Chapter 7

Overview of the environmental evidence

ENVIRONMENTAL OVERVIEW

by Rebecca Nicholson

A comprehensive sampling strategy was adopted throughout excavation in order to examine the range of organic waterlogged deposits present across the site and to better understand the complex processes that formed them. During the excavation a total of 695 soil samples were collected. A total of 561 bulk soil samples, typically of 40 litres, were taken from datable fills and layers. A further 78 samples were column samples (monoliths), taken to allow further study of sediments within the ditches and garden soils, and 56 were samples taken for potential chemical analysis or wood identification. Six boreholes were also dug to investigate key sequences in order to elucidate the site stratigraphy, supplemented by the available geotechnical records for the development area.

Following a preliminary assessment of sample integrity and potential value, samples were prioritised for analysis based on their potential to provide useful information on past diets and/or economic activities in this area of Bristol. In addition, waterlogged samples with rich assemblages of both waterlogged plant remains and insect remains were given priority in order to allow a multi-proxy approach to the investigation of waste deposits, since this type of approach is essential if complex urban deposits are to be properly understood. In particular, it became clear after the assessment that most fills of the ditches and pits contained waste from a range of different sources and that disentangling these in order to look for specific activities, such as tanning, would require detailed work and a range of specialisms.

Summary of the environmental evidence

The earliest excavated deposits at Finzel's Reach were the lowest surviving fills of the Law Ditch. The base of the ditch was recorded at +4.5m OD, indicating that it would have been submerged during high spring tides and dry during the mean high water neap tide (Champness, below). The lowest fills comprised interleaved deposits of rich organic silts, sterile clays and sandy clays typical of low-energy water-lain deposits. Fill 4653, a lens located immediately above basal fill 4652, has been dated to 991± 25BP (NZA 30153) and 962±25BP (NZA 30143), the latter giving a calibrated date of AD 1021–1155 (95%). The diatom assessment (Barker 2009) from the lower fills indicated the presence of species that inhabited high inter-tidal mudflat environments, while both pollen and waterlogged plant remains were poorly preserved, possibly due to seasonal drying out of the ditch (Druce 2009; Smith 2009). The diatom assemblages from higher deposits within the ditch are indicative of estuarine conditions with varying water depths, while the presence of marine plankton in some samples suggests tidal inundation (Barker 2009). That nearly all the samples contain diatoms indicates the majority of the sediment was deposited under waterlogged or at least tidally inundated conditions, while high levels of nutrients evident in the samples could be either from naturally eutrophic creeks or augmented by human wastes.

Pollen preservation within the ditch appears to be limited to a discrete context (4564) mid-way in the fill sequence, which has been dated to 928±25BP, or cal AD 1031–1162 (NZA 30154), and is likely to represent dumped material including chopped straw, cereals, weeds and moss as well as salt-marsh mud (Druce 2009, Smith 2009). An ovicaprid pelvis fragment from context 4417, higher in the ditch sequence, has been dated to 969±25, cal AD 1018–1155 (NZA 30159). This date is very similar to those from underlying deposits 4564 and 4652, suggesting significant redeposition of material within these ditch fills.

Smaller drainage ditches cut in the mid-late 12th century included a recut roadside ditch to the east of Temple Street (1009), which probably drained into the Avon. Pollen from the lowest excavated fill (1239) indicates that this feature channelled slow moving freshwater when first dug, but, as corroborated by diatom evidence, it is clear that the feature soon became flooded with salt water and that salt-marsh conditions prevailed, although it is likely that the area supported a little alder, birch and hazel woodland when the ditch was first dug, with some grassland and disturbed ground nearby. Some cess appears to have entered the ditch too, since fill 1239 included insects typical of faecal waste and sewage (Smith, below).

That rubbish and stabling waste material were frequently discarded into both the Law Ditch and the subsidiary ditches is evidenced by the organic remains within them. Human fleas, for example, were common in fill 1007 of roadside ditch 1009 (see also reports by Jones and Smith, below). The primary fill of ditch 6003 in Area 2 contained abundant anoxically preserved cereal/grass straw fragments and charred cereal chaff together with common arable weeds. Seeds from water plantain, spike-rush and sea arrowgrass reflected the riverside location of the ditch.

While the first phase of the Law Ditch coincides with the earliest identified settlement remains, a group of medieval recuts seems to follow an extensive levelling/land reclamation with the use of reddish and sterile clay which reached a thickness of 0.70m. Alluvial context 3287 (property TSW3) appears to have been minimally affected by enrichment through human activity (Macphail, below), while the waterlogged plant remains from context 7375 of similar date (the fill of ditch 7371, also in property TSW3) included wood from hazel, hawthorn, elder and bramble, together with seeds from weeds, such as nettle, fat-hen, and dock, which suggest a nutrient-rich scrubland environment. The diatoms and the waterlogged plant remains from the fills of the ditch recuts also indicate a nutrient-rich environment, with evidence of rubbish and waste being thrown into the ditch. The natural sluicing of the river may have been sufficient to clear much of the waste generated by the occupants and industries close to the Law Ditch, which may have been why malodorous industries and crafts were located in this area of the site.

A number of pit groups dating from the late 12th-early 13th century appeared during excavation to be associated with tanning, based on their design and layout and the presence of bark and horn cores within their fills. However, these items were accompanied by a much wider range of material, including bones, shells and seeds typical of domestic rubbish and it is likely that they formed part of an assemblage of general refuse rather than tanning waste, particularly since insect fauna indicative of tanning were not recorded in large numbers in these features. Perhaps the best bioarchaeological evidence for tanning comes from pit 2334, a mid 13th-14th century feature in property TSE1N, which contained very degraded wood and bark (unidentified species) as well as a hard white chalky deposit, probably lime. The very strongly decayed nature of the bark could be consistent with tanning (A. Hall pers. comm.). Again, though, evidence was also present to indicate that general domestic rubbish has been dumped into the pit, and although a number of cattle horns and skull fragments were recovered from the fills, so too were a range of other animal bones.

While direct palaeoenvironmental evidence for tanning was limited, there was some evidence for industries relating to textiles. Pit 4431 (A1.15, TSW2) seems to contain some remains typical of cloth working and dyeing, including possible evidence for the coppicing of dyer's greenweed, together with general settlement waste including straw, possible woodworking debris, moss and bark (probably from more than one type of tree). Wool processing is indicated by finds of the puparia of the 'sheep ked' *Melophagus ovinus* in four pits and the sheep louse *Bovicola ovis* in two pits.

Pit 3850 (A1.31, TSW1), a deep well lined with two barrels, seems to have been used as a cesspit, as indicated by an abundance of highly fragmented cereal bran and seeds of corncockle, a common contaminant of flour, together with mineralised organic concretions, mineralised fly pupae and filter flies. Bracken, heather and gorse remains are suggestive of animal bedding, but again there is some evidence in the plant remains for cloth production and dyeing: madder root fragments were frequent and weld seeds were present, together with remains from fuller's teasel and flax. The flower heads from fullers' teasel were used to raise the nap on textiles as part of the finishing process. Similar remains were recovered from early river channel 11010 in Area 3d. There is also some evidence for cloth production and possibly of dyeing from a sample taken from 13th-14th century river alluvium (5209) including small fragments of madder root, over 400 weld seeds, a flax seed and teasel achenes, some definitely identified as fuller's teasel rather than its wild relative.

Other mid 12th-early 13th century features contained evidence for settlement/domestic waste and, particularly, faecal waste. A rich assemblage of cereal bran, small fruit seeds and insects typically found in cess deposits suggests that the last use of pit 3768, on property TSW2, may have been as a latrine and other pits nearby also contained strong indicators of cess. Another pit on this property (7039) included abundant wood shavings, charcoal and bark, which probably reflect debris from woodworking. A third pit in this group (3623) also included small fragments of wood, possibly worked chips as well as some bark. The fills of several pits included material more typical of stabling waste or animal fodder, domestic refuse and human and/or pig faecal waste than of any industrial function, and it seems likely that the fills reflect the secondary use of the features. The two fills of pit 4987 included high concentrations of cereal bran as well as abundant tiny fish bones which included an unusual find of lamprey, together with numerous trickling filter flies, again indicating the incorporation of human faecal material and likely use of this feature as a cesspit. Mid 13th-14th century and later medieval (14th-15th century) pits similarly appear to have been generally filled with a mixture of animal bedding/stabling waste, domestic refuse and cess, probably reflecting the later filling of these features rather than their original use. Pit 4146 also included a cache of fruit stones and pips.

A series of garden soils were formed on top of the reclaimed alluvial surface, although prior to the development of these soils some kind of earlier soil formed naturally over alluvium must have existed and would have undergone the same process of reworking that resulted in the homogenous garden soils. The garden soils produced a significant amount of pottery, which when taken together with the homogenous nature of these garden soils indicates continual reworking over a period of at least 300 years. Ashy material and charred cereal grains attest to the incorporation of hearth and possibly oven rake-out material. Three separate garden soil layers were identified from test pits: 'earlier' garden soils formed after reclamation in the 12th century and 'later' garden soils related to 13th-15th century occupation. Further investigation of early-mid 12th garden soil showed it to be composed of a mixture of alluvium and middening waste, forming a fertile and biologically (eg earthworm) worked soil (Macphail, below). This soil level was subject to flooding, which both deposited alluvium and slaked the soils. The late 12th-early 13th century garden soil, however, showed strong phosphate staining, probably due to the deposition of faecal waste (pig or human) and/or urine to enhance the soil. This soil was also biologically worked and homogenised, probably for cultivation, before it was flooded. Above this, the uppermost garden soil was sealed by a 14th- to 15th-century wall and retains the characteristics of topsoil, although again there is evidence of flooding.

Charred cereals recovered at the site included grains from oats, rye, barley and free-threshing wheat, some of which were probably included with straw as bedding. Where concentrations of charred grain occurred, they were often primarily of bread wheat, but 15th- to mid 16th-century rake-out layer 4687 was composed primarily of charred peas, with a smaller quantity of broad beans and abundant charred grain.

ANIMAL BONE *by Lena Strid*

Overview of the assemblage

The mammal, avian and amphibian bone assemblage comprised 41,523 fragments, from deposits dated from the early-mid 12th century to the mid 15th-16th century. The majority derived from Area 1 and from the mid 13th-14th century. A total of 5073 fragments (12.2%) were identifiable to family, genus or species. This is an unusually low percentage, as most urban assemblages have a significantly higher level of identifiable bones, and can be attributed to the large proportion of the assemblage that was recovered from sieved samples, comprising many small, unidentifiable fragments. The assemblage is dominated by domestic livestock, followed by domestic birds. Other domestic species, wild mammals and wild birds comprise a very small part of the assemblage (Table 7.1). This is similar to other Bristol assemblages (Jones and Watson 1987; Noddle 1985; Barber 1998; Barber 2006; Levitan 1988), and indeed most medieval assemblages excepting those from 'high status' sites (Grant 1988, 152, 160, 163-164).

