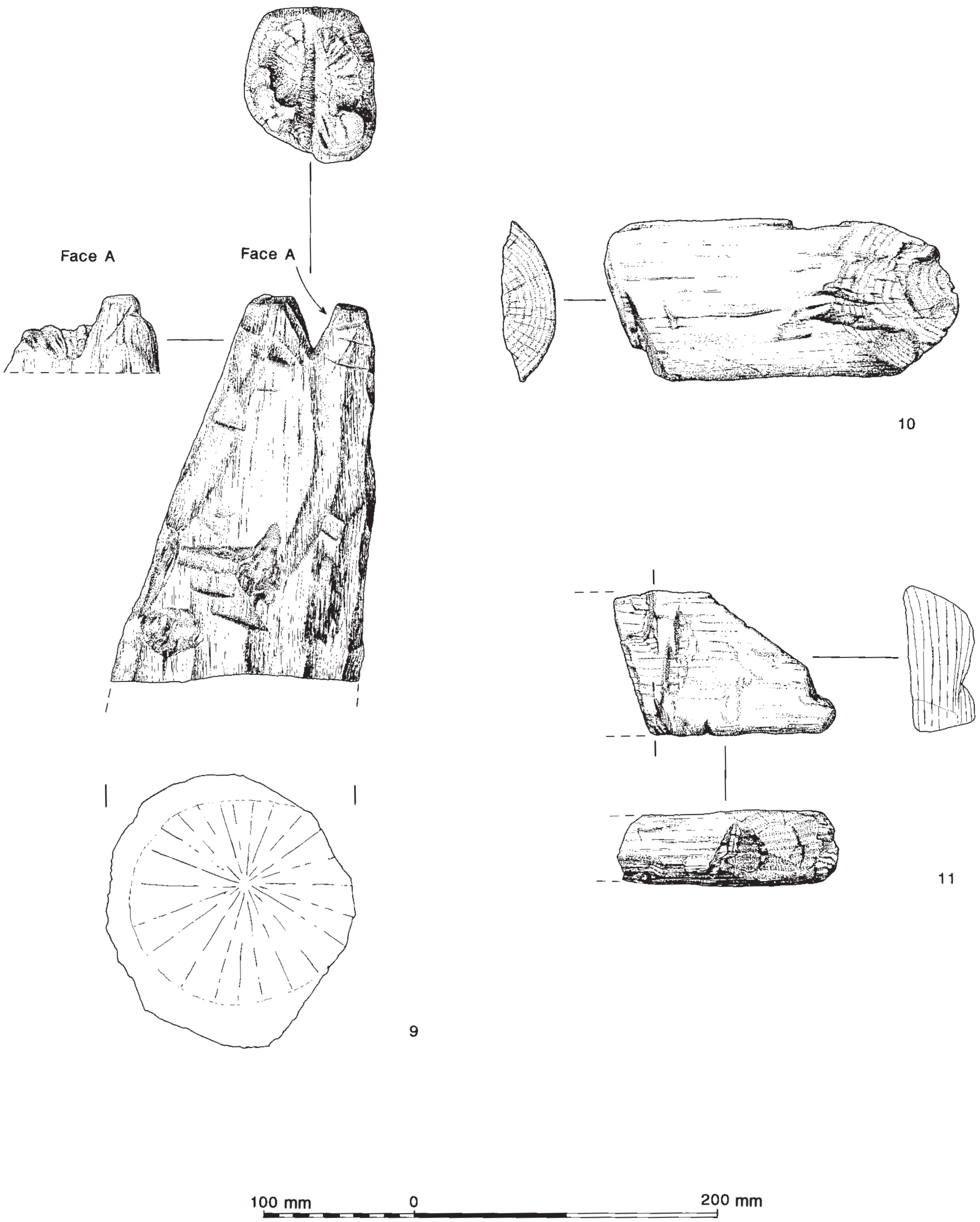


Figure 4.9 Worked oak (catalogue nos 96, 64 and 75)

