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**The land Mollusca from White Horse Stone, Boxley,
Kent**

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1 INTRODUCTION

The White Horse Stone group of sites (ARC WHS98, ARC PIL98, and ARC BFW98) lie within two dry valleys immediately below Bluebell Hill at the foot of the North Downs escarpment (Hayden 2006, Fig.1). The solid geology is Middle Chalk, although extensive drift deposits, predominantly Clay-with-Flints, cap the plateaux to the north and east. On the upper slopes of the valleys topsoil directly overlies chalk bedrock. On lower slopes the bedrock is overlain by Pleistocene and Holocene chalky colluvium. These colluvial deposits thicken down valley to a maximum of 4m in depth on the footslopes. In the larger of the two dry valleys (referred to as White Horse Stone) two distinct palaeosol horizons were identified intercalated within the colluvium. Although no artefactual evidence was recovered from the lower palaeosol the molluscan successions, together with radiocarbon dating of charcoal inclusions, suggest a late Glacial date. The upper palaeosol directly overlay the late Glacial sequence, and sealed archaeological features dating to the Neolithic period, including postholes from the early Neolithic longhouse (structure 4806). Artefactual evidence suggests the upper palaeosol is likely to have been extant during the occupation of an extensive late Bronze Age to early Iron Age settlement excavated on the upper western slopes of the valley. The thick sequence of colluvial deposits overlying the upper palaeosol in the base of the valley appear to have been deposited episodically from the late Iron Age onwards and contained archaeological features dated to the Roman period. In the smaller dry valley to the south (referred to as Boarley Farm, ARC BFW98) a possible buried soil was identified at the base of a thick colluvial sequence. Although this sequence could not be related stratigraphically to archaeological features of Roman and Saxon date on the adjacent slopes a small amount of late Bronze Age pottery was retrieved from the buried soil.

The calcareous nature of the soils at White Horse Stone are very conducive to molluscan preservation and extensive sampling was undertaken during the fieldwork from both archaeological features and pedo-sedimentary sequences. A total of 284 samples were taken specifically for Mollusca in addition to several hundred larger bulk samples retrieved for charred plant and faunal remains. A representative selection of samples, predominantly from the sedimentary sequences, were initially examined during the assessment stage by Prof. M. Robinson at the Oxford University Museum (Robinson 2001) in order to determine their potential for providing data on the local environment of the site for the various periods represented. This further stage of work examines the most useful of those sequences in more detail.

Overall a total 138 samples have been analysed in detail including the identification and quantification of approximately 34,000 shells. The investigation includes the analysis of four representative profiles (F, C, I and J), sampled at 5-10cm intervals through the Pleistocene and Holocene dry valley deposits. Additional sample locations examined at the assessment stage were not considered suitable for more detailed work, either because shell preservation was poor, the deposits were poorly dated, or more representative samples were available. Details can be found in the original assessment report, although the data has been considered in the interpretation of the site assemblages. Detailed descriptions of the pedo-sedimentary sequences can be found in the specialist reports on the geoarchaeology, micromorphology, magnetic properties and chemical analysis (Stafford 2006, Macphail and Crowther 2006).

Spot samples from well-dated archaeological features have also been examined in order to provide supporting data. This includes later Prehistoric and Roman features on the upper western slopes of White Horse Stone valley, as well as features in the base of the valley dating to earlier periods not represented in the main sedimentary sequences. The evidence from archaeological features may to some extent reflect very local conditions associated with features as opposed to soil and sediment sequences that may receive deposits from a wider catchment. It was, however, considered important, particularly given the general lack of pollen preservation at the site and sparseness of the charred plant assemblages, to provide some level of direct environmental data for the earlier periods in which activity is attested in the valley. There are obvious taphonomic problems associated with both lines of investigation, related to the function of features, processes of infilling, sedimentation, erosion, reworking of older sediments, and post depositional disturbance. Pit contexts in particular are problematic and it is important to demonstrate as far as possible if the feature has been deliberately backfilled leading to the mixing of assemblages and/or if the feature has been left open for any period, allowing sufficient time for insitu soil formation to occur. These issues, however, are inherent in molluscan analysis and have been considered in the interpretation of the assemblages.

Overall the samples analysed cover most of the conventional divisions of British prehistory with the exception of the early Bronze Age. However, since features from different phases were not distributed uniformly across the site it is impossible to provide a comprehensive characterisation of the development of the whole area. The distribution of the samples follows that of the dated features (Hayden 2006, Fig. 7; Table 2). The late Glacial environment was analysed from one profile on the lower slopes of the valley (profile F). The Neolithic and Bronze Age samples, with exception of a middle Bronze Age ditch on the western plateau, all derive from the lower slopes and valley bottom (the Pilgrim's Way site and the southern half of the

White Horse Stone site), The later samples are slightly better distributed and include early Iron Age and Roman features on the western plateau (the northern part of the White Horse Stone site) and the pedo-sedimentary sequences on the lower slopes and valley floor (profiles F, C, I and J).

2 METHOD

2.1 Sample processing

All samples were processed at Oxford Archaeology. Samples processed specifically for molluscan analysis were weighed out to 2kg, disaggregated in water, floated onto 0.5mm nylon mesh and airdried. The residues were also retained to 0.5mm. Both flot and residue fractions were sorted for identifiable mollusc fragments under a binocular microscope at x10 and x20 magnifications. The species present in each assemblage were identified and whole shells and apical fragments counted.

Some of the assemblages examined during this study derive from flots of much larger bulk samples of up to 40 litres for which the residue fractions were not available for examination. These samples have been highlighted in both the tables and histograms with an asterix. Although flotation appears to have been generally very good there may be bias in favour of whole shells. Broken apical fragments, particularly those of *Pomatias elegans* and various helicids, and smaller shells such as *Vallonia* sp. and *Carychium* sp. may be under-represented. Despite this the assemblages were still considered useful in providing supporting data and any bias has been taken into account during the interpretation.

2.2 Species identification

Nomenclature follows Kerney (1999). No attempt has been made to identify juveniles and apical fragments of *Cochlicopa* sp. to species level due to difficulties in identification. Similarly, it was considered appropriate to distinguish between apical fragments of *Cepaea* sp. and *Arianta arbustorum* only when preserved larger than the two-whorl stage. Fragments of *A. arbustorum* shell however have been noted when the distinctive shell sculpture of this species was identified. *Monacha cantiana* and *Monacha cartusiana* have been distinguished on the basis of the presence of hair pits and more bulbous apice of the former. It is almost impossible to distinguish between juveniles of *Vallonia excentrica*, *Vallonia pulchella*, and occasionally very worn examples of *Vallonia costata*. Where each species were present juveniles have been divided in the proportions noted for adult specimens. *Cecilioides acicula* was excluded from the totals since it burrows

deeply and provides no useful information on conditions as a sediment or soil formed. It was extremely numerous in some samples and its inclusion in the total tends to obscure the results from the other species. Of the other species listed, *P. elegans*, burrows just below the surface of loose soil or leaf litter, so does give useful palaeoecological information. Note was also made of the size and preservation of some species with robust shells, such as *Clausiliidae* and *P. elegans* (Plate 3), since they tend to reside in soils for longer periods. The presence of well-preserved and whole shells along with the more fragile shelled species such as the *Zonitidae* could be seen as a good indicator of the degree of to which the assemblages are formed insitu (autochthonous), as opposed to those which have been transported (allochthonous).

2.3 Ecological groups

Ecological groups follow the scheme of Evans (1972, 1984) whereby species are broadly divided into those with open-country, catholic and shade-demanding preferences as follows:

- Shade-demanding species (S-D), *Zonitidae* (e.g. *Vitrea* sp., *Aegopinella* sp., *Oxychilus* sp.), *Carychium tridentatum*, *Discus rotundatus*, *Clausiliidae* (e.g. *Clausilia bidentata*, *Cochlodina laminata*) *Ena obscura*, *Acicula fusca*, *Trichia striolata*, *Vertigo pusilla*, *Acanthinula aculeata*, *Helicigona lapicida*.
- Catholic species (C), *Pomatias elegans*, *Cochlicopa* sp., *Trichia hispida*, *Cepaea* sp., *Arianta arbustorum*, the Punctum group (*Punctum pygmaea*, *Vitrina pellucida*, *Nesovitrea hammonis*, *Euconulus fulvus*).
- Open-country species (O-C), *Vallonia* sp., *Pupilla muscorum*, *Helicella itala*, *Abida secale*, *Vertigo pygmaea*, *Truncatellina cylindrica*, *Monacha* sp., *Candidula* sp.

2.4 Diversity indices

The Shannon Weiner (H') and Brillouin (HB) diversity indices have been calculated on a number of the sequences following the formulae of Magurran (1988). Assemblages of high diversity produce the greatest values for H' and HB ($\approx >2.0$). Diversity indices have been calculated only on samples analysed in full i.e. where the fine residues have been sorted, and where similar weights of sediments have been processed in order for the results to be considered reliable.

At a basic level it is assumed that high diversity is a reflection of a more complex environment where the number of potential micro-environments and niches are great, allowing a

wide variety of species too be supported. High values may indicate a relatively mature environment whereby enough time has passed for less rapidly colonising species to become established. Lower values indicate less diverse environments whereby the number of micro-environments and niches are fewer allowing only a small number of species to thrive, or perhaps a relatively immature environment whereby only the rapidly colonizing species have had time to become established. For example, in an environment of established open woodland comprising stands of trees, leaf litter, fallen logs, scrub and areas of grassland, one would expect diverse molluscan assemblages, in contrast to a large area of open grazed grassland where diversity would be much lower. Archaeological features may create micro-environments unrepresentative of the surrounding environment. For example the base of a recently cut ditch, although within an established woodland setting, may produce a low diversity molluscan assemblage composed of a few species capable of rapidly colonizing the new environment. Interpreting diversity indices of subfossil molluscan assemblages is complicated by taphonomic issues such as residuality and transportation. In this respect the variation between the two indices (H' -HB) is useful as an indicator of autochthony following Evans (1991). It is assumed the closer H' is to HB, the nearer the assemblage is to being representative of the original community. A sample that demonstrates high molluscan diversity, but where the difference between H' and HB is great ($\approx >0.1$), may indicate a significant derived component.

2.5 Molluscan zonation schemes

There is a comparatively large set of data regarding late Glacial and Holocene molluscan assemblages deriving from numerous investigations undertaken on dry valley sediment sequences in Kent and the south-east in general (e.g. Ellis 1985, 1986, Evans 1966, 1968, Evans *et al* 1978, 1983, Kerney 1963, 1977, Kerney *et al* 1964, 1980, Preece 1990, 1992, Preece *et al* 1995, Preece and Bridgland 1998, 1999). The North Downs in Kent, positioned in the extreme south east of England, is particularly well sited for biogeographical studies, as species would have arrived at a much earlier date than in more northerly locations. The identification of a consistent broad pattern of increasing molluscan diversity within the late Glacial and Holocene successions has resulted in the creation of a molluscan zonation scheme. This scheme was proposed by Kerney (1977) and has more recently been modified through radiocarbon dating from the exceptionally well preserved sequences at Holywell Coombe near Folkstone (Preece and Bridgland 1998). The molluscan succession at Holywell Coombe is unusually complete and for this reason has been chosen as the type site for the molluscan assemblage zones.

The scheme divides the late Glacial into two zones. Zone y is the earliest, comprising an impoverished fauna (e.g. *P. muscorum*, *V. costata* and *V. pellucida*), reflecting colonisation following the glacial maxima. The later zone z comprises a more diverse fauna (e.g. *A. secale*, *T. hispida*, *H. itala*, *T. geyeri*, *A. arbustorum*, *N. hammonis* and *C. columella*). Based on the radiocarbon dated sequences from Holywell Coombe molluscan zone y occurred between 13160±400 yr BP and shortly before 11530±160 yr BP, and zone z between 11530 ± 160 yr BP and 9820± 90 yr BP. The Holocene sequence is divided into six zones (a-f). Zones a-d, dated at Holywell Coombe to 9760±100yr BP to 5620 ± 90yr BP, see the gradual reduction in species of bare ground such as *P. muscorum* and expansion of thermophilous shade-demanding species indicative of the spread of woodland. The general trend, however, towards the end of the zone d is towards a recession in forested environments largely attributed to the activity of man. The beginning of zone e at Holywell Coombe is diachronous occurring between 5620± 90yr BP to 3980±70yr BP depending on location, nature and extent of human activity. This zone is characterised by the spread of open-country fauna such as the *Vallonia* and *H. itala*, suggestive of woodland clearance and the creation of more extensive open environments. Zone f is similar to zone e, but is characterized by the appearance of species such as *Helix aspersa* and *M. cantiana*, introduced during the Roman and Post-roman period.

Several of the molluscan sequences at White Horse Stone have been divided into numbered zones for interpretative purposes. These zones are sequence specific and as such should not be considered as site assemblage zones, or confused with the regional molluscan zonation scheme described above.

2.6 Data presentation

The shell counts are presented in tabular format (Tables 1-10). Species represented by shell fragments as opposed to whole shells or apical fragments are denoted by '+'. Sequences which have been subject to full analysis have been illustrated as percentage frequency histograms (Figures 1-4, 6-8). The posthole samples from the early Neolithic longhouse, however, have been presented in absolute numbers due to the low shell counts (Figure 5). The species in the histograms are ordered from left to right on the basis of broad ecological groupings, shade-demanding (S-D), catholic (C) and open-country (O-C). For the late Glacial sequence, however, it was considered appropriate to order the species in terms of climatic tolerance with cold tolerant to the left and thermophilous to the right, in line with similar investigations of late Glacial sequences in Kent (Kerney 1963, Preece and Bridgland 1998). Species representing less than 1% of the

totals have been highlighted with a point. Summary diagrams and species diversity plots for H' and HB have also been included in order to illustrate the broad trends within the sequences.

