Channel Tunnel Rail Link

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Oxford Wessex Archaeology Joint Venture

Palaeoenvironmental evidence from Section 1 of the Channel Tunnel Rail Link, Kent

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LIST OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

A large body of environmental data was analysed from excavations along the route of the Channel Tunnel Rail Link. The charred plant remains showed only traces of cereals and wild foods in the early prehistoric period although arable agriculture had became firmly established in the area by the middle to late Bronze Age with the cultivation of hulled wheats and barley. Emmer as well as spelt appears to have been grown well into the Iron Age although spelt becomes the dominant wheat by the Romano-British period. The post-Roman period saw the appearance of free-threshing wheat including bread wheat, rye and oats and the continued cultivation of hulled barley. There was, however, a large amount of hulled wheat remains at one site. Other cultivars include horse bean, pea and flax, present from the late Bronze Age onwards. The weed seeds suggest that a range of soils may have been cultivated but particularly sandy loam soils in the prehistoric period with the increasing use of heavy clay soils in the Roman and post-Roman periods. Crops may have been both spring and autumn sown. Several exotics (including possible imports) of fig, grape and lentil were recovered from a Romano-British cemetery site. The animal bones show the presence of the four mammalian domesticates (cattle, sheep/goat, pig and horse) from the late Bronze Age onwards, with the limited ageing evidence suggesting mixed husbandry strategies but possibly with an increase in sheep at several sites in the medieval period reflecting the importance of the growing wool trade. Marine fish remains suggest that this was an important part of the food economy in both the Roman and post-Roman periods. The hunting of wild game appears to have played some part in the food economy throughout. There was also evidence for bee keeping at the Roman villa at Thurnham. The animal bones from Parsonage Farm are indicative of a high status site in the medieval period.

Evidence on the nature of the environment/landscape was limited although the geo-archaeological sequence at White Horse Stone allowed a reconstruction of the landscape around this settlement in the post-glacial period. Molluscan and pollen evidence suggests local and regional variation within periods and across the route although the charcoal remains appear to indicate that there was little pressure generally on woodland resources at least up until the beginning of the Romano-British period with oak being a dominant element in domestic, economic and ritual activities .

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1 INTRODUCTION

1.1 Project background

The primary aim of the following discussion is to present a comprehensive scheme-wide overview of the palaeoenvironmental and economic evidence retrieved during archaeological investigations carried out in advance of construction of Section 1 of the Channel Tunnel Rail Link (CTRL).

The CTRL was built by London & Continental Railways Limited, in association with Railtrack Group plc. The project was authorised by Parliament with the passage of the CTRL Act, 1996. The high-speed line runs for 109 km (68 miles) between St Pancras station in London and the Channel Tunnel and was built in two sections. Section 1, the subject of this report, lies entirely within Kent and runs for 56km from Fawkham Junction (Gravesham) to Folkestone. More than forty 'sites' were identified and excavated along the route during the lifetime of the project. For the purposes of the post excavation analysis these have been grouped into twenty eight Principal Sites providing archaeological evidence ranging in date from the Late Glacial to post-Medieval periods.

This discussion considers evidence from the analysis of a wide range of biological remains as well as geoarchaeological investigations of soil and sediment sequences from the excavated sites along the route. The amount of previous palaeoenvironmental work carried in this part of south-east England varies depending upon the class of biological remains. There tends to be a greater amount of information from sites to the west (central south England) and north (for example, the Thames valley) of the study area, with Kent being relatively under-represented. Several overviews, however, have been prepared on environmental information covering the south of England including this area of Kent (for example, Greig 1991, Scaife 1987).

1.2 Geology, topography and hydrology of the CTRL route

From the north the CTRL route extends from the Ebbsfleet Valley at Springhead south eastwards across the dip slope of the North Downs. The first 15km of the route south-east of Fawkham Junction to the River Medway is, apart from Scalers Hill, predominantly through Upper Chalk overlain in the deeper cuts by Thanet Beds and/or Head. East of Scalers Hill there are extensive solution features in the the top of the chalk. Scalers Hill is an outcrop of the Lower London Tertiaries consisting of Harwich Formation / Blackheath Beds sands and gravels over Woolwich and Reading Beds clay.

After crossing the River Medway on a 1.3km bridge and viaduct the CTRL runs up the Nashenden Valley mainly through Upper Chalk and then into the 3.2km North Downs Tunnel under Blue Bell Hill. The crest of the North Downs escarpment, overlooking the Weald, reaches a height of *c* 200 m OD and is frequently capped by surface deposits of Clay-with-Flints or Tertiary deposits. Extensive deposits of Quaternary age are mapped as Head on the geological maps, extending from coombes cut into the Chalk escarpment and fanning out onto the plains below. The railway exits the North Downs Tunnel below Bluebell Hill at White Horse Stone and runs in a short cut in Lower Chalk before descending into the Weald of Kent.

Across the Weald the route runs for approximately 4km, at *c* 55-60 m OD, through the Gault Clay of Boxley Vale north of Maidstone, before reaching the dip slope of the Lower Greensand at Snarkhurst Wood. The route to Ashford passes through gently undulating topography adjacent to the M20 motorway cutting, mainly through Folkestone Beds sand, and occasionally Sandgate Beds and Hythe Beds, crossing a number of small streams that drain towards the West Stour River. Through the town of Ashford itself, the CTRL alignment runs below ground level, in retained cuts and cut/cover tunnels through reworked Hythe Beds, Atherfield Clay and Weald Clay, before rising up onto a long viaduct to cross the River Stour. From Sevington, for approximately 4km, the railway runs close to the south flank of the Hythe Beds escarpment, in cuttings through the Hythe Beds and the Atherfield Clay. This is a spring line, with many small streams emanating from this area and crossing under the trace. Between Sellindge and Westenhanger, there are two long embankments over the alluvium of the East Stour River valley, interspersed with cuts through the Sandgate Beds and the Hythe Beds. The last 5 km of the route from Sandling up to the interface with the Channel Tunnel is through the more deeply incised topography characteristic of the Folkestone Beds sand.

The rail link crosses two of the major drainage basins of North Kent, those of the Rivers Medway and Stour. The former has a tributary, the River Len, which flows parallel to the line of the Lower Greensand and Gault Clay. The source of the Len at Lenham is separated by only 1.5 km from the headwaters of the River Stour, which also flows parallel to the strike of the solid geology and to the route of the CTRL. However in most cases the rail line runs perpendicular to the surface drainage patterns which flow down the scarp slopes or dip slopes of the respective geological bands.

2 PROJECT DESIGN

The CTRL route was originally divided into a series of five geological and topographical landscape zones. These zones included three, the North Kent Plain (on the south edge of the River Thames estuary), the North Downs and the Wealden Greensand, which covered the line of the CTRL south of the Thames. Although not a specifically designed 'research' sample, the CTRL has produced a wide transect through the defined landscape zones enabling the study of the development of the landscape of Kent. The CTRL Archaeological Research Strategy (Drewett 1997), which guided fieldwork investigations and subsequent assessment work, outlined a set of research aims within six chronological periods for each landscape zone in which to study the relationship between the landscape and human activity. With reference to paleoenvironmental studies, the research aims focused on environmental reconstruction, identifying evidence of human impact, exploitation and consumption of natural resources, as well as considering the distribution of social, political and ritual organisation within the landscape.

On completion of the fieldwork, an assessment stage followed which culminated in the production of a scheme-wide Updated Project Design (UPD). The UPD (URS 2003) reviewed the original research objectives, the broad range of evidence available in the archive, and itemised a framework of updated research questions for each period sub-division. Given the fact that a large part of the Section 1 route passes through the Wealden Greensand, for the purposes of this discussion the original landscape zones have been divided into eight 'sub-regional zones' (Table 1).

Table 1: CTRL Landscape zones

Landscape zones		General landscape zone/ landscape context	Principal sites
The North Kent Plain	1	The boundary of the North Downs/ and North Kent Plain, hinterland of Dartford and Springhead in the Ebbsfleet Valley, the A2/ Watling Street corridor.	Pepper Hill 330 Zone 1 & 2 Northumberland Bottom Tollgate
The North Downs	2	West side of the Medway Gap, hinterland of Rochester, the A2/ Watling Street corridor.	Cobham Golf Course Cuxton
	3	East side of the Medway Gap, dry valleys either side of the North Downs Tunnel, junction of Pilgrims Way and Rochester to Hastings Roman Road, hinterland of Maidstone.	Nashenden Valley White Horse Stone
The Wealden Greensand	4	North edge of Wealden Greensand landscape zone, on the Gault clay strip, close to the foot of the Downs escarpment. Overlooks the Medway Valley, hinterland of Maidstone.	West of Sittingbourne Road Thurnham Roman Villa

Landscape zones		General landscape zone/ landscape context	Principal sites
	5	North edge of Wealden Greensand landscape zone - between the foot of the Downs escarpment and the River Len.	South of Snarkhurst Wood South East of Eyhorne Street Holm Hill Sandway Road Chapel Mill
	6	North edge of Wealden Greensand landscape zone - between the foot of the Downs escarpment and the source of the River West Stour.	Leda Cottages Tutt Hill Parsonage Farm Beechbrook Wood Lodge Wood
	7	Wealden Greensand landscape zone - between the foot of the Downs escarpment and the River East Stour	Boys Hall Balancing Pond West of Blind Lane Mersham Bower Road Little Stock Farm Church Lane and East Station Road North of Westenhanger Castle
	8	North edge of Wealden Greensand landscape zone - south of the Downs escarpment - Coastal zone, hinterland of Folkestone and Hythe	Saltwood Tunnel

It was intended that the present study should be a route-wide synopsis based on the results from the analyses of the different classes of biological remains and wider environmental studies. It is not intended to be a detailed investigation into the environmental results from individual sites including contextual or spatial variation in biological remains within each excavation. Detailed excavation reports for each site can be found in the CTRL Integrated Site Report Series (ADS 2006) along with individual specialist reports, including those that relate specifically to palaeoenvironmental assemblages. Site data is used as examples to support the various conclusions/themes arising from the overview.

The main potential of the environmental data from the CTRL project was to provide information on the economic (agricultural) development of the study area through time, mainly crop husbandry on the basis of charred plant remains. Animal husbandry could only be explored at a very basic level. There was less scope for exploring the development of the local and regional environment with a few notable exceptions, particularly the Late Glacial and Holocene sequence at White Horse Stone.

3 MATERIALS

A wide range of environmental remains was recovered during excavations along the route of the CTRL. These included micro-remains (pollen, diatoms) and macro-remains (plants, insects, molluscs, animal bone). Geoarchaeological studies of soil and sediment sequences included stratigraphic and geomorphological site descriptions, with deposit characterization supported by techniques such as soil micromorphology and the analysis of chemical and magnetic properties (Figs. 1 and 2).

There were obviously potential strengths and limitations of the environmental dataset. Soil/sediment conditions limited the preservation of many classes of biological remains. The poor representation of 'waterlogged' (aerobic) soils limited the survival of more fragile biological remains, including pollen, insects and 'waterlogged' botanical material to just a few sites. Acidic soils, for example on the Wealden Greensand, severely affected the preservation of animal bone and molluscs. Another potential problem was the question of residual and intrusive remains. This was noted at a number of sites with charred plant remains; for example, there was a question of residual cereal remains at Saltwood Tunnel, a problem which has not been satisfactorily resolved (see below).

Charred plant remains were well represented, being analysed from 18 sites, while information from 25 assessment reports was also considered. Charcoal was analysed from eight sites and assessed from nine excavations. Analytical reports were prepared on animal bones from 14 sites. Smaller numbers of reports were prepared on molluscs (five sites), pollen (one analytical and four assessment reports). There were three reports on 'waterlogged' plant remains, two reports (assessment/analysis) on insects, and single reports on mosses (Thurnham Villa) and diatoms (Parsonage Farm). 12 sites were assessed by geoarchaeological methods. Seven were re-examined during the post excavation phase, although only White Horse Stone was subject to detailed analysis.

The best- represented periods in terms of environmental evidence was the late Bronze Age/early Iron Age, Romano-British and to a slightly lesser extent, the medieval period, with relatively smaller amounts of material from the early prehistoric and Saxon periods.

Consequently, the relative abundance of different classes of environmental material by site and period meant that there was great variation in the temporal and spatial presence of the different biological remains, limiting the potential for significant comparisons between periods and areas.

Charred plant remains made up the bulk of the environmental material recovered from all sites. The preservation of these does not depend on the soils/sediments in which they are deposited, consequently they provided the main source of information on economic data (crop husbandry and processing) and the main focus of the scheme-wide environmental project. The small number of 'waterlogged' plant remains that were examined meant that potential reconstructions of local environments were limited. Similarly, the few pollen studies meant that regional environmental reconstructions were also restricted, with no regionally important sequences being studied.

Animal bones consisted mainly of large mammal bone, primarily from domesticates, although there were generally insufficient quantities of material (Minimum Numbers of Individuals) and limited data for the reconstruction of age at death profiles, to provide statistically reliable conclusions on animal husbandry. Evidence for game was noted at many sites, albeit represented by small amounts of material. There were small quantities of small mammal, bird and amphibian bones, which could provide only limited data on the reconstruction of the local environment, although there were several significant assemblages of fish bone from Roman and medieval sites.

Molluscan studies at several sites provided information on the character of the local environment and how it may have changed over time, for example at White Horse Stone, while the insect remains from the late Roman well at Thurnham also produced some data on the character of the immediate environment.

Wider landscape studies within the CTRL study area were carried out using geo-archaeological techniques, primarily the study of soils and sediments. A very important sequence was uncovered at White Horse Stone, and several other geo-archaeological sequences from various other dry valleys in the North Downs were examined but the lack of potential dating evidence, or direct association with archaeological remains, meant that they were not analysed in detail.

4 PRESENTATION OF RESULTS

The report takes the form of a chronological narrative using the route wide phases and subdivisions when possible, although some of the analysed biological remains were from dated deposits that encompassed more than one period and could not be conveniently placed within these divisions. This is problematic when there are significant differences between the phases covered, although in most instances this was not the case. The geoarchaeological investigations and molluscan analysis of dry valley sequences could only be broadly dated, although a division has been made between the Pleistocene/ Late Glacial and Holocene deposits, the latter being particularly relevant to the later prehistoric and historic periods. Within the chronological narrative, reference will be made to the eight landscape zones, particularly if there are significant differences between the environmental remains in different parts of the study area.

As noted above, the bulk of the discussion is based on the charred plant remains and the development of crop husbandry over time. Environmental reconstruction is limited mainly to the sequences at White Horse Stone, although the charcoal from the various periods allows some comments on woodland resources through time. Any significant differences in the economy and environment (when possible) between landscape zones and periods are noted and comparisons made with previous environmental work in the south-east of England and occasionally with the rest of the country, emphasizing any differences based on current research. In this respect, however, it is worth stressing that one of the major limitations in the environmental scheme-wide project was the nature of the study area itself. The route of the Channel Tunnel Rail Link does not encompass a single landscape zone. It does pass through most of the major landscape zones of Kent, excepting only the High and Low Weald and coastal marshes, but it is difficult to use the environmental analyses to make comparisons with other areas except on a very general level.

5 'HUNTER-GATHERERS' – LATE GLACIAL TO MESOLITHIC & EARLY NEOLITHIC TRANSITIONS (C 13000 UNCAL BC TO C4000 CAL BC)

5.1 Late Glacial (13000-9000BC)

5.1.1 Regional setting

Environmental evidence for the late Glacial period along the Channel Tunnel Rail Link comes primarily from the study of dry valley pedo-sedimentary sequences where the route passes through the chalklands of the North Downs. Dry valleys or 'coombes' are a characteristic feature of the chalklands and occur in large numbers on the North Downs in Kent. The morphology of the valleys is described by Kerney *et al* (1964); they range from significant landscape features, in places breaching the Downs escarpment, to smaller funnel like features dissecting the face of the escarpment from the crest. The valleys exhibit a high degree of variability, inferring a complex history of formation and subsequent infilling. Several workers have emphasized the role of fluvial action and spring sapping to explain their formation (Sparks and Lewis 1957; Small 1965), though periglacial processes, frost shattering and solifluction, are also cited (Kerney *et al*. 1964). It is most likely that a combination of fluvio-glacial processes are responsible, the emphasis of each varying according to local environmental conditions (Ballyntayne and Harris 1994; Jones 1981).

The Quaternary deposits contained within the valleys are largely colluvial in origin. They often show a twofold division between material of Pleistocene periglacial origin forming the lower part of the sequences, and later deposits, predominantly hillwash of Holocene age. The periglacial deposits on the chalk frequently comprise coarse flint and chalk rubble, or 'coombe rock', resulting from frost-shattering of bedrock under intensely cold climates (Ballyntayne and Harris 1994; Kerney 1963), and finer silts and muds deposited by solifluction and meltwater processes. Intercalated buried soils have occasionally been recorded indicative of periods of increased slope stability and climatic amelioration that occurred during the Late Glacial period.

Traditionally two periods of warmer climatic conditions, the Bølling (*c.* 12,000-13,500 cal BC) and the Allerød (*c.* 11,000-12,000 cal BC) interstadials, have been recognised on mainland Europe (Iversen 1954). These are separated by periods of intense climatic deterioration where temperatures have returned to arctic conditions. Much research of organic sequences in upland Britain have generally failed to distinguish or separate the interstadials using pollen analysis. However, important recent work on the chalk at Holywell Coombe Folkestone, conducted in advance of the construction of the Eurotunnel rail terminal, revealed a range soils, sediments and associated biological remains reflecting a complex history. This work identified 'Bølling stage' sediments but also supported the suggestion that the Late Glacial period was much more unstable than previously thought comprising a succession of climatic oscillations approaching the Holocene (Preece and Bridgland 1998).