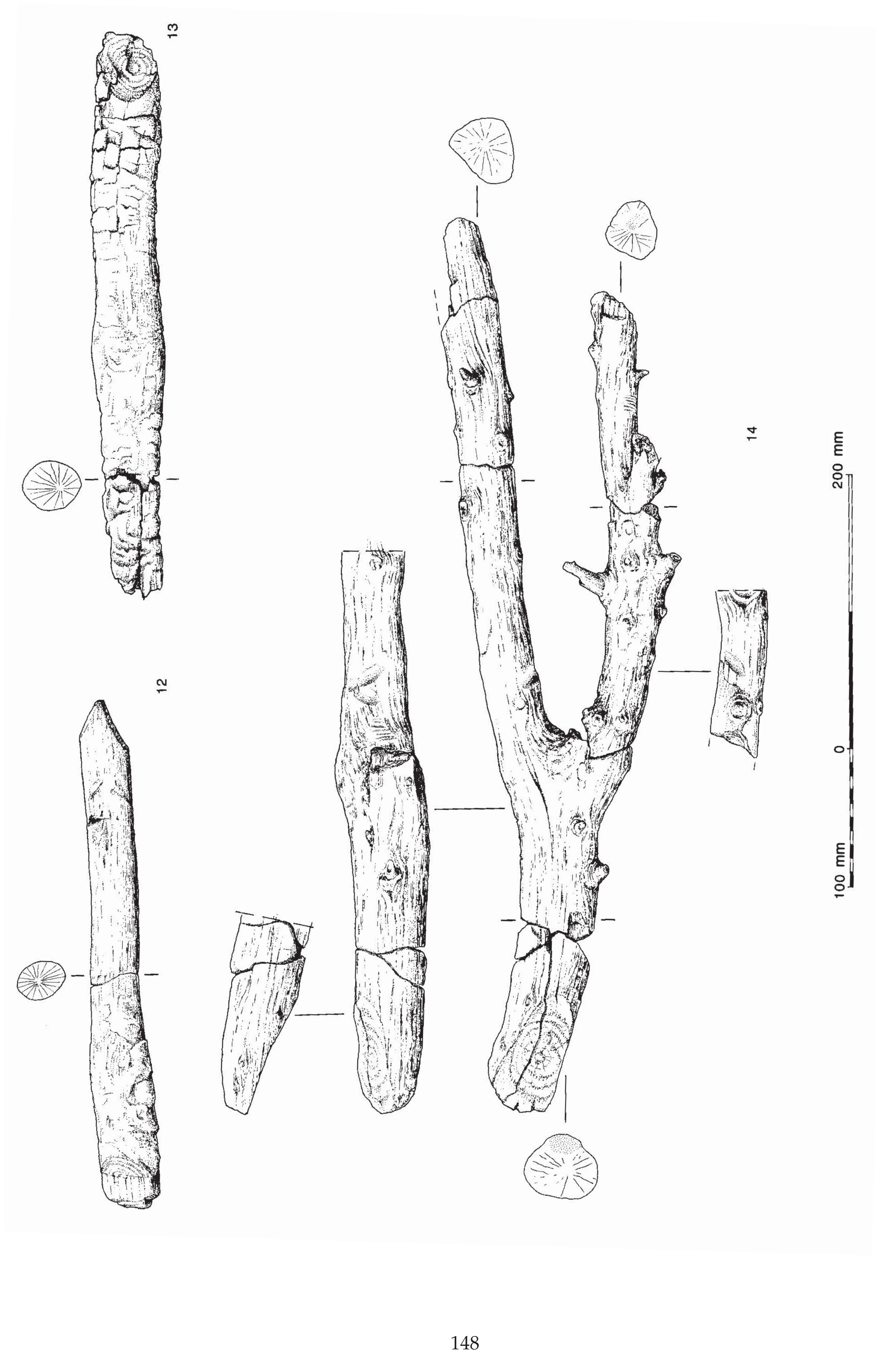
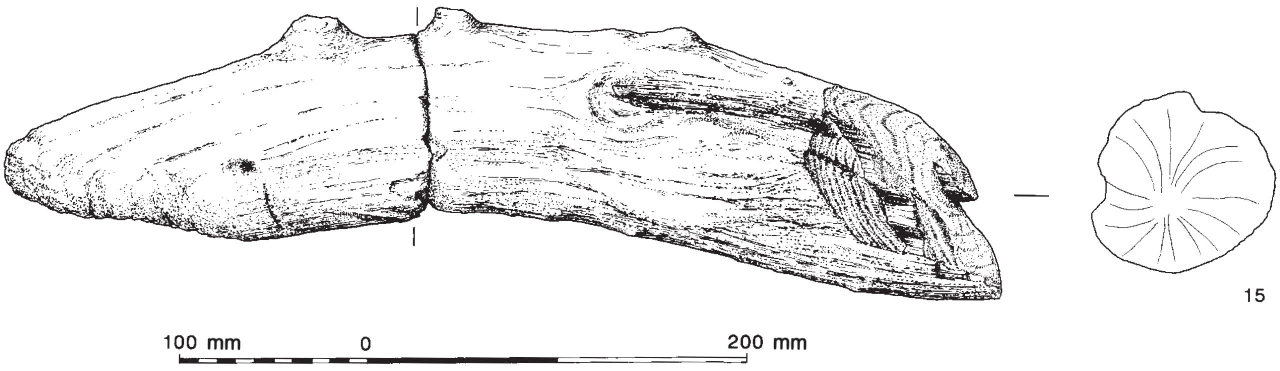


Figure 4.10 Worked wood (catalogue nos 40, 91 and 89)