The results of the analysis are summarized in the following section. The pedo-sedimentary sequences are considered first, followed by the results for the archaeological features in chronological order. This is followed by a discussion of the general site sequence by period, as inferred from the molluscan assemblages. Consideration of the wider environmental context is discussed further in the scheme-wide palaeoenvironmental overview (Giorgi and Stafford 2006).

3 RESULTS

3.1 Representative pedo-sedimentary sequences

3.1.1 Profile F (ARCWHS98 Table 1, Figure 1)

Profile F consisted of 18 samples taken at approximately 5cm intervals from a 90cm deep section located immediately to the north of the Pilgrim's Way trackway on the lower slopes of White Horse Stone dry valley (Hayden 2006, figures 5 and 7). At the base of the sequence chalk bedrock was overlain by up to 2.5m of coarse chalk and flint rubble or coombe rock. The coombe rock was in turn overlain by a sequence of finer chalky silts interpreted as periglacial slope deposits (layers 4936 and 4933). Intercalated within these silts was a dark grey humic silt interpreted as 'soil' horizon (layers 4935 and 4934) equivalent to the late Glacial palaeosol. Overlying the periglacial silts was 0.25m of dark humic silty loam (the later prehistoric palaeosol). This was in turn overlain by up to 2.5m of ploughwash, the base of which has been dated to the early to late Iron Age-Roman period based on artefactual evidence. The ploughwash was not sampled in this section but similar deposits have been examined in profile C. The assemblages can be divided into four zones.

Zone 1: 72-90cm (layer 4936)

Between 90-72cm, a buff coloured chalky silt, an impoverished fauna of very low diversity was recorded ($H'=1.178-0.656$, $HB=1.077-0.527$, $H'-HB=0.502-0.128$). Between 90-87cm only three identifiable shells were recorded comprising three species *P. muscorum*, *V. pellucida* and *V. costata*. Shell numbers increased slightly between 82-87cm to 39 individuals although no additional species were recorded. However, between 72-77cm, immediately below layer 4935, abundance increased to 65 individuals and additional species included *P. pygmaea* and *V. pulchella*.

Thin section analysis of these deposits has suggested deposition of chalk gravel-rich calcareous sediment by cold climate solifluction processes with seasonal formation of very immature calcaric lithosols and seasonal post-depositional rooting and burrowing possibly during the 'Older Dryas' (Macphail and Crowther 2006). The low shell numbers in the samples suggests conditions unconducive to molluscan life or rapid deposition of sediment in unstable conditions and this is reflected in the low diversity indices. Where shell numbers increase, this may suggest temporary decreases in the rate of deposition and increased surface stability. This is matched by a slight reduction in H'-HB index suggesting a small reduction in transported components. This is not, however, matched by significant rises in diversity and this is probably a reflection of the both the simplicity and harshness of the environment and the short period of time in which soil formation occurred. Overall, the character of the deposits and assemblages are consistent with molluscan zone y (Preece and Bridgland 1998), and are indicative of exposed cold climate conditions, an absence of vegetation and much bare ground susceptible to physical weathering. All species, apart from perhaps *V. 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).

Zone 2: 72-45cm (layers 4935 and 4934)

Between 72-64cm was an 8cm thick unit of humic dark brownish grey silt interpreted as a late Glacial or 'Allerød soil' (layer 4935), reworked as soil clasts probably at the onset of the 'Younger Dryas' cold period. Above 64cm (layer 4934) the silt is less humic and intercalated with thin lenses of pale grey chalky silt interpreted as meltwater muds, perhaps deposited seasonally. A *c.* 600 year long(?) period of soil stability and 'temperate' climate during the Allerød can be recognised from the formation of mature rendzina soils, even though later these became eroded and reworked (Macphail and Crowther 2006).

Between 72-64cm shell numbers increased significantly to 262 individuals, along with species diversity ($H'=1.673$, $HB=1.599$, $H'-HB=0.074$), suggesting more conducive conditions and the development of more varied or stable, environments than previously ($H'=1.673$, $HB=1.599$, $H'-HB=0.074$). The $H'-HB$ index was much reduced indicating increased autochthony within the assemblage when compared with Zone 1. Ten species were identified at this level. In addition to the previously recorded taxa, *E. fulvus*, *Cochlicopa c.f. lubrica*, *V. excentrica*, *A. secale*, *H. itala* and *Trochoidea geyeri* were also noted. *V. costata*, however, dominates the assemblage at 49% with *P. muscorum*, *V. pellucida* and *P. pygmaea* continuing in significant numbers. The assemblage is one of open-country affinities. The presence of xerophiles

suggests dry conditions, and the dominance of *V. costata* a grassland environment. The continued presence of *P. muscorum* may suggest some bare ground persisted although this may represent a derived component. The composition of the assemblage is consistent with molluscan zone z (Preece and Bridgland 1998). The presence of *T. geyeri* (Plate 1) is of particular stratigraphic importance. It is a species now extinct in Britain and its modern geographical range is Central European. It is characteristic of dry open calcareous areas with short vegetation and rocks (Kerney 1999). It has been recorded from a number late Glacial sequences in Kent (Kerney 1963), although was not recorded at Holywell Coombe (Preece and Bridgland 1998).

Above 64cm although shell numbers decrease slightly, additional species appear, bringing the total number of species recorded to 16. The diversity indices varied a little ($H' = 1.797-1.636$, $HB = 1.51-1.651$, $H' - HB = 0.146-0.094$), though remained at a relatively high level when compared to Zone 1, The $H' - HB$ index, however, increased slightly suggesting an increased allochthonous component to the assemblages, and sediment input from a number of different, though more diverse, environments. The appearance of c.f. *A. arbustorum*, *N. hammonis*, *Carychium* sp., and *Vitrea* spp, perhaps indicates more mesic environments may have existed within the catchment.

Up-profile *P. muscorum* increased gradually reaching 70% of the total fauna at 45cm, accompanied by smaller increases in *A. secale*. *V. costata* on the other hand is reduced to 10%. This is accompanied by a significant drop in species diversity at the top of the zone, although the shell abundance remained consistent and the $H' - HB$ index was slightly lower suggesting fewer derived components ($H' = 1.188$, $HB = 1.111$, $H' - HB = 0.077$). The assemblages at the top of the zone are indicative of less diverse, dry and open environments within the catchment, with an increase in the amount of bare ground and a decrease in vegetation cover.

Zone 3: 25-45cm (layer 4933)

Above 45cm there is a marked change in both molluscan assemblages. This coincides with a change in lithology with the deposition of a poorly sorted pale grey chalk gravel suggesting a thinning of soils and increased physical weathering of chalk bedrock from upslope. Similar to layer 4936, thin section analysis of this layer suggests deposition by cool climate solifluction processes but with seasonal formation of very immature calcaric lithosols probably sometime during the 'Younger Dryas' (Macphail and Crowther 2006).

There is a significant decrease in shell numbers up-profile from 95 to 19 individuals, suggesting less conducive conditions, consistent with an increase in the rate of sedimentation. Species diversity was variable but generally lower than in Zone 2, with a corresponding increase

up-profile in the H'-HB index suggesting a higher degree of mixing (H'=1.062-0.776, HB=0.928-0.690, H'-HB=0.085-0.233). The assemblages are similar to those at the top of Zone 2. *P. muscorum* continues to dominate averaging approximately 65-70% of the total fauna, continuing the trend towards more extreme dry and open conditions with much bare ground.

The presence of single shells of thermophilous species such as *D. rotundatus* and *Aegopinella. pura*, unknown from other late Glacial sequences in the south and southeast at 30-35cm is perhaps a little anomalous. It is probable these shells represent intrusive elements deriving from the overlying Holocene deposits.

Zone 4: 0-25cm (layer 4144)

This zone equates to layer 4144, a very dark greyish brown silty loam. Thin section analysis identified this layer as an accretionary humic and charcoal-rich rendzina soil containing chalk stones, and with fine structures reflecting ploughing and high levels of biological activity (Macphail and Crowther 2006).

There is a marked increase in numbers of shells from 50 individuals at the base of the zone to 355 individuals at the top. Species diversity also increases along with reduction in the H'-HB index up-profile (H'=0.94-1.606 HB=0.794-1.522, H'-HB=0.154-0.084). The assemblages largely consist of thermophilous species. The presence of species such as *P. elegans*, *Oxychilus cellarius* and *A. fusca*, indicates the assemblages are no earlier than the end of molluscan zone d or the beginning of zone e. Zone d is dated at Holywell Coombe to 7650±80yr BP to 5620 ± 90yr BP. The beginning of zone e is diachronous, occurring between 5620± 90yr BP to 3980±70yr BP (Preece and Bridgland 1998). The presence however of later prehistoric and Roman pottery sherds in the upper levels of the soil, and in the colluvium directly overlying it, suggests it was extant up until a much later date.

A significant percentage of the shells from context 4144 are of a shade-demanding or catholic ecology. The assemblages include *C. tridentatum*, *D. rotundatus*, *Aegopinella* sp., and *O. cellarius*. *A. fusca* occurs in the uppermost part of the unit, a species indicative of mature undisturbed woodland (Kerney 1999:43). Open-country species make up only a small proportion of the assemblages reaching a maximum of 9%, of which 7% comprised *V. costata*. Although usually classed as an open-country species, *V. costata* does occur in low numbers in woodland, closed canopy up to 6% and open woodland up to 12% (Evans 1972:157).

The increase in shell numbers, however, at the top of the profile is due to a super-abundance of *P. elegans*, which makes up 60% of the assemblage at this level. This species favours broken ground and loose soil into which it can burrow. Although this species inhabits leaf

litter on woodland floors it thrives in areas of unstable substrate. Its presence in abundance is often interpreted as reflecting ground disturbance associated with forest clearance (Evans 1972:133). Carter (1990) questions the validity of ‘clearance horizons’ associated with *P. elegans*, pointing out that differential preservation of species with robust shells may result in accumulations at the base of a worm-sorted zone through bioturbation. In profile F the greatest numbers of *P. elegans* occur at the surface of the soil. Although it is possible truncation of the upper surface of the soil may have occurred during a subsequent cultivation phase, it was also noted the majority of the shells appeared to be whole and very well preserved suggesting they had not resided in the soil for a substantial length of time prior to burial. If these assemblages are indeed representative of a clearance episode this implies the soil must have been buried fairly rapidly during or soon after clearance at this location, to such a depth that it was protected from mixing and destruction of shell by soil processes or later cultivation. Open-country taxa may not have had the time to colonize any newly opened areas.

3.1.2 Profile C (ARC WHS98 Table 2, Figure 2)

29 samples were examined through profile C, located on the lower slopes of the valley approximately 50m north of profile F (Hayden 2006, figures 5 and 7). The sequence consisted of 1.45m of deposits. The basal deposits comprised orangey brown chalky silts of late Glacial date. This was overlain by a dark brown humic buried soil, and a sequence of ploughwash. The molluscan assemblages can be divided in six zones.

Zone 1: 125-145cm (layer 4551)

In the basal chalky silt, shell numbers were very low, between 4 and 14 individuals. The main species were *V. costata*, *V. excentrica* and *P. muscorum*, with occasional specimens of *A. secale*, *T. geyeri* and *H. itala*. This unit is likely to be equivalent the cold climate slope deposits examined in the lower part of profile F. The overall composition of assemblages is consistent molluscan zone z (Preece and Bridgland 1998). Thermophilous species *P. elegans* and various *Zonitidae* were noted, although these occur at the interface with the overlying layer 4144 and are likely to represent intrusive elements.

Zone 2: 125-90cm (layer 4144)

This zone represents the later prehistoric buried soil horizon stratigraphically equivalent to that examined in profile F. It consisted of a homogenous very dark greyish brown silty loam with frequent poorly sorted chalk clasts. The micromorphological evidence has indicated the soil in

this profile had been disturbed by cultivation. The majority of the pottery sherds recovered from the upper levels of this soil, and the colluvium directly overlying it, date to the early Iron Age, although occasional middle Iron Age and Roman sherds were also recovered.

In lower part of the soil between 125-110cm, shell numbers increased a little from 64 individuals at 125cm, increasing to 113 individuals at 110cm. Diversity also increased, although the H' -HB index suggested a significant derived component ($H'=1.639-1.867$, $HB=1.673-1.397$, $H'-HB=0.23-0.18$) The assemblages were mixed ecology comprising shade-demanding and open-country species. All samples however were dominated by *P. elegans* which comprised up to 50% of the assemblages.

