A303 Stonehenge
Amesbury to Berwick Down

Archaeological Evaluation Report:

Eastern Portal - Part 1: Text

April 2019

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Executive Summary

This document details the results of archaeological evaluation of land at Countess West, Amesbury within the Stonehenge, Avebury and Associated Sites World Heritage Site (WHS), proposed for construction of the new A303 eastern tunnel portal and approaches.

These results were previously reported in the Environmental Statement (ES) submitted with the Application for Development Consent dated October 2018 and were taken into account in the identification of the baseline and approach to mitigation and in the assessment of likely significant effects in the ES. Paragraphs 6.6.18 to 6.6.24 of the ES summarise the results of the fieldwork, and paragraphs 6.6.104 to 6.6.106, Appendix 6.2 and Figure 6.8 of the ES describe the archaeological baseline for the site. Section 6.8 describes the approach to mitigation of archaeological impacts, and section 6.9 and tables 6.10 to 6.12 describe the assessment of likely significant effects: paragraph 6.9.25 refers to the archaeological evaluation to the Eastern Portal. This document details the results already reflected in the ES.

The evaluation strategy for the eastern portal and approaches comprised several archaeological techniques: ploughzone artefact collection (including fieldwalking and test pitting), trial trenching and geoarchaeological investigations. The trial trenches were positioned to determine archaeological presence within apparently ‘blank’ areas and to target potential features identified through ground penetrating radar (GPR) and geophysical gradiometer survey results. The evaluation followed a series of previous investigations of the eastern portal location carried out for the current Scheme, comprising geophysical survey and the excavation of 27 trial trenches.

The evaluation was successful in confirming the presence and absence of archaeological remains, determining their nature, extent, date, condition and state of preservation. A very small number of archaeological features were uncovered, comprising two parallel ditches of possible Romano-British date cut into a buried soil of probable Late Iron Age to Romano-British date and sealed by post-Roman colluvium in Trench 504, an undated ditch in Trench 506, a small number of features of post-medieval/modern date, and a small number of natural features.

Supporting artefactual, environmental and geoarchaeological evidence was recovered. Artefacts consisted primarily of an even, low-density scatter of worked and burnt flint across the area, with a small number of slightly higher concentrations which may be the remains of activity areas now dispersed within the ploughzone. One concentration of worked flint (in Trench 512, situated beyond the proposed DCO boundary) derived from *in situ* knapping in the later Neolithic period or Early Bronze Age, and is of some potential significance.

Other material was mostly of Post-medieval and modern date, and clustered in the east of the area at near Countess Farm and at the western end, where it probably represented manuring of fields.

Environmental evidence was sparse. Geoarchaeological investigations revealed buried soil sequences towards the centre of the site which have the potential to preserve significant evidence.

1 Introduction

1.1 Project background

1.1.1 Wessex Archaeology Ltd has been appointed as ‘Archaeological Contractor’ by AECOM Mace WSP Joint Venture ('AmW', ‘the Technical Partner') on behalf of Highways England (‘the Employer’) to undertake a programme of archaeological evaluation for the A303 Amesbury to Berwick Down project ('the Scheme').

1.1.2 An Archaeological Evaluation Strategy Report (AESR) [1] sets out the general and specific principles guiding the strategies for field-based investigations. An Overarching Written Scheme of Investigation (OWSI) [2] accompanying the AESR details the methods and techniques employed during the archaeological evaluation. The AESR and OWSI were approved by the Heritage Monitoring and Advisory Group (HMAG: comprising representatives of Wiltshire Council Archaeology Service, the National Trust and Historic England).

1.1.3 A Site Specific Written Scheme of Investigation (SSWSI) [3] for archaeological evaluation of land at Countess West, Amesbury within the Stonehenge, Avebury and Associated Sites World Heritage Site (WHS), detailed the aims and methodologies to be used. This guiding document was approved prior to fieldwork commencing by the HMAG. The land is proposed for construction of the new A303 eastern tunnel portal and approaches (‘the site’).

1.1.4 The evaluation was undertaken between February and April 2018. The evaluation strategy comprised several archaeological techniques: ploughzone artefact collection (including fieldwalking and test pitting), trial trenching and geoarchaeological investigations. The trial trenches were positioned to determine archaeological presence within apparently ‘blank’ areas and to target potential features identified through ground penetrating radar (GPR) and geophysical gradiometer survey results [4].

1.2 Scope of the document

1.2.1 The results of the evaluation of the site were reported in the Environmental Statement (ES) and were taken into account in the identification of the baseline and approach to mitigation and in the assessment of likely significant effects. Paragraphs 6.6.18 to 6.6.24 of the ES summarise the results of the fieldwork, and paragraphs 6.6.104 to 6.6.106, Appendix 6.2 and Figure 6.8 of the ES describe the archaeological baseline for the site. Section 6.8 describes the approach to mitigation of archaeological impacts, and section 6.9 and tables 6.10 to 6.12 describe the assessment of likely significant effects: paragraph 6.9.25 refers to the archaeological evaluation of the eastern portal. This document details the results already reported in the ES.

1.2.2 This document details the results of the evaluation already reflected in the ES, in accordance with the approved SSWSI. In accordance with the OWSI, section 8 of this report recommends further analysis of particular datasets, to be undertaken at a later stage of the archaeological process: these recommendations are part of the ongoing archaeological process which continues beyond and separately from the process required for EIA. They do not affect the baseline conditions, assessment of effects or mitigation approach as identified in the ES.

2 Site Description

2.1 Location, topography and geology

2.1.1 The Site lies within the WHS on the north side of the existing A303 Amesbury Bypass, east of King Barrow Ridge and to the immediate north of Vespasian's Camp, to the west of Amesbury (**Fig. 11.1**).

2.1.2 The Site extends between NGR 414060 142121 and NGR 415191 142073, and is bounded by the A303 to the south and by agricultural land to the north, east and west. The Site comprises agricultural land that at the time of the evaluation was covered mostly by crop stubble, with areas of grass in the east. A series of rectilinear tree plantations relating to the former use of the land as part of the Amesbury Abbey Park lie immediately north and west of the Site.

2.1.3 The Site is generally situated on an east facing slope with ground level falling from approximately 97 m aOD in the west to 70 m aOD in the east. Within this broad pattern, topographical variations are encountered where (from the west) a narrow dry valley runs eastwards, feeding into a more pronounced NNW–SSE aligned dry valley at 79 m aOD (in the vicinity of trench 504). To the east of this, the ground rises to 89 m aOD (near trench 507), before falling eastwards towards the edge of the floodplain of the River Avon, at 70 m aOD, in the far east of the Site.

2.1.4 The solid geology comprises chalk of the Seaford Chalk Formation with no recorded superficial deposits across most of the Site. Bands of Head deposits – clay, silt, sand, and gravel cross the middle and east of the Site, with an area of Head 1 gravels in the east. These are subaerial sedimentary deposits, detrital coarse to fine grained materials, forming down-slope layers and fans of accumulated material [6].

2.2 Archaeological and historical background

2.2.1 This section provides an overview of the archaeological and historical context of the Site, as summarised in the SSWSI [3].

Chronology

2.2.2 The chronological scheme followed in this report follows that at http://www.heritage-standards.org.uk/chronology/. For the purposes of this report, periodization is as follows:

- Palaeolithic -1,000 000 to -10,000 (BC)
- Mesolithic -10,000 to -4,000
- Neolithic -4,000 to -2,200
- Early Neolithic -4,000 to -3,300
- Middle Neolithic -3,300 to -2,900

- Late Neolithic -2,900 to -2,200
- Bronze Age -2,600 to -700
- Early Bronze Age -2,600 to -1,600
- Middle Bronze Age -1,600 to -1,200
- Late Bronze Age -1200 to -700
- Iron Age -800 (BC) to 43 (AD)
- Roman 43 to 410 (AD)
- Early Medieval 410 to 1066
- Medieval 1066 to 1540
- Post-medieval 1540 to 1901
- 20th Century 1901 to 2000

2.2.3 To accommodate the overlap between Late Neolithic (-2,900 to -2,200) and Early Bronze Age (2-2,600 to -1,600) in the above scheme, in this report these terms are used as broad chronological periods. The term 'Beaker' is used to refer to a material culture group that overlaps with both these chronological periods.

Previous investigations within the Site

2.2.4 The Site lies close to the eastern boundary of the Stonehenge part of the WHS and within an area densely populated with important prehistoric funerary and linear monuments. Numerous dedicated research projects have examined this part of the WHS, such as the Stonehenge Environs Project which saw extensive fieldwalking and other surveys at Countess West during the 1980s [7] and large-scale aerial photograph assessments as part of the English Heritage Stonehenge WHS Mapping Project, which was updated in 2016 [8]. The Site was also included within the extensive geophysical survey programme undertaken as part of the Stonehenge Hidden Landscapes Project (SHLP) [9]; the provisional results of this work have been used to enhance the background presented below. Beyond the Site, the Stonehenge Southern WHS Survey project included geophysical survey and small-scale excavations on King Barrow Ridge and Coneybury Hill [8].

2.2.5 Highways improvements have also lead to numerous excavations, surveys and evaluations being carried out. Construction of the Amesbury northern bypass in the late 1960s was accompanied by archaeological observations by Vatcher and Vatcher [10].

2.2.6 A major programme of investigations, spanning several years and including trial trenching, test pitting and geophysical surveys was carried out in connection with the A303 Improvements 2004 Published Scheme [11]. Geophysical survey and trial trenching in 2001 examined land immediately east of the Site on the periphery of the River Avon floodplain [12].

2.2.7 More recent investigations carried out for the current Scheme have included three phases of geophysical survey carried out in 2016-7 [4] [13] [14]. Geophysical surveys within the Site examined some 43.1 ha between King Barrow Ridge and Countess Farm [15]. Subsequent trial trenching of a possible eastern portal location at the western end of the Site comprised excavation of 27 trial trenches [16].

2.2.8 The results of previous fieldwork within the Site are incorporated into the period- based background sections below as relevant, and discussed in detail in section 2.3 below.

Palaeolithic and Mesolithic (*c.*1,000 000 – 4000 BC)

2.2.9 Evidence relating to the Palaeolithic period is particularly scarce in the Stonehenge part of the WHS. Traces of occupation become more conspicuous during the Mesolithic. Notable discoveries include the large post pits found at the site of the former Stonehenge car park and visitors centre in 1966 [17] and 1988-9 [18]. Closer to the Site, trial trenching in 2002 identified near *in situ* middle Mesolithic flintwork in a colluvial deposit on the edge of the Avon floodplain west of Countess Farm, close to the eastern extent of the Site (WSHER number MWI11874) [11]. Excavations at Blick Mead on a spring line on the Avon floodplain near Vespasian's Camp, immediately south of the A303, approximately 100 m south-east of the Site have revealed extensive remains of Mesolithic occupation, including lithic and faunal remains [19].

Early–Middle Neolithic (*c.* 4000–2900 BC), Late Neolithic (*c.* 2900–2200 BC) and Early–Middle Bronze Age (*c.* 2600–1600 BC and *c.* 1600–1200 BC)

2.2.10 The Site lies to the east of the course of the Stonehenge Avenue (NHLE 1010140), a linear feature formed of parallel banks and ditches approximately 10 m apart, providing a formal approach to Stonehenge and linking it with the River Avon at West Amesbury. Although the banks and ditches survive west of King Barrow Ridge as slight earthworks of approximately 200 mm height/depth, they are no longer visible on the surface east of King Barrow Ridge.

2.2.11 Recent excavations at West Amesbury Farm [8] to the south of the A303 revealed a group of five Middle Neolithic pits, which contained a significant assemblage of pottery, worked flint and faunal remains. One pit was cut by another that contained a mortuary deposit including inhumed bone, in turn truncated by another pit. The pits and mortuary deposit appear to have been broadly contemporary with the construction of the Phase 1 Stonehenge ditch.

2.2.12 There are numerous Early Bronze Age round barrows in the area. The Site lies to the east of the important linear round barrow cemetery on King Barrow Ridge, and there are other barrows and cropmarks of ring ditches to the north (Countess Farm) and south of the Site (NHLE 1010331, 1012127, 1012128, 1012129, 101230, 101213, 1014088, 1009142, 1009143, 1009144 and 1009151).

2.2.13 Two scheduled bowl barrows, also known as Amesbury 39b and 39c, are located 50-100 m to the north of the central part of the Site (NHLE 1012128; WSHER MWI12948 and NHLE 1009142; WSHER MWI12947). These were not identified during the recent geophysical survey for the Scheme, neither were they identified by the Hidden Landscapes Project magnetometer survey: it is perhaps pertinent that an extensive 25ha area of broad curvilinear responses (G4) lie less than 80 m to the east, relating to an area characterised by geological and hydrological responses coinciding with low lying land of the former floodplain [9, p. 23].

2.2.14 Provisional results from the Hidden Landscapes Project shows pit-like features within the sub-annular ditch of an oval barrow (with a newly revealed opening on the south side) to the north-west of the Site. This relates to NHLE 1010331 which was excavated by Vatcher in 1959, though there is no mention of the opening in the ditch, during the excavation some pit features found below the barrow mound were dated to the Neolithic [9, pp. 21-22]. A further Neolithic pit (MWI12477) containing a broken ground flint axe and animal bone was excavated on 'Vespasian's Ridge' by Faith Vatcher in 1967 and is thought to have been located where the A303 cuts through the ridge heading northwards from Vespasian's Camp [7, p. 66].

2.2.15 Within the Site, two possible undated ring ditches visible on aerial photographs (MWI12959 and MWI12964) and an undated circular cropmark (MWI12965) may relate to ploughed down round barrows. A further possible former barrow may be represented by a soil mark of potential archaeological origin (MWI12660).

2.2.16 No obvious traces of two undated ring ditches/circular cropmarks just beyond the northern boundary of the Site recorded on the HER [MWI12660 and MWI12965] were identified by the magnetic survey carried out for the Hidden Landscapes Project, referenced in the provisional report as PRN14484, PRN14490 [9, p. 21].

Middle–Late Bronze Age (*c.* 1600–1200 BC – *c.* 1200–700 BC), Iron Age (*c.* 800 BC–AD43) and Roman (AD 43–410)

2.2.17 The Stonehenge landscape was transformed in the middle of the 2nd millennium BC when, 'it's sacred and ceremonial significance seems to have diminished sharply; a more mundane agricultural regime of farmsteads and fields took over or intensified noticeably' [20]. Although the inclusion of cremation burials in barrows continued into the Middle Bronze Age, the tradition of constructing funerary and ceremonial monuments appears to have declined and eventually ceased by, or during, this period.

2.2.18 Conclusive evidence of settlement activity within the Stonehenge landscape during the later Bronze Age remains elusive. Although aerial photography, LiDAR and geophysical survey have identified extensive field systems comprised of small rectangular fields sometimes associated with earthwork lynchets throughout much of the WHS and the surrounding landscape [21], these are not recorded in the vicinity of the Site.

2.2.19 Very little Iron Age activity is evidenced in the WHS, suggesting people may have deliberately avoided the earlier monuments [20]. Limited evidence suggests some settlement activity near Durrington Walls (NHLE 1009133) [22] [23] approximately 1.5 km north of the Site; and on Southmill Hill, Amesbury, roughly 2.3 km south-east of the Site [24] [25]. However, more substantial evidence is present immediately south of the Site in the form of Vespasian's Camp (NHLE 10912126), a large univallate hillfort on the western bank of the River Avon.

2.2.20 Although hillforts are typically associated with the Iron Age, some may have originated in the Late Bronze Age and are often located on the site of earlier monuments; at Vespasian's Camp, three potential earlier barrows have been identified. Although the correlation between hillforts and earlier monuments may relate to preferred use of the same topographic locations, the retention of the upstanding earthworks implies a deliberate association.

2.2.21 The northernmost part of the bank of Vespasian's Camp is now cut by the line of the 1960s A303 Amesbury bypass, and the southern part of the hillfort is separated by the line of Stonehenge Road, with private properties south of this at West Amesbury. In the post-medieval period the Marquess of Queensbury incorporated the hillfort as a feature in landscaping of the grounds of Amesbury Abbey. A grotto, vista, various paths and extensive tree planting date from this period.

2.2.22 Beyond the WHS, several areas of Roman occupation indicate both a continuity of occupation from the Iron Age in some places and the emergence of new settlements. Settlement in the landscape around the WHS seems to have been largely rural within a wider agricultural landscape. There is little activity identified at Vespasian's Camp, although continuity of occupation has been demonstrated at other Iron Age settlements in the wider landscape including west of Scotland Lodge [11] and at Druid's Lodge [26]. Substantial settlement of 3rd–4th century date has also been located on the western edge of Durrington Walls close to the Cuckoo Stone [20].

2.2.23 Beyond the WHS, south-east of the Site, a focus of activity can be seen around Amesbury in the Roman period, with extensive settlement and burial activity at Butterfield Down [27] and Boscombe Down [28] [29] [24] [30] with further activity identified on the western bank of the River Avon and a possible Roman villa located at Countess East [31] [4].

Early medieval (AD 410–1066), medieval (AD1066–1540), post-medieval (1541–1800) and modern (1801–2000)

2.2.24 Amesbury Abbey was founded *c.* 979 AD and the town is thought to have been an important settlement by the 10th century [32] [33]. Possible earlier-dated early medieval activity is suggested by the discovery of several burials near London Road [34]. The abbey was dissolved in 1177, with elements being incorporated into a subsequent priory. The new priory was endowed by Henry II and during the 12th to 14th centuries was a large and influential establishment [34].

2.2.25 A small early to middle Saxon settlement has been confirmed at Countess East, where several sunken-featured buildings where located during archaeological evaluation [31]. This is the only currently confirmed settlement activity of this period in the Stonehenge area, although it is likely that medieval and post-medieval occupation may overlie and obscure evidence for earlier origins.

2.2.26 Several intrusive Saxon burials have also been recorded within the barrow cemeteries of the Stonehenge landscape (e.g. at Lake Barrow Barrows, NHLE 1010863; Winterbourne Stoke West, NHLE 1015019). Although undated, several graves noted as intrusive burials within one of the barrows to the south of Woodhenge [23] could reflect a tradition of association between Saxon burial sites and earlier monuments.

2.2.27 The 1086 Domesday Survey indicates a distribution of settlements similar to that still seen today, with occupation focused along the Avon valley at Wilsford, Amesbury, Ratfyn, Bulford and Durrington. The documentary evidence also suggests the Avon Valley was heavily cultivated during this period with medieval parish and tithing boundaries bisecting the river valley on each side of the river [21] [20]. Cultivation extended into the open fields of West Amesbury, including King Barrow Ridge, Coneybury and Vespasian's Camp [20].

2.2.28 During the medieval period, Amesbury continued to be a significant local centre of 111 households with eight mills also recorded. Settlement is also noted at the small hamlet of Ratfyn east of the town, with other areas of associated settlement thought to have existed at Countess and West Amesbury [35]. Beyond the known settlement sites, areas of ridge and furrow to the west of Amesbury (MWI12817) indicate arable cultivation in and around the Site. Vestiges of medieval ridge and furrow cultivation (ID 220 & 221) were confirmed in the provisional results of the Hidden Landscapes Project to the north/north-west of the Site [9, p. 21].

2.2.29 In 1541, the Crown granted the estate of Amesbury Priory to Edward, Earl of Hertford (later Duke of Somerset), with the priory manor replaced by a new house *c.*1600. A new house was also constructed in the mid-17th century; the present property dates to the 19th century. A park within the priory precinct is known from the 17th century and was extended to the west of the Avon in the early 18th century, with further land to the north and west added in 1760. The monuments at Vespasian's Camp were incorporated into the landscape design with a series of paths and planting which largely still survive today [36]. Remnants of the former parkland can also still be seen in a series of small groups of trees to the north of the A303, commonly known as the Nile Clumps.

2.2.30 An early 18th century map suggests that the common fields of Amesbury largely lay on the eastern bank of the river, although the areas of Vespasian's Camp and Coneybury Hill were also farmed [34]. The pattern of cultivation probably reflects earlier medieval field systems, which were still farmed as strip fields at this time.

2.2.31 The area around the Site was informally enclosed in the latter part of the 18th century by the dominant landowner, the Duke of Queensberry [34]. The present-day field pattern around Amesbury is largely a reflection of this late post-medieval enclosure, although many of the land parcels have been incorporated into much larger fields.

2.3 Previous archaeological fieldwork

English Heritage/National Trust 1995

2.3.1 Magnetic susceptibility and detailed magnetometry surveys. Unsuitable conditions for survey were experienced.

2004 Published Scheme

2.3.2 Surveys in connection with development of the 2004 Published Scheme were undertaken over a period of more than 10 years and included geophysical survey in several phases as route options were developed, and trial trenching.

2.3.3 Geophysical survey of the 'Brown Route' option in 1994 included a small area within the Site; this located isolated ditch and pit type anomalies, but the responses were generally poorly defined [37]. Three other barrow sites were subsequently tentatively identified along with some possible ditch systems [38] [39].

2.3.4 Seven trenches east of the Site identified a former river terrace defining the back of a former floodplain of the River Avon. On the terrace edge, a relict brown forest soil of Holocene date contained a flint scatter of Late Mesolithic/Early Neolithic type (MWI11874) [11].

University of Birmingham 2010-2015

2.3.5 The Stonehenge Hidden Landscapes Project (SHLP) led by the University of Birmingham employed multiple motorized magnetometers, ground-penetrating radar arrays, electromagnetic induction sensors, earth resistance surveys and terrestrial 3D laser scanners. The full results of the project have yet to be published, though preliminary results have been provided to the Highways Agency [9] and relevant information is incorporated in the chronological background (above).

Proposed Scheme

2.3.6 A detailed gradiometer survey and ground penetrating radar (GPR) survey was conducted over all accessible areas of the Site and further areas to the north and east – known as area NE2 in the Scheme's geophysical reports [4, pp. Figs 33-35]. A linear anomaly (4511) running north–south for approximately 95 m was interpreted as a former agricultural feature such as a field boundary or enclosure ditch; it does not relate to any previously known archaeological feature, nor is it recorded on historic mapping. A weak curvilinear anomaly (4512) to the west of 4511, roughly circular in shape with a diameter of around 15 m could be a severely plough damaged barrow, or it may represent a change in the superficial geology.

2.3.7 A weak linear anomaly (4517) in the centre of the area represents the continuation of an existing field boundary and was identifiable on the 1885 edition of the Ordnance Survey map. Another possible field boundary (4518) was not identifiable on historic mapping. Areas of amorphous anomalies (4519; 4520) were detected across the east of the area [4].

2.3.8 In January 2017 Wessex Archaeology carried out evaluation trenching within the western end of the Site [16]. The evaluation area straddled a relatively small but pronounced coombe and colluvial deposits were recorded in all but five trenches on the upper slopes out of the coombe itself. In the uppermost of these trenches a thin calcareous rendzina ploughsoil gave way sharply to solid chalk rock with no periglacial markings, indicating a significant degree of erosion due to ploughing; in all other trenches periglacial cryoturbation features were both abundant and clear, indicating that little if any underlying chalk has been lost to the plough in this part of the site (and therefore that any absence of archaeological features – those cut into the chalk at least - is likely to be real, rather than the product of truncation).

2.3.9 Within the coombe itself, substantial deposits of colluvium were recorded, over 1.05 m thick in Trench 69 in the middle of the dry valley. The colluvial deposits were notable for the apparent absence of standstill episodes within them, potentially indicating a single continuous period of ploughing (upslope of the evaluated area). Although no artefacts were recovered the excavators suggest that a general Bronze Age date would be a reasonable estimate; given the paucity of finds, a Romano-British date would be very unlikely.

2.3.10 Environmental analysis of samples from the colluvium identified wheat grain fragments and chaff, seeds from wild plants, and charcoal fragments from mature wood.

2.3.11 Natural features in the trenches included tree-throw holes and animal burrows. Plough-scars (and other mechanical marks) were noted cutting the natural in a number of trenches and are likely to be of modern date.

2.3.12 The only archaeological feature encountered in the trenches in the 2017 evaluation was a small undated ditch aligned north–south. Although close to the position of a linear anomaly detected by geophysical survey, the alignment did not correspond.