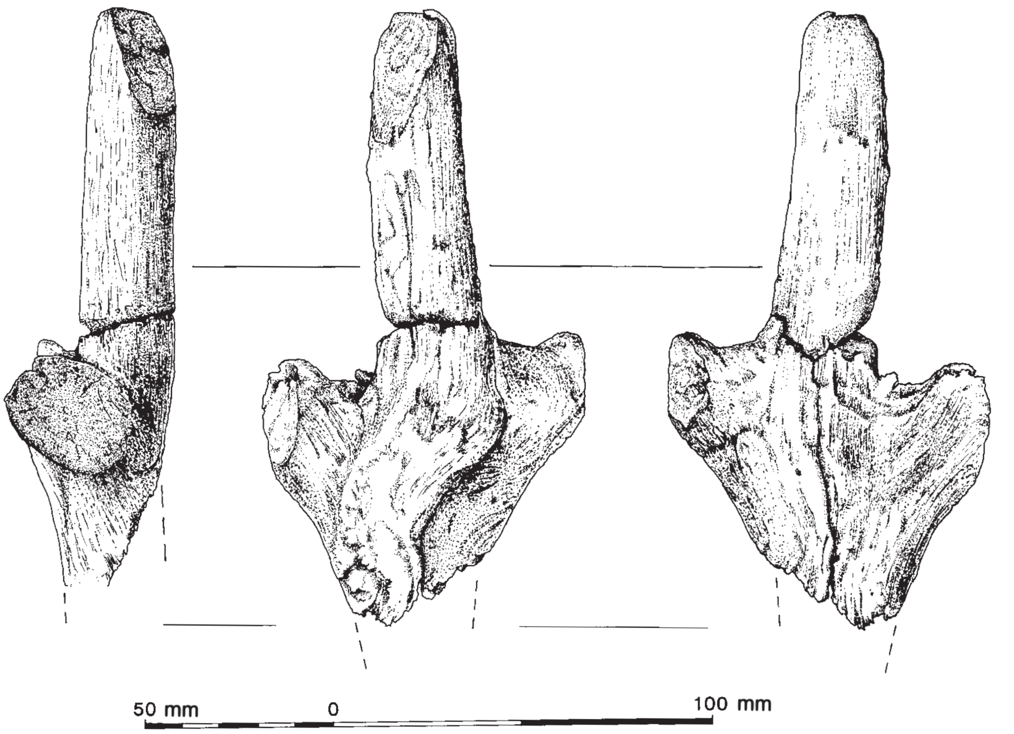


Figure 4.11 Worked wood (catalogue nos 1 and 93)

biggest tree used on the site was a 400 mm diameter oak tree from which a radial plank had been split (Wood 75, Fig. 4.9.11).

Woodworking

Given the relatively small size of the assemblage, a high proportion of the wood from the site was worked (over 50%). There is virtually no small woodworking debris, but a wide variety of woodworking techniques are evident. The woodworking debris that is present is derived from timber-working, and some of it may actually be the remains of badly burnt timbers. There is also virtually nothing to suggest that the wood is an accumulation of 'natural' wood, which has simply fallen off trees. Most of the roundwood is trimmed and much of the rest is either charred or in poor condition so that simple trimmed ends might not have been evident. There is one 'twig' (Wood 79), with a diameter of only 5 mm, but the remainder of the roundwood has a diameter of more than 10 mm (Fig. 4.12).

Hewing

Hewing is not very well recorded from assemblages of prehistoric woodworking. Hewing is a technique of creating a flat surface with an axe or adze. Until saws were invented, splitting or hewing could most

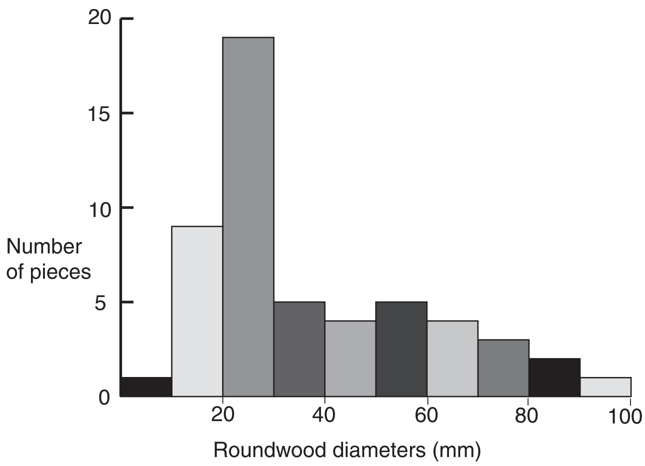


Figure 4.12 Roundwood diameters from wood deposit

efficiently create flat surfaces. Sometimes when the working went wrong, or perhaps wood was not of a high enough quality, split surfaces would have to be hewn to some extent to finish them. The evidence for hewing may be very slight, or even lost through careful finishing or subsequent wear. Sometimes it may be deduced that the most likely technique of shaping is hewing. Wood 17 (Fig. 4.8.5) was originally a half split and then hewn flat. It is very unlikely that such a shape could have been formed by splitting again across the grain. Wood 97 and 95 have both had some of their sapwood hewn off, a common practice at all periods, as sapwood rots faster than heartwood.

Trimming

Trimming is a very common form of woodworking, from trimming up roundwood, to squaring up the ends of timber. Roundwood has to be trimmed to remove the felling faces or the less useful curved ends where wood is coppiced. Wood 1 (Fig. 4.11.15) is trimmed from two directions which are possibly the felling faces of the small trunk. Wood 93 (Fig. 4.11.16), which is clearly part of a coppice stool, has been trimmed. There are a number of pieces of roundwood which have been trimmed at one or both ends: Wood 91 (Fig. 4.10.13), 88, 87, 60, 57, 48, 26, 19 and 2 were all trimmed at one end. Wood 40 (Fig. 4.10.12) is trimmed at both ends. Some pieces might have been trimmed at both ends originally, but several pieces are trimmed one end and charred the other. The burning would have destroyed any traces of trimming that might originally have been there (eg Wood 91, Fig. 4.10.13). Wood 89 (Fig. 4.10.14) is a forked piece which has been trimmed. Natural forks may be trimmed up, taking advantage of the shape, to make a tool, but this fork has only been rough trimmed and is more likely to be derived from a hedge.

Wood 28 (Fig. 4.7.2) is a small piece of timber debris, or an offcut, which has been roughly trimmed at one end. Wood 77 is another offcut with one end trimmed to be slightly concave. Wood 75 (Fig. 4.9.11) is a radially split piece, trimmed square; one end is trimmed from one direction. Wood 64 (Fig. 4.9.10) is split tangentially from a piece of roundwood and trimmed up at one end. Wood 44 is a strange tangential woodchip or piece of debris which was probably generated during the removal of a knot hole from a timber. Wood 54 (Fig. 4.7.1) is a half split piece which may have been trimmed at one end from two directions, or it may be that the piece still retains traces of its original felling faces.