Between 110-90cm shell numbers increased dramatically reaching 265 individuals at 90cm. Diversity continued to increase up-profile with a reduction in H' -HB index at the top of the zone suggesting that these assemblages are relatively autochthonous although with a small allochthonous component ($H'=1.843-1.93$, $HB=1.766-1.832$, $H'-HB=0.12-0.07$). *P. elegans* (20%), other catholic (8%) and shade-demanding (6%) taxa declined in relative abundance up-profile whereas open-country increased reaching 65% of the total at the top of the zone. The assemblages are essentially of open-country character, in contrast to those from the buried soil described above (profile F). Numerically significant species include both *Vallonia* sp. in broadly equal numbers making up to half of the assemblage at 90cm. *P. muscorum* was present in much lower numbers along with various catholic species including *T. hispida*, *H. itala* and *V. pygmaea*. *M. cantiana* was present throughout in low numbers. It is a characteristic snail of waste-ground, typical of roadsides and edges of fields living among tall grasses, nettles and weeds. It is generally regarded as a late Roman introduction to Britain (Kerney 1999:189), although, it is possible that *M. cantiana* was introduced to Britain via Kent in the later prehistoric period. The composition of the assemblage within the upper levels of the soil suggests both a disturbed environment indicative of arable activity and areas of grassland. *T. hispida*, *V. costata*, *V. excentrica* and *H. itala* have been found to predominate in subfossil colluvial assemblages of probable arable origin at numerous sites studied in the chalklands (Bell 1983: 131). The presence of the Vallonidae in such high numbers, however, along with *V. pygmaea* suggests the presence of areas of grassland in the vicinity. The presence of catholic species *Arianta/Cepaea* sp., *Cochlicopa* sp. and *T. hispida* may also indicate localized areas of ungrazed or perhaps lightly grazed grassland perhaps in association with some kind of boundary such as the edge of a field. The abundance of well-preserved shells of *P. elegans* suggests ground disturbance. Peaks in relative abundance appear to occur at the base of the soil. However, when one considers the absolute numbers the peak actually occurs at a depth of 100cm. Such a discrepancy is due to the

dramatic increase in the Vallonidae at this level. The occurrence of *P. elegans* appears to be anomalous with such an environment, usually being associated with scrub, woodland or clearance environments, as was suggested in profile F. At the top of the zone, however, it appears to be not only present but increases in numbers in a clearly open environment. Although in terms modern ecology, *P. elegans*, tends to avoid intensively cultivated areas, there is evidence to suggest that this species was able to inhabit arable environments in prehistory (Thomas 1985:140). It is certainly likely that the shade-demanding elements particularly in the lower part of the buried soil profile are residual elements attesting to a former period when the environment was less open at this location, a similar signal to that described from profile F although less amplified. Towards the top of the zone these elements largely comprise apical fragments of Clausiliidae. The fact that these shells were preserved and remained to some extent stratified at the base of the soil perhaps suggests that cultivation was not intensive or had not been carried out for a substantially long period of time at this location prior to burial. In contrast to profile F however clearance and cultivation had been carried out long enough for open-country faunas to become well established.

Zone 3: 90-60cm (layer 4960 and 4145)

Zone 3 equates with colluvial layers 4960 and 4145. Shell numbers were low within these deposits ranging from 131 individuals at the 90cm, decreasing to only 48 at 60cm, suggesting unconducive conditions and rapid deposition of sediment probably deriving from arable fields upslope. Diversity was variable, although overall the H'-HB index increased significantly (H=2.126-1.445, HB=1.900-1.262, H'-HB=0.17-0.25) suggesting significant mixing of assemblages.

The assemblages were similar to Zone 2 and of open-country character dominated by the *Vallonia*, although in reduced abundance at 25-30% of the totals. Catholic species *Cepaea/Arianta* sp. and *T. hispida* were present at 5-10%, along with *P. elegans* at 30-50%, although the latter is largely represented by broken apical fragments. The same is true for the shade-demanding component, largely comprising worn Clausiliidae fragments that are probably derived. In this zone *M. cantiana* is also joined by *M. cartusiana*, a species characteristic of open unshaded environments usually short-turfed grassland although it also inhabits areas of tall grass, waste-ground and the edges of fields. It is considered to be an introduced species during the later prehistoric period (Kerney 1999:188).

It is perhaps noteworthy that there appears to be an antipathetic relationship in the fluctuations of *V. costata* and perhaps *Arianta/Cepaea* sp. on the one hand and *V. excentrica* on the other. It is not precisely clear what this represents, although it is tempting to suggest variations in land-use such as cycles of arable and grassland, or seasonal input of sediment

representative of different environments. The low numbers of shells throughout these levels, however, does not make such interpretations statistically reliable.

Zone 4: 60-40cm (layer 4146)

In Zone 4 shell numbers remained low and diversity was variable ($H=2.127-1.768$, $HB=1.854-1.579$, $H'-HB=0.27-0.17$). There was, however, a marked increase in the proportion of *H. itala* up-profile reaching a maximum of 22%, and a slight increase in *T. hispida*. *P. elegans* declined to 8%. Both *V. costata* and *V. excentrica* increased making up to half the total numbers for the assemblages, although the latter begins to dominate. At 40-45cm there was a slight increase in shell numbers to 85 individuals, and a decrease in the $H'-HB$ index to 0.17, indicating a slow down in the rate of deposition and an increase in surface stability. This may indicate an increase in areas of (grazed?) grassland in the catchment.

Zone 5: 40-20cm (layers 4146 and 4147)

Although similar in character to Zone 4, overall the assemblages in this zone become less diverse with fewer species dominating ($H=1.878-1.703$, $HB=1.705-1.577$, $H'-HB=0.15-0.12$). Shell numbers increase to between 109 and 165 individuals per sample, and values for the $H'-HB$ index are lower, suggesting increased stability upslope and a slow down in the rate of deposition. Three linear ditches were recorded truncating layer 4147 at the top of this zone, dated by pottery sherds to the Roman period (see below).

V. excentrica predominates increasing to 40% at 20cm and *T. hispida* rises to 14%. *H. itala* decreases from 33% to 17%, and *V. costata* is reduced to 9%. The very low numbers of shade-demanding taxa suggests a very open environment totally free of shade. The appearance of *V. pygmaea* and slight increase in *P. muscorum*, together with the dominance of *V. excentrica* and to a lesser extent *T. hispida* indicates increased areas of short-turfed grazed grassland, possibly becoming a little impoverished. A single shell of *Candidula intersecta* was recorded at 35-40cm. *C. intersecta* is a xerophile, characteristic of open environments, including short grass on downs and waste ground (Kerney 1999:179). It is generally considered a late introduction into the British Isles, possibly during the medieval period. It has been recorded from Cornwall in deposits of allegedly Iron Age date (Bullen 1902, in Evans 1972:179), although Evans suggests this occurrence may actually be of more recent post-Iron Age date.

Zone 6: 20-0cm (layer 4012)

Pottery sherds dating to the medieval period were recovered from layer 4012. Shell numbers were low, varying between 51 and 110 individuals per sample. Molluscan assemblages comprised a more restricted colluvial assemblage whereby two species dominated, *V. excentrica* at up to 50% and *T. hispida* at 20%, with lesser quantities of *V. costata* and *H. itala*. At the very top of this zone a single shell of *Candidula* sp. was recorded.

3.1.3 Profile I (ARCPIL98, Table 3, Figure 3)

20 samples were examined from a sequence of buried soils and colluvium located to the south of the Pilgrim's Way trackway in the base of the valley (Hayden 2006, figure 7). The deposits were preserved within a large hollow cut into late Glacial silts. It is not clear precisely how this hollow was formed. It could be of periglacial origin or it could represent the remains of a very large tree hole.

Zone 1: 135-155cm (layers 970, 961 and 960)

Stratigraphically the earliest deposits comprise sterile buff coloured chalky silts. Shell numbers were generally very low. The assemblages between 1.55-1.45cm comprised an impoverished fauna of *V. costata*, *V. excentrica*, *P. muscorum*, *H. itala* and *T. hispida* suggesting a late Glacial date for the deposits (zone z, Preece and Bridgland 1998). Cold climate conditions were also suggested by the thin section analysis (Macphail and Crowther 2006). The presence of thermophilous species between 1.45-1.35cm, for example, *P. elegans*, *Clausilia bidentata* and *M. cantiana* probably represent intrusive elements as a result of root action.

Zone 2: 135-120cm (layer 910)

At the base of the hollow, a small sub-circular feature truncated late Glacial deposits and was filled with a dark, almost black, humic silty clay loam. This feature contained a large quantity of late Neolithic worked flint and animal bone. The molluscan assemblage from a spot sample from this fill produced a very large assemblage of 1014 individuals. The assemblage was quite diverse ($H' = 2.120$, $HB = 2.078$, $H' - HB = 0.04$) suggesting a relatively mature environment and the low $H' - HB$ index, a relatively autochthonous assemblage.

Shade-demanding species comprised 77% of the assemblage. The main species recorded were *C. tridentatum*, *D. rotundatus* and various *Zonitidae*. Other species in lesser quantities included *A. fusca* and *E. obscura*. Catholic species comprised 9% of which *T. hispida* made up to 6%. Open-country elements comprised 13%, of which *V. costata* made up to 12%. *P. elegans* was

entirely absent. The assemblage is consistent with relatively mature deciduous woodland with much leaf litter. The presence of *V. costata* and *T. hispida*, however, suggests an open aspect to the canopy.

Zone 3: 120-90cm (layer 923)

Zone 3 corresponds with the lower part of a buried soil layer 923. The soil was a very dark brown humic, almost stone free, slightly clayey, silty loam. Molluscan preservation was moderately good throughout, ranging from 145 to 228 individuals per sample. Diversity was moderate to high although the difference between H' and HB indicated some mixing of assemblages ($H'=2.19-1.91$, $HB=1.0-1.71$, $H'-HB=0.16-0.29$).

The base of the zone produced mixed assemblages of shade-demanding, open country and catholic species. *P. elegans* were present in abundance up to 31%. Up-profile there was a gradual increase in the proportion of open-country species, mainly *V. costata*, but also to a lesser extent *V. excentrica* and *H. itala*, although the latter two increase up-profile along with a decline in the shade-demanding component and *P. elegans*. At the top of the zone open-country fauna accounted for 56% and shade-demanding components reduced to 13%. The changes in the character of the assemblages suggests ground disturbance associated with a phase of woodland clearance. Tree cover is much reduced and a more open environment is indicated with *V. costata* the initial colonizing open-country species, followed by additional xerophile species. This together with the reduction in *P. elegans* suggests fewer disturbances and the development of a more open environment of diverse grassland. *M. cantiana* was noted from the base of this zone, in addition to two shells of *Candidula* cf. *gigaxii* at 115-110cm. Similar to *C. intersecta*, *C. gigaxii* is a xerophile species characteristic of short grass on downs but also arable environments (Evans 1972:179). It is generally considered to be introduced to Britain during the Roman period (Kerney 1999:180).

Zone 4: 90-65cm (layer 923)

Zone 4 equates with the upper part of the buried soil horizon. The interface between the two zones is marked by a line of flint nodules, which may represent the base of a worm-sorted zone. Shell abundance remained moderate at between 164 and 234 individuals per sample. Diversity was a little reduced in this zone though the H' -HB index remained relatively high suggesting mixing of assemblages ($H'=1.81-1.62$, $HB=1.48-1.66$, $H'-HB=-0.18-0.13$).

Open-country species predominated comprising up to 70% of the totals with the *Vallonia* comprising up to 63%. There is a significant rise in the proportion of xerophile species in this

zone, particularly *V. excentrica*, which begins to outnumber *V. costata*. There is also a steady increase in the proportions of *H. itala*, and *V. pygmaea* is also more consistently present, albeit in low numbers. Shade-demanding species become insignificant in this zone suggesting an environment totally free of shade. The predominance of the *Vallonia*, especially *V. excentrica*, is strong evidence for open dry short-turfed grassland, but not intensively grazed. Dating evidence from this level is provided by occasional sherds of later prehistoric pottery.

Zone 5: 65-50cm (layer 857)

Zone 5 is equivalent to layer 857. The micromorphological analysis has indicated this layer represents a colluvial ploughsoil. A late Iron Age or early Roman ditch 863 was recorded truncating this deposit. Together with the presence of late Bronze Age and early or middle Iron Age pottery sherds, this suggests the soil may be broadly contemporary with the buried soil identified in profiles F and C, to the north of the Pilgrim's way trackway. The deposits consisted of a homogenous dark greyish brown silty clay loam with abundant poorly sorted chalk and flint clasts. Diversity remained quite low throughout, although the H'-HB index rose significantly suggesting an increased derived component (H'=1.66-1.81, HB=1.59-1.46, H-HB=0.20-0.22).

The character of the assemblages was similar to those in Zone 4 with open-country elements comprising up to 80% of the total. *V. excentrica* overwhelmingly dominates this zone making up to 50% of the total. *T. hispida* also increases to 14%, *H. itala* decreases slightly to 12% and *V. costata* to 10-12%. The molluscan assemblages are consistent with an environment of short turfed grassland, although the micromorphological analysis has suggested this layer represents a colluvial ploughsoil. It is possible that colluvial input may have derived from an area of nearby grassland.

Zone 6: 50-20cm (layer 856)

Zone 6 corresponds to a layer of colluvium. Medieval and Post-medieval pottery sherds were identified above 40cm, although between 40-55cm only undiagnostic prehistoric and Iron Age pottery was identified. The zone was very similar to Zone 6 in profile C and comprised a more restricted colluvial assemblage. *V. excentrica* continued as the dominant species and *T. hispida* increased markedly. *H. itala* declined significantly.

3.1.4 Profile J (ARCBFW98, Table 4, Figure 4)

18 samples were examined from a sequence of deposits infilling a small dry valley to the south of the Pilgrim's Way. The deposits comprised a basal poorly sorted chalk gravel of late Glacial age overlain by a possible buried soil horizon and up to 1.55m of ploughwash.

Zone 1: 175-185cm (layer 1167)

Zone 1 is equivalent to the basal late Glacial chalk gravel. Shell numbers were very low in this deposit, but included *V. costata* and *P. muscorum*. Shade-demanding species *P. elegans*, *T. striolata* and *D. rotundatus* were also noted although are likely to be intrusive elements, possibly deriving from a landscape phase no longer represented in the sedimentary record.

Zone 2: 175-155cm (layer 1157)

Overlying the late Glacial deposits was layer 1157, a friable mid to dark reddish brown clayey silt with occasional small clasts of flint interpreted as a possible buried ploughsoil. One sherd of late Bronze Age pottery was recovered from this layer. Shell numbers were relatively high, between 449 and 688 individuals per sample, along with species diversity ($H' = 2.281-2.383$, $HB = 2.188-2.202$) suggesting moderately stable conditions, with a small derived component, particularly towards the base of the zone ($H' - HB = 0.093$ at 1.75cm decreasing to 0.088 at 1.55cm).