3 Aims and Objectives

3.1 Introduction

3.1.1 The overarching research themes, derived from the WHS Research Framework [40], of the archaeological investigation methods and techniques are as set out in the OWSI [2, pp. 7-8]. In the SSWSI, the potential for the archaeological evaluation to contribute to these themes was considered through period-specific research themes [3, p. section 3]: these are not repeated here. The general aims of the archaeological evaluation as set out in the SSWSI are reproduced below for each evaluation technique proposed for the Site.

3.2 Aims

Ploughzone artefact sampling – fieldwalking

3.2.1 The general aims of the surface artefact collection (fieldwalking) were:

- To confirm the presence or absence of artefactual material within the ploughsoil and their relative concentrations;
- To determine the range, date and quantity of artefactual evidence present;
- To establish the extent, character, date (where possible) and significance of artefact scatters and the contribution they make to the Outstanding Universal Value (OUV) of the WHS; and
- To produce this interpretive report on the findings of the fieldwork and to inform the development of an archaeological mitigation strategy for the Scheme[1].

Ploughzone artefact sampling – dry sieving

3.2.2 The general aims of the dry sieving (gridded test pitting and/or sampling of excavated spoil) were:

- To confirm the presence or absence of artefactual material within the ploughsoil and ploughsoil/subsoil interface and their relative concentrations;
- To determine the range, date and quantity of artefactual evidence present;
- To establish the extent, character, date (where possible) and significance of artefact scatters and the contribution they make to the OUV of the WHS; and
- To produce this interpretive report on the findings of the fieldwork and to inform the development of an archaeological mitigation strategy for the Scheme[1].

Trial trenching

3.2.3 The general aims of the trial trenching were:

[1] The approach to archaeological mitigation for the Scheme is set out in section 6.8 of the ES

- To confirm the presence or absence of surviving archaeological remains;
- To determine the location, nature, extent, date, condition, state of preservation, significance and complexity of any archaeological remains;
- To determine the likely range, quality and quantity of artefactual and environmental evidence present;
- To establish the extent and character of archaeological remains and provide an interpretation of the results in their local, regional, national or international context; and
- To produce this interpretive report on the findings of the fieldwork and to inform the development of an archaeological mitigation strategy for the Scheme[1].

Geoarchaeological investigation

3.2.4 The general aims of geoarchaeological investigation were:

- To assess the presence/absence of archaeological remains associated with buried sediments and archaeological horizons;
- To determine the location, nature, extent, date, condition, state of preservation, significance and complexity of geoarchaeological and palaeoenvironmental sequences;
- To collect palaeoenvironmental and/or geoarchaeological samples for off-site assessment/analysis;
- Provide an assessment of the formation processes behind the deposit sequences and their development through time;
- To establish the extent and character of palaeoenvironmental or geoarchaeological remains and provide an interpretation of the results in their local, regional, national or international context; and
- To produce this interpretive report on the findings of the fieldwork and to inform the development of an archaeological mitigation strategy for the Scheme[1].

3.3 Specific research objectives

3.3.1 The following specific objectives were proposed in order to address the research questions identified in the SSWSI [3, p. section 3.3]:

- To investigate possible Pleistocene/Holocene coombe deposits and the possible influence these may have had on the layout of the Stonehenge Avenue, and add to the baseline data about this period;
- To investigate whether the Mesolithic deposits found at Blick Mead extend to the north of the A303 and, if present, what is their state of preservation;
- To consider the chronology of surviving archaeological remains in the context of barrow group development and the relationship of Early Bronze Age barrows to earlier monuments;
- To identify the nature, orientation and state of preservation of possible Bronze Age ditches which may provide further evidence of Bronze Age

field systems and their relationship to the barrow cemeteries and outliers;

- To investigate whether Iron Age deposits and/or features related to Vespasian's Camp are preserved and, if so, if there is any relationship between them and earlier monuments;
- To investigate whether Romano British deposits and/or features exist; if so what is their nature and state of preservation. Is there any evidence for votive deposition of artefacts and if so is there any recognisable pattern of deposition associated with earlier monuments?
- To identify the impact of previous and current land uses on archaeological survival within the Site; and
- To consider the significance of surviving archaeological remains within the Site in terms of their contribution to the OUV of the WHS.

4 Methods

4.1 Introduction

4.1.1 The evaluation was conducted in accordance with the Standard and Guidance of the Chartered Institute of Archaeologists [41] [42]. A walkover of the Site was made by Wessex Archaeology to determine ground conditions and access arrangements prior to fieldwork commencing. All work was carried out in accordance with the submitted Risk Assessment and Method Statement (RAMS) which included methods to undertake the works safely and reduce risk during the programme of works outlined in the SSWSI [3]. Any changes to those methods proposed within the SSWSI were agreed in advance with HMAG.

4.2 Ploughsoil artefact sampling

Surface artefact collection (fieldwalking)

4.2.1 Surface artefact collection (fieldwalking) was undertaken initially (as shown in **Fig. 11.1**), involving the total collection of all artefactual material visible on the surface within 5 m x 5 m square collection units (25 m²) spaced at 20 m intervals. The collection units were laid out using GPS and marked with flags. Following collection, all finds from fieldwalking were washed, marked and logged on a Microsoft Access Database. National Grid locations and spot height values were also recorded. All artefactual material of pre-modern date was retained, except mass-produced materials such as tin-plates, plastics, modern brick and roofing slate, though their presence and frequency was recorded. Retention and disposal following recording are described in Section 6.

Ploughsoil artefact sampling (test pitting and dry sieving)

4.2.2 Further ploughsoil artefact sampling was undertaken through the hand-excavation of 401 test pits (**Fig. 11.1**), each measuring 1 m² (providing an approximate 1% sample of the overall area) and the on-site sieving of all excavated soil. The test pits were excavated to the base of the ploughsoil and all soil was sieved through a 10 mm mesh with a sub-fraction (approximately 30 litres) sieved through a 5 mm mesh, with any artefacts recovered being retained and allocated a context number specific to the relevant test pit (a unique 10 digit number, prefixed with the 8 digit test pit which is consistent with the OS grid reference of the test pit). Any archaeological features visible at the base of the ploughsoil were recorded in plan, as a minimum.

4.2.3 Some test pits originally proposed in the SSWSI had to be abandoned due to lack of access or ecological constraints, following agreement with HMAG. Test pits completed to the satisfaction of HMAG were backfilled using excavated materials and left level on completion. No other reinstatement or surface treatment was undertaken.

4.2.4 Artefact sampling through ploughsoil sieving was also incorporated within the trial trenching methodology. A 150 litre sample of machined topsoil was sieved on site through a 10 mm mesh every 5 m along each trial trench, with any finds recovered allocated a unique context number. This was undertaken in all excavated trenches bar Trench 504, where four test pits had been already excavated along the north side of the trench for ploughsoil artefact recovery.

4.3 Geoarchaeological auger survey

4.3.1 A powered auger survey targeting the north–south aligned coombe (known from aerial photography) was undertaken concurrently with the test pitting. The initial borehole survey consisted of 12 boreholes drilled in two parallel west-east transects across the dry valley (**Fig. 11.4**). The northern transect (A) extended from close to the northern boundary of the Site and consisted of 6 boreholes. The southern transect (B) comprised 4 boreholes and was located immediately north of the A303. Two further boreholes were spaced between the two transects in the base of the dry valley.

4.3.2 At each coring location, a percussive window sampling rig (Terrier type) was used to extract sleeved core samples down through the deposits, until solid structural chalk rock was reached. The rig was operated by experienced engineers from Ground Technology Services Ltd, under the supervision of a suitably experienced member of the Wessex Archaeology geoarchaeological team.

4.3.3 Core samples retrieved were one metre in length and 100 mm in diameter. The cores were split and described in the field, with selected key sequences being identified for retention. These retained cores were resealed and marked with site code, borehole number and sample depth, before being returned to the Wessex Archaeology laboratory at Salisbury for further investigation.

4.3.4 When split, geoarchaeological descriptions of the deposits and interpretations were recorded. This data was then tabulated by borehole and depth (**Appendix B**).

4.3.5 Before drilling commenced, service plans were consulted, and all locations were scanned using a Cable Detection Tool. Following drilling, the borehole locations were accurately recorded through real time kinematic (RTK) survey using a Leica GNSS connected to Leica's SmartNet service. All survey data was recorded in OS National Grid coordinates and heights above OD (Newlyn), as defined by OSGM15 and OSTN15, with a three-dimensional accuracy of within 50 mm.

4.3.6 The deposit records from the boreholes were entered into industry-standard software (Rockworks™ v17.0). Two transects (A & B) (**Figs 11.22** and **11.23**) were produced, from which cross-sections of the deposits across the dry valley were examined to enable the spatial distribution of stratigraphic units to be modelled and allow trench investigations (below) to be targeted.

4.3.7 Trench 504 was excavated to a depth of 2.5 m to allow the sequence identified in the borehole survey to be investigated, sampled and recorded in detail. It was orientated east-west across the centre of the dry valley, between and parallel to borehole transects A and B. A stepped trench was excavated to investigate the full depth of the sequence using a 360º excavator equipped with a toothless bucket, under the constant supervision and instruction of a suitably experienced monitoring geoarchaeologist. Machine excavation proceeded in level spits of approximately 50–200 mm.

4.3.8 The first step of the trench measured 35.00 m by 7.00 m, with a maximum depth of 1.20 m. The second step measured 25.00 m by 4.00 m, with a maximum depth of 1.20 m. To evaluate the full depth of the sequence above structural chalk two machine dug test pits were excavated in the base at the eastern end and in the centre of the trench; these measured 2.00 m x 2.00 m and were dug to a depth of 0.30 m.

4.3.9 Geoarchaeological descriptions and interpretations were recorded. A broadly consistent stratigraphic sequence was encountered and a single representative section of the south facing section was drawn at a scale of 1:50.

4.3.10 In accordance with the OWSI [2], an additional hand dug test pit measuring 2.00 m by 0.50 m was dug through deposits exposed in the eastern end of the south facing section of the trench. The excavated material from this test pit was sieved to 10 mm at 0.20 m vertical intervals for finds recovery and the position of artefacts plotted in two dimensions. The south facing section through this test pit was selected for detailed palaeoenvironmental sampling and drawn at scale of 1:20 (Section 2, **Fig. 11.19**).

4.3.11 Two parallel ditches, orientated north-north west to south-south east, were identified at the extreme western end of the trench. These were sectioned, sampled (sample numbers 50476 and 50477) and recorded.

4.3.12 The sampling strategy adopted was designed to investigate the palaeoenvironmental and dating potential of the deposits encountered. 48 samples were taken (see **Table 10-1**). A continuous column of 1.5 kg sediment samples for the recovery of molluscs was obtained from the south facing section at the eastern end of the trench (sample series 50417). This sampled the entire geoarchaeological sequence above the structural chalk. Deposits were sampled at 100 mm intervals, except through the buried soil where sampling intervals of 50 mm were adopted. A second continuous column of 1.5 kg sediment samples (sample series 50466) was taken following the same methodology from throughout the buried soil and fills exposed in south facing section of the easternmost ditch [50445] and [50442]. Two bulk samples (50476, 50477) were taken from fill (50455) and (50446) from this ditch [50455].

4.3.13 Overlapping samples suitable for micromorphological assessment were taken through the buried soil in two locations; one from the south facing section at the eastern end of the trench and the other from the south facing section at the western end of the trench.

4.3.14 Samples suitable for OSL sampling were also taken, as in **Table 10-1**.

4.3.15 The position of the trench, test pits, sections and features were accurately recorded through real time kinematic (RTK) survey using a Leica GNSS connected to Leica's SmartNet service. All survey data was recorded in OS National Grid coordinates and heights above OD (Newlyn), as defined by OSGM15 and OSTN15, with a three-dimensional accuracy of within 50 mm.

4.4 Trial trenching

4.4.1 Thirteen trenches (a combination of 50 m x 1.8 m and 10 m x 10 m trenches) were proposed in the SSWSI targeting possible geophysical anomalies as well as apparently 'blank' areas and to augment previous trial trenching for the Scheme. Following agreement with HMAG, twelve trenches were excavated (**Fig. 11.1**). It was not possible to excavate proposed Trench 513 (measuring 10 m x 10 m) at the eastern end of the Site because of the proximity of a tree; following discussion on site with HMAG monitoring visit it was agreed not to relocate this trench given the paucity of archaeological evidence in this vicinity combined with the very low potential apparent in adjacent (previously opened) trenches.

4.4.2 The trial trenches were excavated in the locations proposed in the SSWSI, with any minor adjustments to take account of any on-site constraints agreed with HMAG. This included the shortening of Trench 504 to approximately 35 m long due to ecological constraints. Due to its location in the coombe and need to investigate associated deeply buried deposits, Trench 504 was stepped and was approximately 7 m wide at its surface. It was excavated under the same conditions as the other trenches, under the additional supervision of a geoarchaeologist, as described in Section 4.3 above.

4.4.3 Each trench was scanned for live services with a Cable Avoidance Tool (CAT). The trenches were excavated in level spits using a 360º excavator equipped with a toothless bucket, under the constant supervision and instruction of the monitoring archaeologist. Machine excavation proceeded until either the archaeological horizon or the natural geology was exposed, whichever was encountered first.

4.4.4 A sample of the ploughsoil (approximately 150 l) from each trench was sieved through a 10 mm gauge wire mesh at 5 m intervals along the trench for artefact sampling purposes (above). Any artefacts recovered using this methodology were assigned a unique context number according to their position within the trench. This position was then recorded on Wessex Archaeology's pro forma trial trench records or surveyed with GPS.

4.4.5 Where necessary, the base and sides of the trench were cleaned by hand. A sample of archaeological features and deposits identified was hand-excavated, consistent with those set out in the OWSI [2, p. Table 2] and sufficient to address the aims of the evaluation. All treethrow features were tested by partial excavation to confirm their natural origin; a 10% sample were half-sectioned or quadrant excavated to identify the potential for cultural material to be present, following a request from HMAG.

4.4.6 Stripped surfaces and spoil derived from both machine stripping and hand-excavated archaeological deposits was both metal detected and visually scanned for the purposes of finds retrieval. Where finds were found from the above methods, as well as from ploughsoil artefact sieving (above), artefacts were collected and bagged by context. All artefacts from excavated contexts were retained.

4.4.7 Trenches completed and inspected by HMAG were backfilled using excavated materials in the order in which they were excavated, and left level on completion. No other reinstatement or surface treatment was undertaken.

4.5 Recording

4.5.1 All exposed archaeological deposits and features were recorded using Wessex Archaeology's pro forma recording system. A complete drawn record of excavated features and deposits was made including both plans and sections drawn to appropriate scales and tied to the Ordnance Survey (OS) National Grid. The Ordnance Datum (OD: Newlyn) heights of all principal features were calculated, and levels added to plans and section drawings.

4.5.2 The location of archaeological features was surveyed using a Leica GNSS connected to Leica’s SmartNet service. All survey data is recorded in OS National Grid coordinates and heights above OD (Newlyn), as defined by OSGM15 and OSTN15, with a three-dimensional accuracy of within 50 mm.

4.5.3 A full photographic record was made using digital cameras equipped with an image sensor of not less than 10 megapixels. Digital images have been subject to managed quality control and curation processes, which has embedded appropriate metadata within the image and will ensure long term accessibility of the image set.

4.6 Finds and environmental strategies

4.6.1 Appropriate strategies for the recovery, processing and assessment of finds and environmental samples were in line with those detailed in the SSWSI. The treatment of artefacts and environmental remains was in accordance with: *Guidance for the collection, documentation, conservation and research of archaeological materials* [42], *Environmental Archaeology: A Guide to the Theory and Practice of Methods, from Sampling and Recovery to Post-excavation* [43] and *Geoarchaeology: using earth sciences to understand the archaeological record* [44], except where specified in the relevant sections below.

4.7 Monitoring

4.7.1 The works were monitored by HMAG through regular meetings arranged by AmW. HMAG is advised by a Scientific Committee of independent specialists and experts; members of the Scientific Committee visited the Site on 23 February 2018. Monitoring visits were made by HMAG on a weekly basis in order that the archaeological work could be inspected and reviewed. Any variations to the SSWSI, if required in order to more appropriately address the project aims, were discussed between HMAG and AmW, and approved by HMAG.

5 Results

5.1 Introduction

5.1.1 A total of 401 test pits were hand-excavated across the Site for ploughsoil artefact recovery, via sieving of the excavated ploughsoil (**Figs 11.2–11.8, Plates 12.1** and **12.2**). For the most part, excavation did not proceed below the ploughsoil; the main exceptions to this were test pits in the east of the Site (Section 5.2.6), following a request by HMAG to investigate underlying deposits.

5.1.2 Twelve trial trenches were excavated in total: nine linear trenches measuring 50 m x 2 m and a further shortened one (35 m long), as well as two square trenches measuring 10 m x 10 m (**Figs 11.9–11.18**). Eight of these trenches did not contain any archaeological features or deposits (trenches 501, 502, 503, 505, 507, 508, 509 and 510: **Figs 11.9, 11.10** and **11.12–11.14**).

5.1.3 Summaries of the excavated sequences in each trial trench can be found in **Appendix A**.

5.2 Soil and colluvial sequences, and natural features

5.2.1 While chalk geology remained consistent across most of the Site (except in Trenches 511 and 512 in the east of the Site, where natural soliflucted chalk was encountered containing variable patches of siltier sediment and rarer patches of small flint gravels), the soils and sequences overlying the natural geology varied in presence and character. This is largely a result of ploughing (both ancient and modern) and topography. All the recorded variations were consistent with what can be considered normal for this landscape.

5.2.2 A thin calcareous rendzina ploughsoil (approximately 0.3 m thick on average), a mid greyish brown silty loam, was recorded in the majority of the trenches, though in Trenches 511 and 512 in the east of the Site, the ploughsoil was a more yellowish brown silty clay loam (up to 0.40 m thick), reflecting changes in the underlying geology (detailed in section 2.1).

5.2.3 In Trenches 501 and 502, a thin subsoil consisting of a mid reddish brown silty loam with frequent small chalk inclusions (> 0.12 m thick) lay above compact chalk natural (containing no periglacial stripes). The presence of this layer, best described as an interface (B horizon) between the A (surface) and C (substratum) horizons, appears to indicate that at least the most recent ploughing regime has not been incising into the surface of the chalk below. However, this appears to be localised as in the adjacent trench to the east (Trench 503) no such subsoil was identified, the ploughsoil directly overlaying weathered chalk (with no evidence of periglacial stripes or plough scars). This was also the case in Trenches 506, 507 and 508 located on the eastern slope rising out of NNW–SSE aligned dry valley. Conversely in Trench 510, where ploughsoil also directly overlay the chalk, some periglacial features as well as plough scars were recorded in the surface of the natural chalk (**Fig. 11.16**). This would therefore appear to indicate that in the locality of this trench, the surface of the chalk has been lightly impacted by ploughing but not significantly enough to have removed periglacial scarring. Trench 509 also contained plough scars at its south-western end (**Fig. 11.15**). The only other plough scars recorded cutting the chalk were in Test Pit 1407 4206 on high ground in the far south-west corner of the Site, where the ploughsoil was thinnest (**Plate 12.3**).

5.2.4 The central part of the Site is crossed by a NNW–SSE aligned dry valley: a calcareous colluvial sequence was recorded in Trench 504 (**Fig.11.11** and **Fig.11.19; Plate 12.4**). The ploughsoil and colluvium (50401 and 50402-4 respectively) lay above a buried soil (50405), which in turn overlay slope gravel wash (50406) and natural coombe deposits (50407). This sequence, fully described and sampled by a geoarchaeologist in the field, is detailed in Section 5.4 below in relation to archaeological features that were associated with this sequence. In adjacent Trench 505, a thin calcareous colluvial subsoil, a mid yellowish brown silty clay loam, was present for 30 m at the downslope north-west end of the trench. In this locality, potential colluvial deposits (unexcavated) at the base of test pits were also observed in a swathe closely following the ENE–WSW narrow dry valley that feeds into the more pronounced NNW–SSE aligned coombe. The former correlates with a geophysical anomaly interpreted as superficial geology and the potential colluvial deposits in test pits were recorded in a 10 m swathe either side of this (**Fig.11.2**).

5.2.5 In the east of the Site, in Trenches 511 and 512 the turfed topsoil lay above a thin subsoil with a diffuse lower boundary with evident rootholes descending into the underlying soft soliflucted chalk natural. A large natural hollow (51224) measuring approximately 15 m in width and excavated up to a depth of 1.35 m was located at the north-west end of Trench 512 and was infilled with a colluvial sequence (**Fig. 11.18**). The natural hollow was infilled with decalcified colluvial deposits (51220 and 51221) i.e. sediment accumulated by slope processes. At the base of this upper colluvium, a dark stony horizon (51222) comprising a dark brown silty clay containing abundant small rounded and sub-rounded flint gravel was encountered at a depth of 0.80-0.83 m below the ground surface– this deposit is further discussed in Section 5.4 below. A further layer of decalcified colluvium (51215) underlay this (**Fig. 11.21** and **Plate 12.5**). The natural hollow itself may have been created by solution into the underlying chalk, though as the feature was not excavated to its full depth, this remains uncertain. Although this feature was not viewed in the field by a geoarchaeologist and so is not covered in the geoarchaeological section, the recorded archive (drawn, written and photographic) has been assessed in collaboration with Wessex Archaeology's geoarchaeologist and this has resulted in the enhancement of the initial interpretation of the deposits recorded in the field.

5.2.6 A colluvial sequence, underlying the topsoil and above natural solifluction deposits, was also uncovered in two test pits in the east of the Site: 1506 4210 and 1508 4209 (**Fig. 11.8**). Following a request from HMAG, these were excavated to a greater depth to investigate underlying deposits (in 0.20 m thick arbitrary spits allocated separate context numbers).

5.2.7 A small quantity of finds was recovered from the 0.50 m thick colluvium in Test pit 1506 4210 (**Plate 12.6**), including two fragments of post-medieval/modern ceramic building material (CBM), a single sherd of late medieval/early post-medieval pottery (1506 421004), two worked flint flakes (1506 421005) and a single piece of burnt flint near the surface of the underlying natural solifluction deposit (1506 421006).

5.2.8 Small quantities of finds were also recovered from the 0.46 m thick colluvium in Test Pit 1508 4209: a single sherd of post-medieval/modern pottery, CBM, animal bone, worked and burnt flint from the upper spit (1508 420902, 0.10–0.25 m below the ground surface at 69.6 m aOD); a single sherd of post-medieval/modern pottery, post-medieval/modern CBM, animal bone, 17 pieces of worked flint and five pieces/136 g of burnt flint from 1508 420903 (0.25–0.40 m below the ground surface); and a scrap of CBM of uncertain date, a single worked flint flake, and one piece of burnt flint from the surface of 1508 420904 (0.40–0.86 m below the ground surface). These artefacts of mixed date clearly show the reworked nature of the colluvium.

5.2.9 Further small areas of possible geological variation and tree-throw holes were all sampled in accordance with the agreed methodology. Ten percent of tree-throw holes were half-sectioned and fully recorded including those in Trenches 506 and 507 (**Figs 11.13** and **11.14**). Tree-throw hole 50606 measuring 1.8 m x 1.18m x 0.6 m deep was filled with a redeposited natural fill (50607) and a secondary fill (50612) which contained four worked flint flakes (Section 4, **Fig. 11.20**). Tree-throw hole 50714 was a larger example measuring 2.6 m wide and 0.68 m deep, but contained no finds (Section 5, **Fig. 11.20**). Its location partly overlaps with a possible archaeological geophysical linear anomaly though it clearly does not correspond to this.

5.3 Geoarchaeological auger survey

5.3.1 The geoarchaeological auger survey consisted of 12 boreholes drilled in two parallel west-east transects across the dry valley (**Fig. 11.4**). The northern transect (A) extended from close to the northern boundary of the Site and consisted of six boreholes (**Fig.11.22**). The southern transect (B) compromised four boreholes and was located immediately north of the A303 (**Fig.11.23**).

5.3.2 All boreholes were drilled until structural chalk bedrock was reached and the deposits encountered in each borehole are fully described in **Appendix B**. The general sequence of deposits recorded (from bottom to top) consisted of:

Structural chalk

5.3.3 This was encountered in all boreholes at depths below ground surface ranging from 2.00 m in BH7 to 4.70 m in BH9.

Structureless/weathered putty chalk

5.3.4 This was encountered in all boreholes at depths below ground surface ranging from 0.9 m in BH7 to 2.83 m in BH9, and varies in thickness from 1.06 m up to 2.60 m.

