# The alluvial geoarchaeology of the upper River Kennet in the Avebury landscape: A monumental transformation of a stable landscape



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**The alluvial geoarchaeology of the upper River Kennet in the Avebury landscape: A monumental transformation of a stable landscape**

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ABSTRACT

*Geoarchaeological research as part of the AHRC-funded Living with Monuments (LwM) project investigated the upper Kennet river system across the Avebury World Heritage landscape. The results demonstrate that in the early-mid-Holocene (c. 9500–1000 BC) there was very low erosion of disturbed soils into the floodplain, with floodplain deposits confined to a naturally forming bedload fluvial deposit aggrading in a shallow channel of inter-linked deeper pools. At the time of the Neolithic monument building in the 4th to early 3rd millennium BC, the river was wide and shallow with areas of presumed braid plain. Between c. 4000–1000 BC, a human induced signature of soil erosion became a minor component of fluvial sedimentation in the Kennet palaeo-channel, but it was small scale and localised. This strongly suggests that there is little evidence of widespread woodland removal associated with Neolithic farming and monument building, despite the evidently large timber requirements for Neolithic sites like the West Kennet palisade enclosures. Consequently, there was relatively light human disturbance of the hinterland and valley slopes over the longue durée until the later Bronze Age/Early Iron Age, with a predominance of pasture over arable land. Rather than large Neolithic monument complexes being constructed within woodland clearings, representing ancestral and sacred spaces, the substantially much more open landscape provided a suitable landscape with areas of sarsen spreads potentially easily visible. During the period c. 3000–1000 BC, the sediment load within the channel slowly increased with alluvial deposition of increasingly humic silty clays across the valley floor. However, this only represents small-scale landscape disturbance. It is from the Late Bronze Age–Early Iron Age when the anthropogenic signal of human driven alluviation becomes dominant and overtakes the bedload fluvial signal across the floodplain, with localised colluvial deposits on the floodplain margins. Subsequently~~but it is from this time onwards th~~, the alluvial archive describes more extensive human impact across this landscape, including the disturbance of loessic-rich soils in the catchment. The deposition of floodplain wide alluvium continues throughout the Roman, medieval and post-medieval periods, correlating with the development of a low-flow, single channel, with alluvial sediments describing a decreasing energy in the depositional environment.*

Keywords: fluvial bedload, anthropogenic alluvium, colluvium, OSL dating, Neolithic openness and stability, monumentalisation

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INTRODUCTION

The construction of substantial ceremonial and funerary monuments during the Neolithic and Early Bronze Age represented a significant process of landscape modification, creating landmarks that were often (though not invariably) intended to endure as statements of memory, definitions of sacred space, and/or markers of lineage presence (eg, Bradley 1998; Harding 2013; Cummings & Fowler 2023). Their making involved the movement and relocation of materials, such as stone, timber, earth and turf, sometimes on a considerable scale. Accumulating resources for big construction projects, whether plant foods or animals, ropes, antlers, timbers, and so forth, also left its traces upon landscapes through vegetation modification and associated soil erosion. Making monuments, to paraphrase Bradley (1993), involved acts of 'altering the earth.' Of especial note are events in the latest 4th and mid-3rd millennia cal. BC, which saw the creation of some of the greatest prehistoric ceremonial monuments in Europe; ~~among these those in~~including those of Stonehenge, Dorchester and Avebury landscapes, on Cranborne Chase and Mainland Orkney for example (French *et al.* 2007; 2012; Brend *et al*. 2020; Greaney *et al.* 2020; Parker Pearson *et al*. 2020; 2022). In the case of Stonehenge, there were modifications not just to the local landscape but more distant locations through the quarrying and movement of non-local stone (Parker Pearson *et al*. 2020). This acknowledged, we still understand surprisingly little in detail of the scale and nature of the environmental impacts wrought on these landscapes through the process of monument construction (Whittle 1990; Gillings *et al*. 2002; 2008; Thomas 2020), and it is this matter to which this paper turns, focussing on the geoarchaeological record of the Avebury/upper Kennet valley region of central southern England building on the records of Evans *et al*. (1993), Whittle (1993), Pollard and Reynolds (2002) and Pollard *et al*. (2012).

Here, we are concerned to take a holistic view, recognising that landscapes such as that around Avebury were foci for occupation and other daily activity as well as monument building and ceremony during the 4th to early 2nd millennia cal. BC. Contemporary settlement and other non-monument focused activities have received much less archaeological attention, in part because of the difficulties encountered in their archaeological identification and interpretation, yet their understanding is central to the wider project of comprehending the past dynamics of such landscapes. Equally fundamental are considerations on the nature of the environment from the Early Neolithic onwards, and how Neolithic societies interacted with, and had an impact on, the landscapes that they used and dwelt within. By understanding the human-landscape dynamic, and the context of palaeo-environmental change by human agency, it is possible to start to address *how* landscapes such as Avebury were being used in the Neolithic, alongside informing our interpretations of *why* such landscapes may have been monumentalised. Ideas and speculation centred upon Early Neolithic farmers clearing areas of woodland and creating locales that were special and different, which later become a focus for monument building through recognition of ancestral spaces, only work if this model of the Early Neolithic environment is correct. Indeed, it is now demonstrable that in some of the major monumental landscapes of southern Britain the degree of early Neolithic woodland cover, and by association the level of human induced landscape impact caused by these early societies, has been significantly over-estimated (Allen 2000; 2017; French *et al.* 2007; 2012). The Stonehenge landscape is now interpreted as an ostensibly open, largely grassland landscape with rendzina soils and minimal agricultural disturbance evident at the start of the Neolithic (French *et al.* 2012), and similar scenarios are also evident for the Dorchester monumental complex (Bradley 1998; Smith 1997) and the upper Allen valley area of Cranborne Chase (French *et al.* 2007).

The *Living with Monuments Project* (LwM) has undertaken extensive geoarchaeological and palaeo-environmental analyses across the World Heritage landscape at Avebury (Fig. 1) in order to redress imbalances in our understanding of the dynamics of monument building and settlement, and human-environment relationships in their widest sense. This has been through a coherent and innovative programme of targeted fieldwork combined with extensive geoarchaeological survey and new analyses. These new data are used to re-assess the existing environmental frameworks mainly derived from the work of J.G. Evans and colleagues in the 1970s and 1980s (Evans 1972; 1975; Evans *et al.* 1985; 1993), and are used in conjunction with the results of the archaeological test excavation programme of Neolithic settlement sites and other locales within the Avebury landscape (Pollard *et al*. 2012; 2017; 2018a & b; 2019; 2020a & b; Gillings *et al.* 2015).

This paper documents the geoarchaeological study of the alluvial and colluvial histories of the Kennet floodplain in the Avebury landscape throughout the Holocene. In particular, it aims to provide new contextual data on the nature of the prehistoric landscape with respect to the development of the Neolithic monumental complex. As a companion paper to this (French *et al*. forthcoming), the authors aim to draw together the geophysical, palaeosol, palynological and molluscan data to develop a more detailed understanding of the extent, scale, character and tempo of landscape change related to settlement and monument building in the core area of the Avebury landscape during the Neolithic and Early Bronze Age.

Figure 1

*Alluviation: causes and inferences*

The discussion of the causality between anthropogenic and climatic factors driving Holocene floodplain alluviation is a longstanding debate (eg, Tipping 2000; Macklin *et al*. 2012; 2014). Brown *et al*. (2013) defined the 'Anthropocene' through the onset of Holocene alluvial sediment stacks of different dates across multiple catchments, driven through anthropogenic soil erosion. Macklin *et al*. (2014) also recognised anthropogenically driven alluviation from radiocarbon dated fluvial units in 93 catchments in the UK, with the majority of this alluviation occurring in the Early Bronze Age and the Late Bronze Age/Early Iron Age during the 2$^{nd}$ and 1$^{st}$ millennia BC. Adding further complexity is the chronological relationship between alluviation relative to human landscape disturbance. In particular, the deposition of alluvial sediment on valley floors related to past societal activities such as woodland clearance, cultivation and foraging may not necessarily be synchronous in some valleys and river reaches.

The supply of sediment to a river system can be affected by numerous factors including upslope storage of sediment as colluvium and its movement downslope as hillwash (de Moor & Verstraeten 2008), the scale, intensity and type of impact (eg, woodland clearance, cultivation and pastoral) (Brown 1997; Goldberg & Macphail 2006, 89–95; French 2017) and the size and physical characteristic of the catchment, the underlying bedrock and surficial deposits (Houben *et al.* 2012; Macklin *et al*. 2014). Such factors can affect the synchronicity between human impacts leading to colluviation and then subsequent and associated alluviation. This relationship has been demonstrated as lagged in some catchments, caused by the overflow effect for upslope colluvial storage of eroded sediments (Houben *et al*. 2012) or through land-use practices. Time lags between woodland clearance, prehistoric and Roman cultivation, and later colluviation and alluviation, have been described for the River Nene catchment for example, a function of greater hydro-sedimentary connectivity in the Saxon period due to changes in agricultural practice (Brown 2009). Variations in hydro-sedimentary connectivity and the above floodplain storage of colluvium, questions the synchronous correlation between alluvial deposition and climatic change (eg, Macklin *et al*. 2010). Instead, this focuses the perspective of geoarchaeologists to understand human impacts within river catchments through both erosive factors such as cultivation, and connectivity across a catchment (eg, drainage patterns), leading to more holistic models of human-environmental dynamics within catchments. For this reason, this paper considers both the deposition of colluvial deposits on the floodplain edge and valley sides, alongside floodplain alluviation in the Upper Kennet valley.

*Geographical and soil background*

The River Kennet is a small upland chalk river with a catchment of 1138 km$^2$ which flows from a northwest direction eastwards to Marlborough and on to the River Thames near Reading over a length of *c*. 86 km (Whitehead & Edmunds 2012) (Fig. 1). The upper reach from just to the north of Avebury to Marlborough over a distance of *c*. 28 km is generally a small channel, as a stream to the northwest of Avebury, widening southwards towards Silbury Hill and then eastwards towards Marlborough. It has a relatively narrow floodplain varying between *c*. 50 and 150 m in its upper part through to *c*. 150–200 m downstream. It is a highly localised small catchment of about 25 km$^2$ immediately and demonstrably interlinked with the monuments of the Avebury landscape. Consequently, it creates a sensitive sediment receptor with which to study prehistoric landscape impact and changes associated with this monumental landscape throughout the Holocene.

The present-day soils of the Avebury landscape include calcareous alluvial gley soils on the floodplains, typical brown calcareous earths on the clay-rich Lower Chalk, gravels and Coombe Rock, common rendzinas on the Middle and Lower Chalk downland slopes, under both arable and grassland, and less commonly argillic brown earths in a few areas on Clay-with-Flints (Barron 1976; Findlay *et al*. 1984). These soils are all alkaline, with the possible exception of the argillic brown earths, and are situated on Upper, Middle and Lower Chalk as well as periglacial deposits formed of mixtures of cryoturbated and soliflucted chalk, flint and loess (known as Coombe Rock), and river gravels composed of flint and chalk pebbles. Alkaline groundwater emerges from numerous springs, mainly at the boundary of the more permeable Middle Chalk and the less permeable clay-rich Lower Chalk, such as along the southern edge of Waden Hill below the modern A4 road scarp and the western valley/Y-fork of the Kennet (the Oslip stream) beyond Avebury Trusloe to the northwest.

METHODS

*Field survey, excavation and sampling*

The geoarchaeological survey of the Avebury World Heritage landscape area primarily involved conducting an extensive hand augering programme using a 4 cm diameter Edelman head and 0.5 m long gouge auger as appropriate. A total of 454 boreholes were made in 76 transects across the National Trust's Avebury World Heritage Landscape with a few specific outlier locations such as at North Farm, West Overton, and around East Kennett long barrow (Fig. 2). Of these, some 218 boreholes in 36 transects were placed across and through the Kennet floodplain deposits, followed up with 11 test pits/trenches and a handful of gouge core sample locations to target specific sequences of interest for primarily geoarchaeological and palaeo-environmental sampling. Although coverage is uneven in places due to various access difficulties, this survey provided a comprehensive record of the soils and sediments present in the landscape.

From these boreholes and test pits/trenches, a series of key transects have been constructed to provide an overview of key alluvial and/or colluvial stratigraphies in five valley zones (Fig. 2; Table 1). To cross-correlate between the stratigraphic units present in each borehole in each transect and zone, macro-stratigraphic units were identified, described and used throughout the profile descriptions (Table S1).

The zones A-E used for the presentation and description of results in this study (Appendix S1) are:
Zone A: the upper Kennet to the north and northwest of the Avebury henge;
Zone B: along the western side of Avebury henge that is located on a slight knoll of chalk with Clay-with-Flints;
Zone C: to the south and southeast of the Avebury henge, which contains the massive bulk of Waden Hill and the gigantic Silbury Hill, sat on the floodplain bottom;
Zone D: the floodplain from southeast/east of Silbury Hill towards The Sanctuary;
Zone E: the floodplain eastwards from The Sanctuary to West Overton.

Figure 2

Table 1

Table 2

*Laboratory analyses of alluvial sediments*

The alluvial/colluvial sequences were sampled at nine locations across the floodplain (Fig. 2; Tables 1 & 2), and subsequently analysed for particle size, organic and carbonate content, magnetic susceptibility and soil micromorphological analyses (Appendix S2). These locations were:

- Zone A: the alluvial-buried soil sequences in Test Pits 1, 3 and 4 in Spring Field immediately northwest of Avebury henge on the western bank of the Kennet;
- Zone B: the alluvial sediment sequence in Trench 2 in Butler's Field west of Avebury henge, associated with a basal palaeosol and medieval soil complex, the deep alluvial sequence associated with a low point depression within the floodplain in Trench 5 in Butler's Field, and the alluvial-buried soil sequence in Test Pit 4 located in the floodplain *c*. 100 m to the south;
- Zone C: borehole 375 in the floodplain near East Kennett;
- Zone D: the alluvial sediment sequence in borehole PEC5a downstream of the West Kennet palisaded enclosures between West Kennett Farm and East Kennett village;
- Zone E: Test Pit 1 at North Farm, West Overton, a buried soil associated with a colluvial/alluvial sequence towards the floodplain edge and adjacent Test Pit 2, a moderately deep alluvial sequence in a low point within the floodplain.

In addition, 16 samples were taken and processed for Optically Stimulated Luminescence (OSL) dating by Dr J.C. Wood and Prof P.S. Toms of the University of Gloucestershire's Luminescence Dating Laboratory from Trenches 2 and 5 in Butler's Field and Test Pits 1 and 2 at North Farm (Tables 3 & S2) (Appendix S3) (Toms 2018; Toms & Wood 2020). Given the texture of the deposits, only fine silt quartz OSL dating was possible. This fraction precludes investigation of inter-grain differences in age, using single (125–250 µm) grain analysis. Such variation may be rooted in partial resetting of the OSL signal prior to burial (Olley *et al*. 2004) or bioturbation (Gliganic *et al*. 2016), limiting the affiliation between average OSL age and the age of the event of interest. However, this uncertainty is moderated by the OSL ages presenting in stratigraphic order and the lack of diagnostic issues, on the whole. The exceptions are the significant (>50%) U disequilibrium detected within samples GL18004 and GL21113; these associated OSL ages should be accepted tentatively.

The location of all boreholes and test pits were recorded in the field using a Smartnet Leica GPS system. All data were imported into standard GIS file formats (.shp files) for integration with other project data (eg, lidar, aerial photographs, etc.).

Table 3

*Molluscan and palaeo-environment proxies*

The analysis of the palaeo-environment data from this research forms a second paper for this project (French *et al*. forthcoming). However, it is worth noting here that molluscan samples were taken from Zone A Test Pit 3, Zone B Trenches 2 and 5 in Butler's Field, Zone C calcitic palaeo-channel fill deposits in BH 223 to the south of Silbury Hill, and Test Pits 1 and 2 in Zone E at North Farm, West Overton, for the assessment of preservation and comparison with the previous sequences analysed by Evans *et al*. (1993) from North Farm (Zone E), beneath the Avebury henge bank (Evans 1972; Vatcher & Vatcher 1976) and in Butler's Field (Zone B) (Evans *et al*. 1985), and from buried soils beneath West Kennett and South Street long barrows (outliers to Zone C) and at the Windmill Hill causewayed enclosure (an outlier to Zone A) (Evans 1972).

The assessment and preliminary analysis of the land snails shows an almost total loss of preserved shells from locations and deposits almost identical to those previously sampled by Evans *et al*. (1985; 1993) such as in Butler's Field and North Farm. This strongly indicates that there have been significant changes in the chemical hydrology and hydrological dynamics of the upper Kennet valley in less than a generation. This is a significant loss for further palaeo-environmental enquiry and has forced this project to rely on and re-valuate previously published data (*ibid*.), and these results will be discussed in a forthcoming paper (French *et al*. forthcoming). Furthermore, the new interpretations of this landscape from the geoarchaeological and soil surveys completely shift the fundamental interpretative platform on which the basis of the post-glacial woodland existed (cf. Allen 2017).

In addition, several sets of sub-samples were also taken from the palaeo-channel fills and buried soils for pollen preservation assessment by Prof R.G. Scaife. These include: the palaeosol in BH 528 to the southeast of Avebury henge, the palaeo-channel in Trench 5, Butler's Field and between Silbury Hill and Swallowhead Springs in BHs 223 and 379, the springhead at BH 419 at the southern base of Waden Hill, the palaeosol in BH 524 to the north of East Kennett long barrow, and the buried soil and palaeo-channel at North Farm Test Pits 1 and 2, respectively. Pollen preservation was extremely poor throughout. However, in the last month of the project, sink-hole deposits beneath two Roman wells were discovered in Zone A on the floodplain margin of Spring Field to the northwest of Avebury henge with good pollen preservation throughout an 11 m deep sequence in Trench 4, but which unfortunately only related to the Late Iron Age and Romano-British periods when radiocarbon dated.

## RESULTS

The results will briefly describe the key transects and test pit/trench profiles for each valley zone (Table 2) to provide an overview of the colluvial and alluvial sediment sequences. The overviews presented below are based on more detailed descriptions in Appendices S4 and S5. All reported depths are given as depth below the current ground level (BGL).

### *Zone A*

The borehole transects in Zone A to the northwest of Avebury henge contain very limited upslope storage of hillwash. This aspect is particularly evident in Transect 44 (Figs 2 & S1; Table S1), down slope from Windmill Hill to the Kennet floodplain north of Avebury henge. The transect consistently shows a thin (<0.25 m) rendzina or grassland soil developed on a calcareous parent material. Rendzinas are generally composed of an amorphous, earthworm reworked, turf and organic A (or Ah) horizon over a weathered, calcareous B/C horizon (Limbrey 1975, 128–30). However, at certain points on the downslope there are thin 'fingers' of pale brown silt loam hillwash underneath the present day rendzina topsoil (ie in boreholes BH 335–338), essentially in localised pockets deposited on breaks of slope, which are undated.

The alluvial sequences in this zone of the western side of the upper Kennet floodplain to the northwest of Avebury henge are relatively thin, comprising *c*. 0.3–0.5 m of a pale grey brown silt loam as observed in Spring Field/Winterborne North Test Pits 1, 3 and 4 (Appendices S4 & S5) (Figs 2, 3 & S10) which is probably hillwash derived alluvium. However, preserved beneath these alluvial units are palaeosols which are generally thin, probably truncated and/or modified, but occasionally are moderately well developed argillic (or clay-enriched) brown earth soils (Fedoroff 1968; Bullock & Murphy 1979; Kuhn *et al*. 2010), grading to more ubiquitous rendzina soils upslope beyond the floodplain margins. The absence of more than a few pure (or limpid) clay coatings suggests that this soil was not particularly well developed and therefore probably not indicative of a stable, long-lived woodland soil (Bullock & Murphy 1979; Fedoroff 1968) (Appendix S5). However, the abundance of dusty (silty or impure) clay suggests that these buried soils have undergone repeated episodes of physical disturbance, followed by relative stability for some time in the past (cf. Slager & van de Wetering 1977; Macphail 1992; Lewis 2012). Moreover, the absence of illuvial dusty clay in the voids/channels suggests that there was a minimal effect of more recent alluviation on this buried soil. Thus these pockets of well preserved buried soils define a reasonable floodplain margin stability. It is suspected that the alluvial aggradation did not occur within this zone until the Iron Age or later, based on stratigraphic correlation with the lower valley zones (see below).

Figure 3

### *Zone B*

The investigations in Zone B focused on the alluvial sequences adjacent to the western side of Avebury henge, utilising profiles from Transects 1000, 30 and 1, Trenches 2 and 5 in Butler's Field, and Test Pit 1 about 100 m to the south in the floodplain between the A4361 and Silbury Hill (Figs 2–9, S2 & S3) (Appendices S4 & S5).

The upslope part of Transect 1 beyond the floodplain to the east of Avebury henge revealed very limited storage of colluvial deposits. However, significantly, a brown earth soil with predominant coarse silt (*c*. 25–40%) and very fine quartz sand (*c*. 20–30%) components was discovered in boreholes BH 528 and 536. This suggests an inherited loessic (or wind-blown) component to this soil (cf. Catt 1978; Pye 1995) with the presence of some former, long-standing woodland cover at this locale indicated by the birefringent pure clay (*c*. 5–15%) striae in the groundmass (cf. Bullock & Murphy 1979), but is unfortunately undated.

The floodplain deposit sequences are best revealed in Trenches 2 and 5 in Butler's Field (Figs 2–5). Trench 5 exhibited a deep alluvial sequence within a low point depression in the floodplain, reaching a depth of 2.48 m below ground surface (Figs 4–7 & S3; Tables 2–4 & S3). As such it constituted a somewhat atypically deep alluvial sequence with seven distinct alluvial units recorded. The detailed sediment descriptions are provided in Appendix S4.

Figure 4

Figure 5

The depression that has infilled in Trench 5 revealed five alluvial units divided in two distinct phases of alluviation (Figs 2–5 & S3; Tables 2–4 & S2) (Appendices S4 & S5). The first phase of alluviation was fluvial deposition (units 501, 502 and most of 503), with calcite dissolution causing the deposition of fine-grained (silt-sized) calcitic alluvium with a significant fine sand component at low points in the floodplain. This form of mainly re-precipitation of calcium carbonates can only occur when parts of the chalk valley floor are 'exposed' with a considerable overflow of water to facilitate dissolution (Ahnert 1996, 152–4; Durand *et al*. 2010, 175–6). This then envisages a wider channel with areas of braid plain and little alluvial infilling. The basal pale grey calcitic silt (unit 501) demonstrates that this natural process occurred in moderate to high energy conditions from the very Late Pleistocene (14,270–11,730 BC; GL18001) (Tables 3 & S2) with *c*. 0.45 m of channel fill accumulation. This same process continued throughout unit 502 above with *c*. 0.27 m of grey calcitic silty clay alluvium deposited with a slight elevation in organic content and lowering of the energy of depositional environment (reduced sand fractions). There is an associated OSL date between 8080 and 6610 BC (GL18073) (Tables 3 & S2), across the Mesolithic and into the late Mesolithic-Early Neolithic period.