Open-country species dominated the assemblages averaging around 50% of the totals. The main species were *V. costata* and *V. excentrica* with lesser quantities of *H. itala*, and *P. muscorum*. Shade-demanding species were present in small numbers at around 15% including *A. fusca*. *P. elegans* made up to around 36% of the totals at the base of the deposit decreasing slightly up-profile to 28%. There was no marked stratification noted in this deposit, which suggests it has been substantially disturbed or ploughed. The character of the assemblages suggests an environment free of shade. The shade-demanding elements are likely to represent a previous landscape phase when conditions were more enclosed.

Zone 3: 155-80cm (layers 1152, 1156 and 1151)

Zone 3 corresponds to a sequence of colluvial deposits. There appears to be little significant change in the molluscan assemblages through these deposits. Shell numbers remained moderately high throughout. Diversity was variable but overall values were slightly reduced ($H' = 1.91-2.168$, $HB = 1.829-2.073$, $H' - HB = 0.073-0.099$). Open-country species continued to dominate with an average of 60-65% of the totals. The main species were *V. costata* and *V. excentrica*. Although initially these two species were present in equal numbers, *V. costata* increased its dominance up-profile along with *H. itala*, and at the very top of the zone, *T. hispidula*. The introduced helicid *M.*

cartusiana also appeared at the base of the zone and was consistently present until around 90 cm where it was superseded by *M. cantiana*.

Zone 4 80-30cm (layers 1150 and 1155)

In Zone 4 shell numbers decrease up-profile from 348 individuals at 80cm to 174 individuals at 30cm. Diversity was variable but is also much lower than in Zone 3 ($H' = 1.682-2.1$, $HB = 1.614-1.966$, $H' - HB = 0.068-1.134$). Shade-demanding species were virtually absent apart for occasional zonitids. Three species dominated, *V. costata*, *T. hisipda* and *V. excentrica*, with *H. itala* and *P. muscorum* in lesser quantities.

3.2 Archaeological features

3.2.1 Early Neolithic longhouse structure 4806 (ARC WHS98, Table 5, Figure 5)

Given the absence of securely dated Neolithic deposits in the sedimentary sequences, 16 contexts were initially examined from posthole fills associated with the early Neolithic longhouse structure 4806, on the lower slopes of the valley, to the north of the Pilgrim's Way trackway (ARC WHS98). The first set of eight assemblages examined were from 2kg samples specifically processed for molluscan remains. Shell numbers were, however, extremely low and therefore a further 8 assemblages were examined from larger bulk samples. The majority of samples contained mixed assemblages of open-country species and shade-demanding taxa. There is a clear residual component to the assemblages with species such as *A. secale* and *T. geyeri* probably deriving from the late Glacial deposits the features were cut into. It is not clear if other open-country species such as *V. excentrica*, *P. muscorum* and *H. itala* are also residual or are representative of Holocene environments. Interpretation of these assemblages is therefore problematic although some useful observations can be made.

Of all the samples examined only six did not include *A. secale* and *T. geyeri*. Of those six, contexts 5067 and 5116 were too low in numbers to be useful. The four remaining assemblages, contexts 5118, 4859*, 5281* and 4835*, contained a significant component of shade-demanding species between 40-60%. Context 4835*, however, contained an assemblage of 260 individuals whereby shade-demanding taxa comprised 94% of the fauna. The assemblages were dominated by *D. rotundatus*, various zonitids, *C. tridentatum*, with lesser quantities of Clausiliidae, *A. aculeata* and *A. fusca*. *P. elegans* was present in low numbers in many of the samples, but was more abundant in context 5118. These four assemblages suggest the presence of significant tree cover, or perhaps ground that has been recently cleared of woodland given the high numbers of *V.*

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. Similarly *P. elegans* often inhabits leaf litter on woodland floors though is often found in abundance in disturbed ground where the loose soil provides ideal conditions into which it can burrow. *Vertigo pusilla* was recorded in one early Neolithic posthole context (4849*). Although not particularly indicative of woodland, this species is rare in Southern England and generally unknown from post-Neolithic contexts (Evans and Rouse in Sharples 1991:119)

3.2.2 Middle Neolithic pits (ARCPIL98, Table 6)

Middle Neolithic activity is recorded in the form of isolated pits in the base of the valley to the south of the Pilgrim's Way trackway (ARC PIL98). Two pit contexts were examined, 712 (pit 714) and 709 (pit 711). Both pits were relatively shallow at 34cm and 30cm respectively, and cut directly into chalk bedrock rather than Pleistocene colluvium. The layers examined were the upper fills, described as mid-dark brown clayey silt with occasional chalk and flint clasts. The fills in both pits overlay a thin lens of primary, sterile pale grey chalk silt. The assemblages were broadly similar. Shell numbers recovered from the flots were quite high at 608 and 208 individuals respectively. The assemblages were dominated by shade-demanding taxa comprising 67% and 69%. The main species were *C. tridentatum*, *D. rotundatus*, Zonitidae and *T. hispida*. *A. aculeata* and Clausiliidae were also noted. Open-country species were present in lesser abundance, between 20-25%, predominantly *V. costata*. Other species included *P. muscorum*, *H. itala*, and *V. excentrica*. The assemblages are similar to those examined from the early Neolithic features suggesting the pits were backfilled with soil that formed in a relatively shaded environment or perhaps land recently cleared of woodland. The main difference was the very low numbers of *P. elegans* in the assemblages. This, however, may be due to differential recovery of shell since the assemblages derive from bulk samples and the residues were not available for examination. The presence of xerophile open-country species, albeit in low numbers perhaps suggests tree cover was not complete and open areas, perhaps dry grassland, existed in the vicinity.

3.2.3 Late Neolithic pits (Table 7, Figure 6)

Four late Neolithic Grooved Ware pits were examined comprising a total of 11 assemblages. Pits 4965 and 5256 were analysed in full. They were located on the lower slopes of the valley (ARCWHS98) in the vicinity of the early Neolithic structure 4806.

Pit 4965 measured 0.85m wide and 0.55m in depth. Three contexts were examined covering the full depth of the profile. The lowermost fill, 4966, was described as a mid greyish brown silt. The assemblage comprised 507 shells and was of high diversity ($H'=2.282$, $HB=2.196$) probably containing only a minor derived component ($H'-HB=0.086$), and suggestive of an established and complex environment. This deposit may well derive from the contemporary land surface the pit was cut into. Shade-demanding taxa made up to 54% of the assemblage and suggesting substantial tree cover with abundant leaf litter. Numerically important species were *C. tridentatum* (31%), with smaller quantities of *D. rotundatus* (5%), *A. aculeata*, various Zonitidae, Clausiliidae, *E. obscura*, *A. fusca*, *Helicigona lapicida* and *T. striolata*. *P. elegans* was present at relatively high levels (17%) perhaps suggesting ground disturbance nearby. The open-country component comprised up to 16%, dominated by *V. costata* at 15%, although *V. excentrica* was also noted along with one shell of *P. muscorum*. The relative abundance *C. tridentatum*, catholic species such as *T. hispida* along with *V. costata* may indicate quite an open canopy, perhaps with grassy areas.

The overlying, fill 4967, a dark brown silt, contained a very similar assemblage of 536 individuals, although some of the rarer species were absent. Diversity remained high ($H'=2.146$, $HB=2.075$, $H'-HB=0.071$). The presence of a single shell of *A. secale* suggests a small derived component from the underlying late Glacial deposits. This deposit was interpreted as a deliberate backfill deposit and contained much anthropogenic material such as Grooved Ware pottery, bone, burnt stone and worked flint. The similarity between the two assemblages suggests similar environmental conditions prevailed. It is likely that fill 4967 was deposited soon after the pit was dug and incorporated soil from the contemporary land surface.

In the uppermost fill, 4969, there was a significant increase in the abundance of chalk inclusions along with a notable change in the composition of the molluscan assemblage, which comprised only 78 individuals. Although diversity remained relatively high ($H'=2.263$, $HB=1.99$) some mixing of assemblages appears to have occurred ($H'-HB=0.273$). There was a marked rise in the open-country component to 36%, 24% of which consisted of *V. costata*. Xerophile species also showed a marked increase, including *V. excentrica* at 8% and *P. muscorum* at 4%. Catholic species increased to 43% the chief gain being made by *P. elegans* at 24% of the total assemblage. These changes coincide with a marked reduction in relative and absolute abundance of shade-demanding taxa to 20%. Overall this suggests the pit was infilled, in part, with sediment that had formed in much more open conditions than previously with tree cover much reduced. The significant numbers of *P. elegans* suggests localized ground disturbance, which may be associated with clearance of vegetation. The increase in *V. costata*, *V. excentrica*, and *P.*

muscorum may suggest grass was growing in the vicinity of the feature, perhaps with patches of bare ground. It is possible, as was suggested in the original field notes, that the pit was not completely backfilled after the deposition of fill 4967 and that fill 4969 relates to environmental conditions prevailing slightly later at this location.

Pit 5256 measured 0.72m wide and 0.48m in depth and was located within a few meters of pit 4965. Four contexts were examined covering the full depth of the profile. Shell numbers were somewhat lower in these assemblages.

Although diversity was moderate ($H' = 1.802-2.047$, $HB = 1.428-1.959$) a significant component is likely to be derived ($H' - HB = 0.088-0.374$). The lower most context, 5270, contained only 23 individuals dominated by open- country fauna at approximately 78%. Shade-demanding taxa accounted for only 13% of the total. It is likely given the description of this fill, a light orangey brown silt, that it derives from late Glacial deposits probably redeposited when the pit was dug, hence the predominance of *P. muscorum*, *V. excentrica* and the presence of *A. secale*. The upper fill, 5257, was darker and more humic. 395 individuals were recorded from this deposit. Diversity was slightly higher in this deposit ($H' = 2.047$, $HB = 1.959$) with probably only a minor derived component ($H' - HB = 0.088$), and suggestive of a relatively established and complex environment. This deposit made up over half the depth of the pit and is likely to represent a deliberate backfill incorporating soil from the contemporary land surface. It is similar to the assemblages recorded in layers 4966 and 4967 (pit 4965). Shade-demanding taxa comprised 46% whereby *C. tridentatum* comprised 30% along with other species. The open-country component comprised 29% and was again dominated by *V. costata* at 27%. There is no upper deposit equivalent to fill 4969 (pit 4965) within this pit.

In addition to the subsoil hollow containing late Neolithic flintwork (described above, profile I), samples from two Grooved Ware pits were examined to the south of the Pilgrim's Way trackway in the valley bottom. Since these assemblages derive from bulk samples, for which the fine residues were not available, it is likely that some species such as *P. elegans* are under-represented. The results differed somewhat from those described above, and from those of the nearby subsoil hollow. There appears to be a stronger open-country component, particularly with regard to xerophile species, suggestive of larger perhaps more permanent areas of dry open ground developing in the vicinity. Pit 904 measured 0.82m wide and 0.30m in depth. All of the fills were very similar in terms of lithology consisting of mid greyish brown slightly clayey silt with occasional small chalk and flint clasts and containing varying amounts of pottery sherds, worked flint, animal bone and charcoal. The profile of the feature suggests the upper fill has been truncated, probably through ploughing. The basal fill, layer 907, contained moderate amounts of

shell comprising a mixed assemblage suggesting both open and shaded environments. Of the open-country component, *V. costata* is accompanied by xerophile species *P. muscorum* and *V. excentrica*, with smaller numbers of *H. itala* and *V. pygmaea*. The shade-demanding component comprised Zonitidae, *D. rotundatus* and *C. tridentatum* in abundance with *A. fusca* and Clausiliidae.

In the overlying deposit 906, containing Grooved Ware pottery, the open-country component increased, comprising up to half of the assemblage, particularly *P. muscorum*. Catholic species, notably *T. hispida* and *P. elegans* also increased whereas the shade-demanding component decreased in numbers. The abundance of *Vallonia* suggests areas of grassland, but perhaps some disturbance and bare ground in an increasingly open environment. In the uppermost fill, shell numbers and the number of species were low. The shade-demanding component was reduced to a minor component and open-country species predominated, primarily *P. muscorum* and *H. itala*. *T. hispida* was also abundant comprising up to half of the assemblage. The character of the assemblage suggests the presence of a very dry open environment, free of shade, with disturbed ground in the vicinity, possibly arable. The presence of both species of *Monacha*, however, is quite anomalous since they generally only occur in the later prehistoric deposits at White Horse Stone. Given the shallow depth of the feature it is possible that they are intrusive elements within the upper fill. Alternatively the feature may not have been backfilled completely and fill 905 may have been deposited in the top of the feature a little later.

Pit 958 measured 0.57m wide, 0.30m in depth and contained a single fill, 959. The molluscan assemblage was of mixed character though similar to fill 906 (pit 904) with over half of the assemblage comprising open-country taxa, predominantly *V. costata*, *P. muscorum* and *V. excentrica*, with smaller numbers of *H. itala* and *V. pygmaea*.

3.2.4 Middle Bronze Age ditch 4048 (ARCWHS98 Table 8, Figure 7)

A sequence of samples taken at 10cm and 20cm intervals were examined from a substantial ditch located on the upper slopes of the dry valley (ARCWHS98). Pottery from the secondary fills of the feature date its construction to the middle Bronze Age or slightly earlier. The ditch measured 2.62m wide and 1.80m in depth. It was cut through 0.65m of sterile mid orangey brown fine silt with frequent chalk pellets, in places bedded (4013), which in turn overlay weathered chalk bedrock.