Much of the work on dry valleys in Kent has been concentrated on the sedimentology and biostratigraphy of the Late Glacial deposits. In addition to Holywell Coombe, work was carried out in the 1960s, on the west side of the Medway gap at Holborough and Upper Halling (Kerney 1963) and further south sites include Brook, Dover Hill and Castle Hill (Kerney *et al* 1964). Late Glacial buried soils assigned to the 'Allerød' stage have been identified at a number of these sites. Outside Kent soils have been recorded in Dorset (Hearne and Birbeck 1999), Buckinghamshire (Evans 1966, Evans and Valentine 1974) West Sussex (Allen and Powell *forthcoming*) and on the Isle of Wight (Preece *et al* 1995) (Fig. 3).

From an archaeological perspective, the investigation of the climate and associated environmental change during this period is pertinent to our understanding of the patterns of re-colonization of the British Isles subsequent to the last glaciation. At the time of writing no investigated Late Glacial palaeosols in Kent have produced artefactual evidence indicative of the presence of humans, although a number have contained charcoal and evidence of burning.

5.1.2 Dry Valley sequences in the North Downs

The CTRL route between Fawkham Junction and the North Downs Tunnel passes through a number of dry valleys (Figs. 4 and 5). West of the River Medway these included the Downs Road (ARC STP97/99) and Wrotham Road dry valleys (ARC WNB98 and ARC TLG98), relict tributaries of the Ebbsfleet system, and Cuxton (ARC CXT97), immediately west of the River Medway. On the east side of the Medway the CTRL passes through Nashenden Valley (ARC NSH97/98, Fig.7) before it enters the North Downs Tunnel. The route exits the tunnel below Bluebell Hill at the foot of the Downs escarpment passing through the White Horse Stone dry valley (ARCWHS98, ARCPIL98, Fig.8), and a minor valley at Boarley Farm, (ARC BFW98). Unfortunately, many of the sequences investigated proved to be either unexceptional and largely unfossiliferous or were variably sampled, limiting scope for dating and detailed analysis beyond what was achieved during the assessment stage. Deposits ascribed to the Late Glacial period are predominantly characterized by cold climate coarse solifluction gravels and finer grained silts and sands derived from reworking of chalk bedrock, local Thanet sands, Clay-with-Flints and possibly loessic deposits.

At Tollgate, on the eastern side of the Wrotham Road valley, a palaeosol was identified formed within redeposited Thanet Beds (Fig.6). The soil contained frequent iron nodules, manganese speckles, bleached/leached patches, and white sandy laminae within, characteristic of ice segregation and waterlogging in arctic soils under periglacial conditions. A period of harsher climate and renewed erosion and solifluction was represented by the deposition of the overlying chalk rubble. However, fine-grained lenses within the lower part of the coombe rock may represent former soil material (perhaps formed during a Late Glacial interstadial) eroded and redeposited downslope with the soliflucted chalk. A soil horizon within chalk meltwater deposits was also identified in Nashenden Valley during evaluation trenching (ARC NSH97, 1497TT). Although this was not confirmed during the targeted excavation stage, a possible continuation of this horizon was identified during the cutting of the tunnel portal (ARC NSH98, 3123TT, Fig.7). The sparse molluscan assemblages were typically Late Glacial, highly restricted and dominated by *Pupilla muscorum* and *Vallonia* spp. The species included cf. *Trochoidea geyeri,* a species now extinct in Britain with a modern geographical range in central Europe. It is characteristic of dry open calcareous areas with short vegetation and rocks (Kerney 1999) and has been recorded from a number of Late Glacial sequences in Kent (Kerney 1963). The assemblage from the soil horizon was consistent with other 'Allerød' stage soils investigated in Kent.

At White Horse Stone it was not possible to map comprehensively the extent and thickness of the Late Glacial sediments within the excavation areas, since invariably only the surface of these deposits was exposed. On the upper western slopes within the excavation area, topsoil directly overlay chalk bedrock. On the middle and lower slopes around the valley axis the chalk was overlain by coarse angular flint and chalk gravel. These gravels appeared to thicken down the valley axis and were noted to be approximately 3m thick in the vicinity of the Pilgrim's Way trackway when the cutting for the tunnel portal was excavated. Overlying the gravels on the lower west facing slopes and in the base of the valley were extensive deposits of finer grained chalky gravel and silt deposits (Fig.9). Analysis of the deposits suggests deposition occurred under periglacial cold climate conditions during the Late Glacial period. Active slope erosion of chalk bedrock and other superficial deposits was rapid, perhaps seasonal, resulting in redeposition of sediment from upslope into the base of the valley. Intercalated within these silts at the base of the eastern flanks of the valley was a dark grey humic horizon interpreted as a Late Glacial 'Allerød stage' soil. Thin section analysis of the soil has concluded that it does not technically represent an in situ soil, but occurs as reworked 'humic' soil clasts, occasionally separated by a fine silty soliflual sediments, probably deposited at the onset of the 'Younger Dryas' cold stage (Fig.12). Mature rendzina soil formation however on stable valley sides is inferred for the Allerød period.

The composition of the molluscan fauna from the sequence at White Horse Stone was unmistakably Late Glacial in character. Broadly the sequence is consistent with other sites investigated in the area and all species identified have been recorded previously in Late Glacial deposits. Assemblages from the basal solifluction deposits were sparse and impoverished suggesting cold climate conditions with little vegetation cover. All species identified, apart from perhaps *Vallonia pulchella*, have modern Holarctic ranges extending in Europe to well beyond the Arctic Circle and are adapted to a wide variety of adverse environments (Kerney 1963:206). The fauna associated with the 'Allerød' soil showed an increase in both numbers of individuals and species diversity suggesting increased surface stability and thermophilous species occur, indicating warmer conditions developing. The environment prevalent at the time appears to have been a fairly simple one of dry open grassland, rather exposed on the slopes, where some areas of bare ground may have persisted. As at Nashenden Valley, *T. geyeri* was also recorded in the sequence at White Horse Stone (Stafford 2006a, Fig.10). A more restricted assemblage coincided with the deposition of the overlying chalk silts indicating a development of to more extreme conditions during the 'Younger Dryas'

5.1.3 Discussion

The Late Glacial interstadial soil horizon or Allerød soil (sensu Kerney, 1963) is widely recognized in south eastern England. Within the Medway catchment area the site at Upper Halling has been designated as the regional stratotype for the Late Glacial sequences (including both the Late Glacial soil horizon and the solifluction deposits above and below the soil horizon). This is known as the Upper Halling Bed and forms part of the Brook Formation (Gibbard and Preece, 1999). All deposits discussed in this report and assigned to the Late Glacial period would therefore be equated with the Upper Halling Bed.

It is has been generally thought that the large-scale erosion that created the dry valleys of the North and South Downs occurred in the latter part of the Late Glacial period, between about 14-10ka BP and in particular during the 'Younger Dryas' cold stage that took place between about 11-10ka BP, immediately prior to the Holocene (Preece 1994). At White Horse Stone the basal silts beneath the 'Allerød' horizon produced an impoverished cold climate molluscan assemblages consistent with that attributed to mollusc zone y dated at Holywell Coombe to 13160±400 yr BP and shortly before 11530±160 yr BP. The Tollgate dry valley appears to have already been incised and arctic soils developed prior to a final cold stage that eroded chalk from the valley sides and redeposited it as coombe rock within the valley. Although massive re-shaping of the drainage system appears to have taken place during the Late Glacial which may well, as at White Horse Stone have truncated the *in situ* 'Allerød' stage soils, it is possible that the Tollgate tributary valley escaped drastic re-forming at this time and sediments with incipient arctic soils developed in them were preserved in relatively sheltered locations close to the valley side. Although in other parts of Kent and East Sussex dry valleys, such as Holywell Coombe, have been found to pre-date the 'Younger Dryas' (Preece and Bridgland 1998), such evidence is not common.

The high silt content of many of the described sequences may be derived from inputs of loess, characteristic of the harsh tundra environment of the Late Glacial. Loess is essentially windblown silt (Lowe & Walker 1997, 121) and its deposition has been dated from about 25ka to 10ka BP in this area (Bateman 1998). The sequence investigated in Area 330 Zone 3 (ARC STP99) contained a loessic type deposit with fainter clayey laminations overlying a coarser bedded sand, silt, chalk and flint granules. Recent micromorphological examination of inter-laminated silt and sand in part of a loess / brickearth profile at Heathrow Airport, has shown that wind blown sedimentation was likely to have occurred in winter and surface wash during the summer months (Rose *et al* 2000). Similar laminations are common in loess profiles within the Belgium Loess.

Common to many of the sequences, and examined by thin section analysis at White Horse Stone, were networks of sub-vertical voids filled with inwashed sediment and pseudomorphic replacement of roots by micritic calcite (Fig.11 and 13). This suggests vegetation grew concurrently with accumulation. Kerney (1963) noted similar phenomena on other Late Glacial sequences and suggested in the spring and summer the ground, frozen and frost-shattered during the preceding winter, thawed and a slurry of mud and fine rubble was washed down onto the lower slopes. Vegetation comprising grasses and small herbs probably grew on these surfaces, dying off towards the end of the year and subsequently becoming buried during the next thaws. These deposits were not produced by the mass movement of large bodies of semi-frozen ground but grew by increments.

Notably, thin section analysis of the 'Allerød' soil at White Horse stone has concluded that it does not technically represent an *in situ* soil. Erosion and redeposition of Late Glacial soils by solifluction processes, probably at the onset of the 'Younger Dryas' cold stage, was also evident at Tollgate. At other sites in Kent, for example Upper Halling and Holborough, the 'Allerød soils' are similarly described as chalky colluvia, where mass-movement has produced a 'soil' composed of coalesced eroded soil fragments (Kerney *et al* 1980, Macphail and Scaife 1987), and at Ventnor on the Isle of Wight a Late Glacial palaeosol was described as "transported, accretionary and welded", and not truly an *in situ* soil (Kemp *et al*., 1994, Preece *et al* 1995). The 'Allerød' soil can be considered, as at Ventnor, to be "part of a vertical sequence representing a single complex soil with transported, accretionary and welded components" (Preece *et al*., 1995).

The long held view that the Allerød stage was marked by cool episodes severe enough to cause soils to form mud-flows into valleys cannot be proven on the basis of the evidence from the CTRL sites. Moreover, the suggested maturity of the rendzina soil fragments at White Horse Stone argues better for a lengthy period of slope stability, before becoming eroded in the 'Younger Dryas' stage.

The molluscan assemblages at White Horse Stone from the 'Allerød' horizon and overlying chalky silts are consistent with molluscan zone z dated at Holywell Coombe to between 11530±160 yr BP and 9820±90 yr BP (Preece and Bridgland 1998). They are indicative of comparatively dry conditions with the presence of xerophiles, particularly *Helicella. itala* and *Abida secale*. Hydrophiles are comparatively rare. *Arianta arbustorum* and *Vallonia pulchella*, frequent in many zone z assemblages, are very rare and *Trichia hispida* is conspicuous by its absence. *T. hispida* has been recorded in profusion in many other dry valley sequences, particularly in zone z 'Younger Dryas' deposits (Evans 1966, Kerney 1963, Preece *et al* 1995) leading to the supposition that the climate of the 'Younger Dryas' was probably more humid than previously (Kerney 1963). *A. arbustorum* was however similarly absent in the sequences at Watcombe Bottom (Preece *et al* 1995) and at Pitstone (Evans 1966). At Upper Halling, in contrast to Holborough, both *A. arbustorum* and *T. hispida* were rare (Kerney 1963). Kerney attributed this to the more exposed location of Upper Halling, on the slopes of a dry valley. The sequence at White Horse Stone was at the foot slope of the western flank of the valley, which is particularly steep at this point, and the molluscan faunas are probably reflecting the exposed dry environment prevailing on the slopes where, perhaps, vegetation was a little sparser and areas of bare ground persisted.

Unfortunately, as with other sites dating to this period in Kent, no direct evidence of human activity was found associated with Late Glacial 'soils'. Occasional fragments of charcoal were recovered from soil samples at White Horse Stone. Trace amounts of charcoal could suggest very low inputs of burned organic material, that is, either relict of natural fires or from the dispersed presence of humans. The quantity of charcoal, however, was somewhat disappointing when compared to other investigated sites, especially considering the large volume of material processed. This lack of charcoal makes the White Horse Stone 'Allerød' soil an exception in Kent. Yet fragments of charred uniseriate dicotyledenous material were recorded and dated providing a result of 11,130±48 BP (11500-10900 cal BC) within the range of other dated sites in Kent (i.e. 11,900-10,800 cal BC, Table 2). Perhaps more significant was the indication of Late Glacial burning from a site off the chalk. At Pepper Hill charred parenchyma from a cremation burial produced a result of 12,111±56 BP (13,400-11,700 cal BC), placing it within, according to Iverson's scheme, the 'Bølling' Interstadial (Iversen 1954), and indicating the wider extent of this evidence that had not previously been identified (Allen 2006).

Table 2: Radiocarbon determinations for Allerød buried soils (Allen 2006)

Site	**Material**	**Laboratory number**	**Result BP**	**Cal BC**	**Range**
Westhampnett, W. Sx	*Pinus* + *Betula*	OxA-4167	10,840±100	11200-10650	550
Westhampnett, W. Sx	*Betula* + Rosacea	AA-11679	10,870±80	11190-10690	500
Westhampnett, W. Sx	cf. *Betula*	OxA-4166	10,880±110	11250-10650	600
Upper Halling, Kent	cf. *Betula*	OxA-3236	10,900±120	11250-10650	600
Pitstone, Bucks	charcoal	OxA-415	10,900±130	11250-10650	600
Dover Hill, Kent	*Betula*	OxA-3239	11,100±100	11500-10700	800
White Horse Stone, Kent	uniseriate dicotyledenousmaterial	NZA-22046	11,130±48	11500-10900	600
Brook borehole III, Kent	charcoal	AA-10706	11,170±70	11500-10900	600
Dover Hill, Kent	*Betula*	OxA-3238	11,220±110	11850-10950	900
Upper Halling, Kent	cf. *Betula*	OxA-3237	11,240±110	11850-10950	900
Holywell Coombe, Kent	charcoal	OxA-2089	11,370±150	11900-11000	900
Holywell Coombe, Kent	*Arianta* snail shell	OxA-2159	11,430±100	11900-11050	850
Holywell Coombe, Kent	*Arianta* snail shell	OxA-2158	11,430±110	11900-11050	850
Holywell Coombe, Kent	'reduced carbon'	OxA-2353	11,520±90	11900-11200	700
Holywell Coombe, Kent	*Carex/Scirpus* fruits	OxA-2345	11,530±160	12100-11000	1100
Dover Hill, Kent	charcoal	Q-463	11,550±135	12100-11050	1050

Site	Material	Laboratory number	Result BP	Cal BC	Range
Brook (Pit A), Bucks	*Betula*	AA-10708	11,575±75	12000-11200	800
Holywell Coombe, Kent	charcoal	OxA-2242	11,580±100	12050-11200	850
Holywell Coombe, Kent	humic acids	OxA-2352	11,600±100	12100-11200	900
Watcombe Bottom, IoW	charcoal	OxA-3235	11,690±120	13200-11200	2000
Holywell Coombe, Kent	*Arianta* snail shell	OxA-2479	11,810±120	13300-11400	1900
Pepper Hill, Kent	charred parachyma	KIA-23923	12,111±56	13400-11700	1700
Holborough, Kent	charcoal	Q-473	13,180±230	14600-12600	2000

5.2 Mesolithic (9000 BC-c 4000BC)

There is very little environmental data from the Mesolithic period (the early to mid Holocene) in the study area. Most of the Holocene dry valley pedo-sedimentary sequences investigated were poorly dated, although where associated with archaeological remains, or where molluscan remains were preserved, for example at White Horse Stone, Cuxton and Northumberland Bottom, a later prehistoric and historic date is inferred (see below).This implies a major unconformity within the sediment sequences spanning several thousand years between the Late Glacial and later prehistoric period. An undated horizon identified at the base of a colluvial sequence at Northumberland Bottom had characteristics suggestive of an *in situ* or redeposited 'Bt' horizon of a brown-earth type soil that may date to an earlier period. Unfortunately there was no potential for dating this deposit and no molluscan remains were preserved. In general, preservation of former early to mid Holocene soils in dry valley situations on the chalklands of the south and south-east are rare and are often isolated deposits preserved in subsoil hollows or within archaeological features. Many investigated colluvial sequences appear to date to the Bronze Age or later and the absence of former basal soil has often been interpreted as a result of extensive and severe truncation (Allen 1992, Bell 1992), although incorporation of the original soils into later ones under conditions of relative stability may also be a possibility (Evans and O'Connor 1999, 208).

Direct evidence relating to this period along the CTRL route comes from a charred plant remains assemblage from a pit at Sandway Road (ARC SWR99). The assemblage consisted of occasional traces of hazel nut (*Corylus avellana*) shell, some of which was radiocarbon dated to the early Mesolithic (Allen 2006). There were also four poorly preserved charred cereal grains of wheat/barley (*Triticum/Hordeum* sp.) and a wheat (*Triticum* sp.) rachis fragment. The cereal remains, however, are almost definitely intrusive with a large amount of disturbance (rootlets) in these shallow fills, which was confirmed by radiocarbon dating of one of the grains to the Bronze Age period (*ibid*). Little work has been carried out on plant remains from Mesolithic sites and it is often difficult to establish whether the remains are related to human activity (Greig 1991, 299). The fact that the remains at Sandway Road were charred and also broken, however, increases the likelihood that they are related to human activity. The remains of hazelnut were also found amongst a range of woodland and scrub plants, in a shell midden at the late Mesolithic site of Westward Ho!, Devon (*ibid*., 300) while pollen analyses at several locations dated to the Mesolithic period in southern England have included *Corylus* pollen, indicating the presence of this species at this time (Scaife 1987, 133-5). It is likely that hazel nuts would have provided an important wild food resource during the Mesolithic, as also appears to have been the case in the later Neolithic, on the basis of extensive finds on later Neolithic sites (Greig 1991, Moffet *et al* 1989, see below).

