University of Reading

The Landscape and Ecology of the Anglo-Saxon Conversion: a multi-proxy environmental and geoarchaeological contexturalisation of the high-status settlement at Lyminge, Kent

PhD Archaeology

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Declaration of original authorship

Declaration: I confirm that this is my own work and the use of all material from other sources has been properly and fully acknowledged.

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Abstract

This thesis presents an environmental contexturalisation of the high-status Anglo Saxon settlement at Lyminge in Kent. This site is of national and international importance in understanding the developmental trajectory of high-status centres in England across the Anglo-Saxon conversion to Christianity, with an occupation sequence spanning the 5th to the 11th centuries A.D., incorporating a 7th century 'great hall complex' which later developed into a royal monastery. The integrated palaeoecological and geoarchaeological investigation in this thesis is rare for Anglo-Saxon sites, particularly for downland landscapes long considered to have limited palaeoenvironmental potential.

A diverse range of both on and off-site datasets are investigated, including Mollusca, pollen, geomorphology and sediment micromorphology. Such a diversity of evidence generates an analytical framework compartmentalised by scale into on-site, catchment and regional perspectives, providing a high degree of interpretative robustness. Sources of evidence include occupation contexts, off-site lynchet sequences and, most importantly, a series of paleochannels and organic deposits containing evidence for wood working, livestock management and cereal cultivation. It is rare to find organic preservation in association with an Anglo-Saxon rural settlement and this is the first time that such a sequence has been analysed in association with a known Anglo-Saxon royal and monastic centre.

The results demonstrate stability in land management and vegetation history from the late Romano-British to the medieval periods. Continuities of territory and resourcing are demonstrated which pre-date and define the development of landscapes during later periods. This evidence is employed to critique previous models of landscape economy and estate development, challenging the assumed relationships of Kentish settlements to pre-Anglo-Saxon geographies and contemporary biomes. These findings demonstrate both the high degree of continuity exhibited by Anglo-Saxon subsistence economies across the conversion period in Kent and the antiquity of later monastic estate territories. The depth of analysis demonstrates the importance of integrating individually fragmentary ecological and geoarchaeological datasets with excavation records in order to contexturalise archaeological interpretations.

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Chapter 1 - Research Rationale and Previous Work

1.1 Introduction

The aim of this thesis is to undertake an integrated study of the landscape and ecological context of the early to middle Anglo-Saxon royal settlement at Lyminge, Kent, across its entire history of occupation. This site, located 8km inland from the coast in the Kent Downs at the head of the valley of the river Nailbourne (British National Grid Reference: TR 16107 40861), demonstrates a rare continuity of occupation deposits from the 5th/6th to the 12th centuries A.D. with a high resolution of phasing from artefact and radiocarbon dating (Thomas, 2013; Thomas, 2017). The contiguous occupation sequence began with a 5th century settlement which developed into a royal 'great hall complex' and estate centre in the 7th century and later became a significant early monastic foundation in the 8th (Thomas, 2013; Thomas, 2017; Blair, 2005: 186, 277). The archaeology of this sequence along with the associated early medieval historical sources for the site is fully outlined in Chapter 2.

Given that the fundamental economic underpinnings of such high-status Anglo-Saxon sites were both agricultural and local, a robust understanding of their landscape contexts has long been highlighted as a pronounced need (Arnold, 1988: 17). Nevertheless as Hamerow (2012: 9) has recently highlighted, many significant syntheses of the settlement archaeology of this period have overwhelmingly focussed on "flagship" sites investigated decades ago, with little in the way of broader-scale contextural analysis having been advanced in the interim.

This study aims to enhance understanding of the ecological and economic frameworks within such settlements operated, using a diverse range of scientific techniques, including many which are rarely applied to these sites (section 1.2). Collated analysis of the resultant data will allow deeper contextural interpretation of a range of ecologic and economic processes covering the full range of cultural periods present in the site archaeology (Chapter 2). This analysis will be presented at a range of scales as determined by the resolution of the various proxy methods being collated (Chapter 3) from the on-site and microscale, to the local environmental catchment and out to the wider regional landscape. This will enable a logical progression of inferences in the interpretation allowing development of an environmental narrative for the site as well as examining thematic questions currently posed to the periods represented in the archaeology (section 1.3). Such an integrated and highly diverse scientific methodology when framed against previous work on sites of this period can be seen to represent an unusual approach, offering ample potential for new perspectives.

1.2 Methods and approaches to Anglo-Saxon settlements and landscapes

In Britain, the wider landscape context of early medieval settlement development has traditionally been investigated through a combination of archaeological survey, extensive open-area excavation and historical research from documentary sources (Hamerow, 2002: 121). This approach has only developed in any coherence since the 1970s, prior to which the investigation of Anglo-Saxon settlements was largely confined to the investigation of buildings with little attempt to examine even the settlement layout or development (Hamerow, 2012: 67). This limited perspective has created widely acknowledged difficulties in developing an understanding of landscape and settlement dynamics (Hooke and Burnell, 1995: 18), as well as an artificial separation of material culture from questions of environment and landscape which has resulted in many writers calling for new perspectives (e.g. Reynolds, 2009) and greater regional granularity (Rippon *et al.*, 2014).

Alongside this body of data from settlement excavations, a more holistic “landscape” archaeology in Britain has developed from a tradition of geographical surveys by early writers such as Fox (1923) who sought to understand distributions of sites in relation to topography, geology and to some extent regional ecology. Other writers such as Hoskins (1955) advanced a dual historical and geographical approach to landscape development which sought to enhance the geographical interpretation with a sociological element. Many other landscape studies have been constrained by a more restricted methodology, based upon either historically confined (e.g. Hooke, 1985) or geographically deterministic models (e.g. Evans, 1975: 158-160) which from a modern viewpoint can be critiqued in their lack of a multi-disciplinary perspective.

The addition of data from systematic and wide-ranging fieldwalking surveys represented a distinctly new archaeological approach to what had previously been a largely geographical or historical tradition. These studies quantified the distribution of surface collected and dateable material culture across wide areas, effectively moving landscape investigation beyond a simple reliance on a limited selection of pre-identified monuments. In England such approaches have been applied to mapping landscapes of Anglo-Saxon settlement, particularly in areas such as the East Midlands, where questions about the origins of villages and field systems could be addressed by plotting dateable pottery scatters as a proxy for settlement development (Rippon, 2008: 8-9; Foard, 1978). These types of fieldwalking surveys have also been more widely used in other parts of Europe within different traditions of landscape studies which examined a range of cultural and chronological trajectories. By way of example, the Als project in Demark (Sørensen *et al.*, 2001) examined the landscape history of an entire island using a methodology with cultural, teleological and social experience at its core. This type of work can be viewed to contrast with the more functional themes which often characterise English studies.

Today the geoarchaeological investigation of sediments, terrain, hydrology and topography are widely and almost universally recognised as approaches to the study of a site in its landscape context (Renfrew and Bahn, 1996: 217). The integration of geomorphological and archaeological investigation is also becoming increasingly important in investigating holistic long-term settlement dynamics for entire landscapes with long histories of habitation (Boyer *et al*., 2006: 675). This approach has become prominent to the point that some recent wide-area investigations have defined their archaeological study areas and research remit entirely on the basis of geomorphological parameters (e.g. Booth *et al*., 2007; Crowson *et al*., 2005). These investigations are highly empirical and include a diversity of techniques offering the potential for investigations at a wide range of scales from a basic auger or borehole survey to analytical methods including particle size, magnetic susceptibility, organic content and geochemistry (summarised in Goldberg and Macphail, 2006).

Environmental approaches to settlement archaeology within a wider landscape context utilise two scales of evidence; macro scale to generate a broad picture (such as pollen) and micro scale to provide a highly localised evidence at various levels (using proxies such as plant macrofossils or molluscs) (Evans, 1972: 4). Additional considerations of resolution of scale are apparent between types of catchments, with a longer-term and wider-area record generally being provided by off-site records from bogs and lakes compared to the shorter-term record from on-site sequences (Bell, 1989: 269). The availability of these proxies at any site fundamentally determines the methodological approach that can be taken in undertaking paleoenvironmental study (Evans, 1972: 3). Furthermore, the wide range of data produced by such studies requires careful appraisal of the individual available methods used to ensure that the relative strengths and weaknesses of each are balanced appropriately to most effectively investigate the available record. This type of overlaid or mixed-method analysis can provide greatly enhanced results for many different types of scientific archaeological investigations (Canti, 1995).

The development of such scientific approaches has been overwhelmingly driven by work on prehistoric environments, a situation attributed by Evans (1975: 164) to the perception that written records rendered further methods unnecessary in the study of environments after the mid first millennium A.D. More recent critiques of this perspective by Bell (1989), Bell and Dark (1998), Dark (2000) and Rippon (2009) have concluded that greater prominence needs to be placed upon geo- and bio-archaeological methodologies at different scales of resolution, particularly from off-site sequences, which can help contexturalise early medieval settlement sites within the landscape.

Application of these paleoenvironmental techniques requires a systematic and broad-spectrum sampling of varieties of economic and environmental evidence that until the 1960s was rarely collected, even from on-site catchments. Consequently archaeological methodologies of this type have only developed within the last fifty years (Booth *et al*., 2007: 10). Application of palynological methods to early medieval archaeology has been particularly slow, in part due to a common misconception that pollen sequences are generally limited to prehistoric horizons relevant to questions of Quaternary research (Evans, 1975: 164). Despite this perception however, a small number of off-site regional pollen sequences do exist in south-east and east England covering the early medieval period, with Epping Forest in Essex, Hockham mere in Norfolk and Amberley Wild Brooks in Sussex being probably the best known examples (Dark, 2000: 140-142).

Today, whilst investigation of off-site sequences in relation to the wider contexts of early medieval settlements and landscapes is still unusual, environmental sampling of on-site contexts for paleoecological remains is now routine in Britain. Many excavations which have emerged as site types for Anglo-Saxon settlement studies such as Yeavering in Northumberland or Mucking in Essex, were undertaken before the routine application of environmental sampling (Hamerow and English Heritage., 1993; Hope-Taylor, 1977). Moreover, in comparison to modern standards, the quality of the data recovered from the few early examples of sites subject to environmental sampling is patchy and inconsistent (e.g. Rickett, 1995: 140-141; vs. Ayala *et al*., 2015). Bell (1989) has previously commented upon the poor research design evident from these projects which has left a legacy of limited availability of environmental evidence. This is apparent in many published early medieval sites in Britain where paleoenvironmental data is either completely ignored within the remit of the research, or where the lack is acknowledged but not addressed (e.g. Lane and Campbell, 2000: 6).

Despite this slow development, applications of paleoenvironmental methods at early medieval sites in the 1980s and 1990s did prove valuable, particularly where a palimpsest of pre-medieval and early medieval features allowed good comparative sequential samples to be recovered. In the case of Mucking, the lengthy duration of the project even allowed a retrospective application of newer paleoenvironmental methods during the project lifespan to determine evidence for disruption in occupation prior to the mid 5th century A.D. from boundary ditch sequences (Hamerow, 2012: 15). A major project during the 1980s at Barton Court Farm in Oxfordshire made a notable early use of environmental data from waterlogged Roman and early medieval deposits from on-site well catchments, to produce a long-term history of environmental change and agricultural continuity (Booth, 2007: 29). This integrated approach was, at the time, fairly unusual and only made possible by the presence of waterlogged well deposits on what was otherwise a dry terrace site.

Subsequent research at the nearby site of Yarnton utilised data from both off-site and on-site catchments and brought the interpretation of landscape processes into the centre of the research agenda (Hey, 2004: 18). Researchers here utilised a range of proxies including charred and waterlogged plant macrofossils, pollen, Mollusca and Coleoptera from dated Archaeological features and nearby paleochannel deposits (Hey, 2004: 251). The combined data from this work demonstrated a continuity of open agricultural landscapes across the mid to late first millennium A.D. with no woodland regeneration prior to the Saxon phase (Booth, 2007: 29). Additionally a geoarchaeological assessment of the sequence from paleochannels in the wider study area provided evidence for changing sedimentation and alluviation rates associated with changing intensities of regional anthropogenic activities (Hey, 2004: 381; Booth, 2007: 18-20). This combined approach allowed mutually supporting lines of evidence to be brought together for the purposes of landscape and environmental reconstruction across all phases of the archaeology (Hey, 2004: 393).

Applications of geoarchaeological and environmental analysis in isolation have also proved useful at monastic sites, particularly with regard to understanding of the role of ecclesiastical and other early administrative centres in the development of political regions and territories (Blair, 2005: 2, 252). The use of borehole surveys for landscape reconstruction at Jarrow and Monkwearmouth in the 1950s perhaps provides one of the first examples of this type of work (Cramp *et al*., 2005). This was complemented half a century later with wide area geological survey and pollen sequences from both on and off-site catchments, as well as extensive use of GIS for data synthesis (Turner, 2013: 113-114). Other projects have applied such methods on a more extensive basis as a basis for contexturalising early monastic sites; one successful example being the rescue investigations undertaken at Brandon, Suffolk, in the 1980s (Carr *et al*., 1988). Here investigations of a Middle Saxon monastic settlement on an alluvial island were conducted with a focus on the geomorphological and economic context through wide area excavation and relatively intensive paleoenvironmental sampling, the consequence of which was an (at the time) unprecedented recovery of the layout of a small, lowland monastic settlement (Blair, 2005: 206). More recent investigations at the major Anglo-Saxon site of Bloodmoor Hill (Lucy *et al*., 2009) used geological survey and environmental data to provide an interpretation of wider settlement economy and potential agricultural hinterlands. This project, along with other comparable work at Flixborough (Loveluck, 2007: 70), and the Viking encampment and Saxon *burh* at Torksey in Lincolnshire (Hadley and Richards, 2013), have placed the environmental and geoarchaeological context at the forefront of their investigative agenda.

Expanding upon site-specific studies, several projects beginning in the 1980s advanced a more holistic approach to settlement and landscape. The Shapwick Project in Somerset was one of the first to successfully attempt this by combining a wide range of traditional archaeological survey approaches with geological, geochemical, geophysical, and paleoecological investigations (Gerrard and Aston, 2007, Aston and Gerrard, 2013). This study produced a comprehensive multi-proxy study of the archaeology of a village core and its periphery, allowing the evaluation of various techniques and models with which to investigate the origins and development of nucleated medieval villages (Gerrard and Aston, 2007: 9). The conclusions of this major undertaking were published with the authors' *caveat* that no interdisciplinary and multi-proxy study of this type can "ever be more than partial" (Gerrard and Aston, 2007: 7). Whilst it is clear that the wide variety of methodologies used within this landmark project have much to offer in addressing the themes of the present research, it is perhaps pertinent to note the obvious limitation that studies of such scale necessarily require decades of time and hundreds of researchers (Turner, 2013: 13).

At Raunds in Northamptonshire a wide-area multi-period project in the 1980s investigated a number of sites with a range of research aims including the investigation of Late Saxon village development (Higham and Ryan, 2010: 8; Chapman, 2010; Parry, 2006). This project approached the landscape context of settlement using a range of mutually supportive methods which allowed the development of field systems and Anglo-Saxon agricultural strategies to be examined (Parry, 2006: 236). As part of this agenda/programme, a waterlogged environmental sequence was combined with the results of a multi-proxy environmental analysis from dry ground contexts (Chapman, 2010: 8, 427-428). This work was complemented by geoarchaeological investigations of the hydrogeology and changing fluvial patterns in the wider landscape of the Nene valley across a broad timescale from the lateglacial onwards (Brown, 1997: 193).

Developer-funded excavation resulting from legislation such as PPG16, PPS5 and, more recently, the NPPF (DCLG, 2012) has been critical to the development of multi-proxy archaeological landscape investigation in Britain over the past thirty years Data resulting from these excavations sometimes encompasses entire landscapes and in some cases has been used to generate a total assessment of impact on regional heritage resources (Philips *et al*., 2009: 7-9). As such, commercially-driven archaeology has been cited by Hamerow (2012: 9) as an excellent source of information from which to investigate the chronological, spatial, ecological and economic questions raised by academic studies of Anglo-Saxon settlements, particularly with regards to their relationship to earlier Romano-British and later medieval landscapes. English examples of these types of projects have often been generated by aggregate extraction or other large development projects in lowland alluvial landscapes such as the Blackwater Valley, Essex (Wallis and Waughman, 1998) and the Bourn valley, Cambridgeshire (Abrams and Ingham, 2008), often in areas with no previous record of prospection. Scientific methodologies in the last twenty years have expanded from sampling carbonised plant macrofossils and pollen from on-site catchments to the incorporation of diverse geoarchaeological evidence from the peripheral area (Wallis and Waughman, 1998: 196, 227), more recently utilising GIS as a method of correlating data and interpretations (Abrams and Ingham, 2008: 101). Such work has also been instrumental in advancing an integrated multidisciplinary approach to academic archaeological landscape research, using a “seamless” approach to incorporate evidence from a wide range of contiguous environments with a heavy reliance on the use of GIS for data management (Allen and Gardiner, 2000: 4, 276).

These broad-scale approaches have been well represented in Booth *et al*’s (2007) synthesis of archaeological investigations across the Upper/Middle Thames valley, where paleoenvironmental and geoarchaeological evidence from a large number of individual sites have been collated to investigate regional paleohydrology and the cause and effect relationship between changing agricultural regime, erosion and alluviation. The extensive study area, covering the catchment of the river from its source near Cirencester to the start of the tidal zone at Teddington, provided an unusually rich record of site information and proxies from which to generate landscape reconstruction and analysis across on a macro scale. It is perhaps key to note that although individual excavations within the study did not, on the whole, utilise a wide diversity of proxies, the totality of data allowed collective interpretations to be developed across the region. Such wide-ranging investigations of necessity examines a fundamentally different scale both spatially and chronologically to that of the site-specific work; however the synthesis of both can be achieved through investigation of cultural and material responses at site level to hydrogeological events occurring at the landscape level, such as changing flood regimes (Brown, 1997: 299).

Similarly large-scale developer-funded multi-proxy investigations have also been undertaken in Ireland, for example at sites such as Newrath, county Kilkenny, where periodic wetland encroachment and regression from the Mesolithic onwards preserved an extensive paleoecological dataset including pollen, diatoms, foraminifera and plant macrofossils (Wilkins, 2010: 18). Across the British Isles the academic legacy of these huge research projects is relatively recent, a situation which contrasts markedly with other parts of northern Europe, particularly the Low Countries, where similar approaches have been employed for some considerable time (Heidinga, 1987). This more central role for environmental and geoarchaeological approaches in Dutch medieval archaeology has been attributed to the dynamic role played by land reclamation in the region’s agricultural and settlement history (Groenman-van Waateringe and Wijngaarden-Bakker, 1987: 2). The results of such work have served to highlight the extent to which lowland geomorphological processes such as floodplain alluviation and deposition of windblown sand shape long-term settlement patterns and site distributions across areas such as Hardinxveld in the Rhine-Meuse delta (Mol, 2003) and at

Kootwijk (Heidinga, 1987) in the Netherlands. The importance of understanding such site formation processes within these landscapes exemplified by the long occupation sequences preserved in the form of settlement mounds (terpen) along with concentrations of environmental evidence in the more geomorphologically stable parts of the landscape such as islands and ridgelines.

Common to all of these landscape-scale projects is a diverse array of proxies preserved in the waterlogged alluvial or marshland environments widely encountered in low-lying regions. Such arrays of proxies have also become the basis of comparable studies undertaken in British wetland environments such as the Welland Valley (French, 2003). These types of deposits, typically preserved in paleochannels, mires, alluvial formations and buried soils, when analysed from a range of sites across a wide area provide an opportunity to test models of settlement evolution in a way rarely possible in research projects with more limited resources (Gdaniec *et al*., 2007: 3). A recent study by Crowson *et al* (2005) in eastern England, has shown how more tightly focussed investigations of the specific relationship between settlement networks and landscape can be enhanced by such a diversity of wetland paleoecological proxies. Here, co-ordinated analysis of plant macrofossils, Foraminfera, Mollusca and a wide variety of terrestrial, avian and aquatic animal remains across ten different settlement sites, enabled detailed conclusions to be drawn about environmental transitions. This work demonstrated the direct application of paleoecological and geoarchaeological methods to social and economic questions, allowing pre-existing ideas of early medieval wetland land-use, resource exploitation and land reclamation to be empirically tested (Crowson *et al*., 2005: 290; Murphy, 2010: 212-213).

Despite such advances, application of these methodologies and any broad-spectrum investigations of ecology and environment are more problematic when applied to purely dry-land archaeological landscapes, particularly in chalk downland areas. Characterised by dry valleys and seasonal watercourses without permanent bodies of standing water, chalkland environments rarely provide conditions suitable for the preservation of organic archaeological material (French 2003: 64). Consequently, Geoarchaeological and paleoecological approaches in such areas are often restricted to colluvial sequences in dry valleys or lynchets without any useful input from pollen records (Evans, 1972: 4). In such circumstances, studies of long-term land-use suitable for correlation with settlement investigations are often restricted to a few proxies such as Mollusca which survive well in calcareous and aerobic sediments (Wilkinson, 2003: 725).

Nevertheless some successful paleoecological studies of landscape change and geomorphology have been integrated into studies of Anglo-Saxon downland sites, such as the great hall complex at Cowdery's Down where sequences from Romano-celtic field boundaries were instrumental in demonstrating subtle environmental transitions from arable to pasture-dominated landscapes following the establishment of the overlying Anglo-Saxon settlements (Millett and James, 1983; Bell, 1989). Similar methods have been successfully applied by Bell to colluvial sequences at the early Anglo-Saxon settlement at Church Down and the later Anglo-Saxon and medieval settlement at Chalton, Hampshire, to examine landscape history, cultivation patterns and environmental change from the pre to post settlement phases (Bell, 1989: 279). At Bishopstone in Sussex, several paleoenvironmental studies of the dry-valley sedimentary sequences in the landscape around the settlement site have been undertaken using borehole transects and test pitting to provide molluscan and geoarchaeological data (Thomas, 2010; Bell, 1989). This has proved particularly valuable with regard to improving the understanding of the economic relationship of the site to the coastline as well as the changing patterns of agriculture in the surrounding landscape (Thomas, 2010: 15).

It also remains the case that a majority of Anglo-Saxon settlement investigations have been conducted with limited recourse to geoarchaeological methods at the microscale, specifically micromorphology and associated methods such as electron microscopy. This picture is beginning to change, with studies at sites such as Flixborough in Lincolnshire demonstrating employment of more sophisticated analytical methods for investigations of taphonomy and site formation processes as well as indications of human activities within deposits (Loveluck and Atkinson, 2007). Such investigations when used in isolation are poorly suited to questions about landscape development and site economy, being more usually confined to research questions relating to specific deposits. As at Flixborough, limitations on the physical extent of the sampling may also raise issues of representivity regarding the scaling of interpretations of specific microscale site formation processes to conditions prevalent across the wider area (Loveluck and Evans, 2011: 16).

Investigations at the major settlement site of Bloodmoor Hill in Suffolk have used such microscale geoarchaeological techniques to investigate particular research questions relating to onsite catchments; specifically micromorphological investigation of sunken-featured building fills (Lucy *et al*., 2009: 152-153). This work was intended to provide insight into building structure and function by investigating evidence for primary occupation unobtainable by more conventional methods (Lucy *et al*., 2009: 160). Additionally it was used to provide the insight into fill composition and the anthropogenic inclusions recognised as critical to understanding their deposition (Tipper, 2004). Reviews of micromorphology as an analytical approach to the fills of sunken-featured buildings by Tipper (2004) and Macphail *et al* (2006) have illustrated its value in determining compositional character and evidence for function, structure and post-depositional transformations at a number of early medieval English and Scandinavian sites. However, other micromorphological investigations conducted in isolation have also proved highly inconclusive in resolving similar research questions (e.g. Heathcote, 2003). Leading practitioners such as Milek (2012) are further developing this technique to investigate the question of use of space on early medieval sites, specifically when original floor surfaces can be identified. Such work draws on wider applications of micromorphology to occupation surfaces (e.g. Matthews, 1995).

Applications of soil micromorphology to questions of wider landscape processes have also been attempted, albeit rarely on Anglo-Saxon sites. However successful examples exist from other periods such as analysis of tree-throw features as evidence for early Neolithic land management at Raunds (Robinson in Parry, 2006: 32) and analysis of Romano-British agricultural activity and trackway deposits at Baldock, Hertfordshire (Macphail and Crowther in Philips *et al.*, 2009: 122-123). French (2003: 152) has also used the technique more expansively to demonstrate changing patterns of agriculture at a regional scale in the Cambridgeshire fenlands. Application of this methodology to broader landscape processes is therefore clearly achievable, however challenges due to the small scale of sample representation and the consequent need for appropriate research frameworks remain (French, 2003: 92).

An approach often associated with this technique has been the use of geochemical assay, particularly of heavy metal elements, to assess patterns of enrichment or depletion of species resulting from anthropogenic activities. Use of this technique in isolation has demonstrable issues, not least of which is the complexity of the geochemical interactions within the soils and the geology and the poor understanding of the archaeological interpretations (Jackson in Gerrard and Aston, 2007: 200). Recent empirical work by Wilson *et al* (2009) among others, has stressed the coherence of elemental enhancements resulting from common occupation processes across sites, as well as the profound *caveats* to interpretation required by quantitative variations in scale and the issue of equifinality. Nevertheless, several studies have sought to utilise such geochemical survey methods to contexturalise use of space within settlements; some such as Misarti *et al*'s (2011) study of multi-element geochemistry have demonstrated resolution of midden and floor areas from the natural background. Other studies at settlement sites such as Shapwick in Somerset (Gerrard and Aston, 2007) have proved inconclusive in wide-area applications. Undoubtedly the most successful applications of this methodology have been in combination with other proxies, particularly micromorphology, which allow geological and anthropogenic variables influencing distribution of geochemical species to be more objectively examined (e.g. Milek and Roberts, 2013).

From the overall synthesis presented in this section it can be generally surmised that Anglo-Saxon settlement sites have, to date, largely been investigated with settlement core excavations sometimes contexturalised within broader-scale surveys of historical sources and placename evidence. This approach has resulted in a systematic lack of environmental analysis and a need for greater understanding of the relationship of settlements to landscape contexts. Advances in methodologies in the last fifty years resulting from both developer-funded and academic projects, have created a wide range of potential strategies to address this deficit, ranging from wide-area landscape surveys, to microscale approaches to occupation contexts. This thesis will consequently draw upon a diverse range of methods (Chapter 3) in order to advance interpretations of one highly significant site relating to a range of broader themes (section 1.3).

1.3 Key research questions and conceptual models

Conceptual approaches to landscape, ecology and settlement in archaeology at the broadest level have alternated between environmental determinism and viewing landscapes as a cultural construction. Contemporary approaches tend to view a relationship lying somewhere between these polarities, as a product of both cultural and environmental factors which regard landscapes as “the very substance of archaeology” (O'Connor, 2009: 11). Despite this prevailing view, the general process of contexturalisation of Anglo-Saxon settlements has been criticised for its tendency towards fragmentation and a failure to embrace a multidisciplinary approach (Reynolds, 2009). The rise of post-processual and post-modern theoretical frameworks has also resulted in general trends of interpretation leading to the downplaying of environmental influences on the distributions and formation of Anglo-Saxon settlements in England (Williamson, 2010: 133). The contemporary picture has seen a critique of these perspectives with recent work by Williamson (2010: 154) highlighting how investigations of settlement dynamics need to incorporate a full range of environmental and topographical contextural frameworks in order for the true extent of their significance to be realised.

There has been a lack of research on cognitive aspects of the landscape such as communications routes, boundaries and viewsheds (Reynolds, 2009) which were often completely ignored as being impossible to establish or date archaeologically (Hindle, 1993: 17 & 48). Today such perspectives are recognised as creating a need for new ways of engagement to move beyond textural sources and the restrictions imposed by the limited availability of archaeological evidence (Hooke and Burnell, 1995: 13). This consensus began to be radically challenged during the 1980s by new research which highlighted continuities as well as localised diversity over models of wholesale regression in the countryside (Rippon, 2000: 47).

It is a central proposal of the present research that an understanding of the landscape history and environs of rural high-status settlement sites such as Lyminge requires full consideration of a wide range of geoarchaeological, biological and topographical evidence (Bell and Walker, 2005: 245). These interpretations must also take into account broader cultural factors, some of which are specific to high status sites, which have influenced how landscapes were exploited, valued and perceived by populations in the past. Over the last thirty years these broader research questions have developed along the lines of period-specific themes of agricultural continuity, economic intensification, settlement development and the emergence of state and religious institutions (Hamerow, 2012: 9) which provide a more general framework within which the research questions of the present thesis can be posed (sections 1.3.1 to 1.3.3).

1.3.1 Romano-British continuity and the formation of Anglo-Saxon cultural landscapes (5th-6th centuries A.D.).

A long standing theme within research on English landscape has been the question of continuity and change between the late Roman and early Anglo-Saxon periods. Previous models of Anglo-Saxon and settlement in England have envisioned a pronounced shift between the Roman and Anglo-Saxon periods with little in the way of continuity being evident (Gerrard and Aston, 2007: 3). Hoskins (1955) in particular entrenched this idea with a widely received picture of universal population collapse, abandonment and reforestation of agricultural areas following the Roman period. The result was that Anglo-Saxon settlers became fossilised in the literature as agents of profound environmental change; actively clearing an unexploited or regenerated wooded landscape to establish the dominant field and village layouts which remained until the changes wrought by post-medieval enclosure (Higham and Ryan, 2010: 2).

A prominent focus of current and previous models of this transitive period has been the question of environmental continuity, which has been approached by both broad syntheses (Bell and Dark, 1998; Rippon *et al.*, 2015) and site-specific studies (e.g. Bell, 1977). Alongside this theme is the associated question of agricultural continuities between late Roman and early medieval systems, particularly in densely settled areas such as south and east England (Hinton, 1990: 2, 10). Recent research has driven a more environmentally focussed approach to these topics (Dark, 2000) by placing the interpretation of paleoecological sequences at the heart of the contemporary research agenda (Rippon *et al.*, 2015; Rippon *et al.*, 2013).

Current research on landscape structure has progressed toward recognition of the diversity of regional developments, in particular the influence on emergent estate layouts from antecedent Romano-British field systems. This approach has developed out of a realisation that previous interpretations of the Romano-British landscape have been simplistic in comparison with the more complex regional characterisation which has long been applied to the medieval period (Rippon *et al*., 2013). Other studies have demonstrated the formative influence and continuity of Romano-British estate structures and field systems within the later medieval pattern in areas such as the midlands (Roberts *et al*., 2002).

The early Anglo-Saxon agricultural regimes operating within these field systems are regarded as demonstrating a general decrease in intensity from the Romano-British pattern, both from archaeological evidence on a site by site basis and landscape surveys showing the partial retraction of arable activities and settlement to areas of lighter soils in the 5th century (Hamerow, 2002: 152). The crop regimes throughout this period of transition are typically characterised by a transition from the cultivation of the hulled wheats favoured in Romano-British period (spelt and emmer) in favour of barley and free-threshing bread wheat during the early Anglo-Saxon period (McKerracher, 2014; Hamerow, 2002: 153).

The earliest Anglo-Saxon or post-Roman settlements in south-eastern England are archaeologically characterised by clusters of distinctive earth-fast timber post built structures and sunken featured buildings of a type which demonstrates clear continental influences (Hamerow, 2012). These settlements can be contexturalised as part of a broader tradition evident throughout north-western Europe; in England they are typically characterised by frequent episodes of rebuilding with dispersed, unbounded layouts demonstrating a high degree of variation and little evidence of centralised planning (Hamerow, 2012: 70). Such early settlement sites typically demonstrate a lack of spatial correlation to precursor Romano-British structures, but do indicate continued use of Romano-British farmland (Hamerow, 2012: 15) which has led to interpretations of continuities of estates in areas of early settlement such as Kent (Everitt, 1986: 341). Significant examples of this trend are seen at West Stow (West, 1985: 160) and Mucking (Clark and English Heritage., 1993: 21) where the early Anglo-Saxon structures were built without reference to earlier Romano-British farmsteads in the area and, in the case of Mucking, after several centuries of landscape abandonment and scrub regeneration. At Carlton Colville, an apparent orientation of the early Anglo-Saxon structures on Romano-British trackways and field systems is evident suggestion of possible continuity of landscape usage, however again there is a gap of several centuries between these occupation phases (Lucy *et al*., 2009: 37). This disjuncture between continuity at the site and regional level has been noted by previous studies covering this period such as Everitt (1986: 13) and directly investigated in more recent work such as Rippon *et al*. (2015).

1.3.2 Middle Saxon transformations (7th -9th centuries A.D)

This formative period is associated with growing social complexity, political centralisation and the consolidation of kingdoms. The emergence of these was accompanied by an intensification and increasing specialisation in farming and resource extraction and the beginnings of a major reconfiguration in settlement patterns, termed the “Middle Saxon shuffle”, which has been postulated as the likely origin for medieval settlement and landscape structures in areas such as the Midlands and East Anglia (Williamson, 2003; Foard and Brown, 1998). These developments drove processes of agricultural intensification, technological innovation and expanding trade leading to new economic interactions and the foundation of new types of trading settlement (*wics*) and distinctive high-status settlement types during the early 7th century in the form of great hall complexes and monastic centres. Models of landscape organisation across this period emphasise development from the relatively flat settlement hierarchy and low level, unspecialised rural economy seen in the early Anglo-Saxon period towards centralised collections of resource territories known as “multiple” estates (Faith, 1997: 11). This period consequently represents an era of profound change in society and landscape, which has been characterised at its broadest level in terms of regional diversities in land-use (Rippon *et al*., 2013), agricultural intensification and the role of monastic estates within the critical period termed the “Long eighth century” (Thomas, 2016; Rippon, 2010).

Models of the development and distribution of settlements within this period have focussed on economic networks and the primacy of influence from geological factors such as soil types and watershed topographies (Williamson, 2012) or the relationships with ecological areas and antecedent communications networks (Everitt, 1986; Brookes, 2010). Relatively few attempts have been made to ground individual excavations of Anglo-Saxon settlements within these wider narratives of landscape development, or to use paleoenvironmental or geoarchaeological techniques to examine them. Notable exceptions to this exist at sites such as Yarnton, Oxfordshire (Hey, 2004) and Raunds, Northamptonshire (Parry, 2006; Chapman, 2010)(section 1.2) where a more holistic perspective has been employed to ground the Anglo-Saxon occupation within longer chronologies of environmental change. More broadly, the study of landscapes within this period comprises a tradition of investigations of emergent settlement dynamics at a regional scale (Rippon, 2008). Within this tradition a diverse range of approaches have been employed with methodologies variously focussing on ecological zones (Everitt, 1977), topography and soils (Williamson, 2003), charters and documentary evidence (Hooke, 2000; Rackham, 1986) and the spatial distribution of diagnostic material culture (Foard, 1978).

Some empirical generalities have been proposed as influences on the distribution of middle Anglo-Saxon high-status settlements, most notably their spatial correlation with areas of prime agricultural land and fertile soils near rivers (Aston, 1986: 53). Similarly, the wider networks of associated contemporary satellite settlements such as emporia or *wics* which demonstrate the emergence of new trade and economic structures, have been observed to be distributed according to topographical and geographical considerations of communication and transport (Brookes and Harrington, 2010: 84-85). For other levels of agricultural settlement in the wider networks dominated by these centres, the nature of the soils and topography has been proposed as a deciding factor on location, with earlier sites situated on lighter soils on valley terraces and later settlements concentrating more in valley-floor areas with more clay-rich soils (Rippon, 2010: 51). This apparent transition, long assumed to have been a purely Middle Saxon phenomenon, has since been redefined by Hamerow (2002) as representing a more general continuity of transition from the 5th to 7th centuries A.D. These generalities have been increasingly challenged by wider-ranging syntheses of settlement and estate development patterns across this period, which have highlighted the dominating influence of local variations in geology and topography over such generalised trends (Williamson, 2010). Consequently there is now a considerable prominence for themes of regional diversity in settlement and agricultural patterns which offer the potential for environmental archaeological data to make a significant contribution (Rippon *et al*., 2014).

Despite contemporary advances in the scale and scope of settlement studies (section 1.2), the archaeological approach to individual middle Anglo-Saxon high status sites has generally retained emphasis on the core settlement area and the structural evidence at a scale which fails to address questions of spatial organisation or economy in the wider landscape (Thomas, 2013: 109-110). This situation is now gradually being challenged by work which focuses on economic themes of continuity and change from new perspectives such as botanical (e.g. McKerracher, 2016), zooarchaeological (e.g. Crabtree, 2010) and archaeological evidence (e.g. Hamerow, 2012). The role of the present research can be framed within this trend by approaching similar themes using an integrated set of geoarchaeological and bioarchaeological methods (section 1.5).

From a more theoretical perspective, the development of these hierarchies during the Anglo-Saxon period has been conceptualised in terms of formalised “central place” models of the function of nodes within networks of production, trade, ritual contact and power. This has been integral to ideas of English landscape development and the generalised models of changing settlement structure and layout which have become prevalent (Hamerow, 2002: 121-123). Such ideas derive from continental, particularly Scandinavian, archaeology as an approach to understanding the development of early medieval social and political hierarchies (Hedeager, 2002). Originally largely developed by Walther Christaller (1933) in the 1930s as a hierarchical model explaining settlement distributions, the theory was developed in archaeological circles during the 1970s and 80s, often in terms that were highly reductive and took little account of human agency (e.g. Grant, 1986). As an idea applicable to present day investigations it suffers from a problem of consistency of definition which has often proven problematic for historical and archaeological applications (Schenk, 2010: 11-12).

Despite such issues, the model has significant relevance in investigating the nature and interrelationship of such diverse nodes of emergent social, political and economic geography as meeting places, royal administrative centres, trading emporia and estates (Aston, 1986). Its inductive application requires interpretation of both economic and cultural processes in order to determine and explain the hierarchies supporting and depending upon these nodes, of necessity requiring research to be conducted within a fundamentally spatially defined framework (Schenk, 2010: 12-13). Such theoretical approaches have been criticised as carrying the inherent risk of over-emphasising environmental determinants at the expense of human concerns and also in over-simplifying complex social and political structures (Hamerow, 2002: 103).

The evolution and testing of models of central places and early hierarchies has been hindered by long-established archaeological difficulties in identifying datable early rural settlements (Hamerow, 2012: 3, 11) and in defining and differentiating contemporary high-status secular and religious sites (Bond, 2000: 70). Despite these challenges, the emergence of hierarchies are clearly indicated archaeologically by the category of rarely encountered monumental high-status residence sites comprising unenclosed groups of large timber halls associated with planned layouts of enclosures and outbuildings collectively known as ‘great hall complexes’ (Hamerow, 2012: 102). These sites, which emerged in the early part of the 7th century, range in scale and complexity preventing clear categorisation (Blair, 2005: 275-276) but are best known from well documented examples at Yeavering (Hope-Taylor, 1977), Sutton Courtenay (Brennan *et al.*, 2015) and Cowdrey’s Down (Millett and James, 1983). Architecturally they appear clearly designed to be imposing and ostentatious, if relatively undeveloped compared to Scandinavian parallels, and are characterised by low on-site settlement density and frequent phases of rebuilding (Hamerow, 2002: 98). Lyminge represents a particularly well preserved example of such a complex embedded within a longer trajectory of occupation and thus comprises a highly significant case study for examining their development and function within wider landscapes and networks (Thomas, 2017).

Following the widespread re-introduction of Christianity a new type of high status settlement emerged in the mid-7th century in the form of monastic centres, the earliest of which are known from Kent at sites such as Lyminge. The sequential transition from pagan royal great hall complex to Christian monastic site which occurred here in the 7th century (Chapter 2) is not unusual in England and comparable examples are known more widely, such as Eynsham and Thame in Oxfordshire (Thomas, 2013: 113). This progression from royal to ecclesiastical centre can be more widely inferred from historical sources which suggest that the conversion process was based around regional centres of population and power which developed into foci of both ecclesiastical and lay activity (Foot, 2006: 77; Yorke, 2006: 160). Archaeologically the layout of these monastic settlements often contrasts to the dispersed pattern of structures in earlier high-status settlements demonstrating different building styles and features such as enclosure by a physical boundary (Blair, 2005: 196). Lyminge, in representing the complete process of transition, may well be the first excavated site to archaeologically demonstrate the mechanics of this process.

These early monasteries have been accorded a pivotal role in middle Anglo-Saxon social and economic change, driving the processes of agricultural intensification and transformation observable during the middle Saxon "long eighth century" (Blair 2005; Rippon, 2010). This change likely occurred at all levels of the social hierarchy, with the peasantry working on the land increasingly viewing themselves as distinct from their (non-monastic estate) neighbours and adopting an externally imposed ideological framework distinct from earlier traditions (Blair, 2005: 225). An extant body of contemporary documentary sources such as Hagiographies suggest these early foundations as centres for agriculture, crafts and industry, possibly fostering a resurgence of such activity following the aftermath of the Roman period (Bond, 2000: 68). Such evidence is of course biased by the overwhelming monastic focus of the available historical sources which cannot intrinsically provide a balanced perspective. In the light of archaeological developments from sites such as Lyminge, more recent studies have criticised such a simple attribution of agency to monastic foundations by highlighting that precursor royal sites were also likely to have been major catalysts for these developments (Thomas, 2016).

In contrast to the later medieval picture, the manner in which early monastic foundations functioned economically and how they interacted with contemporary landscapes at this time is poorly understood (Aston, 2009: 15, 21). This situation is complicated by a pronounced lack of contemporary paleoecological data which could help illuminate their utilisation of landscape resources, environmental impact and character of their economic activity (Bond, 2000: 70). In addition, the actual archaeological definition of "monastic" versus "non-monastic" settlements is largely based upon somewhat ambiguous interpretations of material culture associated with literacy and building structures which remain controversial (Aston, 2009: 54). Aston (2009: 21; 1986: 50) has previously raised the question of what, if any, early Anglo-Saxon estates can be described as being characteristically “monastic” in terms of their economic function or spatial layout. Blair (2005: 204-205) has since refined such definitions in terms of sets of recurring characteristics such as structural alignments, rich material culture and preference for enclosure or an elevated location, which although common to both monastic and secular high-status settlements, when encountered in combination, generally correlate to a monastic function. This allows a general identity of monasticism to be applied to sites at the top end of a spectrum of structural development, locational stability and richness of finds which more generally encompass the total range of expression of high-status occupation in the middle Anglo-Saxon period (Blair, 2005: 211).

In comparison to later medieval estates early Anglo-Saxon monastic foundations controlled relatively small spatial areas; however historical models such as that of Faith (1997) have illustrated the complexity, diversity and scale of their holdings. Faith’s model (1997: 12) defines the hierarchical infrastructure of estates during this period as comprising prestigious foci with centres of production served by diverse arrays of satellite settlements and outlying territories. The model delineates the function of intensively utilised “inland” estate core areas around these central foci as crucial to generating the agricultural surpluses underpinning wider societal changes in the Middle Saxon period (Thomas, 2016: 284). By contrast the components of the wider associated “outland” networks demonstrated specialism of services and production with associated differences in population structure, some of which may be evident archaeologically (Faith, 1997: 67-68). Lyminge is perhaps one of the better documented examples of this type of estate structure with charter evidence suggesting a network of territories around the estate centre which provided access to resources such as timber and iron ore (Chapter 2). Despite this complexity of structure and scale, the primary legacy of these estates for the structural development of later medieval landscapes is largely regarded in terms of a genesis of persistent settlement nuclei and estate boundaries rather than in terms of the basis of wide-area landscape organisation (Rippon, 2008: 266).

The spatial distribution of early Anglo-Saxon monastic centres demonstrates geographical similarities comparable to those affecting earlier types of settlement. Most are topographically sited in locally elevated locations, close to or surrounded by watercourses or the sea with those in valley locations were generally sited above the alluvium, or on clay or gravel islands in lowland floodplains (Blair, 2005: 193). Perhaps the dominant factor in the location for the development of a settlement which can be defined as monastic in character is an apparent focus around economic concerns, with major sites such as Brandon and Jarrow having archaeologically attested waterfronts on major rivers capable of significant trade activity. Other comparable sites in areas such as the Thames valley such as Oxford and Eynsham were sited specifically to act as focal points for the distribution and exploitation of a wide environment of regional geological and agricultural resources (Blair, 2005: 257).

Blair has previously highlighted the predominant geographical concentration of English monastic sites founded before circa 680 A.D. on the coast and river estuaries on the eastern side of the country, a factor particularly apparent in Kent (Blair, 2005: 150). This pattern is attributed both to the cultural and religious affiliations of the ruling elites to Francia and also to the trade wealth of the south-east and Kentish areas gained through established connections across the North Sea and English channel (Blair, 2005: 150-151). In contrast to the more aesthetic considerations of contemporary western and northern British and Irish monasteries (summarised in Aston, 2009) which often sought isolation over practicality, the placement of Christian centres in lowland England has been seen to be driven by material concerns for both access to resources and the ability to distribute production surpluses and craft goods; concerns which themselves are largely defined by geology, topography and environment.

The legacy for the medieval pattern of land use precipitated by the major cultural and social shifts of the Middle Saxon period are often more apparent in marginal landscapes than in the heavily settled lowland areas. Work in the Lincolnshire fens by Stocker and Everson (2003) has demonstrated this impact of middle Anglo-Saxon monasticism in the origins of later medieval settlement patterns, field systems and land reclamation processes. Here the early monastic communities were the active agents in transforming the environment through large-scale drainage in the aftermath of dramatic natural environmental transitions from rising sea levels, which ultimately created the medieval agricultural landscape (Stocker and Everson, 2003: 284-285). This work also demonstrated how the foundation of these monastic settlements in a wetland environment was itself partially defined by a precursor landscape of prehistoric causeways, barrows and sites of votive deposition.

In more heavily settled areas, Blair’s (2005) observation that the imposition of new forms of religious estate upon the landscape in the middle Saxon period will have impacted the environment as a result of the imposed change in agricultural and economic regime also allows us to envision a process of formative transformation. So pervasive was this influence that Bond’s (2000: 63) synopses concluded that early monastic activities have been more profound than is generally realised in terms of shaping medieval landscapes. This impact was characterised by economic stability and transformative roles in driving production and consumption of goods and services within the structure of estates, which can be shown to have profoundly influenced the development of later settlement patterns (Booth *et al*., 2007: 99).

1.3.3 Late Saxon and post Saxon developments

English lay estates during the 9th and 10th centuries were evolving and coalescing around permanently resident lords living in stable settlement nuclei, with increasingly productive and efficient economies driven both by developing trade opportunities and an increasing burden of obligations to royal overlords. This resulted in a fragmentation of the older “great” estates and a centralised redistribution of territories and resources by royal and aristocratic authorities which transformed the landscape (Dyer, 2003: 27, 29, 31). Across the same period, these reorganisations catalysed the development of a pattern of localised manorial churches associated with the emergent aristocratic residences. This process was likely focussed on estates with well established “inland” populations, already sufficient to service congregations and other obligations of service (Blair, 2005: 373).

The peasantry living within these rural estates became ever more economically and legally dependent on their landlords as a general transition from slavery to feudal dependency in estate population occurred following the 10th century, with the adoption of legal structures of property endowment and tenure largely borrowed from earlier Anglo-Saxon ecclesiastical precedents. At the same time the surviving “monastic” estates were becoming increasingly intensively managed, with a greater reliance on the use of record keeping and use of documents to control and protect holdings (Dyer, 2003).

Following the decline of the monastery in the 9th century, Lyminge's incorporation into the wider territories of the See of Canterbury undoubtedly resulted in many of these transformations occurring locally, with the old estate core becoming a well populated and powerful manor within one of the largest archiepiscopal estate territories in south east England during the late Saxon period (Chapter 2) (Du Boulay, 1966: 24-5). By the latter 11th century this manor becomes identifiable as part of wider group of English “mother parishes” which demonstrate continuities of earlier ecclesiastical seniority; the process of fragmentation of such old estate cores into parishes is seen as a characteristic element of the more localised church hierarchies emerging by 1066 (Blair, 2005: 3, 298). In Kent this process of development for emergent local parish churches was largely completed by the end of the 11th century A.D. with over 400 establishments recorded on the sites of earlier monastic and later Anglo-Saxon estate centres (Booth *et al.*, 2011: 346).

Following the Norman invasion, a sustained period of economic growth, increase in rural settlement size, widespread land clearance and commensurate agricultural expansion defined the general pattern of English rural landscape development (Dyer, 2003). Contemporary archaeological evidence in Kent suggests that these developments resulted in a complete superposition of new agricultural patterns over earlier geographies of communications, rural settlement and monuments such as cemeteries in the landscape around Lyminge (Booth *et al.*, 2011: 34). Documentary evidence indicates that the structure of this changing landscape predominantly comprised irregularly nucleated settlements within feudal estate areas which were comparatively limited in scale compared to those in other regions (Booth *et al.*, 2011: 347).

A huge expansion in monastic life followed the Norman Conquest, with transplantation of new continental religious orders and patterns of governance (Aston, 2009). As a result of this profound transformation, ownership structures and the geographies of land holdings for monastic estates also changed radically across the late 11th /12th centuries. This change can be viewed in terms of two parallel processes of land redistribution; an increasing burden of royal or aristocratic obligations on churches to provide endowments to feudal nobility and also a fashion amongst the new aristocratic classes to bestow bequests of land to monastic institutions in order to secure spiritual or social prestige (Dyer, 2003). During this period the rural pattern of ecclesiastical life across lay estates was also fundamentally localising as a result of processes of demographic and economic growth, agricultural intensification and changing patterns of community obligation to church and lord (Blair, 2005: 370). These processes manifested at Lyminge as a range of changes to land management and social organisation within the settlement environment transformed the old monastic core into a parish nucleus by the start of the 12th century. At this time the estates of Canterbury and Kent had become a landscape of small rural settlements within a fragmented structure of freehold tenements (Du Boulay, 1966). The manifestation of these changes in terms of land use and the function of the settlement as a central place will be investigated as part of the broader interpretation of the landscape history of the occupation sequence (section 1.5.1).

1.4 The value of Lyminge and Kent as study areas

Kent has been frequently cited as a study area with the potential to offer new insight into some of the themes discussed in section 1.3, including the development of Anglo-Saxon settlement dynamics and economic regimes relating to the exploitation of distinctive resources (Everitt 1986; Brookes, 2010; Higham and Ryan, 2010), emergent patterns of land division and usage (Booth *et al*., 2011: 348) and processes of monastic foundation (Thomas, 2016; Thomas, 2013). This potential arises from the availability of historical and archaeological evidence for an early geography of Anglo-Saxon settlement, a consequence both of proximity to the continent and a fertile landscape which attracted relatively dense occupation by settlers from the 5th century onwards (Drewett *et al*., 1988: 254).

The tradition of archaeological study of Kent has in the past been overwhelmingly dominated by cemetery data (e.g. Richardson, 2005) with very little excavation of early settlement sites. This omission remains especially notable when the excavation record is compared to that of other regions such as the Midlands and East Anglia (Rippon, 2008). More recent syntheses of archaeological data have begun to address this issue, most significantly in the aftermath of the development of High Speed 1 (Booth *et al*., 2011), which has now provided an unusually detailed multi-phase archaeological context for the area.

From an environmental perspective, current regional syntheses of Kent demonstrate a paucity of available data from which to extrapolate representative paleoenvironmental models able to contexturalise the development of landscapes of settlement in Kent. This is primarily as a result of the poor organic preservation conditions presented by the largely calcareous geology of the region which limit the availability of proxies (Harrington and Welch, 2014: 56). Permanently waterlogged catchments, where available, have largely suffered from drainage and peat cutting in post medieval or modern times which has truncated sequences and removed any material relating to the early medieval period or later (Scaife, 1987). Consequently the few sequences available are either not local enough to be useful, such as Amberley Wild Brooks in Sussex (Scaife, 1987: 127), or restricted in coverage to prehistoric periods, such as Frogholt (Godwin, 1962), Holywell Coombe (Preece and Bridgland, 1999) and much of the evidence from Romney Marsh (Long *et al*., 2002; Waller, 2002). This situation has been highlighted in previous syntheses of local long-term vegetation history across the post Iron-Age period in Kent which have simply recorded an almost total absence of published data for this area aside from a couple of isolated sequences from Romney Marsh (Preece and Bridgland, 1999: 1119) (Chapter 13).

Despite these apparent gaps in the archaeological and paleoecological data, the Kentish landscape has been the subject of a long tradition of intensive historical analysis, largely due to the unusual density of early placenames and landscape structures which it contains (Everitt, 1986: 11-12). These studies have varied in scope and methodology from broad historical and geographical syntheses (Whitney, 1976) to more specific studies of socio-political aspects such as administrative division (Jolliffe, 1929). The broad pattern of early medieval land use emerging from these studies demonstrates a pattern of small, potentially ancient, field systems, associated with a typically dispersed settlement plan (Roberts *et al*. 2000). This type of landscape compares markedly with that seen in intensively surveyed regions such as Midlands and East Anglia which are dominated by processes of centrally planned enclosure (Rackham, 1986; Oosthuizen, 2010).

The underpinnings of the distinctively Kentish landscape pattern have been framed by Everitt (1976, 1977, 1986) in terms of the unusual diversity of geology, soils and ecological areas which has created sharply contrasting regions of countryside, or *pays*, which define localised agrarian practices and to some extent cultural traditions. His model of settlement development drew upon these contrasts as defining the distribution and development of estate complexes as well as regional differences in such diverse aspects of life as building styles and religious practices (Everitt, 1977: 2). It framed Kent as an area shaped by an unusual correlation of features of settlement and geography which individually are otherwise seen more widely in England (Everitt, 1986: 333). This work emphasised both the diversity of patterns of continuity and settlement within the Kentish landscape and the inherent problems in extrapolating conclusions applicable to the wider region from reliance on isolated studies (Everitt, 1986: 3). Consequently it connected to themes more widely applied to the Romano-British / Anglo-Saxon transition (section 1.3.1) by emphasising problems associated with attempts to fit broad-scale models onto the highly varied evidence available on a site by site or regional basis. Within Everitt's study Lyminge was highlighted as unusual in both its displacement from the river (Limen) and coastal settlement (Lympne) which may have originally defined its name and territory (Chapter 2) and also demonstrative of a sporadic regional continuity of settlement and territories between the late Romano-British and early Anglo-Saxon periods (Everitt, 1986: 342).

Brookes (2007; 2010) has advanced the development of this type of settlement model in focussing on both landscape and economic themes such as patterns of communications and exchange. His theories regarding the earliest colonisation pattern in Kent have suggested a strong correlation with river valleys and areas of good agricultural soils with emergent territories which can be modelled using distributions of cemeteries (Brookes, 2010: 71). This work has further examined the emergence of multiple estates in east Kent in terms of adaptations to ecological constraints and resource availability, using an approach derived from behavioural ecology (Brookes, 2010: 66). By mapping the correlation of communications routes, resource areas and colonisation patterns, this model draws extensively upon Everitt's (1986) earlier work as a basis for the interpretation of the regional pattern of settlement. It relies on two fundament arguments; firstly that population dispersal is archaeologically evident across Kent during the early to Middle Anglo-Saxon periods and secondly that the landscape can be viewed in terms of a mosaic of biologically diverse resource patches, the distribution of which shaped this dispersal process (Brookes, 2010: 66). The model proposes that early settlement distribution in Kent was a function of strategic decisions relating to these areas, occurring over several distinct phases, with subsequent development of hierarchies, central places and multiple estates being shaped by competition resulting from unequal access to resources (Brookes, 2010: 78-82). These ideas strongly relate to earlier theoretical models concerning the development of central places (section 1.3); however Brookes' research differentiates itself by grounding such abstracts in a rigorous multi-disciplinary framework with a strong modelling component (Brookes, 2007: 2). Within this model Lyminge was highlighted as unusual in not being located at a nodal position between ecological areas, a feature characteristically apparent at other significant contemporary Kentish sites (Brookes, 2010: 70).

The present work aims, in part, to build upon and test the interpretations of some of these studies using a wide range of data from the Anglo-Saxon royal and monastic settlement site at Lyminge in Kent (section 1.5). The potential offered by this site for both pioneering new investigations and testing established ideas about early medieval landscape development derives both from its importance as a high status site and in the unique circumstances of the archaeology. As the first large-scale Anglo-Saxon settlement excavation anywhere in Kent, Lyminge is uniquely significant for examining the development of Anglo-Saxon rural settlement, agriculture and regional hierarchies into the middle Anglo-Saxon period (Rippon, 2010). The site's early demonstration of high status material culture provides an opportunity for understanding the emergence of social hierarchies and kingship in Kent and the development of networks of exchange and power (Brookes and Harrington, 2010: 70). Critically the monastic and pre-monastic foci of the settlement lie in undeveloped areas within the later medieval settlement plan providing a rare opportunity for intensive open-area excavation (Thomas, 2013: 115). Sampling opportunities are extensive due to processes of settlement shift having prevented deposition of later material within earlier occupation contexts (Thomas, 2013: 126) and the proximity of a watercourse which provides opportunities for rare paleoenvironmental investigation. This enables recovery of environmental and geoarchaeological material with a potentially high resolution of phasing from the very earliest Anglo-Saxon settlement to the medieval period (Thomas, 2013: 116).

1.5 Aims and objectives

This chapter has defined the scope of previous work investigating economic and ecological aspects of early medieval settlements and landscape. A review of methodological developments (section 1.2) demonstrates that an integrated application of various environmental and geoarchaeological analyses from the micro to macro scale offers the potential to address some of these issues where suitable evidence can be recovered (Evans, 1972: 3; Canti, 1995).

1.5.1 Research questions

The present study will attempt to address questions based upon the themes discussed in section 1.3 to refine an understanding of the origins, function and development of Lyminge both as a settlement and as an archaeological landscape. These can be summarised as follows:

1. What evidence is there for continuity and change in the environment of Lyminge over the Romano-British to Anglo-Saxon transition?
2. What evidence is there for transitions in land-use, economy and settlement function over the occupation sequence and can this support existing models of landscape change in Anglo-Saxon Kent or conversely provide new suggestions for models?
3. How strategic was the location of Lyminge in terms of controlling resources and how can its role as a royal and administrative centre be reconciled with the fact that it does not appear to occupy a nodal point between environmental resource patches (Brookes 2007, 2010)?
4. How can analysis of the environmental evidence from the various Anglo-Saxon phases at Lyminge enhance an understanding of its economic resource base?
5. Can the environmental and other evidence from the 7-9th centuries validate the historical models of monastic estate organisation proposed by Faith (1997), including the distinction between inland and outland?
6. Can the evidence suggest continuities in occupation which may not be archaeologically or historically attested?

1.5.2 Summary of research design

The analytical methodology of this thesis is intended to integrate fragmentary evidence relating to interactions between human activities and environmental variables such as geology, topography, soils, drainage and ecology. These interrelated environmental components are aspects which have previously been observed to be the most influential and demonstrative components of the dynamic interactions between humans and the landscape (Cleary in Hooke and Burnell, 1995: 11), specifically in studies of early medieval landscapes and the locations of central places (Williamson, 2012). The employment of a diverse range of methods will represent processes covering a range of scales from the very highly localised to the wider regional. This perception of scale will be used as a framework to provide a hierarchy of inference for interpretations, with analysis accordingly compartmentalised into an ascending schema of three levels of resolution:

- On-site (microscale and site-level)
- Catchment (settlement periphery, stream and valley floor)
- Regional (wider area around and outside of the valley)

This evidence will be used to contexturalise the archaeology at Lyminge within a diachronic framework sub-divided to examine periods represented archaeologically at the site (Chapter 2) and, by extension, the major research themes that can be applied across these periods (section 1.3):

- The prehistoric and pre-Roman landscape.
- The Romano-British to Anglo-Saxon transition from the 4th to the 5th centuries A.D.
- Early Anglo-Saxon developments from the 5th to the 6th centuries A.D.
- Middle Anglo-Saxon transformations during the 7th-9th centuries A.D.
- The development of the medieval village and landscape (10th-11th centuries A.D. onward).

The methodology of the work will be both defined and directed by the availability of evidence relating to these phases utilising an approach which has been previously proposed for both method-specific (Canti, 1995) and site-specific geoarchaeological studies (Milek and Roberts, 2013). This can be summarised as a correlation of a wide range of mutually supportive evidence to overcome respective limitations and provide a critically assessed perspective (Milek and Roberts, 2013: 1864). Integration of this data will enable identification of features and processes essentially invisible to conventional excavation methodologies, providing new interpretations of landscape development and usage across these archaeological phases (Bell and Dark, 1998: 187).

A testable hypothesis arising from this methodology is that the various fragmentary geoarchaeological and paleoecological datasets available from dryland rural sites such as Lyminge can be unified to deliver insights greater than the sum of their respective parts, despite the available proxies being individually poorly representative and subject to distortion by taphonomic and post-depositional transformation. This study will therefore undertake careful comparison and analysis of the robustness of interpretations derived from individual proxies against the evidence provided by the full collated dataset across a range of scales, both spatial and chronological. For all of these the scope and quality of the achieved data will define, guide and constrain the development of the final analysis as well as the spatial extent and granularity of the interpretations. This integration will be contexturalised within a GIS, in order to delimit and correate the evidence at the widest scale of observation into a robust and comprehensive landscape overview. By incorporating interpretations into a cohesive analytical hierarchy of inferences, a narrative of landscape development based upon several scales of observation can be proposed as the concluding output (Chapter 14).

1.5.3 Detailed aims and objectives

The central aim of this work is to develop an integrated geoarchaeological and paleoenvironmental contextural framework with which to address more detailed thematic research questions relating to the archaeology of the site. These are summarised in the research questions in section 1.5.1 and can be defined more comprehensively in terms of the following aims:

- The detailed environmental characterisation of an early Anglo-Saxon royal site along with its economy and territorial landscape in order to refine those previously proposed in Kent in much broader terms by Everitt (1977; 1986) and Brookes (2007; 2010).
- The characterisation of agricultural and other economic activities provided by environmental and geoarcheological evidence, which can help define regional patterns of early medieval land use and farming as highlighted in recent studies such as Rippon (2008) and Rippon *et al* (2014).
- The analysis of specific paleoenvironmental evidence relating to the development and definition of early Anglo-Saxon monastic landscapes, as well as to wider processes of arable intensification in the “long eighth century” variously examined by Blair (2005), Rippon (2010) and Thomas (2013: 109; 2016).
- The integration of the site into longer-term patterns of continuity and change in landscape structures and land use, particularly with regard to key transitions such as that between the

late Romano-British and early medieval periods which has been the focus of a major recent synthesis by Rippon *et al* (2015).

These aims will be met through the following objectives:

- The recovery, analysis and correlation of a range of available paleoenvironmental and geoarchaeological evidence and the creation of an integrated dataset with components as follows:
    - Geoarchaeological survey data, providing stratigraphic and geomorphological evaluation along with refined identification of paleoecological sampling areas.
    - Paleoecological material from any waterlogged sequences identified from this survey to enable local vegetation history and land use to be assessed.
    - Molluscan data from a range of phased archaeological contexts to allow analysis of on-site vegetation and ground cover.
    - Micromorphological and geochemical data from targeted on-site contexts to investigate evidence for environment, economy, use of space and site formation processes within occupation deposits (Macphail *et al.*, 2006; Milek and Roberts, 2013).
    - Geoarchaeological and paleoecological data from off-site sequence(s) to provide proxies for wider-area vegetation history and land use.
- The interpretation of site formation processes at a range of scales providing a contextural and taphonomic background for this dataset, specifically through examination of the geomorphological history of the watercourse, site area and valley slopes and the micromorphology of targeted occupation contexts.
- The interpretation of evidence for aspects of human economy and activity from this dataset and the spatial and chronological contexturalisation of these aspects within the main archaeological dataset (www.iadb.co.uk/lyminge).
- The development of a comprehensive GIS and DTM covering the site, its hinterland and its wider environs, to enable reconstruction and modelling of geomorphology, ecology and human geography at a range of scales. This will enable both the investigation of landscape development (Bell and Walker, 2005: 245) and contexturalisation at the widest scale of the study in order to correlate the findings of the present work with other studies (Conolly and Lake, 2006: 43; Brookes, 2010).

1.5.4 The structure of the thesis

In order to achieve these aims, this thesis presents and interprets a range of geoarchaeological and paleoenvironmental evidence relating to the occupation sequence at Lyminge, the archaeology and historical context of which is summarised in Chapter 2. Evidence will be derived from a range of on and off-site sequences and sample areas using methods which are detailed in Chapter 3 as per the objectives in section 1.5.3. Each sample area or sequence will be separately presented and analysed in individual chapters which form the core of the thesis (Chapter 4 to Chapter 10) with each detailing the relevant sampling strategy, datasets and interpretations. The evidence and interpretations from these sources of evidence will be subsequently correlated in order to understand the total geological and ecological history of the wider site using multivariate statistical analysis (Chapter 11), GIS analysis (Chapter 12) and a thematic discussion of the collated interpretations (Chapter 13) in relation to the research aims and in comparison to other sites, using the spatial and chronological schema presented in section 1.5.2. A simplified narrative summary of the site in its environmental and geoarchaeological context as well as the anthropogenic activities and economic processes which occurred across the occupation sequence will be presented in Chapter 14.

Chapter 2 - Archaeological and historical background

This chapter presents a synopsis of the historical evidence relating to Anglo-Saxon Lyminge together with a summary of the archaeological evidence uncovered in previous research and the recent programme of excavations by the University of Reading. This is intended to provide context for interpretations presented in Chapters 4 to 12, a background to the critical review of previous approaches presented in Chapter 13 and some of the rationale for thematic research questions presented in the previous chapter.

2.1 Historical context and documentary sources

The place name of Lyminge with its *gē* (district capital) suffix, has been cited as evidence of the settlement's importance both as the centre of the early Kentish administrative area known as a *Lathe* and also as its identification as a *villae regalis* (Thomas, 2005: 277; Stenton, 1947; Brookes and Harrington, 2010: 71; Drewett *et al.*, 1988). The apparent pre-Saxon origins of the placename and its suggested connection to the river Limen and settlement at Lympne on the coast have been cited by some as evidence for a Romano-British origin to the territory which the Anglo-Saxon settlement controlled (Everitt, 1986: 20, 342). Whatever the antiquity of this political geography, it had become functionally superseded by the Kentish hundreds and manorial system by the late Saxon and Anglo-Norman period (Stenton, 1947: 496).

It is likely that the historical growth and early supremacy of the kingdom of Kent was facilitated by easy access to the sea, a factor which allowed many of its settlements to develop into centres of foreign trade in the 7th century A.D. (Yorke, 1990: 40). These seaborne connections to continental Europe have been cited by historians such as Myres (1986: 128) as powerful influences on the stability of landscape organisation and social infrastructure in Kent between the late Roman and early Anglo-Saxon periods, mainly due to facilitating a widespread presence of Germanic federate settlers and Frankish cultural influences in the 4th century A.D. Subsequent Merovingian expansion into the 6th century embedded Kent within an emerging Frankish sphere of influence, bringing trade, the influence of Roman Christianity and continental models of political organisation which all catalysed Kentish state formation (Yorke, 1990: 43; Hodges, 1982). This continental influence is demonstrated by the early establishment of coinage in Kent relative to other areas of England, in the form of late 6th- century imitations of Merovingian *tremisses* (Brookes and Harrington, 2010: 90; Yorke, 1990: 40). The strength of these connections is further apparent in the distinctive predominance of Frankish material in the archaeology of 6th- century Kent (Yorke, 1990: 49) and in recorded historical events such as the marriage of the Kentish king Æthelbert to the Frankish princess Bertha in 580 A.D. and their daughter Æthelburga's consignment of her children to refuge in the Frankish court in 633 A.D. (Yorke, 1990: 28, 39; Yorke, 2006).

Hagiographic tradition (as recorded in the *Legend of St. Mildreth*) indeed attributes the original church foundation at Lyminge to Æthelburga in 633 A.D. (Yorke, 1990: 25, 37; Thomas, 2013: 119). The documented identity of the site as a pre-Christian royal centre before this period, now clearly demonstrated by four seasons of excavation on Tayne Field (section 2.2.4), further allows speculation of an original association with her father Æthelbert (whose main residence was known to be at Canterbury) or perhaps further back with his father Eormenric (Yorke, 2006: 65, 272). However as the precise historical identity of the 6th-century ruler who was initially responsible for the evolution of the site into a royal centre is unknown and the development of the settlement prior to the conversion period must be understood largely in terms of its material culture and physical remains. The identity of the original abbess at Lyminge has more recently also been questioned by some modern historians who have instead proposed a later 7th-century Abbess of Minster-in-Thanet, Eadburh and a later foundation date (Leyser, 2015: 26). Whatever the identity of the founder, documented land grants from 689 A.D. to 838 A.D. (Brooks and Kelly, 2013: 28-35) can demonstrate a continuity of occupation and organisation at the site throughout this period of foundation, as well as indications that the monastic buildings were intentionally constructed close to those of the earlier royal estate centre (Blair, 2005: 186).

Charters contemporary to the monastery record a wealthy economic hinterland incorporating woodlands and woodland pasture referred to as *Limenweara wald* and used for rearing pigs (Stenton, 1947: 280). These territories extended to areas of the Weald which are documented as a source of iron-ore to the monastic settlement (Kelly, 2005: 105). Documentary evidence suggests that Lyminge also benefited economically from territories in the estuarine areas in Romney Marsh, with access and ownership of extensive resources including livestock (sheep) grazing and salt-pans on the tidal salt marsh (Brooks, 1989; Blair, 2005: 254, 258; Brookes and Harrington, 2010). These areas also included the coastal settlement of *Sandtun* (Figure 1), a documented possession of Lyminge in 732 A.D., which was situated in a tidal inlet adjacent to the Roman shore fort at Lympne at the mouth of the river Limen in the North-East end of Romney Marsh (Canterbury Christ Church S 23, Blair, 2005: 258; Brooks & Kelly, 2013). Here extensive archaeological evidence for continental pottery imports and extensive exploitation of marine resources, particularly cod and flatfish have been recovered (Brookes and Harrington, 2010: 89, 103; Gardiner *et al*., 2001: 166, 258). Salt production activities at this site in the 8th–9th centuries are also historically attested from charter evidence; similar activities are also historically attested at other nearby sites such as the late Saxon settlement at West Hythe (Riddler and Trazaska-nartowski, 2009) as well as providing the placename "Saltwood", a nearby site with Anglo-Saxon cemeteries and occupation evidence (Booth *et al*., 2011).

Lyminge is documented as having had close organisational connections to other Kentish monastic foundations (Figure 1), including the nearby royal double house at Folkestone, reputedly founded by Æthelburga's niece, Eanswith (Kelly, 2005: 104). A particularly close connection was also established with Minster-in-Thanet, with which it became united in the early ninth century under a single Abbess named Selethryth (Leyser, 2015). Lyminge subsequently declined in the later 9th century following a period of Viking raids with its last historical mention as an independent monastic institution in a charter around 844 A.D. (Thomas, 2005; Brookes and Harrington, 2010: 121; Blair, 2005: 298). The remaining foundations experienced fragmentation and reorganisation as their territories were amalgamated into those of the surviving religious centres such as Canterbury, which was granted the estates of Lyminge in 964 A.D. (Brookes and Harrington, 2010: 351; Gardiner *et al*., 2001: 166). By the time of the compilation of the Domesday record in the 1080s, Lyminge was part of the hundred of Loningborough, an area incorporating the Elham valley to the north and areas of the downland west to Hemsted and east to Acrise (Palmer and Slater, 2007). At 170 households, Domesday records Lyminge as being by far the largest settlement in this hundred and indeed in the entire area of the Kentish downs, with only the settlements of Aldington (306 households), Saltwood (272 households) and Folkestone (395 households) in the Holmesdale (Everitt, 1986) area to the south of the downland scarp being locally larger. The village is recorded with a population comprised of "*121 villagers. 32 smallholders, 11 slaves and 6 burgesses*" possessing arable land suitable for being worked by 60 ploughs during the course of an agricultural year. Most interestingly, the village is also recorded as possessing 70 acres of meadow, woodland (for the support of 111 swine), three mills along the Nailbourne and a fishery; although it is likely that some of these elements were located some distance from the village core in the wider area of the former monastic estates (such as Romney marsh). Three churches are also recorded, one of which comprised the former monastic church of St. Mary and St. Ethelburga. The village at this time is recorded as being under the lordship of the archbishops of Canterbury (Palmer and Slater, 2007).

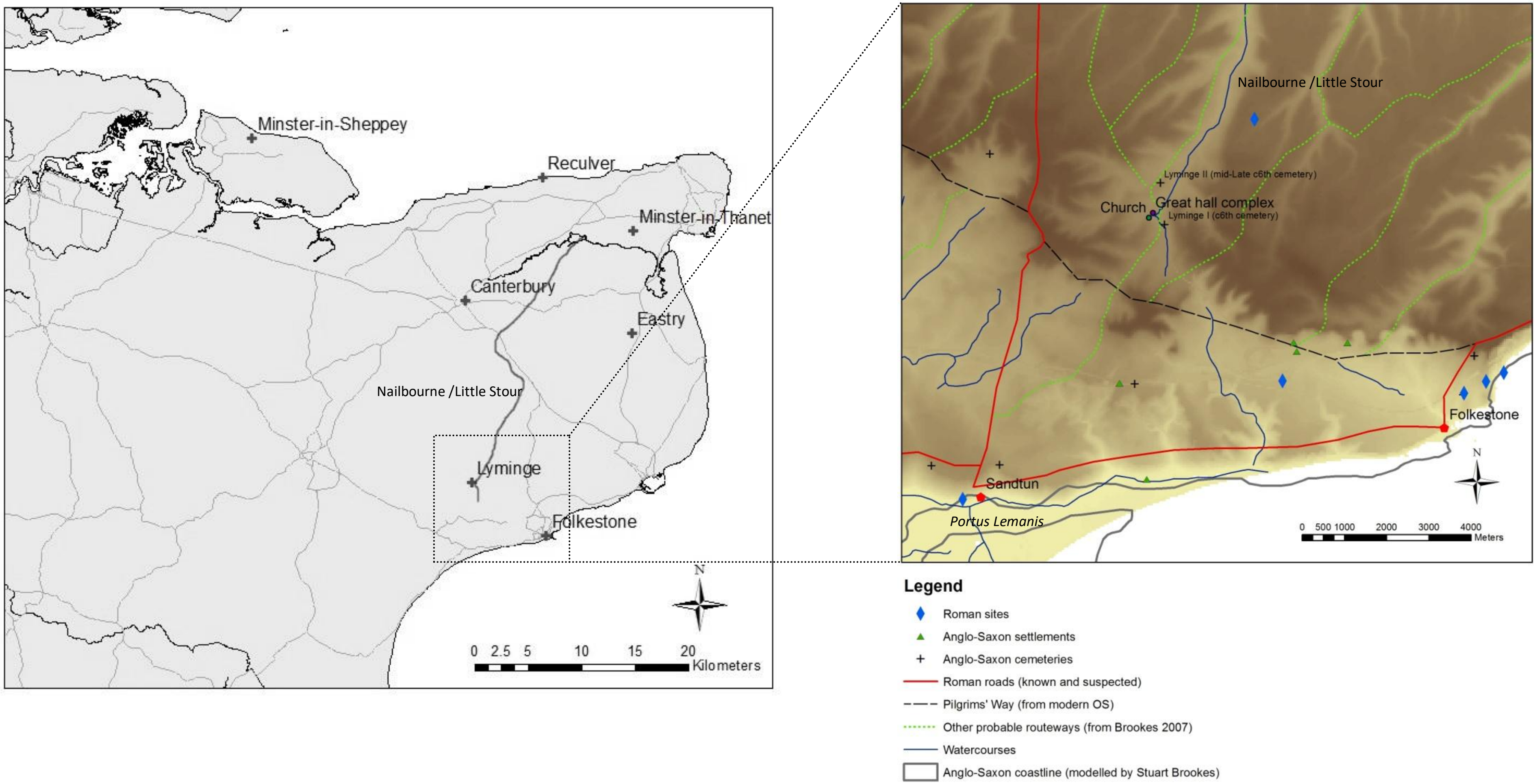

Figure 1: a) Site location in relation to other major contemporary Kentish Anglo-Saxon monastic settlements; b) In its regional archaeological context (see also Chapter 12) © Crown copyright (2017) EDINA Digimap, Ordnance Survey.

Blair (2005: 298) notes that Lyminge is one of a number of Kentish monastic centres (including Dover and Folkestone) where there is a good correlation between the early nucleus and the emergence by Domesday of a mother-parish and group of associated chapels. Certainly by the end of the 11th century Lanfranc, the Norman Archbishop of Canterbury, had a manorial residence to the west of the Anglo-Saxon church, demonstrating the maintenance of the site’s legacy as a centre of religious authority (Kelly, 2005: 100). This residence was apparently repaired or rebuilt by Archbishop Peckham in 1279 (Jenkins, 1874: 217) and afterwards maintained and used, albeit sporadically, by succeeding medieval Archbishops until its final demolition in the 1380s (Jenkins, 1861

During the late 11th and early 12th centuries A.D. the independent status of the estate was weakened when lands and relics formerly held by the monastic church were transferred to St. Gregory’s Priory in Canterbury by Archbishop Lanfranc (Kelly, 2005: 112-113; Leyser, 2015). During this period the old monastic core became relegated to the function of a parish church within a medieval village, albeit one with a likely ceremonial seniority over other churches in the area which were emerging at that time (Brooks and Kelly, 2013: 35).

2.2 The Anglo-Saxon occupation sequence and other archaeology

2.2.1 Early investigations and wider archaeological background

The 7th century church at Lyminge was partially excavated in 1853 by the antiquary Canon Jenkins (1874) who discovered foundations lying partially superimposed by the later (and existing) Saxon and medieval church structure. These finds locate the monastic settlement core around the present churchyard and present church footprint, although the precise structural interpretation of the foundations remains debatable (Thomas, 2013: 115). The church itself was probably heavily influenced architecturally by Italian and Frankish designs, being built of stone with re-used Roman material and mortared floors in the manner of Roman architecture (Brookes and Harrington, 2010: 109). It has long been suspected that this building was part of an architecturally distinct group in Kent along with other examples at Reculver, Canterbury, Rochester which derived their distinctive plan from the work of masons from the continent (Drewett *et al.*, 1988: 311).

Aside from the church itself, the other previous archaeological investigations of direct relevance to this study focussed on the site of a 5-6th-century inhumation cemetery located on the northern outskirts of the modern village (Lyminge II) (Warhurst, 1955). A second cemetery, also demonstrating 6th-century activity, was identified closer to the historic core of the village during the construction of the Elham valley railway in the 1880s (Richardson, 2005).

Despite early claims of the presence of a Roman villa or bath house at Lyminge (e.g. Jenkins, 1889; Brookes, 2007: 95) no direct evidence for Romano-British settlement is known archaeologically (Thomas, 2017: 103). Isolated archaeological indications of activity in this period is known from the wider area of the modern village in the form of occasional small finds, a single isolated 2nd/3rd century inhumation (HER: TR14 SE23) and re-used Roman building materials in the fabric of the church (Historic England, 2015; Warhurst, 1955; Jenkins, 1874). Whilst this may qualitatively suggest a local Romano-British occupation or agricultural presence in the area, it is far from being a substantive demonstration of permanent settlement activity. More widely the archaeological context of the earliest Anglo-Saxon settlement at Lyminge is of a landscape structured by Roman roads and population centres such as Canterbury as well as military centres such as *Portus Lemanis* which remained important into the later phases of the Roman period (Brookes and Harrington, 2010: 24-29).

2.2.2 Lands within and bordering the north of the Old Rectory (2007-2009)

Excavations were initiated by the University of Reading in 2007 in order to investigate the archaeological context of the Anglo-Saxon monastic core brought to light by Canon Jenkins (Figure 2). In 2008 and 2009 investigations around Rectory Paddock revealed extensive evidence for mid-Saxon occupation incorporating structural evidence for a complex of small domestic buildings/cells and larger agricultural buildings, associated with boundary features and pit clusters filled with domestic and industrial refuse (Thomas, 2013: 128-129). This was interpreted as a formalised monastic precinct with a planned rectilinear layout demarcated by palisades and ditches with clear evidence for functional zoning. A radiocarbon date of 660–780 cal A.D. (SUERC-35934, Table 1) established the primary fill of the boundary ditch around the initial phase of the monastic core (Thomas, 2013: 131).

2.2.3 Rectory Lane and Abbots Field (2010)

A season of excavation in 2010 in a field to the east of this site at Rectory Lane revealed extensive pre-Christian settlement evidence in the form of four sunken-featured buildings (SFBs 1-4) and a post-built structure. A radiocarbon date of 570–650 cal A.D. (SUERC-35927, Table 1) from the basal fill of SFB1 provided a *terminus post quem* for its abandonment (Marshall and Thomas, 2011). This particular structure contained a rich material assemblage as well as a placed deposit of a 7kg iron plough coulter in its south-eastern corner (Thomas, 2013: 123; Thomas *et al*., 2016). Other archaeological evidence from this season included a Bronze Age ditch forming part of a more extensive prehistoric field system.

Additional trial-trenching work during this season confirmed the extension to the west of the church of Anglo-Saxon occupation activity, most significantly in the form of a suspected metalworking area (Thomas and Bray, 2010). This was overlain by a cluster of features relating to Saxo-Norman occupation, broadly correlating to the location identified as the probable site of Lanfranc's archiepiscopal residence by Jenkins (1861; 1874). Despite the fact that no contemporary foundations or structural evidence were recorded during the course of this work, the scale of activity evident was judged to indicate a substantial complex of Saxo-Norman settlement, commensurate with the historical evidence for an archiepiscopal residence (Thomas and Knox, 2012a: 15; Thomas and Bray, 2010). Contemporary east-west ditch features excavated on Rectory Paddock to the south may mark the southern boundaries of this complex (Figure 2).

2.2.4 Tayne Field (2012-2015)

During 2012-2015 the project's work focussed on the site of Tayne Field, a large open space some 200m to the north of the Rectory Lane site and north east of the monastic core (Figure 2). These excavations uncovered substantial settlement remains identified as the nucleus of the pre-monastic royal centre (Figure 3) (Thomas, 2013: 116) as well as a range of other archaeology.

Evidence for the earliest prehistoric occupation of this area comprised a large flint assemblage broadly centred on the late Mesolithic period (Lawrence and Mudd, 2015). This material was all extensively redistributed by bioturbation and human activity relating to the occupation phases and later ploughing; as a result no intact prehistoric horizons were identified. However a broad concentration in the south-eastern part of the 2012 trench suggested the possiblity of a disturbed working area on the plateau crest overlooking the site of the spring to the south.

Bronze Age activity on this site comprised a substantial ring ditch feature, interpreted as a levelled barrow. The ditch of this feature was cut by the footprint of a 6th century post-built structure suggesting that it had been infilled by this date. The intrusion of this building footprint into the interior area further suggests an intentional association with this antecedent monument as has been documented at other contemporary settlement sites (Hamerow, 2012: 105; Crewe 2012; Semple

2013). Other evidence for Bronze Age activity comprised a crouched beaker inhumation immediately to the north of Building 4 / Hall complex C (Thomas and Knox, 2015: 3) (Figure 3). The earliest extant Anglo-Saxon occupation activity comprised 5th/6th century post-built buildings, associated pits and sunken-featured buildings, providing radiocarbon dates of 421-561 cal A.D. (OxA-31723, Table 1) (SFB5) and 392-597 cal A.D. (OxA-31961, Table 1) (SFB7) (Chapter 6). The most notable feature from this earliest phase comprised a 12m wide bowl-shaped depression containing a 2m deep sequence of occupation and industrial waste along with *in situ* burnt features such as hearth bases and substantial quantities of bloomery slag, glass and other finds (Chapter 7).

A major phase of subsequent site replanning saw the construction of a great hall complex on this site. This comprised a 21m long E-W hall (Hall A) dated to 428 to 612 cal A.D. (OxA-31714, Table 1), a sequence of three smaller overlapping N-S halls (LYM13 buildings 1-3 / Hall complex B) dating to between 425 to 564 cal A.D. (OxA-31784, Table 1) and 579 to 668 cal A.D. (OxA-31726, Table 1) and a larger 24m long E-W hall (Building 4 / Hall complex C) comprising multiple building phases dating to between 426 to 557 cal A.D. (OxA-31787 , Table 1) and 663 to 770 cal A.D. (OxA-31788, Table 1) (Thomas and Knox, 2012a; Thomas and Knox, 2014; Thomas and Knox, 2015). Associated finds of high status metalwork and glass confirmed the importance of this phase as a potential royal residence complex.

The abandonment of these structures marked the end of the middle Anglo-Saxon occupation sequence. Subsequent to this phase, evidence for extensive domestic activity in the Saxo-Norman period (10th/11th to late 12th centuries A.D.) was present in the form of large pit clusters filled with domestic midden and mineralised cess. These pits provided substantial (2m+) deep sequences relating to intensive occupation activity; however no associated contemporary domestic structures were located during excavations. Associated with these pits were a sequence of north-south boundary ditches running across the site (Thomas and Knox, 2012a: 14). Evidence for later medieval activity on Tayne Field was encountered in the form of substantial ditches which bisected the site from east to west and north to south associated with a contemporary field system. An absence of associated archaeology from this later period suggests that these features bounded fields rather than building plots.

Table 1: Selected Radiocarbon dates (95.4% confidence) from the Lyminge excavations referred to in this thesis.

				Uncalibrated		Calibrated AD (IntCal 13)		
Lab Ref	**Site code**	**Context**	**Association / structure**	**C14 BP**	± BP	**from**	**to**	**%**
OxA-31714	LYM12	3105	Timber Hall	1517	29	428	612	95.4
OxA-31723	LYM12	3739	SFB 5	1561	28	421	561	95.4
OxA-31726	LYM13	6649	Timber Hall 2	1409	35	579	668	95.4
OxA-31727	LYM13	7075	Timber Hall 2	1598	27	404	538	95.4
OxA-31784	LYM13	6687	Timber Hall 1	1553	26	425	564	95.4
OxA-31785	LYM14	99266	99000 Midden	1598	26	405	537	95.4
OxA-31961	LYM13	6277	SFB 7	1612	28	392	537	95.4
OxA-31787	LYM14	9208	Timber Hall 4	1542	26	426	577	95.4
OxA-31788	LYM14	9444	Timber Hall 4	1295	26	663	770	95.4
SUERC-35927 (GU-24773).	LYM10	2508	SFB1	1444	25	570	650	95.4
SUERC-35934 (GU-24777)	LYM09	1820	A/S Minster ditch	1291	20	660	780	95.4
Beta - 389574	LYM14	99275	99000 Midden	1730	30	240	390	95.4

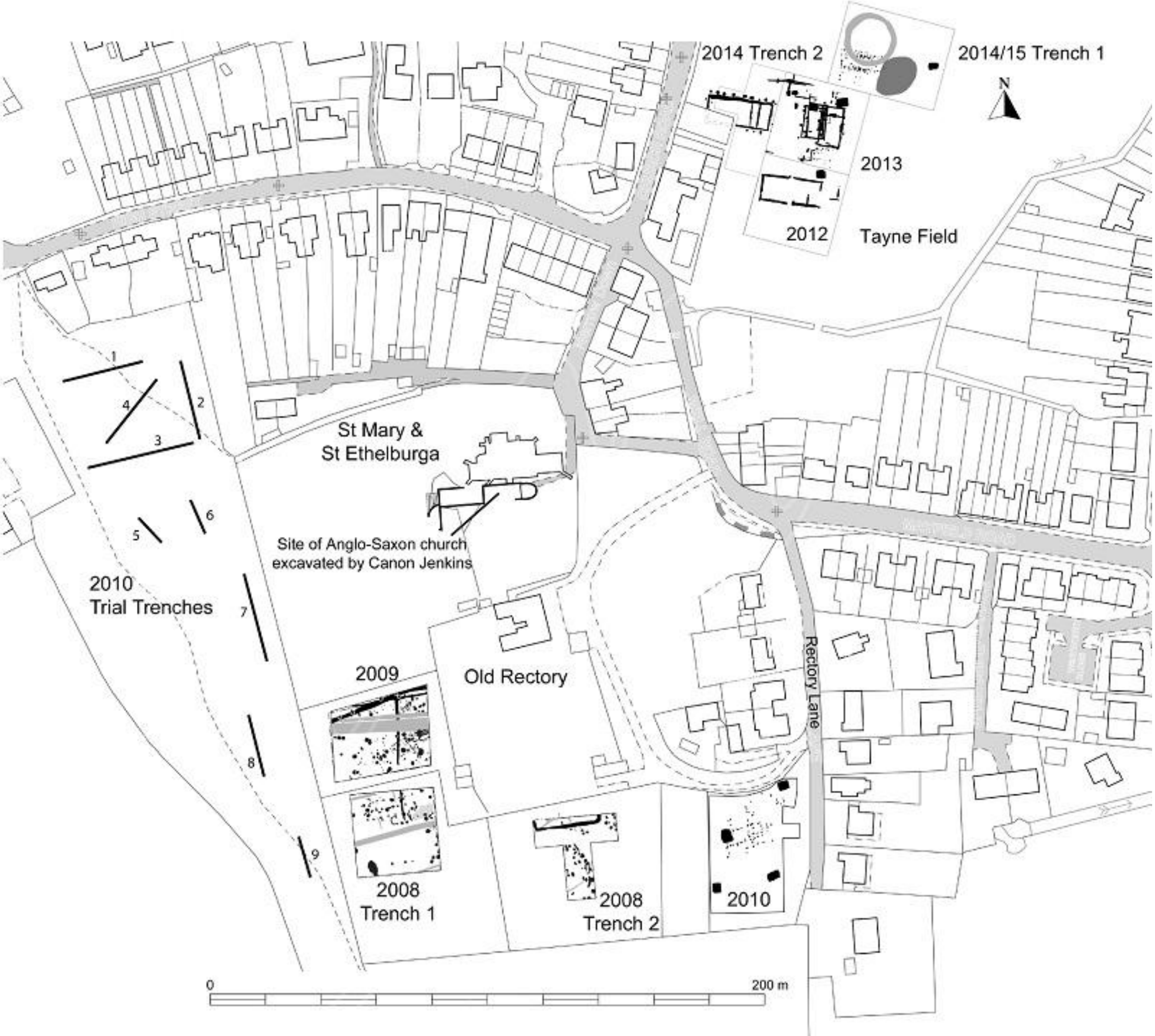

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Figure 2: Site plans of all excavation areas from 2008-2015.

Figure 3: Annotated plan of the main pre-Christian features excavated on Tayne Field between 2012 and 2015.

Chapter 3 - Methods

3.1 Rationale: the multi-proxy approach

The present research relies upon combining datasets which although individually fragmentary, represent elements of wider processes which can be correlated. The range of proxies, together with summaries of their scales of representivity and potential complications of interpretation is summarised in Table 2. Individual methods can potentially radically differ, or even contradict in their environmental representation, as has been demonstrated in previous studies (e.g. Booth, 2007: 30). The employment of this variety of proxies across a range of representation will reduce the errors inherent in isolated application, particularly at small scales (Canti, 1995). Unless otherwise stated in the text, all sample processing, data collection and analysis was undertaken by the author, with the specific exception of on-site charred plant material assessed by Campbell (2012), Balantyne (2014), McKerracher (2012; 2015a) and Austin (2015) and geochemical analysis of the doline sequence (Section 3.4.6; Chapter 7) which was undertaken by Dr. Chris Speed at the University of Reading. Assistance with field sampling and geoarchaeological surveys was provided by Professor Martin Bell and also more generally by staff and students during the 2012-2014 fieldwork seasons under supervision of the author.

Table 2: Summary of proxies used by representivity, scale and potential interpretational complications

Proxy	Scale of representation	Application of representation	Potential complications of interpretation
Micromorphology	On-site	Land management, taphonomic and post-depositional processes, activity areas	Limited spatial representation, problem of equifinality
Auger survey and sediment compositional analysis	On-site / catchment	Land management, soil history taphonomic and post-depositional processes	Limited spatial representation, problem of equifinality
Mollusca	On-site to regional dependent on origins of assemblage	Local ground cover, humidity, vegetation history	Dependent on context; catchments with locally inwashed or autochthonous assemblages can be highly representative, archaeological deposits can be indeterminately mixed
Pollen	On-site and catchment depending on topography and hydrology	Vegetation history	Dependent on productivity and robustness of taxa together with nature of catchment and potential for inwashed material. Likely distorted by concentrations of allochthonous grains derived from dung.
Fungal spores / NPPs	On-site and catchment dependent on taphonomy	Land management, taphonomic processes	Dependent on context; catchments with locally inwashed or autochthonous assemblages can be highly representative, archaeological deposits can be indeterminately mixed
Waterlogged plant macrofossils	On-site and catchment dependent on taphonomy	Vegetation growing or being utilised at specific locations.	Dependent on productivity and robustness of taxa
Charred plant macrofossils	On-site to regional dependent on origins of assemblage	Economic plants, soils, agricultural methods and seasonality across area of origin	Dependent on nature and context of materials, likely imported assemblage, taphonomically complicated and indeterminately mixed

3.2 Sampling areas

This study draws upon a range of data derived from both on and off-site locations, as summarised in Table 3. The on-site environmental samples are divided into three zones based around the excavation areas (Chapter 2); Rectory Paddock (2008 and 2009), Rectory Lane (2010) and Tayne Field (2012-2014) (Figure 5). These areas are to be treated separately in the present synthesis due to variations in basal geology, soils and topographical aspect which systematically differentiate large elements of the paleoecological assemblage, particularly Mollusca which are highly sensitive to localised variations in temperature, moisture and soil chemistry (Davies, 2008: 12-15).

The off-site sample areas comprise two locations; a lynchet exposure along a suspected holloway at Woodland Road (BNG: E 614698, N 141396) (Chapter 10) and a stream side excavation area located 30m from the spring, 50m from the nucleus of the 7th century great hall complex and 100m NE of the Anglo-Saxon monastic church (BNG: E 616195, N 140920) (Chapter 5) (Figure 4).

Table 3: Sampling area descriptions and site codes

Sample Area / site codes	**Geology**	**Soils**	**Contemporary Environment**	**Archaeological phases**
Rectory Paddock LYM08 LYM09	Chalk bedrock (Zig Zag formation, lower /grey chalk subgroup)	Rendzina soils and ploughwash	South-facing agricultural grassland, bounded by hedges	8th-9th century middle A/S occupation (monastic core)
Rectory Lane LYM10	Chalk bedrock (Zig Zag formation, lower /grey chalk subgroup)	Rendzina soils and ploughwash	South-facing agricultural grassland, bounded by hedges	6th-8th century A/S occupation
Tayne Field LYM12 LYM13 LTF13 LYM14 LYM15	Grey chalk marl (Zig Zag formation, lower /grey chalk subgroup) with superficial deposits of soliflucted silty clays, clay-with-flints and possible loess	Silty clay loam and ploughwash	East and south-east facing, heavily managed open non agricultural grassland bounded by stream channel	Prehistoric (Mesolithic to Bronze-Age); 5th-6th century early A/S occupation, 7th century great hall complex; 11th-12th century Saxo-Norman occupation
Stream trench (Tayne Field) LTF14 TP4	Grey chalk marl (Zig Zag formation, lower /grey chalk subgroup)	Colluvium over interleaved alluvial and organic lenses	Partially shaded, wet stream bank in open field area.	5th-10th century A/S activity
Woodland Road	Chalk bedrock (Zig Zag formation, lower /grey chalk subgroup)	Colluvium	Densely overgrown field margin at the foot of sloping open agricultural fields adjacent to a well-established holloway.	Prehistoric flint flakes and Iron Age pottery

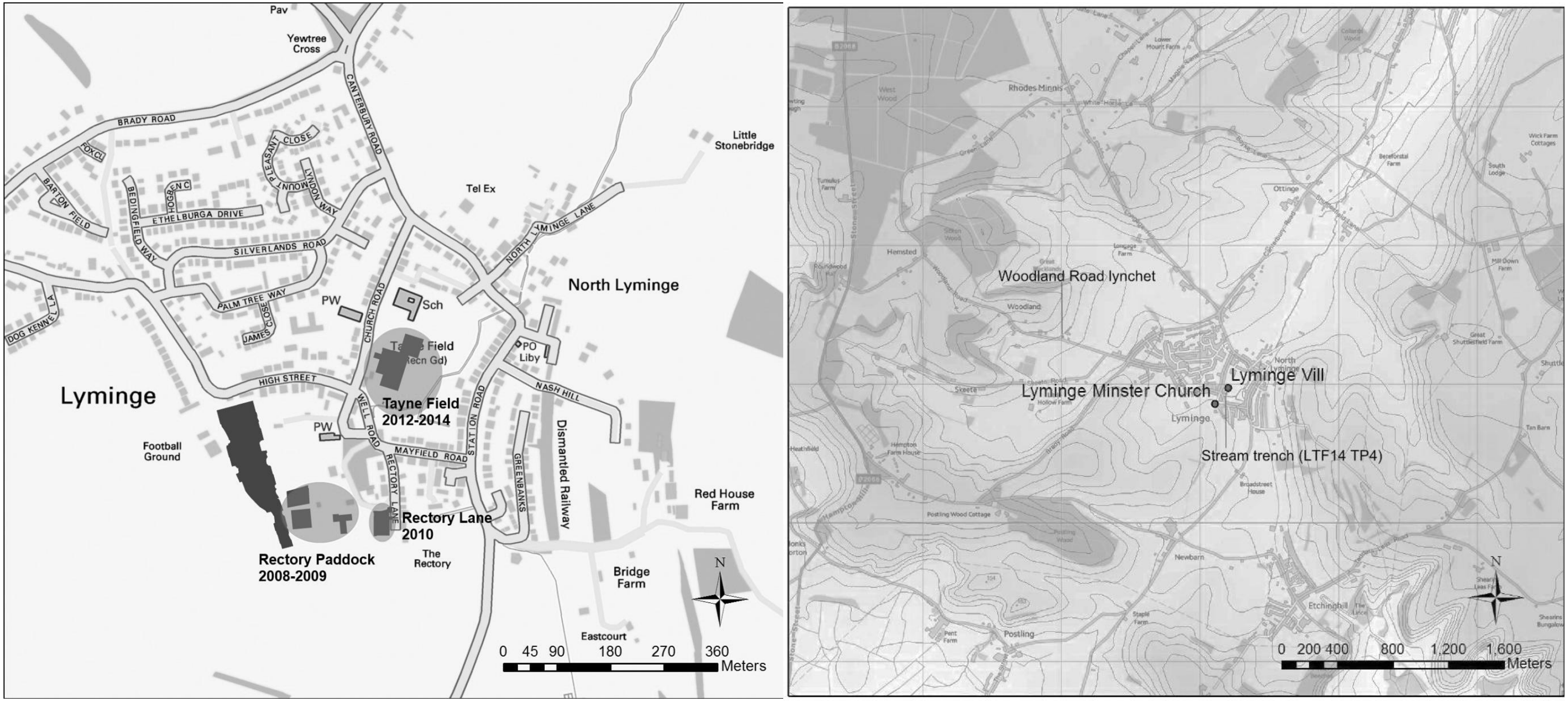


Figure 4: a) On-site and b) off-site sampling areas. Dark grey areas in a) indicate excavation areas. © Crown copyright (2017) EDINA Digimap, Ordnance Survey.

3.3 Field methods

3.3.1 Tayne Field auger Surveys

Auger surveys of Tayne field and the immediate environs of the excavation areas were conducted using Eijkelkamp combination gouge augers during summer 2013 and spring 2014 (Figure 5). Field identifications and descriptions of lithostratigraphy were carried out according to Hodgson *et al* (1974) with additional reference to Munsell charts for soil colour. Grab samples (100g) were recovered from each major unit identified in the field for compositional analysis. Further details of this work are presented in Chapter 4.

3.3.2 Tayne Field environmental excavation (LTF14 TP4).

An environmental sample trench (site code LTF14 TP4, Figure 5) was dug in summer 2014 to investigate the geomorphological history of the stream in terms of channel stability and geomorphological processes relating to the landscape development around the settlement nucleus on Tayne Field. This was also intended to provide data for paleoenvironmental reconstruction at both site and local regional scale. Details of the environmental sampling undertaken in this trench are presented in Chapter 5.

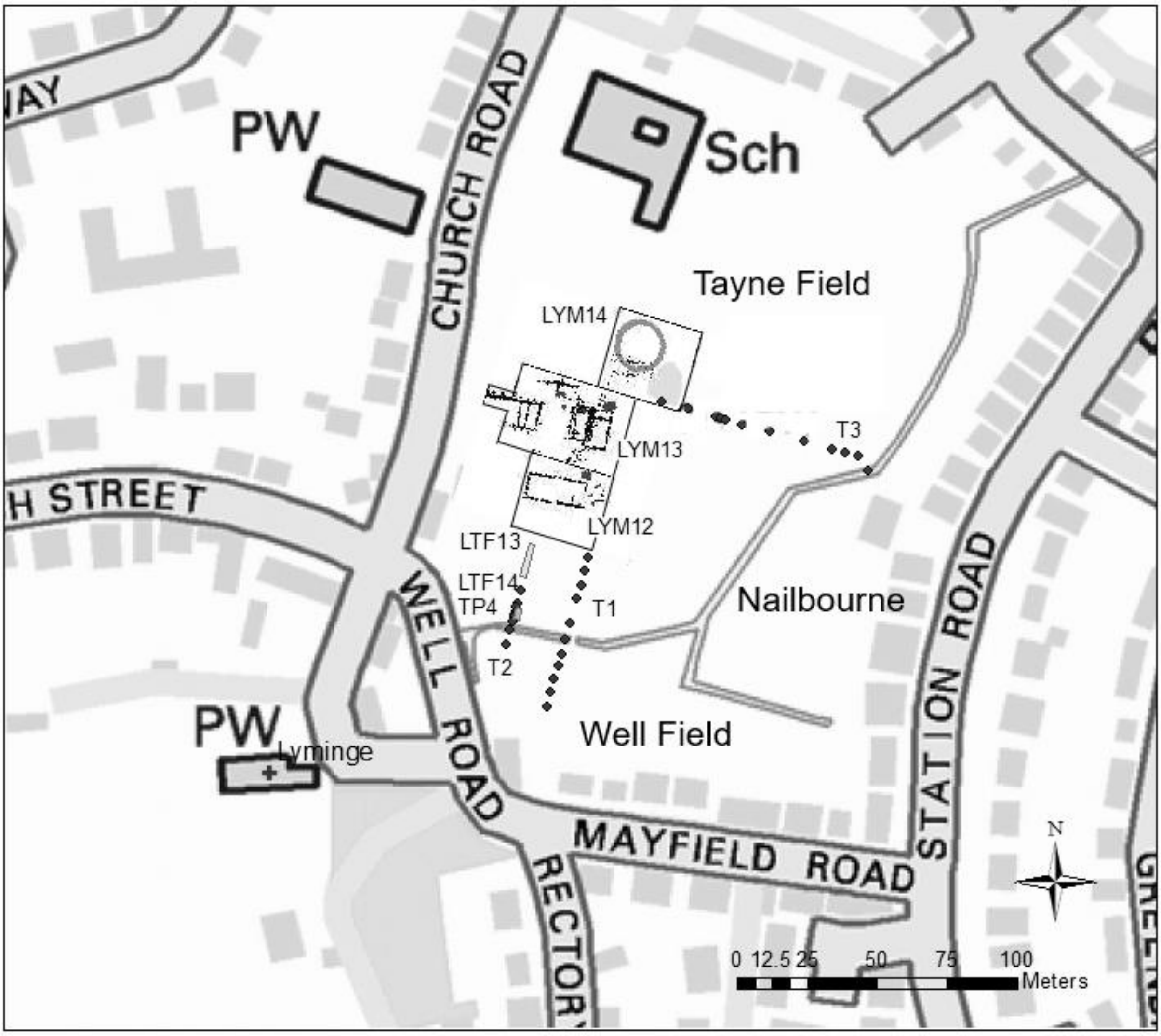


Figure 5: Overview of 2012–14 excavation areas (by site code) and borehole locations on Tayne Field. © Crown copyright (2017) EDINA Digimap, Ordnance Survey.

3.3.3 Bulk sampling for compositional analysis

Sediment samples (100g) were collected in sequences along the eastern N – S baulk of the LYM12 and LYM13 trenches at depth intervals of 10cm from the turf line to the limit of excavation. These sequences were taken at intervals along the baulk corresponding to the main site grid peg intervals of 5m. Another set of sequences were taken from the eastern N – S baulk of the LTF13 trench to provide a southern extension to the LYM12/13 set. Samples were also recovered from the three borehole transects undertaken in summer 2013 and Easter 2014 (section 3.2).

3.3.4 Sampling for mollusc sequences

Sequences of 1kg dry sediment samples were collected from phased Bronze Age (one sequence) and Saxo-Norman / medieval ditch (three sequences) catchments within the LTF13 and LYM13 excavation areas, specifically for mollusc analysis. Sampling was conducted within 5 to 10cm intervals dependent upon identified context boundaries as per Evans (1972: 41). An additional offsite sequence of twelve 1kg bulk samples was collected from the lynchet exposure at Woodland Road (Chapter 10).

3.3.5 On site bulk sampling for environmental analysis

On-site bulk sampling and flotation was conducted during all six main seasons of work at Lyminge from 2008 – 2014; from 2012 to 2014 this program was undertaken by the author. This process involved targeted sampling at volumes of between 5 and 40 litres in accordance with English Heritage guidelines (Campbell *et al*., 2011). Flotation was conducted on-site using a 1mm heavy residue mesh and flot sieves at 1mm and 300µm. These samples were analysed for Mollusca (Chapter 7). Botanical assessments of this material were undertaken by Campbell (2012) for 2008-2010 and Balantyne (2014) for 2012-2013 as part of the wider work of the Lyminge archaeological project. Further analysis of samples of charred plant material from the 2008 and 2014 seasons was conducted by McKerracher (2012; 2015a) and Austin (2015).

3.3.6 Column Sampling from archaeological contexts

Additional monoliths were taken from the potential Bronze-Age boundary feature investigated during 2013 (LTF13) as part of a pilot assessment of pollen preservation within the ditch fills encountered on site. These samples demonstrated limited pollen preservation comprising largely intrusive modern material and were not taken forward into analysis.

3.4 Laboratory Methodologies

3.4.1 Mollusc extraction

Molluscs were extracted from the on-site environmental sampling program using a flotation tank with 1mm and 300 µm sieves and 1mm heavy residue mesh. Over 500 individual samples of originally between 1 and 40 litres were analysed as part of this process from Tayne Field (189 samples), Rectory Paddock (197 samples) and Rectory Lane (137 samples). Dedicated samples of 1 or 2kg bulks from three phased ditch catchments on Tayne Field (Chapter 8), a sequence (<3>) from the stream trench (Chapter 5) and a sequence from an offsite lynchet (Chapter 10) were also recovered for more detailed analysis. These bulk samples were processed followed the standard methods of Evans (1972: 41) by disaggregation using 10% dilute hydrogen peroxide and Calgon (Sodium hexametaphosphate) under a fume hood, before washing through nested sieves (4mm, 2mm, 1mm, 0.5mm). The residues and flot from this process was oven dried at 40°c.

3.4.2 Particle size

Samples taken from trench baulks and auger sequences were processed for quantitative analysis of sediment composition using a Malvern Instruments Mastersizer 3000 laser diffraction particle size analyzer (www.malvern.com/en/products/product-range/mastersizer-range/mastersizer-3000/). This provided representation of particulate composition with an upper threshold of 2mm with analysis constrained to clay/silt/sand fractions only for the sake of simplicity and better comparability across datasets.

3.4.3 Pollen and non-Pollen Palynomorph analysis

Six sub samples were taken from each of the three monoliths extracted from the Tayne Field environmental trench (LTF14 TP4). These samples corresponded to major stratigraphic or sedimentary units relating to hydrological or geomorphological changes in the sequence. Material from these samples was processed by heavy-liquid separation and acetolysis at the University of Reading. Pollen grain identifications were undertaken with reference to Moore and Webb (1978;

1991) using nomenclature after Bennett (1994); non-pollen palynomorph identification and nomenclature follow Reille (1992), Van Geel (1980), Van Geel and Aptroot (2006) and Cugny *et al* (2010).

3.4.4 Waterlogged macrofossil analysis

Fifteen 1 litre bulk samples forming a continuous sequence through the stratigraphy and six further individual samples from waterlogged units not captured within this sequence were extracted from the Tayne Field environmental trench (LTF14 TP4) (section 3.3.2, Chapter 5). These were washed through nested 1mm and 300µm sieves and the extracted material was sorted and assessed using a Leica biological microscope. Taxonomic identifications were made in reference to the Digital Seed Atlas of the Netherlands (www.seedatlas.nl)(Cappers *et al*., 2006) with plant nomenclature after Stace (2010). Additional consultation was sought from Dan Young (Quest, University of Reading) and Dr. Lisa Lodwick (University of Reading). Species were tabulated separately whenever possible; ambiguous or indistinguishable specimens were recorded grouped by family or type.

3.4.5 Thin section preparation and micromorphological analysis

Six samples taken from on-site locations were processed in the thin-section preparation facility of the Department of Archaeology, University of Reading. According to this facility's standard operating procedure, blocks were dried to ensure a water content of less than 1% before impregnation with epoxy resin in a vacuum chamber. Slices were then cut from cured blocks, mounted on slides and ground to ~50µm using Brot and Logitech lapping machines, before being hand-finished to 30µm with fixed-grit paper. Semi-quantitative micromorphological analysis was conducted using a Leica DM EP polarising microscope in plane-polarised light (PPL) and cross-polarised light (XPL) at magnifications of x40, x100 and x400. A Leica DML microscope equipped with a 50w Hg discharge UV lamp was employed for the identification of organic materials by incident light fluorescence (Leica Filter system AS, Filter system N2.1S: wavelength excitation 515–560 nm, transmitting >590 nm) (Courty *et al*, 1989: 48 – 49; Matthews, 2016: 111). Descriptions were made with reference to Bullock *et al* (1985) and Courty *et al* (1989); frequency of features and inclusions were assessed by visual estimation and subject to error ranges of approximately ±5% (Matthews, 2010: 101).

3.4.6 Geochemistry

Three 0.5m monoliths were extracted from the doline / hollow sequence for geochemical evaluation using a portable X-Ray fluorescence device (Pollard *et al*., 2007: 11). Spot sample points were taken from base to top, within identifiable context boundaries and with reference to site records contained at www.iadb.co.uk/lyminge. Details of sample locations are presented in Chapter 7.

3.4.7 Radiocarbon dating

Ten samples from the waterlogged sequence were submitted for radiocarbon dating at the Oxford Radiocarbon Accelerator Unit (ORAU) (www.c14.arch.ox.ac.uk) as part of NERC award NF/2015/2/13. Details of sample location are presented in Chapter 5. Calibration and Bayesian statistical modelling was undertaken in OxCal 4.2 (Bronk Ramsey, 2016) using the IntCal13 calibration curve.

3.5 Mollusc analysis

3.5.1 Quantification and identification

Identification was conducted using a Leica stereo biological microscope to quantify Minimum Number of Individuals (MNI) counts from whole shells and apical fragments. Unless otherwise stated, all quantification was undertaken by the author. Identifications were made with reference to Evans (1972) and Kerney (1999; 1979) and reference collections held at the University of Reading. Further assistance was provided by Professor Martin Bell and Dr. Tom Walker. Taxonomic nomenclature is after Anderson (2005).

Several groups present problems of resolution for their component species not readily resolvable in sub fossil assemblages (Sparks, 1964; Evans, 1972: 49). Ambiguous apical fragments for groups such as Succineidae and particularly tiny Clausiliidae apices are collated into higher level groupings as is standard practice (e.g. Wilkinson in Gerrard and Aston, 2007: 866). Indistinguishable apices or juveniles of genera such as *Vallonia* which comprise two or more morphologically similar species (e.g. *V. excentrica, V. costata* or *V.pulchella*) are quantitatively apportioned from the ratio of identified specimens for the species to the total number of specimens for the genus (Davies, 2008: 176; Robinson in Bennett *et al*., 2014: 174). Several other genera may also potentially comprise two species difficult to reliably differentiate from fragmentary material, however on the basis of whole shells which demonstrate a single main species with no identified alternative, they have generally been assigned a single species membership unless otherwise stated; *Vitrea* to *V. crystallina, Carychium* (from dry-ground contexts) to *C. tridentatum* and *Cochlicopa* to *C. lubricella*. Shells of *Cecilioides acicula*, a burrowing species which can achieve depths of up to 2m, were highly prevalent in most samples and represent a mixture of both sub fossil and intrusive modern material (Evans, 1972: 201). Consequently they were excluded from the paleoecological analysis, as is standard for chalkland assemblages (Robinson in Bennett *et al*., 2014: 174). Slug plates (Limacidae) were only present in samples incorporating heavy residues and were therefore excluded due to inconsistent representation across the dataset.

3.5.2 Interpretation

Interpretation of ecological affiliations follows standard guides (Evans, 1972; Kerney and Cameron, 1979). Table 4 summarises previous attempts to group taxa into ecological groups as synthesised from published lists in Davies (2008) which collate earlier groupings (Evans, 1972; Sparks, 1961; Boycott, 1934). Various problems exist with the application of the more simplistic of these schemes which often assume a 1:1 relationship between taxa and environments, despite the fact that several studies (e.g. Cameron and Morgan-Huws, 1975) have demonstrated that species can exist in very different circumstances during various stages of faunal succession, thereby sometimes occurring in environments which would otherwise not support them. There is furthermore an over-relience on the use of modern distribution data to understand paleoecological relationships which, as a result of changing habitat preferences over time, may not be accurate, challenging the uniformitarian assumptions underpinning the approach (Davies, 1992: 66).

Other complications inherent in these categorisations, highlighted in Thomas (1985), Evans (1972) and Davies (2008), arise from individual species' abundance sometimes being more dependent on micro-scale factors such as geochemical variation or relationships with other species in the community. More recent work by Cameron *et al* (2006) has also highlighted how the presence or absence of microhabitats across sampled areas can be the dominant factor in the present-day balance of species, leading to superficially similar environments producing quite different proportions of taxa. Consequently an overreliance on habitat groupings in the past has led to criticism of over-simplistic blanket interpretations of landscape change, which realistically requires much more extensive validation (Thomas, 1985: 142). Within the present study interpretation of ecology will derive from synecological associations with only limited reliance on either total habitat groupings or the presence or absence of individual “indicator” species.

Ecological groupings, where referred to at all in the present study, are employed to highlight broad variations in the character of the assemblages which can be generally supported in terms of analogy (Davies, 2008: 57). These groupings are therefore presented with extensive *caveats*. In many cases where sample material derives from occupation deposits containing dumped and reworked material, these do not represent natural communities and must be understood as aggregates of a range of local and more distant ground surface ecologies depending on the range formation processes and generative activities. In such cases use of ecological-preference groupings to suggest environmental shifts is applied from a qualitative and comparative perspective using a spatially diverse range of samples to indicate changes in use of space or activities. Work undertaken on pit sequences at Rectory Lane (Chapter 9) in particular makes use of such groupings to investigate broad-scale environmental shifts over time under the assumption that these samples do not represent discrete communities.

Attempts to overcome the issues associated with over-reliance on indicator species or ecological groupings have incorporated multivariate statistical analysis of environmental and taxonomic associations (e.g. Davies, 2008: 11). For subfossil assemblages these associations can only be ascertained indirectly; the use of multivariate approaches in the present work (Chapter 11) attempts to overcome this problem by extracting significant factors of variance in order to approach a more direct degree of comparability, irrespective of small scale ecological shifts over time. These models incorporate a wide range of contemporaneous material from across the sample areas to more accurately investigate spatial scales of environmental variation which are a known weakness of the use of Mollusca for wide-area modelling (Thomas, 1985). This process, of necessity, is guided by the limitations and scope of the dataset and enables resolution of potentially significant ecological transitions and associations contained within the large number of quantified taxa (O'Connor and Evans, 2005: 208-210). This further enables investigation of landscape transitions and variation in land-use in order to attempt identification of putative zones of activity or the impact of settlement shift across time. All conclusions are testable against other proxy data and wider archaeological interpretations to prevent the over-interpretation of insubstantive false-positive conclusions that multivariate ordination methods can produce (Shennan, 1997: 299).

Table 4: Ecological associations highlighted from previous studies associated with taxa recorded at Lyminge

Species	**Ecological grouping (Evans, 1972)**	**Ecological grouping (Sparks 1961)**	**Ecological grouping (Boycott 1934)**	**Cameron & Morgan-Huws 1975 (Chalk grassland faunas)**	**Evans (1991) dry / wet-ground taxocenes**	**Broad ecological affiliation**
Acicula fusca	1d Other shade		4 Anthropophobe / 6a Exclusive woodland			Shade / woodland
Acanthinula aculeata	1d Other shade		5 Anthropophobe / 6a Exclusive woodland			Shade / woodland
Aegopinella nitidula	1a Woodland (Zonitidae)	4 Woodland	3b Synanthropic	Restricted to grassland with longer vegetation.		Shade / woodland
Carychium tridentatum	1b Woodland / 5d Marsh			Catholic, wetter ground, longer vegetation; possibly indicative of transition.	DGT-4: sheltered, cool places with taller vegetation and unstable surfaces.	Shade / woodland
Clausiliidae	1d Other shade		3b Synanthropic	Restricted to grassland with longer vegetation.		Shade / woodland
Discus rotundatus	1c Woodland	4 Woodland	3b Synanthropic	Woodland type generally absent from calcareous grassland faunas.		Shade / woodland
Helicigona lapicida	1d Other shade		5 Stone walls / 6a Exclusive woodland			Shade / woodland
Merdigera obscura	1d Other shade		5 Stone walls			Shade / woodland
Oxychilus cellarius	1a Woodland (Zonitidae)		2e Facultative xerophile / 3b Synanthropic	Restricted to grassland with longer vegetation.		Shade / woodland
Pomatias elegans	2 *Pomatias elegans* / 8 Burrowing	2 Separately grouped			DGT-5: exposed areas with unstable surfaces, possible tillage.	Shade / woodland
Punctum pygmaeum	1d Other shade / 4b Allied open-country / 5c Marsh	1 Marsh and associated	1b Facultative hygrophiles			Shade / woodland
Trochulus striolatus	1d Other shade / 10 Synanthropic		3a Strongly synanthropic			Shade / woodland
Vitrea crystallina	1a Woodland (Zonitidae) / 5c Marsh		3b Synanthropic			Shade / woodland
Vitrea contracta	1a Woodland (Zonitidae)			Catholic, wetter ground, longer vegetation; possibly indicative of transition.		Shade / woodland
Cepaea nemoralis	3 Intermediate / catholic / 5c Marsh			More common on grassland over 10cm with deeper soils.		Intermediate
Cochlicopa lubrica	3 Intermediate / catholic / 5c Marsh	1 Marsh and associated	1b Facultative hygrophile / 3b Synanthropic	Slightly wetter calcareous grassland.	DGT-3: decalcified and impoverished grassland.	Intermediate
Cornu aspersum	7 Alien / introduced / 10 Synanthropic		3a Strongly synanthropic			Intermediate

Species	**Ecological grouping (Evans, 1972)**	**Ecological grouping (Sparks 1961)**	**Ecological grouping (Boycott 1934)**	**Cameron & Morgan-Huws 1975 (Chalk grassland faunas)**	**Evans (1991) dry / wet-ground taxocenes**	**Broad ecological affiliation**
Trochulus hispidus	3 Intermediate / catholic / 5c Marsh		1b Facultative hygrophile / 2e Facultative xerophile / 3b Synanthropic		DGT-3: decalcified and impoverished grassland. DGT-4: sheltered, cool places with taller vegetation and unstable surfaces.	Intermediate
Candidula intersecta	7 Alien / introduced		2a Short grassland / 7 Not usually in woods			Open country
Cernuella virgata	7 Alien / introduced		2a Short grassland / 7 Not usually in woods			Open country
Helicella itala	4a Commonly open-country	2 Dry land	2a Short grassland / 7 Not usually in woods	Shorter grassland with shallower soils, not too exposed / northerly aspect.	DGT-5: exposed areas with unstable surfaces, possible tillage.	Open country
Monacha cantiana	7 Alien / introduced		2e Facultative xerophile / 7 Not usually in woods			Open country
Pupilla muscorum	4a Commonly open-country	2 Dry land	2b xerophiles / 5 Stone walls / 7 Not usually in woods	Shorter grassland with shallower soils, not too exposed / northerly aspect.	DGT-2: stable grassland with possible tillage. DGT-5: exposed areas with unstable surfaces, possible tillage.	Open country
Vallonia excentrica	4a Commonly open-country	2 Dry land / 3 unwooded	1b Facultative hygrophile / 2e Facultative xerophile / 7 Not usually in woods	Shorter grassland with shallower soils, not too exposed / northerly aspect.	DGT-1: stable, well vegetated grassland. DGT-3: decalcified and impoverished grassland.	Open country
Vallonia costata	4a Commonly open-country	2 Dry land / 3 unwooded	2e Facultative xerophile / 3b Synanthropic / 5 Stone walls / 7 Not usually in woods	Shorter grassland with shallower soils, not too exposed / northerly aspect.	DGT-1: stable, well vegetated grassland. DGT-4: sheltered, cool places with taller vegetation and unstable surfaces.	Open country
Vertigo pygmaea	4a Commonly open-country / 5c Marsh	1 Marsh and associated	1b Facultative hygrophile / 2e Facultative xerophile / 7 Not usually in woods	Shorter grassland with shallower soils, not too exposed / northerly aspect.		Open country
Carychium minimum	5c Characteristic marsh	1 Marsh and associated	1b Facultative hygrophile		WGT-2: open areas of lightly grazed flood pasture or water meadow.	Marsh
Oxyloma / Succinea	5b Obligatory marsh	1 Marsh and associated	1a Obligate hygrophiles		WGT-2: open areas of lightly grazed flood pasture or water meadow.	Marsh
Vallonia cf. *pulchella*	5c Characteristic marsh	1 Marsh and associated	2e Facultative xerophiles / 7 Not usually in woods			Marsh
Bathyomphalus contortus						Marsh
Anisus leucostoma	6 Freshwater slum				WGT-5: open grazed flood pasture / water meadow / flooded.	Marsh
Galba truncatula	5a Amphibious / freshwater / 6 slum				WGT-2: open lightly grazed flood pasture or water meadow.	Marsh
Lymnaea peregra						Marsh
Leucophytia bidentata						Marsh
Pisidium					WGT-5: open grazed flood pasture / water meadow / flooded.	Marsh
Zonitoides nitidus	5b Obligatory marsh	1 Marsh and associated	1a Obligate hygrophiles / 7 Not usually in woods			Marsh

3.5.3 Comparison between recovery methodologies

Two methodologies for recovery of Mollusca are utilised in the present research; laboratory wet-sieving to 0.5mm of dedicated 1 litre bulk samples and on-site flotation of environmental bulk samples (of up to 40 litres) with recovery to 250/300µm (for the flot) and 1mm (for the heavy residues). This dichotomy introduces methodological issues for the analysis, largely from variations in breakage patterns leading to differentials in representation of fragile shells such as *Oxyloma* / *Succinea* and identifiable fragments from different sized species (Sparks, 1964). The flotation process introduces bias which will affect species representation due to the method retaining whole shells or fragments which can trap air and float down to 250/300 µm in the flot whilst only retaining fragments over 1mm in size in the heavy-residue. This systematically reduces representation of taxa with shells prone to fragmentation from sample processing (large taxa such as *Cepaea*), which do not float (slug plates) or which are too small to be retained in the heavy residue (apices of smaller taxa).

These issues are the result of limitations imposed by a necessity to sample broadly for a range of proxies other than Mollusca, such as charred plant macrofossils, during fieldwork. Despite these problems, which are partially quantified in the study presented below, flotation samples can be regarded to be comparable due to incorporating such taphonomic and systematic biases consistently across *all* samples in the dataset. This enables comparative analysis to remain applicable across all on-site floated samples and the resolution of relative shifts or transitions in ecological affinities between large numbers of archaeological features and phases to be meaningfully resolved. However direct quantitative comparison with assemblages from other sequences which have been subject to laboratory sieving will not be attempted; for this stage of the analysis multivariate analysis will be undertaken in order to normalise the data and model associations using a semi-quantitative multivariate approach (Chapter 11).

In order to assess the relative impact upon representation that these alternative methods produce upon the data, a comparative study is presented in Table 5 and Figure 6 for two ditch fill contexts from Tayne Field where both on-site floatation and laboratory sieving were applied comparatively. The field labelled *Vallonia* sp. indicates apical fragments unresolvable to species to demonstrate the varying proportion of fragmented specimens recovered by both methods. Context (6745) had three 1 litre bulk samples taken specifically for mollusc extraction compared to the single litre taken for (6764); the data presented for this context thus represents the combined result from all three. This larger volume of dedicated material for context (6745) meant that the variation in extraction methodology did not appreciably change the proportional representation of taxa when comparatively analysed (Figure 6). By contrast the results for context (6764) demonstrate that for smaller (1 litre) individual bulk samples taken from contexts demonstrating a low density of shells, the flotation samples produce a much larger but far more averaged assemblage with potentially less precise representation of individually significant taxa. This is likely due to the potential homogenisation of micro-habitats and sedimentary contexts across large archaeological features subject to uniform programmes of field sampling. Comparison of the different recovery strategies additionally demonstrates that the flot samples may under-represent smaller taxa such as *Vallonia* by up to 20%. Consequently it is acknowledged that use of data from field flotation sampling is likely to present a less accurate picture on a context by context basis; however this is compensated for by the availability of a far larger volume of data across the wider site area.

Table 5: Comparative mollusc counts by extraction method

Sample	Volume (L)	Total shells	*Trochulus hispidus*	*Vallonia sp.*	*Vallonia excentrica*	*Vallonia costata*	*Vallonia pulchella*	*Vertigo Pygmaea*	*Pupilla muscorum*	*Cochlicopa*	*Carychium tridentatum*	*Oxychilus cellarius*	*Galba truncatula*	*Cecilioides acicula*	Limacidae
6745 **(flot)**	16	488	46	17	14	3	0	5	4	4	0	3	0	392	0
6745 **(bulk)**	3	357	18	9	9	2	0	2	1	2	0	2	0	305	7
6764 **(flot)**	20	369	24	18	18	2	2	8	6	3	3	2	1	282	0
6764 **(bulk)**	1	55	7	0	8	1	0	0	1	1	0	0	1	36	0

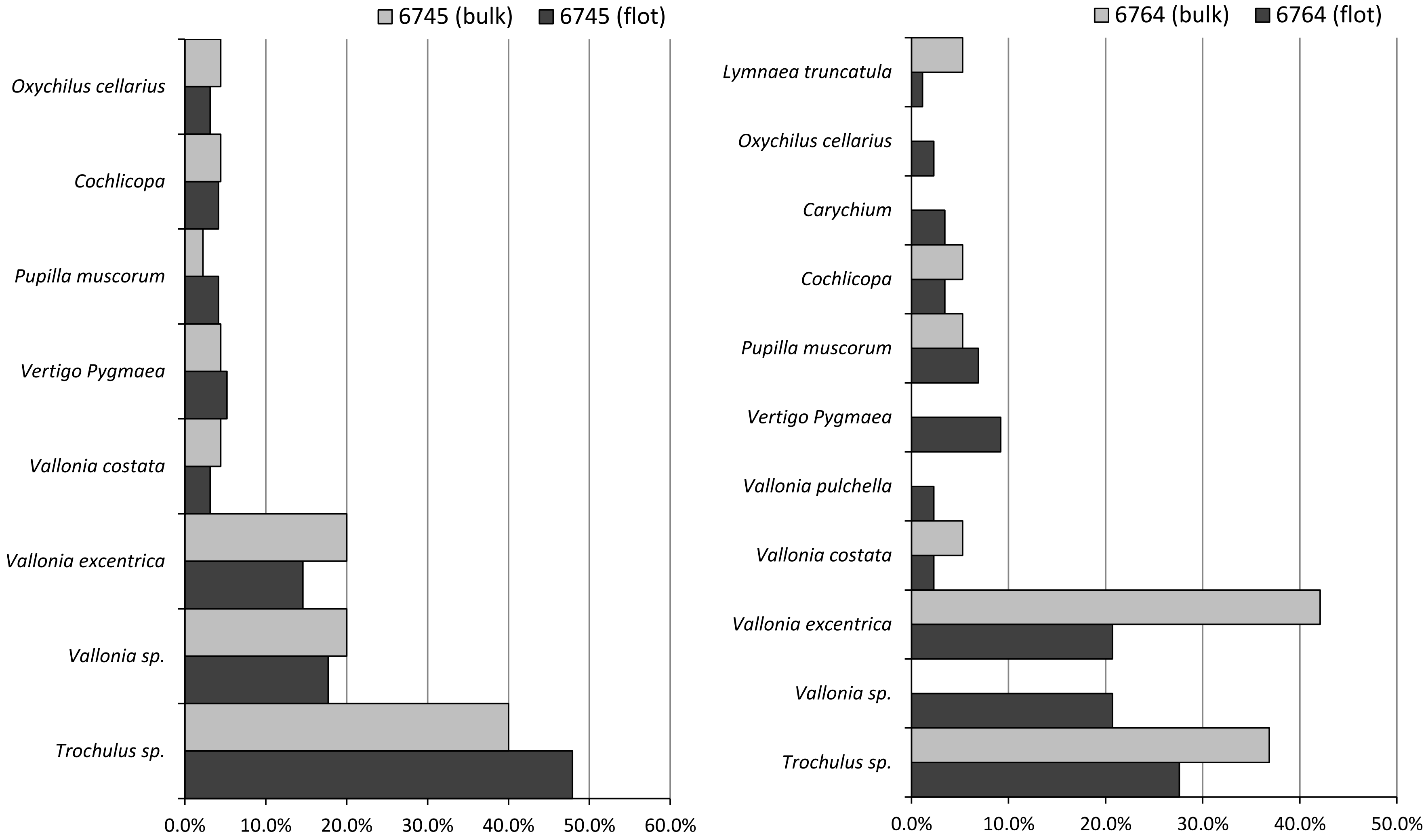


Figure 6: Comparative representations of Mollusc taxa by extraction method for ditch contexts (6745) and (6764).

Within the on-site sample set, other discrepancies are present due to variations in storage and on-site processing. Analysis of samples from the Tayne Field (2012/13/14) seasons was limited to the flot fraction only due to time constraints and the large number of samples; however this was consistent across this entire area which will maintain the comparative validity of the results for this area (Chapter 8). The material from the Rectory Paddock (2008/9) area (Chapter 9) was divided between large numbers of separate bags, many of which had become misplaced since initial processing. This necessitated a sub-sampling approach for samples which were only partially represented, with the result that the recorded relationship between original bulk volume and shell count for these seasons will not be valid. For this sample area, counts were conducted on sufficient available material from each sample until the total shell count for diagnostic species exceed 100 shells; smaller samples were counted to completeness.

For analytical purposes, these variations between samples in total shell number, original volume and other factors resulting from methodological inconsistencies are countered by restricting analysis to proportions rather than absolute counts, thus normalising taxonomic representation irrespective of sample size. All data is collated in MS Excel and mollusc diagrams are generated using C2 data analysis software version 1.7.4 (Juggins, 2011).