Livestock

The relative contribution of the different species to the medieval diet and economy at the site is complicated by a number of factors relating to the relative under- or over-representation of bones and fragments from different taxa in faunal assemblages. Bristol is situated between two areas with contrasting environments: the wetlands along the Severn, which favour cattle and the dry hills of the Cotswolds, where sheep predominate. This suggests that the inhabitants of Bristol would have had regular access to both beef and mutton. Overall, however, it appears to be the case that cattle were more frequent in the mid 12th- to mid 13th-century assemblage, while sheep/goat became the more numerous taxon in the mid 13th- to 14th-century assemblage, albeit by only a very small margin. Butchery marks occurred on all livestock, most frequently on cattle and sheep/goat bones. A progressive increase in the proportions of older sheep/goat and young cattle throughout the medieval period indicates the growing importance of wool production and beef.

Ageing data suggest that surplus young cattle and sheep/goat were culled for meat and adult or older animals were slaughtered when they were past their prime as breeders, draught animals, dairy and/or wool producers. Few cattle were less than 1.5 years old and the majority of sheep/goat were slaughtered at 2-4 years old. Almost all of the pigs were slaughtered young. Neonatal piglet remains were found in small numbers in all periods and since none of these were articulated or semi-articulated, it seems likely that these remains represent kitchen waste rather than natural mortalities.

Relatively few elements were sexable. Cattle pelves show a 1:2 ratio of male to female (n:30), suggesting that cattle husbandry in the surrounding areas was focussed on dairy production, although the morphology of fragmentary female cattle pelves is easier to identify than male ones, which may skew the estimation.

The sex estimation for the sheep/goat assemblage varies depending on which element was used for sexing. The pelves indicate equal numbers of females and castrates, with a small number of entire males as well as a large number of indeterminate males. Medieval records of live sheep flocks from Somerset and Gloucestershire are not available, but records from Oxfordshire show flocks dominated by ewes, wethers and lambs, and a very small number of rams (Postles 1984, 145). Despite lambs not being included in the sex estimation of the bone assemblage, the dead sheep/goat assemblage from Finzel's Reach show great similarities to the live sheep flocks from Oxfordshire. In contrast, males and females are almost equally represented among the goat horn cores, whereas for sheep, male horn cores are very much more common. This suggests that among the goats, both sexes were horned, whereas few female sheep were horned, a sugges-

Table 7.1 Number of bones per taxon in all phases of the Bristol Finzel's Reach assemblage

	Period 1 *(c 950–1100)*	*Period 2* *(c 1100–1150)*	*Period 3* *(c 1225–1375)*	*Period 4* *(c 1375–1500)*	*Period 5* *(c 1500–1550)*
MAMMALS					
Cattle	103	632	830	330	41
Sheep/goat	104	381	653	259	19
Sheep	16	44	69	15	2
Goat	9	17	20	1	
Pig	31	183	321	55	8
Horse		5	2	4	
Dog	2	3	2		
Cat	2	14	21	4	1
Red deer	1			1	
Roe deer			1		
Deer sp.		2	1	1	
Rabbit		1	5	2	2
Hare		2	8	6	1
Squirrel		1			
Stoat/weasel				1	
Total mammals	268	1285	1933	779	74
COMMENSAL SPECIES					
House mouse					1
Mouse sp.		3	8	1	2
Field vole		1			
Bank/field vole		1	6	1	
Rat		1	36	2	1
Rodent		1	17		1
Amphibian	1	22	3	1	
Frog	2	3			1
Microfauna	3	10	53	3	10
Total commensals	6	42	123	8	16
BIRDS					
Fowl	2	73	220	111	30
Galliformes		5		1	2
Peacock			1		
Goose	7	55	86	41	11
Duck		3	10	17	
Mallard				1	
Teal			6		
Woodcock			1	1	
Golden plover		1	1		
Curlew		1			
Snipe			1		
Wader sp.					1
Rallidae sp.				1	
Crow/rook		1			
Jackdaw			1		
Passerine	1	4	8	8	1
Indet. bird	43	371	901	335	140
Total birds	53	514	1236	516	185
Small mammal	5	16	136	19	2
Medium mammal	84	608	1171	604	65
Large mammal	109	806	1497	590	44
Indeterminate	526	6200	16128	5373	502
Total	1051	9471	22224	7889	888

tion that is supported by pictorial studies of medieval manuscripts, where all explicitly stated ewes are hornless (Armitage and Goodall 1977, 75-80; Barber 1999, 77-80). Hornlessness was a desirable trait in a wool-focused sheep economy, as the fleece could be damaged when the animals used their horns to scratch themselves or in fighting (Armitage and Goodall 1977, 85).

The cattle horncores belonged mostly to short-horned cattle (cf Armitage and Clutton-Brock 1976). In the mid 12th-early 13th century, short-horned and medium-horned cattle were evident as two distinct groups in a plot of the basal circumference against the greatest basal width, but otherwise no obvious distinction could be discerned. It is uncertain whether this indicates different sexes or breeds. There is a long tradition of trade in cattle from Wales across the English border (Finberg 1954), and thus the cattle horncores in Bristol may represent cattle born and fattened in Wales as well as from the nearby counties of Somerset, Wiltshire and Gloucestershire. A long-distance trade in live cattle also cannot be excluded. Records further show import of salted hides from Ireland (Carus-Wilson 1951, 198), but it is not clear whether such hides would have included the horncore.

Cattle were the species most affected by pathological conditions, mainly manifesting on the lower legs as exostoses and lipping on phalanges, exostoses, bone absorption and pitting on proximal metapodials and extended articular surfaces on distal metapodials. These conditions, present in all periods except the 15th-mid 16th century, have been associated with the use of cattle for traction (Baker and Brothwell 1980, 114-115; Bartosiewicz *et al*. 1997, 32-33, 43).

Other domestic mammals

All horse remains were of adult animals, which is the norm for medieval urban assemblages, since horse was not normally eaten, being mainly used for transport. Butchery marks were consequently absent, although a hyoid tentatively identified as horse had its oral tip chopped off, possibly an indication of an unscrupulous butcher. Despite gnaw marks from dogs being spatially and chronologically extensive in the assemblage, dog bones were only retrieved from four contexts, ranging from the early-mid 12th century to the mid 13th-14th century. Cat bones are far more common than dog bones. Semi-articulated or probably semi-articulated remains are common, although often only a few bones were present per individual. It is possible that the carcasses have been disarticulated by recutting of features, or by dogs and other scavengers extracting partially buried carcasses. Cut marks were noted on one femur (mid 13th-14th century) that may be associated with disarticulation of the hip joint, and consequently butchery, which is unusual to find on cat bones, as cats were normally not eaten. However, there are medieval sources which mention the use of cat meat for medicinal purposes (Doll 2003, 267). Similar cut marks have been recorded on cat femora from mid 11th- to early 12th-century Winchester (Strid 2011) and 9th- to 11th-century Haithabu, Germany (Johansson and Hüster 1987, 40-44).

Wild mammals

Wild mammals comprise a very small part of the faunal assemblage, as is common in medieval assemblages, since the hunting of wild animals was restricted to the elite (Sykes 2005, 77). However, eating game was not restricted and records show that venison was given as tithes to ecclesiastical houses, as gifts to high ranking officials and estate workers as well as part of payments to forest workers. Poaching was also very frequent and poached meat could be sold to the urban market, as records show a steady trade of illegal meat from the Midlands forests to Bristol (Birrell 1996, 86). Venison received legally may also have been sold to the urban markets, thus blurring the lines between illegal and legal consumption from the consumers' perspective. The red deer and red/fallow deer remains at Finzel's Reach comprise four long bones and two antler fragments. As the burr was not present on any of the antler fragments, it is not known whether they came from gathered shed antlers or from a hunted or poached deer. Bones from hare and rabbit are more frequent in the assemblage than deer bones. Rabbit was an expensive meat (Veale 1957, 89) and it is therefore not unlikely that a large amount of the rabbit bones in urban non-high status assemblages represent poached animals. The rabbit and hare remains in the assemblage came from most parts of the body, suggesting that they were transported whole to the town and butchered either by the local butcher or the consumer.

Birds

The avian assemblage is dominated by domestic fowl, followed by goose. With few exceptions, this is a ubiquitous pattern for medieval bird assemblages in Britain (Serjeantson 2006, 134-136). Other birds present include peacock, ducks, waders, corvids and small passerines. A group of bones from small galliforms, mostly juvenile, may possibly be from partridge or quail, although they could belong to small domestic fowl. With exception of crow/rook and jackdaw, which as scavengers were not considered suitable for eating, all bird species present probably represent kitchen waste. They were probably sourced locally; waders and ducks could have been caught in the Severn estuary or on local rivers, and passerines in fields and woodland around the town. A peacock, represented by a single tarsometatarsus, is unusual for the assemblage, as this species is strongly associated with high status sites. Archaeological remains of peacocks are mainly found in assemblages from wealthy households, such as castles, abbeys, manors and wealthy town houses (Serjeantson 2009, 311). As there are no other archaeological indicators of particularly high status for this property, the bone may have come from a poached bird. Juvenile birds were restricted to domestic fowl, goose and unidentified galliforms and may be evidence for breeding on site, although medieval records show that immature geese were slaughtered and sold as 'green geese'.

Industrial activity

There are several industrial activities that yield specific waste which can be recognised in animal bone assemblages. These include slaughter/primary butchery, tanning and several bone-, horn- and antler-working crafts. Often waste from one craft was the raw material in another. For example, horncores were included on the hides that the tanner bought from the butcher. The tanner would remove the horncores and feet prior to tanning, and either dump these body parts or sell them to horn- and/or boneworkers. It can therefore be difficult to link waste dumps with a particular craft (Serjeantson 1989, 136-141; Yeomans 2007, 111-112). Skeletal elements that can be used to identify industrial activity include skulls with evidence of slaughter (slaughter/primary butchery), horn cores (tanning, horn-working), metapodials (slaughter/primary butchery, tanning, boneworking) and phalanges (slaughter/primary butchery, tanning). These elements often occur in small numbers throughout a site, mixed with domestic waste, and cannot in those cases be used for craft identification. However, when they are found in dumps they can be used as craft indicators (Albarella 2003; Hall and Kenward 2003, 121-124 and 127).

Properties TSE1S (mid 12th-mid 13th century), TSE1N (mid 13th-14th century), TSE2 (mid 13th-14th century) and TSW2 (mid 12th-mid 13th century) included features with a significant number of cattle, goat and sheep horncores and cattle metapodials. Horncores from cattle, goat and sheep were also found in a roadside ditch beside Temple Street (early-mid 12th century) and may indicate that horn-working and/or tanning took place in the area at that time. Properties TSE1N, TSE1S and TSW2 included possible tanning pits but most of these features lack other direct biological tanning indicators, such as large quantities of bark, hair and lime (cf Hall and Kenward 2003). The one exception was pit 2334, on property TSE1N, which contained many highly fragmented and degraded pieces of bark and lime (Jones, below). The pit was associated with two round pits (2328 and 2504) and one small round pit (2203), all of which contained dumps of skeletal material including disproportionally abundant cattle and goat horncores and sheep/goat metapodials. Remains of bark and lime were found in pit 2334, but were absent in the samples from pit 2328. Pit 2504 cut pit 2328, suggesting that activity of a similar nature took place over a long enough period of time to require recutting of the feature.