Of note are residual fragments of pine (*Pinus* sp.) charcoal, retrieved from post-holes from the early Neolithic longhouse structure 4806 at White Horse Stone, which produced radiocarbon dates within the early Mesolithic period, 7600-7520 cal BC (8516±35 BP) and 8530-8280 cal BC (9182±40 BP). A further anomalous result from the Beechbrook Wood ring ditch indicated burning of alder/hazel (*Alnus/Corylus* sp.) charcoal in the later Mesolithic 6020-5840 cal BC (7072±35 BP)(Allen 2006). Although pollen data for the early to mid Holocene in Kent is rather limited, evidence from Holywell Coombe (Preece and Bridgland 1998, Kerney *et al* 1980) and Wateringbury, 9.5km southwest of White Horse Stone (Kerney *et al* 1980) suggests locally forested conditions during the pre-boreal and boreal (c. 9000-5500 BC), initially birch (*Betula* sp.) and pine, followed by hazel and then hazel and elm (*Ulmus* sp.) woodland. It has often been suggested that most of south-east England was wooded prior to *c* 4000 BC (Bell 1983; Ellis 1985; Evans 1972; Kerney *et al.* 1964; Thomas 1982). However, there is debate concerning the natural ecological state of the assumed climax woodland. Traditionally it has been believed that Britain and the rest of Europe was covered by a dense continuous canopy in the early-mid Holocene (Rackham 1986; Peterken 1996). With reference to the chalklands, however, sites such as Willow Garth in the Yorkshire Wolds (Bush and Fenley 1987 and Bush 1993), Cranbourne Chase, Dorset (French *et al* 2003) and Caburn, East Sussex (Waller and Hamilton 2000) provide evidence to suggest that in some areas the woodland development in the earlier Holocene may have been patchier than the traditional model suggests. Some open areas may have persisted that could have been subject to exploitation during the Mesolithic and Neolithic periods. Previous workers have emphasised the role of Mesolithic communities in the disturbance of the natural woodland (Evans 1975; Williams 1985; Simmons 1996). A reduction in arboreal cover in regional pollen sequences, and the increased occurrence of microscopic charcoal, has been interpreted as evidence of the use of fire to create small woodland clearings (Mellars 1976; Simmons and Innes 1997; Simmons 1996). Whitehouse and Smith (2004), however, have recently reviewed the data, (e.g. Buckland and Edwards 1984; Bradshaw and Hannon 1992; Bradshaw and Mitchell 1999; Robinson 2000b; Vera 2000) and in particular the coleopteran evidence. They suggest that although there was undoubtedly an anthropogenic factor, the role of autogenic disturbance (eg tree throw and forest fire) may have been previously underestimated.

6 'EARLY AGRICULTURALISTS' – THE NEOLITHIC AND EARLY BRONZE AGE LANDSCAPE (C4000-2000BC)

6.1 Early Neolithic (c4000 BC-c3300BC)

There was very little environmental evidence from the early Neolithic period within the study area with all the data coming from just two sites at either end of the route; from White Horse Stone at the western end (Zone 3) and Saltwood Tunnel at the eastern extremity (Zone 8). Information on the character of the environment/landscape for this period was based virtually entirely on the evidence from White Horse Stone from studies of the geo-archaeology, soil micro-morphology, molluscs and charcoal. Conversely, the biological remains from the Saltwood Tunnel excavations produced almost all the economic data for the early Neolithic period based on charred plant remains (cereal remains and wild foods) but also some charcoal. There were traces of animal bone remains from both sites.

6.1.1 White Horse Stone

At White Horse Stone the only clue to this period come from feature fills. Thin section analysis from early and late Neolithic posthole fills and the fill of subsoil hollow at the Pilgrim's Way site (923) suggests that humic rendzinas were locally present. This suggests that the local soils had not been eroded, or were little eroded, during these periods. The molluscs from postholes associated with the early Neolithic structure 4806 (Fig.16) provides further evidence on the character of the local environment in the vicinity. Although interpretation of the assemblages was problematic given the presence of clearly residual Late Glacial shells, a significant component comprised shade-demanding species including *Discus rotundatus*, various Zonitidae and *Carychium tridentatum*, suggesting an enclosed environment with much leaf litter. Lesser quantities of rupestral species such as Clausiliidae and *Acanthinula aculeata* were also present that often live on tree trunks and under fallen logs, along with *Acicula fusca* and *Vertigo pusilla* indicating old or mature woodland. This suggests that the fills of the postholes contained soil formed in an environment with significant tree cover, or perhaps ground that had been recently cleared of woodland given the high numbers of *Vallonia costata* in some of the samples. Since this species is often present in woodland in low numbers it is often the first of the open-country species to colonize newly cleared ground. *Pomatias elegans* was present in many of the samples (Fig.17). This species often inhabits leaf litter on woodland floors though it tends to proliferate in disturbed or recently cleared ground where the loose soil provides ideal conditions into which it can burrow. It is logical to assume some clearance of woodland may have been necessary for construction purposes. On the basis of the molluscan evidence from the postholes however, which probably represent a relatively short time period, it is not possible to say how extensive or permanent the clearance was, although the evidence from pit assemblages for woodland environments persisting into the late Neolithic in this area would suggest this was not widespread, and that suitable refugia remained. An interesting aspect of the molluscan assemblages was the absence of some of the rarer species often associated with primary climax forest, perhaps suggesting more prolonged low-level interference in the environment before the construction of the Neolithic longhouse.

The little charcoal that was recovered from the early Neolithic longhouse, pits and other features at White Horse Stone also provided tentative clues as to the nature of the woodland environment in the vicinity of the site. Ash (*Fraxinius excelsior*), possibly for structural use, was the main charcoal recovered together with smaller quantities of oak (*Quercus* sp.), hazel and sloe/blackthorn (*Prunus spinosa*), also possibly for structural use, objects or fuel (although it was not possible to establish which on the basis of the small amount of charcoal). Blackthorn and hazel would have also been potential sources of wild foods. Very small quantities of charred plant remains were recovered from structure 4806: a grain of wheat (*Triticum* sp.) from posthole 5280 and unidentified cereal grains and a few fragments of hazel nut shell from posthole 4817. In addition a poppy seed (*Papaver* sp.) was found in tree-throw hole 5308, and several fragments of hazel nut shell and a single, unidentified cereal grain in tree-throw hole 5393.

Soil micro-morphology and bulk chemical analysis were carried out on deposits from the early Neolithic longhouse at White Horse Stone for potential evidence on economic activities at the site and the possible use of the building for agricultural purposes. There was no definite evidence, however, for *in situ* animal stabling. High phosphate levels could be from burnt animal waste although no micro-evidence of burnt dung was found. The high phosphate levels may also be from burnt bone. It is more likely that the building was used mainly for domestic occupation, as there was evidence for beaten floor soils (Figs. 14 and 18). A single sheep/goat (*Ovies aries/Capra hircus*) tooth at White Horse Stone was the only evidence for animal husbandry at the site during this period.

6.1.2 Saltwood Tunnel

As noted above, virtually all of the remaining environmental evidence for economic activities during the early Neolithic period was recovered from Saltwood Tunnel at the other end of the CTRL route to White Horse Stone. Charred plant remains in nine samples from two early Neolithic pits consisted mainly of hazel nut shell with an apple (*Malus sylvestris*) pip providing evidence of another wild food resource. There was a small number of grains, mostly (where identifiable) being from the hulled wheat, emmer *(Triticum dicoccum*), an identification confirmed by the recovery of an emmer spikelet fork. There were tentative identifications of two barley (*Hordeum* sp.) grains including one possibly of naked barley. These results are similar to those of previous archaeobotanical research for the Neolithic period, which shows the presence mainly of charred hazel nut shell, with less evidence for cultivated cereals including emmer and barley (Greig 1991, Moffet *et al* 1989).

There were few other identifiable charred plant remains in the samples, with the exception of a few probable weed seeds including one of cleaver (*Galium aparine*) and vetches/wild pea (*Vicia/Lathyrus* spp.) as well as several grass culm fragments. An interesting find were tubers of false oat grass/onion couch (*Arrhenatherum elatius*), in deposits associated with the cremation burials /pyre debris. These tubers have previously been found in Bronze Age cremation deposits and have been interpreted as tinder. They may also point to the presence of relatively ungrazed grasslands in the vicinity of the pyres/barrow (Robinson 1988).

A similar range of taxa to White Horse Stone was shown by the charcoal in several early Neolithic pit fill samples at Saltwood Tunnel; oak and hazel dominated the charcoal samples together with smaller amounts of willow/poplar (*Salix/Populus* sp.) and Rosaceae. Oak may be occupation detritus and possibly from structural components while hazel and willow have been associated with wattle screens for structural purposes since very early prehistory?

Three fragments of calcined bone were also recovered from a pit from Saltwood Tunnel although these remains were not identifiable.

6.2 Middle Neolithic – Early Bronze age (c3300 BC – 1600 BC)

Environmental material from this period consisted mainly of charred plant remains from eight sites and all zones except 2 and 4. Animal bones were limited to two sites, mainly White Horse Stone, from which molluscs were also studied. Thus, the potential of the biological material during this phase was biased towards providing information on the food economy (crop and to a lesser extent animal husbandry) with only limited data on the changing environment/landscape.

6.2.1 The charred plant remains

Examination of changes in the nature of the charred plant remains during this phase was not possible because of broad dating of sampled deposits with most of material being from deposits broadly dated as late Neolithic/Early Bronze Age, for example at Tutt Hill, Beechbrook Wood, Temple East of Springhead and Eyhorne Street. The samples from Little Stock Farm were dated as middle/late Neolithic. Only one site, Sandway Road, produced productive deposits, but these were restricted to the middle Neolithic, consisting of traces of possible hazelnut shell. One assemblage exmained, Saltwood Tunnel, was dated firmly within the early Bronze age, with traces of barley and wheat and large legume fragments. As far as any comparisons could be made, there does not appear to have been any significant difference in the composition of the charred assemblages between the sites.

The charred botanical assemblages are fairly similar throughout this period with the different sites producing fairly consistent results. The charred remains consisted mainly of the residues of wild food (fruits/nuts) at five sites, especially hazel nut shell, found in large amounts at Eyhorne Street, Little Stock Farm and White Horse Stone, and to a lesser extent, crab apple, with the remains in a late Neolithic pit fill at Eyhorne Street including part of a crab apple fruit which had fragmented, exposing the seeds in section. There was a particularly large amount of charred crab apple (fruit and seeds) and hazel nut shell in samples from a Beaker pit at Beechbrook Wood which could be the residues of food offerings, although these remains may simply represent discarded nut shells and partially eaten fruit.

A small amount of cereal remains was recovered from each of seven sites, although poor preservation meant that many of the grains could not be identified. The cereal gains consisted of wheat, including emmer, also identified in the basis of two spikelet forks at Eyhorne Street, and barley, with hulled grains (*Hordeum vulgare*) recovered from Eyhorne Street and Tutt Hill. The cereal remains in middle to late Neolithic deposits at Little Stock Farm also included free-threshing wheat (*Triticum aestivum/turgidum*) grain and possibly the hulled wheat spelt (*T. spelta*), the latter tentatively identified on the basis of chaff fragments in the sample. This material, however, may be intrusive because the sample also contained a few fragments of late prehistoric pottery. Spelt wheat has only previously been recorded from the Bronze Age onwards.

The remains of legumes including possibly horse bean (cf. *Vicia faba*) and pea (*Pisum* sp.) were found in early Bronze Age barrow ditch fills at Saltwood Tunnel.

There were very few charred seeds of wild plants/weeds from these sites for potentially more detailed information on crop husbandry with the exception of just one bedstraw (*Galium* sp.) seed from Temple East of Springhead, and a small number of weed seeds at Eyhorne Street.

6.2.2 Animal bones

The animal bones from this period were virtually all from late Neolithic deposits at White Horse Stone (Zone 3): A small assemblage of bones of domesticated animals, with cattle (*Bos taurus*) were the most abundant species followed by pig (*Sus scrofa*) with few sheep/goat remains and a small number of dog (*Canis familiarus*) bones. A predominance of juvenile cattle may suggest a dairy based economy while there was also good representation of young pig bones. Pigs produce large litters with the young often being killed for meat. Animal bone remains at Saltwood Tunnel (Zone 8) from early Bronze Age deposits consisted of just two fragments of cattle teeth which, however, may be intrusive. There was also evidence of hunting at White Horse Stone in the late Neolithic period with the presence of aurochs *(Bos primigenius*) and roe deer (*Copreolus copreolus*) remains. The recovery of red deer *(Cervus elaphus*) antler may have been the result of collection of shed antler rather than hunting of this animal.

6.2.3 The local/regional environment

Evidence for environmental reconstruction of the study area during this period derives mainly from White Horse Stone, particularly the terrestrial molluscs from pit deposits dated to the middle and later Neolithic on the lower slopes and valley bottom. Overall the molluscan assemblages were similar to those from the early Neolithic contexts, dominated by shade-demanding species suggesting the presence of trees and abundant leaf litter. Despite this however the percentages of shade-demanding species did vary somewhat between 40% and 94%, possibly a reflection of various micro-environments around features, but overall suggesting the environment was by no means uniform. A smaller open country element (where not of residual Late Glacial shells) suggests an open aspect to the canopy, with some low-level disturbance (*Pomatias elegans)*, possibly in places interspersed with small areas of scrub, long or lightly grazed grassland. An increase in open country xerophile species in the later Neolithic pits in the valley bottom suggests a trend to slightly more open conditions in this area, possibly the creation of grassland areas. Samples from a nearby subsoil hollow containing late Neolithic struck flint in its lower levels supports this view, providing evidence for a sequence developing from woodland, to woodland clearance and the development of more heavily grazed grassland, perhaps at some time during the Bronze Age. North of the Pilgrim's Way trackway, however, a strong shade-demanding component is present in the assemblages into the Bronze Age, suggesting suitable refugia persisted in these areas.

Certainly the presence of roe and red deer in late Neolithic deposits from White Horse Stone suggests the presence of woodland/scrub habitats in the vicinity of the site.

Charcoal provides traces of information on the character of the local environment around several of the sites. Scrub woodland may be implied by the presence of charred hazel nut shell and crab apple remains on some of the sites (see above). Hawthorn (*Crateagus monogyna*), possibly used as fuel, was also identified at Beechbrook Wood and Saltwood Tunnel. Larger woodland species was represented by ash and alder/hazel charcoal from Eyhorne Street and oak (acorn and charcoal) at Beechbrook Wood.

6.3 Discussion

The environmental remains from this period are largely based on the charred plant material with remains of wild foods (hazelnut shells and crab apple remains) and smaller amounts of cereal remains of wheat (including emmer) and (hulled) barley. The free-threshing wheat and the possible spelt wheat remains at little Stock Farm are probably intrusive.

These results correspond well to previous analyses of archaeobotanical material from this period with extensive evidence for the remains of wild fruits and nuts, particularly hazelnut shell, and small amounts of cereal remains including emmer and (hulled) barley (Greig 1991, Moffet *et al.* 1989). The results are similar to the charred remains from the early Neolithic deposits at Saltwood Tunnel.

The relative importance of collected wild foodstuffs and cereal cultivation during this period has previously been discussed at some length, with the abundance of wild food remains used to suggest that there was a greater reliance on the gathering part of the food economy whereas the general paucity of cereal remains has been interpreted as evidence for only small scale arable cultivation. Recent work, however, has suggested that this may be an oversimplification, and may be due in part to the nature of the sampled Neolithic sites, which are mainly ritual with few domestic sites. Indeed, recent excavation of Neolithic domestic (storage) sites has resulted in the recovery of large charred cereal grain assemblages (Jones 2000). Moreover, taphonomic factors play a role in the survival of the different charred remains with the preservation of hazel nut shell (a by-product rather than the edible part of the fruit) being more resilient to survival than cereal remains, while the potential preservation of the latter may have also been limited by different crop-processing methods in the Neolithic period (Robinson 2000a). While it is still difficult to establish the relative importance of wild as against cultivated plant foods during the early prehistoric period, it has been argued that more extensive sampling, particularly of midden deposits may provide a more reliable indication of the relative importance of wild as against cultivated foodstuffs (Ibid).

The few remains of pulses, with only tentative identifications of bean and pea at Saltwood Tunnel, is similar to previous results from this period (Greig 1991). It has been suggested that the paucity of legumes in the Neolithic period may be due to taphonomic factors and the initial problem of cultivating these crops in a British climate with high ground water levels (McLaren 2000).

The question as to whether the charred remains in the Grooved Ware and Beaker pits are the residues of food offerings is impossible to answer on the basis of the plant remains alone. Late Neolithic Grooved Ware pits on sites in the Upper Thames Valley (Robinson and Wilson 1987) and on the West London gravels (Giorgi, forthcoming) have produced charred assemblages with both cereal grains and wild foods, including hazelnut shell and crab apple remains. This material, however, may simply represent residues from food processing, possibly then used as fuel, rather than from deliberately placed offerings.

It is difficult to comment on the importance of animal husbandry during this period with a limited bone assemblage from just one site, although this does show that both domesticated (cattle, pig, sheep/goat) and wild mammals (auroch, roe deer) were part of the food economy.

The extent of environmental/landscape change during this period is equally difficult to comment on because of the lack of data from the study area. In general the extent and duration of woodland clearance in Kent is not clear. In contrast to other areas such as Wessex, wide-scale clearance on the chalklands of the south-east appears to be predominantly a late Bronze Age phenomenon (Wilkinson 2003, Godwin 1962 and Thorley1981). Locally however there may be much variation with some areas in the Neolithic subject to extensive clearance and other areas where clearance was more localized. There is also evidence of cycles of local woodland/scrub regeneration at various sites investigated (Thomas 1982, Preece and Bridgland 1998, Kerney *et al* 1964, Wilkinson 2003). The molluscan evidence from White Horse Stone suggests a degree of variability in the local environment over relatively short distances and possible evidence for woodland/scrub regeneration. It is certainly not possible on the basis of the limited data to comment upon the extent of woodland clearance during this period; the few remains (charcoal, roe and red deer) points to areas of shrub and (open) woodland.