3.5.4 Controls and environmental analogues

In order to more accurately interpret the ecological affiliations for the subfossil molluscan material, a range of locations around the project sample areas were sampled to provide control assemblages of modern taxa associated with known environments. These locations were selected to provide a full range of representation of typical environmental types likely to have been present during the archaeological phases, including open grassland, arable field and wooded marginal areas. In all cases the sample material was composed of surface-collected litter and soil containing live or freshly empty shells without a significantly abraded ancient sub-fossil component. The range of analogues selected is detailed in Table 6 with corresponding locations mapped in Figure 7.

Table 6: Full list of sampled environmental analogues

Analogue	Location	Habitat description	Vegetation / ground cover
I	SE corner LYM10 excavation area, Rectory Lane sample area.	Overgrown / wooded field margin.	Canopy mainly Hazel and Ash; ground cover mainly Ivy with nettles and woodland plants such as wild *Arum*.
II	S of LYM09 excavation area, Rectory Paddock sample area.	Ploughed arable field (not cereal), 3m from hedgeline, south facing aspect.	Bare, ploughed earth with dry crop (not cereal) stalks.
III	SW corner of Rectory Paddock sample area, south of ALF10 excavation area.	Steep wooded lynchet bank under ploughed arable fields, alongside suspected hollow way.	Canopy of hawthorn, Ash and Maple with ground cover of brambles and Ivy over chalk scree and loose soil on bank slope.
IV	ALF10, Abbot's field, adjacent to LYM08/LYM09 excavation areas in Rectory Paddock sample area.	Overgrown unwooded / waste ground, no recent agricultural or grazing activity.	Long grass, thistles, nettles and extensive Hogweed.
V	NW corner of Tayne Field sample area	Overgrown / wooded field margin.	Canopy mainly Hazel, Hawthorn, Ash, Holly and Yew; ground cover mainly Ivy with nettles and woodland plants such as wild *Arum*.
VI	North bank of Nailbourne, Tayne Field, around 20m from spring.	Stream channel bank, subject to intermittent flooding and management from periodic vegetation clearance.	Long dank grass and nettles with riparian herbaceous vegetation.
VII	Tayne Field, slope mid-point to south of settlement area (LTF13)	Open field area, regularly mown and trampled.	Short-turfed grassland.
VIII	Tayne Field plateau summit, overlaying archaeological features	Open field area, regularly mown and trampled.	Short-turfed grassland
IX	Tayne Field, slope foot to south of settlement area 1.5m from top of stream bank on north side of Nailbourne	Open field area, regularly mown and trampled.	Short-turfed grassland

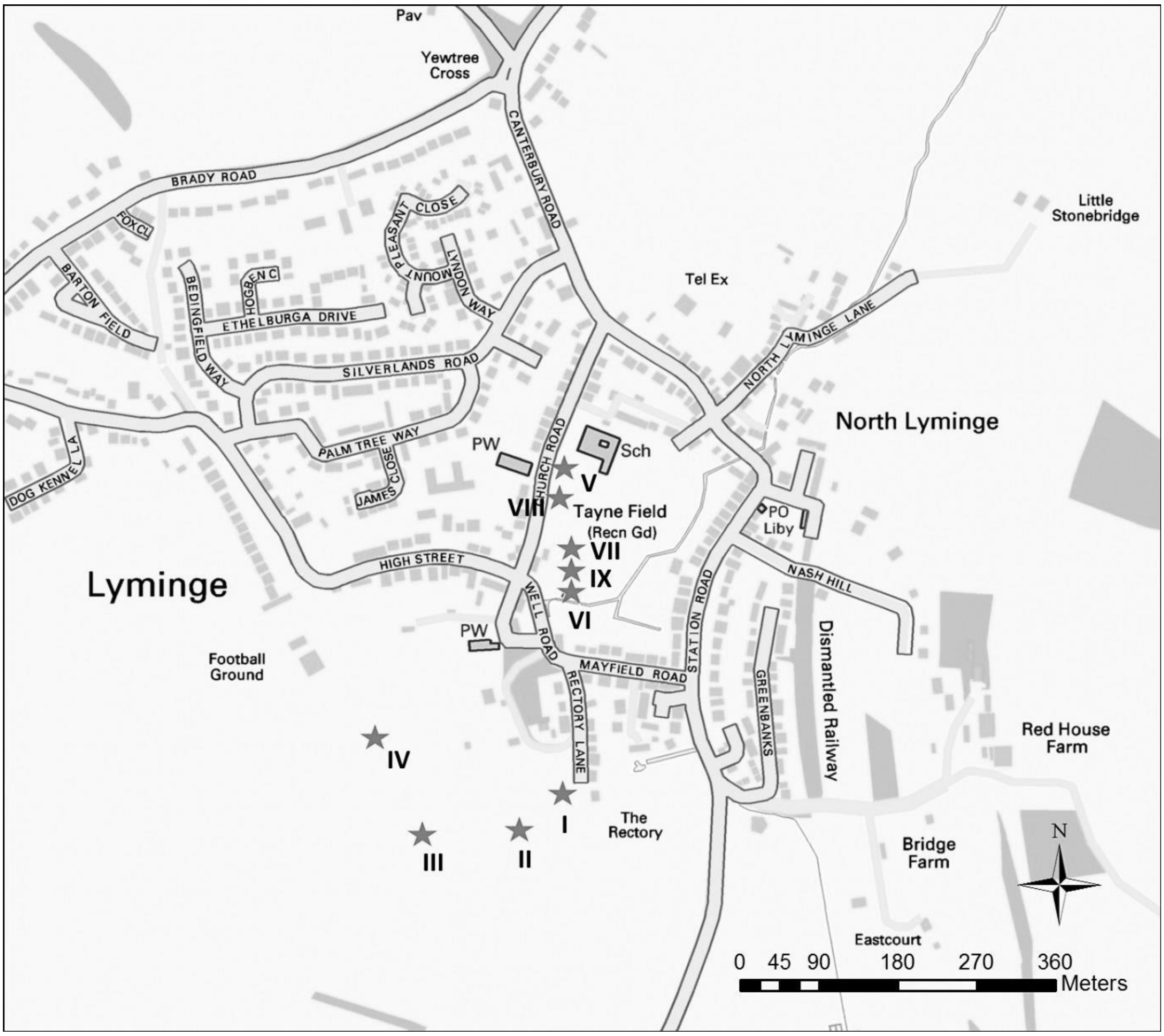


Figure 7: Locations of bulk samples (stars with Roman numerals) taken to provide modern analogues for mollusc distributions in known habitats. © Crown copyright (2017) EDINA Digimap, Ordnance Survey.

Distributions of ecological affinities are summarised in Figure 8 and Figure 9. For these summaries, the three analogues taken from the open areas on Tayne Field were combined into a single grassland analogue due to the very low shell density encountered in the processed samples.

These analogues demonstrate pronounced disparities between the local valley-floor environments around the settlement area with regards to species balance and the dominant types. With regards to the open country samples, the short-turfed grassland areas on Tayne field (analogues VII-IX) which are subject to land management comprising intensive machine mowing, demonstrate a sparse ecology mainly comprised of *Vallonia excentrica*, with a lesser proportion of *Trochulus hispidus*. By contrast, the open arable field location (analogue II) which is managed with regular machine ploughing and other types of agricultural disturbance, demonstrates a sparse ecology dominated almost exclusively by *Trochulus hispidus* together with a limited selection of open-country and shade-loving types. The modern waste ground analogue (analogue IV) was taken from an adjacent field area overgrown with long weeds (nettles, hogweed, long grasses) and contains a much more numerous fauna dominated by *Trochulus striolatus*, *Trochulus hispidus, Aegopinella nitidula* as well as open-country types such as *Vallonia* sp.

The wooded marginal areas around these fields (analogue I) are home to a wide range of species, dominated by *Oxychilus celarius*, *Aegopinella nitidula*, *Trochulus striolatus* and *Trochulus hispidus* together with other shade loving varieties such as *Discus rotundatus*, *Vitrea* sp. and Clausiliidae. A similar type of habitat adjacent to Tayne Field (analogue V) presented a different community, again with large proportions of *Aegopinella nitidula* and *Trochulus striolatus* but here with *Vitrea* sp. also dominating alongside intermediate and dry-ground types from the adjacent open areas. Perhaps most significantly, this sample also contained *Merdigera obscura* a type normally highly specific to old growth woodland when found in dryland areas (Davies, 2008: 83). Comparison between these two analogues, both of which came from wooded margins to open areas in the present day landscape, reveals the high degree of diversity between similar types of shaded environments and also the propensity for taxa conventionally associated with woodland to be found a short distance from open, heavily disturbed areas.

A sample taken from the slope of a lynchet bank along a hollow way to the south of the settlement area (analogue III) contains a mixture of these types of woodland margin species together with a dominant component of *Pomatias elegans* specimens observed during collection to be currently living on the friable slopes of the lynchet bank. This sample also contained a sizeable open-country component comprising *Vallonia excentrica*, *Pupilla muscorum* and *Monacha cantiana* which have presumably been washed down from the field areas above the lynchet.

A sample taken from the bank of the present day watercourse on Tayne field produced a large assemblage dominated by the damp ground type *Carychium minimum* as well as shade loving types such as *Discus rotundatus* and large numbers of freshwater bivalves (*Pisidium* cf. *personatum*) which occur in a variety of marginal freshwater and stream habitats (Killeen *et al*., 2004). This sample demonstrates the potential for shade-loving, marsh and aquatic types to exist in considerable abundance in the long, damp grasses at the watercourse margins in an otherwise open and dry ground area. It also perhaps suggests an origin for shade loving or marsh taxa that are otherwise unknown from the environment in the settlement area where they are encountered in the archaeological samples.

The use of such analogues in molluscan studies is hampered by the inherent variability in species covariation both across local environmental gradients and also through time (Davies, 1992: 66). This prevents simple direct comparison to subfossil material in all but the most general terms. However use of multivariate methods (chapter 11) allows assessment of correlations between distinctive groups of species or taxocenes, which whilst not directly representative of living assemblages from any specific environment do at least provide a basis for comparative analysis (Davies, 1992: 69).

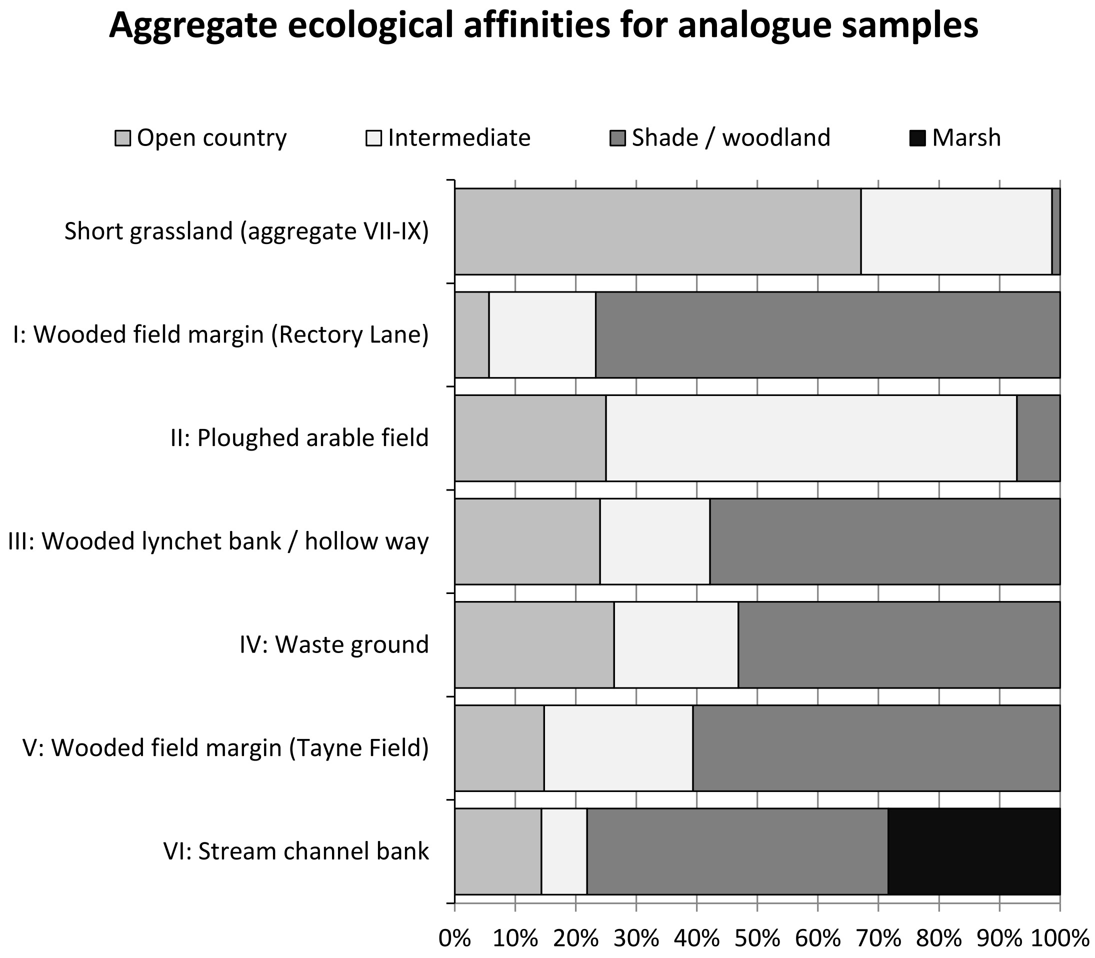


Figure 8: Aggregate data summary of modern mollusc ecologies from analogue samples

Table 7: Modern molluscan analogue samples from contemporary environments around Lyminge.

Analogue	Site ref	environment	Total shells	*Acicula fusca*	*Acanthinula aculeata*	*Aegopinella Nitidula*	*Carychium tridentatum*	Clausilidae	*Discus rotundatus*	*Merdigera obscura*	*Oxychilus cellarius*	*Pomatias elegans*	*Punctum pygmaeum*	*Trochulus striolatus*	*Vitrea* sp.	*Cepaea*	*Cochlicopa*	*Cornu aspersum*	*Trochulus hispidus*	*Candidula intersecta*	*Cernuella virgata*	*Monacha cantiana*	*Pupilla muscorum*	*Vallonia excentrica*	*Vallonia costata*	*Vertigo Pygmaea*	*Carychium minimum*	*Oxyloma / Succinea*	*Pisidium* sp.	*Cecilioides acicula*	Limacidae
I	LYM10	Wooded field margin	164	1	1	27		11	7		53	1		13	8	5	8	3	12			7		2							5
II	LYM09	Ploughed arable field	44						1		1					1		1	17			3		3		1				1	15
III	LYM09	Wooded lynchet bank / hollow way	296		1	21	11		12		14	53	1	54	1	1	3	1	48	2	1	17	14	31	1	4				1	4
IV	ALF10	Waste ground	230			29	5	1			6		1	77			6		40			9		7	43					2	4
V	LYM12/15	Wooded field margin	62			11				2	1			6	17		7	1	7					2	7				1		
VI	LTF14	Stream channel bank	515			61	27		91		1			7	11	9	20	1				1		46	8	2	108	5	115	1	1
VII	LTF13	Mid point on slope around plateau / open grassland	45													1			14					23		1				4	2
VIII	LYM13	Plateau summit / open grassland	15						1										8					6							
IX	LTF14	Top of stream bank / foot of slope, open grassland	25																2					21						1	1

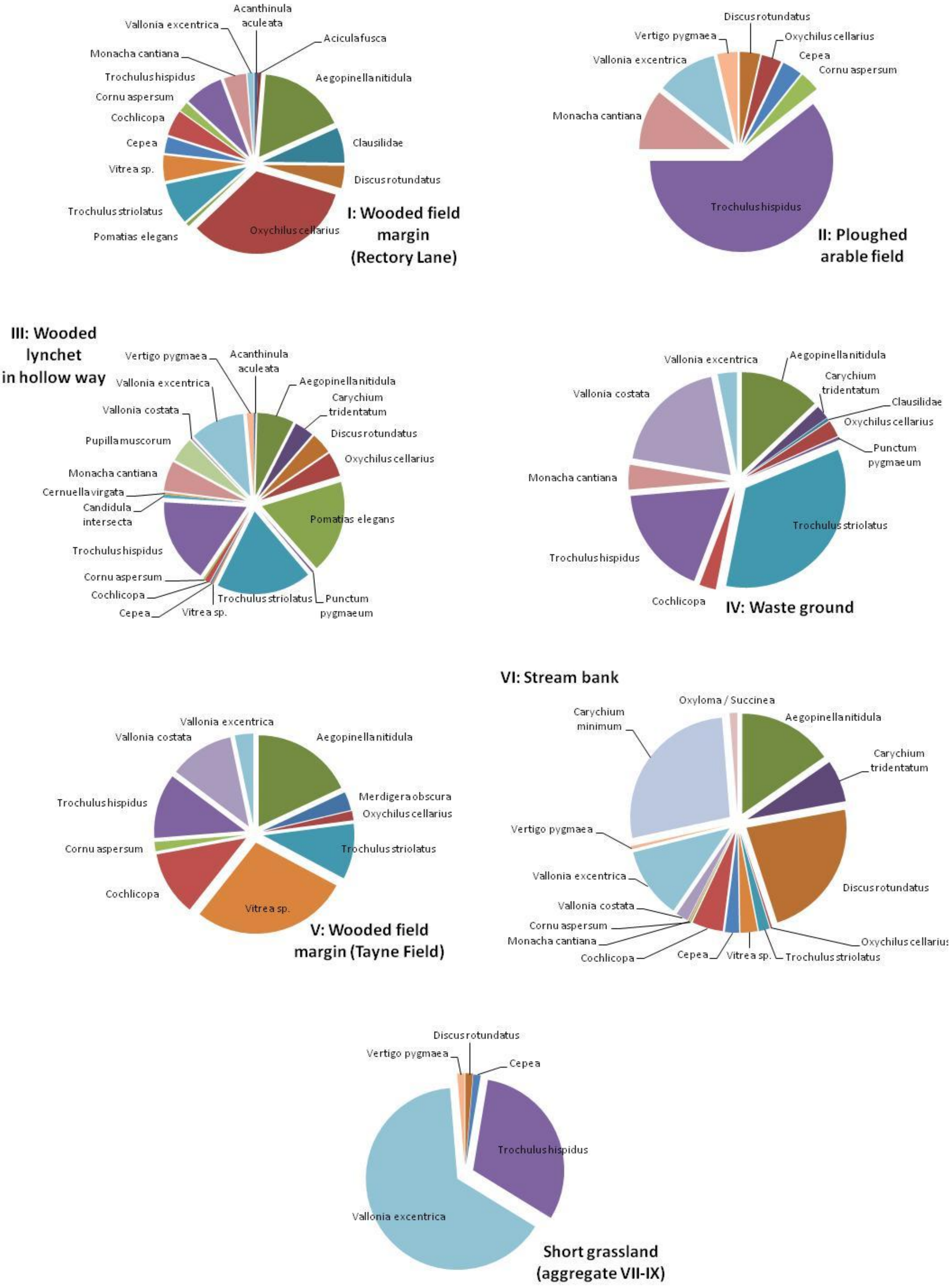


Figure 9: Unweighted proportional distributions of species in modern mollusc ecologies from analogue samples

3.6 Data processing and collation methodologies

3.6.1 GIS

A Geographical Information Systems (GIS) was developed using data sources detailed in Table 8 to provide contexturalisation of research data and interpretations at the widest scale of investigation as well as spatial modelling (Conolly and Lake, 2006). The GIS is compiled using Esri ArcGIS and ArcScene 10.1 with analysis being conducted using the extension packages ArcGIS 3D Analyst and ArcGIS Spatial Analyst. The resulting analysis of landscape and topographical factors relating to settlement location as well as the relationships to other known archaeological sites, ecological areas and natural resources is presented in Chapter 12.

Table 8: GIS layer descriptions and data sources

GIS Layer	Data Source	Description
Archaeological sites	Historic Environment Record (http://www.heritagegateway.org.uk)	Known contemporary archaeological sites including cemeteries and settlements.
Hydrogeology	British Geological Survey (http://www.largeimages.bgs.ac.uk/iip/hydromaps.html?id=kent.jp2, Downloaded: 21/2/2014)	Known spring locations and watershed definitions along with aquifer geology.
Ecological zones	Brookes 2007, Everitt 1986	Ecological provinces and *pays* representing potential resource areas.
Major watercourses	Ordinance Survey Meridian 2 National via Edina Digimap (http://digimap.edina.ac.uk, Downloaded: 10/10/2013)	Rivers and streams.
Drift and solid geology	British Geological Survey via Edina Digimap (http://digimap.edina.ac.uk, Downloaded: 10/10/2013)	Basal geology, Alluvium and head deposits.
Anglo-Saxon coastline	Brookes 2007	Reconstruction of coastline contemporary to main phases of occupation at site.
Historic, Roman and prehistoric routeways	Ordinance Survey Meridian 2 National via Edina Digimap (http://digimap.edina.ac.uk, Downloaded: 10/10/2013) and Brookes 2007	Recorded and postulated pathways, including trackways and roads preserved in modern byways.
Topography	Edina Digimap (http://digimap.edina.ac.uk, Downloaded: 10/10/2013)	Three dimensional terrain and contours for viewshed and topographical analysis.
Modern and historical OS map data	Edina Digimap (http://digimap.edina.ac.uk, Downloaded: 10/10/2013) and Edina Digimap webservice.	OS street and settlement layouts.
LIDAR Data	Environment Agency (www.geostore.com/environment-agency, downloaded 09/03/2012)	LIDAR topographical data for DTM generation, 1m resolution.

3.6.2 On-site Digital Terrain Modelling

On-site sedimentological and topographical data from the coring survey (section 3.3.1) and excavation records was correlated into stratigraphic and terrain models using Rockware's Rockworks 16 software (www.rockware.com). The resulting analysis of the geomorphology and hydrological change affecting the settlement area on Tayne Field is presented and discussed in Chapter 4.

3.6.3 Statistical Analysis

Collation and multivariate clustering and ordination analyses (Shennan, 1997) of the aggregated molluscan dataset compiled across all samples (section 3.4.1) is undertaken using IBM SPSS Statistics (version 23) and PAST (PAleontological STatistics) Version 3.11 (Hammer et al., 2001) (Chapter 11). Bayesian age-depth modelling for Radiocarbon samples is undertaken using OxCal v4.2.4 (Bronk Ramsey, 2009), R v3.2.5 (https://www.r-project.org/) and Bacon v2.2 (Blaauw and Christen, 2011) (Chapter 5).

Chapter 4 - Stratigraphy and geomorphological change around the great hall complex.

This chapter presents results and analysis of geoarchaeological survey work undertaken around the Tayne Field area between 2012 and 2014. This work is presented in accordance to the research objective (Section 1.5.3) of geomorphological evaluation and identification of plaeoecological sampling areas around the area of the great-hall complex and focus of early Anglo-Saxon settlement at Lyminge.

4.1 Stratigraphic survey

4.1.1 Borehole transects

Three borehole transects (Figure 10) were undertaken, with North-South transects (T1 and T2) being conducted in summer 2013 and an East-West transect (T3) during Easter 2014. Each transect was targeted across slope breaks and major topographical transitions evident in field survey between the settlement area on the plateau and the stream around the site margin. Borehole spacing typically varied from 5-10m dependent on ground conditions, with greater frequency undertaken on areas where lateral sedimentological discontinuity was observed in the field (such as T2). Transect T1 (summer 2013) continued the line of the LYM12/13 eastern baulk south across the stream to the southern limit of the recreation area (Well Field) on the south side of the stream. Transect T2 (summer 2013) some 20m west of T1 was intended to continue the line of the Eastern baulk of the LTF13 trench south towards and across the stream course bounding the southern rim of the Tayne field plateau and the Anglo-Saxon settlement nucleus. Transect T3 (spring 2014) continued the line of the Northern baulk of the LYM13 excavation east across Tayne field to the stream and boundary on the far eastern side.

4.1.2 Results

Transect diagrams are presented in Figure 11 - Figure 13. These display rationalised stratigraphic units derived from the field observations whose characteristics are presented in generalised terms in

Table 1. This same basic schema was applied to sequences observed from exposures in the excavation trenches in order to develop the geomorphological models presented in section 4.2. Transects 1 and 2 include the bed of the stream channel (T1 154m and T2 20m). Transect 3 includes two points corresponding to surface heights taken in order to map a noticeable dip observed in the slope profile during fieldwork; similarly T2 30m represents a spot height for the ground surface to the south of the stream bed along the axis of transect 2. In all transect diagrams the horizontal scale presents length in metres whilst the vertical dimension is exaggerated in order to enhance the presentation of topographical position of each borehole location on the slope profile.

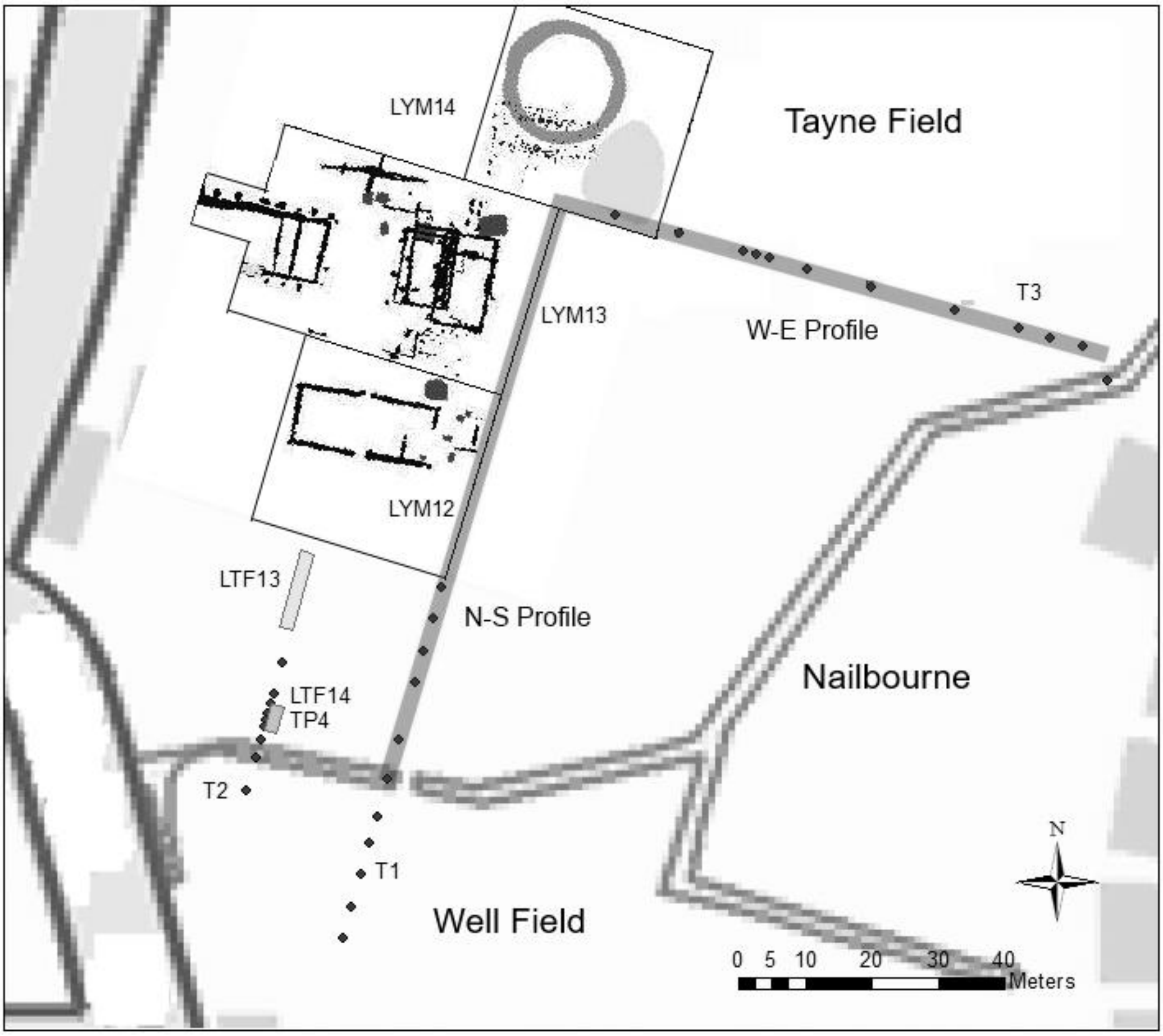


Figure 10: Site plan showing transects discussed in text in relation to major excavated features (black outlines). Shaded lines indicate transects for slope profiles (Figure 18). © Crown copyright (2017) EDINA Digimap, Ordnance Survey.

Table 9: Simplified compositional and descriptive characteristics for stratigraphic units presented in Figure 11 to Figure 13 resulting from Tayne Field borehole surveys.

Unit	**Texture**	**Clay %**	**Silt %**	**Sand %**	**Troels-Smith (1955)**	**Stoniness**	**Munsell colour**	**Colour descriptions**
Topsoil	Silty clay	5	70	25	$As^3\ Ag^1\ Gs^+$	2%	10yr 4/3	Brown
Silty clay subsoil	Silty clay	10	80	10	$As^2\ Ag^1\ Gg^1\ Sh^+\ Gs^+$	5-10%	10yr 4/2	Dark grayish brown
Made ground	Silty clay	10	80	10	$As^2\ Ag^1\ Gg^1\ Gs^+$	10%	7.5yr 5/2	Brown
Colluvial sandy clay and silty clay	Sandy to silty clay	10-20	75-80	5-10	$As^3\ Ag^1\ Sh^+\ Gs^+$	5%+	10 yr 4/2 to 2.5yr 4/1	Dark grayish brown to dark gray
Organic silt and sand	Sandy to silty clay	5	60	35	$As^2\ Ag^1\ Sh^1\ Gs^+$	5%	10y1/1 to 10yr 3/1	Black to very dark gray
Stream bed sand	Sand to sandy gravel	5	65	30	$As^2\ Ag^1\ Gs^1 Gg^+$	2%	10yr 4/2	Dark grayish brown
Stream bed load	Sandy gravel	5	60	35	$As^1\ Ag^1\ Gs^1 Gg^1$	>20%	10yr 4/2	Dark grayish brown
Silt with marl	Calcareous silty clay	20	70	10	$As^3\ Ag^1$	0%	10yr 7/6	Yellow
Chalk marl	Calcareous silty clay with chalk clasts	20	70	10	$As^3\ Ag^1$	0%	2.5yr 7/2	Light gray

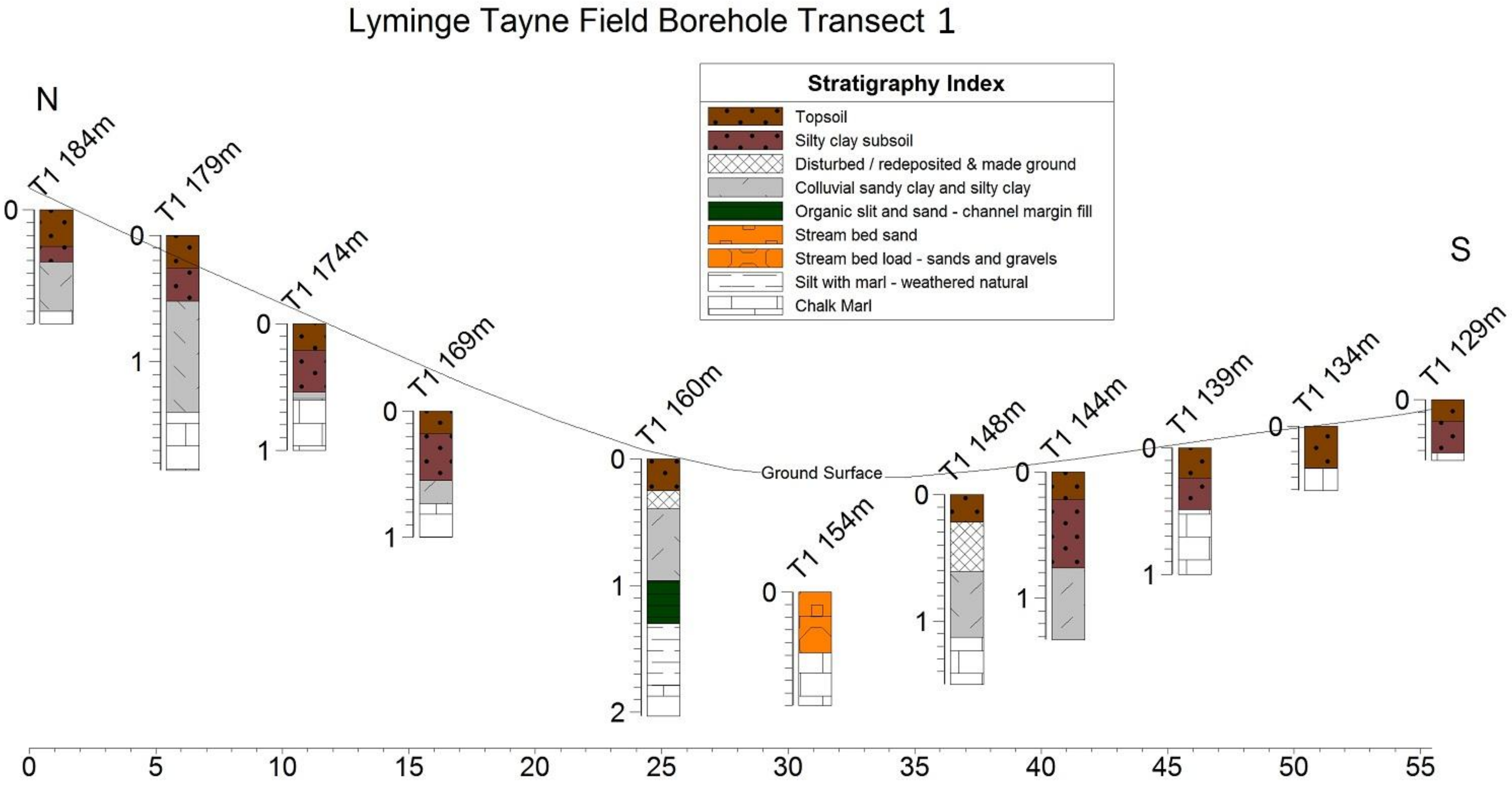


Figure 11: Transect 1 (N TO S), Tayne Field, LYM13 (stream channel represented by core at 154m N; 2012 excavation area adjoins north end at 184m).

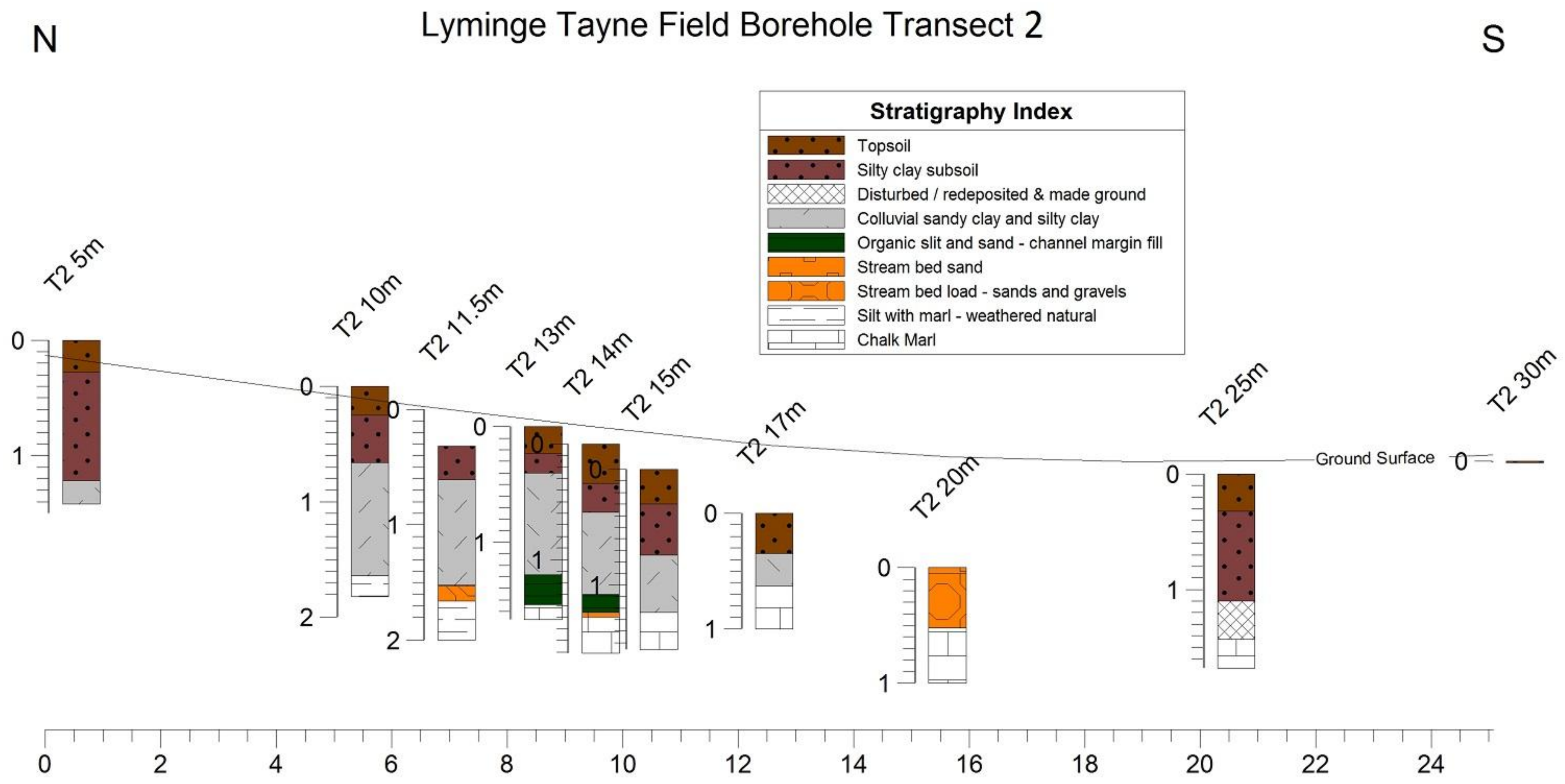


Figure 12: Transect 2 (N TO S), Tayne Field, LYM13 (stream channel represented by core at 20m N).

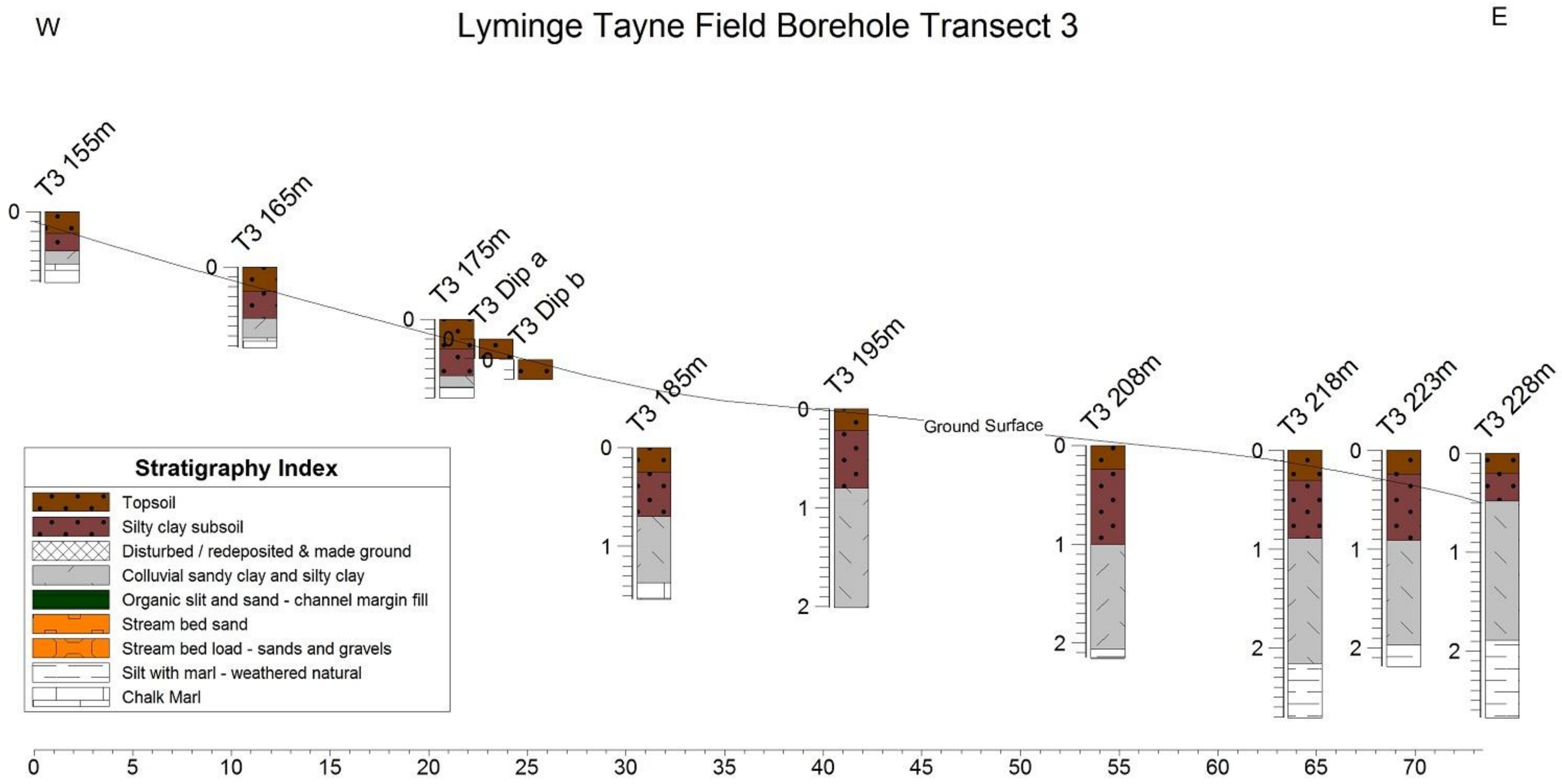


Figure 13: Transect 3 (W TO E), Tayne Field, LTF14

4.1.3 Interpretation

The results of these coring surveys defined a generic stratigraphy for Tayne Field (Table 10). This sequence of sediments was encountered across the site and represents the basic sedimentary context within which all archaeological and paleoenvironmental material was contained.

Table 10: Generic stratigraphy for Tayne Field.

Sediment unit	**Colour**	**Thickness (general range)**	**Description**
Silty topsoil	10yr 4/2 Dark greyish brown	15-35cm	Modern topsoil
Silty clay soil	10yr 4/3 Brown	20-90cm	Modern and post-medieval ploughsoil overlying archaeological deposits on the plateau area
Colluvial silt	7.5yr 6/4 Light brown to 10yr 5/2 greyish brown	10-140cm	Medieval and post medieval colluvium and redeposited sediment containing reworked archaeological material inclusions around the slopes of the plateau
Patchy Holocene subsoil?	10yr 4/4 dark yellowish brown to 10yr 6/6 brownish yellow.	<10cm	Heavily truncated patches of Holocene subsoil possibly developed on *In situ* Pleistocene Loess
Coarse silt/ loess?	10yr 4/4 dark yellowish brown to 10yr 6/6 brownish yellow.	0-40cm	Possible Pleistocene and early Holocene loess
Soliflucted clay-with-flints / valley gravels	10yr 7/3 Very pale brown to 10yr 7/6 yellow	0- 2m+ in the doline sequence (Chapter 7)	Pleistocene deposits of heavily reworked clay-with-flints / valley gravels
Chalk marl	2.5yr 7/2 Light grey to 10yr 7/3 Very pale brown	-	Weathered horizon of natural materials derived from chalk bedrock (Zig-Zag formation of the Grey Chalk Marl subgroup)

An area at the SE corner of the LYM12 excavation area on the plateau crest demonstrated reworked prehistoric sediments and a concentration of worked flint, including ten microliths, interpreted as a potential late Mesolithic and Neolithic tool production site (Lawrence and Mudd, 2015: 20). The depositional context comprised a significant thickness of sandy silt and silty clay potentially representing a reworked subsoil of prehistoric origin developed on Pleistocene loess (Figure 15). Fine resolution of the flint distribution and the detail of the sequence was disrupted by bioturbation and mechanical disturbance from human activity (tillage), with significant clay translocations to the base of the sequence and substantial evidence of earthworm penetration. Test pit excavation during 2012 demonstrated that worked flint was confined to the upper parts of this unit (Mudd and Lawrence in Thomas and Knox, 2012a: 4), suggesting that the lowest parts of the sequence may pre-date it. The results from the T1 cores (Figure 10) further demonstrate that this sequence is laterally constrained to the edge of the plateau area and scarp, potentially due to truncation from medieval ploughing and other post medieval disturbance (Figure 18). The particle size distribution of this sediment (at a depth of 50cm) is unimodal around the coarse silt fraction between 20 and 40µm. This distribution is similar to that of loessic sediments recorded nearby at Holywell Coombe (Preece and Bridgland, 1998: 74), suggesting that a similar loessic component is be present at Tayne Field. Other sedimentary units of suspected prehistoric origin on Tayne Field, such as the basal fill in the Bronze Age ring ditch (Figure 14), demonstrate a similarly unimodal profile suggesting comparable processes of deposition and weathering; however these sediments are much finer, suggesting a reduced loessic component.

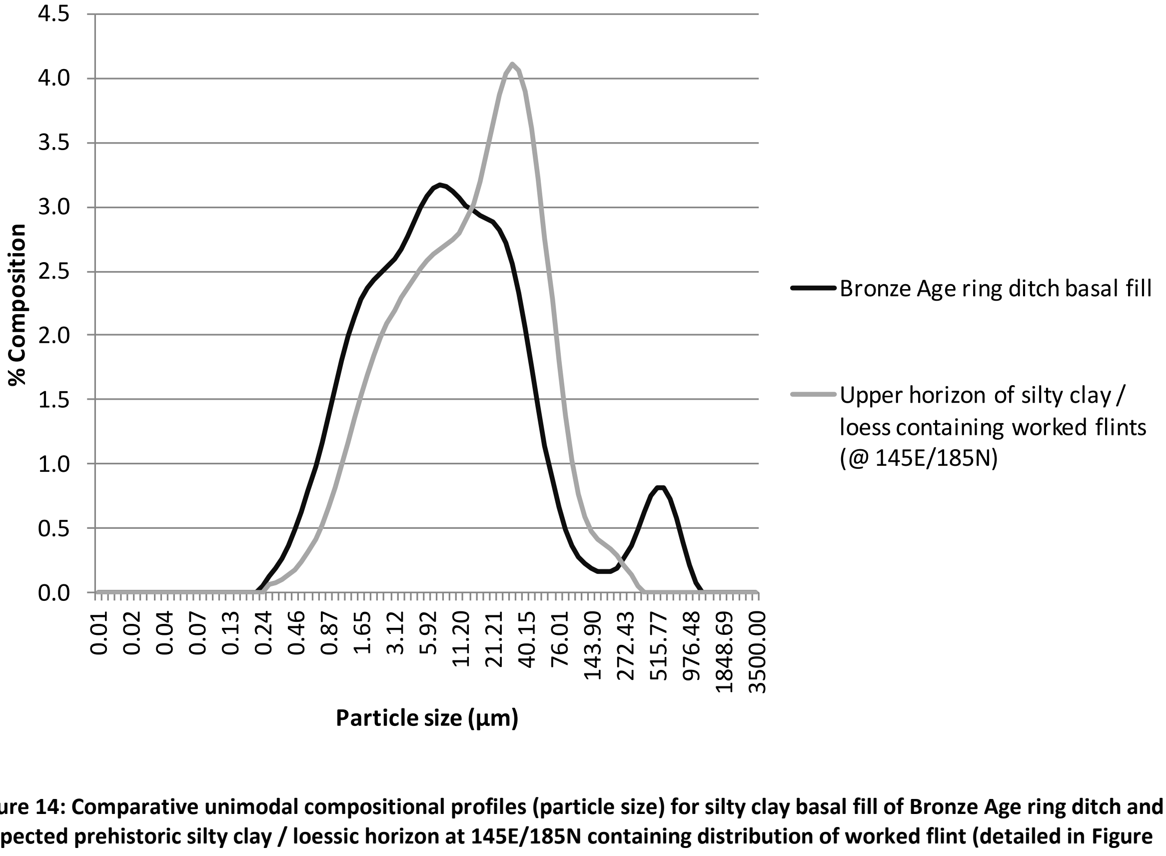


Figure 14: Comparative unimodal compositional profiles (particle size) for silty clay basal fill of Bronze Age ring ditch and suspected prehistoric silty clay / loessic horizon at 145E/185N containing distribution of worked flint (detailed in Figure 15 at 50cm).

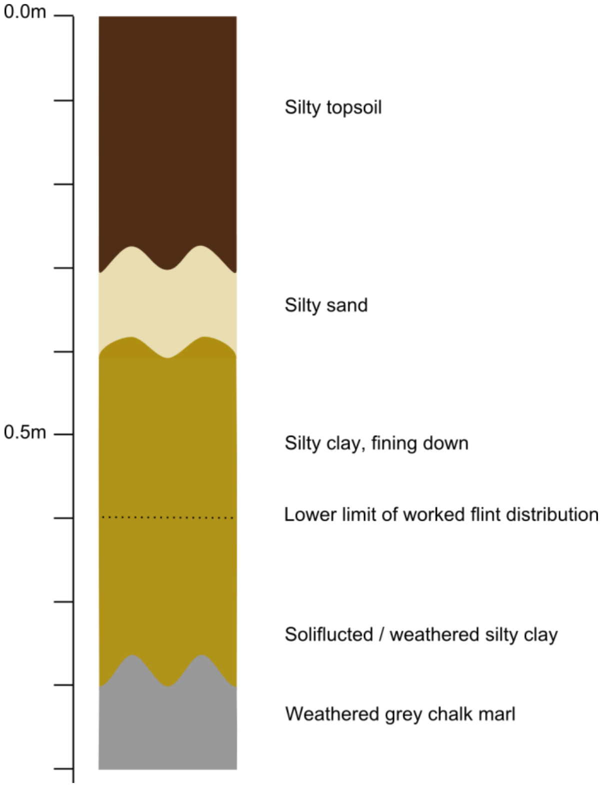


Figure 15: Sedimentary profile at 145E / 184N (SE corner of LYM12 trench and northernmost borehole of T1) and section photo from nearby excavation area showing prehistoric (loessic) subsoil unit recorded in the field and on the profile as "silty clay".

The area to the south of the stream known as Well Field (Figure 10), demonstrated truncation of the basic sequence encountered on Tayne Field, with less than half a metre of modern soil overlaying the basal chalk marl horizon in the southernmost 15m of Transect 1. This likely derives from extensive post-medieval landscaping of this area and modern disturbance from the construction of a playground. Consequently this area was judged unlikely to offer potential for further investigative work.

Other localised variations in the distribution of the units listed in Table 10 were encountered across the survey area, notably around the margins of the stream where areas of landscaping and made-ground around structures such as the bridge over the stream demonstrated discontinuities in the general profile (Figure 17). Along the line of transect 2, localised lenses of organic sediments and sandy gravels were encountered. These lenses were not horizontally bedded, instead comprising an irregular sequence of dipping channel deposits from north to south, interpreted in the field as paleochannels related to former alignments of the stream. Further investigation of these sediments was undertaken by the Tayne Field environmental excavation (Chapter 5).

Using averages from spot samples taken from 11 sequences across these transects, a generalised stratigraphic particle-size / depth model for the plateau (between 185 and 245m N on the local site grid) for the sediments overlaying the excavated archaeology can be generated (Figure 16). This indicates a trend for fining down within the sediment overlying the excavated archaeology across the plateau area. This is likely the result of several potential factors including the existence in several places of a loessic horizon overlying the chalk as well as the erosion and downslope colluviation of sandier Pleistocene sediments (soliflucted clay-with-flints and valley gravels) from the northern part of the site. It is also more widely reflects the downwashing of fine materials from natural processes accentuated by disturbance from human activity which is further demonstrated by micromorphology (Chapter 6, Chapter 7) and in the section illustrated in Figure 15.

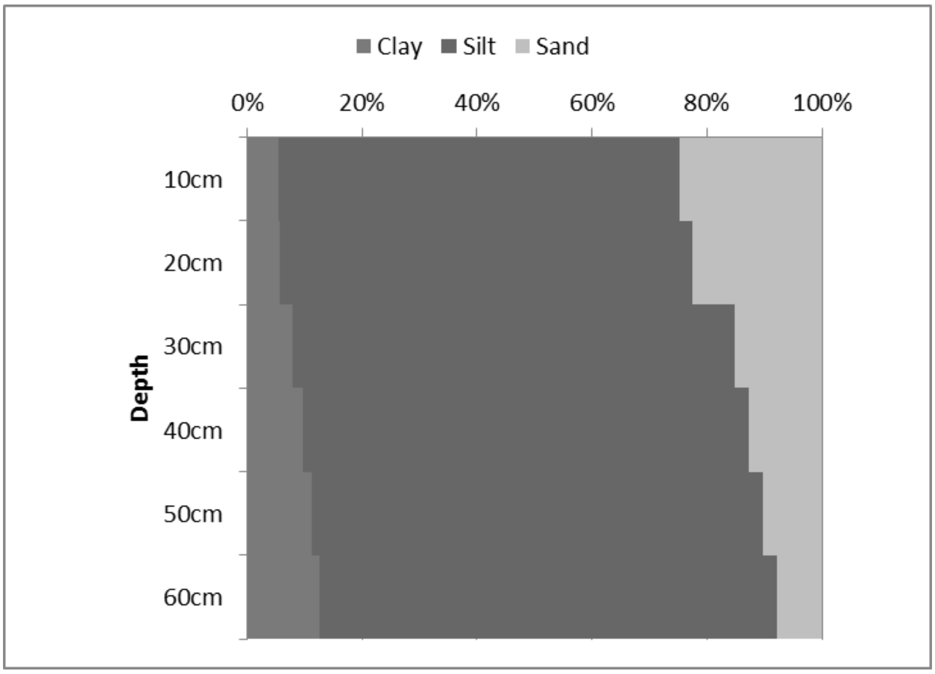


Figure 16: Generalised model for the overburden for the archaeology from LYM12 and LYM13 (based on mean average particle size data from 11 sequences)

Individual sequences which display disruption in this fining trend may indicate localised processes of disturbance and re-deposition of material from anthropogenic processes such as landscaping (Rapp and Hill, 2006: 40). An example of this can be seen from the sequence observed around the bridge access point to the south of the stream (T1 148m – see transect diagram in Chapter 5) where redeposited marls and made ground resulting from landscaping disrupt this pattern with deposit of relatively clay-rich material (Figure 17). This demonstrates a degree of disturbance around the stream margins from modern landscaping which has likely affected the potential for preservation of channel margin deposits similar to those recovered from the excavated sequence around 20m to the west (Chapter 5).

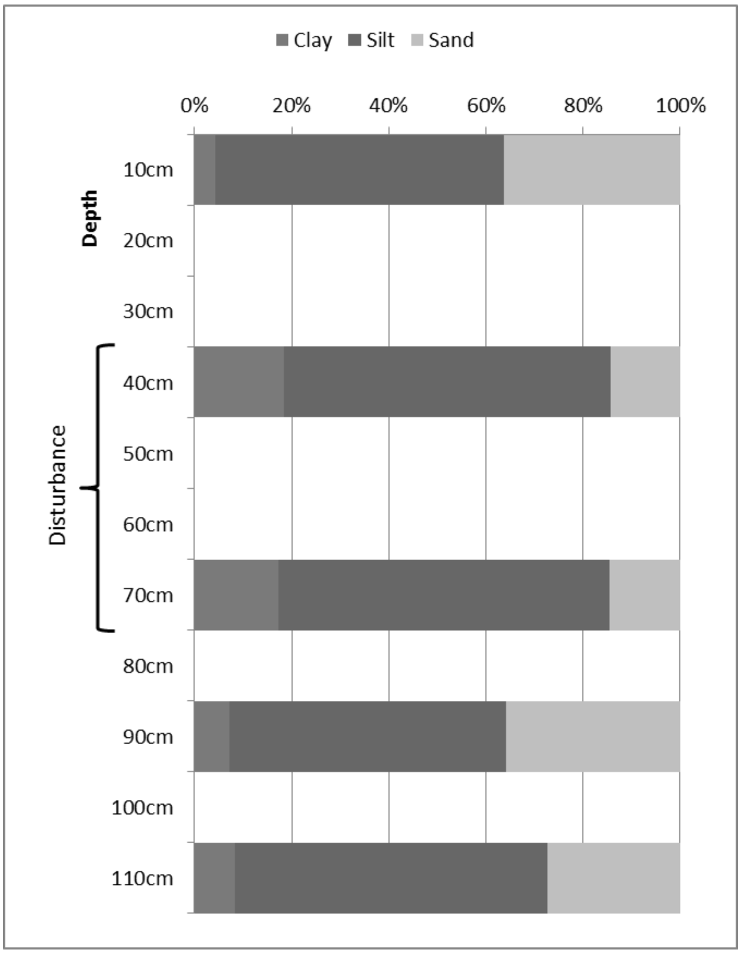
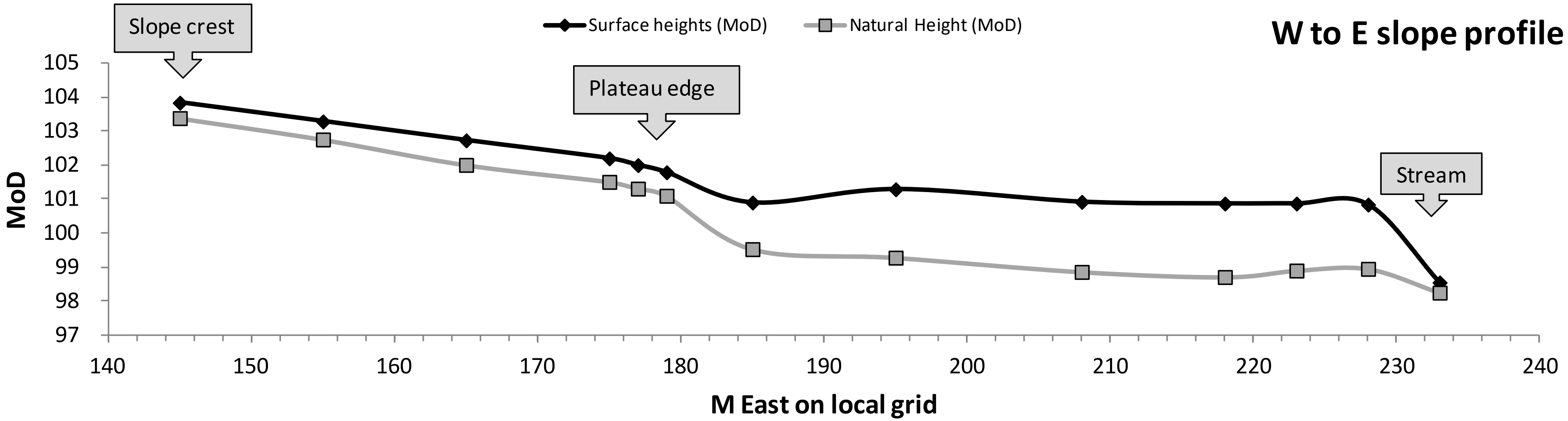


Figure 17: T1 148m particle size sequence demonstrating disruption in fining down from modern disturbance.

The coring surveys around the Tayne Field excavation areas allowed appraisal of the slope profiles across the site. These are compiled for the W to E and N to S transects (see locations in Figure 10) in Figure 18. For both of these the slope crest location at local grid ref 145E/245N marks the NE corner of the LYM13 excavation trench. These profiles demonstrate several features key to the investigation of the geomorphology of the area containing and surrounding the excavated settlement on Tayne Field; specifically the plateau crest upon which the nucleus of 6th-7th century settlement activity occurs, the shallow scarp edge which bounds this area and the stream channel which runs around the base of the plateau. The location of organic channel margin deposits located by transect 2 is also indicated in the N to S profile.

These profiles reveal pronounced increases in depth of the natural horizon at the plateau edges on these slopes (around 171.5 on the N to S profile and around 177 on the W to E profile) corresponding to accumulations of colluvium at the slope breaks. This has the effect of reducing the relative angle of the slope and thus the prominence of the scarp edge in the present day landscape.



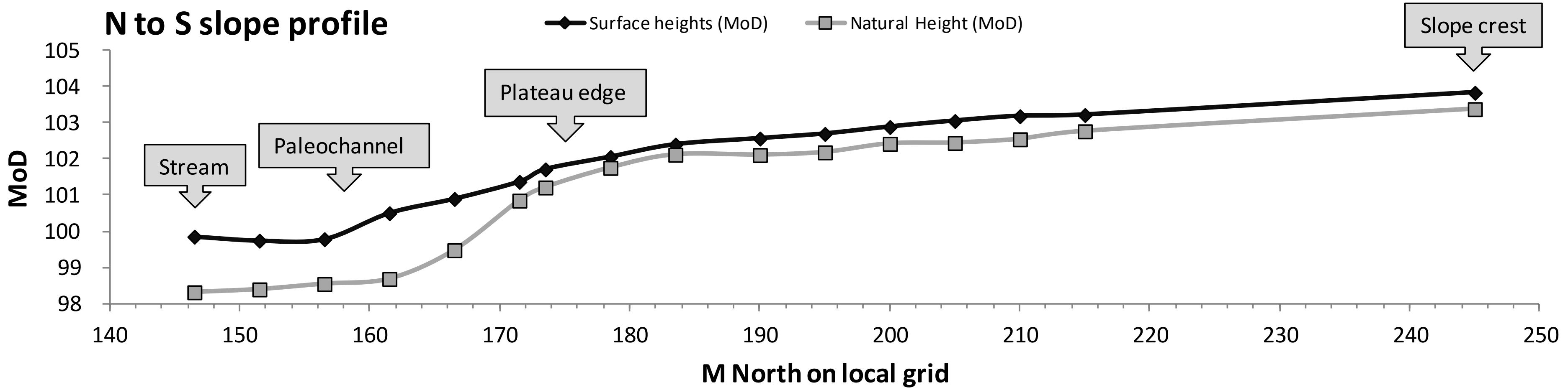


Figure 18: Tayne field slope profiles (survey heights MoD).

4.2 Digital terrain modelling

A digital terrain model was created from data from 29 boreholes from three transects (section 4.1) along with modern ground surface heights from 66 locations around the Tayne Field and data from section drawings from 56 locations compiled during the 2012-2014 interventions. The totality of these locations included locations along the baulks of the 2012, 2013 and 2014 excavations where the complete sequence depth could be observed and recorded. The resulting model defined the surfaces and stratigraphic horizons from the modern topsoil to the basal geology across the entire Tayne Field excavation area to the southern and eastern margins of the site as defined by modern boundaries and the course of the Nailbourne (Figure 19).

The development of this stratigraphic model was undertaken using Rockware's Rockworks 16 software (www.rockware.com). In order to do this, lithological and excavation records collected in the field were rationalised into a standardised stratigraphic schema (Chapter 5). The results defined the extent and topography of the Tayne Field site, with present day surface heights varying from 105.5 MoD on the highest part of the plateau (near the 7th century hall recorded as LYM13 Building 4 (Chapter 2)) to 98.5 MoD at the level of the stream bed.

This model allows the creation of simplified interpolated models of the colluvium thickness to be generated for the totality of the slope profiles from the highest part of the plateau area covered by the 2013-2014 excavations to the stream level. These profiles (Figure 20) are presented for the north-south and west-east axes of the entire model area (Figure 19) and show the colluvium and ploughsoil thicknesses over the underlying natural topography. Basal layers such as eroded parent material (chalk marl) or stream channel bed deposits have been omitted for clarity.

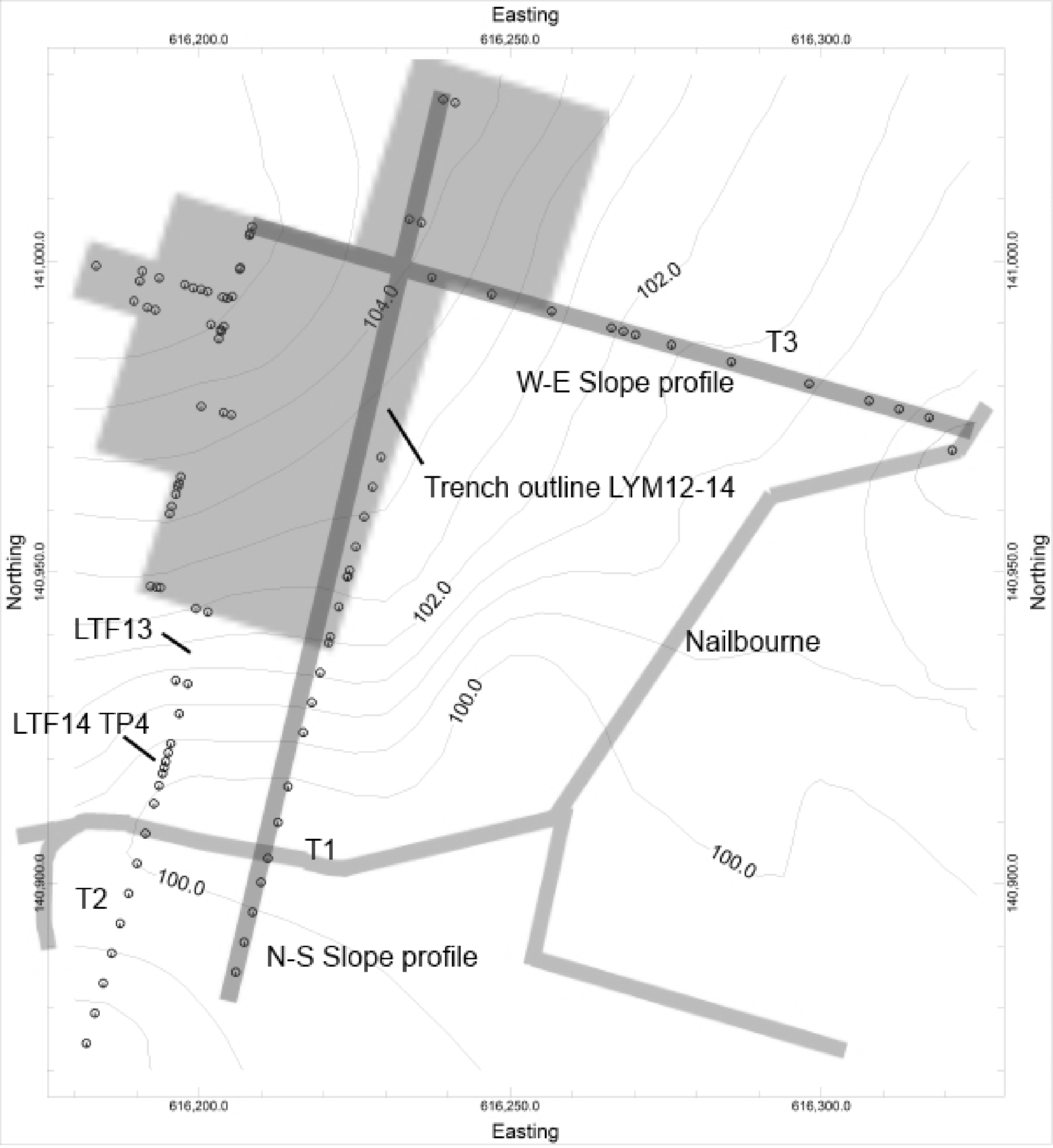


Figure 19: Tayne Field survey locations contributing to the development of the digital terrain and stratigraphic model.

These modelled profiles demonstrate the impact of anthropogenic disturbance leading to accumulations of ploughwash and colluvial material at the slope breaks around the base of the plateau area (light grey coloured units in Figure 20). They further demonstrate the degree to which this accumulation has softened the basic topography presented by the underlying chalk marl. This accumulation is particularly notable with the W to E sequence recorded in transect 3 (Figure 13) where over 2m of colluvium was recorded on the eastern margin of the site.

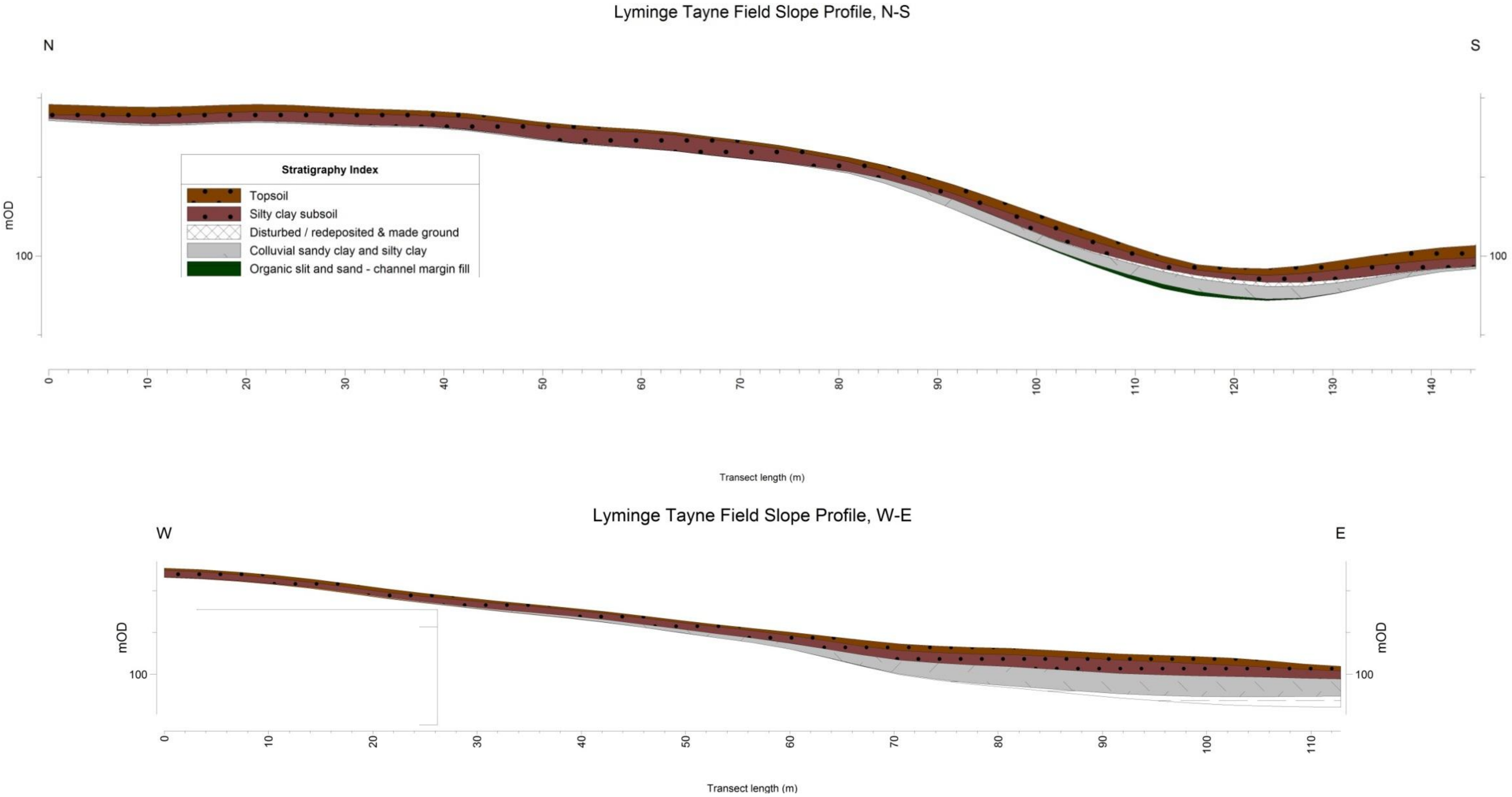


Figure 20: Interpolated stratigraphic profiles for a) the southern and b) the eastern slopes of the Tayne Field plateau (the accumulation of ploughwash is indicated by the light grey unit).

Contour maps for the modelled surfaces for the modern ground topsoil (Figure 22) and the basal chalk marl (Figure 21) were generated using densification and smoothing functions to interpolate data points and maximise the resolution of differential surface topography presented by the model. Within these diagrams, the colours are generated independently to display contrasting heights and similar colours do not represent consistent MoD heights between diagrams. This process reveals that the differential in topographical profile between the horizons of the basal geology and the modern topsoil extends around the entire area, with the plateau defined far more prominently by the contours of the basal geology than it is by the modern ground surface. This data was further used to generate three dimensional models of these surfaces which demonstrate differences in topography between the natural basal horizon and the modern ground level (Figure 23). By removing the extensive colluvial overburden a surface is produced which represents the topography of the plateau prior to extensive redeposition of sediment in the post-settlement era by ploughing and erosion (Figure 23a). In the modern landscape this plateau is defined by ephemeral scarp breaks and gentle slopes down to the stream banks (Figure 18); however this model shows that it once presented a far more distinctive presence within the valley floor area.

A further change in topography can also be seen around the stream area (coloured indigo and violet in these surface models) which prior to the deposition of colluvium sat in a broader and flatter channel area than is evident in the modern landscape. This has implications for any reconstruction of past hydrogeology (Chapter 12) and environment in that a broader channel area will have demonstrated both a difference in flow rate and meander geometry to the present day stream (Brown, 1997: 63-69).

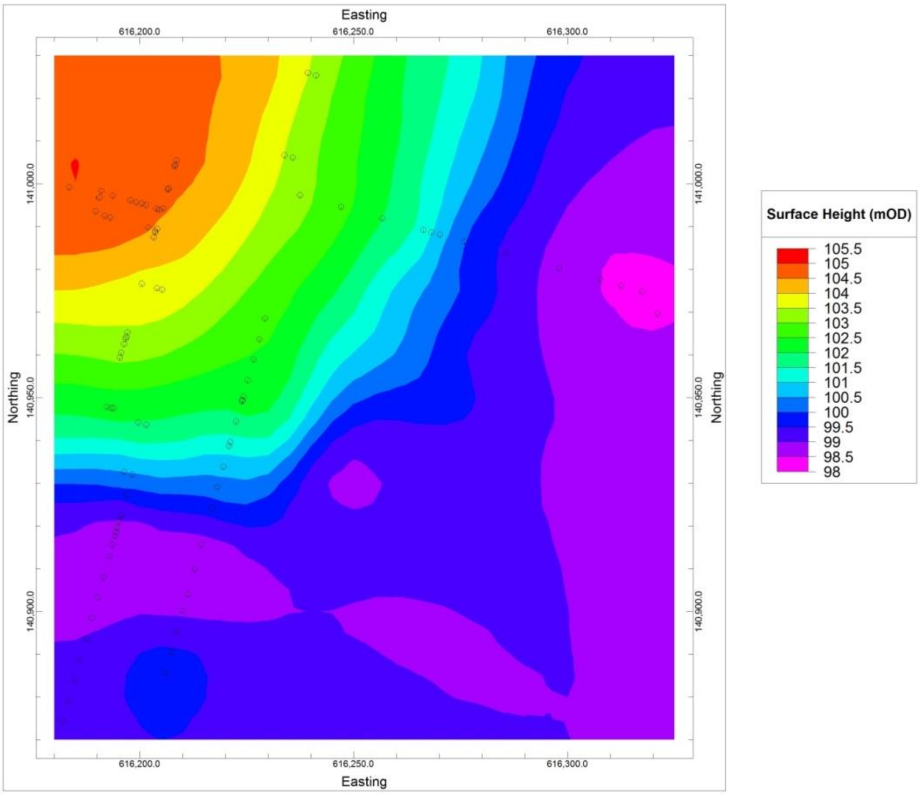


Figure 21: Modelled surface for the natural chalk marl underlying Tayne Field site area; colours do not represent consistent MoD height between diagrams as they are generated seperately.

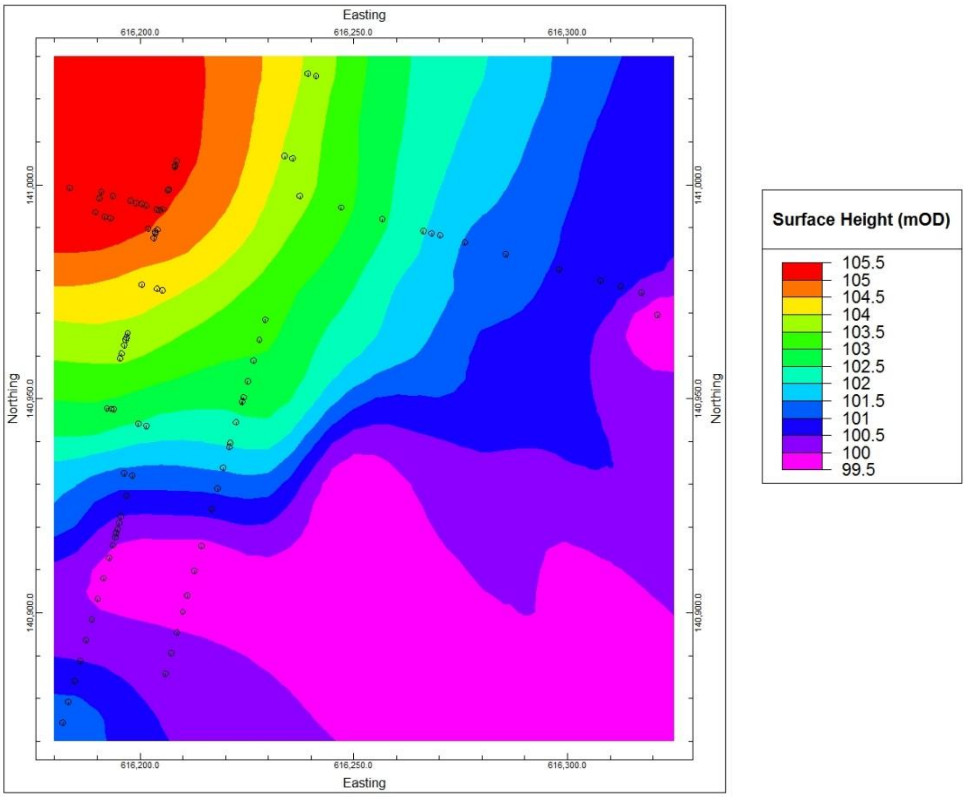


Figure 22: Modelled surface topology (topsoil surface) for the Tayne Field site area; colours do not represent consistent MoD height between diagrams as they are generated seperately. Note shallower and more diffuse contours around plateau centre than in Figure 21.

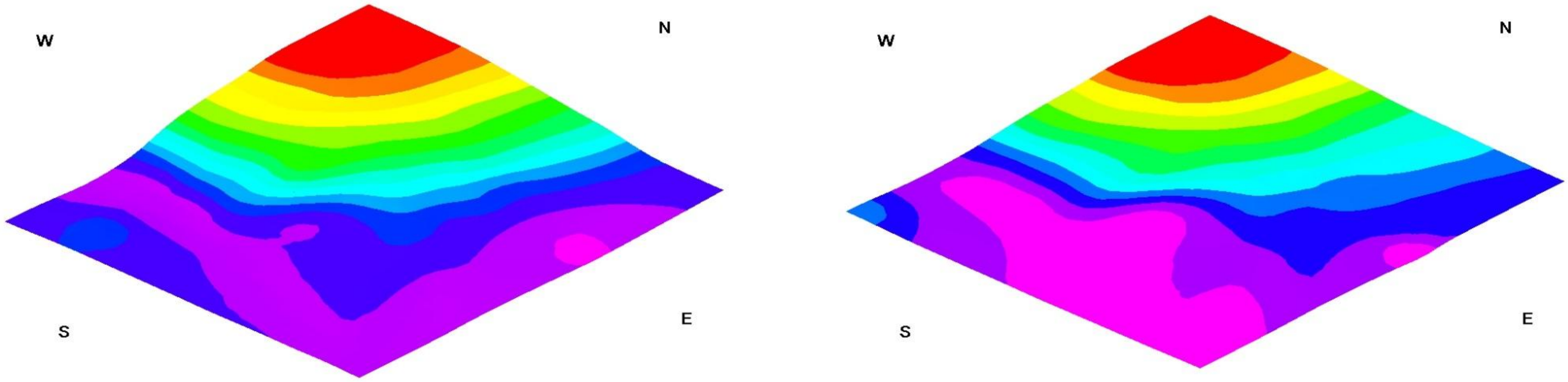


Figure 23: Three dimensional modelled surfaces for: a) chalk marl underlying colluvium and b) modern topsoil surface. Both show the same Tayne Field site area shown in Figure 21 and Figure 22 viewed obliquely from SE.

Using the data from the transect surveys and the interpolated models in Figure 20, a distribution model can be created for the colluvium around the Tayne Field settlement area (Figure 24). This demonstrates a total area of deposition in excess of 4000 m^2 from a contributing slope and plateau area in excess of 9500m^2. The average depth of colluvium across the depositional area can be estimated from the available data at around 1m (from a distribution with a maximum depth at the stream bank >2m and minimum depth effectively feathering out to zero upslope). From this, the average stratigraphic truncation on the plateau slopes and summit can be estimated at around 40cm (i.e. 4000m^3/9500m^2). This figure is a somewhat speculative average as the true quantity of sediment would vary according to slope characteristics; additionally such estimates are hampered by the reduction in the surveyable area of the site by modern buildings (Chapter 12).

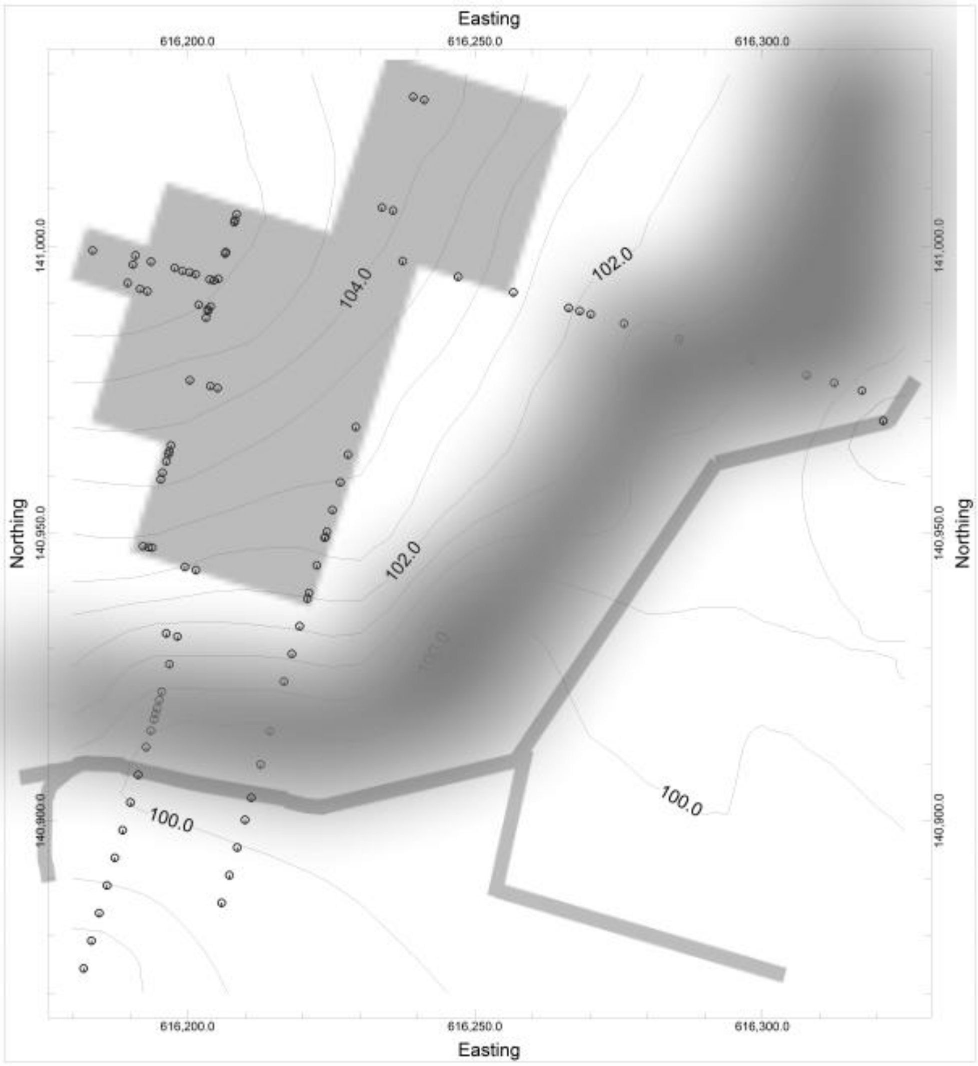


Figure 24: modelled distribution (grey shaded) of colluvium around plateau slopes at Tayne Field.

4.3 Geomorphological Interpretation

The geoarchaeological survey evidence from Tayne Field indicates destabilisation of the ground surface by post-occupational disturbance, most likely the result of cultivation. On the evidence of the Tayne Field environmental trench (Chapter 5), this process of erosion mostly appears to derive from post Anglo-Saxon activity; however undated colluvium encountered on the eastern side of the site (Transect 3) may include earlier deposits. On the basis of evidence from pre-Mesolithic deposits on the plateau and the sedimentary composition of the colluvium, a substantial proportion may be of loessic origin, the redeposition and mixing of which is likely to have changed the character of the original soils around the site. An unknown proportion of this colluvium is also likely to have entered the Nailbourne and been redeposited downstream as alluvium.

These processes have resulted in erosion of the plateau summit, truncation of the archaeological sequence (Chapter 2), and redeposition of sediment around the plateau slopes which has changed the slope profile. The height and relative prominence of the central plateau, the gradient of the slopes and the angles of slope and scarp breaks have consequently all been substantially reduced since the abandonment of the settlement. These processes have consequently reduced the topographical prominence of the site in the valley-floor landscape.

Redeposition of colluvial sediments around the toeslopes of the plateau has also progressively displaced the Nailbourne channel southwards over time, creating a dynamic and unstable hydrological system characterised in the stratigraphy by laterally discontinuous lenses of organic and alluvial sediments (Chapter 5). These processes, along with a known reduction in the spring output in modern times from depredations of the aquifer (Chapter 12) have reduced and narrowed the channel and stream margin area in the period since the onset of this colluvial deposition.

Chapter 5 - The stream-side environment: evidence from trench LTF14 TP4

This chapter discusses the full range of evidence from the trench excavated adjacent to the stream on Tayne Field, Lyminge during 2014, in accordance with the research objective detailed in Section 1.5.3 for the recovery of paleoecological material pertaining to the site vegetation history and evidence for human economy. This sequence, located 30m from the spring, 50m from the nucleus of the 7th century great hall complex and 100m NE of the Anglo-Saxon monastic church, provided a rare opportunity to examine waterlogged material and deposits associated with the stream channel, and local catchment of the Tayne Field site. A condensed version of this work was published in Maslin (2017). Within the text, reference is made to context numbers (fills are signified by round brackets, cuts by square brackets) and field interpretations of the excavators which are directly accessible via the project database at **www.iadb.co.uk/lyminge**.

5.1 Siting and excavation

Organic and potential channel bed sediments were identified 30m to the south of the 2012 excavation area on Tayne Field (Figure 26, Figure 27) by auger survey (Chapter 4). These sediments were most prominent in Transect 2 (125E/158.5N and 125E/157.5N), in a location between areas disturbed by trees closer to the spring and the foundation of a modern concrete footbridge 20m to the east. The shallow sequences encountered in all boreholes undertaken south of the stream are suggestive of extensive truncation. No comparable sediments were evident downstream on the eastern margin of the site, which has been disturbed by modern development on the other side of the stream (see OS maps, Chapter 12).

In order to investigate this sequence in more detail, a trench of 4m by 2m was opened at 125E/160N, 127E/160N, 125E/156N and 127E/156N. From the auger survey the sequence was suspected to be between 1.5 and 2.1m deep prior to excavation; consequentially the western side of the trench was stepped back into the baulk to enable access. Initially, excavation was conducted in 30cm spits down to the natural (chalk marl) with archaeological material being recovered and recorded in terms of position along the north-south transect of the trench and depth below ground level (Figure 34). Once the water table was penetrated, an electric pump was employed to drain the trench. Below this level, waterlogged plant macrofossils, wood and peat materials, were recovered in abundance and their positions recorded. Following the initial recording and assessment, the western side of the trench was extended to allow further investigation of the deposits identified from assessment of the section, which were then excavated and recorded according to the single-context system used across the rest of the site (contexts (14064) to (14084)). In this way, artefact and ecofact densities were recorded by both absolute depth and contextural association.

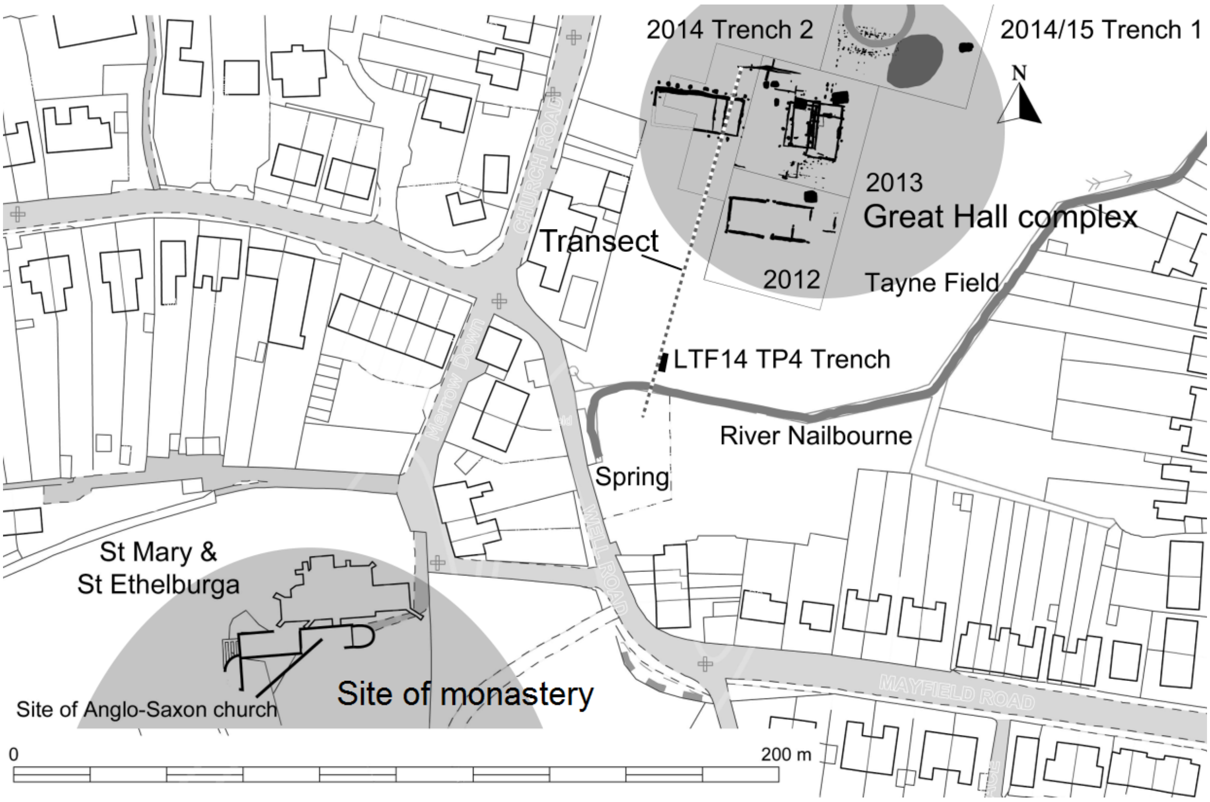


Figure 25: Stream trench (LTF14 TP4) siting in relation to excavation areas: dotted line indicates transect illustrated in Figure 26.

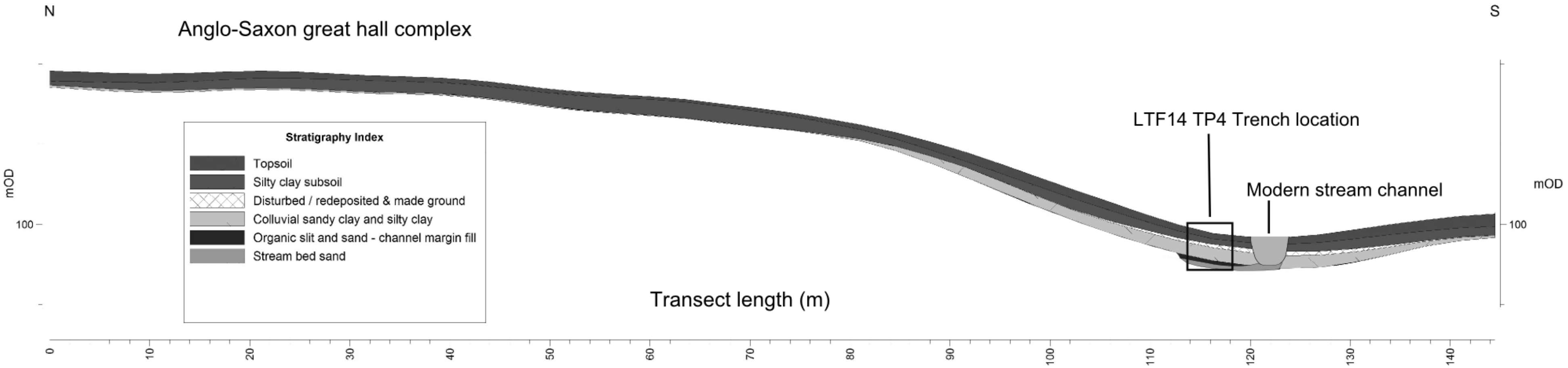


Figure 26: Simplified schematic of site stratigraphy revealed by auger survey (Chapter 4) showing location of trench: location of transect illustrated by dotted line in Figure 25.

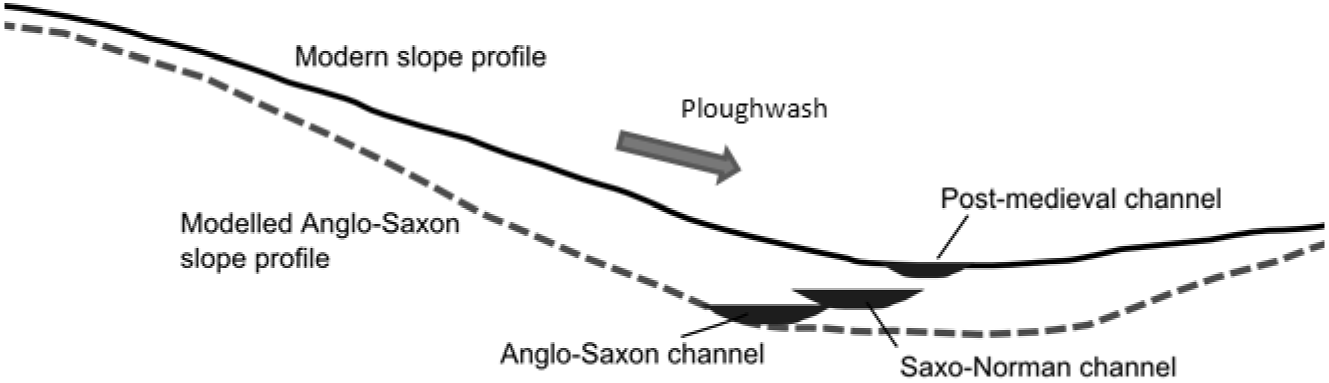


Figure 27: Schematic showing model of channel progression from colluvial deposition as determined by geoarchaeological survey.

5.2 Stratigraphy and sedimentology

A composite stratigraphic sequence derived from compositional data from samples taken from the borehole survey (T2 158.5N/125E) (Figure 12) with the addition of data from the excavated section is presented in Figure 28 and summarised in Table 11. Extensive lateral variation in the sediment lenses means depth and stratigraphy is approximate for the section. A simplified interpretive schematic of the west-facing section on this alignment (Figure 28) is presented in Figure 29.

The base of the excavated sequence comprised grey chalk marl overlain by silty gravel channel deposits and a sequence of calcareous and pelo-calcareous alluvial gley sediments (Brown, 1997: 96) which lay beneath the present water table. These contained lenses of alluvial marl, interleaved with more substantial deposits of organic silt all of which demonstrated excellent organic preservation, with some demonstrating organic matter content in excess of 50% (Figure 51). These lenses were not horizontally bedded, instead comprising an irregular sequence of dipping channel deposits from north to south (Figure 33). Overlying this waterlogged sequence was a substantial deposit (up to 1.5m) of silty clay colluvium capped with subsoil and topsoil, which corresponded to the sequence encountered in the wider survey area (Figure 26).

Particle size distributions for selected units identified during excavation and sampled in the monoliths are presented in Figure 30 and Figure 31. These demonstrate that most units in this sequence comprise a varying continuum of minerogenic and organic matter with a size distribution which is unimodal within the silt fraction. This composition is common to autochthonous organic silts in floodplain backswamp and alluvial margin environments with high groundwater levels and relatively low rates of minerogenic sedimentation (Brown, 1997: 80). The lack of coarser material suggests a relatively low energy deposition environment; the predominant grain size for sediments transported within a hydraulic system being a direct function of the velocity of the flow (Brown, 1997: 327-328).

Table 11: LTF14 TP4 sedimentological profile (taken from position at 158.5N, Figure 28, corresponding to T2 13m borehole (see profiles in Chapter 4)) and associated archaeological contexts.

Depth (cm)	Texture	Clay %	Silt %	Sand %	Troels-Smith (1955)	Stoniness	Munsell colour	Colour descriptions	Horizon boundary	Comments	Archaeological context (in brackets), artefacts and dating evidence
0-23	Silty topsoil	3.7	67.8	28.5	As^3 Ag^1 Gs^+	2%	10yr 4/3	Brown	Diffuse	Good crumb structure, inclusions of modern anthropogenic material.	(14064) Modern material.
23-40	Silty clay	9.0	73.1	17.9	As^2 Ag^1 Gg^1 Sh^+ Gs^+	5-10%	10yr 4/2	Dark grayish brown	Diffuse	Earthworm-sorted stone horizon: large pebbles, pottery and other anthropogenic material.	(14065) Post medieval / early modern material: pottery, decorated glass, iron objects and circa 17th century cu alloy buckle.
40-90	Silty clay	11.3	71.6	17.1	As^3 Ag^1 Sh^+ Gs^+	5%+	2.5 yr 5/3 to 2.5yr 4/2	Light olive brown to dark grayish brown	Diffuse	Daub, charcoal and chalk flecks; oyster shell, wood and large pebble clasts.	(14066) Post medieval / early modern pottery.
90-126	Silty clay	10.2	76.9	12.9	As^3 Ag^1 Sh^+ Gs^+	5%+	10yr 3/1 to 10yr 3/2	Very dark gray to very dark grayish brown	Sharp	Occasional roots, small stones, oyster shell, wood, chalk and charcoal fragments.	(14067/14068/14070) Anglo-Saxon and medieval pottery, pierced Roman coin.
126-128	Silty clay / marl	9.9	72.2	17.9	As^3 Ag^1	0%	10yr 6/1	Gray	Sharp	Some hydromorphic mottling, no inclusions.	(14071) None.
128-139	Organic silt	4.0	61.7	34.3	As^2 Ag^1 Sh^1 Gs^+	5%	10y1/1 to 10yr 3/1	Black to very dark gray	Sharp	Peaty & organic: small stones, rootlets and shell inclusions, some hydromorphic mottling.	(14071/14083/14084) Waterlogged worked and unworked wood, *Corylus* and *Prunus* nut and stone fragments, Animal bone (cow, pig dog), middle Anglo-Saxon (circa 8th century) pottery.
139-154	Sandy silt / silty gravel	6.8	65.2	28.0	As^2 Ag^1 Gs^1Gg^+	2%	10yr 4/2	Dark grayish brown	Sharp	Stream channel bed deposit: large stones, wood stone and shell inclusions.	(14076) middle Anglo-Saxon (circa 8th century) pottery, waterlogged worked and unworked wood.
154-167	Chalk marl	22.4	68.0	9.1	As^3 Ag^1	0%	10yr 8/2	Very pale brown	Sharp	Natural	None

Figure 28: LTF14 TP4 section excavated down to the base of sequence (layer (14076)).

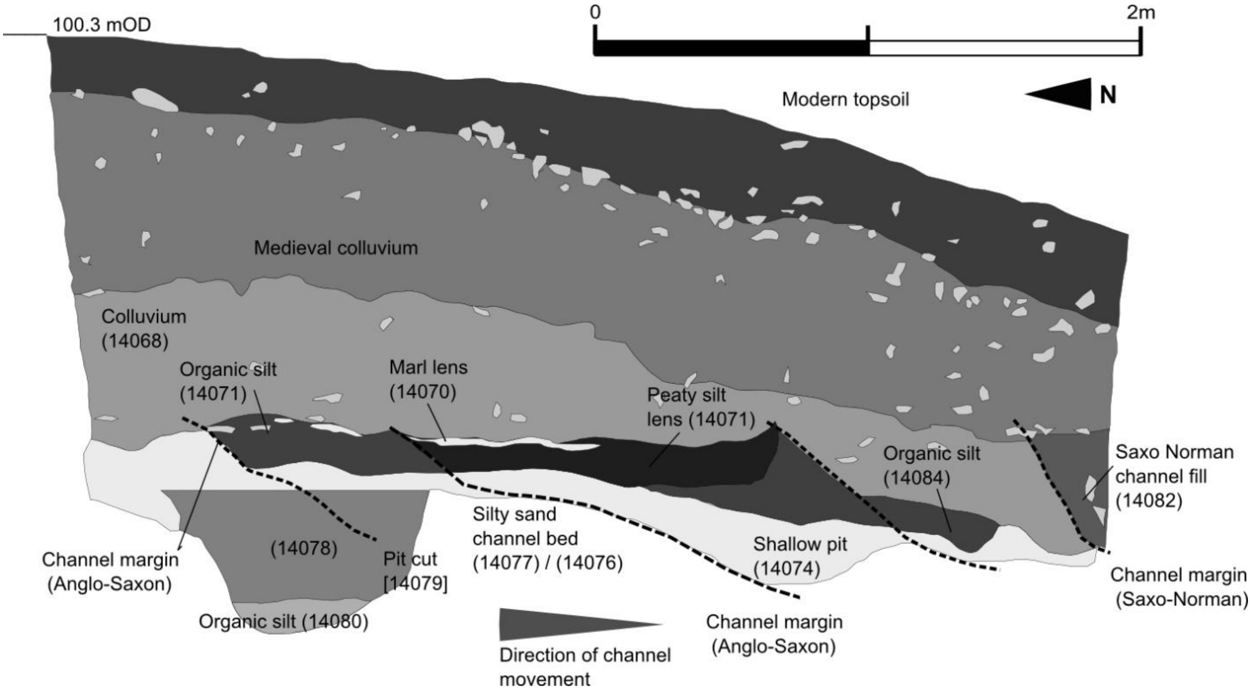


Figure 29: LTF14 TP4 Interpretive stratigraphic summary; interpretation of channel margins and formation process are based upon position of organic lenses and distribution of dateable materials (section 5.3.1) and geoarchaeological survey (Chapter 4).

The basal alluvial unit (14076)/(14077) was particularly strongly unimodal around 30 µm suggesting deposition in continuously moving water; however a large proportion of coarser gravel and large stones was recorded during excavation suggesting a component of intermixed colluvial, bedload and/or dumped material (Table 11). The geomorphological interpretation suggests that a palimpsest of different channel beds may be represented by this layer (Figure 27 and Figure 29); however the recorded composition (particle size, texture and colour) is homogenous across the unit. This prevented resolution of this unit into more than two separate contexts, with these being defined in the field purely on the basis of the superposition of overlying stratigraphy.

The overlying alluvial and organic sediment lenses by contrast demonstrated a high proportion of coarse fibrous wood and plant fragments which skews their distributions towards a coarser mode (Figure 31). Two main organic lenses ((14071)/(14081), Figure 31) appear at similar depths in the stratigraphy in the west and east-facing baulks, overlaying and interleaved with organic silts (14083)/(14084). The compositional and organic matter profiles for these lenses (Figure 51) are very different, with the unit in the west-facing baulk (14071) demonstrating around 10% by mass, whilst that in the east-facing baulk (14081) demonstrates over 50%. This lateral variation suggests variation in deposition date or formation process such as dumping as opposed to fluvial accumulation.

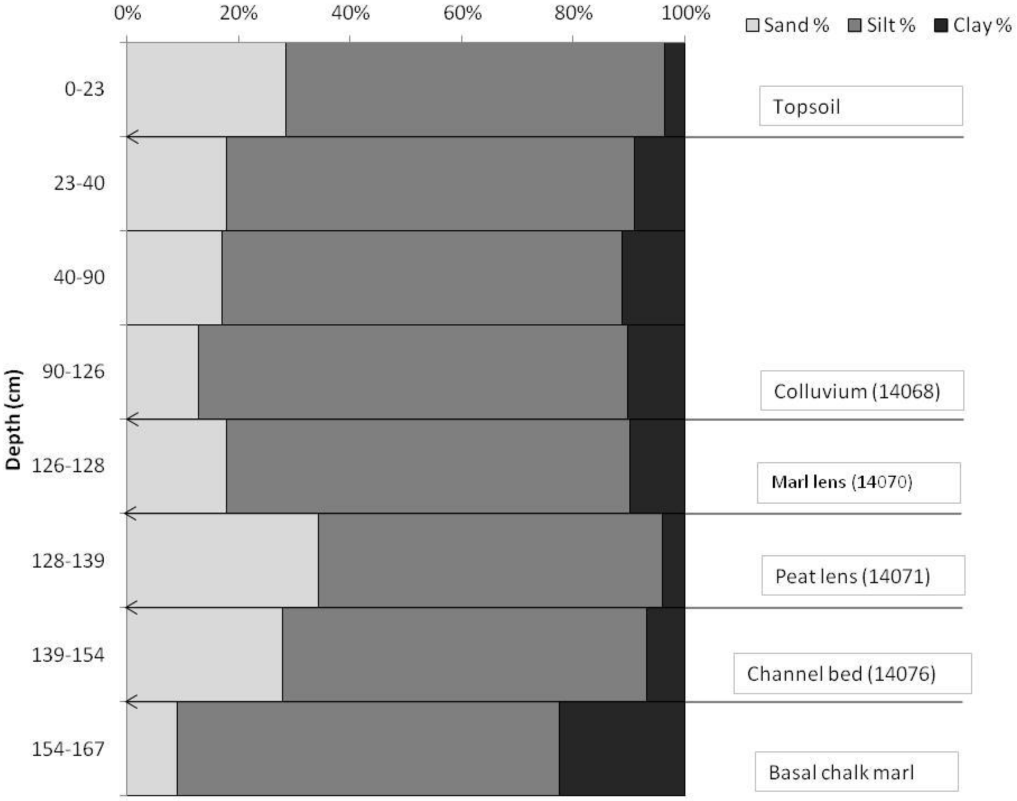


Figure 30: Simplified compositional profile for sequence presented in Table 11 and Figure 28 on the west facing section at 158.5N, with main stratigraphic units indicated.

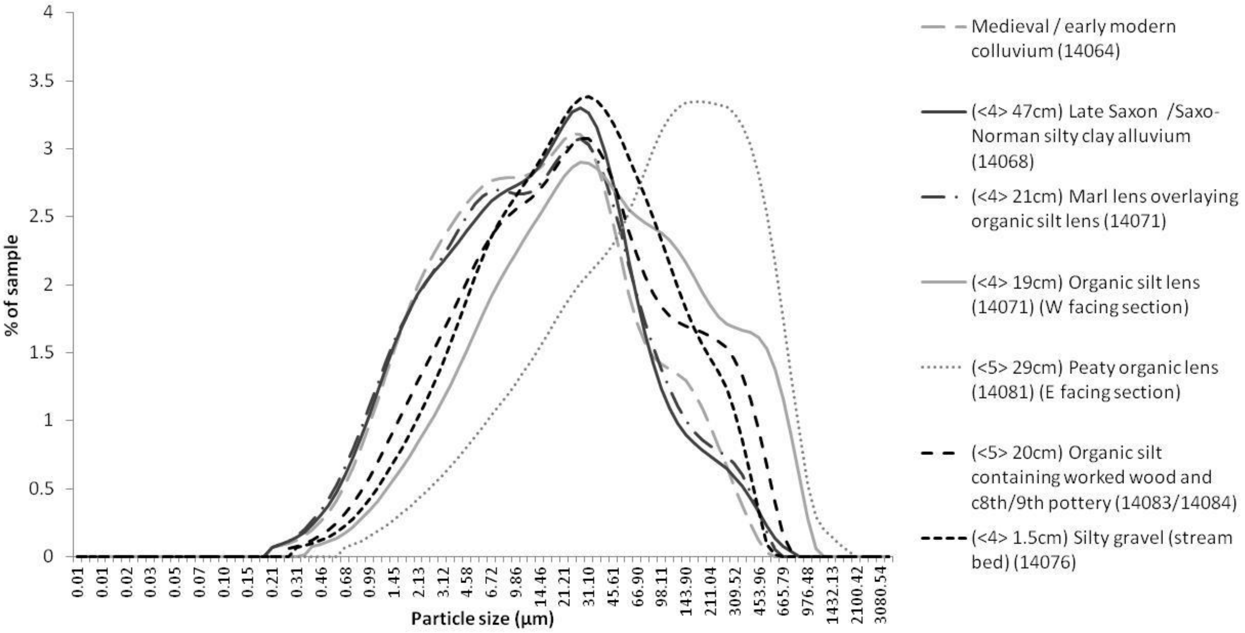


Figure 31: Composition (particle size) profiles for major sediment types from monoliths with accompanying archaeological context numbers (see Table 11 and Table 12).

5.3 Archaeological evidence

Extensive evidence for *in situ* human activity at the margins of earlier stream channels was uncovered by this excavation (Figure 32). This comprised two suspected pit cuts (section 5.3.4), stones (section 5.3.3), as well as stakes possibly aligned with the earlier channel margin (Figure 36 and interpretation in Figure 32) and fragments of worked wood (section 5.3.2). Overlying this was a deep sequence of colluvium containing occupation material redeposited downslope from the settlement (section 5.3.1).

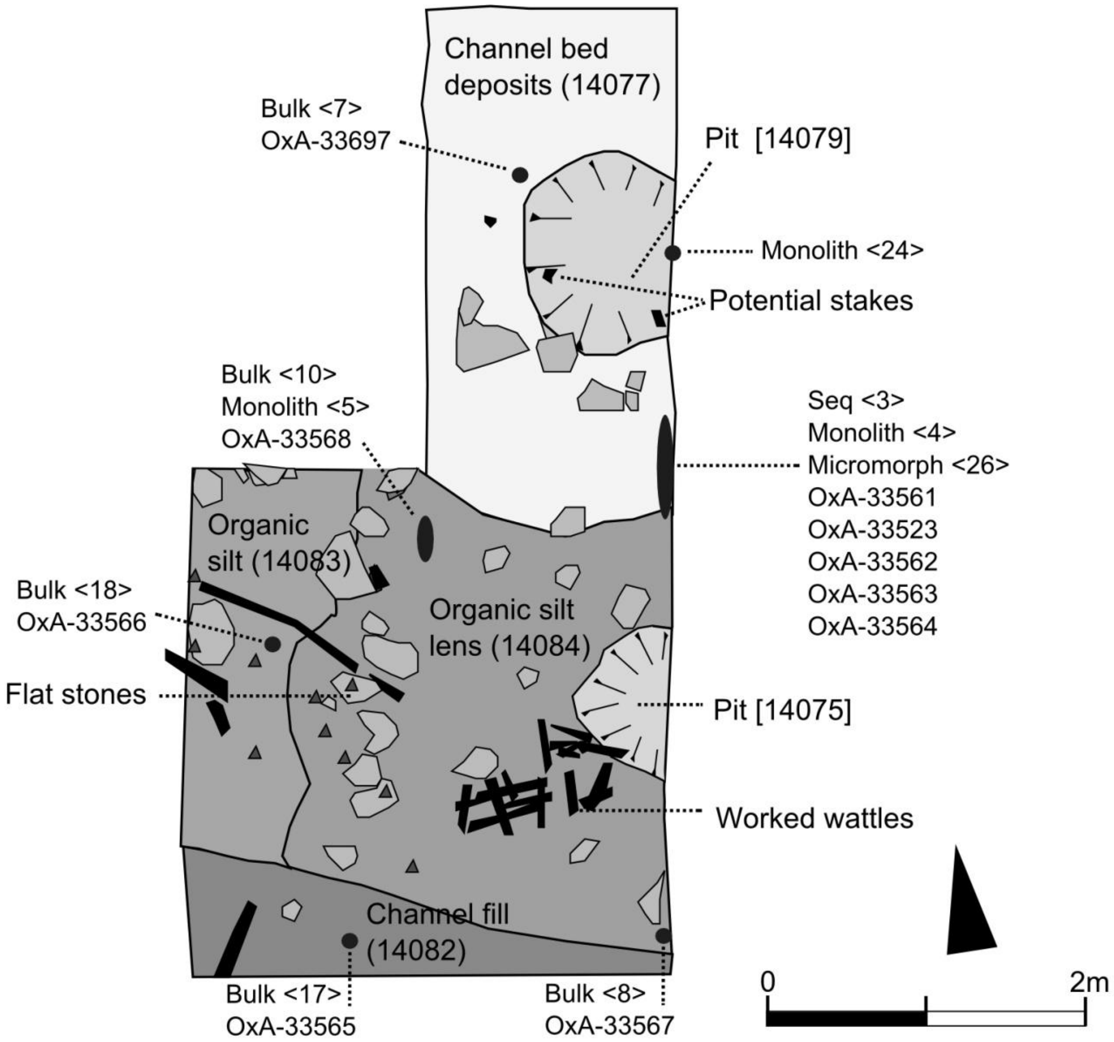


Figure 32: Simplified plan of early medieval features within trench showing: locations of environmental and C14 samples discussed in text with laboratory codes (black dots / ellipses), worked wood (black silhouette), stones (light grey silhouette), wood chips within contexts (14083) and (14084) from in-situ working (dark grey triangles).

5.3.1 Occupation material

Excavation provided a full range of archaeological materials including animal bone and pottery fragments (Table 12, Figure 34). This material demonstrated a marked decrease in the quantities of pottery, CBM, glass and metal debris recovered down the profile, with pottery and materials dating to medieval and post medieval phases dominating the colluvial assemblage ((14068) and overlying units). A majority of the material within the middle and upper parts of the sequence has likely been re-deposited from medieval or later truncation of archaeological contexts on the Tayne Field plateau on the basis of its colluvial context (section 5.2). This has resulted in substantial quantities of residual material being present in the uppermost units, creating a partially inverted chronology to the sequence. This overlies archaeological material contained in the waterlogged part of the sequence which likely comprises a sizeable proportion of dumped or *in-situ* accumulation alongside some redeposited material (section 5.2).

Context (14070) contained no pottery later than late Saxon / Saxo-Norman (10th/11th century); below this layer all the recovered sherds were identified as Anglo-Saxon (Figure 34). Pottery assessment (Dr. Ben Jervis, pers. comm., August 2014) characterised the potsherds within the waterlogged sequence into a broadly dateable distribution demonstrating a southwards progression from mostly middle Anglo-Saxon (contexts (14071), (14083), (14084)) to mostly later Anglo-Saxon material (context (14082)). This is demonstrated by a plot of sherd locations against the stratigraphic section (Figure 33); this diagram also shows the extent of the waterlogging from the plotted distribution of wood fragments. Evident from this distribution is a chronological shift from North to South, with middle Anglo-Saxon fabrics in the northern end of the trench and late Anglo-Saxon material concentrated near the channel cut at the south end. Earlier sherds where encountered may represent residual material; however the high degree of mechanical damage occurring from redeposition has likely limited the preservation of more friable early Saxon sherds in the assemblage (Hey, 2004: 49).

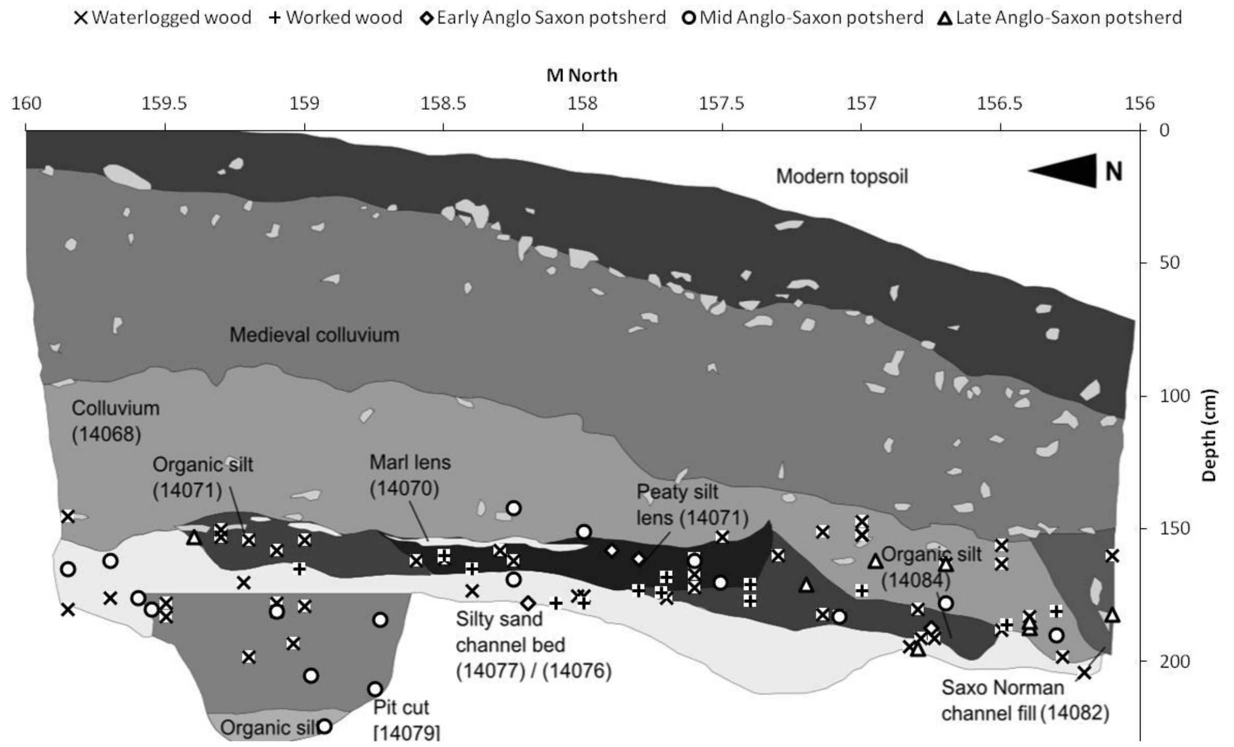


Figure 33: Simplified stratigraphic schematic of LTF14 TP4 overlain with sampled distribution of pottery and waterlogged materials in section.

The quantity of marine shell, metalworking slag and animal bone was greatest at the base of the sequence within the organic layers dated (contexts (14071)/(14083)/(14084)). The extensive evidence for ironworking recovered from the Tayne Field settlement contexts (Keys, 2011; Thomas, 2016; Thomas, 2017) suggests that the majority of bloomery slag in this sequence may represent re-deposited Anglo-Saxon material. The environmental assessment (Table 23) revealed evidence for hammerscale and consistently high quantities of charcoal and charred cereal grains present in these units, particularly in the lenses of organic sediment (14071)/(14081).

The marine shell mainly comprised fragments of Oyster (*Ostrea edulis*) and Mussel (*Mytilus edulis*) as are found throughout the Anglo- Saxon occupation sequence (Campbell, 2010). An additional range of species including common whelk (*Buccinum undatum*), Razor shell (*Ensis arcuatus*) and limpet (*Patella vulgata*) were encountered at the later channel sediments at the south end of the trench (156m N) (14082). Fish bones were recovered from most parts of the sequence, with small concentrations being noted at the base of the colluvium and in organic lens (14081) and charred specimens demonstrating deposition of cooked food waste. The dating model (section 5.5) suggests that this material is likely to derive from later Saxon and Saxo-Norman occupation activity.

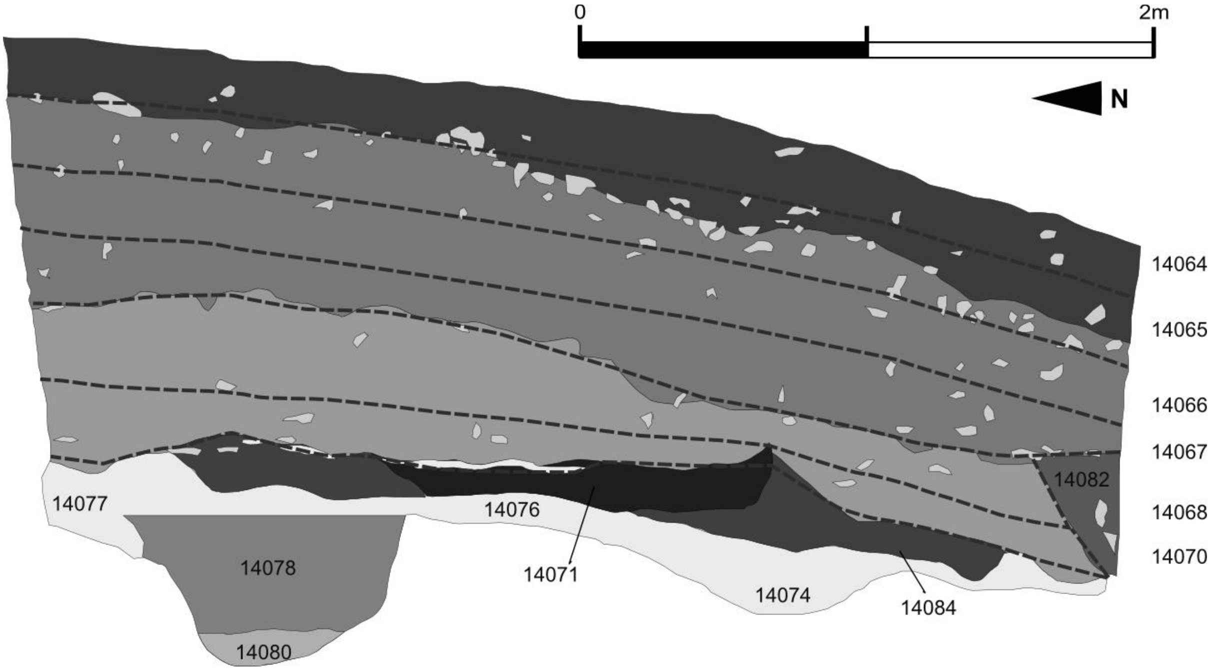


Figure 34: LTF14 TP4 spit and archaeological context numbers in relation to stratigraphic profile.

Table 12: Bulk finds from stream trench spits by total weight (g); dating inferred from artefacts and pottery.

Context	Date	Bone	CBM	Daub	Flint	Glass	Iron/ metal	Pottery	Shell	Slag	Stone
14064	Modern	1989	2305	10	779	534	75	1416	496	38	187
14065	Post medieval	1089	2409	5	599		2	940	413	34	
14066	Medieval /Post medieval	1018	297	14	257	16	30	607	964	95	154
14067	Medieval	46	46					82	203	129	7
14068	Saxo-Norman /Medieval	966	374		30		15	46	1042	116	87
14070	Late-Saxon / Saxo-Norman (9th/10th century)	1022			290		9		347	45	
14071	Middle Anglo-Saxon (8th century)	3145	94		2299			15	1822	319	109
14076	Romano-British / Early Anglo-Saxon ?	105			12			14	10		

5.3.2 Worked wood

Wooden stakes with cut marks were found embedded into the channel bed deposits (14083)/(14084) and sealed beneath units of waterlogged organic silt and peaty organic sediment (14071)/(14081) which provided a late Saxon *terminus ante quem* (for dating discussion see section 5.5). The stakes mostly comprised round-sectioned wood of between 3 and 15cm diameter. Some retained bark (Figure 37) suggesting cutting for this purpose rather than re-use and probably from a denser wood type better able to resist decay such as Oak (Salisbury, 1992: 157). The association of these stakes with stones (section 5.3.3) suggests structural functions such as revetments or the remains of *in situ* features associated with activities such as fishing (Salisbury, 1992: 159); however the proximity to the spring may render the latter explaination unlikely.

At least 17 identifiable fragments of worked wood were recovered, including two assemblages of interleaved wattle wands comprising the highly degraded remnants of hurdles, wattle panels or baskets (Figure 37c). A number of wood chips were found in association with these materials within organic silt contexts (14083) and (14084) (Figure 32) suggesting a working area, or a dump of woodworking debris. Two samples of this worked roundwood were submitted for radiocarbon dating as part of NERC award NF/2015/2/13 (section 5.5); taxonomic identifications of these reveal that *Corylus avelana* (Hazel) and *Acer campestre* (Field Maple) were being worked, with wands cut at around 4 -5 years old potentially indicating a 5 year coppicing cycle. These samples provided dates of 777-981 AD and 891-1027 cal A.D. (OxA-33566, OxA-33567, Table 14) for this activity. A fragment of worked stave that was possibly part of a box or vessel carved from a hardwood, probably *Quercus* (oak) (Figure 35), was recovered from a context (14084) dated to 777-981 cal A.D. (OxA-33566, Table 14).

Figure 35: Fragment of worked wood (cf. *Quercus*) from a larger object (late 8th-10th century AD); context (14084).

Figure 36: Plan view of stream trench at limit of excavation with in-situ features in context (14084).

Figure 37: ***In-situ*** **waterlogged worked wood items preserved in organic silt from left to right 1) stake with packing stones, 2) cut end of wattle and 3) interleaved wattles from a panel, or hurdle (context (14084)).**

5.3.3 Archaeological stones

Large stones comprising flat Greensand slabs together with irregular or rounded nodules of flint or chalk up to 40cm in diameter were found within the same horizon as the majority of the worked wood ((14084), Figure 38). No similar sized stones occur either in the overlying colluvial sequence or in excavated occupation contexts, indicating their origin in this location to be from deliberate placement rather than natural accumulation. The stones are distributed without clusters indicative of dumping and are located at a contiguous level suggesting a broadly contemporary chronology.

Comparison with other stones from paleochannel environments suggests possible functions such as weights for fishing tackle; however no examples were found to be worked or shaped in any way which could suggest such functions (Salisbury, 1992: 159). The linear arrangement of many of the larger examples perpendicular to the channel suggests an interpretation as stepping stones, placed to allow livestock and people access to the water of the stream across a marshy margin area. The most obvious alignment (Figure 36, Figure 32, Figure 38) was sealed by late Saxon organic sediments in (14081) (section 5.5).

Figure 38: in-situ alignments of archaeological stones with worked stakes or wattles in context (14084).

5.3.4 Pits

Two pit cuts were identified during excavation, both of which may relate to waterside activities at points when the channel was in different positions. These were both cut into alluvial and organic sediments relating to earlier or contemporary stream channel margins. Cut [14075]/(14074) (Figure 39b) comprised a shallow pit cut into peat and organic sediments in the southern part of the trench. This contained a notable quantity of large animal bone and a fine-grained alluvial clay fill which was compositionally identical to the organic fluvial sediment overlaying the horizon of the cut.

Cut [14079] (Figure 39a) by contrast comprised a pit some 0.5m deep into the basal layer of silty gravels and marl which bounded and underlay the organic silts and peaty organic sediment lenses immediately to the south. This pit had a highly organic primary fill, overlain by a largely sterile and fine-grained alluvial fill containing several sherds of pottery of middle Anglo-Saxon date (Figure 33). A bulk sample taken from the organic fill at the base of this pit (sample <9>) demonstrated a very high concentration (>1000 shells per kg) of Mollusca (section 5.8.4). No evidence of flax seeds or capsules was found (section 5.8) to suggest the use of this feature as a retting pit, a role which could otherwise be a possible interpretation (Campbell and Robinson, 2010: 502).

Figure 39: Pit cuts; a) [14079], b) [14075]. Note the pronounced orange-brown lens of primary fill containing molluscs and other organic remains at the base of [14079].

5.4 Environmental sampling

Extensive sampling was undertaken on the sections revealed by excavation, (Table 13, Figure 40) with assistance from students and fieldwork staff during the 2014 excavation season under supervision of the author. A single continuous sequence of bulk samples for recovery of plant macrofossils and Mollusca was taken from the intact west-facing section (recorded as <3>, Figure 41a); six additional bulk samples were recovered from archaeological contexts as excavation progressed, including organic lenses containing worked wood, paleochannel sediments and pit fills (Figure 40). These samples were wet sieved. Ten samples of waterlogged wood and plant macrofossils were selected during this process and submitted for radiocarbon dating as part of NERC award NF/2015/2/13 (section 5.5). Monoliths were taken from the waterlogged channel sediments from the stream trench sequence for recovery of pollen and non-pollen palynomorphs and also for compositional analysis (Figure 41a-c). A single micromorphology sample was recovered from the base of the sequence using a Kubiena tin in order to investigate geomorphology and alluvial processes. All laboratory processing, quantification, and analysis was undertaken by the author unless otherwise stated in the text. Additional assistance with identifications was provided by Dr Dan Young (waterlogged plant macrofossils), Dr Lisa Lodwick (charred plant macrofossils) and Dr Catherine Barnett (waterlogged wood) at the University of Reading.

Table 13: Sample scheme for stream trench (LTF14 TP4)

Sample type / code	Rationale	Location	Associated dates
Monolith <4>	Microfossils from waterlogged sequence.	W facing section, equivalent to lowest 0.5m of <3> and (14068) / (14070) / (14071) / (14076).	OxA-33561; OxA-33523; OxA-33562; OxA-33563; OxA-33564
Monolith <5>	Microfossils from organic lens.	E facing section, through organic layer (14081) overlying stones.	OxA-33566 OxA-33568
Monolith <24>	Microfossils from sediments overlaying and partially infilling pit feature.	W facing section through upper fill of pit [14079] and overlying alluvial sediments (14071).	OxA-33697
Bulk sequence <3>	Macrofossils and datable material, complete sequence.	W facing section, 15 x 1l @ 10cm intervals above and 5cm intervals below the water table.	OxA-33561; OxA-33523; OxA-33562; OxA-33563; OxA-33564
Micromorphology sample <26>	Investigation of hydrology and site formation processes.	W facing section, equivalent to lowest 15cm of <3> & <4> and (14068) / (14070) / (14071).	OxA-33562; OxA-33563; OxA-33564
Bulk sample <7>	Anglo-Saxon channel fill	(14077), base of sequence.	OxA-33697
Bulk sample <8>	Saxo-Norman or medieval channel fill	(14082), W facing section, southern end of trench.	OxA-33567
Bulk sample <9>	Organic primary fill of pit.	Fill (14080) of pit [14079].	