Most of the concentrations of skeletal elements suggestive of industrial activity at Finzel's Reach were cattle horncores, and to lesser extent goat and sheep horncores. The deposited horncores include both loose horncores and horncores still attached to the skull. No horncores had been sawn and only one cattle horncore displayed cut marks near the base of the horncore, possibly deriving from removal of the horn sheath. Cut marks on frontal bones from skinning were present on one goat and three cattle horncores. Large numbers of cattle metapodials were only found in six pits in property TSW2. The general scarcity of metapodials compared to horncores in the waste deposits, as well as the absence of dumps of animal hair and lime, may indicate that the main craft in the area related to animal products was horn-working rather than tanning, though the evidence is equivocal.

FISH *by Rebecca Nicholson*

The identified fish assemblage recovered from sieved bulk soil samples comprised almost 9500 items, from an estimated 27,000 fragments weighing 3022g. In addition, some 300 fragments were hand collected on site. This assemblage augments other much smaller medieval fish assemblages from 82-90 and 98-103 Redcliff Street, 30-38 St Thomas Street, 76-79 Victoria Street, Welsh Back and Bristol Bus Station (Locker 2001; Nicholson 2001a; 2001b; 2004; 2006; 2007; 2008/9). Much of the fish bone was in good or excellent condition, the best preserved material coming from waterlogged pits. While anaerobic conditions reduce decay, the excellent condition of bone within some of these features may also be due to the impregnation of bones with tannins produced by the degradation of vegetable matter, which in turn inhibits bacterial decay (see for example Gonzalez-Farias and Mee 1988).

The assemblage

Over 9500 bones and scales were identified (Tables 7.2–3). Herring-family (Clupeidae) and eel (*Anguilla anguilla*) were the most commonly identified taxa, with cod-family fishes (Gadidae) and small flatfishes (including plaice/flounder/dab and sole) also present in many contexts. Other fish recorded in many samples included hake, conger eel, sea bream, gurnards and rays. Sea breams in particular were commonly recognised from their robust and distinctive scales; both red sea bream and gilthead bream were identified, though the former was more common. There was no evidence of butchery on any of the bones. Freshwater fish including small cyprinids, perch and pike were present in a relatively small number of samples. As is the case for eels, salmonids and 3-spined sticklebacks can be found in fresh, brackish and marine environments,

Table 7.2 Hand collected fish remains (number of identified specimens)

Species	*1*	*2*	*3*	*4*	*6*	*7*	*9*	*Total*
Elasmobranchii (sharks/rays)				1				1
Raja clavata (thornback ray)	1	1	1					3
Conger conger (conger eel)	1	7	30	4				42
Salmonidae (salmon/sea trout)			1				1	2
Gadidae (cod family)		5	9	4				18
Gadus morhua (cod)	2	7	6	9				24
Pollachius virens (saithe)				5				5
Gadus/Pollachius sp. (cod/saithe/pollack)			1	1				2
Merlangius merlangus (whiting)				1				1
Melanogrammus aeglefinus (haddock)			1	4				5
Merluccius merluccius (hake)		20	7	4	2		1	34
Molva molva (ling)	20	2	12	3	1			38
Esox lucius (pike)			1					1
Triglidae (gurnards)			1	2				3
Trigla lucerna (tub gurnard)						1		1
Sparidae (sea breams)				1				1
Pagellus bogaraveo (red sea bream)			1	8				9
Flatfishes indet.		1		1				2
Pleuronectidae (right-eyed flatfish)			5					5
Hippoglossus hippoglossus (halibut)				1				1
Pleuronectes platessa (plaice)	1	1	3					5
Pleuronectes platessa/Platichthys flesus (plaice/flounder)			1					1
Unidentified	3	3	9	6	1	1		23
Grand total	28	48	92	51	4	2	2	227

Table 7.3 Fish remains recovered from the residues and flots of sieved soil samples
(Number of identified specimens; see methodology for further details)

Period	*1*	*2*	*3*	*4*	*6*	*7*	*Total*
Lampetra fluviatilis/planeri (river/brook lamprey)		1					1
Elasmobranchii (elasmobranch)	3	21	38	26		5	93
Scyliorhinidae/Squalidae (dogfish)			1				1
Rajidae (ray family)		28	26	11		2	67
Amblyraja radiata (starry ray)		1	1				2
Raja cf. *brachyura* (skate)		1					1
Raja clavata (thornback ray)	36	27	36	10		1	110
Raja microcellata (small-eyed ray)		1	1				2
Raja montagui (spotted ray)		2		1			3
Anguillidae (eels)		2	1				3
Anguilla anguilla (common eel)	31	1,280	368	290		18	1,987
Conger conger (conger eel)		23	52	32			107
Clupeidae (clupeids: herring family)	7	403	809	221	2	1	1,443
Clupea harengus (herring)	24	758	1,140	1,297		24	3,243
Sprattus sprattus (sprat)				1			1
Sardina pilchardus (pilchard)			6	15			21
Alosa cf. *fallax* (shad, cf. twaite)		1					1
Alosa sp.(Shads)		1	5	3			9
Salmonidae (salmon/trout)		4	7	8			19
Cyprinidae (cyprinids: carp family)	1	13	16	4			34
Rutilus sp. (roach/rudd)			2				2
Rutilus rutilus (roach)			1	1			2
Gobio gobio (gudgeon)		2					2
Esox lucius (pike)		7	3	14			24
Gadidae (gadids: cod family)	1	64	121	93	3	1	283

Table 7.3 (continued)

Gadus morhua (cod)	10	9	17	29			65
Pollachius pollachius (pollack)		1	4	18			23
Pollachius sp. (saithe/pollack)			1				1
Gadus/Pollachius spp.		3	2	1			6
Merlangius merlangus (whiting)		26	52	47			125
Gadus/Merlangius spp.		3	4	4		1	12
Melanogrammus aeglefinus (haddock)		10	13	4			27
Trisopterus spp. (bib/pout)		2	4				6
Molva molva (ling)		1	12	7		1	21
Merluccius merluccius (hake)		49	71	20		1	141
Perca fluviatilis (perch)		5	1	5			11
Dicentrarchus labrax (bass)				4			4
Belone belone (garfish)			1				1
Ammoditidae (sand eels)		1					1
Anarhichas lupus (wolffish)				1			1
Cottidae (cottids)				1			1
Triglidae (gurnards)	2	40	57	18			117
Eutrigla gurnardus (grey gurnard)		7	21	5			33
Trigla lucerna (tub gurnard)			7	3			10
Trigla l./*Aspitrigla gurnardus* (tub/red gurnard)			1				1
Gasterostidae (sticklebacks)		1					1
Gasterosteus aculeatus (3-spined stickleback)				2			2
Mugilidae (grey mullets)			1				1
Lisa sp.(thin-lipped/golden grey mullet)			1				1
Gobidae (goby family)		1	1				2
Trachurus trachurus (scad)		3	3				6
Zooarces viviparus (eelpout)				1			1
Labridae (wrasse family)			1				1
Sparidae (sea breams)	1	16	27	8			52
Pagellus bogaraveo (red sea bream)		1	1	6			8
Sparus aurata (gilthead sea bream)		1					1
Scombridae (mackerel family)		6	5	1			12
Scomber scombrus (mackerel)		3	11	20			34
Flatfish indet.	3	56	70	40			169
Bothidae (left-eyed flatfishes)		5		1			6
Scopthalmus maximus (turbot)			1	1			2
Pleuronectidae (right-eyed flatfishes)	4	66	98	93			261
Hippoglossus hippoglossus (halibut)			2				2
Pleuronectes platessa (plaice)	1	11	14	3			29
Pleuronectes/Platychthys sp. (plaice/flounder)		2	2				4
Limanda limanda (dab)			1	1			2
Platychthys/Limanda (flounder/dab)			1				1
Microstommus kitt (lemon sole)		1					1
Solidae (soles)		12	24	12			48
Solea solea (Dover sole)	1	58	56	10	1		126
Unidentified	1	102	112	51	1	1	268
Grand total	126	3,142	3,334	2,444	7	56	9,109

although it is much more likely that these fish were caught in rivers and streams or, at least in the case of eel, in the Severn Estuary. Freshwater fish were relatively expensive in the medieval period, and cyprinids of a size which would be considered inedible today are fairly common archaeological finds and were certainly bought and consumed (Dyer 1988).

The fish bone assemblages from a range of features across Areas 1, 4 and 5 were analysed by property and date (features ranging in date from the mid 12th to the 17th century). In general, despite the date range, a similar range of fish was present, with the diversity of taxa largely a reflection of the kind of deposit and number of identifiable bones rather than the date of the deposit. The 12th-century ditch fills contained a very similar suite of bones to those found in the later medieval pits. This picture has been seen for other organic remains (see Strid above and Jones and Smith, below) and suggests the possibility of considerable dumping and redeposition/reworking within features. Looking in more detail, however, and using a very crude measure based on the number of identified specimens, some general trends appear when the relative proportions of eel, clupeids (largely herring) and gadids/hake are considered. Notably, the proportion of clupeid bones increases significantly between Periods 2 (late 12th-mid 13th century) and 4 (late 14th-15th century), largely at the expense of eel. By Period 3 (mid 13th-14th century) almost 60% of identified bones are from clupeids and this figure rises again in Period 4. Gadids and hake, by contrast, form under 10% of all identifications in each period, and this figure includes small fish likely to have been captured in inshore waters as well as larger specimens that are more likely to have been caught in deep/distant waters. To some extent, the rise in clupeids may be a reflection of the excellent preservational conditions within some pits and wells; however, the fills of many of these features were dated to Period 2, and clupeid bones continued to be relatively abundant later on, almost irrespective of feature/deposit type. The relative proportions of these three groups were similar irrespective of whether the bones derived from a fill or from a general spread (layer).

Fish capture and marketing

The co-occurrence of herring and eel bones is common in medieval urban assemblages and is a particular feature of cess pits – these two fish were relatively cheap and plentiful and both could be preserved. From the numbers of crushed, corroded and cess-encrusted bones it would seem that in many cases the fish were eaten 'bones and all', although it is also possible that some of the remains originated in pig rather than human faeces (see Nicholson, above and Jones, below). Most of the bones from large cod-family fish (gadids and the closely related hake) were from parts of the skeleton usually retained within a dried product, particularly cleithra and caudal vertebrae, suggesting the importation and consumption of preserved fish. Whitefish and herrings were commonly conserved by salting and/or drying (whitefish) and pickling (herring). In medieval and later centuries the port of Bristol was a major landing point for both preserved and fresh fish, particularly from Ireland (Carus-Wilson 1962, 2). The Irish Sea has been described as being 'to the West of England what the North Sea was to Eastern England, and Bristol ... had no need to seek the coasts of Norway for fish or timber' (ibid., 3). The significance to Bristol merchants of herring and salmon as fish from Ireland is illustrated by a 15th-century proverb quoted by Carus-Wilson, 'Heryng of Slegothe and salmon of Bame heis made in Brystowe many a ryche man' (1951, 196). Both white (fresh or salted) and red (salted and smoked) herrings from Ireland commanded a price of £3 for a last of 12,000 fish according to Bristol customs accounts (ibid., 197), whereas herring, sprats and eel were considered to be plentiful and cheap and were frequently purchased by the poorer classes in the middle ages (Littler 1979, 14).