7 'FARMING COMMUNITIES' – THE LATER BRONZE AGE AND EARLY IRON AGE LANDSCAPE (C. 1600 BC TO C300BC) (INCLUDES THE MIDDLE BA TO EARLY/MIDDLE IRON AGE)

A fairly large body of environmental data was recovered from this period with charred plant remains again being the main resource, which together with a smaller amount of animal bones, allows an investigation into the development and growing diversity of the prehistoric economy (crop and animal husbandry) in the late Bronze Age and early Iron Age periods (this discussion includes consideration of middle Bronze Age and early/middle Iron Age deposits). Conversely, there was only limited environmental data from the study area for an investigation of the changing landscape during this period, mainly based on molluscs and charcoal evidence.

7.1 The charred plant remains

The charred plant remains provided extensive evidence for crop husbandry and processing activities with the recovery of material from ten sites and from all zones except Zone 4. Cereal remains were the dominant feature of these charred assemblages although the quality and quantities of the preserved remains varied considerably, with very rich assemblages from late Bronze Age/early Iron Age deposits at Saltwood Tunnel and early to mid Iron Age contexts from White Horse Stone and Eyhorne Street , and only traces of cereals at Tollgate, Cobham Golf Course, Sandway Road and Tutt Hill.

The main cereals in the samples were the hulled wheats, emmer and spelt (represented by both grains and chaff) and (hulled) barley (grains and occasional rachis fragments). Emmer and spelt were represented throughout this period, from the middle Bronze Age to the early/middle Iron Age, and it is difficult to comment on the relative importance of these two hulled cereals. There is tentative evidence to suggest that emmer may have been more widely cultivated in the middle Bronze Age, with better representation in contexts of this date at Beechbrook Wood and Saltwood Tunnel and only emmer chaff being positively identified amongst the hulled wheat remains from a pit fill at Saltwood Tunnel. On the other hand, emmer was also the main wheat grain in an early to mid Iron Age pit fill sample from Tollgate, although this sampled deposit was only provisionally dated to this period. Rich grain deposits from early to mid Iron Age samples at Eyhorne Street show that spelt rather than emmer is the best represented grain in the later part of this period although both cereals were well represented in the rich assemblages from late Bronze Age/early Iron Age Saltwood Tunnel and early to mid Iron Age White Horse Stone. Many of the sites, however, only produced small amounts of cereal remains, upon which it is not possible to draw any significant conclusions.

To summarise, there is tentative evidence to suggest that emmer may have been more prominent in the middle Bronze Age while samples from the late Bronze Age and early/middle Iron Age shows a mixed picture, with spelt probably more widely cultivated at Eyhorne Street (early to middle Iron Age) but with emmer continuing to be important at Saltwood Tunnel, White Horse Stone and possibly Tollgate. Indeed, the importance of emmer as a crop in its own right was confirmed by its dominance in some of the samples from White Horse Stone.

Other cereals in the samples included traces of free-threshing wheat grain from two sites, including possible hexaploid bread wheat (*Triticum aestivum*) at White Horse Stone and a possible free-threshing wheat grain in a Bronze Age ring ditch at Beechbrook Wood. Oat (*Avena* sp.) grains were recovered from several sites, although the absence of floret bases in most of the samples makes it impossible to establish if they are from wild and/or cultivated species. Wild oat florets, however, were identified at a few sites including Eyhorne Street, and the low numbers of these grains from most of the sites may suggest that they are probably cereal weeds. Three fills from early to mid Iron Age deposits at White Horse Stone did include a large amount of wild oats (grains and floret bases), which again may be from arable weeds, possibly harvested as fodder.

The evidence for pulses during this period was almost entirely recovered from late Bronze Age/early Iron Age deposits from Saltwood Tunnel, with large numbers of horse beans in a number of samples, including several thousand in one pit fill, some of which showed evidence of weevil infestation. A few of the pulses had fragments of pod adhering to the seeds. There were also finds of pea in these samples. The only other records of pulses from the study area from this period was possible horse bean from middle/late Bronze Age deposits at Cobham Golf Course and horse bean from middle Iron Age samples at Beechbrook Wood.

Another cultivar from this period was flax (*Linum usitatissimum*), represented on three sites, with large amounts of flax capsules (whole and fragments) but no seeds coming from several late Bronze Age/early Iron Age pit samples from Saltwood Tunnel. A few seeds were tentatively identified in mid Bronze Age deposits from Beechbrook Wood and in an early to mid Iron Age sample from White Horse Stone. Other potential cultivars may be represented by large numbers of mineralised Brassica seeds in four samples from White Horse Stone, which may represent consumed foodstuffs from cultivated species; small numbers of charred Brassica seeds were also found at this site. Charred Brassica seeds were also found at Eyhorne Street while gold of pleasure (*Camelina sativa*) seeds from the same site may have been cultivated for their edible seeds or for their medicinal use, although they may simply be from weeds.

There was also evidence in mid Bronze Age to early/mid Iron Age deposits for the continued use of wild plant resources at four sites across the Channel Tunnel Rail Link route - White Horse Stone/Pilgrims Way, Eyhorne Street, Tutt Hill and Saltwood Tunnel. The quantities of these remains, however, were much smaller than in the previous period, which may reflect the decreasing importance of wild plant foods following the evidence for increased cereal cultivation. Charred hazel nut shell was present at all four sites with occasional fragments appearing in many samples from Saltwood Tunnel.Remains of sloe/blackthorn, crab apple and blackberry/ raspberry (*Rubus fruticosus/idaeus*) (including a few mineralised seeds) were found at White Horse Stone/Pilgrims Way and elder (*Sambucus nigra*) seeds and sloe/blackthorn stones were recovered from Saltwood Tunnel.

7.2 Crop husbandry and processing

Charred weed seeds were recovered from five of the sites across four of the sub-regional zones, with particularly good assemblages and a fairly high species diversity from late Bronze Age/early Iron Age samples from Saltwood Tunnel and early to middle Iron Age samples at White Horse Stone. Smaller numbers of weed seeds were identified at Cobham Golf Course, Cuxton and Beechbrook Wood, these three sites including middle to early Iron Age samples.

In contrast to the earlier prehistoric samples in which there were few weed seeds, the arable weed flora appears to have become more firmly established by this period as cereal cultivation became more widespread. There is some consistency in the range of arable weeds that were represented in this phase, despite the wide distribution of the five sites across the study area. Details on the weed floras from the individual sites may be found in the site reports, although there is evidence at nearly all the sites for the cultivation of sandy acidic soils, including the presence of corn spurrey (*Spergula arvensis*), an acid soil indicator, and sheep's sorrel (*Rumex acetosella*), while knotgrass (*Polygonum aviculare*), black bindweed (*Fallopia convolvulus*) and henbane (*Hyoscyamus niger*) may also be found growing in acidic soils. At the same time, the use of clay soils may be suggested by the presence of bedstraw at all five sites, this weed being a loam indicator, along with corn gromwell (*Lithospermum arvense*), which was identified at Cuxton. Scentless mayweed (*Tripleurospermum inodorum*) was found at Beechbrook Wood; this is a weed seed of heavy, more or less acidic, soils. Other common weed seeds in this period were docks (*Rumex* spp.), grasses including brome (*Bromus* spp.) and cat's tail (*Phleum* spp.), medick/trefoil (*Medicago/Trifolium* spp.), goosefoots (*Chenopodium* spp.) and oraches (*Atriplex* spp.). There were very large numbers of Chenopodiaceae seeds at Saltwood Tunnel, particularly fat hen (*Chenopodium album*), which grows in humus loams and sandy soils.

The weed seed assemblages suggest the possible cultivation of several soils types but with a tendency towards the use of sandy loam soils. The catchment areas of the different sites may have been extensive, or cereals may have been imported from other settlements. For example, the presence of corn gromwell and corn spurrey, indicative of relatively acidic soils at Cuxton, a site which lies on chalky ground, suggests that the cereals may have been grown some distance away. Seeds of corn spurrey, knotgrass, black bindweed and fat hen, may indicate the presence of spring-sown crops, while corn gromwell is often associated with winter-sown cereals.

The charred weed seeds would have been sieved out as part of crop-processing although the larger weed seeds, such as the bromes and bedstraw, may have been extracted by hand. For example, two grain rich early to mid Iron Age pits at Eyhorne Street contained large numbers of bromes and represent a semi-cleaned stored product. The preservation of the charred seed remains shows that the cleanings were used as fuel. For instance, weed seeds were used to fuel a mid to late Bronze Age cremation and middle Iron Age cremation at Beechbrook Wood, together with tubers of false oat grass/onion couch. The latter has been found in association with other Bronze Age cremation burials from England, for example near Raunds, Northamptonshire .

7.3 Animal husbandry

Animal bones from this phase were recovered from seven sites covering zones 1, 2, 3, 5, 7 and 8 although they were not recovered in large quantities except from mainly early to mid Iron Age samples at White Horse Stone and West of Northumberland Bottom (Zone 330 Area B). All the bones from the latter site however, were recovered from one pit and therefore it is difficult to assess whether the remains are representative of the site as a whole. Other animal bones were also recovered from another part of Northumberland Bottom at the Army Camp site. The quantity and quality of the bones from these sites provides some basic data on animal husbandry.

The main domesticates during this period were cattle, sheep/goat and pig. Cattle were the most abundant species at West of Northumberland Bottom (Area B), while sheep/goat were best represented at Cuxton and both were almost equally abundant at White Horse Stone. Pig was not abundant at any of the sites except in early to mid Iron Age deposits from West of Northumberland Bottom Army Camp although these remains were virtually all from one deposit and therefore may be from a single event. There was limited ageing data from the bone remains at these sites. The results suggest that cattle were used for traction and milk as well as meat at West of Northumberland Bottom and in early Iron Age Tollgate (where horn from cattle was also used) while at White Horse Stone and Bronze Age/early Iron Age deposits at Cuxton, the emphasis was on traction and dairying rather than meat. The evidence suggests that sheep/goat were used for wool, milk and meat at West of Northumberland Bottom, Tollgate and White Horse Stone and for meat at Cuxton, with evidence for lambing on site or close by at West of Northumberland Bottom and White Horse Stone. The animal bones suggest pigs were used for meat although a few appear to have been retained for breeding, for example at White Horse Stone.

Occasional horse (*Equus caballus*) bones were recovered from most of these sites and would have been used for traction and possibly for riding. The possible remnants of a horse burial were found in an early to mid Iron Age deposit from Eyhorne Street while another horse burial was found at West of Northumberland Bottom. A complete sheep (*Ovies aries*) skeleton was also recovered from a possible late Bronze Age pit at White Horse Stone. A few dog bones were found at most of the sites; these may have been scavengers, working animals or simply pets. Bones of cat (*Felis catus*) and pine marten (*Martes martes*) were also identified at West of Northumberland Bottom. Occasional bones of domestic fowl (*Gallus gallus*) were found at White Horse Stone in an early to mid Iron Age context. These are fairly early examples with domestic fowl only beginning to emerge in Britain during the mid to late Iron Age. A single herring (*Culpea harengus*) bone was also recovered from West of Northumberland Bottom.

7.4 Game animals

The presence of game animals in the bone assemblages shows that hunting continued to play a part in the food economy at some sites during this period and also suggests that suitable wooded habitats still existed in the vicinity of the settlements. The remains from four sites show that red and roe deer were hunted for meat, with red deer being the second most abundant species after cattle at West Northumberland Bottom (Zone 330 Area B). Roe deer was also identified in an early/middle Iron Age deposit at of West Northumberland Bottom Army Camp site. However, the presence of mainly red and roe deer antler fragments at White Horse Stone and Tollgate, and few other deer bones, suggests that hunting may have only occasionally been taking place at these sites, with the emphasis being on the collection of shed deer antler for bone working. Wild boar bones were also found at West of Northumberland Bottom. An interesting bone assemblage was found in a pit from West of Northumberland Bottom with juvenile bones of cattle and partial young skeletons of red deer, which may be the remains of diseased meat, a feast or sacrifice.

7.5 Soil micromorphology at White Horse Stone

Thin section and bulk chemical analysis of the early Iron Age features from White Horse Stone (Zone 3) produced additional evidence (in support of the charred plant remains and animal bones) for mixed farming in the vicinity of the site which included arable (cereal processing) and stock raising (e.g. use of stables/byres for over-wintering of cattle?, presence of pigs?, animal trampled turf) – with a hearth(s) employing possible near-industrial temperatures, and typical domestic structure occupation (Figs.20, 21 and 22). Thin section analysis of the extensive buried soil within the base of the valley at White Horse Stone identified it as a colluvial ploughsoil showing evidence of plough mixing and structural disturbance, alongside biological working with inputs of anthropogenic material such as worked flint, pottery sherds and burnt dung (Figs. 24 and 25). It seems likely that some manuring of the arable soils down slope took place, employing settlement waste, but not at high intensities, although chemical measurements of phosphate may reflect the diluting effects of colluviation in the palaeosol. This probably helped maintain organic matter levels and biological activity and associated soil stability. Nevertheless, the palaeosol shows increasing evidence of slope soil instability, probably through rill and gully erosion that have been recorded across the chalk of southern England. The consequent concentration of run-off caused soils to slake, and led to the removal of rendzina topsoils. This also resulted in the erosion of gravel size chalk, as the chalk substrate became exposed.

7.6 The local environment

Environmental data on the character of the local environment during this period is limited to large and small mammal evidence, charcoal and molluscan evidence..

7.6.1 Small mammal bones

Small mammal bones of shrew (*Sorex araneus*), field vole (*Microtus agrestis*), wood mouse (*Apodemus sylvaticus*) and pygmy shrew (*Sorex minutus*) from early to mid-Iron Age deposits at West of Northumberland Bottom suggests grassland or sparse woodland close by, while field vole, bank vole (*Clethrionomys glareolus*), house mouse (*Mus musculus*) and wood mouse from similarly dated deposits at White Horse Stone also suggest a semi-rural local habitat, although there is the possibility that these remains may be intrusive. As noted above, the presence of red and roe deer suggests that suitable woodland may have existed in the area of several sites.

7.6.2 Charcoal

Charcoal from five sites (Zones 1, 3 and 8) provide information on the nature of woodland existing in the vicinity of these settlements during this period. A wide range of species was identified, with oak being the dominant type at several settlements suggesting a plentiful supply of this wood. For example, at West of Northumberland Bottom all the prehistoric assemblages were dominated by oak, used for both ritual (cremation) as well as for structural and artefactual uses. Oak was also the main wood charcoal in late Bronze Age/early Iron Age cremations at Saltwood Tunnel and in early Iron Age cremation pyres at White Horse Stone. Other woods, however, were also used in cremation. Ash and alder/hazel were the main woods used in early to late Bronze Age cremation at Tutt Hill with ash also being recorded in a late Bronze Age cremation burial from Beechbrook Wood. Hazel was also used as kindling in these cremations along with more shrubby trees such as hawthorn and sloe/blackthorn The predominance of single taxa in prehistoric cremation assemblages in ritual activities has been noted at previous sites, for example at Radley Barrow Hills (Thompson 1999) and at the Rollright Stones (Straker 1988).

Oak was also the main wood present in the early Iron Age metalworking waste pits at White Horse Stone, being ideal for smelting and smithing because it produces good hard charcoal and maintains high temperatures. Very large amounts of blackthorn were also found in early Iron Age pits at White Horse Stone. This is a very effective hedging/defensive plant and its presence may suggest it was used to control the movement of animals and possibly to keep out humans. Other trees identified from charcoal from this period included occasional finds of willow/poplar and birch.

7.6.3 Molluscs

Molluscs were analysed from just two sites. Open country snails from Saltwood Tunnel suggest woodland clearance and an open landscape by the Bronze Age. In the valley bottom at White Horse Stone, samples from a large subsoil hollow provides evidence for a sequence from woodland, to woodland clearance and the development of more heavily grazed grassland perhaps at some time during the Bronze Age and certainly by the early Iron Age. North of the Pilgrim's Way trackway, however a strong shade-demanding component is present in the assemblages into the Bronze Age. Here there is evidence for the presence of woodland/scrub in the vicinity of a middle Bronze Age ditch on the western plateau, and in a late Bronze Age pit on the lower slopes of the dry valley, suggesting suitable refugia persisted in these areas. The first indication of extensive areas of open ground north of the Pilgrims Way trackway derived from early Iron Age features, and the Iron Age buried soil coincident with extensive settlement and agrarian activity on the western plateau. Open country species account for up to 80% in some assemblages, with shade-demanding species comprising a minor component in the many of the samples examined. This change is likely to reflect a large-scale opening up of the environment with much larger tracts of grassland and arable, in an environment almost totally free of shade. Certain species are recorded for the first time during this period; *Truncatellina cylindrica* for example, a rare xerophile suggestive of very dry open grassland conditions. *Helicella. Itala, Vallonia excentrica* and *Vertigo pygmaea* become much more frequent, along with *Pupilla. muscorum*, suggesting an increase in the amount of bare ground.

7.7 Discussion

The environmental results from the middle Bronze Age to middle Iron Age show a significant increase in the amount of biological material, particularly charred plant remains. These provide information on crop husbandry which shows that large scale cereal production was being carried out in Kent by the Middle Bronze Age.

The large amount of cereal remains, particularly from White Horse Stone, Eyhorne Street and Saltwood Tunnel, show that the hulled wheats, emmer and spelt, together with hulled barley were the main cereals during this period, with only traces of free-threshing wheat. There does not appear to be any regional variation in the composition of the cereal assemblages across the route with similar assemblages at two of the richest sites: White Horse Stone (Zone 3) and Saltwood Tunnel (Zone 8), at opposite ends of the route. This range of cereals is similar to previous archaeobotanical research from southern England which shows that all of these cereals are all found at Bronze Age sites, although spelt becomes more widespread in the Iron Age, together with hulled barley and only occasional finds of emmer and free-threshing wheat (Greig 1991, 302, 306).