Splitting

It is not common to find complete structural timbers from prehistoric sites, but interesting glimpses can be gained from the offcuts or timber debris that occur more frequently. The way that the timber was reduced from the round can often be deduced from quite small fragments, and that in turn can often give an impression of the size of trees available for working. There are, for example, ten pieces of tangentially split wood, all of which are fragments or offcuts. Splitting is a very efficient way of reducing roundwood to planks, boards and beams. Not all woods split easily or cleanly; the best is oak which can be halved and quartered and then split down into increasingly thinner, radial, wedge-shaped planks. Large oaks can be split across the grain, tangentially, to produce useful timber. It is sometimes possible to split other species of trees but none as efficiently as oak. It is not surprising to find, therefore, that all the split wood is oak. Although some of the pieces are quite small pieces of timber debris and offcuts, and some others are badly charred, it is possible to deduce how the wood was split, and sometimes the diameter of the original tree.

Wood 81 (Fig. 4.8.8) is radially split from quite a small trunk. Wood 75 (Fig. 4.9.11), on the other hand, is split from quite a large trunk. It is not possible to calculate how large, but the medullary rays in this piece are virtually parallel, which suggests a substantial trunk. There are plenty of examples of the simplest split of all, the half split trunk, including Wood 32, 49 (Fig. 4.8.6), 54 (Fig. 4.7.1), 59, 61, 62 and 69. Half split roundwood was a common choice for structural beams, with the split face providing the flat horizontal surface. Several fragments of half split, jointed beams survive, although all the joints are either broken or burnt. Wood 27 and 58 (Fig. 4.7.4) both have damaged open joints, of which Wood 58 (Fig. 4.7.4) is the best preserved. This piece is deeply charred and it is very likely that the joint was originally a complete mortice. This is a common joint in half split timbers at Flag Fen (Taylor 2001). Wood 64 (Fig. 4.9.10) is an unusual tangential split because it is taken from quite a small trunk. It is possible that it is a failed half split, where the split has wandered away from the centre of the stem. Wood 31 (Fig. 4.7.3) is possibly similar. This can happen quite easily, especially on fairly small roundwood. Wood 77 is difficult to interpret because it has been deeply charred subsequent to the splitting. Similarly, Wood 73 may have been trimmed up square after splitting tangentially, but it has been heavily charred and so the trimming is difficult to separate from the other shaping. Wood 52 and 42 are also tangentially split, but charred. Wood 28 (Fig. 4.7.2) is tangentially split but too small to draw many conclusions.

Joints

Mortices seem to be very common joints in the later Bronze Age (Taylor 1992, 490) and there are fragments of two here: Wood 17 (Fig. 4.8.5) and 58 (Fig. 4.7.4). The charring is again a problem here. Pieces such as Wood 10 (Fig. 4.8.7) are probably notched but subsequent charring makes it difficult to be quite sure of the shape and function of the 'notch'.

Woodchips

Where wood has been worked, whether split or trimmed, hewn or joints cut, there will be quantities of woodchips. Here, however, there are only three possible examples from the site: two of oak (Wood 30 and 70), and one, of alder, which was recorded in the field but not retained (Wood 22). With only three woodchips from the site, it is quite clear that no serious woodworking was actually being carried out in the immediate vicinity.

Verticals

The verticals were not excavated, but some were sampled and were quite large (170–200 mm) roundwood. It was noted in the field on Wood 95 that some of the sapwood had been trimmed off and this may, in fact, have been the start of the trimming of the vertical to a point to ease insertion. One of the verticals (Wood 96, Fig. 4.9.9) had been shaped and notched in the top. It is very hard to interpret this notch, particularly as it has subsequently deteriorated and is no longer as clear as it is shown to be in the drawing and site photographs.

Charring

Just over half the wood from the site was charred, but within certain classes of wood charring is more or less common. This becomes apparent if the distribution of charred wood (see Fig. 2.7) is compared with the distribution of species (see Fig. 2.8) and the distribution of worked wood (see Fig. 2.9). There are also problems which occur occasionally when attempting to distinguish trimming from burning, and particularly when attempting to distinguish the details of trimming where the wood has been subsequently charred. Charring of the surface of a piece of wood may obscure detail, especially with a technique such as hewing, which only leaves subtle traces. It would be impossible to tell, for example, whether a piece such as Wood 58 (Fig. 4.7.4) was hewn down from the half split, or whether it had been used as a straight half split timber which subsequently charred along its length, subtly altering the shape in section.

Tool marks

Although several pieces had clear marks made by axes trimming up ends etc. (Wood 64, Fig. 4.9.10; Wood 2), only three produced clear profiles of actual tools (Wood 1, 75 and 81, Fig. 4.13). The work on tool marks at Flag Fen, Peterborough (Taylor 2001) and later examples at the Oakbank Crannog, Loch Tay (Sands 1997) have led to an easy way of recording actual profiles as a curvature index of the width of the cutting edge (blade): depth of cutting edge (blade) (in mm). Recorded in this way, the trimmed end of Wood 1 (Fig. 4.11.15) was cut with an axe 40:3. Two other complete profiles were measured on marks trimming up split roundwood. Wood 81 (Fig. 4.8.8) was trimmed up with an axe 36:3. The marks on Wood 75 (Fig. 4.9.11) were made by an axe 30:7 (Fig. 4.13).