The presence of hake, conger eel and pilchard is also consistent with fishing in the Irish Sea or in waters off south-west Britain, where these fish are plentiful (Henderson 2007). There was an important fishery for hake in the sea between England and Ireland from at least the 9th century (Littler 1979, 137) and it is likely that the gurnards, sea breams and most of the flatfish were also caught locally. Town records searched in 1488 indicated that fresh cod, gurnards, ling, hake, ray, conger, haddock, whiting, sea bream, mackerel, plaice and other small fresh fish were all landed at Bristol (Carus-Wilson 1951, 197). Although customs accounts show that 'pecys of saltfische' (dried and salted fish of the cod family, in this case cod, hake, pollack and whiting) were brought into Bristol from Ireland (Carus Wilson 1951, 197), Bristol men are recorded in the Icelandic annals from about 1424 (Carus Wilson 1962, 6). Since the main export from Iceland was dried fish of the cod (gadid) family it is clear that Icelandic stockfish entered the port of Bristol from at least the earlier 15th century.

While salmon were a significant Irish export, together with sea trout these fish were also a profitable catch in the Severn Estuary, where a traditional method of capture was by boat and the use of long-nets in the shallows or Y-shaped nets hung on poles and positioned across the current to trap migrating fish in spring and summer (http://www.salmonboats.co.uk/1206.html, consulted 8/12/10). Putts, and from at least the early 19th century, putchers (fixed basketwork fishtraps comprising rows of conical-shaped baskets, used in conjunction with hurdle fences) were also traditionally used in the Severn Estuary to trap salmon on the ebb tide (Goldbold and Turner 1994, 45-47). Evidence of their use in medieval times was revealed during the construction of the Second Severn Crossing (ibid.). Together with salmon, migrating eels, shad and lampreys were also the focus of extensive fisheries in the Severn Estuary in the medieval period (Littler 1979,8) and in more recent times, although shad and lampreys are now considered rare due to earlier overfishing and industrial pollution (Maitland and Lyle 2006). Lampreys (Fig. 7.1), especially the sea lamprey *Petromyzon marinus*, were greatly esteemed in the medieval period (Littler 1979, 8) and so extensively fished and eaten in Britain that Henry I was famously said to have died from eating a surfeit of them in 1135 (Green 2006, 1). Elvers (young eels) were caught in great quantities during their migration upstream from the sea, while adult eels were caught during their migration downstream back to the sea using baskets and hoop nets strung across the river or positioned across the ends of weirs. The long established Severn Estuary elver fishery lasts from January to May (ibid.) and the tiny fish were commonly eaten fried as elver cakes (Phillips and

*Fig. 7.1 Inferior tooth plate of the river lamprey (*Lampetra fluviatilis *(L.)) or brook lamprey (*Lampreta planeri *Bloch) from sample 3345, context 7122 within pit 4987 (A1.25, Per 2, TSW5)*

Rix 1985, 122). Many of the other fish represented in the Finzel's Reach assemblage (for example the rays, flatfishes, smaller gadids, mackerel, bass, mullet, cottids, gurnards and sea breams) are also known to inhabit the Severn Estuary and may have been caught very locally (Henderson 2007). There is considerable archaeological evidence for fishweirs in the Severn Estuary (Brown *et al*. 2010). As at Welsh Back, Bristol (Nicholson 2008/9), the relatively small size of many of the flatfish at Finzel's Reach suggests that these fish were captured close to the shore, possibly by the use of a shore net or many-hooked line laid across the beach at low tide. It is likely that the small freshwater fish (young pike, perch and cyprinids) came from nearby rivers. Freshwater fish were prized and relatively expensive in the medieval period and it is evident that cyprinids and pike of a size which would be considered inedible today were certainly bought and eaten (Dyer 1988). Despite their small size, fish as tiny as minnows appear on many household account rolls (Littler 1979, 8).

Although larger, the fish assemblage from Finzel's Reach is compositionally similar to assemblages from sites elsewhere in the city (eg Nicholson 2000; 2001; 2004) and to medieval assemblages from other towns in southern England from sites where extensive soil sampling and sieving has been undertaken (such as Winchester, Southampton and even, inland, Oxford (Nicholson 2011a; 2011b; forthcoming)). A significant fish assemblage from Exeter (Maltby 1979) was almost entirely recovered by hand collection, so while the larger fishes represented there are similar to those from Bristol, again suggesting that fish available in the medieval fish markets of coastal towns were largely caught in nearby coastal waters, smaller fish such as herring and eels were markedly rare. Eels are more frequent in the 12th- to 13th-century deposits at Finzel's Reach than in many medieval deposits, even those which have been sieved, and this is likely to be a reflection of the eel and elver fishery in the Severn Estuary and River Avon. As at Southamption, gadids never dominate the fish assemblage and the huge expansion and commercialisation of fishing for cod and ling from the 11th century identified by Barrett *et al.* (2004) is not particularly evident. It seems likely that much of the fish eaten by the citizens of Bristol was caught and prepared locally. Fish brought in from more distant waters would have been traded through the port but is likely to have mostly been bought by merchants and moved inland.

MARINE MOLLUSCS *by Greg Campbell*

Overview of the assemblage

An assemblage of approximately 1980 marine shells was recovered from 280 deposits (Table 7.4). The native, common or flat oyster *Ostrea edulis* L. was the commonest shell, making up 90% of the hand-retrieved material but only 38% of the sieved shells. Oyster preservation was poor and damage to the margins was very common, so there was little evidence for the methods used to open the oysters. The wide size range (30-120mm) and the prevalence

Table 7.4 Marine shells

	Phase	Hand-retrieved No. cxts	Hand-retrieved Total shells	Hand-retrieved Oysters	Hand-retrieved Mussels	Hand-retrieved Cockles	Hand-retrieved Whelks	Hand-retrieved Razor-shells	Sieved No. cxts	Sieved Total shells	Sieved Oysters	Sieved Mussel	Sieved Cockle	Sieved Whelks	Sieved Razor-shells
0	Natural	2	4	4											
1	(*c* AD950–1100)	23	45	45					1	1	1				
2	(*c* AD1100–1150)	51	215	211	1		2		17	27	21	5		1	
3	(*c* AD1225–1375)	81	373	345	6	21	1		29	91	47	28	6		1
4	(*c* AD1375–1500)	44	192	164	23	3	1		18	241	67	66	101	1	1
5	(*c* AD1500–1150)	35	202	171	18	3	7		9	123	43	54	8	1	2
6	(early post-medieval)	15	48	45		1		1	1	3					
7	(late post-med–early Industrial)	14	90	77	3	9	1		1	15	11	4			
8	(late Industrial–Victorian)	11	87	68	2	16	1		0	0					
	All phased	276	1,256	1,130	53	53	13	1	76	501	190	157	115	3	4

of oval, large-hinged forms over round, small-hinged forms indicates that they came mainly from regularly dredged beds, somewhat more often from off-shore beds. The common mussel, *Mytilus edulis* (L.), formed 4.2% of the hand-retrieved shells but about a third of the sieved assemblage. Preservation of both species was poor. Common Whelks (*Buccinum undatum* L.) were also present and razor-shells were rare, but both species were more common in the high medieval Period (Periods 3-5). All of these shells are commonly eaten, and would have been readily available in the Severn Estuary near Bristol. A minor component of the assemblage comprised the shells of smaller molluscs that were probably collected accidentally along with the edible specimens.

Change over time

The number of deposits into which shells were discarded, the number of shells discarded, and the range of shells consumed, all increased sharply during the mid 12th century (Period 2), were most plentiful in the mid 13th to 14th centuries (Periods 3-4), declining gradually over the 15th, 16th and 17th centuries (Periods 5, 6 and 7). This contrasts with what little is reported about shellfish use elsewhere in Bristol. At both Corn Street (Pearson 2007) and Narrow Quay (Good 1987), shellfish were sparse from the 12th to the 15th centuries, were richest and most diverse in the 15th to 16th centuries, and declined in later phases. Overall, the quantities of shells being used and discarded at Finzel's Reach show that shellfish were a small but regular part of the food eaten by its inhabitants throughout its occupation.

PLANT MACROFOSSIL REMAINS *by Julie Jones*

Introduction

Samples for the recovery of plant macrofossil remains were taken from a range of features during the excavation. In total, 561 samples were collected from pits, postholes, ditch fills, garden soils, hearths and many other occupation layers. Following an assessment of 281 samples, 56 samples were chosen for further analysis. Overall the condition of the anoxically waterlogged remains was very good: not only seeds, fruit and nuts, but also more delicate epidermis fragments such as cereal bran and madder root fragments were preserved. Charred cereal grain preservation was more variable, with some well-preserved examples, but others highly clinkered and fragmented from exposure to heat. Remains of cereal chaff were very limited and again preservation was variable, with much fragmentation. Charred weed seeds were generally well preserved. Many of the seeds preserved by anoxic waterlogging were also preserved by partial mineral replacement.

Features examined at Finzel's Reach provide evidence for occupation of this area of Redcliffe adjacent to the banks of the River Avon from the late 12th century. Analysis shows that there are two broad categories of plant macrofossils present, comprising plants which represent the local flora and have become naturally incorporated into these deposits, and plants which represent human activity and are likely to represent deliberate dumping of waste material into pits, ditches and channels, as well as areas of burning from contexts such as hearths and rake-out deposits. Many of the features examined from all periods are pits, some of which were thought originally to have been constructed as tanning pits, although the evidence suggests that the existing fills are secondary and that these pits were used as receptacles for rubbish disposal once their primary function ceased. Despite this, however, the fills provide important information on both industrial and domestic activity on the site.

The evidence suggests that there is a background flora consistently present at low levels during all periods studied, with much of this likely to represent those plants that were growing around the buildings and open spaces on the site, or from wetter areas closer to the riverbank. There was clearly much activity on the site from the late 12th to early 13th centuries associated with cloth production and possibly tanning, creating a highly organic input of material into rubbish pits and refuse heaps, as well as litter swept from stables and floors. Areas such as these, rich in nutrients like nitrogen and phosphate, are seen as characteristic of urban areas. Some of the plants that occur here would quickly become established in such conditions, forming a farmyard type environment in yards and other open spaces. An example is stinking chamomile, which although a typical cornfield weed, also occurs on nutrient-rich disturbed ground and has been recorded today in farmyards, chicken runs and near ponds (Kay 1971). Other plants present that area indicative of soils associated with human disturbance include common nettle, elder, chickweed, and fat-hen, while taxa such as greater plantain, knotgrass and daisy are tolerant of trampling and could have occurred along pathways and lanes. There is also a small group of aquatic and waterside plants that also occur consistently through all periods. The most numerous are sedges, rushes and spike rush which reflect the location of the site adjacent to the riverbank. In several of the earlier Period 2 deposits there are also indications of the tidal nature of the River Avon from several taxa, including sea arrow-grass and horned pondweed, which are more typical of salt marsh locations. Similar salt marsh species have been found at other locations close to Finzel's Reach, at 98-103 Redcliff Street (Jones 2001a), Redcliff Backs (Jones 2001b) and Dundas Wharf (Jones and Watson (1987). The 'background flora' for many of these other sites along the Redcliffe waterfront is also very similar.