Bulk sample <10>	Late Anglo-Saxon organic lens associated with monolith <5>	Organic lens (14081) next to <5>.	OxA-33568
Bulk sample <17>	Saxo-Norman or medieval channel fill	(14082), W facing section, southern end of trench.	OxA-33567
Bulk sample <18>	Anglo-Saxon organic alluvial silt lens.	(14083), below organic lens.	OxA-33566

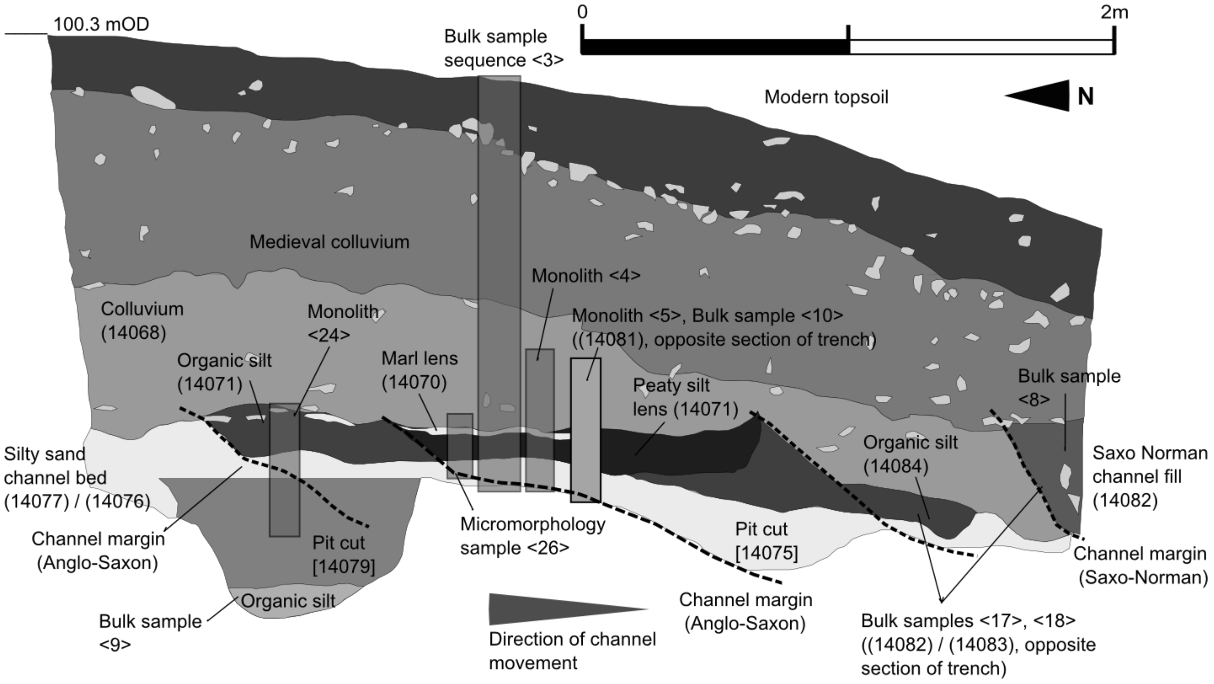


Figure 40: West facing profile of stream trench with context numbers and sampling locations; interpretation of channel margins are suggestions based upon position of organic lenses in section.

a) Location in west-facing section of bulk sequence column <3> and monolith <4>

b) Location in east-facing section of monolith <5> (context (14081)).

c) Location in west-facing section of monolith <24> (contexts (14078)/(14076)).

Figure 41a-c: Sample locations from stream trench sections.

5.5 Dating evidence

The ten radiocarbon samples comprised a sequence of five corresponding to the waterlogged portion (134-157cm) of bulk sample sequence <3> (section 5.4) and five additional spot samples corresponding to excavated contexts containing organic materials and evidence for woodworking. These samples, together with their achieved dating results and laboratory codes are summarised in Table 14 with locations detailed in Figure 32. Individual Bayesian distributions for these samples (by lab code) modelled in OxCal v4.2.4 (Bronk Ramsey, 2016) using the IntCal13 calibration curve, are displayed in Figure 42.

The results from this work are broadly consistent and correspond well to the trajectory of occupation activity at the site (Chapter 2) by demonstrating a timescale of accumulation for the waterlogged sediments in the central part of the section (Figure 33) between the 4th to the 10th century A.D (Figure 43). Exceptions to this consistency are seen in the basal sample in the bulk sequence (OxA-33564), which apparently post-dates the entirety of the overlying sequence (and may be intrusive) and the spot sample from the north end of the channel bed (OxA-33697) which is a thousand years earlier and may be residual. An explanation for the disparity between these two samples derives from the nature of this channel bed/basal layer (section 5.2) which comprised a palimpsest of dipping sediments representing a sequence of channels, potentially of different dates, which could not be individually resolved in the field (contexts (14077) and (14076)).

In order to progress towards a cohesive dating model, an interpolative chronostratigraphic approach focussing purely upon the four well-stratified results from sequence <3> detailed in Figure 43 (OxA-33561, OxA-33523, OxA-33562, OxA-33563) could be undertaken as per Figure 45 (depth in cm). This model, undertaken in the 'Bacon' v2.2 add-on to R v3.2.5 (https://www.r-project.org/), collates the date ranges into a single profile using an iterative Markov Chain Monte Carlo (MCMC) and a gamma autoregressive semiparametric model (Blaauw and Christen, 2011). Using the weighted mean best-fit model generated by this process, the total timescale for accumulation of the sequence could then be judged to span the late 5th to mid 10th century (on the basis that the lowest sample is intrusive) (Table 16).

The assumptions built into this type of model are however contradicted by the stratigraphic evidence, which demonstrates dipping and laterally constrained deposits which are not horizontally bedded and which are compositionally distinct (section 5.2). Consequentially it cannot be assumed that accumulation was consistent or that the laterally discontinuous organic sediments recorded within this trench at similar depths can be grouped together in phases. Such difficulties arising from compositional variation and high degrees of sediment mixing demonstrate the inherent complications encountered when attempting to date fluvial sequences using plant macrofossils, as has been highlighted in some recent studies (e.g. Howard *et al*., 2009).

As a result of this analysis it can be determined that any attempt to scale a mutually-exclusive phase sequence model to the entirety of the sequence is methodologically inappropriate except for these units which are stratigraphically secure (Units 1 to 4, the main environmental sequence from (14076) to (14070)). The remaining spot samples (Units 5 to 7) derive from laterally discontinuous lenses which lack secure superpositionary relationships to each other and consequently must be regarded as potentially overlapping or contemporary phases to the stratigraphically secure sequence. A more comprehensive approach to resolving the dating model must therefore utilise a Bayesian age-depth model combining both overlapping and mutually exclusive phase elements (Table 15 and Figure 44).

A major caveat with this model is the underlying channel bed silt unit which either contains an intrusive or a residual sample (OxA-33564 and OxA-33697) and which, as discussed above, may represent a broad timescale of deposition. In contrast, the overlying sequence from the central part of the section (OxA-33561, OxA-33523, OxA-33562, OxA-33563) comprised well stratified deposits producing a consistent dating sequence and are therefore likely to be more reliable. This dating model consequentially only works if the underlying (later) sample OxA-33564 is assumed to be an outlier, as shown here. Assuming this to be the case, the main environmental sample sequence is bounded between the date of onset of organic accumulation between 382-535 A.D (Unit 2) and the upper limit of alluvial accumulation at this location (14070) between 773-947 A.D. (Unit 4). The final fill from the excavated channel sequence at the southern limit of the trench (14082) which marks the cessation of fluvial processes across the entire span of the excavated area, is modelled at 894-984 A.D.

Table 14: Radiocarbon samples and dating for all samples (NERC Radiocarbon award NF/2015/2/13).

						Uncalibrated		**Calibrated AD (IntCal 13)**									
Lab Ref	**Sample number**	**Material**	**Context / location / depth**	**Location description**	**Dating rational**	**C14 BP**	± BP	**from**	**to**	**%**	**from**	**to**	**%**	**from**	**to**	**%**	**d13c**
OxA-33561	Sequence <3>	*Corylus avelana* shell	127E/158N, 134-137cm (14070)	Marl lens	Top of waterlogged sequence / base of colluvium	1169	31	777	936	68.2	771	967	95.4	714	987	99.7	-27.0
OxA-33523	Sequence <3>	*Corylus avelana* shell	127E/158N, 137-142cm (14071)	Organic lens	To date duration of organic lens formation	1264	24	690	768	68.2	669	797	95.4	664	874	99.7	-26.1
OxA-33562	Sequence <3>	*Corylus avelana* shell	127E/158N, 142-147cm (14071)	Lower portion of organic lens	To date start of organic lens formation	1275	31	685	767	68.2	661	855	95.4	656	878	99.7	-26.5
OxA-33563	Sequence <3>	*Prunus* sp. cf, *avium* stones	127E/158N, 147-152cm (14071)/(14076)	Organic lens / channel bed interface	To date onset of accumulation of organic materials and start of channel infill	1628	30	387	530	68.2	349	536	95.4	264	545	99.7	-26.3
OxA-33564	Sequence <3>	*Prunus* sp. cf, *spinosa* stones	127E/158N, 152-157cm (14076)	Marl / channel bed	Base of sequence / channel bed	1139	28	881	970	68.2	777	982	95.4	772	991	99.7	-29.8
OxA-33565	<17>	*Corylus avelana* shell	(14082)	Potentially Saxo-Norman or medieval channel scour fill.	To date channel infill and end of lateral progression of stream margin.	1148	27	779	968	68.2	777	972	95.4	771	987	99.7	-27.2
OxA-33566	<18>	*Corylus avelana* roundwood	(14083)	Organic alluvial silt containing worked wood and Anglo-Saxon pottery below organic lens (14081).	To date woodworking activity at channel margin and potential evidence for coppicing.	1140	28	880	970	68.2	777	981	95.4	772	990	99.7	-30.3
OxA-33567	<27>	*Acer campestre* roundwood	(14082)	Potentially Saxo-Norman or medieval channel scour fill	To date woodworking activity at channel margin and potential evidence for coppicing.	1051	31	975	1020	68.2	899	1027	95.4	886	1119	99.7	-27.0
OxA-33568	<10>	*Prunus domestica* stone	(14081)	Organic lens associated with dung deposit	To date deposition of dung by stream from livestock activity	1091	29	899	989	68.2	892	1014	95.4	777	1025	99.7	-23.4
OxA-33697	<7>	Prunus sp. cf, spinosa stones	(14077)	Silty sand channel bed deposits	To date base of sequence / channel bed cut by pit [14079].	2447	33	-741	-430	68.2	-754	-410	95.4	-768	-406	99.7	-27.2

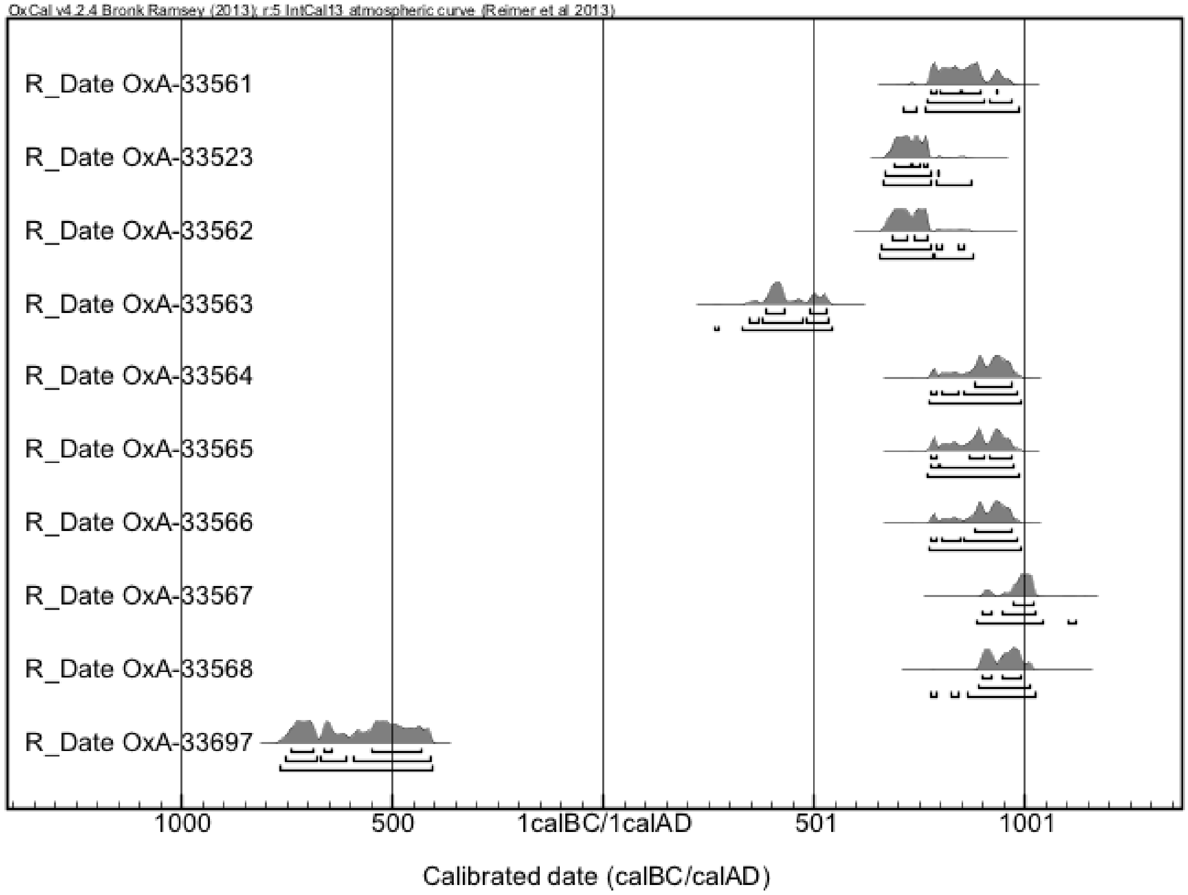


Figure 42: Distributions for all dated samples (IntCal13 calibration curve); confidence ranges indicated by brackets under distributions (from top to bottom: 68.2%, 95.4%, 99.7%).

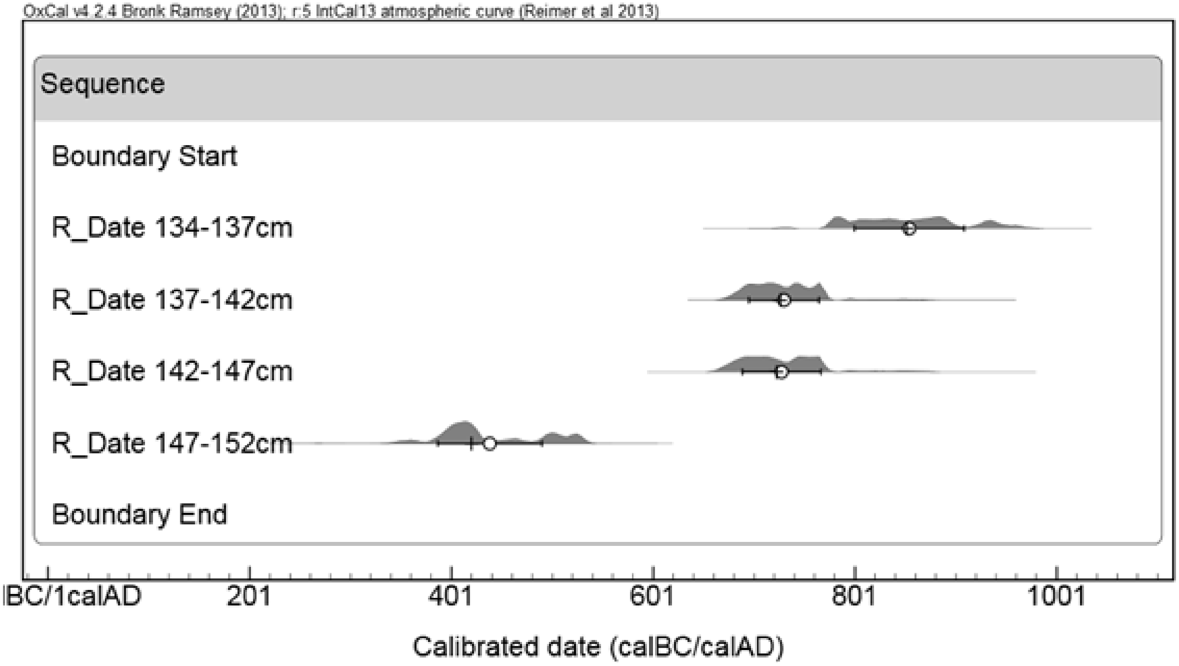


Figure 43: Distributions for sequence <3>, labelled with sample depth to display chronology of sequence, mean (○), median (I) and 1σ ranges; erroneous result from the lowest sample (OxA-33564, 152-157cm) has been removed.

Table 15: Phase model summary.

Phase unit	Description	Dating evidence	Modelled date range (95.4%)	Modelled interval (95.4%)
9	Topsoil	Modern finds.	-	-
8	Medieval and post medieval colluvial sequence, (14068) and overlying deposits.	Medieval / post medieval finds.	-	-
7	Saxo-Norman channel fill (14082)	Late Anglo-Saxon / medieval pottery; OxA-33567; OxA-33565	894-984 A.D.	0-625 years
6	Late Saxon dung deposit / organic sediment (14081)	Late / middle Anglo-Saxon pottery; OxA-33568	892-1006 A.D.	0-923 years
5	Organic silt with woodworking evidence (14083)	Late / middle Anglo-Saxon pottery; OxA-33566	779-980 A.D.	0-883 years
4	Marl lens (14070) sealing (14071): end of organic accumulation at this location.	OxA-33561	773-947 A.D.	0-269 years
3	Accumulation of organic silt lens (14071)	Middle Anglo-Saxon pottery; OxA-33523; OxA-33562	684-768 A.D.	0-188 years
2	Horizon between (14071) and (14076): transition from open channel to organic accumulation and infill	OxA-33563	382-535 A.D.	0-269 years
1	Silty sand channel bed / open channel (14076) / (14077)	OxA-33697; OxA-33564* *(assumed to be intrusive/ outlier on the basis of superposition of four earlier samples)	104-336 A.D.	671-1468 years

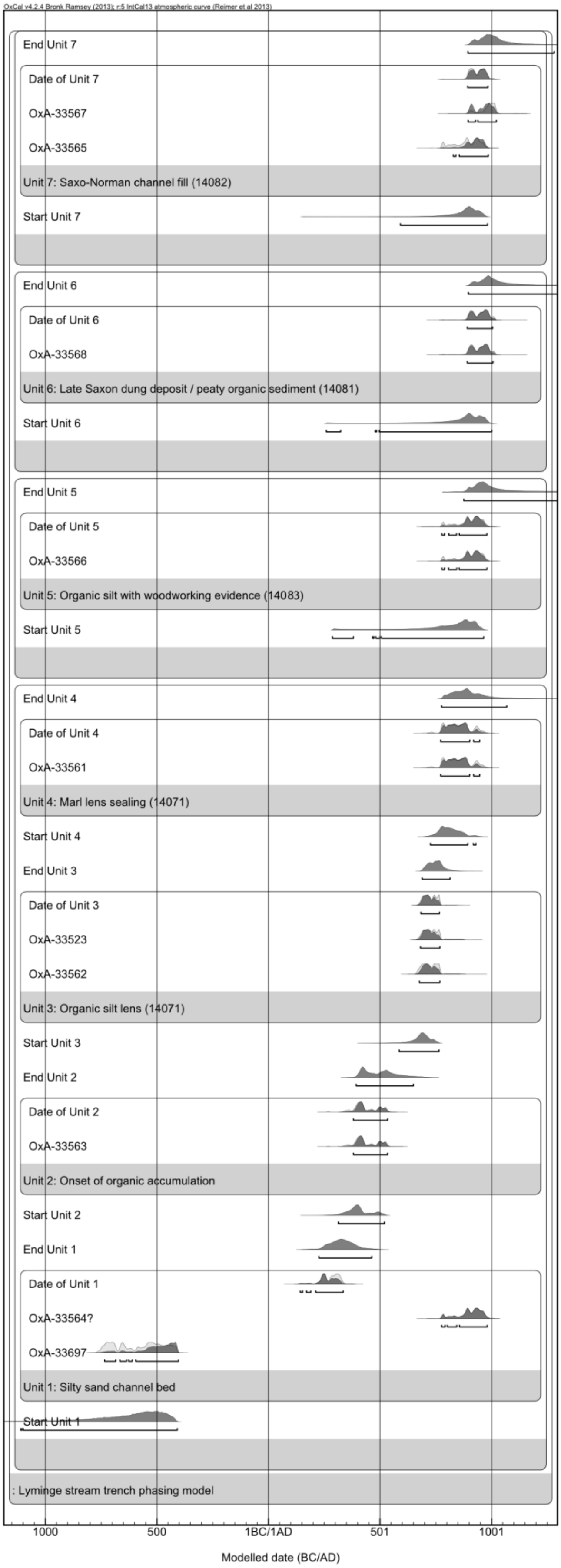


Figure 44: Stream sequence phasing model showing major depositional units and their component dates.

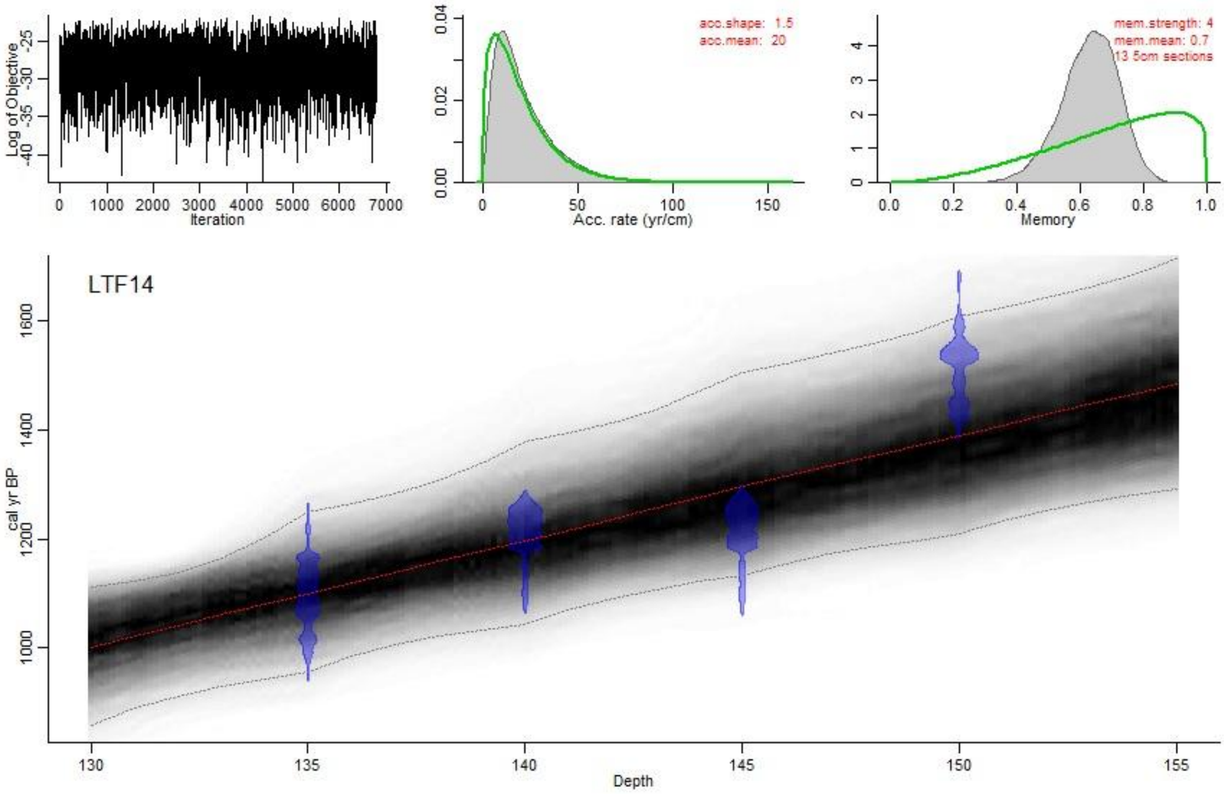


Figure 45: Output from exploratory age-depth / accumulation model undertaken using the Bacon v2.2 add-on to R v3.2.5 for the four contiguous samples (Figure 43) from sequence <3>. Output plots from upper left to right comprise: distribution of MCMC iterations, distributions of prior (green curves) and posterior (grey histograms) accumulation rates and memory; main graph depicts calibrated C14 dates (blue histograms) against age-depth model (calibrated age probability distributions (grey shaded) with 95% confidence intervals (stippled lines) and weighted mean age best fit model (red line)).

Table 16: Calendar date ranges for start and end points of waterlogged sequence generated by exploratory age-depth model created in Bacon v2.2.

Samples included	2σ range for channel bed date	Modelled best-fit date for channel bed	2σ range for upper horizon of alluvial sequence	Modelled best-fit date for upper horizon of alluvial sequence
OxA-33561, OxA-33523, OxA-33562, OxA-33563	235 - 657 AD	466 AD	839 – 1092 AD	949 AD

5.6 Micromorphology

5.6.1 Micromorphological observations

The section from this sequence was observed to comprise five distinct microstratigraphic units; an overview is presented in Figure 46. The tabulated results of the micromorphological analysis are presented in Table 17 (terminology follows Bullock *et al*., 1985; Stoops *et al*., 2009). Deposits are described in more detail in terms of types of deposit, inclusions, components, depositional processes and post-depositional alterations in section 5.6.2.

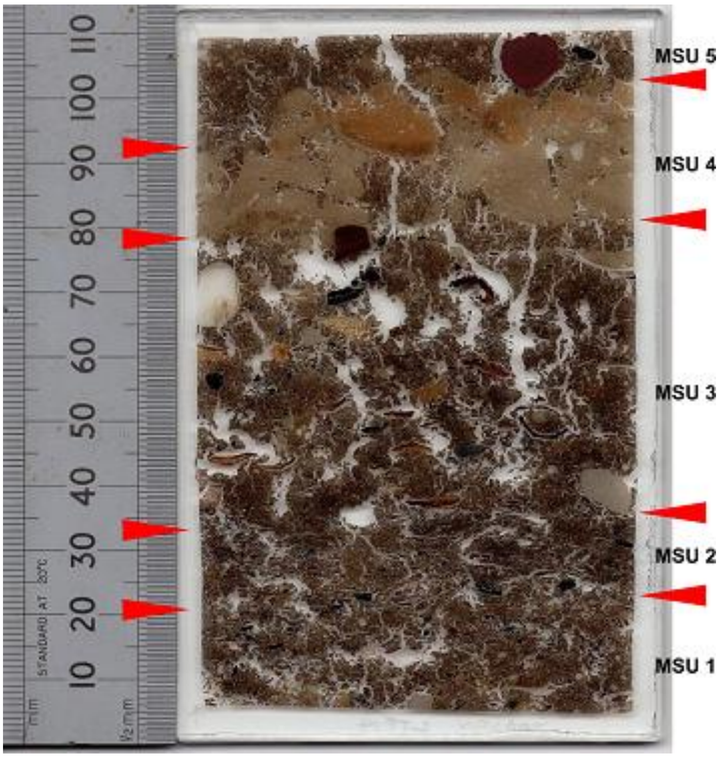


Figure 46: Overview for thin section from stream trench sequence with microstratigraphic unit (MSU) boundaries marked.

Table 17: Micromorphological descriptions for stream trench: inclusions & post-depositional textural pedofeatures (terminology after Bullock *et al*, 1985)

Microstratigraphic unit no.		**MSU1**	**MSU2**	**MSU3**	**MSU4**	**MSU5**
Thickness (mm)		15	12	44	14	7-17
Context		Channel fill	Peaty silt lens	Peaty silt	Marl lens	Peaty silt
Deposit type		Organic silt / channel fill	Organic silt / peaty silt	Organic silt / peaty silt	Chalk marl /calcareous silt	Organic silt / peaty silt
Boundary		N/A	Diffuse, smooth sedimentological	Diffuse, smooth sedimentological	Sharp, smooth sedimentological	Sharp, smooth sedimentological
c/f ratio (10µm limit)		40/60	30/70	30/70	15/85	30/70
Particle Size		Sandy silt loam	Silty clay loam	Silty clay loam	Clay	Silty clay loam
Fine material		Cloudy & speckled, microcrystalline; 30% organic	Cloudy & speckled, microcrystalline; 40% organic	Cloudy & speckled, microcrystalline; 30% organic	Stipple speckled, microcrystalline; 5% organic	Cloudy & speckled, microcrystalline; 30% organic
Related Distribution		Open porphyric	Open porphyric	Open porphyric	Open porphyric	Open porphyric
Sorting		Unsorted	Poor	Unsorted	Bimodal: poorly sorted sand in well sorted clay	Unsorted
Orientation and distribution of inclusions		Weakly orientated; random with some locally referred	Strongly orientated; parallel & referred to boundary	Unorientated; random & unreferred	Unorientated; random & unreferred	Unorientated; random & unreferred
Rock fragments	Chalk	**	-	**	**	**
	Chert/flint	*	*	**	*	*
	Sandstone	*	-	-	-	*
Minerals	Quartz	***	**	**	**	**
	Glauconite	*	*	*	-	*
	Calcite	-	*	-	*	*
Sediment Aggregates	Clay-rich	-	*	**	**	-
	Marl	-	-	*	-	**
	Sandy	-	-	-	-	*
Micro-artefacts	Pottery	*	-	-	-	-
	Daub	*	*	**	-	-
Bioarchaeological	Bone (unburnt)	*	*	**	-	*
	Coprolite	*	-	*	-	*
Organic / Plant Remains	Charred Wood	**	**	**	-	*
	Waterlogged plant tissue	***	****	***	**	**
	Amorphous organic	**	***	**	**	**
Inorganic remains of biological origin	Earthworm granules	*	*	*	*	**
	Mollusc shell	*	*	*	*	*

Key: ****** Very dominant >70%; ***** Dominant 50-70%; **** Common 30-50%; *** Frequent 15-30%; ** Few 5-15%; * Very few <5%

Microstructure	Spongy with planes & vughs: 25% voids	Spongy with frequent planes, vughs & voids: 20% voids	Spongy with planes & voids; 35% voids	Massive with occasional planes & vughs: 10% voids	Spongy with planes & vughs: 20% voids
Intercalated textural pedofeatures	-	-	-	+++	-
Microfaunal excrements	+	++	+	-	-
Voids from shrinking / dissolution	++	+++++	++	-	++
Organic staining of groundmass	+++++	+++++	++++	-	++++
Redoxomorphic Fe/Mn staining	-	-	-	++++	-
Secondary iron nodules	+	+	+	++	+

Key: +++++ Very abundant >20%; ++++ Abundant 10-20%; +++ Many 5-10%; ++ Occasional 2-5%; + Rare <2%

5.6.2 Micromorphological deposit descriptions

Microstratigraphic unit 1

Description

The basal unit for this sample comprises unsorted organic sandy silt with a coarse/fine ratio of 40/60. The unit is dominated by minerogenic inclusions of a wide range of sizes, mainly rounded to sub-angular quartz (15%, <5mm), chalk clasts (5%, <3.5mm) and chert / flint (1%, <1.6mm). The organic content is 30% with large quantities of waterlogged plant material (20%, up to 1cm) including an identifiable seed of *Carex* sp. (sedge family) and organic staining to the groundmass (60%). This material also contains significant anthropogenic inclusions such as sand tempered pottery fragments (2%, <1mm), daub fragments (1%, <1.2mm), bone fragments (1%, <700µm) and charcoal (10%, <4mm). Several larger fragments of charcoal were identifiable as *Corylus avelana* (Hazel). The fabric displays evidence for partial decay of the organic material, with microfaunal excrements and voids from the partial decay of plant material (10%) indicating periods when the sediment was not completed waterlogged.

Interpretation

The unit is coarser than any other in the sample, with a diverse range of clastic and organic components indicating a range of depositional pathways from dumping, in-situ organic accumulation and hydrological action. The post-depositional environment is likely to have not been one of permanent waterlogging at least for a period of time sufficient to allow some microfaunal activity within the organic components of the sediment.

Microstratigraphic unit 2

Description

The second microstratigraphic unit for this sample comprises unsorted organic silty clay with a coarse/fine ratio of 30/70. The organic content is dominant (40%) with organic staining to the groundmass throughout (>70%). The unit is dominated by plant material (40%, <2cm) which is strongly orientated and referred to the unit boundary indicating compaction and compression. Minerogenic inclusions are also present, mainly rounded to sub-angular quartz (15%, <5mm), clay aggregates (2%, <1mm) and chert / flint (1%, <1mm). This material contains only limited anthropogenic inclusions, notably daub fragments (2%, <1.2mm), bone fragments (1%, <600µm) and fragmentary charcoal (5%, <4mm). The fabric displays evidence for partial decay of the organic material, with abundant microfaunal excrements and voids from the partial decay of plant material (30%) indicating periods when the sediment was not completed waterlogged.

Interpretation

The unit contains a large quantity of waterlogged and partially decomposed plant material which has been subject to significant compaction. Consequentially it may represent a surface of dumped or accumulated organic sediments which has been subject to trampling from livestock at the margins of the stream. The inclusions comprise a diverse range of clastic and organic components indicating a range of depositional pathways from dumping, in-situ organic accumulation and hydrological action. The post-depositional environment is likely to have not been one of permanent waterlogging at least for a period of time sufficient to allow some microfaunal activity within the organic components of the sediment.

Microstratigraphic unit 3

Description

This unit comprises unsorted organic silty clay with a coarse/fine ratio of 30/70. The unit contains abundant minerogenic inclusions, mainly rounded to sub-angular quartz (5%, <800µm), chalk clasts (5%, <3mm) and chert / flint (5%, <1cm); however these are notably less prevalent than in the basal unit for the sequence. The organic content is 30% with large quantities of waterlogged plant material (20%, up to 1cm) including *Corylus* shell fragments (5%, up to 5mm) and an identifiable seed of Asteraceae type cf. *Senecio* (Ragwort). There is also abundant organic staining to the groundmass (>20%). This material also contains significant anthropogenic inclusions such as daub fragments (5%, <5mm), bone fragments (5%, <1cm) and charcoal (5%, <8mm). Several larger fragments of charcoal were identifiable as *Corylus* (Hazel), cf. *Salix* (Willow), *Quercus* (Oak) and a single fragment cf. *Rhamnus cathartica* (Buckthorn). Isolated Iron stained flint (5%, <1cm) and iron/manganese nodules (2%, <500µm) precipitated from redoxyhydromorphic processes in soils with free movement of water suggest the presence of materials eroded and redeposited from soils with free movement of water. The fabric displays evidence for partial decay of the organic material, with microfaunal excrements and voids from the partial decay of plant material (<10%) indicating periods when the sediment was not completed waterlogged.

Interpretation

The unit contains a diverse range of clastic and organic components indicating a range of depositional pathways from dumping, in-situ organic accumulation, redeposition from erosion and hydrological action. The post-depositional environment is likely to have not been one of permanent waterlogging at least for a period of time sufficient to allow some microfaunal activity within the organic components of the sediment. This unit is truncated and sealed with a sharp sedimentological boundary to the overlying marl lens.

Microstratigraphic unit 4

Description

This is a lens of well sorted calcareous silty clay with occasional voids (10%), a coarse/fine ratio of 15/85 and very low organic content (5%). The microstructure comprises a massive, well sorted matrix and larger sand-sized inclusions mainly comprising chalk clasts (10%, <1.5mm), rounded to sub-angular quartz (5%, <2cm) and chert / flint (2%, <4mm). The fabric incorporates infrequent intercalated textural pedofeatures (10% of groundmass) of sediment clasts and inwashed material contained within cracks and planes in the marl. These contain similar inclusions to the over and underlying units, such as waterlogged plant material (7%, <1mm) and mollusc shell fragments (2%, 1mm). Extensive iron staining is present on the marl fabric, referred to the top boundary of the unit and covering about 40% of the groundmass. The unit has sharp boundaries with the units above and below it.

Interpretation

The well sorted fabric of this unit indicates alluvial deposition in relatively slow moving water. The sharp boundaries and pronounced discontinuities with the underlying and overlying material indicate together with the lack of any apparent laminations indicate a single discrete episode of formation. The lack of extent anthropogenic or intrusive material suggests that erosion or other mass transportation into the catchment was not a major contributing formation factor. In terms of post-depositional changes, extensive redoxyhydromorphic staining indicates fluctuating water levels and iron mobilisation within the post-depositional environment; inwashed material within textural intercalations indicate some degree of later site disturbance causing translocation of fine material down profile.

Microstratigraphic unit 5

Description

This unit is similar to MSU3 and comprises unsorted organic silty clay with a coarse/fine ratio of 30/70. The unit contains abundant minerogenic inclusions, mainly rounded to sub-angular quartz (5%, <800µm), chalk clasts (5%, <4mm), Greensand clasts (2%, <4mm) and chert / flint (1%, <600µm). The organic content is 30% with waterlogged plant material (12%, up to 1cm) and organic staining to the groundmass (20%). This material also contains significant anthropogenic inclusions such as daub fragments (5%, <5mm), bone fragments (1%, <500µm), charcoal (1%, <1mm) and coprolite fragments (1%, <400µm). Iron/manganese nodules (2%, <600µm) precipitated from redoxyhydromorphic processes in soils with free movement of water suggest the presence of materials eroded and redeposited from soils with free movement of water. The fabric displays evidence for partial decay of the organic material, with voids from the partial decay of plant material (5%) indicating periods when the sediment was not completed waterlogged.

Interpretation

The unit contains a diverse range of clastic and organic components potentially indicating a range of depositional pathways from dumping, in-situ organic accumulation, redeposition from erosion and hydrological action. The post-depositional environment is likely to have not been one of permanent waterlogging at least for a period of time sufficient to allow some microfaunal activity within the organic components of the sediment. This has a sharp sedimentological boundary to the underlying marl lens indicating a rapid transition in deposition environment.

5.6.3 Micromorphological interpretation

The sequence in summary comprises coarser material (MSU1) overlain by finer organic peaty silts (MSU3, MSU5), with two main punctuations in the form of a compacted peaty silt layer (MSU2) and a discrete calcareous marl lens (MSU4). The pronounced discontinuity and sharp sedimentological boundary between the marl lens and the organic silt units above and below it indicates a flood event occurring at one point in the sequence. Compositionally, this lens is dominated by a fine grained massively structured matrix with a very high content of calcite similar to alluvial flood deposits and calcareous floodplain clays widely found in chalk valley environments (Limbrey, 1992).

The sequence demonstrates a depositional environment that has been largely, although not continuously, waterlogged, with partially decayed organic materials mixed into a largely minerogenic matrix of fine silts and clay deposited or reworked by relatively slow moving water. The units within the waterlogged sequence demonstrate a poorly sorted heterogenous fabric indicating that fluvially reworked colluvial materials comprise a major compositional component (French, 2003: 57). Within this component are elements originating in aerobic sediments from upslope areas, notably biogenic calcite grains (Limbrey, 1992: 61) and redoxyhydromorphic iron/manganese nodules (Stoops *et al*., 2009). Reworked occupation deposits comprise abundant pottery, burnt daub and bone fragments which likely originate in settlement contexts situated well away from the stream margin. The highly abraded character of the potsherds within this sequence further suggest that at least some of this redeposited material derived from reworked midden spreads or soils which had been subject to manuring (Simpson *et al*., 1998).

The waterlogged organic remains comprise tissue and plant organ (stem, seed, bud) fragments, along with cellular residues and amorphorous material. Identifiable seeds are present in the sequence with a specimen of *Carex* sp. (sedge family) visible in MSU1 and a seed of the Asteraceae family cf. *Senecio* (Ragwort) and numerous shells of *Corylus avelana* (Hazel) in MSU3. Individual spores comparable in form to those produced by various types of fungal mold are also visible (Figure 47). Evidence for shrinkage and partial dissolution is apparent in terms of laminar voids orientated and referred to extant plant tissues. Weakly fluorescent amorphous cellular and phosphatised calcitic residues in aggregates or hypocoatings around voids (Figure 48d) indicate post-depositional processes of pedogenic humification and organic decay (Babel, 1975: 418; Polo Díaz and Fernández Eraso, 2010: 91). Extensive distributions of neoformed pyrite crystals associated with plant material also indicate organic decay in a waterlogged soil environment (FitzPatrick, 1984: 96-97)(Figure 48b). Post-depositional microfaunal activity is indicated by excrement aggregates characteristic of detritivorous organisms such as *Orbatid* mites or Bibionidae (fly) larvae (Stoops *et al*., 2009), particularly MSU1 and 2, suggesting that the material has not been permanently waterlogged.

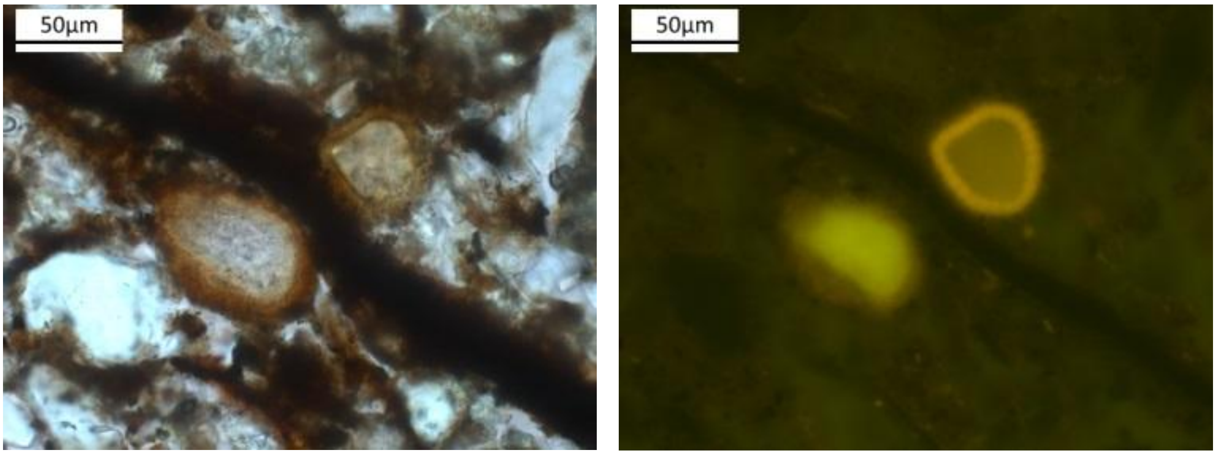
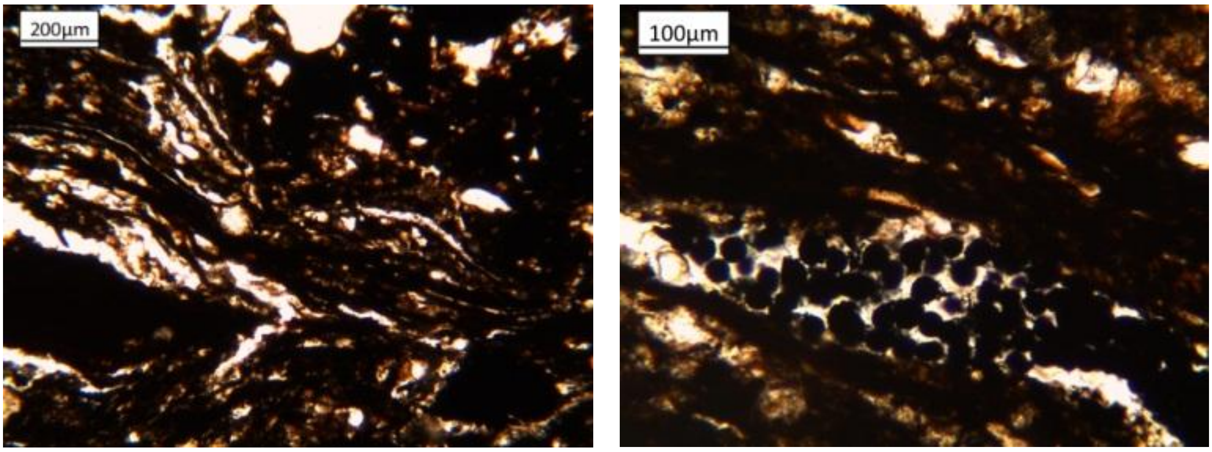


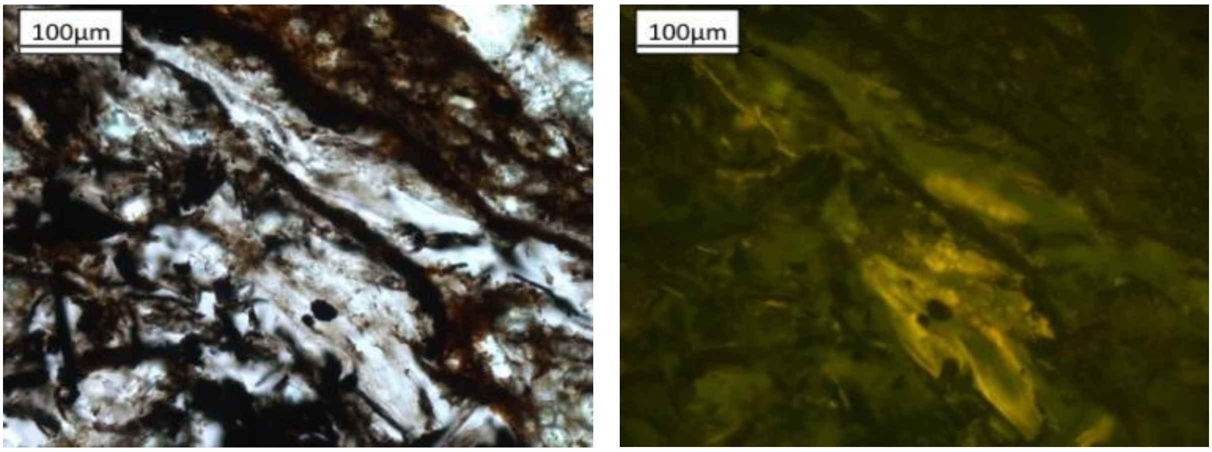
Figure 47: Spore visible within organic material in LT14 MSU3 observed under a) PPL, b) UV.

In the basal unit MSU1, the dominant component of waterlogged plant material demonstrates a degree of local orientation indicating the maintenance of relationship of congruent tissues since deposition, suggesting only limited post-depositional disturbance or partially submerged accumulation. The overlying peaty silt layer (MSU2), comprises a 12mm thick horizon characterised by thin, compressed layers of partially layered plant fragments and amorphous organic material displaying limited fluorescence. The plant material in this layer is notably compacted and strongly orientated (Figure 48a) in a groundmass largely comprising amorphous organic material derived from partially decomposed cellular residues (Figure 48c and fluorescence in d). This type of horizon is similar to dung-strewn floors in byres subject to trampling by livestock and relic stable crusts observed in experimental studies (Macphail *et al.*, 2004: 179). Although no faecal spherulites or coprolitic fragments were observed within the micromorphology of this horizon, significant quantities of cereal pollen (section 5.7.3, Figure 54) may represent concentration within livestock dung. This material can therefore be interpreted as a mixture of partially decayed stream-side vegetation and dumped organic material, such as waste from stabling or byres, which has been compacted *in-situ* by livestock movement. Based upon these findings, a direction for future research could be examination of these deposits using methods such as gas chromatography-mass spectrometry (GC-MS) to identify bile acids, faecal sterols, stanols and other organic compounds, in order to provide further details about the balance of livestock species and potential human component (e.g. Evershed *et al.*, 2001; Matthews, 2010; Shillito *et al.*, 2011).



a) Orientation and layering from compression (PPL)

b) Pyrite crystals within void (PPL)



c) Compressed and partially decomposed cellular residues (PPL)

d) Compressed and partially decomposed cellular residues (UV)

Figure 48: Post-depositional transformation of waterlogged plant material in compacted peaty silt lens MSU2.

Fragments of wood and woody plant tissues are evident throughout the sequence in notable abundance. Variations in preservation pathways are evidenced from the range of colours under plane-polarised light from black (charred) to orange and dark brown (waterlogged); however the majority of most of the larger fragments are charred, which suggests material redeposited from occupation deposits. Taxonomic identifications (Schweingruber (1990)) indicate that the majority of these fragments comprise specimens of *Corylus avelana* (Hazel) along with some fragments of *Salix alba* (Willow) or *Acer campestre* (Field Maple)(Figure 49), together with several fragmentary specimens comparing favourably to *Quercus robur* (Oak), *Sambucus nigra* (Elder) and *Rhamnus cathartica* (Buckthorn). These identifications, in case of *Corylus*, *Salix* and *Quercus* correlate well with the pollen data (section 5.7.3) and in the case of *Corylus*, *Salix* and *Sambucus* correlate with the waterlogged macrofossil data (section 5.8). The majority of the charred material demonstrates sharply defined pore structures and good preservation, indicating combustion conditions which were insufficiently hot (<500°C) to cause the friable form and distorted pore structures associated with higher temperatures and so likely derive from low temperature domestic fires (Braadbaart and Poole, 2008: 2443; Matthews, 2010: 103).

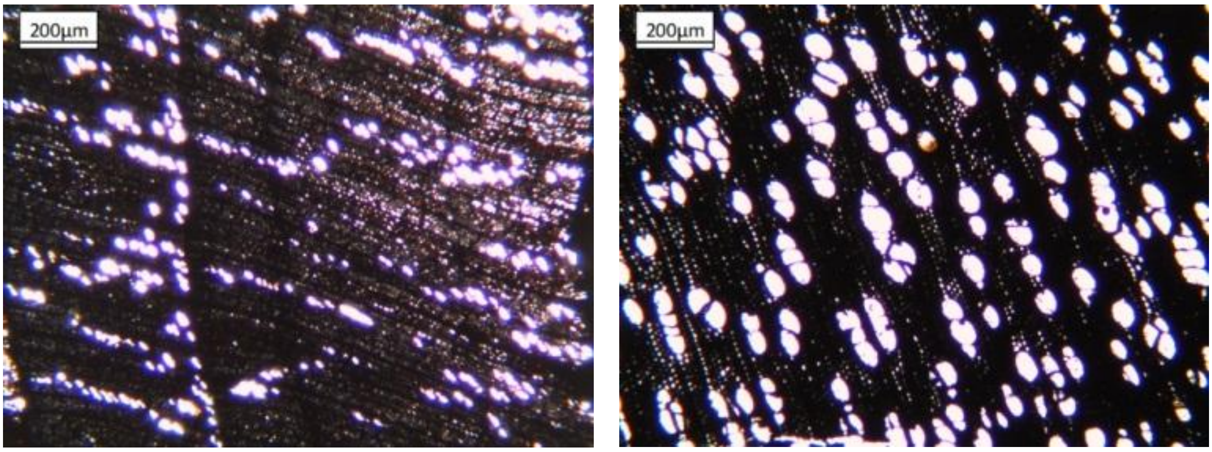


Figure 49: Thin sections of identifiable charred wood from micromorphological sample, MSU3; a) *Corylus avelana* (Hazel), b) *Salix alba* (Willow) or *Acer campestre* (Field Maple).

Isolated and infrequently preserved coprolite fragments in the upper unit of the sequence (MSU5) demonstrate the presence of dung deposited or dumped at the stream edge (Figure 50). These coprolites lack any visible inclusions of fibrous plant material which might suggest a herbivorous origin and are morphologically comparable to those produced by omnivores (i.e. human or pig) (Shillito *et al*., 2011), a finding which correlates with the range of parasite eggs recorded from associated units of peaty silt in monolith <5> and discussed in section 5.7.5.

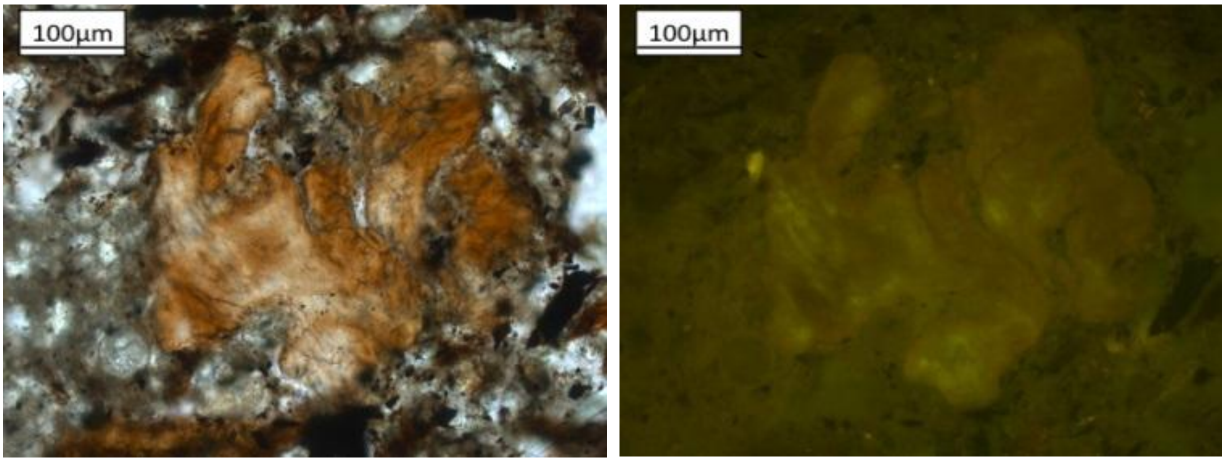


Figure 50: Coprolite, MSU5: a) PPL, b) UV.

5.7 Monoliths

5.7.1 Results

Detailed descriptive information for the three monoliths recovered from the stream trench is presented in Table 18 with compositional summaries in Figure 51. Tabulated counts of pollen and non-pollen palynomorphs from these monoliths are presented in Table 19 and Table 20 with accompanying diagrams in Figure 52 to Figure 56.

Pollen was present throughout the samples, most notably in those corresponding to organic units. Overall, the pollen assemblages demonstrate a broadly consistent ecological picture with the majority of apparent variation in quantity and taxonomic representation being accorded to differentials in preservation conditions. Summarised descriptions of the results for each monolith are presented below. All measurements quoted refer to height from the base of the monolith; associations with microstratigraphic units and excavation contexts are presented in Table 18. Of the three monoliths analysed from this sequence, monolith <4> was judged to represent the most coherent vegetation sequence whilst monolith (<5>) was suspected to largely comprise dumped material and dung on the basis of NPP evidence (section 5.7.5). Monolith (<24>) demonstrated very low grain counts with notably poorer preservation and was judged not representative for analysis.

Fungal spores were present in all pollen samples. These represent a diverse array of organisms with taxonomies often not precisely attributable to species, therefore precise environmental affiliation is often difficult to ascertain. However, the established classification system of Van Geel and the University of Amsterdam (e.g. Van Geel *et al*., 1980) can be used to allow comparison with previous research and the effective establishment of ecological representation (Montoya *et al*., 2010: 169). In all samples both generally detritivorous as well as obligatory coprophilous types were present.

Eggs of several intestinal parasite Helminth worms of the genera *Trichuris* (whipworm) and *Ascaris* (mawworm) (Figure 59) were identified along with a small number of specimens of flatworm eggs including *Dicroelium* (liver fluke). Whilst these types were recorded in samples for all three monolith sequences, the samples from between 20 and 35cm above base in monolith <5> recorded exceptional numbers of *Trichuris* eggs, with associated large numbers of *Ascaris* specimens (Figure 56). The co-occurrence of parasite types observed in these samples is typical for archaeological sites due to the biology of these Helminths, which occupy different regions of the host digestive tract and can occupy the same host organism simultaneously (Fernandes *et al*., 2005: 330).

Table 18: Composition and stratigraphy of stream trench Monoliths.

Monolith <4>

Height from Base (cm)	Depth in sequence (cm)	Texture	Clay %	Silt %	Sand %	Troels-Smith	Munsell colour	Colour descriptions	Horizon boundary	Comments	Associated context	Associated MSU	Associated dates
22-50	99-127	Silty clay	12.0	71.8	16.2	$As^3 Ag^1 Sh^+ Gs^+$	10yr 3/1	Very dark gray	Sharp	Occ. Roots, small stones (~1cm or less), chalk and charcoal frags.	14068	MSU5	
20-22	127-129	silty clay / marl	12.6	70.1	17.4	$As^3 Ag^1$	10yr 6/1	gray	Sharp	Marl lens, some hydromorphic mottling, no inclusions.	14070 /	MSU4	OxA-33561
4-20	129-145	Organic silt	3.9	56.6	39.5	$As^2 Ag^1 Sh^1 Gs^+$	10yr 2/1 to 2/2	Black to very dark brown	sharp	Small stones, rootlets, shell fragments, some hydromorphic mottling.	14070 /14071	MSU3 MSU2 MSU1	OxA-33523
0-4	145-149	silty gravel	5.0	67.1	27.9	$As^2 Ag^1 Gs^1 Gg^1$	10yr 5/3	Brown		Large stone at base ~7cm across. Wood, stone, shell inclusions.	14076	N/A	OxA-33562 OxA-33563

Monolith <5>

35-50	90-105	Silty clay	7.0	72.7	20.3	$As^3 Ag^1 Sh+ Gg^+$	10yr 3/1	Very dark gray	Sharp	Some 1cm+ stones, roots.	14068	N/A	
27-35	105-113	Fibrous organic silt	1.6	36.8	61.5	$Tl^2 As^1 Sh^1$	10yr 2/1	Black	Diffuse	Identifiable chunks of wood.	14081	N/A	OxA-33568
22-27	113-118	Organic silt	1.9	37.3	60.8	$Sh2 As^2$	10yr 2/1	Black	Sharp	Lighter band @ 25cm, few inclusions.	14083	N/A	OxA-33566
0-22	118-140	Silty clay	3.3	61.7	35.0	$As^2 Ag^1 Gs^1 Sh^+$	10yr 3/1	Very dark gray		Some 1cm+ chalk chunks, roots and waterlogged plant macros. Marl / ochre streak @ 16cm.	14084	N/A	

Monolith <24>

28-50	106-128	Silty clay	9.5	71.6	18.9	$As^3 Ag^1 Sh^+ Gs^+ Gg^+$	10yr 3/1	Very dark gray	Diffuse	Pale brown (10yr 6/3) marl/clay lump @ 39-44cm. Large 1cm+ chalk and flint clasts, roots, shell, hydromorphic staining and stones.	14068	N/A	
23-28	128-133	Organic silty clay	6.3	72.8	20.9	$As^3 Ag^1 Sh^+ Th^+$	10yr 3/1	Very dark gray	Diffuse	As above, but more organic, Visible plant material, less stony than above.	14076	N/A	
14-23	133-142	Silty clay channel fill	8.9	69.1	22.0	$As^3 Ag^1 Sh^+ Gs^+$	10yr 3/1	Very dark gray	Diffuse	Shell fragments and small stones.	14076	N/A	OxA-33697
0-14	142-156	Sandy silt	5.5	64.1	30.4	$As^1 Ag^2 Gs^1$	10yr 5/3	Brown		Abundant mollusca.	14078	N/A	

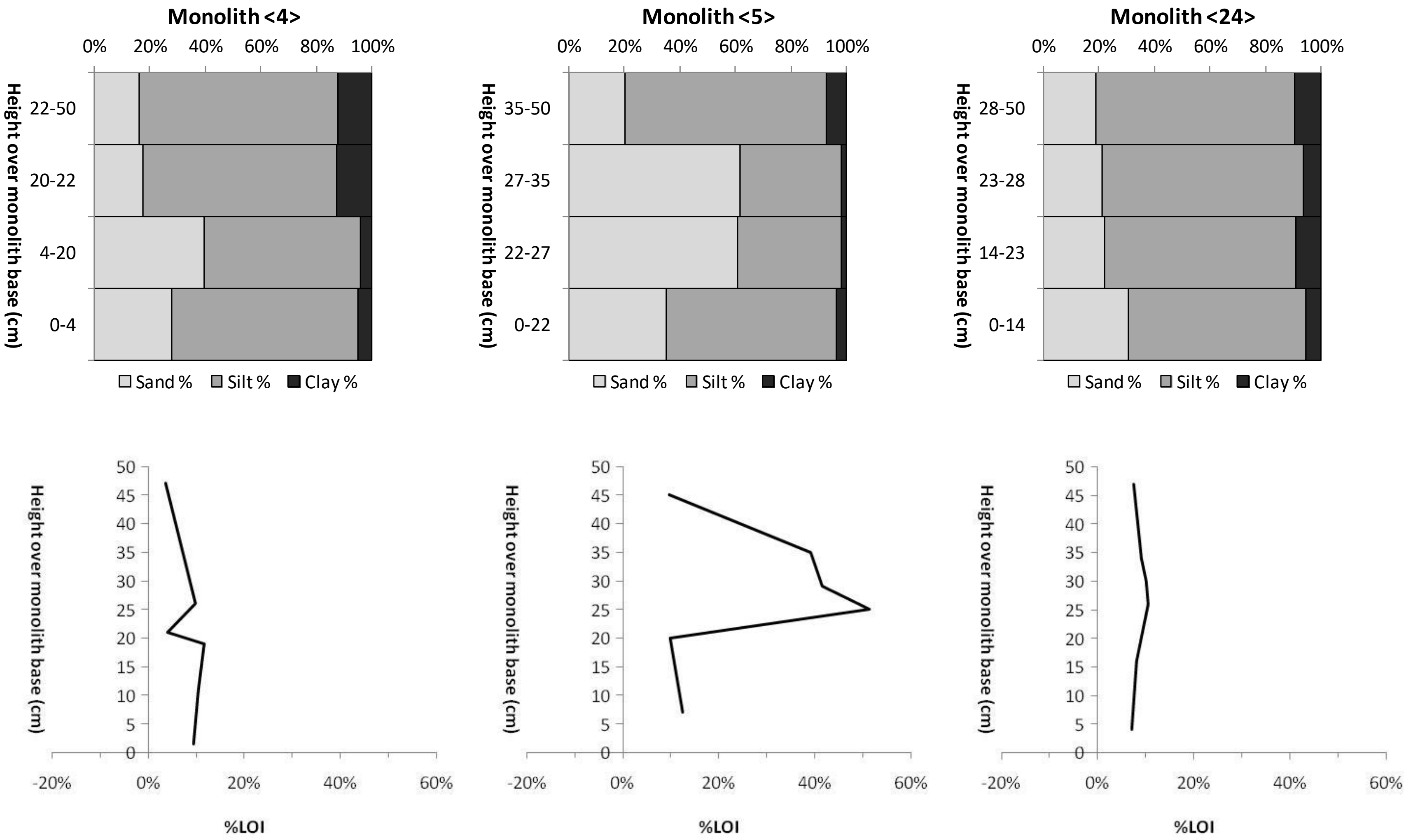


Figure 51: Compositional profiles (particle size & organic content/LOI) for all monoliths.

Table 19: Pollen counts from samples taken from stream trench monoliths

Monolith	**Height above base**	**Depth in sequence**	**Description**	**%LOI**	**Trees**						**Shrubs**		**Herbaceous**														**Ferns / aquatics**				**Unknowns**	**Total land pollen**	**% crumpled / damaged**	**% AP/NAP**	**Pollen concentration per gram**
					Alnus	*Carpinus*	*Fagus*	*Fraxinus excelsior*	*Pinus*	*Quercus*	*Corylus*	*Salix*	Poaceae	*Cereals*	Apiaceae undiff.	Asteraceae undiff.	*Artemisia type*	Caryophyllaceae type	*Chenopodium type*	Lactuceae type	*malva cf. sylvestris*	*Plantago* sp.	*Polygonum cf. lapathifolium*	*Ranunculus* sp.	*Rumex* sp.	*Succisa cf. pratensis*	*Osmunda*	*Polypodium*	*Sphagnum*	*Typha latifolia*					
<4>	47cm	102cm	Silty clay alluvium (14068)	3.6	0	0	0	2	3	0	0	7	20	3	0	2	2	0	1	36	0	1	6	1	0	0	3	0	0	0	47	134	35.1	16.0	5,587
<4>	26cm	123cm	Silty clay alluvium, base (14068)	9.9	0	0	0	0	0	1	0	11	65	9	0	4	6	1	4	12	0	0	3	2	1	0	0	1	0	0	16	136	11.8	11.1	12,763
<4>	21cm	128cm	Marl lens (14070)	4.1	1	0	0	5	1	4	9	13	41	25	3	13	3	0	5	61	0	7	2	8	5	0	3	2	1	0	66	278	23.7	18.4	11,591
<4>	19cm	130cm	Organic silt, top (14071)	11.6	0	0	1	3	0	4	3	24	59	37	3	26	14	0	2	54	0	8	2	10	8	0	1	1	0	2	85	347	24.5	15.4	15,821
<4>	11cm	138cm	Organic silt, base (14071)	10.4	1	0	3	2	0	6	2	33	70	15	6	23	6	1	6	50	1	15	0	9	21	0	3	0	0	1	43	317	13.6	20.7	19,151
<4>	1.5cm	147.5cm	Silty gravel (14076)	9.5	4	1	3	7	1	9	2	26	44	6	9	21	27	1	7	68	1	14	2	5	20	0	4	2	3	2	41	330	12.4	22.5	43,696
<5>	45cm	95cm	Silty clay alluvium (14068)	9.8	0	0	0	3	3	6	0	18	28	44	6	15	1	0	7	78	0	2	0	5	0	0	2	0	0	2	65	285	22.8	15.8	14,147
<5>	35cm	105cm	Peaty organic silt, upper bound (14081)	39.2	0	0	1	2	0	2	15	25	16	77	33	17	30	3	16	18	2	1	0	1	5	0	0	2	0	1	69	336	20.5	20.3	88,670
<5>	29cm	111cm	Peaty organic silt, lower bound (14081)	41.6	0	0	1	3	0	5	17	28	35	108	22	20	18	1	8	7	1	1	0	2	1	0	1	1	0	0	74	354	20.9	23.9	36,019
<5>	25cm	115cm	Organic silt (14083)	51.4	0	0	1	4	1	3	5	26	41	140	13	15	34	0	1	6	0	0	0	1	4	0	1	0	0	0	66	362	18.2	15.6	45,443
<5>	20cm	120cm	Silty clay, upper bound (14084)	9.8	0	0	0	1	1	2	5	22	28	97	9	9	52	2	6	14	0	4	0	1	15	0	1	0	0	1	47	317	14.8	13.0	40,855
<5>	7cm	133cm	Silty clay (14084)	12.5	0	1	1	3	2	5	10	38	87	20	17	19	13	3	6	40	0	15	1	6	21	1	1	0	0	0	44	354	12.4	24.0	19,553
<24>	47cm	109cm	Silty clay alluvium (14068)	7.5	0	0	0	1	0	1	0	6	4	1	1	2	1	0	1	21	0	0	0	0	1	0	1	1	0	0	4	46	8.7	23.5	4,886
<24>	34cm	122cm	Silty clay alluvium (14068)	9.2	1	0	0	2	2	6	2	30	27	12	8	15	2	2	1	75	2	0	2	6	13	0	1	1	0	5	50	265	18.9	25.0	26,308
<24>	30cm	126cm	Silty clay alluvium (14068)	10.2	0	0	0	1	0	5	1	14	7	3	0	1	0	0	2	34	0	0	2	4	4	0	1	1	0	0	21	101	20.8	35.6	27,893
<24>	26cm	130cm	Organic silt / silty clay (14068)/(14076)	10.5	0	0	0	4	5	7	2	42	32	10	2	12	7	0	3	82	0	3	0	7	8	0	7	1	0	4	40	278	14.4	33.7	9,952
<24>	16cm	140cm	Silty clay channel fill (14076)	8.1	0	0	0	1	0	1	0	6	6	3	1	1	1	0	0	16	0	1	0	1	0	0	0	0	0	0	26	64	40.6	26.7	20,621
<24>	4cm	152cm	Sandy silt (14078)	7.1	0	0	0	0	0	0	2	1	13	8	1	4	1	1	0	7	0	2	0	2	0	0	0	1	0	1	19	44	30.2	7.3	24,358

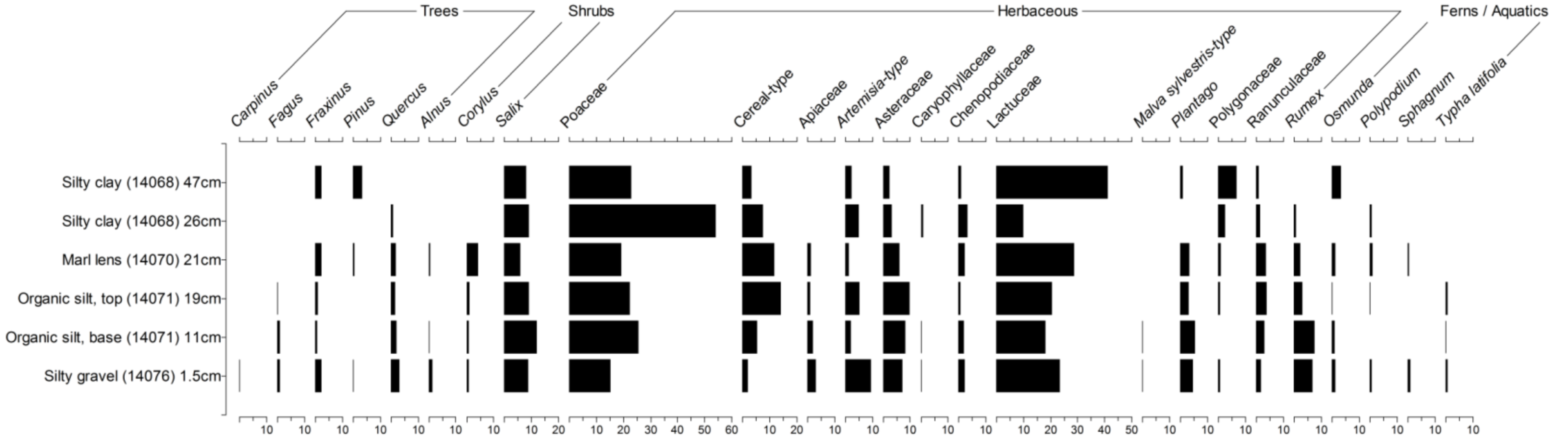


Figure 52: Pollen (% total pollen including ferns/aquatics) diagram for monolith <4> with sample descriptions, context numbers and sample height above monolith base.

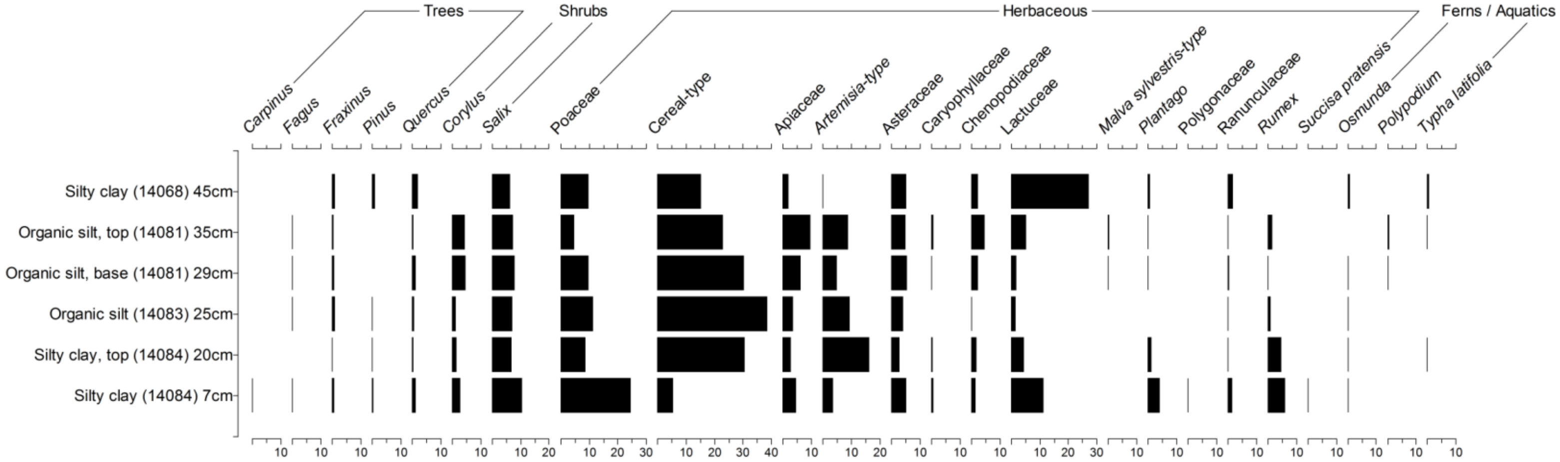


Figure 53: Pollen (% total pollen including ferns/aquatics) diagram for monolith <5> with sample descriptions, context numbers and sample height above monolith base.

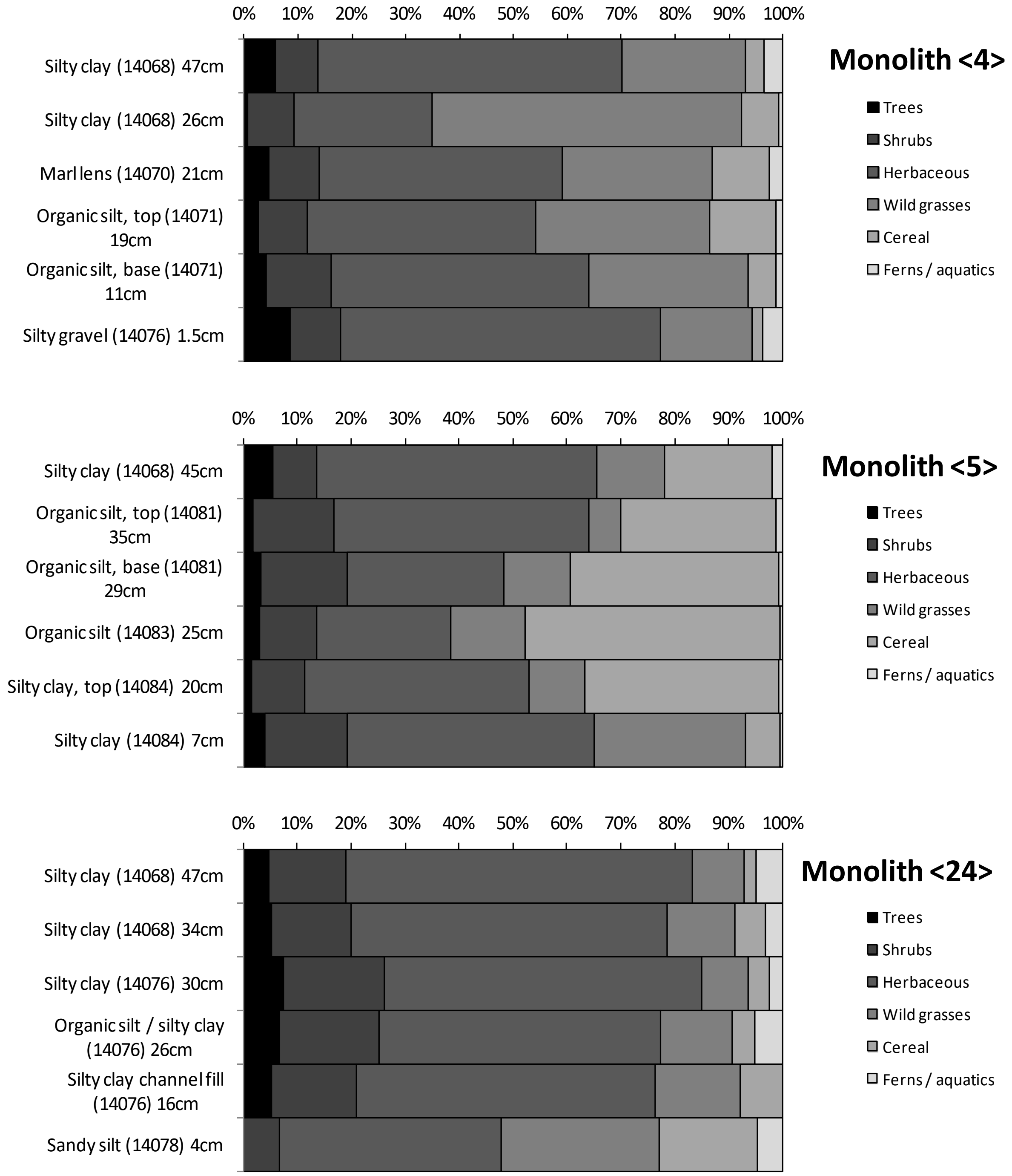


Figure 54: Summary of vegetation types (unweighted % by category) represented by monolith sequences.

Table 20: Non-pollen palynomorph counts from samples taken from stream trench monoliths

Monolith	Height above base	Depth in sequence	Description	%LOI	Fungal spores (general)							Coprophilous spores				Parasite eggs				
					Caryospora callicarpa	*Chaetomium* sp. (HdV-7A)	*Coniochaeta*	*Endophragmiella (?)*	*Gelasinospora*	*Glomus* (HdV-207)	*Valsaria variospora type*	*Coprophilous Sordariales (Tripterospora / Podospora / Cercophora* type)	*Sordaria* type (HdV-55A)	*Sporormiella* type (HdV-113)	*Trichodelitschia*	*Ascaris*	*Dicrocoelium*	*Trichuris*	**Spore concentration per gram**	**Egg concentration per gram**
<4>	47cm	102cm	Silty clay alluvium (14068)	3.6	0	1	5	0	2	9	0	1	6	0	5	0	0	4	1,209	167
<4>	26cm	123cm	Silty clay alluvium, base (14068)	9.9	55	2	1	3	2	8	1	7	11	0	15	0	3	6	9,854	845
<4>	21cm	128cm	Marl lens (14070)	4.1	9	1	0	1	1	11	1	3	12	2	35	0	0	7	3,169	292
<4>	19cm	130cm	Organic silt, top (14071)	11.6	2	1	1	1	0	5	0	6	15	12	30	0	0	5	3,328	228
<4>	11cm	138cm	Organic silt, base (14071)	10.4	4	0	4	3	3	6	0	0	15	3	3	1	0	4	2,477	302
<4>	1.5cm	147.5cm	Silty gravel (14076)	9.5	8	0	10	0	6	8	0	9	29	10	3	2	4	5	10,990	1,457
<5>	45cm	95cm	Silty clay alluvium (14068)	9.8	3	3	0	5	2	2	1	20	23	12	12	7	2	32	4,120	2,035
<5>	35cm	105cm	Peaty organic silt, upper bound (14081)	39.2	0	0	0	0	0	0	0	0	2	0	1	40	0	167	792	54,627
<5>	29cm	111cm	Peaty organic silt, lower bound (14081)	41.6	0	0	0	0	0	0	0	2	4	0	0	51	0	210	610	26,556
<5>	25cm	115cm	Organic silt (14083)	51.4	0	0	0	0	0	0	0	0	1	0	0	33	0	235	126	33,643
<5>	20cm	120cm	Silty clay, upper bound (14084)	9.8	0	2	1	1	0	3	0	0	5	0	6	35	0	110	2,320	18,688
<5>	7cm	133cm	Silty clay (14084)	12.5	3	1	1	0	7	6	0	2	19	1	5	2	0	4	2,486	331
<24>	47cm	109cm	Silty clay alluvium (14068)	7.5	1	0	0	1	6	2	1	0	9	0	27	0	0	1	4,992	212
<24>	34cm	122cm	Silty clay alluvium (14068)	9.2	2	5	5	2	17	14	2	3	22	7	8	0	5	4	8,637	893
<24>	30cm	126cm	Silty clay alluvium (14068)	10.2	0	2	8	0	5	22	7	6	25	6	6	2	3	2	24,027	1,933
<24>	26cm	130cm	Organic silt / silty clay (14068)/(14076)	10.5	0	4	8	4	8	23	12	13	27	4	3	0	4	4	3,795	286
<24>	16cm	140cm	Silty clay channel fill (14076)	8.1	0	1	2	0	2	11	1	3	9	0	7	5	1	0	11,599	1,933
<24>	4cm	152cm	Sandy silt (14078)	7.1	0	0	4	0	1	7	0	1	4	0	0	0	0	0	6,573	-

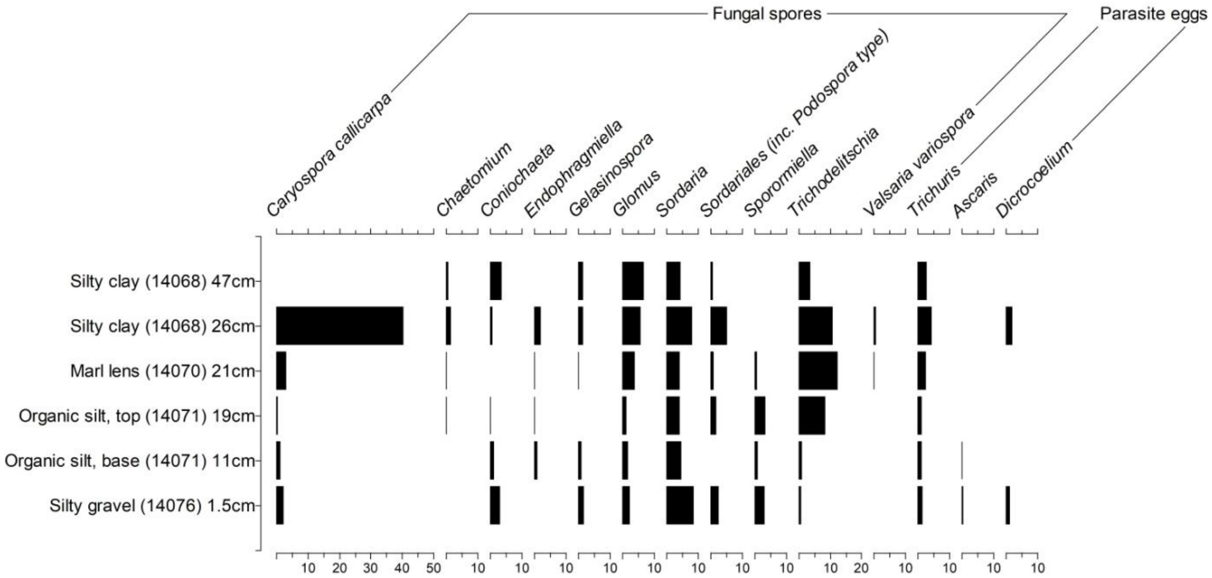


Figure 55: NPP counts (standardised as % of total pollen for each sample) for monolith <4>.

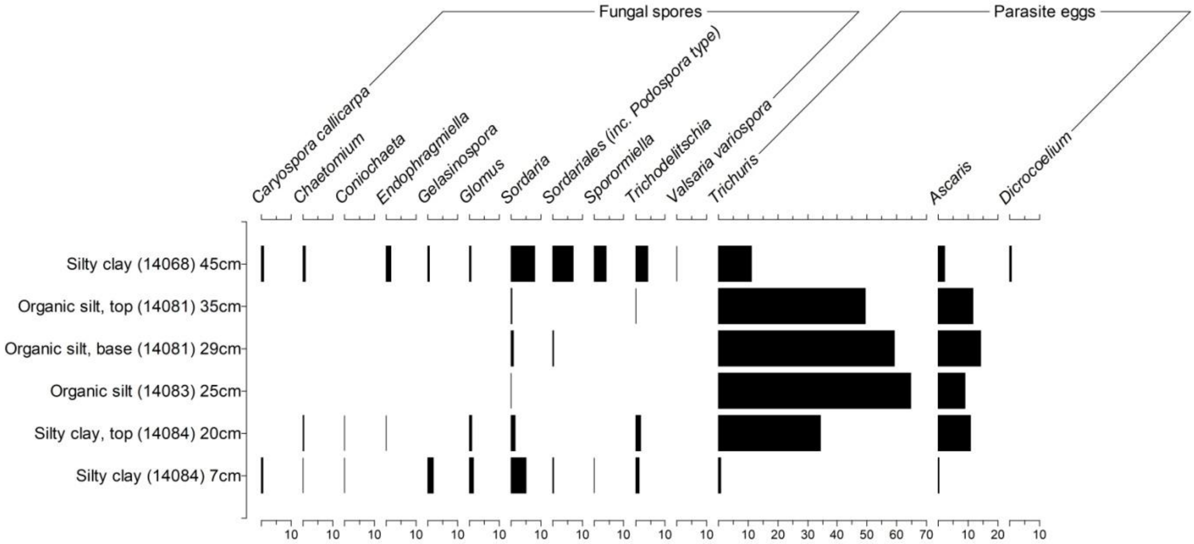


Figure 56: NPP counts (standardised as % of total pollen for each sample) for monolith <5>.

5.7.2 Monolith descriptions

Monolith <4>

This monolith comprised basal silty gravel (0-4cm) overlain by a distinct silty organic unit (4-20cm) and a thin lens of pale calcareous marl (20-22cm). The upper part of the sequence comprised silty clay and colluvium (22-50cm). Physical composition in terms of particle size is summarised in Figure 51; this primarily demonstrates a pronounced transition between the coarser sandy basal deposits and fibrous organic silt lens to the overlying finer grained minerogenic marl and silty clay at around 20cm. A total of six samples for pollen and organic matter determination were taken from this monolith; at 1.5cm, 11cm, 19cm, 21cm, 26cm and 47cm. The organic matter component varied throughout the sequence, ranging from 4.1% in the minerogenic marl lens (21cm) to a maximum value of 11.6% in the underlying silty organic unit (19cm).

The overall characteristics of the pollen assemblage are as follows:

Trees and shrubs; these comprise 16-22% of total pollen and largely comprise Salix (willow) with small amounts of *Corylus* (Hazel) type and trees such as *Quercus* (Oak), *Fraxinus excelsior* (Ash), *Alnus* (Alder) and sporadic occurrences of *Carpinus* (Hornbeam), *Fagus* (Beech) and *Pinus* (Pine).

Herbs; These are dominant throughout (around 80%) and comprise a diverse assemblage of weed, bankside and open country types dominated by Lactuceae (Dandelion family), Poaceae (grasses), Asteraceae (Daisy family) and *Rumex* (Dock family) types with sparser representation of Apiaceae (Carrot family), *Artemisia* (Mugwort family), *Ranunculus* (Buttercup family), Chenopodiaceae (Goosefoots), *Plantago* (Plantains) and Caryophyllaceae (Carnation family). Cereal pollen is represented throughout, peaking at 11% in the silty organic unit.

Spores of ferns and aquatics; These mainly comprise small numbers of spores of *Osmunda* (Royal fern), *Polypodium* (Polypody fern) and *Typha* (Bullrush). *Sphagnum* moss occurs sporadically.

Non pollen palynomorphs; Extensively represented are the soil fungus *Glomus* and the detritivorous type *Caryospora* with lesser representations of generally detritivorous types *Gelasinospoara*, *Coniochaeta*, *Chaetomium* and *Valsaria*. Coprophilous types include various *Sordaria* and other Sordariales types along with *Sporomiella* and *Trichodelitschia*. Intestinal parasite eggs were encountered in the form of *Trichuris* (whip worm), *Ascaris* (hookworm) and flatworm eggs (cf. *Dicrocoelium*).

Monolith <5>

This monolith comprised a basal silty clay unit (0-22cm) overlain by a silty organic unit (22-27cm) and a substantial lens of fibrous dark organic material containing notable quantities of wood (27-35cm). The upper part of the sequence comprised silty clay and colluvium (35-50cm). Physical composition in terms of particle size is summarised in Figure 51; this sequence demonstrates a pronounced dichotomy between the (coarser) highly fibrous organic material from 22-35cm and the finer minerogenic silts over and underlying it. A total of six samples for pollen and organic matter determination were taken from this monolith; at 7cm, 20cm, 25cm, 29cm, 35cm and 45cm. The organic matter content of this monolith was unusually high, with the sample at 25cm corresponding to the silty organic unit demonstrating a peak in excess of 50%.

The overall characteristics of the pollen assemblage are as follows:

Trees and shrubs; these comprise 13-24% of total pollen and largely comprise Salix (willow) and *Corylus* (Hazel) type along with trees such as *Quercus* (Oak), *Fraxinus excelsior* (Ash) and sporadic occurrences of *Carpinus* (Hornbeam), *Fagus* (Beech) and *Pinus* (Pine).

Herbs; These are dominant throughout (around 80%) and are dominated by cereal pollen together with weed, bankside and open country types dominated by Lactuceae (Dandelion family), Poaceae (grasses), Asteraceae (Daisy family), Apiaceae (Carrot family), *Rumex* (Dock family) and *Artemisia* (Mugwort family) types with sparser representation of *Ranunculus* (Buttercup family), Chenopodiaceae (Goosefoots), *Plantago* (Plantains) and Caryophyllaceae (Carnation family). Cereal pollen is represented extensively throughout, peaking at 39% in the lower organic silt.

Spores of ferns and aquatics; these mainly comprise small numbers of spores of *Osmunda* (Royal fern), *Polypodium* (Polypody fern) and *Typha* (Bullrush).

Non pollen palynomorphs; There are sparse representations at the top and base of the monolith of the soil fungus *Glomus* and generally detritivorous types Gelasinospora, *Coniochaeta* and *Chaetomium* together with coprophilous *Sordaria* and other Sordariales types along with *Sporomiella* and *Trichodelitschia*. Extensive and highly abundant Intestinal parasite eggs were encountered in the form of *Trichuris* (whip worm) and *Ascaris* (hookworm) with occasional flatworm eggs (cf. *Dicrocoelium*). These were mainly encountered in the central part of the sequence corresponding to the lower part of the fibrous organic silt unit and the underlying organic silt.

Monolith <24>

This monolith comprised a basal sandy silt (0-14cm) overlain by a unit of silty clay channel fill (14-23cm) under a unit of organic silty clay (23-28cm). The upper part of the sequence comprised silty clay and colluvium (28-50cm). Physical composition in terms of particle size is summarised in Figure 51, which demonstrates a consistent fining-up in the sequence from the coarsest basal sandy silt to the uppermost silty clay colluvium. A total of six samples for pollen and organic matter determination were taken from this monolith; at 4cm, 16cm, 26cm, 30cm, 34cm and 47cm above the base of the sequence. The organic matter component was largely consistent throughout the sequence, ranging from 7.1% in the basal sandy silt (4cm) to a maximum value of 10.5% in the organic silty clay unit (26cm).

The overall characteristics of the pollen assemblage are as follows:

Trees and shrubs; these comprise 16-22% of total pollen and largely comprise Salix (willow) with small amounts of *Corylus* (Hazel) type and trees such as *Quercus* (Oak), *Fraxinus excelsior* (Ash), *Alnus* (Alder) and sporadic occurrences of *Pinus* (Pine) and *Alnus* (Alder).

Herbs; These are dominant throughout (around 80%) and comprise a diverse assemblage of weed, bankside and open country types dominated by Lactuceae (Dandelion family), Poaceae (grasses), Asteraceae (Daisy family) and *Rumex* (Dock family) types with sparser representation of Apiaceae (Carrot family), *Artemisia* (Mugwort family), *Ranunculus* (Buttercup family), Chenopodiaceae (Goosefoots), *Plantago* (Plantains) and Caryophyllaceae (Carnation family). Cereal pollen is represented extensively throughout.

Spores of ferns and aquatics; These mainly comprise small numbers of spores of *Osmunda* (Royal fern), *Polypodium* (Polypody fern) and *Typha* (Bullrush).

Non pollen palynomorphs; Extensively represented are the soil fungus *Glomus* along with various generally detritivorous types including *Caryospora*, *Gelasinospoara*, *Coniochaeta*, *Chaetomium* and *Valsaria*. Coprophilous types include various *Sordaria* and other *Sordariales* types along with *Sporomiella* and *Trichodelitschia*. Intestinal parasite eggs were encountered in the form of *Trichuris* (whip worm), *Ascaris* (hookworm) and flatworm eggs (cf. *Dicrocoelium*).

5.7.3 Pollen

Some degree of post-depositional disturbance throughout the sequence was indicated by a relatively high proportion of folded, crumpled and broken grains. These are likely the result, depending on the depositional origins of the particular unit, of previous exposure to some combination of soil formation processes, bioturbation or physical abrasion from the movement of the larger clastic materials in the colluvium and channel sediments (Brown, 1997: 136). The uppermost samples of monolith <4> and <5> as well as the entirety of monolith <24> demonstrated this most extensively, indicating that these upper colluvial units have, since deposition, experienced only seasonal or partial waterlogging. This has resulted in variable preservation conditions, as demonstrated by the disproportionately high representation of pollen types with more robust exines, such as Lactuceae, that resist deterioration (Dumayne-Peaty, 2001: 383; Scaife, 1987: 148).

The partially, or seasonally, waterlogged colluvial units have been subject to a degree of bioturbation which has compromised the pollen assemblage in the upper parts of the sequence, creating assemblages of mixed age with poor chronostratigraphic resolution (Scaife, 1987: 148). Conversely, the waterlogged sediments from the lower portions of monoliths <4> and <5> contain organic lenses which are likely to have accumulated from autochthonous processes or from discrete episodes of waste dumping, within which microfossil material is likely to have remained at least partially temporally stratified (Davidson *et al*., 1999: 652). The survival of laminated features in the form of sharply defined lenses of marl and peaty organic sediment revealed by the micromorphology (section 5.5) demonstrate that these sediments have remained free of post-depositional earthworm mixing and are thus likely to have remained waterlogged since their deposition (Brown, 1997: 39). The pollen diagrams for these monoliths (Figure 52 and Figure 53) demonstrate the pronounced discrepancies in taxonomic representation resulting from these very different taphonomies.

This stream channel represents a small pollen catchment containing a representation of localised vegetation over a maximum distance of several hundred metres (Hey, 2004: 371). With such a highly concentrated representation, the samples derived from all three monoliths naturally demonstrate a broadly consistent environmental picture dominated by herbaceous taxa and grasses with very low tree cover (Figure 54). The consistency in this balance throughout the sequence suggests a long-term stability in pollen sources at this location despite the evidence for dumped and inwashed material provided by other proxies.

The radiocarbon dates from the lower part of bulk sample sequence <3> (section 5.5) are directly applicable to monolith <4> and reveal a depositional history potentially spanning the late Roman to the medieval period. The corresponding pollen diagram for this monolith (Figure 52) suggests a very open environment with a low proportion of arboreal taxa across the whole period of accumulation. Within this continuum a very slight transition towards more open, grassy conditions and a decline in woodland representation in the later Saxon period is suggested along with a more notable peak in cereal pollen in the 8th/9th century. Despite these tentative trends, differentials in preservation conditions and taphonomic bias arising from variations in the sedimentological origin and composition of the units (section 5.2) make definitive extrapolation of wider environmental transitions problematic. The most pronounced example of this can be seen with the peaty organic silt units from monolith <5> (context (14081)) which displayed exceptional quantities of cereal pollen but also evidence for concentration within dung (see below and section 5.7.5) as opposed to wind-borne deposition.

Within the small arboreal pollen fraction from the Lyminge material, indications of what might be termed “wet” woodland are provided by the combination of *Salix, Corylus* and *Quercus* through the sequence. The relatively high representation of *Salix* pollen suggests this may relate to bank-side stands. Studies of pollen dispersal and relative productivity have estimated *Quercus* pollen productivity to be seven or eight times that of Poaceae (Hjelle and Sugita, 2011: 314) and in terms of other tree species represented in the Lyminge assemblage, typically three to five times that of *Salix* and five to six times that of *Corylus* (Bunting *et al*., 2005: 463). Taking such metrics into account it can be seen that the relatively low representation of *Quercus* and other large tree taxa in the Lyminge samples translates into a very sparse representation of trees in the local environment, with local cover probably limited to isolated stands as well as hedgerows and scrub areas in and around the valley floor. Despite this, it is well established that the relationship in absolute terms between arboreal and non-arboreal pollen proportions is not a straightforward predictor of the openness of an environment due to the relative difference in production and dispersion between species (Mehl *et al*., 2015).

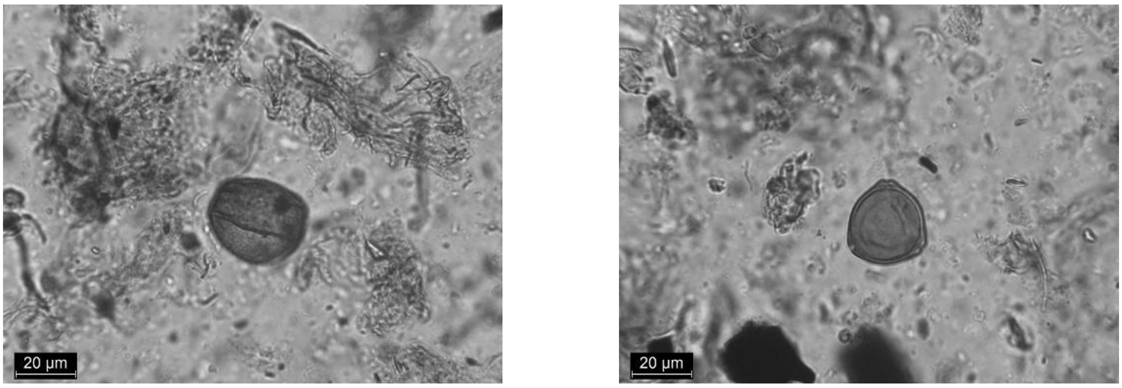
The relatively low productivity of many non-arboreal taxa has typically meant that pollen records at sites also tend to under represent taxa indicative of arable activity in favour of that for pastoral activity or woodland (Dumayne-Peaty, 2001: 380). The clear domination of grasses and waste ground and pasture weed species in the samples from Lyminge cannot therefore be taken to rule out agricultural land in the close vicinity of the sample site. Cereal pollen is also often poorly represented in archaeological assemblages due to low production rates and a relatively short dispersal distance; additionally, the morphology of the grains themselves is often ambiguous with regard to differentiation with wild grasses (Dumayne-Peaty, 2001: 380).

Cultivated cereal types are notable components of the sequence, particularly in the peaty organic and silty organic units in monolith <5> (section 5.1, Figure 54b) where they dominate. These are usually discernible from wild Poaceae which also dominate, based upon grain size and diameter of the pore annulus (Joly et al., 2007) (Figure 57); however as further differentiation by type is not usually deemed possible (Grieg, 1982: 54) the cultivated cereal data is presented in total. A caveat to this data is the presence of wild *Bromus* type grasses in the macrofossil record, which raise the possibility that some of these larger pollen grains may in fact relate to wild oat or other closely related uncultivated varieties, as has been seen in other wetland palynological studies (Waller and Grant, 2012).

Large quantities of cereal pollen in archaeological contexts associated with settlements are usually ascribed more to the processes of human agency than to natural wind dispersal from sites of cultivation (Grieg, 1982: 54). Such processes generally include (although not exclusively) use of pollen-retaining cereal straw or chaff for the purposes of flooring or bedding or the deposition of dung containing the remains of cereal products such as grain feed (Grieg, 1982: 62). Modern experimental analogues have demonstrated how high proportions of cereal as well as grass and Lactuceae grains can be characteristic of sediments containing dung and stabling deposits (Macphail *et al*., 2004: 181). Whilst the sediments encountered in the present research clearly do not relate to such in-situ stabling or byre deposits, the pollen assemblage in the peaty organic sediment lenses from monolith <5> is suggestive of distortion from a high proportion of dung or faeces which can demonstrably concentrate and distort pollen assemblages (Macphail *et al*., 2004: 181). This is further indicated by the high numbers of pig/human parasite eggs encountered in association with these cereal pollen concentrations (section 5.7.5) and the omnivore coprolite fragments observed in similar sediments from the micromorphology sample (section 5.5). This presents problems of taphonomy as it implies mixing of airborne pollen from the background environment with that which has been concentrated and transported by a range of processes (Grieg, 1982: 63). However in simple terms of economy it may also demonstrate a settlement diet reliant on cereals or the use of waste from cereal processing as pig feed.

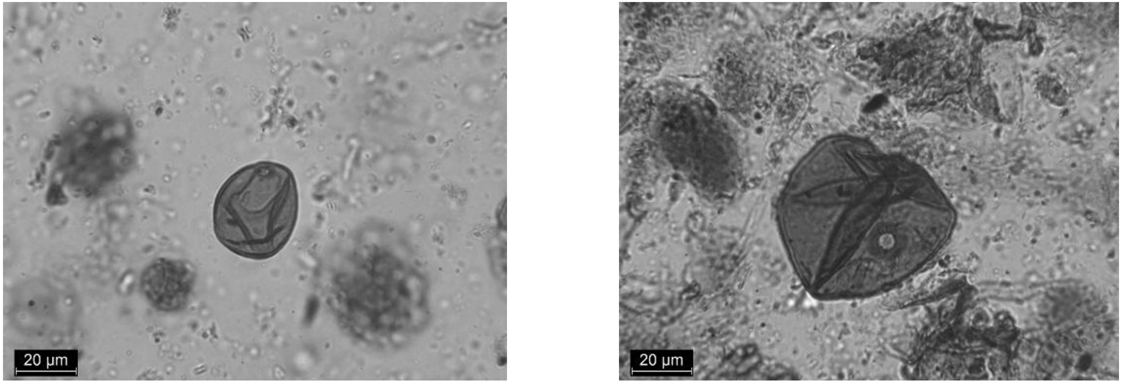
Syntheses of semi-quantitative vegetation reconstruction by Fyfe *et al* (2010) have categorised a range of taxa indicative of widely recognised categories of biome and culturally modified Land Cover Class (Fyfe *et al*., 2010: 1166). Comparison of the Lyminge data to these categories indicates that the high proportions of Poaceae, Lactuceae, Apiaceae, *Ranunculus* and *Rumex* types evident from the monoliths are highly indicative of pasture, disturbed ground and grassland conditions. Additionally a notable arable component is present in the form of cereal pollen, Asteraceae, Chenopodiaceae and

Caryophyllaceae suggesting the presence of both land cover types in the local area. Any quantitative analysis of these samples using established approaches such as pollen transfer functions or plant functional type (PFT) scores (Fyfe *et al.*, 2010: 1166) is inherently problematic at Lyminge due to the taphonomic complications from dung, dumped material and variable preservation. Consequentially this interpretation is limited to a general comparative assessment, most applicable to the settlement and stream area rather than the wider valley due to the inversely proportional relationship between quantity and distance inherent with the deposition of wind-borne pollen (Mehl *et al.*, 2015).



a) *Quercus*

b) *Corylus*



c) Wild grasses (Poaceae)

d) Cultivated cereals (cf. *Triticum*).

Figure 57: Examples of pollen types from stream trench samples.

5.7.4 Fungal spores

Chlamydospores of the endomycorrhizal soil fungus *Glomus* (Figure 58f) which is associated with plant roots, were encountered throughout the sequence in <24> and to a lesser extent in <4> and the silt units of <5>. In other studies this type has been associated with erosion episodes around lake catchments (Van Geel *et al*., 2003: 881) and it is likely here that these spores have been washed into the stream catchment as a result of erosion from the surrounding grassland soils.

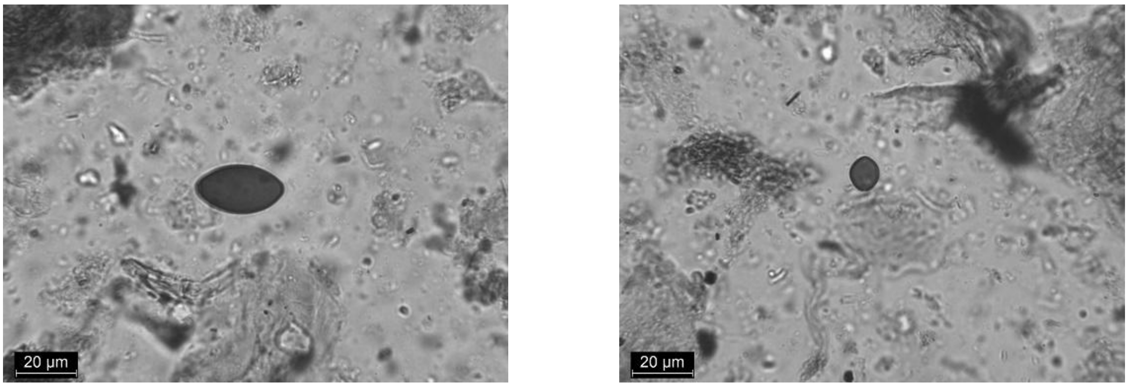
Caryospora callicarpa ascospores (Figure 58c) were encountered in abundance within the peaty silt unit at the base of the sequence in monolith <4>. This species is associated with decaying tree wood (Van Geel and Aptroot, 2006: 317) and is known from other early medieval geoarchaeological deposits in Kent (Hawksworth *et al*., 2010: 58). *Endophragmiella* is another parasitic type known to be associated with living or dead wood and woodland materials such as leaf litter, although it can be found some distance from woodland environments so is not necessarily an indicator of significant local tree cover (Cugny *et al*., 2010: 399).

Chaetomium (Figure 58b) is a cellulose decomposing type which is encountered in a variety of environments and which archaeologically has been associated with materials from human settlement activity (Van Geel *et al*., 2003; Van Geel and Aptroot, 2006: 318). *Gelasinospora* (Figure 58d) are decomposers of cellulose, lignin and other materials (including dung) which are encountered in decomposing peat particularly in association with charred plant remains (Van Geel and Aptroot, 2006: 319). *Coniochaeta* is a type associated with tree cover and the presence of rotting wood and dung (Van Geel and Aptroot, 2006: 318). However previous studies have shown little correlation with intensive grazing or land use and it seems likely that both this type and *Gelasinospora* have heterogenous and unspecific ecological affinities (Cugny *et al*., 2010: 403).

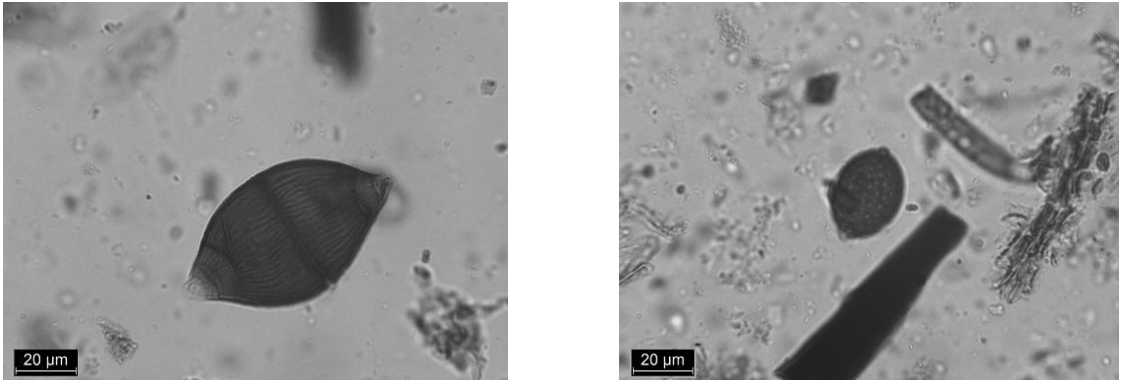
Several varieties of notably or obligatorily coprophilous types were also recorded throughout the sampled units. These have been highlighted in previous work by Van Geel *et al* (2003) as being a category of indicators in environmental data which is under-utilised in contemporary studies and which can provide highly localised and often species-specific representation of land use for animal husbandry and grazing. These grazing indicators are concentrated in monoliths <4> and <24> suggesting that runoff from a grazed land surface around the stream or in-situ deposition by livestock may have contributed more to these sediments than to those in monolith <5>.

Specific types identified at Lyminge which correspond to this broad group include Sordariaceous ascospores categorised by Van Geel as HdV type 55 (Figure 58a) which are mostly coprophilous and have been associated with a notable level of human influence on the landscape, particularly when encountered in high abundance (Van Geel *et al*., 1980: 418-419). Some of these are obligate and highly specialised species-specific coprophiles associated with grazing animals (López-Sáez and López-Merino, 2007: 105). Consequentially they are commonly encountered in archaeological assemblages from settlement sites (Van Geel *et al*., 2003: 880).

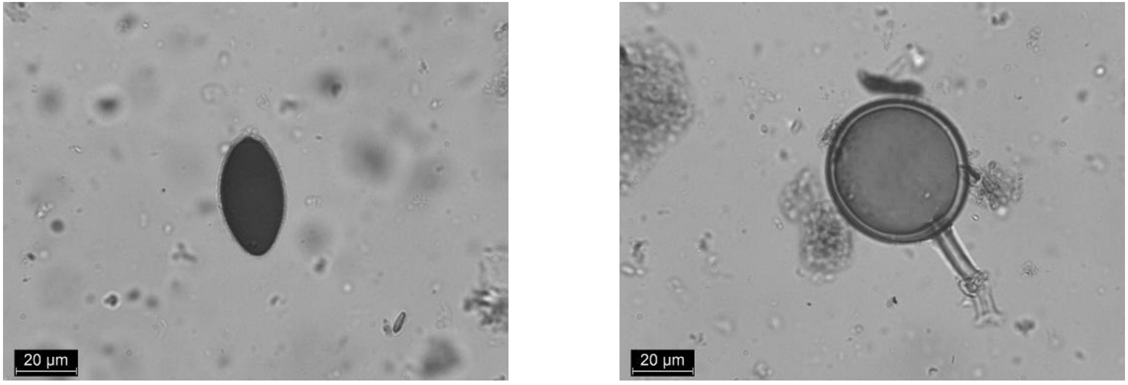
Sporormiella, *Podospora* and *Sordaria* are also types identified from the stream sequence which are known to be strongly associated with grassland used for intensive grazing. The presence of the obligate coprophile *Sporormiella* has been particularly noted as a positive correlate with grasslands under intensive grazing pressure by Cugny *et al.* (2010: 397). Other spores of coprophilous Sordariales present include *Podospora* type (Figure 58e), which have been particularly strongly associated with the presence of domestic animals on archaeological sites (Van Geel and Aptroot, 2006: 323). *Trichodelitschia* (Figure 58h) is another type found in the samples from Lyminge which has demonstrated similar coprophilous affiliations, although it is not widely reported as an archaeological indicator of herbivore dung or grazing activity (Cugny *et al*., 2010: 402).



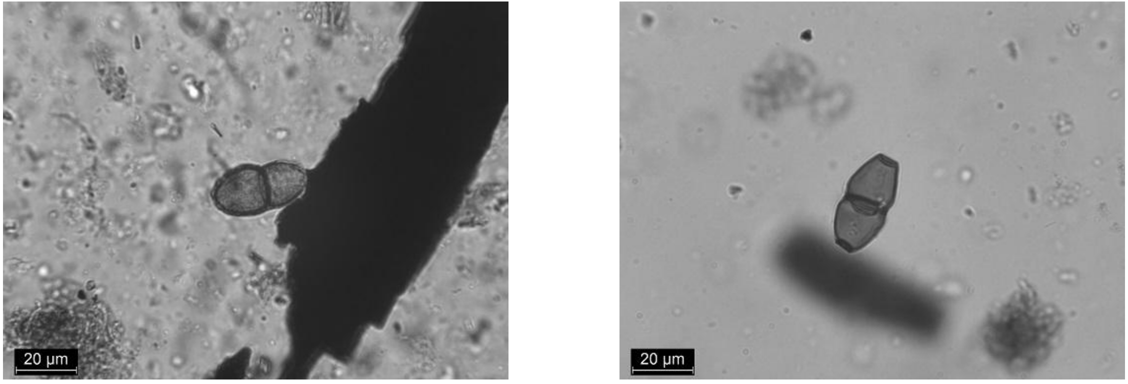
a) Sordariacious ascospore (HdV-55B) **b) *Chaetomium* sp. (HdV-7A)**



c) *Caryospora callicarpa* **d) *Gelasinospora* sp. (HdV-1)**



e) *Podospora* sp. (HdV-368) **f) *Glomus* (HdV-207)**



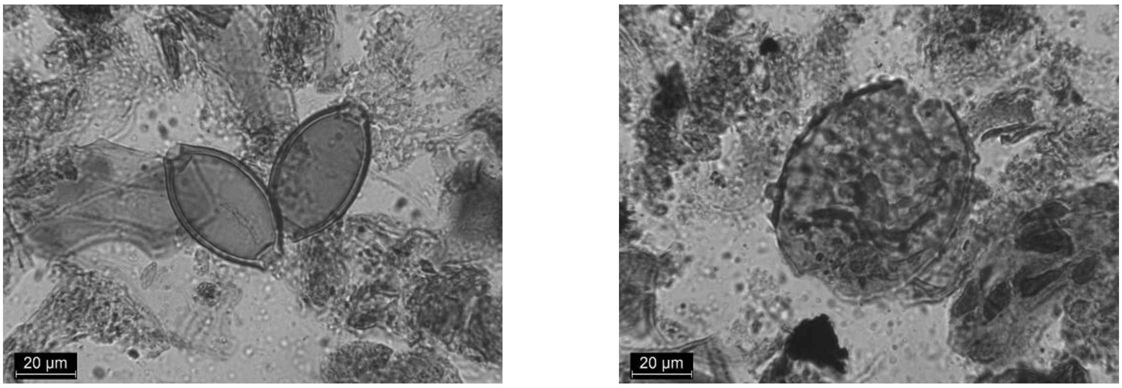
g) *Valsaria* cf. *variospora* (HdV-140) **h) *Trichodelitschia* (HdV-546)**

Figure 58: Predominant fungal spore types from monolith <4> samples (identifications after Van Geel *et al*., 2003; Van Geel and Aptroot, 2006; Cugny *et al*., 2010)

5.7.5 Parasite eggs

Preservation for the *Trichuris* specimens following the pollen preparation was generally very good with the exception of the loss of the distinctive mucoidal plugs in the polar pores during acetolysis (Brinkkemper and van Haaster, 2012: 17). These morphological features are often preserved with less aggressive dedicated paleoparasitological extraction methods and are included in the comparative metrics for diagnosis of species association in published studies (Fernandes *et al*., 2005: 330). Consequentially, the metrics from the present research (Figure 60 and Figure 61) may not be directly comparable to published paleoparasitological data derived from material processed using other methods.

Recent syntheses of analytical methods for these parasite eggs identified in pollen samples (e.g. Brinkkemper and van Haaster, 2012) have highlighted the considerable overlap in dimensions for eggs from *T. trichiura* and *T. suis* (Table 21). The potential for differentiating the human *Ascaris* variant (*A. lumbricoides*) from that of the pig type (*A. suum*) is perhaps even less hopeful (Fernandes *et al*., 2005: 330).



a) ***Trichuris*** **sp.** **b)** ***Ascaris*** **sp.**

Figure 59: Parasite egg types from monolith <5> samples.

With these *caveats* in mind, fifty specimens of *Trichuris* were measured from each of four samples from monolith <5> (20cm, 25cm, 29cm, 35cm above base) using an ocular micrometer, with a view to ascertaining the distribution of egg sizes and thus distinguishing species based upon published size ranges (Table 21, Figure 61).

Table 21: Trichuris egg size ranges by species (from Brinkkemper & van Haaster 2012).

Trichuris **species**	**Egg length range**	**Egg width range**
Trichuris trichiura (human)	50 - 58µ	22 - 27µ
Trichuris suis (pig)	50 - 68µ	21 - 31µ
Trichuris vulpes (fox, dog, cat)	70 - 88µ	25 - 30µ
Trichuris ovis (cattle, sheep, goat)	70 - 80µ	30 - 42µ

Comparison of the recorded egg size distribution in comparison with these published size ranges indicates that average dimensions from the present study sit neatly between both distributions (Figure 61). The present dataset is strongly unimodal, with mean average length and width lying within the expected bounds for human and pig types and firmly outside of that for sheep, cattle and dog (Table 21, Figure 60). This strongly indicates the presence of a single type, with the possibility of it being anything other than human or pig being unlikely. The standard deviations for both sets of measurement data are relatively low, with 66.5% of the distribution lying within the ranges of 49.8-56.6µm by 23.3-30.8µm (i.e. mean ±1σ) (Table 22) with a smaller number of outliers producing the wider distribution demonstrated in Figure 61.

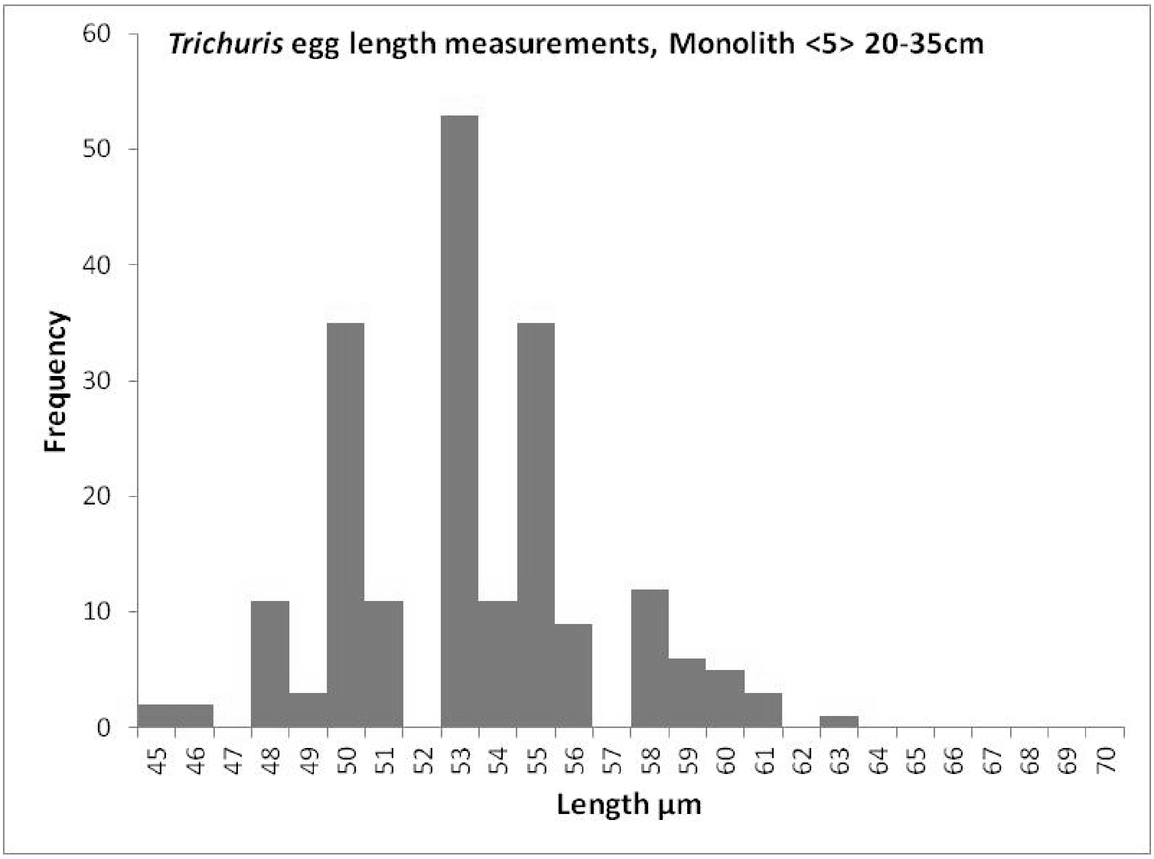
Table 22: Descriptive statistics for *Trichuris* egg size data.

Dimension	**Mean**	**Median**	**Standard deviation**	**Size range (to 1σ):**	
Length (µm)	53.2	53	3.39	49.81	56.58
Width (µm)	27.1	26	3.75	23.31	30.80

By removing the outliers and plotting the distribution of specimens lying within 1σ of the mean (68.3% of the sample), the data demonstrates far tighter clustering, with the length data in particular falling well within the range of what would be expected for the shorter and narrower eggs of *T. trichiura*. This data however, suffers from systematic distortion due to the previously discussed methodological issues concerning the loss of the apical mucoidal plugs from many of the specimens. From observations of surviving examples, these features may account for an additional 6µm to the measured length of individual eggs. Consequentially it is likely that the lengths of many specimens in this assemblage are underrepresented.

The width measurement data conversely do not suffer from this issue. The observed range for this dimension, even with outliers beyond x̄ ± 1σ removed (Figure 62) is still far broader than what would be expected for a sample consisting solely of *T. trichiura* eggs, suggesting instead that the majority of examples in this assemblage are likely to represent *T. suis*.

Well published work in urban sites such as Coppergate, York (Jones, 1985) has revealed the degree to which *Trichuris* eggs can become concentrated in pit fills, often demonstrating egg-counts in excess of 20,000 per gram from cess deposits which are almost entirely faecal in origin. The high degree of disturbance within densely occupied settlement sites also causes redistribution of these eggs into other sediments, leading to occupation deposits and even floor layers demonstrating frequencies in excess of 1,000 per gram (Jones, 1985: 111). Interestingly the concentration of *Trichuris* eggs in more than half of all the samples analysed from Lyminge is over 500 per gram (Table 20), a level directly comparable to such layers in urban sites (Jones, 1985: 112). This may suggest a degree of redeposition throughout the sequence by soil fauna or a prolonged sequence of depositional activity. Using these metrics as a guideline, the organic peaty silt deposits from monolith <5> (context (14081)), which demonstrate egg counts of nearly 55,000 per gram, can be interpreted as consisting largely of dung rather than natural accumulations of vegetation. This correlates to the very different spore and pollen signature from this context when compared to organic units from monolith <4> (Figure 52), particularly with regard to high concentrations of cereal pollen which also suggests the presence of dumped occupation waste.



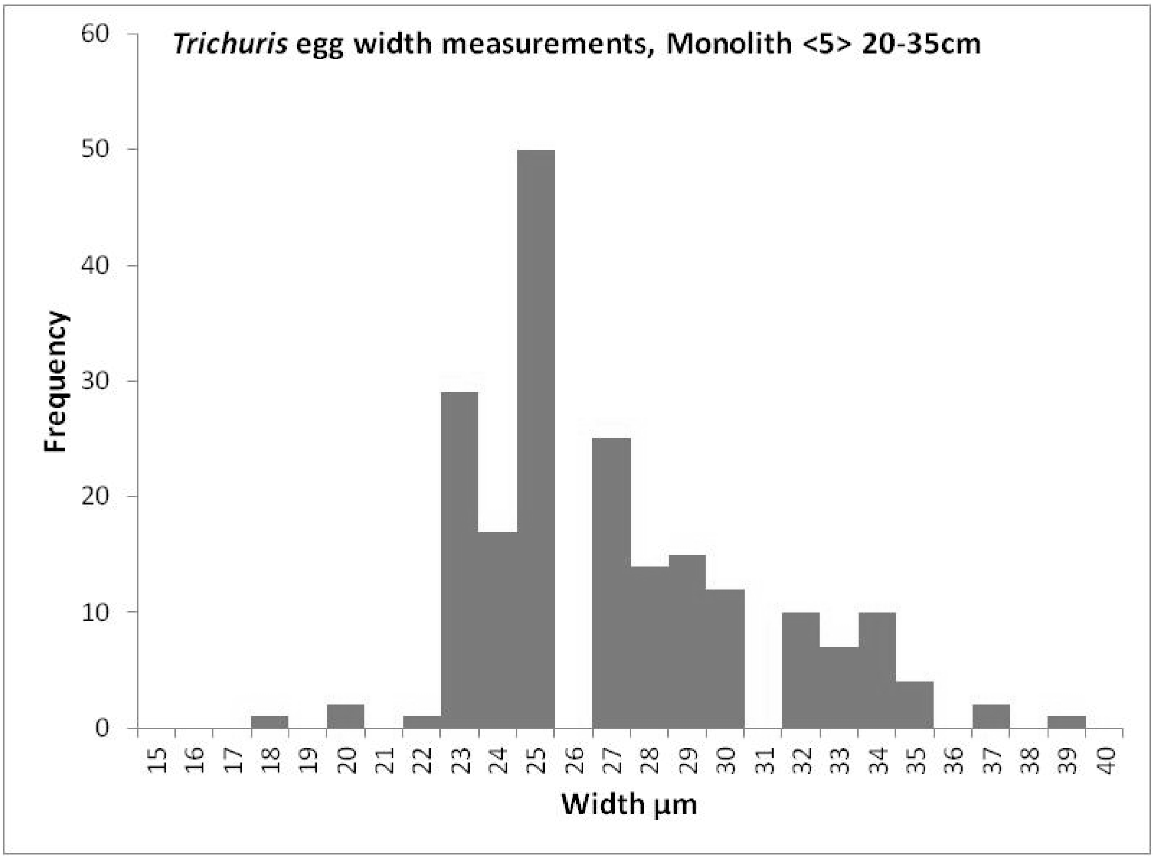


Figure 60: Distribution of size data for measurements of 200 *Trichuris* sp. egg specimens from monolith <5>, 20-35cm from base.

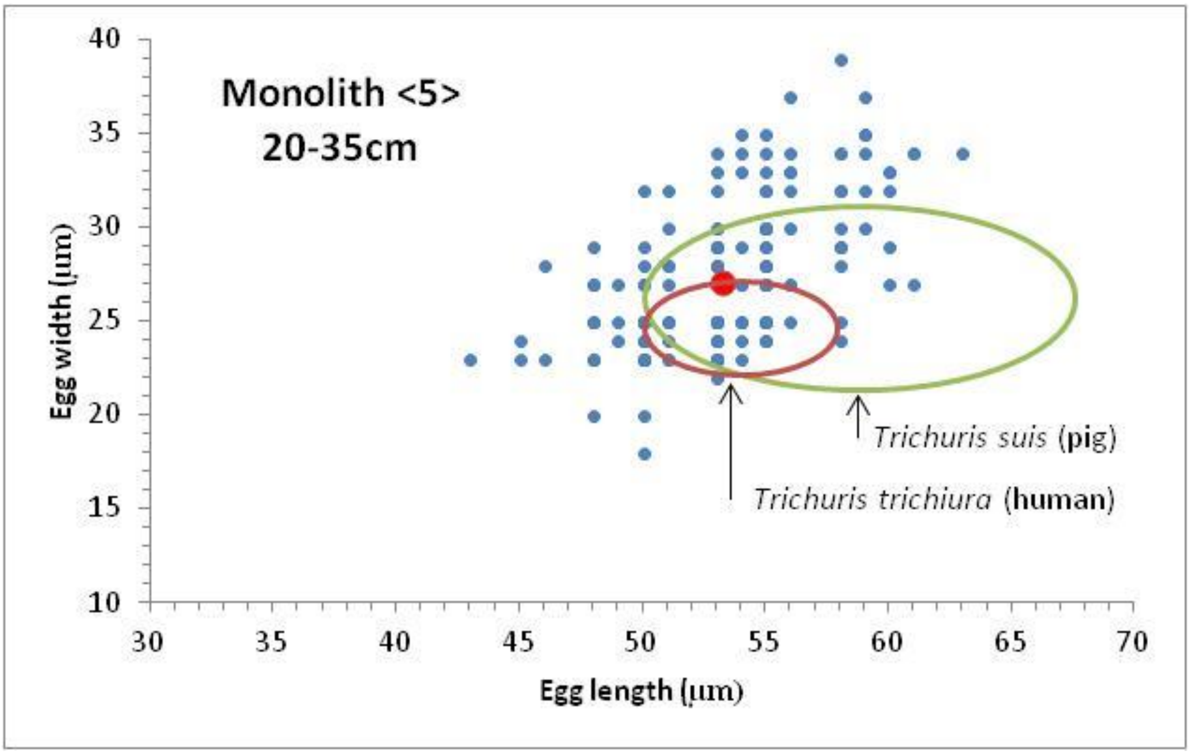


Figure 61: Size distribution of 200 *Trichuris* sp. eggs from monolith <5> samples. Mean average from all samples is indicated by the red circle; the red and green ovals indicate size ranges accorded to species by Brinkkemper & van Haaster 2012 (Table 21).

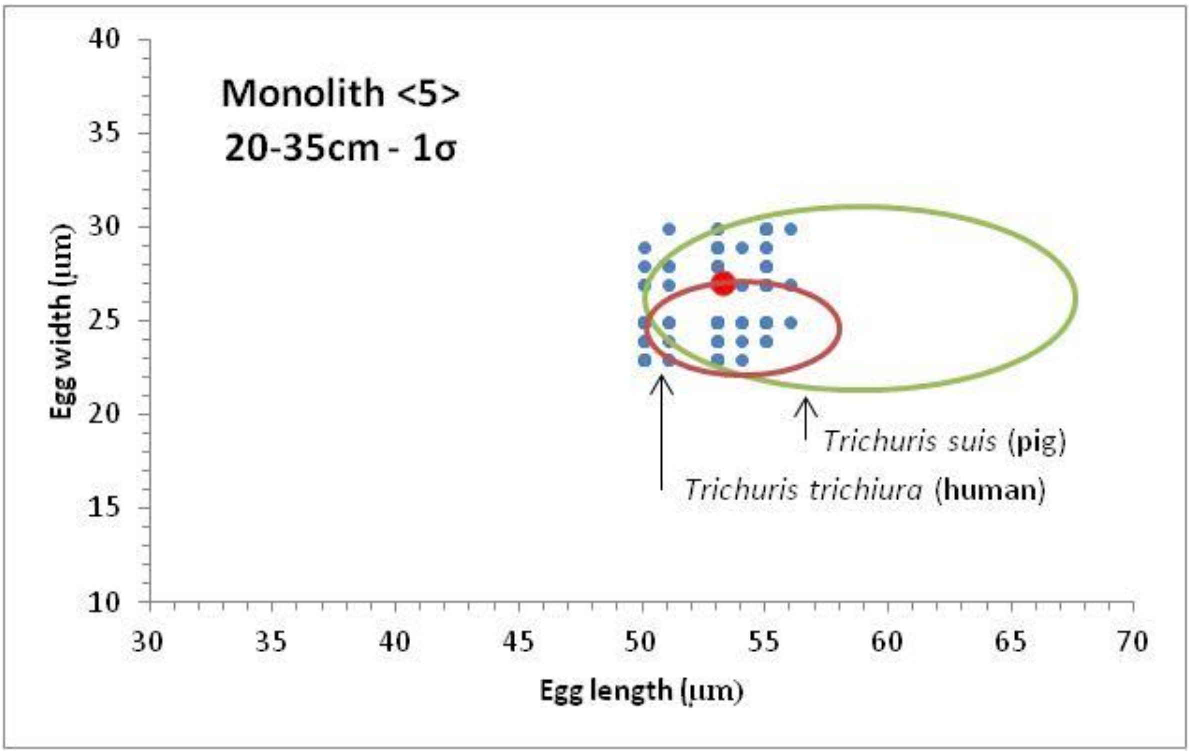


Figure 62: Size distribution of *Trichuris* sp. eggs from monolith <5> within 1σ of the mean (66.5% of sample). Mean average from all samples is indicated by the red circle; the red and green ovals indicate size ranges accorded to species by Brinkkemper & van Haaster 2012 (Table 21).

5.8 Bulk samples

5.8.1 Results

Environmental assessment data for the bulk samples is presented in Table 23 with counts for Mollusca and ostracods in Table 24 and counts for waterlogged and charred plant macrofossils in Table 24 and Table 26. Molluscan taxa are arranged alphabetically by name within broad ecological affiliations that are detailed in Chapter 3; in all subsequent diagrams the plus sign (+) indicates rare taxa and groupings (<1%). Depth figures are not directly comparable between the monolith and bulk sequences due to the slope of the ground surface and sediment layers which varied between the sampling points. Consequently correlation between datasets is best accomplished by context number.

Waterlogged conditions suitable for the preservation of plant macrofossils were encountered only in the lowest 1.5m of sequence <3>. Within this part of the sequence, representation was most pronounced in the lowest levels within and beneath the peaty organic sediment units (Section 5.2). The preservation conditions observed for the various taxa present was notably varied as is typical for waterlogged deposits containing material derived from a range of depositional pathways such as a combination of dumped and inwashed material (Murphy and Wiltshire, 1994). A range of charred cereal grains was also recovered from the lower part of sequence <3> (Table 24) and the spot samples (Table 26). A high degree in variation of preservation was apparent with a large proportion of grains being abraded and damaged by redeposition. Poorer preservation was particularly apparent in the case of specimens recovered from the colluvial portion of the sequence which derive from reworked occupation contexts upslope and represent unstratified and potentially residual material.

The waterlogged organic sediments also demonstrate preservation conditions which are far from ideal for Mollusca, with extensive decalcification being evident in the lower sequence as the result of highly localised acidification from the deposition and partial decay of plant material and dung (O'Connor and Evans, 2005: 96 - 97). This has produced an assemblage of molluscan subfossil material which is highly eroded and fragmentary. This assemblage has two basic components; allochthonous species from up-slope environments redeposited in the stream catchment by surface erosion and autochthonous species from *in situ* bankside and aquatic environments. This type of taphonomically mixed assemblage will therefore necessitate consideration in terms of these separate components rather than in aggregate (Davies, 1992: 67).