Unit 503 above represents a significant change in the chronology and alluvial signature in this part of the upper Kennet floodplain with an Early Neolithic OSL date of 4420–3460 BC (GL18002) (Tables 3 & S2). The composition of the alluvium changed, albeit slowly to start with. A non-calcitic, minerogenic component becomes visible, with a reduction in clay and the very fine sand to coarse sand components, and conversely an increase in the fine-coarse silt components. This began as a minor signal and was probably related to soil disturbance through the release of fine-coarse silt components in the catchment. The natural channel alluviation signature of high calcium carbonate and clay content decreases though the unit, but is still dominant, describing a wide, shallow river channel, flowing over chalk, and re-deposition of calcite within areas of deeper, lower energy water.

If unit 503 had formed throughout the period of *c*. 4000–1000 BC, then the intensity of landscape impact visible through alluvial deposition associated with monument construction is exceptionally low. However, it is also possible that unit 503 was deposited over a much shorter time period, for example at the time of construction of the adjacent Avebury henge and as such represents landscape use and disturbance associated with specific monument construction, and therefore discontinuous deposition. Either way, this alluvial deposit is not widespread and is only deposited in localised topographic low points. Therefore, it does not represent widespread Neolithic-Bronze Age alteration of the landscape. Rather it represents the same process of continued fluvial low point deposition visible throughout the late Pleistocene and into the Mesolithic and Neolithic, but with a small, definable increase in the larger silt fractions, probably representing small-scale, light touch, anthropogenic landscape impacts and associated minor soil erosion.

From unit 504 upwards, a calcitic but more humic, silty clay alluvium was deposited across a much wider swathe of the floodplain, not just in the localised low point depression. The minerogenic components of the coarse, medium and fine silts increase, whilst calcium carbonate contents decrease, defining a floodplain that was infilling with sediments. Towards the top of unit 504, clay and very fine silt start increasing again, defining an overall lowering of energy of the river, associated with an overbank alluvial aggrading valley floodplain, with a meandering single thread channel. The OSL date toward the base of unit 504 is of the Early–Mid–Iron Age (820–410 BC; GL18075) (Tables 3 & S2). Given chronostratigraphic correlations with elsewhere in the valley (in Zones D and E), it is anticipated that unit 504 began to form from the Late Bronze Age at *c*. 900 BC and continued through to the Roman and medieval periods.

Finally, unit 505 demonstrates a river valley with significant deposits of well structured, humic, dark brown silty clay alluvium aggrading across the floodplain and a single channel river system with relatively low energy defined through the higher clay and very fine silt fractions. This low energy alluvial unit is visible across the wider upper Kennet valley and most probably dates to the late medieval-post medieval period (see North Farm also). Unit 505 has some elevated magnetic susceptibility values which may relate to medieval and post-medieval activity at this locale, as was observed in other trenches in Butler's Field.

Figure 6

Figure 7

The other trenches excavated in Butler's Field revealed archaeology interspersed within thinner alluvial deposit sequences that are more characteristic of the wider valley. Trench 2 contained this more characteristic alluvial sequence, having a total alluvial sediment depth of *c*. 1.3 m, overlying a basal palaeosol (Figs 5, 8 & 9; Tables 2–4, S2 & S4) (Appendices S4 & S5). In Trench 2 due to the thinner deposit sequence, a product of the slightly higher basal Pleistocene topography, there is no evidence for the natural alluvial infilling of calcite rich fluvial sediments in the early Holocene. Instead, the basal unit 639 is a floodplain palaeosol with evidence of pedogenic sorting alongside anthropogenic inclusions such as flint flakes and charcoal. It is apparent that this palaeosol was still in existence in the Early–Mid–Iron Age with an OSL date of 690–310 BC (GL18003), although the top of the soil bears clear evidence of alluvial additions, until burial by minerogenic alluvium in the late Iron Age/Roman British period with a caveated OSL date of 210 BC–AD 150 (GL18004) (Tables 3 & S2). This alluvial aggradation continues throughout the medieval period, when the alluvial sequence bears witness to considerable human activity at this locale (McOmish *et al*. 2005). This 'medieval soil complex' is not a widespread deposit and is not evident outside of Butler's Field, with post-medieval alluvium dominated by fine sediment fractions burying it. Of particular note is that the Trench 2 alluvial sequence reveals no evidence of anthropogenic landscape disturbance in either the Neolithic or Bronze Age when large monuments were being constructed. Instead, this phase of substantive landscape alteration and human impact (eg, cultivation) occurred much later during the Iron Age-Romano-British periods.

Figure 8

Figure 9

Also in zone B in the floodplain to the south of Trench 5, a buried soil was present in Test Pit 1 (Fig. 3; Tables 3 & 4), which was buried by *c*. 1.4 m of irregular blocky, humic silty clay alluvial material as in Trench 2 (above). The palaeosol is a calcitic silty clay loam mixed with fine chalk/flint gravel and exhibiting considerable oxidation mottling (Fig. S10d). It is suggested that this partially gleyed B horizon (or Bgk) appears to have undergone little pedogenesis prior to alluvial deposition. But, it has undergone severe transformation through wetting and drying processes (Lindbo *et al*. 2010), and the solution/dissolution of silt-sized calcium carbonate (Ahnert 1996, 152–4; Durand *et al*. 2010), most probably derived from the underlying geology and available groundwater in this part of the Kennet valley.

*Zone C*

Zone C covers the Kennet floodplain to the north of Silbury Hill and the dry valley east of Waden Hill, up to the change in the direction of the River Kennet to a more easterly course downstream (Fig. 2). Borehole transects 50, 65, 47 and 7 provide the stratigraphic overviews of this part of the floodplain (Figs S4 & S5; Table S1) (Appendix S4). Transect 50 traverses downslope from the top of Waden Hill, southwest to northeast. The transect describes a thin rendzina soil on the top of Waden Hill, which slightly thickens downslope with an underlying orange brown/reddish brown silty clay horizon, probably an iron oxide rich Bw horizon of a palaeosol. Transect 7 traverses the valley on the east side of Waden Hill, on a broadly NNW-SSW alignment and records no alluvial deposits within the valley floor, although a thin deposit of colluvial deposits is visible beneath the current topsoil.

Zone C records an alluvial deposit sequence with localised Pleistocene depressions in the floodplain capturing longer alluvial sediment archives similar to Zone B. Transect 65 records a Pleistocene periglacial alluvial deposit, overlain by a rubbly hillwash deposit, before the more recent alluvial unit 3 (Roman–medieval) and alluvial unit 4 (post-medieval) (dated through chronostratigraphic correlation with Trench 5 in Zone B). The valley sides again record little upslope storage of colluvial sediments with only thin deposits evident in transect 50 across Waden Hill. The valley to the east of Waden Hill did not contain any alluvial deposits and the colluvial sediments that had washed into this valley sediment receptor were relatively thin (<0.25 m), although these are undated. These small pockets of low volume of colluvial material do not indicate widespread or intensive landscape (woodland) clearance and/or cultivation with associated destabilisation of soils and subsequent erosion.

*Zone D*

Once east of the sharp bend in the River Kennet southeast of Silbury Hill, the modern river takes on a gently meandering course with several relatively narrow 'pinch-points, such as at the southern end of Waden Hill and between the southern slope of Overton Hill and East Kennett village (Fig. 2). The alluvial sequences in this floodplain zone bear a remarkable similarity to those recorded and analysed in Zone B, with the same general deposition of major alluvial units and a general lack of colluvium observable on the valley sides and breaks of slope. The stratigraphic overview for Zone D is provided from transects 54, 59 and 15 (Figs 2 & S6; Table S1) (Appendix S4). Transect 54 heads downslope on the south side of the Kennet valley, traversing from south to north, stopping just before the floodplain, through the western edge of the West Kennet palisaded enclosures. The transect records a generally thin soil sequence downslope, although two instances of relatively thick (<1 m) colluvium are recorded. In common with Zones A-C, the upslope storage of colluvial deposits recorded in Zone D is minimal and localised.

Transect 59 traverses southwest to northeast on the southern side of the Kennet floodplain, just upstream and to the northwest of the location of the West Kennet palisade enclosures (Fig. S6; Table S1). The transect records a layer of basal pale greyish white calcitic silt, a channel deposit (unit 4), overlain by a dark greyish brown silty clay alluvium (unit 2), beneath the modern soil profile (unit 1). The alluvial deposit sequence is deepest on the southern edge of the floodplain and gets thinner as the basal topography increases in elevation towards the current river channel. Similar to transect 59, transect 15 traverses the Kennet floodplain on the southern side, traversing southwest to northeast. The alluvial sequence thickens towards the river moving northward and reaches a maximum depth of 1.33 m. The deposit sequence has a thin intermittent basal dark grey brown clay silt with sand, abundant fine organic material and small crushed shells. This is overlain by unit 3, a greyish brown calcitic silt with few very fine chalk fragments, a hillwash derived calcitic alluvium. The later interpreted medieval–post-medieval dark silty clay alluvium (unit 2) was intermittently visible in the transects and is present in core PEC5a (below). In general, the depth of the alluvial sediment sequence at this location varied between 0.75–1.33 m BGL, demonstrating the same pattern of alluviation visible in zones B and C, outside of the localised deep deposit sequence such as observed in Trench 5 in Butler's Field. In addition, a single gouge core sample was collected and analysed from transect 15 at borehole PEC5a (Fig. 2).

Core PEC5a, located in the floodplain between West Kennett Farm and East Kennett village, provided a detailed analysis of the floodplain deposits present in Zone D (Figs 2, S7 & S8; Table S5) (Appendix S4). Due to access, it was not possible to excavate a test pit at this locality to provide an OSL chronology for the deposit sequence alongside the sediment analyses. Therefore, after sediment characterisation of this deposit sequence, chronostratigraphic correlations were made between core PEC5a and the dated exposures in Zone B Butler's Field and Zone E North Farm (see below).

The depth and character of the alluvial sequence shows a remarkable correlation to the dated deposit sequences upstream in Zone B at Butler's Field and downstream in Zone E at North Farm. Therefore, there is a high degree of confidence in the interpreted chronostratigraphic sequence put forward. The sediment sequence shows the same character of later prehistoric (Late Bronze Age/Iron Age) alluviation above a weakly preserved land surface as observed in Trench 2 in Butler's Field Zone B. Alluviation continues through the Roman period, when the levels of calcium carbonate start to drop as the floodplain infills. This process continues into the medieval period when an alluviated valley floor and single channel river can be inferred, before the presence of the late medieval/post-medieval alluvial aggradation. The high levels of coarse and medium silt components even in the early carbonate rich (but less than <30%) earliest alluvium, define a clear anthropogenic driver to the alluviation in this sequence. Again, the interpreted chronostratigraphy provides no definition of earlier phases of alluviation associated with the nearby upstream monuments, especially the nearby West Kennet palisaded enclosures.

*Zone E*

Zone E is the reach of floodplain heading eastwards along the River Kennet towards West Overton and Fyfield (Figs 2, 10, 11 & S9). The site of The Sanctuary, the terminus of the West Kennet Avenue, overlooks the floodplain on the north side alongside the Overton barrow cemetery. The stratigraphic overviews for this zone are provided by transects 63 and 62 with detailed analyses of the floodplain stratigraphy in Test Pits 1 and 2 at North Farm (Appendices S4 & S5).

Figure 10

Figure 11

The analysis of Test Pit 2 describes an alluvial sequence with seven distinct sediment units (Figs 11 & S12e–g; Tables 2–4, S2 & S6) (Appendices S4 & S5). It exhibits direct parallels to the alluvial sequences already described in Zones B and D, and bears a remarkable similarity to the alluvial sequences analysed in Butler's Field Trenches 2 and 5 in Zone B and core PEC5a in Zone D. The deposit sequence has infilled a topographic low point in the floodplain, although this depression is not as deep as in Trench 5 in Zone B, but deeper than the deposits recorded in Trench 2 (Zone B) and the depth of the coring at PEC5a (Zone D).

As for Trench 5 in Butler's Field, the definition of both a Late Pleistocene and Mesolithic period alluvium in Test Pit 2 at North Farm are atypical for alluvial sequences in southern England. However, both basal units 107 and 106 (Appendix S4) have been deposited as a consequence of natural channel flow through a topographic low point in the floodplain and as such they represent a naturally forming, calcite rich fluvial deposit. They both describe a floodplain where there was exposed chalk within a wide shallow channel and presumable areas of braid plain, allowing dissolution of chalk and its subsequent re-precipitation in areas of lower energy flow. However, the base of unit 105 produces an Early to mid-Neolithic OSL date of 4090–3180 BC (GL19049) (Tables 3 & S2), and demonstrates a change in the composition of the alluvial sediment character. Whilst this unit is again predominantly a naturally forming, calcite rich fluvial channel deposit with a significant fine sand component, there is an unmistakable signature of increasing medium and coarse silt components. These may be derived from the erosion of soils that had incorporated some loessic material and as such may be a definable anthropogenic disturbance signal within the alluvium. Nonetheless, unit 105 does record some low level landscape disturbance, possibly localised. As such, it is tempting to define this weak alluviation signal with monument construction further upstream, although this interpretation is speculative.

Towards the top of unit 105, the signature of human driven alluviation becomes stronger and by unit 104 has an OSL date of the later first millennium BC/early 1st millennium AD (130 BC–AD 170 (GL19050) (Tables 3 & S2) with an increased rate of anthropogenically driven alluviation across the valley floor. It demonstrates the same pattern of increasing Late Iron Age-early Roman exploitation and impact across the valley catchment with a corresponding increase in alluvial sedimentation. Unit 103 above demonstrates on-going alluviation throughout the post-Roman and medieval periods. As the humic silty clay alluvium continued to be deposited within the floodplain, the river channel became increasingly constrained, with a corresponding reduction in the chalk dissolution reflected through re-deposited calcite. By the late medieval–post-medieval period in unit 102 (AD 1300–1390 (GL19055)) (Tables 3 &

S2), the energy of deposition had substantially reduced with a clay and very fine silt rich alluvium, defining an infilled floodplain dominated by clay rich minerogenic alluvium.

Figure 12

Figure 13

In contrast, Test Pit 1 at North Farm describes a colluvially dominated sequence with three sediment units overlying a buried soil (Figs 10, 11, 14, 15 & S12a–d; Tables 2–4, S2 & S7) (Appendices S4 & S5). The North Farm Test Pit 1 sequence quantitatively describes the 'Avebury soil' as identified by Evans *et al.* (1993). It was originally thought to represent a Mesolithic-Neolithic soil typical of the Avebury area. However, the OSL dating shows this to be an extant soil through much of the Iron Age and into the early Roman period from 550–220 BC (GL19053) to 200 BC – AD 60 (GL19054) (Tables 3 & S2), although this soil does exhibit some alluvial additions. The buried soil evidence (in unit 112) strongly suggests an open and stable brown earth soil, most probably associated with long-term pasture, rather than woodland soils on the river's northern margin. The profile also clearly demonstrates the onset of colluvial sediments reaching the valley floor, in this case covering the 'Avebury soil' from the Iron Age/early Roman period, potentially implying cultivation of areas of previous grassland/pasture just upslope. It is quite possible that this may relate to some form of landscape re-orientation in the Iron Age. Unit 111 is predominately colluvial, but towards the top there is an increasing alluvial fine sediment component which demonstrates landscape use and impact from the medieval period. Above this in unit 110, there was continuing widespread aggradation of late medieval–post-medieval clay and fine silt dominated alluvium with an OSL date of AD 1300–1390 (GL19055) (Tables 3 & S2), although with some colluvial inputs, explaining the continued dominance of the fine-coarse silt fractions.

Figure 14

Figure 15

Table 4

A CHRONOSTRATIGRAPHIC DEPOSIT MODEL FOR THE UPPER KENNET VALLEY

Alluvial deposit sequences were present along the whole length of the upper River Kennet valley from northwest of Avebury (Zone A) to North Farm, West Overton (Zone E). From immediately west of Avebury to North Farm (Zones B to E), the alluvial deposit sequence showed a remarkable cross-correlation, both in the characteristics of the wider sediment units and their chronological relationships. The field data has been necessarily detailed above and in Appendices S1–S5, but is essential to construct true chronostratigraphic deposit models of the wider floodplain reaches, especially when there is an intimate relationship between the river system and prehistoric monumental complexes. However, to simplify this dense data capture, the alluvial zones, key alluvial stratigraphic units, their key sedimentary characteristics, OSL dates (Tables 3 & S2) and associated interpretations are presented in a concise chronostratigraphic deposit model (cf. Carey *et al.* 2019), which has correlated equivalent sediment units across the valley based on their physical characteristics (Tables 5, S1 & S8).

From this model different phases of alluviation are observable that are associated with different phases of landscape utilisation and consequent impacts, with resultant changes in floodplain and channel morphology. The upper Kennet floodplain at both North Farm and Butler's Field contains areas of localised low topography formed during the Pleistocene which have acted as sediment traps for the first phase of channel bed alluviation in both the late Pleistocene and Early Holocene (pre-Neolithic). The composition of the ~~alluvial~~ fluvial units infilling these localised low point depressions is distinct with high clay and carbonate contents, and the presence of chalk and flint pebbles, forming through~~. These alluvial sediment units have formed through~~ water flowing into and pooling in these depressions. Abundant areas of exposed chalk in other parts of the floodplain have facilitated bedrock dissolution through a wide, shallow channel, with some implied areas of braid plain. The relatively high clay content is interpreted as indicative of the differential erosion of soils, resulting from rain-splash, low energy erosion of open but relatively undisturbed topsoils, exaggerating the clay component of the early alluvial deposits. Within the topographic low point depressions, some of the channel bedload has been re-deposited (ie, chalk/flint pebbles) alongside re-precipitation of calcite and the deposition of clay, through standing water.

The second phase from the Early Neolithic through to the Bronze Age was clearly critical within the development of the Avebury landscape. ~~Alongside the record of settlement, t~~This period saw the creation of numerous monuments that provide this landscape with its especial character, starting with long barrows (earthen and chambered) and enclosures in the 4th millennium BC and likely the earliest megalithic settings. Subsequently this was followed seemingly by a hiatus, then the creation from the mid-3rd millennium BC of the greatest monuments, among them Avebury, its Avenues, stone and wooden circles, the West Kennet palisade enclosures and the gigantic mound of Silbury Hill. Even the region's round barrow cemeteries represent a considerable investment in labour. Unsurprisingly, it has been previously hypothesised that there had been widespread clearance of the post-glacial woodland at this time, facilitating monumentalisation of already cleared ancestral spaces within the landscape (Evans *et al*. 1993; Whittle *et al*. 1999). Therefore, understanding the signature of human induced alluviation in the Neolithic–Early Bronze Age is critical in understanding the human-environment context of landscape, land use and impact, and the context of monument construction and use. Those signatures could include soil and vegetation disturbance during the extraction and movement of stones (eg, in excess of 700 megalithic blocks (Gillings & Pollard 2016)), the clearance and breaking of ground for monument building, the felling of trees to provide timber for The Sanctuary and West Kennet palisade enclosures, estimated at *c*. 15 ha of mature woodland by Whittle (1997, 154), and soil erosion through attendant gatherings of people and animals *en masse*.

**Commented [CC2]:** What record of settlement??

It is therefore striking, and somewhat unexpected, that the signals of human induced alluviation caused by landscape impacts throughout this period are slight. Within the localised topographic low point depressions across the floodplain, water continued to flow and deposited calcite rich sediments in a single channel. In many respects, this corroborates the previously modelled palaeo-hydrological study of river flow north of Silbury Hill to at least Avebury henge, rather than a winterbourne channel (Whitehead & Edmunds 2012). However, within these sediments there are increasing fine to coarse silt and very fine quartz sand (or loessic) components that signal a degree human induced soil disturbance of soil surfaces within the catchment and limited wind and rain-splash erosion of soil material. This signal started by about 4000 BC and continued to at least the later Bronze Age between about 1330 and 870 BC (defined from North Farm Test Pit 1) over a period of *c*. 3000 years. The thickness of this second phase of alluvium deposited in this timeframe is relatively shallow (<0.4 m), and it is not widespread as it only forms within the valley floor depressions and it does not overspill to other areas of the floodplain.

Considered together, these first two phases of alluviation must reflect slow, low volume and low velocity erosion ~~movement~~ in this landscape. This strongly suggests a very stable hinterland, whether under woodland or grassland with minimal interference through clearance, agriculture and erosion. The anthropogenic component in the second phase of alluviation during this critical timeframe is interpreted as representing relatively small scale (in a catchment context) landscape disturbance. This is certainly not a model of widespread woodland clearance and derived soil erosion caused through extensive farming on the valley slopes in the Neolithic and Bronze Age. The rate and volume of anthropogenically driven alluviation at this time is more commensurate with small scale soil disturbance, whether this was woodland clearance or simply soil disturbance within grasslands, potentially even at the scale of monument construction (eg, Avebury and Silbury Hill). These enormous prehistoric monuments are situated very close to or directly adjacent to the river channel, both at the floodplain margins and as such demonstrate a direct connection between the river and these monuments (cf. Richards 1996). It is tempting, but speculative, to see the anthropogenic alluviation signature visible in this second phase of alluviation as a product of such localised monument construction and associated soil disturbance, rather than widespread agricultural disturbance and soil erosion.

Whatever is the driver for this minor anthropogenic driven alluviation between the Early Neolithic to Mid–Late Bronze Age, it is clear that the rate of alluvial deposition significantly increased from the Late Bronze–Early Iron Age. It is at the time that more sustained agrarian landscapes developed around the area of the former monument complex (Pollard & Reynolds 2002). The low point depressions on the floodplain floor have largely infilled by this period, and areas of slightly higher topography within the valley bottom that previously had developed soils become inundated and buried by a third phase of alluviation. The alluvium is now defined by eroded soil material composed mainly of the fine-coarse silt and very fine quartz sand fractions, probably derived from inherent loessic soil components from the catchment.

This more widespread and increased intensity of alluviation is probably the product of anthropogenically driven soil erosion on the valley sides from the Mid–Late Bronze Age/Early Iron Age onwards. This implies the expansion of cultivated or at least disturbed land into areas that were previously undisturbed. Nonetheless, this use of the landscape at this time period unequivocally defined a landscape that was largely open grassland, not woodland. It would not have been possible to construct so many interconnected monuments within this landscape without clearing areas of woodland on a larger scale. Of course, the signature of alluviation does not provide a direct palaeo-environmental context for each locale of monument construction, but it does provide a wider catchment view.