A large proportion of the other inclusions found in features from all periods relates to the disposal of waste products from a range of activities. Many of the pit fills included anoxically-preserved rachis fragments of barley and rye, with occasional wheat internodes, associated with stem fragments indicative of straw. Some samples where stem fragments occurred were associated with smaller grass caryopses which, although not identified to species, may have come from meadow-type grasses. These occur in association with other hay meadow taxa including buttercup (*Ranunculus acris/repens/ bulbosus*), hawkbit (*Leontodon*), ox-eye daisy (*Leucanthemum vulgare*) and yellow-rattle (*Rhinanthus minor*) from fills in Period 2 pit groups A1.15 and A1.19. A Period 4 pit fill (7487) also included evidence for Fabaceae (Pea family) flowers, with *Trifolium* (clover/medick) calyces and pod caps and seeds of black medick (*Medicago lupulina*), which are also likely to have come from hay. Straw would have provided ideal litter, useful in absorbing stable waste from stalled livestock, and abundant remains of both gorse and bracken in the same well fill may also have been collected for similar purposes. Kenward and Hall (1997) also quote the use of brushwood, leather off-cuts and wood shavings, all of which occur at Finzel's Reach, as absorptive materials ideal for stable floors. Both gorse and hay would have been used as animal fodder, with the hay perhaps gathered locally from meadows and pasture at the edges of the town. The area of Canon's Marsh, owned by St Augustine's Abbey, which lay between the monastery and the Avon, was known to have been cropped for hay in the medieval period (Beachcroft and Sabin 1938).

There are also occasional examples from Period 2 features in Area 1 of charred cereal grain, with very occasional chaff in association with the anoxically preserved straw remains, suggesting that a proportion of this material was burnt, perhaps as sweepings from domestic buildings or stalled animals. There are increased numbers of charred cereal grains in features from Areas 2 and 5 from all periods associated with hearth fills and other charcoal-rich deposits. Bread wheat is the form most commonly recovered, with oats and lesser amounts of barley and rye, often with limited accompanying chaff. This seems to be a recurrent theme from previous excavations in Bristol, where often only charred grains are recovered. This lack of chaff, particularly in the case of bread wheat, suggests that grain was in an already processed form, with the bulk of the straw and rachis removed.

Much of the processed grain would have been taken to the city mills for flour production and there is evidence for mills both within the medieval city walls and in the suburban areas. The closest to Finzel's Reach may have been the Castle Mill, in Castle Mill Street, served by the Castle Ditch at Broad Weir. The Trin Mills, located on the south side of the Avon near the entrance lock to Bathurst Basin, was known to be in existence by 1373. Other mills are known on the Frome at Bridewell and on the corner of Baldwin Street and Back Street. There seem to have been various regulations concerning the sale of bread, with the Assize of Bread in operation in many towns from 1267, which controlled price. The Mayor of Bristol gave advice to the Bakers concerning 'buying from and bargaining with, those who brought wheat to the town, whether by land or water, not only to keep down the price, but also so there should be no lack of supplies'. There are even provisions forbidding bakers to buy corn at all before it reached the market, and even after it had done so, before a certain hour (Veale 1933, 17-18).

Bread wheat would have been favoured for bread-making and the cereal bran identified as wheat/rye is perhaps more likely to be wheat. Bran occurs in many samples along with fragmented corncockle, a cornfield weed with large seeds about the same size as cereal grains. Poor seed cleaning techniques often left corcockle in the flour after processing, which is known to have caused problems for bread-making. This common occurrence of fragmented corncockle seed coats with cereal bran is taken as one of the indicators of cess. In 1570 Gerard commented that 'cockle is a common and hurtful weede in our Corne…what hurt it doth among Corne, the spoil unto bread as well in colour, taste and unholsomnes, is better known than desired' (White 1912, 187).

The disposal of domestic or kitchen waste into pits, wells and ditch fills from all periods provides evidence for many other food items, in addition to bread wheat. Documentary sources suggest that bread and meat formed the staple diet for many levels of society in the medieval period, with consumption of dairy produce, fresh fruit and vegetables of less importance (Dyer 1983). Animal and fish bone, oyster and occasional mussel occur in many of the samples with varying quantities of eggshell. Much of the evidence, however, comes from fruit, with larger plum and cherry stones, hazelnut fragments and walnut most likely to originate from kitchen waste, while smaller seeds such as figs, grapes and strawberries perhaps came from fruit that had been consumed and formed a constituent of the faecal deposits (Fig. 7.2). Apples were recorded not only as pips, but also as fragments of endocarp, the apple 'core', suggesting that these were commonly eaten. Some fruit is likely to have been cultivated, including plum varieties, cherry, strawberry and apple. There seem to have been local varieties of plums in the medieval period, and on the basis of stone morphology and size it is suggested that bullace/damson and sloes also occur in these deposits. Fruit may have been bought in the city markets, with some perhaps grown in gardens. Although one possible Period 2 garden soil was analysed from Area 5, producing a mostly charred cereal assemblage, it seems unlikely that fruit trees would have been planted at Finzel's Reach, at a time of such concentrated industrial activity, although Millerd's Map records garden plots in the Redcliffe area by 1673.

Fig. 7.2 a) grape pip from sample 1125, fill 1394 of ditch 1268 (A4.6, Per 2, TSE1); b) hazelnut shells from sample 3329, fill 3954 of well 3850 (A1.31, Per 3, TSW1)

In addition to cultivated plants, fruits may also have been collected from the wild, from hedgerow and woodland edge, to produce juice and compote, or as additional flavouring and colour. Fruit was eaten cooked rather than fresh, with strawberries, cherries and bullace made into a murrey, a pulp thickened with breadcrumbs or cereal flour, sweetened and spiced (Wilson 1984, 299). Sloes, considered today as sour and unpalatable, may have been air-dried, making them less astringent, and could then have been eaten as dried fruit, made into beverages or added to meat. Hazelnut fragments occur throughout and could have been gathered from the wild or bought at market. Some fruit may have come from further afield. Fig and grape occur in pit groups from Period 2 and are both known from customs records to have been imported (Cronne 1946). Grapes may well have come dried in the form of raisins, although there is evidence for medieval viticulture (McLean 1981). Walnut, fragments of which were found in only one 13th- to 14th-century pit deposit, may have been imported or grown locally.

Evidence of vegetables in the archaeological record is often difficult to find because it is the leafy parts and roots that are consumed, which leave little trace in waste deposits. There is, however, evidence for peas and beans from charred cotyledons from Period 3 and Period 5, representing an important part of the staple diet. They would have been used in soups and vegetable pottages and would have provided much of the starch and protein in the daily diet (McLean 1981). There were also many Brassicaceae (cabbage family) seeds, classified as *Brassica/Sinapis/Raphanus* that include mustard, cole and cabbage, as well as wild radish, the distinctive fruits of which were also found. While wild radish is a weed of cultivated and rough ground, McLean (1981) suggests that people may have gathered and eaten them, rather than deliberately growing them, and would have used them for 'hotting up' pottages and sauces. There is also evidence from epidermis fragments for the presence of leek, plus seeds of fennel, which may have been used to improve flavours of pottages, salads and sauces. Occasional finds of beet/beetroot (*Beta vulgaris*) are interesting, as although the wild form prefers coastal habitats, Greig (1996) feels that an increasing number of finds of this species in association with other food remains suggest deliberate cultivation for its leaves, which are similar to spinach. These may have been grown in small garden areas at the rear of tenement plots.

While some of the preserved remains of fruit, vegetables and cereals discussed above may have been from domestic waste, a certain proportion clearly originated from the deposition of faecal material. However, the mixed nature of the pit fills does not suggest that any of these were used purely as cess pits and it seems that human waste was just one element of a whole range of rubbish dumped there. The presence of cereal bran, especially in association with fragmented corncockle, showing poor processing of grain for flour, is taken as an indicator of cess and occurs in many pit fills. Often this was found in association with fly pupae, some identified as *Sepsis*, normally associated with cess and urban rubbish, and trickling filter flies, today found in sewage treatment works. Some of the fruit, in particular remains of apple, but also some of the local background flora were also found in a mineral replaced form and suggest conditions in the pits conducive to the replacement of organic material in these seeds and fruits with calcium phosphate. Some 'mineralised concretions' and sediment from several features also produced eggs of intestinal parasites, *Trichuris* and *Ascaris*, which may have originated in human faeces. Finally, Hall suggests that some of the mosses identified from bran-rich deposits were used for sanitary purposes, although it is possible that some of the woodland mosses may have been brought into the medieval city attached to bark destined for the tanning industry.

Documentary evidence shows that the development of Redcliffe saw the establishment of early industries in this area close to the River Avon including the dyers, and a final group of plants of economic importance from Finzel's Reach are those that are relevant to cloth production. Many plants were used for the extraction of dye, but there are

Fig. 7.3 Weld seed from sample 1125, fill 1394 of ditch 1268 (A1.6, Per 2, TSE2)

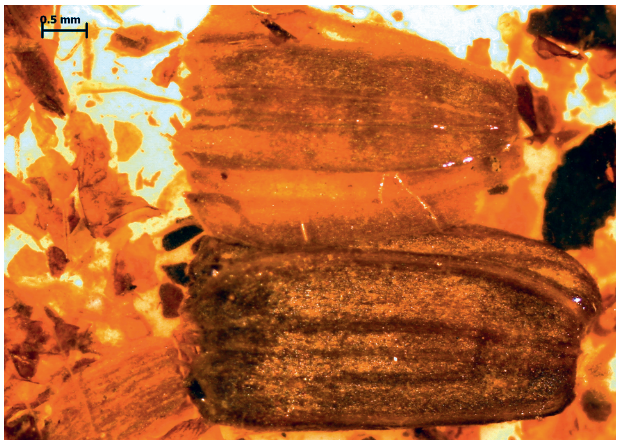

*Fig. 7.4 Two waterlogged teasel achenes of fuller's teasel (*Dipsacus sativus *L.) from sample 3245, fill 4596 of well 3850 (A1.31, Per 3, TSW1)*

several species which seem to recur in the Finzel's Reach deposits. The most important of these is madder, the tiny root epidermis fragments of which occur in many of the features from early occupation of the waterfront in Area 3D and Area 1, together with dyer's greenweed epidermis fragments and weld seeds (Fig. 7.3).

All three dye plants have now been found on a number of sites along the Redcliffe waterfront. At Dundas Wharf the red colouration in an organic dump on the riverbank was recognised as madder root (Jones and Watson 1987) and it was also found at Redcliff Backs (Jones 2001b), where dye vat bases were excavated. More recently it was found at 1-2 Redcliff Street during excavations by Cotswold Archaeology (Jones 2010). Medieval customs accounts show that madder was imported from Holland and Flanders, probably in a processed form. The other major dye-plant known to have been imported into Bristol was woad, the earliest substantial evidence for which, in the form of woad pods, was recovered from 13th to 14th century deposits at 98-103 Redcliff Street (Jones 2001a). Like madder, this is known to have been imported into medieval Bristol, with the many documented regulations and restrictions showing the importance of the woad trade in Bristol at this period (Bickley 1900). Unfortunately, no evidence for woad was forthcoming from the features at Finzel's Reach.