Head deposit

5.3.5 Only recorded in BH12, this consists of a stiff light brown clay with occasional large flints clasts. Formed from the dissolution, decalcification and cryoturbation of the chalk, it has been deposited by slope processes on the valley side. Clear convoluted upper and lower boundaries were observed.

Coombe deposits

5.3.6 This was encountered in all boreholes except for BH12 (located at the western end of Transect A) and BH3 (at the western end of Transect B). It was comprised of stiff light grey brown, poorly sorted silty clay loam, with abundant sub-angular chalk fragments.

Possible buried soil

5.3.7 This was observed at the base of the pedogenically altered colluvium in BH9 and BH11 in Transect A and BH5 and BH6 in Transect B. It consists of a dark brown clay loam with a granular texture and blocky structure.

Colluvium

5.3.8 This is a light brown clay loam with a granular texture and blocky structure. It contains chalk inclusions and is present between the underlying coombe deposits and overlying topsoil. The deposit ranges in thickness from 0.31 m to 0.92 m.

Made ground

5.3.9 This was only recorded in two boreholes, BH4 and BH5 in Transect B. Here, the deposit is approximately 0.3 m thick. It is comprised of a loose light grey, very mixed, clay loam with sub-angular chalk and flint clasts.

Topsoil

5.3.10 This is a firm brown silty loam plough soil with a granular texture, frequent fine chalk fragments and a clear lower boundary. The topsoil ranges from 0.3 m to 0.57 m thick, with the most extensive occurrences located in the bottom of the dry valley.

5.4 Geoarchaeological assessment of Trench 504

5.4.1 An analogous sequence to that encountered in the borehole survey was identified in Trench 504 (**Fig. 11.19**; **Plate 12.4**). The presence of a buried soil was confirmed, while exposure of the deposits in a continuous sequence allowed interpretations of the sequence to be refined.

5.4.2 The stratigraphy encountered was consistent across the excavated area. The full sequence is tabulated in **Appendix A** (Trench 504), while the major stratigraphic units listed are described below:

50408 Structural chalk (Cretaceous)

50407 Coombe deposits

5.4.3 This consists of chalky clay with frequent medium to very coarse angular flint clasts and nodules derived directly from chalk bedrock; it contains periglacial involutions. The deposits reflect material soliflucted downslope under periglacial conditions (alternate freeze-thawing). It was directly underlain by structural chalk.

50406 Angular gravel

5.4.4 This comprises moderately sorted, medium angular gravel in a slightly silty clay matrix. It consists of slope wash material, which may have been subsequently winnowed, reworked downslope during a period of landscape instability post-dating the deposition of the coombe deposits and predating the formation of the overlying soil. It forms the base of the colluvial sequence.

50405 Buried soil

5.4.5 This dark brown, slightly silty clay soil is largely clast free and was found across the trench, although it thins westwards towards the valley margin. It reflects a period of landscape stabilisation. The structure of the soil is incipient and it possibly contains a thin basal relict soil (B horizon) overlain by an upper bA/B (or eroded A "topsoil"). One piece of burnt flint and two sherds (5 g) of abraded Roman pottery were recovered from the buried soil, the basal horizon of which also produced seven pieces of undiagnostic prehistoric worked flint, all flake debitage.

50403/50404 Lower colluvium

5.4.6 The lower colluvium is darker in colour and has a blockier texture than the upper colluvium. It is a slightly clayey silt with occasional medium-coarse sub-angular flint clasts. At the eastern end and through the central portion of the trench the unit transitioned to clayey silt containing frequent medium to very coarse angular and sub-angular flint clasts. This, and the overlying upper colluvium, results from the downslope movement of sediments initiated by landscape instability resulting from the topographical relief and bought on by activities such as clearance of woodland, agricultural activity and soil degradation, leading to downslope movement of sediment.

50402 Upper colluvium

5.4.7 The upper colluvium consists of moderately clayey silt with very occasional medium-coarse sub-angular flint clasts. It is more clay rich, lighter in colour and more calcareous than the lower colluvium.

50401 Plough soil

Palaeoenvironmental evidence

5.4.8 The bulk palaeoenvironmental samples (50476 and 50477) from ditch [50445] and the two continuous snail columns (sample series 50417 and 50466) have been assessed (see Section 7.3).

5.4.9 The assemblages from the bulk samples indicate the existence of background plant exploitation in the area, but due to the small size of the assemblages, their poor preservation and likely mixed nature, they are not significant for understanding past human activities in the area.

5.4.10 The mollusc samples contain a relatively low number of snails reflecting an open environment, and suggest that open and dry conditions have predominated through the time the sampled sediments were accumulating. There is a high likelihood of temporal mixing within the assemblages, however.

OSL dating evidence

5.4.11 Individual samples from the upper colluvium (50402), lower colluvium (50403) and buried soil (50405) were submitted for Optically Stimulated Luminescence dating. The specialist OSL report is included as an appendix (**Appendix D**) outlining the methodology and analytical uncertainty, with a summary of the results provided below.

5.4.12 All three samples produced age estimates that should be accepted tentatively due to three factors that reduce the accuracy of the resulting data, comprising; 1) failed dose recovery test - where the laboratory analytical process alters the natural OSL signal of a sample, 2) potentially significant U disequilibrium – where the OSL dating method assumes a constant dose rate which these samples may not have received, and 3) partial bleaching in the buried soil and lower colluvium, resulting in partial resetting of OSL signals.

5.4.13 The samples from the buried soil (50405) produced an age estimates of 2.08±0.19 ka (260 BC–AD 130) corresponding to the Late Iron Age and Romano-British period.

5.4.14 The sample from the lower colluvium (50403) produced an age estimate of 1.07±0.11 ka (AD 840–1050) corresponding to the late Saxon period.

5.4.15 The sample from the upper colluvium (50402) produced an age estimate of 0.47±0.05 ka (AD 1500–1600).

5.4.16 The three age estimates are in stratigraphic order. However, certain caveats for assessing the reliability of the age estimates should be borne in mind. Successful dating of colluvium requires sufficient resetting of the OSL signal by exposure to daylight. If the last process of erosion does not involve sufficient bleaching (for example where clumps of soil are moved with insufficient exposure of sediment to daylight), then a remnant signal remains which will result in an older age estimation.

5.4.17 With buried soils, bioturbation can result in mixing of grains, resulting in potential partial bleaching and partial resetting of OSL signals. Where mixing occurs, it will result in a broad distribution of equivalent dose rates that are used to determine age.

5.4.18 There is evidence from the buried soil for some potential partial bleaching, which can be caused by a range of potential factors that are difficult to identify and isolate. The age-estimate therefore provides a broad age for the buried soil covering the late Iron Age to Romano-British period.

5.4.19 There is also evidence from the lower colluvium for some potential partial bleaching, which likewise provides a minimum age-estimate for this deposit within the Late Saxon period, but may include partially bleached material from older phases of slope-wash occurring after cessation of formation of the buried soil. There is no evidence for partial bleaching of the upper colluvium, suggesting that the equivalent dose is likely to be the actual dose, bearing in mind the previously highlighted issue of U disequilibrium (para. 5.4.12).

5.4.20 Together the OSL age estimates provide a relative chronology and should be accepted tentatively with these caveats in mind. The issue of partial bleaching cannot be resolved with the current method which involves a cumulative dose-estimate based on multiple grains from multiple aliquots. However, single grain dating would help to eliminate any partially bleached grains from the age-estimate, should further OSL dating be required.

5.5 Archaeological features and deposits

Prehistoric

5.5.1 No features were uncovered in the evaluation that were securely dated to this period, though deposits which may potentially be prehistoric in date were identified in two trenches, beneath colluvial sequences: a buried soil (50405) in Trench 504 and a stony horizon (51222) in Trench 512. Soil horizon 50405 was 0.15 m thick and was present along the entire length of Trench 504 and lay buried below a 0.85 m thickness of colluvium (50402 and 50403, **Fig. 11.19**). Seven worked flint flakes, one piece of burnt flint and two sherds (5 g) of abraded Roman pottery were recovered from the buried soil, which was cut by two parallel ditches (50445 and 50448) of possible Romano-British date. This sequence of deposits is further detailed in section 5.4 above. Environmental samples were taken from this context for snail assessment and for Optically-Stimulated Luminescence (OSL) dating, with the latter producing a date of 2.08±0.19 ka (260 BC–AD 130) corresponding broadly to the Late Iron Age to Romano-British period. The OSL and snail results are presented in Section 5 and 7 respectively.

5.5.2 A stony horizon (51222) lay under nearly 0.6 m of decalcified colluvium (51220 and 51221) infilling a natural hollow (51224) in Trench 512 (**Figs 11.18** and **11.21**; **Plate 12.5**). A coherent group of worked flint comprising primary knapping debris of Late Neolithic date, among which a small Mesolithic component (a bladelet and burin spall) is mixed, was recovered from deposit 51222. This stony horizon could represent a period of stasis within the continual slope process deposits, or it could be related to deflation i.e. when fine-grained material is lost/washed out from the colluvium leaving heavy inclusions (flint and artefacts) in a horizon at the base of the colluvium. A very similar assemblage of worked flint, in terms of quantity and form, and also including a microlith of Mesolithic date, together with one sherd/15 g of Early Neolithic pottery and 5 g of Beaker pottery was recovered from overlying colluvium 51221. Worked flint comprising a scraper and six flakes was also recovered from the upper colluvial layer 51220. No finds were recovered from the underlying colluvium (51215), and therefore its date remains uncertain, as does its full extent. The condition of the worked flint suggests that it has not travelled far and the presence of artefacts of Mesolithic date is not unexpected given findings of Mesolithic lithics to the immediate north of this eastern end of the Site [45] and Mesolithic occupation known approximately 100 m south at Blick Mead [19].

Romano-British

5.5.3 Two parallel NNW–SSE orientated ditches (50445 and 50448), 3.4 m apart, appeared to cut the buried soil (50405) and were overlain by colluvium (50402 and 50403) in Trench 504 (**Figs 11.11** and **11.19**). The westernmost ditch (50448, measuring approximately 1.9 m wide and 0.75 m deep) was slightly more substantial than ditch 50445 to the east, which measured 1.5 m wide and 0.7 m deep (**Plates 12.7** and **12.8**). Both were infilled with a similar sequence of deposits with primary fills (50455 and 50449), secondary fills (50446 and 50451) and tertiary fills (50495 and 50494). The upper fill of ditch 50445 comprises redeposited coombe deposits (50495) and this material is likely to represent ploughed-in bank material which possibly was originally sited to the west of the ditch. No sign of comparable bank material was found in ditch 50448 though this does not negate the possibility of a bank, which may have been situated upslope to the west of the trench. A single greyware jar rim sherd (5 g) was recovered from upper fill 50494 and provides the only tentative dating evidence. A worked flint flake and ten pieces of burnt flint were also retrieved. Two small sherds of Roman black-burnished ware (totalling 5 g) were also recovered from the buried soil (50405), and one greyware jar neck sherd (13 g) was recovered from upper colluvium (50402). The results of OSL dating (**Section 5.4**) suggest that the buried soil is of a broad Late Iron Age to Romano-British date: while the ditches are also, therefore, provisionally considered as of probable Romano-British date, there is a possibility that they could be of Late Iron Age date. These ditches were not recognised in the geophysical survey interpretation, as they lay deeply buried.

5.5.4 In Test pit 1497 4211, a dark yellowish brown silty clay deposit with frequent flint nodules (1497 421102) extended across the base of the test pit and underlay the topsoil from 0.30–0.38 m + below ground level (**Fig. 11.7**). One sherd of Roman pottery and five sherds of Saxon pottery and animal bone fragments were recovered from the surface of this deposit, which may be associated with the colluvium/stony horizon which infills the natural hollow revealed in Trench 512 to the immediate north of the test pit; alternatively, it may represent infilling of a separate archaeological feature.

Post-medieval/modern

5.5.5 Test Pit 1495 4210 contained a probable ditch (1495 421003) cut through the ploughsoil (sealed by a turf line), recorded in the east facing section (**Fig. 11.7; Plate 12.6**). This does not correlate with any archaeological or possible archaeological anomalies from the interpretation of the geophysical survey. The ditch had steep straight sides and measured 0.45 m wide and 0.45 m deep. It was infilled with a single secondary fill (1495 421004) containing 14 pieces/273 g of post-medieval/modern CBM and a single animal bone. Another probable post-medieval/modern feature was cut through the ploughsoil in Test Pit 1408 4209, although no finds were recovered from the infilling deposit (1408 420902).

5.5.6 A small sub-circular pit (1506 421003, **Fig. 11.8**) was uncovered in the north-west of Test Pit 1506 4210, cut into colluvial deposit (1506 421004). It measured 0.7 m+ wide and 0.3 m deep, and was filled with a mid greyish brown sandy silt deposit (1506 421002) from which small quantities of animal bone were the only retrieved finds. Given the similarity of the fill to the ploughsoil, and the post-medieval finds recovered from the underlying colluvium (above) it is considered that this feature is of post-medieval/modern date.

5.5.7 Posthole 51127 in Trench 512 was square-shaped in plan, measuring 0.30 m^2 and 0.19 m deep (**Figs 11.17** and Section 6, **11.20**). It contained a single fill from which no artefacts were retrieved, however its form and the similarity of the fill to the ploughsoil again suggest it is likely to date to this period.

5.5.8 A shallow horizontal cut (50905) truncated the chalk natural in Trench 509, infilled with redeposited chalk natural from which nine flint flakes, an iron post-medieval knife blade and a single sherd of medieval pottery were recovered (**Fig. 11.15** and **Plate 12.9**). Considering the width of the cut and its flat base, this disturbance feature is thought to have been created by machine and therefore to relate to previous construction work for the A303.

5.5.9 A layer of compacted redeposited chalk (possibly resulting from agricultural activity or relating to previous A303 investigations) was recorded in two adjacent test pits (1502 4209 and 1503 4209: **Fig. 11.7**), underlying the ploughsoil and overlying the unexcavated subsoil. A further layer of redeposited chalk was recorded below the topsoil in Test Pit 1507 4208 (**Fig 11.8**), and was interpreted as possibly related to the construction of the adjacent road.

Undated

5.5.10 At the eastern end of Trench 506, a north-south aligned ditch (50603) corresponded to a linear anomaly from the geophysical survey (**Figs 11.13** and Section 3, **Fig. 11.20**). It measured 0.51 m wide and 0.37 m deep and was filled with fills derived from natural silting. No artefacts were recovered from these deposits and so this feature remains of uncertain date.

5.6 Ploughsoil artefact sampling (fieldwalking) and dry sieving (test pitting) and sieving of ploughsoil from trial trenches

Introduction and methods

5.6.1 The results of the fieldwalking exercise were adversely affected by crop debris (consisting of wheat straw, stubble and chaff) covering the ground and much obscured the surface of the ploughsoil, yet despite this a small quantity of finds were retrieved.

5.6.2 Initial quantification of the results of the fieldwalking, test pitting and trench spoil sieving was undertaken using a Microsoft Access database, and this data was used to create the point distribution plots in ArcMap 10.3. Points of increasing size were created at equal intervals for each material within the plots, based upon the count or weight of the material within a fieldwalking, test pitting or trench spoil sieving unit. Worked flint, pottery and metalwork are displayed by count, whilst burnt flint and CBM are displayed by weight (in grams), in **Figures 11.24** to**11.30**.

5.6.3 Underlying contours for the worked flint counts and burnt flint weights were also created using ArcGIS 10.3. These contours illustrate, in standard deviations, the difference from the mean of worked flint counts and burnt flint weights, and have been created based upon the volume of the test pits, fieldwalking units and trench ploughsoil sieving units, allowing all finds recovered from the ploughsoil to be directly comparable.

5.6.4 The data was initially interpolated using the ArcGIS 10.3 'Kriging' Spatial Analyst tool, using a linear semivariogram model. Contours were then produced from the resulting grid using the ArcGIS 10.3 'Contours' Spatial Analyst tool, with intervals set to one standard deviation, allowing areas of finds with potential statistical significance to be more readily visible on the worked flint and burnt flint distribution plots.

Results: artefact distribution

Prehistoric, Roman and Medieval pottery

5.6.5 The distribution of pottery belonging within these periods is shown on **Fig. 11.24**. As such small quantities were recovered, the findspots consist only of isolated or very small groups of sherds, mostly occurring at the eastern end of the area.

Worked and burnt flint

5.6.6 Within the ploughzone, worked flint was distributed across the entire Eastern Portal area (**Fig. 11.25**) with a relatively uniform low-level occurrence of pieces. There were four small clusters of higher incidence, with the densest in the centre of the area. The general pattern accords with that revealed by surface collections carried out as part of the Stonehenge Environs Project, which showed a generally uniform low-level background scatter of material across this area, with some small localised concentrations, mostly flake debitage but with some core material and fewer retouched tools [7].

5.6.7 Previous work within the Eastern Portal zone encountered significant lithic assemblages. Trial trenching west of Countess Farm on the edge of the Avon floodplain encountered a significant assemblage of Late Mesolithic material in one trench [11], at the time of its discovery the only material of this date known from the eastern part of the World Heritage Site and its environs other than a group of soft hammer-struck blades recovered during evaluation works at Countess Roundabout [31]. The current work did not encounter significant concentrations of material of this date, but the occurrence of individual pieces (as noted in Section 6.6 below) and pieces mixed among groups of later material (in Trench 512) indicate that activity was taking place in the immediate vicinity at this time, as do the on-going excavations on the southern side of the A303 at Blick Mead [46].

5.6.8 When considered in isolation, the burnt flint (**Fig. 11.26**) appears to be spread evenly across the Eastern Portal area, with small concentrations at the east and west ends. When considered in conjunction with the worked flint distributions, however, it appears that the western- and eastern-most concentrations of worked flint are located adjacent to, but not coincident with, burnt flint clusters. This phenomenon has been noted elsewhere, and it can be suggested that the occurrence of higher densities of worked and burnt flint together may indicate refuse derived from nearby activity areas. Burnt flint was not collected during the Stonehenge Environs Project [7], so comparable data is not available.

Other finds

5.6.9 This group includes ceramic building materials, metalwork, pottery, glass, clay tobacco pipe, and synthetics, all of Post-medieval or modern date, as well as intrinsically undatable materials such as animal bone, oyster shell, slag and stone. These distributions are shown in **Figs 11.27 – 11.30**. Although many of these categories occur in only very small quantities, all show a widespread distribution across the whole Eastern Portal area. The more numerous groups, such as the ceramic building material (**Fig. 11.27**) and the Post-medieval and modern pottery (**Fig. 11.29**), show two concentrations, one at the eastern end, probably associated with previous occupation of Countess Farm, and the second at the western end. This western distribution is likely to be associated with refuse disposal relating to the rectilinear area of ridge and furrow located to the south-east of the New King Barrows (HER ref MWI 12817; Baseline Study ref. 3077.02 UID).

6 Artefactual evidence

6.1 Introduction

6.1.1 Finds were recovered as in **Table 10.2**. Quantities were for the most part small, with only worked flint and ceramic building material occurring in any quantity (>1000 pieces). Burnt flint, pottery, metal and glass were less frequent (<500 pieces), with smaller quantities (<50 pieces) of animal bone, clay tobacco pipe, marine shell, stone and synthetics. The largest parts of the assemblage dates to the later Neolithic/Early Bronze Age (worked flint) and the Post-medieval and modern periods (most of the other dateable material).

6.2 Animal bone

6.2.1 Animal bone was recovered in very small quantities, with just 43 pieces (303 g) from the test pits and two (2 g) from the trenches. All the pieces survive in relatively poor condition and where more than one piece was found in a context, the fragments generally derive from a single bone. Most belong to the more robust skeletal elements (teeth and long bones) of domesticated species, although one bird bone was noted (Test Pit 1506421001).

6.2.2 Anatomical elements include tibia fragments from sheep (Test Pits 14104211, 1435 4216 and 1506 4210), the latter being a modern, ‘improved’ breed. Part of a pig femur was found in Test Pit 1488 4212, while a third molar and rib and long bone fragments from cattle came from Test Pits 1502 4210 and 1506 4210 respectively. Neither of the pieces from the trenches (Trenches 511, context 51125 and 512, context 51212) could be identified as both were too small and eroded.

6.3 Burnt flint

6.3.1 A total of 417 pieces (6829 g), of unworked burnt flint was recovered from 211 locations within the Eastern Portal area. Although burnt flint is intrinsically undatable, it is generally considered indicative of prehistoric activity and, as such, its distribution can make a valuable contribution to the identification of potentially buried or ploughed-out ‘sites’/ephemeral activity areas. However, in this area, the most prolific location (Test Pit 1421 4214) contained just ten pieces weighing 435 g and no individually significant concentrations in either the number of pieces or weight (no locations contained more than ten fragments and only nine contained more than five fragments or 100 g), were identified. Distributions and densities in comparison to worked flint have been considered above. Given the limitations of the dataset, all the burnt flint was discarded following quantification.

6.4 Ceramic building material

6.4.1 With the exception of five pieces of roof tile with tiny splashes of glaze which are likely to be medieval (Test Pits 1495 4211 – one piece and 1504421001 – four pieces), the entire assemblage is of Post-medieval or modern date. Peg-hole roof tiles, a form developed in the 12th century and continuing into the modern day with very little typological change, dominate the assemblage, with brick fragments occurring in far smaller quantities (fewer than 100 pieces). Other items comprise salt-glazed stoneware drain pipe fragments (four pieces; Test Pits 1415421601, 1417421501, 1436421601 and 15064208501), kitchen/bathroom wall tiles (three pieces; Test Pits 1412421601, 1420421101 and 1474421401) and an air brick fragment (Test Pit 1411421301). No complete lengths or widths survive, the extremely fragmentary nature of the whole assemblage being amply illustrated by its mean weight of just 13.9 g. All this material was discarded after quantification.

6.5 Clay tobacco pipe

6.5.1 Eighteen pieces (42 g) were recovered, all from the test pits. One spur fragment from the topsoil of Test Pit 1415 4211 has a small shamrock leaf stamped on either side of the spur, while the surviving part of the stem carries the letters CORK. All the other pieces were plain stem fragments and were discarded after quantification.

6.6 Flint

6.6.1 1932 pieces of worked flint were recovered, as in **Table 10.3**. The pieces were retrieved from fieldwalking, test pits, trial trenches, and boreholes, but given that it is essentially a topsoil assemblage the material is discussed as a unit regardless of recovery strategy.

6.6.2 The condition of the assemblage is typical of collections from the ploughzone, with a preponderance of heavily patinated, large robust fragments of debitage, of the kind most likely to survive in these conditions, while many (both heavily patinated and less so) have splotchy orange iron staining. Much of the material is indicative of having undergone prolonged ploughing, with weathering of the surface through the patina and common damage. Among these pieces is an admixture of smaller, lighter, better-preserved and unpatinated material, including some that is in mint or very sharp condition lacking any sign of edge damage from ploughing. While much of this better-preserved material came from contexts below the topsoil (especially in Trench 512 – see below), some of it was found in ploughzone layers. In these instances, the degree of patination may indicate locally variable geological conditions, between chalky and more clayey (colluvial) soils.

6.6.3 The predominance of heavily patinated pieces means that colour cannot be assessed in most instances. Where it is visible however (either in more recent breaks or in the few unpatinated examples) it is predominantly grey to dark grey/black. The most likely source of the material is in the local geology.

6.6.4 The nature of the assemblage is such that secure chronological indicators are few. Over 80% of the material consists of unretouched flake debitage, and most of this is broad, squat, and apparently struck with hard hammers.

Among the bulk of this material there are some pieces which are more distinctive.

Mesolithic and/or Early Neolithic

6.6.5 Blade cores were found in 51201 (with a single platform and cortical back), 1401420901 (a sub-pyramidal form) and 1465421701 (a very battered example). Blades (including complete and broken examples, and bladelets), some with well-prepared butts, others plain, one punctiform, were noted among the pieces from 50510, 50916, 51221, 51222, 1401420901, 1407420801, 1408420801, 1411421301, 1412421001, 1414421001, 1414421101, 1414421201, 1418421401, 1420421401, 1431421303, 1459421703, 1470421603, 1480421401, 1481421401, 1481421501, 1483421301, 1487421301, 1488421201, 1488421202, 1488421301, 1489421201, 1489421301, 1490421301, 1491421101, 1491421201, 1492421101, 1495421201, 1496421101, 1498421101, 1501421101, 1504421001 and 1515420901. Some of the pieces trim the faces of bladelet cores. More formal core rejuvenation tablets and/or *flancs de nucléus* came from 1409421401 (a triangular rejuvenation tablet from a bladelet core), 1496421101 (a flake from a bipolar bladelet core) and 88-62201 (a platform-struck *flanc de nucléus* from a blade/bladelet core), both of Mesolithic type. There are also flakes from cores producing blades.