The results from the CTRL sites, however, do not appear to reflect the demise of emmer and increased spelt cultivation in the Iron Age. While there is some evidence to suggest that emmer was the main cereal in the middle Bronze Age, and spelt is sometimes better represented in early to middle Iron Age deposits, both emmer and spelt are almost equally well represented in the late Bronze Age/early Iron Age deposits at Saltwood Tunnel and in early to mid Iron Age samples from White Horse Stone. Thus, the presence of emmer in large quantities in Iron Age deposits in Kent is significantly different from the rest of the south of England where spelt tends to be the dominant hulled wheat by this period.

Other archaeobotanical evidence from sites in Kent suggests that spelt had been introduced into this area by the Middle Bronze Age, with good representation of this cereal (together with emmer) at Dartford (Pelling, unpublished a). The earliest date for significant amounts of spelt from the Channel Tunnel sites was the late Bronze Age/early Iron Age period.

Other sites from the area also show the continued importance of emmer with this cereal being more common than spelt in late Bronze Age deposits from Black Patch in Sussex (Hinton 1982).

Pulses are recorded in large amounts for the first time with pea and bean at Saltwood Tunnel, while flax capsules from the same site, and occasional seeds from two other settlements show the use of this crop during this period. These three crops, flax, horse bean and pea, are rarely found as charred remains in late Bronze Age or even Iron Age deposits, although all three were found as charred remains at Hengistbury Head in Dorset (Nye and Jones 1987). Horse bean was also found in Bronze Age deposits at Black Patch (Hinton 1982). There was a little evidence for the use of wild plant foods, including hazelnut shell and crab apple seeds, although their presence does show that wild foods were still considered a useful resource, although perhaps on a smaller scale than previously.

Animal bones are also recovered in large quantities for the first time from several sites, which show the main domesticates to be cattle, sheep/goat and pig, with limited ageing data suggesting a mixed husbandry strategy for cattle for traction, milk and sometimes meat, sheep/goat for wool, milk and meat and pig mainly for meat. An interesting find was the presence of domestic fowl from White Horse Stone. Red and roe deer appear to have been hunted for food at several sites, along with wild boar at West of Northumberland Bottom, although evidence of antler working at White Horse Stone and Tollgate suggests that the collection of shed antler may have sometimes been more important than the hunting of these animals for food.

The data on the character of the environment/landscape change during this period is very limited and patchy and does not allow comments to be made in a wider context. The mollusc evidence shows regional variation from some possible woodland or scrub environments persisting at White Horse Stone (Zone 3) at one end of the route in the middle and late Bronze Age to woodland clearance at Saltwood Tunnel (Zone 8) at the other end of the route. As previously noted current research suggests that woodland clearance on the chalklands of south-east and south England was mainly a late Bronze Age phenomenon, but the charcoal evidence from the Channel Tunnel Rail Link sites suggests that native woodland was always available in the later prehistoric period with a few exceptions. Charcoal from the sites show the presence of a range of species across the route, which does not suggest particular pressure on woodland resources, with oak being a dominant element in assemblages from sites along the entire route. Shrubby trees such as hawthorn and blackthorn, however, may suggest local clearance. Small mammal bones from several sites also indicate grassland or sparse woodland close to settlements, while red and roe deer may suggest woodland areas.

8 'TOWNS AND THEIR RURAL LANDSCAPE' – THE LATER PRE-ROMAN IRON AGE AND ROMANO-BRITISH LANDSCAPES (C300BC TO CAD 500)

Large amounts of biological remains were recovered from this period, particularly charred plant remains and animal bones, again placing the emphasis on the developing farming economy in the later pre-Roman Iron Age and Romano-British period. More limited environmental information was available from the study area for the changing landscape during this period.

8.1 The charred plant remains

Identifiable charred plant remains were recovered from 15 sites from all zones except Zone 2, although the quantity and quality of the material was very variable with the richest assemblages being from Northumberland Bottom (Fig.30), Thurnham Villa (Fig.29), Bower Road, Little Stock Farm and Saltwood Tunnel. The range of cereals represented at the different sites is generally similar throughout this period, with the bulk of the evidence coming from the earlier part. Spelt was the main cereal, with smaller amounts of hulled barley and generally only traces of emmer at the richest sites, listed above, although emmer was recovered in reasonable quantities from Saltwood Tunnel. Occasional free-threshing wheat grains were recovered from Pepper Hill, Thurnham Villa, Little Stock Farm, Bower Road, Saltwood Tunnel and in a late Roman hearth at Northumberland Bottom. Free-threshing wheat grain has previously been recorded from Romano-British samples from Kent, for example from Springhead (Campbell 1998). A few oat grains were found at Northumberland Bottom, Tollgate, Thurnham Villa, Leda Cottages and Beechbrook Wood and larger amounts from Bower Road. It was not possible, however, to establish if any of the oat grains were cultivated because of the absence of the floret bases.

Evidence for legumes was not particularly extensive although there were occasional horse beans, peas or vetch/bean/pea at Northumberland Bottom, Tollgate, Thurnham, Leda Cottages and Saltwood Tunnel, while vetches and clovers at Thurnham may have been fodder residues or simply cereal weeds.

A particularly interesting and exceptional charred plant assemblage was recovered from a Roman cremation sample at Pepper Hill with evidence for a number of exotic plants. The remains included a grape (*Vitis vinifera*) fruit, a possible fig (*Ficus carica*) fruit, lentils (*Lens culinaris*) and horse beans. These are probably the burnt residues of food offerings with a number of potential imports, fig, and lentils, in the sample, and are perhaps indicative of high status. The assessment report for this site also recorded the presence of about fifty grape pips in a sample. No other examples of grapes and figs are known from cremation deposits in rural Kent although a Roman bustum pit in London produced charred fig fruits (Giorgi 2000) while cremation deposits from the East London cemetery sites included lentils and horse beans (Davis 2000). Another cremation deposit dated to the early Roman period at Beechbrook Wood consisted of a large number of mainly spelt grains, which may have been possible votive food offerings.

Other cultivars were represented by occasional finds of charred flax seeds at Northumberland Bottom and Thurnham, from which 'waterlogged' flax capsule fragments were also found in the late Roman well. There were also traces of charred hazel nut shell at seven sites and remains of sloe/blackthorn and *Prunus* species at Northumberland Bottom, Thurnham and Little Stock Farm. Mineralised *Rubus* seeds were identified at Bower Road. The late Roman well at Thurnham also produced 'waterlogged' fruit remains of sloe/blackthorn, apple, blackberry (*Rubus fruticosus*), blackberry/raspberry plus hazelnut shell. A few carrot seeds (*Daucus carota*) seeds were found in the well although they may be from the wild rather than the cultivated species.

Evidence for possible malting was found in one sample at Thurnham. It was also initially suggested from archaeological evidence in a kiln fill at Northumberland Bottom although there was no evidence of germination seen in the grains from this feature, which exceeded the coleoptiles by a ratio of 5:1. There is evidence for malting sites in Kent at Springhead (Campbell 1998), Mount Roman Villa, Maidstone (Robinson 1999) and Keston Villa, Bromley (Hillman 1991).

8.2 Crop husbandry and processing

A wide range of charred weed seeds was recovered from many of the sites with particularly rich assemblages from Northumberland Bottom, Thurnham, Beechbrook Wood, Little Stock Farm and Bower Road. These provide an opportunity to examine in more detail aspects of crop husbandry such as the range of soils exploited and sowing times, although many of the weed seeds could not be identified to species and thus, cannot be used in such an investigation.

Detailed information on the weed seed flora may be found in the individual site reports. There is an increase in the range of weed seeds compared to the previous period with the weed seed floras suggesting that a number of soils may have been cultivated, for example at Thurnham, Little Stock Farm and Bower Road. There was the appearance of several new species, which suggest the exploitation of other soil types; for example, stinking mayweed (*Anthemis cotula*) appears on a number of sites including Northumberland Bottom, Thurnham, Bower Road and Saltwood Tunnel. This is an indicator of waterlogged loams and clay soils and it is interesting to note that it is common in late Roman samples at

Northumberland Bottom, where evidence of free-threshing wheat was also found. The cultivation of heavier clay soils suggests the introduction of the mouldboard and heavier ploughs. Bedstraw, also found in the previous period, also grows in clay soils and was found at Northumberland Bottom and Little Stock Farm while narrow fruited corn salad (*Valerianella dentata*), associated with dry calcareous soils, was identified at Bower Road.

As in the previous period there was a wide range of weeds associated with acidic soils represented in the samples at a number of the sites, for example sheep's sorrel and scentless mayweed at Beechbrook Wood, blinks (*Montia fontana*) and sheep's sorrel at Little Stock Farm, corn marigold (*Chrysanthemum segetum*), sheep's sorrel, scentless mayweed and wild radish (*Raphanus raphanistrum*) at Bower Road, and blinks and scentless mayweed at East of Station Road. A large number of Chenopodiaceae particularly fat hen were noted at Little Stock Farm. These are associated with nitrogen rich soils and were common in earlier Iron Age samples at the site, but declined in the late Iron Age to Roman period during which there was an increase in leguminous seeds. This may indicate a decrease in the fertility of the soils around the site following excessive use of the land.

The weed seeds also suggest that both dry and wet soils were used for cultivation with the presence of several wetland plants, such as blinks and spike-rush (*Eleocharis palustris*), although these may simply have been growing in one small damp area of an otherwise dry field. Other common weed seeds in these samples included corn gromwell, bromes and small grass seeds, docks, *Polygonum* species including knotgrass and black bindweed, and leguminous seeds, for example. medick/trefoil, vetch/tare/vetchling. Corn cockle (*Agrostemma githago*) was also found at Beechbrook Wood. To summarise, several sites show the cultivation of acidic sandy loams, for example at Beechbrook Wood, others the use of clay soils, for instance at Northumberland Bottom, while some settlements suggest the cultivation of both acidic sandy soils and clay soils, as at Little Stock Farm and West of Blind Lane.

Some of the weed seeds suggest that cereals were spring sown, suggested by the presence of knotgrass, black bindweed and fat hen, as well as winter sown, which may be indicated by the presence of corn gromwell. An interesting insight into possible harvesting techniques was suggested by the recovery of monocotyledon rhizomes in a 2nd to 4th century deposit at Nashenden Valley, which may suggest the harvesting of cereals by uprooting although it is possible that these remains are from turf burnt as fuel.

The charred plant remains from these sites are mainly from the final stages of crop-processing consisting mainly of the cleaned product (the grain), chaff (from de-husking) and large weed seeds, such as bromes, characteristic of virtually cleaned grain. There was generally less evidence for the fine sievings (small weed seeds) separated at an earlier stage of crop-processing. Crop-processing debris appears to have been used for fuel (tinder/kndling).

8.3 The animal and fish bones

Animal bones were analysed from ten sites associated with five zones (1, 3, 4, 7 and 8). Although the majority of the excavations did not produce particularly large amounts of material from which detailed information on animal husbandry could be extracted, there were large assemblages at West of Northumberland Bottom Army Camp and Thurnham Roman Villa, with the latter site producing data showing possible husbandry changes over time.

All four major domesticates, cattle, sheep/goat, pig and horse were identified at most of the sites with cattle and sheep/goat usually being the best represented species. Cattle were the most abundant species at the early Roman site of 330 Zone 1 and 2, at the Roman site of Bower Road and at late Roman Hazels Road. Sheep/goat were the common species at the late Iron Age/early Roman site of Hockers Lane while both sheep/goat and cattle were abundant at the pre-Roman Iron Age site of Little Stock Farm and the Late Iron Age/Roman site of Saltwood Tunnel. In early Roman deposits at West of Northumberland Bottom Army Camp, horse was the best represented followed by sheep/goat, cattle and pig although this included a large number of the horse bones from a burial with one complete fully articulated skeleton.

At Thurnham Villa, results from the animal bone remains using MNI from the late Iron Age to late Roman period (although mostly from the earlier period) showed sheep/goat to be predominant during the late Iron Age and early Roman period with similar numbers to cattle in the mid Roman phase, with sheep/goat then again being dominant in the later Roman phase. Cattle were at fairly constant levels throughout the period while pig was more prominent in the early phase with the reduction in pig numbers in the mid and late Roman phase, possibly a reflection of the decline in areas of suitable woodland grazing. These results, however, can only be considered tentative because the MNI values were not particularly high.

There was limited ageing data from the animal bones for understanding husbandry practices at the different sites, although the general picture appears to be one of mixed strategies with the use of cattle for traction, dairy and meat and associated by-products such as leather and horn, evidence for the latter being found at West of Northumberland Bottom Army Camp. Sheep appear to have been used for wool, dairy and meat, and pigs for meat, with a few retained for breeding purposes. Horses would have been used for traction and possibly riding. This was the general picture at the following sites: 330 Zones 1 and 2; Hazels Road, West of Northumberland Bottom Army Camp, Hockers Lane, Thurnham Villa, Bower Road and Little Stock Farm. There was evidence for breeding of cattle, sheep/goat and pig at 330 Zones 1 and 2, Thurnham Villa and Bowers Road.

Occasional dog bones were found at virtually all these sites with an articulated dog burial found at Saltwood Tunnel; dogs may have been scavengers, pets or used for hunting. A few bones of domestic fowl were found at West of Northumberland Bottom Army Camp, Thurnham Villa, Bower Road and Saltwood Tunnel.

The animal bones from Pepper Hill were mainly from ritual deposits and pyre goods, with the pyre goods from the cremations producing most of the animal bone with joints and occasional complete carcasses. Young pig bones were the most common, followed by domestic fowl with only occasional cattle and sheep/goat bone. Two other interesting bone assemblages, interpreted as possible ritual deposits, were also found during this period. A late Roman pit at Bower Road included a rich assemblage of juvenile bones, skull fragments and partial skeletons from a range of animals (sheep/goat, cattle, pig, horse, red deer). These remains may have a ritual significance or simply be from diseased animals or from a special feast. The well at Thurnham included a complete and partial skeleton of roe deer and a part of a skeleton of a tawny owl (*Strix aluco*) which may have had some ritual or ceremonial significance, deliberately placed to commemorate the official 'killing' of the well as it fell out of use.

Fish bones were also recovered from several sites. Occasional bones of cod (*Gadus morphua*) were identified at West of Northumberland Bottom Army Camp and a few herring bones found at Pepper Hill. Fish bones at Thurnham included herring, flatfish (marine) and eel (*Anguilla anguilla*) (marine and fresh water), while the fish remains from Saltwood Tunnel consisted of large cod, haddock (*Melanogrammus aeglefinus*), herring or sprat (Clupeidae), eel, flatfish and possibly a pike (*Esox lucius*) vertebra (the only exclusively freshwater fish in this assemblage). The presence of cod is unusual for the Romano-British period with the cod industry only developing in the medieval period. The marine fish from all these sites indicate trade with settlements on the coast.

Game animals included finds of red and roe deer, represented by occasional bone remains at Hazels Road and White Horse Stone, antler at Bower Road and Little Stock Farm, and both at Thurnham Villa. This evidence shows that deer were hunted but also that shed antler was probably being collected and used. There was evidence of horn working at West of Northumberland Bottom Army Camp. Hare (*Lepus* sp.) was identified at Thurnham Villa.

8.4 Bee-keeping at Thurnham Villa

A very interesting and unusual find from Thurnham Roman villa was evidence for bee keeping with the recovery of numerous examples of honey bee (*Apis mellifera*) in a the late Roman fill of a well. Honeybee has previously been identified in a Roman well at Hunts Hill, Upminster, Essex (Robinson, unpublished) and at the Roman site of Godmanchester in Cambridgeshire (Robinson, unpublished, a).

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8.5 The local and regional environment

Evidence for the character of the environment/landscape during the late Iron Age and Roman periods comes from animal bones, 'waterlogged' plant remains, pollen, insects and molluscs although the potential of the data from most of the sites was limited. One of the main problems is that the environmental conditions implied by the biological remains may vary significantly over short distances.

Bird and small mammal bones were recovered from a number of sites although they do not provide detailed information on the local environment. Small mammals including wood mouse, house mouse, field vole, bank vole and shrew, mainly at Thurnham Villa and Hockers Lane, provide some evidence for a semi-rural habitat while bird bones included corvid and rook (*Corvus frugileus*) at West of Northumberland Bottom Army Camp. These are scavenger birds and their remains may be from natural casualties, although they were also hunted for game and/or the protection of lambs. At Thurnham, a range of wild bird remains of waders and waterfowl including woodcock (*Apodemus slyvaticus*), Brent goose, duck and teal (*Anas crecca*) indicated a water source close-by; pigeon (*Colomba* sp.) remains and tawny owl bones (see above) were also recovered from this site. Occasional frog/toad (*Rana/Bufo* sp.) bones were also identified, for example at Saltwood Tunnel. The presence of red and roe deer at a number of the sites (see above) points to the presence of woodland in the vicinity of some of the settlements. Badger (*Meles meles*), which was identified at Thurnham, also prefers a woodland environment.

Several sites produced environmental evidence allowing a more detailed examination of the local/regional environment. Data includes molluscan assemblages and associated dry valley deposits along the Kent Plain and North Downs section of the route, a wide range of environmental remains from Thurnham, pollen and macro-plant remains from East of Station Road and 'waterlogged' plant remains from Parsonage Farm. The results from these sites will therefore be discussed in more detail.

8.5.1 Dry valley colluvial sequences along the North Downs

Data on the environment of the North Kent Plain and North Downs section of the CTRL route comes from the investigation of Holocene dry valley colluvial sequences and molluscan analysis. Only a small number of Holocene hillwash sequences have been investigated in detail from Kent and few of the published sites, with the exception of Holywell Coombe, appear to be associated with significant archaeological remains. This is in stark contrast to the substantial work that has been carried out on the chalklands of Wessex (Allen 1988, 1992, French *et al* 2003), the Chilterns (Evans 1966, 1972, Evans and Valentine 1974) and the South Downs (Wilkinson 2003, Bell 1983, Ellis 1986). As opposed to natural environmental processes inferred from Late Glacial sequences, Holocene dry valley colluvial deposits largely formed as a result of anthropogenic activities. Forest clearance and cultivation increase the susceptibility of soils to erosion through the breakdown of structure and loss of nutrients, especially during periods of high rainfall. Agricultural intensification and the practise of autumn sowing adopted in many areas during the later prehistoric and Roman periods may have been a significant factor. Molluscan assemblages contained within the deposits are invariably of open-country affinities suggestive of arable and short-turfed grassland.