Other plants associated with the cloth industry are fuller's teasel and flax. Both the achenes and receptacular bracts of fuller's teasel were recognised from features in Area 1 dating from the late 12th to mid 16th century (Fig. 7.4) and from closer to the waterfront in Area 3 from alluvial deposits dating from the mid 12th to 14th century. Teasel bracts, which cover the whole teasel head, were used in cloth finishing, as they tease the fibre ends from the woollen cloth to raise a nap (Ryder 1994, 23) and their presence suggests that cloth finishing, or fulling, was being undertaken in the vicinity of the site. Fibres from the stems of flax could be used in the production of linen, but no stem fragments were recognised in any of the samples where flax seeds occurred (mostly as individual finds) and it may be that flax seed was valued more as a source of oil.

Tanning was also an important industry in Redcliffe and records from 16th-century Bristol show that 17% of the labour force were tanners, leatherworkers and other craftsmen working with heavy leather (Clarkson 1966, 29). Some of the Period 2 pit groups, particularly from Area 1, were interpreted as possible tanning pits from the nature of their fills. For example, bark-rich dumps were associated with pit 4431, while other pits contained abundant sheep and cattle horn-cores and cattle metapodials, perhaps indicative of hide preparation. Hall and Kenward (2003) suggest possible biological indicator groups for tanning, which involves the steeping of hides in pits or vats with tree bark. Bark was used as a source of tannins, with documentary evidence suggesting a preference for oak bark for leather production from cow hides. This indicator group is characterised by concentrations of very decayed bark with sclereids (small clumps of lignified cells characteristic of certain trees, notably oak, left when bark decays), together with concentrations of the scarabaeid beetle *Trox scaber*, a scavenger found in dry animal remains or wood mould (Hall and Kenward 2003, 122). Many of the samples examined do indeed contain concentrations of fragmented wood and in some cases bark, although in most cases the bark was very fragmented and decayed, which is what one would expect in the caustic environment of a tanning pit. Allan Hall examined the bark from several features at Finzel's Reach and, although it was not possible to give a species identification, he commented that some showed evidence of strongly decayed sclereid clusters, not inconsistent with bark that may have been soaking with hides over long periods, and suggested that a 'sludge' containing decayed bark may have remained in the pits if not removed periodically. However, woodworking clearly occurred on site, including for construction purposes, with some features wood-lined, and debarking of timber locally may have resulted in its deposition into pits as part of the general process of waste disposal on the site. Certainly bark never formed the bulk of the organic content of any one layer, which leaves some uncertainty about the identification of these deposits as tanning waste.

Evidence for plants associated with the cloth industry, kitchen, and domestic and stabling waste was found in fills of features dating to the early occupation of the site at Finzel's Reach from the early to mid 12th century. It was not, however, possible to determine the primary function of these features, which appear to have been used as receptacles for the disposal of waste products once their initial function had ceased. Hence, although the succession of pit groups excavated in Area 1, many with fills of horn cores and bark chippings, were initially interpreted as possible tanning pits, there is no supporting evidence from the plant macrofossil remains. Although bark occurred in some of the sample fills, it was mostly small fragments, too degraded to allow species identification. Its occurrence with other lines of evidence for cloth dyeing and stabling waste, may suggest an alternative explanation for its presence.

Nevertheless, these features have provided a wealth of information relating to the economy, diet, activities and waste disposal practices of the inhabitants of the tenements at Finzel's Reach. Many of the other sites excavated along the medieval waterfront in the suburb of Redcliffe have provided similar evidence to that recorded here, derived from the deposition of huge quantities of organic matter into features such as pits and, on some sites, directly onto the riverbank as part of a process of land reclamation. This represents the disposal of waste materials not only from domestic and kitchen waste from local tenements but also from industrial activities, much of it related to the cloth industry that became established in Redcliffe from the late 12th to early 13th centuries.

WOOD CHARCOAL FROM OVENS AND HEARTHS IN AREA 1 *by Dana Challinor*

Abundant charcoal was preserved from several ovens, hearths and associated deposits from Area 1. Eight samples were selected for analysis in order to examine the types and nature of wood fuel used in the ovens and to determine any temporal changes.

The charcoal came from three context types: deposits from ovens 3307 and 3338 and hearth 3571; rake-out material from ovens 3651, 4100 and 4056; and a layer with probably redeposited material associated with oven 3651 (Table 7.5). All dated from Period 4 (*c* 1375-1500), except the rake-out from oven 4056, which dated from Period 6 (early post-medieval). The material from all the samples

Table 7.5 Charcoal from ovens, hearths and associated contexts

	Period	*4*		*4*	*4*	*4*	*4*		*6*
	Date	*L14-15C*		*L14-15C*	*L14-15C*	*L14-15C*	*L14-15C*		*M16-17C*
	Feature type	*Oven*	*Layer*	*Oven*	*Hearth*	*Rake-out*	*Rake-out*	*Rake-out*	*Rake-out*
	Feature number	*3307*	*3651*	*3338*	*3072*	*3651*	*4100*	*4100*	*4056*
	Context number	*3305*	*4120*	*3340*	*3573*	*3706*	*4679*	*4678*	*4055*
	Sample number	*3002*	*3151*	*3017*	*3018*	*3076*	*3309*	*3275*	*3084*
Ulmus sp.	elm		1r		3r		25		
Fagus sylvatica L.	beech	54r	60r	57r	35r	11	39r	4	17r
Quercus sp.	oak	25rs	12r	29rh	45rhs	4	49rs	47rhs	33h
Betula sp.	birch			10r	2				
Alnus glutinosa Gaertn.	alder	2	3r	1r	2		3		
Corylus avellana L.	hazel	3r		1r	4r			18r	
Alnus/Corylus	alder/hazel		1		1	2			
Betulaceae	birch family			1					
Populus/Salix	poplar/willow	1	3r		4	2			
cf. Ericaceae	heather family						1r		
Maloideae	hawthorn group		5r		2r			5r	
Rosaceae	rose family		2r						
Cytisus/Ulex	broom/gorse							1r	
Ilex aquifolium L.	holly					1			
Acer campestre L.	field maple	6r	3	1r					
Acer sp.	maple				2				
Fraxinus excelsior L.	ash	7r	7rh			1			
Bark		2							
Indeterminate			3r			2	2		
Total		100	100	100	100	23	94	100	50

may reasonably be interpreted as the remains of fuelwood from the final uses of the features.

A diverse range of taxa were recovered from each sample (on average six), with the exception of the assemblage from the rake-out from oven 4100, which was limited to two taxa. These two taxa, beech and oak, were dominant in all assemblages, with other taxa each representing 4% or less of the charcoal record as a whole. Recent evidence from Bristol (Challinor 2006; Gale 2006) and other urban sites such as Southampton (Challinor 2011) and Oxford (Challinor 2009) has shown that beech was an important fuelwood at urban sites, and was used for domestic and some industrial activities. Why beech became a favoured fuelwood in the medieval period is unclear, but there are several possibilities including growth in distribution and scarcity and/or deliberate preservation of oak. It is likely that the fuelwood for the ovens came from faggots or bundles of firewood derived from local(ish) resources and utilised for more than just domestic activities (for example, in medieval dye vats; Gale 2010). There is also no evidence at Finzel's Reach to suggest that a particular wood was specifically selected for the ovens. There is, for instance, only one fragment of gorse/broom, which is traditionally considered a good fuel for bread ovens (Gale and Cutler 2000, 260). The presence of Cerambydae beetles in the elm wood in the rake-out from oven 4100 suggests that the wood was seasoned, since these beetles only inhabit dead wood. It is also possible that the elm had been intended for a different purpose, but was used in the oven when the infestation became apparent. This was the only sample to produce more than an occasional fragment of elm.

The taxa identified represent several environment types including woodland and heathland, and conditions that would have included damp ground and open areas. It has been argued convincingly that the Forest of Dean would have provided a large amount of the timber and fuelwood requirements for Bristol in the 15th century, particularly for the textile industry (Gale 2010). There is no reason to suppose that there were necessarily different wood supplies for domestic and industrial uses, although other, more local woodlands may also have been exploited. There is no direct evidence for coppicing/pollarding in the charcoal residues, but most fuelwood throughout the medieval period was provided from the underwood of local, managed woodlands (Rackham 2006). Certainly it is unlikely that the burgeoning town of Bristol would have sustained its timber and wood requirements without the controlled exploitation of managed woodland resources.

POLLEN FROM DITCH 1009

by Denise Druce

Pollen analysis was undertaken on the lower fills of ditch 1009, which ran along the east side of Temple Street and appears to have formed part of a drainage system cut during Period 2 (mid-late 12th century), representing the initial reclamation of the site. The interpretation of pollen from man-made features is not straightforward, and ditch 1009 is no exception. Given that the site is close to habitation, pollen may have entered the feature from a number of sources, including the surrounding vegetation, or be 'human dispersed' (Greig 1982) along with settlement waste or animal feed/bedding. The fact that the ditch appears to have run alongside a road means that human dispersed pollen is all the more likely, since waste material could have been dumped/washed into the ditch, carrying with it allochthonous pollen grains. The pollen spectra at each level were also fairly uniform, which is a common feature of many pollen diagrams from urban archaeological features, attributed to a consistent 'human dispersed' component (Greig 1982; Hall *et al.* 1983).

If one assumes that the lowermost fill, 1239, contains a larger 'natural' pollen component (and even this is tentative), then the data, dominated by grasses, daisy-type, goosefoot and ribwort plantain, indicate a grassland environment of possible meadows/pasture with some ruderal plant communities. Plant remains of typical disturbed ground taxa were also present in this fill (Jones, above). Although numbers of moist/wet-loving taxa were low, the presence of duckweed and Type 128 microfossil in the earliest ditch fill suggests that the ditch was channelling slow-moving fresh water shortly after it was dug.

Many of the recorded taxa, including sea and buck's horn plantain, and some daisy, clover, and goosefoot species, prefer growing in coastal/brackish areas or grow as part of salt-marsh communities. The presence of some salt-marsh/brackish plants is corroborated by the results of the diatom assessment, which indicated a mixture of freshwater and estuarine conditions (Barker 2009). Ditch 1009 is likely to have been linked to the River Avon and subject to tidal ebbs and flows, with salt-marsh communities and brackish water taxa exploiting the saline conditions that some of the higher tides would have provided.

The small amount of tree/shrub pollen, which was most prevalent in the earliest fill, is likely to originate from natural vegetation and suggests the area supported a little alder, birch and hazel woodland when the ditch was first dug. The very low levels of tree pollen in the subsequent levels, however, indicate that very few trees/shrubs grew nearby. However, it is alternatively possible that the much higher relative counts of grasses and cereal-type pollen in the upper levels may have served to 'dilute' the arboreal assemblage. The presence of ericaceous pollen is slightly unexpected, as the site would not have been particularly suitable for supporting heather. It is possible, however, that the grains came in on animal feed/bedding, thatch, or even peat turves used for construction or fuel. Although one cannot rule out the local cultivation of crops, given that the

Redcliffe area was very much an industrial part of medieval Bristol, it is probably unlikely. The evidence from cereal remains found at Finzel's Reach and other sites in Bristol suggests that grain for human consumption would have been grown away from the city and milled elsewhere or at one of the town mills (Julie Jones pers. comm). It would appear, therefore, that the cereal pollen, and associated pollen of weeds typical of arable ground, are more likely to have arrived at the site along with straw used for animal feed/bedding, thatch or flooring, which was subsequently dumped or washed into the ditch. This interpretation is corroborated by both the plant remains and insect remains from the site, which indicate the presence of stabling and domestic waste in many of the features, including the ditches (see Jones, above and Smith, below). Jones and Watson (1987) suggest that rubbish disposal was a serious problem in many urban areas of medieval Britain, and early Redcliffe was clearly no exception.