6.6.6 This element of the assemblage may be indicative of Mesolithic and/or Early Neolithic activity, although no examples of the type-fossils characteristic of these periods were recovered, with the following exceptions:

Mesolithic

- a single broken B-type microlith from 51221 (accompanied by a collection of primary knapping waste of probable Neolithic date, and consequently not in situ);
- a possible burin spall, also from 51221, and with the same caveats; and
- the blade end from an axe from 1495421101, possibly of tranchet type. Too little survives for certainty, but the removals on the opposite faces are at 90 degrees to each other.

Early Neolithic

- Incomplete (broken and/or unfinished) leaf-shaped arrowheads from 1437421501 and 1451421501;
- the butt of a small flaked axe or chisel with a lenticular section, broken laterally across, the exposed core showing heat damage;
- a very small fragment of the surface of a polished axe from 1479421301; and
- an end scraper on a long trimming flake from a blade core from 1453421601.

Late Neolithic

6.6.7 Technological features that might be expected of the Late Neolithic are sufficiently recurrent to suggest that a large part of the material may be of this date. These features include facetted butts on flakes, a discoidal core (from 1490421101) and the more distinctive of the miscellaneous flake cores (from 1417420901 and unstratified). Given the general prevalence of shorter, broader flakes in the assemblage, it is probable that a sizeable proportion of the material is of general later Neolithic date.

6.6.8 This conclusion is borne out to some extent by the retouched tool component. Although most of the retouched pieces are scrapers, principally end scrapers made on flakes (the most frequent tool type and for the most part insufficiently diagnostic), there is a fabricator, typical of the Late Neolithic. When considered in association with the scrapers, which include discoidal types and examples made on blanks with proportions shown elsewhere in the area to be more typical of Late Neolithic (shorter and thinner) than Early Neolithic (longer and thinner) forms, there is an overall impression of a predominantly Late Neolithic component. There were also a number of flint hammer stones and cores with hammering, which would fit with this date.

6.6.9 A significant group of material of this date came from Trench 512. 266 pieces were recovered from three layers (181 were chips recovered from sieving). Among the material was a blade, a bladelet, 76 flakes, a microlith, two scrapers, a burin spall and three pieces of angular shatter. The material is clearly not all of a single date, but with the exception of the bladelet, microlith and burin spall appears to form a single assemblage of knapping waste of Late Neolithic date. One of the scrapers is an end scraper on a thin blank, while the other is a combined end-and-side scraper and knife. Well-prepared butts are present among the flake debitage. The material is in near-mint condition, without significant patina or wear, and appears to derive from a single episode of knapping (or of deposition of knapping waste).

Bronze Age

6.6.10 There were no forms typical of the Early Bronze Age (thumbnail scrapers, barbed and tanged arrowheads, etc.), although it may be the case that there is an unquantified Early Bronze Age component to the flake debitage.

6.6.11 Insufficient evidence was recorded to suggest a strong Late Bronze Age component, although very sparse examples of miscellaneous retouch (as opposed to damage) through existing patina was noted, including crude scrapers from 50610 and 1490421101. Similarly, crude pieces came from 1491421201. A large piercer on a primary flake from 1469421703 is probably of this date.

6.7 Glass

6.7.1 The assemblage includes 15 pieces of colourless window glass, all from the test-pits, the remainder being vessel glass, predominantly bottles (blue/green, colourless, green, brown and blue) of 19th or 20th century date. The only other diagnostic piece, a wine glass base fragment, was found in Test Pit 1422421301.

6.8 Metalwork

6.8.1 All the metalwork is of Post-medieval or modern date and was predominantly recovered during metal detecting, although at this stage of the project no formal distinction was made between items recovered during the hand-excavation of the test pits and trenches and those from metal detecting.

6.8.2 The copper alloy objects include part of a simple rod handle from an item of furniture (Test Pit 1417 4210), a D-shaped buckle frame with iron pin (Test Pit 1433 4215) and a plain circular button from Trench 512 (context 51210), as well as a piece of fine wire (Test Pit 1414 4216) and a strip fragment (Test Pit 1414 4212).

6.8.3 Almost two-thirds of the iron objects consist of nails (94 examples) occurring in a wide variety of shapes and sizes. The assemblage included horseshoe nails as well as those with flat, round heads and square- or circular-sectioned, tapering shanks used in construction. Other fixing and fittings, such as an L-clamp, nuts bolts and staples, screws, washers, rings, hooks and hinges, were also recovered while more ‘domestic’ items include part of a pair of scissors (Test Pit 1411 4208), fragments of table knives (Test Pits 1454 4218 and 1462 4217 and Trench 509, context 50920) and boot heel reinforcing strips as well as scraps from food cans and other sheet metal fragments. The agricultural use of the landscape is also reflected in the tip of a ploughshare (from Test Pit 1463 4216) and part of an embossed trade plate (the letters]DON[survive, possibly “London”), both probably of 19th century date.

6.8.4 Objects not of iron or copper alloy consist of six caps from shotgun cartridge cases and a rectangular belt buckle frame with a central bar, all of 20th century date. The small quantities of metal working debris largely comprise undiagnostic pieces of iron smithing slag, including one incomplete hearth bottom, measuring 90 mm x 65 mm x 40 mm, from Test Pit 1414 4208. One piece of fuel ash slag came from Test Pit 1482 4212.

6.9 Marine mollusc shell

6.9.1 All the shells (five pieces, 15 g) were from oysters and probably represent food remains brought into the area from coastal zones. All were unmeasurable and too incomplete to determine which valve was represented. Two came from Trench 512 (context 51206), the others from Test Pits 1436 4213, 1473 4214 and 1504 4210.

6.10 Pottery

6.10.1 In total, 257 sherds (1624 g) of pottery were recovered. Of these, 11 are prehistoric, seven Romano-British, one Saxon and 10 medieval, while the remaining 224 pieces were of Post-medieval or modern date. This latter group were all discarded after quantification.

6.10.2 Most of the sherds are in poor, abraded condition, with rolled edges, consistent with a ploughzone assemblage. The distribution of Post-medieval/modern material clustered at the western end of the Eastern Portal area, but the other chronological groups were too small for any such patterns to be discernible (see below). Five of the prehistoric sherds came from Trench 512, with three others from Trench 511, while four of the Romano-British sherds came from Trench 504.

6.10.3 The earliest sherds are those from Trench 512 (context 51221). One plain, thick-walled body sherd (15 g) in a coarse, poorly-sorted flint-tempered fabric could be of Early Neolithic date, but was found alongside four probably re-joining body sherds (5 g) in a mixed sand and grog-tempered fabric. These are likely to be from a Beaker of Late Neolithic or Early Bronze Age date.

6.10.4 A thick-walled, unoxidised body sherd (27 g), in a moderately fine, well-sorted flint-tempered fabric from Test Pit 1490 4213 is probably of Middle or Late Bronze Age date, while the five other prehistoric sherds were all assigned a later prehistoric date on fabric grounds alone. None are diagnostic; three (14 g; Trench 511, context 51125) occur in unoxidised sandy fabrics with occasional flint and/or organic inclusions, one in a reasonably hard but slightly laminated sandy fabric (2 g; Trench 503, context 50305) and the third (4 g; Test Pit 1504 4210) in a sand and fine flint-tempered ware.

6.10.5 The Romano-British sherds include a flake from a mould-decorated Central Gaulish samian bowl of 2nd century AD date (2 g; Test Pit 1497 4211) and a New Forest colour-coated ware body sherd (1 g) of late 3rd or 4th century AD date from Test Pit 1455 4216. The four sherds from Trench 504 cannot be closely dated within the period, but comprise two rolled and abraded South-east Dorset Black Burnished ware body sherds from context 50504, and two sandy Greyware sherds - a rim from an everted rim jar (5 g; context 50445) and a jar neck sherd (13 g) from context 50444. The remaining sherd, also a sandy Greyware body (2 g), came from context 51118 in Trench 511.

6.10.6 The five Saxon sherds (26 g) were all from the topsoil in Test Pit 1497 4211. All are undiagnostic plain bodies, in sandy, organic- and sand with organic tempered fabrics. Similar fabrics of 5th to 8th century AD date are already known from the area [31].

6.10.7 The ten medieval sherds (40 g) comprise three of Kennet Valley-type ware (Test Pits 1409 4211, 1428 2120 and 1493 4211) and seven in moderately coarse sandy fabrics with traces of glaze (Trench 509 context 50921, Test Pits 1450 4216 (2 sherds), 1464 4218, 1499 4209, 1506 4210 and 1508 4209). No diagnostic sherds are present, but most are likely to be of 11th to 13th century date.

6.10.8 The Post-medieval/Modern sherds which form the bulk of the assemblage span the period from the late 17th or early 18th century to the present. These wares are dominated by Redwares (111 sherds), including two slip-decorated pieces (Borehole R618 and Test Pit 1501 4211), although most are of the pale-firing Verwood-type (82 sherds) [47] and from large, internally-glazed bowls or dishes. Domestic crockery in the form of refined whitewares (48 sherds), some transfer printed (a further 27 sherds), also account for a significant proportion of the assemblage. The remaining fabrics comprise 16 pieces of flower pot, 13 of English stoneware, along with one sherd from a German stoneware mug or jug (Test Pit 1412 1420), four of tin-glazed earthenware and two of salt-glazed stoneware.

6.11 Stone

6.11.1 All the stone (28 pieces, 2198 g) came from the test pits. Two fragments likely to be from two quern stones, one of Mayen-type (Neidermendig) lava (120 g), and the other of a medium-coarse grained sandstone from a source somewhere in Southern England were found in topsoil of Test Pits 1420 4212 and 1417 4210 respectively. Both are of Roman or later date.

6.11.2 All the other pieces relate to construction. Three pieces of Carboniferous Limestone from the Mendip region of Somerset found in Test Pits 1408 4209 (1457 g), 1429 4212 (202 g) and 1429 4213 (120 g) probably represent modern ballast brought to the area for use on the A303 itself. The remaining pieces are all roofing slate fragments, a common roofing material in the area since at least the 16th century. All were discarded after quantification.

6.12 Synthetics

6.12.1 All the items here defined as “synthetics” are of 20th century date (26 pieces, 113 g). The majority consisted of fragments of various forms and colours of plastic - hard sheets, strips, pipes, tubes, rods and flower pots – but this group also includes a rubber washer (Test Pit 1427 4213), as well as small pieces of asbestos (Test Pits 1408 4211 and 1410 4215), tarmac (Test Pit 1409 4212) and clay pigeon (Test Pit 1420 4213). All were discarded after quantification.

7 Environmental evidence

7.1 Introduction

7.1.1 A total of 58 samples were taken (**Table 10.1**). A total of six bulk sediment samples were taken (**Table 10.4**), processed and assessed for the presence of environmental evidence, primarily plant macrofossils. Three series of small bulk samples from vertical column sequences were assessed for the presence of molluscs.

7.2 Aims and methods

7.2.1 The purpose of this assessment is to determine the potential of the environmental remains preserved at the site to address project aims and to provide palaeoecological data valuable for wider research frameworks.

7.2.2 The size of the bulk samples varied between 19 and 40 litres, and on average was around 35 litres; the size of the mollusc samples was around 1.5 litres. The samples were processed by standard flotation methods on a Syraf-type flotation tank; the flot retained on a 0.25 mm mesh, residues fractionated into 4 mm and 1 mm fractions and dried. The coarse fractions (>4 mm) were sorted, weighed and discarded. The flots were scanned using a stereo incident light microscopy at magnifications of up to x40 for the identification of environmental remains.

7.2.3 For the assessment of the plant macrofossil evidence, different bioturbation indicators were considered, including the percentage of roots, the abundance of modern seeds and the presence of mycorrhizal fungi sclerotia (e.g. *Cenococcum geophilum*) and animal remains, such as earthworm eggs and insects, which would not be preserved unless anoxic conditions prevailed on site. The preservation and nature of the charred plant and wood charcoal remains, as well as the presence of other environmental remains such as molluscs, animal bone and insects (in cases of anoxic conditions for their preservation), was recorded. Preliminary identifications of dominant or important taxa are noted below, following the nomenclature of [48] for wild plants, and traditional nomenclature, as provided by [49], for cereals. Abundance of remains is qualitatively quantified (A*** = exceptional, A** = 100+, A* = 30-99, A = >10, B = 9-5, C = <5) as an estimation of the minimum number of individuals and not the number of remains per taxa.

7.2.4 The mollusc samples were rapidly scanned under a low power microscope. Shells were identified to at least genus level, using a reference collection where necessary. Ecological information is derived from [50] [51] [52]. Nomenclature follows Anderson [53]. Abundance of each taxon was estimated using a broad quantification scale.

7.3 Results

7.3.1 The flots from the bulk samples were generally small and there were high numbers of roots and modern seeds that are indicative of stratigraphic movement and the probability of contamination by later intrusive elements

(**Appendix C**). Charred material was rare and poorly preserved and comprised exclusively a small number of cereal grains from indeterminate species (Triticeae) and wheat (*Triticum* sp.), minute hazel (*Corylus avellana*) shell fragments and a seed of stinking mayweed (*Anthemis cotula*), in addition to small quantities of small-sized charcoal fragments with no obvious curvature and likely from mature wood.

7.3.2 In the mollusc samples, shells were largely well-preserved. In some cases, the proteinaceous periostracum was still intact, or shells were translucent, both of which may suggest that they are recent intrusions. A high proportion of most sample flots was made up of modern roots.

7.3.3 In the samples from Trench 512, sample 51225 contained only a reworked fossil marine shell. Samples 51226 and 51227 contained only low numbers of snails reflecting an open, grassland environment. *Cecilioides acicula* is a subterranean species, which has been reported up to 2 metres depth [50]. It is thought to be a medieval arrival to the British fauna [54].

7.3.4 The vertical sequence from sample 50467 up to 50475 is dominated by an open country, grassland fauna comprising *Helicella itala, Pupilla muscorum*, and *Vallonia* cf. *excentrica*. *Helicella itala* and are favoured by dry, short sward grassland [52]. Two species favoured by more shaded conditions (*Oxychilus cellarius* and *Pomatias elegans*) occur towards the bottom of the sequence. These may reflect areas of taller vegetation. *P. elegans* is often associated with broken ground and can be found on arable land [50]. *Cecilioides acicula* occurs only at the top of the sequence.

7.3.5 The sequence of samples from sample 50418 up to 50464 begins with 0.7 m (from 0.20-0.90 m) which is devoid of snails. This may represent a periglacial or early post-glacial deposit, possibly coombe deposits. Above 0.90 m the samples are once again dominated by species reflecting an open grassland environment, although this time *Cecilioides acicula* is present throughout the sequence. No snails indicative of shaded conditions are present. *Cernuella virgata*, thought to have arrived in Britain during the Romano-British period [54], is present intermittently above 1.24 m, although it may be intrusive as there is a high proportion of modern roots in the samples above 1.10 m.

8 Archaeological Potential and Significance

8.1 Introduction

8.1.1 The Eastern Portal evaluation was successful in its aims in confirming the presence or absence of archaeological remains, as well as attempting to determine their nature, extent, date, condition and state of preservation. A very small number of archaeological features were uncovered, comprising two parallel ditches of probable Romano-British date cut into a buried soil of broad Late Iron Age to Romano-British date and sealed by post-Roman colluvium in Trench 504, an undated ditch in Trench 506, a small number of features of post-medieval/modern date, and a small number of natural features. The supporting artefactual, environmental and geoarchaeological evidence indicate a generally low level of activity across the Eastern Portal area.

8.1.2 In accordance with the OWSI, this section recommends further analysis to be undertaken at a later stage of the archaeological process. Any such analysis would be part of the ongoing archaeological process which continues beyond and separately from the process required for EIA. These recommendations do not affect the baseline conditions, assessment of effects or mitigation approach as identified in the ES.

8.2 Stratigraphic

8.2.1 The parallel ditches of probable Romano-British date were not detected in the geophysical survey interpretation because of the depth at which they were buried. These ditches may form a trackway or defensive boundary and are approximately aligned towards, or to the immediate west of, Vespasian's Camp. The very slight dating evidence for Vespasian's Camp suggests two phases of rampart construction around the 5th century BC, though the finding of some Roman pottery [55] is evidence of some activity here in the Romano-British period [56]. The ditches uncovered during this evaluation have the potential to add significant new information concerning landscape organisation in the immediate vicinity of the hillfort.

8.2.2 A natural hollow in Trench 512 was filled with colluvium, at the base of which lay a stony horizon (formed from either deflating processes or a period of stasis), with a further colluvial layer below. The worked flint assemblage recovered from this stony horizon (and from the overlying colluvium) appears to be consistent with primary knapping debris largely of Late Neolithic date, with some Mesolithic component, though an Early Neolithic pottery sherd and Beaker sherds were also recovered from the overlying colluvium. The recovery of Roman and Saxon pottery from an archaeological layer below the topsoil in an adjacent test pit may be associated with this deposit sequence, although it could be from a separate archaeological feature that was not fully excavated. Romano-British and Saxon settlement is known nearby from an evaluation to the north-east of Countess Roundabout [31]. Whilst there is clearly potential for significant archaeological deposits of Mesolithic date in the vicinity [11] [46], the uncertainty regarding the reworking of the deposits and the full extent of the sequence means that the level of that significance cannot be gauged at this time.

8.2.3 A comparison of levels between the natural soliflucted Chalk in Trench 512 (70.5 m aOD), in trial trenching and test pitting in DTA 6 (on average 69 m aOD; WA evaluation 54379 on Fig. 11.1) [11] and the natural gravel encountered in boreholes at Blick Mead [46] (67 m aOD) demonstrates a vertical difference of 3.5 m between the floodplain edge at the two locations north of the current A303 (Eastern Portal and DTA 6) and those in the valley proper to the south of the road at Blick Mead. More significantly, the depositional sequences evident in the two locations are entirely different. At Blick Mead, the across-site sequence can be typified as a valley alluvial sequence over sand and gravels, summarised as made ground over alluvium over sand over sand and gravel, with the Mesolithic flint occurring at the base of the alluvium/top of the sand. In Trench 512 of the Eastern Portal and in Trench 3 at DTA 6, on the other hand, the sequence can be typified as a Chalkland colluvial sequence on the flood-plain edge, summarised as topsoil over colluvium over Chalk.

8.2.4 There are significant differences between Trench 512 and DTA 6 however. A simplified description of the latter sequence has an animal-trampled layer (top at approximately 69.15 m aOD) beneath a colluvial layer with Late Mesolithic flintwork at its base, above which was a ploughsoil colluvium of later (possibly Neolithic) date containing reworked Late Mesolithic flint, sealed by stony colluvium and topsoil. If the sequences in DTA 6 and Trench 512 are continuous, then equivalents of the lowest two layers were not reached in Trench 512.

8.2.5 Importantly, no archaeological feature was found correlating to the possible archaeology geophysical anomaly thought to indicate a possible prehistoric barrow in Trench 506. A discrete tree-throw hole situated within the centre of this anomaly did not contain any finds.

8.2.6 The significance of the north–south aligned ditch in Trench 506 is uncertain, as despite hand-excavation which confirmed its presence (as suggested by the geophysical survey), it remains undated. The undated ditch may be related to an undated ditch of similar size and alignment in the easternmost trench of NE2 evaluation area [16], located approximately 250 m to the east. This suggests that these ditches have the potential to provide information about the development and division of the agricultural landscape.

8.2.7 The uncovered Post-medieval/modern features are of local significance only.

8.2.8 The evaluation results suggest that the preservation of archaeological remains within the Site is variable. The deep colluvial sequence in the centre of the Site has buried earlier soils and features, thereby preserving them well. There is also the potential for buried deposits in the east of the Site, particularly within natural hollows. The finding of a shallow but fairly extensive cut feature truncating the chalk natural in Trench 506 shows that the preservation of archaeological remains may be locally impacted by modern activity, probably associated with the construction of the A303. The impact from ancient and historical ploughing is uncertain: there are only slight indications of plough scarring into the natural chalk in limited areas, namely on the higher ground rising out of the dry valleys, though clearly the presence of colluvium indicates ploughing occurring up slope to the north of the Site. The evidence suggests this is post-Roman in date. The presence of periglacial scarring is similarly slight, though this should not necessarily be taken as an indication of truncation of the surface of the natural, particularly in the east of the Site where the geological deposits are more variable.

8.3 Geoarchaeology

8.3.1 The results of this geoarchaeological evaluation met the aims and objectives, as outlined in the SSWSI [3].

8.3.2 Within the dry valley in the centre of the Site a consistent sequence of deposits consisting of structural chalk, coombe deposits and colluvial units were recorded. In the centre of the valley where the colluvial units are thickest they preserved a buried soil near their base.

8.3.3 The coombe deposits result from material soliflucted downslope under periglacial conditions (alternate freeze-thawing), likely during the last glacial period. The potential of these deposits to preserve molluscan fauna was assessed, however, they were devoid of snails (see Section 7). This indicates that the geoarchaeological potential of these deposits is low.

8.3.4 A buried soil is present near the base of the colluvial deposits. Where colluvial sediments have previously been recorded with buried soils, they have usually been associated with two types. The first is typified by the remnants of soil that date from prior to the deposition of the colluvium/solifluction debris, in the second the buried soil has developed within the colluvium/solifluction debris [57].

8.3.5 The buried soil here falls into the former category. It represents a phase of depositional and erosive stasis after the deposition of the solifluction debris (coombe deposits) and the gravelly slope wash that forms the base of the Holocene colluvial sequence. During this period of relative stasis, the sides of the dry valley and the surrounding area would not have been exposed to extensive erosion, whilst the deposition of sediment into the valley was limited and incremental. This resulted in the rate of pedogenesis not being overtaken by the rate of deposition within the valley, allowing for soil development. OSL age estimates on the buried soil suggest this deposit (50405) is most likely of a broad Late Iron Age to Romano-British date (2.08±0.19 ka; 260 BC–AD 130), bearing in mind the caveats discussed in Section 5.4. Subsequently, likely during and/or after the Roman period, the rate of deposition once more increased to a point that the soil was buried and preserved due to the accumulation of the overlying colluvium, halting pedogenesis.

8.3.6 The presence of prehistoric flint work within the buried soil suggests that this period of relatively little erosion and limited, incremental deposition extends from within the post-Pleistocene prehistoric period. The fact that a possible Roman ditch cuts this soil indicates that this phase of relative stasis probably extended to the Roman period.

8.3.7 The lithology of the colluvial deposits overlying the buried soil indicate that the onset of this renewed phase of deposition resulted from the down-slope movement of sheet-wash and soil creep. These deposits have formed in the base of the valley due to the topographical relief of the valley margins, where soil instability – which can be brought on by activities such as clearance of woodland, agricultural activity and soil degradation (but in practice here the overwhelming factor will have been agricultural ploughing) has led to the downslope movement of sediment. The evidence, including the results of the OSL dating, indicates that these changes in land-use practices may have occurred after the Roman period.

8.3.8 Similar colluvial sequences associated with buried soils have been investigated at locales in Sussex. At Ashcombe Bottom, East Sussex, a soil buried by approximately 0.7 m of colluvium contained ceramic evidence for a Beaker settlement [58] [59], while a buried soil at Kiln Combe and Itford Bottom, East Sussex also contained evidence for Beaker activity [60]. Additionally, a soil in fine-grained colluvium was identified at Toadeshole Bottom East, East Sussex which was associated with human activity dated between 2900 and 2250 cal. BC and 1690 to1400 cal. BC [61].

8.3.9 Although buried soils within colluvial contexts are known from chalkland landscapes in southern England (above), they are extremely rare on Salisbury Plain. This is despite extensive research activity focussed on locating and studying colluvial sequences and deeper soil profiles in the Stonehenge landscape [7] [62]. One of the few examples previously identified was recorded in geoarchaeological investigations south of Stonehenge. Here a localised relict argillic brown earth soil was recorded overlying chalk at the base of a shallow colluvial sequence within a hollow in the bedrock [11].