On the whole the majority of the colluvial sequences investigated along the CTRL route were fairly typical of downland dry valley seqences. With the exception of the Down's Road Valley, poorly sorted calcareous sediment dominated, although intercalated stabilization horizons or buried soils at the base of the profiles were detected in a number of sequences, investigated through techniques such as magnetic susceptibility, loss on ignition and molluscan analysis. Unfortunately a number of sequences were poorly dated, although where directly associated with archaeological remains, or where molluscan remains were preserved, a later prehistoric and historic date is inferred.

On the south-west side of the Downs Road dry valley a basal Holocene colluvium examined during evaluation (ARCSTP98) contained localised evidence of pedogenesis, indicating a stabilisation horizon and artefacts included a concentration of worked flint, late Bronze Age pottery and burnt flint (1373TT and 1375TT). A further colluvial sequence examined from the excavation (ARC STP98), however, failed to identify the Bronze Age land surface associated with the primary colluvium. The secondary overlying colluvium was undated, but may represent gradual accumulation throughout the remaining prehistoric period. The clayey, texture manganese flecks, and occasional iron staining of the deposits may suggest damper and possibly episodically wet or flooded conditions in the lowest parts of the valley floor, perhaps as a result of the seepage of springs from the valley side or seasonal bournes. The identification of possible channel features within the valley axis suggests that seasonal bournes were likely to have existed in the valley in the past. However, the lack of coarser material implies that during these episodes the valley floor may have been flooded or soggy as opposed to containing flowing water. The generally well-sorted fine texture and lack of flint and chalk gravel lenses within the colluvial deposits differs from the poorly sorted calcareous valley sediments seen in many downland dry valleys (for example at Cuxton and White Horse Stone). This is probably a result of the finer grained source material available, but may also be caused by different types of colluvial processes operating involving a continuous process of surface wash, together with soil creep, as there is no evidence for the coarser sediments that accumulate at the foot of rills or gulleys. A distinct change in colluviation occurred up profile with inclusions of chalk. This might suggest that at this time activity was focused on the chalk slope to the north east of the valley, possibly associated with the use of the Roman cemetery in the Pepper Hill area. Similar deposits from the evaluation produced Late Iron Age pottery (1386TT).

On the higher ground to the west, at Northumberland Bottom (ARC WNB98), molluscan remains from middle to late Iron Age features in the western and central areas of Zone 3 comprised predominately shade-demanding taxa with a small open-country element indicating the persistence of some scrub or woodland environments during this period. The assemblages from the late Iron Age to early Roman features demonstrated more open conditions containing mixed assemblages of open country and shade-demanding taxa. The Roman features, however, at the eastern end of Zone 3 contained quite different assemblages, dominated by open country species suggesting the presence of established dry open conditions, either open pasture or arable habitats in the vicinity. Indeed, the very presence of colluvial deposits in the Wrotham Road, dry valley does suggest open cultivated land somewhere in the catchment from at least the Roman period onwards.

At the base of the Holocene colluvium on the west side of the Wrotham Road valley (ARC WNB98) an undated clayey sandy silt deposit was interpreted as *in situ* or redeposited 'Bt' horizon of a brown-earth type soil. Peaks in magnetic susceptibility and charcoal flecks may be the result of burning and might indicate forest clearance. Such clearance may have triggered soil erosion resulting in the accumulation of the overlying colluvial deposits. Occasional high magnitude erosion events were in evidence by the presence of coarse gravel lenses, likely to represent debris fans accumulated at the foot of temporary rill or gulley carved into the valley side. Such fans occur today in valley edge locations on the North Downs where water aided slope processes have taken place, for example after winter storms when open fields are unvegetated. Surface flowing water will carry finer material away, but deposit coarse chalk and gravel at the foot of the slope. Unfortunately no molluscs were preserved in the basal deposit. In the overlying colluvial deposits, preservation was poor although the presence of *Candidula giaxii* would perhaps suggest a Roman or later date for the deposits (Kerney 1999, 180). The assemblages consisted entirely of open country fauna.

At Cuxton a buried soil was identified developed on chalk solifluction deposits, sealed by a sequence of colluvial deposits. Again, The presence of the introduced snail species *Candidula gigaxii, Monacha cantiana* and *Monacha cartusiana* suggests a late date for sequence formation. A greater abundance of coarser chalk and flints up-profile probably reflects a shallower topsoil developing upslope through time, due to continued erosion. Severe erosion and downslope movement was represented by the lens of flints and chalk of much larger clast size.

South of the Downs escarpment at White Horse Stone stratigraphic and artefactual evidence suggests extensive colluviation was initiated sometime in the later Iron Age or Roman period. Although it has been demonstrated cultivation was being carried out within the catchment during the occupation of the early Iron Age settlement it is possible there would have been a time lag for the inception of widespread erosion and sedimentation. Initially sedimentation appears to have occurred quite rapidly, possibly within a few high intensity episodes which resulted in the wholesale burial, and therefore preservation, of the ploughsoil. The deposits varied greatly in texture both spatially and with depth and are interpreted as the product of various erosional processes, soil creep, sheet wash, rilling and gullying resulting from episodes of ploughing further upslope. The molluscan assemblages unsurprisingly produced assemblages dominated almost entirely by open country species indicating short turfed grassland and arable environments within the catchment. Molluscs from a ditched trackway dated to the Roman period and stratified within colluvial deposits in the valley bottom suggested the presence of scrub, possibly a hedge line but in an otherwise open environment, and on the western plateau assemblages from ditches and trackways provided similar evidence. A possible stabilization horizon was identified at White Horse Stone at the top of the Roman colluvium, indicated by peaks in magnetic susceptibility and shell abundance. Further sedimentation appears to have been minimal, at least within the areas investigated within the valley, up until the medieval or post-medieval period when a relatively thin layer of colluvium was deposited. The absence of colluviation during the post-Roman period is possibly linked to a change in land use that may have been initiated sometime in the Roman period, perhaps with a heavier emphasis on pastoralism. There is only limited archaeological evidence for activity during these later periods at White Horse Stone, although the evidence for activity at Boarley Farm (ARC BFW98) during the middle Saxon period, which included a relatively large faunal assemblage and a number of animal burials is of particular note (see below).

8.5.2 The late Roman environmental setting at Thurnham

Good organic preservation in the late Roman well (Fig.26) at Thurnham allowed an investigation into the environment around the well, following its abandonment in the late Roman period. Environmental remains analysed from the well consisted of 'waterlogged' plant remains (including mosses), pollen, insects and molluscs, with the results showing a fairly consistent pattern of woodland regeneration during this period.

The insects produced evidence for partly wooded conditions with the majority coming from the surrounding terrestrial landscape and from a range of habitats including woodland and grassland. Scarabaeoid beetles pointed to the presence of domestic animals. There were relatively few, mainly small water beetles, which would have lived in the well.

The molluscs included both land and freshwater species, with evidence for an environment of broadleaf deciduous woodland with an abundance of shade-loving species and an increase in old woodland species during the Roman and later periods. There were almost no dry land open country snails. Freshwater slum species pointed to damp conditions, stagnant or standing water, within the well or possibly indicating puddles around it, while marsh species suggested the presence of lush vegetation with species that are found on erect vegetation such as reeds and sedges. There were also damp tolerant terrestrial molluscs.

The 'waterlogged' plant remains (Fig.27) from the well also suggested woodland regeneration with evidence of 'large' trees, such as oak and ash as well as smaller trees, which were both tolerant, for example holly (*Ilex aquifoilum*), and intolerant, for instance sloe, of shade. There was a moderate range of ruderals, especially stinging nettle (*Urtica dioica*), possibly pointing to human disturbance around the well but few wetland plants, for example sedges (*Carex* sp.), and only occasional grassland plants. The general picture is of oak/ash woodland in the immediate vicinity of the well with an under-storey of smaller trees/shrubs with possibly well trodden areas around the well. Oak and ash were also major components of the charcoal assemblages from Thurnham.

The mosses from within the well came from a number of habitats particularly walls and trees and thus were probably growing on the walls of the well (both dry and wet areas) and on overhanging trees. It is unlikely, however, that they were deliberately introduced as well lining. The most common mosses were *Neckera complanata*, which grows on trees and rocks, and *Leucodon sciuriodes*, which is often associated with ash trees, another indicator of the presence of this tree.

The pollen evidence also confirmed the presence of deciduous woodland with a high value of tree pollen, particularly ash, which is usually underrepresented. Thus, its high value at Thurnham is exceptional. Tree pollen was dominant (75-85%) comprising mainly ash but also with evidence for oak, lime (*Tilia* sp.) and alder (*Alnus* sp.) with shrubs (15%) dominated by hazel. There were only small counts of herb (grass) pollen and few records for aquatic/marshland plants (Fig.28).

The results from the environmental analyses from the well at Thurnham were fairly consistent, showing a wooded environment in the late Roman period. The extent of the woodland regeneration is more difficult to establish although the pollen evidence from the well included little evidence (pollen of cereals and segetals) for arable cropping, which might suggest that the processing of crops at the villa site was not so extensive in the late Roman period as it had been earlier. However, given the presence of a late Roman crop drier in the villa complex, which seems to have remained in use until at least the end of the 4th century, it is possible that the waterlogged remains reflect vegetation immediately surrounding and overhanging the well, which may not be representative of the villa complex as a whole.

8.5.3 The local/regional environment at East of Station Road

Assessment reports on pollen and waterlogged plant remains from fills of a palaeochannel provided evidence on the character of the local and regional environment around this site in the Iron Age/Roman period. The associated archaeological evidence comprised elements of a field system, aligned along a small stream, a tributary of the River West Stour. A small pottery assemblage from the site (including sherds recovered from the recorded stream section) indicates a late Iron Age or early Roman date range, and suggests that a settlement may have lain close by.

The pollen sequence from two monoliths showed predominantly herbaceous vegetation with few trees at the base of the lower column with a dominance of grasses and other pasture types plus arable types including cereal and weeds. The later column produced evidence for increased woodland, including evidence of alder woodland carr, possibly indicating woodland regeneration but still with good pollen evidence for arable and pastoral agriculture. There was then a decline in woodland species further up the column but this may be because of taphonomy rather than indicating a real decrease. Both columns, however, produced only relatively small values for trees and shrubs, and the results reflect a fairly open environment in the later prehistoric period, following the main episode of woodland clearance in the earlier prehistoric (Bronze Age) period. This is also indicated by the very low values of lime in the sequence, this tree being the co-dominant tree over the greater part of south and east England before extensive woodland clearance.

The 'waterlogged' plant remains showed a fairly similar picture with the lower deposits of the paleaochannel indicating a predominantly grassland type habitat of damp/wet grassland with occasional willow and with an arable/ruderal component. The upper deposits produced mainly wood fragments although these could be from just from one tree, with evidence (hazel, elder, stinging nettle, hawthorn) for a scrub type vegetation with some nitrogen loving species.

Thus, both the pollen and 'waterlogged' plant remains suggest a fairly open environment in the vicinity of the site.

8.5.4 The local environment around Parsonage Farm

'Waterlogged' plant remains were analysed from four samples (peat and channel fills) from a stream channel and provided information on the character of the local environment and how it may have changed during the early Roman period. At least three discrete habitats (woodland, wetland, disturbed ground) were represented. There was less definite evidence for woodland in the earlier period but good evidence for mixed broad leaved woodland in the later channel fills. Wetland plant remains in the earlier peat appear to represent a disturbed environment, with the channel submerged in winter but with seasonal drying out. A change to wetter conditions in the later channel fills is suggested by the wetland plants, which are indicative of standing water for all or almost all of the time. Less significant elements of all these plant assemblages was evidence for grassland and ground disturbed by human activity. The results suggest that during the early Roman period there was increasing woodland and wetter conditions within the channel and the immediate environment.

8.6 Charcoal

The charcoal that was recovered from many of the sites may also provide an indication of the character of woodland during this period. While the selection of different taxa for particular activities is not necessarily a direct reflection of the relative abundance of different species, it does, however, at least provide some guidance as to the presence of different species that were growing at the time.

Charcoal was recovered from nine sites covering all the landscape zones except Zones 2 and 3. A range of taxa was present with the best-represented species being oak and ash across most of the zones suggesting the widespread availability of these woodland resources, although there was possible evidence for decline in woodland cover at Saltwood Tunnel at the south-eastern end of the route (Zone 8).

Oak was the dominant charcoal for metalworking at many of the sites, in late Iron Age/early Roman samples from Leda Cottages and Beechbrook Wood, and Roman deposits at Thurnham. One sample from a furnace at Leda Cottages produced a large amount of alder. Oak produces good quality charcoal that can burn at the high temperatures required for metalworking. Evidence for kindling in the deposits at Leda Cottages and Beechbrook Wood included roundwood (branches, twigs) of alder and hazel. Previous evidence from Iron Age and Roman sites in England has shown the dominance of oak, with a range of other variable taxa, from metalworking sites, for example Campbell (1988), Cleere and Crosby (1985) Figuerial (1992), Gale (1999). Another Roman metalworking site in Kent where oak was the main charcoal was at West Hawk Farm, Ashford (Challinor, forthcoming a).

Oak was also dominant in many of the funerary contexts from several of the sites across the route. In Roman samples from Pepper Hill, it was the main wood in bustum pits, pyre deposits and urned cremations and a significant component in the unurned cremation burials. Oak was also the dominant charcoal in most of the early Roman cremations burials from Northumberland Bottom with hawthorn type and blackthorn/cherry (*Prunus spinosa/avium*) charcoal representing kindling materials. Late Iron Age and Roman cremations at Beechbrook Wood and late Iron Age/early Roman cremation urns at Boys Hill Balancing Pond were also dominated by oak charcoal.

There were, however, a few sites, which produced different results. For example, a late Iron Age cremation pit from Chapel Mill was dominated by ash, with a little oak and also tubers presumably for kindling, while another cremation burial from this site yielded alder/hazel charcoal. At Pepper Hill, three unurned cremation burials were dominated by ash, one of the urned examples had 30% alder charcoal and a pyre deposit had mixed oak, ash and field maple (*Acer campestre*) charcoal.

An unusual charcoal assemblage was recovered from a late Iron Age cremation burial at Beechbrook Wood with the greater part of the charcoal being from gorse/broom (*Ulex europaeus/Sarothamnus scoparius*) while hazel was also well represented. Gorse and broom are believed to have had a ritual significance, being associated with the onset of spring and re-birth. Gorse also burns at high temperatures? and was used in Roman bread ovens. The hazel from this deposit may represent kindling or the remains of a wicker structure such as a bower upon which the corpse is placed.

There was possible evidence of pyre goods at Pepper Hill with alder charcoal in a Roman urn possibly from a wooden artefact; this wood does not burn well and was used for the manufacture of domestic items (Pliny XIV.LXXXIV). There was also birch charcoal in an adult burial which may be from a shield (Pliny XVI.LXXVII).

Results from Roman cremation burials in Essex showed that oak and ash were commonly used for fuel wood and pyre structures with occasional other scrub/hedgerow taxa such as hawthorn and blackthorn/cherry, being used for kindling (Challinor, forthcoming b). The selection of fuel wood for rituals would have been made on a practical basis with oak and ash burning at high temperatures while the use of Maloideae and *Prunus*, which produce reasonable fuel, would have been restricted by the difficulty of felling these thorny hedgerow trees. They would however have also been potential plant foods, important in the earlier prehistoric period while apple and pear (*Pyrus* sp.) wood give off a pleasant aroma, which may have been important in cremation rituals.

Evidence of fuel for agricultural structures shows the use of oak and ash from an oven at Thurnham and mainly ash with oak and Maloideae (hawthorn, apple, pear etc), maple and hazel in a corn drier from the same site. Ash was also the dominant charcoal in a late Roman oven from Saltwood Tunnel together with a small amount of Prunoideae and hazel. A late Roman corn drier from Northmberland Bottom had a stoke-hole full of oak and the interior hypocaust system dominated by hazel. There was also evidence for oak being used for structural timbers at Thurnham.

The charcoal evidence suggests that there was a ready supply of oak at many of the sites, for example through to the late Roman period at Thurnham and throughout the use of the cemetery at Pepper Hill. This suggests that there was little pressure on this woodland resource at many of the sites given the many uses of oak for construction purposes (domestic and funerary) as well as for fuel (for metalworking, agricultural, funerary) continuing from its widespread use in the prehistoric period. The recovery of heartwood shows the presence of mature oak trees. The wide range of other woodland taxa represented at these sites, for example at Bower Road, also suggests that there was little pressure on woodland resources during this period. The one possible exception was Saltwood Tunnel where oak was dominant in the early prehistoric suggesting a wide availability, but by the late Iron Age/early Roman period, ash was the main charcoal. A great reduction in the range of taxa in the late Roman period, and a large amount of Rosaceae charcoal, characteristic of open, scrub woodland, could be interpreted as less woodland cover during the later Roman period. On the whole however, there does not appear to be any evidence for widespread restrictions on woodland resources in Kent until the Saxon period for which however the evidence from the Channel Tunnel sites is limited and therefore inconclusive.

8.7 Discussion

The environmental results from the late Iron Age and Romano-British period are mainly concerned with charred plant remains and animal bones and information on the agricultural economy, both crop and animal husbandry. There is evidence from several sites for information on the nature of the environment, notably at Thurnham.