This is significant, as a predominantly grassland landscape would have been distinct to the more wooded river valleys off the chalk uplands (eg, the Greensand vales, such as in the Vale of Pewsey) (Evans 1972, 274–7; Leary & Field 2012) and this has a potential interpretative value in explaining monumentalisation in the Avebury area. Either way, the signature of the fourth phase of alluviation from the Late Bronze Age–Early Iron Age continues throughout the Roman period and into the early medieval period. The rate of anthropogenically driven alluviation from the Late Bronze Age/Early Iron Age substantively increased, providing deeper and more widespread alluvial deposits across the valley floor. Throughout this time-scale the level of calcite steadily decreased, defining a floodplain that was increasingly infilling with fine (silt and clay) alluvial sediments, slowly constraining the channel over time, until it became a single thread channel, meandering across the floodplain.

By the later medieval period there is a very low carbonate content in the alluvium and the overall particle size has decreased, producing a valley wide, fine grained, clay rich alluvium in the fifth and final phase of alluviation. It comprises a very dark brown to dark greyish brown, silty clay loam with a very well developed columnar blocky ped structure. This deposit is very humic and probably topsoil derived from the catchment upstream and upslope, and is associated with the seasonal overbank flooding of long-term pasture. It most probably developed hand-in-hand with the post-late 16th century AD construction of the embanked water catchment ponds system as observed in Butler's Field (McOmish *et al*. 2005; Pollard *et al.* 2018a), and is reflecting topsoil erosion associated with wide-scale arable agriculture in the immediate catchment. This alluvial unit continues into the post-medieval period, defining a floodplain that has infilled and choked up with nearly 2500 years of anthropogenically induced alluvium. Unfortunately, the available geochronological data lacks the resolution to define changes in the rate of alluvial deposition across the floodplain in the Roman and later periods, and it is currently not clear if there are periods of higher or lower alluvial deposition during the post-Roman to post-medieval timeframe.

Table 5

NEOLITHIC STABILITY AND LATE BRONZE AGE/IRON AGE DISTURBANCE

The alluvial sediment record provides a clear model of landscape impacts, and to some extent land-use, throughout the Holocene (Tables 5 & S8). However, this model substantially contradicts previous studies that interpreted much larger impacts by prehistoric societies on these environments (eg, Evans *et al.* 1985; 1993). The new geochronological deposit model presented here stands in stark contrast to the magnificent scale of Neolithic and Bronze Age monuments that characterise this outstanding prehistoric landscape.

Early Holocene and Neolithic-Bronze Age landscape impacts through soil erosion and subsequent alluviation are detectable in the upper Kennet valley, but only from channel bed deposits and limited soil erosion accumulating as alluvium within localised floodplain depressions. These deposits most probably represent low-level landscape impacts across the Neolithic-Early Bronze Age timeframes. The major alluviation in the valley did not start in earnest until the Late Bronze Age/Early Iron Age and provides palaeo-environmental context for this area. However, its ist a dataset that also provides an explanation for understanding human activity in the periods of prehistory when alluviation was not present or slight as in the Neolithic and Early Bronze Age.

The palaeo-environmental context from the soil and sedimentary records in the upper Kennet valley is clear. The majority of the Avebury landscape was relatively stable and ostensibly open grassland on rendzina soils by the Neolithic period. There is no strong evidence for intensive or extensive landscape disturbance in the sediment record during the construction of long barrows, henges, avenues and enclosures in the Neolithic, nor associated with the construction of barrows in the Early Bronze Age within the Avebury World Heritage landscape. Nonetheless, there were undoubtedly some intense -impacts taking place in the middle and third quarter of the 3rd millennium BC in terms of monument construction which have not left substantial fingerprints in the floodplain alluvial record nor in valley bottom colluvial accumulations. This suggests that these events were spatially localised and relatively not disruptive of the wider landscape, over ill-defined and variable timeframes.

Put simply, large areas of woodland did not need to be cleared with associated soil disturbance in order to facilitate monument construction, although . Nonetheless, structures such as the West Kennet palisade enclosures would have required large areas of woodland to be felled (Whittle 1997, 154), and likewise extensive areas of turf and chalk substrate would have been required for the construction of sites such as Silbury Hill (Leary *et al*. 2013). Nonetheless,; the areas affected by human activities are still relatively localised when considered on a catchment scale. Indeed the insect assemblages in the Late Neolithic levels at Silbury Hill are dominated by open country species of herb-rich, light to medium grazed, well drained, unimproved grassland, and significantly no specific fauna that could be linked to bare to disturbed ground and only 0.5% of the Coleoptera were associated with trees and woodland (Robinson 1997; 2011). In addition, the molluscan assemblages beneath the Early Neolithic long barrows in the Avebury landscape such as West Kennet and in the turf stack beneath Late Neolithic Silbury Hill ostensibly exhibited open grassland on thin rendzina soils succeeding a more shaded environment (Evans 1972, 263–7; Leary *et al*. 2013), with the only clear indication of woodland fauna being present observed in a much earlier subsoil hollow beneath the henge bank of Avebury in Vatcher's excavations (Evans 1972, 268–73); Vatcher & Vatcher 1976). These palaeo-environmental aspects will be developed in the succeeding companion paper to this (French *et al*. forthcoming).

Whilst this evidence provides a landscape context, perhaps this also helps to interpret the remarkable concentration of Neolithic and Bronze Age monuments in the Avebury landscape. It is known that earlier monuments, such as long barrows and cursus monuments, provide a focus for later aggrandisation and monumentalisation, but why are these early Neolithic monuments built within these specific landscapes to start with (cf. Pollard 2012)? Maybe it was the already largely open nature of this landscape, with increased visibility, extensive horizons and sky-scapes that provided an area suitable for both settlement and the construction of monuments, and/or an ancestral or spiritual realm, which were different to other nearby off-chalk plateaux environments? Rather than monuments being constructed within woodland clearings, the more substantially open landscape provided a setting suitable for monument construction with areas of sarsen spreads easily visible. In other words, the monuments did not create the landscape, but the landscape enabled the creation of the monuments. Certainly, several other major chalkland landscapes in southern England that have substantive monumentalisation such as Stonehenge/Durrington Walls, Dorchester and Cranborne Chase also revealed a similar, largely open, grassland aspect to their Neolithic and Bronze Age environments (Smith 1997; French *et al*. 2007; 2012). Moreover, these landscapes may be part of longer term, patchy open landscape trajectories and that may have had greater longevity than hitherto expected (cf. Svenning 2002; Whitehouse & Smith 2010; Robinson 2014).

Ideas of semi-sedentary lives in the early Neolithic and more mobile transhumant lives in the later Neolithic have been postulated (Bradley 1998; Thomas 1999; Leary & Kador 2016). It is also clear that there is a wider reduction of cereal growth in the middle and later Neolithic (Stevens & Fuller 2015). However, is there a signature of small scale horticulture on some of the valley sides in the Neolithic at Avebury? The answer is certainly not on a scale that has caused deposition of either deep or widespread colluvial or alluvial deposits in this landscape. As such, the alluvial archive record represents a landscape of wider sustained stability and only small scale localised disturbance despite a number of Neolithic lithic scatters and spreads seemingly being suggestive of an active and very much lived in landscape. The nature of the alluvial record might not be such a juxtaposition to the monumental record as it first appears. Maybe the archaeological and geoarchaeological records tell the same story. It was a landscape that was certainly visited, used and lived in, but may not have been cultivated in any great intensity during the 4th through to the mid-2nd millennia BC. But to maintain this landscape of ostensibly open grassland, it would have had to have been grazed and managed at a reasonable intensity. For example, dynamic ecosystem modelling of this aspect in the upper Allen valley by Samarasundera (2007, 199–205) has suggested that it could have required as few as 2.5 livestock (ie sheep and cattle) per hectare to keep the downland as grassland and free of woodland regeneration.

Perhaps also, the extent and scale of settlement presence across the region during the Neolithic has been over-estimated by the LwM team, and especially during the latter part of that period. Consequently, this must feed into how to think about the nature of environmental impacts. This is an observation that comes out of the various lithic scatter excavations undertaken during the LwM project. Some, such as the Foot of Avebury Down (FAD) initially looked like they represented a very dense and sustained Neolithic presence, but following analysis of the lithic assemblage, it was clear that much of the flintwork was of probable Middle Bronze Age date (B. Chan, pers. comm.; Pollard *et al*. 2017). There are still Early, Middle and Late Neolithic components that can be drawn out of this site, but they are quite localised and do not constitute a dense and sustained presence. Likewise, on Folly Hill west of Silbury Hill, where there is a 'background' of Early Neolithic lithic material, but much is again of probable Middle Bronze Age date (Pollard *et al.* 2020a). In contrast, sites like the Middle Neolithic occupation on the West Kennet Avenue may be exceptional in terms of representing a more sustained presence (Gillings *et al.* 2015a & b), potentially linked to gathering for the building of the earliest phase settings and earthwork at Avebury.

The one location in the region where settlement is well attested is at the causewayed enclosure on the summit and southern slopes of Windmill Hill (Whittle *et al*. 1999). This may be the principal settlement locale throughout the Neolithic. Although interpretation of the site as a settlement focus might run counter to current views of causewayed enclosures as gathering points for communities and sites of ceremony (through equation with its monumental status) (Bradley 1998; Edmonds 1999; Whittle *et al*. 2011), the material signatures there conform closely to what we should expect of settlement activity at scale (ie large and varied numbers of tools, and, from the enclosure, querns, hearth debris, etc.) (Pollard 2021).

It is also worth expanding our focus outwards, and considering how some of the environmental impacts of both monument building and dwelling might be more distributed, extending in part beyond the region. Accepting a degree of settlement mobility, perhaps more so in the Middle and Late Neolithic, it follows that communities were spending some of their time, seasonally or at greater interval, outside the Avebury region. In the case of monuments, we have Whittle's observation that the straight-grown timbers used in the West Kennet palisades were most likely brought in, perhaps from clay-with-flints areas *c*. 4+ km to the east (Whittle 1997, 154). In this case, the environmental impact of monument construction may have taken place elsewhere. There is also the situation during the Late Neolithic, again with the West Kennet palisade enclosures, where isotope evidence shows a number of the animals consumed at the site were raised off the chalk, some from a great distance (Evans *et al.* 2019; Madgwick *et al.* 2019), and the material record (ie cores likely from East Anglia and granodiorite from the northeast) also supports the idea of people and animals coming in to the region for monument building and ceremony. It may be that the total environmental impact was greater than that seen in the Avebury World Heritage landscape *per se*, being both more temporary and ephemeral (cf. Robinson 2014) and distributed across a range of locations on a wider inter-regional scale.

CONCLUSIONS

The date of human induced alluviation in river valleys across southern England has been shown to vary greatly between localities (Brown *et al*. 2013; Macklin *et al*. 2014). This has been linked more broadly to the archaeological record of wider landscape disturbance within different settings. It is useful to consider the upper Kennet valley in this context, although it is a relatively small catchment in terms of some of the other river systems that have been studied, but has truly massive scale Neolithic and Early Bronze Age monuments. However, although alluviation is definable from the Neolithic, it is unexpectedly small scale and localised. It is in the Late Bronze Age–Early Iron Age that alluviation accelerates. In the upper Kennet valley and several other areas of the chalk downlands of southern England, it appears that the scale of Neolithic monumentalisation was not necessarily related to extensive and/or intensive landscape impacts. Rivers such as the Kennet flowing through the Avebury monumental landscape record little Neolithic and Bronze Age anthropogenic alluviation. Similarly in the upper Allen valley on Cranborne Chase, colluviation and alluviation occurred much later, mainly from post-Roman times (French *et al.* 2007), and in later prehistoric (Iron Age) times in the Avon valley between Durrington Walls and Stonehenge (French *et al*. 2012). Moreover, in these chalk downland cases, soil erosion, colluviation and alluviation were all relatively low level in intensity and extent. As such, it is perhaps time to re-appraise scenarios of post-glacial woodland development and Neolithic clearance, ceremonial and agricultural impacts; themes which will be further developed in the succeeding paper (French *et al*. forthcoming).

This record can be contrasted to many other river valleys in England. For example in the River Lugg (Worcestershire) valley, large Neolithic monuments are not common but alluviation is clearly visible from the Late Neolithic/Early Beaker period, such as at Wellington Quarry (Carey *et al*. 2017). On the River Frome in Herefordshire, large scale alluviation occurred from the Beaker period/Early Bronze Age (*c*. 2500 BC) onwards (Brown *et al*. 2009), although the landscape only contains a smattering of known small Neolithic monuments. On the confluence of the Trent-Soar in Nottinghamshire, alluviation starts from the later Neolithic/Early Bronze Age (Knight & Howard 2004). Conversely, other localities with extensive Neolithic and Early Bronze archaeological records appear to sometimes record earlier and greater volumes of anthropogenically induced alluviation such as in the lower river valleys of the Cambridgeshire fen-edge (French 1990; 2003).

Whilst different river catchments and reaches will have nuances in their colluvial and alluvial histories, it is possible that the seemingly low levels of alluvial sedimentation associated with several major monumentalised landscapes on the chalk downlands of southern England might also be an explanatory force for their construction and use through the Neolithic and Bronze Age. It is postulated here that landscapes such as the upper Kennet around Avebury are exceptional, just as those investigated in the Avon valley around Durrington Walls (French *et al*. 2012; Parker Pearson *et al.* 2020; 2022) and the upper Allen valley of Cranborne Chase (French *et al*. 2007). They were all relatively open and stable by the Neolithic, in a sense pre-adapted to the construction of big monuments of ceremony and death as well as everyday living. It was a landscape of a very different kind of everyday – with varying intensities of activity (as attested by monuments and lithic scatters), some of which involved the felling of hectares of mature forest for monument construction from elsewhere beyond the upper Kennet catchment and/or the 'skinning' of hectares of grassland for turf. Yet whilst these activities might have been locally intense and are interpreted as visible minor components within the alluvial sediment archives, it is human activity from the Mid–Late Bronze Age onwards that describes wider level landscape disturbance and alluviation across the upper Kennet valley.

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# TABLES

| *Zone* | *Transect Number* | *Boreholes* | *Rationale* |
|---|---|---|---|
| Zone A | Transect 44 | 331-341 | Investigate deposits from Windmill Hill to floodplain |
| | | | |
| Zone B | Transect 1000 | 291-288, 251-253 | Investigate alluvial sequences in Zone B, adjacent to Avebury henge |
| | Transect 30 | 242-246 | Investigate alluvial sequences in Zone B, adjacent to Avebury henge |
| | Transect 1 | 101-117 | Investigate colluvial sequences in Zone B |
| | | | |
| Zone C | Transect 50 | 380, 381, 383-386 | Investigate colluvial sequences in Zone C, Waden Hill |
| | Transect 65 | 373-376 | Investigate alluvial sequences in Zone C, adjacent to Silbury Hill |
| | Transect 47 | 368-372 | Investigate alluvial sequences in Zone C, adjacent to Silbury Hill |
| | Transect 7 | 150-154 | Investigate colluvial and alluvial sequences in valley to the east of Waden Hill |
| | | | |
| Zone D | Transect 54 | 405-409, 411-413 | Investigate the colluvial and alluvial sequences in Zone D, adjacent to the Palisaded Enclosures |
| | Transect 59 | 438, 440-443 | Investigate alluvial sequences in Zone D |
| | Transect 15 | 183, 182, PEC5a, 191, 180, 429 | Investigate alluvial sequences in Zone D, downstream of the Palisaded Enclosures |
| | | | |
| Zone E | Transect 62 | 444-447 | Investigate alluvial and colluvial sequences at Zone E, North Farm and adjacent floodplain, with TP1 and TP2 excavated on the transect |
| | Transect 63 | 472-474, 449, 448, 450, 454, 451, 453, 452 | Investigate alluvial and colluvial sequences at Zone E, North Farm and adjacent floodplain |

Table 1: Transects and boreholes used for the analysis of the alluvial zones A-E

| *Zone* | *Test pit (TP) Excavation (Tr) Borehole (BH)* | *Sampled for* | *Overview* |
|---|---|---|---|
| **A** North of Avebury henge | TP3 (Winterborne North) | Soils (TS), Mollusca | Upper Kennet floodplain, west of Avebury: brown silty clay loam; buried soil/old land surface, 33-42cm, developed on chalky flint |
| **A** North of Avebury henge | TP4 (Winterborne North) | Soils (TS) | Upper Kennet floodplain, west of Avebury: orangey brown silty clay loam; buried soil/old land surface, 48-58cm, developed on chalky silt |
| **B** North of Avebury henge | TP1 (Winterborne South) | Soils (TS) | Kennet floodplain, southwest of Avebury: orangey brown silty clay loam; buried soil beneath alluvium, 143-153cm, developed on weathered chalk |
| **B** Avebury Henge | Butler's Field TP3 | | Kennet floodplain, west of Avebury: 74cm of silty clay alluvium over a buried soil |
| **B** Avebury Henge | Butler's Field TP8 | | Kennet floodplain, west of Avebury: 95cm of silty clay alluvium over a buried soil |
| **B** Avebury Henge | Butler's Field: Tr 1 | | Kennet floodplain, west of Avebury: 62cm of silty clay alluvium over a rubble bank sealing a buried soil |
| **B** Avebury Henge | Butler's Field: Tr 2 | Sediments OSL | Kennet floodplain, west of Avebury henge. 116cm of alluvium over a buried soil |
| **B** Avebury Henge | Butler's Field: Tr 3 | Soils (TS) | Kennet floodplain, west of Avebury: 106cm of silty clay alluvium over a buried soil |
| **B** Avebury Henge | Butler's Field: Tr 5 | Sediments, Soils (TS) Mollusca, OSL | Kennet floodplain, southwest of Avebury: 104cm of silty clay alluvium and 133cm of calcitic silt palaeo-channel deposits |
| **B** Avebury Henge | BH251: | Soils (TS) | Kennet floodplain, southwest of Avebury: 104cm of silty clay alluvium and 133cm of calcitic silt palaeo-channel deposits |
| **C** Waden and Silbury Hill | BH375: Between A361 & Silbury Hill | | Kennet floodplain, southwest of Avebury: 84cm of silty clay alluvium and 29cm of calcitic silt palaeo-channel deposits |
| **C** Waden and Silbury Hill | BH223: South of Silbury Hill | Mollusca | Kennet floodplain, south of Silbury Hill and north of Swallowhead Springs: 60cm of silty clay alluvium and 225+cm of calcitic silt palaeo-channel deposits |
| **D** Timber Palisades | PEC5 East Kennett floodplain | Sediments | Alluvial floodplain sequence (104cm) over weakly preserved palaeosol |
| **E** North Farm | North Farm TP1 | Soils, Sediments, Mollusca, OSL | Kennet floodplain in Narrow Meadow, North Farm, West Overton: *c*. 50cm of alluvium and 30cm of hillwash over a buried soil |
| **E** North Farm | North Farm TP2 | Soils, Sediments, Mollusca, OSL | Kennet floodplain in Narrow Meadow, North Farm, West Overton: *c*. 80cm of alluvium over 250cm of palaeo-channel fill deposits |

Table 2: Valley zones, with the trench, test pit and borehole numbers selected for further analyses: soil thin section (TS), sediments, mollusca and OSL) and field descriptions from the upper Kennet floodplain area in the LwM project

| *Trench* | *Field Code* | *Lab Code* | *Total $D_r$ ($Gy.ka^{-1}$)* | *$D_e$ (Gy)* | *Age (ka)* | *Date* |
|---|---|---|---|---|---|---|
| Butler's Field Tr 2 | ABRY08 | GL18004 | 1.01 ± 0.07 | 2.1 ± 0.1 | *2.0 ± 0.2 (0.2)* | *210 BC – AD 150* |
| | ABRY07 | GL18003 | 1.60 ± 0.10 | 4.0 ± 0.2 | 2.5 ± 0.2 (0.2) | 690 BC – 310 BC |
| Butler's Field Tr 5 | ABRY06 | GL18075 | 0.81 ± 0.06 | 2.1 ± 0.1 | 2.6 ± 0.2 (0.2) | 820 BC – 410 BC |
| | ABRY05 | GL18002 | 0.72 ± 0.05 | 4.3 ± 0.2 | 6.0 ± 0.5 (0.4) | 4420 BC – 3460 BC |
| | ABRY04 | GL18074 | 0.85 ± 0.06 | 5.1 ± 0.2 | 6.0 ± 0.5 (0.4) | 4550 BC – 3550 BC |
| | ABRY02 | GL18073 | 0.75 ± 0.05 | 7.0 ± 0.2 | 9.4 ± 0.7 (0.6) | 8080 BC – 6610 BC |
| | ABRY01 | GL18001 | 0.59 ± 0.04 | 8.8 ± 0.3 | 15.0 ± 1.3 (1.1) | 14,270 BC – 11,730 BC |
| North Farm Test Pit 2 | ABRY18 | GL19052 | 1.79 ± 0.10 | 1.2 ± 0.0 | 0.66 ± 0.05 (0.04) | AD 1320 – AD 1410 |
| | ABRY16 | GL19051 | 1.09 ± 0.07 | 1.6 ± 0.1 | 1.5 ± 0.1 (0.1) | AD 400 – AD 620 |
| | ABRY15 | GL19050 | 1.07 ± 0.07 | 2.1 ± 0.1 | 2.0 ± 0.1 (0.1) | 130 BC – AD 170 |
| | ABRY10 | GL19049 | 0.66 ± 0.05 | 3.7 ± 0.1 | 5.7 ± 0.5 (0.4) | 4090 BC – 3180 BC |
| North Farm Test Pit 1 | ABRY22 | GL19055 | 2.38 ± 0.13 | 1.6 ± 0.1 | 0.68 ± 0.04 (0.04) | AD 1300 – AD 1390 |
| | ABRY20 | GL19054 | 2.36 ± 0.12 | 4.9 ± 0.2 | 2.1 ± 0.1 (0.1) | 200 BC – AD 60 |
| | ABRY19 | GL19053 | 2.24 ± 0.13 | 5.4 ± 0.2 | 2.4 ± 0.2 (0.1) | 550 BC – 220 BC |
| | ABRY13 | GL21113 | 0.92 ± 0.06 | 2.9 ± 0.1 | *3.1 ± 0.2 (0.2)* | *1330 BC – 870 BC* |