Table 23: Environmental assessment from stream trench bulk samples (Key: 0 = Estimated Minimum Number of Specimens (MNS); += single example;1 = 1 to 25; 2 = 26 to 50; 3 = 51 to 75; 4 = 76 to 100; 5 = 101+).

		Environmental Assessment																					
		Charred					Waterlogged			Mollusca			Bone						Artefacts				
Sample number or Depth (cm)	Description	Charcoal (>4mm)	Charcoal (2-4mm)	Charcoal (<2mm)	Seeds	Cereal grain	Wood	Seeds	Insects	Whole	Fragments	Marine (fragments)	Large vertibrate whole	Large vertibrate fragments	Small vertibrate	Fish	Amphibian	Bird	Pottery	Slag	Daub	Hammerscale	Worked flint
0-20	Silty topsoil		2	3				1		2	3	1		1					1	1	1	+	1
20-40	Silty clay (worm sorted horizon)		2	4						4	4	3		1	1				1	2	2	1	1
40-60	Silty clay (colluvium)	1	4	5	1	1				1	1	2		1		1	1	1	1	1	1	1	1
60-80	Silty clay (colluvium)	1	4	5		1				1	1	3	+	1	1	1			1	+	2	2	1
80-90	Silty clay (colluvium)	1	4	5		+		+		3	3	3	1	4	1	1	+				2	1	
90-100	Silty clay (colluvium)	1	3	5	+	1				2	2	2		3	1	1			1	+	1		1
100-110	Silty clay (colluvium)	1	3	5		+		1		1	1	2		3	1	1					1		
110-120	Silty clay (colluvium)	1	4	5	+	1		1		1	1	3		5	1	+	+			+	1		
120-125	Silty clay (colluvium)	2	5	5	1	1	1	5	1	1	1	2		2	1	1			+		1		
125-134	Silty clay / marl	2	5	5	1	3	2	5		1	1	3		2	1	2			+	+	1		
134-137	Marl lens (14070)	1	3	5	1	2	2	5	1	2	3	1		1		1							
137-142	Organic lens (14071)	1	3	5	1	5	5	5	3	1	1	2	+	1	1	1	+				1		
142-147	Lower portion of organic lens	2	4	5	1	2	5	5	3	2	2	1		2	1	+			+		+		
147-152	Organic / channel bed interface	2	3	5	1	1	5	5	3	5	5	2	1	3	1	1	+		+	1	1		+
152-157	Marl / channel bed (14076)	3	5	5	1	+	5	5	3	5	5	3	1	3		1					1		
<9>	Base of cut [14079] (220cm)		1	1			2	5	1	5	5	1		2					1				
<8>	Channel fill, base of sequence.	2	5	5	1	2	5	5	1	3	3	4	1	3	1	1		+	1	1	2		1
<7>	Channel bed (14077)	1	5	5			5	5	1	5	5	4		2	1				1	+	1		1
<10>	Organic lens (14081) next to <5>	1	3	4		+	5	5	4	1		2		1	1	2					1		1
<17>	Channel fill (14082).	1	4	4	1	1	5	5	4	1	1	3		3	1	1	1	+	1	+	1		
<18>	Channel fill (Saxon)(14083).	1	5	5	1	1	4	5	1	1	3	4	+	4	1	1	1		1	+	1		1

Key: 0 = Estimated Minimum Number of Specimens (MNS) = 0; += single example;1 = 1 to 25; 2 = 26 to 50; 3 = 51 to 75; 4 = 76 to 100; 5 = 101+

Table 24: Mollusca / ostracod counts from stream trench bulk samples.

		Mollusca																															
			Woodland / shade loving									Intermediate				Open country						Unspecific		Marsh		Aquatic				Ostracods			
Sample number or Depth (cm)	Description	Total shells	*Aegonipella nitidula*	*Carychium tridentatum*	Clausiliidae	*Discus rotundatus*	*Oxychilus cellarius*	*Pomatias elegans*	*Punctum pygmaeum*	*Trochulus striolatus*	*Vitrea* sp.	*Cepaea nemoralis*	*Cochlicopa* sp.	*Cornu aspersum*	*Trochulus hispidus*	*Helicella itala*	*Monacha cantiana*	*Pupilla muscorum*	*Vallonia costata*	*Vallonia excentrica*	*Vertigo pygmea*	*Cecilioides acicula*	Limacidae	*Carychium minimum*	*Oxyloma / Succinea*	*Galba truncatula*	*Lymnaea peregra*	*Pisidium* sp.	*Ostracods*	*Candona / Pseudocandona* sp.	*Herpetocypris* cf. *reptans*	*Prionocypris* sp.	*Ilyocypris* sp.
0-20	Silty topsoil	23													2					21		1	1										
20-40	Silty clay (worm sorted horizon)	79	1										1		42			1		32	2	4	3										
40-60	Silty clay (colluvium)	11													7					4			2										
60-80	Silty clay (colluvium)	15											1		9			1		3	1	2											
80-90	Silty clay (colluvium)	24											1		10		2	1		10		21	6										
90-100	Silty clay (colluvium)	14											1		10					3		14	2										
100-110	Silty clay (colluvium)	8													7					1		2	11										
110-120	Silty clay (colluvium)	3													2							1	3		1								
120-125	Silty clay (colluvium)	0																					2										
125-134	Silty clay / marl	1																	1				1										
134-137	Marl lens (14070)	21					3						1		4			2	2	9		20	2										
137-142	Organic lens (14071)	2																		2			2										
142-147	Lower portion of organic lens	20		1			4						1		9					3	2		11						11	7	3		1
147-152	Organic / channel bed interface	145	4	6	1	9	8		2	2	1	4	6	1	41			3	7	27	5		16	1	5	1	4	7	16	12			4
152-157	Marl / channel bed (14076)	173	2	10		8	5					3	10		52			3		43	4		14	7	5	2	7	12	10	6	1	1	2
<9>	Base of cut [14079] (220cm)	1012	43	22	1	1	8		53	6			161		117			4	62	323	46		6	111		23	1	30	2		2		
<8>	Channel fill, base of sequence.	39	1			1				1			1		12				2	12	1	11	8		2	2	1	3	72	42	20		10
<7>	Channel bed (14077)	262	2	7		5	1	1	2	2			19		45	2		7	5	89	9		23	2	2	9	9	44	18	6	4	8	
<10>	Organic lens (14081) next to <5>	1											1										2										
<17>	Channel fill (14082).	8											2		2					2	2		3						14	11	3		
<18>	Channel fill (Saxon)(14083).	9					3								6								10						2		2		

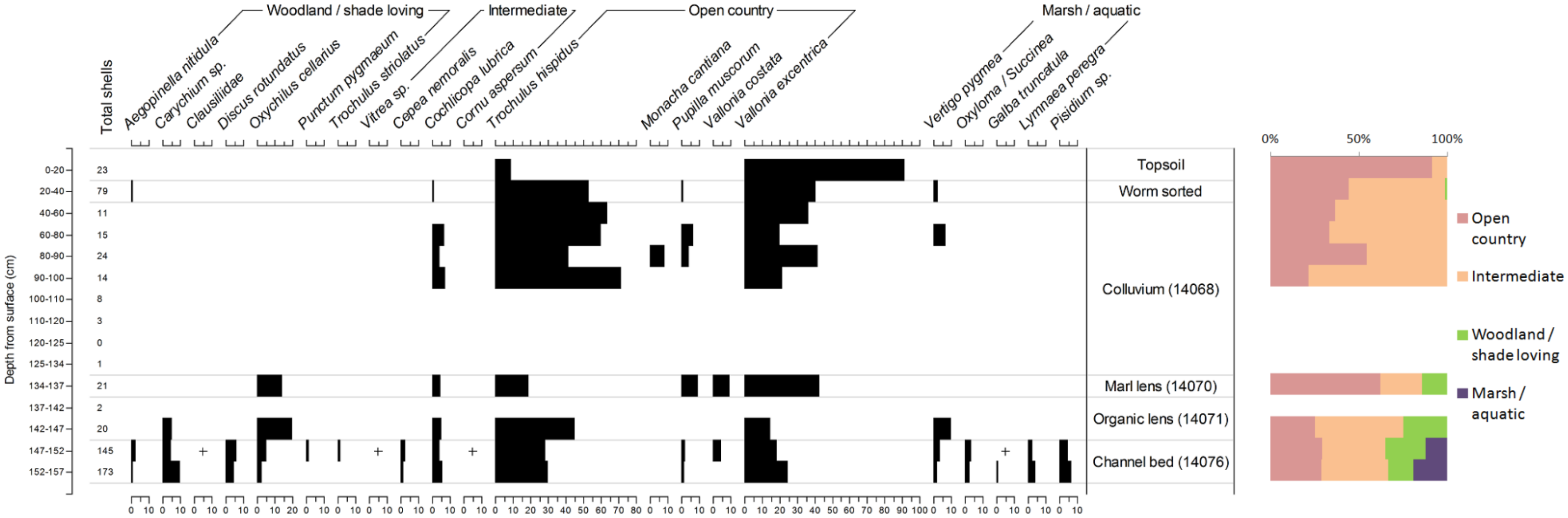


Figure 63: Mollusc sequence for bulk sequence <3> with summary of ecological affiliations; units with very low (<10) shell counts removed to clarify trends

Table 25: Waterlogged and charred plant macrofossils from stream trench bulk sample sequence <3>.

	Charred plant macrofossils								Waterlogged plant macrofossils																																														
									Trees & shrubs										Ruderal weeds							Arable weeds				Unspecific herbaceous / weeds													Riparian & emergent											Aquatic		
Sample Depth (cm)	*Hordeum* type	*Triticum* type	*Avena* type	*cereal indet..*	*Rumex / polygonum sp.*	*Vicia/Pisum sp.*	*Bromus sp.*	*Corylus avelana*	*Alnus glutinosa*	*Corylus avelana*	*Crataegus monogyna*	*Malus / Pyrus sp.*	*Prnus avium*	*Prunus domestica*	*Prunus spinosa*	*Salix alba*	*Sambucus nigra / racemosa*	*Rubus idaeus / fruticosus*	*Carduus / Cirsium sp.*	*Crepis sp.*	*Papaver sp.*	*Silene / Stelaria sp.*	*Sonchus asper*	*Rumex / polygonum sp.*	*Urtica cf. dioica*	*Aethusa cynapium*	*Anthemis cotula*	*Chenopodium album*	*Vicia / Lathyrus sp.*	*Agrimonia eupatoria*	Apiaceae indet.	Asteraceae indet.	*Brassica/ Sinapis sp.*	*Daucus carota*	*Galeopsis sp.*	*Hypericum sp.*	*Malva sp.*	*Marrubium vulgare*	*Pastinaca sativa*	*Ranunculus repens*	*Solanum sp.*	*Bromus sp.*	*Apium nodiflorum*	*Carex sp.*	Cyperaceae indet.	*Eleocharis sp.*	*Hypericum elodes*	*Juncus sp.*	*Lycopus europaeus*	*Persicaria amphibia*	*Rumex conglomeratus*	*Rumex palustris*	*Typha latifolia*	*Ranunculus peltatus / aquatilis*	*Zannichellia sp.*	*Mosses / sphagnum*
0-20																	3																																							
20-40																																																								
40-60	8	4			1	1																																																		
60-80	1	3																																																						
80-90																												1																												
90-100				5				1																																																
100-110	1		1														6																																							
110-120	1		1	1	1												10											8													3			3			1							1		
120-125	7	2	1					1	1								18	12	1					35	135	1		17					4								12			1												
125-134	18	12	10					1		1		2			1		7	14	8		2	1	1	16	108	3		57					42							9	29				2			120								
134-137	15	6	8			1	1	1	1								3	1	2			1	10	50	30		1	8	3				13			1		1		1	3			3				5								
137-142	20	10	20				3			20		1				1	4	2	30	6			9	115	13	3	5	52		1	2		61				11	1		10	3			1	2	1			3		2			2		
142-147	10	12	4					1		2		2				4	90	10	38	4	10	7	10	170	64	2	4	20	1		3		14				30	4		9	8		10	18	1	5			10		40	1		25	2	
147-152										1			2		2	2	300	10	10	3	13	1	2	110	52			23	1		4		4				4	2		48	7	6	65	26	4			5	44	15	48	3		70	8	
152-157											3		1		4	2	130	5	7		5	1	1	61	26			12	3				4			1		1		40	12		45	5	2	1			21	7	15	1		130	10	

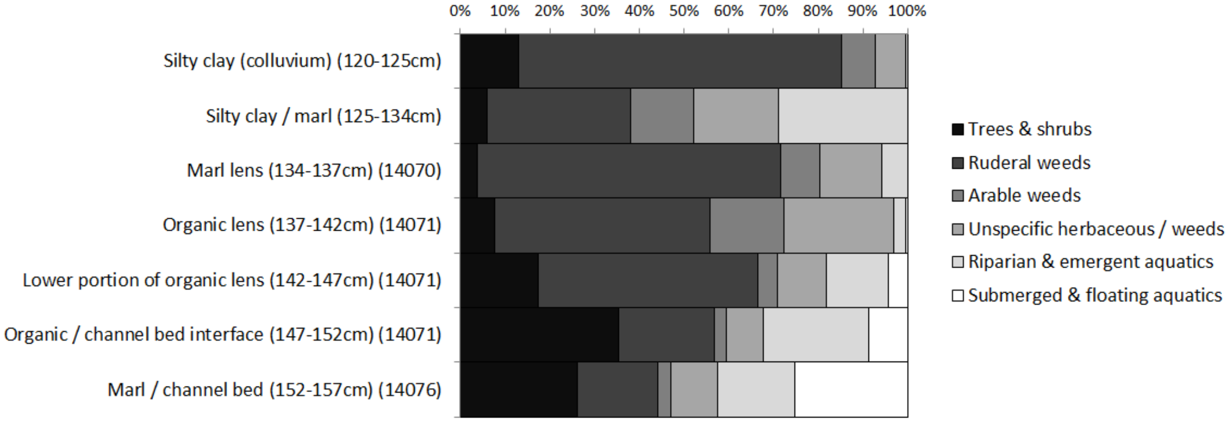


Figure 64: Summary of unweighted distributions of seeds by vegetation type for bulk sequence <3> by sample depth and context (waterlogged layers only).

Table 26: Waterlogged and charred plant macrofossils from stream trench spot bulk samples.

	Charred plant macrofossils								Waterlogged plant macrofossils																																															
									Trees & shrubs										Ruderal weeds							Arable weeds				Unspecific herbaceous / weeds													Riparian & emergent											Aquatic		
Sample	*Hordeum* type	*Triticum* type	*Avena* type	*cereal* indet..	*Rumex / polygonum sp.*	*Vicia/Pisum sp.*	*Bromus sp.*	*Corylus avelana*	*Alnus glutinosa*	*Corylus avelana*	*Crataegus monogyna*	*Malus / Pyrus sp.*	*Prnus avium*	*Prunus domestica*	*Prunus spinosa*	*Salix alba*	*Sambucus nigra / racemosa*	*Rubus idaeus / fruticosus*	*Carduus / Cirsium sp.*	*Crepis sp.*	*Papaver sp.*	*Silene / Stelaria sp.*	*Sonchus asper*	*Rumex / polygonum sp.*	*Urtica cf. dioica*	*Aethusa cynapium*	*Anthemis cotula*	*Chenopodium album*	*Vicia / Lathyrus sp.*	*Agrimonia eupatoria*	*Apiaceae indet.*	*Asteraceae indet.*	*Brassica/ Sinapis sp.*	*Daucus carota*	*Galeopsis sp.*	*Hypericum sp.*	*Malva sp.*	*Marrubium vulgare*	*Pastinaca sativa*	*Ranunculus repens*	*Solanum sp.*	*Bromus sp.*	*Apium nodiflorum*	*Carex sp.*	*Cyperaceae indet.*	*Eleocharis sp.*	*Hypericum elodes*	*Juncus sp.*	*Lycopus europaeus*	*Persicaria amphibia*	*Rumex conglomeratus*	*Rumex palustris*	*Typha latifolia*	*Ranunculus peltatus / aquatilis*	*Zannichellia sp.*	*Mosses / sphagnum*
<9>									1						1		24	3	2		2	1		10	2			3	2				1			5		4		240			6	19		3						56		27		
<8>	6	6						1	3	3						1	17	10	2	5	11	5	2	23	120	3	1	39		1	3	1	30	9				1		9	1		16	3	2			3	1	30	8			4	2	
<7>									1		3				12	1	49	10	5		1			7	6			11	10									1		22	14		15	15	5			2		5		10	2	68	7	
<10>	1									1				8				189	1		4	2	3	1	27	5	4	13					5				1		1	4									1	1				21		3
<17>	7	5	2							1					1		11	6	6		69	4	2	39	86	6		18			4		15		4			7		11	1		52	6				5		15	4	2		2		1
<18>	8	6	2							1					1		16	6	5		2	3	2	130	105	6		33	2				3					5		18	10		12	15				6	12	2	28	3		5		

5.8.2 Waterlogged plant remains

The representation of different plant taxa in terms of seeds in a waterlogged assemblage is highly influenced by their relative physical robustness, their mode of dispersal and the often vast differences in number produced by type (Nicholson, 2001: 183). Additionally, the determining factor for preservation is the hydrological regime and water table level which biases the representivity of the assemblage towards the wetter environments. Consequentially it is not sufficient to rely only on relative abundance of types in order to characterise the nature of the environment, or the transitions over time, as only fragmentary representation of specific parts of the wider ecology are preserved (Brown, 1997: 129). Large variations in the relative production of pollen and seeds between taxa will meant that the macrofossil and pollen records for the lowest part of sequence <3> which corresponds to monolith <4> whilst being complimentary cannot be expected to be identical (Grieg, 1981: 274).

Evidence for some degree of tree and shrub cover along the banks of the stream channel occur in the form of abundant nut shells of Corylus (Hazel) along with stones of *Prunus spinosa* (Blackthorn / Sloe) as well as several catkins of *Alnus glutinosa* (alder) and a bud of *Salix* sp. (willow) in the lowest sample of the sequence. Also encountered in the organic and peaty sediments were a number of preserved thorns of either *Prunus* sp. (Blackthorn / Sloe) or *Crataegus* sp. (hawthorn). Present throughout the sequence are abundant seeds from other shrubs such as *Sambucus nigra / racemosa* (black elder), *Rubus idaeus* / *fruticosa* (Raspberry / Blackberry) and *Solanum* sp. (nightshades). The high quantity of *Sambucus* seeds is likely to be a consequence of the extreme robustness of these seeds which allows their survival in even aerobic and dry environments (Murphy and Wiltshire, 1994). As a result they are also widely recorded as uncharred macrofossils in samples from the on-site Anglo-Saxon archaeological contexts (McKerracher, 2015a).

Food plants are present in the form of *Corylus avelana* (hazelnut), *Sambucus nigra / racemosa* (black elder), *Rubus idaeus* / *fruticosa* (Raspberry / Blackberry) and *Prunus spinosa* (sloe) as well as small number of specimens of *Malus* sp. (apple) *Prunus avium* (Cherry) and *Prunus domestica* (plum). All of these types produce relatively large, heavy fruits which could not have travelled far from their source without fluvial, anthropogenic or faunal agency. Some of the hazelnut shells are also charred, indicating a degree of processing or burning of waste. A large number of *Rubus* (Blackberry) seeds in organic lens (14081) (sample <10>) correlates to samples in monolith <5> with highly abundant parasite eggs (section 5.7.5) suggesting concentrations within dung deposits (Dennell, 1976: 231).

The lowest part of the sequence (dated to 349-536 cal A.D. (OxA-33563, Table 14)) contains some species characteristic of a wholly aquatic and submerged-leaved flora with *Zannichellia* sp. (Horned pondweed), *Ranunculus peltatus* (Water crowfoot) and *Apium nodiflorum* (Fools water cress) all present in substantial quantities. This correlates with the presence of molluscan and ostracod species which live in aquatic conditions in the lowest part of the sequence (section 5.8.4 and 5.8.5). Alongside these aquatic plant types, species characteristic of riparian (wet bankside) or muddy environments are well represented by various types of *Carex* (sedges), *Juncus* (rushes) and other *Cyperaceae* (rushes) along with *Lycopus* (Gypsywort / Bugleweed), *Rumex conglomeratus* (clustered dock), *Rumex palustris* (Marsh dock), *Persicaria amphibia* (water knotweed), *Ranunculus peltatus* (Water crowfoot) and *Apium nodiflorum* (Fools water cress). Some of these types are also represented in the pollen data which further indicates other aquatic plants such as *Typha latifolia* (bulrush) growing in and alongside the channel (section 5.7.3). These species favour waterlogged and anaerobic soils containing a high proportion of organic matter (Brown, 1997: 112) and collectively suggest disturbed bankside areas possibly subject to regular vegetation clearance, alongside a watercourse with relatively clean, unpolluted water (Smith, 2013: 8, 64).

Evidence for vegetation in the wider area around the channel is presented by taxa which produce wind-borne seeds which are more likely to be allochthonous such as *Carduus / Cirsium* (thistles), *Sonchus asper* (Sow thistle) and *Crepis* (Hawksbeards) (Brown, 1997: 129). The presence of many of these, particularly the thistles and weeds such as *Stellaria* (Chickweed) comprise an essentially ubiquitous component of disturbed ground flora characterised by taxa with prolific seed dispersal (Grieg, 1981: 274). Consequentially they are relatively undiagnostic aside from being generally indicative of free-draining calcareous pasture, grassland or waste ground soils enriched by human activities around the stream channel (Martin and Kent, 1965; Smith, 2013).

Other abundant terrestrial taxa such as *Urtica dioica* (stinging nettle) and *Chenopodium* cf. *album* (fat hen), are more specific to disturbed waste ground with a high degree of nutrient enrichment from organic wastes and dung (Smith, 2013: 61). Also present throughout the sequence is *Ranunculus repens* (creeping buttercup), a type common to cultivated land and pastures as well as wet meadow environments (Martin and Kent, 1965). Other annual weed types such as *Anthemis cotula* (stinking mayweed) and Brassicae (mustard family) are more indicative of arable landscapes or disturbed areas around agricultural settlements (Robinson in Hey, 2004: 367). A concentration of *Papaver* (Poppy) seeds in the paleochannel fill at the south end of the trench (sample <17> / (14072)) also potentially demonstrates arable weeds; however it may also indicate cultivation of opium poppy, as was suggested from the on-site assemblage from Rectory Lane by McKerracher (2012).

In contrast to this diversity, the dominant flora from the colluvial sediments overlaying the waterlogged sequence solely consists of weed species such as *Urtica dioica* (stinging nettle) and

Rumex / Polygonum sp. (Docks / sorrel / knotgrass) demonstrating an environment heavily disturbed by human activity (Grime *et al*., 1988). The high concentration of *Rumex* in association with *Chenopodium* is typical of heavily grazed areas around settlements where trampling, denudation from grazing and nutrient enrichment from dung deposition are prevalent (Robinson, 1992: 203). This environment likely corresponds to a later (post 10th-century) Saxo-Norman occupation phase as the modelled date range for the marl lens underlying this colluvium provides a *terminus post quem* of 773-947 A.D. (section 5.5).

The sequence thus demonstrates a pronounced transition from an ecology containing a cohesive riparian / bankside and partly aquatic ecology to one dominated by a mixture of ruderal / waste ground and riparian types (Figure 64). This trend compares well to the molluscan evidence (section 5.8.4). The upper units (down to 134cm) represent poorly sorted silty colluvium which is taphonomically mixed and demonstrates organic deterioration from periodic drying out and mass movement of sediment down the slope. The timescale for this progression can be determined as 5th to mid 9th centuries A.D. from the radiocarbon evidence (section 5.5).

5.8.3 Charred plant remains

The extensive micromorphological evidence for colluvial mixing throughout the sequence (section 5.6.3) indicates that a proportion of the charred grains within the waterlogged alluvial sediments may derive from inwashed material. More frequent and better preservation evident within organic lenses which also contain cereal pollen and parasite eggs (sequence <3> bulk samples between 125 and 147cm which equate to context (14071)) likely represent concentration within dumped occupation wastes.

The better preserved cereal grains largely consist of *Hordeum* (barley) along with a smaller proportion of *Triticum* (wheat) and considerable quantities of *Avena* (oat) which likely represent both wild and cultivated (*Avena sativa*) varieties. A high degree of variation in the forms of the *Triticum* grains suggests a proportion of glume wheat (Spelt) being present alongside more prevalent types of free threshing bread wheat (Dr. Lisa Lodwick, pers. comm., November 2016). These results compare well to those from the on-site assemblages, particularly to the 8th / 9th-century monastic contexts which contained evidence for all four major cereal types as well as both Spelt and free-threshing Wheat varieties (Campbell, 2012; McKerracher, 2012; McKerracher, 2015a). This similarity in basic composition, particularly the substantial presence of a variety of wheat types and the large proportion of oats, may suggest that the present assemblages derive from the same type of middle Anglo-Saxon agricultural economy (McKerracher, 2015b).

5.8.4 Mollusca

A mollusc diagram and summary of ecological affiliations (with unrepresentative samples (<10 shells) removed) are displayed in Figure 63. This shows the channel bed assemblage between 147 and 157cm, the marl lens between 134 and 137cm, the colluvium between 20 and 100cm and the topsoil between 0 and 20cm. Presentation of this sequence in terms of changing absolute abundance of taxa over time is complicated by the taphonomic mixing and variation in preservation conditions which compromise representative time-depth biostratigraphy. Consequentially, environmental interpretations must of necessity be presented in qualitative terms.

The base of the sequence contains a diverse terrestrial assemblage with a high degree of taphonomic mixing likely from both fluvial and slope erosion processes. Consequentially, species characteristic of open country (e.g. *Vallonia excentrica*) likely washed in from upslope environments are present alongside a range of shade-demanding types such as *Carychium*, *Discus rotundatus* and *Oxychilus cellarius* which may derive from areas of long vegetation around the stream channel itself. The aquatic fauna present alongside them comprises freshwater bivalves (*Pisidium* sp.) as well as *Lymnaea peregra* (the Wandering Pond Snail) and the amphibious *Galba truncatula*. The presence of these types indicates the hydrology of the stream at the time of deposition to be characterised by stable perennial flow with only infrequent punctuations of intermittent flow from periods of drought (Davies, 2008b: 21-22). It is worth noting that this terrestrial and aquatic diversity was mirrored by the individual bulk samples (<7>,<8>,<17>,<18>) from other areas of channel fill within the trench.

These species were recovered alongside ostracod valves (section 5.8.5) and macrofossils from aquatic vegetation (section 5.8.2) suggesting a mixed terrestrial and aquatic assemblage. This is consistent with the fluvial sedimentary composition of the lowest units (section 5.2) and may allow interpretation as an aquatic environment with a large inwashed dry ground and bankside component. The location for this material at only 15-20m from the spring head effectively guarantees that some of this material represents an autochthonous aquatic ecology rather than redeposited material from overbank or downstream flow, a taphonomic issue which characteristically complicates analysis of fluvial deposits (Davies, 2008b: 154).

The organic sediment unit overlying the channel fill produced very low shell counts consistent with more acidic preservation conditions, which were also encountered in the bulk sample <10> from context (14081). The lower portion of the colluvial unit overlying these organic sediments also demonstrated very low shell counts; consequentially the samples from 100-134cm and 137-142cm are highly skewed and unrepresentative in the mollusc diagram (Figure 63). The marl lens between these two units contained a small number of shells consistent with an open-country ecology, suggesting an origin for the assemblage in eroded grassland soils.

In contrast the upper part of the colluvial sequence produced an assemblage with a dominant component of *Trochulus hispidus*, consistent with ploughwash from cultivation on the slopes above the stream. This conclusion is supported by the similar domination of this particular species in the modern arable / ploughed field analogue (Chapter 3). The consistently high associated proportions of *Vallonia excentrica* further indicate the presence of grazed grassland during these periods of arable land use and subsequent colluviation which may suggest fallow episodes or periodic grazing consistent with a pattern of mixed land-use or rotation following the abandonment of the settlement. This ecology contrasts markedly with the “modern” assemblage from the open areas of Tayne Field (<3> 0-20cm and modern analogue detailed in Chapter 3) which is almost exclusively restricted to the notably xerophilic *Vallonia excentrica*, corresponding to the present-day short grass and stable ground surface.

In sharp contrast to this sequence and to the various other bulk samples, the assemblage from the base of pit [14079], sample <9> (section 5.3.4) was dominated by a diverse range of terrestrial types (Figure 65) with a wide range of shade demanding (*Carychium minimum, Punctum pygmaeum, Aegopinella nitidula*), intermediate (*Trochulus hispidus, Cochlicopa* sp.) and short-grassland / xerophilous habitat preferences (*Vallonia excentrica*) which would not normally be expected to exist together in high abundance (Davies, 2008a: 175-176). This unusual concentration likely represents a combination of micro-habitats from areas of long bankside vegetation and muddy substrate to areas of transitional calcareous long grassland (e.g. Cameron and Morgan-Huws, 1975: 228) around the stream. The representation of terrestrial Mollusca in the modern bankside analogue (Figure 65) demonstrates comparable shade-loving and damp-ground types such as *Carychium minimum* in the long vegetation surrounding the present-day stream margins which are not encountered elsewhere around the site (Chapter 3).

Freshwater Mollusca within this fill comprised amphibious types (*Galba truncatula*) and at least two species of *Pisidium* bivalve; *P. personatum*, a slum species common to marginal ditch and damp ground habitats and *P. supinum* a moving-water species indicative of clean, calcareous water (Killeen *et al*., 2004). These indicate a range of aquatic habitats and likely reflect both muddy margins along the banks as well as clean, calcareous and deeper moving water in the stream channel. The modern analogue sample taken from the stream bank (Chapter 3) demonstrates similar high concentrations of *Pisidium personatum* in the long vegetation and damp ground at the water's edge; the modern absence of *P. supinum* may indicate a decrease in the size and depth of the channel over time.

Alongside this assemblage were a large number of seeds, most notably from *Ranunculus repens* (creeping buttercup) as well as various other aquatic and riparian plants. The high concentration of *Ranunculus* seeds in the pit fill potentially relates to the presence of meadow or grassland vegetation and may be an indication of land around the stream being used for growing hay (Grieg, 1981: 274). This evidence correlates well to the molluscan diversity by suggesting material inwashed from the bankside area and accumulating at the base of the pit during a prolonged period when it remained open and in use, prior to being sealed by infill or abandonment.

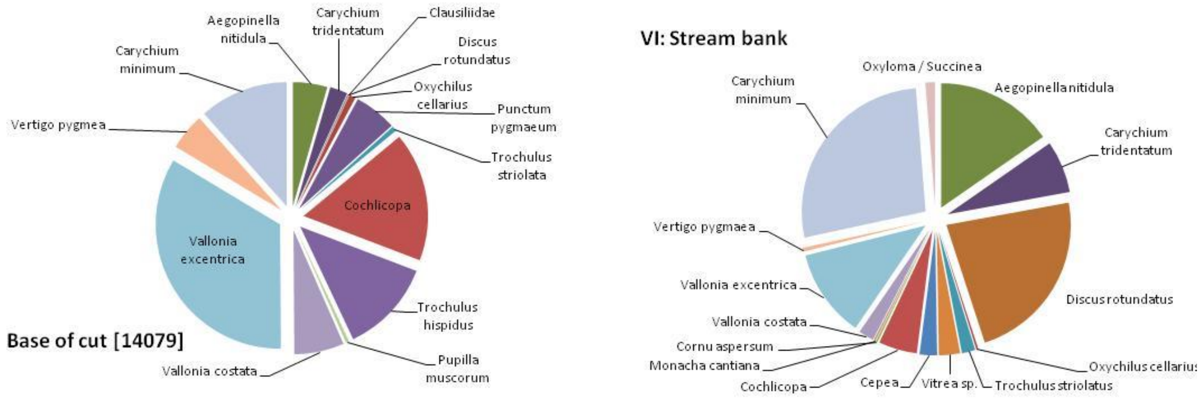


Figure 65: Terrestrial Mollusca from the basal fill of pit [14079] vs. modern stream bank assemblage (Chapter 3).

5.8.5 Ostracods

Ostracod valves were recovered from the lowest part of the sequence (below 142cm) and from individual bulk samples <7>, <8>, <9>, <10>, <17> and <18>. Specimens were identified using available reference works (Griffiths *et al*., 1993; Griffiths and Holmes, 2000) to genera level, which is regarded as being sufficient for basic paleoenvironmental reconstruction (Griffiths *et al*., 1993: 57). Results are tabulated and presented in Table 24. The largest group present in the samples from Lyminge comprised the genera *Candona* and *Pseudocandona*. These are taxonomically difficult to differentiate to species level (Griffiths *et al*., 1993: 57); however a likely candidate for the majority of them is *Pseudocandona rostrata*. This species is associated with submerged vegetation at the margins of bodies of water (Griffiths and Holmes, 2000: 51-52). In broad terms, species in this group also generally favour environments with substrates of muddy and fine grained organic sediment (Griffiths and Holmes, 2000: 49). A wide range of sizes of valves of this type were recovered from these samples indicated the presence of a range of juvenile moult stages, a factor regarded as indicative of an autochthonous assemblage (Griffiths *et al*., 1993: 56).

The second most abundant form encountered in these samples belongs to the genus *Herpetocypris*, comparing most favourably to *Herpetocypris reptans,* which feed on dead leaves, detritus and aquatic vegetation in small bodies of water (Griffiths *et al*., 1993: 61). This type is known to favour environments limited to salinity down to 6‰ and to require moderate temperature and pH ranges and oxygen concentrations which are relatively low (<8mg/l) (Ruiz *et al*., 2013: 1117). Additionally they are known to favour fine grained and stable muddy substates (Griffiths *et al*., 1993: 49). It is worth noting that an example of this type was recovered from the molluscan analogue (VI) taken from sediment from the modern stream bank (Chapter 3) demonstrating the persistence of this type in the modern environment. Both this type and members of a further genus recorded from these samples, *Prionocypris*, are also known components of groundwater ecosystems living in the sediment around stream channels (Gilbert *et al*., 2013: 31).

Several specimens of *Ilyocypris* sp. were recovered from the lower part of the main sequence and from the channel fill sample <8>. This type exhibits a notably high degree of intraspecific morphological variation in valve shape, size and sculpturing as a result of population and genetic variations, making assignment to species particularly problematic (Mazzini *et al*., 2014); however all favour shallow water environments with low salinity, moderate pH and a fine grained substrate (Ruiz *et al*., 2013).

5.9 Discussion

This sequence represents the main environmental history for the settlement site, presenting a consistent palynological picture of ruderal weeds and grassland plants typical of pasture, well supported by the associated molluscan assemblage. This generates a key finding of the present research by demonstrating the presence of an open, well managed environment around the stream as well as the areas generating intrusive components. The associated archaeology (section 5.3) provides important, previously unknown, evidence for economic activities including the manufacture of hurdles and other artefacts from coppiced hazel, willow and field maple wands during a period modelled at 779–980 AD. Structural evidence in the form of stakes and stones indicates that the stream bank may have been stabilised or modified, perhaps even accommodating a working area for these activities, all of which continued long after the abandonment of the great hall complex in the 8th century A.D. Grazing and livestock movement occurred around the stream throughout the sequence further suggesting that the lines of stones (section 5.3.3) were perhaps placed to allow livestock to access the water. Important evidence for edible plant types in the stream-side flora and potential concentrations of fruit seeds within waste deposits, indicate a food economy incorporating wild plants and foraging (section 5.8).

The small size of this catchment does however restrict representation to a few hundred metres from the stream, limiting wider area interpretations (Hey, 2004: 371). Taphonomic complexities also arise from colluvial sediments (section 5.6.3), laterally interleaved organic lenses and channel phases (section 5.2) as well as contamination from dung and dumped occupation wastes (section 5.7.5). Disparities in composition between interleaved units suggest a range of formation processes from natural accumulation to dumping of waste from different sources (section 5.2). Extensive microfossil evidence of dung and micromorphological evidence for trampling, demonstrates a churned bankside surface of local vegetation detritus, dung and dumped occupation wastes, incorporating sediments and microfossils imported from the wider area on the hooves of animals (Chadwick, 2016: 107). This collectively suggests that this sequence may reflect a mixture of both local environments and anthropogenic processes connected with occupation activities which defy easy separation.

The associated stratigraphic evidence (Chapter 4) demonstrates that agricultural disturbance began following the deposition of the uppermost alluvial horizon (modelled at 773-947 A.D.). Colluvial infill progressively displaced the channel southwards (Figure 27), creating a dynamic hydrological system characterised by laterally discontinuous deposition. No evidence was found for similar sediments north of and pre-dating the basal deposits, suggesting that earlier stream channels were more stable, with contemporary deposits likely lost to *in-situ* channel bed erosion.

Chapter 6 - Micromorphological evidence from sunken featured building fills

This chapter collates the discussion and interpretation for the micromorphological sections taken from the fills of the sunken-featured buildings on Tayne Field. This was undertaken in order to interpret site formation processes and evidence for use of space and economy on the settlement site in accordance with the research objectives detailed in Section 1.5.3. These structures were excavated between 2012 and 2015 and were associated with the early Anglo-Saxon occupation phase. Remnant ecological or archaeological evidence existing within these sequences largely comprise occupation materials lost from other areas of the site by post depositional erosion, truncation and disturbance. Within the text, reference is made to context numbers (fills are signified by round brackets, cuts by square brackets) and field interpretations of the excavators which are directly accessible via the project database at **www.iadb.co.uk/lyminge**.

6.1 Archaeology

Four sunken featured buildings were excavated on Tayne Field, with locations in relation to the other archaeology as presented in Chapter 2. All were excavated in quadrants, as is typical for this type of feature (Lucy *et al*., 2009: 49). One structure (SFB6) was heavily truncated by the foundation trenches of later timber halls (Thomas and Knox, 2014: 3), whilst two (SFB5 and SFB7) were undisturbed and relatively well preserved. These latter two sequences were prioritised for micromorphological investigations. A fourth SFB (SFB8) was excavated in 2015 after this process of sampling had concluded and is therefore not included in the present research. SFB5 was excavated during 2012, measuring 3.1m by 2.4m with a maximum depth of 0.62m, with two primary gable end structural posts and extensive evidence for stake holes around the periphery. The fill comprised occupation waste dating to around 421-561 cal A.D. (OxA-31723, Table 1) and contained artefacts such as bone combs, metalworking crucibles and a copper-alloy toilet set (Thomas and Knox, 2012: 7-9). SFB7 was excavated during 2013 and comprised a well preserved feature measuring 3.9m by 2.6m with a maximum depth of 0.37m, with two gable end structural posts and a fill dating to 392-597 cal A.D. (OxA-31961, Table 1) comprising domestic occupation waste (Thomas and Knox, 2014: 2-3). Both of these structures conform in terms of area and structural post-hole arrangement to the most commonly encountered type of sunken featured buildings in England (Tipper, 2004: 64, 68).

6.2 Sampling

Two blocks were processed into thin sections for micromorphological analysis with the aim of investigating site formation processes, occupation deposits and potential surfaces at the base of SFB5 and SFB7 respectively. Four blocks were originally taken in two sequential pairs from exposed sections during summer 2012 and 2013 (Figure 66) using paper towel and tape to tightly consolidate the sediments as they were removed (Goldberg and Macphail, 2006: 331). The uppermost samples in each pair represent secondary dumped infill, rather than deposits representing the structure or lifetime of use of the building, and are excluded from the present research due to time constraints. Consequently the analysis here is only of the two basal samples. A comparable analysis of secondary fill from SFB sequences at the Rectory Lane site can be found in Maslin (2015).

Figure 66: Sampling locations for SA91 (SFB5) and SA130090 (SFB7). The blocks processed into thin sections as part of the present research are the lower of the pairs in each sequence.

6.3 Results

Micromorphological results from the two samples (SFB5 <91> and SFB7 <90>) are presented below. Following micromorphological evaluation each sample was observed to comprise three basic microstratigraphic units; a basal massive chalk marl corresponding to the natural material into which the feature was cut, a thin lens of mixed natural and occupation deposits overlain by larger clasts of natural sediment and an overlying unit of dumped occupation deposits. Slide overviews are presented in Figure 67 and Figure 68 with microstratigraphic unit (MSU) boundaries indicated. These units are described in terms of their general characteristics and basic interpretation. Detailed interpretations of origin and taphonomic processes are presented in section 6.4. Frequencies for inclusions and textural pedofeatures for each MSU are presented in Table 27 and Table 28 (terminology follows Bullock *et al*., 1985; Stoops *et al*., 2009).

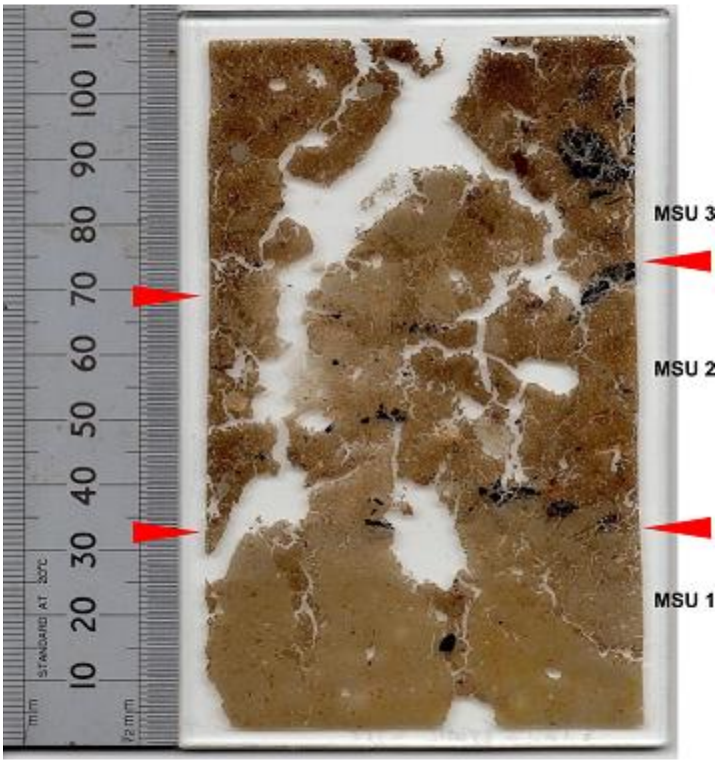


Figure 67: Overview for thin section from LYM12 SFB5 sample <91> with microstratigraphic unit (MSU) boundaries marked.

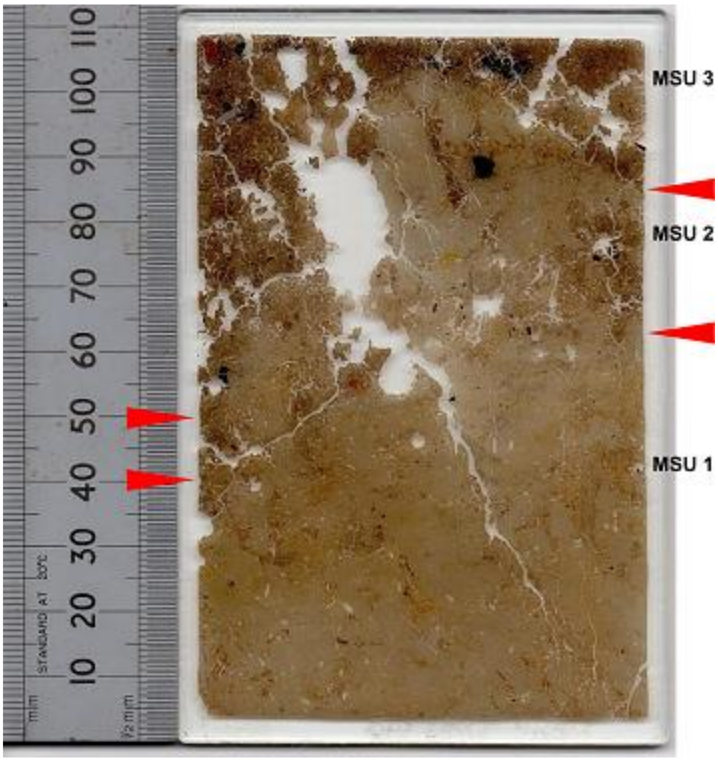


Figure 68: Overview for thin section from LYM13 SFB7 sample <90> with microstratigraphic unit (MSU) boundaries marked.

Table 27: Tayne field SFB micromorphological counts and inclusions (terminology after Bullock *et al*, 1985)

Thin section no.		**LYM12 SFB5 <91>**	**LYM12 SFB5 <91>**	**LYM12 SFB5 <91>**	**LYM13 SFB7 <90>**	**LYM13 SFB7 <90>**	**LYM13 SFB7 <90>**
Microstratigraphic unit no.		**MSU1**	**MSU2**	**MSU3**	**MSU1**	**MSU2**	**MSU3**
Thickness (mm)		30	35-40	20-38	35-55	10-40	5-45
Context		Base of SFB5 cut	Primary fill of SFB5 cut	Primary fill of SFB5 cut	Base of SFB cut	Primary fill of SFB7 cut	Primary fill of SFB7 cut
Deposit type		Chalk marl	Deposits at interface between base of cut and primary fill	Dumped fill / occupation deposits	Chalk marl	Deposits at interface between base of cut and primary fill	Dumped fill / occupation deposits
Boundary		N/A	Sharp, irregular anthropic	Diffuse, irregular anthropic	N/A	Sharp, irregular anthropic	Diffuse, irregular anthropic
c/f ratio (10µm limit)		5/95	35/65	30/70	5/95	30/70	40/60
Particle Size		Silty clay	Sandy silt	Sandy silt	Silty clay	Sandy silt	Sandy silt loam
Fine material		Speckled, microcrystalline; 5% organic, 95% inorganic	Speckled, microcrystalline; 15% organic, 85% inorganic	Speckled, microcrystalline; 10% organic, 90% inorganic	Speckled, microcrystalline; 5% organic, 95% inorganic	Speckled, microcrystalline; 10% organic, 90% inorganic	Speckled, microcrystalline; 20% organic, 80% inorganic
Related Distribution		Open porphyric	Open porphyric	Open porphyric	Open porphyric	Open porphyric	Open porphyric
Sorting		Bimodal: poorly sorted sand in well sorted silt	Unsorted	Unsorted	Bimodal: poorly sorted sand in well sorted silt	Unsorted	Unsorted
Orientation and distribution of inclusions		Unorientated; random & unreferred	Weakly expressed (~30%), otherwise unorientated; parallel and referred to boundary (~30%), otherwise unreferred	Unorientated; random & unreferred	Unorientated; random & unreferred	Unorientated; random & unreferred	Unorientated; random & unreferred
Rock fragments	Chalk	**	*	*	**	**	*
	Microcrystaline chert /Flint	*	*	-	-	*	*
	Sandstone	-	-	-	-	-	*
Minerals	Quartz	*	**	**	*	**	**
	Glauconite	-	*	-	-	*	*
	Calcite	*	-	-	*	*	*
Sediment Aggregates	Ash-rich aggregates	-	*	*	-	*	*
	Clay-rich aggregates	-	-	**	-	*	**
	Sandy aggregates	-	-	*	-	-	*
	Marl aggregates	-	**	**	-	*****	**
Micro-artefacts	Pottery	-	*	-	-	*	**
	Daub	-	*	*	-	*	*
Bioarchaeological	Bone (unburnt)	-	*	*	-	*	*
	Partially burnt bone	-	-	-	-	-	*
	Coprolite	-	*	-	-	*	-
Organic / Plant Remains	Charred Wood	-	**	**	-	*	**
	Charred Plant Tissue	-	*	*	-	*	*
	Fungal bodies	-	*	*	-	-	-
Inorganic remains of biological origin	Earthworm granules	*	*	*	*	*	*
	Mollusc shell	-	*	*	*	*	*
	Fossils	**	-	-	**	**	-

Key: ****** Very dominant >70%; ***** Dominant 50-70%; **** Common 30-50%; *** Frequent 15-30%; ** Few 5-15%; * Very few <5%

Table 28: Tayne field SFB sample post-depositional and textural pedofeatures (terminology after Bullock *et al*, 1985)

Thin section no.	**LYM12 SFB5 <91>**	**LYM12 SFB5 <91>**	**LYM12 SFB5 <91>**	**LYM13 SFB7 <90>**	**LYM13 SFB7 <90>**	**LYM13 SFB7 <90>**
Microstratigraphic unit no.	**MSU1**	**MSU2**	**MSU3**	**MSU1**	**MSU2**	**MSU3**
Microstructure	Massive with occasional vughs: 10% voids	Vughy to spongy: 30% voids	Planes and vughs: 40% voids	Massive with occasional vughs: 10% voids	Vughy: 30% voids	Spongy and vughy: 40% voids
Intercalated textural pedofeatures	++++	+++++	+++	+++	+++	+++++
Earthworm burrows & exc. fabric	-	+++	+++	-	++	++++
Root channels / modern roots	-	+++	+++++	-	++	++++
Partially collapsed voids	+	++	+++	+	++	+++
Dusty clay hypo/quasicoatings	+	++	+++	+	++	+++
Impure clay / silt / sand hypocoatings	-	+++	+++	-	+++	++
Redoxomorphic Fe/Mn staining	++++	++++	++++	++++	+++	++++
Secondary iron nodules	+	++	+++	+	+	+

Key: +++++ Very abundant >20%; ++++ Abundant 10-20%; +++ Many 5-10%; ++ Occasional 2-5%; + Rare <2%

6.3.1 Deposit descriptions

SFB5 and SFB7 microstratigraphic unit 1

Description

The lowest units on each slide are classified as natural material originating from in-situ weathering of the parent geology (the Zig-zag chalk formation). These deposits are dominated by a massive, well sorted calcareous silt microstructure containing abundant microfossils eroded from the chalk (5%). This massive structure is punctuated by occasional vughs (10% of groundmass area) and intercalated textural pedofeatures (5-15% of groundmass area) comprising inwashed material from the overlaying fill within cracks probably derived from episodes of periodic drying and shrinkage. These intercalations largely reflect the fill composition containing sub-rounded to sub-angular chalk (5%, < 4mm) and mineral inclusions such as quartz (1-2 %, < 600µm), from the surrounding geology. The particle size overall is thus bimodal, dominated by the fine silty clay matrix of the marl with sand-sized inclusions in the intercalations and an overall coarse/fine ratio of 5/95. The organic content of less than 5% is notably lower than that in the overlying deposits. The fabric demonstrates some evidence for post-depositional disturbance with occasional micritic translocated hypocoatings within voids (2%) and voids partially infilled with illuviated material (2%). Extensive evidence for fluctuating ground water is present in the form of redoxyhydromorphic nodules of iron and manganese (2%, <500µm) as well as extensive staining to the calcareous marl groundmass (10%).

Interpretation

The absence of anthropogenic materials and the predominantly geological origin of the structure confirm these units to comprise undisturbed natural into which the SFBs have been cut. The units are truncated by sharp, irregular boundaries with no evidence for in situ surfaces or compression. The post-depositional features indicate exposure to pronounced variations in water content which has caused cracking in the groundmass and the subsequent illuviation and inwashing of larger clastics into these cracks and voids.

SFB5 and SFB7 microstratigraphic unit 2

Description

The units overlying the natural in both samples demonstrated a combination of eroded geological materials and anthropogenic inclusions characteristic of occupation deposits. The particle size is sandy silt with a coarse/fine ratio varying between 30/70 and 35/65. The unit is dominated by marl aggregates (particularly in SFB7 with 50-60%, <3cm) and intercalations of fine micritic groundmass (10-20% of groundmass) which are also found within the marl clasts. The organic content (10%) includes significant charcoal (2-5%, <5mm) including identifiable fragments of *Corylus avelana* (Hazel) and *Fraxinus excelsior* (Ash) in SFB5. A range of other archaeological inclusions are visible including sand tempered pottery (1 – 2%, 900µm – 2.5mm, daub fragments (1%, <800µm), mineralised coprolite fragments (1%, <400µm), bone fragments (2%, < 5mm) and ashy aggregates of black fragmentary charred plant material (2%, < 800µm). The sample from SFB5 contains notably more of this material, particularly the charcoal and demonstrates a weak orientation for some (around 30%) of the larger pieces, comprising around three parallel alignments of inclusions in the fabric related to the underlying interface with the natural. No such alignments are evident in the sample from SFB7 which is overlain by marl fragments in the uppermost part of the unit. Both deposits are bioturbated, with abundant mammilated excrement fabrics (10%), root channels (5-10%) and earthworm granules (2%, 350µm – 1.7mm). The fabric demonstrates some evidence for post-depositional disturbance with impure and dusty micritic translocated hypocoatings within voids (5%) and some voids partially infilled with this illuviated material (2%). Extensive evidence for fluctuating ground water is present in the form of redoxyhydromorphic nodules of iron and manganese (5%, <4mm) as well as extensive staining to the calcareous marl groundmass (10%).

Interpretation

The combination of occupation deposits and geological clasts overlying the base of both SFB cuts, demonstrates a process of infill of occupation deposits into the features, possibly during their use, followed by the erosion into the cut of a small amount of material from the surrounding geology, which followed this deposition. These occupation deposits in SFB5 demonstrate a weak but notable orientation indicating deposition on a surface rather than as part of a dumped fill; the presence of several such alignments points to a punctuated process of silting up in the cut. The inclusions are likely to relate to domestic processes and may derive from hearth sweepings and food processing waste. This material has been subject to considerable post-depositional alteration from bioturbation and translocations from movement of water and fine material down the profile.

SFB5 and SFB7 microstratigraphic unit 3

Description

The uppermost units in the samples for SFB5 and SFB7 comprise unorientated and unreferred material with a pronounced anthropogenic content typical of dumped material. The particle size of these deposits is sandy silt loam with a coarse/fine ratio of between 30/70 and 40/60. The unit contains clay-rich aggregates (5% < 2mm) and marl clasts from the underlying natural (5%, <2mm) with abundant intercalations of fine micritic groundmass (>10%). This material contains abundant anthropogenic inclusions and has a higher organic content (10 – 20%) than the underlying deposit. The fabric is heavily bioturbated, with mammilated excrement fabric from earthworm action (10%), root channels (30%) with root material still evident and earthworm granules (1 – 2% < 1.5mm). The fabric demonstrates evidence for post-depositional disturbance with impure and dusty micritic translocated hypocoatings within voids (5%) and some voids partially infilled with illuviated material (5%). Some of these coatings present evidence for layering and orientation around the voids from repeated episodes of inwashed deposition. Further evidence for fluctuating ground water is present in the form of redoxyhydromorphic nodules of iron and manganese (5%, <5mm) as well as extensive staining to the calcareous marl groundmass (10%).

Interpretation

A range of anthropogenic inclusions, including ashy aggregates (2%, <800µm), bone (1%, <1.5mm), charred wood (5%, < 1.2mm), daub (1%, <2mm), sand and flint tempered pottery (6%, 1-5mm) are present. The high proportion of unoriented and unreferred anthropogenic inclusions most likely represents intentionally dumped domestic waste materials into the SFB pits following the demolition or removal of the timber superstructures. This material has been subject to considerable post-depositional alteration from bioturbation and translocations from movement of water and fine material down the profile.

6.4 Interpretations

6.4.1 Evidence for building structure and fill composition

The micromorphological sequences from SFB5 and SFB7 both demonstrate clear parallels in stratigraphy and evidence for post-depositional processes relating to the Tayne Field settlement area. In both samples, the basal MSU1 represents the natural weathered chalk marl underlying the archaeology which is characterised by intrusive earthworm burrows or root channels and stained by iron translocation due to fluctuating water content. In both samples, the interface between this natural horizon (MSU1) and the primary infill (MSU2) comprised a sharp truncation from the SFB cut; no evidence was present for compaction from trampling or the presence of a sunken earthen floor or pit lining (e.g. Tipper, 2004: 64, 74) for either building. The sharp and irregular (unworn) interface between the fill and the cut observed for both building studied here corresponds to the prevalent view of these types of buildings as presenting no unambiguous evidence for earthen floor surfaces (Tipper, 2004: 92).

In both samples MSU2 comprises a mixture of anthropogenic and natural materials corresponding to primary infill. In the SFB5 (LYM12) sample an orientation is evident for some of the anthropogenic inclusions comprising two or three lines deposited parallel to each other and aligned to the base of the cut (Figure 69). These orientations are not compressed or associated with features such as horizontal bedding, laminar voids or evidence for puddling and slaking which could indicate that these surfaces constitute archaeological floors (Stoops *et al*., 2009; Courty *et al*., 1989); however the high degree of bioturbation in the lower part of the sequence would likely have removed such detail. This collectively suggests that this material may represent a deposit or feature contemporary to the lifespan of use of this building.

A process previously proposed as a contributing factor for similar basal deposits observed in sunken-featured buildings under experimental conditions (Tipper and Lucy, 2012: 165) has been occupation material falling through gaps in a timber floor suspended over the SFB pit. If this were the case at Lyminge, it would indicate both that the SFB structures incorporated suspended timber floors with activities occurring within these structures (or at least in SFB5) leading to the accumulation of small quantities of charred fuel and occupation debris across the base of the underlying pit. Despite experimental analogues however, this process has yet to be conclusively demonstrated in archaeological deposits (Tipper, 2004: 154) with comparable work on excavated

SFBs at Bloodmoor Hill by Milek (2009) instead suggesting that the observed microstructure of basal deposits in SFBs are simply the result of infill and post-depositional processes.

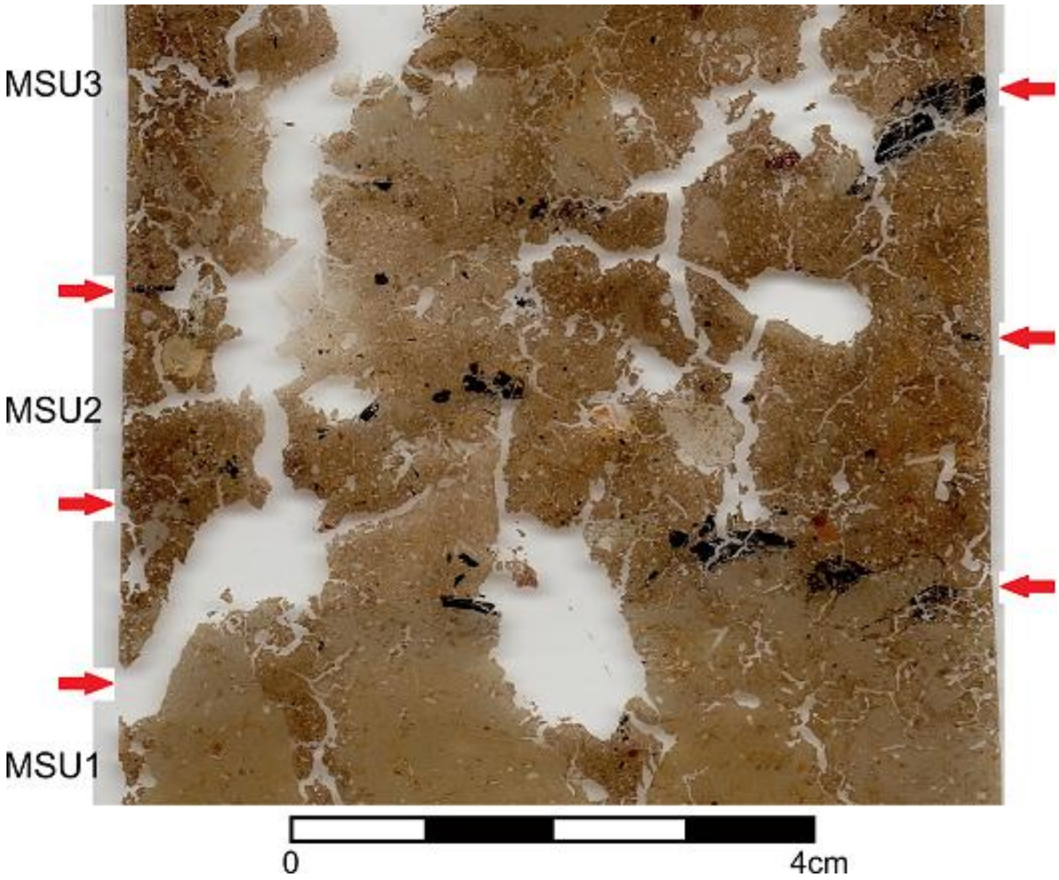


Figure 69: LYM12 sample mid section with microstratigraphic units indicated; arrows indicate end points for three weakly orientated parallel lines of anthropogenic inclusions

An alternative origin for these features could be periodic erosive infill of quantities of occupation deposits from around the pit edges, which could be suggested in both samples, most particularly in SFB7, by large clasts of chalk marl overlying and partially embedded within these MSU2 deposits. It is possible that some of these clasts represent weathered structural daub fragments deposited during demolition as was seen at West Heslerton (Macphail, 1996); however the lack of pseudomorphic voids or inclusions of plant or dung material does not support this interpretation. It is most probable that these fragments represent erosion of the sides of the cut either during the lifetime of use of the building, or during the demolition phase prior to the final infill. Experimental analogues at West Stow have demonstrated how a periodicity to this postulated erosion process can arise from variations in rates of weathering and stabilisation from vegetation regrowth which could demonstrably result in the kind of weakly orientated laminations observed here (Tipper, 2004: 105).

However in both of these samples, particularly for SFB7, the marl clasts are most prevalent at the top margin of the MSU, partially sealing the basal deposits. This suggests that a majority of the anthropogenic material was deposited prior to this period of erosion, suggesting their origin lies prior to any exposure of the pit base following demolition of the building.

The uppermost unit in each sample (MSU3) comprises anthropogenic and minerogenic material which is unsorted with unorientated inclusions including bone, charcoal and coprolite fragments and corresponds to anthropogenic infill following the demolition of the building structure. This material has been dated to 421-561 A.D. (OxA-31723, Table 1) for SFB5 (LYM12) and 392-537 A.D. (OxA-31961, Table 1) for SFB7 (LYM13) providing a consistent *terminus ante quem* for the end of life for both buildings. The fill is heavily bioturbated compared to the underlying sediments, as has previously been observed with organic fills which concentrate earthworm activity in SFB cuts on substrates with low organic content (French and Milek, 2012: 88). The composition, with notable quantities of hearth waste and coprolitic material, closely matches the anthropogenic fills encountered in SFBs from comparable sites on chalk such as West Heslerton (Macphail, 1996). This type of composition also matches that seen in SFBs at the Rectory Lane site at Lyminge where midden material from a range of primary sources represents a discrete closure event for the building, dated to 570-650 A.D. or later (SUERC-35927 (GU-24773), Table 1) (Maslin, 2015).

6.4.2 Site disturbance and post-depositional change

Previous models of SFB stratigraphy have variously postulated single, bipartite or tripartite infill derived from a range of anthropogenic and erosive processes (Tipper, 2004). The SFB fill samples from Tayne Field, although limited in extent, provide no evidence for anything other than single phases of dumping with limited exposure of the cut sides to erosion following demolition of the building structure. This trajectory is also seen in other SFB sequences at Rectory Lane (Maslin, 2015). These fills have all been extensively transformed by bioturbation, as demonstrated by burrow channels and an extensively mammilated excremental pedofabric created by long periods of earthworm action on the profile; additionally biocalcite granules produced by earthworms (Annelids) and slugs (Arionids) are encountered throughout (Courty *et al.*, 1989: 144). This type of extensive biological reworking of chalky material in the primary deposits of both of the SFBs is comparable to that observed by Macphail (1996) in the fills of similar structures at West Heslerton and is a typically dominant feature for these types of sequence in calcareous soils. Extensive root channels are also present in the upper parts of the fill, some (e.g. LYM13 MSU3) also containing mineralised and partly decayed root material from living or dead roots (Babel, 1975: 417).

Post-depositional geochemical change is demonstrated by neoformed iron nodules and redoxomorphic Fe/Mn oxyhydroxide mottling which were observed throughout both samples. These are known to be precipitated as a result of fluctuating oxidation conditions resulting from variations in soil water content and microbial action during post-depositional humification (Rapp and Hill, 2006: 99; Wilding and Lin, 2006). The sheer abundance of these features within these samples can be interpreted as further indication of high levels of organic content in the original fill (Stoops *et al.*, 2009: 30). Post-depositional transformation driven by water percolating down the profile has generated pedofeatures comprising dusty to impure hypocoatings and quasicoatings within voids (Figure 70a). Some of these coatings demonstrate partial sorting, layering, marked variations in iron staining and the inclusion of orientated bands of courser minerogenic and organic particles including fine broken down and redeposited black microcharcoal. The presence of partially collapsed void spaces demonstrating infill with these coatings suggests a range of possible post-depositional anthropogenic disturbance acting on the deposit (Courty *et al*, 1989: 156; O'Connor and Evans, 2005: 152). The coatings within root channels and earthworm burrows indicate synchronicity of bioturbation activity with these other kinds of disturbance - a combination of processes recorded in biologically active archaeological agricultural soils by Macphail *et al* (1990).

The morphology of these features is comparable to previous observations associated with agricultural disturbance and manuring on light and previously unploughed grassland soil (Courty *et al.*, 1989; Macphail *et al.*, 1990: 56). The various intercalated textural pedofeatures and soil aggregates within cracks in the underlying marl (Figure 70, b, c), are typical of profiles subjected to long periods of tillage and ploughing where mixing and movement of soil aggregates at the base of the plough zone has been recorded (Macphail *et al.*, 1990: 56). The depth of these samples however suggests processes occurring below the plough zone with translocation of clay and silt accumulating low in the profile in a manner more consistent with a combination of faunal agents and the effects of vegetation growing in the abandoned SFB. This degree of bioturbation will effectively remove the majority of textural pedofeatures relating to cultivation, unless they are rapidly sealed in archaeological contexts (Davidson, 2002). Consequently although the samples from Tayne Field contain a range of features comparable to those identified on chalk geologies with histories of cultivation (Limbrey, 1992: 56-57), the evidence for faunal agents and vegetation suggests that these features may simply demonstrate the action of post-depositional processes such as water percolation on an unconsolidated fill with a high level of biological activity.

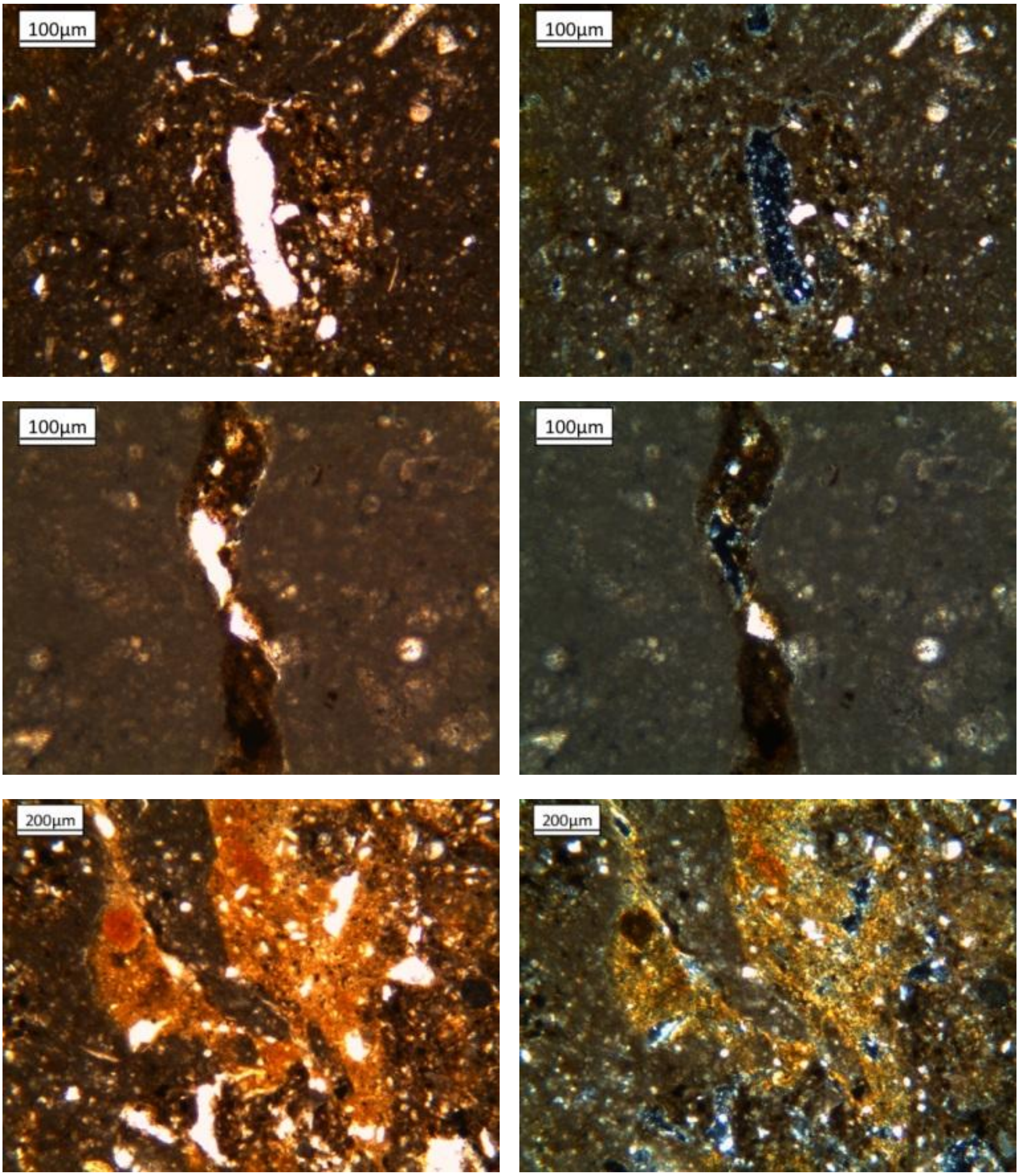


Figure 70: Textural pedofeatures possibly associated with agricultural disturbance and tillage: a-b) impure hypocoatings of translocated fine material around voids (SFB7, MSU2); c-d) crack in chalk marl partially infilled with translocated soil material (SFB5, MSU3); e-f) intercalations of clay within mixed sediment aggregates (SFB7, MSU3), all images in PPL (left) and XPL (right).

6.4.3 Evidence for ecology and economy

The biological materials revealed by these samples provide evidence for a palimpsest of on-site and catchment scale anthropogenic processes. Comparable evidence from sunken-featured buildings from Rectory Paddock can be found in Maslin (2015) which demonstrated coherent and single-phase depositional events comprising occupation material from a range of sources. The largest single anthropogenic component of the sediment within the Tayne Field sequences comprised charred plant and wood fragments in a range of sizes (Table 27) along with ashy aggregates. These were encountered within the occupation deposits in the upper portion of both samples (MSU2/3) strongly indicating that this material incorporates hearth sweepings containing fuel from domestic contexts. As Van-der-Veen (2007: 979, 987) has noted, this type of depositional pathway from everyday cleaning activity is typically the source of the majority of charcoal from archaeological contexts. The morphology of the majority of the fragments is highly carbonised and charred, as is typical from lower temperature (sub 500°C) combustion, with a well preserved cell structure lacking the distortion and disintegration typically observed from higher temperature (over 800°C) burning (Braadbaart and Poole, 2008: 2443; Matthews, 2010: 103). This morphology corresponds to a low degree of phosphorescence observable under UV for some of these fragments, similar to that interpreted as evidence of low-temperature fires at West Heslerton (Macphail, 1996). This collectively indicates an origin for this material in smaller domestic hearths rather than from larger kilns or furnaces.

The small size of most of the charcoal fragments indicates substantial reworking and break-up from trampling and raking (Goldberg and Berna, 2010: 61). Larger fragments in MSU2 of the SFB5 sample proved identifiable from pictorial references such as Schweingruber (1990); species present include *Corylus avelana* (hazel), *Fraxinus excelsior* (ash) and *Quercus robur* (oak). These observed taxa match those recorded in the charcoal assessment conducted on environmental samples from these SFB contexts (Austin, 2015). However the degree of fragmentation and a lack of identifiable sections make species assignation for the majority of observable fragments highly problematic (Matthews, 2010: 101). Studies have demonstrated that *Quercus* charcoal is most often over-represented in distributions of larger fragments due to its mechanical properties (Chrzazvez *et al.*, 2014) a factor which will affect the number of sections identifiable in micromorphological samples. It is therefore likely that the fuel woods being employed in the domestic contexts during the 5th/6th-century phase at Tayne Field may have more commonly comprised Hazel and Ash than oak. The prevalence of Hazel in particular raises the question of whether this fuel wood came from managed (coppiced) sources. Correlating evidence for the local growth of this taxa from the pollen and plant macrofossil record from the stream sequence (Chapter 5) indicates that this source may be in the immediate environment of the settlement, possibly near the stream channel.

Evidence for local land use and ecology was provided by fungal spores preserved in the fill. A fruiting body for a *Sporormiella* type fungus with ascii still in place and ascospores attached was encountered in the basal fill (MSU2) of SFB5. Species of this type are typically obligate coprophiles associated with herbivore dung and land used for grazing or keeping animals (Van Geel and Aptroot, 2006: 324). This deposition in fill material largely otherwise comprised of domestic waste implies the presence of grazing animals in and around the settlement core area, close to residential occupation structures. Similar spores were also extensively recorded in the NPP counts from the stream samples (Chapter 5) indicating a more widespread distribution of herbivore dung around the settlement area from manuring or grazing activities.

Chlamydospores of the endomycorrhizal soil fungus *Glomus* were also encountered in the basal fill of SFB5. This genus of arbuscular mycorrhizal fungi represents a vast range of types which live symbiotically on the roots of a majority of vascular plants and are undiagnostic with regards to specific vegetation communities (Schwarzott *et al.*, 2001). The presence of these fungal bodies here either indicates an autochthonous component of the post-depositional soil ecology at this location, or redeposited soil clasts from elsewhere around the site. This type was also present in the environmental samples from the stream sequence (Chapter 5) indicating likely site-wide representation of this type in the general environment.

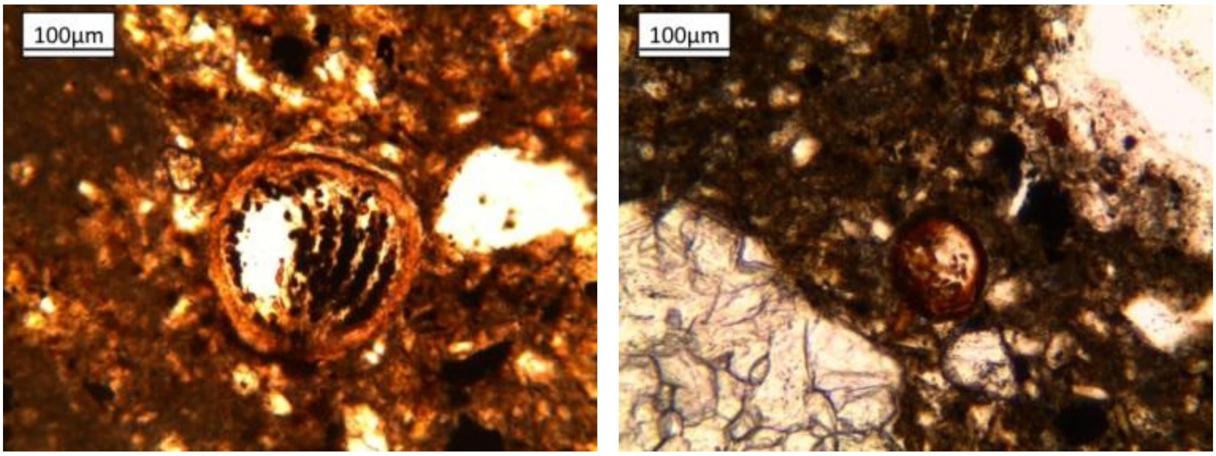


Figure 71: Fungal spores from Tayne Field samples from SFB5 primary fill (MSU2); a) cf. *Sporormiella* fruiting body, b) *Glomus* chlamydospore.

Phosphatic mineralised coprolite fragments were observed within the fill, some of which contain fragments of plant material which had been partially impregnated with iron. Under PPL these range in colour from light to dark brown and under XPL they demonstrate minimal birefringence; however they demonstrate a diagnostically high degree of fluorescence under UV light (Courty *et al*, 1989: 114) (Figure 72). The plant material inclusions includes dendritic husk/epidermal phytoliths of several sizes with narrower specimens of ~12µm in width broadly comparable in type to those for *Hordeum* (barley) and a wider example of ~25µm potentially representing *Triticum* (wheat)(Rapp *et al*., 1992: 135-136) (Figure 73). Several of these Phytoliths are preserved in contiguous distribution which indicates larger plant tissue fragments which have decayed *in situ* within the coprolitic material (Vrydaghs *et al*., 2015). The amorphous fine material and absence of linear fibrous structure or observable faecal spherulites suggested an omnivorous rather than herbivorous origin (Shillito *et al*., 2011: 1873) and is suggestive of dung from pigs fed on waste from cereal processing or human cess. The preservation of this material demonstrates the inclusion of significant quantities of cess or dung within the fill, potentially representing *in-situ* deposition from livestock housed in the structure. Alternatively it may simply represent redeposition from primary midden areas and the use of the hollow to dispose of such waste following demolition. In either case, the preservation demonstrated by this material necessitate periodic waterlogging along with a source of soluble phosphate such as dung and a source of soluble calcium such as lime (used to sterilise cess pits) or calcareous basal sediments (Green, 1979; McCobb *et al*., 2001).

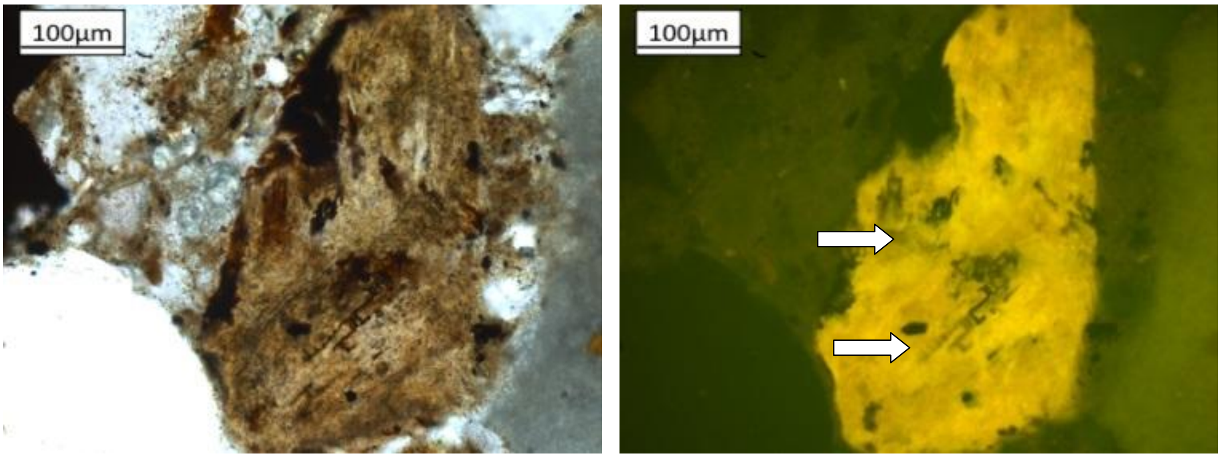


Figure 72: Coprolite fragment containing plant material and iron-stained phytoliths (indicated by arrows). SFB5 primary fill (MSU2): a) PPL, b) UV.

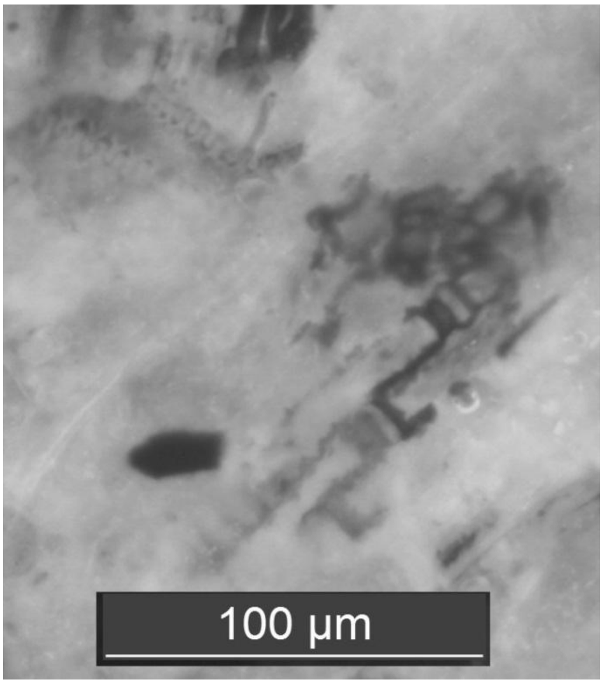


Figure 73: Detail of phytoliths in coprolite fragment from SFB5 primary fill (MSU2).

The distribution of phytoliths within this sequence is restricted to inclusions within coprolitic material and no comparable examples were observed within the general groundmass. With the exception of the waterlogged deposits (Chapter 5), all of the samples from Lyminge have lacked extensive preservation of Phytoliths. This is not necessarily surprising; previous studies have demonstrated partial or total dissolution of Phytoliths within sediments with a relatively alkaline pH (Weiner, 2010: 143; Cabanes *et al.*, 2011). The staining on the phytoliths remaining within the coprolitic material indicates diagenetic transformations and translocations of iron within the fluctuating geochemical microenvironments during the mineralisation process which were initially characterised by a very low-pH from remnant bile acids (Matthews, 2010: 103; Shillito *et al*, 2011: 1027). These observations match those from previous micromorphological work from the SFB sequences at Rectory Lane, which also demonstrated a limited distribution of Phytoliths in association with mineralised coprolitic fragments (Maslin, 2015).

Chapter 7 - The doline sequence on Tayne Field

This chapter discusses the evidence from the sequence excavated in the doline / solution hollow feature on Tayne Field, Lyminge which was analysed for evidence of use of space, economy and site formation processes, in accordance with the research objectives detailed in Section 1.5.3. This highly unusual feature lay at the heart of the oldest part of the Anglo-Saxon settlement site and contained a deep infill sequence of waste from industrial and occupation activities. Aligned to and slightly overlying the western edge of this feature was a substantial 6th century timber building. An earlier spatial association with the Bronze Age barrow on the site is also apparent. Within the text, reference is made to context numbers (fills are signified by round brackets, cuts by square brackets) and field interpretations of the excavators which are directly accessible via the project database at **www.iadb.co.uk/lyminge**.

7.1 Geology

The profile of this feature, determined from a coring survey in August 2015 (Figure 74) is steep and conical. This suggests that it comprises a natural solution hollow (a doline or sinkhole) rather than a periglacial feature (pingo) or anthropogenic excavation such as a quarry or dew pond. Dolines typically form as a consequence of dissolution or collapse of calcareous bedrock by percolation of water through fissures or as a result of the collapse of underlying karstic voids or evaporates from fluctuating groundwater levels (Huggett, 2011: 197-198). In valley floor areas such as at Lyminge with soft Grey Chalk basal geology such features are rare; typically dolines in the Kentish downs are associated with areas of Clay-with-Flints on the higher areas (Adams, 2008: 9). However they are known from similar geological contexts in the western part of the North Downs where they can originate as seasonally active spring outlet or bourne hollows created by fluctuating water tables and subsurface flow (Dr. Clive Edmonds, pers. comm., November 2015).

The formation of such features is dependent upon the existence of a hydrological mechanism to focus dissolution on soluble geological strata, such as groundwater moving through fissured geology to an outlet spring (Williams, 2003). The basal hydrogeology at Lyminge comprises a highly productive chalk aquifer (Chapter 12) with groundwater flow concentrated through fractures and discontinuities, as demonstrated by the presence of the spring. This differential concentration is potentially sufficient to have generated this type of feature; it may alternatively exist as a relic of a much earlier Holocene hydrological regime which has since become inactive.

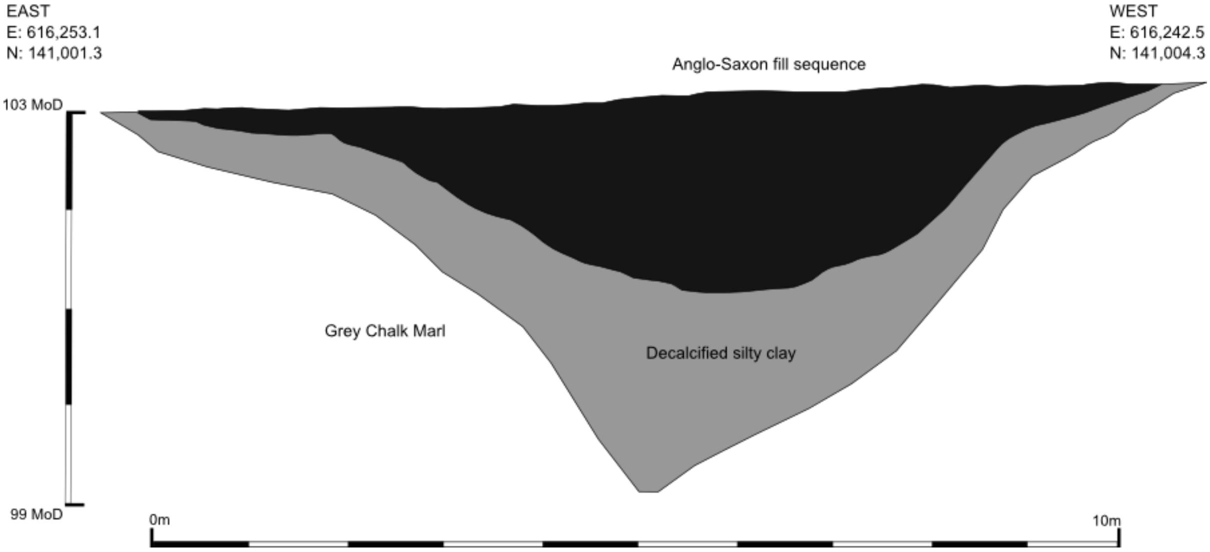


Figure 74: Schematic demonstrating the E-W profile of the suspected doline on Tayne Field

7.2 Archaeology

This feature upon excavation in 2014 comprised an ovoid (measuring 18m N-S by 12m E-W) depression ajacent to the Bronze Age barrow on Tayne Field (see Chapter 2). The lowest part of the excavated sequence within this feature comprised a deep (up to 2m) (Figure 74) deposit of fine-grained decalcified silty clay derived from eroded Grey Chalk marls, with a coarser component potentially derived from a mixture of inwashed head deposits, loessic silt or weathered clay-with-flints (Chapter 4) (Table 29). This was found to be largely archaeologically sterile aside from a small number of worked flints and prehistoric ceramics suggesting that the hollow was open and subject to erosive infill during the later prehistoric period (Thomas, 2017: 103; Thomas and Knox, 2015).

Overlaying this deep silty deposit was a distinctive flint spread (context (99275), Figure 76 and Figure 85) which was sealed by and partially incorporated occupation waste including a (possibly residual) late Roman animal bone fragment producing a radiocarbon date of 240-390AD (Beta – 389574, Table 1). The presence of this feature is comparable to some other examples of excavated doline sequences found elsewhere in the chalklands of East Kent containing prehistoric material (e.g. Halliwell and Parfitt 1993; Parfitt and Halliwell 1996) and northern France, some which have also been recorded with similar sequences of decalcified silt overlain by a flint spread or pavement (e.g. Rady, 2010: 168-169). Natural origins for such features could conceivably derive from eroded and inwashed Paleogene deposits such as clay-with-flints; in areas where such lithologies do not occur locally, suggestions of artificial construction by prehistoric communities to allow access for livestock to ponded water have been proposed. At Lyminge an artificial origin for this spread can be supported on the basis that the geology does not provide an origin for these stones in sediments within the immediate environs of the feature (Chapter 12). Further excavation during 2015 refined the definition of this feature into a 2m wide ramp running from the base of the feature to the northern edge at a constant gradient of 26° (Thomas, 2017: 103).

This pavement was overlain by a 2m deep sequence of burnt materials along with more typical domestic midden material forming a number of discrete episodes or cycles of dumping. The sequence incorporated interleaved *in situ* features interpreted as hearth bases and potential work surfaces (Figure 75) as well as large quantities of glass fragments and metalworking waste (Broadley 2017: 120; Thomas, 2017: 103; Thomas and Knox, 2015). Large quantities of charcoal potentially representing fuel woods for high temperature burning (*Quercus* (oak), *Fraxinus* (ash)) as well as a small quantity of charred cereal grain and associated weed seeds were recovered from samples taken from these burnt deposits (McKerracher, 2015; Austin, 2015). Diagnostic pottery and metalwork was also recovered, suggesting a timescale for deposition beginning in the 5th century, with an intense phase of deposition between 500-570 A.D. and completion of infill by the end of the 6th century (Thomas, 2017: 103). Additional dating evidence comprised a radiocarbon sample from a cattle skull within the lower part of the fill (context (99266), Figure 85) which produced a date of 405-537AD (OxA-31785, Table 1).

Figure 75: Hearth feature sampled by section <175> under excavation.

Figure 76: Basal silt sampled by section <178> and flint "pavement" under excavation

7.3 Sampling

A series of three micromorphology samples were taken from the sequence in 2014/2015 by the author in order to investigate significant points in the sequence potentially diagnostic of origin, usage and depositional history, specifically; an *in-situ* hearth base (sample 175, Figure 75), burnt deposits (sample 179) and the basal silt overlain by the flint pavement (sample 178, Figure 76). These blocks were extracted using metal c-section forms measuring 10cm per side (Figure 78). A series of monoliths were also taken by the author in order to provide complementary geochemical data (pXRF) for the main layers in the sequence (Figure 77); this specific process of laboratory data collection was undertaken at the University of Reading by Dr. Chris Speed.

As part of the broader on-site environmental sampling program during 2014, additional bulk samples were selected from various levels of the anthropogenic fill as well as from the basal silt associated with the lower horizon of the flint pavement (context (99275), Figure 77)). These samples were subject to on-site processing with the flot being subject to Mollusc analysis (Chapter 3) and botanical assessment by McKerracher (2015). Geochemical spot sampling locations for the monoliths (Figure 77) are detailed in Figure 79; numbering (Table 31) is in ascending order, base to top. Forty spot samples were taken in total, from locations within discrete areas corresponding to observed features and context bounds.

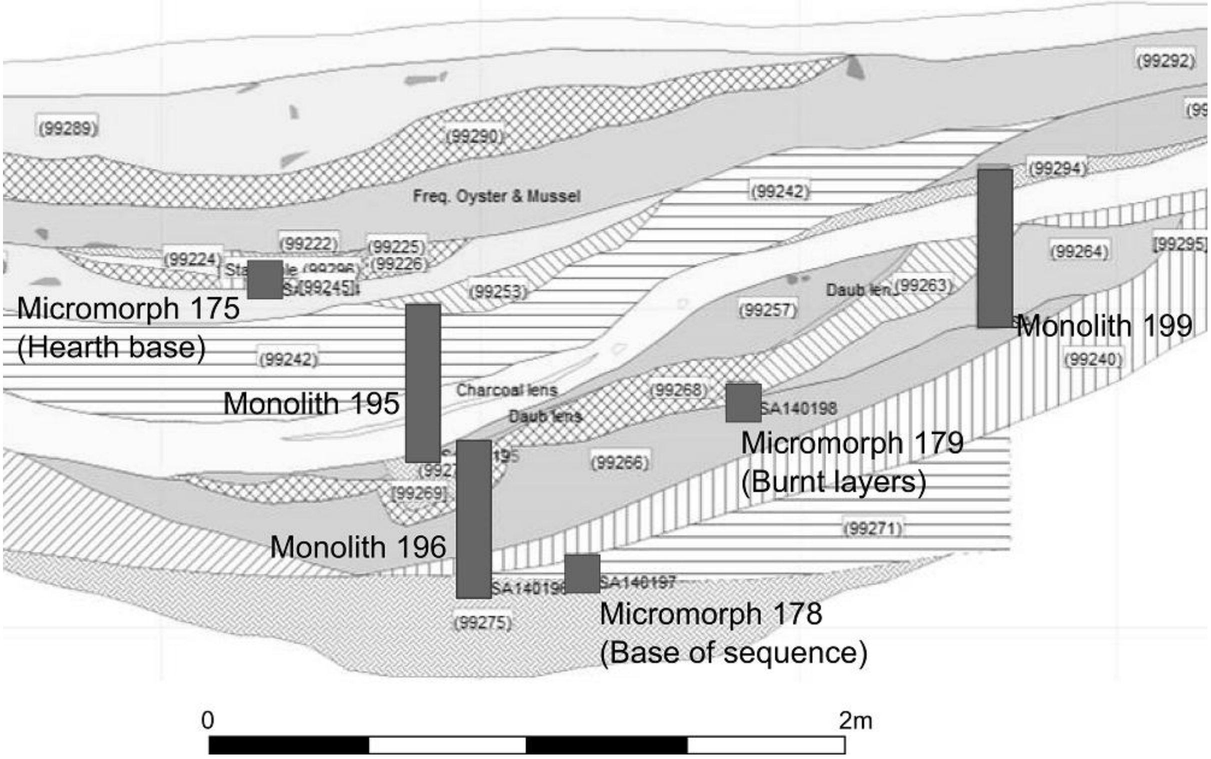


Figure 77: Locations of geochemical monolith and micromorphological samples taken from the north facing section with context numbers and stratigraphy.

Figure 78: North facing section showing sampling tins in place prior to extraction, August 2014

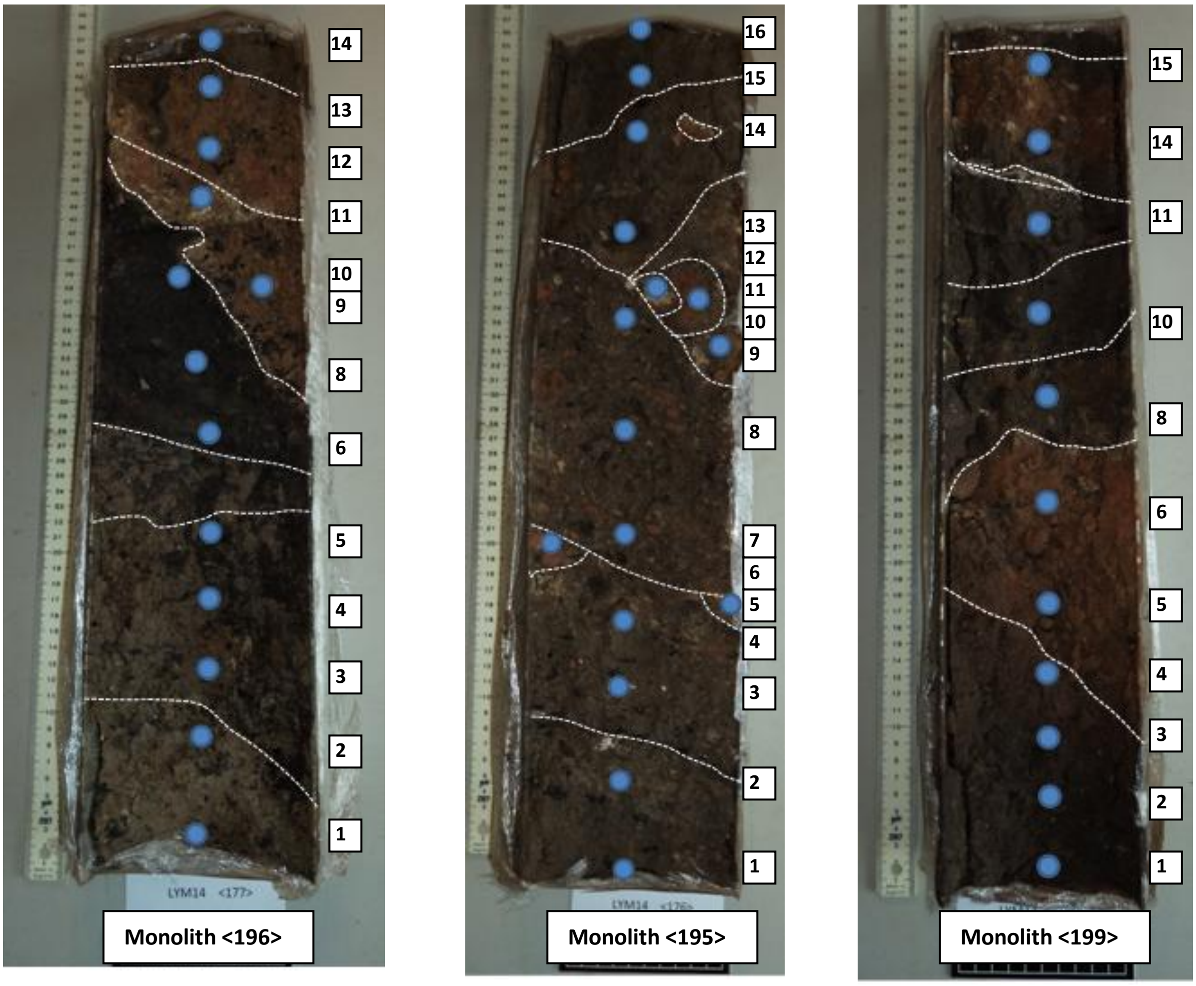


Figure 79: Geochemical sampling locations on monoliths (sample numbers as per Table 31). Source: Dr. Chris Speed, University of Reading

7.4 Micromorphology

7.4.1 Results

Micromorphological observations and counts are presented below; results are discussed in terms of types of deposit, inclusions, components, depositional processes and post-depositional alterations. Detailed interpretations of origin and taphonomic processes are presented in section 6.4. Slide overviews are presented in Figure 80 to Figure 82 with microstratigraphic unit (MSU) boundaries indicated in red. Frequencies for inclusions and textural pedofeatures for each MSU are presented in Table 29 to Table 30 (terminology follows Bullock *et al*., 1985; Stoops *et al*., 2009).

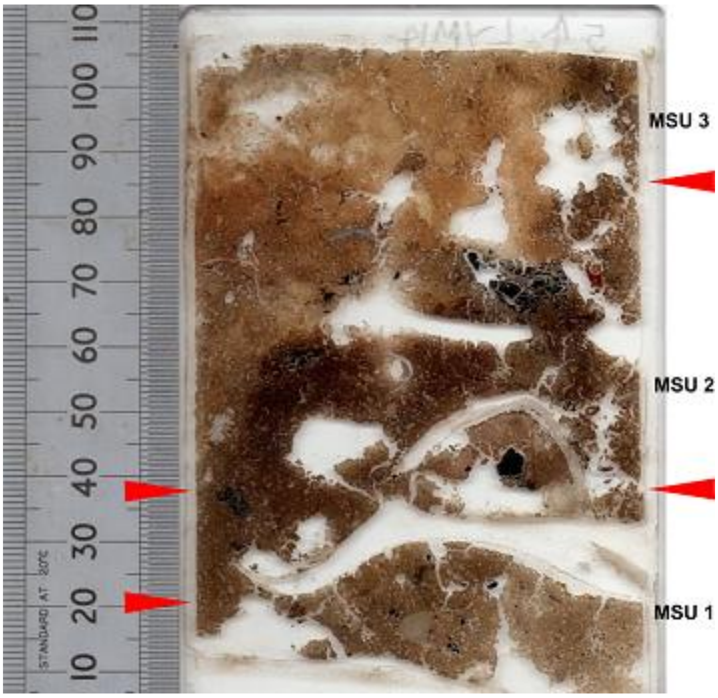


Figure 80: Overview for thin section from LYM14 sample <175> with microstratigraphic unit (MSU) boundaries marked.

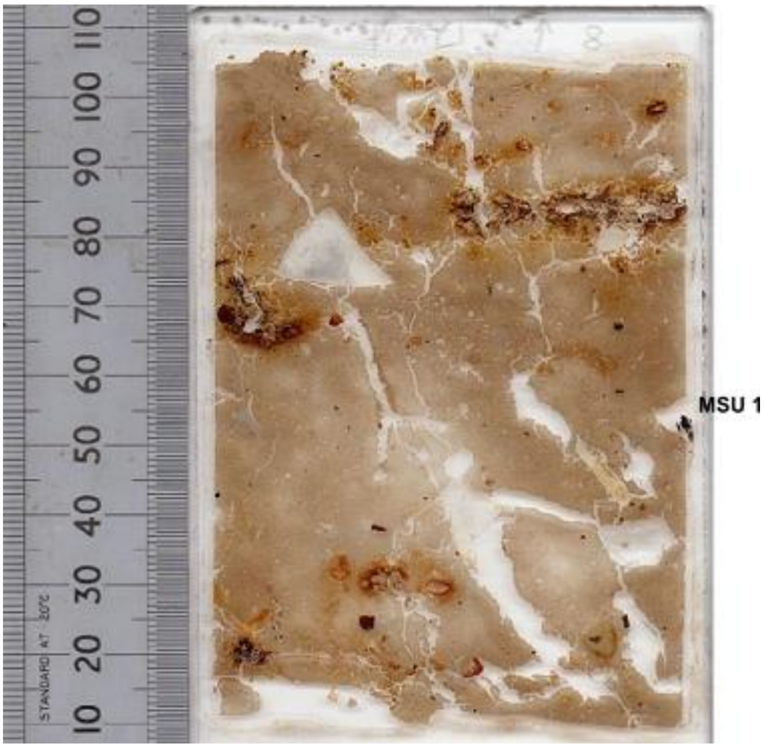


Figure 81: Overview for thin section from LYM14 sample <178> with microstratigraphic unit (MSU) boundaries marked.

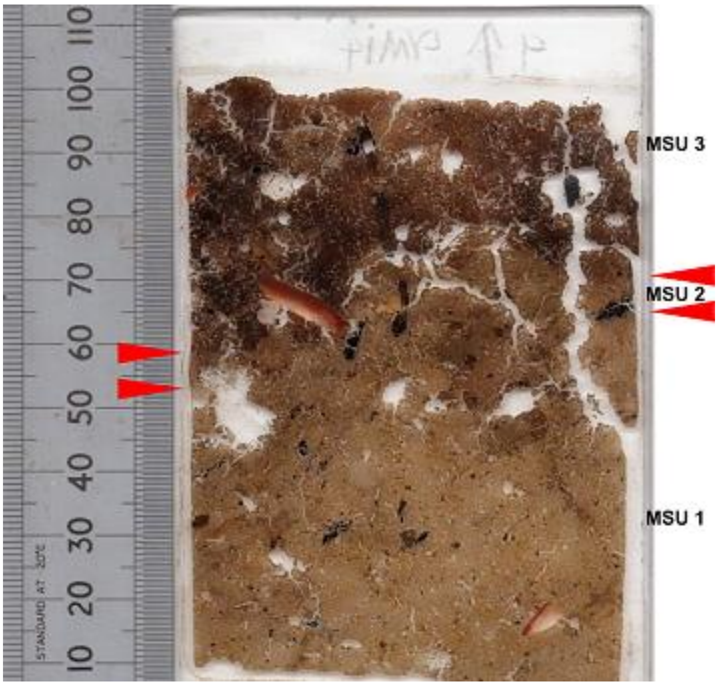


Figure 82: Overview for thin section from LYM14 sample <179> (burnt layers) with microstratigraphic unit (MSU) boundaries marked.

Table 29: Tayne Field doline / hollow sequence micromorphological counts and inclusions (terminology after Bullock *et al*, 1985)

Thin section no.		**LYM14 <175>**	**LYM14 <175>**	**LYM14 <175>**	**LYM14 <178>**	**LYM14 <179>**	**LYM14 <179>**	**LYM14 <179>**
Microstratigraphic unit no.		**MSU1**	**MSU2**	**MSU3**	**MSU1**	**MSU1**	**MSU2**	**MSU3**
Thickness (mm)		30	10-30	30-50	-	40-50	0-30	25-40
Context		Burnt deposits	Burnt deposits	Hearth base	Basal silt in hollow	Burnt deposits	Burnt deposits	Burnt deposits
Deposit type		Burnt deposits associated with hearth	Burnt deposits associated with hearth	Burnt calcareous silt	Calcareous silt	Burnt deposits and calcareous silt	Illuviated clay infill	Burnt deposits and calcareous silt
Boundary		N/A	Diffuse, irregular anthropic	Diffuse, irregular anthropic	N/A	N/A	Wavey and sharp natural	Wavey, irregular anthropic
c/f ratio (10µm limit)		30/70	25/75	20/80	15/85	30/70	10/90	30/70
Particle Size		Clay loam	Clay loam	Silty clay	Silty clay	Clay loam	Clay	Silty clay loam
Fine material		Speckled, microcrystalline; 10% organic, 90% inorganic	Speckled, microcrystalline; 15% organic, 85% inorganic	Speckled, microcrystalline; 5% organic, 95% inorganic	Stipple speckled, microcrystalline; 99% inorganic	Speckled, microcrystalline; 10% organic, 90% inorganic	Cloudy, microcrystalline; 5% organic, 95% inorganic	Speckled, microcrystalline; 10% organic, 90% inorganic
Related Distribution		Open porphyric	Open porphyric	Open porphyric	Open porphyric	Open porphyric	Open porphyric	Open porphyric
Sorting		Poorly sorted	Moderately sorted	Moderately sorted	Well sorted	Moderately sorted	Perfectly sorted with inclusions	Poorly sorted
Orientation and distribution of inclusions		Unorientated; random & unreferred	Unorientated; random & unreferred	Unorientated; random & unreferred	Unorientated; random & unreferred	Unorientated; random & unreferred	Unorientated; random & unreferred	Unorientated; random & unreferred
Rock fragments	Chalk	**	*	*	**	**	**	*
	Microcrystaline chert	-	*	**	**	*	*	*
	Burnt chert	-	-	**	-	*	-	**
	Sandstone	-	*	-	*	*	-	*
Minerals	Quartz	**	**	*	**	**	**	**
	Glauconite	-	-	-	-	*	*	-
	Calcite	*	**	*	**	*	-	*
Sediment Aggregates	Ash-rich aggregates	*	*	**	-	-	**	**
	Clay-rich aggregates	*	**	**	*	*	**	*
	Sandy aggregates	-	*	*	-	-	-	**
	Marl aggregates	-	**	-	-	-	-	*
	Iron Oxyhydrite	*	-	-	*	*	*	*
Micro-artefacts	Pottery	-	-	*	-	*	-	*
	Hammerscale	-	-	*	-	-	-	*
Bioarchaeological	Bone (unburnt)	-	*	*	*	*	-	*
	Partially burnt bone	-	-	-	-	-	-	*
Organic / Plant Remains	Charred Wood	**	**	*	-	**	**	**
	Charred Plant Tissue	-	*	-	-	-	-	-
	Fungal bodies	-	-	*	-	-	*	*
Inorganic remains of biological origin	Earthworm granules	*	*	*	*	-	-	*
	Mollusc shell	***	**	*	*	*	-	-
	Fossils	-	-	*	*	*	-	*

Key: ****** Very dominant >70%; ***** Dominant 50-70%; **** Common 30-50%; *** Frequent 15-30%; ** Few 5-15%; * Very few <5%

Table 30: Tayne Field doline / hollow sequence sample post-depositional and textural pedofeatures (terminology after Bullock *et al*, 1985)

Thin section no.	**LYM14 <175>**	**LYM14 <175>**	**LYM14 <175>**	**LYM14 <178>**	**LYM14 <179>**	**LYM14 <179>**	**LYM14 <179>**
Microstratigraphic unit no.	**MSU1**	**MSU2**	**MSU3**	**MSU1**	**MSU1**	**MSU2**	**MSU3**
Microstructure	Spongy: 40% voids	Spongy: 40% voids	Vughy: 25% voids	Massive / prismatic with planes: 10-20% voids	Vughy with vesicles: 30% voids	Planar cracks and vesicles: 40% voids	Spongy: 30% voids
Intercalated textural pedofeatures	+++	++	-	++++	++	-	-
Earthworm burrows & exc. fabric	-	-	-	-	-	-	+
Infilled burrows	+	-	-	-	++	++	++
Partially collapsed and infilled voids	+++	-	++	-	+++	+++++	+++
Calcitic pedofeatures	-	-	+	-	-	+++	+
Impure clay / silt hypocoatings & coatings	++	++	++	++	+++	+++++	+++
Laminated clay coatings and crusts	+	+	+	+	++	+++++	++
Redoxomorphic Fe/Mn staining	-	+++	-	+++	-	-	-
Secondary iron nodules / crystals / domains	++	++	++	++++	++	-	++

Key: +++++ Very abundant >20%; ++++ Abundant 10-20%; +++ Many 5-10%; ++ Occasional 2-5%; + Rare <2%

7.4.2 Deposit descriptions

The three sections taken from the sequence are described below in terms of their general characteristics and basic interpretation. Sections are described in order, from the lowest to the uppermost in the sequence.

Section <178> (basal silt)

Description- microstratigraphic unit 1

This section, the lowest in the sequence, corresponds to excavation context (99275) and comprises a contiguous deposit of weathered calcareous silt with no visible boundaries; consequently it is interpreted as a single unit, despite field identification of two separate contexts ((99271) and (99275)) across the location covered by this section. The deposit comprises a massive to prismatic well sorted microstructure of fine calcareous silt (c/f ratio 15/85) with very low organic content (<5%), punctuated by occasional voids (20%) and intercalated textural pedofeatures of fine clay which notably increase in frequency in the upper part of the sequence (ranging from around 5% in the lower 60% of the section to a maximum of 20% in the upper 40%). Geological inclusions comprise rounded to sub-angular chalk (10%, < 5mm) and minerals such as quartz (10 %, < 200µm to

2.5mm). Potential anthropogenic materials are limited to a few sub angular bone fragments (1%, 500µm to 3mm). The dominant post-depositional features within this section consist of prominent neoformed ferruginous domains comprising fibrous, amorphous and radial crystalline structures of iron minerals (suspected to include neoformed goethite, pyrite and possibly siderite) indicating waterlogging. These domains demonstrate some degree of post-formational fragmentation. Additional evidence for prolonged exposure to water saturation is present in the form of redoxyhydromorphic nodules of iron and manganese (2%, <150µm) as well as ferric hypocoatings around voids (2%) and staining to the groundmass (10%). Evidence for illuviation consists of translocated impure clay coatings and hypocoatings within voids (5%) and a laminated clay micropan which had been partially broken up by a later period of disturbance.

Interpretation

This section contains almost no anthropogenic materials and likely pre-dates the entire occupation sequence at this location. The material is almost entirely of natural origin, either from inwashed sediments or *in-situ* weathering of the parent material (Grey Chalk marls). The post-depositional features indicate prolonged exposure to water which has caused translocation and diagenetic precipitation of a range of iron minerals. These ferric domains have subsequently been coating by illuviated clays and disrupted by mechanical disturbance which has also partially disrupted some of the illuviated clay features.

Section <179> (burnt layers)

Description - microstratigraphic unit 1

The lowest unit in section <179> corresponds to the burnt layer in excavation context (99266) and comprises moderately sorted calcareous silt (c/f ratio 30/70) with 10% organic content and a vughy microstructure and vesicles (30% voids). The inclusions are largely geological such as quartz (15%, up to 3 mm), chalk (5%, up to 5 mm) and sandstone clasts (ca 3%, up to 6 mm). Anthropogenic inclusions comprise infrequent pottery fragments (1%, 5mm) and bone fragments (1%, up to 1 mm) as well as burnt materials such as charcoal (5%, up to 6 mm; 2 fragments cf. *Quercus*) and burnt microcrystalline chert/flint (1%, up to 1 cm). The fabric demonstrates evidence for repeated and prolonged post-depositional illuviation with impure clay coatings and hypocoatings within and around voids (5%), convoluted laminated impure clay crusts and coatings within and associated with voids (2%) and partially infilled voids (5%). Further evidence for fluctuating ground water is present in the form of redoxyhydromorphic nodules of iron and manganese (5%, <5mm).

Description - microstratigraphic unit 2

The second unit in section <179> comprises an extensive domain of illuviated impure clay pedofeatures with embedded inclusions such as Quartz (5%, up to 250 µm) chalk (5%, up to 5 mm) as well as sediment aggregates from the overlying and underlying units (15%). The well sorted clay groundmass (c/f ratio 10/90) has a low organic content (5%) and a microstructure of planar cracks and vesicles (40% voids) comprising partially collapsed voids and extensive areas of both impure (35%) and laminated infill (25%, parallel to convolute laminations (c 250µm) referred to aggregates and inclusions). Calcitic neoformed pedofeatures (10%, 1cm by 100 µm) are associated with and orientated parallel to these laminations. Bands of silt are also present in laminations throughout, demonstrating periodic changes to a higher depositional energy. Anthropogenic inclusions are limited to a few fragments of charcoal (5%, up to 0.5 mm). Extensive evidence for bioturbation is present from vermiform burrows with crescentic infill (5%, 5mm) and burrows infilled with dark brown to black fill and various inclusions (2%, 8 mm by 2 mm). These burrows are themselves disrupted by redeposited sediment aggregates and impure clay illuviation features demonstrating a complex palimpsest of post-depositional disturbance.

Description - microstratigraphic unit 3

The uppermost unit in section <179> corresponds to excavation context (99268) identified in section as charcoal layer, and comprises a deposit consisting of poorly sorted calcareous silty clay loam with a spongy microstructure (30% voids), a c/f ratio of 30/70 and an organic content of around 10%. The dark colour is suggestive of heating / burning which is supported by frequent fragmentary charcoal (10%, up to 4.5 mm) with fragments attributable to the Betulaceae family cf. *Alnus* (alder). Other charred anthropogenic materials comprise unburnt or partially burnt bone (ca 1%, up to 500µm), burnt microcrystalline chert/flint (5%, up to 2 cm) and ashy aggregates of black fragmentary charred plant material (10%, up to 4 mm) as well as fragments of pottery (1%, 1mm) and infrequent hammerscale (<1%, 800 µm) are evident, far more so than in the underlying units of the section. Inclusions from the natural geology are also frequent, including chalk (2%, up to 3 mm), quartz (10%, up to 2 mm), calcite (1%, up to 800µm) and sandstone clasts (2%, up to 0.5 mm). The fabric demonstrates evidence for repeated and prolonged post-depositional illuviation and diagenesis with impure clay coatings and hypocoatings within and around voids and inclusions (10%), weakly laminated clay crusts and coatings within and associated with voids (5%) some of which contain compound calcitic pedofeatures (2%, up to 600µm). Extensive evidence for bioturbation is present in burrows containing microfaunal excrements (2%) and burrows infilled with dark brown to black fill and various inclusions (5%, 3 cm by 2.5mm). These burrows are themselves disrupted by redeposited sediment aggregates and impure clay illuviation features demonstrating a complex palimpsest of post-depositional disturbance.

Interpretation

This section comprises a largely anthropogenic deposit of dumped burnt material overlying calcareous sediments which may have been largely inwashed. The anthropogenic component lacks evidence of domestic refuse such as bone and also contains indications of metalworking residue, suggesting an origin in pyrotechnological craft activities such as metalworking. An extensive illuviated pedofeatures identified as MSU2, demonstrates pronounced episodes of downwashing of clays from higher in the sequence post deposition which is also reflected by illuviated clay infills and crusts in both MSU1 and MSU3. This inwashing is likely the result of destabilisation following the chemical degradation of ash and other anthropogenic materials along with ground water percolation and prolonged periods of mechanical disturbance from human activity. Following this downwashing, deposition of compound calcitic pedofeatures within the illuviated clay structures demonstrates ongoing diagenetic processes within the deposit.

Section <175> (hearth base)

Description - microstratigraphic unit 1

The lowest unit in section <175> corresponds to the excavation context (99226) which underlay the hearth base and comprises a deposit consisting of poorly sorted calcareous silty clay loam with a spongy microstructure (40% voids), a c/f ratio of 30/70 and an organic content of around 10%. Geological inclusions comprise quartz (10%, up to 0.5 mm) and chalk (10%, up to 6mm). The anthropogenic component is strongly indicative of burning, with charcoal (5%, up to 2 mm; 2 fragments cf. *Quercus*), ashy aggregates of black fragmentary charred plant material in silty clay (2%, up to 1 mm) and burnt clay aggregates (as MSU 2 fabric) (ca 5%, up to 4 mm). The fabric demonstrates evidence for repeated and prolonged post-depositional illuviation with impure clay coatings and hypocoatings within and around voids (5%), laminated impure clay crusts and coatings within and associated with voids (2%) and partially infilled voids with laminated and impure clay infilling (10%). Bioturbation is indicated by burrows infilled with dark brown to black fill and various inclusions (2%, up to 0.5cm). Further evidence for fluctuating ground water is present in the form of redoxyhydromorphic nodules of iron and manganese (5%, up to 0.5 mm).

Description - microstratigraphic unit 2

The second unit in section <175> corresponds to the layer in excavation context (99226) which underlay the hearth base and comprises a deposit consisting of moderately sorted calcareous silty clay loam with a spongy microstructure (40% voids), a c/f ratio of 25/75 and an organic content of around 15%. Geological inclusions comprise quartz (ca 10%, up to 2 mm), sandstone clasts (ca 2%, up to 2mm) and chalk (5%, up to 3mm). The anthropogenic component comprises bone fragments (2%, 4 mm) and material strongly indicative of burning, with charcoal (15%, up to 1.5 cm; 2 fragments cf: *Corylus,* 2 fragments cf. *Quercus*, 1 fragment cf. *Alnus*) and frequent burnt clay aggregates (15%, up to 0.5cm). The fabric demonstrates evidence for repeated and prolonged post-depositional illuviation with impure clay coatings and hypocoatings within and around voids (5%), laminated impure clay crusts and coatings within and associated with voids (2%) and Intercalated clay textural pedofeatures within groundmass (ca 2%). Further evidence for fluctuating ground water is present in the form of redoxyhydromorphic nodules of iron and manganese (ca 5%, up to 1.5 mm).

Description - microstratigraphic unit 3

The uppermost unit in section <175> corresponds to the excavation context (99225) which was identified as a hearth base. The fabric comprises moderately well sorted calcareous silt (c/f ratio 20/80) which has a low organic content (5%) a vughy microstructure (25% voids) and a red-brown colour suggestive of *in-situ* exposure to heat. Geological inclusions comprise quartz (ca 2%, up to 3 mm), calcite (2%, up to 3 mm) and chalk (2%, up to 3mm). The anthropogenic component comprises bone fragments (<2%, 0.8 mm), hammerscale (round droplet, 0.4mm) pottery (<1%, 1mm) and material strongly indicative of burning, with charred plant materials and fragmentary charcoal (2%, up to 1mm), burnt microcrystalline chert/flint (5%, up to 3 mm and frequent aggregates of ashy material (ca 10%, up to 1cm) and burnt clay (ca 10%, up to 0.5cm). The fabric demonstrates evidence for repeated and prolonged post-depositional illuviation and diagenisis with impure clay coatings and hypocoatings within and around voids (5%), laminated impure clay crusts and coatings within and associated with voids (2%) some of which contain compound calcitic pedofeatures (1%, up to 2mm) and partially infilled voids with laminated and impure clay infilling (5%). Further evidence for fluctuating ground water is present in the form of redoxyhydromorphic nodules of iron and manganese (ca 5%, up to 1 mm).

Interpretation

This section comprises an archaeologically identified hearth base and underlying anthropogenic deposits of dumped burnt material. The fabric is heavily rubified with extensive burnt clay and ashy aggregates which do not demonstrate disruption or redeposition suggesting *in-situ* heating. The anthropogenic component contains tentative indications of metalworking residue, suggesting an origin in pyrotechnological craft activities such as metalworking; however pottery and bone fragments also indicate a domestic component. Clay coatings within voids demonstrate downwashing of clays from higher in the sequence, likely destabilised by the chemical degradation of ash and other anthropogenic materials followed by prolonged periods of disturbance from human activity. Following this downwashing, deposition of compound calcitic pedofeatures within the illuviated clay structures demonstrates ongoing diagenetic processes within the deposit.

7.4.3 Micromorphological interpretation

The samples comprised weathered calcareous silty clays (section <178>) overlain by a deep fill sequence of burnt anthropogenic materials (section <179>) and in-situ pyrotechnological features (sections <175>) (Figure 75). The scope of this sampling (section 7.3) did not investigate the composition of the uppermost layers (overlying sample <175>) which were interpreted as dumps of 6th-century domestic waste by the excavators (Thomas and Knox, 2015: 7).

In contrast to the overlying sequence, the basal sediments underlying the midden sequence within the doline / hollow on Tayne Field (<178>) (Figure 76) contain almost no material with potential anthropogenic origins aside from a few bone splinters. The sediment is likely derived from natural processes, consisting of decomposed calcareous marls with a possible component of loess or other weathered Tertiary sediments such as Clay-with-flints on the basis of wider evidence (Chapter 4) which have been inwashed and heavily weathered. The fabric demonstrates extensive iron depletion to the groundmass from long periods of leaching and extensive formations of diagenetic ferruginous domains (Figure 84f), concentric impregnated ferruginous nodules, sesquioxide hypocoatings and groundmass staining from the mobilisation of iron compounds by fluctuating ground water and seasonal waterlogging. The absence of Manganese nodules demonstrates that this waterlogging was never more than temporary (Stoops *et al.*, 2009: 30). The presence of Illuviated clay crusts and coatings, particularly around the voids within the ferruginous domains, indicates downwashing of fines, likely of similar type to that encountered higher up the sequence. Disruption to these crusts and ferruginous domains (Figure 84a-b) suggests later phases of physical disturbance; however the almost total lack of anthropogenic inclusions demonstrates that this sediment never comprised an exposed surface into which occupation material or sediment aggregates were trodden and thus likely dates to a period where there was no significant local occupation activity.

The samples representing material from the overlying anthropogenic sequence (<175> and <179>) demonstrate clear parallels in terms of origins and post-depositional histories of diagenetic and physical change indicating a prolonged timescale of deposition with repeated cycles of burning and dumping. The section taken from the hearth feature (<175>) comprises sediments correlating to the clay base of the feature (Figure 75) with underlying burnt sediments relating to earlier fires. The extensive rubification of the sediments from the hearth base (<175>, MSU3) and the burnt deposits in sections <175> (MSU1, MSU2) and <179> (MSU3) derive from iron oxide transformations likely due to heat from fires hotter than those typically used for domestic purposes (> 500°c) on iron bearing clay substrates (Canti and Linford, 2000). In the case of the hearth base itself, this heating occurred *in situ* as demonstrated by the undisrupted nature of the sediment in the corresponding sample unit (<175> MSU3). No remaining structural evidence was associated with this feature (Thomas and Knox, 2015) (Figure 75), consequently it may represent the base of a kiln which was dismantled after firing or simply an open bonfire.

The friable, powdery and largely disintegrated charcoal recorded throughout these two sections demonstrate higher temperature burning characteristic of industrial rather than domestic fires (Braadbaart and Poole, 2008: 2443). This fragmentary charcoal is dispersed throughout the fill units suggesting processes of oxidation and movement by soil fauna well demonstrated under experimental conditions (French and Milek, 2012: 88) which indicate representation of a small fraction of the original component. Taxonomic identification of such fragmentary remains is problematic; however fragments of *Quercus* (oak), *Corylus* (hazel) and cf. *Alnus* (alder) are visible in the layers associated with a hearth base in <175> with *Quercus* (oak) and *Alnus* (alder) identifiable in the separate burnt deposits from <179> (Figure 83a). The domination of *Corylus* and *Quercus* in these fuel ashes is paralleled in the charcoal assessment from this sequence (Austin, 2015) and may represent selection of Hazel / Alder roundwood for kindling with denser logs of oak and ash providing the heat for pyrotechnical processes. This selection is matched by charcoal assemblages at Iron Age and Romano-British ironworking sites in Kent (Alldritt, 2006a: 5; Alldritt, 2006b: 6) and has been more widely observed at early metalworking sites in England by Tylecote (1986).

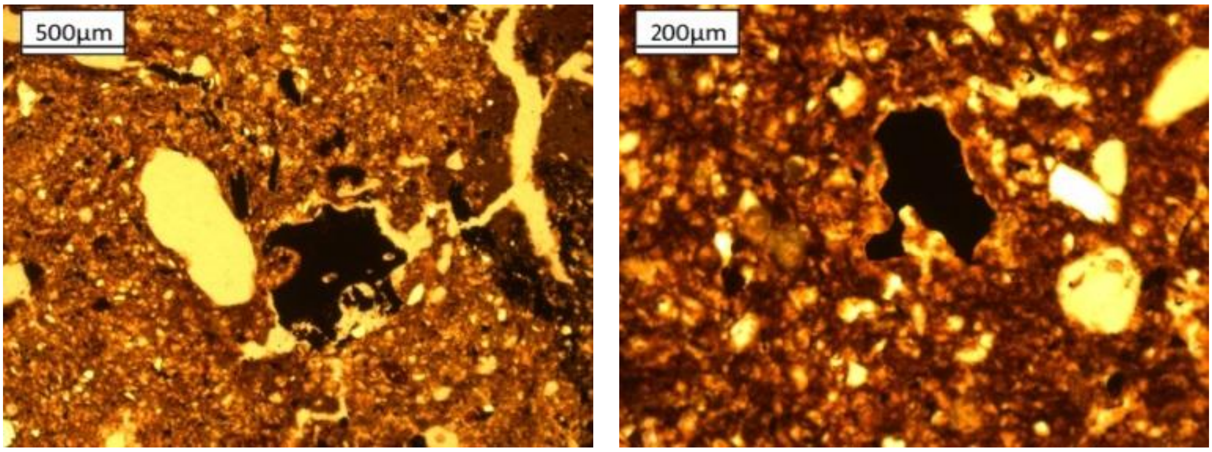


Figure 83: Microartefact evidence of pyrotechnology from the doline / hollow fill sequence: a) fragmentary oak charcoal and burnt material <179> MSU3; b) microslag or hammerscale fragment <179> MSU3. All images in PPL.

The very abundant clay pedofeatures encountered in sections <175> (hearth base) and <179> (burnt layers) demonstrate extensive post-depositional clay translocation. This is seen most apparently in <179> MSU2 where well sorted and impure clay pedofeatures are punctuated by coarser bands of silt and redeposited calcite demonstrating a range of depositional processes from low-energy illuviation (clay bands) to higher energy illuviation (silt bands) as well as decalcification and precipitation (calcite laminations) (Stoops *et al.*, 2009) (Figure 84c-e). These demonstrate substantial water movement, suggesting rainwater runoff funnelling down the interior slope of the open hollow. These clay pedofeatures are comparable to those recorded in other studies where a high pH depositional environment caused by extensive ash deposits has caused extensive disaggregation and translocation of clays as well as decomposition of charcoal (Huisman *et al.*, 2012) and which here has also led to extensive post-depositional iron staining to the sediment from dissolution and precipitation of iron hydroxides (Huisman *et al.*, 2012: 999). The lack of directly observable ash in any form other than microcharcoal within clay-rich aggregates also suggests disaggregation and breakup of the structure of the deposit due to the dissolution of silica in the calcareous and alkaline depositional environment (Weiner, 2010: 172-173). The presence of calcitic lenses within the laminated illuviated clay domains also indicates decalcification of the calcitic ash component and redeposition of this motile calcite by groundwater (Stoops *et al.*, 2009: 31).

Extensive post-depositional disturbance is demonstrated within the burnt deposits by burrows infilled with darker burnt material downwashed from overlying units (Figure 84e). These burrows and illuviated clay pedofeatures, particularly within the dumped deposits sampled in section <179> and the lowest portion of <175> (underlying the hearth base), also demonstrate disruption from later periods of mechanical disturbance which has caused dislocation of sediment aggregates and coatings from downwashed fine material. This effectively creates a palimpsest of post-depositional features attesting to a prolonged period of post-depositional disturbance from bioturbation and trampling on these layers of dumped burnt material. These units contrast notably with the hearth base layer sampled in <175> (MSU3) where little evidence for physical disruption or bioturbation was demonstrated. This contrast between disrupted and reworked dumped / trampled deposits with interleaved layers of homogenous rubified silt from *in-situ* burning suggests a pattern of repeated discrete burning events being followed by ash rakeout and trampling.

Micromorphological evidence for metalworking within this sequence is restricted to isolated occurrences of vesicular microslag (Figure 83b) and hammerscale (Macphail *et al*., 2016). This contrasts markedly to experimental analogues which have demonstrated that occupation deposits relating to metalworking areas can be expected to contain proportions of slag and metalworking residues of up to 15-30% (Banerjea *et al*., 2015: 98). Comparable sequences from West Heslerton additionally demonstrate pronounced compositional differences between waste from different types of process, with deposits produced by ironworking containing large quantities of metalworking residues, in contrast to those produced by processes such as malting which simply comprised rubified sediments and ash (Macphail, 1996). At Lyminge, the large amount of ironworking slag recovered at various levels during excavation of this feature (Thomas and Knox, 2015: 7) demonstrates intense iron smelting activity; however the micromorphology suggests that the deposits specifically analysed here may not represent bloomery or smithing. Other associated processes such as ore roasting in open fires prior to smelting (Harrington and Welch, 2014: 106-107), could perhaps better explain high-temperature hearths lacking microscopic metalworking residues. These interpretations are also supported by the presence of sandstone clasts and iron-rich sandy aggregates, particularly within the dumped burnt deposits (<179> MSU3), which may represent degraded remnants of the type of low-quality ores from local Greensand deposits known to have been utilised at other early ironworking sites in Kent (Spurrell, 1883: 292; Bradshaw, 1970: 179-180).

The recovery of abundant glass fragments (Broadley, 2017: 120; Thomas and Knox, 2015: 10) alongside a small quantity of glass manufacturing residues (ingot, moil and melted waste) from this sequence suggests an alternative origin for some of these deposits in glass making or working (Broadley, 2017: 123). The process of glass manufacture from ground “frit” (pre-mixed and fused raw glass) requires temperatures of 750-800°C followed by short periods of final melting at over 1000°C (Powell, 2009: 127; Davison, 1989: 82). This is consistent with the friable and degraded morphology of much of the surviving charcoal. Glass production is a process associated archaeologically with small, albeit variable, amounts of waste due to extensive recycling and the rapid break-up of frit through post-depositional action; additionally it produces substantial quantities of ash (Powell, 2009: 132). At Lyminge the degredation of ash within the sequence has resulted in this latter becoming invisible to conventional excavation.

The lowest microstratigraphic unit in the burnt layer sampled by <179> (MSU1) comprised material with a largely geological origin. This represents a possible hiatus in the deposition of the fill allowing erosion and accumulation within the hollow prior to the deposition of the burnt waste represented by MSU3. The interface with the overlying deposit is characterised by a broken and disrupted surface containing frequent clay aggregates which may represent material being carried onto and trampled into the deposit. This suggests a period of activity on the ground surface created by the dumped material and demonstrates a prolonged depositional chronology to this sequence, with repeated cycles of burning, ash rake-out, trampling and hiatuses allowing erosional accumulations.