Coppicing and hedging

Coppicing and hedging both involve heavy cutting back of certain species of woody plants. The regrowth of coppice tends to have characteristic

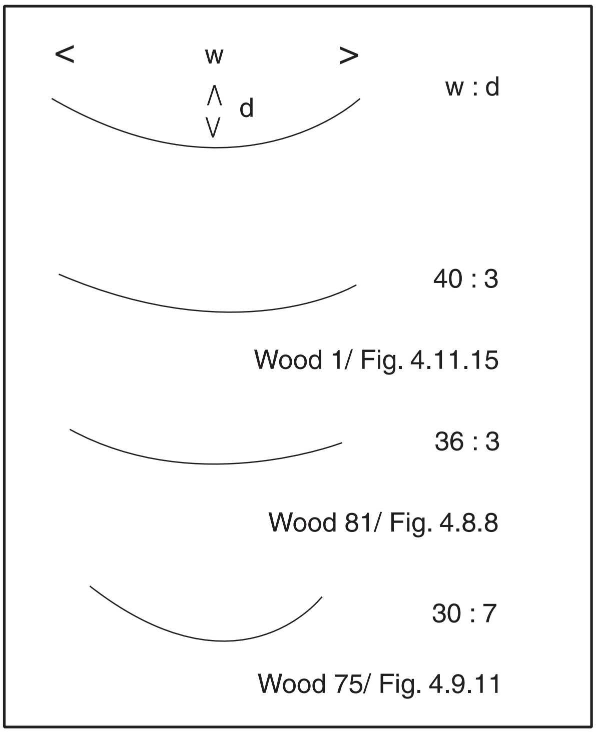


Figure 4.13 Toolmarks observed on wood

shapes: curved stems with heels and long straight stems. There also tends to be a characteristic ring pattern in coppice that grows on for several years: fast-grown rings for a few years, then very slow growth. Characteristic shapes in hedging are less clear, but where hedges have been laid, to make them stock-proof, certain characteristic shapes of regrowth or growing can occur (Taylor 1996, 107). In particular, cuts and right-angled bends in stems are unlikely to be caused by anything else.

Wood 93 (Fig. 4.11.16), which is oak, is the clearest evidence for coppicing. It is part of a coppice stool with three stems. Wood 57, which is hazel, has a long straight stem and slight curve. Both oak and hazel were commonly coppiced in the past to produce raw materials for charcoal-making, fencing and building purposes. Some of the pieces of Pomoideae are also curved. Wood 1 (Fig. 4.11.15) and Wood 5 have curved stems. Wood 2 also has a long straight stem and Wood 6 was recorded in the field as 'bent'. Only one piece shows the characteristic right-angled shape discussed above and that is Wood 26.

The *Prunus* sp. that was found was all roundwood and although it could not be identified more closely, some of it appeared to be blackthorn. Either cherry or blackthorn could have been incorporated into a hedge.

Discussion

A good deal of the comparative material for this discussion section will necessarily be drawn from Flag Fen where extensive research into the wood there has recently been carried out (Taylor 2001). One of the problems for the excavators at Flag Fen is that comparative material is so rare that it is difficult to know whether the assemblage of wooden artefacts and woodworking found at Flag Fen is 'normal'.

Species selection is very important for all aspects of woodworking. It is not surprising to find that all the oak shows signs of having been worked. Oak, especially with hazel, is the classic structural combination: oak timbers with hazel wattle infill. The Pomoideae and *Prunus* are much less likely to have been selected for building work, although both woods have their uses, such as carving. Alder can be an important timber tree and its roundwood may be used in place of hazel in areas where it is too wet for hazel to flourish. Ash is a good second-grade tree which often turns up in structures. Pomoideae and *Prunus* are most likely to occur as hedging plants.

If the distribution of driftwood/worked wood (see Fig. 2.9) is compared with the distribution of species (see Fig. 2.8), then virtually all the Pomoideae and *Prunus* were considered in the field to be driftwood, suggesting that the hedge (or hedges) was somewhere in the area, and that debris from hedges found its way into the water.

Previous work on the diameter measurements of roundwood used in wattle structures has shown that there are, not surprisingly, strong patterns in the types and sizes of roundwood used for this kind of construction (Taylor 1988; 1998). Over half the roundwood diameters here fall between 11 mm and 30 mm diameter. Other than one small twig with a diameter of 5 mm, all the remainder is larger roundwood, up to and over a diameter of 60 mm. The pattern is very like that of a wattle hurdle, although heavier. Work is currently underway at Flag Fen on the excavation and analysis of a wattle wall which may be a revetment, and although this work is still at an early stage, initial impressions are that the wattle of this revetment may be rather heavier than that of other recorded hurdles. Work is also ongoing on coppice products from the site at Yarnton.