Table 3: OSL dates for Trenches 2 and 5 in Butler's Field and North Farm Test Pits 1 and 2. Dose Rate ($D_r$), Equivalent Dose ($D_e$) and Age data of OSL samples. $D_r$ values are based on Gamma Spectrometry (*in situ* NaI and *ex situ* Ge), dose rate conversion factors (Adamiec & Aitken 1998), grain size (Mejdahl 1979), burial moisture content (Zimmerman 1971; assumed synonymous with present moisture content), depth, site surface altitude and a geomagnetic latitude of 51°N (Prescott & Hutton 1991). $D_e$ values are based on conventional multi-grain, single-aliquot regenerative-dose (SAR) OSL measurements of fine silt quartz (Murray & Wintle 2000; 2003; Berger *et al*. 1980). Age estimates are based on the Central Age Model (Galbraith *et al*. 1999) and expressed relative to year of sampling (2018). Uncertainties in age are quoted at 1σ confidence, are based on analytical errors and reflect

combined systematic and experimental variability and (in parenthesis) experimental variability alone. Note: italicised age estimates are accompanied by significant U disequilibrium (Olley *et al*. 1996), so are tentative only

| *Sample area* | *Micromorphological features* | *Interpretation* | *Wider implications & relative dating* |
|---|---|---|---|
| Avebury henge (east of Zones A & B) | a *c.* 20-30 cm thick horizon of pale brown to yellowish/reddish brown silt loam beneath the turf, over a strong reddish brown silty clay loam with few fine chalk and flint gravel pebbles, all developed on weathered chalk | argillic buried soils with a loessic component on clay-with-flints geology to the east and southeast of the henge; rendzinas to the north, south and west | long-lived, stable, well vegetated (and wooded) conditions in places; but mainly grassland elsewhere; argillic brown earths present on the eastern side of the henge |
| Winterborne Northwest (Zone A) | (n/a) | this Oslip stream western fork of the upper Kennet is more of a low-lying spring-fed zone than a floodplain valley *per se* with often waterlogged rendzina pasture soils | natural spring-fed wet zone with no alluvial accumulation throughout |
| Winterborne North (Spring Field) & South in Kennet floodplain (Zone B) | brown, very fine sandy/silty clay loam exhibiting an irregular small blocky ped structure with few to common chalk and flint gravel pebbles, becoming more calcitic with depth, over a well structured golden brown, fine sandy/silty clay loam buried soil with illuvial well oriented dusty and occasional pure clays | *c.* 35-50 cm of silty clay alluvium, increasingly calcitic, over a thin, probably truncated, moderately well developed argillic (clay-enriched) brown earth soils on the western margin of the floodplain, grading to rendzinas beyond the western floodplain edge | reasonable floodplain margin stability and absence of significant alluvial aggradation probably until Roman or later times |
| Butler's Field in Kennet | up to a *c.* 2.5 m sequence depth of well structured | as above for the floodplain margin soil, but subject to | most of floodplain area affected by water ponding |

| | | | |
|---|---|---|---|
| floodplain (Zone B) | dark greyish brown silty clay upper alluvium ('Arion clay') over a basal alluvium of pale grey/yellowish brown very fine sandy silt with fine shell fragments over either a buried soil of poorly developed greyish brown silt loam with few fine charcoal, chalk and flint fragments, or over grey calcitic silts infilling a palaeo-channel | both calcitic silt (from *c*. 4400 BC) and silty clay (from after *c*. 690-310 BC) alluvial aggradation accumulating in interlinked small basins; as the slope rises westwards and eastwards, rendzinas prevail | from Neolithic times; from Iron Age and Roman times subject to silty clay alluvial aggradation; from late 16$^{th}$ century most of the area was made into fishing ponds |
| Silbury Hill, Swallowhead Springs & Kennet floodplain to West Kennett Farm (Zone D) | thin dark brown silty clay alluvium over either a thin, poorly developed sandy loam buried soil or shallow calcitic silt fills of a palaeo-channel | sharp-angled river channel, with much avulsion only north of Swallowhead Springs, subject to both calcitic silt and silty clay alluvial aggradation; thin brown earth soils on the southeastern flank of Silbury Hill and probably also where the West Kennet palisaded enclosures were built, which had already largely degraded to rendzinas before the later 4$^{th}$ millennium BC when the palisaded enclosures were probably built | essentially one main channel occupying the whole width of the floodplain, with aggradation from later prehistoric and Roman/post-Roman times; defined by terrace on southern flank and rising ground to north; abrupt transition to rendzina soils to south, but more mixed rendzina to brown earths on the north and south banks beyond on the floodplain margins and foot of downland slopes |
| Floodplain from West Kennett Farm east to West Overton (Zones D & E) | well structured dark brown silty clay alluvium over a greyish brown calcitc silt with few very fine chalk fragments over brown sandy/silt loam buried soil | loessic-like brown earth development on the north bank, probably disturbed by human activities; buried at *c*. 1400 BC by rubbly calcitic hillwash from the downland slopes immediately to the east, and then silty clay loam | whole floodplain subject to both calcitic silt and silty clay alluvial aggradation through later prehistoric and historic times, respectively, with occasional small lobate zones of chalky hillwash |

| | | | |
|---|---|---|---|
| | | eroded soil aggrading as alluvium from Roman times onwards | accumulation on the northern margins of the floodplain |
| Floodplain in the Fyfield to Clatford area (east of Zone E) | shallowing dark brown silty clay alluvium over thin, brown sandy/silt loam with chalk rubble soils | west to Fyfield area as above, but by Clatford floodplain area almost no alluvial aggradation is evident | changes to wide, shallow, active floodplain with minimal alluvial aggradation, associated with rendzina soils on its northern slopes |

Table 4: Summary descriptions, interpretations and wider implications of the soil micromorphological data from the upper Kennet valley

| *Period of alluviation* | *OSL dates* | *Alluvial sediment* | *Sequence* | *Alluvial zone* | *Overview interpretation* |
|---|---|---|---|---|---|
| Late Pleistocene | 14,270-11,730 BC | (501) | Trench 5 | Zone B | **Natural fluvial deposition** in Pleistocene topographic low point depressions within channel.<br>No definable anthropogenic impact within the valley. |
| | | (107 | North Farm TP2 | Zone E | |
| | | | | | |
| Early Holocene (pre-Neolithic) | 8080-6610 BC | (502) | Trench 5 | Zone B | **Natural fluvial deposition** in Pleistocene topographic low point depressions within channel.<br>No definable anthropogenic impact within the valley. |
| | | (106) | North Farm TP2 | Zone E | |
| | | | | | |
| Neolithic – Middle Bronze Age | 4550-3550 BC & 4420-3460 BC | (503) | Trench 5 | Zone B | **Transitional.** Within channel deposition predominated with minor anthropogenic minerogenic alluviation signal, which slowly increased.<br>Slight and small scale landscape impacts detectable. |
| | 4090-3180 BC | (105) | North Farm TP2 | Zone E | |
| | | | | | |
| Late Bronze Age, Iron Age & Early Roman | 820-410 BC | (504) (lower) | Trench 5 | Zone B | **Anthropogenically driven alluviation** dominant, defining increased and widespread land surface disturbance on the valley sides.<br>Aggradation of the valley floor with minerogenic silt rich alluvium began to constrain the channel system.<br>Alluvium buried the previous extant land-surfaces (palaeosols) on the valley floor. |
| | 690-310 BC | (639) | Trench 2 | Zone B | |
| | | (PE6) | PEC5a | Zone D | |
| | | (PE5) | PEC5a | Zone D | |
| | 1330-870 BC (with caveat) to 130 BC – AD 170 | (104) | North Farm TP2 | Zone E | |
| | 550 BC – 220 BC to 200 BC – AD 60 | (112) | North Farm TP1 | Zone E | |
| | | | | | |
| Roman – Medieval | | (504) Upper | Trench 5 | Zone B | **Anthropogenically driven alluviation** continued.<br>Decrease in overall particle size defining a fluvial regime of decreasing energy, with increased infilling of the floodplain with minerogenic silty clay alluvium.<br>Extensive evidence for medieval activity on and adjacent to the floodplain causing anthropogenic additions to the medieval soil complex. |
| | 210 BC – AD 150 (with caveat) | (638) | Trench 2 | Zone B | |
| | | (311) | Trench 2 | Zone B | |
| | | (PE4) | PEC5a | Zone D | |
| | | (PE3) | PEC5a | Zone D | |
| | AD 400-620 | (103) | North Farm TP2 | Zone E | |
| | after 200 BC – AD 60 & | (111) | North Farm TP1 | Zone E | |

| | | | | | |
|---|---|---|---|---|---|
| | before AD 1300-1390 | | | | |
| | | | | | |
| Late Medieval - Post Medieval | | (505) | Trench 5 | Zone B | **Anthropogenically driven alluviation** continued. Continued decrease in overall particle size, defining a reduction in fluvial energy. Valley floor increasingly infilled with anthropogenic derived minerogenic humic silty clay alluvium, constraining the river to a single thread, relatively deep and narrow channel. **Anthropogenic modification of river channel and floodplain** (eg, fishponds) |
| | | (641) | Trench 2 | Zone B | |
| | | (PE2) | PEC5a | Zone D | |
| | AD 1320-1410 | (102) | North Farm TP2 | Zone E | |
| | AD 1300-1390 | (110) | North Farm TP1 | Zone E | |

Table 5: A summary chronostratigraphic model for the Upper Kennet Valley

Supplementary Information Appendix TABLES

| *Units* | *Description* |
|---|---|
| | |
| 1 | Modern turf/topsoil |
| 2 | Blocky structured, dark greyish brown silty clay loam; alluvium ('Arion clay') |
| 3 | Pale dark greyish brown silty clay loam with frequent chalk fragments; hillwash derived alluvium |
| 4 | Pale grey sandy/silt loam with few fine chalk and shell fragments; alluvium |
| 5 | Weathered chalk substrate; C |
| 6 | Dark brown silt loam with even mix of flint gravel; buried soil of Bw/B/C |
| 7 | Brown calcitic silt with even mix of chalk fragments; B/C |
| 8 | Pale whitish brown calcitic silt loam and chalk fragments; hillwash |
| 9 | Pale yellowish brown silty clay loam with fine chalk fragments; hillwash |
| 10 | Greyish brown silt loam with few fine charcoal, chalk and flint fragments; buried soil of Bw |
| 11 | Orangey brown, very fine sandy/coarse silt loam with few fine flint pebbles, becoming orange mottled with depth; probably decalcified Bw/t horizon |
| 12 | Very dark brown silt loam with common chalk fragments; mix of 'medieval soil' of Evans (1985) and alluvium |
| 13 | Mix of pale grey silt loam and pea-grit fine chalk gravel; hillwash on channel bed |
| 14 | Chalk pebble silt; periglacial deposit |
| 15 | Reddish brown silty clay loam with flint gravel; upper B horizon in colluvium |
| 16 | Pale greyish white calcitic silt with very abundant pea-grit and very abundant fine chalk fragments (<1 cm); thin/discontinuous slightly humic lens at 1.54-1.55 m; periglacial B/C |
| 17 | Orangey brown silt loam with few fine chalk pebbles (<1 cm); hillwash |
| 18 | Greyish brown silty clay loam with common fine chalk pebbles (<1 cm); hillwash |
| 19 | Compacted flint gravel (<5 cm) |
| 20 | Medium brown silt loam with chalk fragments; B horizon with hillwash |
| 21 | Dark brown silty clay loam with few micro-charcoal and pottery fragments; alluvium with soil stabilisation horizon |

Table S1: Macro-stratigraphic units key for the cross-correlating the borehole profiles

| Trench | Field Code | Lab Code | Overburden (m) | Grain size ($\mu m$) | Moisture content (%) | NaI $\gamma$-spectrometry (in situ) $\gamma$ $D_r$ ($Gy.ka^{-1}$) | Ge $\gamma$-spectrometry (ex situ) | | | $\alpha$ $D_r$ ($Gy.ka^{-1}$) | $\beta$ $D_r$ ($Gy.ka^{-1}$) | $^{226}Ra/^{238}U$ | Cosmic $D_r$ ($Gy.ka^{-1}$) | Preheat (°C for 10s) | Low Dose Repeat Ratio | High Dose Repeat Ratio | Post-IR OSL Ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | K (%) | Th (ppm) | U (ppm) | | | | | | | | |
| Butler's Field Tr 2 | ABRY08 | GL18004 | 1.06 | 5-15 | 25 ± 6 | 0.28 ± 0.03 | 0.49 ± 0.05 | 3.83 ± 0.37 | 0.73 ± 0.10 | 0.13 ± 0.02 | 0.42 ± 0.06 | 2.13 ± 0.67 | 0.18 ± 0.02 | 260 | 0.97 ± 0.09 | 1.01 ± 0.05 | 0.95 ± 0.09 |
| | ABRY07 | GL18003 | 1.25 | 5-15 | 23 ± 6 | 0.49 ± 0.05 | 0.73 ± 0.06 | 6.79 ± 0.47 | 1.37 ± 0.13 | 0.25 ± 0.03 | 0.69 ± 0.08 | 1.50 ± 0.25 | 0.17 ± 0.02 | 240 | 1.03 ± 0.06 | 0.99 ± 0.04 | 1.01 ± 0.06 |
| Butler's Field Tr 5 | ABRY06 | GL18075 | 1.56 | 5-15 | 23 ± 6 | 0.22 ± 0.03 | 0.30 ± 0.05 | 3.22 ± 0.33 | 0.67 ± 0.11 | 0.12 ± 0.02 | 0.30 ± 0.04 | 1.02 ± 0.32 | 0.17 ± 0.02 | 220 | 1.01 ± 0.03 | 0.98 ± 0.02 | 0.97 ± 0.03 |
| | ABRY05 | GL18002 | 1.74 | 5-15 | 23 ± 6 | 0.19 ± 0.02 | 0.6 ± 0.05 | 2.82 ± 0.32 | 0.53 ± 0.09 | 0.10 ± 0.02 | 0.27 ± 0.04 | 1.40 ± 0.32 | 0.16 ± 0.02 | 260 | 1.00 ± 0.05 | 0.96 ± 0.03 | 1.00 ± 0.05 |
| | ABRY04 | GL18074 | 1.91 | 5-15 | 23 ± 6 | 023 ± 0.03 | 0.40 ± 0.05 | 2.75 ± 0.35 | 0.68 ± 0.11 | 0.11 ± 0.02 | 0.36 ± 0.05 | 1.50 ± 0.45 | 0.16 ± 0.01 | 220 | 0.98 ± 0.02 | 0.99 ± 0.01 | 0.98 ± 0.02 |
| | ABRY02 | GL18073 | 2.22 | 5-15 | 22 ± 6 | 0.20 ± 0.02 | 0.32 ± 0.05 | 2.23 ± 0.32 | 0.69 ± 0.09 | 0.10 ± 0.02 | 0.31 ± 0.04 | 1.16 ± 0.38 | 0.15 ± 0.01 | 220 | 0.99 ± 0.02 | 1.01 ± 0.02 | 0.98 ± 0.02 |
| | ABRY01 | GL18001 | 2.36 | 5-15 | 22 ± 5 | 0.15 ± 0.02 | 0.23 ± 0.04 | 1.61 ± 0.32 | 0.51 ± 0.09 | 0.07 ± 0.01 | 0.22 ± 0.04 | 1.16 ± 0.31 | 0.14 ± 0.01 | 280 | 0.95 ± 0.05 | 0.99 ± 0.04 | 0.96 ± 0.05 |
| North Farm Test Pit 2 | ABRY18 | GL19052 | 0.40 | 5-15 | 19 ± 5 | 0.55 ± 0.05 | 0.78 ± 0.07 | 7.51 ± 0.49 | 1.23 ± 0.12 | 0.27 ± 0.03 | 0.78 ± 0.08 | 1.00 ± 0.16 | 0.20 ± 0.02 | 220 | 1.01 ± 0.08 | 0.99 ± 0.05 | 0.99 ± 0.08 |
| | ABRY16 | GL19051 | 0.62 | 5-15 | 19 ± 5 | 0.30 ± 0.03 | 0.49 ± 0.05 | 3.96 ± 0.37 | 0.64 ± 0.11 | 0.14 ± 0.02 | 0.45 ± 0.05 | 1.25 ± 0.25 | 0.19 ± 0.02 | 220 | 0.98 ± 0.05 | 0.99 ± 0.04 | 0.98 ± 0.05 |
| | ABRY15 | GL19050 | 0.78 | 5-15 | 21 ± 5 | 0.31 ± 0.03 | 0.42 ± 0.05 | 4.66 ± 0.38 | 0.68 ± 0.09 | 0.16 ± 0.02 | 0.42 ± 0.05 | 1.39 ± 0.27 | 0.19 ± 0.02 | 240 | 0.99 ± 0.06 | 1.01 ± 0.04 | 1.02 ± 0.06 |
| | ABRY10 | GL19049 | 1.18 | 5-15 | 23 ± 6 | 0.17 ± 0.02 | 0.24 ± 0.04 | 2.33 ± 0.32 | 0.47 ± 0.10 | 0.08 ± 0.01 | 0.23 ± 0.04 | 1.12 ± 0.32 | 0.18 ± 0.02 | 220 | 0.97 ± 0.04 | 1.01 ± 0.04 | 0.97 ± 0.04 |
| North Farm Test Pit 1 | ABRY22 | GL19055 | 0.32 | 5-15 | 17 ± 4 | 0.75 ± 0.06 | 0.98 ± 0.08 | 9.88 ± 0.59 | 1.91 ± 0.14 | 0.39 ± 0.04 | 1.04 ± 0.10 | 1.20 ± 0.14 | 0.20 ± 0.02 | 240 | 1.02 ± 0.06 | 0.98 ± 0.04 | 1.00 ± 0.06 |
| | ABRY20 | GL19054 | 0.65 | 5-15 | 16 ± 4 | 0.74 ± 0.06 | 0.97 ± 0.08 | 9.39 ± 0.57 | 1.94 ± 0.14 | 0.38 ± 0.04 | 1.04 ± 0.10 | 1.32 ± 0.17 | 0.19 ± 0.02 | 220 | 0.99 ± 0.04 | 1.01 ± 0.03 | 0.98 ± 0.04 |
| | ABRY19 | GL19053 | 0.80 | 5-15 | 20 ± 5 | 0.70 ± 0.06 | 0.99 ± 0.08 | 9.00 ± 0.57 | 1.95 ± 0.14 | 0.36 ± 0.04 | 1.00 ± 0.10 | 1.48 ± 0.22 | 0.19 ± 0.02 | 240 | 1.00 ± 0.04 | 1.00 ± 0.04 | 0.99 ± 0.04 |
| | ABRY13 | GL21113 | 0.95 | 5-15 | 16 ± 4 | 0.26 ± 0.03 | 0.28 ± 0.06 | 4.02 ± 0.36 | 0.57 ± 0.10 | 0.14 ± 0.02 | 0.33 ± 0.05 | 2.18 ± 0.74 | 0.18 ± 0.02 | 240 | 1.02 ± 0.03 | 1.01 ± 0.03 | 1.02 ± 0.04 |



Table S2: Dose Rate ($D_r$), Equivalent Dose ($D_e$) and Age data of OSL samples. $D_r$ values are based on Gamma Spectrometry (*in situ* NaI and *ex situ* Ge), dose rate conversion factors (Adamiec & Aitken 1998), grain size (Mejdahl 1979), burial moisture content (Zimmerman 1971; assumed synonymous with present moisture content), depth, site surface altitude and a geomagnetic latitude of 51°N (Prescott & Hutton 1991). $D_e$ values are based on conventional multi-grain, single-aliquot regenerative-dose (SAR) OSL measurements of fine silt quartz (Murray & Wintle 2000; 2003; Berger *et al*. 1980). Age estimates are based on the Central Age Model (Galbraith *et al*. 1999) and expressed relative to year of sampling (2018). Uncertainties in age are quoted at 1σ confidence, are based on analytical errors and reflect combined systematic and experimental variability and (in parenthesis) experimental variability alone. The dates in black indicate samples with accepted age estimates; the date in italics indicates an age estimate with analytical caveats (GL18004: significant U disequilibrium; Olley *et al*. 1996)

| Context | | Clay (%) | Very fine silt (%) | Fine silt (%) | Medium silt (%) | Coarse silt (%) | Very fine sand (%) | Fine sand (%) | Medium sand (%) | Coarse sand (%) | Organic content (%) | Carbonate content (%) | Magnetic susceptibility |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 501 | Mean | 24.26 | 12.69 | 9.87 | 10.19 | 16.8 | 14.01 | 4.67 | 3.44 | 3.33 | 1.17 | 33.63 | 0.000000028055 |
| | Min | 18.99 | 8.81 | 7.99 | 7.55 | 12.28 | 8.56 | 1.57 | 0.18 | 0.00 | 0.82 | 24.44 | 0.0000000087 |
| | Max | 32.95 | 18.57 | 12.95 | 12.81 | 19.59 | 18.76 | 9.04 | 8.62 | 9.94 | 1.73 | 36.61 | 0.000000118 |
| 502 | Mean | 22.32 | 10.90 | 10.93 | 11.58 | 13.56 | 11.10 | 5.57 | 6.28 | 6.34 | 1.74 | 31.08 | 0.000000031207143 |
| | Min | 15.85 | 7.94 | 7.95 | 8.23 | 10.13 | 6.65 | 2.84 | 1.32 | 0.13 | 1.28 | 24.14 | 0.0000000176 |
| | Max | 30.07 | 14.49 | 15.33 | 15.19 | 19.70 | 16.38 | 8.76 | 12.95 | 14.07 | 2.12 | 34.67 | 0.0000000931 |
| 503 | Mean | 14.08 | 11.21 | 14.89 | 18.34 | 19.51 | 11.14 | 3.09 | 2.95 | 3.45 | 1.74 | 28.99 | 0.000000044935 |
| | Min | 8.79 | 7.76 | 10.97 | 14.92 | 14.77 | 7.86 | 1.01 | 0.20 | 0.73 | 1.49 | 23.14 | 0.0000000307 |
| | Max | 21.10 | 14.21 | 16.35 | 22.70 | 24.07 | 17.51 | 6.05 | 5.21 | 8.96 | 2.097 | 31.76 | 0.0000000538 |
| 504 | Mean | 12.63 | 11.923 | 18.69 | 25.61 | 21.71 | 7.09 | 0.64 | 0.69 | 0.76 | 1.98 | 28.13 | 0.000000042031148 |
| | Min | 9.00 | 8.08 | 11.97 | 16.25 | 17.83 | 2.05 | 0 | 0 | 0 | 1.30 | 21.02 | 0.0000000262 |
| | Max | 14.60 | 14.55 | 22.38 | 29.47 | 24.53 | 14.31 | 4.88 | 4.43 | 6.84 | 2.86 | 32.45 | 0.0000000947 |
| 505 | Mean | 18.02 | 19.52 | 22.76 | 21.61 | 14.15 | 3.47 | 0.14 | 0.13 | 0.14 | 4.08 | 9.25 | 0.000000092912676 |
| | Min | 12.52 | 12.01 | 17.52 | 16.90 | 9.30 | 1.23 | 0 | 0 | 0 | 2.17 | 1.43 | 0.000000035600000 |
| | Max | 23.22 | 22.93 | 26.07 | 27.35 | 22.57 | 8.02 | 2.84 | 3.78 | 2.70 | 5.91 | 23.25 | 0.000000156000000 |