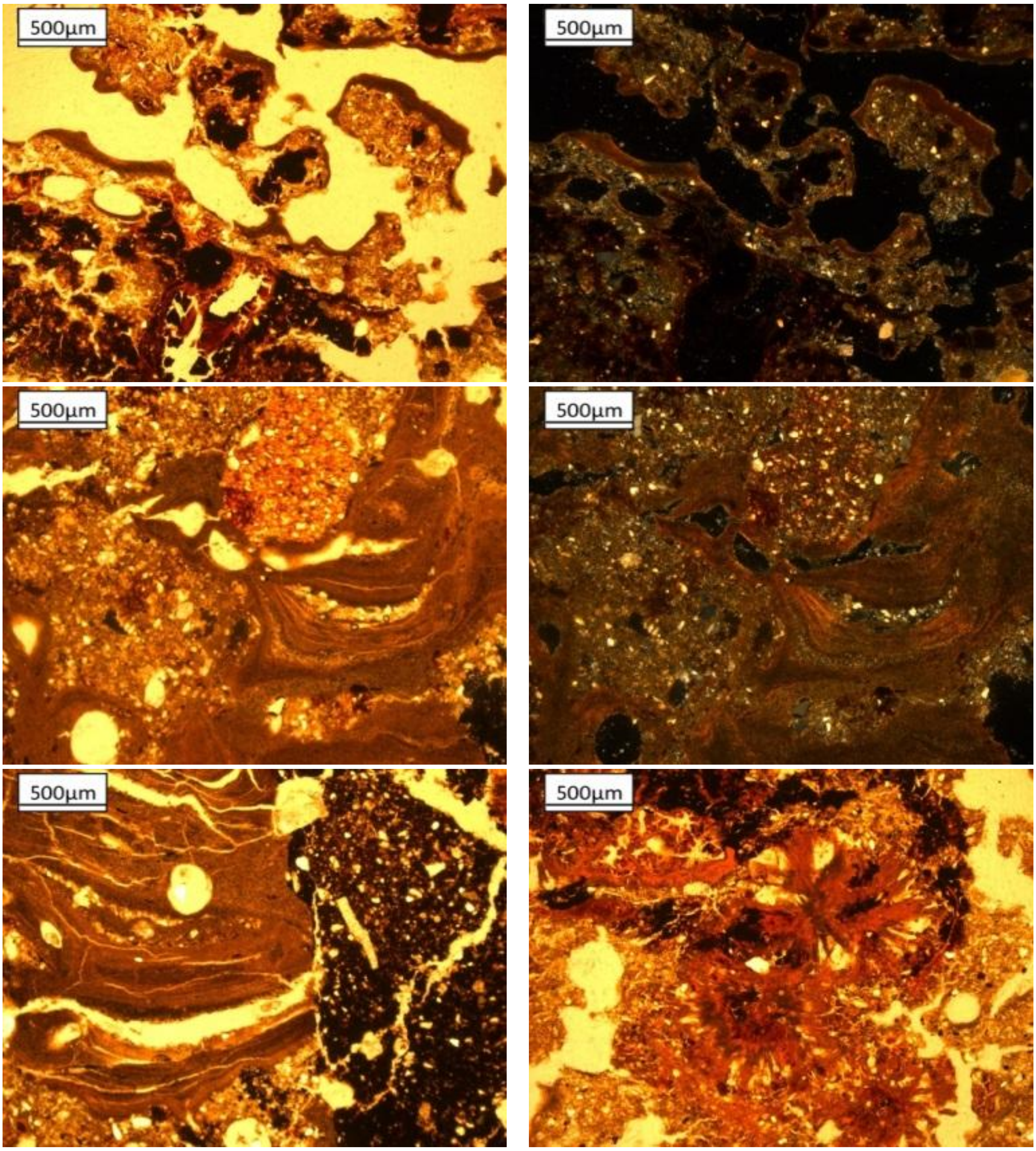


Figure 84: Textural pedofeatures associated with post-depositional disturbance and water movement in doline / hollow sequence: a, b) disrupted neoformed iron features with impure clay crusts and coatings, basal silt <178> (PPL & XPL); c, d) impure clay and calcite laminations, crusts and coatings around voids, sediment aggregates and charcoal <179> MSU2 (PPL & XPL); e) impure clay and calcite laminations truncated by burrow with darker infill from overlying burnt deposits <179> MSU2 (PPL); f) neoformed iron domains with radial crystal structure, basal silt <178> (PPL).

7.5 Geochemistry

7.5.1 Results

Geochemical (pXRF) results are presented in Table 31 along with their context associations and indications where outliers in the distribution are present. Sample data is presented in ascending order up each monolith from 1 (base of sequence) to n (top of sequence), with sample points illustrated in photos in Figure 79. Summary statistics for this dataset are presented in Table 32. Missing numbers in each sequence of sample points indicate discarded readings which were not representative due to poor sample contact or insufficient duration.

A simplified stratigraphic profile displaying the relationship between the units subject to geochemical analysis is presented in Figure 85; the relationship to the broader stratigraphy of the feature can be seen in Figure 77. Averaged results for geochemical concentrations for each of these units is presented in Table 33 with reference to published average soil abundances for general comparison (Jenkins, 1989: 58; Mason and Moore, 1982). Within this sequence the basal silt unit (99275) represents the closest proxy to a geological background and was notably depleted in a range of species such as Al and Mn, as well as in trace elements such as S and Cu.

Table 31: Geochemical (PXRF) spot data (Parts Per Million) from monoliths. Source: Dr. Chris Speed, University of Reading.

Sample	Monolith	Context	Field Description	Al	Si	P	K	Ca	Ti	Mn	Fe	Cl	S	V	Cr	Ni	Cu	Zn	Pb	Rb	Sr	Nb	Ba	Zr	Bi	As	W
1	**196**	**99275**	**BASAL SILT**		45,410		5,476	13,725	1,543		13,962			79	75			42		37	59	8	199	196			
2	**196**	**99240**	Lowest A/S deposit	13,741	136,028	2,865	7,526	26,036	2,144	637	22,478		225	127	88			94	15	34	108	8	310	155	6	6	
3	**196**	**99240**	Lowest A/S deposit		49,145		3,159	12,762	874	277	11,066			46	40			112		25	86	3	264	118			
4	**196**	**99266**	Lower A/S deposit		45,628		3,826	13,426	910	185	13,050			72	34			107		31	65	6	168	108			
5	**196**	**99266**	Lower A/S deposit	19,665	135,178	2,899	6,923	32,345	2,098	545	16,138		198	117	75			156	24	36	87	9	153	242	7		
6	**196**	**99268**	Char layer	12,748	110,423	3,662	6,685	35,938	1,777	902	17,806		234	121	66		36	127		31	92	6	172	137	3		
8	**196**	**99268**	Char layer	8,562	85,982	2,904	6,447	32,892	1,566	452	17,098		311	110	60		13	91		29	75	5	112	113			
9	**196**	**99268**	Char layer	15,153	115,161	3,521	7,706	29,362	1,870	697	20,383		200	121	66		23	106		38	75	6	154	129	5		
10	**196**	**99268**	Char layer	12,571	98,884	7,918	6,076	55,042	1,605	1,483	17,834		462	116	80		17	142		27	132	7	172	133			
11	**196**	**99268**	Char layer	6,966	67,679	8,825	3,672	46,567	964	388	11,378	192	528	71	42			95		14	96	3	51	65			
12	**196**	**99257**	Burnt orange silt	11,410	93,612	5,436	6,419	56,241	1,668	1,326	17,399		460	104	76			118	8	29	123	8	203	134	7		
13	**196**	**99257**	Burnt orange silt	9,582	103,230	6,808	5,407	41,653	1,359	1,464	17,528			111	52			131		29	125	8	195	146			
14	**196**	**99257**	Burnt orange silt	33,780	166,873	5,511	8,995	40,671	2,405	1,129	24,034		467	180	100			110	6	38	92	7	274	133	4	4	
1	**195**	**99270**	Post hole fill	6,434	91,911	2,465	6,381	31,391	1,686	1,215	19,583			129	71			127		30	96	7	180	132			
2	**195**	**99256**	Furnace demolition	6,854	82,414	1,230	5,508	38,122	1,449	1,116	18,003			124	71			84		28	111	6	222	144		6	
3	**195**	**99256**	Furnace demolition		85,338		2,983	15,606	638	233	10,024			50		323		50		21	106		244	92			
4	**195**	**99256**	Furnace demolition	4,196	63,238		4,776	45,835	1,146	416	15,018			86	64			69		25	131	4	203	87			
5	**195**	**99256**	Furnace demolition	17,738	153,079	3,034	9,578	21,239	2,428	298	27,617		91	140	71		13	77	8	41	104	13	350	308	7		
6	**195**	**99256**	Furnace demolition	3,616	72,997		6,091	24,821	1,425	564	17,888			109	61			70		27	105	6	176	122	8		
7	**195**	**99242**	Furnace demolition		169,524		5,304	17,015	958		13,632			87		286		66		19	88		260	134			
8	**195**	**99242**	Furnace demolition	3,470	82,673		4,441	39,531	1,085	541	13,102			77	74			58		20	115	3	231	103			
9	**195**	**99242**	Furnace demolition	7,205	78,882	3,206	5,698	59,724	1,344	685	15,989		251	110	65		25	79		25	131	4	122	130			
10	**195**	**99242**	Furnace demolition	20,474	166,849	4,349	8,891	33,964	2,302	3,082	27,932		280	144	71		16	104	36	32	108	10	278	215	8	8	
11	**195**	**99242**	Furnace demolition	5,937	100,523	2,862	6,423	27,357	1,688	454	17,158			121	78			41	6	29	100	9	140	262			
12	**195**	**99242**	Furnace demolition	7,459	57,658	2,253	3,806	98,988	1,145	263	11,738		554	79	46			44		11	195	4	161	49		5	
13	**195**	**99242**	Furnace demolition	11,456	133,246	1,698	7,614	28,650	2,110	1,003	17,337			151	105			68	13	29	88	7	306	197	6		
14	**195**	**99242**	Furnace demolition	20,137	150,259	3,725	8,028	44,116	2,251	1,019	18,729		427	137	73		23	82	20	31	93	7	269	205	4		
15	**195**	**99242**	Furnace demolition	1,906	60,065		5,506	22,211	1,298	498	19,274			114	49			64		33	77	5	193	114			
16	**195**	**99253**	Silty clay lens	4,096	75,284	1,275	5,660	38,502	1,452	779	18,967			101	77		20	81		29	107	7	228	149			
1	**199**	**99266**	Lower A/S deposit		61,408		3,030	8,872	656	217	10,359					324		72		28	55	4	179	139			
2	**199**	**99264**	Burnt deposit		137,469		3,142	9,707	638		10,421					738		63		32	45		468	122			
3	**199**	**99264**	Burnt deposit		106,548		2,900	9,413	664		9,835					467		85		26	58	5	330	136			
4	**199**	**99264**	Burnt deposit		120,690		2,813	9,748	654		10,789					454		51		26	57	6	328	131			
5	**199**	**99263**	Burnt orange silt		75,033		2,744	9,563	607		9,541					439		86		24	54	5	342	125			
6	**199**	**99263**	Burnt orange silt		92,179		2,929	14,081	594	242	9,597					318				22	89	10	270	106			314
8	**199**	**99256**	Furnace demolition		66,709		2,161	12,357	397	330	9,815					239		60		21	83	8	365	116			
10	**199**	**99256**	Furnace demolition		82,920		2,455	10,131	546		8,873			61	81	275		47		25	67	6	270	124			
11	**199**	**99256**	Furnace demolition	10,624	112,209	1,695	6,888	36,381	1,752	734	22,978			129	90			95	13	36	81	8	286	144			
14	**199**	**99294**	Furnace demolition		79,121		3,261	25,516	655		8,748			55		200		79		19	118		235	108			
15	**199**	**99294**	Furnace demolition	14,906	102,561	5,347	8,780	125,271	1,896	1,041	19,240		203	142	61			101		29	202	7	242	148	6		

Light grey: >= upper quartile (ie top ¼); Dark grey are outliers >= (1.5* interquartile range above the upper quartile).

Table 32: Summary statistics for geochemical data.

	Al	Si	P	K	Ca	Ti	Mn	Fe	Cl	S	V	Cr	Ni	Cu	Zn	Pb	Rb	Sr	Nb	Ba	Zr	Bi	As	W
Mean	11,180.3	97,850.5	3,794.8	5,402.7	32,369.2	1,356.3	756.7	15,808.5	192.4	326.2	106.6	68.7	369.2	20.7	85.4	15.0	27.8	97.0	6.5	232.6	141.3	5.9	6.0	314.3
Median	10,103.2	92,045.1	3,119.8	5,506.8	29,005.9	1,392.0	600.5	16,618.1	192.4	279.9	110.7	70.9	322.7	20.3	82.2	13.0	28.6	92.8	6.5	229.3	132.3	6.1	6.1	314.3
Upper quartile	14,614.7	116,543.4	5,097.8	6,735.3	39,815.9	1,758.2	1,024.7	18,788.3	192.4	461.0	126.8	77.0	446.5	23.4	104.8	19.0	31.6	108.7	7.8	274.9	146.7	6.9	6.2	314.3
Lower quartile	6,539.4	74,524.2	2,564.2	3,235.3	13,992.1	821.8	373.4	10,996.7	192.4	214.0	79.2	60.8	280.4	16.3	64.6	8.3	24.6	76.7	5.0	175.1	115.4	4.8	5.0	314.3
Inter Quartile range	8,075.3	42,019.2	2,533.6	3,500.0	25,823.8	936.4	651.3	7,791.6	-	247.0	47.6	16.2	166.1	7.1	40.2	10.6	7.0	32.0	2.8	99.8	31.3	2.0	1.2	-
Upper whisker	26,727.7	179,572.2	8,898.2	11,985.4	78,551.5	3,162.8	2,001.7	30,475.8	192.4	831.6	198.1	101.3	695.6	34.1	165.2	34.9	42.1	156.6	12.1	424.6	193.7	9.9	7.9	314.3
Lower whisker	-5,573.6	11,495.4	-1,236.2	-2,014.8	-24,743.6	-582.7	-603.6	-690.7	192.4	-156.5	7.8	36.5	31.3	5.6	4.2	-7.6	14.0	28.8	0.8	25.4	68.4	1.8	3.2	314.3
Variance	50,423,248	1,184,204,266	4,284,269	4,303,327	554,161,266	350,396	327,280	25,726,408		20,636	998	271	22,622	53	826	91	42	1,083	5	6,502	2,508	2	3	
Standard Deviation	7,100.9	34,412.3	2,069.8	2,074.4	23,540.6	591.9	572.1	5,072.1		143.7	31.6	16.5	150.4	7.3	28.7	9.5	6.5	32.9	2.3	80.6	50.1	1.5	1.6	

7.5.2 Interpretations

The multiplicity of anthropogenic processes which are represented by these dumped deposits have resulted in elevations and concentrations of trace element species; however these collectively are unspecific to any particular process (Wilson *et al*., 2009). Additional complications in attribution to anthropogenic process arise from the high degree of background variability of metal element concentrations in natural soils (Haslam and Tibbett, 2004: 733) and from the effects of certain components such as buried charcoal or bone which can act to selectively concentrate or deplete elements through post-depositional adsorption or release (Misarti *et al*., 2011: 1452-1453; Jenkins, 1989: 59).

The stability of phosphate compounds in archaeological deposits has made P the most widely used geochemical indicator of anthropogenic processes (Oonk *et al*., 2009: 36); however as several syntheses have highlighted (Holliday and Gartner, 2007; Haslam and Tibbett, 2004; Oonk *et al*., 2009), its complex chemical behaviour in sediments makes interpretations problematic. The general enhancement of this element within the fill over what might be expected (between 200% and 1300% where recorded) simply therefore demonstrates a high level of anthropogenic input to the fill from organic wastes or other materials.

Amongst the suite of trace elements which may be potentially concentrated as a result of human activity, Cu, Pb and Mn are consistently cited as potential indicators of archaeological smelting and production sites (Oonk *et al*., 2009: 38). Cu and Pb were slightly elevated above the background levels in some parts of the sequence, most notably context (99242) which was recorded as potential redeposited debris from a furnace. Such modest elevations are comparable to those recorded at Roman hearth features at Silchester and attributed to unspecific domestic or industrial activities involving metals or metal vessels (Cook *et al*., 2010).

Broader comparison to published average soil abundances (Jenkins, 1989: 58) indicates that the values for Cu, As and Pb in much of the sequence generally lie within the magnitude of what might be expected to be natural background variation in valley soils. Alongside this, the recorded levels of other trace elements such as Sn, Ag and Au which would be regarded as significant indicators of the presence of residues of intensive non-ferrous metalworking were below detectable levels. This suggests that non-ferrous metalworking was not a significant contributor to this specific layer in the sequence, especially when compared to results of other assays of archaeological sediments (e.g. Macphail *et al*., 2016). Despite this result, extensive artefactual evidence for copper-alloy working within the settlement area, including moulds, crucibles, offcut fragments and wrought fittings were clearly evident in other parts of the sequence, particularly the overlying (midden) deposits as well as in contemporary SFB fills (Dr. Gabor Thomas, pers. comm.). The geochemical evidence therefore suggests that such activities were not occurring within the area of the hollow during this particular period of deposition, likely demonstrating a zonation of ferrous and non-ferrous metalworking activities across the settlement during the 6th century.

The levels of Ni in parts of this sequence are particularly high in comparison to the general ranges reported from calcareous geologies (Haslam and Tibbett, 2004: 739). This element is notably depleted in the local iron-bearing Greensand geology (Morgan-Jones, 1985) and such localised elevation here may relate to localised oxidation of pyrite minerals (Shand *et al*., 2003: 36) or the aggregated results of a range of anthropogenic occupation processes which are not readily differentiable (Oonk *et al*., 2009: 38).

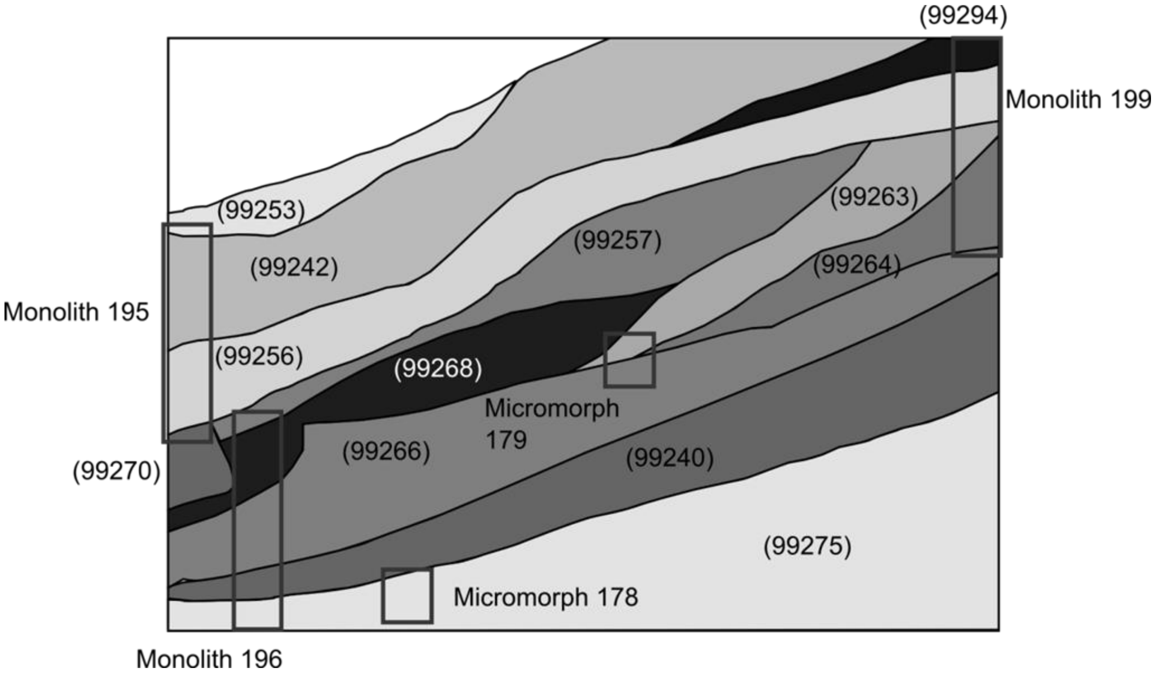


Figure 85: Simplified stratigraphic scheme for geochemical profile showing archaeological contexts (for position against section see Figure 79) and monolith and micromorphological block outlines.

Table 33: Average concentrations (ppm) for elements by archaeological context with comparison to some generic published examples of “average” soil values.

Average of all samples (ppm)

Context	N samples	Description	Al	Si	P	K	Ca	Ti	Mn	Fe	Cl	S	V	Cr	Ni	Cu	Zn	Pb	Rb	Sr	Nb	Ba	Zr	Bi	As	W
99253	1	Silty clay lens	4,096	75,284	1,275	5,660	38,502	1,452	779	18,967	-	-	101	77	-	20	81	-	29	107	7	228	149	-	-	-
99242	9	Furnace demolition	9,756	111,075	3,015	6,190	41,284	1,576	943	17,210	-	378	113	70	286	21	67	19	25	111	6	218	157	6	7	-
99294	2	Furnace demolition	14,906	90,841	5,347	6,021	75,393	1,276	1,041	13,994	-	203	98	61	200	-	90	-	24	160	7	239	128	6	-	-
99256	8	Furnace demolition	8,606	89,863	1,986	5,055	25,561	1,223	527	16,277	-	91	100	73	279	13	69	11	28	99	7	264	142	8	6	-
99270	1	Post hole fill	6,434	91,911	2,465	6,381	31,391	1,686	1,215	19,583	-	-	129	71	-	-	127	-	30	96	7	180	132	-	-	-
99257	3	Burnt orange silt	18,257	121,238	5,918	6,940	46,188	1,811	1,306	19,654	-	463	131	76	-	-	120	7	32	114	8	224	138	6	4	-
99268	5	Char layer	11,200	95,626	5,366	6,117	39,960	1,556	784	16,900	192	347	108	63	-	22	112	-	28	94	5	132	115	4	-	-
99263	2	Burnt orange silt	-	83,606	-	2,837	11,822	600	242	9,569	-	-	-	-	379	-	86	-	23	71	7	306	116	-	-	314
99264	3	Burnt deposit	-	121,569	-	2,952	9,623	652	-	10,348	-	-	-	-	553	-	66	-	28	53	6	375	130	-	-	-
99266	3	Lower A/S deposit	19,665	90,403	2,899	5,375	22,885	1,504	365	14,594	-	198	94	55	-	-	131	24	34	76	7	161	175	7	-	-
99240	2	Lowest A/S deposit	13,741	92,586	2,865	5,343	19,399	1,509	457	16,772	-	225	86	64	-	-	103	15	29	97	5	287	137	6	6	-
99275	1	BASAL SILT	-	45,410	-	5,476	13,725	1,543	-	13,962	-	-	79	75	-	-	42	-	37	59	8	199	196	-	-	-
Averaged soil compositions (Mason and Moore, 1982; Jenkins, 1989)			71,000	330,000	650	14,000	13,700		850	38,000	5,000	700	100		40	20	50	10	100	300		500			6	

7.6 Mollusca

7.6.1 Results

Mollusc counts are presented in Table 34. These counts are derived entirely from floated material with the important exception of the basal sample (140154) which was a dedicated bulk sample and processed separately (Chapter 3). This distinction is important to note and means that this data will not be subject to direct quantitative analysis. Use of multivariate methods (Chapter 11) will allow semi-quantitative integration into the wider dataset; however interpretations in the present chapter will be purely qualitative (section 7.6).

The Molluscan assemblage demonstrates a fundamental dichotomy between the basal layer and the overlying Anglo-Saxon fill sequence. The basal sample demonstrates a highly diverse (Shannon’s h of 2.21) assemblage of types with diverse habitat preferences indicating a distinctive ecology relating to conditions predating the anthropogenic infill process. In contrast the majority of the sequence of dumped and burnt layers of interleaved Anglo-Saxon occupation waste demonstrates a relatively low shell count with a similarly species-poor, intermediate and open country assemblage (dominated by *Vallonia excentrica* and *Trochulus hispidus*) as is found across the Tayne Field settlement site area (Chapter 8). These may represent a palimpsest of species living on or around the areas of activities generating the fill deposits.

Table 34: Mollusc counts from environmental bulk samples (flot only aside from sample 140154 (highlighted at foot of table) which was a dedicated bulk sample).

Sample ID	Context	Description	Total shells	*Acanthinula aculeata*	*Aegonipella nitidula*	*Carychium* sp.	Clausiliidae	*Discus rotundatus*	*Oxychilus cellarius*	*Punctum pygmaeum*	*Trochulus striolatus*	*Vitrea* sp.	*Cochlicopa* sp.	*Trochulus hispidus*	*Monacha cantiana*	*Pupilla muscorum*	*Vallonia excentrica*	*Vallonia costata*	*Vertigo pygmaea*	*Hydrobiidae*	*Galba truncatula*	*Cecilioides acicula*	Limacidae	Shannon's H	Broken vs. total
140088	99051	Spit 2	40	0	0	0	0	0	1	0	0	0	0	9	0	1	26	0	3	0	0	104	0	0.99	53.8%
140124	99250	Spit 5	11	0	0	0	0	0	0	0	0	0	0	3	0	2	2	0	2	0	0	107	2	1.37	50.0%
140129	99261	Spit 6	26	0	0	0	0	0	0	0	0	0	1	14	0	0	7	0	4	0	0	61	0	1.10	42.9%
140084	99224		18	0	1	0	0	0	0	0	0	0	1	11	0	0	3	0	2	0	0	45	0	1.16	33.3%
140101	99228		21	0	0	0	0	0	0	0	0	0	1	9	0	1	7	0	2	1	0	74	0	1.39	57.1%
140072	99221	Spit 3	13	0	0	0	0	1	2	1	0	0	0	2	0	0	7	0	0	0	0	20	0	1.30	71.4%
140181	99279	Spit 10	9	0	0	0	0	0	0	0	0	0	0	2	0	2	5	0	0	0	0	16	0	1.00	80.0%
140139	99265	Spit 5	30	0	0	0	0	0	0	0	0	0	4	7	0	2	15	0	2	0	0	31	0	1.32	26.7%
140063	99185	Spit 2	9	0	0	0	0	0	1	0	4	0	0	0	0	0	4	0	0	0	0	22	0	0.96	75.0%
140057	99060	Spit 2	20	0	0	1	0	0	1	0	5	0	0	3	0	1	8	0	1	0	0	96	0	1.60	87.5%
140109	99250	Spit 3	21	0	1	0	0	0	0	0	0	0	0	5	0	0	13	0	2	0	0	48	0	1.01	23.1%
140087	99157	Spit 2	33	0	0	0	0	0	0	0	0	0	0	9	0	2	19	0	3	0	0	71	0	1.06	73.7%
140119	99255	Charcoal lens	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	4	0	0.00	
140061	99177	Spit 2	13	0	0	0	0	0	4	0	0	0	1	3	0	0	5	0	0	0	0	68	0	1.27	100.0%
140069	99125	Spit 2	59	0	0	0	0	0	1	0	5	0	2	5	0	5	35	0	6	0	0	69	0	1.35	54.3%
140125	99250	Spit 5	24	0	0	0	0	0	0	0	3	0	1	3	0	0	16	0	1	0	0	46	0	1.06	37.5%
140116	99255	Ash lens	16	0	0	0	0	0	0	0	0	0	0	4	0	0	11	0	1	0	0	36	0	0.78	54.5%
140082	99225		23	0	0	0	0	0	0	0	0	0	0	14	0	1	6	0	2	0	0	62	0	1.00	66.7%
140100	99236		25	0	0	0	0	0	2	0	2	0	1	9	0	2	7	0	2	0	0	30	0	1.66	28.6%
140099	99249	Spit 3	30	0	0	0	0	0	0	0	0	0	1	4	0	1	20	0	4	0	0	108	0	1.03	40.0%
140120	99250		16	0	0	0	0	0	0	0	0	0	0	5	0	2	9	0	0	0	0	69	0	0.95	55.6%
140055	99215	Spit 1	39	0	0	0	0	0	0	0	0	0	2	8	0	4	20	0	5	0	0	63	0	1.32	65.0%
140090	99239	Spit 4	30	0	0	0	0	0	0	1	0	0	1	7	1	1	11	2	6	0	0	82	0	1.66	38.5%
140058	99199	Spit 2	15	0	0	1	0	0	2	1	3	0	0	3	0	0	5	0	0	0	0	36	0	1.64	80.0%
140065	99041	Spit 2	54	0	0	0	0	0	1	0	0	0	4	6	0	8	32	0	3	0	0	112	0	1.26	34.4%
140098	99249	Spit 3	37	0	0	0	0	0	0	0	3	0	2	3	0	1	23	0	5	0	0	58	0	1.23	34.8%
140121	99250	Spit 5	18	0	0	0	0	0	0	0	0	0	0	6	0	0	9	0	3	0	0	30	0	1.01	11.1%
140110	99250	Spit 4	35	0	0	0	0	0	0	0	0	0	1	11	0	4	13	0	6	0	0	78	0	1.38	30.8%
140079	99232	Spit 3	10	0	0	0	0	0	0	0	0	0	0	4	0	0	4	0	2	0	0	41	0	1.05	50.0%

Sample ID	Context	Description	Total shells	*Acanthinula aculeata*	*Aegonipella nitidula*	*Carychium* sp.	Clausiliidae	*Discus rotundatus*	*Oxychilus cellarius*	*Punctum pygmaeum*	*Trochulus striolatus*	*Vitrea* sp.	*Cochlicopa* sp.	*Trochulus hispidus*	*Monacha cantiana*	*Pupilla muscorum*	*Vallonia excentrica*	*Vallonia costata*	*Vertigo pygmaea*	*Hydrobiidae*	*Galba truncatula*	*Cecilioides acicula*	Limacidae	Shannon's H	Broken vs. total
140112	99250	Spit 4	21	0	0	0	0	0	0	0	0	0	0	8	0	2	6	0	3	2	0	48	0	1.45	33.3%
140060	99217	Spit 1	90	0	1	0	0	0	0	0	0	0	2	19	0	1	62	0	5	0	0	145	0	0.93	48.4%
140071	99237	Spit 2	30	0	0	0	0	0	0	0	0	0	1	4	0	2	19	0	4	0	0	72	0	1.12	42.1%
140127	99262		38	0	0	0	0	0	0	0	0	0	0	0	0	36	0	0	1	0	1	8	0	0.24	
140108	99250		31	0	0	0	0	0	0	0	0	0	1	11	0	4	11	2	2	0	0	96	0	1.46	38.5%
140054	99199	Spit 1	11	0	0	1	0	0	0	0	0	0	1	4	0	0	5	0	0	0	0	27	0	1.16	60.0%
140130	99261		14	0	0	0	0	0	0	0	0	0	0	8	0	2	1	0	3	0	0	37	0	1.12	100.0%
140090	99239		6	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	2	0	0	44	0	1.10	100.0%
140104	99250	Spit 3	41	0	0	0	0	0	0	0	0	0	3	16	0	2	17	0	3	0	0	40	0	1.26	29.4%
140138	99265	Spit 6	14	0	0	0	0	0	0	0	0	0	1	2	0	2	6	0	2	1	0	33	0	1.57	33.3%
140095	99243	Spit 4	5	0	0	0	0	1	0	0	0	0	0	2	0	0	2	0	0	0	0	16	0	1.05	0.0%
140102	99250	Spit 3	42	0	0	0	0	0	0	0	0	0	2	11	0	6	18	0	5	0	0	96	0	1.39	33.3%
140126	99250	Spit 6	9	0	0	0	0	0	0	0	0	0	0	1	0	2	5	0	1	0	0	10	0	1.15	40.0%
140066	99223	Spit 2	37	0	0	0	0	0	0	0	0	0	0	11	0	3	20	0	3	0	0	86	0	1.10	60.0%
140111	99250	Spit 4	25	0	0	0	0	0	0	0	3	0	2	6	0	0	10	0	4	0	0	105	0	1.46	30.0%
140073	99231	Spit 3	20	0	0	0	0	0	2	1	0	0	1	7	0	0	8	0	1	0	0	84	0	1.41	50.0%
140154	99275	Prehistoric silt under A/S seq	235	2	10	53	9	1	17	5	0	1	20	38	0	0	0	28	7	0	0	0	44	2.03	67.9%

7.6.2 Interpretations

The sample taken from the basal horizon underlying the flint pavement (context (99275), Figure 77 and Figure 85) displays a markedly different ecology to that found within the overlying anthropogenic fill. This is clearly illustrated a crude overall summation of generalised ecological affiliations (Figure 86); however more importantly the dominant species and balance of species between the two components of the sequence was profoundly different suggesting entirely different ground surface environments. The material from the lowest sample in the sequence was eroded and highly fragmentary, indicating an absence of intrusive specimens and also a consistent taphonomy defined by abrasion and decalcification through incorporation in leached and eroded silt and inwashed sediments. Micromorphological analysis (section <178>, section 7.4) confirms a long history of leaching and diagenesis from periodic short term waterlogging which will have affected shell preservation within this basal unit.

The balance of species from the lowest point in the sequence is dominated by *Carychium tridentatum*, *Vallonia costata*, *Trochulus hispidus*, *Oxychilus cellarius* and a smaller proportion of *Vitrea*. This allows an identification of Evans’ (1991) Dry Ground Taxocene 4, a synecological grouping demonstrative of long vegetation, shade and low surface stability at the base of pits or ditches (see groupings analysis in Chapter 11). Also present within this ecology is a more obligatory woodland element in the form of *Acanthinula aculeata* and Clausiliidae (Evans, 1972: 153; Davies, 2008: 173). Studies of contemporary ecological analogues have clearly demonstrated the influence of microclimatic variation on the distribution of such non-heliophilic types in otherwise open country areas (Bush, 1988: 860). Other studies of chalk grassland faunal succession have demonstrated the potential of long grassland to harbour communities containing high concentrations of such “characteristic” woodland taxa during periods of environmental transition (Cameron and Morgan-Huws, 1975: 228). Consequently the ground cover at this time cannot be assumed to be more substantive than long, rank grass and associated vegetation.

Another notable absence in the basal assemblage from the doline / hollow is *Trochulus striolatus*, which occurs in samples from across the site; this type is known to have demonstrated a transition in ecological preference from a largely woodland to strongly synanthropic association between the prehistoric and post-Roman periods (Evans, 1972: 176-177). Its absence here may therefore indicate both an undisturbed and relatively open environment at this time and also perhaps the relative age of the sample. The complete absence of the intrusive burrowing type *Cecilioides acicula*, which is generally highly abundant across the site, was also notable. This species is known to burrow up to

2m into archaeological sequences and furthermore to be a relatively recent, probably medieval introduction to the native fauna (Evans, 1972: 168; Davies, 2010: 170). The complete absence of this taxon as well as the depth within the sequence suggests that this layer is undisturbed by any intrusive specimens deriving from bioturbation in the post-Saxon period. The only dating evidence for this layer consists of a single radiocarbon sample 240-390AD (Beta – 389574, Table 1) from the overlaying flint pavement, which could suggest that that this assemblage corresponds to the Romano-British period; however the composition and preservation of this material strongly suggests that it may be a relic assemblage of prehistoric date.

Within the overlying sequence of interleaved layers of burnt / occupation waste, several component contexts demonstrate localised clusters of types indicative of anthropogenic transportation and processing of materials not found in the site environment. Specimens of Hydrobiidae (contexts (99228), (99250), (99265)) demonstrate material originating in a brackish coastal estuarine area, as was also seen in the SFB sequences from Tayne Field (Chapter 8) and Rectory Lane (Chapter 9). Additionally a specimen of *Galba truncatula* (context (99262)) indicates the presence of material originating in a fresh water environment. These allochthonous taxa all display evidence for abrasion and charring from partial burning and redeposition as well as post-depositional mineralisation. Another cluster of charred, abraded and mineralised specimens of *Pupilla muscorum* contained within a lens of organic material in the fill (context (99262)) suggests the presence of material brought to the site from a very open, dry-ground environment (Kerney and Cameron, 1979: 90). High concentrations of this type were recorded in the Woodland Road sequence (Chapter 10) and likely relate to material originating in heavily grazed areas on the slopes of the downs around the valley which has been subsequently charred and/or deposited within burnt organic wastes.

A pronounced variation within this sequence between the basal assemblage and the overlying Anglo-Saxon occupation sequence is a differential in proportional representation of species of *Vallonia*. Across the Tayne Field sample area, *V. excentrica* predominates, often exclusively. By contrast, the sample from the basal silt in the doline / hollow contains only *V. costata*. In other sample from areas such as Rectory paddock (Chapter 9), this species is seen mainly in the form of infrequently occurring and highly abraded specimens suggestive of reworked residual material. This type is also a major component of some of the modern assemblages from waste ground and field margin environments (Chapter 3) suggesting that the relative balance between these two species has either shifted over time or may very relate to subtle variations in the competitiveness of species across local habitats, with *V. costata* dominating less disturbed and more overgrown areas and *V. excentrica* dominating the more exposed and heavily managed environments. The shifting balance between these species in downland environments is known to lead to one often being entirely absent from recorded assemblages, possibly due to variations in inter-species competition in habitats with limited resources (Evans, 1972: 109). Previous observation of these species in archaeological contexts by Evans (1972: 154) has however concluded that *V. costata* rarely occurs in mechanically disturbed arable land and is far less common in intensively grazed pasture than *V. excentrica*.

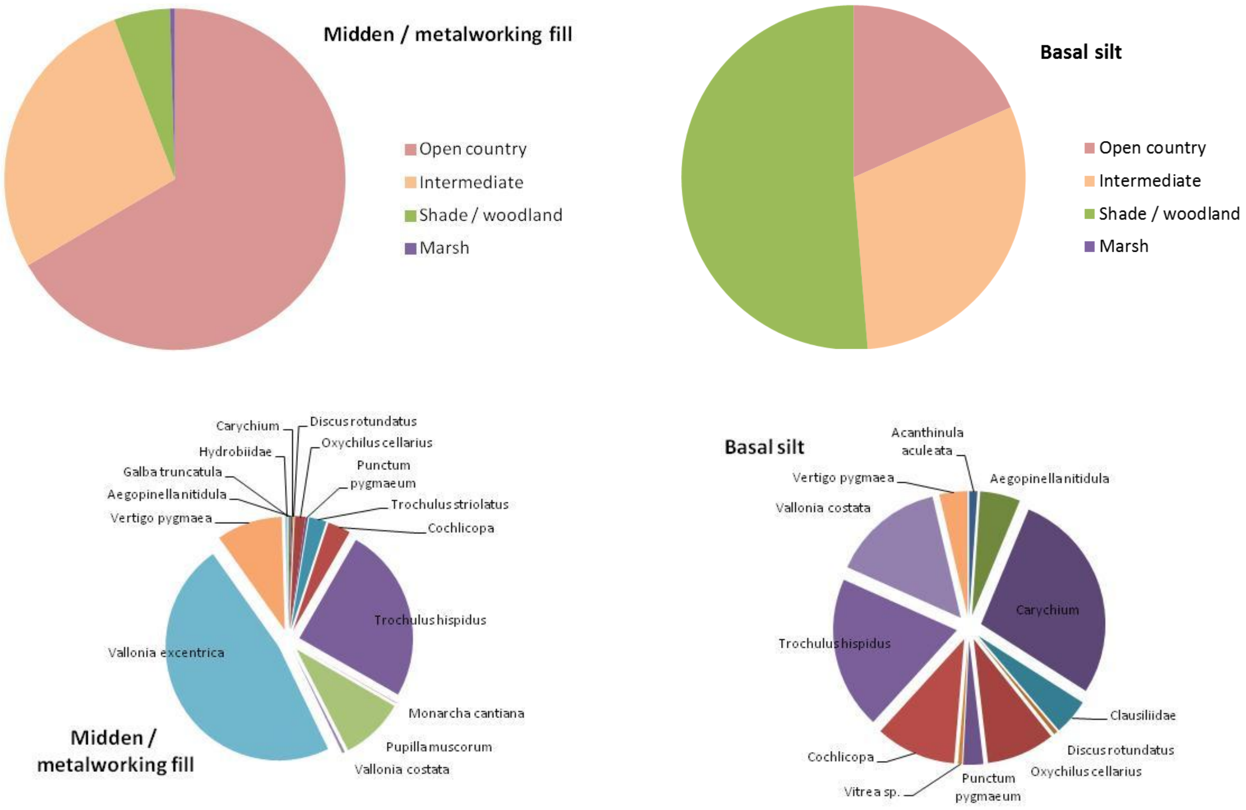


Figure 86: Ecological affinities and unweighted species distributions for all samples from the doline / hollow: divided into those from the Anglo-Saxon metalworking / midden sequence and the underlying prehistoric basal silt.

7.7 Discussion

The evidence from this feature suggests that it comprises a natural doline on the basis of the profile (section 7.1) and sedimentology (section 7.1, 7.4.3, 7.5) which has been subject to a lengthy period of natural erosive infill followed by appropriation and use for cultural and economic purposes resulting in complete infill. An alternative anthropogenic origin as a marl pit or quarry would seem unlikely given the difficulties of accessing the steeply sided lower portion; a function as a dew pond is also unlikely due to its proximity to the watercourse.

The molluscan assemblage (section 7.5) from the basal silt within this feature provides some indication of prehistoric ground-surface ecology, likely comprising a mixture of species living within the exposed hollow as well as shells washed in from the ground around the edge of the feature over an extended (and undated) period of time. This demonstrates long vegetation in or around the base of the hollow during the accumulation of this unit and suggests that the base of the hollow and the contemporary surrounding land surface comprised overgrown grassland or meadow relatively free from human disturbance. The presence of species more typical of woodland environments (e.g. Clausiliidae) may also demonstrate an element of woodland or scrub in the contemporary surrounding landscape.

This assemblage is entirely terrestrial without marsh or aquatic types, excluding any interpretation of the feature as being permanently filled with water prior to the Anglo-Saxon appropriation. The micromorphological evidence for periodic waterlogging in the sediment beneath the flint surface does however support the idea that it was deliberately laid to allow access into the hollow by consolidating soft wet sediments at its base, as has been suggested for other examples of similar doline features (Rady, 2010: 168-169). The construction of this feature can be dated both on the basis of a radiocarbon sample incorporated within it and artefacts within the occupation deposits lying in direct superposition, to some point in or shortly prior to the 5th century A.D.

When compared to more general analysis of SFB fill composition at Lyminge (Chapter 6 and Maslin, 2015) the burnt horizons within the doline / hollow fill sequence demonstrate both a greater volume of charred material and a reduced diversity in contributory waste streams and formation processes. This is exemplified by the lack of evidence for organic and coprolitic materials more generally seen in SFB fills, suggesting that dung, domestic and agricultural waste did not comprise a significant component. These burnt layers further demonstrate higher temperature burning processes than are seen in SFB fills at Lyminge, most clearly demonstrated by the abundance of friable and fragmentary microcharcoal within rubified sediments and extensive ash deposits.

The overlying and underlying layers in the interleaved infill sequence were notably richer than the sampled horizons in occupation materials, suggesting pronounced diachronic shifts in waste streams and formation processes across the trajectory of infill. The present micromorphological work, being limited to small portions of specific layers, cannot fully represent this total diversity. Excavation evidence can, in contrast, demonstrate multiple phases of intensive activity across a prolonged duration of infill which, on the basis of dateable metalwork and pottery, may stretch from the 5th into the late 6th century A.D. (Thomas, 2017: 103). During this time the hollow was clearly the focus of intensive industrial activity defined by multiple *in-situ* burning events, likely in the form of large open fires, or short-lived kiln structures which were completely demolished after use. The micromorphological analysis indicates that these burning events were each followed by dumping and rake-out of ash and furnace demolition waste across the base of the hollow, creating new surfaces which were then subject to mechanical disturbance from trampling. This process was punctuated by periods of hiatus allowing a degree of erosive infill and weathering, suggesting a periodicity of burning events and activities. This cycle created an aggrading surface of trampled ashes, metalworking and furnace debris mixed with colluvial sediments which gradually infilled the hollow prior to a final deposition of domestic waste which completely closed the hollow following the cessation of burning activities in the late 6th century A.D.

Material evidence from the wider site suggests that this period of industry may have comprised any combination of ferrous and non-ferrous metalworking, associated activities such as ore roasting and, potentially, more unusual activities such as glass production (Broadley, 2017: 123). This hypothetical range of activities are considerably narrowed by the associated geochemical evidence (section 7.5) which provides no evidence for enhanced concentrations of metals such as copper, lead or tin which could be expected from intensive processes of non-ferrous metalworking over long periods of time. This suggests that ironworking and, to a lesser, glass working are the two most likely industries generating the wastes in this sequence. The general absence of microslag or hammerscale revealed by the micromorphology strongly suggests that the majority of the ironworking activity in this specific area was related to either smelting or preparatory activities such as ore roasting, rather than smithing.

Chapter 8 - Molluscan evidence from the Tayne Field sample area

This chapter presents interpretations and discussion of the molluscan assemblages sampled from across the archaeological contexts on Tayne Field during fieldwork in 2012-2014 and analysed for evidence of on-site vegetation and ground cover in accordance with the research objectives detailed in Section 1.5.3. All data in this chapter, unless otherwise specified, derives from the floated fraction which were extracted on-site and sorted in the laboratory. Several ditch sequences were also sampled specifically for Mollusca using 1l bulk samples which were sieved and sorted in the laboratory. Due to the different extraction methodology (Chapter 3) these are discussed separately. Within the text, reference is consistently made to context numbers recorded on the original project records accessible via the project database at **www.iadb.co.uk/lyminge**. Within the text, fill numbers are signified by round brackets, cut number by square brackets.

These assemblages demonstrate close ecological correlation to other environmental analyses conducted on the same occupation contexts during the wider project, which have been previously published and which are discussed at the end of this chapter (section 8.4).

8.1 Contexts

A summary of the archaeological features uncovered in this sample area is presented in Figure 87. This area contained the main focus of the Great Hall complex in the pre-Christian phase (Thomas, 2009), comprising timber halls, sunken-featured buildings, ditches and pits (Figure 87). Earlier archaeological phases are present in the form of a Bronze-Age ring ditch and barrow, cremation burials and a Beaker-period inhumation (Thomas and Knox, 2015); however these failed to generate any significant molluscan assemblages during sampling so cannot be discussed here. Post Anglo-Saxon phases are represented by Saxo-Norman pits and ditches and later medieval boundary ditches. Each of these feature classes represents a very different set of taphonomic pathways with only the ditch fills and to a lesser extent the structural post holes able to demonstrate any clear correlation to the contemporary ecology of the surrounding ground surface.

Figure 87: Simplified site plan for Tayne Field excavations showing location of features discussed in text (numbered ditch sections highlighted). Note: LTF13 not shown on this plan, for location see Fig 5.

8.2 Results

Data from ditch features sampled specifically for Mollusca are presented in Table 35, Table 36 and Figure 90 to Figure 94. Full tabulated data for all mollusc counts from the flot samples from the Tayne Field excavation contexts are presented in Table 38. In all data tables, taxa are arranged alphabetically by name within broad ecological affiliations that are detailed in Chapter 3; in all subsequent diagrams the plus sign (+) indicates rare taxa and groupings (<1%). A summary for the aggregated ecological affiliations (see Chapter 3) of the total assemblage for each class of archaeological feature (Figure 87) is presented in Figure 95; summaries of the basic proportional distribution of species are presented in Figure 96a-h.

The subfossil material demonstrates a range of preservation conditions, with a high degree of variation within individual assemblages being suggestive of physical abrasion from reworking and post-depositional mixing from earthworm action. The majority of the assemblages are dominated by the highly xerophilic *Vallonia excentrica* (Figure 96), a species strongly associated with open country conditions (Evans, 1972: 159). Here it dominates a community with *Trochulus hispidus* and *Cochlicopa* sp. corresponding broadly to Evans' (1991) Dry Ground Taxocene 3, which collectively indicates short-turfed grassland and closely grazed pasture with a high surface stability (Davies, 2008: 63). Colluvial, calcareous soils derived from agricultural activity characteristically produce such species-restricted assemblages dominated by these two particular species (*Trochulus hispidus* and *Vallonia excentrica*) (Davies, 2008: 121; Bell, 1983). This pattern is seen in the majority of the Lyminge material and also in the modern analogues for Tayne Field (Chapter 3); the Rectory Lane and Rectory Paddock sample areas demonstrate a more intermediate ecology (Chapter 9).

Alongside these dominant taxa, a range of over 30 other species were represented in the on-site material. Amongst these are the Romano-British introductions *Monacha Cantiana* and *Cornu aspersum* (Evans, 1972: 70; Davies, 2010); however early medieval introduced types found in other study areas, such as *Candidula intersecta* and *Cernuella virgata* are notably absent. This may in part be due to the majority of Tayne Field samples deriving from contexts which pre-date their introduction; however localised variations in soil chemistry or aspect relative to other sample areas (Chapter 3) may also explain their absence from later contexts along with other xerophile/calciphile types found locally, such as *Helicella itala* (Davies, 2008: 13; Rouse and Evans, 1994). This interpretation is supported by the presence of *Candidula intersecta* and *Cernuella virgata* in modern analogue samples from the Rectory Paddock area and the complete absence of these taxa from modern analogue samples from around Tayne Field (Chapter 3).

Table 35: LYM13 Ditch section mollusc counts

LYM13 Section ID	Height from base of seq (cm)	Context	Description	Total shells	*Aegopinella nitidula*	*Carychium* sp.	Clausiliidae	*Discus rotundatus*	*Oxychilus cellarius*	*Punctum pygmaeum*	*Trochulus striolatus*	*Vitrea* sp.	*Cochlicopa* sp.	*Cepaea nemoralis*	*Cornu Aspersum*	*Trochulus hispidus*	*Helicella itala*	*Monacha cantiana*	*Pupilla muscorum*	*Vallonia costata*	*Vallonia excentrica*	*Vertigo pygmaea*	*Oxyloma / Succinea*	*Vallonia pulchella*	*Cecilioides acicula*	Limacidae	Shannon's H	Broken vs. total
32	70-80	(6002)	Topsoil	15				1								8					6				1		0.88	16.7%
32	60-70	(6002)	Worm sorted horizon 3	97					1		25		2	1		24					37	4		3	4	2	1.48	55.0%
32	50-60	(6002)	Worm sorted horizon 2	110	3		1	1	2		30		3	1		16		1	1		44	6	1		9		1.69	43.2%
32	40-50	(6002)	Worm sorted horizon 1	341	39	35	2	31	22	1	114	1	12	7		15				5	50	3		4	36	6	2.08	33.9%
32	30-40	(6005)	Ditch fill	384	64	35	1	31	9	1	152	1	8	8	2	23	1			6	29	7	1	5	56	12	2.00	33.3%
32	20-30	(6005)	Ditch fill	143	17	8	1	8	15		56		7	3		7				9	9	1	1	1	75	5	2.04	38.9%
32	10-20	(6005)	Ditch fill	121	12	4		6	9	1	58	1	4	2		7		1		8	8				92	4	1.86	86.7%
32	5-10	(6005)	Ditch fill	70	8	2		3	2		25		5	2		12				3	8				49	3	1.93	60.0%
32	0-5	(6555)	Eroded natural / primary fill	15	1	1			1					1		7					3	1			32		1.58	66.7%
37	30-40	(6596)	Medieval secondary ditch fill	39		1				1				1		15					18	1		2	101	11	1.25	47.8%
37	20-30	(6596)	Medieval secondary ditch fill	22						1						12					8	1			62	3	0.98	62.5%
37	10-20	(6745)	Ditch fill	15												5				2	8				88	4	0.97	20.0%
37	5-10	(6745)	Ditch fill	15									1			5			1		7	1			78	1	1.26	71.4%
37	0-5	(6745)	Ditch fill	15					2				1			8					3	1			139	2	1.29	66.7%
40	35-45	(6600)	Medieval secondary ditch fill	50					6	1				1		9				2	24	5	1	1	60	4	1.59	51.9%
40	25-35	(6742)	Ditch fill	24					2							7					13		1	1	37	5	1.16	57.1%
40	15-25	(6743)	Clay	15									1	1		9				1	3				54	5	1.17	0.0%
40	5-15	(6743)	Clay	12												3					9				27	2	0.56	11.1%
40	0-5	(6764)	Charcoal layer	19									1			7			1	1	8		1		36		1.35	0.0%

Table 36: LTF13 suspected Bronze Age Ditch or boundary feature [7452] mollusc counts

Context	Description	Total shells	*Oxychilus cellarius*	*Trochulus striolatus*	*Cepaea nemoralis*	*Cochlicopa* sp.	*Trochulus hispidus*	*Monacha cantiana*	*Pupilla muscorum*	*Vallonia excentrica*	*Vallonia costata*	*Vertigo pygmaea*	*Oxyloma / Succinea*	*Cecilioides acicula*	Limacidae	Shannon's H	Broken vs. total
7454	Primary ditch fill	15	0	0	0	1	5	0	1	7	0	1	0	26	24	1.12	37.5%
7453	Secondary ditch fill	50	1	1	0	0	7	0	2	34	3	1	1	21	7	1.42	37.8%
7451	Worm sorted horizon	103	1	1	0	1	44	1	3	42	3	3	4	35	9	1.57	62.2%
7450	Overburden	39	0	0	1	0	14	0	0	23	0	1	0	4	2	1.10	60.9%

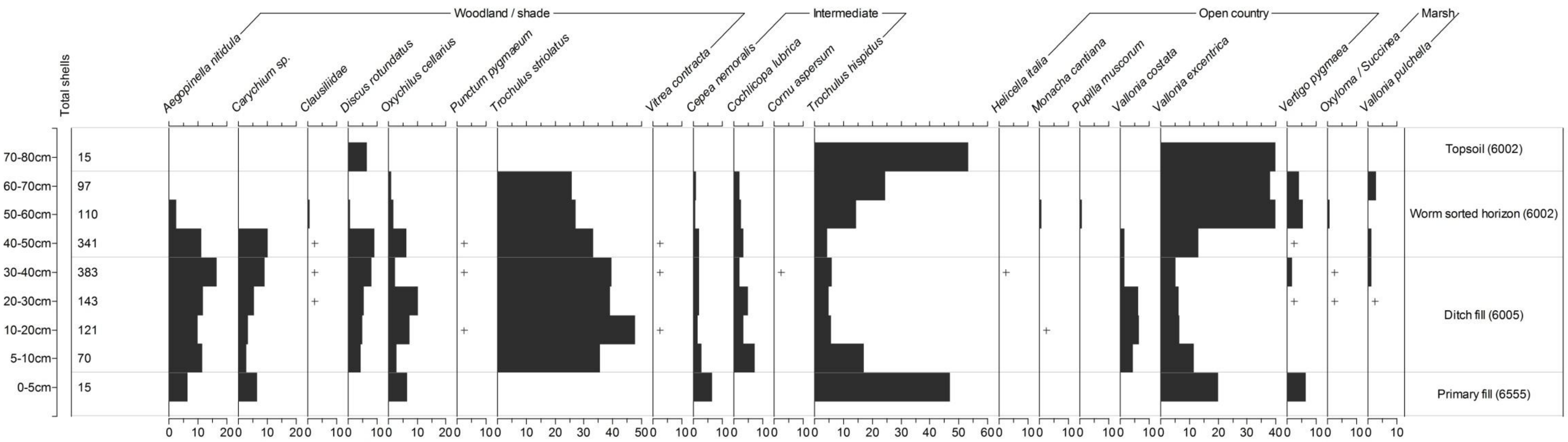


Figure 88: LYM13 Medieval ditch [6004] (Section 32) Mollusc profile

Table 37: Hand collected shells, context (6661), E end of medieval Ditch, as context (6005).

Taxa	**Frequency**
Cornu aspersum	43
Cepaea nemoralis	33
Monacha cantina	3
Aegopinella nitidula	4
Discus rotundatus	1

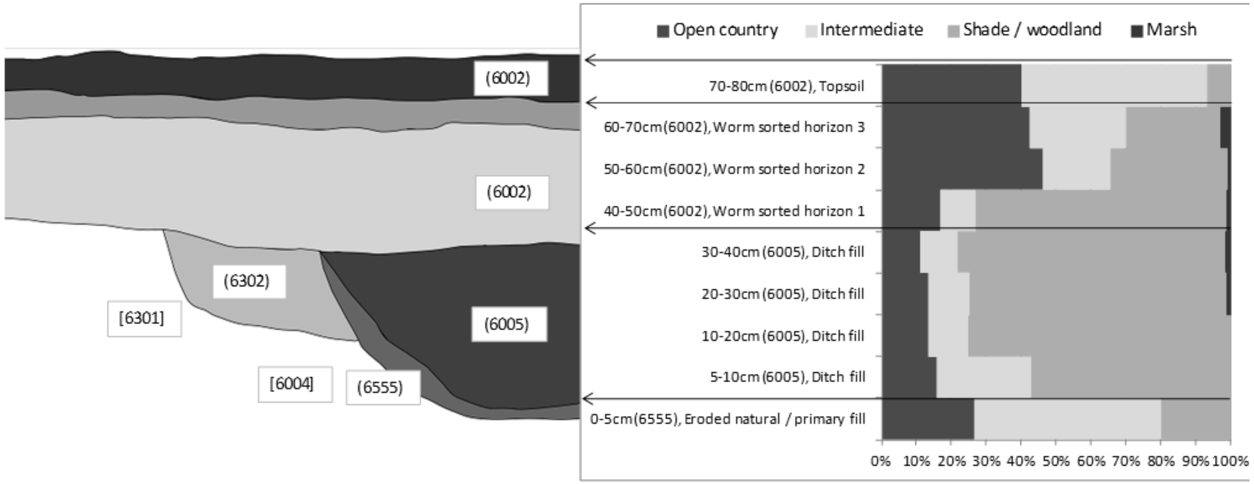


Figure 89: LYM13 Medieval ditch [6004] (Section 32) Mollusc ecological affinity profile.

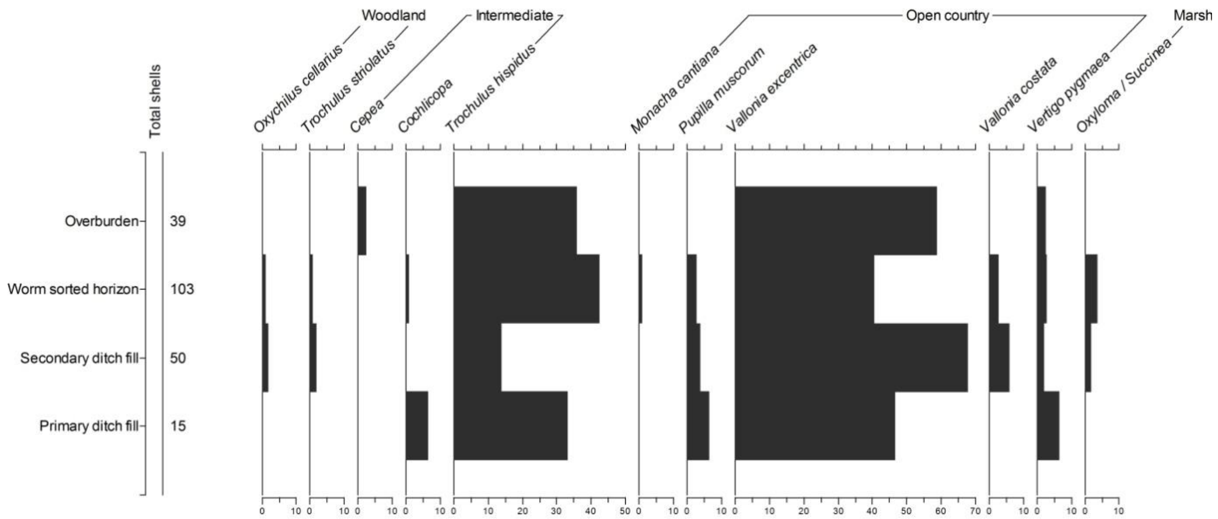


Figure 90: LTF13 Suspected Bronze Age ditch or boundary feature [7452] Mollusc profile.

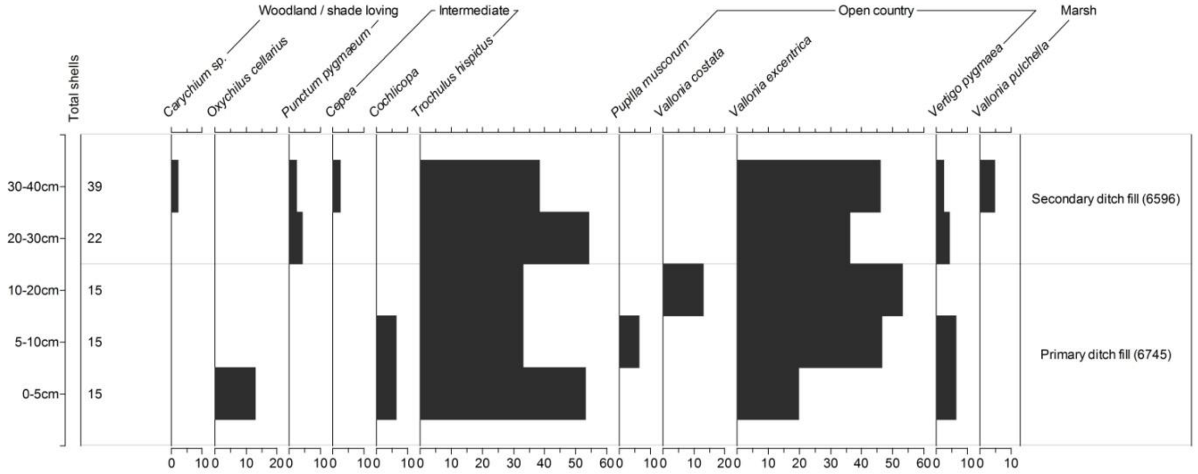


Figure 91: LYM13 Saxo-Norman ditch [6595] (Section 37) Mollusc profile

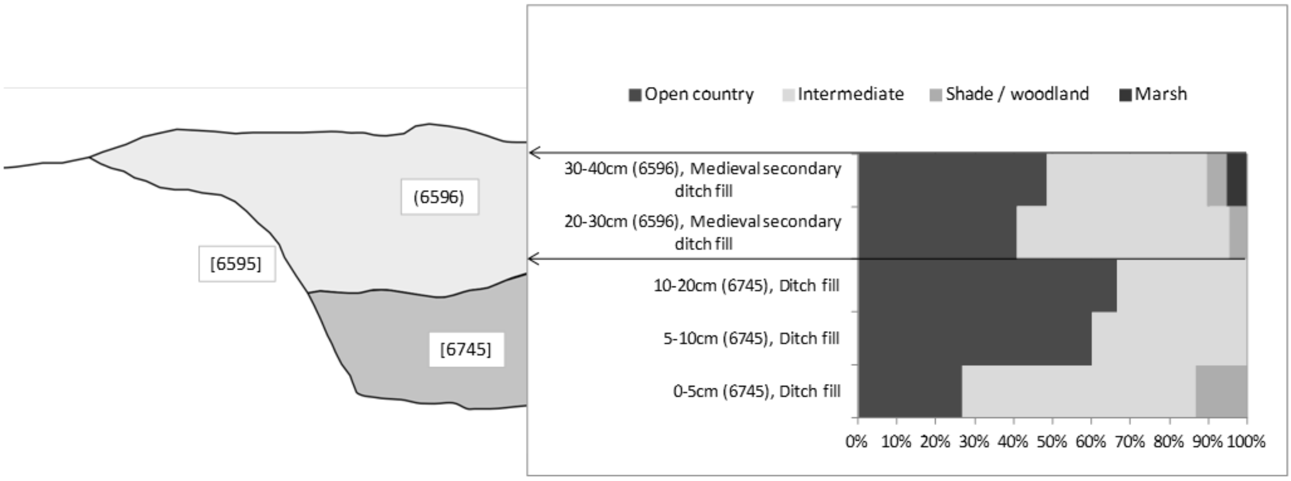


Figure 92: LYM13 Saxo-Norman ditch [6595] (Section 37) Mollusc ecological affinity profile

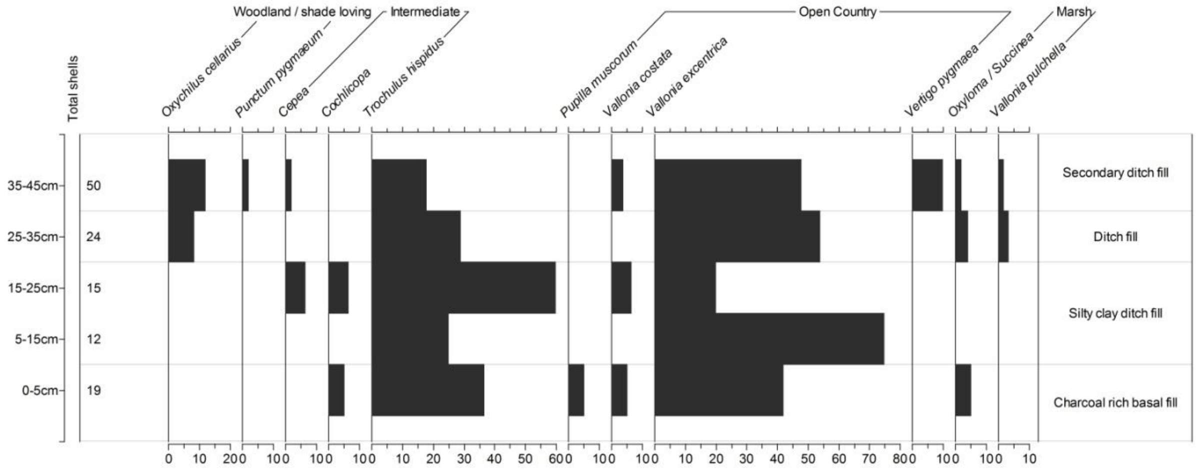


Figure 93: LYM13 Saxo-Norman ditch [6599] (Section 40) mollusc profile

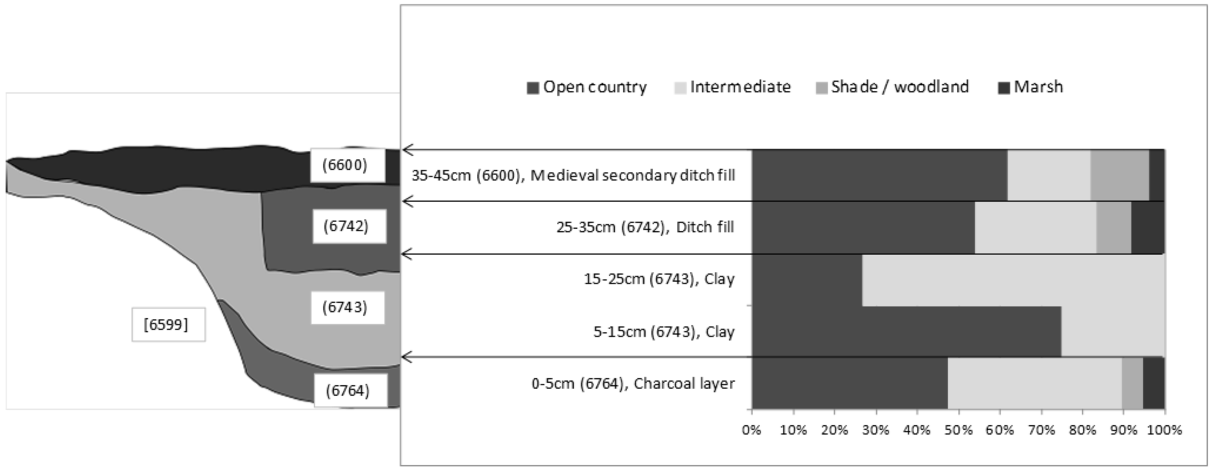


Figure 94: LYM13 Saxo-Norman ditch [6599] (Section 40), mollusc ecological affinity profile.

Table 38: Tayne Field (LYM12-14) mollusc counts from environmental bulk samples (flot only)

Sample ID	Context	Description	Total shells	*Acanthinula aculeata*	*Acicula fusca*	*Aegopinella nitidula*	*Carychium* sp.	Clausiliidae	*Discus rotundatus*	*Oxychilus cellarius*	*Pomatias elegans*	*Punctum pygmaeum*	*Trochulus striolatus*	*Vitrea* sp.	*Cochlicopa* sp.	*Cepaea nemoralis*	*Cornu Aspersum*	*Trochulus hispidus*	*Monarcha cantiana*	*Pupilla muscorum*	*Vallonia excentrica*	*Vallonia costata*	*Vertigo pygmaea*	*Oxyloma / Succinea*	*Vallonia* cf. *pulchella*	Hydrobiidae	*Leucophytia bidentata*	*Galba truncatula*	*Cecilioides acicula*	Limacidae	Shannon's H	Broken vs. total
130077	6701	Potential BA post hole	22	0	0	0	0	0	0	0	0	1	4	0	0	0	0	4	0	1	11	0	1	0	0	0	0	0	68	0	1.39	54.5%
130054	6119	A/S c6th Pit [6118], SW Quad	52	0	0	0	0	0	0	2	0	0	0	0	0	0	0	8	0	2	32	0	7	0	1	0	0	0	123	0	1.18	66.7%
130055	6119	A/S c6th Pit [6118], NW Quad	75	0	0	0	0	1	0	1	0	0	0	0	0	0	0	15	0	6	33	13	6	0	0	0	0	0	101	0	1.51	69.6%
130058	6119	A/S c6th Pit [6118], SE Quad	57	0	0	0	0	0	0	1	0	0	13	0	0	0	0	0	0	5	28	4	6	0	0	0	0	0	112	0	1.39	46.9%
130064	6965	A/S c6th Pit [6118], SW Quad	72	0	0	0	0	0	0	0	0	0	4	0	2	0	0	12	0	4	33	7	9	0	1	0	0	0	200	0	1.62	67.5%
130130	7156	A/S c6th Pit [6118], Lower fill	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	1	0	0	0	0	0	50	0	0.35	62.5%
12	3288	A/S c7th Pit [3194]	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	14	0	0.69	50.0%
13	3195	A/S c7th Pit [3194]	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	5	0	2	0	0	0	0	0	53	0	1.04	60.0%
14	3296	A/S c7th Pit [3194]	15	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	10	0	3	0	0	0	0	0	47	0	0.95	70.0%
15	3302	A/S c7th Pit [3194]	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5	0	1	0	0	0	0	0	57	0	0.90	60.0%
100	3207	A/S c7th Pit [3206]	15	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	2	10	0	0	0	0	0	0	0	75	0	0.99	60.0%
101	3936	A/S c7th Pit [3206]	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3	0	0	0	0	0	0	0	24	0	0.56	66.7%
41	3597	A/S c7th Pit fill	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	2	20	0	4	0	0	0	0	0	62	0	0.99	55.0%
130028	6766	A/S c7th Pit fill	13	0	0	0	0	0	1	0	0	0	6	0	0	0	0	0	0	1	4	0	0	0	0	1	0	0	21	0	1.31	25.0%
130175	6253	A/S c7th Pit fill	78	0	0	0	0	0	0	1	0	0	0	0	2	0	0	13	0	6	45	2	4	1	3	0	0	1	102	0	1.45	54.0%
130176	7288	A/S c7th cess pit	57	0	0	0	0	0	0	0	0	0	10	0	2	0	0	10	0	0	26	0	8	0	1	0	0	0	140	0	1.43	37.0%
16	3188	S/N cess pit [3187]	51	0	0	0	0	0	0	0	0	0	5	0	1	0	0	5	0	3	34	0	3	0	0	0	0	0	125	0	1.14	79.4%
17	3242	S/N cess pit [3187]	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	2	9	5	8	0	0	0	0	0	79	0	1.51	57.1%
21	3240	S/N pit [3090], primary fill	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	16	0	0.00	100.0%
20	3208	S/N pit [3090], cess fill	10	0	0	0	1	0	0	0	0	0	0	0	2	0	0	2	0	0	5	0	0	0	0	0	0	0	23	0	1.22	80.0%
19	3189	S/N pit [3090], cess fill	19	0	0	1	0	0	0	1	0	0	4	0	0	0	0	4	0	1	7	0	1	0	0	0	0	0	41	0	1.64	71.4%
18	3091	S/N pit [3090], upper fill	62	0	0	2	0	0	1	6	0	0	11	1	1	0	0	6	0	2	28	0	4	0	0	0	0	0	115	0	1.72	53.6%
34	3534	S/N pit [3397], cess fill	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	4	11	0	1	0	0	0	1	0	70	0	1.26	72.7%
31	3398	S/N pit [3397]	42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	1	29	2	3	0	0	0	0	0	116	0	0.98	58.1%
45	3673	S/N pit [3264], primary fill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	-	0.0%
43	3665	S/N pit [3264]	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3	0	0	0	0	0	0	0	3	0	0.56	100.0%
42	3641	S/N pit [3264]	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	2	0	0.64	100.0%
38	3535	S/N pit [3264]	21	0	0	0	0	0	0	0	0	0	0	0	2	0	0	3	0	1	9	2	3	0	1	0	0	0	42	0	1.66	33.3%
37	3525	S/N pit [3264]	17	0	0	0	0	0	0	0	0	0	0	0	1	0	0	4	0	2	7	0	3	0	0	0	0	0	80	0	1.43	42.9%
36	3265	S/N pit [3264], cess fill	91	0	0	0	0	0	0	0	0	0	0	0	4	0	0	14	0	8	52	0	13	0	0	0	0	0	200	0	1.24	53.8%
64	3463	S/N pit [3030]	35	0	0	0	0	0	0	0	0	0	0	0	2	0	0	5	0	2	23	0	3	0	0	0	0	0	150	0	1.09	65.2%
65	3484	S/N pit [3030], cess fill	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3	0	0.00	0.0%
66	3637	S/N pit [3030]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	-	0.0%

Sample ID	Context	Description	Total shells	*Acanthinula aculeata*	*Acicula fusca*	*Aegopinella nitidula*	*Carychium* sp.	Clausiliidae	*Discus rotundatus*	*Oxychilus cellarius*	*Pomatias elegans*	*Punctum pygmaeum*	*Trochulus striolatus*	*Vitrea* sp.	*Cochlicopa* sp.	*Cepaea nemoralis*	*Cornu Aspersum*	*Trochulus hispidus*	*Monarcha cantiana*	*Pupilla muscorum*	*Vallonia excentrica*	*Vallonia costata*	*Vertigo pygmaea*	*Oxyloma / Succinea*	*Vallonia* cf. *pulchella*	Hydrobiidae	*Leucophytia bidentata*	*Galba truncatula*	*Cecilioides acicula*	Limacidae	Shannon's H	Broken vs. total
67	3667	S/N pit [3030]	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	4	0	0.69	0.0%
103	3697	S/N pit [3092]	3	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	9	0	0.64	100.0%
105	3893	S/N pit [3092]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	-	0.0%
130169	6739	S/N pit [6382], primary fill	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3	0	1	0	0	0	0	0	34	0	1.00	100.0%
130170	6383	S/N pit [6382], secondary fill	45	0	0	0	0	0	0	0	0	0	0	0	1	0	0	8	0	2	24	2	8	0	0	0	0	0	170	0	1.31	46.2%
40	3539	S/N pit [3054]	51	0	0	1	0	0	0	1	0	0	0	0	1	0	0	17	0	1	16	7	7	0	0	0	0	0	225	0	1.58	56.5%
47	3639	S/N pit [3262], cess fill	34	0	0	0	0	0	0	0	0	0	0	0	1	0	0	6	0	5	16	0	6	0	0	0	0	0	145	0	1.35	56.3%
130166	6919	S/N pit [7078]	113	0	0	0	0	0	0	4	0	0	0	0	4	0	0	22	0	8	49	11	13	0	2	0	0	0	95	0	1.65	61.3%
130095	6401	S/N pit [6400], upper fill	127	0	0	0	2	0	2	13	0	0	23	0	4	0	0	10	0	2	53	9	9	0	0	0	0	0	300	0	1.79	67.7%
124	3527	S/N pit [3464]	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	8	0	1	0	0	0	0	0	41	0	0.98	25.0%
130167	6387	S/N pit [6386]	69	0	0	0	0	0	0	0	0	0	0	0	2	0	0	6	0	7	40	2	12	0	0	0	0	0	170	0	1.27	47.6%
130168	6385	S/N pit [6384]	27	0	0	0	0	0	0	0	0	0	4	0	1	0	0	0	0	2	14	0	6	0	0	0	0	0	61	0	1.27	64.3%
130012	6499	S/N pit [6498], upper fill	191	0	0	0	0	0	0	27	0	0	20	0	19	0	0	41	0	11	56	3	11	1	2	0	0	0	300	0	1.90	24.6%
126	3825	S/N pit [3088]	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0.00	0.0%
4	3248	S/N ditch [3454]	66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	9	44	5	2	0	0	0	0	0	177	0	1.06	57.1%
27	3483	S/N ditch [3482]	15	0	0	1	0	0	0	0	0	0	0	0	0	0	0	4	0	0	9	0	1	0	0	0	0	0	17	0	1.02	77.8%
130020	6594	S/N ditch [6593]	263	0	0	4	10	0	14	35	0	5	28	4	6	4	0	42	0	8	84	8	10	0	1	0	0	0	300	0	2.16	48.4%
130022	6306	S/N ditch [6305]	51	0	0	1	0	0	1	0	0	0	5	0	1	0	0	10	0	2	21	4	6	0	0	0	0	0	115	0	1.72	72.0%
130024	6745	S/N ditch [6595], charcoal fill	97	0	0	0	0	0	0	3	0	0	35	0	4	0	0	12	0	4	28	6	5	0	0	0	0	0	392	0	1.68	50.0%
130027	6764	S/N ditch [6599]	87	0	0	0	3	0	0	2	0	0	8	0	3	0	0	16	0	6	34	4	8	0	2	0	0	1	282	0	1.90	45.0%
130011	6429	S/N ditch [6428], upper fill	255	0	0	4	1	0	0	17	0	0	0	0	15	0	1	61	0	5	125	19	6	1	0	0	0	0	300	0	1.53	56.9%
130023	6661	Medieval ditch [6660]	376	0	0	26	65	5	60	29	0	4	50	0	2	1	0	2	0	3	18	18	8	0	0	0	0	1	70	0	2.13	50.0%
1	3101	Medieval ditch [3100], upper fill	175	1	1	6	5	2	2	13	0	0	101	0	1	1	0	10	0	0	24	7	1	0	0	0	0	0	60	0	1.54	71.0%
2	3144	Medieval ditch [3100]	87	0	0	5	0	2	5	6	0	0	41	0	2	0	1	13	0	0	9	0	3	0	0	0	0	0	15	0	1.73	77.8%
44	3707	SFB5	57	0	0	0	0	0	0	0	0	0	0	0	4	0	0	5	0	5	33	0	10	0	0	0	0	0	221	0	1.24	51.5%
30	3704	SFB5, Spit 3	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	21	0	1	0	0	0	0	0	93	0	0.51	61.9%
33	3729	SFB5, Spit 3	65	0	0	0	0	0	0	0	0	0	11	0	2	0	0	0	0	2	47	0	3	0	0	0	0	0	140	0	0.89	72.3%
32	3705	SFB5, Spit 4	216	0	0	0	0	0	0	0	1	0	7	0	2	0	0	14	0	6	63	0	12	0	0	111	0	0	325	0	1.32	60.3%
35	3705	SFB5, Spit 4	29	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	21	0	4	0	0	0	0	0	61	0	0.88	52.4%
51	3734	SFB5, Spit 6	65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	10	37	0	7	0	0	0	0	0	300	0	1.15	62.2%
50	3708	SFB5, Spit 7	157	0	0	0	0	0	0	0	0	0	0	0	4	0	0	24	0	11	87	4	27	0	0	0	0	0	500	0	1.29	53.8%
130186	6842	SFB 6	45	0	0	0	0	0	0	1	0	0	0	0	1	0	0	9	0	2	23	0	9	0	0	0	0	0	134	0	1.29	56.5%
130061	6812	SFB 6, Spit 3, NW Quad	32	0	0	0	0	0	0	0	0	0	5	0	0	0	0	5	0	2	16	2	2	0	0	0	0	0	102	0	1.45	44.4%
130063	6809	SFB 6, Spit 3, NW Quad	49	0	0	0	0	0	0	0	0	0	0	0	1	0	0	4	0	1	30	6	7	0	0	0	0	0	110	0	1.20	66.7%
130045	6805	SFB 6, Spit 2, Interior sample	39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	1	17	4	6	0	2	0	0	0	90	0	1.47	47.8%

Sample ID	Context	Description	Total shells	*Acanthinula aculeata*	*Acicula fusca*	*Aegopinella nitidula*	*Carychium* sp.	Clausiliidae	*Discus rotundatus*	*Oxychilus cellarius*	*Pomatias elegans*	*Punctum pygmaeum*	*Trochulus striolatus*	*Vitrea* sp.	*Cochlicopa* sp.	*Cepaea nemoralis*	*Cornu Aspersum*	*Trochulus hispidus*	*Monarcha cantiana*	*Pupilla muscorum*	*Vallonia excentrica*	*Vallonia costata*	*Vertigo pygmaea*	*Oxyloma / Succinea*	*Vallonia* cf. *pulchella*	Hydrobiidae	*Leucophytia bidentata*	*Galba truncatula*	*Cecilioides acicula*	Limacidae	Shannon's H	Broken vs. total
130046	6806	SFB 6, Spit 2, Exterior sample	52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	1	27	8	4	0	0	0	0	0	110	0	1.24	62.9%
130031	6826	SFB 6 Spit 1, Interior sample	77	0	0	0	0	0	1	0	0	0	8	0	1	0	0	8	0	5	41	5	7	0	1	0	0	0	147	0	1.55	59.6%
130032	6826	SFB 6, Spit 1, Exterior sample	112	0	0	0	0	0	0	0	0	0	0	0	2	0	0	19	0	6	55	9	20	0	1	0	0	0	162	0	1.43	56.9%
130001	6201	SFB7 Spit 1, exterior	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	7	15	3	0	0	0	0	0	64	0	1.23	86.4%
130002	6201	SFB7 Spit 1, interior	147	0	0	0	0	0	0	1	0	0	13	0	1	0	0	0	0	3	92	19	18	0	0	0	0	0	150	0	1.18	68.5%
130003	6226	SFB7 Spit 1, exterior	86	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	5	54	8	8	0	1	0	0	0	120	0	1.20	63.5%
130004	6226	SFB7 Spit 1, interior	120	0	0	0	0	0	0	1	0	0	0	0	1	0	0	19	0	4	61	20	14	0	0	0	0	0	165	0	1.38	59.3%
130015	6202	SFB 7 Spit 2, interior	63	0	0	0	0	0	1	2	0	0	0	0	2	0	0	6	0	5	35	3	9	0	0	0	0	0	120	0	1.46	68.4%
130016	6202	SFB 7 Spit 2, exterior	79	0	0	0	0	0	0	0	0	0	0	0	2	0	0	14	0	7	42	7	7	0	0	0	0	0	150	0	1.38	57.1%
130017	6229	SFB 7 Spit 2, interior	65	0	0	0	0	0	0	0	0	0	0	0	1	0	0	8	0	1	39	11	5	0	0	0	0	0	130	0	1.19	54.0%
130018	6229	SFB 7 Spit 2, exterior	80	0	0	0	0	0	0	0	0	0	0	0	3	0	0	8	0	3	52	6	8	0	0	0	0	0	146	0	1.18	51.7%
130019	6230	SFB 7 Spit 2	83	0	0	0	1	0	0	0	0	1	5	0	1	0	0	10	0	6	48	3	8	0	0	0	0	0	121	0	1.44	62.7%
130029	6233	SFB 7 Spit 3, interior	50	0	0	0	0	0	1	0	0	0	0	0	2	0	0	7	0	2	28	6	4	0	0	0	0	0	225	0	1.39	45.5%
130030	6233	SFB 7 Spit 3, exterior	35	0	0	0	0	0	0	0	0	0	0	0	1	0	0	7	0	1	21	3	2	0	0	0	0	0	86	0	1.21	62.5%
130035	6236	SFB 7, Spit 3	101	0	0	1	0	0	0	0	0	0	14	0	1	0	0	3	0	5	55	7	15	0	0	0	0	0	400	0	1.42	40.3%
130037	6204	SFB 7, Spit 3, NE Quad, interior	68	0	0	0	0	0	0	1	0	0	10	0	0	0	0	10	0	5	29	11	1	0	0	1	0	0	280	0	1.60	55.0%
130038	6204	SFB 7, Spit 3, NE Quad, exterior	48	0	0	0	0	0	0	0	0	0	5	0	2	1	0	5	0	2	21	6	6	0	0	0	0	0	195	0	1.70	51.9%
130048	6207	SFB 7, Spit 4, NW Quad, interior	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	3	30	0	4	0	0	0	0	0	200	0	0.97	60.0%
107	3205	LYM12 Hall post hole	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	5	0	0.00	33.3%
79	3253	LYM12 Hall post hole	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	5	0	0.00	100.0%
88	3948	LYM12 Hall post hole	3	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	3	0	0.64	50.0%
95	3427	LYM12 Hall pit	33	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3	0	3	21	4	1	0	0	0	0	0	80	0	1.19	52.0%
46	3805	LYM12 Hall wall trench	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	1	21	0	3	0	0	0	0	0	73	0	0.86	61.9%
89	3560	LYM12 Hall wall trench	60	0	0	0	0	0	0	0	0	0	3	0	0	0	0	7	0	1	45	0	4	0	0	0	0	0	101	0	0.86	57.8%
130049	6520	LYM13 B1 post hole	70	0	0	0	0	0	1	1	0	0	3	0	2	0	0	14	0	5	34	0	9	0	1	0	0	0	127	0	1.54	74.3%
130051	6937	LYM13 B1 post hole	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	1	17	5	1	0	0	0	0	0	77	0	1.09	59.1%
130110	7058	LYM13 B1 post hole	56	0	0	0	0	0	1	0	0	0	12	0	2	0	0	0	0	4	25	5	7	0	0	0	0	0	156	0	1.55	63.3%
130026	6578	LYM13 B1 post hole	53	0	0	1	15	0	2	1	0	3	15	0	1	0	0	0	0	3	10	0	2	0	0	0	0	0	133	0	1.83	70.0%
130116	6449	LYM13 B1 post hole	59	0	0	0	2	0	4	4	0	1	16	0	0	0	0	0	0	2	20	7	3	0	0	0	0	0	126	0	1.79	70.4%
130126	7151	LYM13 B1 wall trench, charred	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	10	0	0.00	100.0%
130118	6928	LYM13 B1 door post	120	0	0	2	29	0	3	12	0	5	0	5	3	0	0	15	0	3	27	12	2	0	2	0	0	0	190	0	2.15	70.7%
130119	7027	LYM13 B1 door post	23	0	0	1	1	0	0	1	0	0	0	0	1	0	0	6	0	1	8	0	4	0	0	0	0	0	100	0	1.70	75.0%
130120	7038	LYM13 B1 door post	14	0	0	0	1	0	0	0	0	0	2	0	0	0	0	4	0	0	3	3	1	0	0	0	0	0	47	0	1.67	60.0%
130121	6633	LYM13 B1 post hole	32	0	0	0	0	0	0	2	0	0	0	0	0	0	0	4	0	3	18	0	5	0	0	0	0	0	85	0	1.27	38.9%
130145	6524	LYM13 B1 post hole	50	0	0	0	0	0	0	0	0	0	0	0	2	0	0	9	0	4	23	5	6	0	0	0	0	1	65	0	1.56	60.7%

Sample ID	Context	Description	Total shells	*Acanthinula aculeata*	*Acicula fusca*	*Aegopinella nitidula*	*Carychium* sp.	Clausiliidae	*Discus rotundatus*	*Oxychilus cellarius*	*Pomatias elegans*	*Punctum pygmaeum*	*Trochulus striolatus*	*Vitrea* sp.	*Cochlicopa* sp.	*Cepaea nemoralis*	*Cornu Aspersum*	*Trochulus hispidus*	*Monarcha cantiana*	*Pupilla muscorum*	*Vallonia excentrica*	*Vallonia costata*	*Vertigo pygmaea*	*Oxyloma / Succinea*	*Vallonia* cf. *pulchella*	Hydrobiidae	*Leucophytia bidentata*	*Galba truncatula*	*Cecilioides acicula*	Limacidae	Shannon's H	Broken vs. total
130097	6987	LYM13 B2 wall trench cutting SFB 6	49	0	0	0	0	0	0	3	0	0	0	0	0	0	0	6	0	5	27	0	8	0	0	0	0	0	277	0	1.29	44.4%
130114	7074	LYM13 B2 door post	34	0	0	0	1	0	0	1	0	2	5	0	1	0	0	3	0	2	14	3	1	0	1	0	0	0	205	0	1.93	66.7%
130128	7136	LYM13 B2 plank slot	14	0	0	0	2	0	0	0	0	2	0	0	2	0	0	1	0	2	4	0	1	0	0	0	0	0	70	0	1.85	100.0%
130129	7134	LYM13 B2 plank slot	4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	36	0	1.39	0.0%
130133	7138	LYM13 B2 plank slot	11	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	4	2	1	0	0	0	0	0	42	0	1.52	50.0%
130134	7146	LYM13 B2 plank slot	11	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	7	0	2	0	1	0	0	0	25	0	1.03	37.5%
130135	7140	LYM13 B2 plank slot	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	17	0	0.00	33.3%
130152	7209	LYM13 B2 wall trench	80	0	0	0	0	0	1	0	0	0	0	0	3	0	0	16	0	2	39	2	14	0	2	0	0	1	240	0	1.49	55.8%
130069	6814	LYM13 B2 wall trench cutting SFB 6	43	0	0	0	0	0	0	2	0	0	7	1	2	0	0	0	0	3	19	5	4	0	0	0	0	0	152	0	1.69	37.5%
130162	6877	LYM13 B2 wall trench	72	0	0	1	0	0	0	1	0	0	0	0	2	0	0	5	0	2	38	13	9	0	1	0	0	0	90	0	1.47	74.5%
130034	6803	LYM13 B2 wall trench cutting SFB 6	60	0	0	0	0	0	1	0	0	0	4	0	0	0	0	8	0	1	32	7	3	0	4	0	0	0	89	0	1.50	41.9%
130137	7144	LYM13 B2 plank slot	41	0	0	0	0	0	0	1	0	0	12	0	1	0	0	0	0	4	15	1	7	0	0	0	0	0	150	0	1.53	25.0%
130062	6811	LYM13 B2 wall trench	48	0	0	0	0	0	0	1	0	0	10	0	2	0	0	0	0	7	22	4	2	0	0	0	0	0	107	0	1.52	53.8%
130067	6815	LYM13 B2 wall trench	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	16	1	3	0	0	0	0	0	113	0	0.99	23.5%
130144	7166	LYM13 B2 corner post hole	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	13	0	0.64	
130107	7030	LYM13 B3 plank slot	24	0	0	0	1	0	0	0	0	1	7	0	0	0	0	0	0	0	13	0	2	0	0	0	0	0	105	0	1.16	76.9%
130057	6842	LYM13 B3 wall trench cutting SFB 6	33	0	0	0	0	0	0	2	0	0	0	0	0	0	0	4	0	1	24	0	2	0	0	0	0	0	100	0	0.93	50.0%
130108	6706	LYM13 B3 post hole	78	0	0	0	2	0	0	1	0	3	14	0	5	0	0	0	0	3	41	7	2	0	0	0	0	0	141	0	1.53	72.9%
130060	6931	LYM13 B4 post hole	5	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	20	0	1.33	100.0%
130025	6763	LYM13 B4 post hole	15	0	0	0	0	0	0	0	0	0	0	0	1	0	0	5	0	1	7	0	1	0	0	0	0	0	21	0	1.26	0.0%
130006	6039	LYM13 B4 post hole	21	0	0	0	0	0	0	1	0	0	0	0	0	0	0	4	0	1	13	0	2	0	0	0	0	0	63	0	1.13	69.2%
130008	6025	LYM13 B4 post hole	13	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	2	6	0	1	0	0	0	0	0	79	0	1.42	33.3%
130082	7014	A/S c7th post hole	59	0	0	0	0	0	5	5	0	0	0	0	2	0	0	16	0	1	24	0	6	0	0	0	0	0	134	0	1.55	45.8%
130083	7016	A/S c7th post hole	20	0	0	0	0	0	0	2	0	0	0	0	0	0	0	5	0	2	10	0	1	0	0	0	0	0	48	0	1.30	30.0%
130079	6105	A/S c7th post hole	63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	2	33	8	10	0	0	0	0	0	118	0	1.29	63.4%
130158	6351	A/S c7th post hole	26	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	16	2	5	0	0	0	0	0	44	0	1.19	55.6%
130159	6373	A/S c7th post hole	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	17	0	1	0	0	0	0	0	44	0	0.68	64.7%
78	3911	A/S c7th post hole	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	11	0	4	0	0	0	0	0	23	0	0.87	45.5%
130092	6333	A/S c7th post hole	28	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3	0	2	21	0	1	0	0	0	0	0	55	0	0.88	57.1%
130127	7164	A/S c7th post hole	54	0	0	0	0	0	0	0	0	0	3	0	1	0	0	10	0	0	26	8	6	0	0	0	0	0	173	0	1.43	47.1%
6	3245	S/N post hole	7	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	3	0	2	0	0	0	0	0	41	0	1.28	33.3%
130013	6304	S/N post hole	218	0	0	0	0	0	0	2	0	0	13	0	7	0	0	76	0	7	87	16	9	0	1	0	0	0	140	0	1.51	56.7%
130014	6316	S/N post hole	245	0	0	0	0	0	0	1	0	0	30	0	5	0	0	61	0	5	129	0	14	0	0	0	0	0	40	0	1.29	62.8%
130078	6093	A/S c7th post hole	26	0	0	0	0	0	0	0	0	0	0	0	3	0	0	2	0	2	17	0	2	0	0	0	0	0	41	0	1.12	82.4%
130080	6107	A/S c7th post hole	44	0	0	0	0	0	0	0	0	0	8	0	1	0	0	4	0	1	20	7	3	0	0	0	0	0	79	0	1.53	59.3%

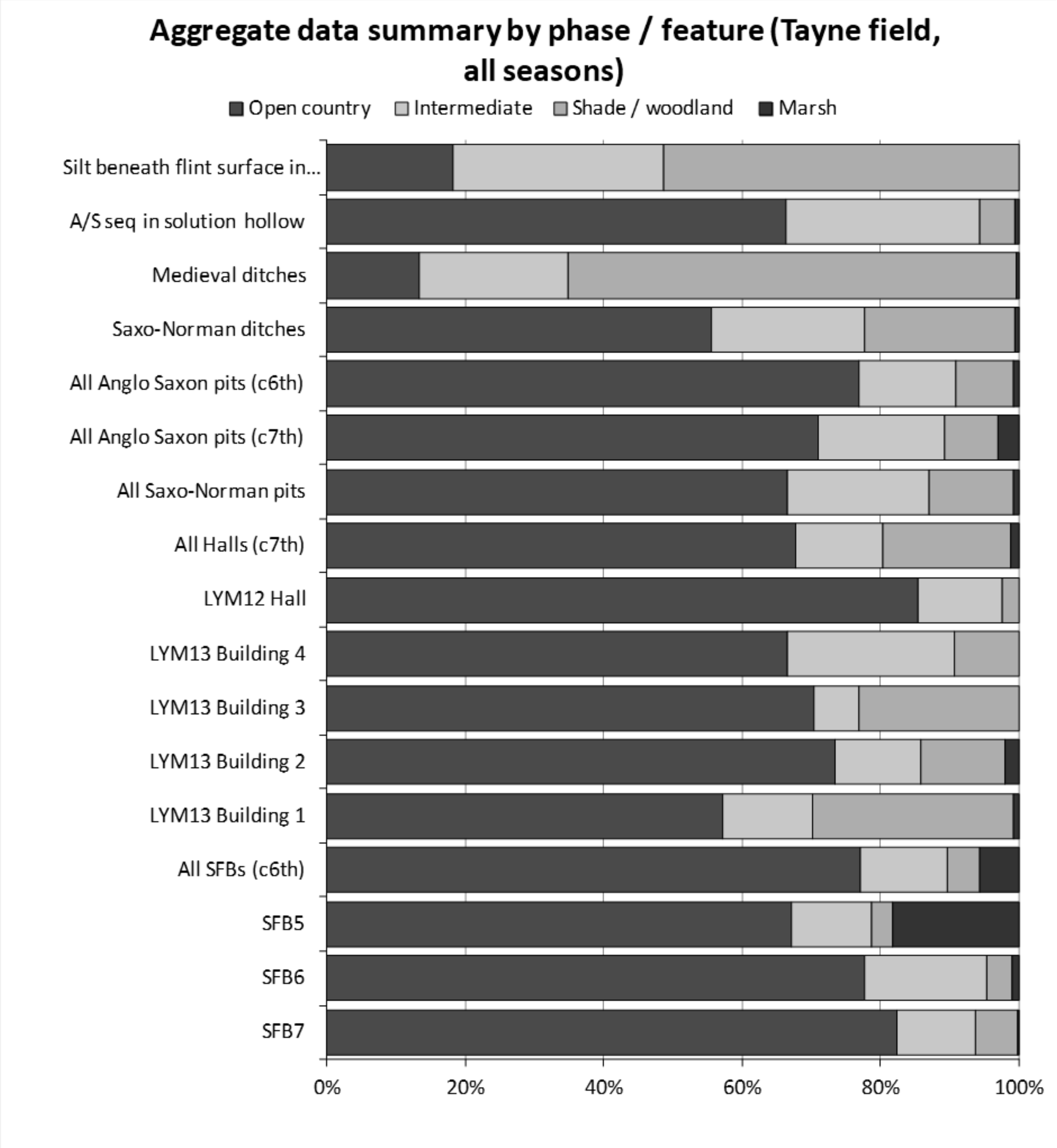


Figure 95: Aggregate data summary of mollusc ecologies for main Tayne Field (LYM12-14) archaeological features grouped by type for purposes of comparison.

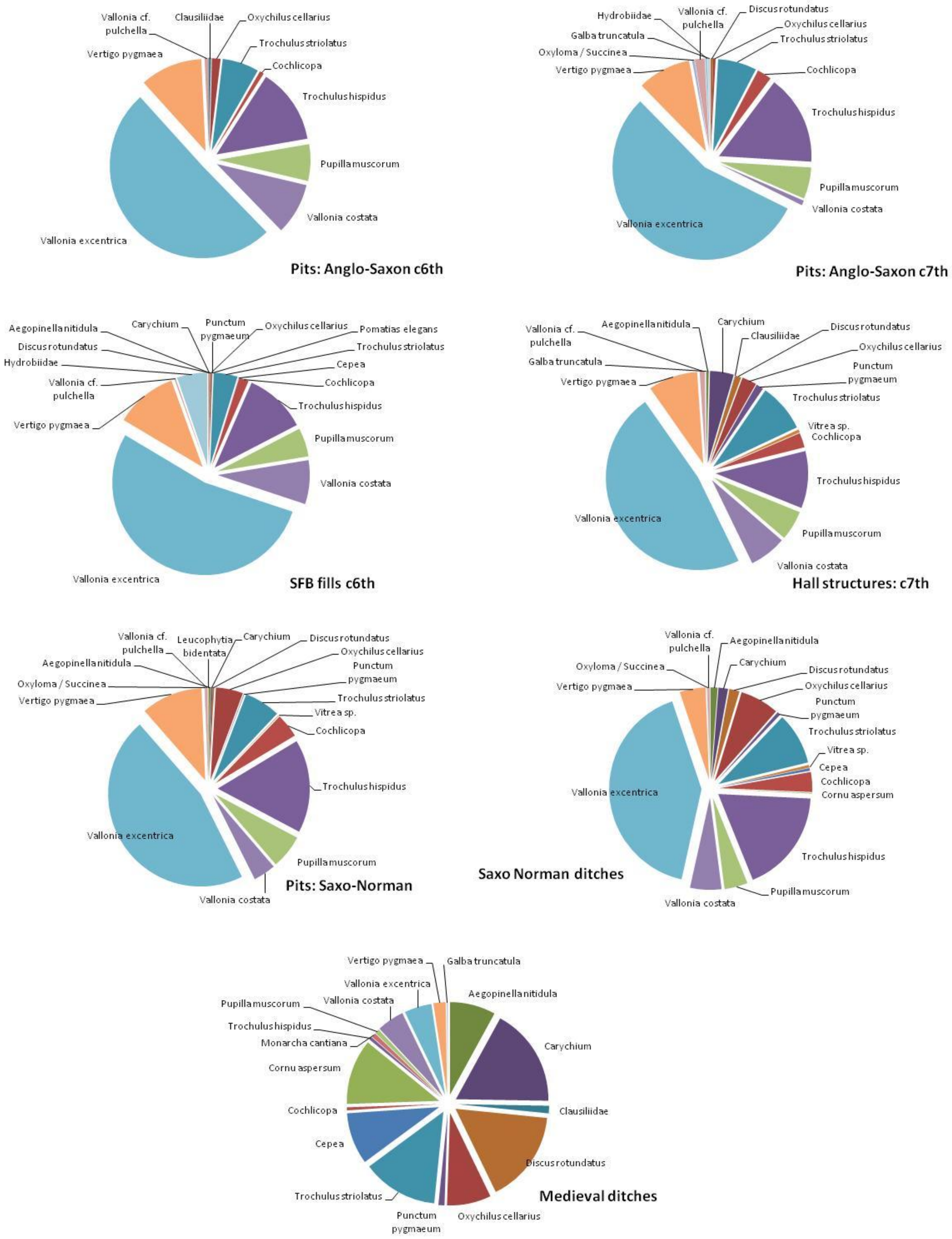


Figure 96: Unweighted proportional distributions of species by phase / feature (Tayne Field, LYM12/14).

8.3 Interpretation

8.3.1 Timber halls

A concentration of shade-loving types, specifically *Carychium tridentatum*, *Oxychilus cellarius, Punctum pygmaeum* and *Vitrea* sp. within large structural door post holes associated with the LYM13 timber halls, may indicate long grass or vegetation either around the base of the structures or growing after abandonment. These assemblages may also contain molluscs imported to the site attached to the bark of unworked structural timbers later used in the construction of the buildings. Previous studies have demonstrated the limited distribution of such shade-loving taxa in open areas with peripheral overgrown or woodland habitats (Davies, 1999). The distribution of such types is likely to represent highly localised features, with the caveat that anthropogenic interference may have caused lateral redistribution of material which will have distorted spatial distribution.

Isolated specimens of *Galba truncatula* encountered in post hole fill (6524) and wall trench fill (7209) may, as with similar examples found associated with the timber building at Rectory Lane (Chapter 9) indicate the presence of vegetation from stream-side environments such as rushes used as flooring materials or thatch in these buildings. Comparison with modern analogues around the site (Chapter 3) also raises the possibility for a similar origin for some of the shade loving types present in these timber hall contexts, notably *Carychium minimum / tridentatum* which are today found in abundance at the stream margin but are otherwise absent from the open grassland area and wooded margins of the site.

8.3.2 Sunken featured buildings

The SFB fills are taphonomically complicated by anthropogenically mixed and thus ecologically allochthonous fill material (Evans, 1972: 34). Of particular importance to the present analysis are the primary fill units which incorporate material from the sides of the cut and to a lesser degree from the ground surface immediately around it (Schiffer, 1987: 118). Previous micromorphological work on SFB fills at Rectory Paddock (Maslin, 2015) has demonstrated the potential for a diverse range of material originating across a wide area to be present and the representation of a wide range of micro and macro-scale habitats. This situation differs from that for material contained in refuse pits (e.g. Chapter 9) which can be assumed to represent more tightly spatially and chronologically defined sets of domestic and industrial processes occurring in nearby structures, at least on the basis of later medieval analogues (Keene, 1982).

Despite these hypothetical sources of taphonomic variation, the assemblages from the SFBs analysed here demonstrate a very similar balance of species to other contemporary and slightly later (7th-century hall phase) occupation contexts (Figure 96). This suggests that the broader area of the settlement during the period of use and infill comprised a set of largely homogenous environments, such that the differences in waste stream inputs between pit and SFB fills were not sufficient to generate notable differences in assemblage composition. From this it is reasonable to infer that the wider settlement environment was open, with little in the way of marked habitat variation across the activity and occupation areas generating these waste streams.

Within the SFB fills, a notable indication of transportation of materials from off-site ecological areas can be seen with the large number of Hydrobiidae discovered in samples from SFB5 (context (3705)), which were blackened by charring and also mineralised. This suggests some form of processing from burning, perhaps as waste material, and then deposition in cess or other midden dumps containing high concentrations of soluble phosphates available for redistribution by percolating groundwater (Green, 1979: 281). Further specimens were recovered from the fill of SFB7 (context (6204)) and the sequence from the doline / hollow (context (99228)) (Chapter 7). These types are brackish water molluscs, typically found on vegetation in coastal estuarine or salt marsh environments (Davies, 2008: 167) and suggest the exploitation and use of materials from these environments, such as reeds for thatching or flooring, or grasses for fodder (see also Chapter 7 & 9).

The presence of isolated specimens of these allochtonous types can in some instances be explained by natural taphonomic vectors such as transport by birds (Bush, 1988: 860); this is clearly demonstrated in the recorded presence of a single specimen of freshwater bivalve (*Pisidium* sp.) in a contemporary woodland margin assemblage (analogue V, Chapter 3). Despite this potential vector, the wider presence of aquatic types within various occupation contexts from Tayne Field and Rectory Lane indicates a wider process of anthropogenic import and use of materials from freshwater and coastal marsh environments across the early (6th-century) occupation phases. It is notable that two of the recorded freshwater taxa (*A. leucostoma* and *B. contortus*) are entirely absent from the modern molluscan analogue recorded from the stream bank (Chapter 3) which may indicate a source for this material further away from the site than the nearby stream channel or the impact of ecological changes to the stream environment.

8.3.3 Ditch sequences

Three post-Saxon ditch sequences were sampled specifically for Mollusca during the 2013 field season (Figure 87). All of these sequences were sieved and sorted in the laboratory. These ditch fills all lack any representation of freshwater Mollusca which could demonstrate a use for drainage (e.g. Davies, 2008: 22). Two of these sequences (Sections 37 & 40) corresponded to ditches relating to the Saxo-Norman phase (11th/12th century) and were associated with animal remains including a fully articulated horse carcass and charred cereal deposits (Thomas and Knox, 2014: 12-13). The third (Section 32) was taken from the western end section of a major ditch [6004] running east-west across the site which produced a significant number of hand-collected shells of larger and notably synanthropic types (*Cepaea nemoralis*, *Cornu aspersum*) (Table 37) along with medieval ceramics (Thomas and Knox, 2014: 13). The profiles are all strongly affected by earthworm sorting, evidenced by worm-sorted stone horizons and stone-free turf line which has compromised the stratification (Evans, 1972: 208). In the major E-W medieval ditch (context [6004], Figure 89) three distinct worm-sorted stone lines were evident, indicating previous soil horizons buried through landscaping following the construction of military huts on the field during the Second World War (Chapter 12).

The typical ditch profile encountered in both excavated and experimental sequences comprises a tripartite sequence of eroded primary material, secondary organic sediments accumulating under vegetation and a tertiary deposit of ploughwash from later cultivation (Davies, 2008: 68). This is apparent in the medieval ditch [6004] (Figure 88, Figure 89), where the molluscan sequence reflects open country conditions in the primary fill (*Trochulus hispidus*, *Vallonia excentrica*) overlain by a secondary fill dominated by a large and diverse range of shade-loving types (*Discus rotundatus*, *Carychium tridentatum*, *Aegopinella nitidula*, *Oxychilus cellarius* and *Vitrea* sp.) beneath a sparser plough soil assemblage dominated by *Vallonia excentrica*. This type of transition is a common feature of ditch fill sequences and is typically interpreted in terms of wider landscape reforestation, particularly provided when such a combination of key shade-demanding species are found in abundance (Davies, 2008: 83). Here however, there is no evidence for any comparable transition in the contemporary pollen, macrofossil or molluscan evidence from the stream sequence (Chapter 5) which could indicate a wider reforestation or abandonment; instead the evidence points to an open and largely arable landscape. The high number of larger synanthropic types recorded in the hand collected assemblage (Table 37) furthermore demonstrates the concentration of large numbers of such taxa in a specific area within this wider, species poor agricultural landscape, suggesting interpretation as a localised feature such as a hedge line (Evans, 1972: 127, 201).

In the earlier Saxo-Norman features (Figure 91 to Figure 94), the overburden of plough soil had been removed by excavation prior to sampling. The upper contexts in these sequences (6600) and (6596) represent secondary fill. Both sequences demonstrated very low numbers of shells and a restricted range of species. Nevertheless, they both contain taxa indicating localised shade or longer vegetation within the ditch (*Carychium tridentatum*, *Punctum pygmaeum*, *Oxychilus cellarius*) with a transition to more exclusively open country / arable fauna (*Vallonia excentrica*, *Trochulus hispidus*) followed by a return to a more mixed community (Figure 91, Figure 93Figure 94). Comparison with the aggregate data from associated pit contexts (Figure 96) indicates a mix of open-country and intermediate types dominated by *V. excentrica*, demonstrating that the wider environment at the time was predominantly open ground or arable. This suggests these specific features did not differ too markedly from the wider ecologies at the time and most likely comprised dry and overgrown field boundaries rather than substantial hedge lines as are seen in the later ditch [6004]. Comparison to the contemporary pit assemblages demonstrates larger proportions of *Oxychilus cellarius* and *Trochulus striolatus* suggesting that the ground surface around these ditches was more overgrown with (Figure 96) and that they represent less heavily trampled areas of the site.

An additional sequence (Figure 90) from a suspected Bronze Age feature (LTF13) between the site of the great hall complex and the stream demonstrated low shell counts and a species-poor assemblage with no substantive transitions. As with a majority of other Tayne Field assemblages this sequence was dominated by *V. excentrica* and *T. hispidus*, indicating an open-country ecology. With only a tenuous attribution to the prehistoric / Bronze Age this assemblage cannot be assumed to be representative.

8.4 Correlation with on-site botanical data

Botanical (mainly charred plant macrofossil) data covering a range of the on-site bulk samples discussed in this chapter and in Chapter 7 and Chapter 9, is available in Campbell (2010), McKerracher (2012 and 2015) Ballantyne (2014) and Austin (2015). This botanical data is presently only available to assessment level; consequently the following commentary is intended merely to compliment the wider interpretations of the analysis.

A summary of the collated data is presented in Figure 97. This shows the cumulative relative proportion of all samples from each feature/structure grouping which contained charred botanical remains representing vegetation groupings in comparison to aggregate ecological affiliations for the Mollusca recovered from the same samples. The chart for the botanical data presents diversity of macrofossil types (relative proportional size of bar segments) against total abundance of specimens recovered for that archaeological feature class (total length of bar). The data has been normalised against the most abundant total feature class in order to represent relative the distribution across the total on-site dataset. Feature/structure groupings with longer bars demonstrated higher overall frequencies of macrofossils per unit sample whereas shorter bars generally demonstrate low macrofossil frequencies for those groupings. This data omits SFB4 for the botanical table due to an absence of macrofossils within the relevant samples and also the post-built hall from the LYM14 season on Tayne Field for which no molluscan material was analysed due to time constraints.

This charred plant material represents seeds from identifiable taxa which have been gathered and processed before being dumped. Whilst they may not represent environments in the vicinity of the sampled contexts they may reflect the environments at the origin points for the materials which came to be included in the various fills and therefore also the origins for some of the Mollusca in the same fill. Limited samples sizes and a scarcity of identifiable charred seeds make this data problematic to interpret in any systematic way and the presentation here must be regarded as semi-quantitative at best. Low overall sample sizes for some groupings such as the LYM12 timber hall and the medieval ditch (Table 39) have resulted in bars on the summary chart in Figure 97 which are disproportionately large in relation to the very small sizes of the represented assemblage and which comprise segments essentially representing individual specimens.

Table 39: Total samples from each feature/structure assessed for charred botanical remains from reports commissioned by the Lyminge Archaeological Project (Campbell, 2010; McKerracher, 2012; Ballantyne, 2014; Mckerracher, 2015; Austin, 2015)

Feature / phase	**Number of samples assessed for charred plant macrofossils**
SFB 1 (Rectory Lane, Chapter 9)	30
SFB 2 (Rectory Lane, Chapter 9)	15
SFB 3 (Rectory Lane, Chapter 9)	19
SFB 5 (Chapter 6)	7
SFB 6	12
SFB 7 (Chapter 6)	16
LYM12 Timber Hall	4
LYM13 Building 1	10
LYM13 Building 2	16
LYM13 Building 3	4
LYM13 Building 4	12
LYM08 Timber building (Rectory Paddock, Chapter 9)	13
Post built building, LYM10 (Rectory Lane, Chapter 9)	23
LYM14 Post built building	35
A/S Ditch (monastic) (Rectory Paddock, Chapter 9)	14
A/S Pits (monastic) (Rectory Paddock, Chapter 9)	135
A/S Pits (6thcentury)	5
A/S Pits (7thcentury)	9
A/S sequence in doline (Chapter 7)	25
S/N Pits	38
S/N Ditch	7
Medieval ditch	3

Sizeable proportions of the charred assemblages of seeds recovered from the fill of many of the SFBs (notably SFB2 (Chapter 9), SFB5, SFB6 and SFB7 (Chapter 6)) as well as from the sequence in the doline / hollow on Tayne (Chapter 8) field represent arable weed types. These correlate well to molluscan assemblages which are dominated by open country and intermediate types such as *Vallonia excentrica* and *Trochulus hispidus*, indicating the presence of material resulting from agricultural processing (such as threshing) occurring in open areas within or around the settlement or materials collected directly from unshaded arable fields (such as straw).

The fills of the monastic phase pits in the Rectory Paddock area (Chapter 9) and the Saxo-Norman features from Tayne Field present the most diverse and substantial botanical assemblages, with a diversity of plant types representing all categories of environments. A relatively low proportion of arable weed types implies that waste from agricultural processes represents only a small proportion of the fill material which otherwise incorporates extensive evidence for charred domestic hearth waste, food wastes such as fish bones and cess with extensive mineralisation and evidence for fly puparia (Ballantyne, 2014 and Campbell, 2010). The input to these pits likely originates in domestic processes and incorporates seeds representing local weeds and Mollusca from within the settlement area. The fills of both the ditches (section 8.3.3) and pits relating to the Saxo-Norman phase on Tayne Field demonstrate a similar botanical profile suggesting waste material from a similar range of environments being present in their fills.

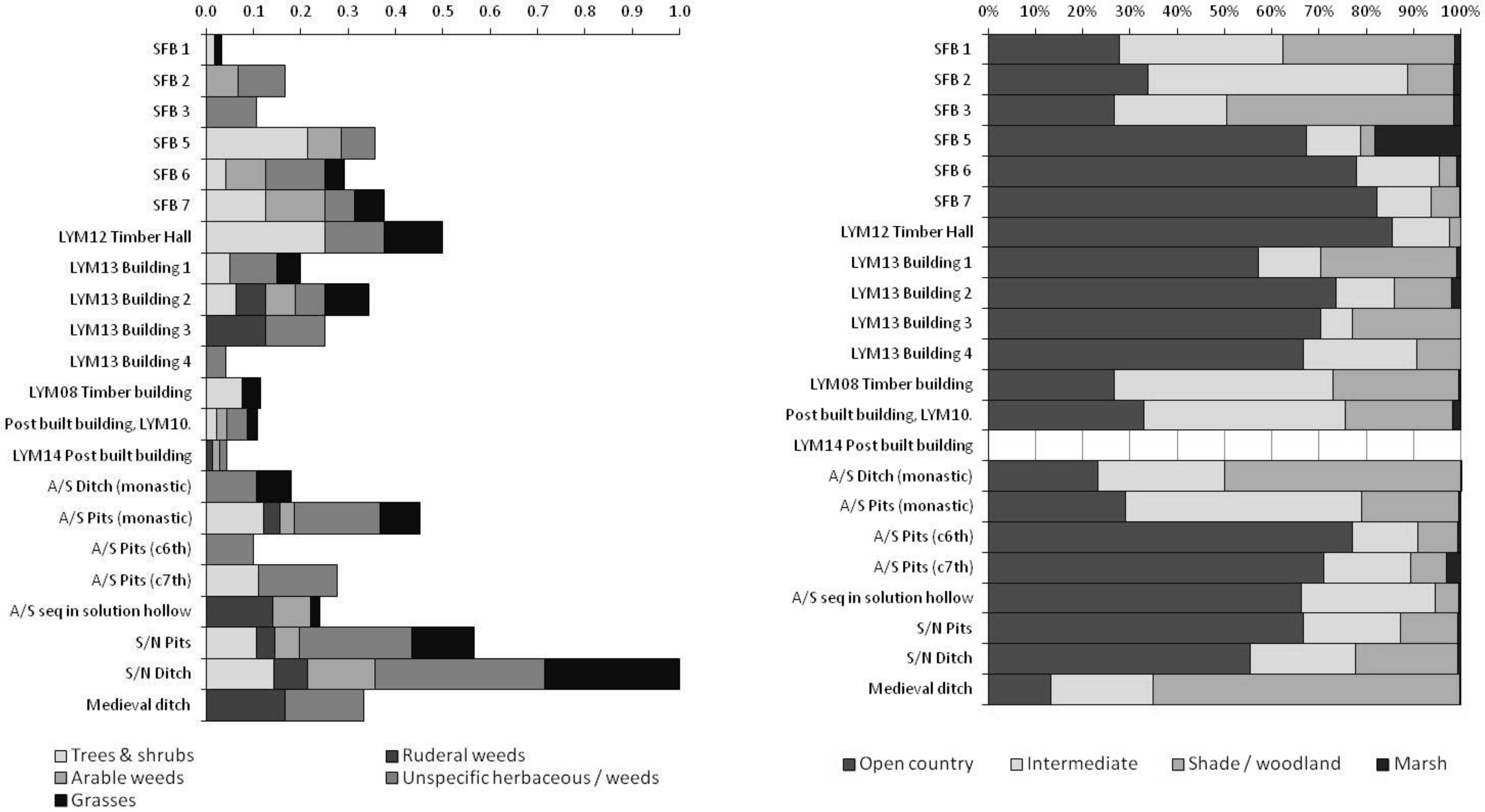


Figure 97: Indexed total abundance / representation by category of charred botanicals vs. aggregate ecological affiliations of Mollusca for each archaeological phase/feature/structure group.

Chapter 9 - Molluscan evidence from the Rectory Lane and Rectory Paddock sample areas

This chapter presents results and interpretations of the molluscan assemblages from the archaeological contexts associated with the southern zone of early Anglo-Saxon occupation (Rectory Lane) and middle Anglo-Saxon monastic core (Rectory Paddock) which were analysed for evidence of on-site vegetation and ground cover in accordance with the research objectives detailed in Section 1.5.3. All samples derive from on-site environmental sampling programs pre-dating the present research period and so not undertaken by the author. Within the text, reference is consistently made to context numbers and the field interpretations of the excavators which are recorded on the original project records accessible via the project database at **www.iadb.co.uk/lyminge**. Within the text, fill numbers are signified by round brackets, cut number by square brackets. All samples in this chapter were processed by on-site flotation.

9.1 Contexts

The archaeological context of these sample areas is summarised in Chapter 2. A number of prominent feature classes can be highlighted for specific analysis in this chapter based upon their archaeological significance, or the richness of their molluscan assemblage. Each of these feature classes represents a very different set of taphonomic pathways; with only the ditch fills and to a lesser extent the structural post holes able to demonstrate any clear correlation to the contemporary ecology of the surrounding ground surface.

Rectory Paddock contained a number of features contemporary to the 8th-century monastic phase (Thomas, 2009), comprising ditches, pits and a post-built building. Sampling for these areas focussed on pit and ditch sequences as well as structural post holes from the timber building. Rectory lane contained a number of features dating to a 7th-century pre-monastic phase (Thomas, 2011), comprising ditches, a post-built building and four sunken-featured buildings. This area has been interpreted as representing a peripheral zone of settlement associated with both the great hall complex and earlier phases of settlement at Tayne Field (Thomas, 2016: 286). Sampling for this site focussed on the sunken-featured building fills which contained rich assemblages of artefacts and charred macrofossils. Other significant features included structural post holes from the timber building and several significant pit sequences.

Figure 98: Simplified site plans for a) Rectory Paddock and b) Rectory Lane excavation areas, showing location of features discussed in text.

9.2 Results - overview

The majority of assemblages comprise a mesophilic / intermediate ecology dominated by two genera: *Trochulus* and to a lesser extent, *Vallonia*. The *Trochulus* group comprises both the catholic *T. hispidus*, a common type favouring a wide range of environments, and the more synanthropic *T. striolatus* which typically favours more shaded conditions (Davies, 2008: 179). This latter species, an infrequent component of prehistoric assemblages where it is generally associated with woodland, has been strongly associated with environments disturbed by human activity in post Roman periods (Evans, 1972: 176-177). Modern analogues taken from nearby arable and waste ground areas (Chapter 3) indicate this dominance of *T. hispidus* and *T. striolatus* continues today. The ecology of these areas fundamentally differs from that of Tayne Field (Chapter 7-8) which demonstrates communities more characteristic of open country conditions with a decreased representation of longer-vegetation or shade-demanding types such as *Oxychilus cellarius* and *T. striolatus* in favour of a more dominant population of *Vallonia excentrica*. This variation may largely be dependent on the different aspect and soils of these two sites (Chapter 3) rather than anthropogenic processes.

A range of Romano-British (*Monacha cantiana, Cornu aspersum, Cernuella virgata*) and early medieval (*Candidula intersecta*) introduced types (Davies, 2008: 178; Davies, 2010) are present; the latter being specifically confined to 8th-century monastic contexts at Rectory Paddock. These are paralleled in the off-site assemblages from Woodland Road (Chapter 10). The absence of *C. intersecta* in earlier (6th/7th-century) assemblages from Tayne Field (Chapter 7-8) may demonstrate the local absence of this type prior to the 8th century.

In all results tables in this chapter, taxa are arranged alphabetically by name and grouped within broad ecological affiliations that are detailed in Chapter 3. In all mollusc diagrams the plus sign (+) indicates rare taxa and groupings (<1%).

9.3 Results – Rectory Paddock (LYM08-09)

Count data for the Rectory Paddock sample area (LYM08, LYM09) is presented in Table 40. A summary of aggregated ecological affiliations (Chapter 3) for each class of archaeological feature is presented in Figure 99. Summaries of distributions of species for each of these classes are presented in Figure 100a-d. Mollusc diagrams for selected pit and ditch sequences together with summary diagrams of each section are presented in Figure 101 to Figure 110.