THE INSECT REMAINS *by David Smith*

Samples for insect analysis were selected during the processing and assessment of the plant macro fossils. Final selection of the most applicable samples for analysis was based on dating and context.

General nature of the fauna recovered and deposition

Domestic and settlement waste

The majority of the insect faunas are clearly derived from a range of settlement waste including domestic rubbish, food waste, flooring and cess. This is indicated by the recovery of a large number of insects that are associated in the archaeological record with settlement materials such as flooring, thatch and stabling matter. This group of species has been labelled as the 'house fauna' by Harry Kenward (Hall and Kenward 1990; Kenward and Hall 1995), although they are in fact indicative of settlement rather than housing *per se*. Several of these species are thought to be strongly synanthropic and dependent on human settlement (Kenward 1997). Typical of this group of species are the beetles *Xylodromus concinnus*, the cryptophagids, the lathridiids, *Typhaea stercorea*, *Mycetea hirta*, the 'woodworm' *Anobium punctatum*, the 'powder post beetle' *Lyctus linearis*, the 'spider beetles' *Ptinus fur* and *Tipnus unicolor*, the 'darkling beetle' *Tenebrio molitor*, the colydid *Aglenus bruneus*, *Dermestes* spp. and *Attagenus pellio*. Several of the species of fly puparia (Fig. 7.5) recovered are also usually associated with human settlement and waste. This includes the 'housefly' *Musca domestica*, the 'blue bottle' *Calliphora* spp, and the 'fruit fly' *Drosophila* spp. (K G V Smith 1989). Another strong indicator that this material was mainly being derived from settlement waste is the recovery of

Fig. 7.5 Mineralised fly puparia or 'maggots' from sample 3330, fill 4720 of well 3850 (A1.31, Per 3, TSW1)

relatively large numbers of the human flea (*Pulex irritans*) and individuals of the dog and cat fleas (*Ctenocephalides canis* and *Ctenocephalides felis felis*) in some contexts. A direct indication of food or butchery waste occurring in many of these deposits is the almost ubiquitous occurrence of the small nitidulid *Omosita colon* and, in one instance, the clerid *Necrobia violacea* both of which are usually associated with dry bone (Harde 1984). Decayed wood and domestic timber probably also entered these deposits with many individuals of both the 'woodworm' *Anobium punctatum* and the 'powder post' beetle *Lyctus linearis*. The small 'long horn' *Gracilia minuta* is thought to be associated with wickerwork and basketry in the archaeological record (Kenward and Hall 1995).

Cess

A number of insects recovered, particularly the fly puparia, are often associated with cess in the archaeological record. Perhaps the clearest indicator is the small fly *Thoracochaeta zosterae*, which is now mainly recovered from under seaweed on the seashore but was in the past particularly common in waterlogged archaeological cess pits (Belshaw 1989; Skidmore 1999; Webb *et al.* 1998). It is presumed that the continued breakdown of sewage and other organic materials into water could lead to a level of 'salinity' similar to that found on the coast. The 'latrine fly' *Fannia scalaris* and the 'rat tailed maggot' *Eristalis tenax* are also often associated, both in the past and the present, with faecal-filled water (Skidmore 1999; K G V Smith 1989). The *Sepsis* flies, recovered in very large numbers in many of the deposits from Finzel's Reach, are also associated with cess and dung (K G V Smith 1989). Very large numbers of the fore-bodies of either Pyschodidae or Scatopsidae were also recovered from the majority of the deposits. Identification of isolated abdomens in some of the samples suggested that these remains probably represented either *Pyschodidae alternata* or

Scatopse notata. These are the 'filter' and 'drain flies', both associated with the mats of microbial slime that build up in drains and filter beds in sewage works (K G V Smith 1989). Another indicator that cess was incorporated into these deposits is the large numbers of the 'pea weevil' *Bruchus pisorum* in many of these deposits. This species is a field pest of pea and beans (Harde 1984; Koch 1992) and is commonly recovered in archaeological cesspits. Though it could have been dumped into these deposits along with spoiled pulses, it seems more likely that it has passed through the dietary tract of humans in food such as pottage or 'horse' bread (Osborne 1983; Smith 2006). Though only recovered in relatively small numbers at Finzel's Reach, the 'granary weevil' *Sitophilus granarius* is also thought to often enter archaeological cesspits through the same route (Osborne 1983).

The majority of the faunas from Finzel's Reach contain elements from this 'cesspit' group. This, to some extent, suggests that cess became incorporated into most features on site. However, this fauna is particularly dominant in the 'barrel latrine' feature 3850 (TSW1), pit 4146 (TSW3), pit 4987 (TSW5), the fill of pit 10118 (WB), river channel fills 5260 and 5603 and, to some extent, in the fill of the barrel from the base of pit 4155 (TSW3). This probably suggests that these features were primarily cesspits, or at least places where cess was dumped, rather than rubbish pits that also contained some cess.

Stabling material

Stabling waste has a very clear archaeoentomological fauna that allows it to be clearly identified in the archaeological record (Kenward and Hall 1997). Some aspects of this fauna, for example *Typhaea stercorea*, *Anthicus floralis*, *Musca domestica* and *Stomoxys calcitrans* are dominant in some of the contexts at Finzel's Reach that also contain the remains of straw and hay.

Tanning wastes and wool processing

Many of the insect faunas examined at Finzel's Reach come from pits that were interpreted during excavation as possible tanning pits. Tanning waste from the archaeological record is thought to have a fairly distinctive insect fauna (Hall and Kenward 2003). In particular, the scarabiid *Trox scaber* and the nitiduliid *Omosita colon* are thought to be particularly indicative of this type of waste (Hall and Kenward 2003). However, they are not encountered in very large numbers in the pits from Finzel's Reach, certainly not in enough numbers to give a definitive identification.

In contrast, the insect faunas recovered from Group 1.15 from Area 1 do suggest that wool processing may have occurred in the area at this time. This is indicated by the puparia of the 'sheep ked' *Melophagus ovinus* (Fig. 7.6), which was recovered in some numbers from Period 2 pits 4388, 4431 and 7039 at property TSW2 and Period 3 pit 4728 at property TSW4. Pits 4388 and 4431 also contained individuals of the sheep louse *Bovicola ovis*. The occurrence of these ectoparasites of sheep in the archaeological record has been interpreted as indicating that wool processing has occurred on site (Buckland and Perry 1989; Hall and Kenward 2003). This activity, and these insects, largely seem to be absent in the pit fills from later periods at Finzel's Reach.

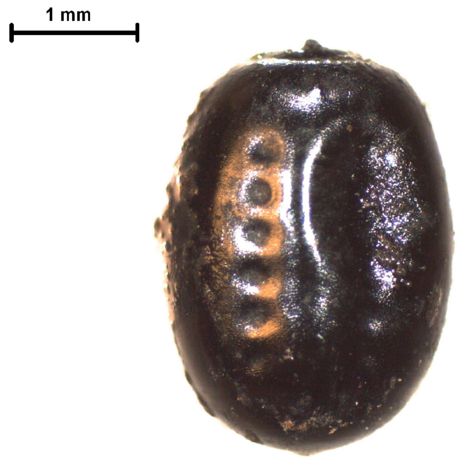

Fig. 7.6 Sheep ked pupa from sample 3175, fill 4365 of pit 4388 (A1.15, Per 2, TSW2)

MINERALISED CONCRETIONS AND POSSIBLE HAIR SAMPLES *by Andrew Wilson*

Following assessment of the flots and residues from samples taken during the excavation, a number of grey-brown nodules were sent to the author for further identification. In particular, several were

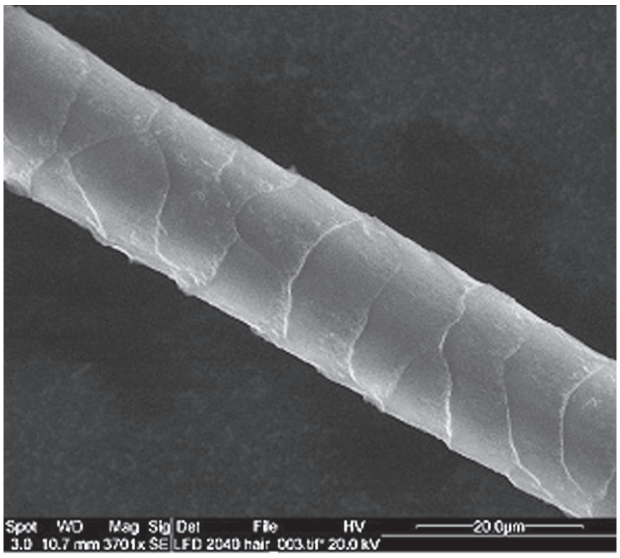

Fig. 7.7 Example of hair from sample 2040, showing detail of the cuticle

associated with pits thought to have been used for tanning and so it was hoped that further examination would help to determine whether or not hairs were present and if so, whether further taxonomic identification was possible. The majority of the nodules proved to be unidentified striated nodules or mineralised concretions with observable structure suggestive of degraded wood and/or degraded fibres. Some of the concretions contained spherical casts/void-like structures, perhaps associated with entomological activity, and one had impressions possibly from textile. Intact mammalian hair fibres of different diameters, some with observable cuticles were, however, found in samples from fills 2559 and 2700 of pit 2493 (A5.7, Per 2, TSE1S), although these have not been characterised further (Fig. 7.7). These hairs are consistent with the interpretation of the features as pits related to the tanning or tawing process.

INTESTINAL PARASITES

by Patrik Flammer

A significant number of the bulk sieved soil sample residues contained coprolites or mineralised concretions. The majority of these samples produced numerous and well-preserved examples of roundworm (*Trichuris)* and/or maw worm (*Ascaris)* eggs (Fig. 7.8). Where speciation of *Trichuris* eggs was possible using DNA analysis, all the eggs were from the human form of the roundworm (*Trichuris trichiura*) rather than the very similar porcine (pig) or murid (mouse) forms. This suggests that the majority of the parasite-producing faecal material distributed in and around features at Finzel's Reach was of human origin. Very low parasite egg counts were made for samples dating from the late 14th century to the 17th century, which could reflect a decline in prevalence at this time, but is more likely to result from poor preservation and the small number of samples analysed.

The roundworm *A. lumbricoides* infects the small intestine. Infection occurs after ingestion of the parasite eggs. The eggs are found in human faeces and are thus transmitted by soil or water containing human faeces or by uncooked food contaminated by human faeces. After ingestion, the eggs hatch into larvae in the intestine and penetrate the duodenal walls to enter the blood stream. The larvae are carried through different organs to enter the pulmonary circulation. They grow and moult inside pulmonary alveoli. After about three weeks the larvae pass from the respiratory system to be coughed up and swallowed again to get to the small intestine where they mature to adult worms. After fertilisation female worms can produce up to 200,000 eggs per day for several years. Eggs embryonate in soil within 2-3 weeks and remain infective for a prolonged time.