8.3.10 Colluvial sequences and associated deposits have the potential to provide archaeological and palaeoenvironmental datasets that can greatly enhance our understanding of prehistoric landscapes, environments and changes in land-use practices. Consequently, the presence of a buried soil towards the base of the colluvial sequence within this dry valley is potentially significant. However, samples taken for the recovery of molluscan fauna from the buried soil and the overlying colluvium have been assessed and indicate that here is a high likelihood of temporal mixing within the assemblages. Consequently, the palaeoenvironmental potential of the buried soil and the overlying colluvium may be limited.

8.4 Finds

8.4.1 With the exception of the lithics and prehistoric pottery, none of the material recovered has any potential to address any of the research questions associated with the project, and as such does not warrant further analysis.

8.4.2 Earlier prehistoric pottery is of intrinsic interest and as such warrants further analysis. In neither instance (Early Neolithic and Beaker) is the identification absolutely secure, and full fabric and form analysis should consequently be carried out, following nationally-recommended guidelines [63] [64]. Although very little material was recovered, the possible periods of its manufacture and use (the Early Neolithic and Late Neolithic/Early Bronze Age) are ones of very significant activity elsewhere in the World Heritage Site (including major phases of construction at Stonehenge itself) and as such the identification of potential locations of contemporary activity in areas where it has not previously been known (no prehistoric pottery was recovered from the Eastern Portal area during the Stonehenge Environs Project [7], for instance) is of some significance.

8.4.3 Later prehistoric pottery (Middle and Late Bronze Age) is similarly scarce, but also warrants full fabric and form analysis. Activity dating to these periods in the World Heritage Site and its environs is not well-understood, and was identified as in need of further research in the Research Framework [40]. Of particular significance in terms of the Eastern Portal, in proximity to the barrows east of King Barrow Ridge was the recognition that the spatial relationships between the Early Bronze Age mortuary landscape and later Bronze Age activities largely remains to be explored [40].

8.4.4 Flint scatters were identified as an under-utilised resource in the Research Framework [40]. While largely confirming the results of earlier surveys, the lithic assemblage does contain elements deserving of further study. The occurrence of unpatinated pieces within the ploughzone assemblage should be plotted in order to determine if it correlates with geology, or if there are any significant concentrations. The blade component should be isolated from the rest of the debitage, its technology described, and its distribution plotted and examined, to determine, if possible, if it forms a chronologically coherent group and (if so) in what period it originated. Likewise, the retouched component should be fully described and plotted, and a representative selection illustrated. The significant group of debitage from Trench 512 should be examined fully and compared to other later Neolithic/Early Bronze Age assemblages in the locality, to see if it is contemporary with the possible Beaker ceramics in the same trench. A comparison of the Trench 512 material with that recovered from Blick Mead [46] and DTA 6 Trench 3 [11] should be undertaken to ascertain if the Mesolithic components of these assemblages are contemporary or not, and to determine if contextually-secure later Neolithic flint knapping activity is more widespread.

8.5 Environmental

8.5.1 The assemblages recovered so far have little potential and require no further analysis but should be included in prospective reports and publications.

8.5.2 The assemblages from the bulk samples indicate the existence of plant exploitation activities in the background but due to the small size of the assemblages, their poor preservation and likely mixed nature, they are not significant for understanding past human activities in the area.

8.5.3 The mollusc samples contain a relatively low number of snails reflecting an open environment, and suggest that open and dry conditions have predominated through the time the sampled sediments were accumulating. There is, however, a high likelihood of temporal mixing within the assemblages.

8.5.4 No further work is recommended for these series of samples and they are not recommended for archival retention.

8.6 Concluding remarks

8.6.1 Taken as a whole, the results of the evaluation exercise at the Eastern Portal suggest a generally low level of activity across the evaluation area, with some localised areas of interest in Trenches 504 (Romano-British ditches) and 512 (lithics).

8.6.2 Palaeoenvironmental sequences are likely to be preserved beneath colluvium in various locations, and the colluvium may also mask archaeological features. That those ditches revealed are of probable Romano-British date, or possible Late Iron Age date, is of some significance given the proximity of Vespasian's Camp and the generally poor understanding of landscape organisation and use in the locality at this time.

8.6.3 Similarly, concentrations of flint – both in the topsoil and preserved in layers beneath the ploughzone – suggest that activity was occurring from at least the Mesolithic period. Most of the evidence indicates later Neolithic and/or Early Bronze Age activity, some of it possibly related to the ploughed-out barrows east of King Barrow Ridge. Other evidence of this type and date has been found east of Countess [31], including debitage from the manufacture of a flint dagger. The evidence then points to a broad zone of activity extending beyond the limits of the World Heritage Site, and this evidence may be relevant to attributes of its Outstanding Universal Value.

8.6.4 Recommendations for further analytical work on material from the Eastern Portal investigations are as follows:

- Environmental samples: no further work
- Geoarchaeological samples: no further work
- Prehistoric pottery: full fabric and form analysis; contextualisation; illustration of selected pieces.

- Flint: plot of unpatinated element; description of blade component, its distribution and chronology; description of retouched component, its distribution and chronology, and illustration of selected pieces; full analysis of the material from Trench 512 and its contextualisation in relation to the DTA 6 and Blick Mead assemblages.

8.6.5 It is recommended that this work be undertaken as a part of the scheme-wide post-excavation analysis programme, along with other available relevant information from evaluations of on-going works.

9 Storage and curation

9.1 Museum

9.1.1 It is proposed that the project archive resulting from the excavation be deposited with the Salisbury Museum. Deposition of any finds with the museum will only be carried out with the full agreement of the landowner. Until final deposition with the museum the archive will be stored at the offices of Wessex Archaeology Southern Region in Salisbury under the code 117881.

9.2 Preparation of the archive

9.2.1 The complete site archive, which will include paper records, photographic records, graphics, artefacts, ecofacts and digital data, will be prepared following the standard conditions for the acceptance of excavated archaeological material by the Salisbury Museum, and in general following nationally recommended guidelines [65] [66] [67] [68].

9.2.2 This finalised report will be sent to Wiltshire County Archaeology Services (WCAS) and the Wiltshire Historic Environment Record (HER) and OASIS.

9.2.3 All archive elements will be marked with the site code, and a full index will be prepared. The physical archive comprises the following:

- cardboard boxes or airtight plastic boxes of artefacts and ecofacts, ordered by material type;
- Three files/document cases of paper records and A3/A4 graphics; and
- Five A1 graphic sheets.

9.3 Selection policy

9.3.1 The complete site archive will be retained until a point at which selection, retention and discard are deemed appropriate, and through a process of consultation with curators and other stakeholders. Selection policy will adhere to national guidance.

9.3.2 Wessex Archaeology follows the guidelines set out in Selection, Retention and Dispersal [69], which allows for the discard of selected artefact and ecofact categories which are not considered to warrant any future analysis. Any discard of artefacts will be fully documented in the project archive.

9.3.3 The discard of environmental remains and samples follows nationally recommended guidelines [43] [68] [69].

9.4 Security copy

9.4.1 In line with current best practice [66], on completion of the project a security copy of the written records will be prepared, in the form of a digital PDF/A file. PDF/A is an ISO-standardised version of the Portable Document Format (PDF) designed for the digital preservation of electronic documents through omission of features ill-suited to long-term archiving.

10 Tables

Table 10-1 Samples taken from Trench 504

Sample no	Context no	Sample series	Description
50476	50455		Bulk sample
50477	50546		Bulk sample
50418	50407	50417	Mollusc column 1
50419	50407	50417	Mollusc column 1
50420	50407	50417	Mollusc column 1
50421	50407	50417	Mollusc column 1
50422	50407	50417	Mollusc column 1
50423	50407	50417	Mollusc column 1
50424	50407	50417	Mollusc column 1
50425	50407	50417	Mollusc column 1
50426	50406	50417	Mollusc column 1
50427	50406	50417	Mollusc column 1
50428	50406	50417	Mollusc column 1
50429	50406	50417	Mollusc column 1
50430	50405	50417	Mollusc column 1
50431	50405	50417	Mollusc column 1
50432	50405	50417	Mollusc column 1
50433	50405	50417	Mollusc column 1
50434	50405	50417	Mollusc column 1
50435	50404	50417	Mollusc column 1
50436	50403	50417	Mollusc column 1
50437	50403	50417	Mollusc column 1
50438	50403	50417	Mollusc column 1
50439	50402	50417	Mollusc column 1
50460	50402	50417	Mollusc column 1
50461	50402	50417	Mollusc column 1
50462	50401	50417	Mollusc column 1
50463	50401	50417	Mollusc column 1
50464	50401	50417	Mollusc column 1
50467	50455	50417	Mollusc column 1
50468	50455	50466	Mollusc column 2
50469	50446	50466	Mollusc column 2
50470	50446	50466	Mollusc column 2
50471	50446	50466	Mollusc column 2
50472	50405	50466	Mollusc column 2
50473	50405	50466	Mollusc column 2
50474	50454	50466	Mollusc column 2

Sample no	Context no	Sample series	Description
50475	50447	50466	Mollusc column 2
50410	50406-50405	50494	Micromorphology 1
50411	50405-50404	50494	Micromorphology 1
50412	50405-50404	50494	Micromorphology 1
50413	50404-50403	50494	Micromorphology 1
50491	50406-50405	50495	Micromorphology 2
50490	50405-50403	50495	Micromorphology 2
50489	50405-50403	50495	Micromorphology 2
50416	50405		OSL
50493	50405		OSL
50465	50455		OSL
50415	50403		OSL
50414	50402		OSL
50492	50402		OSL

Table 10-2 Finds by material type (number of pieces/weight in grammes)

	Field-walking (201782)		Test-pitting (201783)		Trial trenching 201787		Borehole survey 201788		Eastern Portal Total	
Material	**No**	**Wt**	**No**	**Wt**	**No**	**Wt**	**No**	**Wt**	**No**	**Wt**
Animal bone			43	303	2	2			45	305
Burnt Flint	15	284	351	5961	51	584			417	6829
Ceramic building material	12	161	1597	22038	36	692	3	52	1648	22943
Clay pipe			18	42					18	42
Flint	9	75	1481	9980	429	3739	13	123	1932	13917
Glass	2	11	163	941	3	14			168	966
Metalwork: Copper alloy Iron Other metal Metal working debris			 4 158 7 24	 50 3136 39 730	 1 4	 3 44			 5 162 7 24	 53 3180 39 730
Pottery	2	18	236	1515	19	99	1	2	258	1634
Shell			3	14	2	1			5	15
Stone			28	2198					28	2198
Synthetics	1	6	23	106			2	1	26	113
Total	41	555	4218	47053	562	5178	20	178	4841	52964

Table 10-3 The composition of the flint assemblage

Type	No.	%
Cores		
Blade cores	3	0.15
Flake cores	4	0.21
Core fragments	2	0.10
(sub-total cores)	(9)	(0.46)
Debitage		
Core rejuvenation tablets	2	0.10
Bladelets (incl. broken)	11	0.57
Blades (incl. broken)	39	2.02
Flakes (incl. broken)	1597	82.66
Chips	242	12.53
Irregular debitage	3	0.15
Burin spall	1	0.05
(sub-total debitage)	(1895)	(98.08)
(sub-total cores & debitage)	(1904)	(98.54)
Retouched tools		
Microliths	1	0.05
Scrapers	11	0.57
Fabricator	1	0.05
Knife	1	0.05
Projectile points	2	0.10
Axes	2	0.10
Piercers	1	0.05
Miscellaneous retouch	9	0.46
Sub-total retouched tools	(28)	(1.45)
Total	1932	100

Table 10-4 Sample provenance summary

Trench	No. of samples	Volume (litres)	Feature types
504	2	78	Ditch
506	1	19	Ditch
512	3	118	Natural hollow
Totals	6	215	

Abbreviations List

AESR	Archaeological Evaluation Strategy Report
AmW	AECOM Mace WSP Joint Venture
CIfA	Chartered Institute for Archaeologists
DCO	Development Consent Order
EIA	Environmental Impact Assessment
GPR	Ground penetrating radar
HER	Historic Environment Record
HMAG	Heritage Monitoring and Advisory Group
OSL	Optically-Stimulated Luminescence
OUV	Outstanding Universal Value
OWSI	Overarching Written Scheme of Investigation
OWSI	Overarching Written Scheme of Investigation
NHLE	National Historic List Entry
NGR	National Grid Reference
RAMS	Risk Assessment and Method Statement
SHLP	Stonehenge Hidden Landscapes Project
SSWSI	Site Specific Written Scheme of Investigation
WA	Wessex Archaeology
WCAS	Wiltshire Council Archaeology Service
WHS	World Heritage Site

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Appendices

Appendix A Trench tables

A.1 Trenches 501-512 context summary tables

Trench 501	50 x 0.9m		NGR 414257 142154 (Centre of Trench)	86.8 m OD
Context	**Interpretation**	**Fill of**	**Description**	**Depth (m)**
50101	Ploughsoil		Mid greyish brown sandy silt. Friable compaction. Infrequent flint inclusions >10mm, at a 10% frequency.	0.00–0.32
50102	Subsoil		Light orangey brown sandy silt. Frequent chalk flint inclusions <10mm, at a 40% frequency. Friable compaction.	0.32-0.46
50103	Natural		White chalk. Very compact.	0.46+
50104	Ploughsoil		Sieved ploughsoil context 50101.	
50105	Ploughsoil		Sieved ploughsoil context 50101.	
50106	Ploughsoil		Sieved ploughsoil context 50101.	
50107	Ploughsoil		Sieved ploughsoil context 50101.	
50108	Ploughsoil		Sieved ploughsoil context 50101.	
50109	Ploughsoil		Sieved ploughsoil context 50101.	
50110	Ploughsoil		Sieved ploughsoil context 50101.	
50111	Ploughsoil		Sieved ploughsoil context 50101.	
50112	Ploughsoil		Sieved ploughsoil context 50101.	
50113	Ploughsoil		Sieved ploughsoil context 50101.	
50114	Ploughsoil		Sieved ploughsoil context 50101.	
50115	Ploughsoil		Sieved ploughsoil context 50101.	

Trench 502	10 x 10 m		NGR 414314 142145 (Centre of Trench)	83.8 m OD
Context	**Interpretative category**	**Fill of**	**Description**	**Depth (m)**
50201	Ploughsoil		Mid orangey brown loose clayey silt with moderate flecks of chalk, moderate medium and small subangular flint 0.02-0.07m.	0.00–0.27
50202	Subsoil		Only present in N facing section of (502), common flecks of chalk, rare large subangular flint.	0.27-0.33
50203	Natural		Chalk, moderate amount of patches of yellow discolouration, with subangular and angular large and medium flint nodules in 0.08-0.15m.	0.33+
50204	Ploughsoil		Sieved ploughsoil context 50201. SW Corner.	
50205	Ploughsoil		Sieved ploughsoil context 50201. SE Corner.	
50206	Ploughsoil		Sieved ploughsoil context 50201. NW Corner.	
50207	Ploughsoil		Sieved ploughsoil context 50201. NE Corner.	
Trench 503	**50 x 1.8 m**		**NGR 414358 142148 (Centre of Trench)**	**84.6 m OD**

Context	Interpretative category	Fill of	Description	Depth (m)
50301	Ploughsoil		Mid yellow brown clayey silt. Containing frequent chalk flecks.	0.00–0.40
50302	Natural		Chalk weathered bedrock.	0.40+
50303	Ploughsoil		Sieved ploughsoil context 50301.	
50304	Ploughsoil		Sieved ploughsoil context 50301.	
50305	Ploughsoil		Sieved ploughsoil context 50301.	
50306	Ploughsoil		Sieved ploughsoil context 50301.	
50307	Ploughsoil		Sieved ploughsoil context 50301.	
50308	Ploughsoil		Sieved ploughsoil context 50301.	
50309	Ploughsoil		Sieved ploughsoil context 50301.	
50310	Ploughsoil		Sieved ploughsoil context 50301.	
50311	Ploughsoil		Sieved ploughsoil context 50301.	
50312	Ploughsoil		Sieved ploughsoil context 50301.	
50313	Ploughsoil		Sieved ploughsoil context 50301.	

Trench 504	35 m x 7 m		NGR 414424 142147 (Centre of Trench)	78.9 m OD
Context	**Interpretative category**	**Fill of**	**Description**	**Depth (m)**
50401	Ploughsoil		Medium grey brown silty loam, friable. Occasional medium course sub-angular flint clasts. Occasional chalk flecks. Diffuse-moderate horizon with (50402).	0.00–0.27
50402	Colluvium		Upper colluvium. Light greenish yellow clayey silt, friable. Very occasional moderate subangular flint clasts. Occasional chalk flecks (colluvium). Diffuse horizon with (50403).	0.27-0.51
50403	Colluvium		Lower colluvium. Medium greenish brown slightly clayey silt, friable, blocky texture. Occasional medium-course subangular flint clasts. Occasional chalk flecks (colluvium). Diffuse horizon with (50404).	0.51-0.69
50404	Colluvium		Light greenish brown slightly clayey silt, friable. Frequent medium-very course angular and subangular flint clasts. Frequent chalk flecks. Abrupt horizon with (50405).	0.27-0.69
50405	Buried Soil		Buried soil cut by ditches 50442=50448, and 50445. Dark brown slightly silty clay, largely clast free with frequent chalk flecks. Abrupt lower horizon.	0.89-1.15
50406	Slope wash gravel		Medium angular flint gravel, medium brown slightly silty clay matrix. Well consolidated. Abrupt lower horizon.	1.15-1.25

Trench 504	35 m x 7 m		NGR 414424 142147 (Centre of Trench)	78.9 m OD
Context	**Interpretative category**	**Fill of**	**Description**	**Depth (m)**
50407	Coombe deposit with periglacial involutions		Light grey-brown chalky clay; frequent medium-coarse angular flint clasts and bedrock flint nodules; well consolidated; frequent chalk flecks. Abrupt lower horizon.	1.25-2.50
50408	Structural Chalk		Structural chalk with bedrock flint nodules	2.50+
50409			Not used	
50410	Enviro Sample		Kubiena Tin through contact between (50405) and (50406)	0.9
50411	Enviro Sample		Kubiena Tin through (50405)	0.9
50412	Enviro Sample		Kubiena Tin through contact between (50405) and (50404)	0.8
50413	Enviro Sample		Kubiena Tin through contact between (50404) and (50403)	0.7
50414	Enviro Sample		OSL (50402)	0.45
50415	Enviro Sample		OSL (50403)	0.55
50416	Enviro Sample		OSL (50405)	0.95
50417	Enviro Sample Series		Trench 504	
50418	Enviro Sample		Snail Column SS 50417	2.35-2.45
50419	Enviro Sample		Snail Column SS 50417	2.25-2.35
50420	Enviro Sample		Snail Column SS 50417	2.15-2.25
50421	Enviro Sample		Snail Column SS 50417	2.05-2.15
50422	Enviro Sample		Snail Column SS 50417	1.95-2.05
50423	Enviro Sample		Snail Column SS 50417	1.85-1.95
50424	Enviro Sample		Snail Column SS 50417	1.75-1.85
50425	Enviro Sample		Snail Column SS 50417	1.65-1.75
50426	Enviro Sample		Snail Column SS 50417	1.55-1.65
50427	Enviro Sample		Snail Column SS 50417	1.45-1.55
50428	Enviro Sample		Snail Column SS 50417	1.35-1.45
50429	Enviro Sample		Snail Column SS 50417	1.25-1.35
50430	Enviro Sample		Snail Column SS 50417	1.20-1.25
50431	Enviro Sample		Snail Column SS 50417	1.15-1.20
50432	Enviro Sample		Snail Column SS 50417	1.10-1.15
50433	Enviro Sample		Snail Column SS 50417	1.05-1.10
50434	Enviro Sample		Snail Column SS 50417	1.00-1.05
50435	Enviro Sample		Snail Column SS 50417	0.90-1.00
50436	Enviro Sample		Snail Column SS 50417	0.80-0.90
50437	Enviro Sample		Snail Column SS 50417	0.70-0.80
50438	Enviro Sample		Snail Column SS 50417	0.60-0.70
50439	Enviro Sample		Snail Column SS 50417	0.50-0.60
50440			Not used	
50441			Not used	

Trench 504	35 m x 7 m		NGR 414424 142147 (Centre of Trench)	78.9 m OD
Context	**Interpretative category**	**Fill of**	**Description**	**Depth (m)**
50442	Cut		Easternmost of two parallel ditches running NNW—SSE through western end of trench. Same as [50445]. Filled by (50456), (50446) and (50494). Cuts (50407), (50406) and (50405).	0.80-1.65
50443			Not used	
50444	Tertiary deposit	[50442]	Possible reworked bank material, overlying layer (50494) Light grey-brown chalky clay; frequent medium-coarse angular flint clasts and bedrock flint nodules; frequent chalk flecks (redeposited coombe deposit)	0.80-1.05
50445	Cut		Easternmost of two parallel ditches running NNW—SSE through western end of trench. Same as [50442]. Filled by (50456), (50446) and (50494). Cuts (50407), (50406) and (50405)	0.80-2.10
50446	Fill	[50445] & [50442]	Secondary fill of ditch. Dark brown silty clay; largely clast free; occasional chalk flecks	1.10-1.30
50447			Not used	
50448	Cut		Westernmost of two parallel ditches running NNW—SSE through western end of trench. Filled by (50449), (50451) and (50495)	1.05-1.85
50449	Fill	[50448]	Secondary fill of ditch. Reddish light brown silty loam; occasional medium small sub-angular flint clasts; occasional chalk flecks	1.15-1.85
50450			voided	
50451	Fill	[50448]	Secondary fill of ditch. Light reddish brown silty loam; moderately frequent small-medium sub-angular flint clasts	1.25-1.50
50452			Not used	
50453			Not used	
50454	Layer		Thin medium flint gravel horizon at contact between (50405) and (50403)	0.75-0.78
50455	Fill	[50445]	Primary fill of [50445]. Same as (50456). Dark brown silty loam; rare small-medium sub-angular flint clasts, frequent chalk flecks. Same as (50456)	1.80-2.10
50456	Fill	[50442]	Primary fill of [50442]. Same as (50455)	1.40-1.65
50457			Not used	
50458			Not used	
50459			Not used	
50460	Enviro Sample		Snail Column SS 50417	0.40-0.50
50461	Enviro Sample		Snail Column SS 50417	0.30-0.40
50462	Enviro Sample		Snail Column SS 50417	0.20-0.30
50463	Enviro Sample		Snail Column SS 50417	0.10-0.20

Trench 504	35 m x 7 m		NGR 414424 142147 (Centre of Trench)	78.9 m OD
Context	**Interpretative category**	**Fill of**	**Description**	**Depth (m)**
50464	Enviro Sample		Snail Column SS 50417	0.00-0.10
50465	Enviro Sample		OSL Ditch [50445]	1.70
50466	Enviro Sample		Sample Series for Snail Column Ditch [50445]	0.45
50467	Enviro Sample		Snail Column SS 50466	
50468	Enviro Sample		Snail Column SS 50466	0.60-0.70
50469	Enviro Sample		Snail Column SS 50466	0.50-0.60
50470	Enviro Sample		Snail Column SS 50466	0.40-0.50
50471	Enviro Sample		Snail Column SS 50466	0.30-0.40
50472	Enviro Sample		Snail Column SS 50466	0.25-0.30
50473	Enviro Sample		Snail Column SS 50466	0.20-0.25
50474	Enviro Sample		Snail Column SS 50466	0.10-0.20
50475	Enviro Sample		Snail Column SS 50466	0.00-0.10
50476	Small finds/object		Test Pit through S Facing Section	0.55
50477	Small finds/object		Test Pit through S Facing Section	0.65
50478	Small finds/object		Test Pit through S Facing Section	0.68
50479	Small finds/object		Test Pit through S Facing Section	0.98
50480	Small finds/object		Test Pit through S Facing Section	0.95
50481	Small finds/object		Test Pit through S Facing Section	0.90
50482	Small finds/object		Test Pit through S Facing Section	0.97
50483	Small finds/object		Test Pit through S Facing Section	0.93
50484	Small finds/object		Test Pit through S Facing Section	1.00
50485	Small finds/object		Test Pit through S Facing Section	0.89
50486	Small finds/object		Test Pit through S Facing Section	0.93
50487	Small finds/object		Test Pit through S Facing Section	0.95
50488	Small finds/object		Test Pit through S Facing Section	0.95
50489	Enviro Sample		Kubiena (50404) (50405)	0.80
50490	Enviro Sample		Kubiena (50404) (50405)	0.90
50491	Enviro Sample		Kubiena (50404) (50405) (50406)	1.00
50492	Enviro Sample		OSL (50402)	0.35
50493	Enviro Sample		OSL (50405)	0.92

Trench 504	35 m x 7 m		NGR 414424 142147 (Centre of Trench)	78.9 m OD
Context	**Interpretative category**	**Fill of**	**Description**	**Depth (m)**
50494	Fill	[50442] & {50445]	Final infilling of ditch. Dark reddish brown silty loam; occasional medium small sub-angular flint clasts'; occasional chalk flecks	
50495	Fill	[50448]	Final infilling of ditch. Dark reddish brown silty loam; occasional small-medium sub-angular flint clasts	

Trench 505	50 x 1.85m		NGR 414518 142159 (Centre of Trench)	85.6 m OD
Context	**Interpretative category**	**Fill of**	**Description**	**Depth (m)**
50501	Ploughsoil		Dark yellowish brown silty clay with 40% abundant chalk fragments and flecking ≤40mm 1% rare rounded pebbles, 10% moderate sub-angular flint ≤60mm	0.00–0.28
50502	Subsoil		Probable colluvium, as only present at downslope NW end of trench for 35m. Mid yellowish brown silty clay with 5% sparse chalk fragments and flecking, and pea grit. Subsoil only present at SW end. Well defined horizon with natural.	0.28 – 0.32
50503	Natural		Light greyish white fairly degraded chalk with patches of pea grit	0.32 +
50504	Ploughsoil		Sieved ploughsoil context 50501.	
50505	Ploughsoil		Sieved ploughsoil context 50501.	
50506	Ploughsoil		Sieved ploughsoil context 50501.	
50507	Ploughsoil		Sieved ploughsoil context 50501.	
50508	Ploughsoil		Sieved ploughsoil context 50501.	
50509	Ploughsoil		Sieved ploughsoil context 50501.	
50510	Ploughsoil		Sieved ploughsoil context 50501.	
50511	Ploughsoil		Sieved ploughsoil context 50501.	
50512	Ploughsoil		Sieved ploughsoil context 50501.	
50513	Ploughsoil		Sieved ploughsoil context 50501.	
50514	Ploughsoil		Sieved ploughsoil context 50501.	