Table 40: Rectory Paddock (LYM08-09) mollusc counts from environmental bulk samples

Sample ID	Context	Description	Total shells	*Acanthinula aculeata*	*Aegopinella nitidula*	*Carychium* sp.	Clausiliidae	*Discus rotundatus*	*Merdigera obscura*	*Oxychilus cellarius*	*Pomatias elegans*	*Punctum pygmaeum*	*Trochulus striolatus*	*Vitrea* sp.	*Cepaea nemoralis*	*Cochlicopa* sp.	*Cornu Aspersum*	*Trochulus hispidus*	*Candidula intersecta*	*Cernuella virgata*	*Helicella itala*	*Monacha cantiana*	*Pupilla muscorum*	*Vallonia excentrica*	*Vallonia costata*	*Vertigo pygmaea*	*Oxyloma / Succinea*	*Vallonia* cf. *pulchella*	*Cecilioides acicula*	Limacidae	Shannon's H	Broken vs. total
55	305	Post hole, LYM08 Timber building.	33	0	0	0	0	0	0	2	0	0	3	0	0	1	0	19	0	0	0	0	4	4	0	0	0	0	12	0	1.32	2.7%
51	298	Post hole, LYM08 Timber building.	67	0	0	0	0	0	0	2	0	0	15	0	0	2	0	31	0	0	0	0	6	10	0	1	0	0	72	0	1.46	11.7%
60	310	Post hole, LYM08 Timber building.	107	1	0	0	0	0	0	12	0	0	11	1	0	10	0	45	0	0	0	0	9	17	0	1	0	0	104	0	1.70	5.6%
61	312	Post hole, LYM08 Timber building.	113	0	0	0	0	0	0	3	0	0	14	0	0	14	0	37	0	0	0	0	18	22	2	3	0	0	1	0	1.76	8.8%
64	324	Post hole, LYM08 Timber building.	99	0	0	0	0	0	0	5	0	1	25	0	0	5	0	32	0	0	0	0	11	18	1	1	0	0	159	0	1.71	3.4%
38	203	Post hole, LYM08 Timber building.	179	0	0	0	1	1	0	35	0	0	37	0	0	10	0	33	0	0	0	0	20	36	2	2	1	1	184	0	1.90	10.1%
48	140	Post hole, LYM08 Timber building.	68	0	0	0	0	0	0	7	0	0	8	0	0	9	0	20	0	0	0	1	6	11	5	0	1	0	144	0	1.94	7.1%
58	116	Post hole, LYM08 Timber building.	117	0	0	1	0	0	0	9	0	0	25	0	0	13	0	31	0	0	0	1	5	24	7	0	0	1	79	0	1.87	14.9%
35	209	Post hole, LYM08 Timber building.	65	0	0	0	0	0	0	7	0	0	35	0	0	7	0	13	0	0	0	2	0	0	0	0	1	0	2	0	1.31	0.0%
9	92	Post hole, LYM08 Timber building.	93	0	0	0	0	0	0	1	0	0	5	0	0	15	0	64	0	0	0	1	4	0	0	2	1	0	26	0	1.07	6.3%
50	124	Post hole, LYM08 Timber building.	67	0	0	0	0	0	0	0	0	0	4	0	0	13	0	35	0	0	0	0	4	9	2	0	0	0	110	0	1.37	5.1%
27	191	Post hole, LYM08 Timber building.	62	0	0	0	0	0	0	0	0	0	13	0	0	9	0	27	0	0	0	0	12	0	0	1	0	0	41	0	1.35	4.9%
123	1615	Fill of ditch [1589], cuts A/S ditch [1092]	235	0	10	2	0	2	0	15	0	0	80	0	0	22	0	78	0	0	0	1	6	17	2	0	0	0	178	0	1.69	3.1%
137	1711	Ditch [1448] (overlies (1820), dated 660 - 780AD (95%)).	168	0	0	0	0	0	0	2	0	0	32	0	0	7	0	78	0	0	0	0	1	46	0	1	1	0	300	1	1.30	12.1%
140	1764	Fill of ditch [1688] below (1751) (overlies (1820), dated 660 - 780AD (95%)).	19	0	0	0	0	0	0	3	0	0	2	0	0	0	0	11	0	0	0	0	0	3	0	0	0	0	5	0	1.14	0.0%
143	1751	Fill of ditch [1688] below (1689) (overlies (1820), dated 660 - 780AD (95%)).	229	0	0	1	1	0	0	6	0	0	48	1	0	14	1	96	0	0	0	1	2	53	4	1	0	0	220	0	1.55	5.6%
142	1689	Fill of ditch [1688] (overlies (1820), dated 660 - 780AD (95%)).	181	0	0	9	0	0	0	6	0	0	30	0	0	6	0	48	0	0	0	2	9	64	6	1	0	0	235	0	1.73	8.4%
34	1456	Fill of presumed A-S ditch [1092] below (1452).	95	0	1	0	0	0	0	12	0	0	39	0	0	7	0	20	0	0	0	0	0	4	12	0	0	0	9	0	1.59	4.5%
33	1452	Chalky lower fill of Anglo-Saxon ditch [1092] below (1408).	92	0	3	1	0	0	0	7	0	0	57	0	1	5	0	6	0	0	0	0	0	0	12	0	0	0	10	0	1.30	7.7%
32	1408	Lower fill of Anglo-Saxon ditch [1092] at east end of trench.	186	0	1	0	0	0	0	11	0	0	67	0	1	9	0	37	0	0	0	1	0	21	38	0	0	0	35	0	1.66	15.9%
31	1439	Fill of presumed A-S ditch [1092] overlying (1408).	279	0	1	0	0	0	0	14	0	0	142	0	0	16	0	29	0	0	0	4	0	42	28	1	2	0	80	0	1.55	12.9%
36	1466	Fill of presumed A-S ditch [1092], underlying (1460).	69	0	0	0	0	0	0	3	0	0	48	0	1	8	0	0	0	0	0	0	0	1	8	0	0	0	13	0	1.01	2.6%
35	1460	Chalk fill at base of presumed A-S ditch [1092].	14	0	0	0	0	0	0	1	0	0	7	0	0	0	0	3	0	0	0	0	0	0	3	0	0	0	3	0	1.20	5.9%
145	1592	Fill of ditch [1591].	266	0	6	1	0	0	0	22	0	0	76	1	0	22	0	95	0	0	0	1	4	36	2	0	0	0	60	1	1.66	2.0%
55	1494	Fill within linear [1457] below (1458), slot 2.	151	0	8	0	0	0	0	13	0	0	82	1	6	6	0	7	0	0	0	0	9	16	2	1	0	0	104	0	1.63	5.9%
53	1458	Upper fill of palisade ditch [1457] overlying (1494).	202	0	0	0	0	4	0	31	0	0	86	0	0	17	0	15	0	0	0	2	7	27	12	1	0	0	88	0	1.76	6.6%
87	1509	Fill of palisade cut [1575].	282	0	36	2	0	9	0	13	0	0	140	0	3	32	1	10	0	0	0	0	3	21	12	0	0	0	250	0	1.71	5.1%
52	1455	Fill of palisade ditch [1454].	348	0	10	0	0	8	0	28	0	0	161	0	4	23	0	12	0	0	0	0	13	65	20	4	0	0	290	0	1.75	11.8%
5	164	Pit fill.	21	0	0	0	0	0	0	1	0	0	0	0	1	1	0	15	0	0	0	1	0	0	0	0	2	0	8	0	1.04	0.0%
6	160	Pit fill.	120	0	0	0	0	0	0	3	0	0	11	0	0	8	0	72	0	0	0	0	5	17	0	1	3	0	90	0	1.34	5.8%

Sample ID	Context	Description	Total shells	*Acanthinula aculeata*	*Aegopinella nitidula*	*Carychium* sp.	Clausiliidae	*Discus rotundatus*	*Merdigera obscura*	*Oxychilus cellarius*	*Pomatias elegans*	*Punctum pygmaeum*	*Trochulus striolatus*	*Vitrea* sp.	*Cepaea nemoralis*	*Cochlicopa* sp.	*Cornu Aspersum*	*Trochulus hispidus*	*Candidula intersecta*	*Cernuella virgata*	*Helicella itala*	*Monacha cantiana*	*Pupilla muscorum*	*Vallonia excentrica*	*Vallonia costata*	*Vertigo pygmaea*	*Oxyloma / Succinea*	*Vallonia* cf. *pulchella*	*Cecilioides acicula*	Limacidae	Shannon's H	Broken vs. total
7	180	Organic pit fill.	59	0	0	0	0	0	0	0	0	0	3	0	0	11	0	33	0	0	0	0	4	6	1	1	0	0	73	1	1.34	3.0%
15	126	Pit fill.	204	0	0	0	0	0	0	4	0	0	31	0	0	19	0	62	0	0	0	0	27	56	2	3	0	0	200	0	1.68	11.8%
25	229	Pit fill.	53	0	0	0	0	0	0	3	0	0	7	1	0	7	0	21	0	0	0	0	1	11	0	2	0	0	104	0	1.66	9.4%
30	233	Daub rich pit fill.	132	0	16	0	0	0	0	5	0	0	19	0	0	14	0	38	0	0	0	1	8	21	3	6	1	0	291	0	2.02	5.8%
31	274	Charcoal-rich pit fill.	9	0	0	0	0	0	0	0	0	0	0	0	0	3	0	4	0	0	0	0	1	1	0	0	0	0	22	0	1.21	0.0%
34	198	Cess fill of pit under chalk capping.	191	0	0	0	0	0	0	1	0	0	5	0	0	17	0	104	0	0	1	0	13	40	5	2	1	2	327	0	1.43	11.4%
36	254	Primary pit fill.	23	0	0	0	0	0	0	4	0	0	4	0	0	2	0	8	0	0	0	0	1	4	0	0	0	0	51	0	1.63	7.4%
40	247	Organic pit fill.	180	0	0	1	0	0	0	3	0	0	21	0	0	15	0	89	0	0	0	1	12	32	4	2	0	0	294	0	1.55	7.9%
41	268	Post hole.	92	0	0	0	0	0	0	3	0	0	9	0	0	17	0	41	0	0	0	0	10	11	0	1	0	0	62	0	1.56	4.9%
44	132	Pit fill.	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.0%
46	277	Pit fill.	117	0	0	1	0	0	0	1	0	0	2	0	0	11	0	81	0	0	0	1	4	15	0	1	0	0	179	0	1.09	6.8%
56	12	Pit fill.	120	0	0	1	0	1	0	6	0	0	20	0	0	9	0	45	0	0	0	0	3	24	10	1	0	0	135	0	1.75	15.6%
59	306	Pit fill.	58	0	0	0	0	0	0	0	0	0	0	0	0	7	0	44	0	0	0	0	3	4	0	0	0	0	60	0	0.80	0.0%
65	234	Pit fill adjacent to wall trench.	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	19	0	0.00	0.0%
66	272	Secondary pit fill.	70	0	0	0	1	0	0	11	0	0	16	0	0	4	0	27	0	0	0	0	2	6	1	0	2	0	118	0	1.69	2.6%
67	206	Primary cess fill.	17	0	0	0	0	0	0	3	0	0	0	0	0	1	0	12	0	0	0	0	1	0	0	0	0	0	43	0	0.89	0.0%
500	503	Pit fill.	231	0	0	0	0	0	0	1	0	0	11	0	0	22	0	79	0	0	0	0	26	79	3	7	1	2	253	0	1.60	9.9%
501	525	Pit fill.	164	0	0	0	0	0	0	7	0	0	4	0	0	12	0	72	1	0	0	0	19	44	0	4	1	0	169	0	1.53	6.3%
502	519	Pit fill.	316	0	0	0	0	0	0	8	0	0	22	0	0	17	0	89	0	0	0	0	30	126	0	17	4	3	582	0	1.64	13.1%
512	679	Primary pit fill.	191	0	1	0	0	0	0	4	0	0	12	0	0	29	0	86	0	0	0	0	27	26	0	5	1	0	300	1	1.60	5.5%
518	700	Pit fill.	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	11	0	0.69	33.3%
522	624	Upper pit fill.	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	1	0	0	0	0	11	0	0.56	20.0%
540	744	Pit fill.	2	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	8	0	0.69	0.0%
3 / 8	82	Charcoal-rich pit fill.	25	0	0	0	0	0	0	0	0	0	0	0	0	2	0	22	0	0	0	1	0	0	0	0	0	0	2	0	0.44	0.0%
11	184	Secondary fill of pit [145], overlying (192).	208	0	1	0	0	0	0	18	0	0	42	1	1	15	0	92	0	0	1	1	5	27	2	1	1	0	207	0	1.66	4.6%
10	169	Third fill of pit [145] underlying (146), overlying (184).	121	0	0	0	0	0	0	0	0	0	5	0	0	13	0	55	0	0	0	0	9	29	5	5	0	0	170	0	1.53	5.2%
53	296	Fill of pit [255] below (256).	27	0	0	0	0	0	0	2	0	0	5	0	0	6	0	5	0	0	0	0	5	2	0	1	0	1	65	0	1.90	6.9%
54	303	Primary fill of pit [255], under (296).	13	0	0	0	0	0	0	0	0	0	0	0	0	4	0	8	0	0	0	0	0	1	0	0	0	0	0	0	0.86	0.0%
39	225	Fill of pit [7] underlying (207).	152	0	0	0	0	0	0	0	0	0	8	1	1	9	0	91	0	0	0	0	6	34	1	1	0	0	107	0	1.22	3.7%
18	207	Layer under stone / daub context (204) in [7].	126	0	0	0	0	0	0	11	0	0	0	1	0	12	0	70	0	0	0	0	8	19	3	0	0	2	300	0	1.42	4.7%
509	646	Cess fill of [526] underlying (642).	87	0	0	0	0	0	0	1	0	0	0	0	0	8	0	43	0	0	0	0	7	25	0	3	0	0	200	0	1.30	5.4%
506	642	Compact clay-like layer underlying (634) in cut [526].	224	0	0	0	1	0	0	7	0	0	19	0	0	10	0	51	0	0	0	0	17	105	0	14	0	0	300	1	1.54	17.9%

Sample ID	Context	Description	Total shells	*Acanthinula aculeata*	*Aegopinella nitidula*	*Carychium* sp.	Clausiliidae	*Discus rotundatus*	*Merdigera obscura*	*Oxychilus cellarius*	*Pomatias elegans*	*Punctum pygmaeum*	*Trochulus striolatus*	*Vitrea* sp.	*Cepaea nemoralis*	*Cochlicopa* sp.	*Cornu Aspersum*	*Trochulus hispidus*	*Candidula intersecta*	*Cernuella virgata*	*Helicella itala*	*Monacha cantiana*	*Pupilla muscorum*	*Vallonia excentrica*	*Vallonia costata*	*Vertigo pygmaea*	*Oxyloma / Succinea*	*Vallonia* cf. *pulchella*	*Cecilioides acicula*	Limacidae	Shannon's H	Broken vs. total
505	634	Fill of pit [526] underlying (527).	135	0	0	0	1	0	0	6	0	0	26	0	0	11	0	31	0	0	0	0	15	41	2	2	0	0	321	0	1.76	9.0%
503	527	Upper fill of pit [526].	173	0	0	0	0	0	0	2	0	0	11	0	0	7	0	65	0	0	0	0	13	67	0	8	0	0	230	0	1.43	10.8%
508	650	Fill of [530] underlying (644).	54	0	0	0	0	0	0	0	0	0	0	0	0	4	0	38	0	0	0	0	7	5	0	0	0	0	137	0	0.93	0.0%
507	644	Fill of [530] underlying (531).	106	0	0	0	0	0	0	0	0	0	7	0	0	7	0	50	0	0	0	0	15	24	0	3	0	0	400	0	1.43	7.7%
510	647	Chalky fill of [547] underlying (641).	51	0	0	0	1	0	0	10	0	0	5	1	1	4	0	22	0	0	0	1	0	3	0	2	1	0	83	0	1.79	3.7%
515	684	Layer of fill in pit [547] underlying (664).	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	2	0	0.69	0.0%
511	661	Fill of [547] underlying (660).	150	0	0	0	0	0	0	18	0	0	5	0	1	12	1	65	0	0	0	0	13	30	0	3	2	0	104	0	1.67	7.8%
47	1485	Pit [1384] (primary fill)	16	0	0	1	0	0	0	1	0	0	8	0	0	1	0	3	0	0	0	0	0	2	0	0	0	0	110	0	1.44	5.6%
46	1385	Pit [1384] (secondary fill)	81	0	1	1	0	0	0	1	0	0	29	0	1	6	1	26	0	0	0	0	2	8	5	0	0	0	119	0	1.69	5.3%
70	1325	Cess depost within pit [1025] below chalk capping (1310).	49	0	0	0	0	0	0	1	0	0	16	0	0	1	0	11	0	0	0	0	7	7	4	2	0	0	219	0	1.75	8.3%
51	1311	Fill of pit [1025] below (1310).	74	0	0	0	0	0	0	1	0	0	24	0	0	4	0	36	0	0	0	1	1	5	1	0	1	0	170	1	1.35	0.0%
50	1310	Fill of pit [1025] below (1293).	49	0	0	0	0	0	0	1	0	0	14	0	0	0	0	19	0	0	0	0	6	8	0	1	0	0	80	0	1.44	8.8%
40	1293	Fill underlying (1026) in pit [1025].	83	0	0	0	0	0	0	1	0	0	20	0	0	1	0	31	0	0	0	2	7	21	0	0	0	0	145	0	1.46	5.8%
42	1296	Dark layer of fill underlying (1295) in [1025].	243	0	0	0	0	0	0	2	0	0	66	0	0	5	0	111	0	0	0	0	6	49	0	2	1	1	524	0	1.33	7.5%
41	1295	Tipping line in pit fill underlying (1026) in [1025].	77	0	0	0	0	0	0	1	0	0	10	0	0	5	0	36	0	0	0	0	5	18	2	0	0	0	156	1	1.47	8.2%
39	1026	Pit [1025] (uppermost fill).	216	0	0	0	0	0	0	0	0	0	49	0	0	7	0	85	0	0	0	0	13	53	7	0	2	0	271	0	1.48	3.6%
7	1286	Fil of pit [1066] below (1067).	223	0	0	0	0	0	0	0	0	1	10	0	0	6	0	144	1	0	0	0	4	54	0	3	0	0	40	1	1.04	8.3%
6	1067	Upper fill of pit [1066].	362	0	0	0	0	0	0	4	0	0	2	0	0	6	0	194	0	0	0	0	12	139	2	2	1	0	50	0	1.03	13.9%
11	1298	Chalk fill below (1294) in pit [1017].	158	0	0	0	0	0	0	2	0	0	9	0	0	5	0	116	0	0	0	2	7	14	0	1	2	0	115	3	1.05	4.1%
10	1294	Fill in pit [1017] underlying (1018).	254	0	1	0	0	0	0	5	0	0	41	0	0	12	2	128	0	0	0	2	2	56	0	3	2	0	320	1	1.42	9.7%
9	1018	Upper fill of pit [1017].	261	0	0	0	1	0	0	5	0	3	20	0	0	13	0	92	0	0	0	0	12	113	0	1	1	0	125	0	1.41	18.2%
20	1330	Chalky grey fill of pit [1009] below brown silt layer (1324).	12	0	0	0	0	0	0	1	0	0	0	0	0	0	0	10	0	0	0	0	0	1	0	0	0	0	102	0	0.57	7.7%
19	1324	Cess deposit within pit [1009] below capping layer (1313).	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	1	0	0	0	0	0	35	0	0.38	0.0%
18	1313	Fill of pit [1009] below (1285).	34	0	0	0	0	0	0	1	0	0	5	0	0	4	0	19	0	0	0	0	1	4	0	0	0	0	77	0	1.32	5.3%
5	1285	Charcoal lens in pit [1009] underlying (1278).	162	0	0	0	0	0	0	1	0	0	31	0	0	15	0	82	0	0	0	0	12	20	0	1	0	0	73	0	1.40	4.4%
16	1278	Fill of pit [1009] below (1010).	62	0	0	0	0	0	0	1	0	0	2	1	0	6	0	45	0	0	0	0	3	3	0	1	0	0	31	0	1.06	1.5%
12	1312	Charcoal lens in pit [1007] below (1277).	66	0	0	0	0	0	0	0	0	0	0	0	0	9	0	39	0	0	0	0	2	16	0	0	0	0	68	0	1.03	2.4%
22	1312	Fill of pit [1007] below (1277).	34	0	0	0	0	0	0	1	0	0	0	0	0	1	0	27	0	0	0	0	0	5	0	0	0	0	111	0	0.67	10.3%
21	1277	Fill of pit [1007] below (1008).	77	0	0	0	0	0	0	0	0	0	13	0	0	2	0	42	0	0	0	0	3	16	0	1	0	0	242	1	1.24	6.5%
17	1008	Upper fill of pit [1007].	99	0	0	0	0	0	0	5	0	0	6	0	0	6	0	44	0	0	0	0	5	27	0	6	0	0	70	0	1.53	8.7%
29	1447	Fill of [1153] below C1445.	69	0	0	0	0	2	0	18	0	0	27	0	0	3	1	5	0	0	1	0	3	7	0	1	1	0	186	0	1.76	3.9%
28	1445	Fill of pit [1153] below capping layer (1444).	13	0	0	0	0	0	0	4	0	0	5	0	0	0	0	2	0	0	1	0	0	1	0	0	0	0	51	0	1.41	0.0%

Sample ID	Context	Description	Total shells	*Acanthinula aculeata*	*Aegopinella nitidula*	*Carychium* sp.	Clausiliidae	*Discus rotundatus*	*Merdigera obscura*	*Oxychilus cellarius*	*Pomatias elegans*	*Punctum pygmaeum*	*Trochulus striolatus*	*Vitrea* sp.	*Cepaea nemoralis*	*Cochlicopa* sp.	*Cornu Aspersum*	*Trochulus hispidus*	*Candidula intersecta*	*Cernuella virgata*	*Helicella itala*	*Monacha cantiana*	*Pupilla muscorum*	*Vallonia excentrica*	*Vallonia costata*	*Vertigo pygmaea*	*Oxyloma / Succinea*	*Vallonia* cf. *pulchella*	*Cecilioides acicula*	Limacidae	Shannon's H	Broken vs. total
27	1420	Fill of pit [1153] below (1154).	81	0	0	0	0	0	0	12	0	0	12	0	0	6	0	40	0	0	0	0	0	9	0	1	1	0	300	0	1.46	2.2%
26	1154	Upper fill of pit [1153].	107	0	2	2	0	1	0	13	0	0	30	0	1	3	2	42	0	0	0	0	0	9	0	2	0	0	95	1	1.67	4.3%
45	1482	Fill of cut [1044] below (1464).	40	0	1	0	0	0	0	1	0	0	9	0	0	3	0	19	0	0	0	1	0	6	0	0	0	0	114	0	1.44	10.9%
44	1464	Fill of pit [1044] below (1045).	93	0	0	0	0	0	0	7	0	0	4	0	0	9	1	53	0	0	0	0	3	15	0	1	0	0	135	0	1.38	3.7%
43	1045	Fill of pit [1044].	98	0	0	0	0	0	0	4	0	1	16	0	0	4	0	32	0	0	0	0	4	34	0	3	0	0	175	0	1.57	10.6%
49	1502	Fill of pit [1363] below silty fill (1364).	90	0	0	0	0	0	0	2	0	0	11	0	0	4	0	44	0	0	0	1	5	23	0	0	0	0	253	0	1.39	7.1%
48	1364	Fill of pit [1363].	85	0	1	0	0	0	0	1	0	0	10	0	0	5	0	54	0	0	0	0	1	11	0	0	2	0	92	2	1.22	4.2%
60	1333	Fill of pit [1147] below (1329).	7	0	0	0	0	0	0	1	0	0	0	0	0	1	0	3	0	0	0	0	0	2	0	0	0	0	56	0	1.28	11.1%
59	1329	Fill of pit [1147] below (1319).	64	0	0	0	0	0	0	2	0	0	0	0	0	1	0	37	0	0	0	0	1	22	0	1	0	0	145	0	0.99	5.8%
58	1319	Fill of pit [1147] below (1148).	115	0	0	0	0	0	0	2	0	1	7	3	0	1	0	53	0	0	0	0	1	46	0	0	1	0	160	1	1.22	6.8%
57	1148	Secondary fill of pit [1147].	756	0	12	0	0	0	0	5	0	1	3	0	0	15	1	508	3	1	0	1	4	195	0	7	0	0	32	0	0.94	9.4%
64	1473	Fill of pit [1117] below (1463).	34	0	0	0	0	1	0	1	0	0	11	0	1	2	0	17	0	0	0	1	0	0	0	0	0	0	50	0	1.29	0.0%
63	1463	Fill of [1117] below (1443).	54	0	0	0	0	0	0	3	0	0	5	0	0	6	0	33	0	0	0	0	0	6	0	0	1	0	55	0	1.24	0.0%
62	1443	Orange silt fill of pit [1117] below (1379).	144	0	3	2	0	0	0	5	0	0	28	1	0	13	0	70	0	0	0	1	2	19	0	0	0	0	60	0	1.54	0.6%
61	1379	Fill of pit [1117] below (1118).	70	0	0	1	0	1	0	1	0	1	17	0	0	5	0	30	0	0	0	0	1	13	0	0	0	0	65	0	1.51	4.8%
68	1552	Fill of pit [1359] below (1514).	44	0	0	0	0	0	0	7	0	1	12	0	0	3	1	12	0	0	0	0	0	7	1	0	0	0	80	0	1.73	3.8%
67	1514	Fill of pit [1359] below (1360).	164	1	4	0	0	1	0	22	0	0	40	1	2	11	0	57	0	0	0	1	1	18	3	1	1	0	162	0	1.84	3.8%
66	1360	Fill of pit [1359].	224	0	1	2	1	0	0	22	0	0	96	0	1	16	0	48	0	0	0	1	3	26	4	2	1	0	152	0	1.69	5.1%
74	1327	Fill of pit [1027] below (1309).	33	0	0	0	0	0	0	0	0	1	5	0	0	4	0	15	0	0	0	0	1	5	0	2	0	0	140	0	1.57	7.9%
75	1309	Fill of pit [1027] below (1297).	79	0	0	1	0	0	0	0	0	0	8	0	0	4	0	49	0	0	0	0	4	13	0	0	0	0	222	0	1.18	2.2%
76	1297	Fill underlying (1284) in [1027].	165	0	1	0	0	1	0	4	0	0	20	0	0	8	0	89	0	0	0	0	14	27	0	1	0	0	223	0	1.42	2.6%
77	1284	Charcoal rich fill of pit [1027] below (1279).	242	0	1	0	0	1	0	18	0	0	25	1	0	15	0	127	0	0	0	0	7	41	0	3	3	0	430	0	1.52	5.3%
103	1571	Fill of pit [1094] below C1545.	87	0	3	4	0	0	0	26	0	0	14	1	0	3	0	21	0	0	0	0	1	10	3	1	0	0	114	0	1.89	9.0%
79	1545	Fill of pit [1094] below (1095).	213	0	4	2	0	1	0	15	0	1	88	0	1	8	0	64	0	0	0	0	2	25	2	0	0	0	190	1	1.57	5.0%
78	1095	Upper fill of pit [1094].	231	0	0	8	0	4	0	48	0	1	74	2	0	9	0	53	0	0	0	0	2	24	4	1	1	0	272	0	1.80	5.8%
86	1517	Primary chalky fill of pit [1347] below (1348).	12	0	0	0	0	0	0	0	0	0	7	0	0	1	0	4	0	0	0	0	0	0	0	0	0	0	30	0	0.89	0.0%
85	1348	Secondary fill of pit [1347].	133	0	0	0	0	2	0	33	0	0	33	0	2	12	1	30	0	0	0	2	0	16	0	0	2	0	200	0	1.79	6.0%
98	1520	Fill of pit [1064] below (1506).	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	5	1	0.00	50.0%
97	1506	Thin, sandy secondary fill of [1064] below (1500).	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	9	0	0.69	33.3%
94	1487	Fill of pit [1064] below (1446).	5	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	15	0	0.50	44.4%
95	1503	Sterile yellow silt fill of pit [1064] below (1487).	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	-	0.0%
93	1446	Fill of [1064] below (1374).	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	-	0.0%

Sample ID	Context	Description	Total shells	*Acanthinula aculeata*	*Aegopinella nitidula*	*Carychium* sp.	Clausiliidae	*Discus rotundatus*	*Merdigera obscura*	*Oxychilus cellarius*	*Pomatias elegans*	*Punctum pygmaeum*	*Trochulus striolatus*	*Vitrea* sp.	*Cepaea nemoralis*	*Cochlicopa* sp.	*Cornu Aspersum*	*Trochulus hispidus*	*Candidula intersecta*	*Cernuella virgata*	*Helicella itala*	*Monacha cantiana*	*Pupilla muscorum*	*Vallonia excentrica*	*Vallonia costata*	*Vertigo pygmaea*	*Oxyloma / Succinea*	*Vallonia* cf. *pulchella*	*Cecilioides acicula*	Limacidae	Shannon's H	Broken vs. total
92	1374	Fill of pit [1064] below (1336).	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	-	0.0%
91	1336	Fill of [1064] below (1334).	31	0	0	0	0	0	0	4	0	1	0	0	0	0	0	16	0	0	0	0	2	8	0	0	0	0	26	0	1.24	5.1%
90	1334	Fill of pit [1064] below (1065).	8	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	0	2	2	0	1	0	0	19	0	1.56	10.0%
89	1065	Upper fill of pit [1064].	186	0	0	0	0	0	0	19	0	1	61	0	2	11	3	23	0	0	0	3	5	54	0	4	0	0	132	0	1.77	10.0%
99	1041	Secondary fill of pit [1040] overlying (1299).	125	0	0	0	0	0	0	8	0	0	18	0	0	2	0	37	1	1	0	0	10	42	0	6	0	0	180	0	1.67	10.2%
101	1332	Fill of pit [1040] below (1326).	100	0	0	0	0	0	0	2	0	0	4	0	0	9	0	47	0	0	0	0	2	33	1	2	0	0	110	0	1.35	7.5%
111	1596	Fill of pit [1038] below (1580).	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	-	0.0%
110	1580	Fill of pit [1038] below (1573).	10	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	7	0	0	0	0	3	0	0.80	29.4%
109	1567	Fill of pit [1038] below (1516).	8	0	0	0	0	0	0	2	0	0	0	0	0	2	0	1	1	0	0	0	0	1	0	1	0	0	7	3	1.73	0.0%
108	1516	Clay fill of pit [1038] below (1515).	20	0	0	0	0	0	0	5	0	0	7	0	0	0	0	4	0	0	0	0	1	0	1	0	2	0	12	0	1.57	0.0%
107	1515	Chalky fill of pit [1038] below (1507).	25	0	1	0	0	1	0	4	0	0	4	1	0	1	0	8	0	0	0	0	3	1	0	0	1	0	29	1	1.98	0.0%
106	1507	Sandy fill of [1038] below (1479).	39	0	0	0	0	0	0	3	0	0	12	0	0	0	0	18	0	0	0	0	1	5	0	0	0	0	45	0	1.27	6.8%
105	1479	Charcoal fill in pit [1038] below chalky layer (1039).	73	0	0	0	0	1	0	3	0	0	16	0	0	4	0	32	0	0	0	0	2	13	2	0	0	0	58	1	1.55	8.0%
104	1039	Upper fill of pit [1038].	78	0	0	0	0	0	0	6	0	0	18	1	0	5	0	23	0	0	0	0	6	19	0	0	0	0	44	0	1.67	6.2%
114	1603	Fill of pit [1467] below (1599).	54	0	0	0	0	0	0	14	0	0	13	0	0	1	0	13	0	0	0	0	1	12	0	0	0	0	105	0	1.52	10.6%
113	1599	Fill of pit [1467] below (1468).	40	0	2	0	0	1	0	1	0	0	5	0	0	0	0	21	0	0	0	0	1	9	0	0	0	0	70	0	1.36	10.2%
112	1468	Upper fill of pit [1467].	111	0	0	1	0	0	0	3	0	0	13	0	0	7	0	55	0	0	0	0	7	21	2	2	0	0	144	0	1.55	9.0%
116	1492	Fill of pit [1229] below (1481).	25	0	0	0	0	0	0	3	0	0	0	0	0	2	0	14	0	0	0	0	1	5	0	0	0	0	71	0	1.23	10.0%
115	1481	Fill of pit [1229] below (1230).	375	0	2	0	0	0	0	4	0	0	28	0	0	15	0	130	0	0	0	4	42	128	14	8	0	0	48	1	1.63	9.1%
120	1566	Fill of pit [1165] below (1565).	123	0	0	0	0	0	0	0	0	0	5	0	0	3	0	106	0	0	0	0	2	6	0	1	0	0	86	0	0.60	0.0%
119	1564	Fill of pit [1165] below (1166).	100	0	1	0	0	0	0	0	0	0	6	0	0	2	0	54	0	0	0	0	1	31	2	3	0	0	236	1	1.22	10.5%
118	1166	Upper fill of pit (1165).	209	0	0	1	0	0	0	3	0	1	0	0	1	0	1	115	0	0	0	0	2	79	4	2	0	0	94	0	1.02	13.7%
131	1619	Fill of pit [1321] below (1618).	102	0	0	0	0	0	0	7	0	0	41	0	0	9	0	25	0	0	0	1	7	11	0	0	1	0	152	0	1.62	5.3%
130	1618	Fill of pit [1321] below (1617).	152	0	1	0	0	0	0	7	0	0	13	0	0	9	0	82	0	0	0	0	15	22	3	0	0	0	206	1	1.47	4.0%
129	1586	Fill of pit [1321] below (1585).	158	0	2	0	0	0	0	8	0	0	20	0	0	16	0	67	0	0	0	2	12	29	1	1	0	0	150	0	1.69	4.8%
102	1600	Fill of pit [1036] below (1508).	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0.00	0.0%
69	1508	Charcoal layer in [1036] below (1037).	171	0	0	0	0	0	0	14	0	0	28	0	1	4	1	81	0	0	0	0	6	31	0	5	0	0	300	0	1.53	5.4%
56	1495	Lower fill of pit [1349] underlying (1350).	49	0	0	1	0	0	0	5	0	0	4	0	0	5	0	25	0	0	0	0	1	4	2	0	1	1	30	0	1.67	0.0%
54	1350	Fill of pit [1349].	185	0	0	1	0	2	0	11	0	0	68	0	0	8	5	48	0	0	0	3	1	22	12	0	4	0	95	5	1.80	6.4%
139	1730	Fill of pit [1663] below (1672).	130	0	0	1	0	2	0	5	0	0	9	0	0	5	0	70	0	0	0	0	3	33	2	0	0	0	59	0	1.37	7.9%
126	1672	Tertiary fill of pit [1663] below (1665).	116	0	1	0	0	0	0	0	0	0	11	0	0	6	0	70	0	0	0	1	3	22	0	2	0	0	189	0	1.24	8.0%
138	1698	Fill of pit [1048] below (1694).	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0.00	0.0%

Sample ID	Context	Description	Total shells	*Acanthinula aculeata*	*Aegopinella nitidula*	*Carychium* sp.	Clausiliidae	*Discus rotundatus*	*Merdigera obscura*	*Oxychilus cellarius*	*Pomatias elegans*	*Punctum pygmaeum*	*Trochulus striolatus*	*Vitrea* sp.	*Cepaea nemoralis*	*Cochlicopa* sp.	*Cornu Aspersum*	*Trochulus hispidus*	*Candidula intersecta*	*Cernuella virgata*	*Helicella itala*	*Monacha cantiana*	*Pupilla muscorum*	*Vallonia excentrica*	*Vallonia costata*	*Vertigo pygmaea*	*Oxyloma / Succinea*	*Vallonia* cf. *pulchella*	*Cecilioides acicula*	Limacidae	Shannon's H	Broken vs. total
117	1340	Fill of pit [1048] below (1049).	124	0	0	0	0	1	0	52	0	0	37	0	2	5	1	17	0	0	0	0	0	7	0	0	2	0	48	5	1.50	3.8%
81	1570	Fill of pit [1151] below (1521).	78	0	1	0	0	0	0	0	0	0	11	0	0	3	0	52	1	0	0	0	1	9	0	0	0	0	87	0	1.09	1.1%
80	1521	Fill of pit [1151] below (1501).	37	0	0	0	0	0	0	2	0	0	5	0	1	3	0	18	0	0	0	0	0	6	2	0	0	0	54	0	1.53	8.9%
8	1075	Pit fill.	160	0	0	0	0	0	0	1	0	0	11	0	0	4	0	78	0	0	0	0	8	58	0	0	0	0	38	0	1.18	9.2%
13	1079	Upper pit fill.	59	0	0	0	0	0	0	1	0	0	16	0	0	1	0	13	0	0	0	0	2	24	0	2	0	0	40	0	1.42	10.8%
15	1120	Pit fill.	201	0	3	0	0	1	0	7	0	0	48	0	0	22	0	80	0	0	0	1	3	36	0	0	0	0	95	0	1.55	3.4%
38	1425	Pit fill.	110	0	2	0	1	0	0	2	0	0	34	0	1	12	0	34	0	0	0	0	3	20	0	0	1	0	110	0	1.65	10.8%
88	1409	Pit fill.	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0.00	0.0%
128	1142	Pit fill.	169	0	1	7	3	11	1	14	0	1	37	8	1	4	0	31	0	0	0	0	10	30	9	1	0	0	112	0	2.25	12.5%
124	1653	Pit fill.	39	0	0	0	0	0	0	1	0	0	19	0	0	3	0	4	0	0	0	0	0	5	3	0	4	0	53	0	1.57	10.6%
134	1653	Pit fill.	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	23	1	0.00	0.0%
135	1085	Pit fill.	132	0	0	0	0	12	0	13	0	0	63	0	0	5	0	10	0	0	0	2	2	21	0	1	3	0	120	0	1.66	7.2%
136	1682	Pit fill.	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	42	0	0.64	40.0%
144	1839	Organic pit fill.	60	0	0	2	0	3	0	5	0	0	5	0	0	1	0	29	0	0	0	0	2	13	0	0	0	0	111	1	1.54	2.7%
1	54	Post hole	66	0	0	0	0	0	0	0	0	0	4	0	0	12	0	43	0	0	0	0	7	0	0	0	0	0	110	0	1.00	9.1%
4	172	Post hole	147	0	0	0	0	0	0	0	0	0	24	0	0	15	0	65	0	0	0	1	10	27	0	2	3	0	79	0	1.56	9.8%
37	222	Post hole.	99	0	0	0	0	0	0	2	0	0	11	0	0	8	0	32	0	0	0	0	25	19	0	2	0	0	80	0	1.63	5.9%
43	260	Post hole.	37	0	0	0	0	0	0	0	0	0	9	0	0	4	0	18	0	0	1	0	1	4	0	0	0	0	3	0	1.37	0.0%
49	295	Post hole.	55	0	0	0	0	0	0	2	0	0	0	0	0	7	0	31	0	0	0	0	5	10	0	0	0	0	8	0	1.23	3.1%
23	1113	Post hole.	62	0	0	1	0	0	0	2	0	0	7	0	0	2	0	39	0	0	0	0	0	10	0	0	1	0	35	0	1.19	6.9%
24	1376	Post hole.	53	0	0	0	0	0	0	1	0	0	4	0	0	5	0	37	0	0	0	0	0	4	0	2	0	0	21	0	1.06	3.5%
25	1378	Post hole.	112	0	1	1	0	2	0	4	0	0	15	0	0	8	1	75	0	0	0	0	0	5	0	0	0	0	65	2	1.18	0.0%
141	1811	Post hole.	142	0	1	2	0	1	0	2	0	0	48	0	2	11	0	63	0	0	0	0	4	7	0	1	0	0	48	4	1.46	1.3%
127	1140	Post hole.	83	0	1	0	0	1	0	9	0	0	18	0	0	8	1	41	0	0	0	0	1	3	0	0	0	0	50	0	1.48	0.0%
125	1662	Post hole.	126	0	0	3	0	0	0	6	0	0	4	0	0	11	0	74	0	0	0	0	3	25	0	0	0	0	67	0	1.28	5.3%
121	1638	Post hole.	58	0	3	0	0	0	0	1	0	0	0	0	0	3	0	46	0	0	0	0	2	3	0	0	0	0	8	0	0.83	1.6%
122	1643	Post hole.	29	0	0	0	0	0	0	2	0	0	6	0	0	3	0	15	0	0	0	1	0	2	0	0	0	0	39	0	1.39	0.0%
100	1346	Post hole.	26	0	0	0	0	0	0	9	0	0	11	0	0	1	0	4	0	0	0	0	0	0	1	0	0	0	75	0	1.27	0.0%
82	1577	Post hole.	170	0	3	1	0	1	0	3	0	0	24	0	0	8	0	98	1	0	0	0	2	22	2	2	3	0	96	8	1.46	5.7%
83	1582	Post hole.	174	0	3	0	1	0	0	0	0	0	22	0	0	17	0	90	0	0	0	0	10	28	3	0	0	0	65	0	1.46	2.9%
84	1416	Post hole.	192	0	1	0	0	1	0	7	0	0	37	0	0	23	0	93	0	0	0	0	6	20	2	2	0	0	90	0	1.54	4.2%
30	1371	Post hole.	125	0	3	0	0	0	0	7	0	0	39	1	0	8	0	35	0	0	0	0	3	28	0	1	0	0	188	0	1.65	9.8%

Sample ID	Context	Description	Total shells	*Acanthinula aculeata*	*Aegopinella nitidula*	*Carychium* sp.	Clausiliidae	*Discus rotundatus*	*Merdigera obscura*	*Oxychilus cellarius*	*Pomatias elegans*	*Punctum pygmaeum*	*Trochulus striolatus*	*Vitrea* sp.	*Cepaea nemoralis*	*Cochlicopa* sp.	*Cornu Aspersum*	*Trochulus hispidus*	*Candidula intersecta*	*Cernuella virgata*	*Helicella itala*	*Monacha cantiana*	*Pupilla muscorum*	*Vallonia excentrica*	*Vallonia costata*	*Vertigo pygmaea*	*Oxyloma / Succinea*	*Vallonia* cf. *pulchella*	*Cecilioides acicula*	Limacidae	Shannon's H	Broken vs. total
37	1269	Post hole.	122	0	0	1	0	0	0	1	0	0	5	0	0	9	0	77	0	0	0	1	4	24	0	0	0	0	100	0	1.16	4.8%
14	1302	Post hole.	19	0	1	0	0	0	0	6	0	0	0	0	0	2	0	8	0	0	0	0	0	2	0	0	0	0	200	0	1.36	0.0%
3	1004	Post hole.	331	0	2	0	0	0	0	3	0	0	58	0	2	21	0	135	0	0	0	2	13	88	2	5	0	0	40	2	1.55	9.5%
65	1542	Post hole.	99	0	0	0	0	0	0	3	0	0	19	1	0	5	0	38	0	0	0	2	3	24	2	1	1	0	152	0	1.69	10.4%
133	1149	Post hole / natural feature.	172	0	1	1	0	1	0	7	0	0	31	0	0	9	0	75	0	0	0	0	1	43	0	2	1	0	140	1	1.50	7.0%
72	1546	Post hole.	44	0	0	0	0	0	0	2	0	0	10	0	0	1	0	20	0	0	0	0	5	3	2	1	0	0	35	0	1.58	4.1%
73	1550	Post hole.	80	0	0	0	0	0	0	1	0	0	7	0	0	6	0	35	0	0	0	0	4	26	0	1	0	0	92	0	1.39	10.4%

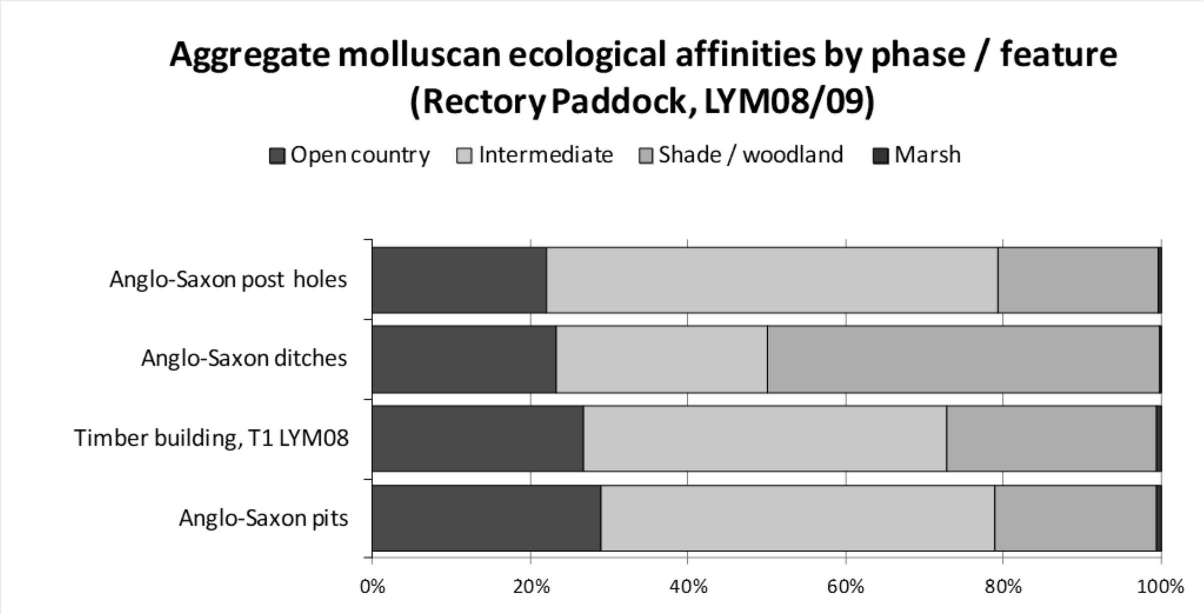


Figure 99: Aggregate summary of mollusc ecologies for main Rectory Paddock (LYM08-09) archaeological feature classes

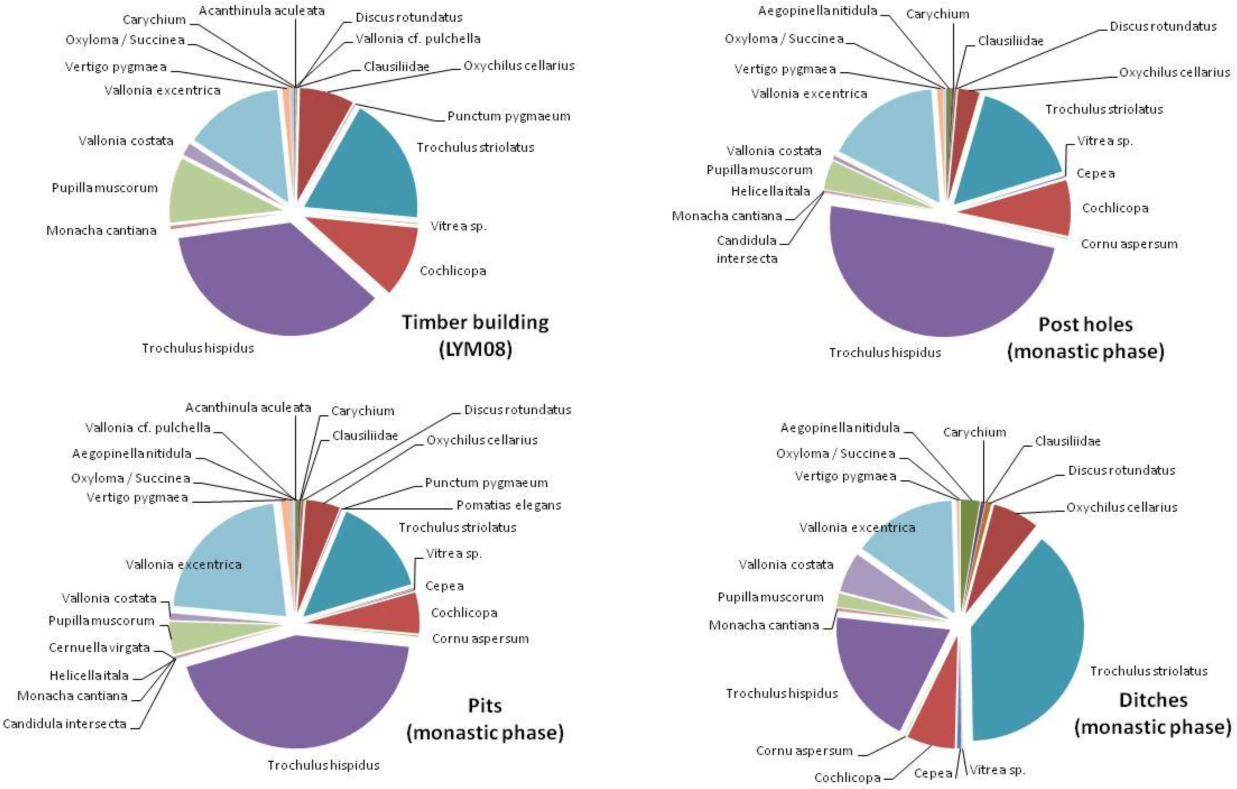


Figure 100: Unweighted proportional distributions of species by phase / feature (Rectory Paddock, LYM08/09).

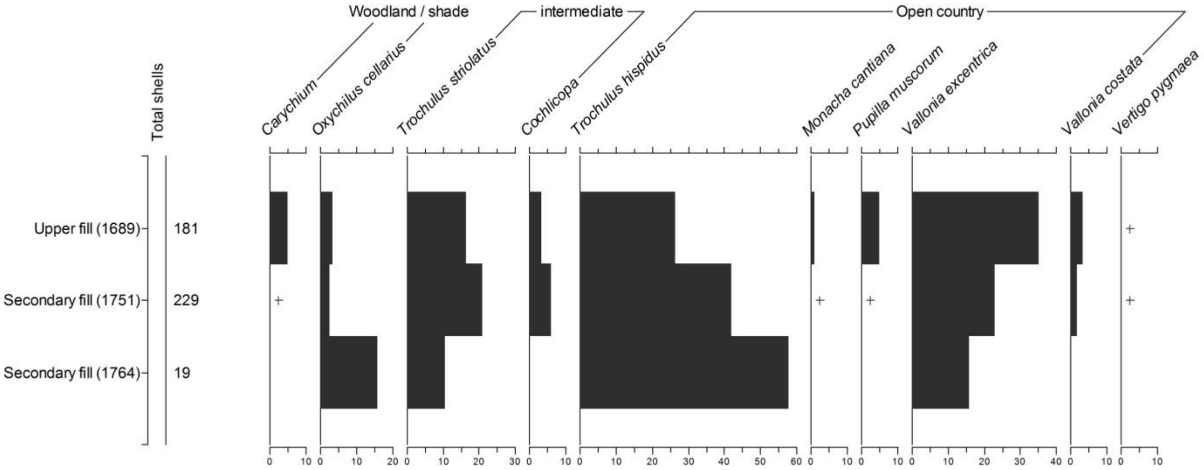


Figure 101: LYM09 Anglo-Saxon boundary ditch ([1688]) mollusc profile.

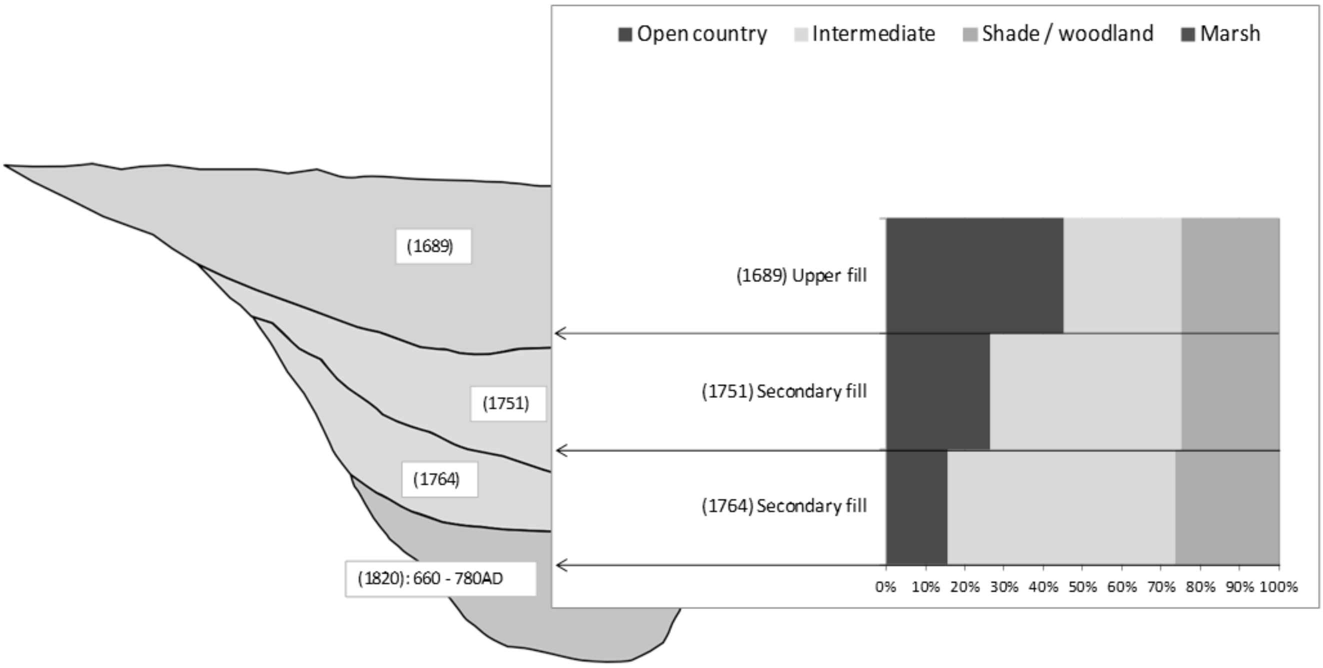


Figure 102: Ecological affinity profile for dated LYM09 Anglo-Saxon boundary ditch [1688]

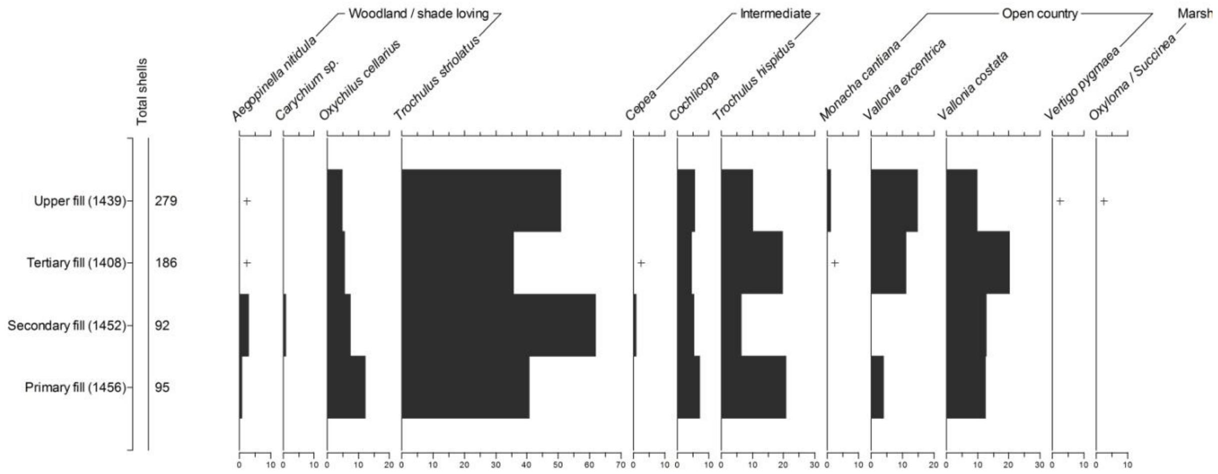


Figure 103: LYM09 Anglo-Saxon boundary ditch ([1092]) mollusc profile.

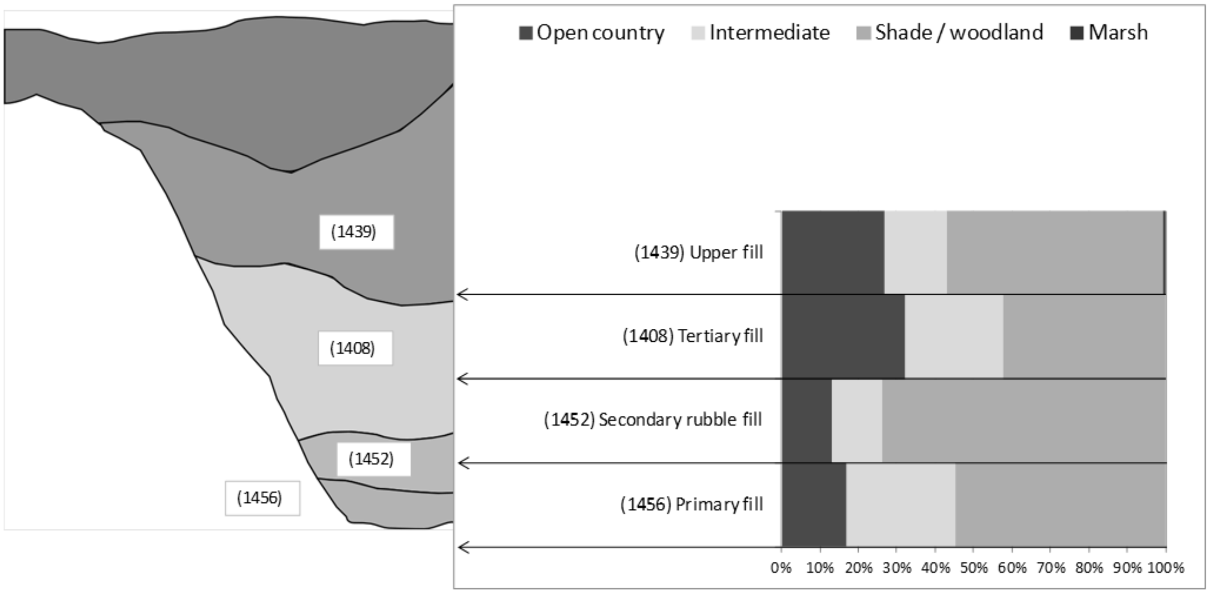


Figure 104: Aggregate ecological affinity profile for LYM09 Anglo-Saxon boundary ditch [1092]

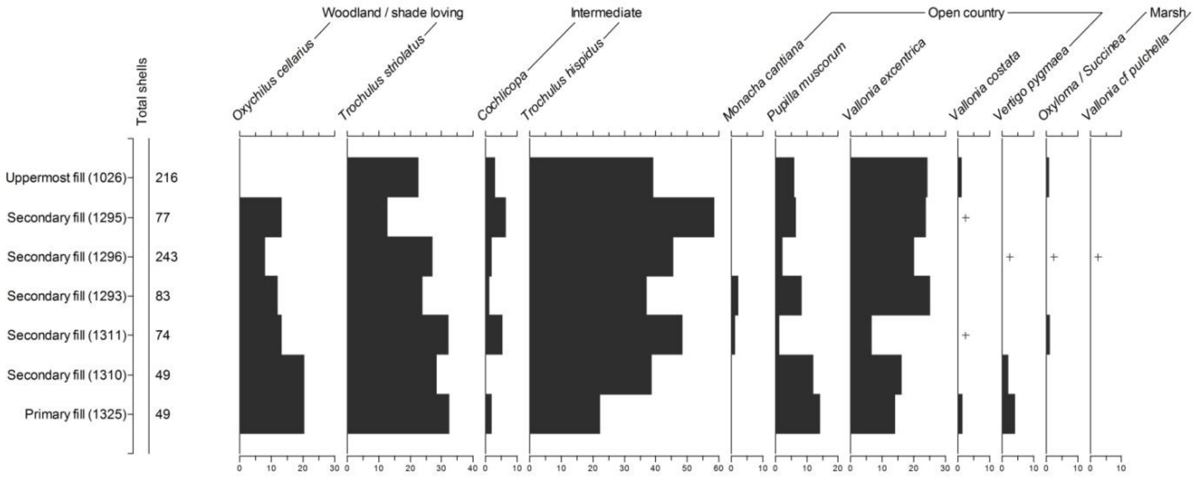


Figure 105: LYM09 Anglo-Saxon pit [1025] mollusc profile

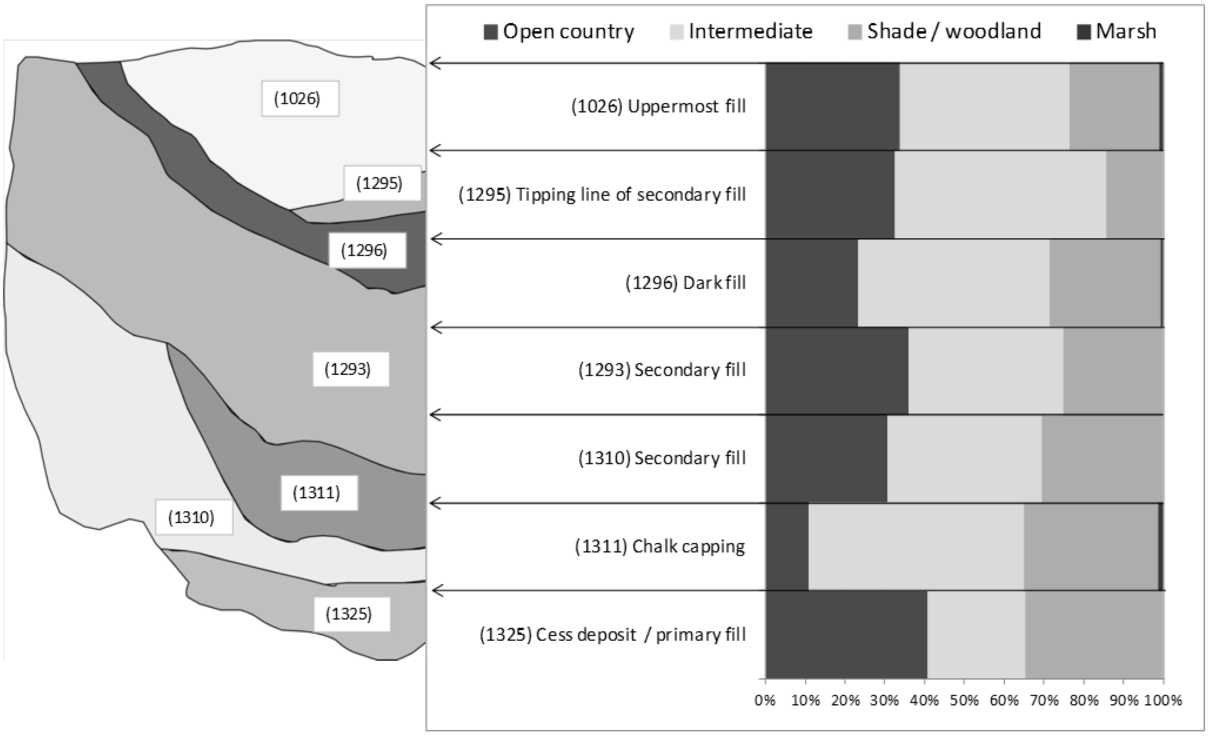


Figure 106: Models of changing ecological affinities: a pit dug in an open area of the site which stayed that way in the final period of infill, pit [1025], LYM09.

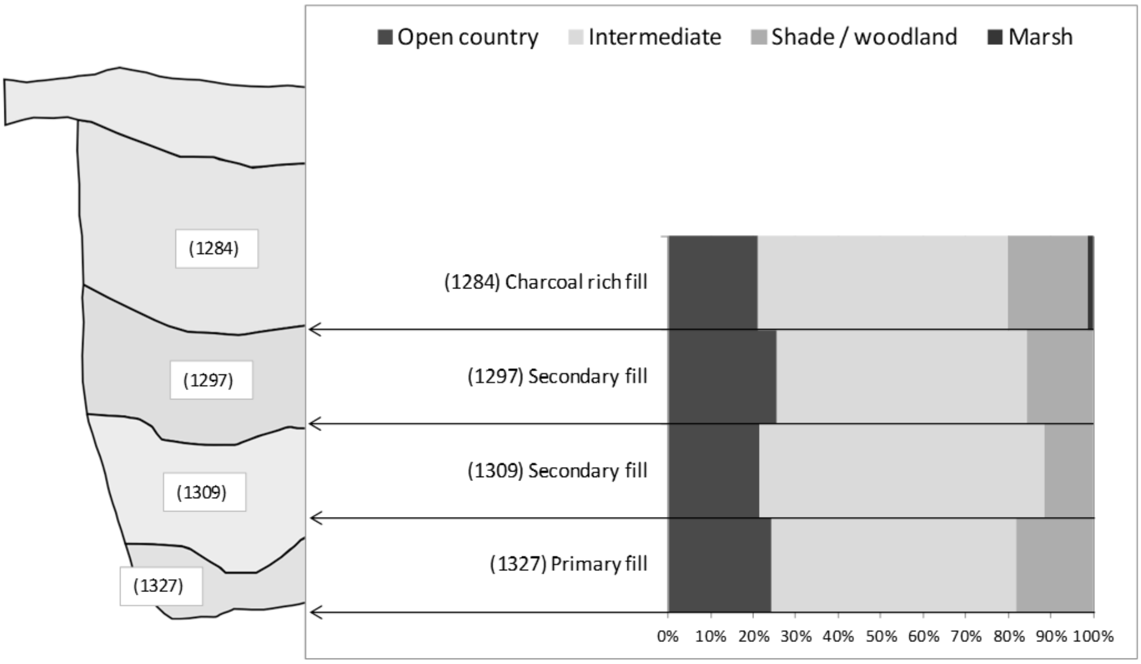


Figure 107: Models of changing ecological affinities: a pit dug in an open area of the site which stayed that way in the final period of infill, pit [1027], LYM09.

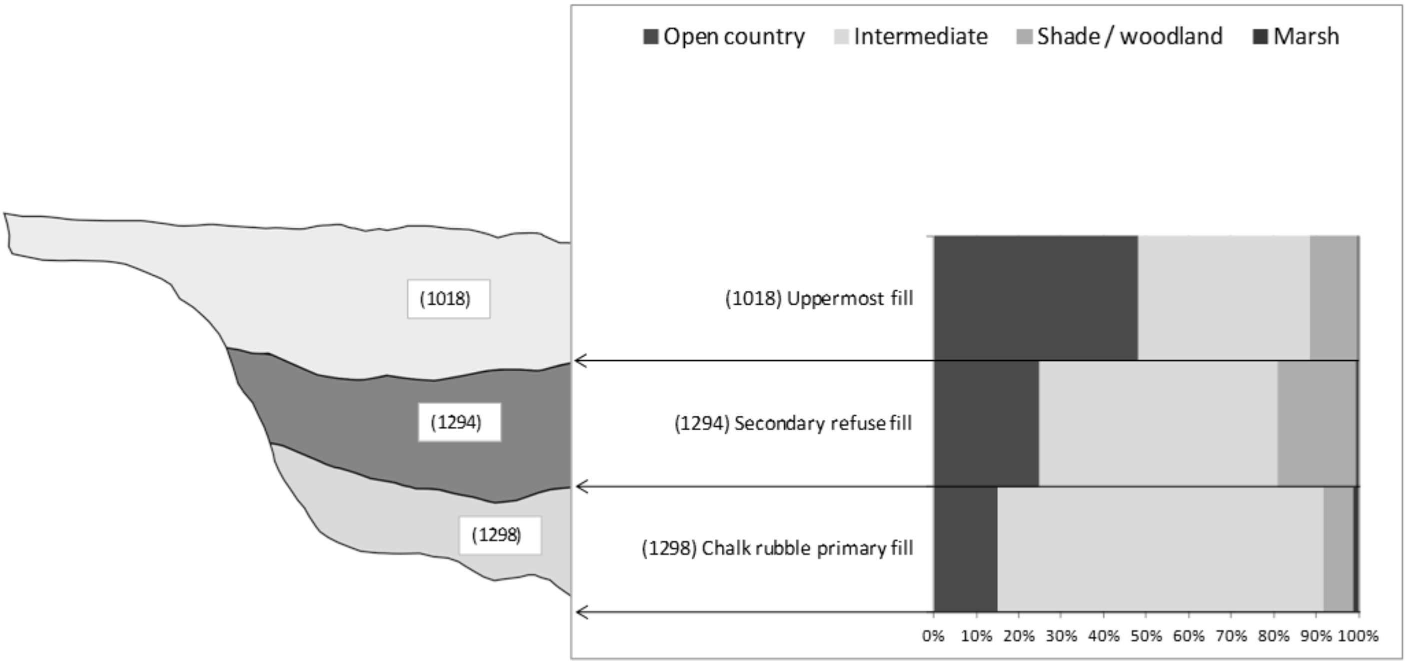


Figure 108: Models of changing ecological affinities: a pit dug in an open area of the site with shorter and sparser vegetation in the final period of infill, pit [1017], LYM09.

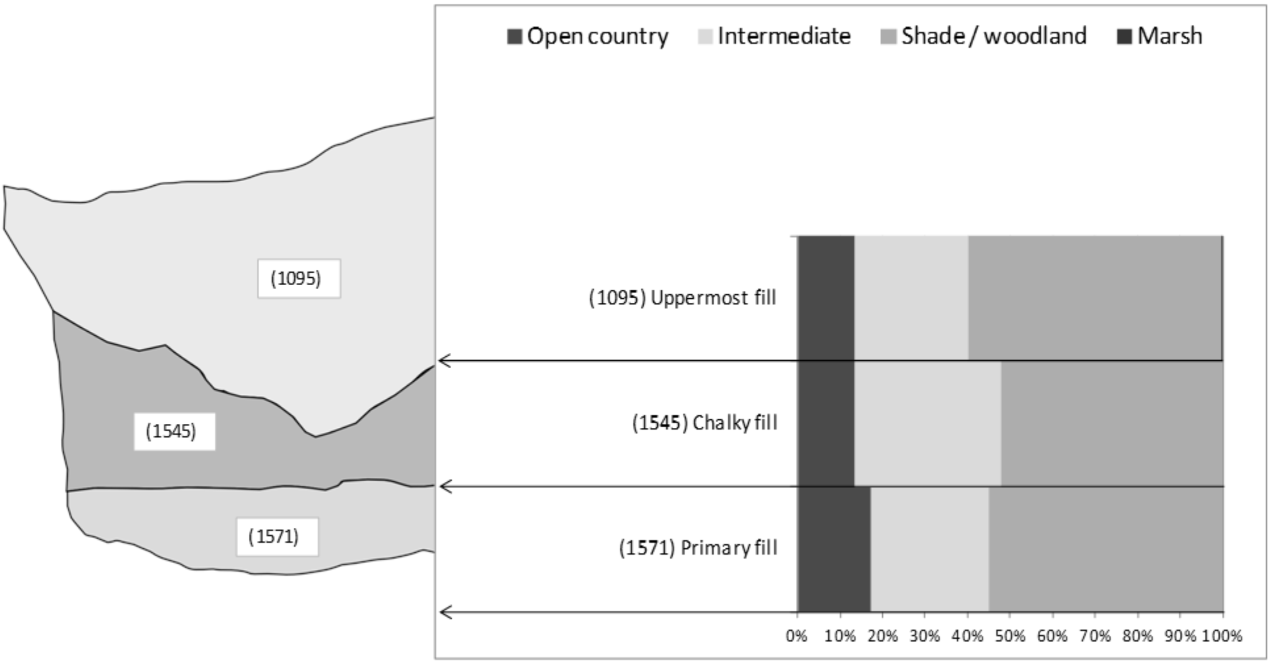


Figure 109: Models of changing ecological affinities: a pit dug in a damp, overgrown part of the site which stayed that way in the final period of infill, pit [1094], LYM09.

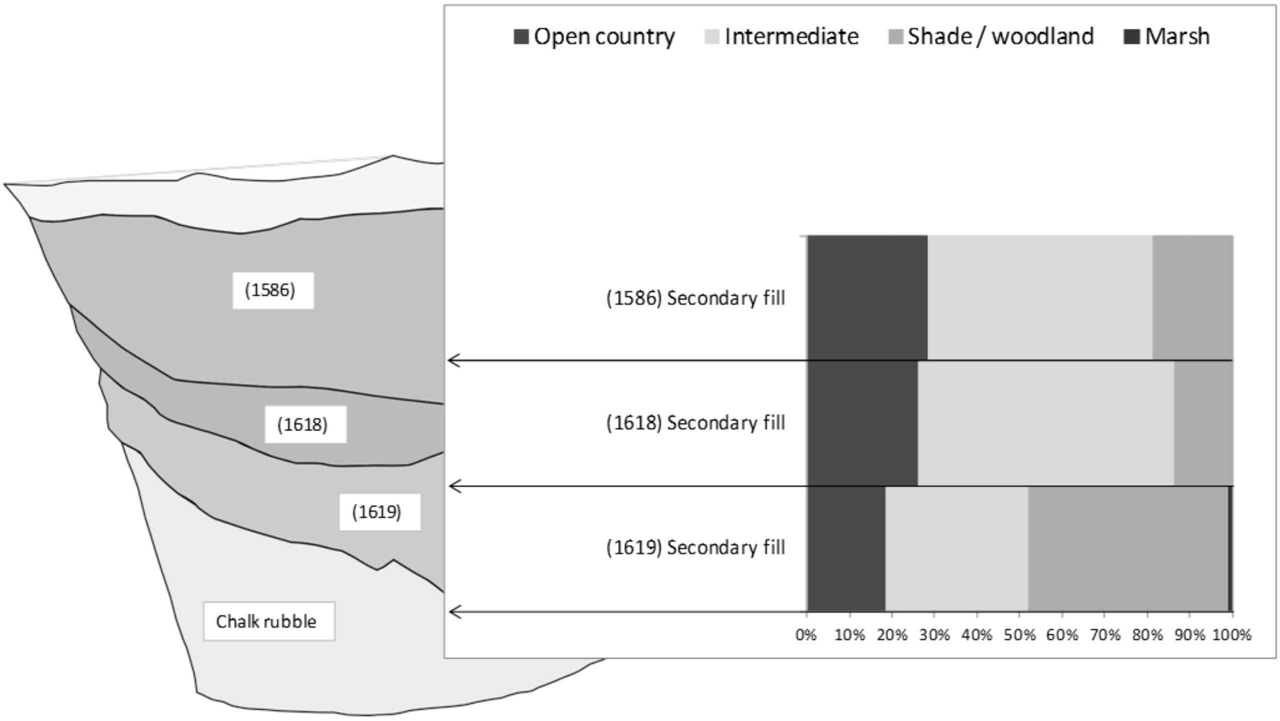


Figure 110: Models of changing ecological affinities: a pit dug in a relatively damp, overgrown part of the site, with shorter and sparser vegetation in the final period of infill, pit [1321], LYM09.

9.4 Interpretation - Rectory Paddock (LYM08-09)

9.4.1 Post-built structures

The post-hole fills associated with the LYM08 timber building, the only structure from the Rectory Paddock area, are dominated by a community comprising *Trochulus hispidus* along with smaller quantities of V*allonia excentrica* which is typical of well-drained agricultural environments (Campbell and Robinson, 2010: 506). This likely represents a mixture from post-packing, decay infill and accumulation processes across the lifespan of the structure (Evans, 1972: 34). Consequently, the area immediately around this building across its trajectory of use and abandonment can be reconstructed as dry ground with some longer vegetation present around the footings of the building to attract shade loving types such as *Oxychilus cellarius* and *Trochulus striolatus* which also form a significant component of the community.

9.4.2 Ditches

The ditch features uncovered in this area comprise monastic settlement boundaries with fills of occupation debris. The Molluscan assemblages are characterised by intermediate and shade loving taxa such as *Trochulus striolatus*, *Trochulus hispidus* and *Oxychilus cellarius*, indicating marginal environments with longer vegetation (Figure 100). The high proportion of *T. striolatus* within these features (Figure 100d) demonstrates the impact of human activity on the environment in these areas (Kerney and Cameron, 1979: 194). A general sequential progression in land use from open area in the middle Anglo-Saxon period to overgrown margin or abandonment in the later Anglo-Saxon period can be determined from the assemblages contained within a sequence of intercutting ditches [1688], [1092] and [1589] (Table 40).

Ditch [1688] (Figure 101) was interpreted as a boundary of the inner core of the monastic complex, running SW-NE across the northern part of the site. A calibrated radiocarbon date of 660-780 cal A.D. (SUERC-35934 (GU-24777), Table 1) was obtained from the primary fill (1820) providing a *terminus post quem* for the overlying units; however no corresponding environmental samples were recovered by the excavators. The overlying deposit (1764) (Figure 102) represents silty clay eroded from the sides of the ditch, containing few artefacts with a sparse ecology dominated by the intermediate type *Trochulus hispidus* typical of well-drained agricultural environments and similar to assemblages from the LYM08 timber building (Figure 99). The consistent representation of shade-loving types (*Carychium tridentatum* and *Oxychilus cellarius*) demonstrates longer vegetation within the ditch whilst the upper units in the sequence comprise artefact-rich occupation deposits dominated by open country types (*Vallonia excentrica*, *Pupilla muscorum*, *Monacha cantiana*) suggesting dumping of materials originating in heavily grazed or intensively used areas.

A later E-W orientated ditch [1092] which cuts ditch [1688] (Figure 98), comprised a primary fill of silt (1456) and chalk rubble (1452) with a tertiary fill of dumped occupation debris (1439) (Figure 103 and Figure 104). This sequence was dominated by a limited range of shade-loving taxa (*Trochulus striolatus*, *Aegopinella nitidula, Oxychilus cellarius*) (Figure 103) which, on the basis of comparative studies, likely indicate long grass or overgrown vegetation within the ditch rather than any substantive woodland regrowth (Cameron and Morgan-Huws, 1975). This contrasts notably with the earlier ditch [1688] (Figure 101 and Figure 102) suggesting that following the mid 8th century, the boundary became overgrown, with a reduction of occupation activity and disturbance in this locality. The fill of ditch [1589] (Table 40) which also cuts [1688] also represents a later phase in the occupation sequence and is dominated by a more diverse shade-loving community of *Trochulus striolatus*, *Aegopinella nitidula, Oxychilus cellarius, Carychium tridentatum* and *Discus rotundatus* which may suggest a partial abandonment of this part of the settlement.

9.4.3 Pits

Pit sequences comprise anthropogenically mixed and thus ecologically allochthonous fill material (Evans, 1972: 34). The assemblages consequently represent a range of different waste streams and may represent the final stage in a sequence of activity involving periodic cleaning and re-use. This creates variations in post-depositional environments between fill units which impacts on shell preservation. By way of example, highly mineralised cess and also many charcoal-rich deposits demonstrated low shell counts due to conditions of high acidity from organic decay following deposition of cess (Weiner, 2010: 173). Of particular importance to analysis are the primary fill units which incorporate material from the sides of the pit and to a lesser degree from the ground surface immediately around it (Schiffer, 1987: 118). Disparities between the primary fill (possible use and contemporary land surface), the secondary (dumped material) and tertiary fills (accumulations following abandonment) may therefore allow some insight into changing distributions of material from different environments over time, which reflect patterns in use of space and ground surface conditions around the site. Analogues of activity and refuse disposal patterns from medieval settlements allow an assumption of a highly localised influence for the fill material (Keene, 1982: 29). From this it can be seen that pronounced differentials in composition between assemblages from broadly contemporary pits may be used to approach a crude resolution of ecological zonation.

Several isolated occurrences of types not generally encountered in the local ecology indicate anthropogenic processes of movement of materials from off-site environments. An example of this may be seen with the highly xerophilic type *Helicella itala* (Davies, 2008: 178) which comprises a significant component of the off-site sequence (Chapter 10). The specimens of this type found in the pits at Rectory Paddock display evidence of mineralised from deposition in cess, abrasion from redeposition and in some cases evidence of charring. This strongly indicates the secondary deposition of material within these pit contexts that originated in the exposed downland environment on the hillsides around the valley area as well as processing of these materials by burning. Other dry ground taxa found within the pit fills include the introduced types *Monacha cantiana, Cernuella virgata* and *Candidula intersecta* and large proportions of *Pupilla muscorum* and *Vallonia excentrica* throughout.

Examples of uncommon types in pit fills demonstrate movement and processing of materials from woodland or shaded environments such as charred specimens of Clausiliidae (context 634) and heavily mineralised specimens of *Discus rotundatus* (context (744)). A single specimen of the woodland type *Merdigera obscura* is represented within an assemblage containing notable numbers of other woodland types such as *Discus rotundatus*, *Vitrea* sp. and Clausiliidae (context (1142)) in a sample from pit [1141]. Conversely, the occurrence of small numbers of highly eroded specimens of *Vallonia costata* in some Anglo-Saxon contexts (e.g. pit [1359] and ditch [1688], section 9.4.2) may represent a residual component from an earlier, less disturbed land surface. This type is not encountered in any abundance at Lyminge in any samples other than those from the prehistoric basal horizon in the doline / hollow feature on Tayne Field (Chapter 7) and in modern analogues relating to marginal wooded and waste ground habitats (Chapter 3).

A range of modelled profiles for pit sequences from the Rectory Paddock sample area is presented in Figure 106 to Figure 110. The spectrum of ecological representation varies markedly between individual pits from sequences consistently representing material collected from an open country environment characterised by *Trochulus hispidus* and *Vallonia excentrica* to intermediate assemblages more dominated by *Trochulus hispidus* and sequences representing humid and shaded ecologies dominated by *Trochulus striolatus* and *Oxychilus cellarius*. These sequences demonstrate two fundamental modes of ecological transition; either broadly consistent in the representation of affinities down profile (e.g. pit [1025] Figure 105 / Figure 106) or with apparent gradients of transition (e.g. pit [1017] (Figure 108)). These may be interpreted to correspond respectively to pits containing material from a consistent environment versus those comprising deposits from a range of environments which changed across the period of infill (e.g. damp and relatively overgrown, to open and drier or *vice versa*). These contrasts may indicate both changes in the type and location of activities contributing to the waste streams and also the changing intensity and nature of the use of space in the areas where the activities occur. Such transitions likely comprise either reduction in vegetation cover from trampling and increased activity, or increase in ground cover resulting from diminished usage of a particular area.

Some evidence for zonation in habitat across the site possibly representing areas of concentration of particular types of human activity is represented by similarities in these profile types from spatially associated pits where the pattern of ecological representation is consistent. Assuming a broad synchronicity of use it seems reasonable to suggest that the basal assemblages are representative of the local ground surface across the wider area between and around these pits at the time of excavation. From this it is possible to extrapolate an interpretation of ground cover across the Rectory Paddock site area for the period of occupation activity (Figure 111).

A number of primary fills dominated by *Trochulus hispidus* demonstrate that much of the settlement area had a moderately vegetated or weedy grassland cover. The upper fills of several of these pits by contrast both contain material derived from less well vegetated or grazed areas, with a notable component of the dry ground / grassland types *Vallonia excentrica*, *Pupilla muscorum* and to a lesser extent *Vertigo pygmaea*, suggesting a trampled short-turfed grassy environment. Assuming an origin from domestic activities occurring nearby it is plausible that these areas of the site became more heavily used or grazed over the lifetime of use of these pits with a greater degree of trampling resulting in sparser ground vegetation by the time of the final infill (yellow areas, Figure 111).

By contrast pits such as [1094] (Figure 109) and [1321] (Figure 110) contain primary fills with high proportions of the shade-demanding types *Trochulus striolatus* and *Oxychilus cellarius*. Assuming that these basal fills contain a significant component of material eroded in shortly after excavation and represent the land surface around them at the time of first use, these features can be interpreted to have been dug in areas of weeds and long grass. Significantly, these pits all lie adjacent to linear features (section 9.4.2) which are likely to be contemporary and contain assemblages similarly dominated by *Trochulus striolatus* and *Oxychilus cellarius* (Figure 99 and Figure 104) indicating shaded microhabitats at the settlement margins. These results also correlate with the primary fills of various other spatially associated features to collectively represent a marginal area of the settlement away from the main contemporary zones of activity and disturbance (green areas, Figure 111).

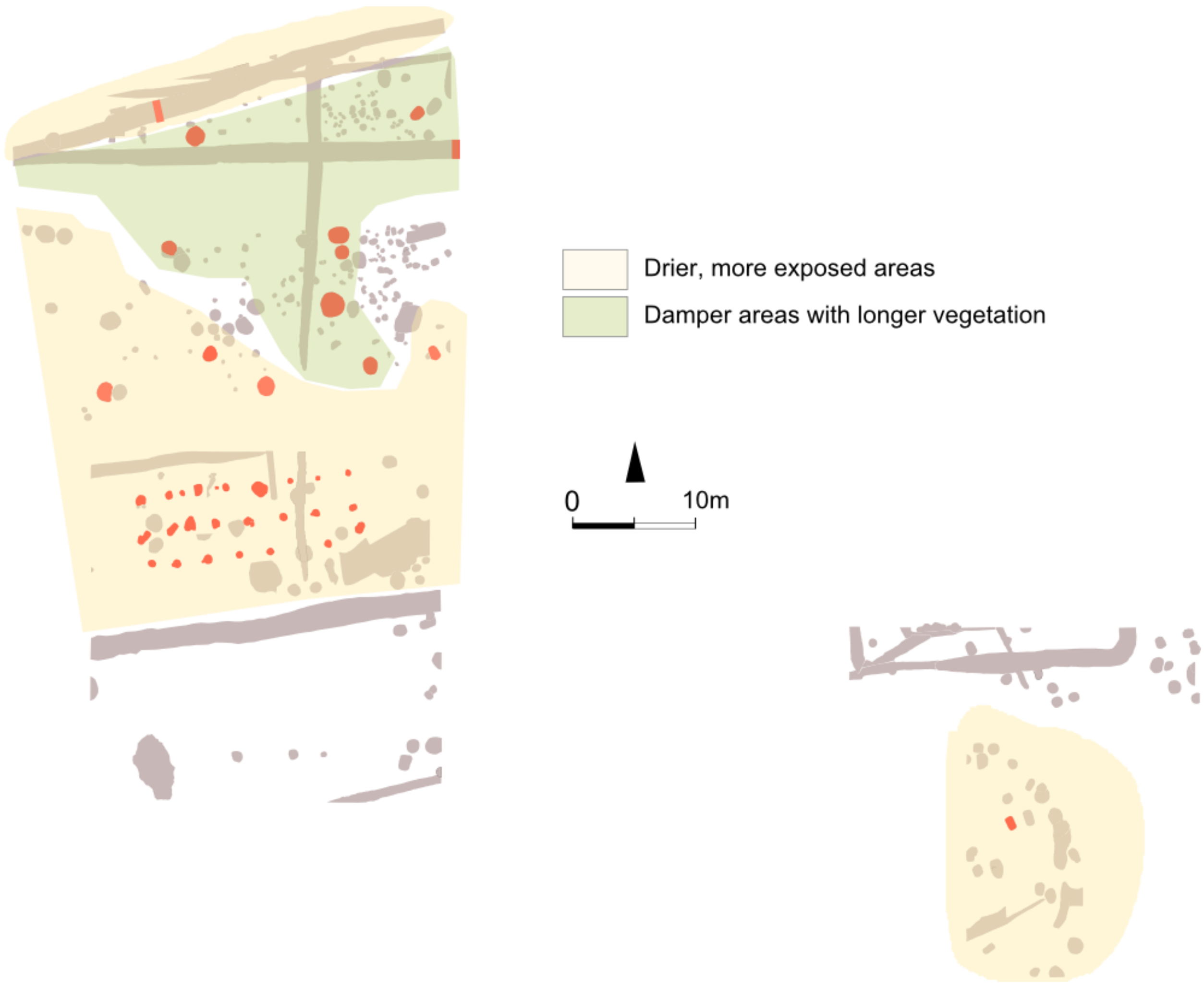


Figure 111: Generalised reconstruction of ground surface cover at Rectory Paddock site area during occupation.

9.5 Results – Rectory Lane (LYM10)

Count data for the Rectory Lane sample area (LYM10) are presented in Table 41. A summary for the aggregated ecological affiliations (Chapter 3) for each class of archaeological feature is presented in Figure 112. Summaries for the distribution of species recorded for each of these classes are presented in Figure 113 and Figure 114.

Table 41: Rectory Lane (LYM10) mollusc counts from environmental bulk samples

Sample ID	Context	Description	Total shells	*Acanthinula aculeata*	*Acicula fusca*	*Aegopinella nitidula*	*Carychium sp.*	Clausiliidae	*Discus rotundatus*	*Oxychilus cellarius*	*Pomatias elegans*	*Punctum pygmaeum*	*Trochulus striolatus*	*Vitrea sp.*	*Cochlicopa sp.*	*Cepaea*	*Cornu aspersum*	*Trochulus hispidus*	*Cernuella virgata*	*Monarcha cantiana*	*Pupilla muscorum*	*Vallonia excentrica*	*Vallonia costata*	*Vertigo pygmaea*	*Oxyloma / Succinea*	*Vallonia cf. pulchella*	*Anisus leucostoma*	*Bathyomphalus contortus*	*Hydrobiidae*	*Galba truncatula*	*Cecilioides acicula*	Limacidae	Shannon's H	Broken vs. total
1	2087	Post hole	8	0	0	0	0	0	0	2	0	0	0	0	0	0	0	5	0	0	0	1	0	0	0	0	0	0	0	0	4	0	0.90	0.0%
2	2195	Post hole	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	4	6	0	0	0	0	0	0	0	0	3	0	0.99	50.0%
3	2279	Post hole	8	0	0	0	0	0	0	1	0	0	0	0	0	0	0	4	0	0	0	2	1	0	0	0	0	0	0	0	9	0	1.21	100.0%
4	2267	Post hole - building	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	1	0	0	0	0	15	0	1.05	
5	2089	Post hole	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	2	0	0	0	0	0	0	0	0	2	0	0.53	50.0%
6	2227	Post hole	26	0	0	0	0	0	0	2	0	0	0	0	1	0	0	13	0	0	5	5	0	0	0	0	0	0	0	0	42	0	1.30	20.0%
7	2263	Post hole	69	0	0	0	0	0	0	1	0	0	0	0	3	0	0	35	0	0	4	26	0	0	0	0	0	0	0	0	49	0	1.07	61.5%
8	2177	Post hole	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	3	0	0	0	0	0	0	0	0	21	0	0.61	33.3%
9	2280	Post hole	38	0	0	0	0	0	0	3	0	0	13	0	0	0	0	13	0	0	3	5	0	0	1	0	0	0	0	0	4	0	1.50	60.0%
10	2095	Heavily truncated pit	42	0	0	0	0	0	1	1	0	0	14	0	0	0	0	14	0	0	0	9	2	0	1	0	0	0	0	0	18	0	1.47	63.6%
12	2075	Upper fill of pit [2074]	486	0	0	0	0	0	1	8	0	0	29	0	12	0	0	203	0	0	41	157	15	14	0	3	1	0	0	2	164	0	1.55	48.3%
13	2270	Lower fill of pit [2074]	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	6	14	4	0	0	0	0	0	0	0	24	0	1.28	50.0%
14	2337	Post hole - building	10	0	0	0	0	0	0	3	0	0	0	0	0	0	0	4	0	0	1	1	0	1	0	0	0	0	0	0	3	0	1.42	100.0%
15	2105	Post hole	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	1	0	1	0	0	0	0	0	0	3	0	1.33	0.0%
16	2235	Post hole	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0.00	
17	2260	Post hole - building	5	0	0	0	0	0	0	1	0	0	0	0	0	0	0	3	0	0	0	1	0	0	0	0	0	0	0	0	3	0	0.95	100.0%
18	2237	Post hole - building	56	0	0	0	0	0	0	5	0	0	0	0	3	0	0	25	0	0	7	13	0	3	0	0	0	0	0	0	111	0	1.49	61.5%
19	2272	Post hole - building	10	0	0	0	0	0	0	1	0	0	0	0	0	0	0	6	0	0	1	1	0	1	0	0	0	0	0	0	6	0	1.23	100.0%
23	2369	Post hole - building	12	0	0	0	0	0	0	1	0	0	0	0	0	0	0	6	0	0	2	3	0	0	0	0	0	0	0	0	32	0	1.20	33.3%
24	2225	Post hole - building	22	0	0	0	0	0	0	1	0	0	0	0	0	0	0	11	0	0	4	3	2	0	0	0	0	1	0	0	21	0	1.43	100.0%
25	2223	Post hole - building	19	0	0	0	0	0	0	0	0	0	6	0	1	0	0	6	0	0	0	3	1	2	0	0	0	0	0	0	11	0	1.57	100.0%
26	2419	Ditch fill [2418] (upper)	135	1	0	32	8	2	52	6	1	0	17	0	1	1	0	0	0	0	2	12	0	0	0	0	0	0	0	0	61	0	1.76	25.0%
27	2507	Ditch fill [2418] (lower)	114	0	0	24	17	0	31	9	0	3	4	5	1	0	0	4	0	0	6	2	7	1	0	0	0	0	0	0	38	0	2.11	44.4%
28	2257	Post hole - building	44	0	0	0	0	0	0	13	0	0	0	0	1	0	0	15	0	0	4	10	0	1	0	0	0	0	0	0	37	0	1.45	50.0%
29	2515	Post hole	23	0	0	0	0	0	0	1	0	0	4	0	1	0	0	4	0	0	0	6	6	1	0	0	0	0	0	0	13	0	1.72	36.4%
30	2255	Post hole - building	22	0	0	0	0	0	0	1	0	0	0	0	2	0	0	10	0	0	2	6	0	1	0	0	0	0	0	0	9	0	1.43	83.3%
31	2355	Post hole - building	38	0	0	0	0	0	0	4	0	0	13	0	1	0	0	17	0	0	1	2	0	0	0	0	0	0	0	0	87	0	1.31	50.0%
32	2357	Post hole - building	22	0	0	0	0	0	0	1	0	0	11	0	0	0	0	0	0	0	3	5	0	1	1	0	0	0	0	0	17	0	1.38	40.0%
33	2359	Post hole - building	12	0	0	0	0	0	0	1	0	0	0	0	0	0	0	9	0	0	2	0	0	0	0	0	0	0	0	0	18	0	0.72	
34	2111	Post hole	10	0	0	2	2	0	0	0	0	0	0	0	0	0	0	5	0	0	0	1	0	0	0	0	0	0	0	0	3	0	1.22	100.0%
35	2515	Post hole	40	0	0	0	0	0	0	0	0	0	11	0	0	0	0	11	0	0	2	16	0	0	0	0	0	0	0	0	15	0	1.23	56.3%
36	2103	Post hole	22	0	0	0	0	0	0	0	0	0	0	0	2	0	0	13	0	1	1	3	1	1	0	0	0	0	0	0	2	0	1.36	75.0%
37	2363	Post hole - building	24	0	0	0	0	0	0	3	0	0	0	0	0	0	0	7	0	0	4	8	0	1	0	1	0	0	0	0	35	0	1.55	50.0%

Sample ID	Context	Description	Total shells	*Acanthinula aculeata*	*Acicula fusca*	*Aegopinella nitidula*	*Carychium* sp.	Clausiliidae	*Discus rotundatus*	*Oxychilus cellarius*	*Pomatias elegans*	*Punctum pygmaeum*	*Trochulus striolatus*	*Vitrea* sp.	*Cochlicopa* sp.	*Cepaea*	*Cornu aspersum*	*Trochulus hispidus*	*Cernuella virgata*	*Monarcha cantiana*	*Pupilla muscorum*	*Vallonia excentrica*	*Vallonia costata*	*Vertigo pygmaea*	*Oxyloma / Succinea*	*Vallonia cf. pulchella*	*Anisus leucostoma*	*Bathyomphalus contortus*	*Hydrobiidae*	*Galba truncatula*	*Cecilioides acicula*	Limacidae	Shannon's H	Broken vs. total
38	2480	Post hole	35	0	0	0	0	0	0	0	0	0	0	0	2	0	0	15	0	0	3	15	0	0	0	0	0	0	0	0	77	0	1.10	46.7%
40	2347	Post hole - building	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	3	0	0.64	100.0%
41	2365	Post hole - building	11	0	0	0	0	0	0	1	0	0	0	0	0	1	0	4	0	0	2	1	0	1	1	0	0	0	0	0	10	0	1.77	0.0%
42	2367	Post hole - building	29	0	0	0	0	0	0	2	0	0	5	0	0	0	0	11	0	0	3	8	0	0	0	0	0	0	0	0	20	0	1.45	50.0%
43	2502	Post hole	170	0	1	4	24	0	41	35	4	0	11	5	2	0	0	22	0	0	10	9	2	0	0	0	0	0	0	0	86	0	2.12	54.5%
44	2502	Post hole	14	0	0	0	0	0	1	2	0	0	0	0	2	0	0	6	0	0	1	1	0	0	0	1	0	0	0	0	32	0	1.67	0.0%
45	2171	Post hole	149	0	0	0	5	0	12	20	0	0	0	5	7	1	0	59	0	0	9	20	7	4	0	0	0	0	0	0	231	0	1.92	44.4%
46	2510	Post hole	5	0	0	0	1	0	0	1	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	18	0	1.33	100.0%
47	2525	Post hole	43	0	0	0	0	0	1	0	0	0	0	0	1	0	0	36	0	0	1	3	0	0	1	0	0	0	0	0	21	0	0.68	66.7%
48	2353	Post hole	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	3	0	0	0	0	0	0	0	0	0	0	1.01	66.7%
49	2351	Natural hollow	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0.00	
52	2396	Post hole	38	0	0	0	0	0	0	1	0	0	0	0	3	0	0	19	0	0	5	7	2	0	0	1	0	0	0	0	16	0	1.47	44.4%
53	2544	Post hole - building	5	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	1	0	1	0	0	0	0	0	0	12	0	1.33	0.0%
55	2175	Post hole	52	0	0	0	1	0	5	9	0	0	10	2	1	0	0	10	0	0	5	7	0	0	2	0	0	0	0	0	26	0	2.06	57.1%
57	2371	Post hole - building	27	0	0	1	0	0	0	1	0	0	0	0	0	0	0	13	0	0	2	8	0	0	1	1	0	0	0	0	20	0	1.39	37.5%
58	2554	Post hole	3	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.64	
59	2333	Post hole - building	49	0	0	0	0	0	0	0	0	0	0	0	1	0	0	33	0	0	3	12	0	0	0	0	0	0	0	0	56	0	0.86	50.0%
60	2402	Post hole	16	0	0	0	0	0	0	1	0	0	6	0	0	0	0	3	0	0	4	2	0	0	0	0	0	0	0	0	3	0	1.46	0.0%
61	2394	Post hole	23	0	0	0	0	0	0	1	0	0	11	0	1	1	0	0	0	0	1	8	0	0	0	0	0	0	0	0	23	0	1.27	100.0%
66	2349	Post hole - building	78	0	0	1	0	0	1	9	0	0	0	0	1	0	0	44	0	0	5	9	7	0	0	1	0	0	0	0	49	0	1.44	43.8%
70	2561	Post hole	68	0	0	0	0	0	0	5	0	0	9	0	1	0	0	27	0	0	5	18	0	2	1	0	0	0	0	0	60	0	1.60	50.0%
75	2560	SFB2 (post hole)	26	0	0	0	0	0	0	4	0	0	4	0	1	0	0	11	0	0	1	5	0	0	0	0	0	0	0	0	260	0	1.51	20.0%
77	2455	Post hole	59	0	0	0	0	0	1	7	0	0	0	0	2	0	0	27	0	0	6	14	0	2	0	0	0	0	0	0	160	0	1.48	50.0%
80	2484	SFB2 (post hole)	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	2	2	0	0	0	0	0	0	0	0	6	0	1.00	50.0%
84	2484	Post hole	31	0	0	0	0	0	0	1	0	0	0	0	2	0	0	18	0	0	1	9	0	0	0	0	0	0	0	0	25	0	1.07	33.3%
87	2390	Post hole	39	0	0	0	0	0	0	3	0	0	0	0	2	0	0	18	0	0	4	11	0	1	0	0	0	0	0	0	55	0	1.39	54.5%
89	2287	Post hole	12	0	0	0	0	0	0	1	0	0	0	0	0	0	0	5	0	0	2	2	2	0	0	0	0	0	0	0	5	0	1.47	50.0%
90	2301	Post hole	92	0	0	0	0	0	0	12	0	0	34	0	2	0	0	19	0	0	7	12	4	2	0	0	0	0	0	0	71	0	1.72	81.3%
92	2329	Post hole - building	349	0	0	1	0	0	0	23	0	0	90	0	12	2	0	90	0	0	11	100	7	6	3	4	0	0	0	0	394	0	1.75	44.9%
97	2622	Post hole	36	0	0	0	0	0	0	1	0	0	7	0	2	0	0	15	0	0	0	10	0	1	0	0	0	0	0	0	37	0	1.40	50.0%
98	2377	Post hole - building	73	0	0	0	0	0	0	4	0	0	0	0	4	0	0	36	0	0	6	12	4	4	2	1	0	0	0	0	84	0	1.64	56.3%
99	2379	Post hole - building	40	0	0	0	0	0	0	5	0	0	0	0	3	0	0	22	0	0	5	5	0	0	0	0	0	0	0	0	19	0	1.30	60.0%
112	2229	Post hole	17	0	0	0	0	0	0	3	0	0	0	0	0	0	0	11	0	0	1	1	0	1	0	0	0	0	0	0	53	0	1.09	0.0%
118	2381	Post hole	49	0	0	0	0	0	0	0	0	0	0	0	1	0	0	27	0	0	7	12	1	0	0	1	0	0	0	0	124	0	1.19	69.2%
126	2670	Post hole - building	16	0	0	0	0	0	0	0	0	0	0	0	1	0	0	6	0	0	5	4	0	0	0	0	0	0	0	0	4	0	1.25	50.0%

Sample ID	Context	Description	Total shells	*Acanthinula aculeata*	*Acicula fusca*	*Aegopinella nitidula*	*Carychium* sp.	Clausiliidae	*Discus rotundatus*	*Oxychilus cellarius*	*Pomatias elegans*	*Punctum pygmaeum*	*Trochulus striolatus*	*Vitrea* sp.	*Cochlicopa* sp.	*Cepaea*	*Cornu aspersum*	*Trochulus hispidus*	*Cernuella virgata*	*Monarcha cantiana*	*Pupilla muscorum*	*Vallonia excentrica*	*Vallonia costata*	*Vertigo pygmaea*	*Oxyloma / Succinea*	*Vallonia cf. pulchella*	*Anisus leucostoma*	*Bathyomphalus contortus*	*Hydrobiidae*	*Galba truncatula*	*Cecilioides acicula*	Limacidae	Shannon's H	Broken vs. total
201	2578	SFB1 Quad A (post hole)	58	0	0	0	0	0	0	5	0	0	12	0	3	0	0	12	0	0	2	19	4	1	0	0	0	0	0	0	55	0	1.75	47.8%
202	2588	SFB1 Quad A (post hole)	10	0	0	0	0	0	0	1	0	0	0	0	1	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0.64	
203	2590	SFB1 Quad A	10	0	0	0	0	0	0	0	0	0	7	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	6	0	0.80	
204	2592	SFB1 (post hole)	76	0	0	0	0	0	0	6	0	0	42	0	3	0	0	7	0	0	9	5	3	0	1	0	0	0	0	0	164	0	1.49	62.5%
209	2274	SFB1 Quad C	334	0	0	0	0	1	1	40	0	0	111	0	4	3	0	59	1	1	16	80	7	3	5	2	0	0	0	0	280	0	1.80	57.5%
214	2362	Post hole - building	98	0	0	1	0	0	0	22	0	0	13	0	3	1	0	38	0	0	9	8	0	2	0	1	0	0	0	0	390	0	1.72	50.0%
215	2608	SFB4 Quad B (post hole)	36	0	0	0	0	0	1	4	0	0	7	0	0	0	0	7	0	0	5	11	0	1	0	0	0	0	0	0	41	0	1.72	45.5%
216	2656	SFB4 Quad C (post hole)	60	0	0	0	4	0	0	5	0	0	0	4	1	1	0	21	0	2	9	11	2	0	0	0	0	0	0	0	300	0	1.89	61.5%
228	2293	SFB2 Quad A	39	0	0	0	0	0	0	1	0	0	0	0	3	0	0	19	0	0	2	14	0	0	0	0	0	0	0	0	56	0	1.16	35.7%
229	2293	SFB2 Quad A	20	0	0	0	0	0	0	1	0	0	0	0	1	0	0	9	0	0	2	5	2	0	0	0	0	0	0	0	61	0	1.47	66.7%
230	2293	SFB2 Quad A	42	0	0	0	0	0	0	2	0	0	0	0	2	0	0	33	0	0	1	4	0	0	0	0	0	0	0	0	63	0	0.79	75.0%
231	2293	SFB2 Quad A	20	0	0	0	0	0	0	1	0	0	0	0	0	0	0	11	0	0	1	6	0	0	1	0	0	0	0	0	62	0	1.14	33.3%
232	2556	SFB1	12	0	0	0	0	0	0	2	0	0	3	0	1	0	0	3	0	0	0	3	0	0	0	0	0	0	0	0	17	0	1.55	66.7%
233	2556	SFB1	22	0	0	0	0	0	0	1	0	0	0	0	1	0	0	18	0	0	0	2	0	0	0	0	0	0	0	0	47	0	0.66	0.0%
236	2556	SFB1	32	0	0	0	0	0	0	3	0	0	5	0	0	0	0	15	0	1	2	5	0	0	1	0	0	0	0	0	34	0	1.55	40.0%
237	2508	SFB1	30	0	0	0	0	0	0	1	0	0	0	0	0	0	0	14	0	0	3	10	1	1	0	0	0	0	0	0	75	0	1.29	81.8%
239	2508	SFB1	12	0	0	0	0	0	0	1	0	0	0	0	1	0	0	5	0	0	2	2	0	1	0	0	0	0	0	0	28	0	1.58	50.0%
240	2508	SFB1	31	0	0	0	0	0	0	0	0	0	0	0	1	0	0	22	0	0	3	5	0	0	0	0	0	0	0	0	39	0	0.87	100.0%
241	2508	SFB1	10	0	0	0	0	0	0	0	0	0	0	0	2	0	0	5	0	0	0	2	0	1	0	0	0	0	0	0	18	0	1.22	50.0%
242	2163	SFB3 Quad B NW	55	0	0	1	2	0	1	4	0	0	6	0	1	0	0	18	0	0	2	20	0	0	0	0	0	0	0	0	120	0	1.63	20.0%
243	2163	SFB3 Quad B	90	1	0	13	10	0	7	11	6	2	0	6	0	1	0	18	0	0	4	10	0	1	0	0	0	0	0	0	84	0	2.28	60.0%
244	2163	SFB3	49	0	0	0	0	0	0	4	0	0	30	0	0	0	0	0	0	0	4	10	0	0	0	1	0	0	0	0	67	0	1.11	20.0%
245	2163	SFB3 Quad B	66	0	0	0	4	0	1	5	1	0	20	4	1	1	0	20	0	0	3	4	0	1	0	1	0	0	0	0	90	0	1.95	25.0%
246	2163	SFB3	70	1	0	2	3	0	1	6	0	1	28	2	1	3	0	0	0	1	1	14	3	2	1	0	0	0	0	0	95	0	2.03	35.3%
247	2163	SFB3 Quad C NW	108	0	0	0	2	0	2	6	1	1	39	1	2	1	0	20	0	0	8	19	3	1	2	0	0	0	0	0	124	0	1.95	86.4%
248	2163	SFB3 Quad C	42	0	0	0	1	0	1	4	0	0	0	2	0	0	0	15	0	0	5	12	0	1	1	0	0	0	0	0	43	0	1.70	16.7%
249	2163	SFB3 Quad C	77	0	0	0	1	0	0	4	0	0	19	0	0	0	0	29	0	0	9	14	0	1	0	0	0	0	0	0	112	0	1.54	64.3%
250	2163	SFB3 Quad C SE	36	0	0	1	2	0	1	1	0	0	0	0	1	0	0	14	0	0	7	6	0	2	1	0	0	0	0	0	83	0	1.80	16.7%
251	2163	SFB3	29	0	0	0	1	0	0	0	0	0	0	1	1	0	0	14	0	0	2	7	0	3	0	0	0	0	0	0	64	0	1.46	28.6%
252	2556	SFB1 Quad C NW	17	0	0	0	0	0	0	2	0	0	0	0	0	0	0	12	0	0	1	1	0	1	0	0	0	0	0	0	10	0	1.00	100.0%
253	2555	SFB1	20	0	0	0	0	0	0	1	0	0	0	0	0	0	0	10	0	0	2	6	0	1	0	0	0	0	0	0	19	0	1.24	66.7%
254	2556	SFB1 Quad C	46	0	0	0	0	0	0	2	0	0	23	0	4	0	0	12	0	0	0	5	0	0	0	0	0	0	0	0	24	0	1.29	60.0%
255	2556	SFB1	6	0	0	0	0	0	0	0	0	0	0	0	0	1	0	4	0	0	1	0	0	0	0	0	0	0	0	0	3	0	0.87	
257	2541	SFB2 Quad D NW Corner	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	1	6	0	0	0	0	0	0	0	0	21	0	0.92	16.7%
258	2541	SFB2 Quad D NE	14	0	0	0	0	0	1	1	0	0	0	0	1	0	0	8	0	0	1	2	0	0	0	0	0	0	0	0	10	0	1.35	50.0%

Sample ID	Context	Description	Total shells	*Acanthinula aculeata*	*Acicula fusca*	*Aegopinella nitidula*	*Carychium* sp.	Clausiliidae	*Discus rotundatus*	*Oxychilus cellarius*	*Pomatias elegans*	*Punctum pygmaeum*	*Trochulus striolatus*	*Vitrea* sp.	*Cochlicopa* sp.	*Cepaea*	*Cornu aspersum*	*Trochulus hispidus*	*Cernuella virgata*	*Monarcha cantiana*	*Pupilla muscorum*	*Vallonia excentrica*	*Vallonia costata*	*Vertigo pygmaea*	*Oxyloma / Succinea*	*Vallonia cf. pulchella*	*Anisus leucostoma*	*Bathyomphalus contortus*	*Hydrobiidae*	*Galba truncatula*	*Cecilioides acicula*	Limacidae	Shannon's H	Broken vs. total
259	2541	SFB2	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	3	0	0	0	0	0	0	0	20	0	0.48	33.3%
260	2541	SFB2 Quad D	24	0	0	0	0	0	0	0	0	0	0	0	2	0	0	12	0	0	0	8	0	1	1	0	0	0	0	0	81	0	1.18	37.5%
261	2541	SFB2 Quad D SE Corner	10	0	0	0	0	0	0	1	0	0	0	0	0	0	0	5	0	0	0	4	0	0	0	0	0	0	0	0	19	0	0.94	50.0%
263	2685	SFB1 Quad C	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1	0	0	0	0	0	0	0	0	0	4	0	0.56	
264	2683	SFB1	76	0	0	0	0	0	0	13	0	0	13	0	3	0	0	26	0	0	10	8	0	2	0	1	0	0	0	0	120	0	1.76	50.0%
265	2693	SFB3 Quad B	170	0	0	4	2	0	1	9	0	0	97	0	3	1	0	7	0	0	4	29	4	4	5	0	0	0	0	0	440	0	1.55	24.2%
266	2584	SFB3 Quad C	46	0	0	0	0	0	0	4	0	0	12	0	0	0	0	21	0	0	4	3	0	1	0	1	0	0	0	0	39	0	1.48	66.7%
267	2696	SFB3 Quad C	21	0	0	0	0	0	0	1	0	0	15	0	0	0	0	0	0	0	1	3	0	0	0	1	0	0	0	0	16	0	0.95	33.3%
268	2704	SFB4 Quad A	52	0	0	0	0	0	0	8	0	0	0	0	1	0	1	23	0	0	5	13	0	1	0	0	0	0	0	0	188	0	1.45	53.8%
269	2604	SFB4 Quad A	239	0	0	1	0	0	1	4	0	0	45	0	9	3	0	63	0	0	20	76	2	7	1	7	0	0	0	0	350	0	1.80	46.2%
270	2640	SFB3 Quad B	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0.00	
271	2555	SFB1 Quad B NW	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	1	2	1	0	1	0	0	0	0	0	37	0	1.29	100.0%
272	2556	SFB1 Quad B NE	11	0	0	0	0	0	0	1	0	0	3	0	1	0	0	3	0	0	0	3	0	0	0	0	0	0	0	0	30	0	1.50	100.0%
273	2555	SFB1, Quad B Middle	33	0	0	0	0	0	0	0	0	0	13	0	0	2	1	13	0	0	0	2	0	1	1	0	0	0	0	0	33	0	1.39	100.0%
274	2555	SFB1 Quad B SW	13	0	0	0	0	0	0	0	0	0	0	0	1	0	0	8	0	0	2	1	0	0	0	0	0	0	1	0	0	0	1.18	0.0%
275	2555	SFB1 Quad D SE corner	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	1	0	0	1	0	0	0	0	0	13	0	0.60	100.0%
276	2583	SFB3	22	0	0	0	0	0	0	1	0	0	4	0	0	0	0	8	0	0	1	4	4	0	0	0	0	0	0	0	130	0	1.58	28.6%
277	2574	SFB3 Quad B	43	0	0	0	3	0	2	3	1	1	16	0	2	0	0	0	0	0	2	10	3	0	0	0	0	0	0	0	82	0	1.87	38.5%
278	2711	SFB3 Quad B	53	0	0	0	3	0	2	0	0	0	0	2	0	1	0	29	0	0	8	7	0	0	0	1	0	0	0	0	140	0	1.44	42.9%
279	2702	SFB4 Quad A (post hole)	75	0	0	1	0	0	0	7	0	0	26	2	0	0	0	13	0	0	5	13	6	1	0	1	0	0	0	0	300	0	1.87	47.4%
280	2642	SFB3 Quad A	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	5	0	0.00	
281	2726	SFB4 Quad A	11	0	0	0	0	0	0	1	0	0	0	0	0	0	0	7	0	0	0	2	0	0	1	0	0	0	0	0	76	0	1.03	50.0%
282	2721	SFB1 Quad B	40	0	0	0	0	0	0	0	0	0	0	0	1	1	0	26	0	0	2	10	0	0	0	0	0	0	0	0	46	0	0.96	60.0%
283	2722	SFB1 Quad B	71	0	0	0	1	0	0	4	0	0	11	0	3	0	0	29	0	0	2	14	5	2	0	0	0	0	0	0	70	0	1.72	36.8%
284	2580	SFB1 Quad A/B	60	0	0	1	0	0	0	9	0	0	0	0	3	0	0	32	0	0	9	6	0	0	0	0	0	0	0	0	180	0	1.35	50.0%
285	2581	SFB1 Quad A/B	35	0	0	0	0	0	0	7	0	0	22	0	2	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	96	0	1.09	33.3%
286	2734	SFB4	9	0	0	1	0	0	0	0	0	0	0	0	0	0	0	5	0	0	1	2	0	0	0	0	0	0	0	0	54	0	1.15	50.0%
289	2612	SFB3 Quad B	75	0	0	5	14	0	4	5	1	1	19	3	0	0	0	10	0	0	2	0	9	0	2	0	0	0	0	0	84	0	2.14	11.1%
290	2756	SFB1 Quad B	14	0	0	1	0	0	0	3	0	0	7	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	90	0	1.33	0.0%
291	2709	SFB2 Quad D (post hole)	22	0	0	0	0	0	0	3	0	0	0	0	0	0	0	4	0	0	1	12	0	0	2	0	0	0	0	0	280	0	1.27	41.7%
292	2739	SFB2 Quad D	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	2	5	0	1	0	0	0	0	0	0	31	0	1.12	40.0%
293	2634	SFB2 Quad A/C	54	0	0	0	0	0	1	10	0	0	0	0	2	0	0	24	0	0	6	7	0	3	1	0	0	0	0	0	304	0	1.61	42.9%
294	2707	SFB2 (post hole)	39	0	0	0	0	0	0	5	0	0	0	0	1	0	0	19	0	0	2	9	2	0	0	0	0	0	1	0	390	0	1.44	54.5%
295	2271	SFB1 Quad C	96	0	0	0	0	0	0	13	0	0	43	0	2	0	0	8	0	0	4	18	4	2	2	0	0	0	0	0	83	0	1.66	45.5%

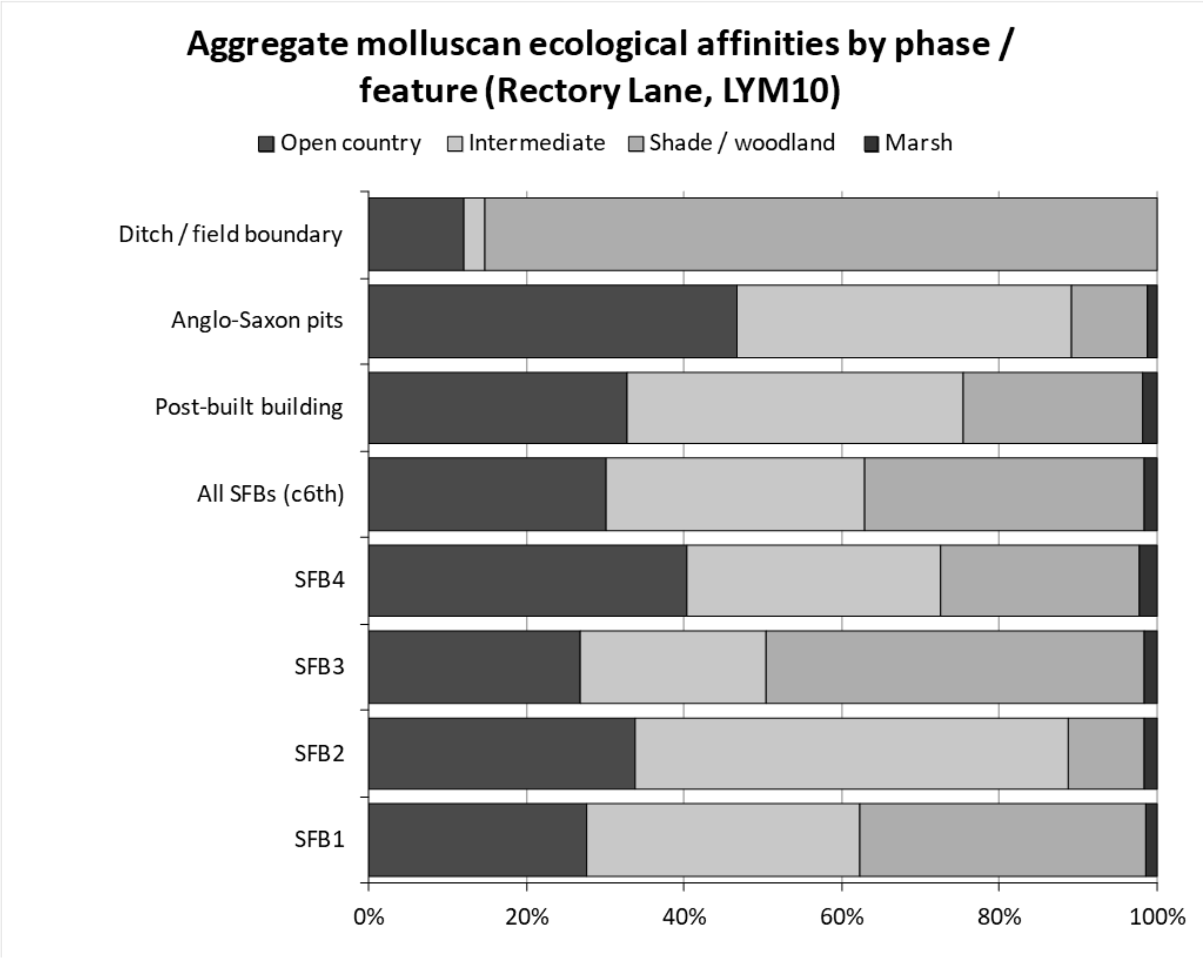


Figure 112: Aggregate summary of mollusc ecologies for main Rectory Lane (LYM10) archaeological feature classes

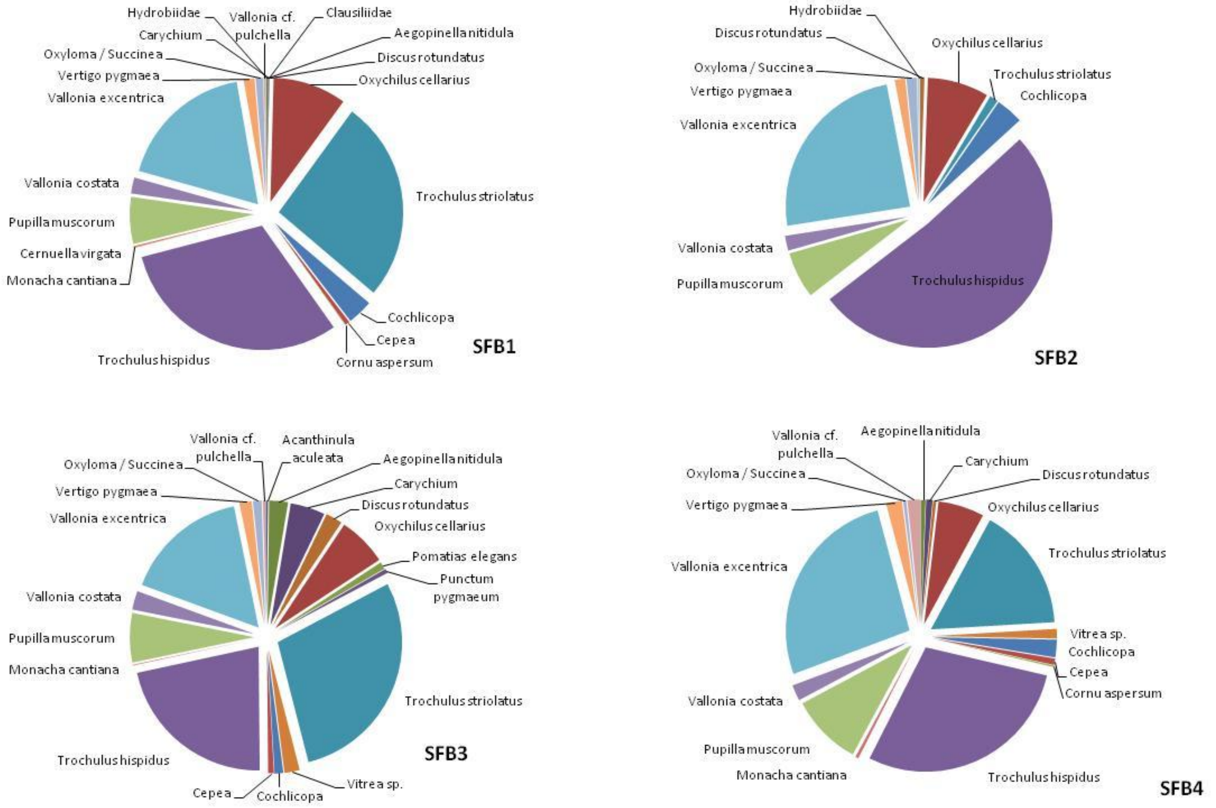


Figure 113: Unweighted distribution of species, Rectory Lane SFB fills

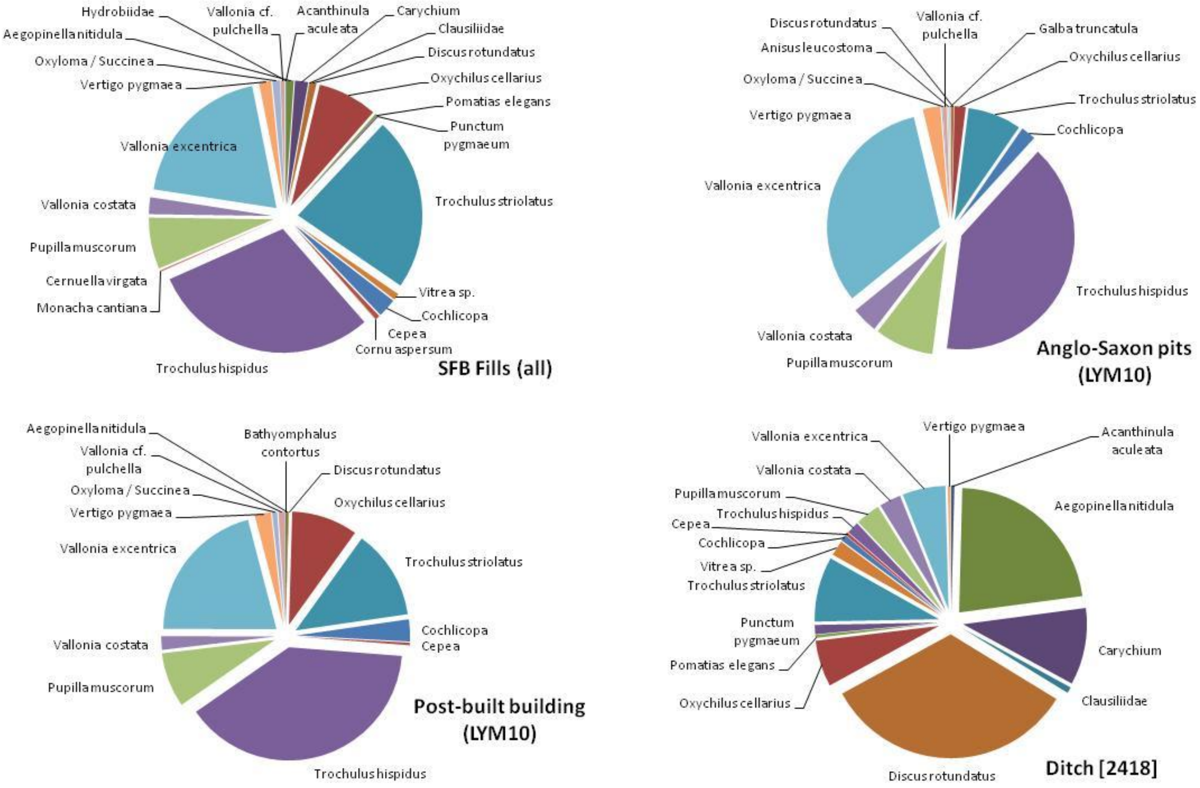


Figure 114: Unweighted distribution of species, Rectory Lane features.

9.6 Interpretation - Rectory Lane (LYM10)

9.6.1 Post-built structures

The majority of posthole fills, particularly the post-built structure adjacent to SFB1 (Thomas, 2011), represented a predominantly intermediate and dry ground / open country assemblage of low ecological diversity dominated by *Trochulus hispidus* and *Vallonia excentrica*, which was stable throughout the trajectory of construction, use and abandonment. Accentuating this picture, samples from several contexts within this structure contain relatively high proportions of the xerophile *Pupilla muscorum* which may relate to bare earth or trampled and very short grass around the building within the settlement area (Davies, 2008: 60). Several other postholes (e.g. (2328) and (2257)) contain more shade-demanding ecologies dominated by *Trochulus striolatus* and *Oxychilus cellarius* which may indicate longer vegetation growing around the footings of the structures or following abandonment.

A single example of a freshwater species, *Bathyomphalus contortus* from a post hole (2225) within this structure potentially indicates the presence of imported rushes used as thatch or flooring in this particular structure, an interpretation made for similar finds of marsh snails in structural postholes on dry-ground downland sites (Evans, 1972: 34).

The assemblages from a cluster of associated post pits [2170] / [2501] (contexts (2171) and (2502)) near the later east-west ditch which transects the site, demonstrate concentrations of species such as *Carychium tridentatum*, *Oxychilus cellarius* and particularly *Discus rotundatus* which is rare in open downland (Evans, 1972: 185). Most significantly is the presence of *Pomatias elegans*, a type associated with off-site contexts (Chapter 10) and a single specimen of *Acicula fusca*, which is a woodland species uncommon on archaeological sites of this date (Evans, 1972: 135). The assemblages from nearby postholes were markedly different and did not indicate any spatial continuity of this community, suggesting that these features are either not chronologically or structurally associated. The sequence from another feature, cut [2418], also demonstrates a similarly localised shaded habitat from substantial populations of *Discus rotundatus* and *Aegopinella nitidula*, potentially representing the terminal for a hedge-line or a tree-throw pit.

9.6.2 Sunken featured buildings

The four SFBs from this sample area display contrasting communities of species (Figure 113) with a collectively enhanced representation of types favouring shade or woodland conditions such as *Discus rotundatus*, *Oxychilus cellarius, Carychium* sp. and *Vitrea* sp. alongside the high proportions of intermediate and open country species which are widely encountered across the site.

Assemblages derived from SFB fills are taphonomically mixed as a result of the intentional deposition of a range of domestic and geological materials at the end of life of the buildings (Tipper, 2004). Previous work on the fills of these structures (Maslin, 2015) has demonstrated this fundamental variation in sources of fill material, which explains the observable diversity of taxa contained within them. Isolated finds of aquatic types including *Anisus leucostoma* and *Galba truncatula* in pit fill and SFB fill contexts in particular demonstrate the movement of materials such as vegetation from a freshwater or marsh environment to the settlement. Specimens of Hydrobiidae from SFB1 (context (2555)) and SFB2 (context (2707)) expand upon this picture by demonstrating the similar presence of materials derived from a coastal or estuarine environment (Davies, 2008: 167). Similar types recovered from occupation contexts at Tayne Field (Chapters 7-8) suggest the broad action of processes of import for materials from these types of environment across the early (6th-century) occupation phases at Lyminge.

This diversity of inputs makes straightforward correlation of species balance to wider site environment inherently problematic. Despite this major problem, a comparison between these SFB assemblages which, unlike those at Tayne Field, display clear variation (Figure 113), may point toward collective broad-scale changes in local environments. The SFBs themselves have been typologically dated by Scull (2011) with SFB2 representing the earliest structure, abandoned in the early 6th century and SFB3 likely dating to the later 6th/7th century. SFB1 had a primary fill radiocarbon dated to 570-650 cal A.D. (SUERC-35927 (GU-24773), Table 1) concurring with this chronology. The individual assemblages from these structures demonstrate broad progression from an intermediate / open country ecology dominated by *Trochulus hispidus* and *Vallonia excentrica* (SFB2) to communities of shade loving or woodland types (SFB1 and SFB3), dominated by *Trochulus striolatus* and *Oxychilus cellarius* along with more unusual types such as *Vitrea* and *Pomatias elegans*. The proposed chronological relationship of these assemblages together with these differentials in species composition suggest the site area becoming progressively more overgrown and/or less intensively used between the early 6th and mid 7th centuries.

Chapter 10 - An off-site sequence: the Woodland Road lynchet

10.1 Stratigraphy and archaeology

A stratigraphic exposure adjacent to Woodland Road, Lyminge (BNG: E 614698, N 141396) ~1km from the village core excavation areas was revealed by the collapse of a retaining wall following heavy rainfall during February 2014 (Figure 115). This revealed a lynchet sequence accumulated alongside a holloway running west from the village to the Roman road (Stone Street) between Lympne and Canterbury (Chapter 12). The stratigraphy comprised solid chalk bedrock overlain by ploughwash with coarse chalk inclusions (Figure 118) suggesting agricultural disturbance of the overlying slopes across a prolonged period of time (Prof. Martin Bell, pers. comm.). Subsequent observation following a period of weathering revealed stratigraphically earlier lynchets in the section (Figure 115 and 116). This produced flint flakes as well as pottery fragments identified as Sandy ‘Belgic’ grog-tempered ware, (c. 50BC- 80AD) and Iron Age or later Bronze Age sparse flint-tempered and flint-tempered wares (pre 50 BC) (Prof. Martin Bell and Keith Parfitt, pers. comm. April 2017). These provide a late Iron Age / Romano-British *terminus post quem* for the overlaying sequence discussed in this chapter, which was analysed as a proxy for wider-area vegetation and land use in accordance with the research objectives detailed in Section 1.5.3.

10.2 Sampling

Twelve 1kg bulk samples were taken, working upwards from the basal chalk to prevent contamination by disturbance of overlaying material. Sample spacing was corrected for the slope profile to a regular vertical height (Figure 116), with frequency based upon observed concentration of shells. Samples were processed as per Chapter 3 by Dr. Chris Speed with quantification undertaken by students as part of the University of Reading’s undergraduate archaeology program in spring 2015. Identifications were checked by the author, Prof. Martin Bell and Dr. Tom Walker with reference sources detailed in Chapter 3. Two samples were taken for luminescence dating in the field by Professor Martin Bell in August 2015 at 27cm and 102cm above the base of the sequence (Table 44). These were processed at the University of Gloucestershire Luminescence dating laboratory by Dr. Phil Toms in December 2015. Seven samples of 33 individual picked shells from single taxa (Table 43) were extracted by Professor Martin Bell and the author in the laboratory and were subject to U-Series dating by Dr. Stuart Black at the University of Reading in summer 2015.

a) Prior to collapse of wall in Feb 2014 **b) Exposed section Aug 2014**

Figure 115: sample site, Woodland Road, Lyminge (source: Google Streetview, accessed January 2015; Martin Bell).

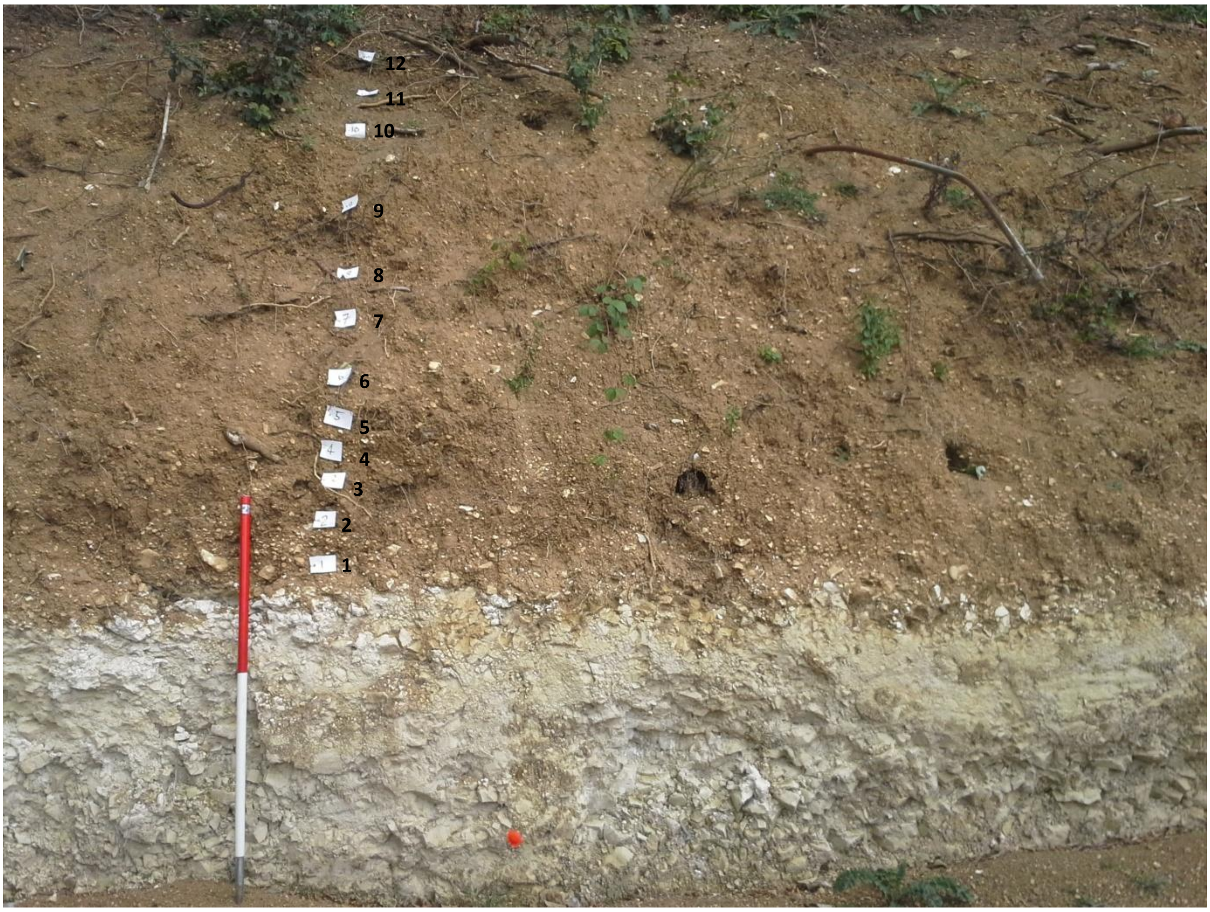


Figure 116: Woodland Road lynchet showing stratigraphy and sample locations (Aug 2014). Finds detailed in section 10.1 were recovered from lower part of section several metres to the right of this photo (approx 2m to the right of overhanging bushes shown on the right side of Fig 115 b).

10.3 Results

Compositional data for these sediments is presented in Table 42 and Figure 118, with associated OSL dating evidence in Table 3 (Toms, 2015). The sequence demonstrates a fining upwards from the natural, with a corresponding fractional increase in organic content, and a high carbonate component throughout. The material was poorly sorted and large clastics mostly comprising chalk bedrock fragments, comprised between 35% and 60% of the coarse fraction.

Mollusc count data from the sequence is presented in Table 45 and Figure 119 with associated U-Series dating for selected shells in Table 43. The diagram resulting from these data is presented in Figure 117. Shell counts for the collected samples exceeded 250 shells per litre in all cases (Figure 119), with over 500 per litre encountered in four samples. The assemblages are dominated by several key taxa, notably *Pupilla muscorum*, which declines in proportion and *Vallonia excentrica* and *Trochulus hispidus* which broadly increase in dominance moving up the sequence. These and the majority of other taxa are largely mirrored by species found in the on-site and modern analogue assemblages (Chapter 3, Chapter 7, Chapter 8 and Chapter 9) such as *Vertigo pygmea* and a range of shade-demanding types such as *Aegopinella nitidula* and *Discus rotundatus*. Representation of these shade-demanding types is most apparent in the lowermost and uppermost units, with representation of open country taxa most prevalent in the central portion between 20cm and 130cm above the base of the sequence.

The main source of taxonomic variation as compared to the on-site assemblages in and around the Lyminge village area (Chapters 8-9) arises from a significant proportion of *Pomatias elegans*, as well as a more diverse array of open-country types such as *Helicella itala* and *Candidula intersecta*. Additional variation was encountered from the presence of *Zonitoides nitidus* and *Helicigona lapicida* which were encountered from individual specimens in the lynchet sequence but were not encountered in any on-site or modern analogue samples potentially suggesting their absence from the modern environment. A number of introduced types were present, similar to those encountered in other sample areas (Chapter 8-9); these are discussed in relation to the dates of their introductions in section 10.4.1.

Table 42: Woodland Road Lyminge: Compositional data for lynchet sequence (organic matter / carbonate determinations undertaken by Dr. Chris Speed, University of Reading).

Sample number	Height over natural (cm)	Sample vol (L)	Residue weight (g)	% LOI	% CaCo3	Particle size by fractional mass:			
						4mm+	2-4mm	1-2mm	0.5-1mm
12	190-220	1	280.2	7.2%	-	34.9%	34.8%	15.6%	14.7%
11	160-190	1	270	7.3%	20.4%	41.4%	27.1%	17.5%	13.9%
10	130-160	1	250.6	7.9%	21.1%	41.7%	20.8%	20.8%	16.6%
9	100-130	1	254.6	6.0%	22.7%	19.3%	42.4%	18.8%	19.5%
8	80-100	1	449.3	5.6%	21.7%	59.3%	18.5%	11.1%	11.1%
7	60-80	1	342.7	5.2%	23.8%	35.3%	36.3%	14.0%	14.4%
6	50-60	1	400.6	4.9%	25.5%	61.3%	19.5%	11.4%	7.8%
5	40-50	1	302.9	5.3%	23.1%	52.5%	24.8%	12.2%	10.6%
4	30-40	1	239.1	5.8%	23.7%	54.3%	20.2%	13.0%	12.5%
3	20-30	1	199.5	6.3%	21.4%	54.6%	19.1%	11.9%	14.4%
2	10-20	1	287.5	6.1%	20.3%	50.5%	32.9%	7.9%	8.7%
1	0-10	1	252.7	5.8%	26.7%	56.4%	19.6%	12.4%	11.6%

Table 43: U-Series shell dates, Woodland Road Lynchet sequence (source: Dr. Stuart Black, University of Reading).