Table S3: Sediment characterisation data from Butler's Field Trench 5, Zone B

| *Context* | | *Clay (%)* | *Very fine silt (%)* | *Fine silt (%)* | *Medium silt (%)* | *Coarse silt (%)* | *Very fine sand (%)* | *Fine sand (%)* | *Medium sand (%)* | *Coarse sand (%)* | *Organic content (%)* | *Carbonate content (%)* | *Magnetic Susceptibility* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 641 | Mean | 23.27 | 21.07 | 20.93 | 17.15 | 11.33 | 4.05 | 1.00 | 0.567 | 0.47 | 6.00 | 10.72 | 0.00000037028 |
| | Min | 20.21 | 18.17 | 19.72 | 15.40 | 8.72 | 2.48 | 0.56 | 0.19 | 0 | 5.32 | 6.59 | 0.0000001974 |
| | Max | 25.61 | 23.87 | 24.00 | 18.88 | 13.99 | 5.71 | 1.51 | 1.07 | 1.25 | 6.88 | 15.87 | 0.0000006833 |
| 311 | Mean | 16.13 | 13.91 | 17.31 | 21.57 | 20.22 | 8.25 | 1.46 | 0.68 | 0.40 | 4.80 | 19.83 | 0.000000432315789 |
| | Min | 14.17 | 11.36 | 15.24 | 18.92 | 14.53 | 5.14 | 0.25 | 0 | 0 | 3.91 | 17.12 | 0.0000002911 |
| | Max | 20.90 | 18.38 | 21.40 | 23.14 | 24.13 | 10.43 | 3.02 | 1.71 | 1.38 | 5.47 | 22.76 | 0.0000007606 |
| 311a | Mean | 14.73 | 12.30 | 16.35 | 23.12 | 22.62 | 8.77 | 1.10 | 0.51 | 0.36 | 3.86 | 21.91 | 0.000000181283333 |
| | Min | 14.11 | 11.93 | 15.73 | 22.39 | 21.79 | 7.56 | 0.78 | 0.04 | 0 | 3.53 | 18.69 | 0.0000001635 |
| | Max | 15.20 | 13.11 | 17.40 | 23.90 | 23.49 | 9.98 | 1.43 | 1.44 | 1.29 | 4.53 | 23.06 | 0.0000002171 |
| 638 | Mean | 12.60 | 10.73 | 16.36 | 25.36 | 24.57 | 8.93 | 0.68 | 0.30 | 0.35 | 2.64 | 25.49 | 0.0000000856975 |
| | Min | 10.95 | 9.31 | 14.61 | 23.17 | 21.64 | 4.05 | 0 | 0 | 0 | 1.80 | 20.25 | 0.0000000515 |
| | Max | 16.11 | 12.99 | 19.03 | 29.72 | 28.16 | 10.61 | 1.59 | 1.48 | 1.68 | 3.53 | 28.92 | 0.0000001716 |
| 639 | Mean | 17.34 | 14.19 | 16.69 | 22.14 | 20.66 | 7.20 | 0.60 | 0.41 | 0.38 | 3.51 | 12.65 | 0.000000104088889 |
| | Min | 12.48 | 10.43 | 14.96 | 19.37 | 18.29 | 5.01 | 0.04 | 0 | 0 | 2.44 | 5.19 | 0.0000000666 |
| | Max | 21.99 | 17.12 | 18.14 | 24.46 | 23.38 | 10.04 | 1.58 | 1.66 | 1.82 | 4.19 | 23.37 | 0.0000001619 |

Table S4: Sediment characterisation data from Butler's Field Trench 2, Zone B

| Context | | Clay % | Very fine silt (%) | Fine silt % | Medium silt (%) | Coarse silt % | Very fine sand % | Fine sand % | Medium sand % | Coarse sand % | Organic content (%) | Carbonate content (%) | Magnetic Susceptibility |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (PE1) | Mean | 16.05 | 19.16 | 21.91 | 18.06 | 12.79 | 6.58 | 2.67 | 1.62 | 0.98 | 15.02 | 3.41 | 0.000537052631579 |
| | Min | 11.24 | 13.48 | 17.01 | 15.52 | 6.08 | 1.61 | 0.63 | 0.42 | 0.03 | 6.59 | 2.48 | 0.000072 |
| | Max | 22.74 | 26.48 | 27.57 | 19.54 | 17.41 | 12.17 | 5.71 | 3.18 | 4.33 | 25.12 | 6.13 | 0.00085 |
| (PE2) | Mean | 25.57 | 25.40 | 23.84 | 15.13 | 7.66 | 1.94 | 0.24 | 0.20 | 0.03 | 4.09 | 11.54 | 0.000749434782609 |
| | Min | 22.62 | 22.83 | 21.39 | 13.05 | 5.72 | 1.06 | 0 | 0 | 0 | 2.86 | 3.05 | 0.000627 |
| | Max | 28.70 | 27.41 | 26.68 | 17.23 | 10.16 | 3.32 | 0.79 | 1.06 | 0.31 | 5.53 | 16.83 | 0.00102 |
| (PE3) | Mean | 16.36 | 18.05 | 22.96 | 23.71 | 15.51 | 3.27 | 0.10 | 0.04 | 0.01 | 2.59 | 22.55 | 0.000430095238095 |
| | Min | 12.53 | 13.00 | 20.19 | 15.81 | 8.23 | 1.04 | 0 | 0 | 0 | 1.76 | 16.09 | 0.000089 |
| | Max | 24.13 | 26.44 | 25.69 | 27.43 | 20.68 | 5.91 | 0.55 | 0.60 | 0.11 | 3.57 | 27.14 | 0.000643 |
| (PE4) | Mean | 14.74 | 14.04 | 20.96 | 25.93 | 18.91 | 4.68 | 0.38 | 0.29 | 0.07 | 2.39 | 23.69 | 0.000339870967742 |
| | Min | 9.84 | 9.31 | 16.61 | 22.99 | 14.30 | 1.67 | 0 | 0 | 0 | 0.54 | 18.08 | 0.000025 |
| | Max | 16.84 | 15.97 | 24.18 | 28.21 | 25.28 | 8.02 | 1.82 | 1.19 | 0.73 | 3.99 | 26.89 | 0.000412 |
| (PE5) | Mean | 11.13 | 10.75 | 19.68 | 28.84 | 22.17 | 5.53 | 0.75 | 0.68 | 0.36 | 2.19 | 27.42 | 0.000257916666667 |
| | Min | 9.95 | 9.64 | 17.21 | 25.85 | 17.42 | 1.79 | 0 | 0 | 0 | 1.45 | 23.69 | 0.000144 |
| | Max | 13.44 | 13.23 | 23.62 | 31.14 | 24.57 | 8.67 | 1.72 | 1.92 | 1.01 | 2.64 | 30.77 | 0.000405 |
| (PE6) | Mean | 12.00 | 12.18 | 21.71 | 29.74 | 19.75 | 3.96 | 0.57 | 0.80 | 0.54 | 2.17 | 23.42 | 0.000229125 |
| | Min | 10.26 | 11.73 | 19.52 | 28.08 | 16.16 | 1.01 | 0 | 0 | 0 | 1.23 | 16.64 | 0.000026 |
| | Max | 13.11 | 13.35 | 24.68 | 31.69 | 22.13 | 6.87 | 2.80 | 4.24 | 2.92 | 2.58 | 28.40 | 0.000359 |

Table S5: Sediment characterisation data from core PEC5a, Zone D

| Context | | Clay (%) | Very fine silt (%) | Fine silt (%) | Medium silt (%) | Coarse silt (%) | Very fine sand (%) | Fine sand (%) | Medium sand (%) | Coarse sand (%) | Organic content (%) | Carbonate content (%) | Magnetic susceptibility |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 101 | Mean | 13.34 | 13.58 | 16.07 | 17.18 | 16.88 | 10.82 | 4.93 | 3.43 | 2.86 | 10.99 | 11.65 | 0.000000143811111 |
| | Min | 10.91 | 11.61 | 14.46 | 15.66 | 15.78 | 8.87 | 2.54 | 1.48 | 0.86 | 7.21 | 10.77 | 0.000000119700000 |
| | Max | 17.41 | 16.16 | 17.52 | 18.36 | 17.59 | 12.37 | 6.43 | 5.34 | 4.98 | 15.40 | 12.89 | .000000165600000 |
| 102 | Mean | 19.49 | 19.38 | 21.05 | 19.04 | 13.16 | 4.51 | 1.01 | 0.90 | 1.00 | 5.54 | 13.91 | 0.000000118983871 |
| | Min | 16.43 | 14.47 | 16.97 | 16.96 | 10.23 | 1.69 | 0 | 0 | 0 | 4.05 | 12.43 | 0.000000087700000 |
| | Max | 21.99 | 22.92 | 24.87 | 22.12 | 19.07 | 9.22 | 3.58 | 2.64 | 4.79 | 7.03 | 17.26 | 0.000000180500000 |
| 103 | Mean | 15.14 | 14.41 | 19.55 | 24.24 | 18.90 | 5.46 | 0.59 | 0.59 | 0.79 | 3.51 | 22.67 | 0.000000086072000 |
| | Min | 12.04 | 11.00 | 15.80 | 20.32 | 11.12 | 1.53 | 0 | 0 | 0 | 2.81 | 17.84 | 0.000000030100000 |
| | Max | 20.74 | 22.33 | 24.85 | 28.65 | 23.10 | 9.32 | 3.17 | 3.56 | 2.95 | 4.34 | 25.83 | .000003367100000 |
| 104 | Mean | 14.54 | 14.10 | 21.09 | 25.30 | 18.23 | 5.00 | 0.59 | 0.48 | 0.48 | 2.34 | 28.41 | 0.000000058100000 |
| | Min | 11.85 | 9.76 | 15.31 | 21.22 | 7.97 | 0.27 | 0 | 0 | | 1.75 | 25.54 | 0.000000032100000 |
| | Max | 19.20 | 19.93 | 28.69 | 28.84 | 25.85 | 11.02 | 2.95 | 3.30 | 3.78 | 3.15 | 31.99 | 0.000000188200000 |
| 105 | Mean | 19.17 | 14.35 | 18.85 | 21.28 | 16.27 | 6.54 | 1.68 | 1.03 | 0.46 | 1.72 | 33.62 | 0.000000031630769 |
| | Min | 15.46 | 10.51 | 12.33 | 14.62 | 10.09 | 1.12 | 0 | 0 | 0 | 1.42 | 31.34 | 0.000000017900000 |
| | Max | 23.75 | 19.32 | 25.44 | 26.83 | 21.11 | 15.06 | 4.81 | 3.630 | 2.65 | 2.10 | 34.38 | 0.000000099100000 |
| 106 | Mean | 26.53 | 16.91 | 17.77 | 17.41 | 13.57 | 5.78 | 1.17 | 0.45 | 0.32 | 1.74 | 35.45 | 0.000000024780000 |
| | Min | 19.17 | 13.86 | 13.39 | 13.30 | 8.93 | 0.62 | 0 | 0 | 0 | 1.48 | 33.74 | 0.000000014500000 |
| | Max | 31.16 | 19.38 | 23.40 | 21.41 | 19.73 | 11.59 | 4.51 | 2.00 | 3.01 | 2.40 | 37.90 | 0.000000041000000 |
| 107 | Mean | 28.55 | 17.30 | 16.12 | 15.65 | 14.082 | 6.55 | 1.15 | 0.20 | 0.26 | 1.50 | 35.56 | 0.000000019368421 |
| | Min | 18.38 | 13.26 | 12.24 | 12.26 | 5.11 | 1.11 | 0 | 0 | 0 | 1.20 | 33.91 | 0.000000011300000 |
| | Max | 36.13 | 25.20 | 20.12 | 22.92 | 19.35 | 13.48 | 3.86 | 1.43 | 3.82 | 1.83 | 37.19 | 0.000000032700000 |

Table S6: Sediment characterisation data from Test Pit 2, Zone E

| *Context* | | *Clay (%)* | *Very fine silt (%)* | *Fine silt (%)* | *Medium Silt (%)* | *Coarse silt (%)* | *Very fine sand (%)* | *Fine sand (%)* | *Medium sand (%)* | *Coarse sand (%)* | *Organic content (%)* | *Carbonate content (%)* | *Magnetic susceptibility* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 110 | Mean | 14.12 | 15.56 | 19.97 | 23.52 | 19.25 | 6.35 | 0.68 | 0.36 | 0.12 | 6.86 | 2.52 | 0.000000279357 |
| | Min | 12.90 | 13.52 | 15.66 | 18.09 | 17.04 | 3.80 | 0 | 0 | 0 | 6.102 | 1.901 | 0.0000002280 |
| | Max | 15.62 | 16.81 | 21.80 | 26.17 | 21.93 | 9.46 | 4.02 | 3.54 | 1.07 | 8.80 | 3.34 | 0.0000004057 |
| 111 | Mean | 15.16 | 13.82 | 18.47 | 24.19 | 20.77 | 6.42 | 0.39 | 0.35 | 0.32 | 5.01 | 5.81 | 0.000000341419 |
| | Min | 13.77 | 10.85 | 14.91 | 21.34 | 14.52 | 2.69 | .01 | 0 | 0 | 3.86 | 1.97 | 0.0000002236 |
| | Max | 16.70 | 17.94 | 23.29 | 26.23 | 24.24 | 9.21 | 1.50 | 1.66 | 1.80 | 6.51 | 9.33 | 0.0000012070 |
| 112 | Mean | 13.24 | 11.14 | 15.76 | 23.79 | 24.10 | 9.52 | 0.90 | 0.58 | 0.76 | 4.23 | 7.54 | 0.000000195427 |
| | Min | 9.44 | 8.79 | 12.19 | 18.78 | 18.59 | 2.99 | 0 | 0 | 0 | 3.64 | 5.54 | 0.0000001151 |
| | Max | 15.95 | 14.09 | 20.48 | 27.99 | 28.22 | 15.28 | 2.35 | 2.57 | 3.80 | 5.01 | 9.54 | 0.0000003828 |

Table S7: Sediment characterisation data from Test Pit 1, Zone E

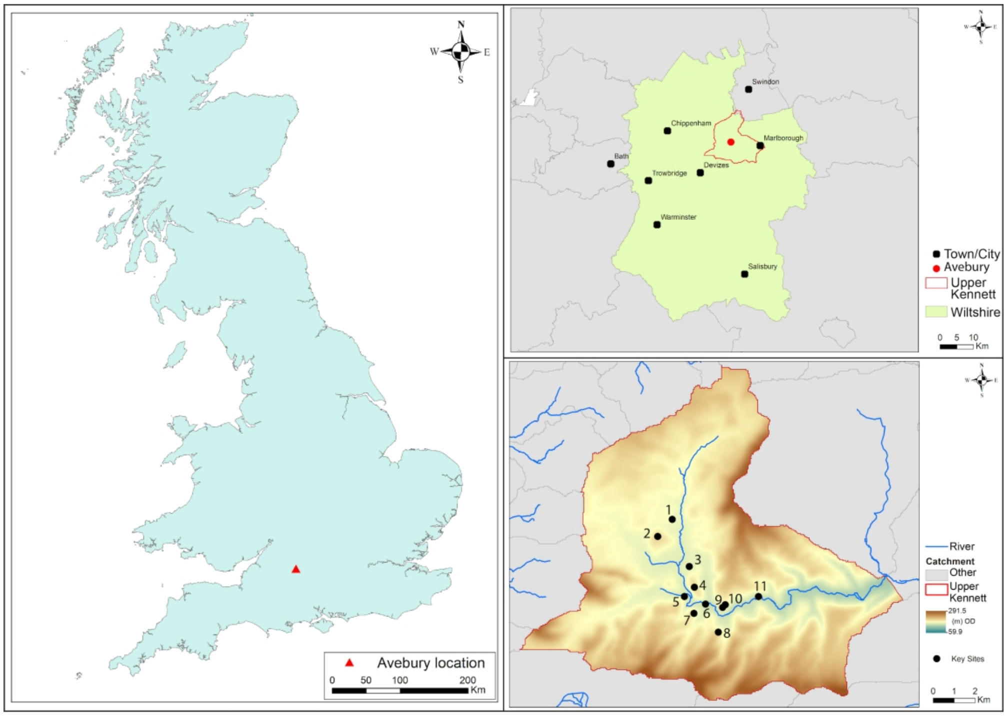
| *Phase/ period of alluviation* | *Alluvial sediment* | *Sequence* | *Alluvial Zone* | *OSL date* | *Key supporting data* | *Interpretation of sediment aggradation (human vs natural)* | *Interpretation of wider floodplain environment* |
|---|---|---|---|---|---|---|---|
| 1) Late Pleistocene | (501) | Trench 5 | Zone B | ABRY01 2.38m BGL 15.0+/-1.3 14,270-11,730 BC | High calcitic carbonate content of sediments (>30%); high clay content; low fine-coarse silt components; frequent chalk/flint pebbles/clasts | Natural climatic aggradation from within channel deposition; forms in Pleistocene low point depressions within the floodplain; re-precipitation of calcite from solution alongside channel bedload; rate of alluvial deposition is low and localised to floodplain low points | Open floodplain, with widespread exposure of chalk bedrock on valley floor; channel form is wide and shallow, with probable areas of braid plain, alongside some single channel locations in areas of deeper topography |
| | (107 | North Farm Test Pit 2 | Zone E | Interpreted date | | | |
| | | | | | | | |
| 1) Early Holocene (pre-Neolithic) | (502) | Trench 5 | Zone B | ABRY02 2.22m BGL 9.4+/-0.7 8080-6610 BC | High calcitic carbonate content, (>30%), although reduced slightly from Late Pleistocene values; decrease in the clay content, coupled with a slight rise in the silt fractions; reduction in size/abundance of chalk clasts | Natural climatic aggradation from within channel deposition; forms in Pleistocene topographic low points in the floodplain; high carbonate content through re-precipitation of calcite in low flow periods, chalk clasts derived from channel bedload; rate of alluvial deposition is low and localised to floodplain low points | A floodplain containing a wide, shallow channel system with areas of braid plain, flowing over exposed chalk bedrock in places; presumably some vegetation growth and soil development along floodplain fringes and in areas of high floodplain topography |
| | (106) | North Farm Test Pit 2 | Zone E | Interpreted date | | | |
| | | | | | | | |
| 2) Neolithic – Middle Bronze Age | (503) | Trench 5 | Zone B | ABRY05 1.74m BGL 6.0+/- 0.5 4420-3460 BC<br><br>ABRY04 1.90m BGL 6.0+/-0.5 4550-3550 BC | Continued reduction in clay content, with a slight but definable rise in the fine silt-coarse silt fraction; carbonate content remains high | Naturally driven calcitic within channel alluviation (dominant), but with am anthropogenic minerogenic alluviation signal present (minor) but increasing; deposited within localised topographic low points in the floodplain; the minor, but distinct human induced alluviation signal with rising fine-coarse silt fractions, is caused by soil disturbance and inwashing of soil derived loessic silt fractions; this landscape disturbance signal is small scale and likely reflects localized disturbance; rate of alluvial deposition is low, but has increased from the pre-Neolithic | Floodplain still open, with continuation of wide shallow channel, with presumable areas of braid plain, alongside single thread channel across topographic low points; evidence for some deposition of alluvial sediments with valley low points, linked to silt erosion derived from soil erosion; it is potentially linked to localised phases of monument building adjacent to floodplain (e.g. Avebury henge) |
| | (105) | North Farm Test Pit 2 | Zone E | ABRY10 1.18m BGL 5.7+/- 0.5 4090- | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | 3180 BC | | | |
| | | | | | | | |
| 3) Late Bronze Age, Iron Age – Early Roman | (504) (lower part of the unit) | Trench 5 | Zone B | ABRY06 1.54m BGL 2.6+/- 0.2 820-410 BC | Alluvial unit, continued increasing in fine-coarse silt fraction; medium silt dominant; carbonate content decreases throughout | Anthropogenically driven alluviation is now dominant, defining increased and widespread land surface disturbance on the valley sides; soil erosion through ploughing is providing silt rich loessic derived soil material to wash into the floodplain; previous land surface palaeosols (PE6), (639) and (112) located on slightly higher points within the floodplain are buried by alluvial sediments between the late Bronze Age and very Early Roman period | The rate of carbonate deposition starts to slightly decrease and a minerogenic silt dominated alluvium is deposited in increasing amounts on the valley floor; the channel form is still wide, with presumably some areas of braid plain extant; however, the infilling of the valley floor with minerogenic silt rich alluvium starts to constrain the channel system |
| | (639) | Trench 2 | Zone B | ABRY07 1.25 2.5+/- 0.2 690-310 BC | Palaeosol land surface extant until burial by alluvium | | |
| | (PE6) | PEC5a | Zone D | Interpreted date | Palaeosol land surface extant until burial by alluvium | | |
| | (PE5) | PEC5a | Zone D | Interpreted date | Alluvial unit burying palaeosol. High carbonate levels, yet the modal sediment fraction is medium silt (29%), with coarse silt and fine silt also high | | |
| | (104) | North Farm Test Pit 2 | Zone E | ABRY15 0.78m 2.0+/- 0.1 130 BC – AD 170 | Alluvial unit, continued increase in fine-coarse silt fraction; medium silt dominant; carbonate content decreases throughout | | |
| | (112) | North Farm Test Pit 1 | Zone E | ABRY20 0.65m 2.1 +/- 0.1 200 BC – AD 60<br><br>ABRY19 0.80m 2.4 +/- 0.2 550-220 BC | Palaeosol land surface extant until burial by alluvium | | |
| | | | | | | | |
| 4) Roman – Medieval | (504) Upper | Trench 5 | Zone B | After ARBY06 | Alluvial unit, continued deposition of minerogenic alluvium dominated by fine- | Anthropogenically driven alluviation with clear deposition of eroded soil material. Extensive evidence for | The decrease in overall particle size defines a fluvial regime of decreasing energy; this has |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | medium silt, with medium silt modal; corresponding continued reduction in carbonate content | medieval activity on and adjacent to the floodplain at Butlers field (Zone B), causing the anthropogenic additions to the medieval soil complex | been caused through deposition of alluvium on the valley floor, which has started to infill the valley bottom, constraining the channel; this process is ongoing from early Iron Age (above); the reduction of channel width and constraining of the channel has led to a reduction in chalk dissolution with a corresponding decrease in carbonate calcite re-precipitation within the alluvial sediment stack |
| | (638) | Trench 2 | Zone B | ABRY08 1.0m BGL 2.0+/-0.2 210 BC – AD 150 (date accepted with caveat) | Alluvial unit, continued deposition of minerogenic alluvium dominated by fine-medium silt, with medium silt and coarse silt both very high; corresponding continued reduction in carbonate content | | |
| | (311) | Trench 2 | Zone B | Date provided by excavated remains in Butlers Field | Palaeosol medieval soil complex | | |
| | (PE4) | PEC5a | Zone D | Interpreted date – Post Roman-Early medieval | Alluvial unit, with medium silt modal fraction, a reduction in coarse silt with a corresponding increase in clay, very fine and fine silts | | |
| | (PE3) | PEC5a | Zone D | Interpreted date – early Medieval to late medieval | Alluvial unit, with medium silt modal fraction, a reduction in coarse silt with a corresponding increase in clay, very fine and fine silts | | |
| | (103) | North Farm Test Pit 2 | Zone E | ABRY16 0.62m 1.5+/- 0.1 AD 400-620 | Alluvial unit, with medium silt modal fraction, a reduction in coarse silt with a corresponding increase in clay and very fine silt | | |
| | (111) | North Farm Test Pit 1 | Zone E | After ARBY20, before ARBY22 | Colluvial unit with later alluvial additions, defining on onset of colluviation at a floodplain edge location; abundant small clasts, alongside modal medium silt, and high fine and coarse silt components | Anthropogenically driven colluvial sediment, with alluvial additions higher in the unit | |
| | | | | | | | |