It was uncertain at the time of excavation whether the silt deposits were late Glacial or later prehistoric in date. The general character suggested accumulation occurred by slope erosion with sediment being deposited within a hollow in the surface of the chalk probably during the late

Glacial or early Holocene. The sediment was very similar to deposits investigated in the valley bottom. A sequence of samples taken at 10cm increments through this deposit was examined during the assessment stage. No Mollusca were present in the lower part of the deposit. In the upper part the assemblage was extremely sparse (1-35 individuals per sample), and of mixed character suggestive of both open and shaded environments. The low concentration of shells in the samples means that the sequence is unable to contribute much to the reconstruction of the environment. Of the open-country component all species, apart from *V. pygmaea*, have been recorded in late Glacial deposits in the valley bottom. The presence of *A. secale* in the primary fill of ditch 4048 would seem to support a late Glacial date for a component of the assemblage (see below). The presence, however, of *Discus rotundatus*, a thermophilous species and later addition to the British fauna (Preece and Bridgland 1998:207) suggests at least the upper part of the sequence may have either been reworked incorporating additional shells representative of a more shaded environment, perhaps by root action. One also cannot discount some of the open-country shells also being of Holocene date. The presence of *M. cantiana* is anomalous in deposits predating a middle Bronze Age ditch. As previously noted, it is generally regarded as Roman introduction to Britain. It is likely, since shell numbers were so low from these deposits, only a very small component of the ditch assemblages are likely to represent residual elements.

Zone 1: 180-150cm (fills 4049, 4047, 4046 and 4045)

It is likely the assemblages in basal fills of the ditch are a reflection of both the pre-ditch environment deriving from the erosion of the ditch edges and perhaps topsoil turves falling into the ditch, as well as the initial colonizing fauna reflecting local conditions of loose rubbly surfaces within the feature at this level. The lowermost primary fill, 4049 between 180-170cm, comprised fine chalk rubble within a mid brown silt. The assemblage contained a moderate amount of shell with 156 individuals identified ($H'=2.109$, $HB=1.946$, $H'-HB=0.163$). There is some indication of a fairly open aspect to the environment, although this may be very local to the feature. Open-country species accounted for 43% of the assemblage and shade-demanding 13%. The most abundant species were *T. hispida* (20%) and *V. costata* (33%), common in the earliest stages of ditch colonization, along with *P. elegans* (13%), reflecting much broken ground. There was a small shade-demanding component to the assemblage dominated by the zonitids, particularly *O. cellarius*, and to a lesser extent *Vitrea* sp., occasional *D. rotundatus*, *C. tridentatum* and Clausiliidae. All except for the Clausiliidae were recorded in layer 4013 and may relate to a previously wooded environment. The relative abundance however of the zonitids suggests these species were beginning to colonize the ditch at this level. Some form of refuge

must have persisted in the vicinity of the feature from which these species could colonize. Lesser quantities of xerophiles *V. excentrica* (6%), *H. itala* (3%) and *P. muscorum* were also noted. The presence of *A. secale*, frequent in late Glacial deposits at White Horse Stone confirms some elements derive from the silts the feature was cut through.

The upper primary fills (4047-45), between 170-150cm, produced similar assemblages, although, the total number of individuals and species diversity gradually increased ($H' = 1.773$ - 2.288 , $HB = 1.685$ - 2.066 , $H' - HB = 0.222$ - 0.088). This, together with a decrease in clast concentration and a reduction in the $H' - HB$ index, suggests stabilization of the edges of the feature. There was a slight increase in, initially the catholic species, particularly *T. hispida*, the Punctum group, and the zonitids, *O. cellarius*, then *A. nitidula*, and a modest decline in open-country elements.

Zone 2: 150-125cm (fills 4044 and 4043)

Between 150-125cm shell abundance and diversity continued to increase. There was a distinctive change in the assemblage with a significant increase in shade-demanding taxa to 40%, particularly *D. rotundatus*, but also other species such as *E. obscura*, suggesting the growth of vegetation. The proportion of *P. elegans* also decreased suggesting increased stabilization of surfaces within the feature.

At 125cm shell numbers peaked at 436 individuals along with species diversity ($H' = 2.256$, $HB = 2.178$, $H' - HB = 0.078$), suggesting a relatively autochthonous assemblage and probably the surface of a soil forming. This is equivalent to the top of layer (4043), a relatively stone free mid brown silt. At this level in the ditch it is not possible to be certain how representative this is of the environment of the area as a whole. The apparent rapid spread and colonization by shade-demanding species suggest refuges remained close at hand, open woodland/scrub nearby and within the feature. Open-country species however remained at 20-30%, predominantly *V. costata*, but also *V. excentrica*, *P. muscorum* and *H. itala* at approximately 4%, suggesting some open ground may have been present, perhaps grass interspersed with patches of bare ground. It was at this level in the ditch middle Bronze Age pottery was retrieved.

Zone 3: 125-100cm (fill 4042)

At 125cm, layer 4042, there was a marked increase in the relative proportion of *P. elegans* (16%) suggesting some disturbance around the feature. *T. hispida* (23%) also increased slightly along with a small peak in *V. excentrica* (13%). Values for *D. rotundatus* and the zonitids decreased, and some of the other shade-demanding species disappear. These changes are accompanied by a

decrease in shell numbers to 141 individuals, along with a significant rise in the H'-HB index ($H'=2.163$, $HB=2.004$, $H'-HB=0.159$). This may reflect disturbance in the vicinity, perhaps some attempt to clear vegetation from and around the ditch resulting in erosion of sediment and may relate to activity associated with the settlement. In the sample above the 'clearance zone' early Iron Age pottery was retrieved. There was a marked increase in *V. costata*, which may have taken advantage of the newly cleared surfaces.

Zone 4: 100-75cm (fill 4041)

Above 100cm, in layer 4041, there was an increasing trend towards open conditions within the vicinity of the ditch with associated fauna rising to approximately 50% of the assemblage. It is possible the faunas here are becoming more representative of the surrounding environment as the profile of the ditch became shallower. Although *V. costata* continued to dominate, *V. excentrica*, *P. muscorum*, *H. itala* and *V. pygmaea* were also present in greater abundance. Some shade-demanding elements continued at approximately 18% and there was a notable rise in the proportion of *C. tridentatum*. *D. rotundatus* continued but never achieved the numbers seen in the lower deposits. These elements may, however, be very local to the feature. *C. tridentatum* although classed as shade-demanding has more catholic habitat preferences than *D. rotundatus* and will thrive in well-vegetated places including tall grassland (Cameron and Morgan-Huws 1975). Its presence may represent the growth of herbaceous vegetation within the feature in an otherwise open environment. At the top of layer 4041 the H'-HB index is reduced to 0.09 and shell numbers increase to 363 suggesting stability within the feature and possible soil formation.

Zone 5: 75-30cm:

The deposit overlying 4041 is interpreted as a ploughsoil, which may have had colluvial elements. It extends beyond the edges of the feature and may have truncated it. This is reflected in the rise in the H'-HB index to a maximum of 0.152. Open-country elements comprised up to 70% of the fauna. The composition of the assemblages was similar to Zone 4, although there were increases in the proportion of open-country species, *P. muscorum*, *H. itala* and *V. excentrica*.

3.2.5 Late Bronze Age pit 5421 (ARCWHS98 Table 9, Figure 8)

Ten samples were examined from pit 5421 located on the lower slopes of the valley to the north of the Pilgrim's Way trackway. The sediment was sampled from monolith tins at roughly 10cm intervals, or from each context if less than 10cm, covering the full profile of the feature. Although

the volumes processed were quite low, 0.5kg per sample, shell numbers in some of the deposits were very high.

The two lower most layers, 5453 and 5452, were devoid of shell between 101-87cm. The basal layer, 5453, comprised orangey brown slightly clayey silt, and layer 5452 a pale grey to white chalky silt. The character of the deposits suggested the material derives from late Glacial silts probably redeposited rapidly either during, or immediately after, the pit was dug.

The overlying layer, 5449, between 97-75cm, comprised a greyish brown, slightly clayey, chalky silt. Late Bronze Age pottery was recorded within this layer. The burnt residue from one sherd was dated to NZA-22006 2804±40 BP (1130-890 cal BC, see Allen 2006). The deposit produced an assemblage of 196 individuals. The diversity indices were moderately high, although, the difference between H' and H_B indicates some mixing ($H'=2.373$, $H_B=2.226$, $H'-H_B=0.147$). It is probable at this level that a component of the assemblage represents the pre-pit environment deriving from the topsoil falling into the pit. Shade-demanding species dominated the assemblage at 79%. The main species were the zonitids at 60%, predominantly *O. cellarius*, *Vitrea* sp. and *A. pura*, although *A. nitidula* was also present in low numbers. *C. tridentatum* was present at 11% and the catholic species *Arianta/Cepaea* sp. at 11%. *Discus rotundatus* was present in small numbers along with some Clausiliidae. The open-country component was very low at only 4% of the total assemblage, 3% of which comprised *V. costata*. The overall character of the assemblage indicates soil formation in shaded conditions, leaf litter, and is consistent with broadleaf deciduous woodland. The presence of *T. hispida*, *V. costata* and *P. elegans* may hint at some disturbance and perhaps an open aspect to the canopy.

Layer 5426 may well represent an erosional deposit. The diversity indices are notably lower, and the difference between H' and H_B is greater suggesting an allochthonous component ($H'=1.949$, $H-H_B=1.752$, $H-H_B=0.197$). This deposit produced an assemblage of only 90 individuals suggesting the deposit formed in conditions less conducive to molluscan life and perhaps rapid deposition of sediment. The main species were the Zonitidae (33%), *V. costata* (39%), *T. hispida* (12%) and the Punctum group (4%), all common colonizing species. *C. tridentatum* and *D. rotundatus* were comparatively low in abundance along with other shade-demanding species. It is likely that the assemblage at this level is reflecting the micro-environment of the pit with surfaces relatively bare of vegetation and an unstable substrate.

Layer 5423, a very dark brown humic silty loam, may represent a soil horizon. It is not clear if this layer represents soil formation within the pit indicating the feature was left open for some time, or whether the soil was topsoil, redeposited from a contemporary ground surface. The deposit produced an assemblage comprising 488 individuals. Diversity indices were quite high

and the difference between H' and HB low, suggesting a fairly autochthonous assemblage ($H'=2.11$, $H-HB=2.038$, $H'-HB=0.072$). Shade-demanding taxa continued to predominate (66%), but *D. rotundatus* increased at 18% and *C. tridentatum* to 31% with the zonitids in lesser abundance. *V. costata* continued as the predominant open-country element at 15%. The character of the assemblages indicates soil formation, whether in situ or redeposited, occurred in an environment of open woodland.

Layer 5456, at 62-52cm, produced a similar molluscan assemblage dominated by shade-demanding taxa at 75%. This deposit is very disturbed and mixed and probably represents a deliberate backfill of material. It also contained late Bronze pottery. Additional woodland species *E. obscura* and *H. lapicida* were present in this sample. There is also a minor input from xerophile species in this deposit including *V. excentrica*, *H. itala* and *P. muscorum*. The character of the assemblage is a little mixed and indicates both woodland and more open environments. An increase in *P. elegans* to 7% may indicate increased disturbance.

Layer 5422 was distinctly different to the deposits below, comprising 52cm of homogenous non-humic mid brown, slightly clayey silt, with numerous rounded chalk pellets. The character of the deposit was very similar to colluvial deposits exposed in the sediment sequences. Pottery dating to the early Iron Age was identified within this deposit. It is likely that these deposits are more representative of the surrounding environment than the lower fills. In the lower part of the deposit, at 37-52cm, the difference between H' and HB remained low at 0.09. Certain shade-demanding species, such as *D. rotundatus*, *E. obscura*, and the Clausiliidae were reduced in abundance suggesting a reduction in tree cover in the vicinity. Although the zonitids are present in reduced numbers they still represented 29% of the assemblage. A corresponding increase in *C. tridentatum* may reflect the presence of more herbaceous vegetation or areas of long grass. The presence of *P. elegans* at 12% may indicate some form of ground disturbance in the vicinity. Up-profile the difference between H' and HB increased suggesting some mixing of assemblages. There is a corresponding reduction in shade-demanding taxa to approximately 20% and an increase in open-country taxa to 45-50%. *V. costata*, *T. hispida* and *Arianta/Cepaea* sp. dominate the assemblages but xerophile species, *V. excentrica*, *P. muscorum*, *H. itala*, and *V. pygmaea* were also present in low numbers indicating the presence of open-country possibly dry short turfed grassland or arable environments present in the vicinity. The shade-demanding taxa, predominantly Zonitidae and *C. tridentatum* may represent local conditions, such as longer grass, growing within or in the immediate vicinity of the feature as it infilled.

3.2.6 Early Iron Age features (Table 10)

Five contexts were examined from the early Iron Age settlement on the upper western slopes of the dry valley. The samples derive a penannular ditch (19022, 19037 and 19045) in the western area of the settlement, a ditch within the metal working area to the east (7216), and the fill of a negative lynchet to the south (4181). All produced assemblages dominated by open-country species although the proportions varied somewhat, reflecting slight variations in local conditions as the features infilled.

Spot samples from three profiles were examined from the penannular ditch. The assemblages were dominated by *V. costata* and *T. hispida*. Xerophile open-country species were relatively abundant comprising *H. itala*, *P. muscorum*, *V. excentrica* suggesting a rather open environment probably short turfed grassland in the vicinity with perhaps some areas of bare ground. In fills 19045 and 19037 shade-demanding components made up a small proportion of the assemblages. Fill 19022, however, was comparatively species rich with the shade-demanding component comprising mainly the zonitids, though *D. rotundatus* and *C. tridentatum* were present along with shells of other species. The assemblage may suggest the gully was sited close to an area of long, ungrazed grass, perhaps a hedgeline or area of scrub.