Bulk Sample Number	Depth (cm)	Species	Depth (cm)	U-Th Age whole sample (years B.P.)	Uncertainty	U-Th Age isochron (years B.P.) for this depth	Isochron Uncertainty	Isochron MSWD	Isochron Probability	Isochron Initial 234U/238U	Isochron Uncert	Approx calender age (AD)
Sample 1 (base)	0 to 10	*Pomatius elegans*	5	3097	144	Not calculated						~3000 BC
Sample 1 (base)	0 to 10	*Pomatius elegans*	5	2925	202							
Sample 2	10 to 20	*Pupilla muscorum*	15	1779	43	1832	42	2.3	0.032	1.34	0.15	183
Sample 2	10 to 20	*Pupilla muscorum*	15	2134	83							
Sample 2	10 to 20	*Pupilla muscorum*	15	1700	114							
Sample 2	10 to 20	*Pupilla muscorum*	15	1844	122							
Sample 2	10 to 20	*Pupilla muscorum*	15	1871	51							
Sample 4	30 to 40	*Pupilla muscorum*	35	1539	49	1594	91	0.76	0.66	1.346	0.056	421
Sample 4	30 to 40	*Pupilla muscorum*	35	1506	95							
Sample 4	30 to 40	*Pupilla muscorum*	35	1661	102							
Sample 4	30 to 40	*Pupilla muscorum*	35	1601	50							
Sample 4	30 to 40	*Pupilla muscorum*	35	1581	65							
Sample 4	30 to 40	*Pupilla muscorum*	35	1666	45							
Sample 4	30 to 40	*Pupilla muscorum*	35	1494	100							
Sample 7	60 to 70	*Monacha cantiana*	65	1293	134							
Sample 7	60 to 70	*Monacha cantiana*	65	1375	136							
Sample 7	60 to 80	*Pupilla muscorum*	70	1371	46	1346	43	1.3	0.25	1.324	0.043	669
Sample 7	60 to 80	*Pupilla muscorum*	70	1356	60							
Sample 7	60 to 80	*Pupilla muscorum*	70	1259	37							
Sample 7	60 to 80	*Pupilla muscorum*	70	1345	97							
Sample 7	60 to 80	*Pupilla muscorum*	70	1397	36							
Sample 7	60 to 80	*Pupilla muscorum*	70	1358	39							
Sample 10	130 to 160	*Pupilla muscorum*	145	1027	86	1028	16	0.77	0.6	1.314	0.053	987
Sample 10	130 to 160	*Pupilla muscorum*	145	991	73							
Sample 10	130 to 160	*Pupilla muscorum*	145	971	155							
Sample 10	130 to 160	*Pupilla muscorum*	145	1050	111							
Sample 10	130 to 160	*Pupilla muscorum*	145	1040	76							
Sample 12	190 to 220	*Pomatius elegans*	205	536	72	496	16	0.07	1	1.347	0.061	1519
Sample 12	190 to 220	*Pomatius elegans*	205	497	151							
Sample 12	190 to 220	*Pomatius elegans*	205	556	131							
Sample 12	190 to 220	*Pomatius elegans*	205	484	105							
Sample 12	190 to 220	*Pomatius elegans*	205	505	156							
Sample 12	190 to 220	*Pomatius elegans*	205	473	68							

Table 44: OSL dates, Woodland Road sequence (Toms, 2015).

Lab code	Height above base of sequence (cm)	Grain size (µm)	Moisture content %	Achieved date (ka) at 1σ	Approx calender date (AD)	Caveats to accuracy
GL15049	27	5-15	9±2	1.7 ± 0.1 (0.1)	300	Potentially significant U disequilibrium
GL15050	102	5-15	6±2	1.2 ± 0.1 (0.1)	800	None

Table 45: Mollusc counts from Woodland Road lynchet sequence.

Sample number	Height over natural (cm)	Total shells	*Acanthinula aculeata*	*Aegopinella nitidula*	*Carychium tridentatum*	*Clausilia bidentata*	*Cochlodina laminata*	*Discus rotundatus*	*Helicigona lapicida*	*Merdigera obscura*	*Macrogastra rolphi*	*Oxychilus cellarius*	*Pomatias elegans*	*Punctum pygmaeum*	*Trochulus striolatus*	*Vitrea contracta*	*Cochlicopa*	*Cepaea*	*Cornu aspersum*	*Trochulus hispidus*	*Candidula intersecta*	*Helicella itala*	*Monacha cantiana*	*Pupilla muscorum*	*Vallonia excentrica*	*Vallonia costata*	*Vertigo pygmaea*	*Oxyloma / Succinea*	*Zonitoides nitidus*	*Ceciloides acicula*	Limacidae	Shannon's H	Broken vs. total
12	190-220	214		14	9	1		2		1		2	7		1		1	1		60	1	14	4	24	56	5	9	2		108	7	2.13	14.8%
11	160-190	228		6	15	2		5				14	9	4	1		2			36	1	5	11	28	73	0	14	2		75	5	2.22	64.4%
10	130-160	371		23	23	1		6				3	27	2			3	1		68	4	5	14	36	86	35	24	9	1	101	9	2.35	53.7%
9	100-130	187		4	1	1				1			11	1	1					43		4		29	76	2	9	4		61	12	1.74	53.8%
8	80-100	352			3	1		1				3	21					1		56		21	16	86	117	10	16			135		1.85	58.3%
7	60-80	433		6	5	2		2				2	17	1			2	1	1	53	1	13	26	101	144	23	31	2		160	21	2.00	61.7%
6	50-60	399					2					6	14	1	1			1		56		20	24	80	137	20	35	2		72		1.93	48.7%
5	40-50	450		3	3	3							5				3	4		49		20	22	122	160	31	24	1		105	9	1.83	58.1%
4	30-40	472	2	3	4			1					15	2	1		1			57		24	17	152	139	11	43			68	6	1.82	44.0%
3	20-30	465	1	5	4	1	4	2	1			4	11				2	2		49		36	3	154	104	29	52	1		59	4	1.97	31.6%
2	10-20	372	2	4	7		2	8		1		6	41		2	2	5	3		36		25		114	82	9	23			63		2.11	48.9%
1	0-10	293		19	11	1		10			2	2	74	4		6	7	6		29		4		45	57	2	14			13	5	2.23	49.2%

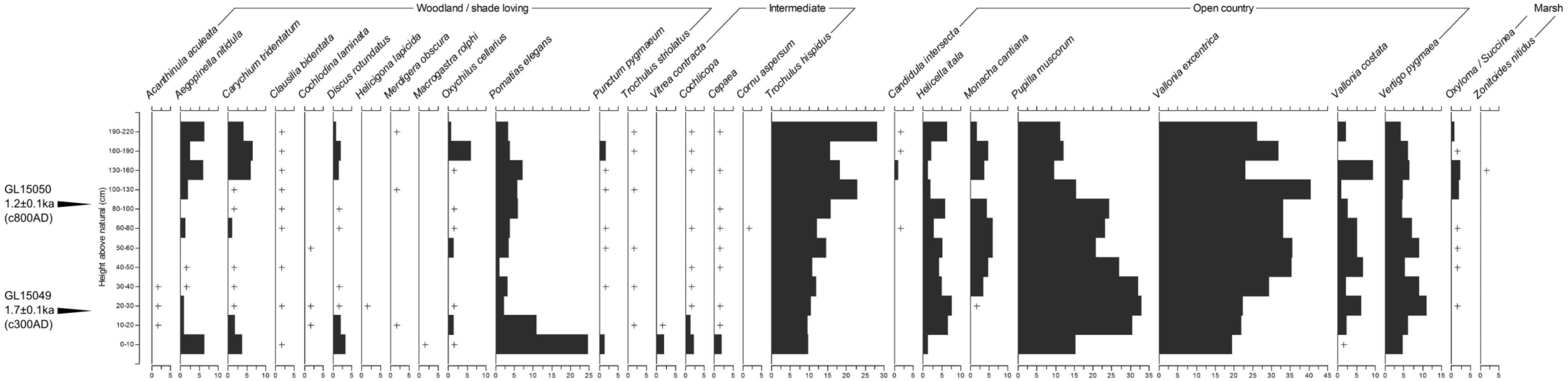


Figure 117: Woodland Road Mollusc diagram with OSL dates (Toms, 2015).

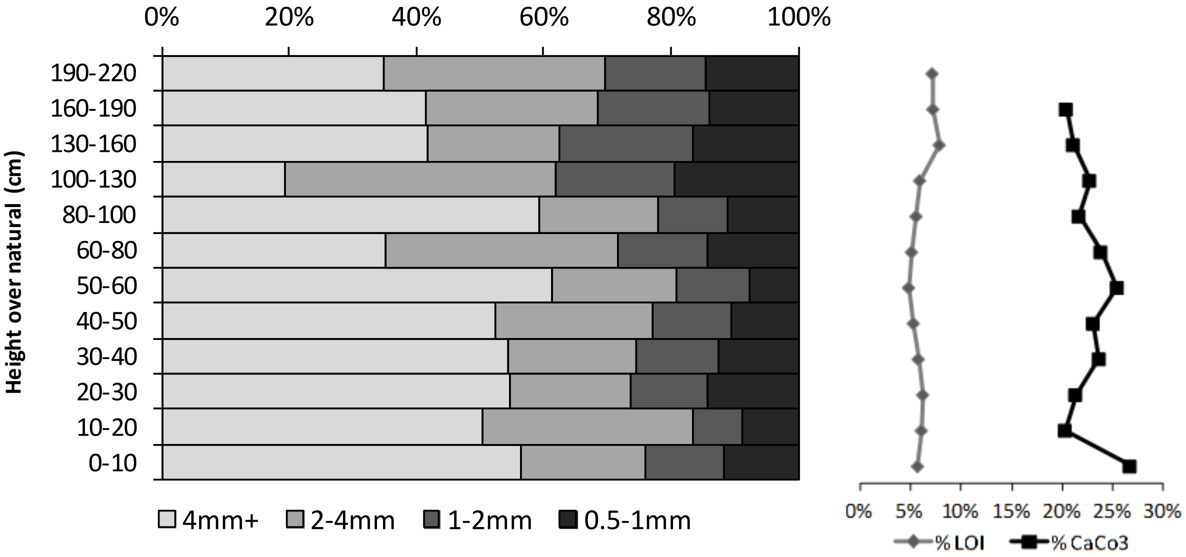


Figure 118: Woodland Road lynchet sequence; compositional data (left to right: particle size by fractional mass, organic content and carbonate content).

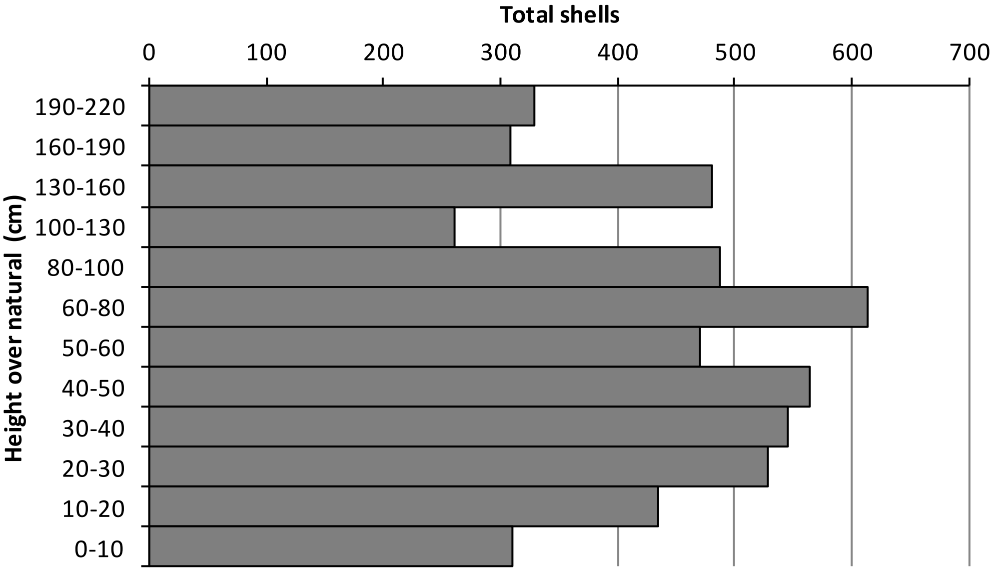


Figure 119: Woodland Road lynchet shell abundance

10.4 Interpretation

10.4.1 Dating and chronostratigraphy

The U-Series results (Table 43) demonstrated a linear chronostratigraphic trend, with the exception of the lowest two samples from the 0-5cm layer, which were Bronze-Age (c1000 BC / 3000 BP). This anomaly is readily explainable from the presence within the subsoil of a partially truncated prehistoric soil containing residual shells of particularly resistent taxa (*P. elegans*) which are considerably older than the other components of the assemblage. The other samples accord closely with the OSL dates from associated levels (Figure 120) and also associated artefact evidence (section 10.1). The lower of the two OSL samples (GL15049) displayed a disequilibrium in radionuclides which potentially compromises accuracy (Toms, 2015); however this result is still supported by the associated U-Series dates.

These data indicate that the period of lynchet accumulation spans the early Romano-British period (2nd century / 1800 BP) to the late medieval (15th century / 500 BP) with the uppermost portion corresponding to post medieval and modern deposits which remain unsampled. The very lowest sample in the sequence contains shells of *Pomatias elegans* dated by U-Series to around 1000 B.C. / 3000 BP (Table 43) indicating that the total mollusc sequence contained within this lynchet spans the late Bronze Age to the later medieval period.

The lynchet accumulation rate can be modelled from comparison of the U-Series isochrons to the sample depth spacing (Figure 121). From this it can be seen that the accumulation rate in the mid Anglo-Saxon (7th century / 1300 BP) to late Anglo-Saxon period (10th century / 1000 BP) was greater than that in the earlier Anglo-Saxon (5th century / 1500 BP to 7th century / 1300 BP) as well as the Romano-British periods. Several caveats are noted to this analysis; the lower part of the sequence may partially be distorted by compression from the weight of the overlying sediment whilst the upper part was observed to slope away from the vertical, which may distort this result by affecting the regularity of sample spacing.

On the assumption that this model has any validity, an interpretation can be made that the upper part of the sequence indicates a decline in the rate of sediment accumulation on the lynchet. This implies a reduction in erosion and runoff and an increase in surface stabilisation on the hillslopes above the trackway. Such a change likely indicates a transition in the nature or scale of activity on the hillslopes from the 10th century onward.

This chronostratigraphy can be correlated to the points of appearance for introduced species in the sequence, which can act as another broad proxy for dating (Davies, 2010). Most numerous of these is the Kentish snail, *Monacha cantiana*, an introduced type which arrived in Kent in late Roman times and spread slowly throughout the south east of England after this period (Kerney, 1999: 189). This date is matched in the present sequence where the type first appears at 20-30cm above the base, at a level corresponding to the late Romano-British OSL sample (GL15049: c300 A.D., Table 44). The absence of this type below this level therefore further suggests an early or pre Romano-British date for the earliest sediment accumulation in the lynchet.

Two other introduced types are evident in this sequence; *Cornu aspersum*, introduced in the early Roman period and *Candidula intersecta* which is believed to have been introduced during the early medieval period (Kerney, 1999: 179, 205). Both types first occur here in the sequence at 60-80cm as isolated specimens. This level corresponds to the late 7th century / 1300 BP (Figure 120), which in the case of the latter type represents an unusually early presence in southern England (Davies, 2010: 176). More frequent occurrence of *Candidula intersecta* begins at 130-160cm, dated by U-Series to the late 10th century / 1000 BP. The late Saxon OSL sample produced at 102cm (GL15050: c800 A.D., Table 44) also corroborates this mid-Saxon date for the first appearance in the sequence of both of these taxa. The increasing frequency of *Candidula intersecta* in the late Saxon period suggests an increasing distribution throughout the native fauna during this time. This close correlation of dating derived from molluscan introductions along with the U-Series, OSL (Figure 120) and associated artefactural evidence (Section 10.1), suggests a robust chronology for this sequence.

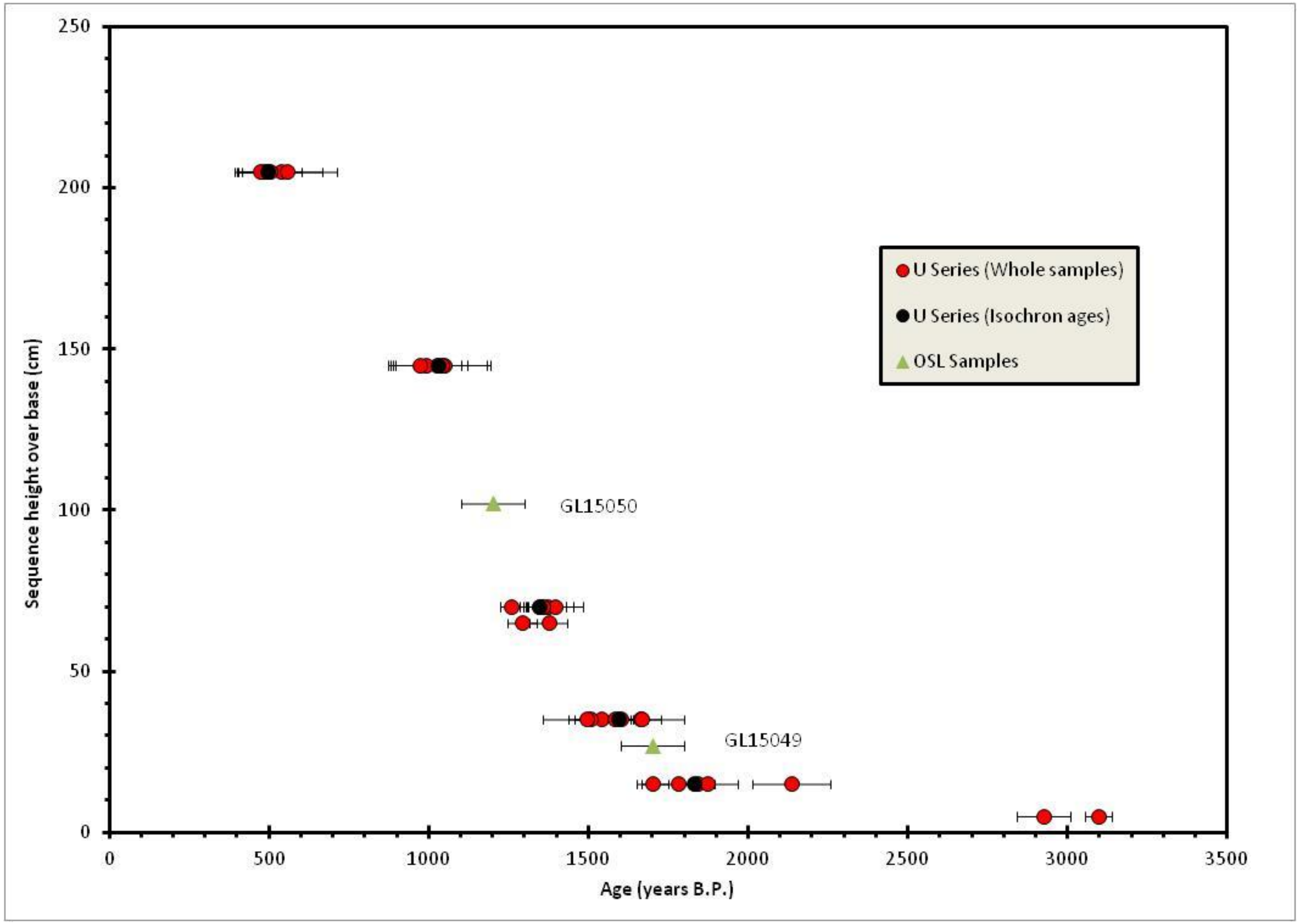


Figure 120: U Series and OSL chronostratigraphy, Woodland Road Lynchet sequence (source: Dr. Stuart Black, University of Reading; (Toms, 2015)).

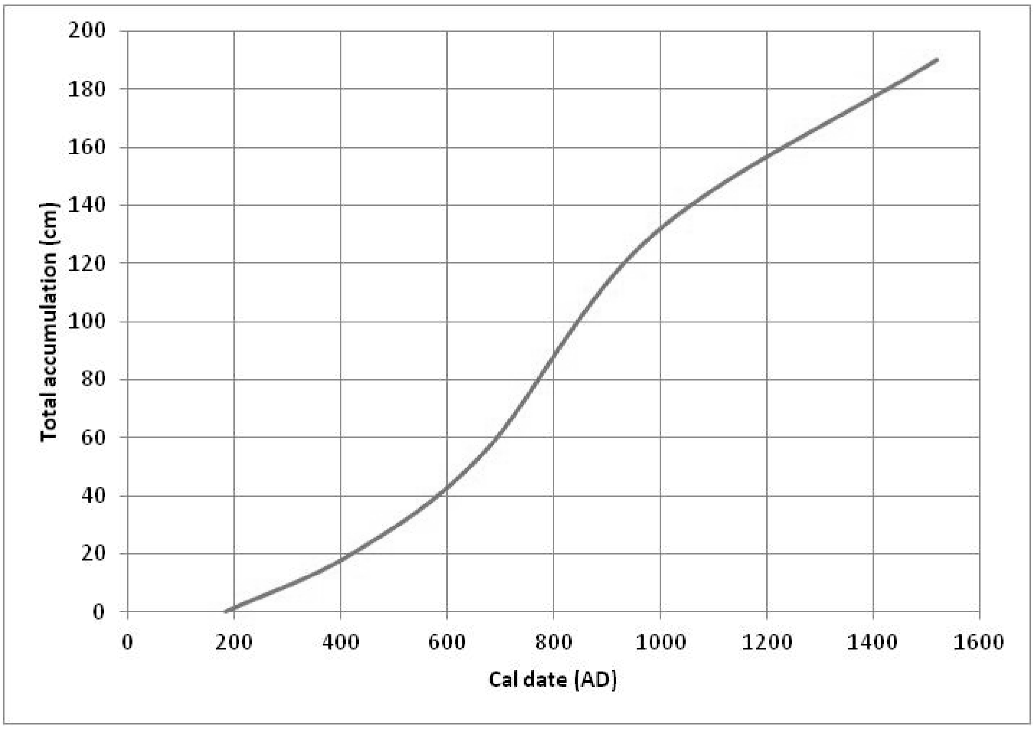


Figure 121: Sedimentation rate based upon U-Series isochrons

10.5 Mollusc Analysis

10.5.1 Taphonomy

Whilst shell counts were notably more numerous in the lower-middle part of the sequence, no overall trend in numbers down the profile was observed which would correspond to the theoretical “positive gradient” described by Evans (1972: 210) for a soil profile forming *in situ*. This is to be expected, as lynchet formation occurs through redeposition of sediments, which therefore creates a taphonomically mixed assemblage. This redeposition process is demonstrated by the varying degrees of abrasion damage observed on the sub-fossil shells resulting from their downslope movement. Thus a range of environments from the vegetation on the bank itself to various parts of the slope above it may be assumed to be represented by this material (Thomas, 1985: 143). Additionally a process of *in situ* earthworm mixing following final redeposition within the lynchet sequence must also be taken into consideration. The discrete ecological picture is compromised to some degree for individual samples, although an overall age gradient and preservation of broad transitions down the lynchet can still be assumed (Evans, 1972: 210). This assumption is supported by the chronostratigraphy for this sequence (section 10.4.1).

In terms of species distribution, the concentration of *Pomatias elegans* and (to some extent) Clausiliidae at the base of the profile is typical for a ploughwash-derived sequence on chalk downland (Carter, 1990). This phenomenon has been recognised from other sites such as West Kennet and Badbury Earthwork as a natural function of differential preservation for species with thicker shells and apices more resistant to breakage and decalcification (Evans, 1972: 212-213). This naturally implies that a sizeable fraction of such taxa may be residual; a speculation borne out by the U-Series dating of potentially disproportionately old *Pomatias elegans* specimens from the base of the sequence (section 10.4.1).

10.5.2 Ecology and land use

All samples demonstrated a relatively diverse ecological representation, with calculated values of the Shannon's H diversity index being consistently over 2. This diversity is most prominent in the lowest (pre Roman) and uppermost (medieval) parts of the sequence where shade-loving taxa are most varied and relatively numerous (Figure 123). A summary of the broad-scale transitions in ecological affiliations within the mollusc sequence is displayed in Figure 122.

Two main transitions in community composition are demonstrated in this sequence. The first occurs at around 20-30cm, during the late Roman period (OSL GL15049, Table 44), with a transition from an assemblage with a woodland or shade loving component (*Aegopinella nitidula*, *Carychium tridentatum* and *Discus rotundatus*) along with a large, likely residual, population of *Pomatias elegans* to a characteristically dry-ground open country ecology (*Vallonia excentrica* and *Pupilla muscorum*). The second major transition occurs during the later Anglo-Saxon period around 100-130cm (OSL GL15050, Table 44) to a more intermediate ecology (*Vallonia excentrica* and *Trochulus hispidus*) with a pronounced shade-loving component (*Aegopinella nitidula*, *Carychium tridentatum*, *Discus rotundatus* and *Oxychilus cellarius*).

The high concentrations of the Round-mouthed snail, *Pomatias elegans*, in the lower part of the sequence indicate a particularly favourable localised habitat for this type, which strictly favours highly calcareous loose soils within which it can burrow (Kerney, 1999: 30). Comparison with the modern analogue taken from a similar lynchet bank / hollow way environment (analogue III, Chapter 3) demonstrate that significant populations of this type persist in the modern environment on shaded banks characterised by loose chalk scree and moderate ground cover. Concentrations of this type when encountered *in situ* archaeologically are widely interpreted as evidence for soil erosion in the immediate aftermath of landscape clearance, particularly when encountered in prehistoric contexts (e.g. Buckland *et al*., 2006: 136). The U-Series dates for the lowest samples in the sequence suggest that these particular specimens relate to the late Bronze-Age (c1000BC / 3000 BP) and likely represent a residual subsoil remnant of an ecology entirely pre-dating the formation of the lynchet, possibly deriving ultimately from woodland clearance episodes in the late 2nd or early first millennium B.C. This interpretation is supported by the stony and calcareous sediment at this depth which indicates the base of a rendzina rather than redeposited ploughwash (Figure 116, Figure 118).

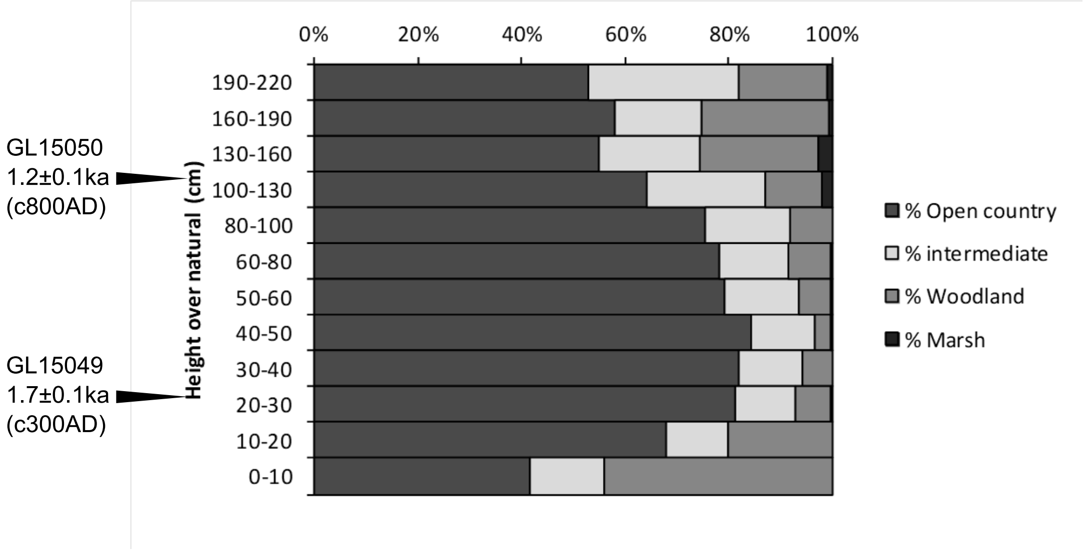


Figure 122: Summary of Woodland Road mollusc sequence by aggregate ecological preference (after Evans, 1972) with OSL dates (Toms, 2015).

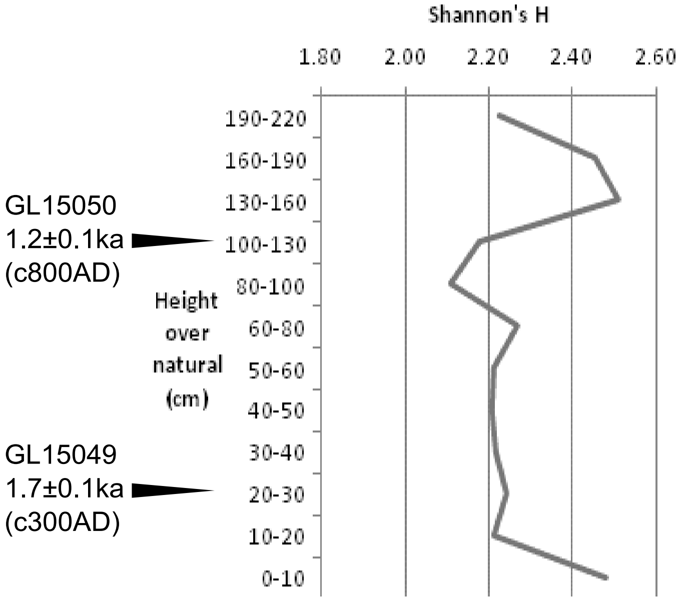


Figure 123: Ecological diversity indices for Woodland Road lynchet sequence with OSL dates (Toms, 2015).

Whilst a shade-demanding element is evident in the lowest part of the profile (*Vitrea contracta*, *Carychium tridentatum*, *Aegopinella nitidula* and *Discus rotundatus*) dating evidence (section 10.4.1) indicates that much of the material is Romano-British (2nd century A.D. / 1800 BP), clearly post-dating any prehistoric land clearance events which may be indicated by the prevalence of residual specimens of *P. elegans*. The overall ecology demonstrates a mixed mosaic of locally shaded areas within a more open environment of grassland, fields or pasture as indicated by the balance of dominant xerophilous *Pupilla* and *Vallonia* with the intermediate *Trochulus hispidus*. This type of assemblage is similar to those encountered from late Bronze-Age and Iron-Age sequences in other parts of the chalk downland suggesting a similarity of land use, typically interpreted as being orientated towards subsistence agriculture (Wilkinson, 2003: 734). Interestingly this early evidence for agriculture and land management does not correspond to any known archaeological evidence for local occupation activity in the Romano-British period (Chapter 2, Chapter 13).

The overlying Anglo-Saxon sequence in contrast is dominated by *Pupilla muscorum*, a type which notably favours exposed ground such as intensively grazed short-turfed pastures (Kerney, 1999: 103). The predominance of this type notably declines across the Anglo-Saxon period to around 10-15% in the medieval landscape. Similar peaks in the representation of this species in other mollusc sequences in similar southern English downland environments have been interpreted as indicating arable intensification, particularly in the Romano-British period (Wilkinson, 2003: 748). However, the large associated populations of *Vallonia excentrica* are more typical of stable calcareous short-turfed grassland or grazed pasture rather than cultivated landscapes (Kerney, 1999: 109).

This co-dominance of *Pupilla muscorum* and *Vallonia excentrica* together with the more intermediate *Trochulus hispidus*, suggests an alternation of cultivated and grassland phases. This correlates with the geoarchaeological context within a substantial lynchet, a feature requiring regular ground surface disturbance from cultivation to form (Fowler, 2002: 318). An analysis of the sedimentation rate (Figure 121) indicates that this part of the sequence between 700 and 900 A.D. (1300 – 1100 BP) may have seen the greatest relative rate of accumulation suggesting intensive and cyclical phases of tillage across the mid to late Anglo-Saxon period. These allowed grassland molluscan communities to flourish between episodes of surface destabilisation, erosion and organic matter depletion. An indication of these cycles may be provided by fluctuations in sediment composition and stoniness between 50 and 130cm (Figure 118), the last of which (100-130cm) comprises a decrease in stoniness coinciding with both a peak in *Trochulus hispidus* and *Vallonia excentrica* and a decline in *Pupilla muscorum*, suggestive of a cultivation phase.

Indicators that the landscape across these cycles of use remained very open throughout the Anglo-Saxon period include *Vertigo pygmaea*, another species which is actively intolerant of shade and woodland conditions (Kerney, 1999: 95) and which is found throughout the sequence with proportional changes in representation correlating to the changing populations of *Vallona excentrica* and *Pupilla muscorum*. The presence of *Helicella itala* in some abundance, particularly in the parts of the sequence where other xerophiles dominate, also indicates stable phases of short-turfed grassland which was not cultivated (Kerney, 1999: 182). The relatively low frequency of this species in relation to the large numbers of *Pupilla* encountered here is a feature of other downland sequences which has been attributed by Evans (1972: 182) to the presence of a high proportion of bare ground resulting from trampling and intensive grazing.

A particularly significant factor regarding the distribution of *Helicella itala* and *Candidula intersecta* in this sequence is the almost complete absence of these types from samples associated with archaeological contexts (Chapter 8 and Chapter 9) or modern environments (Chapter 3) around the settlement areas. This indicates a very low abundance, or even absence, of such dry ground taxa around the valley floor, although it is notable that *Candidula intersecta* still occurs in the modern lynchet analogue, suggesting a similarity in the modern outlying field and holloway environments to that represented in the sub-fossil material at Woodland Road. This dichotomy also correlates to a greater abundance of *Pupilla muscorum* on the downland slopes compared to the settlement area. Comparing these variations across the valley profile to other studies where these species have been extensively used as indicators of changing agricultural regime could potentially suggest a fundamental aggregate gradient of land use during the Anglo-Saxon period, from a higher proportion of mixed arable land use around the settlement to a higher proportion of open grazed areas on the downland slopes further out (Thomas, 1985: 143).

The important archaeological implication of this evidence is for a landscape being utilised in an intensive and, given the extent of soil erosion, perhaps ultimately unsustainable way on the slopes around 1.3km from the village core. The dating evidence (section 10.4.1) indicates that this relates to land management practices during the Anglo-Saxon period across both the pre-monastic and monastic phases of settlement. After the 9th century A.D (1100 BP) the decline in stable grassland indicators suggests a shift in the later Saxon phase towards a greater proportion of arable activity in place of livestock grazing (Evans, 1972: 159).

The upper (medieval) part of this sequence demonstrates a more pronounced decline in the representation of *Pupilla muscorum*. Similar declines at sites elsewhere such as Kiln Combe in Sussex (Bell, 1983) and Badbury, Dorset (Evans, 1972: 340) have been interpreted as demonstrating regular destabilisation of the land surface resulting from a transition from grazing to mechanically disturbed arable cultivation. This transition is further indicated by the increased prevalence of *Trochulus hispidus* which suggests a well drained environment with a land management regime dominated by arable farming and regular ploughing (e.g. Campbell and Robinson, 2010). In contrast to this picture is the apparent reduction in the rate of sediment accumulation during this later period (Figure 121) suggesting that although the land management may have shifted more towards cultivation, the rate of erosion and sediment redeposition had reduced.

The increase in representation of shade-loving types in the upper part of the sequence further suggests the development of other environments such as hedgerows, field boundaries and areas of long grass around arable fields which provide shaded and more humid habitats. Comparison of this sequence with the modern analogue taken from a similar type of shaded hollow way bank environment (analogue III, Chapter 3) demonstrates that these shade loving types (particularly *Carychium tridentatum*, *Aegopinella nitidula, Oxychilus cellarius* and *Discus rotundatus*) may be favouring environments around trees, shrubs and undergrowth growing on the lynchet itself and their increase in the uppermost part of the sequence may therefore relate to the growth of the vegetation as the bank accumulated. Conversely the dry ground types, notably *Pupilla muscorum* and *Vallonia excentrica* are far less frequently encountered in this modern analogue and within the Woodland Road sequence their presence can be taken to represent conditions prevalent up slope from the lynchet. It is perhaps significant that the contemporary holloway bank analogue was taken in a location where the land surface either side of the trackway (from where shells will have been inwashed) comprised intensively ploughed arable fields (Chapter 3). *Pupilla muscorum* is notably averse to intensively ploughed environments (Evans, 1972: 146) and this type of land use is a factor likely to have dramatically reduced the frequency of occurrence in the modern analogue.

The combination of this evidence suggests a transition around the 10th century A.D (1000 BP) to a medieval landscape characterised by small ploughed fields with longer vegetation and trees or hedgelines along the margins. This pattern of land use coincides with a potential decrease in lynchet accumulation rates after the late Anglo-Saxon period (Figure 121). This may suggest that although arable cultivation became the more prevalent form of land use, tillage was generally less intensive than during the middle Anglo-Saxon period. This in turn may reflect a decrease in local population levels or a change in the structure of the agricultural economy.

Chapter 11 - Multivariate methods: modelling ecologies

This chapter correlates molluscan ecological data presented in chapters 5, and 7 to 10 into a semi-quantitative model intended to investigate the covariation and correlation of species. This is undertaken in order to further analyse site environment and changing patterns of local land use as per the objectives set out in Section 1.5.3. In order to accomplish this, the data can be aggregated into feature / structure / phase association "cases" and subject to exploratory multivariate data analysis. This analysis uses both archaeological and modern distributions in an attempt to "ground truth" environmental associations and attempt to differentiate archaeological phases in terms of ground cover and land use.

The models discussed in the present chapter are based upon data aggregated in cases representing prominent phases or feature classes within the total dataset. The quantity of samples contributing to each case is detailed in Table 46. Each excludes intrusive taxa such as the burrowing type *Cecilioidies acicula* and wholly aquatic taxa (e.g. *Lymnaea* sp.) which are not representative of dry-ground surface conditions around the site. Distributions are normalised for comparative data analysis (Table 47). Off-site samples from the Tayne Field stream sequence and Woodland Road lynchet sequence are included in order to relate off-site to on-site ecologies and investigate archaeological and paleoecological associations in the wider area. For the lynchet sequence from Woodland Road, four discrete samples are presented based upon the associated dating evidence (Chapter 10), corresponding the major archaeological phases of the settlement archaeology. These are selected from the prehistoric (0-10cm, pre-Roman and residual Bronze Age), Late Roman (20-30cm, 4th century), Anglo-Saxon (60-80cm, 7th/8th century), Saxo-Norman (100-130cm, 11th century) and late medieval (190-220cm, 15th/16th century) horizons. The colluvial origin and limited chronostratigraphic resolution of this sequence was not sufficient to allow accurate early/middle zonation within the broader Anglo-Saxon phase. Modern analogue samples are also included in order to attempt to relate archaeological sub-fossil assemblages with synecological groupings from known environments and types of land use.

The rationale behind the quantity of samples aggregated into each case is a simple inverse relationship to the degree of taphonomic mixing; the more representative the case is to a specific context or process, the fewer the number of samples required to create an accurate picture for that case. Consequently cases comprising material disturbed, mixed or reworked by anthropogenic processes (SFB fills and pit fills) are aggregated from a far larger number of individual samples than those representing autochthonous assemblages (modern analogues from known environments or natural accumulations from stream margins and ditch fills). This process aims to smooth out variation and create representative and homogenous ecological “signatures” to maximise comparability. These signatures can be compared to those of heterogeneous environments such as ploughed fields, stream margins and waste ground to ascertain similarity in multivariate space which will have implications for the origins of the archaeological material or the formation processes. This process does however suffer a basic limitation in regarding each case as a coherent assemblage. The extent to which taxa represented within each sample all co-existed in space and time as a single community will vary depending on the formation processes, taphonomy and depositional timescale of that assemblage. This complication will be addressed where appropriate by examining the origins and taphonomies of various cases within the models; however it represents an acknowledged methodological caveat in the interpretations, due to some modelled cases actually comprising mixtures of several communities.

Table 46: Case summary for multivariate model

Case	Sample site	site code	n samples	Total count	Mean count	Standard deviation
I: Wooded field margin (Rectory Lane)	Modern analogue	LYM10	1	159	-	-
II: Ploughed arable field	Modern analogue	LYM09	1	28	-	-
III: Wooded lynchet bank / hollow way	Modern analogue	LYM09/LTF10	1	291	-	-
IV: Waste ground	Modern analogue	LTF10	1	224	-	-
V: Wooded field margin (Tayne Field)	Modern analogue	LYM12-15	1	61	-	-
VI: Stream channel bank	Modern analogue	LYM12-15	1	398	-	-
Short grassland (aggregate VII-IX)	Modern analogue	LYM13,LTF13,LTF14	3	77	25.67	12.22
Anglo-Saxon pits (monastic phase)	Rectory Paddock	LYM08-09	144	14271	99.11	97.26
Timber building, T1 LYM08	Rectory Paddock	LYM08	12	1070	89.17	37.84
Anglo-Saxon ditches (monastic precinct)	Rectory Paddock	LYM09	16	2816	176.00	97.73
Anglo-Saxon post holes (monastic phase)	Rectory Paddock	LYM09-09	25	2623	104.92	69.57
SFB1	Rectory Lane	LYM10	29	1200	41.38	61.56
SFB2	Rectory Lane	LYM10	15	363	24.20	13.26
SFB3	Rectory Lane	LYM10	19	1061	55.84	38.96
SFB4	Rectory Lane	LYM10	7	482	68.86	78.91
Post-built building	Rectory Lane	LYM10	26	1078	41.46	67.38
Anglo-Saxon pits	Rectory Lane	LYM10	2	558	186.00	257.25
Ditch / field boundary (LYM10)	Rectory Lane	LYM10	2	249	124.50	14.85
SFB7	Tayne Field	LYM13	15	1097	73.13	32.10
SFB6	Tayne Field	LYM13	7	406	58.00	27.69
SFB5	Tayne Field	LYM12	7	502	61.80	46.17
LYM13 Building 1	Tayne Field	LYM13	11	504	45.82	32.42
LYM13 Building 2	Tayne Field	LYM13	15	497	33.13	25.42
LYM13 Building 3	Tayne Field	LYM13	3	135	45.00	28.93
LYM13 Building 4	Tayne Field	LYM13-15	4	54	13.50	6.61
LYM12 Hall	Tayne Field	LYM12	6	130	21.67	23.39
All Saxo-Norman pits	Tayne Field	LYM12-14	62	1092	35.23	44.25
All Anglo-Saxon pits (7th century)	Tayne Field	LYM12-14	10	233	23.30	24.63
All Anglo-Saxon pits (6th century)	Tayne Field	LYM12-14	5	265	53.00	26.45
Saxo-Norman ditches	Tayne Field	LYM12-14	7	833	119.00	99.21
Medieval ditches	Tayne Field	LYM12-14	1	375	202.67	152.33
A/S seq in solution hollow	Tayne Field	LYM14-15	45	1123	24.96	16.34
Silt beneath flint surface in solution hollow	Tayne Field	LYM14-15	1	191	-	-
Woodland Road - Prehistoric	Woodland Road lynchet	N/A	1	291	-	-
Woodland Road - Late Medieval	Woodland Road lynchet	N/A	1	213	-	-
Woodland Road - Late Roman	Woodland Road lynchet	N/A	1	465	-	-
Woodland Road - Anglo-Saxon	Woodland Road lynchet	N/A	1	433	-	-
Woodland Road - Saxo-Norman	Woodland Road lynchet	N/A	1	186	-	-
A/S Stream margin	Stream trench, Tayne Field	LTF14	4	307	76.75	76.67
Medieval colluvium	Stream trench, Tayne Field	LTF14	7	75	10.71	8.04

Table 47: Normalised aggregate data for all cases.

Case	*Acanthinula aculeata*	*Acicula fusca*	*Aegonipella nitidula*	*Carychium tridentatum*	*Clausiliidae*	*Discus rotundatus*	*Merdigera obscura*	*Oxychilus cellarius*	*Pomatias elegans*	*Punctum pygmaeum*	*Trochulus striolata*	*Vitrea*	*Cepea*	*Cochlicopa*	*Cornu aspersum*	*Trochulus hispidus*	*Candidula intersecta*	*Cernuella virgata*	*Helicella itala*	*Monacha cantiana*	*Pupilla muscorum*	*Vallonia costata*	*Vallonia excentrica*	*Vertigo Pygmaea*	*Carychium minimum*	*Oxyloma / Succinea*	*Vallonia pulchella*
Analogue I	0.006	0.006	0.170		0.069	0.044		0.333	0.006		0.082	0.050	0.031	0.050	0.019	0.075				0.044			0.013				
Analogue II						0.036		0.036					0.036		0.036	0.607				0.107			0.107	0.036			
Analogue III	0.003		0.072	0.038		0.041		0.048	0.182	0.003	0.186	0.003	0.003	0.010	0.003	0.165	0.007	0.003		0.058	0.048	0.003	0.107	0.014			
Analogue VII-IX						0.013							0.013			0.312							0.649	0.013			
AS pits (monastic)	0.000		0.005	0.003	0.001	0.004		0.049	0.000	0.001	0.141	0.002	0.002	0.058	0.002	0.439	0.001	0.000	0.000	0.003	0.046	0.010	0.217	0.013		0.004	0.001
LYM08 Building	0.001			0.001	0.001	0.001		0.078		0.001	0.182	0.001		0.101		0.362				0.005	0.093	0.018	0.141	0.010		0.004	0.002
AS ditches (monastic)			0.027	0.006	0.000	0.008		0.066			0.390	0.001	0.006	0.069	0.001	0.194				0.004	0.019	0.057	0.148	0.004		0.001	
AS p holes (monastic)			0.008	0.004	0.000	0.003		0.030			0.157	0.001	0.002	0.079	0.001	0.491	0.000		0.000	0.003	0.042	0.005	0.163	0.008		0.003	
SFB1			0.002	0.001	0.001	0.001		0.096			0.263		0.033	0.006	0.001	0.308		0.001		0.002	0.061	0.021	0.179	0.014		0.010	0.003
SFB2						0.006		0.080			0.011		0.036			0.515					0.061	0.019	0.245	0.014		0.014	
SFB3	0.002		0.025	0.045		0.022		0.064	0.009	0.006	0.287	0.020	0.011	0.008		0.218				0.001	0.064	0.025	0.162	0.016		0.011	0.005
SFB4			0.006	0.008		0.004		0.060			0.162	0.012	0.023	0.008	0.002	0.288				0.004	0.093	0.021	0.266	0.021		0.004	0.017
LYM10 building			0.004			0.001		0.095			0.128		0.032	0.004		0.391					0.078	0.019	0.209	0.023		0.007	0.009
AS pits LYM10						0.004		0.016			0.077		0.022			0.405					0.084	0.038	0.323	0.025		0.002	0.005
Ditch LYM10	0.004		0.225	0.100	0.008	0.333		0.060	0.004	0.012	0.084	0.020	0.008	0.004		0.016					0.032	0.028	0.056	0.004			
SFB7			0.001	0.001		0.002		0.005		0.001	0.052		0.001	0.015		0.098					0.048	0.114	0.560	0.102			0.001
SFB6						0.002		0.002			0.032			0.012		0.163					0.044	0.084	0.515	0.135			0.010
SFB5									0.002		0.036			0.028		0.114					0.070	0.008	0.616	0.127			
LYM13 Building 1			0.008	0.095		0.022		0.042		0.018	0.095	0.010		0.022		0.109					0.052	0.073	0.369	0.079			0.006
LYM13 Building 2			0.002	0.008		0.004		0.018		0.008	0.076	0.004		0.030		0.095					0.060	0.076	0.485	0.115			0.018
LYM13 Building 3				0.022				0.022		0.030	0.156			0.037		0.030					0.030	0.052	0.578	0.044			
LYM13 Building 4					0.019	0.019		0.019			0.037			0.019		0.222					0.074		0.519	0.074			
LYM12 Hall											0.023			0.015		0.108					0.038	0.031	0.723	0.062			
SN pits			0.004	0.003		0.003		0.048		0.001	0.063	0.001		0.042		0.164					0.060	0.039	0.460	0.108		0.001	0.005
AS pits (7th century)						0.004		0.004			0.069			0.026		0.159					0.056	0.009	0.558	0.094		0.004	0.017
AS pits (6th century)					0.004			0.015			0.064			0.008		0.132					0.064	0.091	0.506	0.109			0.008
SN ditches			0.012	0.017		0.018		0.068		0.006	0.091	0.005	0.005	0.035	0.001	0.181					0.041	0.055	0.414	0.046		0.001	0.004
Med ditches			0.080	0.173	0.013	0.163		0.077		0.011	0.133		0.091	0.005	0.115	0.005				0.008	0.008	0.048	0.048	0.021			
A/S seq in hollow			0.003	0.003		0.002		0.015		0.004	0.025			0.033		0.250				0.001	0.092	0.004	0.476	0.094			
Basal silt in hollow	0.010		0.052	0.277	0.047	0.005		0.089		0.026		0.005		0.105		0.199						0.147		0.037			
Analogue IV			0.129	0.022	0.004			0.027		0.004	0.344			0.027		0.179				0.040		0.192	0.031				
Analogue V			0.180				0.033	0.016			0.098	0.279		0.115	0.016	0.115						0.115	0.033				
Analogue VI			0.153	0.068		0.229		0.003			0.018	0.028	0.023	0.050	0.003					0.003		0.020	0.116	0.005	0.271	0.013	
Wlnd Rd - Prehist			0.065	0.038	0.010	0.034		0.007	0.247	0.014		0.021	0.021	0.024		0.100			0.014		0.155	0.007	0.196	0.048			
Wlnd Rd - L Med			0.066	0.042	0.005	0.009	0.005	0.009	0.033		0.005		0.005	0.005		0.282	0.005		0.066	0.014	0.113	0.023	0.263	0.042		0.009	
Wlnd Rd - L Rom	0.002		0.011	0.009	0.011	0.004		0.009	0.024				0.004	0.004		0.105			0.077	0.006	0.331	0.062	0.224	0.112		0.002	
Wlnd Rd - AS			0.014	0.012	0.005	0.005		0.005	0.039	0.002			0.002	0.005	0.002	0.122	0.002		0.030	0.060	0.233	0.053	0.333	0.072		0.005	
Wlnd Rd - SN			0.022	0.005			0.005		0.059	0.005	0.005					0.231			0.022		0.156	0.011	0.409	0.048		0.022	
A/S Stream			0.020	0.052	0.003	0.055		0.055		0.007	0.007	0.003	0.023	0.055	0.003	0.332					0.020	0.023	0.244	0.036	0.026	0.033	
Med col														0.040		0.600				0.027	0.027		0.280	0.013		0.013	

Hierarchical cluster analysis of this dataset allows determination of ecologically similar groupings and an assessment of structure based upon the environmental parity between assemblages (Shennan, 1997). In the present model, the technique is applied in order to better understand the hierarchy of relationships based upon similarity for different communities or aggregated death assemblages of molluscs in order to determine ecological groupings. In this way commonalities of environment can be ascertained for groups of archaeological features and structures which will better allow an understanding of land surface conditions during the period off accumulation of these assemblages.

The correlation or similarity matrix for this data (Table 48) allows an understanding of the basic structure of correlation and the strong associations which drive the generation of these clusters and groupings. In this table, strong correlations are highlighted in yellow, strong inverse correlations are highlighted in red. This demonstrates relative levels of similarity and dissimilarity with which to contexturalise and evaluate the results of the cluster analysis (Shennan, 1997: 255). These patterns attempt to approach a synecological understanding of the association of individual species with each other and their environments and demonstrate resolution of meaningful taxocenes from the study area (Davies, 2008: 61). This can be demonstrated immediately from the clear pattern of association between shade-loving taxa (top left part of table) which are commonly found together in samples where they occur at all. The two numerically dominant taxa from the total sample population, *V. excentrica* and *T. hispidus*, exhibit strong negative correlations with this shade-loving group. This demonstrates a fundamental dichotomy to the data between open-country / intermediate and shade-loving taxa. This vector provides the principle driving force behind the group separations in the cluster analysis and also the primary inertia behind the data reduction in the DCA plots where it essentially underpins the separation along Axis 1 (Figure 125-Figure 127).

Table 48: Correlation or similarity matrix demonstrating associations between taxa across total dataset (strong correlations highlighted in yellow, strong inverse correlations highlighted in red).

	Acanthinula aculeata	*Acicula fusca*	*Aegonipella nitidula*	*Carychium tridentatum*	*Clausilidae*	*Discus rotundatus*	*Merdigera obscura*	*Oxychilus cellarius*	*Pomatias elegans*	*Punctum pygmaeum*	*Trochulus striolata*	*Vitrea*	*Cepea*	*Cochlicopa*	*Cornu aspersum*	*Trochulus hispidus*	*Candidula intersecta*	*Cernuella virgata*	*Helicella itala*	*Monacha cantiana*	*Pupilla muscorum*	*Vallonia costata*	*Vallonia excentrica*	*Vertigo Pygmaea*	*Carychium minimum*	*Oxyloma / Succinea*	*Vallonia pulchella*
Acanthinula aculeata		0.438	0.395	0.639	0.786	0.200	-0.074	0.539	0.079	0.404	-0.052	0.045	-0.030	0.304	-0.012	-0.183	0.120	0.193	0.010	0.119	-0.116	0.197	-0.444	-0.187	-0.063	-0.162	-0.172
Acicula fusca	0.438		0.379	-0.079	0.783	0.041	-0.033	0.840	-0.030	-0.091	-0.013	0.141	0.190	0.114	0.118	-0.152	-0.045	-0.032	-0.051	0.250	-0.155	-0.149	-0.232	-0.181	-0.028	-0.096	-0.088
Aegonipella nitidula	0.395	0.379		0.327	0.400	0.677	0.409	0.336	0.137	0.118	0.109	0.540	0.161	0.227	0.213	-0.438	0.111	0.079	-0.005	0.132	-0.275	0.206	-0.612	-0.467	0.328	-0.090	-0.292
Carychium tridentatum	0.639	-0.079	0.327		0.424	0.425	-0.081	0.140	0.034	0.674	-0.064	-0.040	0.267	0.215	0.376	-0.291	0.035	0.013	-0.031	-0.088	-0.217	0.334	-0.414	-0.160	0.132	-0.039	-0.163
Clausilidae	0.786	0.783	0.400	0.424		0.105	-0.071	0.738	0.022	0.236	-0.132	0.077	0.184	0.248	0.186	-0.224	-0.060	-0.074	0.043	0.155	-0.105	0.095	-0.366	-0.143	-0.063	-0.171	-0.199
Discus rotundatus	0.200	0.041	0.677	0.425	0.105		-0.083	0.105	0.014	0.173	-0.062	0.038	0.364	-0.097	0.328	-0.364	-0.019	0.015	-0.097	-0.002	-0.222	-0.126	-0.366	-0.292	0.498	0.041	-0.187
Merdigera obscura	-0.074	-0.033	0.409	-0.081	-0.071	-0.083		-0.104	-0.018	-0.098	-0.028	0.947	-0.121	0.408	0.082	-0.099	0.022	-0.041	0.059	-0.077	-0.098	0.248	-0.202	-0.179	-0.036	-0.011	-0.114
Oxychilus cellarius	0.539	0.840	0.336	0.140	0.738	0.105	-0.104		-0.105	0.035	0.250	0.075	0.396	0.189	0.216	-0.014	-0.066	0.056	-0.196	0.176	-0.258	-0.111	-0.483	-0.398	-0.109	-0.017	-0.054
Pomatias elegans	0.079	-0.030	0.137	0.034	0.022	0.014	-0.018	-0.105		0.158	-0.088	-0.009	-0.003	-0.152	-0.063	-0.158	0.503	0.531	0.212	0.189	0.325	-0.201	-0.155	-0.043	-0.055	-0.043	-0.170
Punctum pygmaeum	0.404	-0.091	0.118	0.674	0.236	0.173	-0.098	0.035	0.158		0.002	-0.066	-0.022	0.169	0.087	-0.361	-0.080	-0.037	-0.100	-0.152	-0.123	0.309	-0.083	-0.014	-0.086	-0.122	-0.091
Trochulus striolata	-0.052	-0.013	0.109	-0.064	-0.132	-0.062	-0.028	0.250	-0.088	0.002		0.018	0.044	0.167	0.030	-0.035	0.022	0.228	-0.287	-0.008	-0.254	0.228	-0.354	-0.424	-0.132	-0.134	0.085
Vitrea	0.045	0.141	0.540	-0.040	0.077	0.038	0.947	0.075	-0.009	-0.066	0.018		-0.052	0.473	0.099	-0.186	-0.064	-0.041	-0.075	-0.051	-0.189	0.233	-0.301	-0.247	0.055	-0.096	-0.094
Cepea	-0.030	0.190	0.161	0.267	0.184	0.364	-0.121	0.396	-0.003	-0.022	0.044	-0.052		-0.285	0.788	0.072	-0.116	-0.020	-0.110	0.158	-0.173	-0.225	-0.402	-0.364	0.119	0.142	-0.066
Cochlicopa	0.304	0.114	0.227	0.215	0.248	-0.097	0.408	0.189	-0.152	0.169	0.167	0.473	-0.285		-0.081	0.011	-0.165	-0.119	-0.247	-0.171	-0.332	0.235	-0.332	-0.253	0.127	-0.037	-0.177
Cornu aspersum	-0.012	0.118	0.213	0.376	0.186	0.328	0.082	0.216	-0.063	0.087	0.030	0.099	0.788	-0.081		-0.134	-0.046	-0.024	-0.081	0.240	-0.221	-0.011	-0.317	-0.170	-0.024	-0.129	-0.139
Trochulus hispidus	-0.183	-0.152	-0.438	-0.291	-0.224	-0.364	-0.099	-0.014	-0.158	-0.361	-0.035	-0.186	0.072	0.011	-0.134		-0.014	-0.028	-0.093	0.249	-0.080	-0.359	-0.132	-0.321	-0.218	0.345	-0.051
Candidula intersecta	0.120	-0.045	0.111	0.035	-0.060	-0.019	0.022	-0.066	0.503	-0.080	0.022	-0.064	-0.116	-0.165	-0.046	-0.014		0.762	0.347	0.400	0.153	-0.145	-0.144	-0.099	-0.049	-0.006	-0.153
Cernuella virgata	0.193	-0.032	0.079	0.013	-0.074	0.015	-0.041	0.056	0.531	-0.037	0.228	-0.041	-0.020	-0.119	-0.024	-0.028	0.762		-0.064	0.331	-0.037	-0.154	-0.178	-0.159	-0.035	-0.061	-0.091
Helicella itala	0.010	-0.051	-0.005	-0.031	0.043	-0.097	0.059	-0.196	0.212	-0.100	-0.287	-0.075	-0.110	-0.247	-0.081	-0.093	0.347	-0.064		0.083	0.772	-0.002	-0.048	0.212	-0.056	0.119	-0.176
Monacha cantiana	0.119	0.250	0.132	-0.088	0.155	-0.002	-0.077	0.176	0.189	-0.152	-0.008	-0.051	0.158	-0.171	0.240	0.249	0.400	0.331	0.083		-0.028	-0.074	-0.341	-0.190	-0.059	-0.116	-0.224
Pupilla muscorum	-0.116	-0.155	-0.275	-0.217	-0.105	-0.222	-0.098	-0.258	0.325	-0.123	-0.254	-0.189	-0.173	-0.332	-0.221	-0.080	0.153	-0.037	0.772	-0.028		-0.119	0.127	0.390	-0.165	0.077	0.028
Vallonia costata	0.197	-0.149	0.206	0.334	0.095	-0.126	0.248	-0.111	-0.201	0.309	0.228	0.233	-0.225	0.235	-0.011	-0.359	-0.145	-0.154	-0.002	-0.074	-0.119		-0.125	0.149	-0.080	-0.284	0.064
Vallonia excentrica	-0.444	-0.232	-0.612	-0.414	-0.366	-0.366	-0.202	-0.483	-0.155	-0.083	-0.354	-0.301	-0.402	-0.332	-0.317	-0.132	-0.144	-0.178	-0.048	-0.341	0.127	-0.125		0.689	-0.152	-0.124	0.277
Vertigo Pygmaea	-0.187	-0.181	-0.467	-0.160	-0.143	-0.292	-0.179	-0.398	-0.043	-0.014	-0.424	-0.247	-0.364	-0.253	-0.170	-0.321	-0.099	-0.159	0.212	-0.190	0.390	0.149	0.689		-0.165	-0.235	0.362
Carychium minimum	-0.063	-0.028	0.328	0.132	-0.063	0.498	-0.036	-0.109	-0.055	-0.086	-0.132	0.055	0.119	0.127	-0.024	-0.218	-0.049	-0.035	-0.056	-0.059	-0.165	-0.080	-0.152	-0.165		0.262	-0.097
Oxyloma / Succinea	-0.162	-0.096	-0.090	-0.039	-0.171	0.041	-0.011	-0.017	-0.043	-0.122	-0.134	-0.096	0.142	-0.037	-0.129	0.345	-0.006	-0.061	0.119	-0.116	0.077	-0.284	-0.124	-0.235	0.262		-0.094
Vallonia pulchella	-0.172	-0.088	-0.292	-0.163	-0.199	-0.187	-0.114	-0.054	-0.170	-0.091	0.085	-0.094	-0.066	-0.177	-0.139	-0.051	-0.153	-0.091	-0.176	-0.224	0.028	0.064	0.277	0.362	-0.097	-0.094	

Figure 124 displays the dendrogram resulting from the hierarchical cluster analysis, produced using a method based around average Euclidean between-group linkage in PAST 3.08. The results demonstrate four basic groupings, which are correlated around modern analogues and sample areas demonstrating both the dominant influence of local geology, aspect and vegetation for each area, as well as the prevalent land use.

The pre-Christian archaeological features on Tayne Field are clustered together with the modern grassland analogue, with little differentiation by phase between the earliest (the doline fill sequence and SFBs) and the latest (the Saxo-Norman pits and ditches). This consistency indicates a basic continuity of environmental parameters across these phases in this location and a strong association with ground cover typical of open, short-turfed grassland, trampled ground and heavily grazed pasture. The continuity irrespective of phase is particularly notable; here no changes in ecology significant enough to have altered the fundamental associations are evident between the early Anglo-Saxon and Saxo-Norman material.

The pre-monastic and monastic features in the Rectory Paddock and Rectory Lane sample areas by contrast demonstrate a strong association between two modern analogues corresponding to ploughed arable fields and waste ground. This demonstrates both continuity of environment across the conversion period in this area and also a continuum between arable agricultural and overgrown marginal environments. Within this group a subtle distinction is apparent between the monastic precinct boundary ditches and the fills of SFB1 and 3 which demonstrate a stronger association with overgrown waste-ground environments and the settlement core features such as post built buildings and pits associated with domestic activity which are more closely associated with the arable field analogue. Additionally several cases from outside of this sample area are present amongst this cluster; notably the medieval colluvium and stream margin locations from Tayne Field and the uppermost (late medieval) portion of the off-site lynchet sequence from Woodland Road. These are strongly associated with the arable field analogue, most likely due to domination of their assemblages by the intermediate type *Trochulus hispidus*, which in this circumstance may demonstrate the influence of agricultural activity. In the case of the medieval colluvium and stream margin samples from the Nailbourne channel on Tayne Field this association likely relates to the existence of a heavily ploughed arable environment existing in the former settlement area.

Another cluster in the dendrogram collects the pre-medieval lynchet samples together with their modern equivalent, demonstrating a basic continuity of community in these off-site environments. This continuity arises from the presence of several species such as *Pomatias elegans* which are only encountered infrequently in the other sample areas and which comprise a compositionally distinctive community potentially associated with non-settlement environments in the wider area.

A final cluster collects the various modern marginal woodland and riparian analogues together with the medieval ditches / potential hedge lines from Tayne Field and Rectory Lane. Interestingly the pre-Saxon assemblage from the basal silt sequence in the hollow on Tayne Field is incorporated into this group, demonstrating a substantial difference in ground cover on the plateau area prior to the establishment of the settlement. Collectively these cases represent populations of shade-loving types which exist in wooded marginal areas around the settlement as well as around specific features such as hedges, ditches, hollows and heavily vegetated field margins. As a result the association of these features in this model has little to do with the similarity of the specific environments they represent and more to do with the similarities in their marginal and non-settlement shade-loving ecologies, which can be seen in the correlation matrix for the total dataset (Table 48).

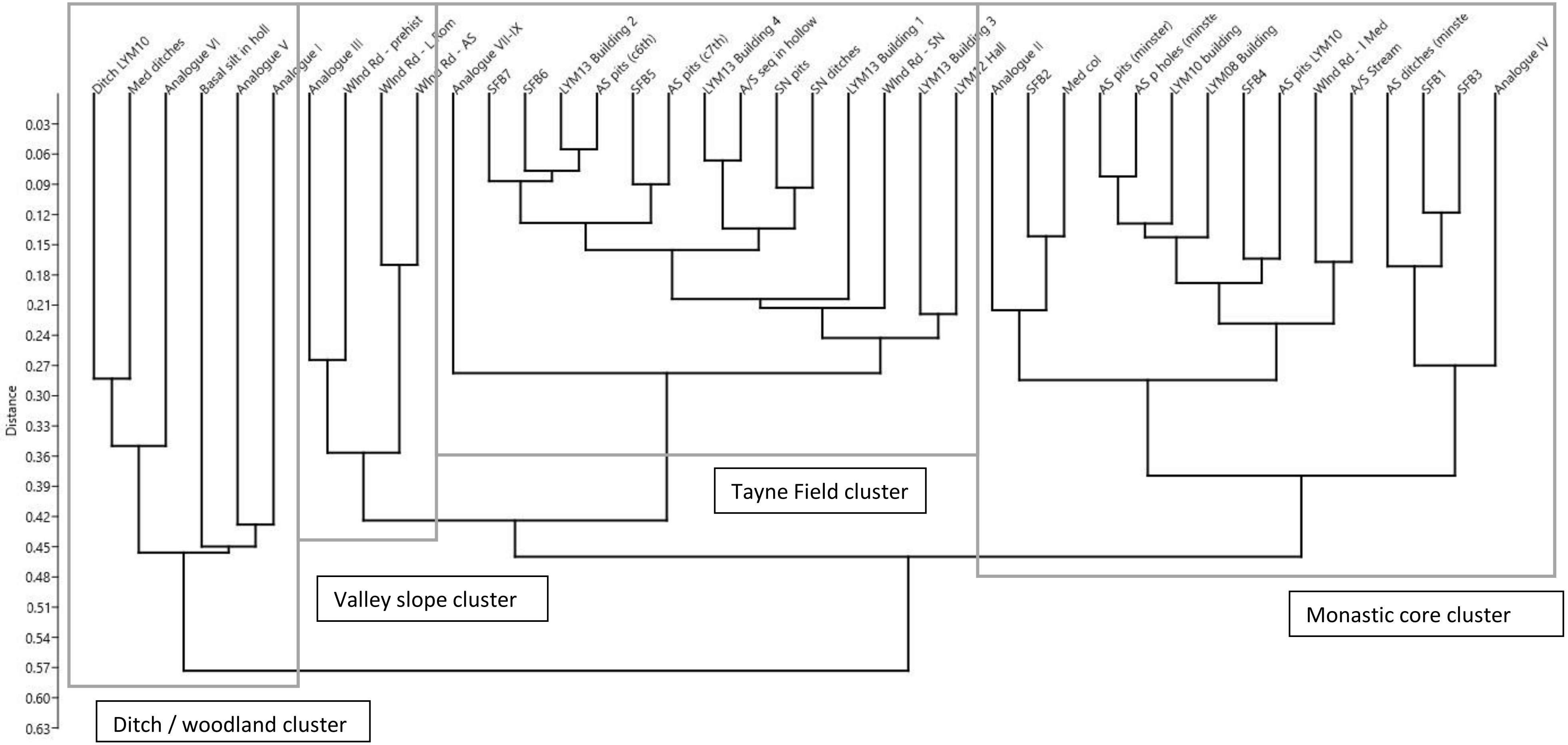


Figure 124: Dendrogram displaying results of cluster analysis (based upon a Euclidean similarity index)

Multivariate ordination techniques can be used to refine the analysis of groupings presented so far and detail the influencing factors between them in order to explore synecological relationships. This approach in theory enables extraction of the major dimensions of variation which give rise to the cluster groupings previously ascertained. In doing so it can provide an insight into the relationships between both the variables (proportions of taxa) and the unit categories (archaeological features, phase groups and discrete structures) (Shennan, 1997: 297). The inherent inter-correlation of proportional numeric data is an established issue for some types of multivariate analysis such as Principle Components Analysis (Shennan, 1997: 298). Application of correspondence analysis is more appropriate for numerical data, particularly relating to taxa and environmental conditions which can be applied directly to a dataset comprising count data or count-based proportions (Shennan, 1997: 308). Whereas other forms of factor analysis such as PCA assume a linear response for component variables, correspondence analysis allows for a unimodal response of frequency to environmental parameters (e.g. humidity) which is more appropriate for this type of ecological dataset. Correspondence analysis displays each sample as a discrete point and allows comparison of species composition and ordination of characteristics of similarity in multivariate space. Distributions of points when projected as a two dimensional plot reflect the environmental characteristics of the aggregated assemblage in terms of the soil type and ground vegetation cover. The patterns produced by this process are assessed subjectively as detrending is a process which compensates for the tendency of natural ecological gradients to give rise to artificial patterns in the data (Peacock and Gerber, 2007: 134). This type of approach has been widely used in order to attempt an effective comparative analysis of molluscan taxocenes and to allow parity between subfossil and modern assemblages (Davies, 1992: 69).

The results of a DCA performed using PAST 3.08 is displayed in Figure 125 to Figure 127. This analysis compresses the multivariate dataset into two dimensions with two axes of variance. Examination of the distribution of species (Figure 127) demonstrates that whilst Axes 1 is very clearly based around a simple dichotomy of open country / shade demanding attributes (as seen in Table 48), Axes 2 is a multivariate composite without a straightforward ecological correlation. According to this model, the distribution of archaeological cases and modern analogues demonstrates the clear zonation seen in the cluster analysis (Figure 124), with most Tayne Field features clustered around the short-grassland analogue (corresponding well to Evans' (1991) short grassland / stable land surface taxocene DGT-3, (Table 49)) and most Rectory Paddock / Rectory Lane features associated more with the arable field (II) and waste ground analogue (IV). The off-site and marginal cases are spread to the upper part and right hand side of the diagram as loosely affiliated outliers. When these outliers are removed from the plot (Figure 126) the archaeological phasing becomes more apparent, with the pre-Christian and Saxo-Norman environments in the Tayne Field area occupying a similar area in multivariate space. The monastic core environment by contrast demonstrates a different set of associations, heavily influenced by more overgrown ground surfaces and the presence of the synanthropic type *Trochulus striolatus*.

Beyond this simple distribution, the position occupied by individual species within this model demonstrates clear trends (Figure 127). This enables the interpolation of dominant ground cover / vegetation and land use types along definable synecological vectors environmentally resolvable as dichotomies of arable vs. pasture, settlement core vs. settlement periphery and settlement core / pasture vs. wooded margins or hedgerows. This diagram also demonstrates correlation to four of Evans' (1991) dry ground taxocene groupings within this space. These groupings (Table 49) were created from analysis of dry-ground soils in archaeological environments and demonstrate molluscan communities potentially diagnostic of ground surface stability, vegetation and land use (Evans, 1991; Davies, 2008: 63-64).

Table 49: Evans' (1991) Dry Ground Taxocenes (after Davies (2008))

Group	Typical species composition	Interpretation
DGT-2	*Pupilla muscorum* dominant	Low surface stability, ploughed grassland.
DGT-3	*Vallonia excentrica* dominant, with *Trochulus hispidus* and *Cochicopa*	Grassland with limited vegetation and high surface stability.
DGT-4	*Vallonia costata* dominant, with *Trochulus* sp. and *Carychium*, *Vitrea* and *Oxychilus*.	Ditch / pit fills; long vegetation, shade, low surface stability.
DGT-5	*Pomatias elegans*, *Pupilla muscorum*, *Helicella itala*	Exposed, low surface stability, possibly ploughed.

Although a large number of cases representing Anglo-Saxon and Saxo-Norman settlement archaeology are presented, the assemblage from the basal silt sequence in the hollow or doline represents the only pre-Anglo-Saxon sub fossil material from the Tayne Field sample site. This sample corresponds favourably to Evans' (1991) DGT-4 (Table 49) and can therefore be interpreted to represent an overgrown, shaded and damper environment with a low degree of surface stability. This differs markedly from the other samples in the model, hence its placement to the far right hand side of the plots (Figure 125 - Figure 126).

The woodland road lynchet sequence is represented by four cases representing ecologies broadly conforming to the prehistoric, Romano-British, Anglo-Saxon, Saxo-Norman and medieval phases, as determined from the chronostratigraphic model for the sequence (Chapter 10). The DCA plot groups all five in the upper part of the diagram, revealing a dominant underlying geological / geographical component to these ecologies which distinguishes them from the sample sites in the settlement area (Figure 125). This separation is also apparent in the hierarchical cluster analysis which groups these cases together (Figure 124). Figure 127 reveals this component to be characterised by open country species in conjunction with a high proportion of *Pomatias elegans* which compares reasonably well to Evans' (1991) unstable ground surface group DGT-5 (Table 49). This species is also highly abundant in the modern analogue for a shaded trackway / eroding lynchet bank environment (analogue III) which was taken from an area of unstable ground surface, although with abundant shade.

Interpretations of the remaining cases which relate to various spatially localised habitats, such as the stream bank and the ditches / hedge lines from Tayne Field and Rectory Lane, must be approached with caution due to the fact that they are generally unrepresentative of the wider environment. That being the case, what may be noted here is that the two cases equating to the LTF14 TP4 stream sequence (labelled medieval colluvium and stream bank) which the cluster analysis previously grouped with the arable field / monastic core area, are here treated quite differently. In the DCA plot the colluvial case is firmly associated with the interface between the Tayne Field (shorter grassland) and Rectory Paddock / Lane (arable / longer grassland) areas whilst the stream bank from Tayne Field is firmly separated with the arable analogue case. This may reflect both the transition from longer bankside to shorter grassland vegetation at the sample location as the stream channel moved away from it and also a high degree of taphonomic mixing in the colluvium which will have blurred any ecologically distinct signature in relation to specific patterns of medieval land use.

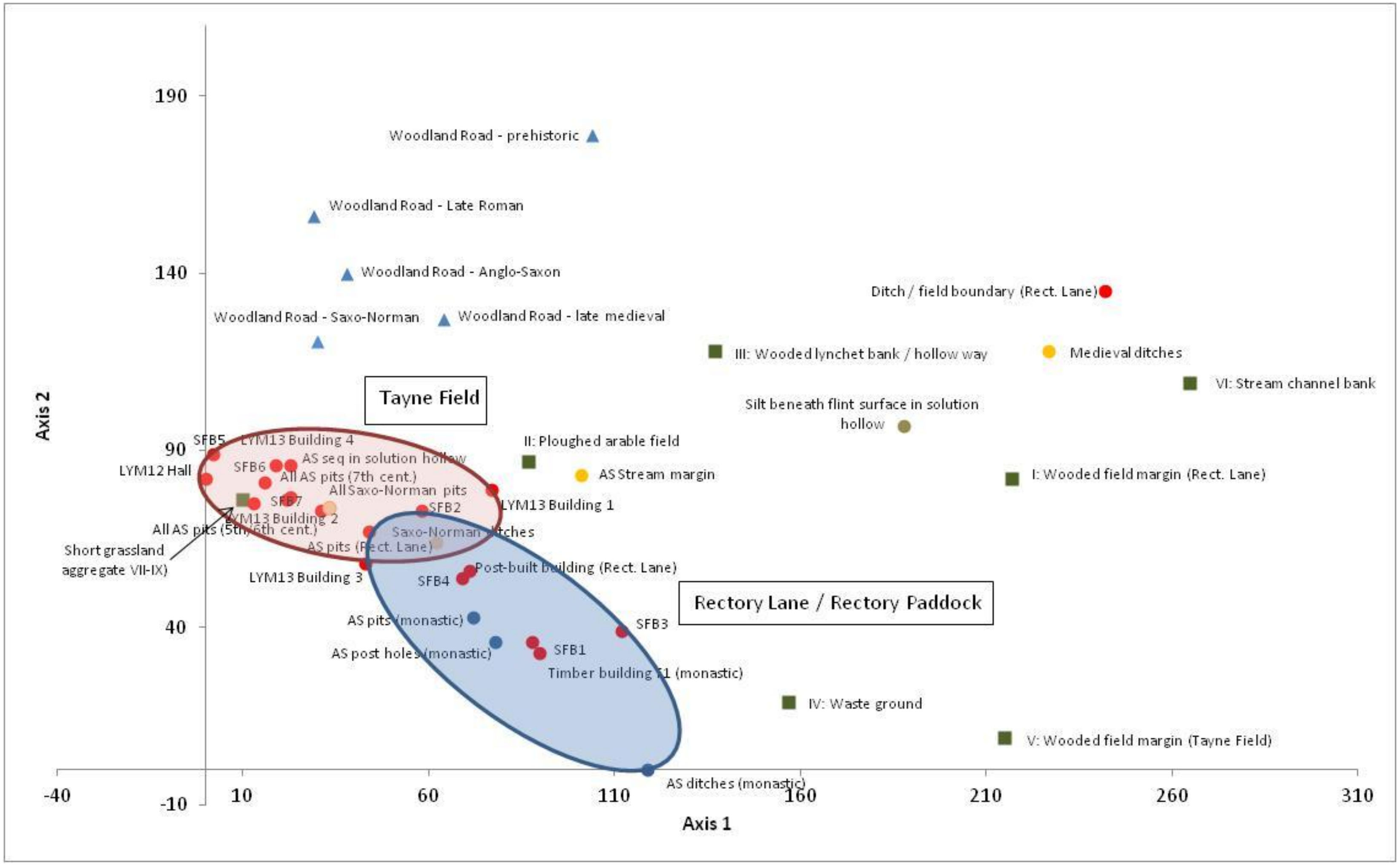


Figure 125: Detrended Correspondence Analysis for entire dataset.

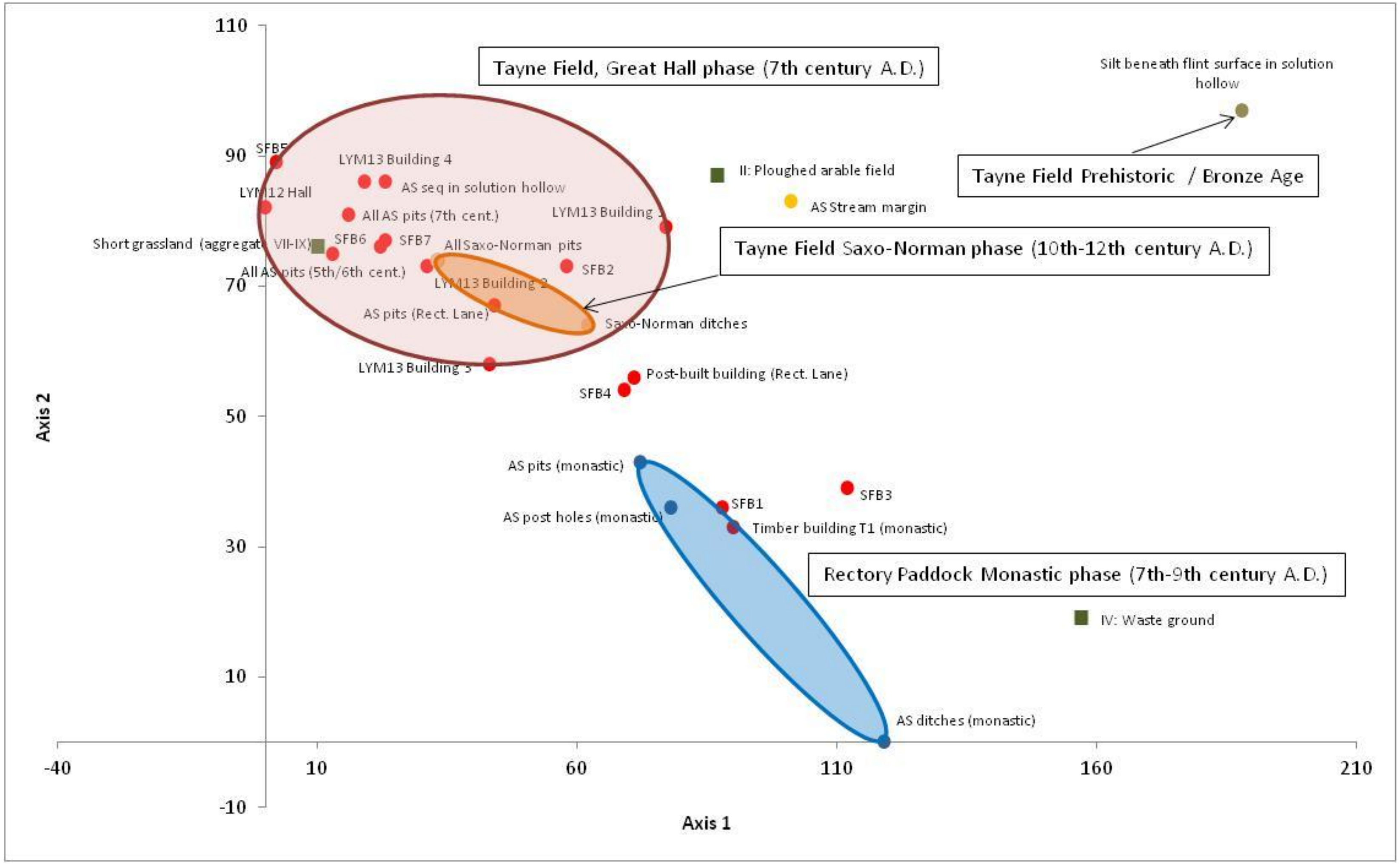


Figure 126: Detrended Correspondence Analysis plot with outliers removed.

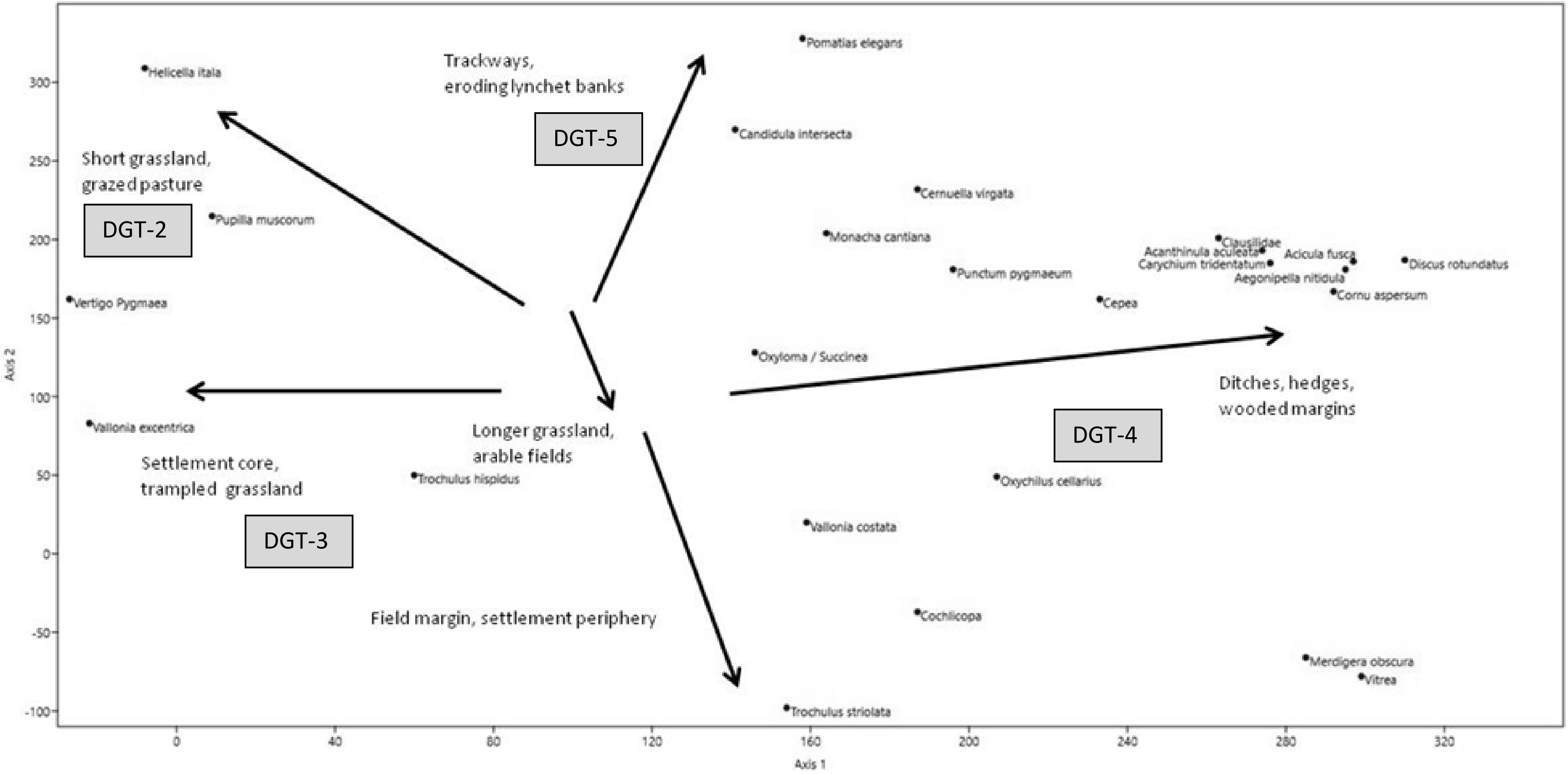


Figure 127: Detrended Correspondence Analysis plot of species distribution and summary of major synecological vectors for predominant modes of ground surface cover / vegetation and land use. Approximate correlation to four of Evans' (1991) dry ground taxocenes indicated.

From this work some basis for generalised ecological shifts over time is evident for certain collections of cases from discrete sample areas. These are summarised in Figure 128 in terms of the two most apparent vectors for the downland slopes (blue arrow) and the site of the Great Hall complex on Tayne Field (red arrows). The downland slopes demonstrate an ecological continuum of transition from the prehistoric to the medieval across the diagram. This suggests a broad trajectory of land management across the first millennium AD on the downland slopes from an Iron Age / Romano-British mixed mosaic of small fields with local patches of shrubs / trees to intensively grazed Anglo-Saxon pasture and then to ploughed medieval arable around the valley. The Anglo-Saxon phase in particular is characterised by a high proportions of *Pupilla muscorum* and accords well to Evans' (1991) DGT-2 (Table 49) indicating short grassland with an unstable ground surface caused by periodic ploughing. This type of land surface could well be expected to produce the high volumes of surface runoff needed to create the lynchet, so this interpretation is supported by the geoarchaeological evidence (Chapter 10).

The Tayne Field area exhibits a similar trajectory from a pre-settlement environment of overgrown meadow or long grassland to trampled and probably grazed short-turfed settlement core and then another shift to ploughed arable land following the final abandonment of settlement at the site. Within this simple progression it is possible that the transition from Anglo-Saxon Great Hall complex to Saxo-Norman occupation activity is also marked by a small shift of the locus of the respective case groups down the diagram along the vector towards the waste ground ecological analogue (Figure 126, Figure 128). This shift is slight and unlikely to represent more than a very subtle change in vegetation relating to the alteration of land use from trampled settlement core to more overgrown areas behind domestic buildings. Both these sequences of transitions end up in broadly the same ecological area in the centre of the diagram, which equates to ploughed arable agricultural land, a land use seemingly dominant locally by the end of the medieval period on both valley slopes and around the settlement area.

The locus for the main phases in the monastic core area (Rectory Paddock / Rectory Lane) also demonstrates a slight shift down the diagram between pre-monastic and monastic environment along the vector from arable to settlement periphery (Figure 127). This may relate to changing patterns of activity across the conversion period which shifted the relative locations of the overgrown / damp marginal and dry ground / trampled core areas (Chapter 9). Other than this, these sample areas demonstrate a stable ecology across the conversion period. This is likely to reflect both the dominance of the unchanging variables of aspect, soils and geology on these ecologies as well as similar intensities of occupation activity at these locations in all the featured archaeological phases.

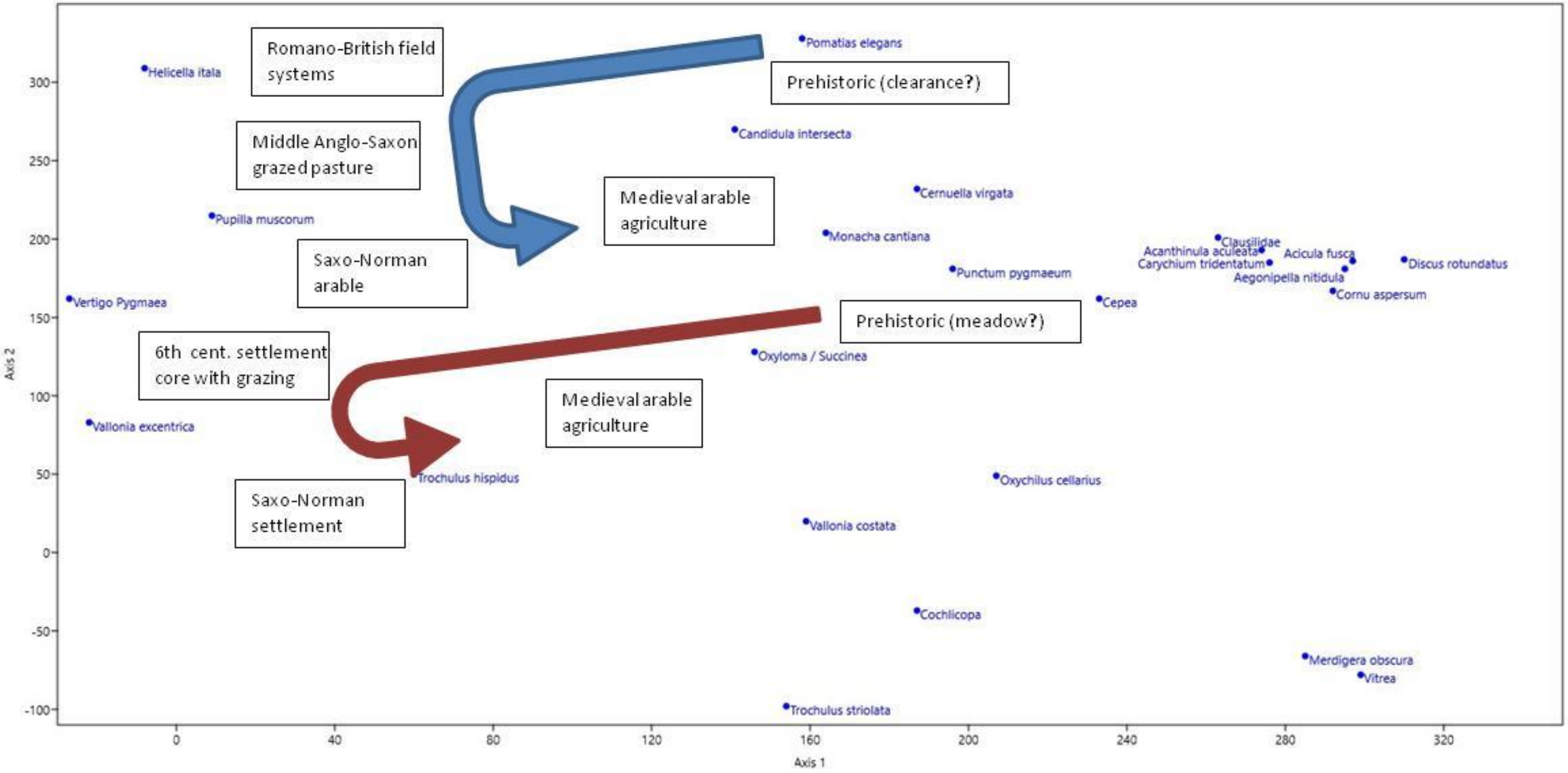


Figure 128: Simplified schematic of major ecological shifts over time for ground surface /vegetation cover on downland slopes (blue arrow) and Tayne Field (red arrow).

Chapter 12 - Landscape and routeways: GIS and regional analysis

This chapter examines the wider regional landscape context of Lyminge in order to contexturalise the interpretations drawn in previous chapters. This work incorporates GIS analysis of both primary and third party survey data enabling paleoenvironmental, geoarchaeological and archaeological synthesis at the widest scale of the study as per the final stated objective in Section 1.5.3. Unless otherwise stated all maps in this chapter are generated using ESRI ArcMAP 10.1 and ArcScene 10.1 and contain OS data © Crown copyright (2015) as supplied from the EDINA Digimap Ordnance Survey Service and the British Geological Survey. Other data sources are detailed in the summary of methods (Chapter 3).

12.1 Geology

Lyminge is situated within a valley environment within the easternmost portion of the ridge of the North / Kent Downs, the names given to the northern chalk rim of the Wealden anticline (Bannister, 2007: 23). The site sits on the Zig-Zag formation of the Grey Chalk Subgroup (formerly the Lower Chalk group) which underlies the majority of the valley floor area (Figure 2). This formation is typically encountered as weathered silty chalk marl in the field (Chapter 4, Chapter 5). Overlying this parent material are localised deposits of alluvium associated with the course of the Nailbourne, along with soliflucted and colluvial head deposits associated with dry channels within the valley catchment (Figure 129). These latter sediments typically comprise highly varied sequences between 3 and 5m deep with laterally constrained facies of silt and sandy clay containing larger clasts of chalk and flint and less abundant quantities of chert and ferrugenised and silicified sandstone (Adams, 2008: 19).

The downland slopes and crests around the valley area are comprised of more solid chalk from the Holywell Nodular and New Pit formations. This is frequently overlain by Clay-with-Flints, a deposit of sandy clay containing abundant pebbles and flint nodules deriving from the diagenesis and extensive weathering of Paleogene deposits which originally widely overlay the chalk. It is a primarily heterogeneous deposit, containing sands, gravels, silicified sandstones and quantities of fine-grained aeolian deposits (loess/brickearth) which have become mixed in by cryoturbation and solifluction (Adams, 2008: 20). These formations can be up to 6m thick and are frequently associated with solution features in the underlying calcareous geology (Chapter 7).

Iron-rich drift deposits are known to occur within these Clay-with-Flints deposits and also within the head which overlie the chalk on ridge crests and the upper reaches of the downs. These typically consist of laterally confined and localised formations of ferruginous sands, gravels and sandstone such as the Lenham Beds (Adams, 2008: 8-9). Archaeological evidence for the exploitation of these deposits in the form of shallow quarries and excavations dating back to pre-Roman times are known elsewhere on the downs, sometimes in association with known or suspected holloways (Bannister, 2007: 25). Closer to Lyminge undated although probably medieval iron bloomery activity is known from Westwood and Westwell near Ashford where poor quality ores deriving from local Greensand outcrops associated with the scarp edge of the downs were utilised (Spurrell, 1883: 292; Bradshaw, 1970: 179-180). These various types of sediments comprise the closest source for fragments of iron pan and other ferrugenised stones encountered archaeologically across the occupation site at Lyminge and potentially represent exploitable deposits suitable for supplying the intensive iron working activity occurring at the site from the 6th century A.D onwards (e.g. Thomas and Knox, 2015; Thomas and Knox, 2014) (Chapter 7).

To the south of the Lyminge, the edge of the downs is marked by outcrops of the underlying Gault and the Greensand of the Folkestone Formation which are themselves underlain by sandstones, siltstones and mudstones nearer the coast. The Folkestone and Hythe Formations of the Lower Greensand beds which outcrop on the coast south of Lyminge are the likely source of Greensand fragments encountered archaeologically across the site. These materials are known elsewhere to have been used for the production of early medieval querns and pebble whetstones (Peacock, 1998: 17, 53) and were certainly used locally by both Roman and later quernstone industries at Folkestone (Coulson *et al*, 2013).

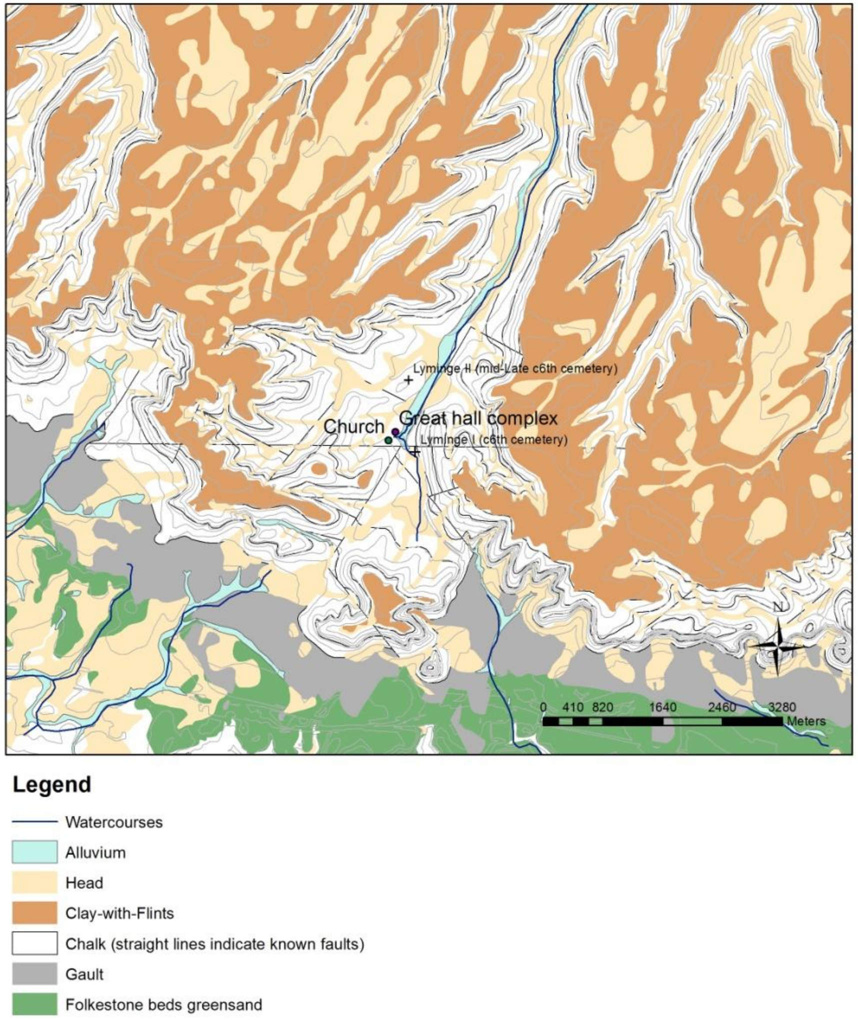


Figure 129: Summary of drift and solid geology around Lyminge. © Crown copyright (2015) EDINA Digimap, Ordnance Survey, British Geological Survey.

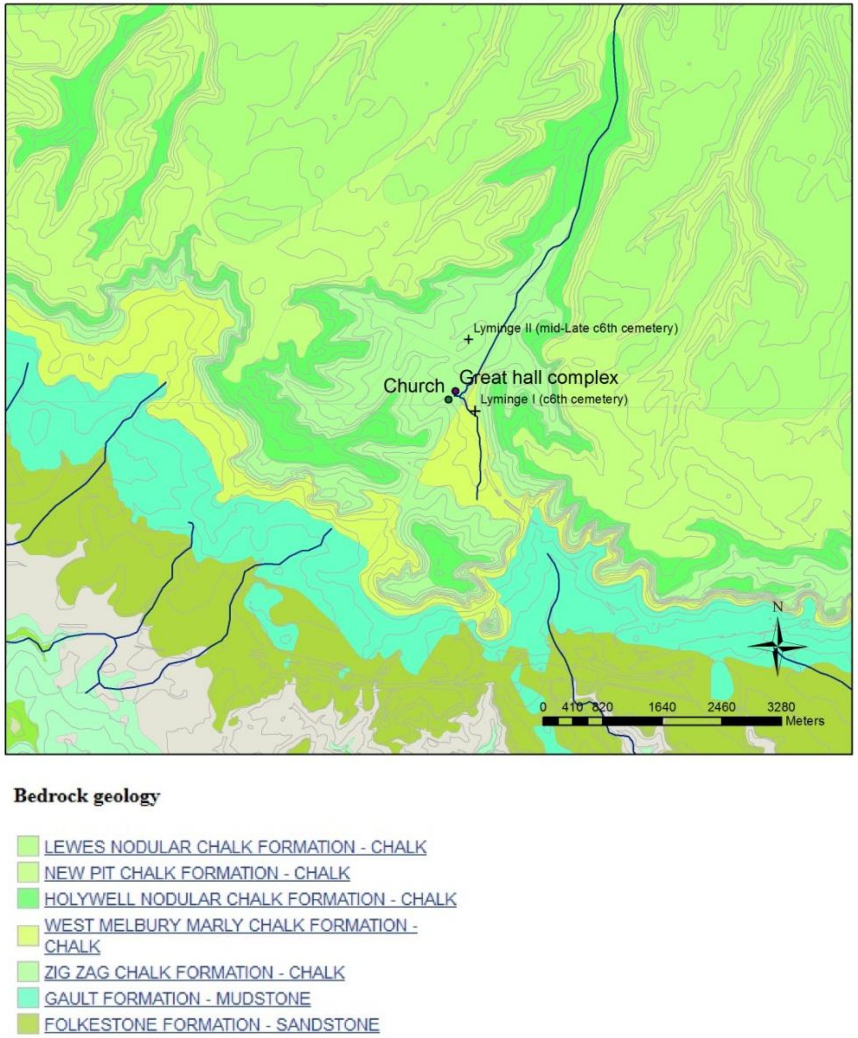


Figure 130: Solid geology around Lyminge (linear features indicate known faultlines). © Crown copyright (2015) EDINA Digimap, Ordnance Survey, British Geological Survey.

12.2 Hydrogeology and topography

Lyminge sits within a region where the presence of permanent or semi-permanent bodies of surface water are concentrated along the spring-line of the Downs scarp foot (Figure 132), but are otherwise locally restricted due to the porous, free-draining geology (Williamson, 2012: 192). The only extant watercourses comprise groundwater-fed streams with intermittent and irregular flow, collectively called Nailbournes. The Elham valley Nailbourne, which is fed by the stream flowing along Tayne Field and north from Lyminge, is the largest of three similar streams in this district of Kent and flows north to become the Little or Lesser Stour, finally joining the main river Stour near West Stourmouth (Harrington and Coleman, 2014). This 30km course cuts across the dip slope of the downs, dropping from around 120m to 2m above sea level and drains a catchment of approximately 287km^2, of which some 90% is underlain by Middle or Upper Chalk geology (Adams, 2008: 49). The spring at Tayne field known as St. Ethelburga's well rises at a boundary between two units of this chalk, specifically the subgroups of the West Melbury Marly Chalk and the overlaying Zig Zag grey Marly Chalk (Figure 130). This basal geology comprises a highly productive aquifer (section 12.1) which can produce flow rates of up to 5l/s despite the depredations of post-medieval and modern borehole extractions, which are estimated to have reduced the current flow to around 15-20% of its natural pre-development state (Adams, 2008: 49; BGS, 2014). The present day output of this spring is sufficient to create a permanent flow into the Nailbourne watercourse even under drought conditions (Harrington and Coleman, 2014); however even in wet months with unusually high groundwater levels, it is not enough to cause overbank flooding around Tayne Field (Figure 131) (Environment Agency, 2014: 11). The coombe or valley watershed within which Lyminge is situated receives an annual rainfall of around 740mm with a higher total of 820mm falling on the downland scarps overlooking the site (Adams, 2008: 50). This results in a high degree of weathering and generally denuded soils that are free-draining and completely oxidised with poor organic preservation (section 12.3) (French, 2003: 64). Proxy records for climatic change in Britain across the period covered by the present study can be found in peat bog surface wetness, dendrochronology, documentary sources and ice-cap cores (Roberts, 1998: 212-215). These suggest periods of temperature deterioration and increased rainfall around 500-600 A.D. and after 1400 A.D., with warmer, drier periods prior to 500 A.D. and between 800 and 1200 A.D. (Bell and Walker, 2005: 93). The evidence from the present study is too limited in scale and influenced by anthropogenic factors to offer any effective climate proxies for the site (Roberts, 1998: 212). Nevertheless an apparent stability in vegetation history (e.g. Chapter 5, Figure 52) suggests that any wider climatically forced changes in rainfall or temperature had only limited impact on the local ecology across the settlement period.

Figure 131: Stream level maximum following exceptionally wet winter, February 2014.

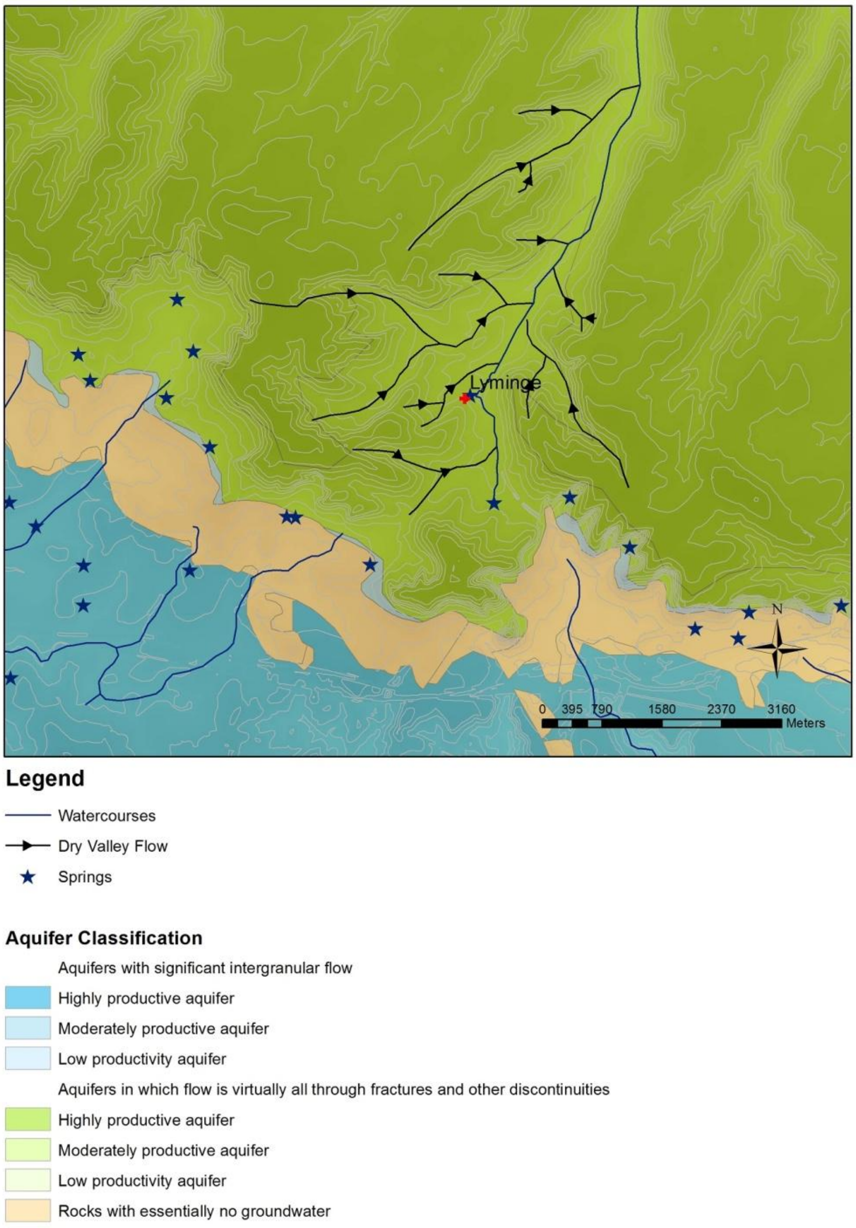


Figure 132: Regional hydrogeology. © Crown copyright (2015) EDINA Digimap, Ordnance Survey, British Geological Survey.

Runoff patterns are dictated by a varying slope topography resulting from differential weathering depending on the aspect and orientation of the basal chalk strata, leading to an abundance of dry valleys and coombe valleys (Harrington and Welch, 2014: 44). A contour model of the watershed around Lyminge (Figure 132) comprises dry valleys orientated to the north away from a drainage divide created by the line of the downs to the south forming a basin around the Nailbourne. In order to bridge the gap between this wide-area GIS contour model and the interpretations of the site-area geoarchaeological survey previously presented in Chapter 4, a digital terrain model (DTM) for the whole settlement area at Lyminge can be developed using 1m resolution LIDAR data and ARC Scene 10.2.2 software (Figure 133, Figure 140 and Figure 141). This provides a more nuanced appreciation of the landscape than is achievable from the course resolution contour map and clearly shows the definition of the plateau spur underlying the Tayne Field site as well as the location of the monastic precinct on a hanging promontory to the south (excavation outlines as per Chapter 2).

The prominence of the ovoid plateau underlying Tayne Field on the valley floor becomes particularly apparent in this model, with an elevation some two metres or more above the immediate surrounding area and a total length of around 180m on a south-west to north-east axis. The locally elevated position for the church is a feature generally encountered in contemporary early monastic layouts (Blair, 2005: 193); the LIDAR DTM demonstrates clearly that this location not only represents the highest point close to the estate centre but also the highest point in the central part of the valley near the spring. These elements are fundamental to the visual aspect and viewshed of each site nucleus, which are fully discussed in section 12.5. When compared with known axes of dry-valley flow (BGS, 1970), this model reveals the Tayne Field site to be bounded both by the permanent watercourse of the Nailbourne to the east and also by a major dry valley channel to the west. In periods of higher rainfall prior to the impact of modern development and agriculture on the watershed, this channel is likely to have witnessed intermittent or seasonal flow which would have effectively bounded the Tayne Field site by water on three sides. The DTM demonstrates another linear depression between the great hall complex and Monastic core, running to the north west of the present day spring location (Figure 133). This relates to the routeway represented by the present-day High Street; however it is also possible that this route may itself follow an earlier relic channel dividing the settlement areas. Today these dry channels have largely been obliterated by housing developments preventing easy investigation (Figure 148).

Taking the evidence from the geoarchaeology and micromorphology presented in Chapters 4, 5 and 6 into consideration, the topography of the plateau would have been more prominent with the stream presenting a substantial barrier to movement during the early medieval period. The model of geomorphological change presented in Chapter 4 allows reconstruction of the great hall complex in a locally elevated, naturally bounded position on this oval plateau above the valley floor. This position is likely to have provided the great hall complex with a degree of topographical prominence critical to its visual and geographical presentation as a centre of regional power (section 12.5). Assuming a larger watercourse at this time further allows a wider range of potential activities such as watering livestock, fishing and processing materials by soaking or retting to be considered as possible aspects of economic life.

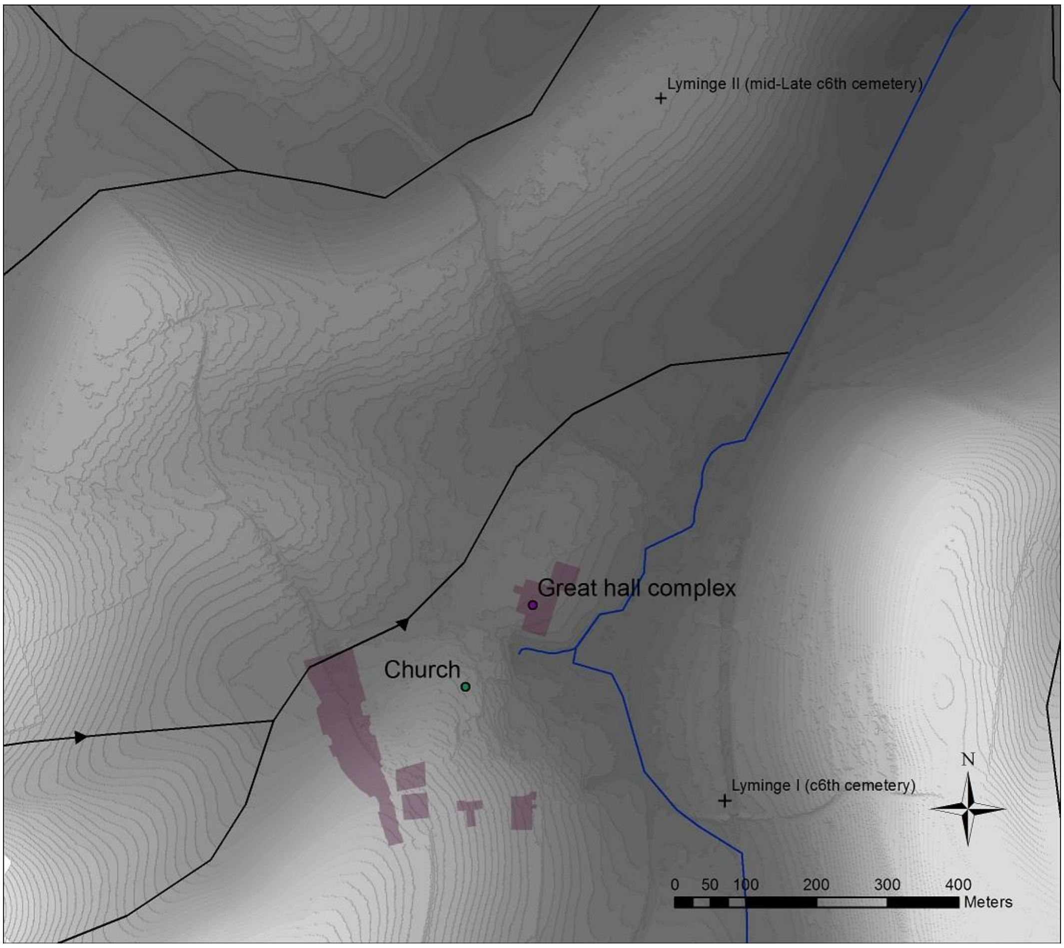


Figure 133: 1m resolution LIDAR surface for Lyminge site area, overlain with Nailbourne watercourse (blue), approximate major axes of dry-valley flow (arrowed lines) and shaded excavation areas. Grey linear features cutting contours are modern roads. LIDAR data courtesy of the Environment Agency.

12.3 Soils

The settlement area in general terms sits on lime-rich well-drained calcareous fine silty soils bounded to the north and east by shallow valley side soils, to the west by clay rich soils and to the south by coarser, well-drained silty soils (Figure 134 and Table 50). On the valley floor these soils sit over calcareous clay marls of the grey chalk group (Harrington and Coleman, 2014) which are free-draining (section 12.1). In contrast however, the less permeable soils over Clay-with-Flints on the surrounding hilltops can become seasonally waterlogged (Figure 129). These soils are typically stiff, red-brown silty and sandy clay containing abundant flint nodule and pebbles which are stained by manganese and iron (Adams, 2008: 18). Deeper soils comprising mixed sands and clays (head deposits) are also found in the dry gullies following the overland drainage flow of the valley to the north east (Figure 129, Figure 132 and Figure 7). The proximity of the settlement nucleus to spring and valley-floor meadowland in a wider locality of thinner downland soils accords to the model of terrain cited by Williamson as both a motivation for early settlement and the subsequent formation of communal farming strategies in the later Saxon period (Williamson, 2010: 136, 140).

More specifically descriptions can be made with reference to some of the 300 soil associations defined by the National Soil Resources Institute in terms of pH, texture, drainage and agricultural or ecological potential, derived from a simplified version of the National Soil Map for England and Wales (1:250,000). According to this scheme, the soils around the Lyminge valley area correspond to soil types within the Coombe 2, Andover 1, Batcombe and Wantage 1 Associations respectively (for descriptions see Table 50). All soils in the area are lime-rich with moderate to high fertility (National Soil Resources Institute, 2013). According to this schema, soils predominant in the settlement locale are suitable for cereals, vegetable crops and short-term grazing, with the downland slope and crest areas being characterised by thinner soils supporting some cereals, grazing and deciduous woodland. Harrington and Welch (2014) have further refined these categories into an edaphic (soil influenced) schema based around NSRI definitions of drainage and fertility. Under this classification the Lyminge valley environment is characterised as possessing free-draining, lime-rich soils over chalk of moderate fertility (edaphic unit F3FD). This particular type of soil has been identified by Welch and Harrington (2014: 90) as prevalent in association with distributions of cemeteries and to a lesser extent with settlements in the early Saxon period (up to circa 570AD), which may suggest that it was particularly well suited to contemporary agricultural activity.

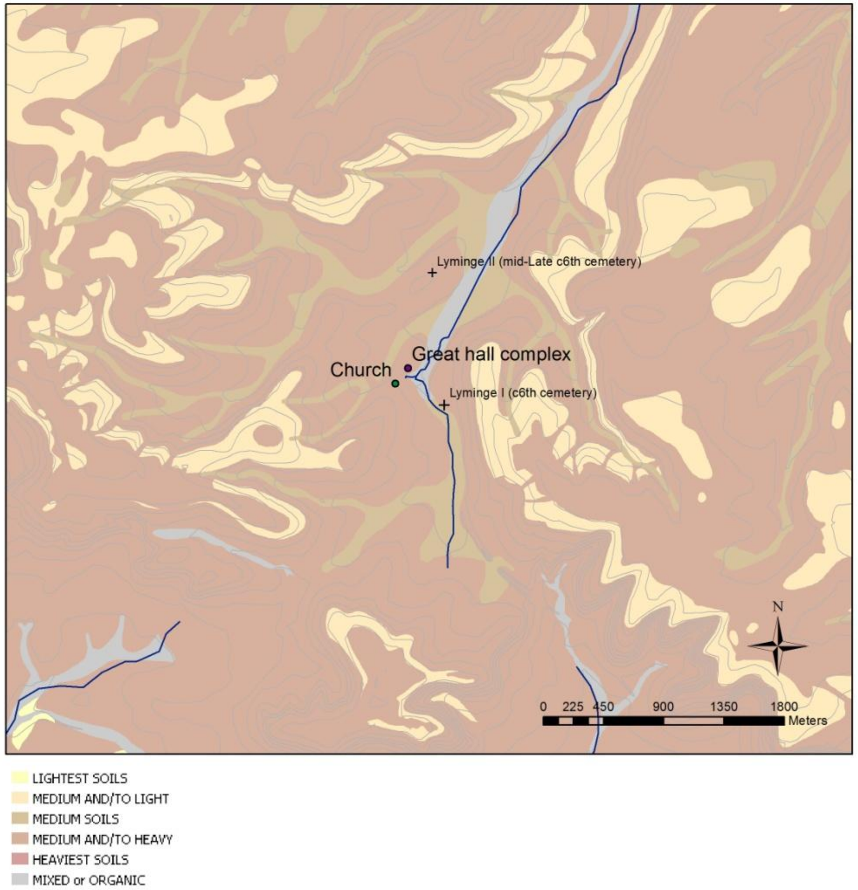


Figure 134: Lyminge local area soils - by basic type / composition. © Crown copyright (2015) EDINA Digimap, Ordnance Survey, British Geological Survey.

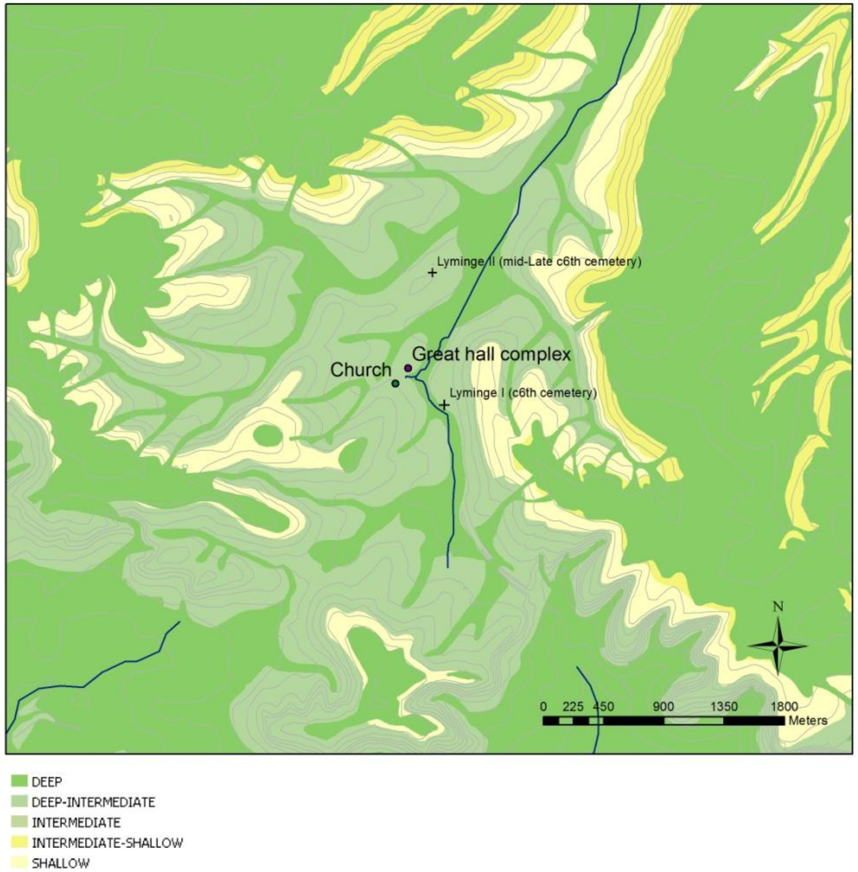
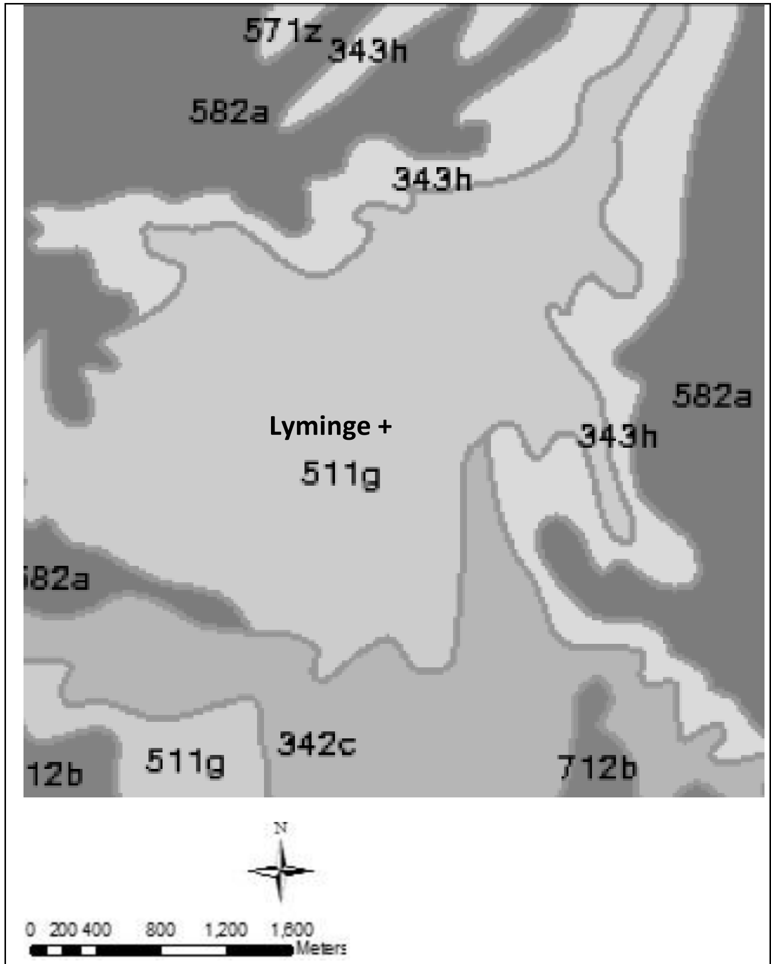


Figure 135: Lyminge local area soils - by depth. © Crown copyright (2015) EDINA Digimap, Ordnance Survey, British Geological Survey.

Table 50: Soil associations encountered in site region, with descriptions (National Soil Resources Institute, 2013).



Soil Association	Code	Relationship to site	Description	Land use (contemporary)
Coombe 2	**511g**	Valley floor, immediate site environs.	Well-drained, calcareous silty soils.	Cereals, vegetables, short-term grassland for livestock.
Andover 1	**343h**	Hillside slopes to north and east of site bounding valley floor area.	Shallow, well-drained calcareous silty soils.	Cereals, short-term grassland for livestock, some deciduous woodland.
Batcombe	**582a**	Hillslopes and crests on downland around site, particularly to west.	Fine silty and clayey soils, slowly permeable and prone to occasional seasonal waterlogging.	Cereals, permanent grassland for livestock, deciduous woodland.
Wantage 1	**342c**	Toeslopes of downs to south of site, towards the coast.	Well-drained, calcareous silty soils.	Cereals and grassland for livestock, principally dairy.

12.4 Ecology

Kent contains diverse ecological areas, defined by variations in geology, topography and soils (section 12.3). Everitt has published classifications of these *pays* (Everitt, 1986: 43); their distribution is shown in Figure 136 along with areas of woodland attested from later records and placename evidence (Brookes, 2007: 46). Lyminge comprises an area of lime-rich pasture within the largely herbaceous downland *pays* (National Soil Resources Institute, 2013). Over 20% of the land area of this region of the downs is wooded; the proportion of "ancient" woodland within this area is estimated at around 70%. Deciduous woodland of ash, beech and yew on the chalk areas and oak and hornbeam on the Clay-with-Flints (Figure 129) is present locally and in the larger area now known as West Wood but recorded in a charter of 786 as *Buckholt* ("Beech wood") (Canterbury Christ Church S 125: Bannister, 2007: 24; Brookes, 2007, Brooks & Kelly, 2013).

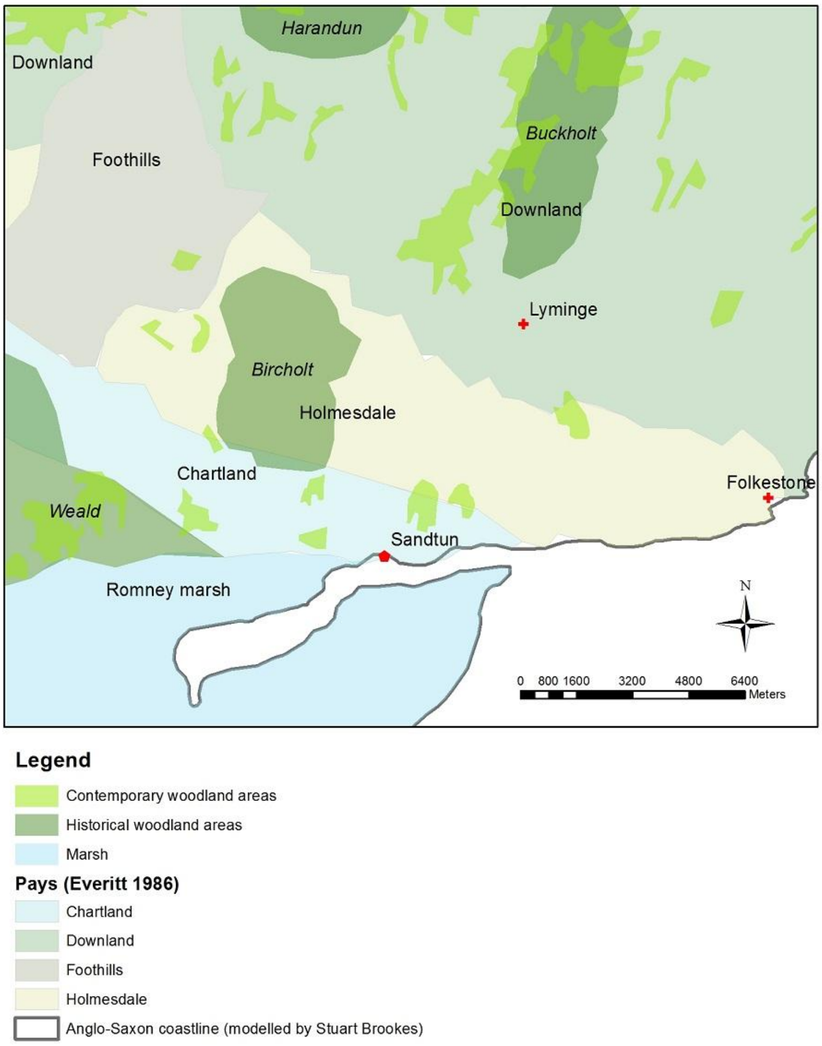


Figure 136: ***Pays*****, contemporary (modern OS) and historical areas of wood / marshland from charters (Brookes 2007).**

12.5 Aspect and viewsheds

Analysis of such aspects of site placement and landscape by determining areas of intervisibility has become a popular concern of GIS studies in archaeology within the last twenty years (Conolly and Lake, 2006: 225). Applications of this approach to the Anglo-Saxon landscape in Kent, albeit focussed on the distribution of burials, have previously been attempted by Brookes (2007a: 68 - 71). This work investigated the role of mortuary monuments in demarcating 6th/7th century territories across the region and concluded that such sites likely comprised the imposition of an idealised geography associated with territorial claims.

This section presents results and interpretation of a viewshed raster and digital elevation model based on modern terrain sourced from the British Geological Survey and the 3D Analyst extension in ARC Map 10.2.2. This approach is naturally limited by the use of both modern landscape profile data and the lack of control from any accurate understanding of paleoenvironmental vegetation cover which may have hindered visibility (Conolly and Lake, 2006: 230-231). Accordingly this analysis is presented with the assumption of an open country environment, which is broadly supported by the present research (e.g. Chapter 5, Chapter 10). It excludes the impact of localised topographical alterations resulting from tillage and erosion (Chapter 4) which are difficult to quantify and with an order of magnitude in the order of ±1m across the viewpoint area, are unlikely to significantly alter the result at this scale of resolution (a radius of c5km from the viewpoint).

This analysis frames the nucleus of the 7th century timber hall phase in Tayne field at a locally elevated position in the valley-floor with an aspect which provided views along the axis of the valley both north and south (Figure 137). This comprised a distinctive node on the axis of a significant routeway with strong contemporary correlations to monuments and easily traversable topography (section 12.6). This location optimised the views of the northern and southern approaches to the site along the valley as well as to the lines of the trackways which crossed scarp of the downs from east to west around 1.5 miles south of the site (the Pilgrims' Way) and other routeways which ultimately provided access to the coast (Figure 143).

The location of the great hall complex on Tayne Field was intervisible with the two sixth-century cemetery locations in the valley area (Figure 139). These locations offer good line of sight to the main settlement nucleus and beyond, comparable to the total viewshed from the settlement core (Figure 137) in effect overlooking the north and south approaches up and down the valley. Given the alignment and the relationship with the valley topography it seems reasonable to suppose that this siting relates to the main axis of communication to the early settlement; this is further supported by the cost distance modelling presented in section 12.6 and the routeways previously proposed by Brooks (2007).

Applying the LIDAR data (Figure 133) to a three dimensional topographical model using ARC Scene 10.2.2 allows these axes of site and communication to be demonstrated using oblique projections (Figure 140 and Figure 141). These project the plan of the great hall complex excavated in 2012-14 against the valley topography which defines the viewshed. The model demonstrates the local elevation of the great hall complex above the valley floor and its orientation to the axis of the Nailbourne. It is likely that these elements were integral to the layout of the complex, providing a strategic aspect which maximised line-of-sight along the main communications route through the valley (Section 12.6). The subsequent establishment of the church and monastic core on higher ground to the south west of the great hall complex, shifted the viewshed wholly to the north (Figure 138). It is tempting to speculate that this re-orientation, at least in part, may reflect a wholesale change in mindset on the part of the inhabitants and perhaps the increased importance of the mother church at Canterbury lying at the northern end of the Elham valley.