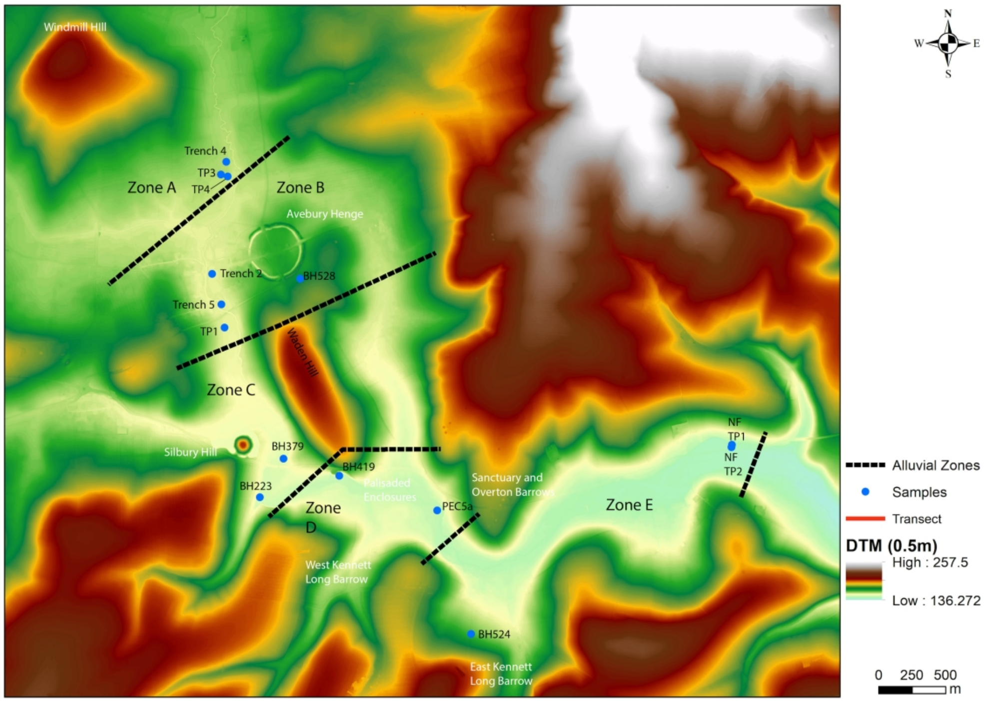
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5) Late Medieval – Post-Medieval | (505) | Trench 5 | Zone B | Interpreted date | Particle size reduces with clay and very fine silt increasing, clay/very fine silt often modal; corresponding reduction in coarse silt, medium silt and very fine sand fractions; low carbonate content; few to no calcite aggregates; defined by Evans *et al*. (1993) as the '*Arion clay*' | Anthropogenically driven alluviation with clear deposition of eroded soil material | The valley floor has been increasingly infilled with anthropogenically derived minerogenic alluvium, constraining the river to a single thread, relatively deep and narrow channel; this channel form has deposited alluvium through overbank deposition with a reduction in overall particle size, defining a reduction in fluvial energy; little dissolution of chalk and associated re-precipitation of calcite |
| | (641) | Trench 2 | Zone B | Post-dates the medieval soil complex (311) | | | |
| | (PE2) | PEC5a | Zone D | Interpreted date | | | |
| | (102) | North Farm Test Pit 2 | Zone E | ABRY18 0.40m 0.66+/-0.05 AD 1320-1410 | | | |
| | (110) | North Farm Test Pit 1 | Zone E | ABRY22 0.32m BGL 0.68+/-0.04 AD 1300-1390 | | | |
| | | | | | | | |

Table S8: A chronostratigraphic model for the Upper Kennet Valley, with associated date ranges, interpretations of the drivers of alluviation and the floodplain environment (green defines natural alluviation in topographic low points within the floodplain; yellow defines natural alluviation in topographic low points within the floodplain (dominant) but with a minor component of human induced alluviation visible through changing sediment fractions; beige defines anthropogenically driven alluviation)




The location of Avebury at a national scale (left)); the location of Avebury within Wiltshire at a regional scale, highlighting the Upper Kennet catchment (top right), and the Upper Kennett catchment shown against topography at a local scale, with key sites highlighted (bottom right) (1 = Millbarrow; 2 = Windmill Hill; 3 = Avebury Henge; 4 = Waden Hill; 5 = Silbury Hill, 6 = Palisaded Enclosures; 7 = West Kennett Long Barrow, 8 = East Kennet Long Barrow; 9 The Sanctuary; 10 = Overton barrows; 11 = North Farm) (C. Carey)

297x210mm (300 x 300 DPI)

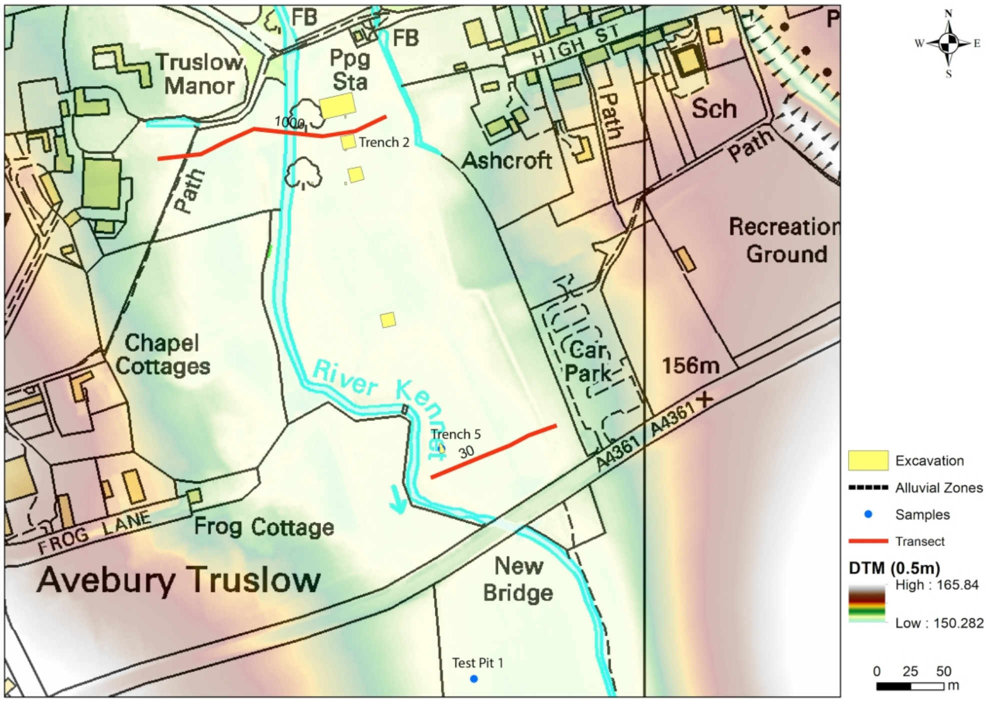



The alluvial zones used for the description of the results, with the location of key transects, test pits, and excavation areas shown against an unconstrained DEM (C. Carey)

297x210mm (300 x 300 DPI)

Zone A Test Pit field photographs of profiles TP3 (top left) and TP4 (bottom middle), and Zone B Test Pit profile TP1 (top right) (C. French)

206x290mm (300 x 300 DPI)

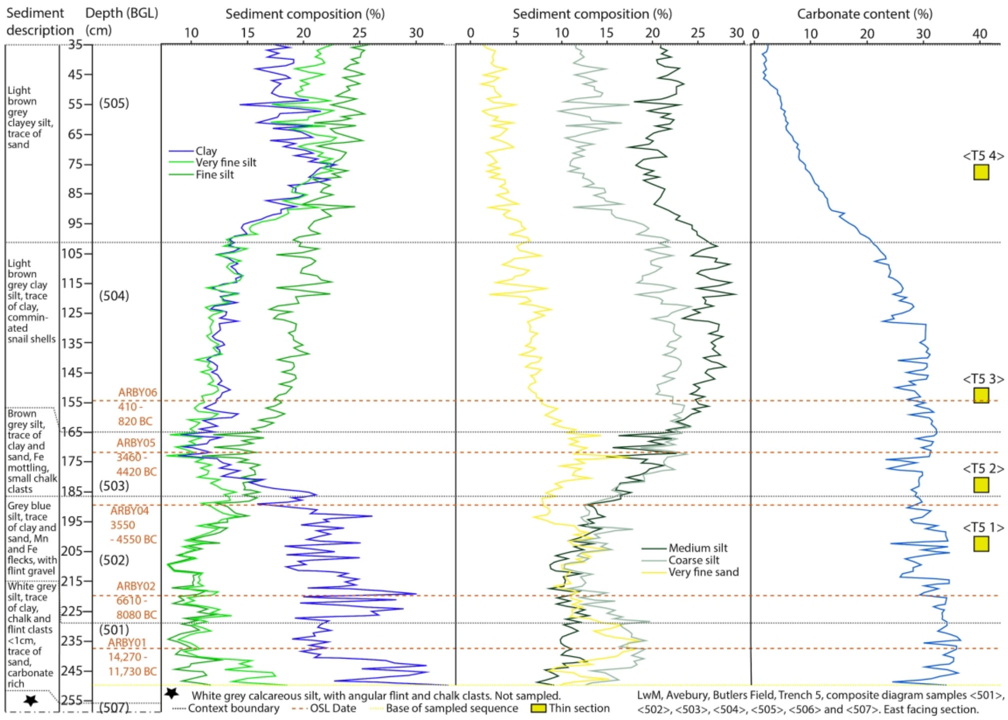



The location of test pit and excavation areas in Zone B Butler's Field (C. Carey)

297x210mm (300 x 300 DPI)

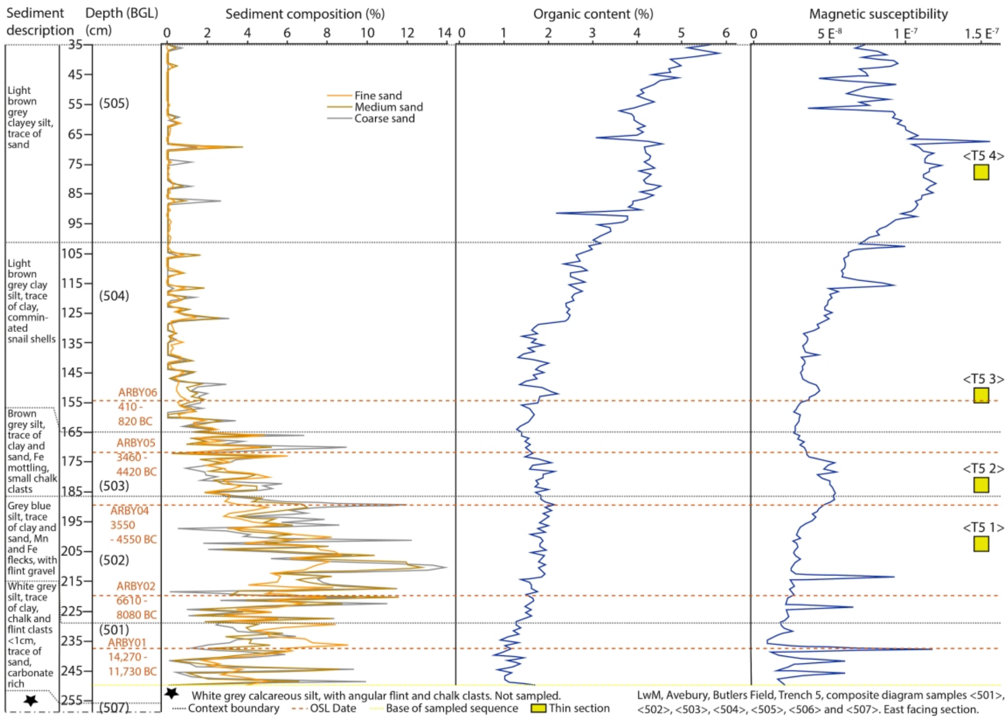
Zone B Butler's Field, photographs of alluvial sampling showing the sediment profiles in Trench 5 (left) and Trench 2 (right) (C. French)

297x196mm (300 x 300 DPI)



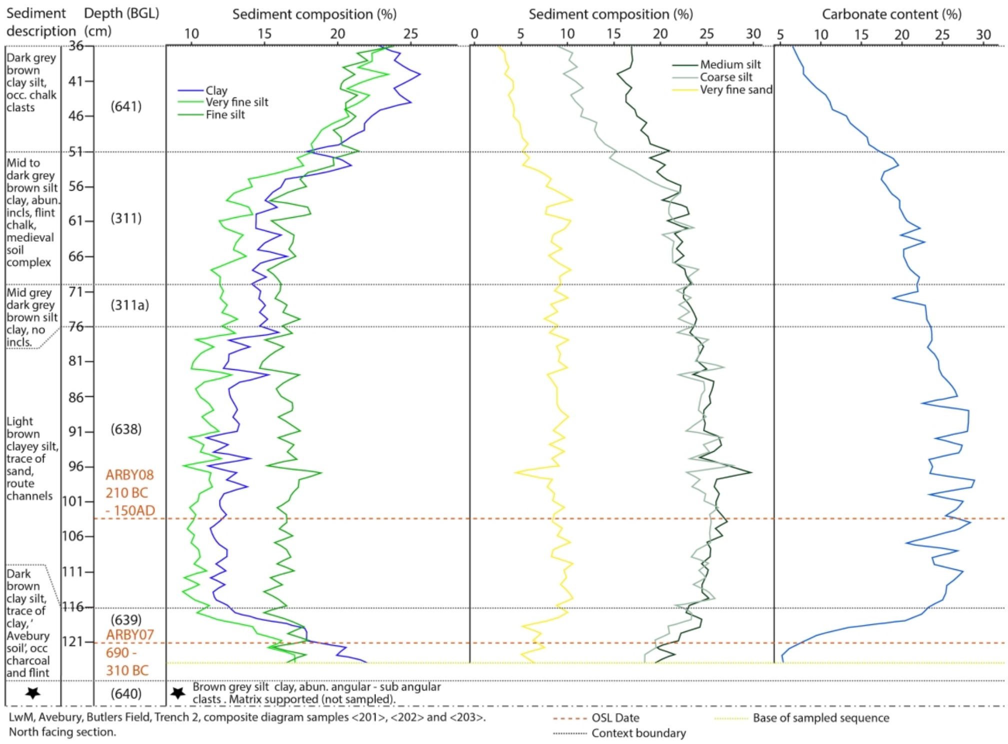

Zone B Butler's Field Trench 5 sediment data 1. Also refer to Table S3 (C. Carey/N. Crabb)

293x208mm (300 x 300 DPI)



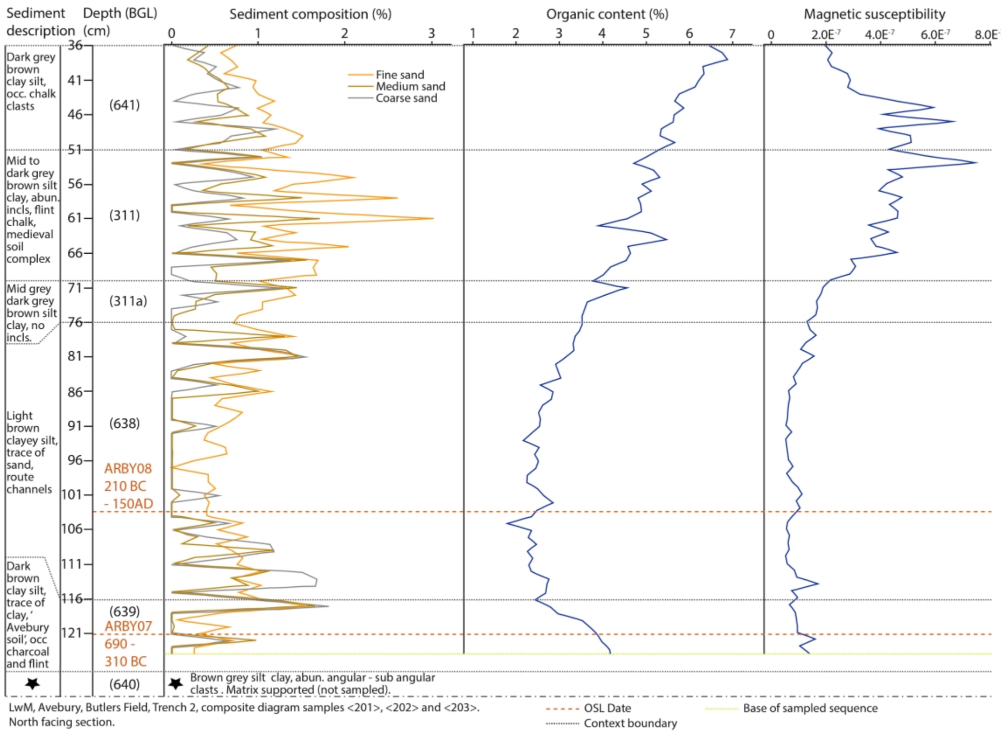

Zone B Butler's Field Trench 5 sediment data 2. Also refer to Table S3 (C. Carey/N. Crabb)

293x208mm (300 x 300 DPI)




Zone B Butler's Field Trench 2 sediment data 1. Also refer to Table S4 (C. Carey/N. Crabb)

284x208mm (300 x 300 DPI)




Zone B Butler's Field Trench 2 sediment data 2. Also refer to Table S4 (C. Carey/N. Crabb)

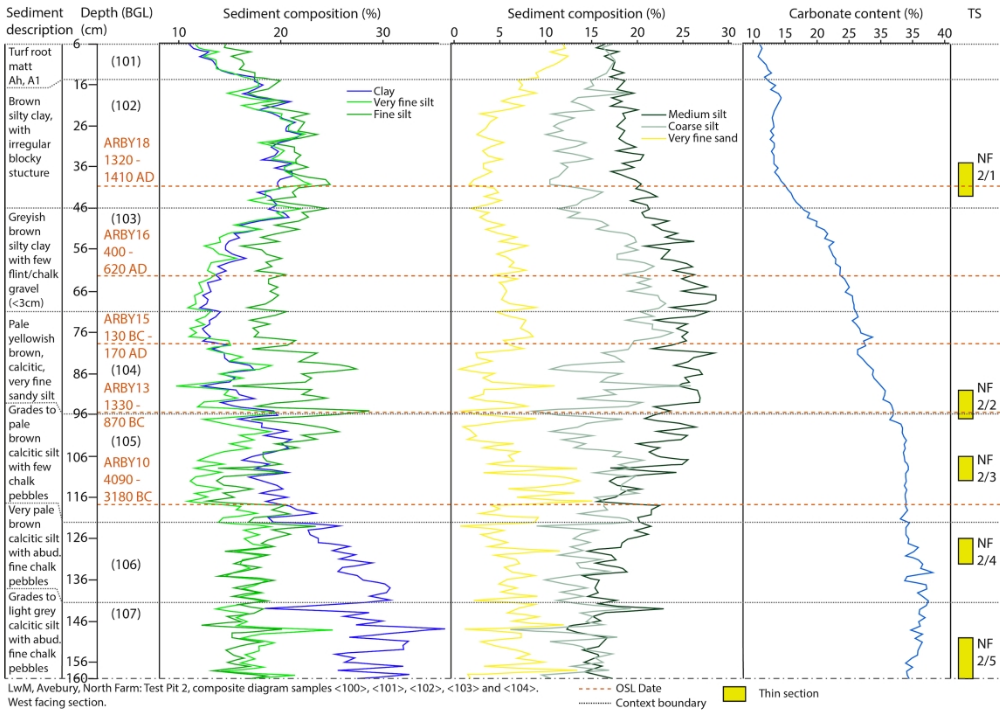
288x208mm (300 x 300 DPI)


The location of test pit and excavation areas in Zone E North Farm (C. Carey)

297x210mm (300 x 300 DPI)

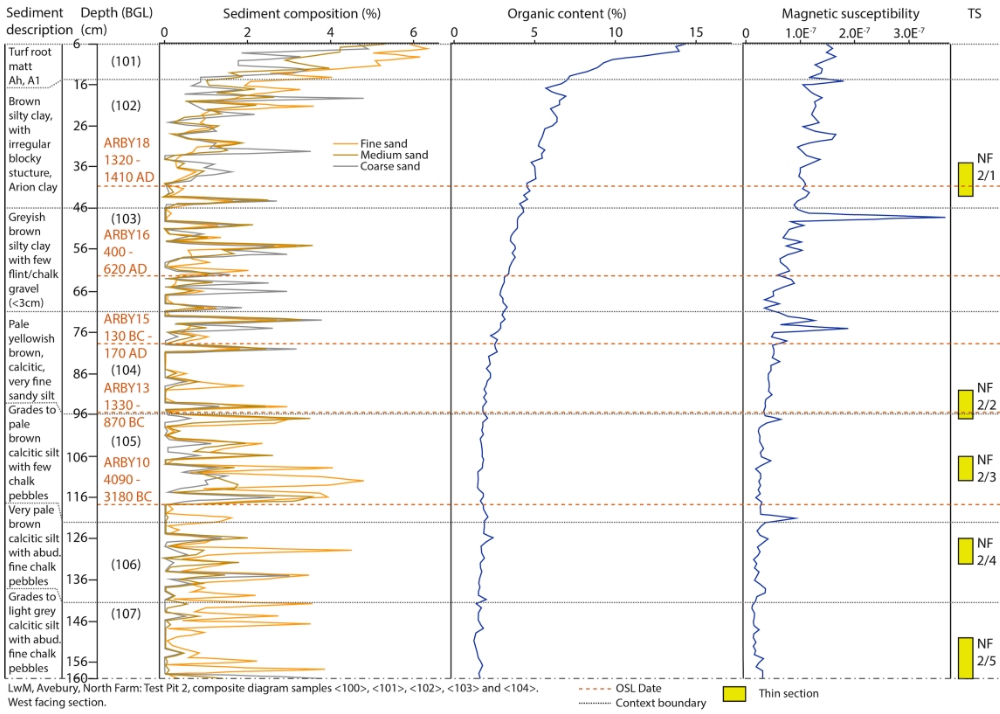
Zone E North Farm, photographs of the sediment profiles during excavation, showing Test Pit 2 (above left) and Test Pit 1 (above right), and sample locations in TP1 below (C. French)