The fill of the negative lynchet produced a large assemblage of low diversity. Open-country species *H. itala* and *P. muscorum* predominated with *V. costata*, *T. hispida* and *V. excentrica* in broadly equal numbers. This assemblage is indicative of rather harsh xerophilous environment and is typical of ploughwash deposits indicating cultivation and perhaps moister grassland environments prevailing at field boundaries. The obligatory xerophile *Truncatellina cylindrica* was present in the fill of lynchet. Although it is rare today there is some suggestion of a much wider distribution in the prehistoric period. It inhabits very dry exposed places such as calcareous short-turfed grassland (Evans 1972:140). It is noteworthy that this species does not occur at White Horse Stone in any pre-Iron Age assemblages.

In ditch fill 7216 on the eastern side of the settlement *V. costata* predominated comprising up to nearly half of the assemblage, with lesser quantities of *T. hispida* and *V. excentrica*, suggesting open short turfed grassland in the vicinity.

3.2.7 Roman features (Table 10)

Six contexts were examined from features dated to the Roman period. Three derive from two ditches to the west of the early Iron Age settlement on the upper slopes of the valley, and three from ditches stratified within colluvium on the lower slopes.

Upper western slopes

Ditches 2100 and 2249 form part of the sub-rectangular enclosure on the upper western slopes. These ditches appeared to respect the area of the early Iron Age settlement and it is possible they originate in the early Iron Age and were still extant in the Romano-British period. Dating is derived from occasional Roman-British pottery sherds. Both profiles were very shallow and had probably been subject to some plough truncation.

Ditch 2100 was 0.20m deep, 0.50m wide and contained one fill. The assemblage was mixed comprising shade-demanding and open-country species. The shade-demanding components are not particularly indicative of woodland conditions, as some commonly occurring species are absent. The vegetation was probably lusher than the surrounding area with the growth of tall grass and this is reflected in the high numbers of *T. hispida*, zonitids, particularly *A. pura* and *Vitrea* sp. The xerophiles *P. muscorum* and *H. itala*, were, however, also present in significant numbers along with low numbers of *Vallonia* suggesting dry grassland with perhaps some bare ground and disturbance in the vicinity.

Ditch 2249 was significantly wider and contained two fills. Shade-demanding species predominated in the lower fill. The assemblage was much more diverse. *C. tridentatum* was abundant, with lesser quantities of zonitids (*A. nitidula*, *A. pura*, *O. cellarius* and *Vitrea* sp.) and *T. hispida*. *D. rotundatus* was present, as was *A. aculeata*, and one shell of *E. obscura*. Again, *Vallonia* were present in low numbers, along with *V. pygmaea* and *Candidula* sp. The assemblage indicates the presence of long grass/scrub within the feature, perhaps a hedgeline. The upper fill contained significantly fewer shade-demanding species with much greater abundances of *V. costata*, *P. muscorum*, *V. pygmaea* and *H. itala* suggesting more open grassland conditions.

Lower slopes

Running parallel down the centre of the valley axis three linear gullies were identified. It has been suggested that these define the extent of a ditched trackway. Artefactual material from the fills of these features suggest a Romano-British date. All three features were sampled on the lower slopes where they were stratified within colluvial deposits adjacent to profile C. Ditch 4001 contained a very similar assemblage to ditch 4429, dominated by shade-demanding species indicative of scrub. Ditch 4004 and 4006 however immediately adjacent only contained a minor component of shade-demanding species comprising a few zonitids and *C. tridentatum*. The assemblages were dominated by *T. hispida*, *Vallonia*, *H. itala* and to a lesser extent *P. muscorum*. This suggests the scrub present in ditch 4000 was contained within the feature and may represent some form of

hedgeline in an otherwise open environment. The hedgeline may have formed a boundary along side the trackway.

3.2.8 Medieval and post-medieval features (Table 10)

One fill was examined from a medieval ditch 687 in the valley floor. The assemblage was dominated by *V. costata*, *V. excentrica*, with *T. hispida* and *P. muscorum*. There was however a notable shade-demanding component comprising mainly the zonitids although *D. rotundatus* and *C. tridentatum* were present along with other species. This suggests grassland with rank vegetation growing in the ditch with perhaps some bare ground around the edges of the feature or in the vicinity.

One fill was also examined from a Post-medieval ditch 6034 on the upper western slopes of the valley in the vicinity of the early Iron Age settlement. The shade-demanding component was notably higher in this sample accounting for half of the assemblage. The zonitids, however, predominated, mainly *A. pura* and *Vitrea* sp. This is not particularly indicative of woodland but may indicate the growth of scrub, perhaps a hedgeline. Other species present included *E. obscura*, *D. rotundatus* and *C. tridentatum*. Most of the common open-country species were present suggesting an open environment beyond.

4 DISCUSSION

4.1 The late Glacial period

The late Glacial molluscan assemblages analysed at White Horse Stone derive primarily from deposits sampled in the lower part of profile F on the lower slopes of the valley. Dating is based on the stratigraphy of the deposits and on the composition of the molluscan fauna, which is unequivocally late Glacial in character. Assemblages belonging to both y and z mollusc zones (Preece and Bridgland 1998) are present, and although all species identified have been recorded previously in late Glacial deposits, a number of points are worthy of note.

Zone y is represented by the basal deposit, layer 4936. Assemblages were sparse and impoverished suggesting unconducive cold climate conditions, slope instability and little vegetation cover. Active slope erosion of chalk bedrock and other superficial deposits was probably rapid with material from upslope being redeposited in the base of the valley. The closest comparable sequences are those at Upper Halling and Holborough on the western side of the River Medway (Kerney 1963). At Upper Halling a rise in numbers of shells within cold climate

deposits below the 'Allerød soil' was interpreted as representing a period of climatic warming possibly associated with the Bølling interstadial (Kerney 1963). Radiocarbon dates were unavailable for the Upper Halling sequence, but at nearby Holborough a thin organic horizon below the 'Allerød soil' provided a radiocarbon date of 13180 ± 230 yr BP (Preece 1998). At Holywell Coombe, further to the east, a 'Bølling stage' was represented by organic marsh deposits that accumulated between ca. 13,000 and 12,000 yr BP in the valley bottom, preserving an impoverished temperate molluscan fauna of open ground and wetland communities. Subsequent cold climate chalk rubbles emplaced prior to the 'Allerød stage', although unfossiliferous, in places were intercalated with organic lenses, suggesting they were not emplaced by a single mass movement event, indicating a complex accretionary history. At White Horse Stone, although there is no marked change in species composition, shell numbers vary quite markedly within layer 4936. Although this may not be representative of interstadial conditions, at the very least it may indicate a reduction in deposition rates which could conceivably be brought about under less severe conditions, perhaps seasonally. The micromorphology has suggested that this basal deposit although deposited by solifluction processes had been subject to episodes of incipient pedogenesis.

Layer, 4935, has been identified at White Horse Stone as a reworked late Glacial soil. The fauna at this level is consistent with molluscan zone z and shows a marked increase in both numbers of individuals and species diversity suggesting increased surface stability. Thermophilous species are present that indicate warmer conditions developing. The environment prevalent at the time appears to have been a fairly simple one of open, probably dry grassland though with some areas of bare ground persisting. A radiocarbon date from charcoal fragments retrieved from layer 4935 produced a date of NZA-22046 $11,130 \pm 48$ yr BP, which is consistent with other 'Allerød soils' investigated across southern Britain. An abrupt faunal change at the base of the 'Allerød soil' was similarly noted at Upper Halling where it was suggested the sequence was rather more condensed when compared to other sites. At Dover Hill near Folkestone for example the increase in frequency of shells, and the first appearance of new species reflecting climatic amelioration, occurred some 60cm below the palaeosol (Preece 1998).

As suspected in the field, and confirmed by thin section analysis, it appears that the 'Allerød soil' at White Horse Stone had been subject to substantial disturbance (Stafford 2006, Macphail and Crowther 2006). The 'soil' probably derived from further upslope and had at a later stage, possibly coinciding with climatic deterioration at the onset of the 'Younger Dryas', been subject to erosion and re-deposition as soil clasts within a chalky silt matrix into the base of the valley. The molluscan diversity indices however suggest a fairly autochthonous assemblage, at

least within layer 4935. It should be noted that sampling for molluscan remains was undertaken with great care. Profile F was located where the deposit appeared to contain much larger intact clasts of soil. As far as possible only these clasts were sampled. The same however cannot be said of the overlying deposit 4935 which was much more heterogeneous and in places displaying laminations of humic and chalky sediment. It is likely the molluscan assemblages at this level derive from a number of different environments and this is reflected in the diversity indices. A further period of slope instability is represented by layers 4935 and 4933 whereby chalk bedrock appears to have been eroded from further upslope. This coincides with a substantial drop in shell numbers and molluscan diversity. The composition of the fauna is indicative of much bare ground and reduced vegetation. This may well relate to a climatic deterioration associated with the 'Younger Dryas' cold stage.

It is perhaps noteworthy that the diversity indices for the upper part of the later prehistoric rendzina soil in profile C (layer 4144) did not achieve values much greater than layer 4935. Assemblages from both contexts exhibit some similarity with a predominance of open-country species. The zone z assemblages are indicative of comparatively dry conditions with the presence of xerophiles, particularly *H. itala* and *A. secale*. Hydrophiles are comparatively rare, perhaps surprising considering some of the later deposits are interpreted as 'meltwater muds'. *A. arbustorum* and *V. pulchella*, frequent in many zone z assemblages, are very rare and *T. 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. Profile F at White Horse Stone was located 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.

The distribution of the xerophile *A. secale* at White Horse Stone is noteworthy. At Holywell Coombe and other sites, this species was absent for the earliest part of the late Glacial but was noted to proliferate in the 'Allerød soil' and later deposits. This species is strongly calciphile (i.e. requires lime) and requires open, treeless environments preferring a certain amount of bare or loose rock. The authors at Holywell coombe found its presence in the 'Allerød soil'

surprising in view of this species modern western Atlantic and Alpine range. At White Horse Stone *A. secale* is present in the layer 4935 but occurs in relative abundance in the overlying layer 4935 along with increasing numbers of *P. muscorum*, another species that prefers areas of bare ground. It is present in the lower part of layer 4933 in reduced numbers but disappears up-profile. *P. muscorum*, however, which is more tolerant of colder temperatures continued. It has been suggested that deposition within layer 4934 as well as 4933 occurred under conditions of increasing climatic deterioration, with poorer vegetation cover and increased slope instability. The molluscan succession would appear to support this.

4.2 The early Prehistoric period

There is no direct molluscan evidence available from White Horse stone relating to the environment of the earlier-mid Holocene period (mollusc zones a-c, Preece and Bridgland 1998). No deposits, either buried soils or colluvial deposits, relating to this period were identified within the principal dry valley pedo-sedimentary sequences (Stafford 2006, Macphail and Crowther 2006). The earliest Holocene deposit was an extensive buried soil dated to the later prehistoric period which directly overlay late Glacial sediments, and sealed Neolithic and Bronze Age features. This implies a major unconformity within the sediment sequences spanning several thousand years. In general, early former Holocene soils in dry valley situations on the chalklands of the south and south-east are rarely preserved. 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). It is impossible to say with certainty when, and if, erosion episodes removed the early-mid Holocene soils at White Horse Stone. Localised colluvial deposits were identified on the upper western slopes of the valley where they were cut by a middle Bronze Age ditch (4048). This could be seen as implying that an erosional event, not represented in the main dry valley sequences and not necessarily extensive, occurred prior to the major early-middle Iron Age settlement activity in this area. If erosion was confined to episodic, localised events it is possible the soils in the valley under relatively stable conditions were simply biologically worked over a long period up until the late Iron Age or Roman period when they were buried by colluvium. The only evidence relating to the early-mid Holocene came from feature fills and subsoil hollows. Thin-section analysis of samples taken from early and late Neolithic posthole fills at the White Horse Stone site and the fill of the subsoil hollow at the Pilgrim's Way site indicates that humic rendzinas were locally present. This suggests that the

local soils had not been eroded, or were little eroded, during these periods (Macphail and Crowther 2006).

The earliest Holocene molluscan assemblages derive entirely from deposits contained within postholes from the early Neolithic longhouse (structure 4806) and pit deposits of middle and late Neolithic date. Species identified include, *C. tridentatum*, *D. rotundatus*, *P. elegans*, occasional *A. fusca*, *T. striolata*, *H. lapicida*, along with various *Zonitidae*, *Clausiliidae*, *E. obscura*, *A. aculeata* and *V. pusilla*. These assemblages can be broadly placed towards the end of molluscan zone d and the beginning of zone e (Preece and Bridgland 1998). The assemblages from the early Neolithic postholes were highly variable and mixed and suggestive of a significant residual element deriving from late Glacial deposits. Because of the residual component it is difficult to clarify to what extent the open-country fauna are reflective of contemporary ground conditions. What can be said however is that of those assemblages that did not contain obvious late Glacial shells there was a strong shade-demanding component indicative of arboreal cover. There is also however an open-country element to the assemblages, dominated by *V. costata* but also with occasional shells of other species, along with variable abundances of *P. elegans*. *P. elegans*, although occurring in leaf litter in woodland, prefers loose soil conditions into which it can burrow and often flourishes in land recently cleared of woodland (Evans 1972:133). This together suggests perhaps an open aspect with some disturbance during the occupation of the longhouse within a previously wooded environment. Given the strong evidence for woodland it is likely that it was cleared not long and probably for the purpose of construction. If substantial areas of woodland had been cleared some time before construction one would not expect the shells to survive and one would perhaps expect a stronger open-country signal. It is not possible to say how much woodland persisted in the vicinity during the period of occupation, however, the continued persistence of associated fauna into the middle and late Neolithic at White horse Stone suggests suitable refugia remained.