The charred cereal remains from this period showed that spelt was the main grain with smaller amounts of hulled barley and generally only small amounts of emmer. Spelt and hulled barley are usually the main cereals found in late Iron Age and Romano-British deposits from southern England (Greig 1991) with poor representation of emmer (van der Veen and O'Connor 1998, Campbell 2000). It is usually assumed that emmer was no longer being extensively cultivated in southern England during this period although the presence of reasonably high quantities of emmer in Roman samples from Saltwood Tunnel could suggest that it may have continued to play a role in the agricultural economy in Kent. Other results from south-east England show that it may have still been an important crop, at least in the late Iron Age, with almost equal proportions of emmer and spelt in a late Iron Age pit at

Wilmington, Kent (Hillman 1982) and a large amount of emmer in a similarly dated pit from Hascombe in Surrey (Murphy 1979).

Pulses and flax are not particularly well represented in this period while there is only limited evidence for the use of wild foods, mainly hazelnut shell. The presence of the exotics from Pepper Hill is particularly important with the presence of grape, possibly fig and lentils being unusual for a rural site in Kent although finds of these fruits and pulses are relatively common in Romano-British urban centres (see above).

Animal bones were recovered in fairly large quantities from several sites, with the range of mammalian domesticates being similar to the previous period with cattle, sheep/goat, pig and horse plus occasional evidence for domestic fowl. It was again however difficult to establish the relative importance of the different species on the basis of limited amounts of material and limited ageing data with mixed husbandry strategies suggested for most of the sites. Game animals included roe deer, red deer and hare. The presence of marine fish remains on several sites was interesting, showing the development of a fishing industry during this period. The evidence for bee keeping at Thurnham was particularly important.

There was not a great deal of information from the biological remains on the character of the local environment at most of the sites. The use of a range of biological evidence from the Thurnham well showed extensive woodland at the site in the late Roman period and ‘waterlogged’ remains from Parsonage Farm suggest an element of woodland in the early Roman period. However, pollen and ‘waterlogged’ plant remains from East of Station Road showed a fairly open environment in the Iron Age/Roman period. Evidence from dry valley colluvial deposits and associated molluscan assemblages from the North Downs sites suggest largely open environments of arable and grazed pasture. The charcoal evidence suggested that there was little pressure on woodland resources although possibly a more open environment was suggested on the basis of the results from Saltwod Tunnel (as well as East of Station Road).

9 'TOWNS AND THEIR RURAL LANDSCAPES II'- THE POST ROMAN AND ANGLO-SAXON LANDSCAPE (C410 AD TO C1000AD)

There were relatively few biological remains from Saxon period samples. Some charred plant remains, charcoal and animal bones were analysed, although the quantity did not allow detailed investigations into crop and animal husbandry or woodland resources during this period.

Charred plant remains were recovered from three sites in three zones but the quantity and quality of the material was not particularly good. Only a few unidentifiable charred grains and weed seeds were found in a Saxon pit from Little Stock Farm, but better charred assemblages were recovered from the other two sites at opposite ends of the route, Boarley Farm West (Zone 3) and Saltwood Tunnel (Zone 8).

Large amounts of cereal remains in three Saxon pits, including thousands of grains in one pit, were recovered from Boarley Farm West. Free-threshing wheat including hexaploid wheat and cultivated oats (*Avena sativa*), identified on the basis of florets, were the best represented cereals in two Saxon pits while free-threshing wheat and hulled barley were the most common grains in the other Saxon/medieval pit. Smaller amounts of charred cereal remains were identified in ten samples from Saxon sunken floor buildings and pits at Saltwood Tunnel. These also included evidence for hulled barley and also rye (*Secale cereale*) but the interesting point about these samples was the presence of emmer/spelt grain and chaff in every sample, albeit only represented by small amounts of grain and chaff. The presence of hulled wheats in post-Roman contexts is unusual although the question as to whether these remains may represent residual finds from earlier deposits at the site has yet to be resolved.

Other cultivars in the Saxon samples included a few seeds suggesting possible flax cultivation at Boarley Farm West, and horse bean in one sample from Saltwood Tunnel. There was also evidence for gathered wild foods with charred hazelnut shell at both these sites and possible mineralised elder seeds at Saltwood Tunnel. There was also a mineralised grape pip in a Saxon/medieval pit from Boarley Farm.

The charred weed seeds found in association with the grain at Boarley Farm and Saltwood Tunnel do not provide much information on crop husbandry. The weed seeds at Boarley Farm included goosefoots, docks, grasses (brome, cat's tail) and petty spurge (*Euphorbia peplus*), the latter an indicator of fresh to moderately dry well-aerated soils. The range of weed seeds at Saltwood Tunnel was similar to earlier periods at the site (see above) but oats and vetches/wild pea were better represented than Chenopodiaceae. One sample from this site, however, contained small numbers of seeds of stinking mayweed, a weed closely associated with the cultivation of clay soils.

Animal bones were recovered from Saxon deposits associated with just two sites from White Horse Stone (Zone 3) and Saltwood Tunnel (Zone 8) and consisted mainly of bones from animal burials. Animal burials were found in four pits at White Horse Stone (West of Boarley Farm site - ARC BFW98) (Hayden 2006, figs 109-10), two (1036 and 1004) at the northern end of the main scatter of archaeological features, and two (1061 and 1040) near the southern end. Two of the burials consisted of almost complete, articulated skeletons: a cow in pit 1036 (Hayden 2006, pl.35) and a horse in pit 1061 (Hayden 2006, pl.36). Radiocarbon dates were obtained for both of these burials, the cattle skeleton in pit 1036 giving a date of cal AD 770-1000 (GU-9086: 1150±50 BP), and the horse skeleton in pit 1061 a date of cal AD 670-950 (GU-9087: 1210±50 BP). Both lay on their left sides on the base of the pits. A deposit of articulated goat limbs, from at least four animals, was placed over the upper right leg of the cow. Pit 1036 also contained a domestic fowl ulna and further sheep/goat distal limb bones. The horse in pit 1061 was associated with a few isolated sheep bones (tibia and phalanx) and a cattle tibia. In addition to these a sheep burial was found adjacent to the cow burial (1036) in evaluation trench 1510 (the skeleton were fully excavated during the evaluation). Although undated, this too is most likely to be of Anglo-Saxon date given it's proximity to the two dated Anglo-Saxon skeletons.

Most of the evidence for animal husbandry was from White Horse Stone with remains of the main mammalian domesticates - cattle, sheep/goat, goat, pig and horse. Cattle were the most abundant species although 95% of the remains were from the adult cattle burial described above (ARC BFW98). Limited ageing data suggests that sheep/goat were raised primarily for meat and wool. Skeletal evidence, including the lower limbs, skull fragments and horn cores, from sheep/goat points to the presence of primary butchery waste and/or skinning/tanning waste. The limited pig remains included a neo-natal pig burial Domestic fowl bones, a potential source of meat, eggs and feathers, were also found at White Horse Stone. The presence of young domestic fowl bones suggests that breeding may have taken place on site.

Apart from the complete skeletons, the Anglo-Saxon assemblage from the White Horse Stone (West of Boarley Farm) site is dominated by skull and lower limb elements. This suggests that the area was used for a specific activity, possibly as a primary butchery site for activities such as leather preparation (Hayden 2006 and Kitch 2006i).

The animal bones from Saltwood Tunnel consisted virtually entirely of the remains of a horse skeleton (associated with a human burial) with an approximate age of death of between five and six years. Only occasional bone fragments of cattle, sheep/goat, pig and cat were found on the site. Fewer than 20 other complete horse burials are known from Anglo-

Saxon England, with the Saltwood Tunnel being the most southerly find. They are virtually always found in association with male burials and may have been a high status offering (Pestell 2001, 256).

There is very little evidence for the character of the local/regional environment during the Saxon period, with only a little charcoal from two sites at White Horse Stone and Saltwood Tunnel, providing some indication of woodland resources. The mid/late Saxon horse burial at White Horse Stone (described above) produced an equal amount of hazel and oak and a trace of blackthorn, probably background occupation scatter. A Saxon cremation deposit at Saltwood Tunnel only contained alder for use as pyre material, which may suggest a reduction in the availability of oak by this period. A fairly open environment at this site was also suggested from the charcoal remains from the late Roman period (see above).

9.1 Discussion

There was only a small body of environmental data from a few sites from this period which makes it difficult to generalise on the agricultural economy or environment.

The range of cereals is different from the Romano-British period with evidence for the presence of free-threshing (including hexaploid) wheat, hulled barley, rye and cultivated oats. The one anomaly is the presence of emmer/spelt remains from Saltwood Tunnel. Free-threshing wheat, hulled barley, rye and oats are usually the main cereals found in Saxon deposits from southern England (Greig 1991, 351). Emmer, however, has recently been found in Saxon sites along the Thames Valley (Pelling and Robinson 2000) although it has not yet been decided whether the hulled wheats at Saltwood Tunnel are Saxon or residual material. Other cultivars included occasional evidence for flax and horse bean which have also been recovered from other Saxon sites; for example, flax from Staunch Meadow, Brandon (Greig 1991, 318).

Most of the evidence for animal husbandry was from White Horse Stone with the presence of the four main domesticates (cattle, sheep/goat, pig, horse) although the quantity of remains, limited ageing data, makes it difficult to establish husbandry strategies. There is very little useful information from the biological remains from this period on the nature of the environment.

10 THE MEDIEVAL AND RECENT LANDSCAPES C AD 1000 TO THE MODERN DAY

A large body of environmental data for information on the rural economy (crop and animal husbandry) and the use of wild resources (game, fishing) was recovered from this period.

10.1 Crop husbandry and other plant food remains

Large quantities of charred plant remains, including a number of rich assemblages, were recovered from eight sites associated with Zones 1 (Northumberland Bottom, Tollgate), 3 (Pilgrims Way), 6 (Parsonage Farm), 7 (Mersham, Little Stock Farm, North of Westernhanger Lane) and 8 (Saltwood Tunnel). The main cereals were free-threshing wheat, including hexaploid bread wheat, hulled barley, rye and oats. Free-threshing wheat was dominant in many of the samples but the other three cereals were also well represented and occasionally the main grain in some samples from several of the sites, with no obvious difference in the range of cereals between the different zones. The only variation from this picture was the presence of hulled wheat (emmer/spelt) in a few samples from Saltwood Tunnel. While small numbers in individual samples from the site may be residual, it was suggested that the large amount of emmer/spelt remains in a ditch fill sample, together with a large amount of free-threshing wheat grains, are less likely to be reworked from an earlier deposits.

Evidence for cultivated pulses included large numbers of pea and horse bean at Northumberland Bottom and Parsonage Farm, with the latter site also containing possibly vetch (*Vicia sativa*). At Mersham there was horse bean remains and tentative evidence for lentil although it may possibly be an immature seed of vetch, pea or bean. Horse bean was also recorded at North of Westenhanger Castle and Saltwood Tunnel. Several charred seeds from Mersham and Little Stock Farm produced potential evidence for flax cultivation or at least the use of this plant at these two sites.

Evidence for wild food resources included hazelnut shell at several sites with fairly large amounts at Saltwood Tunnel and occasional plum (*Prunus domestica*) and cherry (*P. avium*) stones at Northumberland Bottom and mineralised and charred plum stones from Mersham. These fruits may have been from cultivated species.

In addition to cereals and pulses, other interesting food remains were recovered from Mersham. A large amount of mineralised Brassica seeds were recovered from a pit. These seeds could not be identified further but may be from cultivated foods including spices or for medicinal use, with their presence as calcified remains possibly suggesting that they derive from sewage. There were also the charred fruit remains of beet (*Beta vulgaris*). Although it is difficult to distinguish the wild from the cultivated species, this plant was used for its leaf and roots and is rarely found, possibly because it is used before it sets seed. Charred remains of beet have been found in mid-Saxon deposits in Lundenwic and 'waterlogged' remains of beet in samples from Roman, Saxon and medieval London (Anne Davis, pers. comm.).

Many of the medieval samples produced a wide range of charred weed seeds, with the increasing presence of stinking mayweed and corn cockle, the latter a characteristic feature of medieval cornfields. The different weed seeds suggest the use of a range of soils at many of the individual sites with no significant difference between sites in the different zones across the route. Thus, in Zone 1, weed seeds at Tollgate suggest the cultivation of both acidic sandy soils, with the presence of corn cockle, knawel (*Scleranthus annuus*) and black bindweed, as well as waterlogged loams and clay soils, with the presence of stinking mayweed. Stinking mayweed was also identified at Northumberland Bottom, also in Zone 1, along with corn gromwell.

At Parsonage Farm in Zone 6, stinking mayweed suggests the cultivation of heavy clay soils and wild radish, an acid soil indicator, the use of sandy loam soils. In Zone 7, the weed seed assemblage at Mersham included a number of weeds associated most commonly with light and loamy soils, while the weed seed assemblage at Little Stock Farm was similar to those in the Iron Age samples, including stinking mayweed, indicative of heavier clay soils. A very wide range of weed seeds at North of Westenhanger Castle suggest that a range of soils were exploited around the site with evidence for the cultivation of both lighter sandier soils with wild radish, ribwort (*Plantago lanceolata*), corn spurrey, and heavier clay soils (stinking mayweed). It was also suggested that the presence of spike-rush at this site may indicate the use of wet/seasonally flooded soils with sedges at Mersham also being interpreted as use of wetter soils for cultivation. In both instances, however, these may simply be from one small part of an otherwise dry field, possibly along the field boundaries. In Zone 8, the presence of stinking mayweed amongst a range of weed seeds at Saltwood Tunnel also suggests the cultivation of heavier clay soils. The presence of ribwort plantain at Mersham and North of Westenhanger Castle was interesting because this is a perennial species which does not survive well in intensively cultivated fields that are subjected to mouldboard ploughing and hand-weeding. Other weed seeds that were fairly common in the medieval samples but could not be reduced to species included *Lathyrus/Vicia* species, Chenopodiaceae, grasses particular bromes, and docks.

A number of the weeds represented in the samples suggest that cereals were both spring-sown and winter sown during the medieval period, as in earlier periods, with weeds indicative of spring sown cereals including wild radish and corn spurrey. Indicators of winter sown crops include corn gromwell. Other weeds, however, such as corn cockle and annual knawel, may be found in both spring and winter sown crops.

Evidence (grain, chaff, weed seeds) of crop-processing activities was present at most of the sites with remains from both the earlier stages, for example rye and free-threshing wheat rachis fragments from North of Westenhanger Lane, through to the later stages of cereal cleaning and food preparation, for instance, mainly grains and large weed seeds at Mersham. It was suggested that the predominance of cleaned cereals and legumes at Parsonage Farm, with only small amounts of weed seeds and chaff, may be indicative of a consumer site with crop-processing activities likely to have been carried on outside the moated enclosure. The distinction of producer and consumer sites on the basis of charred plant remains must, however, be treated with caution.

10.2 Animal husbandry

Animal bones were recovered from five sites from five zones with most of the evidence being from the eastern end of the route (Zones 6, 7 and 8). There was evidence for all the main mammalian domesticates although the quantity of remains does not allow detailed investigations into animal husbandry, as there was limited ageing data from the sites. In terms of species representation, cattle were dominant in early medieval assemblages at West of Northumberland Bottom and in medieval samples at Parsonage Farm and Mersham, followed by sheep/goat and pig and occasional horse. In later medieval deposits sheep/goat bones were the most abundant at West of Northumberland Bottom, followed by almost equal amounts of cattle and pig bones, and also in medieval/post-medieval samples from Saltwood Tunnel, which also contained pig and a few cattle bones. It was suggested that the rise in the number of sheep/goat bones at West of Northumberland Bottom may be indicative of the growth of the wool trade in the late medieval period.

There was limited ageing data from the medieval/post-medieval sites, with the evidence suggesting mixed husbandry strategies, for example at West of Northumberland Bottom and Mersham. The presence of older animals (cattle, sheep/goat) at Parsonage Farm suggests secondary produce (wool, milk, manure, traction) were the main priorities, with surplus animals being used for meat and mutton. Pigs were used mainly for meat with a few retained for breeding. The presence of horn cores at Mersham suggests that horn working was important at the site, possibly using imported cores as well. There was evidence (neonatal, foetal bones) from medieval/post-medieval samples for breeding of sheep/goat at Mersham, while the absence of young animals at Parsonage Farm was interpreted as evidence for the raising of cattle off-site.

Horse was represented at all five sites and was probably used for traction and riding while dog bones were found at most of the sites, dogs possibly being used for hunting, guarding or simply as pets. Most of the animal bones from medieval Saltwood Tunnel were from an articulated dog skeleton, which was aged over 18 months at death. Cats, which would have been useful mousers and ratters, were represented at Mersham and Saltwood Tunnel. Modern and undated bone assemblages from Saltwood Tunnel included a sheep/goat burial and two partial cattle burials. Large amounts of bird bones at medieval Parsonage Farm and bird bones in post-medieval samples at Mersham included evidence for domestic poultry, goose (*Anser anser*) and duck, which may have been used for their meat, feathers and eggs.

10.3 Game

The animal remains from medieval Parsonage Farm included evidence for red and fallow deer (*Dama dama*), with meat bearing bones indicating that they were eaten. These animals may have been from deer parks. Evidence for rabbit (*Oryctolagus cuniculus*) and hare were also found at the site while there were bones from a wide range of wild birds including mallard (*Anas platyrhynchos*), woodcock (*Scolapax rusticola*) and pheasant (*Phasianus colchicus*), all of which may have been exploited as a food resource during the medieval period. The presence of game birds (and red and fallow deer) at Parsonage Farm suggest the presence of a fairly rich and privileged household by the late medieval period. The predominance of wheat at the site was also interpreted as a possible sign of the high social status of the manor house.

10.4 Fishing industry

The recovery of bones from a range of marine species at three sites shows the importance of off-shore fishing in the medieval period. The three sites which produced rich assemblages of fish remains (bones and scales) were Parsonage Farm (Zone 6), Mersham (Zone 7) and Saltwood Tunnel (Zone 8), all at the south-eastern end of the Channel Tunnel Rail Link, close to the coast.