297x143mm (300 x 300 DPI)



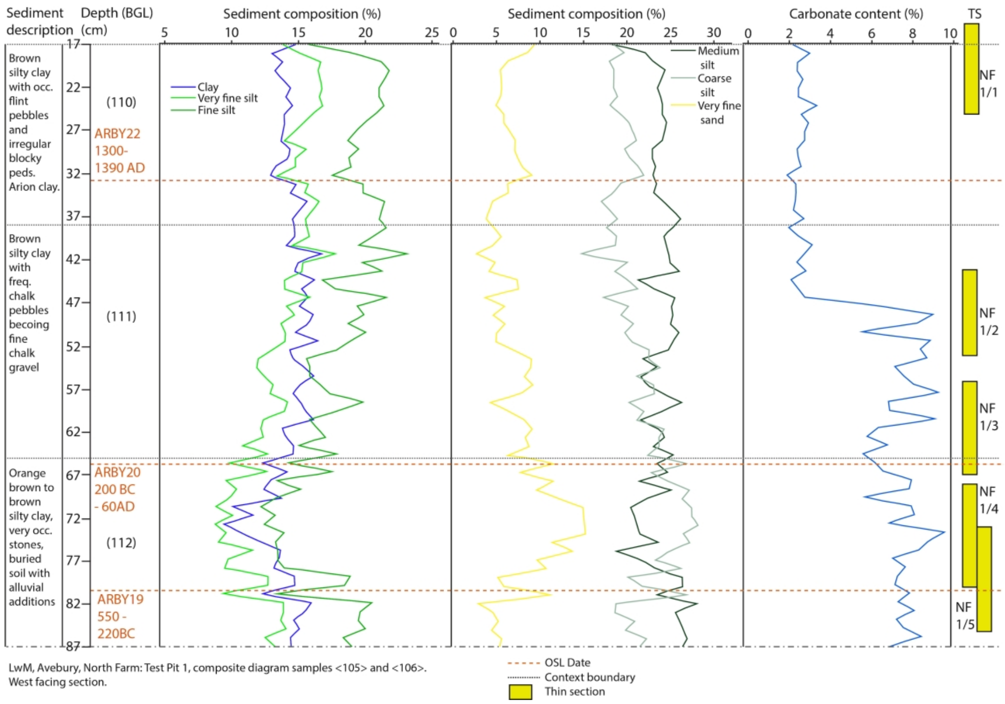

Zone E North Farm Test Pit 2 sediment data 1. Also refer to Table S6 (C. Carey/N. Crabb)

296x208mm (300 x 300 DPI)



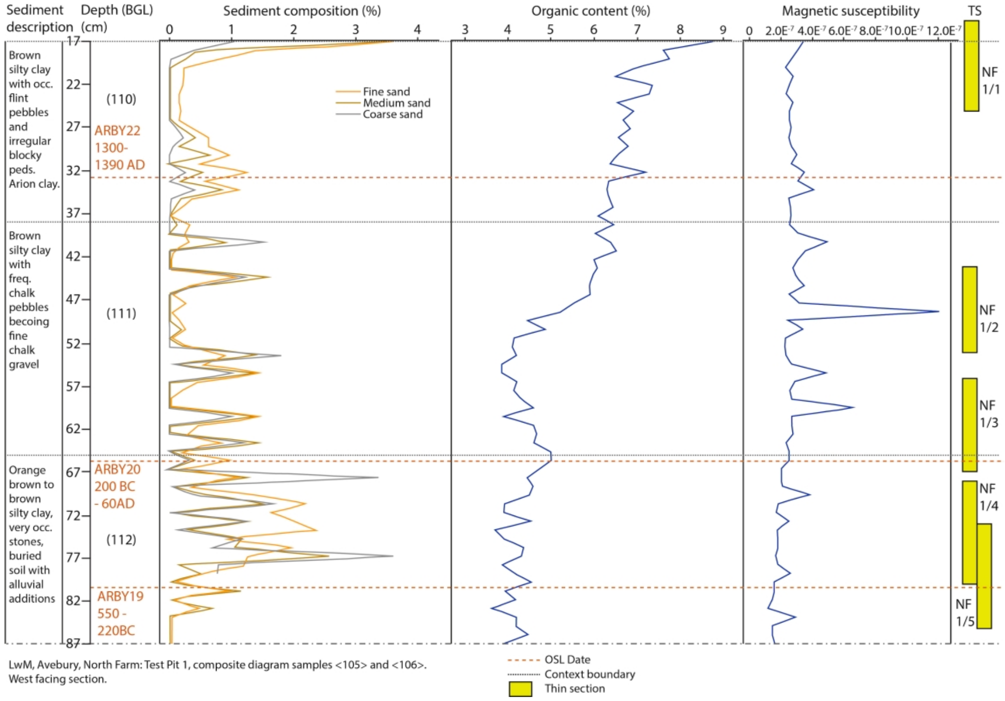

Zone E North Farm Test Pit 2 sediment data 2. Also refer to Table S6 (C. Carey/N. Crabb)

296x208mm (300 x 300 DPI)



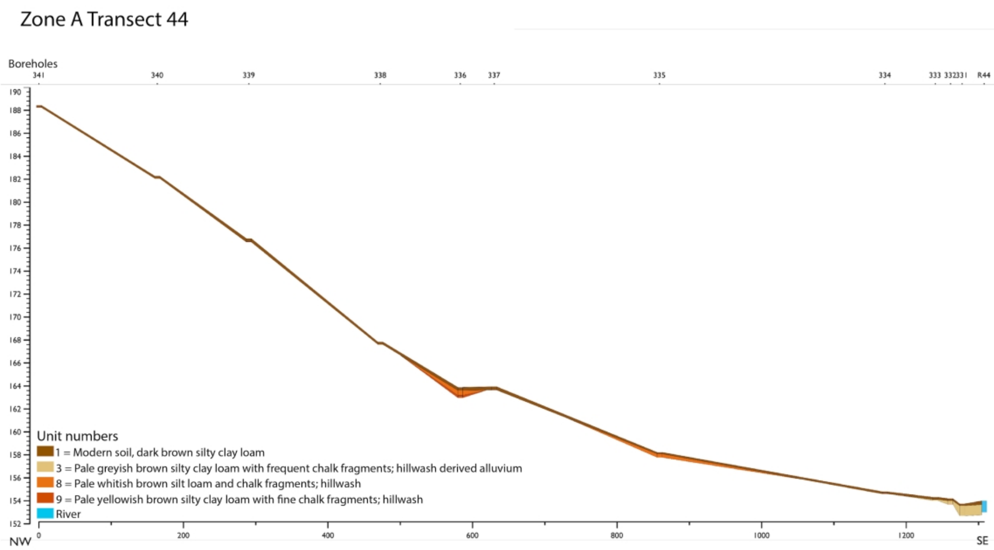

Zone E North Farm Test Pit 1 sediment data 1. Also refer to Table S7 (C. Carey/N. Crabb)

296x205mm (300 x 300 DPI)



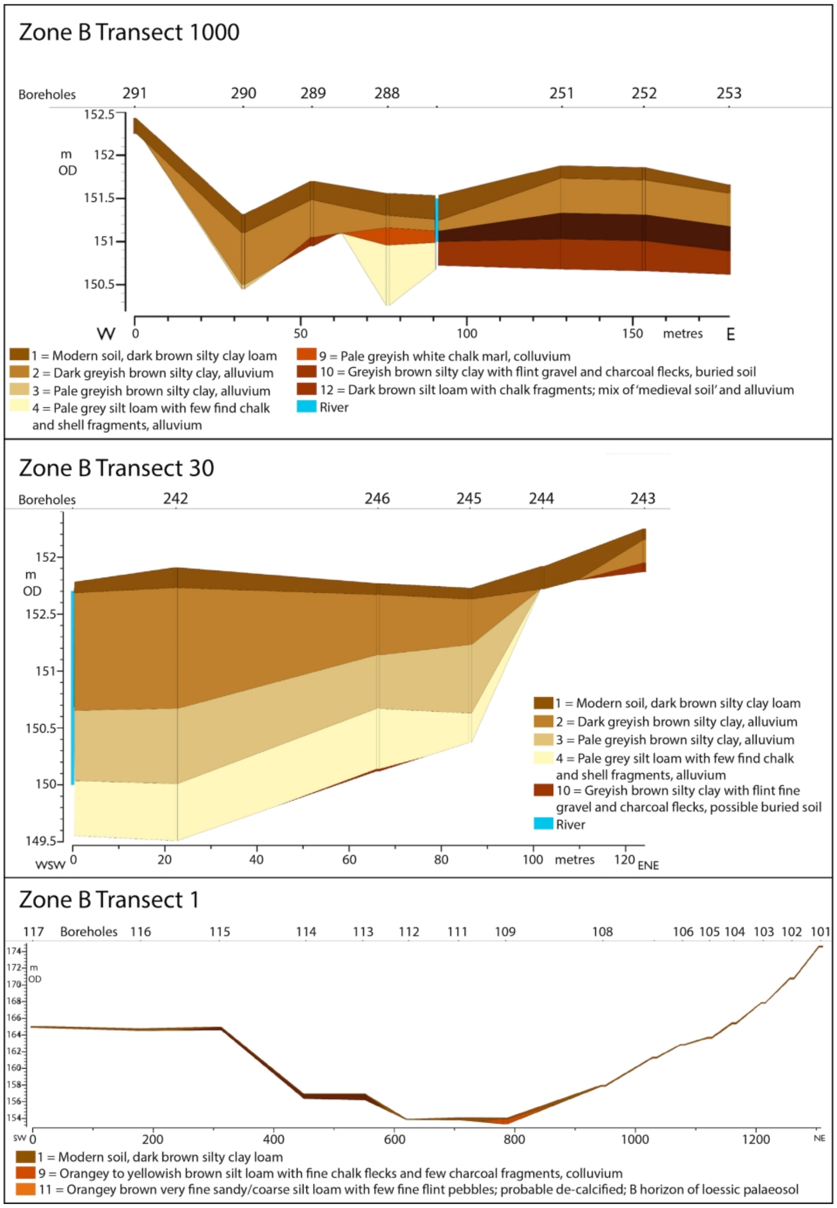

Zone E North Farm Test Pit 1 sediment data 2. Also refer to Table S7 (C. Carey/N. Crabb)

296x205mm (300 x 300 DPI)



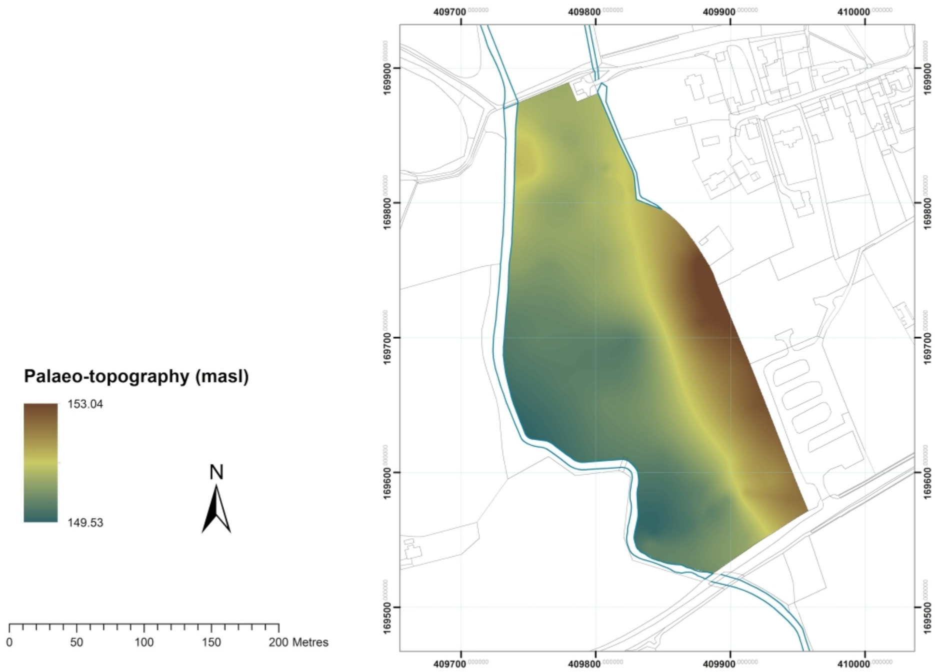

Zone A: Transect 44 covers the down slope from Windmill Hill to the Kennet floodplain northwest of Avebury henge (C. Carey/N. Crabb)

297x163mm (300 x 300 DPI)



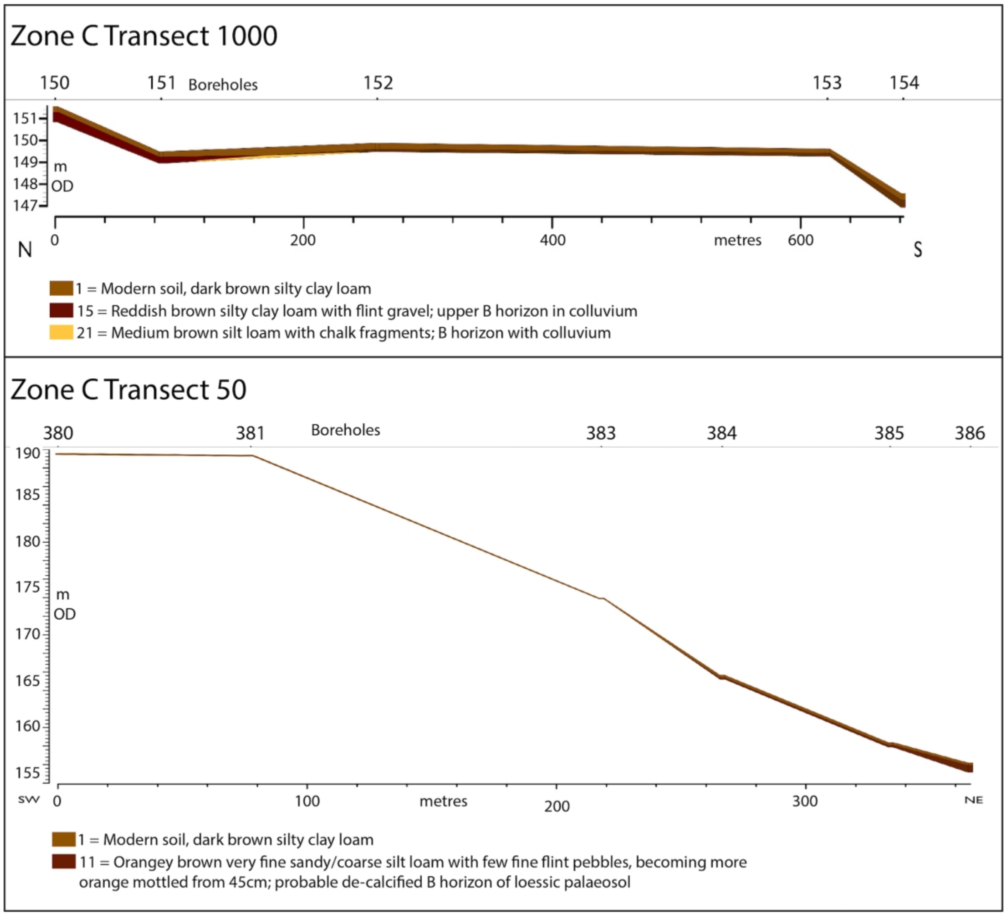

Zone B: Transects 1000, 30 and 1 provide the stratigraphic overview of Zone B in the landscape immediately surrounding the Avebury henge (C. Carey)

210x304mm (300 x 300 DPI)



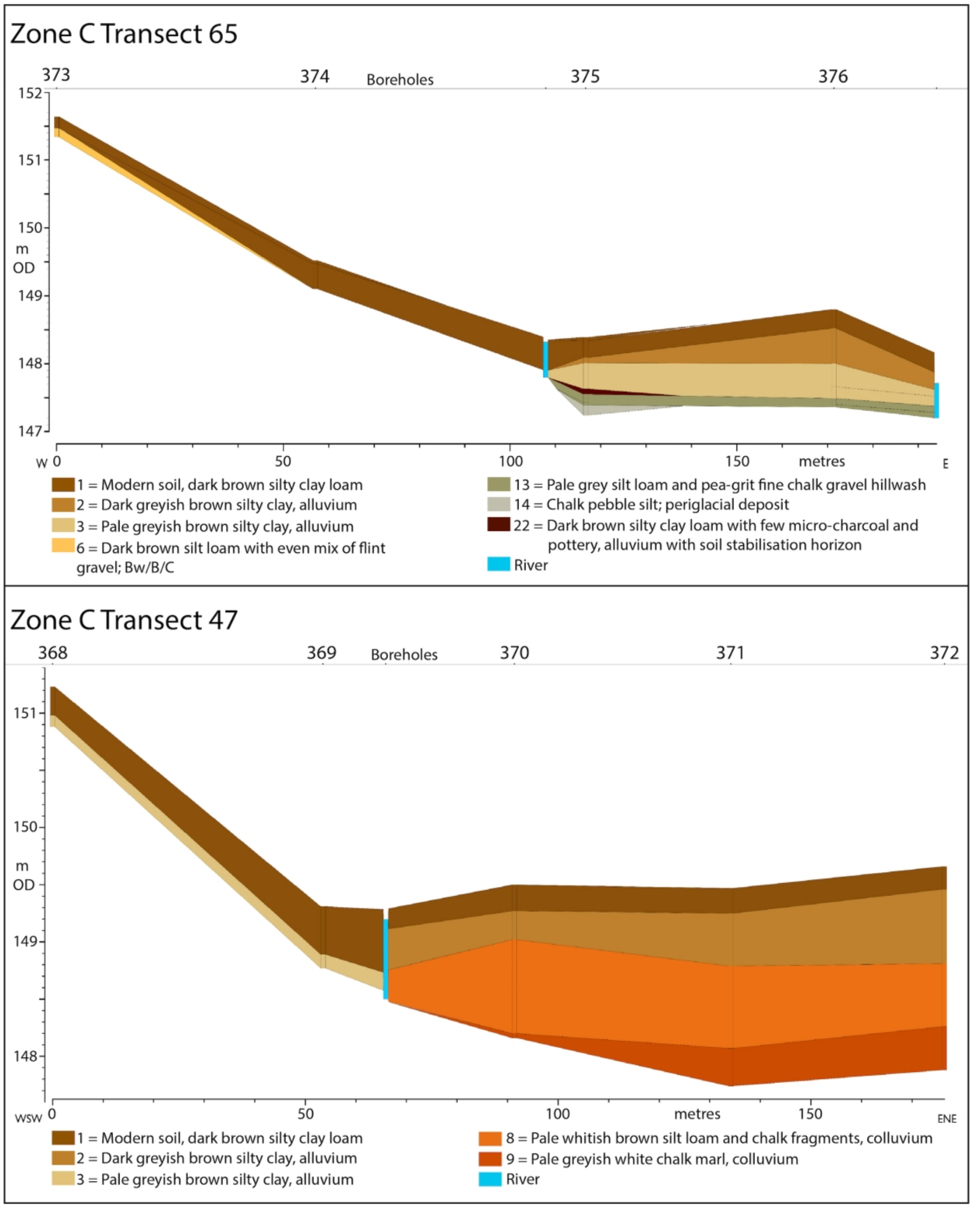

Sub-terrain DEM contour map of Butler's Field with the alluvial cover removed (M. Gillings)

296x210mm (300 x 300 DPI)



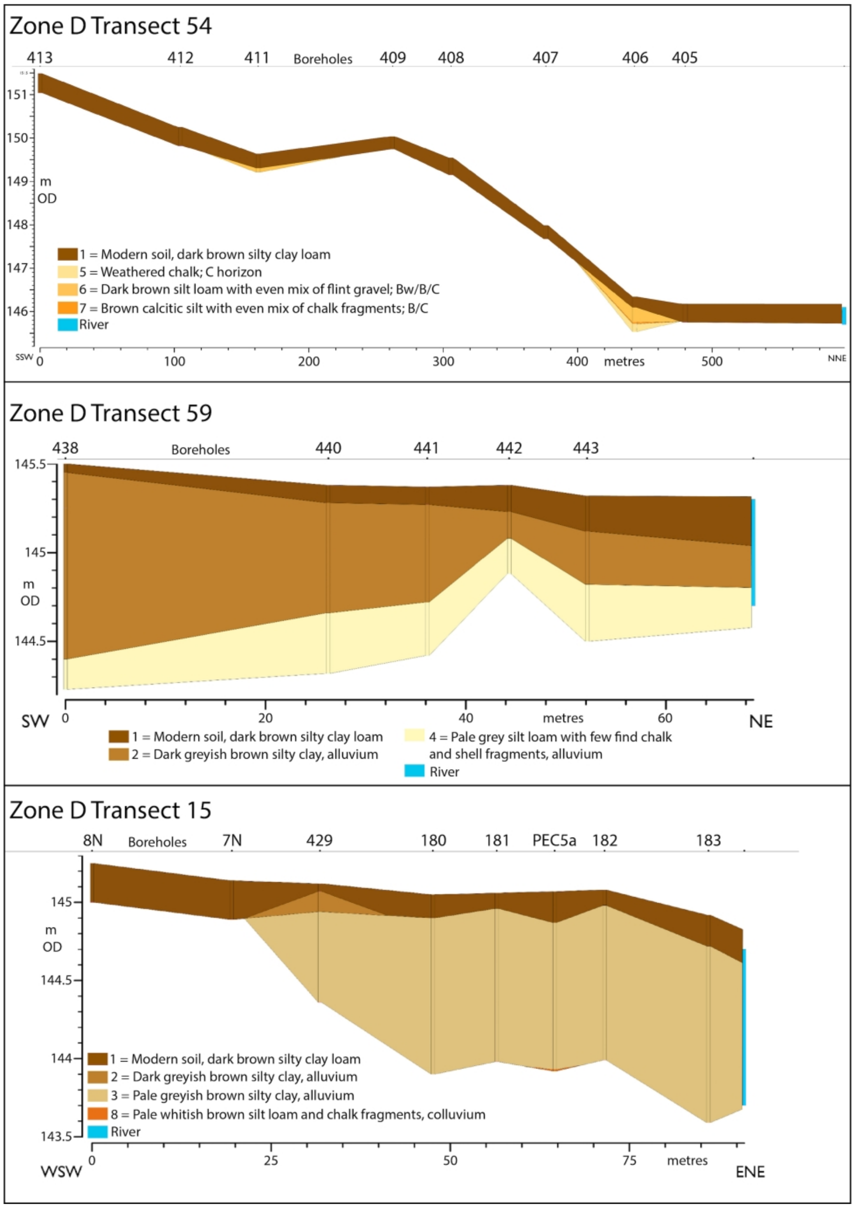

Zone C: Transect 50 traverses downslope from the top of Waden Hill, southwest to northeast (C. Carey)