Trench 506	50 x 2m		NGR 414581 142167 (Centre of Trench)	90.8 m OD
Context	**Interpretative category**	**Fill of**	**Description**	**Depth (m)**
50601	Ploughsoil		Mid greyish brown loose clayey silt with abundant small chalk fragments ≤10mm and common angular to sub-angular medium-sized chalk fragments ≤30mm	0.00–0.30

Trench 506	50 x 2m		NGR 414581 142167 (Centre of Trench)	90.8 m OD
Context	**Interpretative category**	**Fill of**	**Description**	**Depth (m)**
50602	Natural		Chalk with occasional patches of yellow discolouration and sparse clusters of large sub-angular flint nodules ≤150mm	0.30 +
50603	Ditch		Ditch running N-S, very steep straight edges with a flat base. Likely to be a field boundary, date unknown. Contains 3 secondary fills.	0.37
50604	Secondary Fill	[50603]	Slow silting from upcast, created from making field boundary ditch [50603], brought in from wind and rain action. Mid greyish brown loose clayey silt with abundant chalk fragments ≤50mm and rare angular flints ≤150mm. Loose, soft compaction, heavily leached from natural. First episode of secondary fill for field boundary ditch [50603].	0.37
50605	Secondary Fill	[50603]	After initial first episode of silting (50604) from upcast material, larger course components rolled in through wind and rain action, this is the second episode of ditch stabilisation post abandonment. Mid greyish brown silty clay. 25% very common chalk fragments and flecking, 10% moderate large flint nodules ≤ 100mm across. Fairly loose compaction. Clearly defined boundary distinction with (50604) and (50611).	0.37
50606	Natural Feature		Tree uprooted to E/NE. Irregular slopes varying gentle-steep with irregular base. Burrowing possibly evident. Clear horizons between chalk natural and fills. Contains fills (50607) primary and (50612) secondary. Clear distinction between primary from tree roots and later silting.	0-0.6
50607	Secondary Fill	[50606]	Material fallen from roots when the tree was felled. Mid greyish brown loose clayey silt with common subangular flints ≤150mm. Contains mostly chalk and pea grit. More compact at E side of fill.	0.3-0.6
50608	Tree Throw		Subcircular in plan with straight moderate slope and flat base (slightly irregular).	
50609	Secondary Fill	[50608]	Mid greyish brown clayey silt with rare chalk fragments ≤100mm and rare angular flints ≤10mm.	
50610	VOID			
50611	Secondary Fill	[50603]	The final of three episodes for silting up of possible field boundary ditch [50603], the final stabilisation episode, created from wind and rain action. Later truncated from ploughing. Mid greyish brown loose clayey silt. 10% moderate pea grit, 3% sparse subangular flint ≤60mm across.	0.3-0.37

Trench 506	50 x 2m		NGR 414581 142167 (Centre of Trench)	90.8 m OD
Context	**Interpretative category**	**Fill of**	**Description**	**Depth (m)**
50612	Secondary Fill	[50606]	Silting where tree trunk has made a void. Mid greyish brown loose clayey silt.10% chalk, 10-40mm, subangular. Clear, abrupt horizon with primary fill.	0.25-0.3
50614	Ploughsoil		Sieved ploughsoil context 50601.	
50615	Ploughsoil		Sieved ploughsoil context 50601.	
50616	Ploughsoil		Sieved ploughsoil context 50601.	
50617	Ploughsoil		Sieved ploughsoil context 50601.	
50618	Ploughsoil		Sieved ploughsoil context 50601.	
50619	Ploughsoil		Sieved ploughsoil context 50601.	
50620	Ploughsoil		Sieved ploughsoil context 50601.	
50621	Ploughsoil		Sieved ploughsoil context 50601.	
50622	Ploughsoil		Sieved ploughsoil context 50601.	
50623	Ploughsoil		Sieved ploughsoil context 50601.	
50624	Ploughsoil		Sieved ploughsoil context 50601.	

Trench 507	50 x 2m		NGR 414639 142165 (Centre of Trench)	89.4 m OD
Context	**Interpretative category**	**Fill of / filled with**	**Description**	**Depth (m)**
50701	Ploughsoil		Mid brown friable silty clay with abundant medium and small chalk nodules 0.04-0.07m.	0.00–0.27
50702	Natural		Chalk, occasional yellow discolouration. Sparse large subangular flints >0.15m.	0.27+
50703	Ploughsoil		Sieved ploughsoil context 50701.	
50704	Ploughsoil		Sieved ploughsoil context 50701.	
50705	Ploughsoil		Sieved ploughsoil context 50701.	
50706	Ploughsoil		Sieved ploughsoil context 50701.	
50707	Ploughsoil		Sieved ploughsoil context 50701.	
50708	Ploughsoil		Sieved ploughsoil context 50701.	
50709	Ploughsoil		Sieved ploughsoil context 50701.	
50710	Ploughsoil		Sieved ploughsoil context 50701.	
50711	Ploughsoil		Sieved ploughsoil context 50701.	
50712	Ploughsoil		Sieved ploughsoil context 50701.	
50713	Ploughsoil		Sieved ploughsoil context 50701.	
50714	Tree throw	FW 50715 and 50717	Steep-sided cut on NW side, irregular shaped moderate to shallow sides to SE. Irregular base. Measuring 2.25 m long and width of trench (2.00 m +)	0.60 deep
50715	Secondary Fill	[50714]	Upper silting of tree throw hole. Mid brown silty clay. Rare medium subangular flint and chalk.	0.23 deep

Trench 507	50 x 2m		NGR 414639 142165 (Centre of Trench)	89.4 m OD
Context	**Interpretative category**	**Fill of / filled with**	**Description**	**Depth (m)**
50716			VOIDED	
50717	Primary Fill	[50714]	Redeposited natural lower fill of tree throw. Natural chalk, abundant frequency within slight mid brown silty clay matrix. Sparse large subangular flint.	0.6 deep

Trench 508	10 x 10 m		NGR 414666 142168 (Centre of Trench)	86.7 m OD
Context	**Interpretative category**	**Fill of**	**Description**	**Depth bgl (m)**
50801	Ploughsoil		Mid brown silty clay. Containing frequent chalk flecks and small fragments.	0.00–0.30
50802	Natural		Weathered chalk surface. Contains occasional, large subangular flint nodules.	0.30+
50803	Ploughsoil		Sieved ploughsoil context 50801.	
50804	Ploughsoil		Sieved ploughsoil context 50801.	
50805	Ploughsoil		Sieved ploughsoil context 50801.	
50806	Ploughsoil		Sieved ploughsoil context 50801.	

Trench 509	50 x 2 m		NGR 414717 142151 (Centre of Trench)	82.0 m OD
Context	**Interpretative category**	**Fill of**	**Description**	**Depth bgl (m)**
50901	Ploughsoil		Dark greyish brown silty clay loam with common fine chalk pea grit and fine small triangular flint gravel.	0.00–0.28
50902	Natural		Chalk, very smooth and crushed surface +/- 100mm thick, blocky and clean thereafter.	0.28+
50903	VOID			
50904	Fill	[50905]	Redeposited chalk and silt in a horizontal truncation perhaps related to landscaping/construction of A303.	
50905	Cut		Shallow truncation cut over most of length, modern related to A303 construction? All upper periglacial material removed down to solid chalk. Backfilled with spoil- chalk and soil.	0.28+
50906	Fill	[50905]	Subdivided into 50919-50924 & 50904- hand dug sondages to prove redeposited fill in truncation.	
50907	Ploughsoil		Sieved ploughsoil context 50901.	
50908	Ploughsoil		Sieved ploughsoil context 50901.	
50909	Ploughsoil		Sieved ploughsoil context 50901.	

Trench 509	50 x 2 m		NGR 414717 142151 (Centre of Trench)	82.0 m OD
Context	**Interpretative category**	**Fill of**	**Description**	**Depth bgl (m)**
50910	Ploughsoil		Sieved ploughsoil context 50901.	
50911	Ploughsoil		Sieved ploughsoil context 50901.	
50912	Ploughsoil		Sieved ploughsoil context 50901.	
50913	Ploughsoil		Sieved ploughsoil context 50901.	
50914	Ploughsoil		Sieved ploughsoil context 50901.	
50915	Ploughsoil		Sieved ploughsoil context 50901.	
50916	Ploughsoil		Sieved ploughsoil context 50901.	
50917	Ploughsoil		Sieved ploughsoil context 50901.	
50918	Ploughsoil		Sieved ploughsoil context 50901.	
50919	Fill	[50905]	See 50906.	
50920	Fill	[50905]	See 50906.	
50921	Fill	[50905]	See 50906	
50922	Fill	[50905]	See 50906	
50923	Fill	[50905]	See 50906	
50924	Fill	[50905]	See 50906	

Trench 510	50 x1.8 m		NGR 414788 142140 (Centre of Trench)	79.1 m OD
Context	**Interpretative category**	**Fill of**	**Description**	**Depth bgl (m)**
51001	Ploughsoil		Dark greyish brown silty clay loam with frequent pea grit and small flint gravels, occasional flint ≤300mm.	0.00–0.35
51002	Natural		Natural: Soft degraded chalk much dissected with small-quite large periglacial striped ice wedge at NW end.	0.35+
51003	Ploughsoil		Sieved ploughsoil context 51001.	
51004	Ploughsoil		Sieved ploughsoil context 51001.	
51005	Ploughsoil		Sieved ploughsoil context 51001.	
51006	Ploughsoil		Sieved ploughsoil context 51001.	
51007	Ploughsoil		Sieved ploughsoil context 51001.	
51008	Ploughsoil		Sieved ploughsoil context 51001.	
51009	Ploughsoil		Sieved ploughsoil context 51001.	
51010	Ploughsoil		Sieved ploughsoil context 51001.	
51011	Ploughsoil		Sieved ploughsoil context 51001.	
51012	Ploughsoil		Sieved ploughsoil context 51001.	
51013	Ploughsoil		Sieved ploughsoil context 51001.	

Trench 510	50 x1.8 m		NGR 414788 142140 (Centre of Trench)	79.1 m OD
Context	**Interpretative category**	**Fill of**	**Description**	**Depth bgl (m)**
51014	Natural Feature		Ice wedge. C. 1.5m wide and cutting +/- E-W across N end of trench, In approx. position of AP anomaly shown on NMP data. Very irregular edged and filled with interweaved and cryoturbation deposits of red brown silty clay, chalk marl, olavconitic sand, fine sandy chalk shingle and flint gravel/rubble (photos 0018-0020). No drawing, but on GPS survey as Geology.	

Trench 511	50 x 0.9 m		NGR 414910 142118 (Centre of Trench)	73.2 m OD
Context	**Interpretative category**	**Fill of**	**Description**	**Depth bgl (m)**
51101	Topsoil		Turfed. Dark yellowish brown silty clay with 10% moderate subangular flint <60mm across. 20% common chalk fragments and flecking. Fairly loose compaction. Undulating well defined boundary distinction with (51102).	0.00–0.4
51102	Subsoil		Mid yellowish brown silty clay with 40% abundant chalk fragments and flecking. Diffuse boundary with rooting evident into surface of underlying soliflucted chalk.	0.4-0.5
51103	Natural		Mottled light yellowish white with mid yellowish brown soliflucted chalk, very degraded. Common patches of mid yellowish brown silt and rarer patches of flint gravels.	0.5+
51104	Subsoil		Sieved subsoil context 51101.	
51105	Subsoil		Sieved subsoil context 51101.	
51106	Subsoil		Sieved subsoil context 51101.	
51107	Subsoil		Sieved subsoil context 51101.	
51108	Subsoil		Sieved subsoil context 51101.	
51109	Subsoil		Sieved subsoil context 51101.	
51110	Subsoil		Sieved subsoil context 51101.	
51111	Subsoil		Sieved subsoil context 51101.	
51112	Subsoil		Sieved subsoil context 51101.	
51113	Subsoil		Sieved subsoil context 51101.	
51114	Ploughsoil		Sieved ploughsoil context 51101.	
51115	Ploughsoil		Sieved ploughsoil context 51101.	
51116	Ploughsoil		Sieved ploughsoil context 51101.	
51117	Ploughsoil		Sieved ploughsoil context 51101.	
51118	Ploughsoil		Sieved ploughsoil context 51101.	
51119	Ploughsoil		Sieved ploughsoil context 51101.	

Trench 511	50 x 0.9 m		NGR 414910 142118 (Centre of Trench)	73.2 m OD
Context	**Interpretative category**	**Fill of**	**Description**	**Depth bgl (m)**
51120	Ploughsoil		Sieved ploughsoil context 51101.	
51121	Ploughsoil		Sieved ploughsoil context 51101.	
51122	Ploughsoil		Sieved ploughsoil context 51101.	
51123	Ploughsoil		Sieved ploughsoil context 51101.	
51124	Ploughsoil		Sieved ploughsoil context 51101.	
51125	Ploughsoil		Sieved ploughsoil context 51101.	
51126	Natural Feature		Possible posthole found to be geology	
51127	Cut		Posthole	
51128	Natural Feature		Possible posthole found to be geology	
51129	Fill	[51127]	Secondary fill	
51130	Layer		Very compact chalk, possibly from post-med/modern activity	
51131	Natural		Soliflucted chalk. Same as (51103)	
51132	Natural		Same as (51103). This deposit is seen within machine trench in various places, and has been laid down by fluvial action on glacial till within scraped out limestone, possibly by glacial activity or water movement. Light brown silt.	
51133	Natural		Same as (51103). Very light brown silt.	
51134	Natural		Same as (51103). Mid yellowish brown sand and small gravel.	
51135	Natural		Same as (51103). Light green sand and degraded chalk.	
51136	Natural		Same as (51103). Natural (hard) upper limestone and occasional flint.	
51138	Sample		40L sample of (51135)	

Trench 512	45.8 x 1.9 m		NGR 414981 142105 (Centre of Trench)	70.9 m OD
Context	**Interpretative category**	**Fill of**	**Description**	**Depth bgl (m)**
51201	Topsoil		Turfed. Dark yellowish brown silty clay with fine rooting towards the upper horizon with 5% sparse subangular flint <80mm across. 10% moderate chalk fragments and flecking.	0.00–0.30
51202	Subsoil		Mid yellowish brown silty clay with 10% moderate chalk fragments and flecking, 10% moderate mix of flint nodules <110mm across and sub angular flint <80mm across. Diffuse boundary with rooting evident into surface of underlying soliflucted chalk.	0.30-0.40
51203	Natural		Soliflucted chalk, very degraded-patches of light yellowish white and mid yellowish brown.	0.40+
51204	Ploughsoil		Sieved ploughsoil context 51201.	
51205	Ploughsoil		Sieved ploughsoil context 51201.	
51206	Ploughsoil		Sieved ploughsoil context 51201.	
51207	Ploughsoil		Sieved ploughsoil context 51201.	
51208	Ploughsoil		Sieved ploughsoil context 51201.	
51209	Ploughsoil		Sieved ploughsoil context 51201.	
51210	Ploughsoil		Sieved ploughsoil context 51201.	
51211	Ploughsoil		Sieved ploughsoil context 51201.	
51212	Ploughsoil		Sieved ploughsoil context 51201.	
51213	Ploughsoil		Sieved ploughsoil context 51201.	
51214	Ploughsoil		Sieved ploughsoil context 51201.	
51215	Layer	[51224]	Lower colluvium infilling hollow in the underlying soliflucted chalk. Dark yellowish brown silty clay.	0.83-1.35+
51216	Cut		Small possible secondary hollow within (51215) – possible result of bioturbation	
51217	Fill	[51216]	Secondary fill. Wash in from colluvium. Dark brown silty clay loam. Contains abundant sub-rounded and subangular flint, poorly sorted.	
51218	-		VOIDED	
51219	-		VOIDED	
51220	Layer		Upper colluvial deposit formed in hollow [51224]. Dark-mid brown silty clay. Contains very sparse flint course, possibly formed as an early horizon, prior to modern ploughing infill. Possibly same as 51201.	0.30-0.50
51221	Layer		Upper colluvial deposit. Formed in hollow [51224]. Similar to (51220), slightly darker with more sub-rounded flint course.	0.50-0.80

51222	Layer	[51224]	Stony horizon at base of upper colluvium in hollow. A thin layer of dark brown silty clay, formed in hollow Contains abundant small rounded and sub-rounded flint gravel.	0.80-0.83
51223	Layer		A patch of flint gravel, sub-rounded, poorly sorted. Contained within (51215).	
51224	Cut		Natural hollow.	
51225	Enviro Sample		Snail sample- (51220)	
51226	Enviro Sample		Snail sample- (51221)	
51227	Enviro Sample		Snail sample- (51222)	
51228	Enviro Sample		Bulk sample 40L	
51229	Enviro Sample		Bulk sample 40L	
51230-51242	Small finds/objects			

Appendix B Borehole logs

B.1 BH1–BH12 Log tables

NGR: 414425.4 142150.3		Borehole ID: BH1	Comments: 201788 Borehole Survey	
Level (top):79.31m OD				
Depth		Sediment description	Interpretation	Unit
m bg	m OD			
0.00 – 0.42	79.31 – 78.89	Light brown silty loam plough soil, granular structure, common small chalk fragments, clear lower boundary.	Topsoil	
0.42 – 1.35	78.89 – 77.86	Light/medium brown clay loam, granular/blocky structure, occasional SA chalk fragments becoming more abundant with depth, gradual lower boundary	Colluvium	
1.35 – 2.90	77.86-76.01	Stiff light grey brown poorly sorted silty clay loam, abundant SA fragments of chalk	Coombe deposits	
2.90 – 3.70	76.01–75.21	Weathered chalk, putty like in consistency with occasional fine soil filled voids around the chalk gravels.	Structureless chalk/coombe rock formed under cold climate/periglacial conditions	
3.70 – 4.00	75.21–74.91	Hard chalk with visible intact structure	In-situ bedrock Chalk	

NGR: 414439.8 142154.0		Borehole ID: BH2	Comments: 201788 Borehole Survey	
Level (top): 79.24 m OD				
Depth		Sediment description	Interpretation	Unit
m bg	m OD			
0.00 – 0.57	79.24–78.67	Light brown silty loam plough soil, granular structure, common small chalk fragments, clear lower boundary.	Topsoil	
0.57 – 1.33	78.67–77.91	Light/medium brown clay loam, granular/blocky structure, occasional SA chalk fragments becoming more abundant with depth, gradual lower boundary	Colluvium	
1.33 – 2.20	77.91–77.04	Stiff light grey brown silty clay loam, abundant SA fragments of chalk	Coombe deposits	

NGR: 414439.8 142154.0		Borehole ID: BH2	Comments: 201788 Borehole Survey	
Level (top): 79.24 m OD				
Depth		Sediment description	Interpretation	Unit
m bg	m OD			
2.20 – 4.30	77.04–74.94	Weathered chalk, putty like in consistency with occasional fine soil filled voids around the chalk gravels.	Structureless chalk/coombe rock formed under cold climate/periglacial conditions	
4.30 – 4.50	74.94–74.74	Hard chalk with visible intact structure	In-situ bedrock Chalk	

NGR: 414382.6 142132.3		Borehole ID: BH3	Comments: 201788 Borehole Survey	
Level (top): 82.25m OD				
Depth		Sediment description	Interpretation	Unit
m bg	m OD			
0.00 – 0.30	82.25–81.95	Light brown silty loam plough soil, granular structure, common small chalk fragments, clear lower boundary.	Topsoil	
0.30 – 1.70	81.95-80.55	Weathered chalk, putty like in consistency with occasional fine soil filled voids around the chalk gravels.	Coombe deposits	
1.70 – 2.00	80.55–80.25	Hard chalk with visible intact structure	In-situ bedrock Chalk	

NGR:414410.9 142131.1		Borehole ID:BH4	Comments: 201788 Borehole Survey	
Level (top): 79.92m OD				
Depth		Sediment description	Interpretation	Unit
m bg	m OD			
0.00 – 0.30	79.92–79.62	Light brown silty loam plough soil, granular structure, common small chalk fragments, clear lower boundary.	Topsoil (A horizon)	
0.30 – 0.60	79.62–79.32	Loose light grey brown silty clay soil matrix, well mixed containing large SA broken fragments of flint towards bottom of unit, with a sharp lower boundary	Made ground	

NGR:414410.9 142131.1		Borehole ID:BH4	Comments: 201788 Borehole Survey	
Level (top): 79.92m OD				
Depth		Sediment description	Interpretation	Unit
m bg	m OD			
0.60 – 1.60	79.32–78.32	Stiff light grey brown silty clay loam, abundant SA fragments of chalk	Coombe deposits	
1.60 – 2.10	78.32–77.82	Abundant SA large chalk gravels <0.04m, poorly sorted in a very light brown silty clay matrix	Coombe deposits	
2.10 – 3.70	77.82–76.22	Weathered chalk, putty like in consistency with occasional fine soil filled voids around the chalk gravels.	Structureless chalk/coombe rock formed under cold climate/periglacial conditions	
3.70 – 4.00	76.22–75.92	Hard chalk with visible intact structure	In-situ bedrock Chalk	

NGR: 414424.9 142134.1		Borehole ID: BH5	Comments: 201788 Borehole Survey	
Level (top): 79.4m OD				
Depth		Sediment description	Interpretation	Unit
m bg	m OD			
0.00 – 0.30	79.40–79.10	Light brown silty loam plough soil, granular structure, common small chalk fragments, clear lower boundary.	Topsoil	
0.30 – 0.60	79.10–78.80	Loose light grey brown silty clay soil matrix, well mixed containing large SA broken fragments of flint towards bottom of unit, with a sharp lower boundary	Made ground	
0.60 – 1.30	78.80–78.10	Stiff light grey brown silty clay loam, abundant SA fragments of chalk	Coombe deposits	
1.30 – 1.50	78.10–77.90	Firm medium brown clay loam with a blocky/granular structure, common small SA chalk fragments and a clear lower boundary.		
1.50 – 2.40	77.90–77.00	Abundant SA large chalk gravels <0.04m, poorly sorted in a very light brown silty clay matrix	Coombe deposits	
2.40 – 4.50	77.00–74.90	Weathered chalk, putty like in consistency with occasional fine soil filled voids around the chalk gravels.	Structureless chalk/coombe rock formed under cold climate/periglacial conditions	
4.50 – 5.00	74.90–74.50	Hard chalk with visible intact structure	In-situ bedrock Chalk	