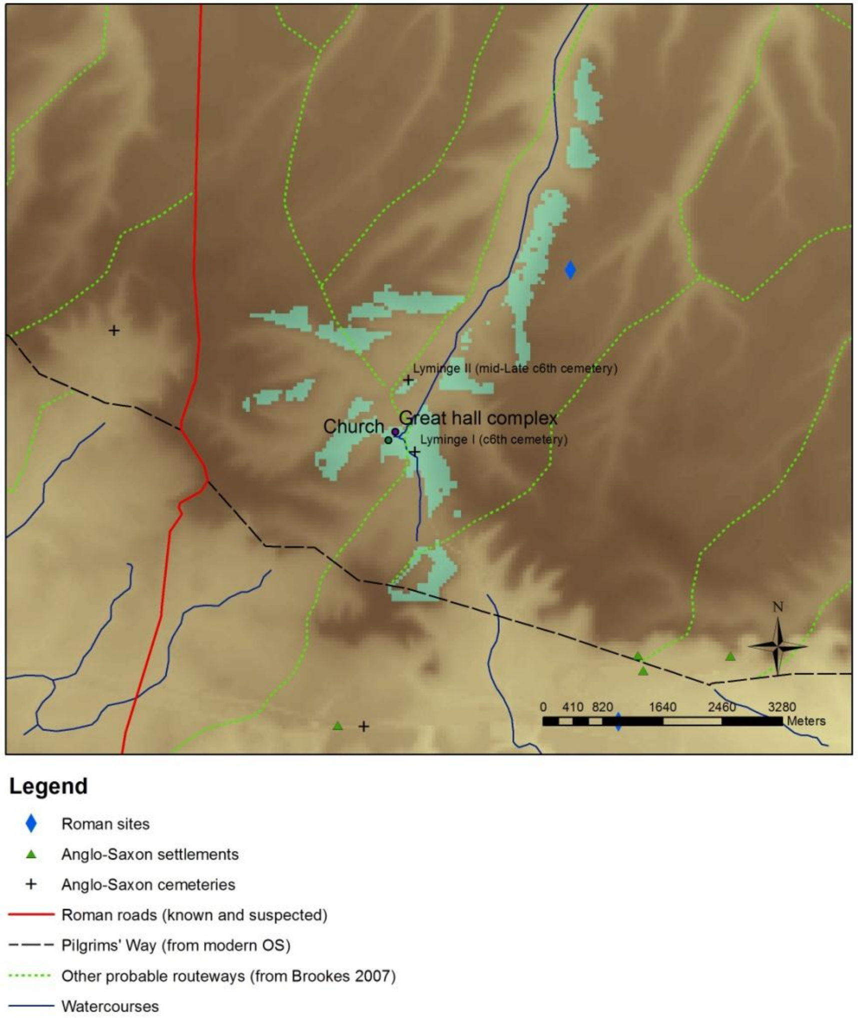


Figure 137: Viewshed (blue) from Great hall complex and pre-monastic settlement core. © Crown copyright (2015) EDINA Digimap, Ordnance Survey.

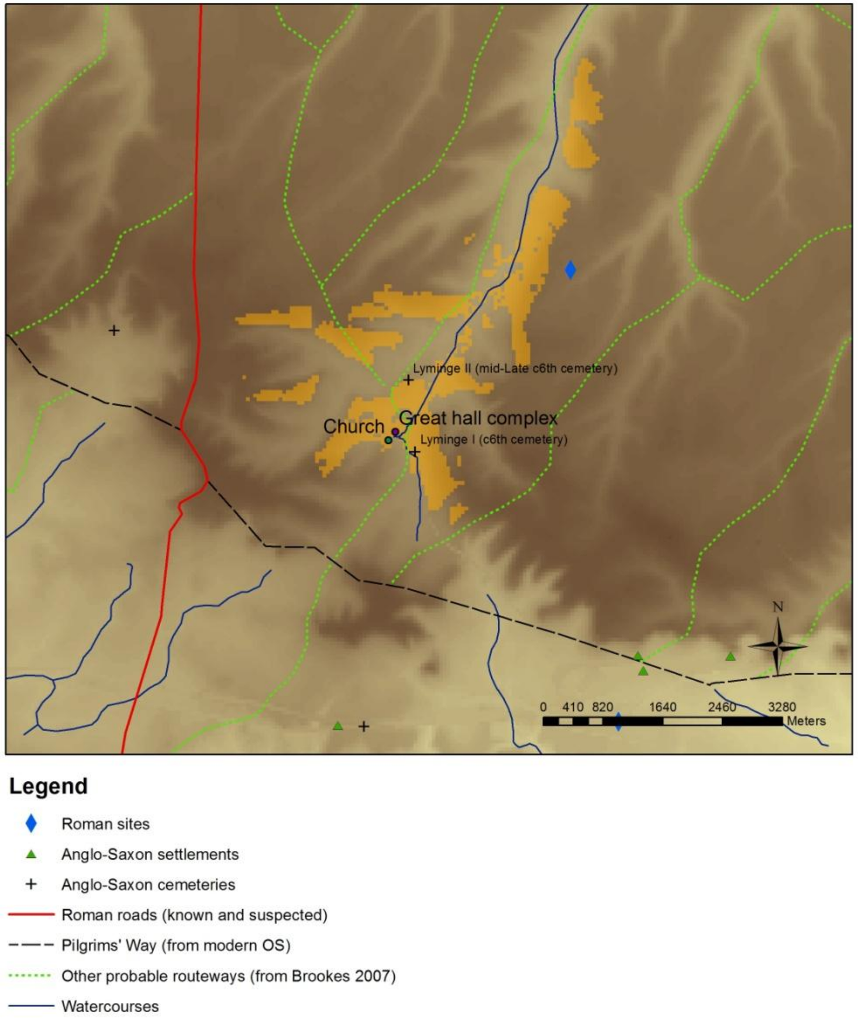


Figure 138: Viewshed (yellow) from church and monastic core. © Crown copyright (2015) EDINA Digimap, Ordnance Survey.

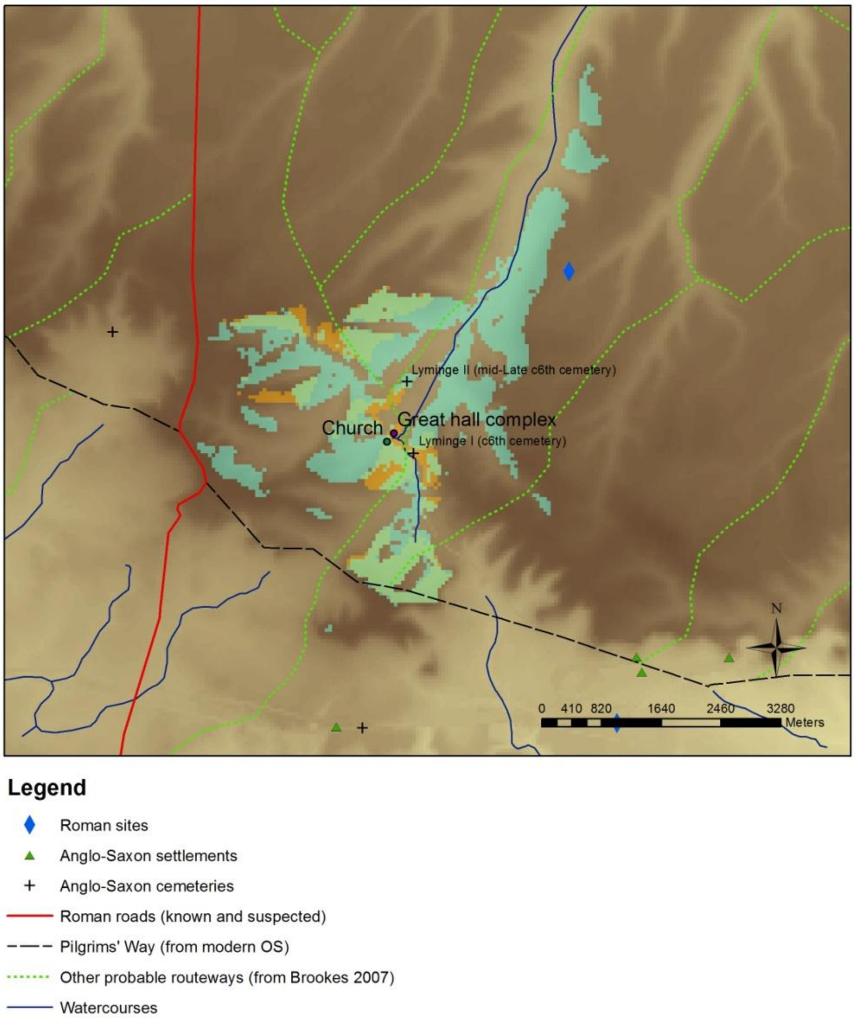


Figure 139: Intervisibility of cemeteries around Lyminge; viewsheds for Lyminge I only (orange), Lyminge II only (blue), visible from both (green). © Crown copyright (2015) EDINA Digimap, Ordnance Survey.

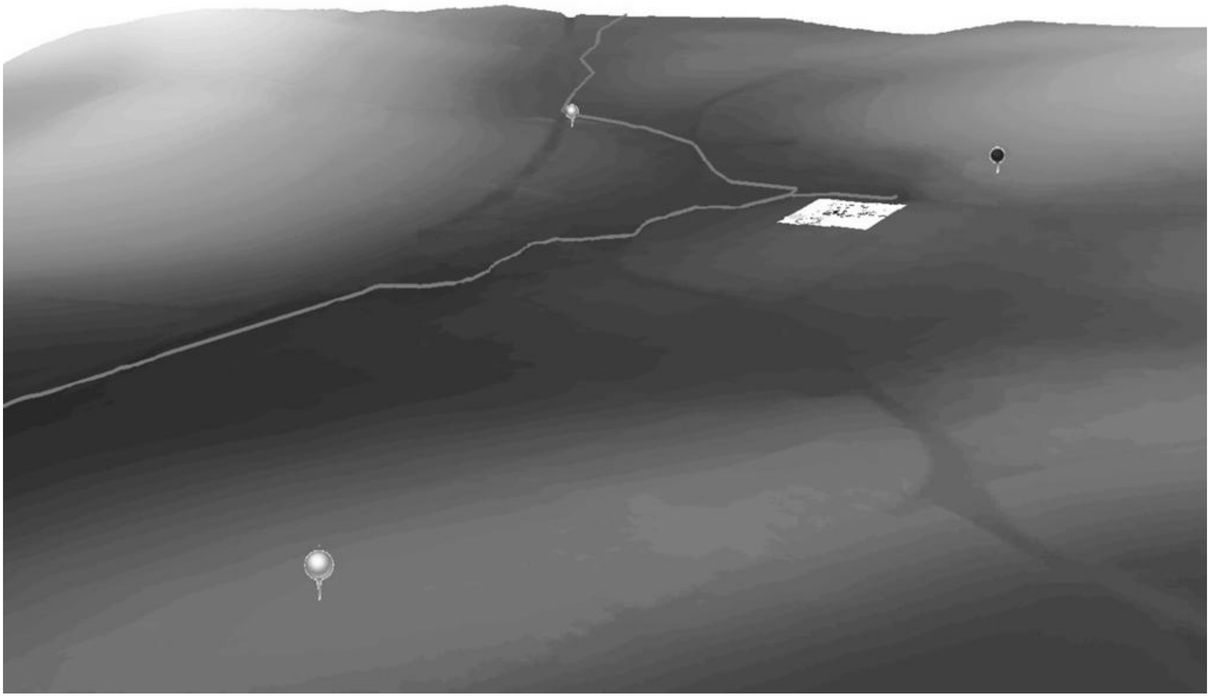


Figure 140: Oblique view across Tayne Field settlement area showing topography, cemeteries (grey pins), church (black pin) and great-hall complex (white site plan). LIDAR data courtesy of the Environment Agency.

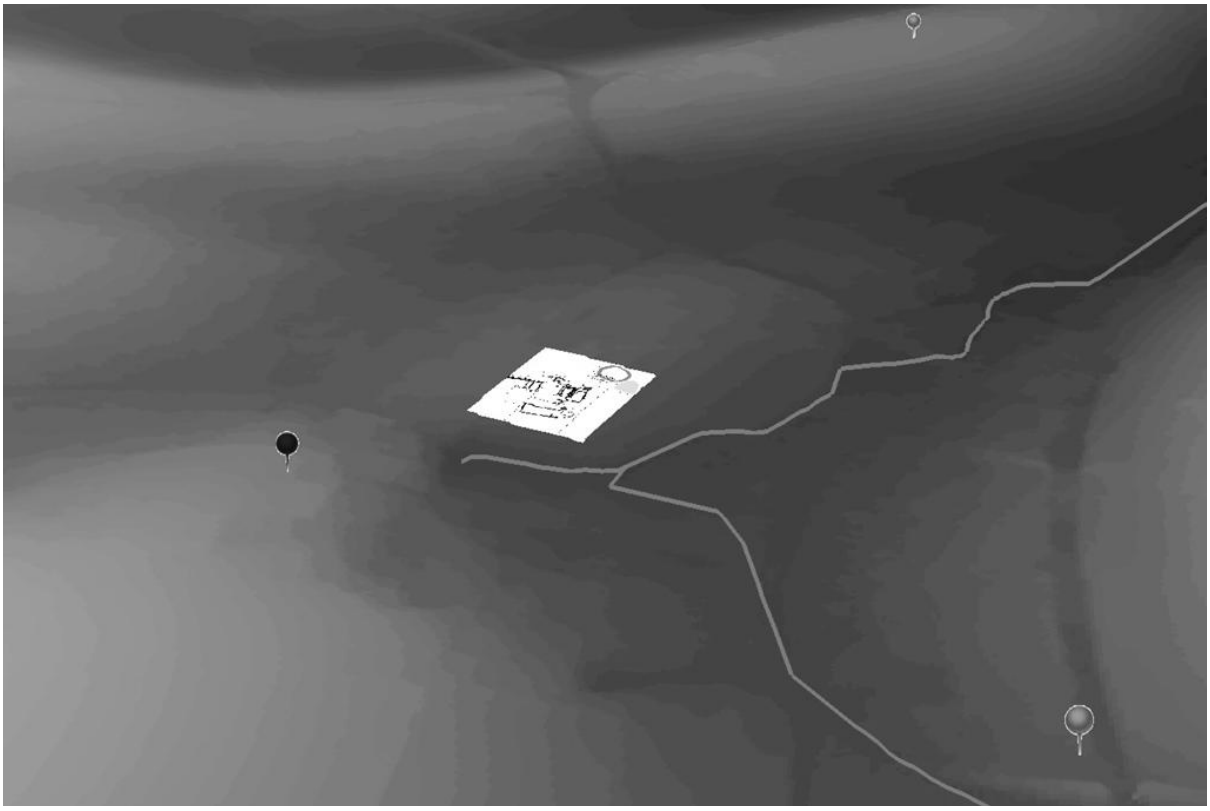


Figure 141: Oblique view south-north across Tayne Field settlement area showing topography, cemeteries (grey pins), church (black pin) and great-hall complex (white site plan). LIDAR data courtesy of the Environment Agency.

12.6 Communications

Potential, albeit undated, archaeological evidence for a droveway or other type of track at Tayne Field comprised a ~3m wide linear feature excavated in April 2013 following identification from a magnetic gradiometry survey (Figure 142). The axis of this feature runs approximately NW to SE, parallel with the line of the stream near the spring. To the south-east, this may imply the former location of a ford and/or a place where livestock congregated to drink, now lost to modern development in the south eastern corner of Tayne Field. Beyond Tayne Field to the north-west this feature follows the alignment of High Street (modern OS map in Figure 148). This may represent a continuation of this route through the village and west towards the Roman road via the holloway now called Woodland Road (Figure 145).

Another east-west feature identified as a holloway was uncovered at the Rectory Lane site in 2009 around 200m south and 100m west of the Tayne Field trackway. This routeway may be associated with the Saxo-Norman archiepiscopal complex around the church and could have connected to the holloway running north-south along the western boundary of the monastic area (Figure 145) (Thomas and Bray, 2010). Stratigraphically, its superposition over middle Anglo-Saxon boundary ditches and other archaeology indicates that it clearly post-dates abandonment of the monastic precinct area.

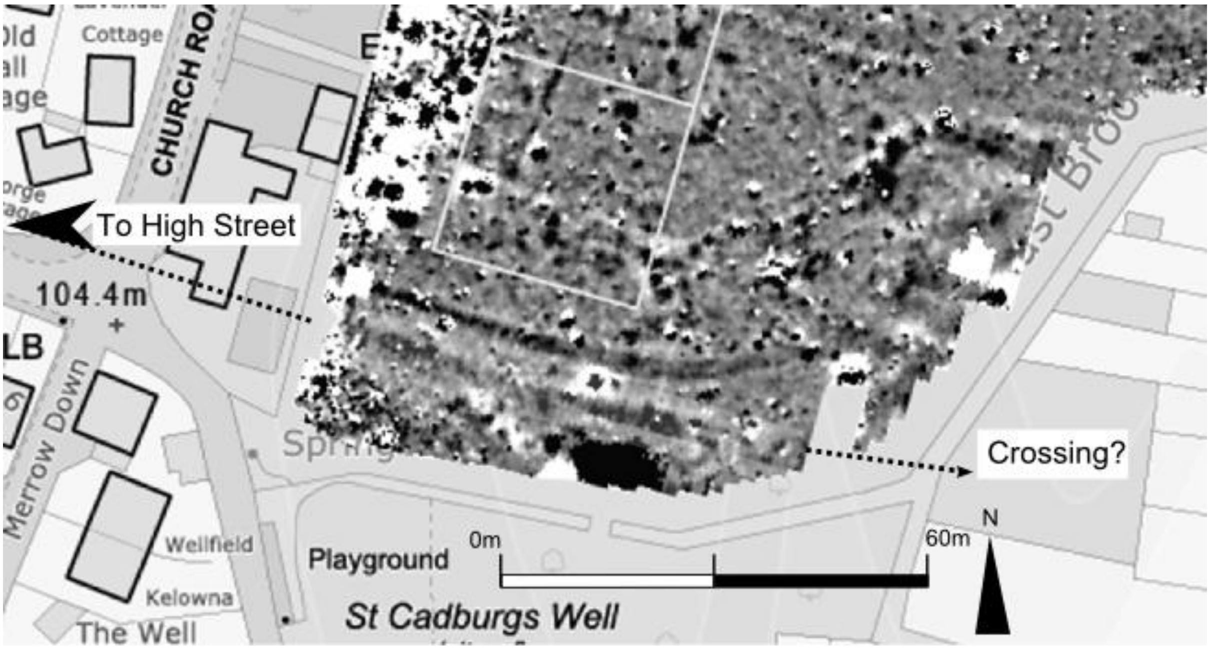


Figure 142: Gradiometry plot for the southern part of Tayne Field (with LYM12 and LYM13 trench outlines marked) showing the feature excavated in April 2013 and interpreted as a droveway (source: David Thornley, University of Reading).

Across the wider study area, historical sources provide little precision in their reference to routes of travel in Anglo-Saxon Kent; previous studies of early medieval landscape and communications routes have tended to rely heavily on the known layout of Roman roads (Reynolds and Langlands, 2011: 412). Figure 143 presents a summary of the known and suspected routes in contemporary use at the time of the Anglo-Saxon settlement at Lyminge according to other research as detailed below.

The spatial arrangement of local communications routes around Lyminge itself is heavily influenced by the downland topography which has been suggested by Williamson (2012: 42) to have been the determining influence on settlement distribution in this region. The landscape around the site provides a range of steep gradients which act as natural barriers to movement into and through the valley area which may have been a major influence on the settlement's position and communications. Archaeological work at Saltwood 4km to the south of Lyminge (Booth *et al*., 2011) has highlighted the density of minor prehistoric/Romano-British trackways across the foothills of this part of the downs suggesting that the network of pre-existing local routeways within which Lyminge developed would have been far more extensive than is apparent today.

The major pre Anglo-Saxon north-south connections known in this area comprise the Roman roads of Stone Street (Canterbury to Lympne) and Wattling Street (London to Canterbury, Canterbury to Richborough and Dover) (Baker and Brookes, 2013a: 340). A coastal route is suggested between *Lemanis* and Dubris on some early maps such as the *Peutinger Table* (Euratlas.net / Österreichische Nationalbibliothek, 2007); a comparable route below the downs escarpment from Dover to Hythe, *Lemanis* and north west towards Maidstone was also proposed by Margary (1965). None of these various routes have substantive archaeological verification, demonstrating the uncertainty inherent in such reconstructions (Baker and Brookes, 2013a: 340). Previous investigators have highlighted the two most likely alternatives for a communications route from Dover into the study area; one along the cliff tops and another further inland along a ridge approximately following the line between the centres of Dover and Lympne (Parfitt in Coulson *et al.*, 2013: 52). In the case of a clifftop route, coastal erosion will have almost certainly long since removed any potential for recovering archaeological evidence. To the west of Folkestone, no obvious ongoing route is apparent archaeologically or through map regression and subsequent development has likely removed any real possibility of establishing the totality of any line to Lympne. The exception to this is found to the west of Hythe where Parfitt (2013: 53) has suggested a potential connection with the southern extremity of Stone street running along an ancient trackway today known as Old London Road. Figure 143 presents this route between Folkestone and Lympne running through the vale along the coast for illustrative purposes. As has been noted with other settlements of the period, Lyminge is sited well away from such Roman axes despite the logistical advantage their proximity could confer; this may imply that Stone Street functioned more as a boundary line than a convenient communications axis during the early Anglo-Saxon period (Hindle, 1993: 48).

A potentially much older east-west routeway running to the south of the site along the axis of the downs consists of the Pilgrims' way, a group of long distance trackways or ridgeways widely assumed to have prehistoric origins (Baker and Brookes, 2013a: 140, 340). Current archaeological evidence for this degree of antiquity is questionable, with the earliest clearly established date from excavation seeming to be mid-Saxon at the site of Whitehorse Stone (Booth *et al*., 2011). These routeways are attested in early medieval charters as boundary lines as well as communication routes, demonstrating influence on developing regional geographies (Reynolds and Langlands, 2011). In the region around Lyminge, the routes are determined by the topography with two or more parallel alternatives being probable; one along the escarpment and the other along the lower springline. These alternatives are likely to reflect seasonal changes in ground conditions which were alternately favoured by travellers at different times of the year (Parfitt in Coulson *et al.*, 2013: 22). In the region around Lyminge this variability may have had a substantive influence on seasonal movements of livestock and people around the settlement and wider estate area along the southern flank of the downs particularly with regard to the movement of flocks of grazing animals between higher and lower lying pastures. All of the variations of this route likely intersected with the later Roman road network, most likely with the Lympne to Dover road somewhere along the crest of the downs to the north of Folkestone (Parfitt in Coulson *et al.*, 2013: 52).

The Bronze-Age barrow located at Tayne Field on the low plateau within the valley floor area (Figure 133) potentially provides material evidence for the antiquity of the trackways through this site. As Tilley (1994: 159) has highlighted from examples in other chalk downland landscapes, the association of such prehistoric monuments with contemporary trackways is highly probable. This correlation of monuments and routeways has certainly been demonstrated in the landscape around Lyminge with excavations at Saltwood revealing associations of prehistoric trackways and monuments which later determined the positioning of Anglo-Saxon cemeteries (Booth *et al*., 2011: 34, 348). This type of persistence may also be observed at Lyminge if the deliberate orientation of the earliest settlement phase with the barrow and its associated landscape is accepted (Thomas, 2017).

The concentrations of late Mesolithic and Neolithic flints around the Tayne Field plateau (Lawrence and Mudd, 2015) indicate an even longer history of use for the valley as an axis of communication.

As Tilley (1994: 207) has emphasised, such flint concentrations comprise a palimpsest of highly significant recurrent and long-term patterns of activity, which represent nodal points in both functional networks of movement and cultural memory. This intensive accumulation of lithics therefore demonstrates long-term use of the landscape at this location, probably as part of a wider pattern of regular movement which may have lead to the establishment of a long-standing route. If this antiquity of activity is to be accepted then the Anglo-Saxon presence at this location may have originally been influenced by a major and potentially very ancient trackway along the valley floor.

Recent work by Brookes (2007) used place-name evidence, distributions of known sites, map regression and GIS modelling of topographical least-cost paths, to postulate undocumented routeways in the vicinity of Lyminge during the Anglo-Saxon period (Figure 143). The major north-south axis along the Elham valley generated by this model (Brookes, 2007: 64) may correspond to this hypothetical prehistoric trackway alongside which the barrow was constructed. Brookes (2007: 79) noted during this study that the northern end of this particular axis corresponded to a number of burials and stray finds which may indicate its established significance as an axis of communications through the downs; the placement of cemeteries at the southern end in the area of Lyminge during the 6th century (Figure 143) also demonstrates the importance of this corridor for the pre-Christian Anglo-Saxon settlement.

The proliferation of networks of trackways in the Anglo-Saxon period linking estates nearer the coast to inland woodland areas and the Holmesdale (Figure 136) are known from the Sussex Weald further west; these were often connected in charters with pannage or grazing rights and movement of animals such as pigs (Hooke, 2010: 145). Archaeological evidence for earlier examples of such trackways are known from excavations at Saltwood, 4km to the south of Lyminge, where Iron Age holloways and tracks running north-south and south-east to north-west were uncovered in association with an Anglo-Saxon cemetery (Booth *et al.*, 2011: 350). These demonstrated a continuity of use over at least 2,000 years and are likely to represent a long established pattern of interconnecting and predominantly local routes linking the diverse resources and ecological zones between the ridge of the downs and the coast.

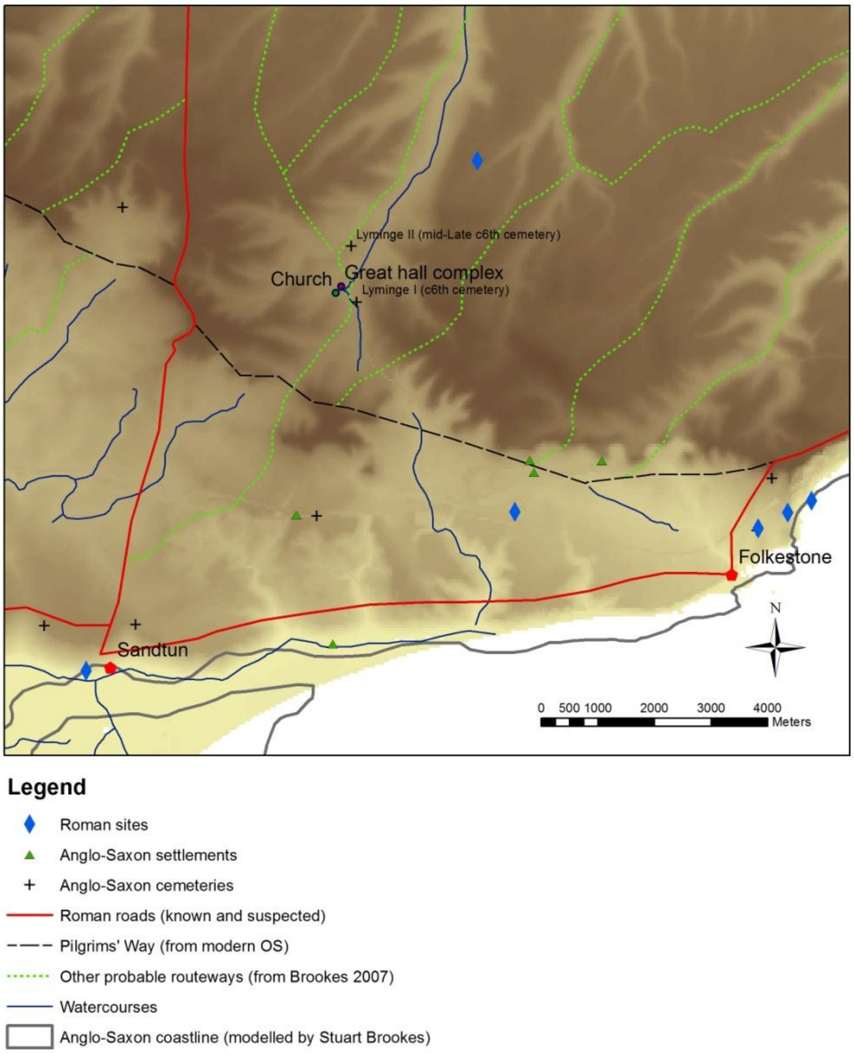


Figure 143: Previously proposed communications routes and contemporary archaeological sites in the study region. © Crown copyright (2015) EDINA Digimap, Ordnance Survey.

In order to build upon these known and suspected networks, a Cost Distance model for the landscape around Lyminge can be constructed based upon topography, with steeper slopes and scarps presenting greater obstacle to travel than valley floors and terraces. This attempts to model accumulated cost in travelling outward from an origin point (the settlement) using contemporary transportation methods (i.e. walking, riding or by cart). The cost-surface generated by undertaking this process with the Spatial Analyst extension in Arc Map 10.2.2 is presented in Figure 144; here the areas easiest to physically travel to from the settlement are shown in the yellow areas, with those hardest to access shown in the pink and purple regions. A caveat to this process is that it is of necessity limited to an analysis of contemporary topography and coastal geography, which as can be seen by comparison with Figure 143, has undergone substantial change since the 7th century A.D.

This cost-distance surface can be used as a basis for a least-cost path analysis which attempts to optimise communications routes for travel to a specified destination and to therefore model routeways between given pairs of points which are no longer evident in the archaeological landscape. This method has been widely applied in archaeological GIS analysis; however it always needs to be understood with regard to the overwhelmingly functional assumptions it incorporates and the correspondingly sub-optimal paths it sometimes produces with regards to the considerations of human geography (Conolly and Lake, 2006: 252-255). Consequently the work presented here is merely intended as a predictive model rather than a definitive conclusion of early medieval communications geography.

In terms of the present research, several routes to the site are already clearly understood, in particular the northern approach to and from the settlement along the route of the Nailbourne and the Elham valley as indicated in previous work by Brookes (2007) (Figure 143). By contrast the access route from the site to the coast and the contemporary *wic* at Sandtun and settlement at Folkestone seems less immediately apparent, at least in terms of known routes. Folkestone in the early and mid Saxon period comprised a contemporary royal centre of power and trade boasting a parallel and potentially earlier monastic foundation than Lyminge (Richardson in Coulson *et al.*, 2013: 76), whilst *Sandtun* is comprised one of the most significant known contemporary coastal centres for fishing and trade (Chapter 2). These sites therefore likely represent the most significant settlements and major nodes for the communications network between Lyminge and the coast.

Modelling a potential routeway in terms of a functional least-cost path to these coastal sites to the south produces the results presented in Figure 144. This reveals an optimum path between the settlement at Lyminge and the coastal plain running along the valley past Etchinghill and south along the valley axis, upslope of and following the line of the Seabrook stream. This is a route with no known archaeological or documentary verification; however it would, in purely topographical terms, have presented the easiest route for travel directly to the coast to the south east for the inhabitants of the valley.

When comparison with the viewshed analysis presented in Figure 137 is made, this route corresponds with the southward extension of the vista from the settlement core on Tayne Field, lending weight to the idea of a strategic aspect for this settlement focus in commanding the main valley axis between Canterbury at the north end of the Elham valley and the resources of the coast. It furthermore runs directly past the 6th century Lyminge I cemetery to the south of the settlement, potentially providing some confirmation of the rationale behind the siting of the cemetery as a "symbolic entry point" (Thomas, 2013: 118). This intentional association of cemeteries with routeways is widely seen in early Anglo-Saxon contexts and is often interpreted as the presentation of ideological and political identity to travellers moving through the landscape (Booth *et al*., 2011: 350-351). In Kent specifically, this association has further been demonstrated for a significant proportion of known and hypothesised routeways by Brookes (2007).

Further afield, the modelled route intersects with the course of the suspected, if archaeologically unverified, Roman road between *Portus Lemanis*, Folkestone and ultimately east to *Dubris* (Parfitt in Coulson *et al.*, 2013: 52-53; Baker and Brookes, 2013a: 340). It furthermore runs through the known later Saxon settlement at Hythe (HER TR 13 SE 24) suggesting that this coastal communications route may have maintained or increased its importance into late Saxon times. Despite the limitations of this model, based as it is purely on modern topographical data, it seems clear that some sort of direct connection between Lyminge and the coast along the valley past Etchinghill is possible. This route would further have provided a more direct south-eastern connection to Folkestone via the east-west axis of the Pilgrims Way and the axis of the suspected Dover to Folkestone Roman road at the crest of the downs to the North of Folkestone.

This suggested route makes sense with regards to accessing the Saxon settlements at Hythe and Folkestone but in terms of facilitating access to the settlement at Sandtun a shorter and more practical route for the inhabitants of Lyminge would have clearly been via the route corresponding to Woodland Road (Chapter 10) (Figure 145) and the old Roman road to *Portus Lemanis.* Such alternative pathways, each suggested by different sets of evidence, are not mutually exclusive options and likely represent only part of the diversity of routeways within which Lyminge was enmeshed.

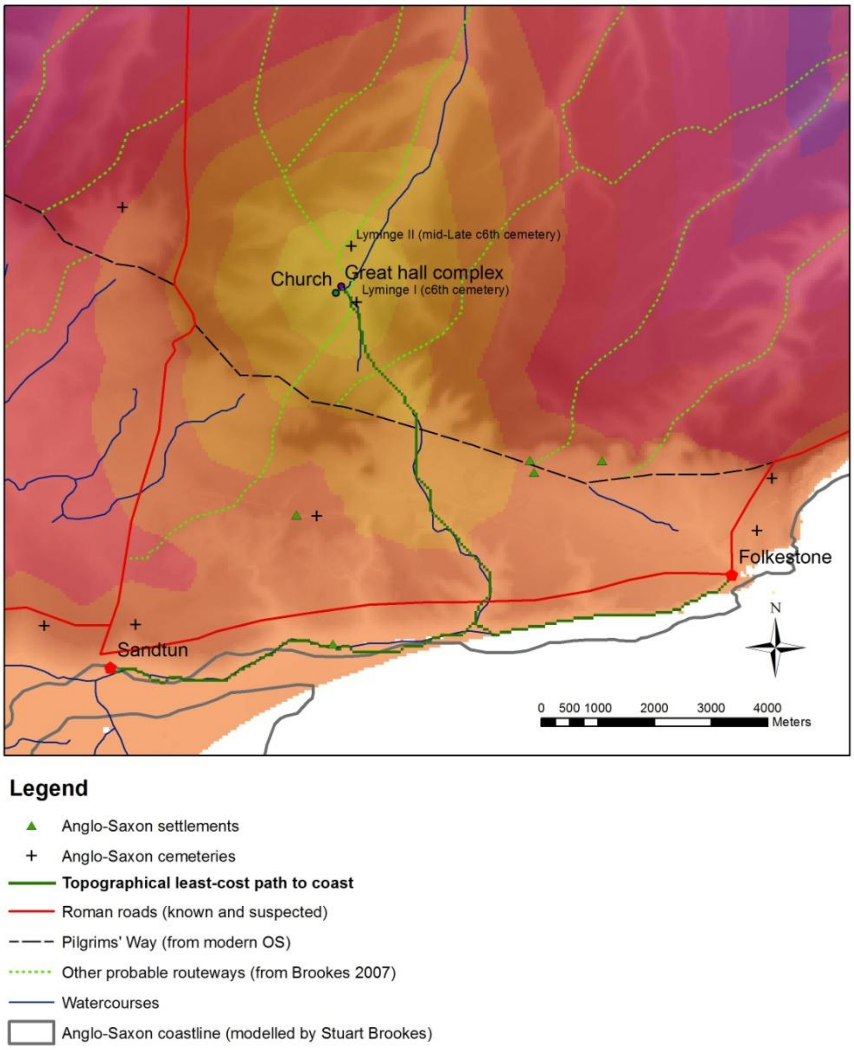


Figure 144: Least Cost Path analysis between Lyminge and the coast, based upon a cost / distance model derived from regional topography. Least Cost Paths to known contemporary Anglo-Saxon coastal sites are presented by the route shown by the darker green solid line. Colours display relative difficulty of reaching areas by direct overland travel from Lyminge; pale yellow (easiest) to indigo (hardest). © Crown copyright (2015) EDINA Digimap, Ordnance Survey.

Compiling this work with the previous work of Brookes (2007), the holloways and drove ways revealed by site survey and the analytical work previously covered in this chapter, several probable trackways to the settlement core can be proposed (Figure 145). These provide important clues about the relationship of the settlement to the pre-existing and contemporary landscape. The route past the northern cemetery and then along the Elham valley to Canterbury and the associated route running north-west to the Roman road (Figure 145 [3]) were both proposed in Brookes' analysis (Figure 143) using map regression. These trackways have no supporting archaeological evidence to corroborate their age, but both topographically situate along valley corridors through the downs which offer easy access to the north and are thus likely to have been utilised by people moving through the area since prehistoric times (Bell, 2016).

The route to the west along Woodland Road (Figure 145 [1]) was located during field survey and represents the most direct approach to the north-south axis of the Roman road. The off-site lynchet sequence analysed as part of the present research (Chapter 10) was located alongside this route. The OSL dating results from this sequence demonstrates that sediment accumulation against the line of this routeway was underway during the 4th century A.D. Consequently this trackway must pre-date the establishment of the Anglo-Saxon settlement and likely has Romano-British or pre-Roman origins.

The route to the south west (Figure 145 [2]) follows another holloway of unknown age located during field survey on the western side of the suspected site of the medieval archiepiscopal complex (Thomas and Bray, 2010). It furthermore runs along the line of a route proposed by Brookes by map regression (Figure 143) south to the line of the Pilgrims' Way along the southern scarp of the downs and further south west to the Weald. This trackway provided the sample site for a modern molluscan analogue for holloway bank environments (Chapter 3).

The route to the south east (Figure 145 [4]) follows the pathway predicted by the topographical modelling previously discussed (Figure 144). Although no archaeological evidence exists for this proposed route further out towards the coast, the excavation of a droveway running east-west along the southern slope of Tayne Field in 2013 (Figure 142) provides a possible segment of this path across Tayne field; the orientation and alignment with the line of High Street which leads to Woodland Road (see modern map in Figure 148) suggests a continuity of this trackway through the heart of the medieval village and west to the Roman road. Also implied by this orientation is a crossing point of the stream at the eastern margin of Tayne Field, a location since largely lost to modern development (section 12.7).

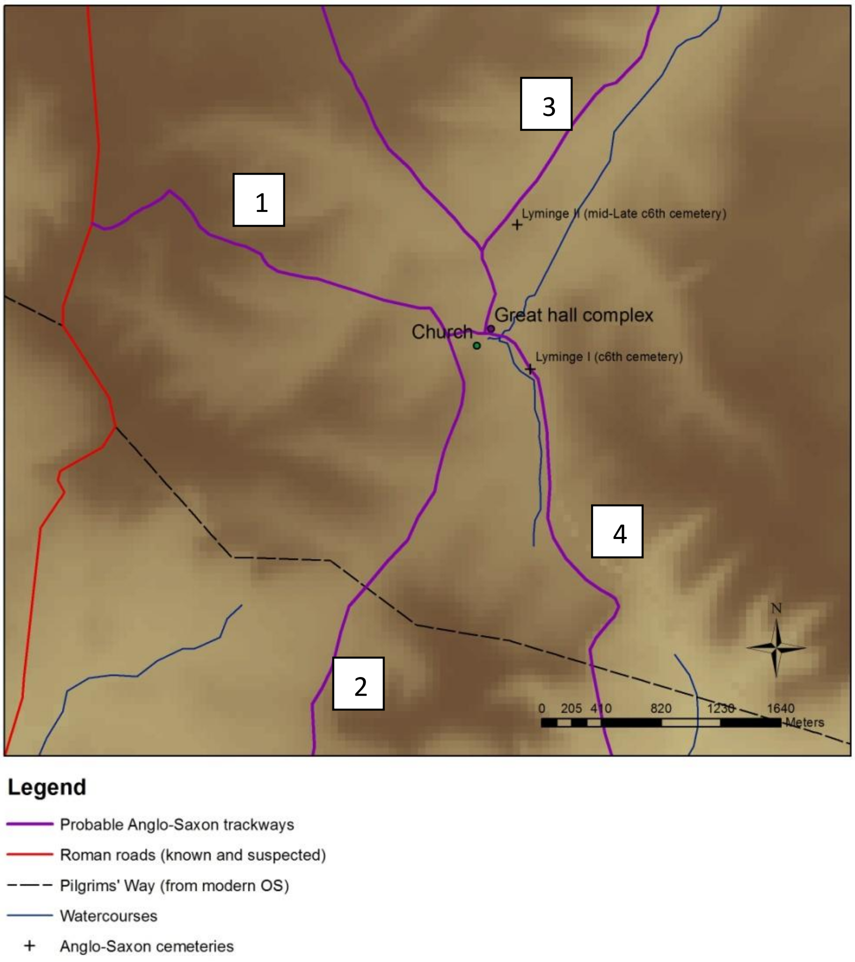


Figure 145: Suspected ancient trackways leading to site area: 1) Pre-Saxon holloway (Woodland Road), leading to Roman road (Stone street); 2) Holloway to south leading to Pilgrims way and south west to the Weald as revealed by site survey; 3) Northern trackways leading to Roman Road (Stone street) and up Elham valley to Canterbury, as proposed by Brookes (2007); 4) Hypothetical trackway past southern cemetery along East Brook channel to Pilgrims way and coast, as modelled by least-cost path analysis (Figure 144) and connecting to droveway on Tayne Field excavated in April 2013. © Crown copyright (2015) EDINA Digimap, Ordnance Survey.

12.7 Developments affecting the site in modern times

Reference to OS mapping data reveals the impact of the development of the railway between 1870 (Figure 146) and 1898 (Figure 147) which led to the development of the east side of the village and the joining of the settlement nuclei of Lyminge and North Lyminge, previously separated by the expanse of Tayne Field. The eastern side of the Nailbourne at Tayne Field was further altered by the development of houses along Station Road in the 20th century (Figure 148) during which process the stream banks were stabilized and landscaped by the creation of the garden plots which run down to the banks. To the west and north-west, further extensive development in the 20th century has masked the contours of the dry valley channel and the periphery of the Tayne Field plateau revealed by LIDAR (Figure 133).

The absence of visible field boundaries in the 1870 OS map indicates that the Tayne field area itself has not been subject to subdivision or marked differentials in land use during the last 150 years. However, the development of a complex of military huts in the 1940s (Figure 149) and the subsequent construction of the school on the plateau area of Tayne Field in the 1960s (Figure 148) has truncated the sequence to the north and west of the excavation and survey areas.

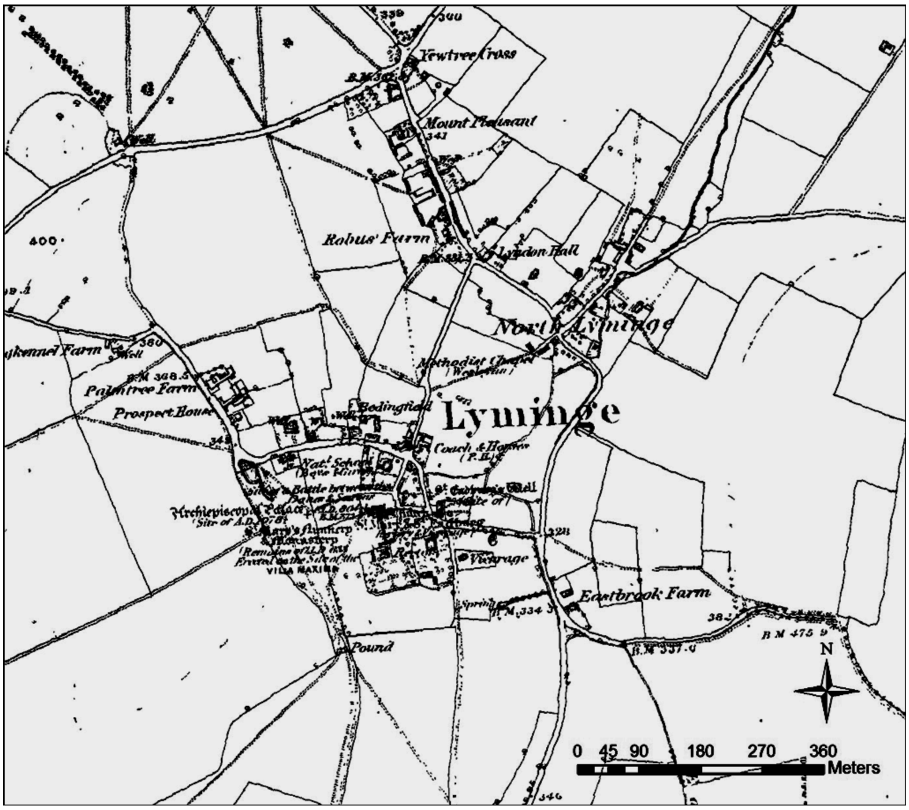


Figure 146: Ordinance Survey map of 1870. © Crown copyright (2013) EDINA Digimap, Ordnance Survey.

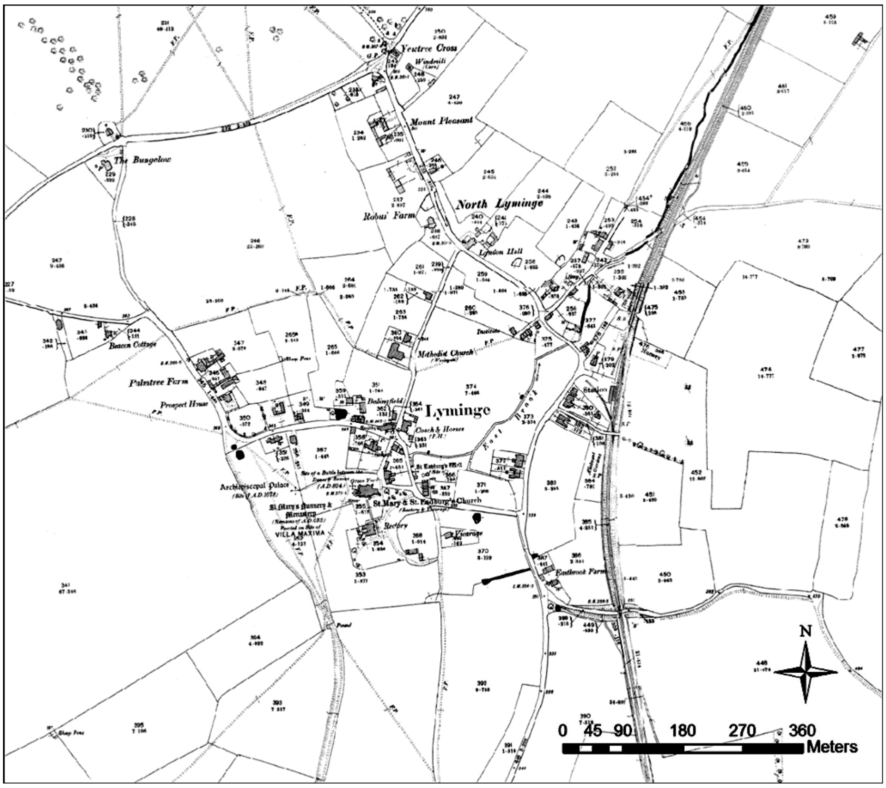


Figure 147: Ordinance Survey map of 1898. © Crown copyright (2013) EDINA Digimap, Ordnance Survey.

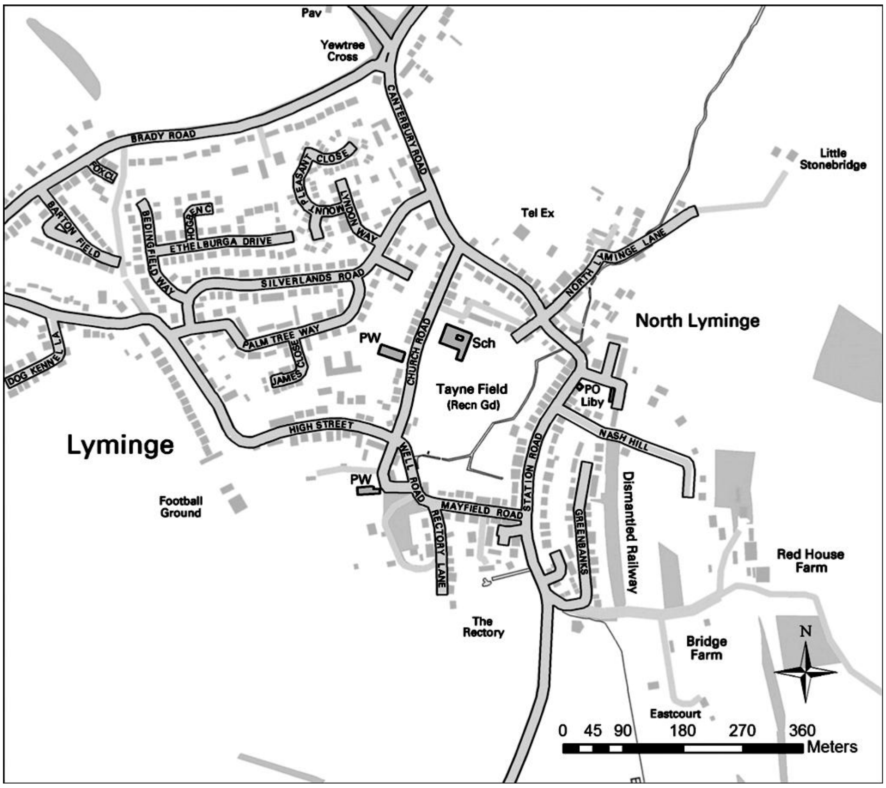


Figure 148: Modern OS map of Lyminge. © Crown copyright (2015) EDINA Digimap, Ordnance Survey.

Figure 149: Aerial photograph of Lyminge, January 1947, showing the extent of the wartime development on Tayne Field (source: Lyminge Archaeological Project).

12.8 Conclusions

This chapter has drawn out a number of key points regarding the site in its regional context, highlighting the highly functional underpinnings of the location in relation to resource-rich biomes, hydrology and topography as well as cultural aspects which have shaped and been shaped by these elements. Situational changes in the landscape setting can be seen to particularly define transitions in these cultural facets of settlement geography in terms of a shift away from an emphasis on strategic projection of power following the conversion period (section 12.5). One of the most significant outcomes of this regional-scale analysis has been to identify a pre-Roman routeway, on the basis of a combination of field archaeology and scientific dating (Chapter 10), which was unpredicted by earlier studies and which may have later become a pivotal aspect of the Anglo-Saxon landscape. This demonstrates the impact of such methods when deployed intensively upon the unravelling of routeway geographies and, in the present study, demonstrates both a greater antiquity and a different orientation to the pre Anglo-Saxon communications landscape at Lyminge than was previously understood.

Chapter 13 - Discussion

This chapter presents discussions of the interpretations separately detailed in Chapters 5 to 12. This is undertaken in relation to the wider archaeological research agenda and structured around the chronological phases presented in Chapter 1, with interpretations relating to each phase compartmentalised into three progressive scales of investigation: on-site, local catchment and wider regional context (section 1.5.2). Interpretations will be discussed in relation to wider research themes and previously published applicable models (section 1.3) with reference to comparable sites and studies for broader contexturalisation and validation. Thematic elements will be examined within the previously detailed chronological phases and scales of investigation and further compartmentalised in terms of the following generalised topics: site formation processes, environment, economy, topography and landscape.

13.1 Introduction: the nature of the evidence

The major findings of the present research must be contexturalised within a clear understanding of the quality of the supporting evidence. The on-site deposits across all sample areas have been extensively affected by post-depositional change from bioturbation and diagenetic processes such as oxidation and the results of fluctuating water content common to aerobic and calcareous agricultural soils. All of these have defined the potential for preservation of organic proxies within the occupation contexts (e.g. Goldberg and Macphail, 2006: 47). This is demonstrated most explicitly in the present thesis by micromorphological evidence for diagenetic post-depositional transformations in on-site fill sequences (Chapter 6, Chapter 7), the pronounced contrast between preservation conditions in the on-site and waterlogged deposits (Chapter 5) and also the ubiquity of poorly sorted and homogenised worm-mixed sediments and stone horizons in sediments overlying archaeological layers (Chapter 4) and the stream channel sequence (Chapter 5). These horizons in places also incorporate earlier sediments from prehistoric environments, such as loessic silts in the base of the doline/hollow and overlying the chalk marl in isolated patches on Tayne Field (Chapter 4); however these deposits were heavily weathered and contained little paleoenvironmental evidence, with the exception of Mollusca in the basal layers of the doline which is of pre Anglo-Saxon date (Chapter 7).

The on-site environmental data comprises charred plant macrofossils and Mollusca from archaeological deposits (Chapter 7 to Chapter 11) which are taphonomically complicated from anthropogenic transportation and colluvial redeposition. These datasets largely represent reworked or imported materials representing a range of processes and depositional pathways rather than coherent proxies of local environmental conditions (Evans, 1972; Thomas, 1985; Van-der-Veen, 2007). Concentrations of this evidence in SFB catchments includes rare microscale evidence such as mineralised coprolite fragments containing preferentially preserved phytoliths, a notable finding of the present research. Identification of such microscale evidence presents a potential future avenue of investigation using biomolecular analyses by methods such as FTIR or GC-MS, which could enhance understanding of cultivated cereals and feed strategies as well as the balance of different species of livestock and human dung inputs to deposits (Matthews, 2010).

The site formation processes discussed in Chapter 4 have led to conditions of waterlogged preservation in sediment lenses which represent the local catchment area adjacent to the stream and can be regarded as exceptional (Hamerow 2012, 2). A Bayesian model derived from sequential radiocarbon dates from this sequence suggests that organic accumulation occurred between 382-535 A.D. and 773-947 A.D. alongside a channel which moved across a relatively limited area during the Anglo-Saxon period. Micromorphological analysis demonstrates that the subsequent process of colluvial burial enabled the survival of these laminated features by sealing them in a waterlogged environment which minimised post-depositional organic decay and bioturbation (Brown, 1997: 39). No evidence was found for any similarly waterlogged organic sediments north of or pre-dating this sequence suggesting that the earliest phases of the channel existed in a stable landscape with contemporary environmental or archaeological deposits likely lost to *in-situ* channel bed erosion. The paucity of Mollusca in some parts of the sequence may reflect an earlier phase of non-calcareous or circum-neutral soils. These likely became more calcareous in the Saxon and Medieval periods as a result of erosion truncating the soil profile and increasing the quantity of eroded basal chalk within the shallower soil.

Organic preservation is concentrated within spatially constrained lenses of waterlogged sediments within a wider area characterised by dry valleys and seasonal watercourses devoid of permanent bodies of standing water (French 2003: 64). The complementary representation of taxa within this sequence as detailed in Chapter 5 demonstrates the value of simultaneous use of both pollen and macrofossil analysis (Birks and Birks, 2001). Limitations are however imposed by the shallow and limited resolution of this record when compared to deeper sequences at sites like Brandon, Suffolk and Yarnton, Oxon, which occupy the alluvial floodplains of major rivers (Carr *et al*. 1988; Hey 2004).

Other complications are generated by the taphonomic complexities inherent in such small fluvial sequences (Chapter 5) which confine representation to a palimpsest of the environments of the local catchment as well as the processes influencing it.

As a result of these issues in scales of representivity, comparative discussion of evidence for environment and resource exploitation will be broadly divided between that for the settlement area and that pertaining to the wider region. At the largest scale covered by the present study, a small selection of published environmental sequences contemporary to the phases of occupation at Lyminge can be related to the study area to enable broader comparison and analysis of the wider landscape context (Figure 150). These sites are all located in lowland and coastal areas or around Romney marsh, itself the subject of intensive paleoenvironmental and hydrological study (e.g. Long *et al*., 2002).

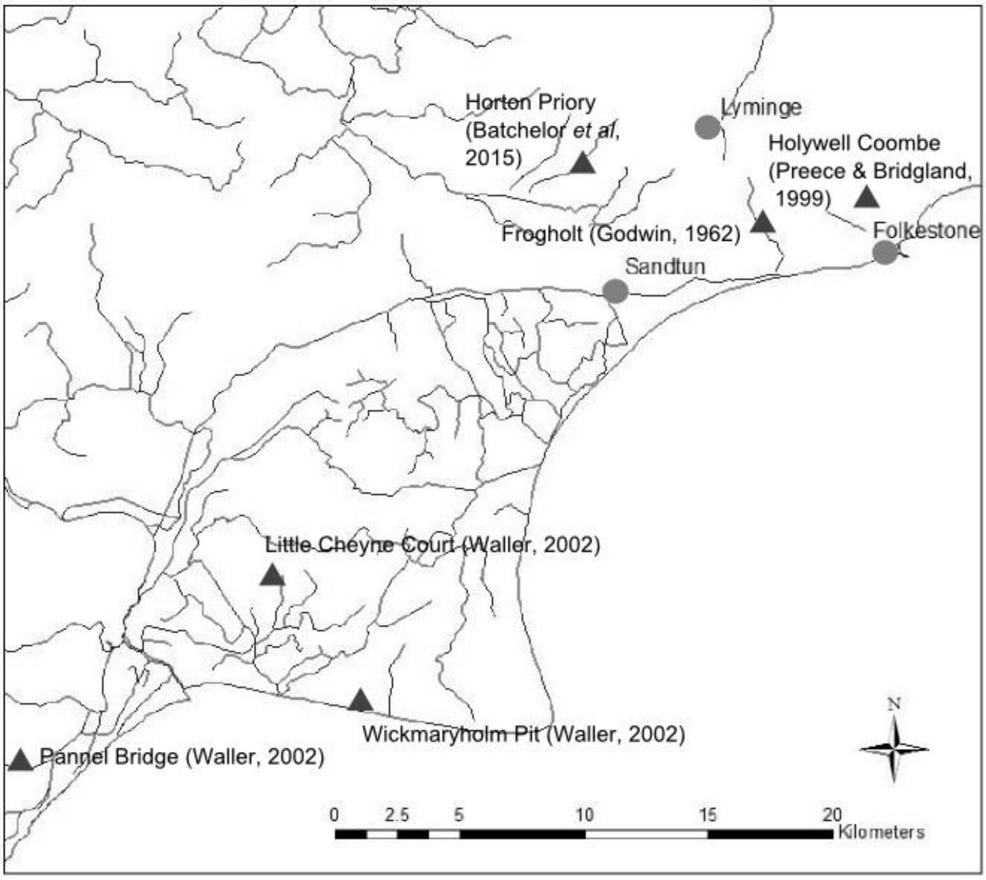


Figure 150: Location of sites with published environmental sequences (triangles) in the wider region contemporary to the settlement phases at Lyminge

13.2 The prehistoric and pre-Roman landscape

13.2.1 On-site evidence

The Mesolithic activity evident from flint scatters on areas overlooking the stream at Tayne Field is paralleled by clusters of flint artefacts at Saltwood (Booth *et al*, 2011: 42-43), Hawkinge and Folkestone (Coulson *et al*, 2013: 14-15), all within 5km of Lyminge. Whilst no on-site environmental evidence specific to this period is evident from the present study, it may be envisioned that communities moving through and utilising the landscape at Lyminge formed part of a wider pattern of seasonal and resource-orientated movement over a prolonged period of time, leading to the establishment of routeways through key locations such as the Elham valley to its headwaters which persisted into the later prehistoric period.

The association of a Bronze Age monument with the doline at Tayne Field is paralleled elsewhere in southern Britain and has been suggested to indicate an emergent prehistoric perception for such hollows as spiritual places and centres of power (Tilley, 2010: 234). This association clearly demonstrates a new cultural value to the Tayne Field site area which is also attested by the lone crouched beaker inhumation (Thomas and Knox, 2015) and various stray finds. Across the excavated areas, traces of Bronze Age field systems are represented by ditches at Rectory Lane and Tayne Field (Thomas 2011; Thomas and Knox 2012a). These features, although not directly dated, demonstrate that agricultural activities were occurring in the valley area during the later prehistoric period and it may further be inferred that the site environment comprised a managed open landscape during this phase.

The only on-site environmental evidence for ground cover or vegetation prior to the Anglo-Saxon occupation is preserved within the molluscan assemblage within the silt at the base of the doline hollow at Tayne Field (Chapter 7). This may be wholly or partially attributable to the latter prehistoric or Romano-British periods on the basis of stratigraphy; however it more likely represents a much earlier residual prehistoric ecology on the basis of its context. The mixed taphonomy of this assemblage, within a thick deposit inwashed over a considerable period of time, has poor chronostratigraphic resolution and likely represents a palimpsest of localised micro-habitats within and around the doline hollow, rather than a solid proxy for the wider ecology of the area. Despite these reservations, it generally demonstrates an open and undisturbed ground cover of long chalk grassland and meadow vegetation surrounding this feature prior to the Anglo-Saxon settlement, suggesting low intensity management sufficient to prevent scrubland regeneration. If this assemblage were contemporary to the Bronze Age archaeology it may be interpreted as further evidence for agricultural activity also indicated by the excavated ditches; however this is currently unsupportable without additional chronological determinants.

13.2.2 The local catchment

Important evidence for prehistoric woodland clearance in the valley is contained within the lowest portion of the sequence at Woodland Road (Chapter 10, Figure 117) by a dominance of *Pomatias elegans,* a mollusc often associated with clearance activity in downland environments (Davies, 2008: 173). In this context these shells likely represent residual material derived from heavilly reworked prehistoric subsoils (dated by U-Series to around 1000 BC). Early agricultural activity on the valley slopes is also clearly demonstrated in the sequence by prehistoric lynchets containing a variety of pottery fabrics dating to the later Bronze Age or Iron Age. This archaeological evidence suggests well established field systems around the valley slopes at this time, potentially contemporary to the on-site evidence discussed in section 13.2.1 and, most importantly, clearly demonstrating that the settlement developed in a landscape long subject to agricultural management.

13.2.3 The wider regional context

The wider onset of woodland clearance in the region broadly coincides with the emergence of farming activities demonstrated locally by evidence of Neolithic cultivation in the downland at Holywell Coombe, around 7km south east of Lyminge (Bennett *et al*, 1998) and comparable later prehistoric fieldsystems and charred cereal grains excavated south of the downs at Saltwood, 4km from Lyminge (Booth *et al*, 2011: 57-59). At Holywell Coombe (Figure 150) the contemporary molluscan record suggests progressive deforestation and clearance of the landscape during the Neolithic prior to cultivation in the Bronze Age by which time the landscape largely comprised grassland and scrubland (Preece and Bridgland, 1999: 44). The peak of woodland clearance activity in Kent is widely reckoned to have occurred broadly contemporary to these activities, with a generalised regional reduction in tree cover from a prehistoric maximum over 50% down to 30-40% by the early medieval period (Brookes, 2007: 47). The Kentish downland saw the majority of this clearance and the resulting development of agricultural landscapes before 1500 BC, albeit with a high degree of localised variation due to settlement density (Turner, 1970: 100). The extensive Bronze Age or Iron Age coaxial field systems recorded in Kent likewise suggest an open and probably extensively pastoral landscape (Yates, 2007).

Beyond the downland area, a pollen sequence from Pannel Bridge at the western margin of Romney Marsh (Waller, 2002: 9) (Figure 150) demonstrates clearance and agriculture (cereal pollen) more widely across coastal areas during the Bronze Age around 1400 B.C., followed by regeneration of fen carr / wet woodland (*Alnus* (Alder), *Quercus* (Oak), *Corylus* (Hazel), *Betula* (Birch)). An early Bronze Age date for clearance is also demonstrated by a pollen sequence from Frogholt, 5km from Lyminge, on the coastal plain near Folkestone (Figure 150) (Godwin, 1962). This site provides a prehistoric palynological record, albeit extending only until the Iron Age (c500 B.C.), when a stable agricultural landscape was prevalent. Variations in herbaceous taxa within this and other sequences suggest a high degree of periodic fluctuation in the intensity or location of agricultural activity in the coastal plain area south of the downs (Turner, 1970: 99).

By the later prehistoric and pre-Roman period the environmental evidence from Holywell Coombe and Romney Marsh broadly suggests localised decline or shifting patterns of agricultural activity (Waller, 2002; Preece and Bridgland, 1999). Against this ecological backdrop, the prevalent coaxial field systems identified to this period have been interpreted by Yates (2007) as demonstrating a general prevalence of pastoral activity across the region. Scaife (1987) has more specifically interpreted such evidence across Kent during the later Bronze and early Iron Ages in terms of a dichotomy in predominant land use between arable in the lowland areas and pasture on the downs. Archaeological syntheses of the contemporary Iron Age settlement landscape in Kent correlates to this idea of topographical variation in land economy by suggesting that the focus of settlement density also lay within coastal areas away from the downs (Coulson *et al*, 2013: 24-25).

13.3 The landscape of the Romano-British to Anglo-Saxon transition (4th-5th centuries A.D.)

The cultural transitions of the 4th and 5th centuries A.D in eastern Kent occur against an archaeological background of decline and abandonment at local Roman sites, such as the villa at Folkestone, along with a more generally widespread regional decline in material evidence for occupation activity (Coulson *et al*, 2013: 56). Syntheses of archaeological evidence in Kent have generally suggested only sporadic and localised continuities in occupation and suggest a widespread dislocation and disintegration of established estate structures across this period (Booth *et al*, 2011: 344). This can be compared to regional models suggesting more generalised continuities in downland areas in southern England on the basis of a variety of paleoecological evidence for a more general persistence of rural economy and landscape management (Rippon *et al*, 2015).

Against this pre-existing body of evidence, the development of the earliest settlement at Lyminge can be framed within a well established late Romano-British agricultural landscape characterised by villas and scattered farms (Drewett *et al.*, 1988: 254). A general trend formulated by previous studies has been the emphasis of settlement continuity, especially with regards to "central place" sites (e.g. Everitt, 1986); Lyminge has previously been contexturalised in such terms, largely on the basis of placename evidence and archaeological misconceptions of the existence of a precursor villa (Chapter 2). The dislocation from Romano-British communications networks analysed within the present study (Chapter 12, section 12.6), conversely suggests the deliberate establishment of this particular settlement in what had previously been a sparsely settled rural hinterland; the absence of substantive archaeological evidence for Romano-British occupation around Lyminge (Chapter 2) further demonstrates this. This finding presents a relatively unusual trajectory of new colonisation away from established centres, which is paralleled at some other sites across Kent (Brookes and Harrington, 2010: 37) and further afield, such as Mucking in Essex (Hamerow, 2012: 15).

13.3.1 On-site evidence

No direct archaeological evidence for Romano-British occupation was recovered from the excavated areas aside from redeposited and, in some cases, potentially curated material such as metalwork. With the possible exception of the pre Anglo-Saxon Mollusca underlying the flint pavement at the base of the doline sequence (Chapter 7, Section 7.6), which is of uncertain date and likely earlier, no on-site environmental evidence was recovered to directly allow further analysis of this phase.

13.3.2 The local catchment

Critical evidence for continuity and change in the environment of Lyminge specific to the Romano-British to Anglo-Saxon cultural transition can be found in both the waterlogged sequence (Chapter 5) and the off-site colluvial sequence at Woodland Road (Chapter 10, Chapter 11). The Bayesian dating model from the stream sequence (Chapter 5, Figure 44) suggests that the earliest portions (382-535 A.D.) of the pollen record may represent the very end of the Romano-British period and the transition into the early Anglo-Saxon settlement. This suggests that the locally open environment it demonstrates partially pre-dates the Anglo-Saxon occupation and was maintained across the colonisation phase without indications of abandonment, clearance or other disruption. This represents an important conclusion of the present research, albeit one complicated by taphonomic issues limiting the resolution of the data. The lowest portion of the off-site molluscan sequence at Woodland Road (Chapter 10, Figure 117) supports these interpretations by suggesting an open, well-managed and largely agricultural Romano-British rural landscape of small fields around the valley area. This record also suggests a subsequent shift towards a more open hillside environment with increased grazing during the early Anglo-Saxon period, which represents another significant finding of the present research.

13.3.3 The wider regional context

These important indications of environmental continuity at Lyminge are paralleled more widely by palynological evidence in England suggesting that, whilst the scale of agricultural activity may have widely decreased, pre-existing Romano-British agricultural landscapes continued to be widely used by early Anglo-Saxon settlers (Hamerow, 2012: 152). Similar continuities in patterns of agriculture and vegetation cover have been more specifically reported for downland areas, albeit with a high degree of localised variability (Dark, 2000; Rippon *et al.*, 2015: 139-140). This perspective of continuity is particularly well established in Kent, where early historical or geographical studies (Hoskins, 1955) and more recent palynological work (Waller, 2002) provide no indications of substantive woodland clearance resulting from the process of Anglo-Saxon colonisation in the 5th century.

Comparable evidence can also be found within the molluscan sequence from Holywell Coombe (Preece and Bridgland, 1999) (Figure 150). This sequence is of relatively low resolution across the middle of the first millennium A.D.; however the fauna is dominated by the same key taxa found at Lyminge (*Trochulus hispidus*, *Vallonia* sp., *Pupilla muscorum* and *Vertigo pygmaea*) (Chapters 8-9) (Preece and Bridgland, 1999: 20). Despite little direct evidence for activity in the Anglo-Saxon period at Holywell Coombe, the general transition from sporadic Romano-British arable to Anglo-Saxon pasture and continuity of open grassland conditions across the Romano-British and early Anglo-Saxon periods (Preece and Bridgland, 1999: 16) matches that previously discussed on the hillslopes around Lyminge (Chapter 10). This transition can also be correlated to that seen at geologically similar downland sites such as Bishopstone in Sussex (Bell, 1977: 258) and also to syntheses of environmental evidence from other parts of England which characterise a contemporary decrease in arable productivity and a continuity or increase in use of open land for grazing as attributes of the early Anglo-Saxon rural economy (Murphy, 1994). This suggests a prevalent pattern of continuity in land use across the downland which, again, supports the larger-scale contemporary models of Rippon *et al.* (2015: 139-140).

13.4 The Early Anglo-Saxon settlement (5th-6th centuries A.D.)

This thesis demonstrates, from a wide range of evidence, that the location of Lyminge as a centre of power and production was ultimately defined in terms of its ability to access and control resources. Models of Anglo-Saxon colonisation developed by researchers such as Hooke (1985), Everitt (1986: 43) and Williamson (2012) have long proposed that the distribution of these resources and the resultant developmental pattern of settlements and territorial boundaries were strongly influenced by geological and topographical factors as watersheds or valleys. These topographical factors were also highly influential on the development of nodal points of communication in the landscape within which centres of secular or religious power and identity developed (Reynolds and Langlands, 2011) and which have been particularly emphasised by studies focussed on Anglo-Saxon Kent (Brookes, 2007: 79; Williamson, 2012). Other studies have further highlighted these aspects as determinants on the distribution of settlements, monuments and trackways in prehistoric periods (Cox and Collins, 1923) and ultimately pointed to their influence on patterns of medieval estates and parish geography (Rippon *et al.*, 2014: 199).

The new evidence from the present survey is important to address regional models of multiple estate formation based upon environmentally determinant geological and ecological zones of settlement, such as those developed by Everitt (1977; 1986). Brookes' more recent syntheses of the development of Anglo-Saxon settlements in Kent (2007; 2010) refined these ideas of influence on distribution from soil type, topography and ecological *pays* (Brookes, 2010: 67) (Chapter 12). Within these models Lyminge has been highlighted as unusual in not occupying a nodal location between ecological areas, in marked contrast to contemporary settlement and monastic sites such as Eastry and Folkestone (Brookes, 2010: 70). These ecological boundaries were further regarded as influential on both the development of early Anglo-Saxon districts and their association with the older geography of Roman communication routes (Brookes, 2010: 67).

13.4.1 On-site evidence

Site formation processes

A central focus of this thesis has been interpretation of the narrative of landscape development resulting from changing patterns of land use and human activities. Tayne Field particularly demonstrates the impacts of this anthropogenic agency during the earliest Anglo-Saxon settlement phases which has altered the topography of the site and created deposits and sequences central to the present study. The earliest of these transformative processes was associated with the Bronze-Age barrow adjacent to the doline / hollow close to the summit of the Tayne Field plateau (Chapter 2) which was levelled and the ditch infilled at some point prior to the earliest Anglo-Saxon settlement phases. There is currently no evidence to suggest a date for the levelling of the mound and backfill of the ditches, or to clarify whether the transformation represents demolition or the result of ploughing during a later Bronze or Iron-Age arable phase. What is known from archaeological evidence is that during the 5th to early 6th centuries A.D., a series of timber buildings, potentially of high status, were superimposed across the ditch and flattened central area of the barrow, probably in association with the activities which infilled the adjacent doline / hollow (Thomas and Knox, 2015: 4-5; Thomas, 2017) (Chapter 7). The intentional superimposition of this building over a prehistoric monument implies that the latter was still visible in the landscape at the time of Anglo-Saxon settlement to the extent that it constituted an appropriable landmark. Similar associations of buildings with antecedent prehistoric monuments are seen at comparable high-status Anglo-Saxon complexes such as Sutton Courtney (Brennan *et al*., 2015) and more widely constitute a factor in many early settlement layouts (Crewe, 2012; Semple, 2013). These interpretations must however be presented with a *caveat*, as apparently coincidental associations of chronologically unrelated archaeological structures with the same natural landscape features are known at other sites such as Springfield Lyons (Tyler and Major, 2005: 143).

The geomorphology of this hollow feature (Chapter 7, Figure 74) demonstrates a substantial, naturally infilled, sinkhole modified by a wide range of anthropogenic processes. The question of to what degree this feature was concealed by naturally inwashed silt at the time of Anglo-Saxon occupation in unclear; the hollow may have been excavated for clay extraction prior to the onset of iron working activities, or it may have already comprised a visible depression in the terrain at this time. If the association of Bronze Age barrow and doline is regarded as intentional (section 13.2.1) then the feature must have been visible in the landscape at that earlier time. Whether it remained open by the 5th century A.D. is less certain, although topographical visibility with significance to the settlement can perhaps be argued on the basis of the importance of the associated 6th century building (Thomas, 2017).

The incorporation of the feature at the core of an area of intensive, high status metal (and possibly glass) working activities at the centre of the settlement during the 5th-6th century is a clear indication of its significance within the cultural topography of settlement. The existence of hearths and micromorphological evidence for trampling across the various burnt layers demonstrates that at least some pyrotechnological activity occurred within the hollow itself, with the remainder perhaps originating in the adjacent building and other nearby work areas. Hamerow (2002: 190) has previously suggested from continental parallels that spatial separation of smelting activity from settlement areas and an archaeological association with deposits of animal bones can be interpreted as evidence for the special status and the rituals associated with iron working. At Lyminge the importance of the activity is, by contrast, demonstrated by its incorporation within the core area of the settlement, suggesting a process of control over the activity and any associated ritual aspects. Complicating this interpretation of the feature is the composition of the earliest and latest layers in the sequence which largely comprise occupation waste, suggesting a complex and changing biography of use across these earliest phases of settlement.

This early Anglo-Saxon phase culminated in a process of settlement replanning which saw the demolition and infill of SFB pits with occupation waste (Chapter 6) (Thomas and Knox, 2014: 2-3). The micromorphology of these fills suggests single-phase depositional events, potentially incorporating the internment of “special” deposits as part of wider cultural practices of SFB closure (Tipper, 2004; Hamerow, 2006). Comparable processes are seen at Rectory Lane, where an SFB fill sequence contained a placed deposit of an iron plough coulter (Chapter 2) underneath fill material which, on the basis of micromorphological evidence, similarly derived from a single depositional event (Maslin, 2015; Thomas *et al*., 2016).

Environment

The 5th-6th century molluscan evidence from on-site SFB and doline fill contexts (Chapter 7-8) suggests stable ground surface conditions within the settlement area, comprising short-turfed and likely well-grazed areas of grassland. The occupation site to the south, at Rectory Lane, by contrast demonstrates a far more diverse set of environments during this phase (Chapter 9), with substantial overgrown or localised wooded areas nearby, suggesting that it comprised a less open and perhaps less intensively used or marginal part of the settlement.

Economy

Critical on-site evidence for the 5th-6th century settlement economy has been recovered from SFB fill sequences (Chapter 6) and material from the doline sequence (Chapter 7). This demonstrates a range of significant occupation and industrial processes including the keeping of livestock, the processing of cereals and a range of craft activities including bone and antler working, ferrous and non-ferrous metal and glass working. Micromorphological evidence from these same sequences suggests differentials in use of space with livestock being kept at least periodically within certain areas of the settlement (Chapter 6) as well as a likely spatial zonation for different types of metalworking activity on the basis of discrepancies between artefact and geochemical evidence within layers of the doline fill (Chapter 7).

Fungal spore and coprolite fragments from SFB fills (Chapter 6 and Maslin (2015)) demonstrate the use of these cuts for the disposal of both herbivore (i.e. sheep) and omnivore (i.e. pig or human) dung following demolition of the building structure. This suggests an active process of management for waste from livestock pens within the settlement, as has been suggested by analysis of SFB fills on other English sites (Macphail *et al.*, 2006: 122-123). Clusters of charred Mollusca from short-grass environments within these contexts (Chapter 7 to Chapter 9) may further suggest use of turves or dung from animals grazing on nearby hillslopes as fuel.

A considerable amount of evidence for cereal cultivation during this early phase is found within the charred botanical assemblages from the early occupation phases. Campbell's (2012) assessment refined this evidence by demonstrating that barley was the dominant crop in the SFBs at Rectory Lane whilst the slightly later timber building on this site produced a higher proportion of wheat. This may suggest a distinction of use for these structures in the early settlement area (Campbell, 2012: 7). In both cases the presence of whole burnt grains with few associated weed seeds indicates the presence of accidentally or deliberately burnt cereal products (such as malted barley for brewing or wheat grain intended for milling into flour) rather than processing waste (Van-der-Veen, 2007; Campbell, 2012). The high concentration of barley in the SFBs is possibly related to their use in animal feed and the presence of burnt stable waste (Campbell, 2012: 7). This correlates with the micromorphological evidence for extensive deposition of dung within the fill (Maslin, 2015). Barley is the most widely encountered cereal from early Anglo-Saxon sites and grows in a wide range of basic heavy to light soils (Harrington and Welch, 2014: 68). In East Kent, contemporary rural sites such as Church Whitfield, 16km from Lyminge at the eastern end of the downs, have produced assemblages which demonstrate not only that a heavy reliance on barley is widely prevalent in the contemporary agriculture of the region but also that wheat (spelt and emmer) as well as oats and legumes were cultivated alongside in lesser quantities (Bennett *et al*., 2014: 172).

13.4.2 Local catchment

Environment

The 5th-6th century pollen assemblage (Chapter 5, Section 5.7) provides a core set of evidence which correlates closely to the on-site molluscan analysis in demonstrating an open settlement environment dominated by plants typical of weedy settlement margins, meadows and pasture. Comparison to previous interpretations of early Anglo-Saxon landscapes in lowland alluvial areas with a similar spectrum of grassland flora, suggests the occurrence of processes of low intensity land management, such as grazing and agriculture, occurring around the early settlement area (Harrington and Welch, 2014: 71). The contemporary molluscan record from the valley hillslopes (Chapter 10) correlates closely to this by demonstrating dry, open grassland with little tree cover and a low surface stability, providing critical evidence for the present research by further suggesting regular disturbance and phases of both pasture and arable cultivation as part of the wider land management regime at this time.

Economy

An important outcome from this research has been the identification of wild food plant types (e.g. Blackberry, Cherry, Elderberry, Sloe) in the lowest unit from the stream sequence (14076), suggesting foraging activities during the earliest phase of settlement (Arnold, 1988: 17)(Chapter 5). Such data is critical to support critique of previously discussed ecological models such as Brookes (2007; 2010) and Everitt (1977; 1986), regarding the relationship of the settlement to ecological areas in its catchment. This new evidence from Lyminge suggests extensive collection and usage of materials and food resources from the stream area during both the early phase and across the entire Anglo-Saxon occupation sequence. Geoarchaeological evidence (Chapter 4) also demonstrates that this area was more extensive and far more productive than is apparent today.

The evidence for this activity suggests that the Nailbourne represented a valuable and readily exploitable wetland environment to the settlement inhabitants. The present study crucially demonstrates how the localised scale of this type of resource patch means that it was naturally overlooked as an exploitable biome within the broad-scale model of Everitt (1977; 1986) despite being clearly sufficient to supply a wide range of food and material resources. Consideration of such diversity may explain the apparently “unusual” location of this particular estate centre (Brookes, 2010: 70) by demonstrating that although Lyminge was not physically placed at a nodal point between the type of wide-area ecological resource zones highlighted by Brookes (2007) and Everitt (1986), its territories orientated around a mosaic of resource patches represented by the local stream channel, valley meadow and drier downland areas, with provision of permanent access to more distant resources in the coastal marsh and Weald. The major impact of these conclusions is to suggest that current perspectives on wide-area ecological zonation and distribution as influencing factors behind settlement development may require revision. Such a demonstrably rich, highly localised diversity of ecological resources may also help explain how the chalkland environments of southern Britain came to hold a pivotal role in the emergence of the earliest Anglo-Saxon kingdoms (Harrington and Welch 2014).

Topography and landscape

The conclusions of the GIS and desk-based landscape survey (Chapter 12) support many previously discussed ideas concerning the influence of geology and watershed topography on resource patches and in the definition of the core estate area by natural focal points for resource exploitation (Williamson, 2003: 40). With its clear orientation to the location of the spring, the emergent estate at Lyminge can now be firmly included within a wider pattern of small and very early springhead estates in Kent (Everitt, 1986: 87-90) more typically associated with the springline at the southern foot of the downs (Chapter 12). These locations represent the most accessible water to facilitate occupation over wide areas of otherwise dry downland and it is likely that the selection of the site at Lyminge was primarily driven by such considerations.

The layout and structure of the earliest estate territories at Lyminge would have also been defined by the viewshed of the settlement nucleus (Reynolds and Langlands, 2011: 423) (Chapter 12). The site of the earliest occupation at Tayne Field, as well as the later great hall complex, both utilise a locally elevated position partially bounded by water, providing viewsheds orientated along the main axis through the valley (Chapter 12). This mode of locally elevated, strategic placement offering commanding views of a approaches along a valley, as well as intervisibility with nearby cemeteries, is also known from contemporary high status sites such as Rendlesham, Suffolk (Scull *et al*., 2016: 1602). Previous studies of early estate centres in downland areas have highlighted the predominance of the topographical association with spring locations seen at Lyminge (Williamson, 2003: 38) as well as the strong correlations between viewsheds and the zones of political control in Kent (Brookes, 2007). The association between viewsheds and communications axes between settlements has also been more widely demonstrated as integral to the development of settlement networks in other parts of lowland England such as Wessex (Hamerow *et al.*, 2013) exemplifying the broader cultural role that use of topography played in the projection of power.

As with the development of comparable royal sites such as Yeavering, this process of territorial development and projection within the locale likely utilised a range of natural landmarks, a process which, in the case of Lyminge, potentially incorporated the doline / hollow feature at Tayne Field (Frodsham and O'Brien, 2005). Topographical analysis (Chapter 4, Chapter 11) develops these considerations further by reconstructing the early settlement nucleus being at least partially bounded by permanent or seasonally flowing watercourses. On the basis of similar associations known elsewhere (Lund in Carver *et al*., 2010: 55), these access points to the settlement can be regarded as nodal elements in the settlement’s projection of power within the local landscape.

The precise layout of the early estate within this landscape is likely to remain unknown; however elements may be preserved in the locations of the two known nearby cemeteries (Chapter 2, Chapter 12) which may have defined both symbolic and organisational division of space around the settlement (Carver *et al*., 2010: 32; Brookes, 2007: 71). This spatial association between settlements and burial areas is known at comparable sites in east Kent, such as Eastry, where it was maintained across similar occupation trajectories from cultic centres into royal and later monastic sites (Semple, 2013: 120). At Lyminge the proximity of the cemeteries to the settlement together with the evidence for movements of materials and resources from areas well beyond them suggests that they did not functionally delimit the estate boundary but instead demonstrated a more abstract identity within it (Berglund, 1991: 85). The evidence for an open, intensively managed environment around the settlement may perhaps allow a suggestion that these cemeteries defined the agricultural infield area (Arnold, 1977: 311). The early dichotomy of infield (arable, hay meadow) and outfield (pasture and woodland) is widely seen in contemporary settlement layouts in both England and Scandinavia, often being marked by a physical barrier such as a fence (Berglund, 1991: 57). Studies of slightly later (Middle Saxon) rural settlements at Raunds, Northants (Oosthuizen, 2013: 63; Chapman, 2010) postulated a typical size for such an infield area ranging between 100 and 200 acres (i.e. 400,000 to

800,000m^2). This magnitude compares very well to the area bounded by the cemeteries at Lyminge (roughly 700,000 to 800,000m^2; see maps in Chapter 12); however this coincidence is hardly conclusive.

13.4.3 The wider regional context

Environment

Contextural impressions of the wider structure of the early Anglo-Saxon rural landscape are provided by excavations connected with the High Speed 1 developments in Kent across the southern scarp of the downland and the foothills and holmsdale *pays* (Everitt, 1986) (Chapter 12). Evidence from Saltwood Tunnel, 4km to the south of Lyminge, and White Horse Stone, over 40km to the north west, demonstrate that this landscape comprised farms and small settlements interconnected by a network of trackways, possibly waymarked by prehistoric monuments (Booth *et al*., 2011: 367, 377). The arboreal (i.e. tree + shrub) proportion of Total Land Pollen during this portion of the pollen record at Lyminge (382-535 A.D.) stands at around 18%, enhancing the archaeological picture by suggesting a relatively open and likely well utilised landscape which may also have contained localised managed woodland areas.

Economy

The very early date of the intensive ironworking activity from the hollow / doline feature on Tayne Field (Chapter 7) implies the equally early establishment of a local or regional network of procurement for ore and fuel woods, centuries prior to the monastic foundation. The burnt waste deposits indicate a fuel regime for metalworking and other higher-temperature processes that was consistently reliant on roundwood Hazel kindling and use of Oak or Ash for high-temperature fuel (Chapter 7) (Austin, 2015). This is a pattern which has been more widely observed at early metalworking sites and which implies large-scale exploitation of mature woodland and the production of charcoal (Tylecote, 1986). The low proportion of these hardwood types within the local pollen record (Chapter 5) suggests that woodland areas sufficient in scale to have supplied these intensive burning activities from the 6th century onwards may have been located some distance from the settlement. Larger contiguous areas of economically exploited woodland are suggested locally in later charters (Chapter 12); these were likely accessible along networks of trackways such as modelled by Brookes (2007) and the present thesis (Chapter 12). These trackways were potentially used to transport iron ore, either from localised downland extractions with a ferrugenised clay-with-flints geology (Chapter 12) such as Lyminge Forest, or from more distant sources in the Weald which are recorded historically as being utilised in the Middle Anglo-Saxon period by the monastic community (Kelly, 2005: 105).

The archaeological evidence for the importance of the coastal area as a source of food for the earliest Anglo-Saxon inhabitants of Lyminge is most obviously seen in evidence for the consumption of fish, which in the 5th-6th century phases was limited to inshore varieties alongside unusual evidence for consumption of high-status or “luxury” species such as Sturgeon (Knapp, 2017: 138). This is paralleled by considerable quantities of shellfish, principally Mussel (*Mytilus edulis*) and Oyster (*Ostrea edulis*) (Campbell, 2010). This pattern of shellfish exploitation is not unique to Lyminge, having direct contemporary parallels at the nearby rural settlement of Church Whitfield, located a similar distance (c5km) from the coast, where deposits of oyster (*Ostrea edulis*) and limpet (*Patella vulgata*) were recovered from 6th-7th century SFB fills (Bennett *et al*., 2014).

The present study has provided important new evidence for exploitation of resource areas at the coast by the 5th-6th century inhabitants of Lyminge, in the form of molluscan assemblages from both the SFB and doline fills (Chapter 8, Chapter 9), where burnt and mineralised specimens of salt-marsh taxa (Hydrobiidae) indicate importation and processing of organic material from coastal / brackish water environments. The presence of similar taxa has been recorded at contemporary sites near coastal areas, including in pit contexts at Bishopstone, where their association with burnt structural daub was used to suggest the presence of thatching material or turf used as fuel (Thomas, 2010: 71). The presence of similar specimens in settlement pit contexts at Flixborough in Lincolnshire has also been suggested to indicate use of dung from salt-marsh grazing livestock or geese as fuel (Dobney, 2007: 195). This latter hypothesis could explain both the extraordinary concentration of this taxon in SFB5 at Lyminge as well as the notable levels of mineralisation on the shells, which is highly suggestive of deposition within faecal waste (Green, 1979: 281) and the micromorphological evidence for mineralised dung within the same fill (Chapter 6). Despite this, the lack of associated evidence for identifiable salt-marsh plants in the charred assemblage (e.g. Campbell, 2012; Balantyne, 2014) and the disaggregation of shells from diagnostic aggregates during the floatation process, make further resolution of depositional pathways problematic. What can be clearly determined however, is that this 5th-6th century movement of materials from tidal marshland environments significantly predates the historically documented (circa 732 A.D.) existence of monastic territories in these areas (e.g. Canterbury Christ Church S 23, Chapter 2; Blair, 2005: 258; Brooks & Kelly, 2013), demonstrating a far longer history of access and control.

Topography and landscape

Lyminge has previously been highlighted as an unusual location for a major settlement in Kent due to its displacement from the regional Roman communications networks long considered the primary influence on the early Anglo-Saxon colonisation process (Brookes, 2007: 101). The downland topography was the key determinant for its geography of communications, which in part were also influenced by the legacy of earlier regional communities (Tilley, 1994: 30-31). The established role of antecedent prehistoric networks of pathways in the utilisation of landscapes and the definition of boundaries for Anglo-Saxon communities (Hamerow *et al.*, 2013: 67) suggests that the origins of the estate boundaries at Lyminge may be at least partially based in similar networks. The present survey provides a vital new perspective from which to examine this idea by highlighting a pivotal role for pre-Roman communications routes, primarily the north-south axis through the Elham valley, as a major influence on settlement location (Chapter 12, Section 12.6). Excavated evidence from Saltwood (Booth *et al.*, 2011: 34, 348) further demonstrates how the development of rural landscapes of settlement at this time in early Anglo-Saxon Kent was heavily influenced by such antecedent prehistoric geographies.

13.5 The middle Anglo-Saxon settlement (7th-9th centuries A.D.)

The role of the church and more specifically the establishment of monasteries as estate centres as catalysts for agricultural development in the 8th century, has been proposed by various writers including Hodges (1982), Faith (1997), Blair (2005) and Crabtree (2010) from a range of methodological perspectives. At the level of individual rural settlements this development comprises an escalation of both agriculture production and livestock husbandry and new consumption patterns (Quirós Castillo, 2014). This increasing production of arable surpluses is a phenomenon of what has become termed the ‘long eighth century’ as demonstrated more widely in southern England from evidence for new crop types, developments in field systems, settlement layouts and agricultural infrastructure (Rippon, 2010). Key to the archaeological identification of surplus production is evidence for differentials in the scale of processing evidence for cereals across chronological phases

(Booth *et al*., 2007: 322). Such increases in productivity are certainly evident at Lyminge with extensive structural evidence for the development of cereal storage and processing areas alongside a suspected barn within the 8th century settlement area at Rectory Paddock (Thomas, 2009a; Thomas, 2016).

Across the wider landscape, these changes manifested in the beginnings of drainage and land reclamation in marginal areas whilst estate core “inland” areas developed into intensively managed agricultural systems geared towards the production of surpluses (Faith, 1997; Thomas, 2016). These inland areas comprised an intensively utilised, often physically bounded central part of the estate with specific functions, legal privileges and tied labour resources designed to increase agricultural productivity (Faith, 1997: 16; Thomas, 2016: 284). Faith’s (1997: 12) model surrounds this centre with a portfolio of ecologically and spatially diverse satellite territories and a hierarchy of specialised production and service sites forming a hinterland or “outland”. On the basis of historical evidence, these territories are likely to have been functionally and legally structured into defined roles with varying rights of access such as exclusive royal hunting grounds or grassland areas with levels of grazing rights (Faith, 1997: 30-31). The populations of these outland areas were also likely subject to a very different set of taxation obligations and legal freedoms from those of the inland as defined by terms such as *warland* used in charters to indicate this basic dichotomy within later monastic estates such as Battle in Sussex (Faith, 1997: 91).

13.5.1 On-site evidence

Environment

The on-site molluscan evidence from the Anglo-Saxon occupation sequence demonstrates a dry and open grassland environment around the settlement, with indications of damper microenvironments such as patches of long grass and weeds probably localised around structures and cut features (Chapter 8, Chapter 9). This type of ground cover ecology is similar to that seen around contemporary settlement sites such as Flixborough (Loveluck *et al*. in Loveluck, 2007: 94), suggesting comparable influences from practices of land management and economic process common to rural settlements of the Middle Anglo-Saxon period. The pollen record for the Middle Anglo-Saxon period from the wider catchment contexturalises this on-site evidence within a wider area of open country, apparently continuing from previous phases, typically weeds and grassland with only limited tree cover.

An important conclusion from the Molluscan analysis is the absence of substantive transitions in molluscan ecology evident across this period within the occupation sequence at Tayne Field. This suggests that the processes of settlement replanning preceding the establishment of the great hall complex in the 7th century did not incorporate prolonged phases of abandonment or significant alteration in land use (Chapter 11). More broadly, the molluscan assemblages across the other Middle Anglo-Saxon occupation areas also demonstrate a basic continuity of open conditions across this period, which is matched by the pollen sequence from the wider catchment. This lack of evidence for any on-site environmental transition across the 7th / 8th centuries corresponds to archaeological ambiguities in the transition from royal palace to monastic site which may suggest initial incorporation of the church into the great hall complex prior to the establishment of the monastic precinct (Thomas, 2017).

Evidence from several sequences (Chapter 5, Chapter 10) demonstrates no major changes in land use from the point of monastic foundation in the 8th century until the wholesale switch from pastoralism to arable land use subsequent to the abandonment of the monastery in the 10th century. This picture is however blurred by taphonomic issues and the coarse resolution of the data which likely conceal shifting intensities of activity around the settlement area across the middle Anglo-Saxon occupation. It is also worth highlighting that within this broad continuum there are some exceptions, particularly with regard the southern peripheral settlement area (Rectory Lane) which became generally more overgrown and less well used between the 6th and 8th centuries (Chapter 9) suggesting abandonment as the Monastic precinct immediately to the west (at Rectory Paddock) became established. Additionally a general increase in the prevalence of Mollusca tolerant of open ground and ploughed fields around the area of the monastic precinct (Chapter 11) may reflect increasing levels of arable activity consistent with intensification during this time.

On the basis of comparison with other high status sites, the usage of space in and around the pre Christian and monastic settlement core areas at Lyminge during this period was likely to have been highly regulated, both to control access to high status areas (Hamerow, 2002: 98 - 99) and to allow the organised function of economic activities. The ground-surface conditions around the settlement areas demonstrate a broad distinction between short turfed, trampled or bare-earth zones around the buildings and more humid and overgrown peripheral, pasture or meadow areas around the margins (Chapter 8, Chapter 9). These may correspond to a basic distinction between zones of domestic and craft activities in and around structures and zones of less intensive, marginal activities at the settlement periphery. This basic on-site division of active and marginal zones may reflect the spatially distinct clustering of pit groups which are also evident at other settlement sites such as Bishopstone (Thomas, 2010: 208).

The monastic settlement at Lyminge during the 8th and 9th centuries presents particular evidence for localised shifts in the distribution of these activity zones across the precinct area over time which is reflected in the various ecological transitions within the pit and ditch sequences (Chapter 9). These specifically include the progressive accumulation of vegetation alongside a boundary area following the mid 8th century which may reflect a later period of internal reorganisation or abandonment. The precinct area at this time was divided by dry, relatively shallow and slightly overgrown internal boundaries (Chapter 9) (Blair, 2005: 196-198). The lack of evidence for any enclosing external ditch features similar to those recorded at contemporary ecclesiastical sites such as Whithorn (McComish and Petts, 2008), suggest that the monastic core may have sat unbounded within its infield area.

Economy

One of the most important findings from this research has been the wide range of economic and subsistence activities relating to the middle Anglo-Saxon period evidenced by the various datasets. In many cases these show significant levels of continuity from the earlier phase and suggest a "background" signal of economic subsistence practices continuing across the cultural and societal transitions of the period. As with the more general evidence for site environment (section 13.4.2), this evidence allows further contexturalisation of other kinds of activities at the site, in this case with a range of processes otherwise essentially invisible within the dry-ground archaeology. Such evidence is critical to understanding the functions of middle Anglo-Saxon estates and patterns of connectivity in their landscapes, as well as in demonstrating a greater antiquity to those elements which can also be identified in later historical sources.

Perhaps the most persistent activity occurring in and around the settlement areas at Lyminge at this time, from the earliest occupation period onwards, was livestock grazing. Evidence for this is found in the form of Molluscan taxa demonstrative of well-grazed grassland in Middle Anglo-Saxon occupation contexts (Chapter 6 to Chapter 9). The consistency of these indicators within the wider catchment as well as the on-site assemblages demonstrates continuity throughout the occupation history; the spatial distribution within and around the settlement suggests livestock being kept close by, either permanently or seasonally when other pastures in the wider area were less accessible or productive (Oosthuizen, 2013: 62). The resolution of livestock related activities across the settlement area is inherently complicated by the extensive redeposition of evidence by ploughing.

The charred plant material recovered from the monastic occupation contexts demonstrate a diverse and intensive cultivation of barley, wheat, rye and oats as well as both spelt and bread wheat during the 8th century (Campbell, 2012: 8). Palynological and macrofossil evidence providing corroborating evidence for cultivation of these cereals in the wider Middle Saxon settlement catchment is also extensive, notwithstanding the taphonomic complexity of the material (Chapter 5). These crops individually favour different types of soils, from deep, well-watered clay loam (oats) to light, sandy, poorer quality soils (rye). If all of them were actively grown around the settlement area it is likely that some degree of specificity in cultivation areas for each crop was employed (Harrington and Welch, 2014: 68). The assessment of the weed species associated with this material by Campbell (2012: 9) demonstrated weeds likely growing in and around the monastic settlement area which were undiagnostic with regards to further evaluating harvesting and planting strategies. Many of these ruderal or environmentally unspecific taxa (e.g. Polygonaceae (docks / knotweed / Sorrel) and *Urtica* (nettles)) match those recovered in abundance from the stream sequence (Chapter 5) suggesting a general presence in wider site areas disturbed by human activity (Grime *et al.*, 1988).

Some components within these on-site assemblages may also indicate cultivation and culinary use of more unusual crops such as opium poppy, as has been suggested by McKerracher (2012), particularly during the monastic phase. Similar suggestions have been made at other sites from waterlogged deposits (e.g. Campbell and Robinson, 2010); however the presence of poppy seeds could imply either cultivation or simply elements of the local wild flora. Other potentially cultivated food plants such as Brassicae (mustards/cabbages) are present in both the waterlogged and charred samples from Lyminge, particularly in the mineralised deposits from the monastic phase pits (Campbell, 2012). This suggests regular culinary usage of mustard or cabbage cultivars, as has been suggested from contemporary pit deposits at Sutton Courtenay (Booth *et al.*, 2007: 319) and at West Cotton, Raunds (Campbell and Robinson, 2010).

Evidence for the use of flax was recovered from the charred assemblage from the Rectory Paddock monastic phase; however local cultivation was not reflected in the pollen or waterlogged macrofossil record from the stream at Tayne Field (Chapter 5). Flax is an insect-pollenated plant with a highly limited potential dispersal so its absence from the pollen record at Lyminge is hardly conclusive (Tester *et al.*, 2014: 335). The thin and free draining calcareous soil types in the local area (Chapter 12) are not particularly suitable for flax cultivation, so these may represent an imported crop (Harrington and Welch, 2014: 68). The absence of seeds, stems or capsule fragments in the stream sequence (Chapter 5) further indicates that if flax was used or processed at the site, it was not being retted in the stream area near the spring, although it may well have occurred downstream, away from the settlement. The intentional displacement of this activity away from the occupation area has similarly been suggested to explain the lack of evidence of *Linum* pollen or retting pits next to the settlement at Brandon, Suffolk, despite the presence of other evidence suggesting that flax processing occurred somewhere at the site (Tester *et al*., 2014: 335).

Beyond the agricultural signature, the on-site assemblages also demonstrate tentative evidence for the importation of exotic botanicals (McKerracher, 2016) which could indicate development of importation of luxury foodstuffs or the sudden proliferation of more complex trade in a market-orientated economy (Orengo and Livarda, 2016). Alongside this, evidence for wild fruit in the waterlogged sequence at Lyminge (blackberry, sloes, plums, apples) is paralleled by charred and mineralised assemblages from occupation contexts (Campbell, 2012: 9) which have been highlighted by McKerracher (2016) as representing unusual diversity for this middle Anglo-Saxon period. Any proposition of period-specific transformations in these patterns of consumption of foraged or horticultural food plants is however hindered by strong evidence for continuity in the reliance on locally grown and foraged food plants from the earliest Anglo-Saxon occupation, both from the on-site (Campbell, 2012) and wider catchment data. Many of these taxa highlighted by McKerracher (2016) as representing unusual diversity for the middle Anglo-Saxon phase (e.g. apple/pear, plum, sloe, elder, blackberry, cherry) can now be seen to comprise a continuous local subsistence economy from the early Anglo-Saxon period onwards.

Other indications of economic change during this period are found in the material evidence for the increased importance of textile production within the monastic economy in the form of loomweights and pin beaters from the monastic core (late 7th-8th century) area at Rectory Paddock (Thomas, 2009b). This type of transition to a sheep-based economy is seen elsewhere during the mid-Anglo-Saxon period, particularly on rural sites (Hamerow, 2002: 149 - 150) where it is demonstrated by zooarchaeological assemblages dominated by sheep in association with similar archaeological evidence for weaving or other cloth working equipment (Booth *et al*., 2007: 331). Contemporary evidence for the existence of settlements with specialised wool production economies is known from both rural sites such as Shakenoak in Oxfordshire (Blair, 1994: 20-22) as well as monastic settlements such as Brandon (Carr *et al*., 1988). In contrast to such known sites the 8th/9th century sheep age profile data from Lyminge does not suggest a specialised economy centred on cloth manufacture and export, instead suggesting a mixture of activities such as dairying alongside more localised wool production (Knapp, 2017: 139).

A change in arable strategy is tentatively reflected in geoarchaeological evidence for the onset of tillage on the site of the great hall complex after the 8th century (Chapter 4, Chapter 5). The changing age profile of the on-site faunal assemblage during the Middle Saxon period correlates to this by indicating increased use of cattle for traction during the 8th/9th centuries, demonstrating the growing importance of ploughing within monastic land management (Knapp, 2017: 139). Such evident increase in agricultural production at Lyminge during the crucial transition between great hall complex and monastery may concur with Blair's (2005: 256) attribution of agricultural surpluses to the changing consumption patterns of English monastic communities and also to Faith's (1997) model of monastic estate "inland" core production. These interpretations must be considered with the *caveat* of taphonomic distortions from dumped waste (Macphail *et al*., 2004: 183) and against broader increases in arable productivity across the mid Anglo-Saxon period in England from the 7th century onwards, which are not specific to monastic estates (McKerracher, 2015b).

13.5.2 Local catchment

Environment

The 8th/9th century pollen profile from Lyminge (Chapter 5, Figure 52) demonstrates dry ground and riparian herbaceous taxa, albeit with a pronounced shrub component, around a muddy bankside area which was heavily disturbed and possibly subject to regular vegetation clearance. This supports an interpretation of a localised area of riparian vegetation contained within a more open landscape of settlement which was intensively utilised and managed. The presence of arboreal taxa such as *Corylus* (Hazel), *Alnus* (Alder) and *Salix* (Willow) also suggests the presence of "wet woodland" areas growing along the channel banks within a wider arable or grazed meadow environment. Similar interpretations are recorded at contemporary Anglo-Saxon settlements such as Raunds (Campbell and Robinson, 2010) and particularly Brandon, Suffolk, where the settlement margins were dominated by a herbaceous dryland and riparian flora with limited aquatic or arboreal taxa, demonstrating well-managed valley floor, reed marsh and riparian environments where carr or valley woodland distribution was restricted by active management (Wiltshire in Tester *et al*., 2014: 320).

Economy

One of the most significant archaeological findings of this research has been evidence for wooden bankside structures and the working of roundwood wattles and other woodworking from the stream, corresponding to the monastic and later phases of settlement within a modelled date interval of 779-980 A.D. (Chapter 5). This likely demonstrates the on-site manufacture of wattle panels, hurdles and other artefacts from species such as hazel, willow and field maple. Maintaining the flexibility of these wands was critical for the manufacture of such products; experimental studies by Grocock (2010: 28) have demonstrated that this can be done by keeping them damp, such as by storing them in long grass. These studies have also demonstrated the importance in maintaining coppiced stands close to the site of manufacture to minimise wastage due to drying which would make the wands too brittle to use. The presence of commonly coppiced species such as *Salix* (willow) and *Corylus* (hazel) within both the pollen record and the identified fragments of worked roundwood further suggest that local, potentially coppiced, stands may have been actively exploited during this period. This evidence for wood working, the active management of local wood resources (Chapter 5) and the diversity of hardwoods used for fuel in domestic contexts (Austin, 2015), collectively suggests a pattern of procurement and exploitation of a wide range of both woodland and hedgerow or scrub trees. The broader diversity of fuel wood types is similar to that typical of charcoal assemblages across the period in other parts of southern England (Booth *et al*., 2007: 320, 330) which have been interpreted in terms of a generally opportunistic approach to the local gathering of domestic fuel.

The stream sequence also provides crucial new evidence in the form of concentrations of charred cereal grains (Chapter 5), to suggest intensification and diversification in cereal cultivation strategies which accord to wider trends in England at this time (Thomas, 2016: 287). This approximates to the apparent increase in cereal-type pollen (monolith <4>) evident across a span modelled at 684-768 A.D. (Chapter 5, Figure 52). This micro and macrofossil material is likely to represent a complex palimpsest of localised activities relating to the settlement economy, such as changing proportions of cereal processing residues in animal feed or the dumping of domestic waste by the stream. On the basis that these processes collectively reflect aspects of the agricultural economy in the aftermath of the abandonment of the great hall complex, a general increase in local cereal production at this time can be suggested. This period corresponds to the height of monastic activity, characterised in the on-site botanical assemblages by an increased diversity and abundance of cereal varieties, most notably barley, oats and specimens of both free threshing and, to a lesser extent, glume wheat (McKerracher, 2017; Campbell, 2012). This variety has been characterised by McKerracher (2012, 2016) in terms of a “high status” signature demonstrating emergence of an agricultural strategy for producing surpluses through diversification. The high proportion of oat (*Avena*) type grains within the stream sequence, assuming that they represent cultivated types, may also reflect another observed pattern in the increasing importance of Oats as a crop type across the 8th century (McKerracher, 2015b).

Associated with this activity is important waterlogged evidence for a continuing subsistence economy of wild food plants (blackberry, elder, sloes, plums, apples, hazelnuts) with a modelled date range of 684-768 A.D. Assuming a component of this material derives from dumped occupation waste in addition to what was growing wild around the stream, this evidence may also indicate use of land for horticulture or orchards in the vicinity of the settlement, as has been suggested at Yarnton (Hey, 2004: 48). The concentrations of *Rubus* (Blackberry) and *Sambucus* (elderberry) seeds in the stream sequence (Chapter 5, Table 25 & Table 26) may also demonstrate collection of certain taxa for non-food uses such as cloth dyeing, as was suggested for concentrations of *Sambucus* (elderberry) seeds in peat lenses at Brandon (Tester *et al*., 2014: 373). This evidence correlates well with the assemblages derived from on-site occupation contexts (Campbell, 2012: 9) which have been highlighted by McKerracher (2016) as being unusually diverse in the monastic phase. Such a diverse combination of evidence for fruit collection and consumption is paralleled in other waterlogged early medieval deposits in alluvial contexts, such as at the contemporary site of West Cotton, Raunds (Campbell and Robinson, 2010) and the later Saxon (10th-11th centuries) sequence from at Trill Mill Stream, Oxford (Dodd *et al*., 2003). In the context of recovery at Lyminge however, possible taphonomic concentration within deposits of human or livestock dung complicate the robustness of these interpretations.

Across this period a major transition in livestock regime from pigs to sheep is evident from on-site zooarchaeological evidence, which can be contexturalised in terms of a transition from an economy orientated around high-status royal activities of conspicuous consumption to one characterised by new dietary preferences following the conversion (Knapp, 2017: 141, 143). These changes in sociological terms likely reflect the later Anglo-Saxon influence of Benedictine Rule and the rejection of pre-Christian ceremonial feasting practices in favour of monastic ideals of fasting and food purity (Knapp, 2017: 143-144). This cultural transition significantly correlates to evidence for intensive grazing in the catchment of the settlement during the 8th century identified by the present research on the slopes around the valley (Chapter 10) and around the stream area (Chapter 5). In both cases however, the scale of evidence is more or less continuous across the entire occupation sequence and demonstrates insufficient resolution to fully investigate these changes revealed in the faunal record. Micromorphological evidence further demonstrates that the stream margin was subject to frequent trampling by livestock congregating by the waterside. Dumps of organic waste including omnivore (likely pig) dung also accumulated as a result of such activity which continued long after the initial abandonment of the settlement area on Tayne Field at the end of the 7th century, with particular concentrations dating to 892-1006 A.D. relating to the very late Anglo-Saxon monastic or later Saxo-Norman settlement phases (Chapter 5). The widespread distribution of highly abraded early medieval potsherds around the site, notable quantities of which accumulated by the stream channel downslope from the settlement area (Chapter 5), may indicate use of dung for manuring in infield or kitchen garden areas (Oosthuizen, 2013: 63) as has been suggested from similar evidence at Cowdery's Down (Millett and James, 1983) and also Yarnton (Hey, 2004: 49).

The stream margin also demonstrates a focus of other kinds of economic activities contemporary to the occupation sequence demonstrating intensive utilisation of localised landscape resource areas by the settlement inhabitants, as has been suggested at other sites (Arnold, 1988: 17). This may have included regular collection of various types of vegetation attested from the environmental record (reeds, rushes) for fodder or use as flooring or fuel. This process of regular management and removal of the bankside vegetation is suggested by the dominance of aquatic plant types intolerant of long vegetation around the stream channel (Chapter 5).

Topography and landscape

A major transformation in approach to the local topography can be identified following the conversion with the refocusing of the settlement core around the new monastic church on the hanging promontory overlooking the spring. Such use of a localised elevation within the landscape is typical for newly established monastic churches (Blair, 2005: 193) and may draw upon an older tradition of utilising such hanging promontory locations as assembly sites (Baker and Brookes, 2013b). At Lyminge it indicates a fundamental nonconformity with earlier pre-monastic landscape perceptions, most significantly demonstrated in the present research by the dislocation in viewsheds, which re-orientated north-east up the valley, perhaps towards Canterbury (Chapter 12). A consistant focal point within this changed landscape was the Nailbourne spring, which across the conversion period may perhaps form part of a pattern of pre-monastic cult foci which acquired monastic associations with later Christian saints, both in Kent (Everitt, 1986: 297) and more widely (Blair, 2005: 226-7; Semple in Carver *et al*., 2010: 33). In the earliest stages of conversion such locations may also have been associated with activities such as baptism (Yorke, 2006: 161).

The valley landscape around this re-structured settlement core, on the basis of ecological evidence for long-term stability and intense management, can be regarded in terms of a defined "inland" or core area under the model of multiple estates proposed by Faith (1997:30-31). The existence of an economically integrated but ecologically contrasting "outland" is demonstrable at Lyminge from evidence for regular access to ecologically diverse areas at some distance from the Middle Anglo-Saxon settlement. This evidence for earlier dichotomies of infield and outfield, stable access to a portfolio of resource areas and the existence of an intensively managed core area, may suggest that this characteristic monastic estate structure developed organically from the early Anglo-Saxon territorial structures which preceded it.

13.5.3 The wider regional context

Environment

The arboreal (i.e. tree + shrub) proportion of Total Land Pollen from Lyminge declined slightly from approximately 13% during the 7th-8th century to 10% in the late Saxon / Saxo-Norman period (10th-11th century) (Chapter 5, Table 19). This reduction in wooded cover matches the general trajectories of land management and arable intensification across south east England derived from both historical and palynological evidence (Rackham, 1986: 84; Rippon *et al*., 2015). These values are lower than would be expected from contemporary south-eastern English landscapes, specifically in Kent where general regional estimates of arboreal pollen during the middle Anglo-Saxon period have been placed at between 35% and 45% in recent syntheses (Rippon *et al*., 2014: 212-213). The evidence derivable from charters relating to this period in east Kent can broadly contexturalise this interpretation of a very open environment by illustrating the very small proportion (2-3%) of contemporary landscape features (along estate boundaries) identifiable as woodland areas (Rackham, 1986: 80). This absence of evidence for woodland regeneration and the long-term maintenance of grassland habitats across the occupation phases is similarly a feature of the record at Brandon, Suffolk, which has been used to demonstrate continuous processes of land management around the settlement (Wiltshire in Tester *et al*., 2014: 321). In the broader context, such open and sparsely wooded environments are commonly seen at this time in landscapes across Northern Europe (Berglund, 1991: 85).

Contemporary archaeological evidence for Anglo-Saxon landscapes and ecology from east Kent is highly limited and comprises charred plant macrofossils and Mollusca from a few 6th-7th century rural settlement contexts subject to environmental assessment. Nevertheless, these broadly correlate in indicating open environments with localised patches of woodland (*Quercus* (Oak), *Acer campestre* (Field Maple)) and scrub (*Prunus spinosa* (Blackthorn), *Corylus* (Hazel)) (Harrington and Welch, 2014:

71-72). In the wider context such evidence for these types of Anglo-Saxon open agricultural landscapes with highly localised woodland of *Quercus* (Oak) and *Corylus* (Hazel) is also found in settlement sites on the margins of Kent such as 7th century *Lundenwic*, where indications of coppicing and woodland management from preserved wood were also found (Malcolm *et al*., 2003).

Economy

A central finding of the present research is that continual access to off-site resources and territories lay at the core of both the middle Anglo-Saxon pre-monastic and monastic economies (Thomas, 2016), particularly with regard to important processes such as iron production which occur across the occupation sequence (Chapter 7). This consistency of scale would not seem to suggest the type of intensification or diversification identified by Blair (2005: 254) as characterising “new” monastic economies. This continuity may further demonstrate that Lyminge is an atypical case with the royal estates which preceded the monastic foundation providing a pre-existing network of resources which in this case the monastic foundation did not need to expand upon.

The changing pattern of marine resource exploitation evident at Lyminge across this period reflects wider regional developments in supply networks and technology and the development of regional marine fisheries seen archaeologically at West Hythe and Dover (Thomas, 2016: 291; Riddler and Trazaska-nartowski, 2009). The pattern of fish consumption evident at Lyminge demonstrates a dramatic increase in scale and intensity from fresh and inshore to deep-sea species between the 5th-7th and 8th-9th centuries (Thomas, 2016). Romney Marsh is known from charter evidence to encompass estates territories connected to the monastic site at Lyminge during the 8th century (732 A.D., Canterbury Christ Church S 23, Blair, 2005: 258; Brooks & Kelly, 2013) including significant fisheries such as *Sandtun* which, on the basis of archaeological evidence, were capable of providing sizeable catches (Gardiner *et al*, 2001). These sites demonstrate a potential role played by the estates and their community in driving demand for wider developments in fishing productivity. Alongside this function, other economic roles for sites in the areas under control of the estate included salt production. Comparisons to Anglo-Saxon salt-production sites in other areas (Hooke, 1981) suggest extensive networks of trackways – “saltways” – may have developed as a consequence of this activity, profoundly influencing the development of the communications landscape south of Lyminge (Chapter 12).

Across this period, these coastal regions of salt marsh were being shaped by processes of shingle barrier development, sedimentation and marine regression as well as anthropogenic reclamation and drainage potentially driven in part by activities supplying regional centres such as Lyminge (Brookes, 2007: 40). During the later part of this period, Romney marsh became extensively occupied with the establishment of Anglo-Saxon Hundreds and an increasingly complex pattern of land holding dominated by the estates of Canterbury, which had incorporated the holdings of Lyminge by the end of this period in the 10th century (Chapter 2). A pollen sequence from Little Cheyne Court on Romney Marsh around 25km from Lyminge (Figure 150) provides a contemporary environmental record indicating a largely open landscape of grasses, rushes and *Corylus* (Hazel) scrubland with limited tree cover ((*Quercus* (Oak), *Alnus* (Alder), *Betula* (Birch)) (Waller, 2002: 10-12). This sequence further provides evidence of agriculture and clearance from a prevalence of *Plantago lanceolata* and cereal pollen, indicating exploitation of the marshland and the maintenance of an open, unwooded landscape. Further out on the coast, a second contemporary sequence from Wickmaryholm Pit (Dungeness) confirms the extent of an open environment suitable for grazing in the marshland and shingle areas across Romney, again almost certainly as the result of a degree of active management (Waller, 2002: 13-14). Later medieval records show land reclamation efforts through drainage, construction of flood defences and in some cases the growing of legumous arable crops to improve soil quality being well underway by the 9th century (Rippon, 2002). Occupation at *Sandtun* is likely to have ended by this time in the wake of increasing sea-borne Viking raids, a factor also likely instrumental in the decline of the monastic settlement at Lyminge some decades earlier (Brookes and Harrington, 2010).

The presence of materials in the occupation contexts at Lyminge which originate from this range of off-site environments (Chapter 7-9) provides an important indication of the scale and composition of the monastic estates during the middle to late Saxon period. These remain remarkably consistent between the early and middle Saxon phases, ranging in extent from the settlement locality (materials from the stream margin and agricultural infield), to 1km away (materials from the downland hillslopes), 2-3km away (materials from woodland areas) and 5km away (materials from the coastal marshes and sea) from the settlement. Additional access to mineral and pannage areas in the Weald, as suggested by later charter evidence (Chapter 2), would stretch such a putative hinterland to more than 10km from the settlement (Chapter 12). This suggests continuous agency of the economy across a wide-ranging area, implying both stability in territories and the prevalence of a strong central authority, with control of a diverse resource base sufficient to generate a rich material culture (e.g. Thomas, 2013; Thomas, 2017).

13.6 Late Saxon and post-Saxon developments

13.6.1 On site and local catchment evidence

Site formation processes

At some point following the abandonment of the great hall settlement on Tayne Field in the early 8th century (Chapter 2) and deposition of the final fluvial lens in the stream sequence around 773-947 A.D. (Chapter 5), a dramatic alteration of site topography occurred when the land was turned over to agricultural tillage. Micromorphological and sedimentological evidence from several sources (Chapter 4-6) demonstrates the impact this process had on the plateau profile by truncating the archaeological sequence and redistributing sediment around the site through colluviation. In terms of site preservation, this process will also have led to the loss of any areas of dark earth or midden spreads which may have accumulated on the land surface around the buildings similar to that recorded at comparable sites such as Flixborough (Loveluck and Atkinson, 2007: 108). The extensive organic deposits remaining in SFB fills and the doline sequence demonstrate the potential for nitrate and phosphate enrichment that such redeposited material would have effected on the agricultural potential for the site, once the built structures had been removed. This process of transformation began to significantly alter the physical setting of the former settlement area (Chapter 12) as well as the hydrology and positioning of the stream channel (Chapter 5).

Economy

The pollen and microfossil record suggests nothing in the way of any significant reduction in agricultural or pastoral activity with a continuation of open conditions in this area after 1000 A.D., at which time the area was being subject to regular, intensive ploughing. The off-site molluscan sequence by contrast demonstrates change in activity and landscape structure around the settlement at this time, with an increase in the prevalence of small fields defined by hedgerows or other overgrown boundaries (Chapter 10). This apparent contradiction is likely a function of scale of resolution, with major landscape changes at this time occurring at a distance from the settlement core not resolvable within the catchment pollen record.

This transition also corresponds to a possible reduction in sedimentation rates in valley lynchets after the 10th century which may be interpreted to suggest a localised change in the prevalence of tillage activity, assuming it is in any way representative (Chapter 5, Chapter 10). By the later Middle

Ages, the former site of the great hall complex and Saxo-Norman occupation at Tayne Field was turned entirely over to agriculture, becoming a tilled landscape of fields bound by E-W hedgerows perpendicular to the channel of the stream which was, by this time, being shifted in its course by the colluvial bank accumulating alongside it (Chapter 4).

The final abandonment of the monastery at Lyminge precipitated a process of transformation for the settlement into a medieval village, focussed on the former monastic church site, which itself became the parish church which remains today. At the site of the former great hall complex, the substantial waste-filled pits relating to the Saxo-Norman (11th century) occupation phase (Thomas and Knox, 2012a) demonstrate clearly that following the hiatus in monastic occupation in the 10th century, local occupation activity was maintained. This archaeological evidence further indicates that the layout of the medieval village became essentially crystalised during this time, with the orientation of building plots to the later road pattern (Chapter 12) being evident. This phase is likely to be broadly contemporary to the continuation of the settlement as a peripheral estate of Canterbury and activity associated with the inhabitation of the nearby bishop's residence to the west of the church (Kelly, 2005: 100). This occupation evidence is directly contemporary to the later phases of activity at the stream-side, comprising evidence of local wood working, waste dumping and the presence of livestock around the stream area (Chapter 5). The large corpus of environmental evidence from this location demonstrates that these basic subsistence processes had in effect been continuous elements of local life since the earliest phases of Anglo-Saxon occupation.

13.6.2 The wider regional context

The wider landscape continued to remain open across this period well into the 16th century, as is demonstrated by a late medieval pollen sequence from an infilled medieval fishpond at Horton Priory, 6km west of Lyminge at the southern edge of the downs (Figure 150). This site also demonstrates the presence of localised dry (*Quercus* (Oak)) and wet (*Alnus* (Alder), *Salix* (Willow)) woodland areas with approximately 26% arboreal pollen (of the Total Land Pollen count) evident around 1430-1620 A.D. (Beta-403953, 95.4%)) (Batchelor *et al.*, 2015). This evidence suggests that the diversity of localised ecological resource patches evident across the occupation phases at Lyminge continued regionally throughout the Middle Ages, albeit with the introduction of new and imported species such as *Juglans* (Walnut).

The evidence from this study collectively demonstrates some form of regional transition in agricultural economy and function as the estate was re-structured under changing archiepiscopal management. This restructuring, on the basis of other historical parallels, may have comprised fragmentation and loss of outland territories and a consolidation of the inland area as a smaller agricultural manor, perhaps also alongside a commensurate decrease in wealth and arable productivity (Faith, 1997: 184). Documentary evidence suggests the active continuity of the estate at this time as a well-populated and wealthy manor under the wider control of Canterbury (Du Boulay, 1966). Domesday records more widely contexturalise this by suggesting an open landscape in east Kent with only around 13% of the area comprising woodland or wood pasture by 1086 AD (Rackham, 1986: 78). The molluscan evidence from Holywell Coombe at this time confirms this wider continuity and also demonstrates a change from a late Anglo-Saxon landscape of pastures towards a more substantive arable use in the 11th century (Preece and Bridgland, 1999: 37).

At the same time the structural and ecclesiastical re-orientation of the village into a parish was well underway by the 11th century, with the former monastic church re-emerging as a “mother” church with responsibilities over a network of dependent parishes (Brooks & Kelly, 2013: 34-35). This hierarchical seniority undoubtedly maintained an aspect of the former central place role of Lyminge, evident since the very earliest Anglo-Saxon settlement some six centuries earlier, into the post-conquest ecclesiastical landscape.

This late Saxon origin for what would become a recognisably medieval settlement by Domesday (Chapter 2) is paralleled by processes of middle to late Anglo-Saxon settlement nucleation observed at some other high status Anglo-Saxon sites (Oosthuizen, 2010: 120-122) and more generally within contemporary rural settlement landscapes across other parts of the country (e.g. Foard and Brown, 1998). Other studies have further demonstrated how many of these early nucleated settlement layouts represented ongoing processes of transformation rather than any stable plan (Rippon, 2010: 56); without further evidence the precise origins of the medieval layout of Lyminge is likely to remain somewhat speculative.

Chapter 14 - Conclusions and summary

The broad narrative generated by this study concludes on a central premise that the regional and site-scale environmental history at Lyminge was defined by a high degree of continuity and stability, with little in the way of broad-scale ecological change from the late Romano-British to the late Anglo-Saxon periods. Across the Anglo-Saxon occupation sequence the settlement area was very open and shaped by trajectories of arable and livestock management which indirectly reflect broader contemporary processes such as evolving social hierarchies and the development of monasticism. Evidence from this study goes beyond this somewhat superficial imposition of change to conclusively demonstrate the importance of a basic continuum of subsistence economy which persisted despite the effects of major social and religious transformations.

The narrative of human activity attested by the archaeology at Lyminge fundamentally begins in the Mesolithic, when the Nailbourne valley represented a nodal point for movement and resource exploitation, manifested in trackways, temporary work areas and possibly camps orientated around the valley axis and its permanent freshwater spring. The endurance of this cultural focal point in the landscape persisted over millennia, eventually motivating mortuary activities to be monumentalised at the site in the later Bronze Age. Tentative evidence for cultivation and clearance on the nearby valley slopes suggests contemporary agricultural activity beginning in the area at this time, which accords with indications from the wider region that the Kentish downland landscape, previously partially forested, was being subject to clearance and increasing levels of arable activity. By the end of the Roman period the evidence from Lyminge suggests that the valley area had become a mature agricultural landscape characterised by small arable fields interspersed with patches of scrub and woodland. The existence of more substantive rural settlement structures in the area, although currently archaeologically unattested, also seems plausible at this time. This open, well travelled and fertile agrarian landscape, orientated around a year-round spring and valley corridor, provided a sound functional basis for eventual Anglo-Saxon colonisation.

The original location of Anglo-Saxon settlement in the 5th century was clearly influenced by topographical elevations and prominent physical features in the valley floor, most specifically the spring and the nearby elevated plateau area at Tayne Field. A doline on this localised area of high ground and an associated barrow, assuming either remained visible at the time, may also have represented more abstract motivations. The ground area around this earliest settlement core became ecologically transformed from long-grass stream-side meadow to short grassland, with localised areas of bare earth patches and longer weeds around the margins and built structures. This area became heavily used for a range of activities relating to domestic and craft processes and subject to intensive trampling from both people and animals. Contemporary infield areas were also likely enhanced with manure from livestock kept close to the settlement for at least part of the time. Evidence for zones of industrial and craft activities is provided within the hollow/doline feature at Tayne Field which demonstrates evidence for high-temperature pyrotechnology and industrial processes within the fill. Following deliberate infill of this feature, a change of use for this part of the site is demonstrated by the construction of new buildings and replanning around a new high-status great hall complex in the 7th century, partially superimposed across the footprints of earlier SFBs. A comparable shift in use of space from domestic or craft areas focussed around SFBs to areas defined by smaller timber halls also occurred in the southern peripheral part of the settlement area (Rectory Lane).

As early as the late 5th century A.D, exploitation of a diverse range of resource areas across considerable distances by the inhabitants is evident. Regular import of a range of materials from coastal and lowland environments supplied the needs of both subsistence and craft activities and subsequently shaped the later estate territories which were eventually recorded in charters. During this early period of settlement in the 5th/6th centuries, downland slopes around the wider valley area became transformed into an open and intensively grazed pastoral landscape punctuated by phases or changing areas of arable tillage. Within the valley area ringed by this activity, the present study proposes the important economic role of a diverse mosaic of localised environments such as wet woodland and meadow areas around the centre of the valley alongside more typical open infield / “inland” areas of cereal cultivation and grazing. The evidence demonstrates a range of otherwise archaeologically “invisible” activities across the Anglo-Saxon occupation sequence which utilised these mosaic areas, including the use of reeds for thatching or flooring, the collection of wild fruit, grazing of domestic animals and wood working, possibly to create hurdles or structural panels used in the buildings excavated on site.

By the early 8th century the high ground on the western margin of this southern area of early occupation activity became the focus of the early monastic settlement core. A shifting pattern of varying occupation intensity and activity areas focussed around cereal processing and craft activities within this settlement reflected a general increase in arable production, likely precipitated by the changing socio-economic role of the monastery. This activity was set within an environment of arable fields and weedy open grassland bounded by marginal areas of longer, damper vegetation around the various settlement margins, the distribution of which altered as the settlement developed during the 8th and 9th century. A broad continuity of environmental conditions across this conversion period suggests that despite the profound social and functional transformations within the settlement, the wider pattern of land use and subsistence activity remained essentially consistent. Within this continuity may be seen indications of a shift towards the production of surpluses of cereals and a transition to sheep rearing as part of a market economy developing organically out of pre-existing activities previously focussed on supplying both subsistence processes and higher-status behaviours such as feasting. These developments drew upon resources from a pre-existing extensive set of territories; unlike at contemporary sites, the scale of these does not appear to have undergone dramatic expansion following the conversion period, demonstrating the stability and antiquity of the estate structures controlled by middle Anglo-Saxon Lyminge.

Following the establishment of the monastery, occupation activity ceased at the former site of the great hall complex between the late 7th and 10th/11th centuries. This hiatus was characterised by a decrease in ground disturbance and a continuity of open country and grassland vegetation, corresponding to contemporary evidence of grazing. The stream area continued to be intensively used by livestock, for the collection of food and vegetation, for wood working and for waste disposal by the monastic community. During this time the former site of the great hall complex also became used for cereal cultivation by the monastic settlement during the 8th century, with geoarchaeological evidence for intensive arable tillage beginning in the late-Saxon period (9th/10th century). This agricultural activity began to impart a pronounced change in the landscape with extensively redistributed sediment and ploughwash changing the topography of the plateau and displacing the stream channel to the south.

A reduction in activity on the hillsides around the valley suggests a decline in local population following the final abandonment of the monastery in the 9th century, possibly in the face of disturbance from Viking incursions. Later in the 10th/11th century the area of the former great hall complex once more became the site of occupation activity generating substantial rubbish pits within domestic areas bounded by shallow ditches. These may have constituted burghage plots behind buildings along the line of the road to the west, set within arable fields bounded by more heavily vegetated ditches and weedy marginal areas around the settlement. During the same period, the Rectory Lane / Rectory Paddock area was also turned over to agricultural use, and became an area of ploughed fields bounded by densely vegetated field boundaries or hedgerows. On the valley slopes around the settlement, a more enclosed landscape of arable fields and pasture, suggests a transition in land management to lower-intensity agriculture. This likely relates to the broader transformation of the settlement from Anglo-Saxon royal monastery to the centre of a rural archiepiscopal manor, alongside an accompanying decline in productivity.

Following the final abandonment of the occupation areas on Tayne Field in the later Middle Ages, the agricultural regime became more intensive as the village grew. The area became divided into larger ploughed fields providing ecologically restricted and regularly disturbed ground cover but bounded by substantial hedges with highly localised ecological diversity. This cultivation maintained the ongoing processes of landscape destabilisation and the dislocation of the channel course by colluvial redeposition. Alongside this physical change, post-medieval drainage across the wider landscape reduced the spring discharge and flow rate, further reducing the extent of the channel and riparian margin area near the stream. These processes culminated in landscaping and development in the 19th and 20th centuries which included substantial truncation and disturbance of the Tayne Field plateau area by construction activities during World War 2 and in the 1960s.

The central aim of this thesis has been the contexturalisation of the archaeological record at Lyminge within as detailed an environmental history of ecology, economy and land use as can be achieved from the available evidence. This has been approached using correlated mixed-method analysis of fragmentary geoarchaeological and bioarchaeological proxies from both on and off site contexts. Such different lines of evidence can be seen to have mutually supportive roles in interpretation, although some correlations are notably more successful than others; for example molluscan assemblages and botanical evidence which correlate closely across many of the datasets. An important aspect of the process is the way in which very different lines of evidence can contribute in mutually supportative ways to this story. A particular example of this can be found in the routeways analysis, where GIS-based least-cost path analysis produced results confirming those previously suggested by other models of regional networks, whereas paleoecological work produced strong evidence for previously unrecognised trackways within those same networks. Overall, perhaps the single most significant aspect of this methodology has been the recovery and correlation of waterlogged evidence with dry-ground archaeology, demonstrating the potential for recovering new sources of environmental data from highly localised sequences within downland environments.

Throughout this analysis questions of scale, taphonomy and representivity have fundamentally defined the interpretive framework which has enabled new and, in some cases, archaeologically invisible aspects of the site narrative to be revealed. These have demonstrated continuities in site use and activity far less apparent from other types of material evidence as well as a legacy of networks and resource appropriation much older than previously suspected. The diversity of spatial scales employed by this research has allowed a fine resolution of diverse evidence for economic continuity and patterns of regional connectivity, underpinning coarser and more conventional archaeological sources which can subsume such detail beneath superficial evidence for change.

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