The finds from Parsonage Farm included cod, whiting (*Merlangus merlangus*), flatfish and a single eel bone, a species that may be either freshwater or marine, while fish bones from Mersham included eel and deep-sea cod. Fish remains were recovered from both medieval and medieval/post-medieval samples from Saltwood Tunnel. In the earlier medieval samples cod was the most common species with remains also from conger eel (*Conger conger*), ling (*Malva malva*), whiting, mackerel (*Scomber scombrus*), tub gurnard (*Triglia lucerna*), flatfish and possibly bearded rockling (*Gaidropsarus vulgaris*). A large number of fish bones were recovered from a medieval/post-medieval pit fill at Saltwood Tunnel, consisting of the remains of mainly juvenile herring/sprat and smelt (*Osmerus eperlanus*). Other fishes represented in this pit fill and other medieval/post-medieval samples from the site included eel, conger eel, tub gurnard, mackerel, ray, thornback ray (*Raja clavata*), whiting, flatfishes, cod and possibly stickleback (*Gasterosteus aculeatus*).

The consumption of fish would have been an important part of the diet in the medieval period particularly in light of religious restrictions on meat consumption, with abstinence from meat three times a week and during Lent. The fish may have been imported from the coast, either fresh or preserved (smoked, salted). There was a major expansion in off-shore fishing in the first part of the 2nd millennium AD with cod fishing being particularly important.

10.5 The local/regional environment

Biological evidence for the character of the local/regional environment during the medieval and post-medieval period is fairly limited and allows little detailed comment at any of the sites.

With regard to the animal bones, small mammal and amphibian bones at Mersham can only point to a semi-rural environment, while field vole and vole at Saltwood Tunnel suggests a grassland environment with frog and frog/toad bones from the same site showing proximity to water. Bird bones at Saltwood Tunnel included evidence for possible pigeon, small passerines and corvid, all of which may have been scavengers, but all of which could have been eaten. Fallow deer and red deer at Parsonage Farm may indicate the presence of woodland, possibly a deer park close-by.

Charcoal was analysed from just one site, from Northumberland Bottom in Zone 1. A medieval oven produced charcoal from a range of woods including beech, oak, maple and hawthorn type, typical of mixed deciduous woodland. Managed woodland was the most likely source for fuel wood in the medieval period because of the pressure on woodland resources with almost all woodlands under the control of local manorial/religious estates by 1250 (Rackham 1996).

10.5.1 The environment in the vicinity of Parsonage Farm

The character of the medieval landscape around Parsonage Farm was examined mainly on the basis of pollen evidence. ‘Waterlogged’ plant remains and diatoms were also studied from the site but produced few results.

The few ‘waterlogged’ seeds from moat fills (eastern and western arms) were mainly from disturbed ground species, for example brambles, buttercups (*Ranunculus* spp.), thistles (*Carduus/Cirsium* spp.), with only a few wetland plants, for example, sedge, celery-leaved crowfoot (*Ranunculus sceleratus*), being represented. Little comment may be made on the local environment on the basis of these remains.

Diatoms, which may provide information on the aquatic environment, were present in two samples from the uppermost part of one sequence sampled through deposits in the southern part of the moat. The diatoms were non-planktonic species, which live attached to submerged surfaces, for example on the leaves of aquatic macrophytes, or within the surface of submerged mud. The absence of planktonic diatoms may indicate that the water body was fairly small and shallow. There was no evidence from the diatoms for very high levels of nutrients in the water which suggests that there was no discharge of large amounts of organic waste into the moat as has been shown to be the case at other moated sites and pools, ponds and lakes associated with human habitation. The aquatic diatoms suggest that the water body was permanent during the build up of the sediments although the presence of aerophilous diatoms may represent material from bank or soil erosion or partial drying out of the water-body.

The pollen evidence provides information on the character of the regional environment. Pollen from two columns taken through medieval sediments on the fringes of the moat was examined and produced broadly similar results. In one of the columns, tree and shrub pollen dominated in the upper part with a wide diversity of trees, particularly alder with oak and hazel being the most important non-wetland taxa. There were some herbs, mainly grasses, but also some cereal and arable weed pollen. It was interesting to note that there were few marsh and aquatic taxa represented by pollen. The other column saw oak being the most important tree, together with hazel, in the lower part, with an expansion of tree pollen, particularly alder and to a lesser extent hazel, in the upper levels. The reduction of oak in the upper part of this column may be due to felling or expansion of alder. Grasses were the most important herbs in this column with high levels of cereal pollen especially in the lower levels, although herb pollen declines towards the top. Again, there was little pollen from marsh and aquatic species.

The characteristics of both columns were the increase in alder, possibly growing on the fringes or within the moat/ditch, and the development of woodland taxa while cereal pollen from cultivation and the use of the ditch for domestic activities, appears to decline. Oak and hazel, represented in both columns, is a characteristic feature of pollen remains from the historic period from managed woodland.

10.6 Discussion

The charred cereal remains from the medieval period show a similar range to those in the Saxon period with free-threshing (including hexaploid) wheat, hulled barley, rye and oats being the main grains, which is similar to previous archaeobotanical results from this period (Greig 1991, 351). There were again emmer/spelt grains at Saltwood Tunnel with a large number in one sample. The question as to whether these are medieval or residual finds has not been satisfactorily resolved. Pulses (pea, horse bean) were well represented at several sites, and there was again occasional evidence for flax. There were additional plant food remains at Mersham, which included a large number of mineralised Brassica seeds and beet. Other sites in the south-east with similar results to the Channel Tunnel Rail Link sites include the charred plant remains from 12th/13th century deposits from Ebbsfleet, where there was free-threshing wheat, hulled barley, rye, oats, possibly spelt wheat and horse bean and pea (Scaife 1995), while samples from 11th/12th century deposits at Northfleet produced free-threshing wheat, barley, oats, rye and pulses (bean, pea, cultivated vetch) (Pelling, unpublished b).

The animal remains showed the presence of the main domesticates cattle, sheep/goat, pig, horse and also poultry (goose, duck) at the sites although there was a similar problem to previous periods with the limited quantity of remains and ageing data making it difficult to comment on husbandry strategies, although the evidence suggests that these were mixed. There was possible evidence for the growing importance of the wool trade in the late medieval period as shown by increased numbers of sheep/goat bones at West of Northumberland Bottom.

Parsonage Farm produced an interesting bone assemblage with evidence for red and fallow deer and hare. The first record for pheasant and rabbit in the whole assemblage is indicative of a high status site. The medieval period samples also produced a wide range of fish bones showing the growing importance of the fishing industry at this time. There was very little information from the biological remains on the character of the local environment of the sites, with the exception of the pollen remains from Parsonage Farm.

11 DIGITAL ARCHIVE

This schemewide specialist report has been prepared and published as part of the Channel Tunnel Rail Link Section 1 Post-excavation Project. This report is one of five publication level schemewide specialist reports available to download from the Archaeology Data Service website: **http://ads.ahds.ac.uk/catalogue/projArch/ctrl/**. These provide synthetic overviews of the specialist data from CTRL Section 1 in its regional context. The ADS site also includes 20 integrated site reports, which present synthesised data from key site sequences at an interpretative level that can be readily assimilated into complementary studies. Underpinning the site reports and overviews, is a comprehensive archive of individual specialist reports and databases, which are also available to download ('CTRL specialist report series'). The CTRL reports and data can be accessed through the 'Project Archives' section of the ADS website.

Hard copy publication of the CTRL Section 1 results comprises a single volume synthetic overview of the excavated results in their regional context, which includes a complete site gazetteer and guide to the archive (Booth et al 2007).

Table 3 below details all available digital data for the palaeoenvironmental schemewide overview. Reports and accompanying figures are presented as downloadable, print-ready Adobe Acrobat files (.pdf). ADS also maintain archive versions of report image pages (.tiff). Databases are also available as excel files (.xls).

Table 3: Digital archive

Principal site name	Description	Filename root	Principal authors and organisation
Schemewide specialist report			
Palaeoenvironment Schemewide Report	Palaeoenvironment Schemewide Report	ENV_SSR	Giorgi J (MoLSS) and Stafford E (OWA JV)
Specialist research reports			
02 Pepper Hill	Faunal remains	ENV_Fauna_PHL	Kitch J (OWA JV)
02 Pepper Hill	Charred plant remains	ENV_Charredplants_PHL	Davis A (MoLSS)
02 Pepper Hill	Wood charcoal	ENV_Charcoal_PHL_text	Challinor D (OWA JV)
03 Whitehill Road Barrow	Faunal	ENV_Fauna_WHR	Kitch J (OWA JV)
03 Whitehill Road Barrow	Charred plant remains	ENV_Charredplants_WHR	Giorgi J (MoLSS)
03 Whitehill Road Barrow	Geoarchaeology	ENV_Geoarch_WHR	Corcoran J (MoLAS)
04 Northumberland Bottom	Faunal remains	ENV_Fauna_WNB	Kitch J (OWA JV)
04 Northumberland Bottom	Charred plant remains	ENV_Charredplants_WNB	Davis A (MoLSS)
04 Northumberland Bottom	Geoarchaeology	ENV_Geoarch_WNB	Corcoran J (MoLAS)
04 Northumberland Bottom	Molluscs	ENV_Molluscs_WNB	Stafford E (OWA JV)
04 Northumberland Bottom	Wood charcoal	ENV_Charcoal_WNB	Challinor D (Freelance)
05 Tollgate	Faunal remains	ENV_Fauna_TLG	Kitch J (OWA JV)
05 Tollgate	Charred plant remains	ENV_Charredplants_TLG	Davis A (MoLSS)
05 Tollgate	Geoarchaeology	ENV_Geoarch_TLG	Corcoran J (MoLAS)
06 Cobham Golf Course	Faunal remains	ENV_Fauna_CGC	Kitch J (OWA JV)

Principal site name	Description	Filename root	Principal authors and organisation
06 Cobham Golf Course	Geoarchaeology	ENV_Geoarch_CGC	Corcoran J (MoLAS)
06 Cobham Golf Course	Charred plant remains	ENV_Charredplants_CGC	Davies A (MoLSS)
07 Cuxton	Faunal remains	ENV_Fauna_CXT	Kitch J (OWA JV)
07 Cuxton	Geoarchaeology	ENV_Geoarch_CXT	Corcoran J (MoLAS)
07 Cuxton	Charred plant remains	ENV_Charredplants_CXT	Davies A (MoLSS)
09 White Horse Stone	Faunal remains	ENV_Fauna_WHS	Kitch J (OWA JV)
09 White Horse Stone	Charred plant remains	ENV_Charredplants_WHS	Giorgi J (MoLSS)
09 White Horse Stone	Geoarchaeology	ENV_Geoarch_WHS	Stafford E (OWA JV)
09 White Horse Stone	Geoarchaeology	ENV_Geoarch_WHS	Macphail RI (UCL) and Crowther J (UW Lampeter)
09 White Horse Stone	Wood charcoal	ENV_Charcoal_WHS	Alldritt D
12 Thurnham Villa	Faunal remains	ENV_Fauna_THM	Kitch J (OWA JV)
12 Thurnham Villa	Charred plant remains	ENV_Charredplants_THM	Smith W (OWA JV) and Davis A (MoLSS)
12 Thurnham Villa	Molluscs	ENV_Molluscs_THM	Stafford E (OWA JV)
12 Thurnham Villa	Mosses	ENV_Moss_THM	Stow L
12 Thurnham Villa	Pollen	ENV_Pollen_THM	Scaife R (Freelance)
12 Thurnham Villa	Waterlogged plant remains	ENV_Waterloggedplants_THM	Giorgi J (MoLSS)
12 Thurnham Villa	Wood charcoal	ENV_Charcoal_THM	Challinor D (Freelance)
14 Eyhorne Street	Faunal remains	ENV_Fauna_EYH	Kitch J (OWA JV)
14 Eyhorne Street	Charred plant remains	ENV_Charredplants_EYH	Davies A (MoLSS)
16 Sandway Road	Charred plant remains	ENV_Charredplants_SWR	Giorgi J (MoLSS)
18 Leda Cottages	Wood charcoal	ENV_Charcoal_LED	Challinor D (Freelance)
19 Tutt Hill	Charred plant remains	ENV_Charredplants_TUT	Giorgi J (MoLSS)
20 Parsonage Farm	Faunal remains	ENV_Fauna_PFM	Kitch J (OWA JV)
20 Parsonage Farm	Diatoms	ENV_Diatoms_PFM	Cameron N (UCL)
20 Parsonage Farm	Geoarchaeology	ENV_Geoarch_PFM	Corcoran J (MoLAS)
20 Parsonage Farm	Pollen	ENV_Pollen_PFM	Scaife R (Freelance)
20 Parsonage Farm	Charred plant remains	ENV_Charredplants_PFM	Davis A (MoLSS)
21 Beechbrook Wood	Charred plant remains	ENV_Charredplants_BBW	Giorgi J (MoLSS)
21 Beechbrook Wood	Wood charcoal	ENV_Charcoal_BBW	Alldritt D
25 Mersham	Faunal remains	ENV_Faunal_MSH	Kitch J (OWA JV)
25 Mersham	Charred plant remains	ENV_Charredplants_MSH	Stevens C (OWA JV)
26 Bower Road	Charred plant remains	ENV_Charredplants_BOW	Stevens C (OWA JV)
26 Bower Road	Faunal remains	ENV_Fauna_BOW	Kitch J (OWA JV)
27 Little Stock Farm	Faunal remains	ENV_Fauna_LSF	Kitch J (OWA JV)
27 Little Stock Farm	Charred plant remains	ENV_Charredplants_LSF	Stevens C (OWA JV)
29 Westenhanger Castle	Charred plant remains	ENV_Charredplants_WGC	Stevens C (OWA JV)
30 Saltwood Tunnel	Faunal remains	ENV_Fauna_SLT	Worley F (OWA JV) and Nicholson R (OWA JV)
30 Saltwood Tunnel	Charred plant remains	ENV_Charredplants_SLT	Stevens C (OWA JV)
30 Saltwood Tunnel	Molluscs	ENV_Molluscs_SLT	Allen MJ (OWA JV)
30 Saltwood Tunnel	Wood charcoal	ENV_Charcoal_SLT	Alldritt D
Specialist research datasets			
02 Pepper Hill	Faunal remains	ENV_Fauna_PHL	Kitch J (OWA JV)
02 Pepper Hill	Charred plant remains	ENV_Charredplants_PHL	Davis A (MoLSS)
02 Pepper Hill	Wood charcoal	ENV_Charcoal_PHL	Challinor D (OWA JV)
03 Whitehill Road Barrow	Faunal remains	ENV_Fauna_WHR	Kitch J (OWA JV)
03 Whitehill Road Barrow	Charred plant remains	ENV_Charredplants_WHR	Giorgi J (MoLSS)

Principal site name	Description	Filename root	Principal authors and organisation
04 Northumberland Bottom	Faunal remains	ENV_Fauna_WNB	Kitch J (OWA JV)
04 Northumberland Bottom	Charred plant remains	ENV_Charredplants_WNB	Davis A (MoLSS)
04 Northumberland Bottom	Wood charcoal	ENV_Charcoal_WNB	Challinor D (Freelance)
05 Tollgate	Faunal remains	ENV_Fauna_TLG	Kitch J (OWA JV)
05 Tollgate	Charred plant remains	ENV_Charredplants_TLG	Davis A (MoLSS)
06 Cobham Golf Course	Charred plant remains	ENV_Charredplants_CGC	Davies A (MoLSS)
07 Cuxton	Faunal remains	ENV_Fauna_CXT	Kitch J (OWA JV)
07 Cuxton	Charred plant remains	ENV_Charredplants_CXT	Davies A (MoLSS)
09 White Horse Stone	Faunal remains	ENV_Fauna_WHS	Kitch J (OWA JV)
09 White Horse Stone	Charred plant remains	ENV_Charredplants_WHS	Giorgi J (MoLSS)
09 White Horse Stone	Wood charcoal	ENV_Charcoal_WHS	Alldritt D
12 Thurnham Villa	Faunal remains	ENV_Fauna_THM	Kitch J (OWA JV)
12 Thurnham Villa	Charred plant remains	ENV_Charredplants_THM	Smith W (OWA JV) and Davis A (MoLSS)
12 Thurnham Villa	Wood charcoal	ENV_Charcoal_THM	Challinor D (Freelance)
14 Eyhorne Street	Faunal remains	ENV_Fauna_EYH	Kitch J (OWA JV)
14 Eyhorne Street	Charred plant remains	ENV_Charredplants_EYH	Davies A (MoLSS)
16 Sandway Road	Charred plant remains	ENV_Charredplants_SWR	Giorgi J (MoLSS)
18 Leda Cottages	Wood charcoal	ENV_Charcoal_LED	Challinor D (Freelance)
19 Tutt Hill	Charred plant remains	ENV_Charredplants_TUT	Giorgi J (MoLSS)
20 Parsonage Farm	Faunal remains	ENV_Fauna_PFM	Kitch J (OWA JV)
20 Parsonage Farm	Charred plant remains	ENV_Charredplants_PFM	Davis A (MoLSS)
21 Beechbrook Wood	Charred plant remains	ENV_Charredplants_BBW	Giorgi J (MoLSS)
21 Beechbrook Wood	Wood charcoal	ENV_Charcoal_BBW	Alldritt D
25 Mersham	Faunal remains	ENV_Faunal_MSH	Kitch J (OWA JV)
25 Mersham	Charred plant remains	ENV_Charredplants_MSH	Stevens C (OWA JV)
26 Bower Road	Charred plant remains	ENV_Charredplants_BOW	Stevens C (OWA JV)
26 Bower Road	Faunal remains	ENV_Fauna_BOW	Kitch J (OWA JV)
27 Little Stock Farm	Faunal remains	ENV_Fauna_LSF	Kitch J (OWA JV)
27 Little Stock Farm	Charred plant remains	ENV_Charredplants_LSF	Stevens C (OWA JV)
29 Westenhanger Castle	Charred plant remains	ENV_Charredplants_WGC	Stevens C (OWA JV)
30 Saltwood Tunnel	Faunal remains	ENV_Fauna_SLT	Worley F and Nicholson R (OWA JV)
30 Saltwood Tunnel	Wood charcoal	ENV_Charcoal_SLT	Alldritt D

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