NGR: 414439.4 142136.2		Borehole ID:BH6	Comments: 201788 Borehole Survey	
Level (top):79.3m OD				
Depth		Sediment description	Interpretation	Unit
m bg	m OD			
0.00 – 0.52	79.30–78.78	Light brown silty loam plough soil, granular structure, common small chalk fragments, clear lower boundary.	Topsoil	
0.52 – 1.30	78.78–78.00	Light/medium brown clay loam, granular/blocky structure, occasional SA chalk fragments becoming more abundant with depth, gradual lower boundary	Colluvium	
1.30 – 2.35	78.00–76.95	Stiff light grey brown silty clay loam, abundant SA fragments of chalk	Coombe deposits	
2.35 – 4.00	76.95–75.20	Weathered chalk, putty like in consistency with occasional fine soil filled voids around the chalk gravels.	Structureless chalk/coombe rock formed under cold climate/periglacial conditions	
4.00 – 5.00	75.20–74.20	Hard chalk with visible intact structure	In-situ bedrock Chalk	

NGR: 414487.1 142164.2		Borehole ID:BH7	Comments: 201788 Borehole Survey	
Level (top):83.49 m OD				
Depth		Sediment description	Interpretation	Unit
m bg	m OD			
0.00 – 0.34	83.49–83.15	Light brown silty loam plough soil, granular structure, common small chalk fragments, clear lower boundary.	Topsoil	
0.34 – 0.90	83.15–82.61	Abundant SA large chalk gravels <0.04m, poorly sorted in a very light brown silty clay matrix	Colluvium	
0.90 – 2.00	82.61–81.51	Weathered chalk, putty like in consistency with occasional fine soil filled voids around the chalk gravels.	Structureless chalk/coombe rock formed under cold climate/periglacial conditions	
2.00 – 3.00	81.51–80.51	Hard chalk with visible intact structure	In-situ bedrock Chalk	

NGR: 414468.7 142163.6	Borehole ID:BH8	Comments: 201788 Borehole Survey
Level (top):81.41m OD		

Depth		Sediment description	Interpretation	Unit
m bg	m OD			
0.00 – 0.35	81.41–81.06	Light brown silty loam plough soil, granular structure, common small chalk fragments, clear lower boundary.	Topsoil (A horizon)	
0.35 – 0.66	81.06–80.75	Light/medium brown clay loam, granular/blocky structure, occasional SA chalk fragments becoming more abundant with depth, gradual lower boundary	Colluvium	
0.66 – 1.00	80.75–80.41	Abundant SA large chalk gravels <0.04m, poorly sorted in a very light brown silty clay matrix	Coombe deposits	
1.00–2.50	80.41–78.91	Weathered chalk, putty like in consistency with occasional fine soil filled voids around the chalk gravels.	Structureless chalk/coombe rock formed under cold climate/periglacial conditions	
2.50 – 3.00	78.91–78.41	Hard chalk with visible intact structure	In-situ bedrock Chalk	

NGR: 414450.1 142165.8	Borehole ID:BH9	Comments: 201788 Borehole Survey
Level (top):79.75m OD		

Depth		Sediment description	Interpretation	Unit
m bg	m OD			
0.00 – 0.48	79.75–79.27	Light brown silty loam plough soil, granular structure, common small chalk fragments, clear lower boundary.	Topsoil	
0.48 – 1.20	79.27–78.35	Light/medium brown clay loam, granular/blocky structure, occasional SA chalk fragments becoming more abundant with depth, gradual lower boundary	Colluvium	
1.20 – 1.40	78.35–78.25	Firm medium brown clay loam with a blocky/granular structure, common small SA chalk fragments and a clear lower boundary.	Possible buried soil	
1.40 – 2.83	78.25–76.82	Stiff light grey brown silty clay loam, abundant SA fragments of chalk	Coombe deposit	
2.83 – 4.70	76.82–74.95	Weathered chalk, putty like in consistency with occasional fine soil filled voids around the chalk gravels.	Structureless chalk/coombe rock formed under cold climate/periglacial conditions	

NGR: 414450.1 142165.8		Borehole ID:BH9	Comments: 201788 Borehole Survey	
Level (top):79.75m OD				
Depth		Sediment description	Interpretation	Unit
m bg	m OD			
4.70 – 5.00	74.95–74.75	Hard chalk with visible intact structure	In-situ bedrock Chalk	

NGR: 414436.1 142165.3		Borehole ID: BH10	Comments: 201788 Borehole Survey	
Level (top):79.34m OD				
Depth		Sediment description	Interpretation	Unit
m bg	m OD			
0.00 – 0.30	79.34–79.04	Light brown silty loam plough soil, granular structure, common small chalk fragments, clear lower boundary.	Topsoil	
0.30 – 1.20	79.04–78.14	Light/medium brown clay loam, granular/blocky structure, occasional SA chalk fragments becoming more abundant with depth, gradual lower boundary	Colluvium	
1.20 – 2.00	78.14–77.34	Stiff light grey brown silty clay loam, abundant SA fragments of chalk	Coombe deposits	
2.00–3.50	77.34–75.84	Weathered chalk, putty like in consistency with occasional fine soil filled voids around the chalk gravels.	Structureless chalk/coombe rock formed under cold climate/periglacial conditions	
3.50 – 4.00	75.84–74,34	Hard chalk with visible intact structure	In-situ bedrock Chalk	

NGR:414423.8 142164.3		Borehole ID:BH11	Comments: 201788 Borehole Survey	
Level (top): 79.68m OD				
Depth		Sediment description	Interpretation	Unit
m bg	m OD			
0.00 – 0.47	79.68–79.21	Light brown silty loam plough soil, granular structure, common small chalk fragments, clear lower boundary.	Topsoil	

NGR:414423.8 142164.3		Borehole ID:BH11	Comments: 201788 Borehole Survey	
Level (top): 79.68m OD				
Depth		Sediment description	Interpretation	Unit
m bg	m OD			
0.47 – 1.24	79.21–78.54	Light/medium brown clay loam, granular/blocky structure, occasional SA chalk fragments becoming more abundant with depth, gradual lower boundary	Colluvium	
1.24 – 1.84	78.54–77.94	Stiff light grey brown silty clay loam, abundant SA fragments of chalk	Coombe deposits	
1.84 – 2.90	77.94–76.88	Weathered chalk, putty like in consistency with occasional fine soil filled voids around the chalk gravels.	Structureless chalk/coombe rock formed under cold climate/periglacial conditions	
2.90 – 4.00	76.88–75.78	Hard chalk with visible intact structure	In-situ bedrock Chalk	

NGR: 414408.8 142160.8		Borehole ID: BH12	Comments: 201788 Borehole Survey	
Level (top):80.7m OD				
Depth		Sediment description	Interpretation	Unit
m bg	m OD			
0.00 – 0.30	80.70–80.40	Light brown silty loam plough soil, granular structure, common small chalk fragments, clear lower boundary.	Topsoil	
0.30 – 1.50	80.40–79.20	Weathered chalk, putty like in consistency with occasional fine soil filled voids around the chalk gravels.	Structureless chalk/coombe rock formed under cold climate/periglacial conditions	
1.50 – 1.85	79.20–78.85	Stiff light brown clay with occasional large SA flints, clear convoluted upper and lower boundary.	Head/solifluction deposit formed from the dissolution, decalcification and cryoturbation of the chalk, which has then been deposited as a discrete head deposit on the valley side	
1.85 – 2.90	78.85–77.80	Weathered chalk, putty like in consistency with occasional fine soil filled voids around the chalk gravels.	Structureless chalk/coombe rock formed under cold climate/periglacial conditions	
2.90 – 4.00	77.80–76.70	Hard chalk with visible intact structure	In-situ bedrock Chalk	

KEY: NGR= National grid Reference, m bg= metres below ground, m OD = metres Ordnance Datum

Appendix C Environmental data

C.1 Assessment of the charred plant remains and charcoal

Feature	Context	Sample	Vol (L)	Flot (ml)	Bioturbation proxies	Grain	Chaff	Cereal Notes	Charred Other	Charred Other Notes	Charcoal > 4/2mm	Charcoal	Other	Comments (Preservation)
50445	50455	50476	39	20	30%, C	-	-	-	C	Anthemis cotula	Trace in <1mm	Mature	Moll-t	Poor
50445	50446	50477	39	15	30%, C	-	-	-	-	-	Trace in <1mm	Mature	Moll-t	-
50603	50604	50613	19	40	60%, A, E, I	C	-	Triticeae	-	-	Trace	Mature	Moll-t	Poor
	51135	51138	38	10	20%, A, E, I	C	-	*Triticum* sp., Triticeae	-	-	Trace in <1mm	Mature	Moll-t	Poor
51224	51221	51228	40	35	75%, B, E	C	-	Triticeae	C	Corylus avellana	<1ml	Mature	Moll-t	Poor
51224	51222	51229	40	30	85%, A, E, I	C	-	*Triticum* sp., Triticeae	C	Corylus avellana	<1ml	Mature	Moll-t	Poor

Key: A*** = exceptional, A** = 100+, A* = 30-99, A = >10, B = 9-5, C = <5; Bioturbation proxies: Roots (%), Uncharred seeds (scale of abundance), F = mycorrhizal fungi sclerotia, E = earthworm eggs, I = insects, Moll-t = terrestrial molluscs.

Appendix D OSL report

D.1 External report from University of Gloucestershire Luminescence dating laboratory for Wessex Archaeology (18 June 2018)

University of Gloucestershire

Luminescence dating laboratory

Optical dating of sediments: A303 Eastern Portal (Trench 504), UK

to

Dr C. Mellett

Wessex Archaeology

Analysis & Reporting, Dr P.S. Toms
Sample Preparation & Measurement, Mr J.C. Wood
18 June 2018

Contents

Scope of Report

This is a standard report of the Luminescence dating laboratory, University of Gloucestershire. In large part, the document summarises the processes, diagnostics and data drawn upon to deliver Table 1. A conclusion on the analytical validity of each sample's optical age estimate is expressed in Table 2; where there are caveats, the reader is directed to the relevant section of the report that explains the issue further in general terms.

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Field Code	Lab Code	Overburden (m)	Grain size (μm)	Moisture content (%)	Ge γ-spectrometry (*ex situ*)			β D_r (Gy.ka^{-1})	γ D_r (Gy.ka^{-1})	Cosmic D_r (Gy.ka^{-1})	Preheat (°C for 10s)	Low Dose Repeat Ratio	Interpolated:Applied Low Regenerative-dose D_e	High Dose Repeat Ratio	Interpolated:Applied High Regenerative-dose D_e	Post-IR OSL Ratio
					K (%)	Th (ppm)	U (ppm)									
(50402) / 50492	GL17147	0.4	125-180	17 ± 4	0.42 ± 0.05	3.59 ± 0.36	1.08 ± 0.11	0.42 ± 0.06	0.32 ± 0.06	0.20 ± 0.02	280	0.96 ± 0.03	0.95 ± 0.02	0.99 ± 0.02	1.00 ± 0.02	0.97 ± 0.03
(50403) / 50415	GL17148	0.6	125-180	17 ± 4	0.40 ± 0.05	3.45 ± 0.38	1.01 ± 0.10	0.40 ± 0.06	0.30 ± 0.05	0.19 ± 0.02	280	0.99 ± 0.04	0.98 ± 0.02	0.98 ± 0.02	0.98 ± 0.02	0.93 ± 0.03
(50405) / 50493	GL17149	0.9	125-180	17 ± 4	0.63 ± 0.06	5.15 ± 0.44	1.50 ± 0.13	0.61 ± 0.08	0.46 ± 0.07	0.18 ± 0.02	280	0.94 ± 0.02	0.93 ± 0.02	0.96 ± 0.01	0.96 ± 0.01	0.93 ± 0.02

Field Code	Lab Code	Total D_r (Gy.ka^{-1})	D_e (Gy)	Age (ka)	Date
(50402) / 50492	GL17147	0.94 ± 0.08	0.44 ± 0.03	0.47 ± 0.05 (0.05)	1500 A.D. – 1600 A.D.
(50403) / 50415	GL17148	0.89 ± .008	0.96 ± 0.05	1.07 ± 0.11 (0.10)	840 A.D. – 1050 A.D.
(50405) / 50493	GL17149	1.25 ± 0.10	2.60 ± 0.12	2.08 ± 0.19 (0.17)	260 B.C. – 130 A.D.

Table 1 D_r, D_e and Age data of submitted samples located at c. 51°N, 1°W, 100m. Age estimates expressed relative to year of sampling. 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 (see 6.0). **Blue** indicates samples with accepted age estimates, **red**, age estimates with caveats (see Table 2).

Generic considerations	Field Code	Lab Code	Sample specific considerations
Absence of *in situ* γ spectrometry data (see section 4.0)	(50402) / 50492	GL17147	Failed Dose Recovery test (see section 3.1.2 and Fig. 2) Potentially significant U disequilibrium (see section 4.0 and Fig. 5) Accept tentatively
	(50403) / 50415)	GL17148	Potentially significant U disequilibrium (see section 4.0 and Fig. 5) Accept tentatively
	(50405) / 50493	GL17149	Failed Dose Recovery test (see section 3.1.2 and Fig. 2) Potentially significant U disequilibrium (see section 4.0 and Fig. 5) Accept tentatively

Table 2 Analytical validity of sample suite age estimates and caveats for consideration

1.0 Mechanisms and principles

Upon exposure to ionising radiation, electrons within the crystal lattice of insulating minerals are displaced from their atomic orbits. Whilst this dislocation is momentary for most electrons, a portion of charge is redistributed to meta-stable sites (traps) within the crystal lattice. In the absence of significant optical and thermal stimuli, this charge can be stored for extensive periods. The quantity of charge relocation and storage relates to the magnitude and period of irradiation. When the lattice is optically or thermally stimulated, charge is evicted from traps and may return to a vacant orbit position (hole). Upon recombination with a hole, an electron's energy can be dissipated in the form of light generating crystal luminescence providing a measure of dose absorption.

Herein, quartz is segregated for dating. The utility of this minerogenic dosimeter lies in the stability of its datable signal over the mid to late Quaternary period, predicted through isothermal decay studies (e.g. Smith *et al*., 1990; retention lifetime 630 Ma at 20°C) and evidenced by optical age estimates concordant with independent chronological controls (e.g. Murray and Olley, 2002). This stability is in contrast to the anomalous fading of comparable signals commonly observed for other ubiquitous sedimentary minerals such as feldspar and zircon (Wintle, 1973; Templer, 1985; Spooner, 1993)

Optical age estimates of sedimentation (Huntley *et al*., 1985) are premised upon reduction of the minerogenic time dependent signal (Optically Stimulated Luminescence, OSL) to zero through exposure to sunlight and, once buried, signal reformulation by absorption of litho- and cosmogenic radiation. The signal accumulated post burial acts as a dosimeter recording total dose absorption, converting to a chronometer by estimating the rate of dose absorption quantified through the assay of radioactivity in the surrounding lithology and streaming from the cosmos.

$$\text{Age} = \frac{\text{Mean Equivalent Dose } (D_e\text{, Gy})}{\text{Mean Dose Rate } (D_r\text{, Gy.ka}^{-1})}$$

Aitken (1998) and Bøtter-Jensen *et al*. (2003) offer a detailed review of optical dating.

2.0 Sample Preparation

Three sediment samples were collected within opaque tubing and submitted for Optical dating. To preclude optical erosion of the datable signal prior to measurement, all samples were opened and prepared under controlled laboratory illumination provided by Encapsulite RB-10 (red) filters. To isolate that material potentially exposed to daylight during sampling, sediment located within 20 mm of each tube-end was removed.

The remaining sample was dried and then sieved. The fine sand fraction was segregated and subjected to acid and alkaline digestion (10% HCl, 15% H_2O_2) to attain removal of carbonate and organic components respectively. A further acid digestion in HF (40%, 60 mins for 125-180 μm) was used to etch the outer 10-15 μm layer affected by α radiation and degrade each samples' feldspar content. During HF treatment, continuous magnetic stirring was used to effect isotropic etching of grains. 10% HCl was then added to remove acid soluble fluorides. Each sample was dried, resieved and quartz isolated from the remaining heavy mineral fraction using a sodium polytungstate density separation at 2.68g.cm^{-3}. Twelve 8 mm multi-grain aliquots (*c*. 3-6 mg) of quartz from each sample were then mounted on aluminium discs for determination of D_e values.

All drying was conducted at 40°C to prevent thermal erosion of the signal. All acids and alkalis were Analar grade. All dilutions (removing toxic-corrosive and non-minerogenic luminescence-bearing substances) were conducted with distilled water to prevent signal contamination by extraneous particles.

3.0 Acquisition and accuracy of D_e value

All minerals naturally exhibit marked inter-sample variability in luminescence per unit dose (sensitivity). Therefore, the estimation of D_e acquired since burial requires calibration of the natural signal using known amounts of laboratory dose. D_e values were quantified using a single-aliquot regenerative-dose (SAR) protocol (Murray and Wintle 2000; 2003) facilitated by a Risø TL-DA-15 irradiation-stimulation-detection system (Markey *et al*., 1997; Bøtter-Jensen *et al*., 1999). Within this apparatus, optical signal stimulation is provided by an assembly of blue diodes (5 packs of 6 Nichia NSPB500S), filtered to 470±80 nm conveying 15 $mW.cm^{-2}$ using a 3 mm Schott GG420 positioned in front of each diode pack. Infrared (IR) stimulation, provided by 6 IR diodes (Telefunken TSHA 6203) stimulating at 875±80nm delivering ~5 $mW.cm^{-2}$, was used to indicate the presence of contaminant feldspars (Hütt *et al*., 1988). Stimulated photon emissions from quartz aliquots are in the ultraviolet (UV) range and were filtered from stimulating photons by 7.5 mm HOYA U-340 glass and detected by an EMI 9235QA photomultiplier fitted with a blue-green sensitive bialkali photocathode. Aliquot irradiation was conducted using a 1.48 GBq $^{90}Sr/^{90}Y$ β source calibrated for multi-grain aliquots of 125-180 μm quartz against the 'Hotspot 800' ^{60}Co γ source located at the National Physical Laboratory (NPL), UK.

SAR by definition evaluates D_e through measuring the natural signal (Fig. 1) of a single aliquot and then regenerating that aliquot's signal by using known laboratory doses to enable calibration. For each aliquot, five different regenerative-doses were administered so as to image dose response. D_e values for each aliquot were then interpolated, and associated counting and fitting errors calculated, by way of exponential plus linear regression (Fig. 1). Weighted (geometric) mean D_e values were calculated from 12 aliquots using the central age model outlined by Galbraith *et al*. (1999) and are quoted at 1σ confidence (Table 1). The accuracy with which D_e equates to total absorbed dose and that dose absorbed since burial was assessed. The former can be considered a function of laboratory factors, the latter, one of environmental issues. Diagnostics were deployed to estimate the influence of these factors and criteria instituted to optimise the accuracy of D_e values.

3.1 Laboratory Factors

3.1.1 Feldspar contamination

The propensity of feldspar signals to fade and underestimate age, coupled with their higher sensitivity relative to quartz makes it imperative to quantify feldspar contamination. At room temperature, feldspars generate a signal (IRSL; Fig. 1) upon exposure to IR whereas quartz does not. The signal from feldspars contributing to OSL can be depleted by prior exposure to IR. For all aliquots the contribution of any remaining feldspars was estimated from the OSL IR depletion ratio (Duller, 2003). The influence of IR depletion on the OSL signal can be illustrated by comparing the regenerated post-IR OSL D_e with the applied regenerative-dose. If the addition to OSL by feldspars is insignificant, then the repeat dose ratio of OSL to post-IR OSL should be statistically consistent with unity (Table 1). If any aliquots do not fulfil this criterion, then the sample age estimate should be accepted tentatively. The source of feldspar contamination is rarely rooted in sample preparation; it predominantly results from the occurrence of feldspars as inclusions within quartz.

3.1.2 Preheating

Preheating aliquots between irradiation and optical stimulation is necessary to ensure comparability between natural and laboratory-induced signals. However, the multiple irradiation and preheating steps that are required to define single-aliquot regenerative-dose response leads to signal sensitisation, rendering calibration of the natural signal inaccurate. The SAR protocol (Murray and Wintle, 2000; 2003) enables this sensitisation to be monitored and corrected using a test dose, here set at 5 Gy preheated to 220°C for 10s, to track signal sensitivity between irradiation-preheat steps. However, the accuracy of sensitisation correction for both natural and laboratory signals can be preheat dependent.

The Dose Recovery test was used to assess the optimal preheat temperature for accurate correction and calibration of the time dependent signal. Dose Recovery (Fig. 2) attempts to quantify the combined effects of thermal transfer and sensitisation on the natural signal, using a precise lab dose to simulate natural dose. The ratio between the applied dose and recovered D_e value should be statistically concordant with unity. For this diagnostic, 6 aliquots were each assigned a 10 s preheat between 180°C and 280°C.

That preheat treatment fulfilling the criterion of accuracy within the Dose Recovery test was selected to generate the final D_e value from a further 12 aliquots. Further thermal treatments, prescribed by Murray and Wintle (2000; 2003), were applied to optimise accuracy and precision. Optical stimulation occurred at 125ºC in order to minimise effects associated with photo-transferred thermoluminescence and maximise signal to noise ratios. Inter-cycle optical stimulation was conducted at 280ºC to minimise recuperation.

3.1.3 Irradiation

For all samples having D_e values in excess of 100 Gy, matters of signal saturation and laboratory irradiation effects are of concern. With regards the former, the rate of signal accumulation generally adheres to a saturating exponential form and it is this that limits the precision and accuracy of D_e values for samples having absorbed large doses. For such samples, the functional range of D_e interpolation by SAR has been verified up to 600 Gy by Pawley *et al*. (2010). Age estimates based on D_e values exceeding this value should be accepted tentatively.

3.1.4 Internal consistency

Abanico plots (Dietze *et al*., 2016) are used to illustrate inter-aliquot D_e variability (Fig. 3). D_e values are standardised relative to the central D_e value for natural signals and are described as overdispersed when >5% lie beyond $\pm$ 2σ of the standardising value; resulting from a heterogeneous absorption of burial dose and/or response to the SAR protocol. For multi-grain aliquots, overdispersion of natural signals does not necessarily imply inaccuracy. However where overdispersion is observed for regenerated signals, the efficacy of sensitivity correction may be problematic. Murray and Wintle (2000; 2003) suggest repeat dose ratios (Table 1) offer a measure of SAR protocol success, whereby ratios ranging across 0.9-1.1 are acceptable. However, this variation of repeat dose ratios in the high-dose region can have a significant impact on D_e interpolation. The influence of this effect can be outlined by quantifying the ratio of interpolated to applied regenerative-dose ratio (Table 1). In this study, where both the repeat dose ratios and interpolated to applied regenerative-dose ratios range across 0.9-1.1, sensitivity-correction is considered effective.

3.2 Environmental factors

3.2.1 Incomplete zeroing

Post-burial OSL signals residual of pre-burial dose absorption can result where pre-burial sunlight exposure is limited in spectrum, intensity and/or period, leading to age overestimation. This effect is particularly acute for material eroded and redeposited sub-aqueously (Olley *et al*., 1998, 1999; Wallinga, 2002) and exposed to a burial dose of <20 Gy (e.g. Olley *et al*., 2004), has some influence in sub-aerial contexts but is rarely of consequence where aerial transport has occurred. Within single-aliquot regenerative-dose optical dating there are two diagnostics of partial resetting (or bleaching); signal analysis (Agersnap-Larsen *et al*., 2000; Bailey *et al*., 2003) and inter-aliquot D_e distribution studies (Murray *et al*., 1995).