210x191mm (300 x 300 DPI)



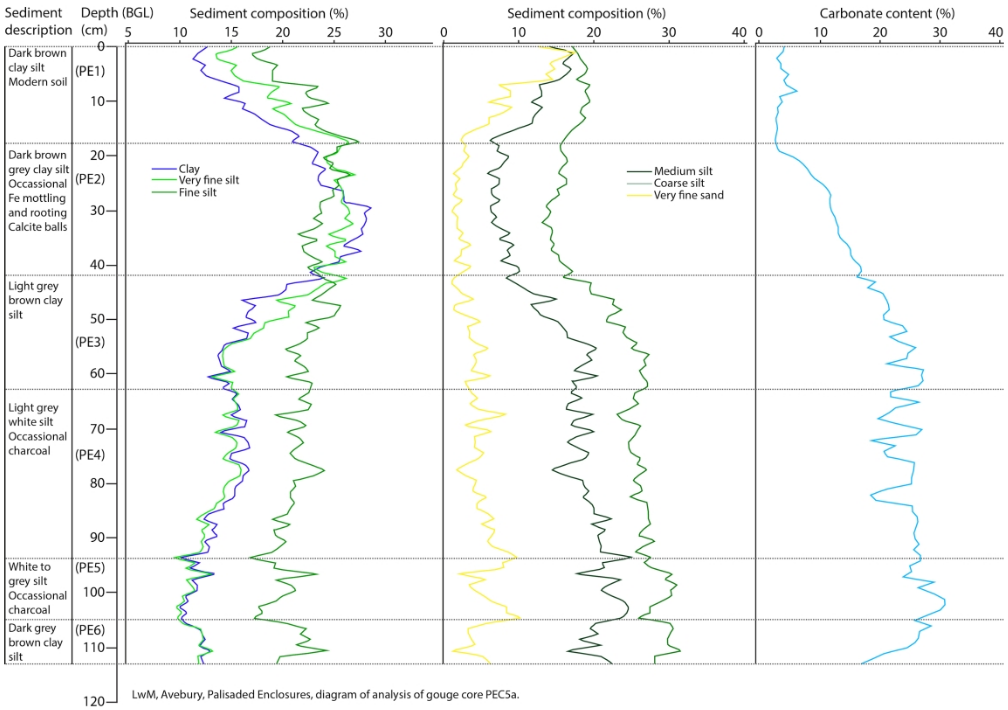

Zone C: Transect 47 traverses the floodplain to the northeast of Silbury Hill, southwest to northeast and Transect 65 traverses the floodplain to the east of Silbury Hill, on an east/west alignment (C. Carey)

210x261mm (300 x 300 DPI)



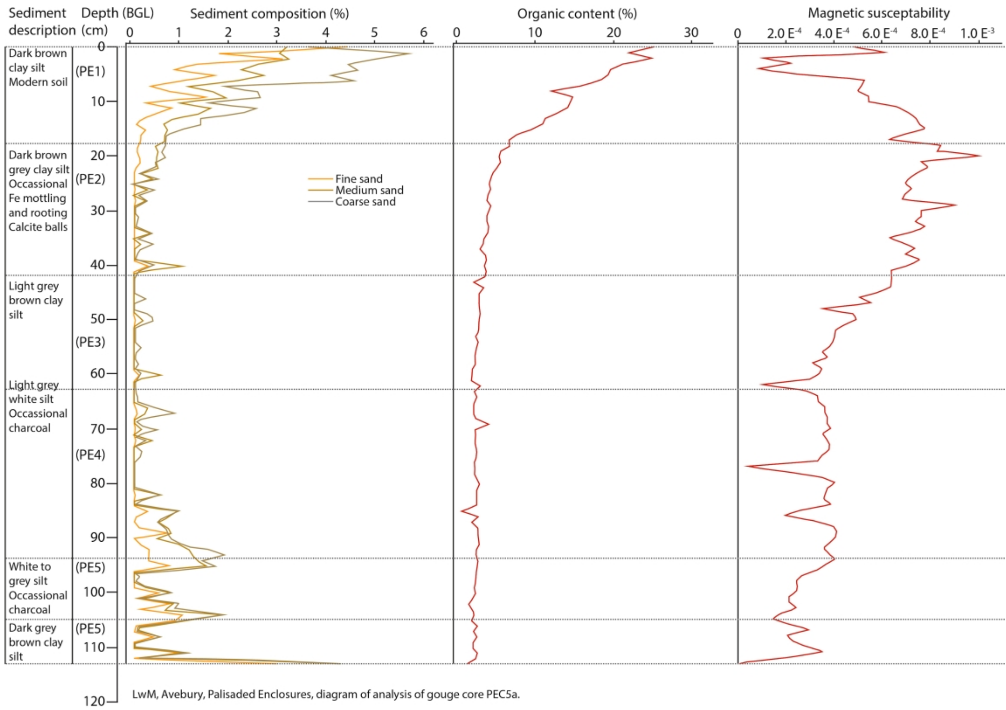

Zone D: Transects 54, 59 and 15 traverses south to north from the West Kennet palisade enclosures across the floodplain towards West Kennett farm (C. Carey)

210x297mm (300 x 300 DPI)



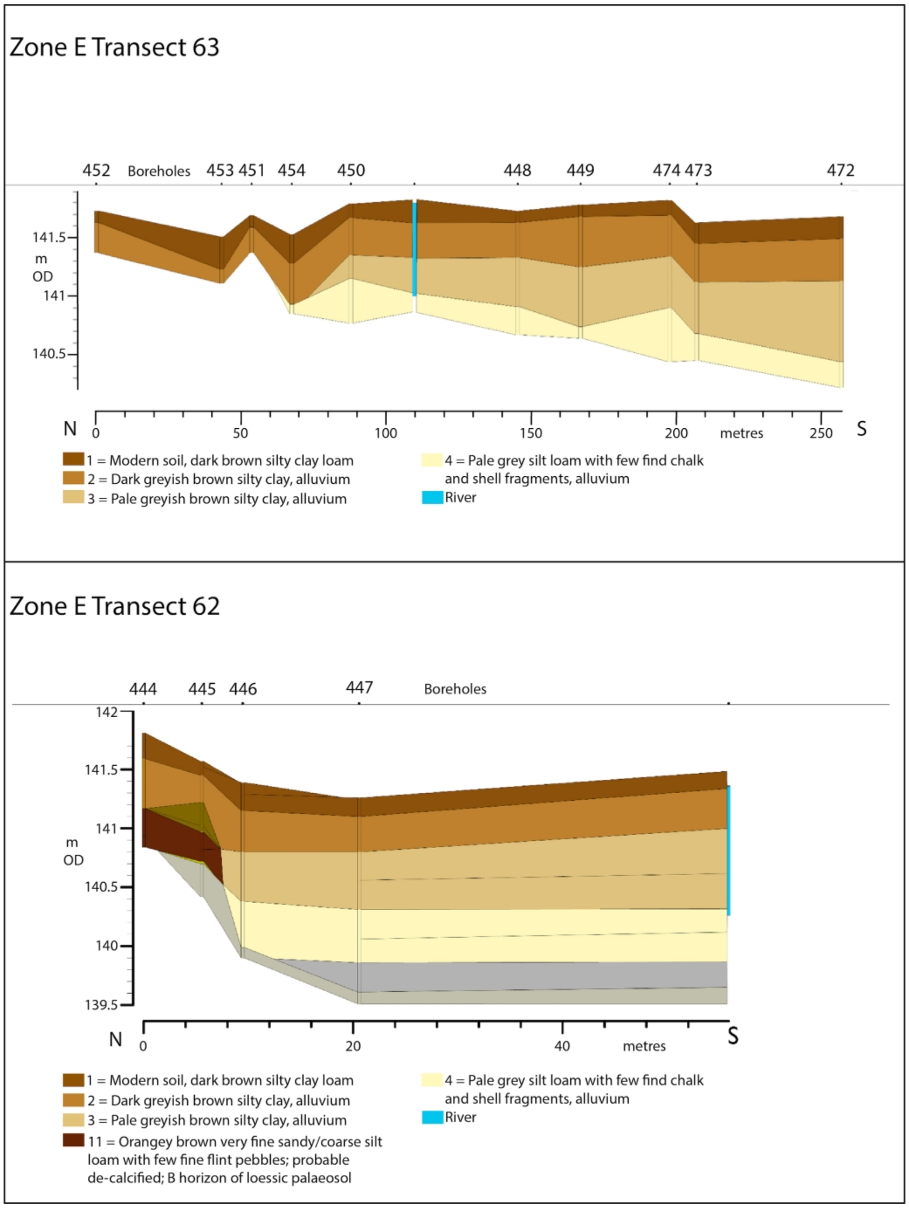

Zone D PEC5a gouge core sediment data 1. Also refer to Table S3 (C. Carey/N. Crabb)

294x207mm (300 x 300 DPI)



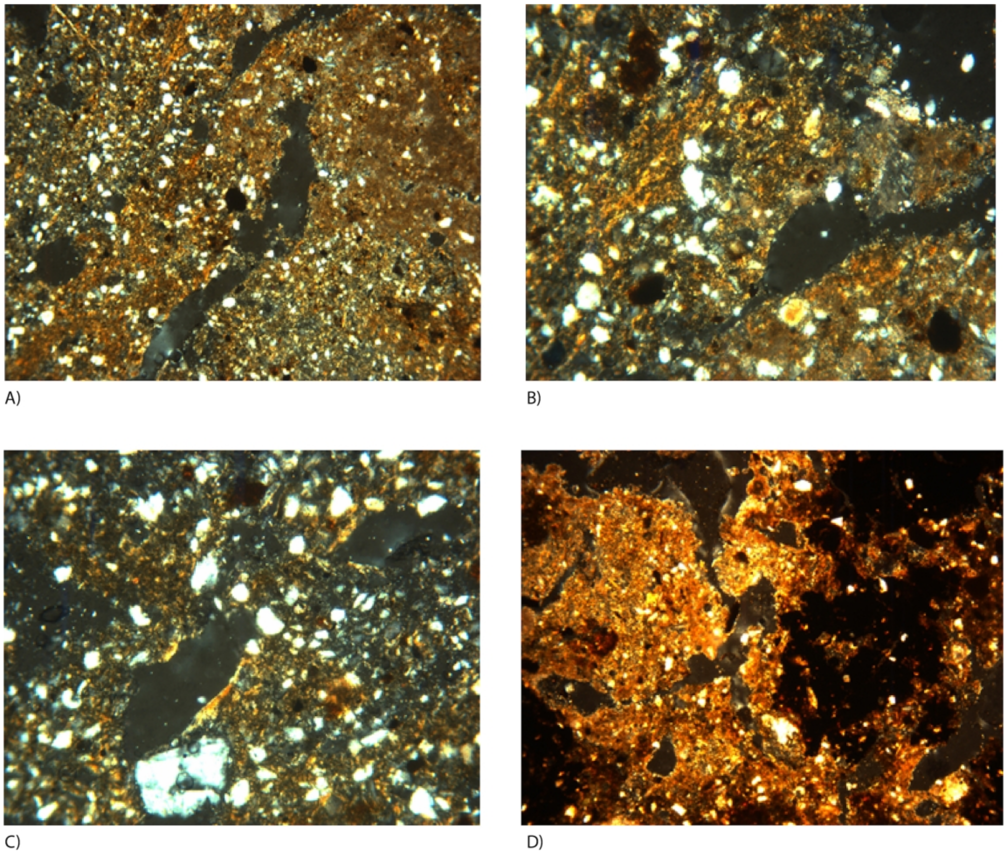

Zone D PEC5a gouge core sediment data 2. Also refer to Table S3 (C. Carey/N. Crabb)

294x207mm (300 x 300 DPI)




Zone E: Stratigraphic overviews for this zone are provided by transects 63 and 62 with detailed analyses occurring at Test Pits 1 and 2, North Farm (C. Carey)

210x279mm (300 x 300 DPI)




Winterborne North/Spring Field Test Pits 3 and 4 (Zone A) and Winterborne South Test Pit 1 (Zone B) thin section photomicrographs (C. French):

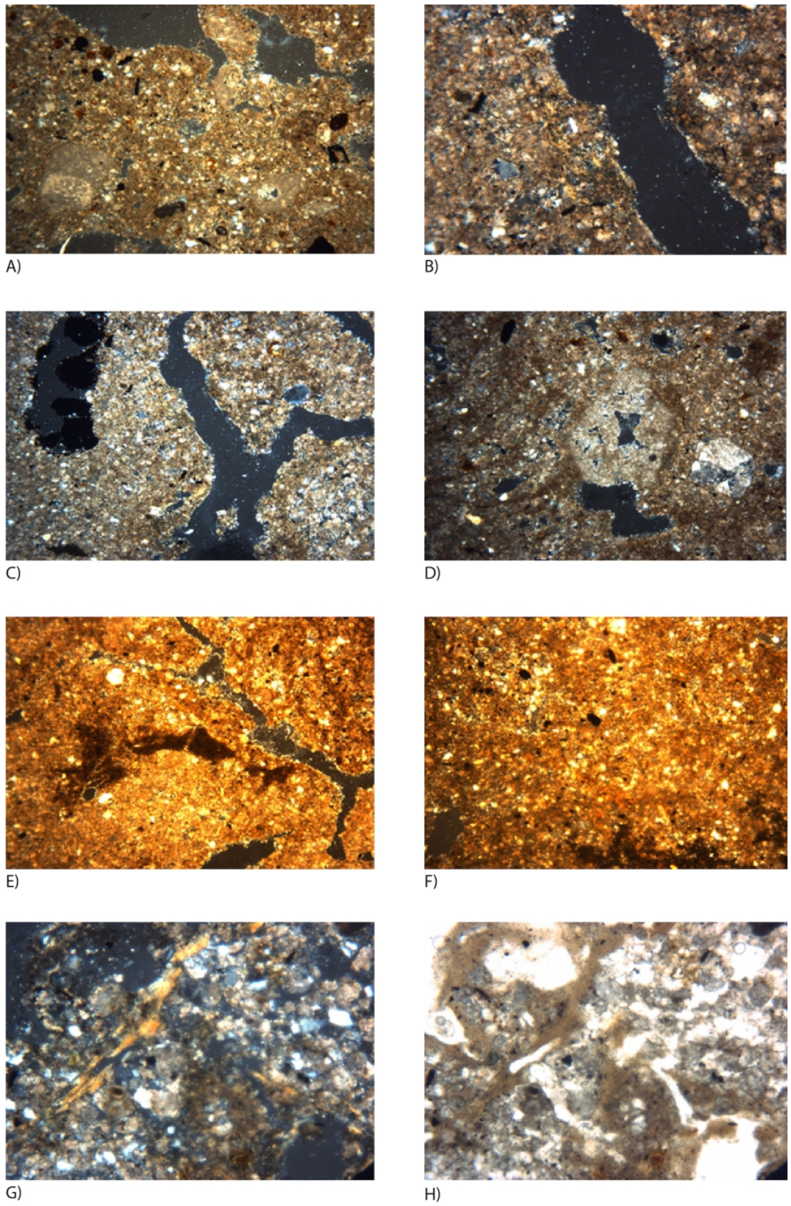
A) Photomicrograph of the partly depleted, very fine sandy/silty clay loam fabric, TP3, sample 2 (frame width = 4.5mm; cross polarized light)

B) Photomicrograph of the striated, birefringent dusty clays in the groundmass, TP3, sample 2 (frame width = 2.25mm; cross polarized light)

C) Photomicrograph of the striated, birefringent dusty clays in the groundmass and as a void coating, TP4, sample 1 (frame width = 2.25mm; cross polarized light)

D) Photomicrograph of the micritic silty clays with strong to weak sesquioxide staining, TP1, sample 1 (frame width = 4.5mm; cross polarized light)

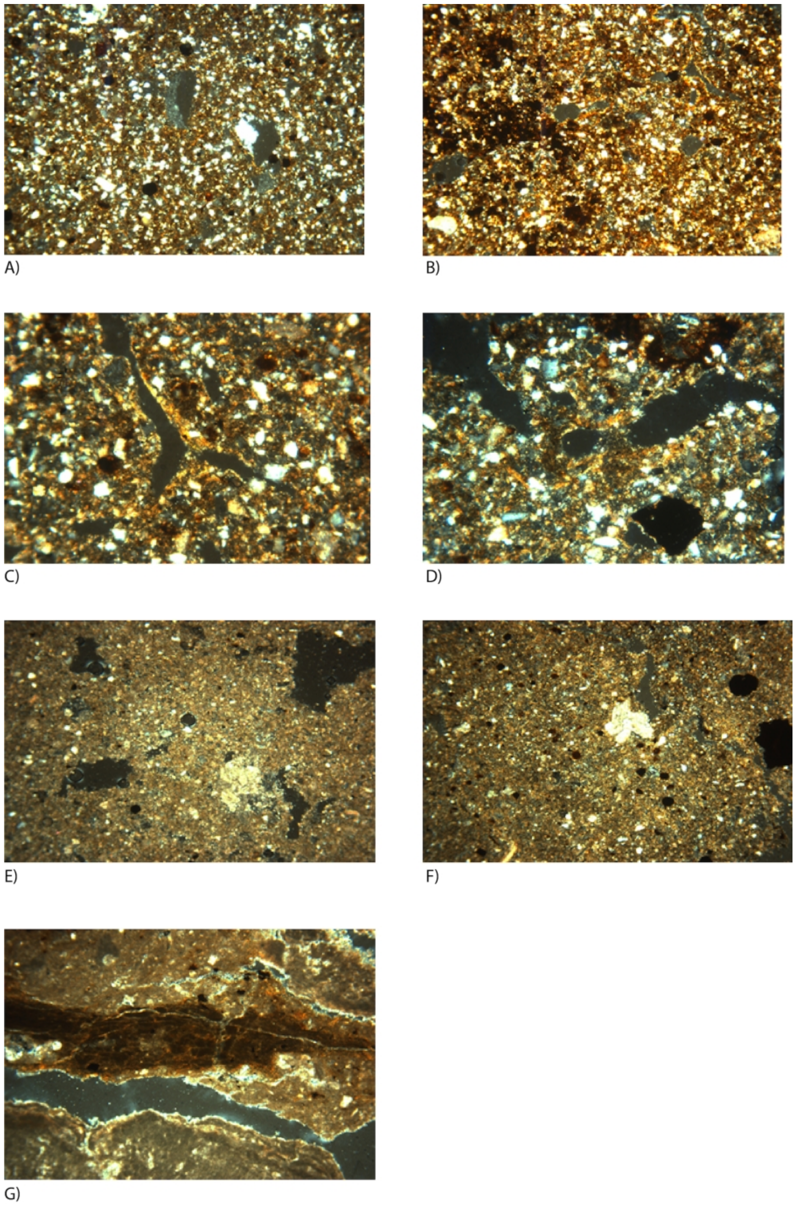
233x198mm (300 x 300 DPI)



Photomicrographs of Butler's Field test trenches and test pits in Zone B (C. French):
A) Photomicrograph of groundmass is dominated by silt-sized calcium carbonate and unoriented dusty clay, Trench 1, sample 1 (4.5mm = frame width; cross polarized light)
B) Photomicrograph of illuvial dusty clay coatings evident in the groundmass and around the margins of the voids, Trench 1, sample 3 (4.5mm = frame width; cross polarized light)
C) Photomicrograph of a fine dust of very fine fragments of organic matter and charcoal, Trench 1, sample 3 (4.5mm = frame width; cross polarized light)
D) Photomicrograph of calcitic infill of a void, Trench 1, sample 3 (4.5mm = frame width; cross polarized light)
E) Photomicrograph of calcitic very fine sandy silt, Trench 3, sample 4 (4.5mm = frame width; cross polarized light)
F) Photomicrograph of fine horizontal laminations, Trench 5, sample 4 (4.5mm = frame width; cross polarized light)
G) Photomicrograph of dusty clay striae, Test Pit 8, sample 1 (2.25mm = frame width; cross polarized light)

H) Photomicrograph of dusty clay linking grains and fabric, Test Pit 8, sample 1 (2.25mm = frame width; plane polarized light)

187x287mm (300 x 300 DPI)




Photomicrographs from Zone E North Farm Test Pits 1 and 2 (C. French):
A) Photomicrograph of abundant short striae and speckled dusty clay in the very fine sandy/silty clay groundmass, Test Pit 1, sample 1/1 (4.5mm = frame width; cross polarized light)
B) Photomicrograph of very fine sandy/silty clay loam soil fabric with common, irregular zones of amorphous sesquioxide impregnation, Test pit 1, sample 1/3 (4.5mm = frame width; cross polarized light)
C) Photomicrograph of very fine sandy/silty clay loam soil with a well developed columnar blocky ped structure with speckled and striated groundmass, Test Pit 1, sample 1/4 (4.5mm = frame width; cross polarized light)
D) Photomicrograph of the weakly reticulate striated groundmass with abundant dusty clay, Test Pit 1, sample 1/5 (2.25mm = frame width; cross polarized light)
E) Photomicrograph of calcitic silt, Test Pit 2, sample 2/1 (4.5mm = frame width; cross polarized light)
F) Photomicrograph of very fine sandy/silty clay loam, Test Pit 2, sample 2/2 (4.5mm = frame width; cross polarized light)
G) Photomicrograph of dense calcitic silt with the occasional dusty clay striae and silty clay crust with hints

of a micro-laminated structure, Test Pit 2, sample 2/5 (4.5mm = frame width; cross polarized light)

187x285mm (300 x 300 DPI)