The evidence for the middle and late Neolithic at White Horse Stone is a little more comprehensive. In the valley bottom the main fills from the middle Neolithic pits suggest an environment of open woodland where the shade-demanding species comprising up to 70% of the assemblages and *V. costata* made up a large proportion of the open-country assemblage. Associated ground disturbance in the vicinity appears to have been minimal.

In the late Neolithic on the lower slopes of the valley the assemblages from the main fills of the Grooved Ware pits see more mixed assemblages with the shade-demanding components at around 45%. Some of the commonly occurring woodland species such as *D. rotundatus* become less abundant suggesting tree cover was more widely dispersed and the abundance of species such

as *C. tridentatum* perhaps suggests rank grassland in the vicinity. There is an increase in open-country xerophile species in the upper fills of some of the pits perhaps suggesting more open areas of dry grassland developing. To the south of the Pilgrim's Way trackway, in the valley bottom, the signal is more amplified, with a greater increase in open-country xerophile elements within the main fills of the Grooved Ware pits. The evidence from the nearby subsoil hollow containing late Neolithic flintwork that suggests relatively recent tree cover existed nearby that was subsequently cleared. This could represent real spatial variation in the environment of the late Neolithic, given the timescales involved, however, such different environments may only be considered relatively contemporaneous. The overlying fills within the subsoil hollow (layer 923) contained mixed assemblages suggesting clearance of woodland in this area culminating in the development of a rather open environment probably of short-turfed grassland at the top of layer 923. It is not clear precisely over what period of time this occurred, although the fact the deposits are overlain by deposits dated to the early Iron Age suggests sometime from the late Neolithic to late Bronze Age. The presence of introduced species such as *M. cantiana* and *Candidula* perhaps suggests the latter date may be more likely.

No archaeological features or deposits dating to the early Bronze Age were identified at White Horse Stone. A small number of residual Beaker sherds were, however, retrieved from the later prehistoric palaeosol suggesting some activity had taken place in the vicinity. The middle Bronze Age ditch excavated on the upper western slopes does, however, provide a clue. This is the earliest molluscan evidence available for environment conditions on the upper western slopes of the valley. The basal fills contained a minor open-country component. Although the assemblages were dominated by *V. costata*, open-country xerophiles were also present in lower numbers suggesting some open aspect, although this may have been quite local. The open-country species, however, were rapidly replaced by taxa indicative of more enclosed conditions. The speed with which this occurred suggests that some form of tree cover prevailed in the vicinity of the feature from which these snails could colonize. The assemblages are most certainly indicative of tree cover rather than simply tall vegetation growing in the ditch. This could represent some form of hedgeline. It is unlikely, given the very low numbers of open-country xerophiles, that this was isolated within an otherwise open environment although it is possible given the fact this is interpreted as some form of boundary ditch the assemblages may be reflecting a boundary between two different type environments, one comprising open grassland.

The evidence from late Bronze Age pit 5421 on the lower slopes of the valley indicates some form of arboreal cover persisted in this area into the late Bronze Age. Shade-demanding taxa comprised up to 80% of the assemblages in the lower fills. It is interesting to note that

assemblages produced the highest diversity values of all samples analysed at White Horse Stone ($H'=2.58$) suggesting a rather mature and complex environment. There are indications, however, of local disturbance and possible vegetation clearance in the later stages of infilling and it is possible the colluvial inwash indicates open areas of bare ground may have existed upslope in the late Bronze Age. This may be associated with renewed disturbance recorded in the upper levels of ditch 4048.

Overall it is worthy of note that the Neolithic assemblages examined although indicating the presence of woodland environments throughout this period, in reality perhaps do not exhibit the diversity one usually associates with undisturbed primary climax forests of the mid Holocene. Some of the rarer species are conspicuously absent. Although there was no archaeological evidence for earlier activity, one may speculate this points to a more prolonged low-level interference in the environment prior to the activity associated with the longhouse. Two fragments of *Pinus* charcoal retrieved from postholes from the early Neolithic structure 4806 were dated of $9182 \pm 4\text{yrBP}$ and $8516 \pm 35\text{yrBP}$, although this does not necessarily indicate anthropogenic activity. It is a wide held view that most of Southeast England was wooded during the early to mid Holocene (e.g. Bell 1983, Ellis 1985, Evans 1972, Kerney *et al* 1964 and Thomas 1982). There is, however, an ongoing debate over the natural ecological state of the assumed climax woodland. Traditionally it has been believed Britain and the rest of Europe was covered by a dense continuous canopy (Rackham 1986, Peterken 1996). Previous workers have emphasized the role of Mesolithic communities in the disturbance of that woodland (e.g. Evans 1975, Williams 1985 and 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 to encourage grazing animals for hunting (e.g. Mellars 1976, Simmons and Innes 1997 and Simmons 1996). Whitehouse and Smith (2004) recently reviewed the data, specifically the coleopteran evidence, suggesting although there is an undoubted anthropogenic factor, the role of autogenic disturbance e.g. tree throw, forest fire, and the impact of wild herbivore grazing (Buckland and Edwards 1984, Bradshaw and Hannon 1992, Bradshaw and Mitchell 1999, Robinson 2000 and Vera 2000) may have been previously underestimated. With reference to the chalklands, research at 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) provides 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. At Caburn pollen evidence dated to the

mid-Holocene suggests, although the slopes above the site may have been well-wooded, scrub and grassland was present, with plant species specific to chalk grassland. from ca. 6000 cal. yr BP onwards.

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 Watlingbury, 9.5km southwest of White Horse Stone (Kerney *et al* 1980), suggests locally forested conditions during the pre-boreal and boreal initially birch and pine, followed by hazel and then hazel and elm woodland. The extent and duration of woodland clearance on the chalklands of the south and south-east is not clear, although research suggests it was predominantly a late Bronze Age phenomenon (e.g. Bell 1982, 1983, Thorley 1971, 1981, and Scaife 1982). 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, sometimes demonstrating cycles of woodland/scrub regeneration (Wilkinson 2003). At some sites clearance does not appear to have been complete, with localized woodland environments persisting into the Iron Age and historic periods (e.g. Bell 1983, Allen 1992, 1995, in Wilkinson 2003). Along the route of the CTRL, the presence of (regenerated) woodland has been demonstrated during the Iron Age and Roman periods at Thurnham Villa, East of Station Road and Parsonage Farm. At White horse Stone itself, the overall picture during the early prehistoric period, from the early Neolithic onwards, is one of open woodland possibly interspersed with grassy clearings subject to some disturbance associated with localized activity. Although there appears to be a gradual trend in the late Neolithic to more open conditions, particularly in the valley bottom with evidence for the creation of open grassy areas, a strong shade-demanding component persists in the assemblages into the Bronze Age on the lower and middle slopes, to the north of the Pilgrim's Way trackway. Here there is evidence of woodland/scrub in the middle Bronze Age on the western slopes and in the late Bronze Age on the lower slopes. The first indication of a dramatic opening up of the environment and the creation of large tracts of open-country grassland and arable does not appear to occur until the early Iron Age coincident with extensive settlement and agrarian activity.

4.3 The later Prehistoric and Roman periods

A marked change in the molluscan assemblages at White Horse Stone appears to occur some time in the late Bronze Age to early Iron Age. In many of the assemblages analysed there is a dramatic increase in the proportion of open-country species and a corresponding reduction in shade-demanding species in the many of the areas investigated. 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. This change must undoubtedly have been associated with the extensive settlement activity on the upper western slopes of White Horse Stone dry valley where the micromorphology has revealed evidence of both agrarian and pastoral practices.

The assemblages are broadly consistent with molluscan zones e and f (Preece and Bridgland 1998). *P. muscorum* becomes a little more abundant during this period suggesting an increase in the amount of bare ground, and *H. itala*, *V. excentrica* and *V. pygmaea* become much more frequent. Certain species appear for the first time; *T. cylindrica* for example, a rare xerophile suggestive of very dry open grassland conditions. The two species of *Monacha* also become ubiquitous from deposits dating from the early Iron Age and later. As previously noted, although *M. cantiana*'s modern day distribution is widespread, it is regarded as a possible Roman introduction to Britain (Kerney 1999:189). At Holywell Coombe this species occurs in Romano-British and later deposits (zone f, Preece and Bridgland 1998:208). It is very plausible however that *M. cantiana* was introduced to Britain via Kent in the late prehistoric period. In contrast the modern day distribution of the closely related species *M. cartusiana* is restricted to a few sites in the southeast, primarily Kent. It is also considered to be an introduced species, a 'weed' of cultivation during prehistoric times. It once possessed a wider distribution and was more ubiquitous on the North Downs (Kerney 1999:188). At Holywell Coombe it was living in the valley from the Bronze Age onwards (zone e, Preece and Bridgland 1998:203, 208). Both *M. cantiana* and *M. cartusiana* are occasionally present in early and late Neolithic features at White Horse Stone. All however are from deposits where there has been some suggestion of intrusive elements due to the shallow depth of burial and therefore cannot be considered reliable. Neither species was identified in the fills of the deep middle Bronze Age pit 4048 or the late Bronze Age pit 5421. *M. cantiana* does appear however in the Iron Age buried soil in profile C and within several early Iron Age features on the western slopes of the valley. It appears at the base of the buried soil 923 in profile I. Although the dating of this context is a little tenuous, it has been suggested it dates somewhere between the late Neolithic and early Iron Age. *M. cartusiana* is also present in most of these contexts though becomes more frequent in later colluvial deposits and Roman features. Overall this suggests both species of *Monacha* were living within the valley at White Horse Stone from at least the early Iron Age onwards. One notable absence in the later open-county assemblages is *A. secale*. This species, which was frequent in the late Glacial sequence, does not re-establish itself at White Horse Stone despite what appears to be suitable habitats. This was also found to be the case at Holywell Coombe where it was not recorded beyond zone d (Preece and Bridgland 1998:209).

To summarize the later prehistoric sequences at White Horse Stone, the molluscan evidence from the upper fills of the early Bronze Age ditch 4048 on the western slopes of White Horse Stone dry valley suggest that subsequent to the presence of a scrub/woodland environment in the middle Bronze Age there appears to be a phase of disturbance and evidence of bare ground around the feature, perhaps reflecting some attempt to clear vegetation from the ditch, or the increasing proximity of arable and grassland environments. There is a gradual increase in open-country fauna rising to 70% of the assemblage at the top of the sequence where early Iron Age pottery was retrieved. Some shade-demanding elements continue which probably indicate the growth of long grass or scrub in an otherwise dry open environment of grassland and/or arable. The molluscan evidence from the early Iron Age features in this area, support this, containing assemblages of wholly open-country character. There is some variation in small proportions of shade-demanding and catholic species probably related to tall vegetation growing in damp open features such as ditches and gulleys.

The earliest Holocene deposits infilling the main dry valley at White Horse Stone are represented by the extensive buried soil, which directly overlies Pleistocene colluvium. Artefactual material recovered from the upper levels of this soil suggest it was buried some time in the late Iron Age or Roman period. On the whole the assemblages are of open-country character suggestive of extensive grassland and arable environments. There is some variation between the profiles, for example the strong woodland component recorded in profile F adjacent to the Pilgrim's Way trackway as opposed to the open-country assemblages of profiles C and I. One could postulate colluvial deposition and burial of the soil occurred at slightly different times, perhaps earlier in the location of profile F. Erosion may have been significantly more rapid subsequent to scrub clearance in the southeast area of the site as it is at this point that the valley slopes are at their steepest. If this is the case there may have not been enough time for a full open-country fauna to develop before the soil was buried. Alternatively this may represent a real spatial variation in the landscape. Additional samples from the evaluation phase in the vicinity of profile F (Trench 3035) produced a similar woodland assemblage. It has been demonstrated that tree cover was present in close proximity during the infilling of the late Bronze Age from pit 5421 but that bare ground may have existed a little further upslope with inputs of colluvial material into this feature. It is possible some clearance further upslope occurred in the late Bronze Age and on the lower slopes in the vicinity of the Pilgrim's Way trackway perhaps a little later. It has also been demonstrated that the colluviation that resulted in the burial of the soil, at least in profile F occurred not long after this area was cleared and cultivated.