Of the timber and timber debris, 70% was charred. Over 80% of the hazel roundwood was charred, but only a small proportion of the Pomoideae roundwood was charred and none of the *Prunus.*

Although there are not enough complete profiles for any detailed work on the tools, the axe marks here fall within the range of profiles recorded from other Bronze Age sites. The average blade width at Wallingford is 35.77 mm, while at Flag Fen it is 38.06 mm, but this is still within the range of widths for socketed axes and some palstaves (Taylor 2001). It seems that tool marks on wood tend to be narrower than the tools which originally produced them, and this may be a factor here. This problem is discussed in detail in Taylor (ibid.). Using the width and depth of the impression of the blade edge to produce a curvature index (%) has been a very productive way of analysing tool marks at Flag Fen, where the most commonly used tool turned out to be the socketed axe. Even with such a small number of impressions the range of curvature on the wood from Wallingford is very limited: Wood 1: 1.78; Wood 81: 1.44; Wood 81: 0.18 (see Fig. 4.13). This gives an average of 1.13, which is in the lower end of the range for socketed axes. The work undertaken so far suggests that flat and flanged axes and palstaves all have much higher indices for their lower limit. In other words they are more curved. The date from the wood (1000–800 cal BC) would fit with the use of socketed axes.

With evidence for hewing, splitting and trimming from the site, there is a fair range of woodworking techniques from such a relatively small assemblage. Also, a good deal of the woodworking detail is distorted and obscured because of the level of charring. It is possible that there may have been other joints than the two mortices (Wood 17 – Fig. 4.8.5 and Wood 58 – Fig. 4.7.4), which did not survive the burning. Hewing and trimming of wood produces large quantities of woodchips and as these are absent from the site then it can be said with some confidence that there is no evidence that any extensive woodworking was being carried out on site.

There is much to suggest that a great deal of the material here is derived from a burnt-down structure. There is a lack of any obvious horizontal member or timber *in situ*, but the high proportion of timber and hazel of an appropriate size for wattling is interesting, and it seems to be mostly this material that is charred. Mark Robinson (see above) found no beetles that might be associated with structural buildings, so his suggestion that the building burned down (or was demolished) elsewhere and then dumped here seems very likely. It is also supported by the fact that there were quantities of burnt hazel among the charred plant remains from the site.

Catalogue of wood *(Figs 4.7–11)*

1. Fig. 4.11.15. Roundwood (Pomoideae – apple, hawthorn etc.). Possible felled trunk or stem, trimmed one end/two directions, tool marks on the felling facet with tool mark 40:3 (Fig. 4.13). Slight curve may indicate coppicing. Conserved by freeze-drying. L: 530 mm; Dia.: 100 mm.
2. Roundwood (Pomoideae – apple, hawthorn etc.) Trimmed one end/one direction, long straight stem (possibly coppiced). Conserved by freeze-drying. L: 1160 mm; Dia.: 92/58 mm.
3. Timber debris (Pomoideae – apple, hawthorn etc.), half split. Disintegrated on lifting.
4. Roundwood (*Prunus* sp. – sloe, cherry etc.). Recorded as trimmed in the field. L: 780 mm (field measurement); Dia.: 80 mm.
5. Roundwood (Pomoideae – apple, hawthorn etc.). Trimmed one end/all directions, curved stem possibly indicates coppicing or hedging. L: 480 mm; Dia.: 80 mm (field measurements).
6. Roundwood (Pomoideae – apple, hawthorn etc.). Recorded as bent and trimmed in the field. L: 250 mm; Dia.: 35 mm.