The human whipworm *T. trichiura* infects the large intestine. Similar to *A. lumbricoides*, the eggs are deposited from human faeces to soil where they embryonate within 2-3 weeks. After ingestion, the eggs hatch in the small intestine. The larvae penetrate the villi and develop further in the small intestine. After moulting, the young worms move to the cecum and penetrate the mucosa where they complete the development to adult worms. A female adult worm produces up to 20,000 eggs per day. The development of the adult worm from the ingested egg to the mature worm takes about three months. A mature worm can remain in the large intestine for several years.

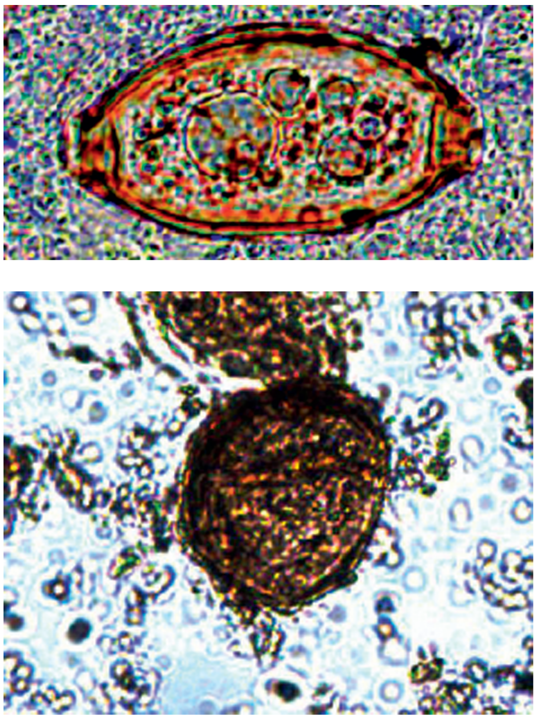

Fig. 7.8 Human parasites: a) Trichuris trichiura *egg (40x) from fill 7122 of pit 1987 (A1.25, Per 2, TSW5); b)* Ascaris lumbricoides *egg (40x) from fill 4432 of pit 4431 (A1.15, Per 2, TSW2)*

GEOARCHAEOLOGY *by Carl Champness*

The sediment sequence

A desk-based assessment of all geotechnical records available for the proposed development area was undertaken prior to any fieldwork in order to develop an initial understanding of the site stratigraphy and help develop a suitable field sampling methodology. Based upon this model, the most suitable locations were chosen for six further purposive archaeological boreholes in order to ground truth and refine this model. Detailed recording of the site's sedimentary sequence was also undertaken during the excavation. A deposit model of the sedimentary formation sequence was specifically developed for the site.

The mapping of the gravel topography prior to major Holocene sedimentation demonstrates gradually lower elevations in the middle of the site representing two former meanders of the River Avon. The site appears to occupy an area of the Avon floodplain which was fluvial in the late Pleistocene and early Holocene.

The beginnings of Holocene sedimentation saw the accumulation of laminated sand and silts. These represent in-channel fluvial deposits that would have been affected by tidal fluctuations, most likely predating human activity in the immediate area. These deposits were sealed by clayey silt overbank alluviation that potentially signifies a shift in the path of the river to the north of site. The first evidence of reclamation of the alluvial surface appears to date from the early medieval period and to be contemporary with the phase of early medieval activity identified on the site. Evidence of early activity has been previously identified from alluvial deposits within the vicinity of Bristol Bridge associated with submerged early landsurfaces and buried topographical islands. It is possible that the low elevations identified across the site were either inundated very early in the Holocene or were eroded by the later channel activity.

Biostratigraphy of the Law Ditch

The lower surviving fills of the Law Ditch were extremely sterile, showing interstratified deposits of rich organic silts, sterile clays and sandy clays indicative of low-energy water-lain deposits with occasional organic saltwater mud. The base of the ditch was recorded at +4.5m OD, indicating that it would have been submerged only during high spring tides and dry during the mean high water neap tides. Successive dumps of rubbish material and organic deposits were also identified within the upper sequence, contemporary with the early medieval tenements that developed along the edges of the ditch. Paleoenvironmental evidence indicates that the ditch was connected to the river and inundated seasonally during high spring tides, leaving saltwater muds at low neap tides. The may help to explain the rapid rate at which the ditch initially silted up.

The medieval waterfront

In order to understand the sequence of waterfront development and river walls at the site it is necessary to examine the structures in relation to the tidal range. The main function of the waterfronts was to facilitate transportation and docking of vessels. This was particularly difficult in Bristol due to the large tidal range, which would have made navigation and economic use of the river particularly hazardous. The medieval Mean High Water Spring Tide (MHWS) has been estimated by measuring the level to which fluvial clays have accumulated on other waterfront sites (Jones 1991). Although there are inherent problems in using the alluvium to estimate past tidal ranges, it does provide a useful benchmark. The upper alluvial clays accumulated on the site to a height between +6.4m and +7.0m OD. This is consistent with other medieval sites north of the river, estimated at Dundas Wharf as +6.4m OD (Jones and Watson 1987, 1.39) and +6.6-6.7m OD at Canynges House (Jones 1991). The Modern Mean High Water Neap Tide (MHWN) is estimated to be +3.65m OD. It has been previously suggested that the medieval MHWN would have been around +3.2m OD at the other waterfront sites. Based on these estimates we can suggest a maximum medieval tidal range of 3.8m within this area of Bristol. During the low tides all navigation would have ceased on the river and some boats would have been left dry on tidal mudflats. The reclamation and construction of a series of waterfronts would have been necessary in order to utilise as much of the tidal range as possible.

The 12th-century wooden revetment (5256) appears to represent the first attempts to stabilise the riverbank. The exact base of the revetment could not be established within the excavation but we can assume that the adjacent foreshore would have been dry during the MHWN. This would have formed a landing place at high tides, but would have left any boats stranded at low tides. In the 13th and 14th century the waterfront was extended forward, with reclamation of the bank and the construction of a stone wall (5035). This was placed some 10m in front of the early medieval waterfront and originally well above the level of the MHWS. The post-medieval stone wall/jetty (85001) appears to have been constructed to facilitate the docking of larger vessels and unloading of goods.

SOIL MICROMORPHOLOGY, CHEMISTRY AND MAGNETIC SUSCEPTIBILITY

by Richard Macphail and John Crowther

The Finzel's Reach soils were analysed by soil micromorphology, chemistry and magnetic susceptibility analyses. Eight thin section samples and seven bulk samples were subsampled from six monoliths.

Soils are broadly characterised by the mixing of natural fine loamy alluvium with household (hearth and kitchen) and latrine waste *sensu lato* (coprolites, coprolitic bone, calcium phosphate nodules of cesspit origin), both through biological activity (earthworm burrowing and rooting) and the homogenisation processes associated with garden cultivation (Courty *et al*. 1989; Macphail 1994; Simpson 1997). This made the clear identification of context junctions difficult, although some variations and differences in land use practices and inundation events can be tentatively recognised. Other anthropogenic materials are of constructional, craftsman (lead oxide) and industrial (strongly burned mineral material, iron slag) origin, the most strongly burned materials with the highest magnetic susceptibility enhancement possibly dating to 17th-18th century spreads at context 3024.

A sample of the 11th-12th century 'natural' alluvial soil 3287 (A1.11, Per 2) shows the smallest organic, heavy metal and phosphate content, as well as recording the lowest magnetic susceptibility. Upwards, it appears that the early 12th-13th century garden soil 3513 (A1.4, Per 1, LDW3) is composed of a mixture of alluvium and middening waste forming a fertile and biologically (eg earthworm) worked soil. Waste material was presumably added both to improve garden soil fertility and as a convenient waste-disposal practice. This soil level was subject to flood inundation, which both deposited alluvium and slaked the *in situ* soils. In fact, elutriated silts (washed silts) were washed down-profile along previously formed earthworm burrows. It can be noted that there is little trace of liquid phosphate (faecal) waste being deposited here at this time compared to similarly dated context 3600 (A1.11, Per 2, TSW3) and later contexts elsewhere (3069, 3078, both A1.56)). At context 3600, however, strong phosphate staining may be due to ensuing 14th century and later practices. In fact, this soil also shows it was biologically worked and homogenised by gardening ahead of being partially slaked by a flooding event(s). It is also worth examining upper context 3069, because this 14th century garden soil again shows little contamination by phosphate waste. Soil 3069 was sealed by a 14th-15th century wall, and retains structural, rooting and organic microfabric characteristics of an upper topsoil, and was perhaps protected by later periods of phosphate waste disposal. It, on the other hand, also preserves clear structural collapse evidence of being flooded.

It is not known whether the high amounts of liquid phosphate contamination that affects 14th century contexts 3069, 3078 and 3875 all date to this period or are location-specific. As the phosphate (either as amorphous yellow Fe-P-Ca infills and impregnations or as crystalline vivianite ($Fe_3[PO_4]_2.8H_2O$)) is in a secondary form (Karkanas and Goldberg 2010) and not as bone or coprolites, for example, it is difficult to determine its exact origin. It may come from cesspit leakage, the direct dumping of human latrine waste or from pig slurry if pigs were housed in these backgarden areas at times – a likely possibility (Macphail and Goldberg 2010).

Another aspect of these garden soils is the effect of flooding and alluviation. The first caused slaking, structural collapse and sometimes inwash of elutriated silts (Macphail *et al*. 2010), the second led to soil accumulation, alongside middening/manuring. Some of the textural pedofeatures (eg intercalations) could have arisen from the tillage of water-saturated soils (Jongerius 1970, 1983). Lastly, the presence of pyrite and gypsum testify to the influence of coastal marshy/coastal acid sulphate soil formation processes within the generally pelo-calcareous alluvial gley soils, which are developed in marine alluvium (Newchurch soil association) (Avery 1990; Findlay *et al.* 1984; Kooistra 1978).

TREE-RING DATING OF ARCHAEOLOGICAL TIMBERS *by Daniel Miles*

A large collection of timbers were excavated, 30 of which were selected for tree-ring dating. Seven timbers from the lining of Period 2 (AD 1150-1225) well 1353 were analysed and five upright pales were found to cross-match together well, possibly deriving from the same tree. Three of the timbers retained bark edge, and were found to have been felled in the winter of AD 1200/1201. This probably represents the date of construction of the well, given that there was no weathering of the timbers, and the sapwood was still intact. If they had been reused from another structure it is not likely that the sapwood would have survived for very long.

A barrel from possible tanning pit 2493, attributed to the same period, had a single timber dating to AD 1076 with no sapwood or evidence of the heartwood/sapwood boundary, thus producing a felling date range of sometime after AD 1085. A timber beam in Period 1 (1100-1150) posthole 2762, is dated with a heartwood/sapwood boundary of AD 1080, producing a felling date range of AD 1099-1131.

No other timbers could be dated, including fifteen samples of barrel staves from three casks reused as wells. It is quite possible that the casks originated from a foreign source where there are few medieval reference chronologies with which to compare the samples.