The assemblages examined from the colluvial sequences at White Horse Stone unsurprisingly produced assemblages dominated almost entirely by open-country assemblages. The dating of these sequences is a little tenuous, artefactual dating providing a *terminus post quem* for deposition. There is limited evidence for colluvial deposition prior to the formation of the Iron Age palaeosol in the base of the valley. This is in general concurrence with the molluscan assemblages at least on the lower slopes that suggest some tree cover and relative stability persisted up until the late Bronze Age in some areas. It is difficult to interpret precisely what the fluctuations in the various open-country species signify given the variety of different sources the shells may derive from. There is however evidence for both short turfed grazed grassland and arable environments within the catchment. The very presence of colluvium suggests extensive areas of open bare ground within the catchment. The colluvial sequence examined on the lower slopes (profile C) produced some evidence for environmental change. The lower silty part of the colluvial sequence appears to have been deposited rather quickly given the low numbers of shells. There does however appear to be a trend up-profile to increasing stability with greater shell numbers reflecting a slow down in colluviation, perhaps more extensive grassland areas developing in the vicinity coincident with evidence for Roman activity. This is supported by the assemblages from the Roman features which suggest localised scrub regeneration and the establishment of hedges within some of the ditches, but in an otherwise open environment of predominantly dry grassland. The thin layer of colluvium sealing the Roman ditches within profile C produced sherds of medieval pottery. This in itself suggests a hiatus in the sediment sequence during the Roman period, and renewed accretion associated with medieval activity, although one cannot rule out a later episode of erosion. There is some variation in profile I where the colluvial deposits were much thinner. The molluscan assemblages indicate the predominance of grassland in this location during the period when the Iron Age soil was extant. A late Iron Age-early Roman ditch 863 was recorded truncating the early Iron Age soil at one location suggesting the very base of the valley was not receiving substantial amounts of colluvial material during the Iron Age. Although only undiagnostic prehistoric sherds were retrieved from the lower levels, medieval and post-medieval sherds were recovered from the upper part of the overlying colluvial sequence. Dating of the colluvial sequence in the small dry valley to the south (ARC BFW98) was very limited. Although there was evidence of Roman and Saxon activity on the higher ground these features were not stratified within the sediment sequence. The basal deposit was interpreted as a possible ploughsoil and produced only one sherd of late Bronze Age pottery. The assemblages suggested a similarly very open environment with little evidence of significant landscape change within the colluvial sequence. Similar to profile C, the presence of shade-

demanding species in the ploughsoil attests to a former period when more enclosed conditions prevailed. This suggests the open conditions reflected further up the sequence had perhaps not been established for a substantially long period of time.

5 REFERENCES

- ADS, 2006 CTRL Digital Archive, Archaeology Data Service
[<http://ads.ahds.ac.uk/catalogue/projArch/ctrl/index.cfm>]
- Allen, M J, 1988 Archaeological and environmental aspects of colluviation in South East England, in *Man made soils* (eds Groeman van Waateringe and M. Robinson), BAR International Series **410**, 67-92, Oxford
- Allen, M J, 1992 Products of land erosion and the prehistoric land-use of the Wessex chalk, in *Past and Present Soil Erosion Archaeological and Geographical Perspectives* (eds M. Bell and J. Boardman), Oxbow Monograph **22**, 37-50, Oxbow Books, Oxford
- Allen, M, 2006 Radiocarbon dates from Section 1 of the Channel Tunnel Rail Link, Kent, CTRL scheme-wide specialist report series, ADS 2006
- Bell, M, 1982 The effects of land-uses and climate on valley sedimentation, in *Climatic change in later prehistory* (ed. A.F. Harding), 127–147, Edinburgh University Press, Edinburgh
- Bell, M, 1983 Valley sediments as evidence of prehistoric land use on the South Downs, *Proceedings of the Prehistoric Society* **49**, 119-150
- Bell, M, 1992 The prehistory of soil erosion, in *Past and Present Soil Erosion Archaeological and Geographical Perspectives* (eds M. Bell and J. Boardman), Oxbow Monograph **22**, 21-36, Oxbow Books, Oxford
- Boardman, J. 1992 Current erosion on the South Downs: implications for the past, in *Past and Present Soil Erosion Archaeological and Geographical Perspectives* (eds M. Bell and J. Boardman), Oxbow Monograph **22**, Oxbow Books, Oxford
- Bradshaw, R, and Hannon, G, 1992 Climatic change, human influence and disturbance regime in the control of vegetation dynamics within Fiby Forest, Sweden. *Journal of Ecology* **80**, 625-32
- Bradshaw, R. and Mitchell, F J G, 1999 The palaeoecological approach to reconstructing former grazing-vegetation interactions, *Forest Ecology and Management* **120**, 3-12
- Buckland, P C, and Edwards, K, 1984 The longevity of pastoral episodes of clearance activity in pollen diagrams: the role of post-occupation grazing, *Journal of Biogeography* **11**, 243-9
- Bush, M B, 1993, An 11,000 year palaeoecological history of a British chalk grassland, *Journal of Vegetation Science*, **4**, 47-66

- Bush, M.B and Fenley, J R, 1987 The age of the British chalk grassland, *Nature*, **329**:434-436
- Cameron R A D and Morgan –Huws, D I, 1975 Snail faunas in early stages of chalk grassland succession *Biological Journal of the Linnean Society*, **7**,215-229
- Carter S P, 1990 The stratification and taphonomy of shells in calcareous soils: Implications for land snail analysis in Archaeology, *Journal of Archaeological Science* **17**, 495-507
- Clarke, A F, 1983 The Neolithic of Kent: a review, in *The archaeology in Kent to AD 1500*, (ed Leach P), The Council for British Archaeology Research Report 48, 25-30
- Ellis, C, 1985 Flandrian mollusc biostratigraphy and its application to dry valley infill deposits in East Sussex, in *Palaeobiological investigations: research design, methods and data analysis* (eds N R J Fieller, D Gilbertson and N G A Ralph), BAR Int Ser 266 157-166, Oxford
- Ellis, C, 1986 The Postglacial molluscan succession of the South Downs dry valleys, in *The scientific study of flint and chert* (eds G. de Sieveking and M.B. Hart), 175–184, Cambridge University Press, Cambridge
- Evans, J G, 1966 Late-glacial and Postglacial subaerial deposits at Pitstone Buckinghamshire, *Proceedings of the Geologists Association* **77**, 347-364
- Evans, J G, 1968 Periglacial deposits on the Chalk of Wiltshire, *Wiltshire Archaeological and Natural History magazine* **63**, 12-26
- Evans, J G, 1972 *Land Snails in Archaeology*, Seminar Press, London and New York
- Evans, J G, 1974 Ecological changes induced by prehistoric man at Pitstone, Buckinghamshire, *Journal of Archaeological Science*, **1**, 343-351
- Evans, J G, 1975 *The Environment of Early Man in the British Isles*, London, Elek
- Evans, J G, 1984 Stonehenge, the environment in the late Neolithic and early Bronze Age and a beaker burial, *Wiltshire Archaeological and Natural History Magazine*, **78** 7-30
- Evans, J G, 1991 An approach to the interpretation of dry ground and wet ground molluscan taxocenes from central southern England, in *Modelling ecological change* (eds D R Harris, and K D Thomas), Institute of Archaeology, London
- Evans, J G, French, C, Leighton, D, 1978 Habitat change in two Late-glacial and Postglacial sites in southern Britain: the molluscan evidence, in *The effect of man on the lowland zone*

- (eds S, Limbrey and J G Evans), Council for British Archaeology Research Report 21, 63-75
- Evans, J G, and Smith, I F, 1983 Excavations at Cherhill North Wiltshire, *Proceedings of the Prehistoric Society*, 49, 43-117
- Evans J G, and Valentine K W G, 1974 Ecological changes induced by prehistoric man at Pitstone, Buckinghamshire, *Journal of Archaeological Science* 1, 343-351.
- French, C, Lewis, H, Allen M J, Scaife, R G, Green, M, 2003 Archaeological and Palaeo-environmental Investigations of the Upper Allen Valley, Cranborne Chase, Dorset (1998–2000): a New Model of Earlier Holocene Landscape Development, *Proceedings of the Prehistoric Society* 69, 201-234
- Giorgi, J and Stafford, E (eds) 2006 Palaeoenvironmental evidence from Section 1 of the Channel Tunnel Rail Link, Kent, CTRL specialist report series, ADS 2006
- Godwin, H, 1962 Vegetational history of the Kentish Chalk Downs as seen at Wingham and Frogholt, *Veröffentlichungen des geobotanischen* 37, 83-9 Zurich
- Hayden, C, 2006 The Prehistoric Landscape at White Horse Stone, Boxley, Kent, CTRL Integrated Site Report Series, ADS 2006
- Kerney, M P, 1963 Late-glacial deposits on the chalk of south-east England, *Philosophical Transactions of the Royal Society of London* B246, 203-254
- Kerney, M P, 1977 A proposed zonation scheme for Late-glacial and Postglacial deposits using land mollusca, *Journal of Archaeological Science* 4, 387-390
- Kerney, M P, 1999 *Atlas of land and freshwater molluscs of Britain and Ireland*, Harley books
- Kerney, M P, Brown, E H, Chandler, T J, 1964 The late Glacial and Post glacial history of the Chalk Escarpment near Brook, Kent, *Philosophical Transactions of the Royal Society of London* 248, 135-204
- Kerney, M P, Preece, R.C, Turner C, 1980 Molluscan and plant biostratigraphy of some Late Devensian and Flandrian deposits in Kent *Philosophical Transactions of the Royal Society of London* B291, 1-43
- Macphail, R I, and Crowther, J, 2006 White Horse Stone: Soil Micromorphology, Phosphate and Magnetic Susceptibility, CTRL specialist report series, ADS 2006

- Magurran, A E, 1988 *Ecological Diversity and Measurement*, Princeton University Press, Princeton
- Mellars, P, 1976 Fire ecology, animal population and man: a study of some ecological relationships in prehistory, in *Proceedings of the Prehistoric Society* 42, 15-45
- Peterken, G F, 1996 *Natural Woodland: ecology and Conservation Northern Temperate Regions*, Cambridge University Press, Cambridge
- Preece, R C, 1990 The molluscan fauna of late Devensian loess from Reculver, Kent, *Journal of Conchology* 33, 295-297
- Preece R C, 1992 Episodes of erosion and stability since the late-glacial: the evidence from dry valleys in Kent, in *Past and Present Soil Erosion Archaeological and Geographical Perspectives* (eds M. Bell and J. Boardman), Oxbow Monograph 22, 175-183, Oxbow Books, Oxford
- Preece, R C, 1994 Radiocarbon dates from the ' Allerød soil' in Kent. *Proceedings of the Geologists Association* 105, 111-123
- Preece, R C, 1998 Upper Halling, in *The Quaternary of Kent and Sussex, Field Guide* (eds J B Murton, C A Whiteman, M R Bates, D R Bridgland, A J Long, M B Roberts, M P Waller) Quaternary Research Association, London
- Preece, R C and Bridgland, D R, 1998 *Late Quaternary Environmental Change in North-West Europe. Excavations at Holywell Coombe, South- East England*, Chapman and Hall
- Preece, R C and Bridgland, D R, 1999 Holywell Coombe, Folkestone: A 13,000 year history of an English Chalkland Valley, *Quaternary Science Reviews* 18(8), 1075-1125
- Preece, R C, Kemp, R A, Hutchinson, J N, 1995 A Late-glacial colluvial sequence at Watcombe Bottom, Ventnor, Isle of Wight, England, *Journal of Quaternary Science* 10(2), 107-121
- Rackham, O, 1986 *The History of the Countryside*, J.M. Dent and Sons, London
- Robinson, M A, 2000 Middle Mesolithic to Late Bronze Age insect assemblages and an Early Neolithic assemblage of waterlogged macroscopic plant remains, pp.146-67 in Needham, S.P. (ed.), *The passage of the Thames: Holocene environment and settlement at Runnymede* (Runnymede Bridge Research Excavations 1). London: British Museums Press
- Robinson, M A, 2001 Molluscs, in URS 2001

- Rouse, A J, and Evans, J G, 1994 Modern Land mollusca from Maiden Castle, Dorset, and their relevance to the interpretation of subfossil archaeological assemblages, *Journal of Molluscan Studies* 60, 315-329
- Scaife, R.G., 1982 Late Devensian and early Flandrian vegetation changes in southern England, in *Archaeological aspects of woodland ecology* (eds. Bell M.G. and Limbrey S.), BAR International Series 146, 57-74, Oxford: British Archaeological Reports
- Sharples, N M, *Maiden Castle: Excavations and field survey 1985-6*. Historic Buildings & Monuments Commission for England: English Heritage Report 19:118-125, London
- Simmons, I G, 1996 *The Environmental Impact of Later Mesolithic Cultures*, Edinburgh University Press, Edinburgh
- Simmons, I G, and Innes, J B, 1997 Mid Holocene adaptations and the Later Mesolithic forest disturbance in Northern England, *Journal of Archaeological Science* 14, 385-403
- Stafford, E C, 2006 The geoarchaeology of White Horse Stone and Pilgrim's Way, Aylesford, Kent, CTRL specialist report series, ADS 2006
- Thomas, K D, 1982 Neolithic enclosures and woodland habitats on the South Downs of Sussex, England, in *Archaeological aspects of woodland ecology* (eds S Limbrey and M Bell), BAR Int Ser 146 147-170
- Thomas, K D, 1985 Land snail analysis in archaeology: theory and practice, in *Paleobiological investigations: research design, methods and data analysis* (eds N R J Fieller, D D Gilbertson, and N G A Ralph) British Archaeological Reports International Series 266, 131-156 Oxford
- Thorley, A, 1971 Vegetational history of the Vale of Brooks, Institute of British Geographers Conference, 5, 47-50
- Thorley, A, 1981 Pollen analytical evidence relating to the vegetation history of the Chalk, *Journal of Biogeography* 8, 93-106
- Vera, F W M, 2000 *Grazing Ecology and Forest History Oxfordshire*, Cabi Publishing
- Whitehouse, N J, and Smith, D N, 2004 Islands in Holocene Forests: Implications for Forest Openness, Landscape Clearance and Cultural Steppe Species, *Environmental Archaeology* 9, 199-208

- Wilkinson, K N, 2003 Colluvial deposits in dry valleys of Southern England as proxy indicators of palaeoenvironmental and land-use change, *Geoarchaeology* 18, 725-755
- Williams, C T, 1985 *Mesolithic exploitation patterns in the Central Pennines: A palynological Study of Soyland Manor*, BAR British Series 139, Oxford, British Archaeological Reports
- URS, 2001 White Horse Stone, Aylesford, Kent (ARC WHS98): Detailed archaeological works assessment report, unpubl. report prepared by OAU for Union Railways (South) Limited, in ADS 2006