7. Discarded in the field.
8. Roundwood (*Corylus avellana* – hazel), charred. Dia.: 25 mm.
9. Roundwood (*Corylus avellana* – hazel), almost totally charred. Dia.: 20 mm.
10. Fig. 4.8.7. Timber debris (*Quercus* sp. – oak), heavily charred. Radially split and trimmed flat, with V-shaped notch in one end. L: 215 mm; W: 73 mm; Th.: 52 mm.
11. Roundwood (Pomoideae – apple, hawthorn etc.), charred. Dia.: 70 mm.
12. Roundwood (*Corylus avellana* – hazel), charred. L: 460 mm; Dia.: 15 mm.
13. No ID, ?sample lost or not taken, partially charred. Roundwood, possibly trimmed. L: 210 mm; Dia.: 27 mm.
14. Roundwood (*Corylus avellana* – hazel), almost totally charred. Dia.: 30 mm.
15. Roundwood (*Corylus avellana* – hazel). Dia.: 20 mm.
16. ?Roundwood. L: 32 mm; Dia.: 20 mm. No further details available.
17. Fig. 4.8.5. Timber debris (*Quercus* sp. – oak), partially charred. Half split and hewn tangentially. L: 250 mm; W: 10 mm; Th.: 44 mm.
18. Roundwood (*Corylus avellana* – hazel), partially charred. Possibly trimmed. L: 240 mm; Dia.: 25 mm.
19. Roundwood (*Corylus avellana* – hazel), almost totally charred. Trimmed one end/to a point. Dia.: 30 mm.
20. Roundwood (*Prunus* sp. – sloe, cherry etc.). Dia.: 60 mm.
21. Roundwood (poss. Pomoideae – apple, hawthorn etc.), partially charred. Dia.: 30 mm.
22. Debris (*Alnus glutinosa* – alder). L: 160 mm; W: 90 mm.
23. Roundwood (Pomoideae – apple, hawthorn etc.). L: 240 mm; Dia.: 25 mm.
24. Timber debris (*Quercus* sp. – oak), charred almost all over. Half split. L: 570 mm; W: 70 mm; Th.: 60 mm.
25. Roundwood (unidentifiable), ?totally charred. 'Cut' marks observed in the field. L: 100 mm; Dia.: 30 mm.
26. Roundwood (Pomoideae – apple, hawthorn etc.). Right-angled bend and curve, trimmed at one end. Dia.: 70 mm.
27. Timber debris (*Quercus* sp. – oak). Half split with open joint. L: 200 mm; W: 90 mm; Th.: 40 mm.
28. Fig. 4.7.2. Timber debris (*Quercus* sp. – oak). Tangential split, trimmed one end/one direction. Conserved by freeze-drying. L: 80 mm; W: 30 mm.
29. Roundwood (*Prunus* sp. – sloe, cherry etc.). Dimensions not recorded.
30. Timber debris (*Quercus* sp. – oak). Tangential split. L: 50 mm; W: 30 mm; Th.: 35 mm.
31. Fig. 4.7.3. Timber debris (*Quercus* sp. – oak). Tangential split (slab). L: 420 mm; W: 80 mm; Th.: 20 mm.
32. Timber debris (*Quercus* sp. – oak), partially charred. Half split. L: 120 mm; W: 60 mm; Th.: 30 mm.
33. Roundwood (*Corylus avellana* – hazel), one end charred lightly. Dia.: 20 mm.
34. Roundwood (*Coryus avellana* – hazel), partially charred. L: 235 mm; Dia.: 20 mm.
35. ?Debris. L: 16 mm (max.); W: 8 mm. No further details available.
36. Roundwood (*Corylus avellana* – hazel), partially charred. L: 340 mm; Dia.: 25 mm.
37. Timber debris (*Quercus* sp. – oak), almost totally charred. L: 200 mm; W: 90 mm.
38. Roundwood (Pomoideae – apple, hawthorn etc.). L: 160 mm; Dia.: 20 mm.
39. Roundwood (*Corylus avellana* – hazel), partially charred. L: 180 mm; Dia.: 30 mm. UB-3138 2776±40 BP.
40. Fig. 4.10.12. Roundwood (*Corylus avellana* – hazel). Trimmed one end/one direction (with a flattish blade), one end/ two directions and side branches. L: 330 mm; Dia.: 50 mm.
41. Roundwood. L: 380 mm Dia.: 20 mm. No further details available.
42. Timber debris (*Quercus* sp. – oak), heavily charred. Tangentially split. L: 180 mm; W: 90 mm; Th.: 30 mm.
43. Roundwood (Pomoideae – apple, hawthorn etc.). Trimmed one end/one direction. Dia.: 45 mm.
44. Debris (*Quercus* sp. – oak). Tangential trimming of knot hole. Conserved by freeze-drying. L: 60 mm; W: 30 mm; Th.: 56 mm.
45. Roundwood (*Corylus avellana* – hazel). L: 340 mm; Dia.: 20 mm.
46. Roundwood (*Corylus avellana* – hazel). Dia.: 30 mm.
47. Roundwood (*Corylus avellana* – hazel), partially charred. Dia.: 40 mm.

48. Roundwood (*Corylus avellana* – hazel), charred one end. Trimmed one end/two directions. L: 900 mm; Dia.: 25 mm.
49. Fig. 4.8.6. Timber (*Quercus* sp. – oak), charred heavily on one side. Half split. L: incomplete; W: 170 mm; Th.: 120 mm.
50. Roundwood (*Corylus avellana* – hazel), charred one end. Possibly trimmed to a point, but charred. Dia.: 24 mm.
51. Roundwood (*Corylus avellana* – hazel), charred one end. Trimmed or charred to a point. Conserved by freeze-drying. L: 1100 mm; Dia.: 35 mm.
52. Timber debris (*Quercus* sp. – oak), charred heavily on one side. Tangentially split. L: 225 mm; W: 150 mm; Th.: 70 mm.
53. Discarded in the field.
54. Fig. 4.7.1. Timber debris (*Quercus* sp. – oak), charred on outside and ends quite deeply. Half split and trimmed one end (possibly felling facets). L: 300 mm; W: 220 mm; Th.: 120 mm; orig. Dia.: 220 mm.
55. Roundwood (*Quercus* sp. – oak), heavily charred. L: 240 mm; Dia.: (distorted) 60/50 mm.
56. Discarded in the field.
57. Roundwood (*Corylus avellana* – hazel), charred almost all over. Straight stem and possible curve of coppice heel. Trimmed one end/one direction. Conserved by freeze-drying. L: 740 mm; Dia.: 60 mm.
58. Fig. 4.7.4. Timber (*Quercus* sp. – oak), partially charred on one side and end. Half split with open joint. L: 740 mm; W: 220 mm; Th.: 60 mm. UB-3139 2713±35 BP.
59. Timber debris (*Quercus* sp. – oak), charred almost all over. Half split. Conserved by freeze-drying. L: 220 mm; W: 70 mm; Th.: 60 mm.
60. Roundwood (*Corylus avellana* – hazel), charred lightly all over. Possibly trimmed one end/one direction. Dia.: 30 mm.
61. Timber debris (*Quercus* sp. – oak), heavily charred. Half split. L: 185 mm; W: 105 mm (max.) 70 mm (min.); Th.: 55 mm.
62. Timber debris (*Quercus* sp. – oak), heavily charred. Half split. L: 130 mm; W: 80 mm; Th.: 50 mm.
63. Roundwood (*Corylus avellana* – hazel), partially charred. L: 250 mm; Dia.: 20 mm.
64. Fig. 4.9.10. Timber debris (*Quercus* sp. – oak). Tangentially split and trimmed one end, one direction. Conserved by freeze-drying. L: 160 mm; W: 110 mm; Th.: 30 mm.
65. Timber (*Quercus* sp. – oak), partially charred. Recorded as a 'plank' in the field. L: 400 mm; W: 80 mm; Th.: 20 mm.
66. Roundwood (*Quercus* sp. – oak), heavily charred. Split log. L: 530 mm; W: 110/70 mm.
67. Roundwood, partially charred. Dia.: 25/15 mm.
68. Roundwood (*Corylus avellana* – hazel). Dia.: 20 mm.
69. Timber debris (*Quercus* sp. – oak), heavily charred. Half split. W: 150 mm; Th.: 50 mm.
70. Debris (*Quercus* sp. – oak), charred on one side. Radial woodchip. L: 127 mm; W: 60 mm; Th.: 20 mm.
71. Timber (not sampled for ID), charred over whole surface. Described in the field as a 'plank'. L: 1050 mm; W: 180 mm.
72. Roundwood (Pomoideae – apple, hawthorn etc.). L: 1140 mm; Dia.: 90/70 mm.
73. Timber (*Quercus* sp. – oak), charred heavily all over. Tangentially split, possibly trimmed square. L: 1050 mm; W: 60 mm; Th.: 35 mm.
74. Roundwood (Pomoideae – apple, hawthorn etc.). Dia.: 70 mm.
75. Fig. 4.9.11. Timber debris (*Quercus* sp. – oak). Radial split, trimmed one end/one direction, with tool mark 30:7 (Fig. 4.13). Conserved by freeze-drying. Orig. Dia.: 400 mm.
76. Roundwood (*Corylus avellana* – hazel), partially charred. Dia.: 25 mm.
77. Timber debris (*Quercus* sp. – oak), charred on one side. Tangentially split, and trimmed one end/concave. Conserved by freeze-drying. L: 180 mm; W: 80 mm; Th.: 35 mm.
78. Roundwood (*Corylus avellana* – hazel), partially charred. Dia.: 60/50 mm.
79. Roundwood twig (Pomoideae – apple, hawthorn etc.). L: 90 mm; Dia.: 5 mm.
80. Roundwood (*Corylus avellana* – hazel). L: 570 mm; Dia.: 20–25 mm.
81. Fig. 4.8.8. Timber debris (*Quercus* sp. – oak). Split and trimmed both ends and side branches – one end/flat, one end/two directions, with tool mark 36:3 (Fig. 4.13). L: 250 mm; orig. Dia.: 100 mm.
82. Discarded in the field.
83. Roundwood (Pomoideae – apple, hawthorn etc.). Dia.: 60 mm.
84. Timber debris (*Quercus* sp.– oak). Recorded in the field as 'radial split'. L: 240 mm; W: 50 mm; Th.: 15 mm.
85. Roundwood (*Prunus* sp. – sloe, cherry etc.). Dia.: 40 mm.
86. Timber debris (*Alnus glutinosa* – alder). Recorded in the field as 'split log'. W: 90 mm; Th.: 40 mm.
87. Roundwood (*Corylus avellana* – hazel), partially charred. Trimmed one end/one direction. Dia.: 20 mm.
88. Roundwood (Pomoideae – apple, hawthorn etc.). Trimmed one end/one direction. L: 500 mm; Dia.: 50/40 mm.
89. Fig. 4.10.14. Roundwood (*Prunus* sp. – sloe, cherry etc.). Natural fork, gnarled. Trimmed one end/one direction. Conserved by freeze-drying. Dia.: 50 mm.
90. Debris (*Fraxinus excelsior* – ash). L: 160 mm; W: 50–60 mm; Th.: 20–30 mm.
91. Fig. 4.10.13. Roundwood (*Corylus avellana* – hazel), almost totally charred. Trimmed one end/one direction. Conserved by freeze-drying. L: 410 mm; Dia.: 54 mm.
92. No details available.
93. Fig. 4.11.16. Roundwood debris (*Quercus* sp. – oak). Part of a coppice stool with three stems. Three stems trimmed one direction. Conserved by freeze-drying. Dia.: 25 mm.
94. Roundwood (*Corylus avellana* – hazel). L: 380 mm; Dia.: 30–40 mm.
95. Roundwood (*Quercus* sp. – oak). Some sapwood hewn off. Structural vertical. Dia.: 170 mm.
96. Fig. 4.9.9. Roundwood (*Quercus* sp. – oak). Structural vertical with notch or joint cut in top. Dia.: 170 mm.
97. Roundwood (*Quercus* sp. – oak). Some sapwood hewn off. Structural vertical. Dia.: 200 mm. UB-3141 2736±45 BP.
98. Roundwood (*Quercus* sp. – oak). Structural vertical. Dia.: 200 mm. UB-3140 2739±40 BP.

SHELL

by Greg Campbell

A very small number of shells (34 complete valves or hinged parts of valves of bivalves, and 38 fragments) were recovered by hand from 17 contexts during the course of excavation. One of the part valves is from a swan or duck mussel (*Anodonta* sp.), with the remaining 33 valves or part valves of painter's mussel (*Unio* sp.). The thickness of the unidentifiable fragments implies that the great majority of these are also *Unio*.

Both of these are mussels of lime-rich fresh water of medium to slow flow. While both mussels are edible, none of the intact valves refit, nor do any show evidence of opening breakage or of burning. This assemblage represents a population that would be washed up dead on the edges of a gravelly island in a reticulated river system, rather than food debris. The contexts in which the shells were recovered are almost all riverbanks around the edges of the eyot. The few fragments from the dry ditch 2413 probably eroded out of the gravel forming the eyot.