Within this study, signal analysis was used to quantify the change in D_e value with respect to optical stimulation time for multi-grain aliquots. This exploits the existence of traps within minerogenic dosimeters that bleach with different efficiency for a given wavelength of light to verify partial bleaching. D_e (t) plots (Fig. 4; Bailey *et al*., 2003) are constructed from separate integrals of signal decay as laboratory optical stimulation progresses. A statistically significant increase in natural D_e (t) is indicative of partial bleaching assuming three conditions are fulfilled. Firstly, that a statistically significant increase in D_e (t) is observed when partial bleaching is simulated within the laboratory. Secondly, that there is no significant rise in D_e (t) when full bleaching is simulated. Finally, there should be no significant augmentation in D_e (t) when zero dose is simulated. Where partial bleaching is detected, the age derived from the sample should be considered a maximum estimate only. However, the utility of signal analysis is strongly dependent upon a samples pre-burial experience of sunlight's spectrum and its residual to post-burial signal ratio. Given in the majority of cases, the spectral exposure history of a deposit is uncertain, the absence of an increase in natural D_e (t) does not necessarily testify to the absence of partial bleaching.

Where requested and feasible, the insensitivities of multi-grain single-aliquot signal analysis may be circumvented by inter-aliquot D_e distribution studies. This analysis uses aliquots of single sand grains to quantify inter-grain D_e distribution. At present, it is contended that asymmetric inter-grain D_e distributions are symptomatic of partial bleaching and/or pedoturbation (Murray *et al*., 1995; Olley *et al*., 1999; Olley *et al*., 2004; Bateman *et al*., 2003). For partial bleaching at least, it is further contended that the D_e acquired during burial is located in the minimum region of such ranges. The mean and breadth of this minimum region is the subject of current debate, as it is additionally influenced by heterogeneity in microdosimetry, variable inter-grain response to SAR and residual to post-burial signal ratios.

3.2.2 Turbation

As noted in section 3.1.1, the accuracy of sedimentation ages can further be controlled by post-burial trans-strata grain movements forced by pedo- or cryoturbation. Berger (2003) contends pedogenesis prompts a reduction in the apparent sedimentation age of parent material through bioturbation and illuviation of younger material from above and/or by biological recycling and resetting of the datable signal of surface material. Berger (2003) proposes that the chronological products of this remobilisation are A-horizon age estimates reflecting the cessation of pedogenic activity, Bc/C-horizon ages delimiting the maximum age for the initiation of pedogenesis with estimates obtained from Bt-horizons providing an intermediate age 'close to the age of cessation of soil development'. Singhvi et al. (2001), in contrast, suggest that B and C-horizons closely approximate the age of the parent material, the A-horizon, that of the 'soil forming episode'. Recent analyses of inter-aliquot D_e distributions have reinforced this complexity of interpreting burial age from pedoturbated deposits (Lombard *et al*., 2011; Gliganic *et al*., 2015; Jacobs *et al*., 2008; Bateman *et al*., 2007; Gliganic *et al*., 2016). At present there is no definitive post-sampling mechanism for the direct detection of and correction for post-burial sediment remobilisation. However, intervals of palaeosol evolution can be delimited by a maximum age derived from parent material and a minimum age obtained from a unit overlying the palaeosol. Inaccuracy forced by cryoturbation may be bidirectional, heaving older material upwards or drawing younger material downwards into the level to be dated. Cryogenic deformation of matrix-supported material is, typically, visible; sampling of such cryogenically-disturbed sediments can be avoided.

4.0 Acquisition and accuracy of D_r value

Lithogenic D_r values were defined through measurement of U, Th and K radionuclide concentration and conversion of these quantities into β and γ D_r values (Table 1). β contributions were estimated from sub-samples by laboratory-based γ spectrometry using an Ortec GEM-S high purity Ge coaxial detector system, calibrated using certified reference materials supplied by CANMET. γ dose rates can be estimated from *in situ* NaI gamma spectrometry or, where direct measurements are unavailable as in the present case, from laboratory-based Ge γ spectrometry. *In situ* measurements reduce uncertainty relating to potential heterogeneity in the γ dose field surrounding each sample. The level of U disequilibrium was estimated by laboratory-based Ge γ spectrometry. Estimates of radionuclide concentration were converted into D_r values (Adamiec and Aitken, 1998), accounting for D_r modulation forced by grain size (Mejdahl, 1979) and present moisture content (Zimmerman, 1971). Cosmogenic D_r values were calculated on the basis of sample depth, geographical position and matrix density (Prescott and Hutton, 1994).

The spatiotemporal validity of D_r values can be considered a function of five variables. Firstly, age estimates devoid of *in situ* γ spectrometry data should be accepted tentatively if the sampled unit is heterogeneous in texture or if the sample is located within 300 mm of strata consisting of differing texture and/or mineralogy. However, where samples are obtained throughout a vertical profile, consistent values of γ D_r based solely on laboratory measurements may evidence the homogeneity of the γ field and hence accuracy of γ D_r values. Secondly, disequilibrium can force temporal instability in U and Th emissions. The impact of this infrequent phenomenon (Olley *et al.*, 1996) upon age estimates is usually insignificant given their associated margins of error. However, for samples where this effect is pronounced (>50% disequilibrium between ^{238}U and ^{226}Ra; Fig. 5), the resulting age estimates should be accepted tentatively. Thirdly, pedogenically-induced variations in matrix composition of B and C-horizons, such as radionuclide and/or mineral remobilisation, may alter the rate of energy emission and/or absorption. If D_r is invariant through a dated profile and samples encompass primary parent material, then element mobility is likely limited in effect. Fourthly, spatiotemporal detractions from present moisture content are difficult to assess directly, requiring knowledge of the magnitude and timing of differing contents. However, the maximum influence of moisture content variations can be delimited by recalculating D_r for minimum (zero) and maximum (saturation) content. Finally, temporal alteration in the thickness of overburden alters cosmic D_r values. Cosmic D_r often forms a negligible portion of total D_r. It is possible to quantify the maximum influence of overburden flux by recalculating D_r for minimum (zero) and maximum (surface sample) cosmic D_r.

5.0 Estimation of Age

Ages reported in Table 1 provide an estimate of sediment burial period based on mean D_e and D_r values and their associated analytical uncertainties. Uncertainty in age estimates is reported as a product of systematic and experimental errors, with the magnitude of experimental errors alone shown in parenthesis (Table 1). Cumulative frequency plots indicate the inter-aliquot variability in age (Fig. 6). The maximum influence of temporal variations in D_r forced by minima-maxima in moisture content and overburden thickness is also illustrated in Fig. 6. Where uncertainty in these parameters exists this age range may prove instructive, however the combined extremes represented should not be construed as preferred age estimates. The analytical validity of each sample is presented in Table 2.

6.0 Analytical uncertainty

All errors are based upon analytical uncertainty and quoted at 1σ confidence. Error calculations account for the propagation of systematic and/or experimental (random) errors associated with D_e and D_r values.

For D_e values, systematic errors are confined to laboratory β source calibration. Uncertainty in this respect is that combined from the delivery of the calibrating γ dose (1.2%; NPL, pers. comm.), the conversion of this dose for SiO_2 using the respective mass energy-absorption coefficient (2%; Hubbell, 1982) and experimental error, totalling 3.5%. Mass attenuation and bremsstrahlung losses during γ dose delivery are considered negligible. Experimental errors relate to D_e interpolation using sensitisation corrected dose responses. Natural and regenerated sensitisation corrected dose points (S_i) were quantified by,

$$S_i = (D_i - x.L_i) / (d_i - x.L_i) \qquad \textbf{Eq.1}$$

where D_i = Natural or regenerated OSL, initial 0.2 s

L_i = Background natural or regenerated OSL, final 5 s

d_i = Test dose OSL, initial 0.2 s

x = Scaling factor, 0.08

The error on each signal parameter is based on counting statistics, reflected by the square-root of measured values. The propagation of these errors within Eq. 1 generating σS_i follows the general formula given in Eq. 2. σS_i were then used to define fitting and interpolation errors within exponential plus linear regressions.

For D_r values, systematic errors accommodate uncertainty in radionuclide conversion factors (5%), β attenuation coefficients (5%), a-value (4%; derived from a systematic α source uncertainty of 3.5% and experimental error), matrix density (0.20 $g.cm^{-3}$), vertical thickness of sampled section (specific to sample collection device), saturation moisture content (3%), moisture content attenuation (2%), burial moisture content (25% relative, unless direct evidence exists of the magnitude and period of differing content) and NaI gamma spectrometer calibration (3%). Experimental errors are associated with radionuclide quantification for each sample by NaI and Ge gamma spectrometry.

The propagation of these errors through to age calculation was quantified using the expression,

$$\sigma y\ (\delta y/\delta x) = (\Sigma\ ((\delta y/\delta x_n).\sigma x_n)^2)^{1/2} \qquad \textbf{Eq. 2}$$

where y is a value equivalent to that function comprising terms x_n and where σy and σx_n are associated uncertainties.

Errors on age estimates are presented as combined systematic and experimental errors and experimental errors alone. The former (combined) error should be considered when comparing luminescence ages herein with independent chronometric controls. The latter assumes systematic errors are common to luminescence age estimates generated by means identical to those detailed herein and enable direct comparison with those estimates.

Fig. 1 Signal Calibration

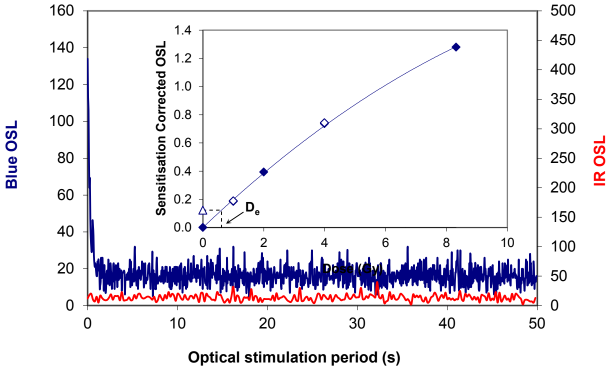


Fig. 1 Signal Calibration Natural blue and laboratory-induced infrared (IR) OSL signals. Detectable IR signal decays are diagnostic of feldspar contamination. Inset, the natural blue OSL signal (open triangle) of each aliquot is calibrated against known laboratory doses to yield equivalent dose (D_e) values. Repeats of low and high doses (open diamonds) illustrate the success of sensitivity correction.

Fig. 2 Dose Recovery The acquisition of D_e values is necessarily predicated upon thermal treatment of aliquots succeeding environmental and laboratory irradiation. The Dose Recovery test quantifies the combined effects of thermal transfer and sensitisation on the natural signal using a precise lab dose to simulate natural dose. Based on this an appropriate thermal treatment is selected to generate the final D_e value.

Fig. 3 Inter-aliquot D_e distribution Abanico plot of inter-aliquot statistical concordance in D_e values derived from **natural** irradiation. Discordant data (those points lying beyond ±2 standardised ln D_e) reflect heterogeneous dose absorption and/or inaccuracies in calibration.

Fig. 4 Signal Analysis Statistically significant increase in **natural** D_e value with signal stimulation period is indicative of a partially-bleached signal, provided a significant increase in D_e results from **simulated partial bleaching** followed by insignificant adjustment in D_e for simulated **zero** and **full bleach** conditions. Ages from such samples are considered maximum estimates. In the absence of a significant rise in D_e with stimulation time, simulated partial bleaching and zero/full bleach tests are not assessed.

Fig. 5 U Activity Statistical concordance (equilibrium) in the activities of the daughter radioisotope ^{226}Ra with its parent ^{238}U may signify the temporal stability of D_r emissions from these chains. Significant differences (disequilibrium; >50%) in activity indicate addition or removal of isotopes creating a time-dependent shift in D_r values and increased uncertainty in the accuracy of age estimates. A 20% disequilibrium marker is also shown.

Fig. 6 Age Range The Cumulative frequency plot indicates the inter-aliquot variability in age. It also shows the **mean age range**; an estimate of sediment burial period based on mean D_e and D_r values with associated analytical uncertainties. The **maximum influence** of temporal variations in D_r forced by minima-maxima variation in moisture content and overburden thickness is outlined and may prove instructive where there is uncertainty in these parameters. However the combined extremes represented should not be construed as preferred age estimates.

Fig. 2 Dose Recovery

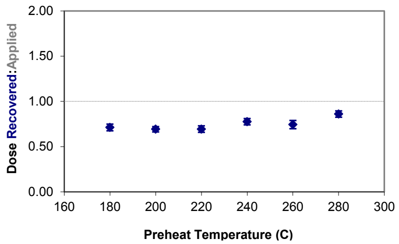
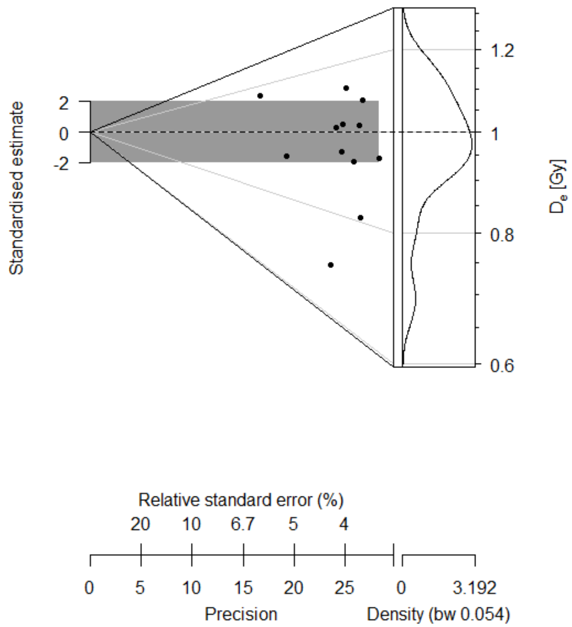


Fig. 3 Inter-aliquot D_e distribution



Sample: GL17147

Fig. 4 Signal Analysis

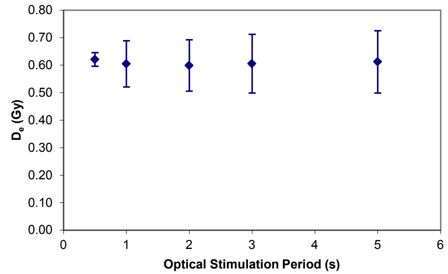


Fig. 5 U Decay Activity

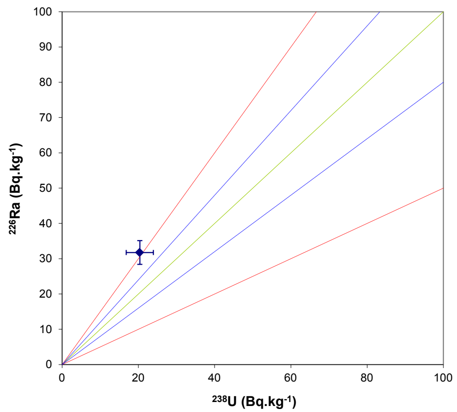


Fig. 6 Age Range

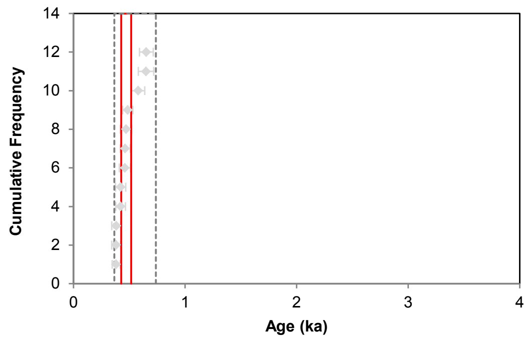


Fig. 1 Signal Calibration

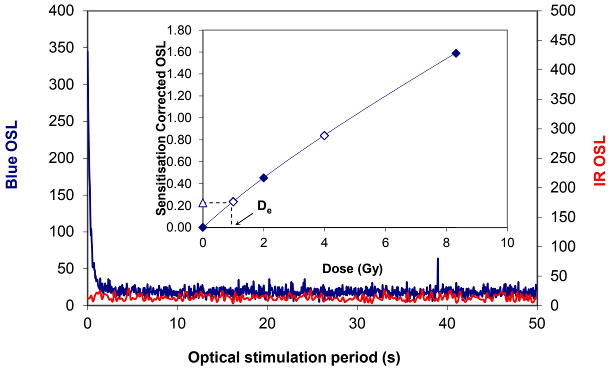


Fig. 2 Dose Recovery

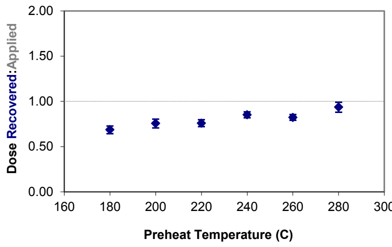


Fig. 4 Signal Analysis

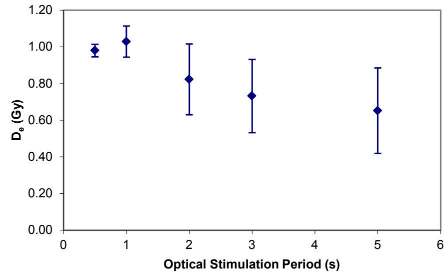


Fig. 3 Inter-aliquot D_e distribution

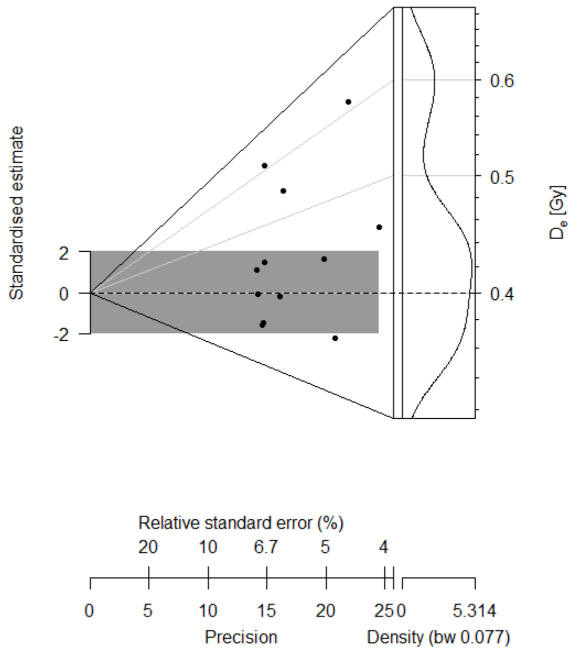


Fig. 5 U Decay Activity

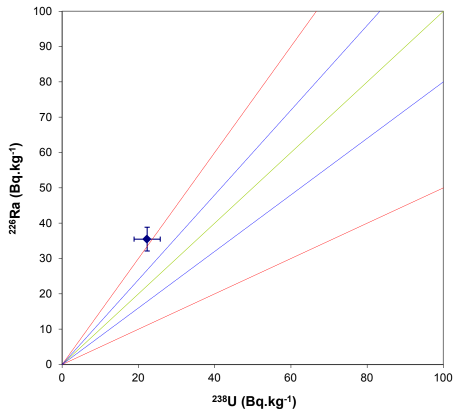


Fig. 6 Age Range

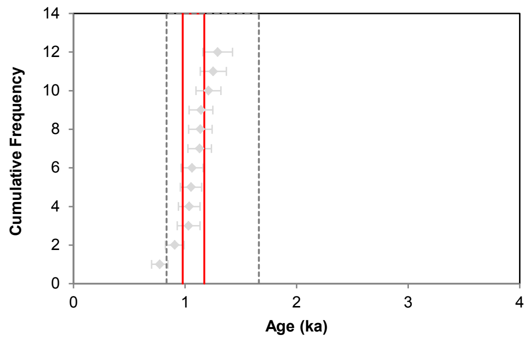


Fig. 1 Signal Calibration Natural blue and laboratory-induced infrared (IR) OSL signals. Detectable IR signal decays are diagnostic of feldspar contamination. Inset, the natural blue OSL signal (open triangle) of each aliquot is calibrated against known laboratory doses to yield equivalent dose (D_e) values. Repeats of low and high doses (open diamonds) illustrate the success of sensitivity correction.

Fig. 2 Dose Recovery The acquisition of D_e values is necessarily predicated upon thermal treatment of aliquots succeeding environmental and laboratory irradiation. The Dose Recovery test quantifies the combined effects of thermal transfer and sensitisation on the natural signal using a precise lab dose to simulate natural dose. Based on this an appropriate thermal treatment is selected to generate the final D_e value.

Fig. 3 Inter-aliquot D_e distribution Abanico plot of inter-aliquot statistical concordance in D_e values derived from **natural** irradiation. Discordant data (those points lying beyond **±2 standardised ln D_e**) reflect heterogeneous dose absorption and/or inaccuracies in calibration.

Fig. 4 Signal Analysis Statistically significant increase in **natural** D_e value with signal stimulation period is indicative of a partially-bleached signal, provided a significant increase in D_e results from **simulated partial bleaching** followed by insignificant adjustment in D_e for simulated **zero** and **full bleach** conditions. Ages from such samples are considered maximum estimates. In the absence of a significant rise in D_e with stimulation time, simulated partial bleaching and zero/full bleach tests are not assessed.

Fig. 5 U Activity Statistical concordance (equilibrium) in the activities of the daughter radioisotope ^{226}Ra with its parent ^{238}U may signify the temporal stability of D_r emissions from these chains. Significant differences (disequilibrium; >50%) in activity indicate addition or removal of isotopes creating a time-dependent shift in D_r values and increased uncertainty in the accuracy of age estimates. A 20% disequilibrium marker is also shown.

Fig. 6 Age Range The Cumulative frequency plot indicates the inter-aliquot variability in age. It also shows the **mean age range**; an estimate of sediment burial period based on mean D_e and D_r values with associated analytical uncertainties. The **maximum influence** of temporal variations in D_r forced by minima-maxima variation in moisture content and overburden thickness is outlined and may prove instructive where there is uncertainty in these parameters. However the combined extremes represented should not be construed as preferred age estimates.

Sample: GL17148

Fig. 1 Signal Calibration

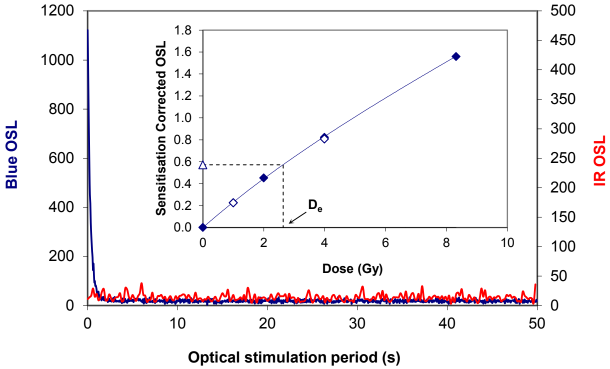


Fig. 2 Dose Recovery

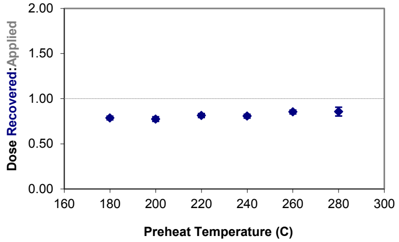


Fig. 4 Signal Analysis

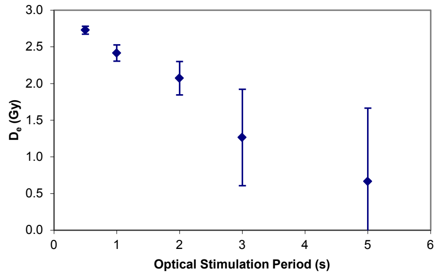


Fig. 3 Inter-aliquot D_e distribution

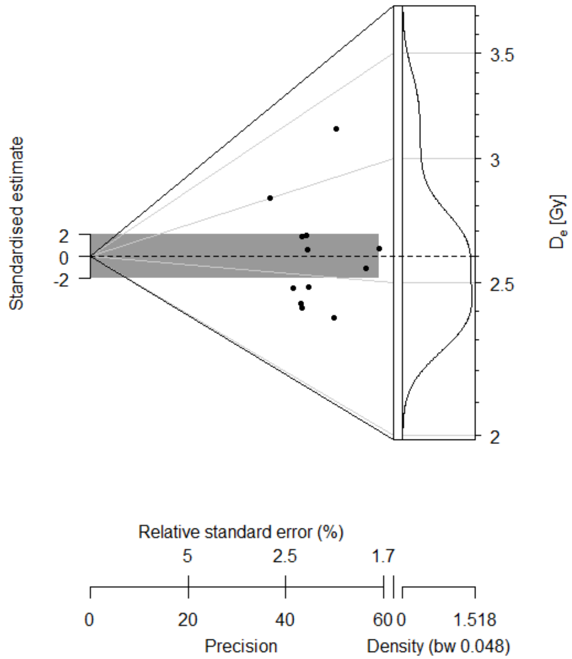


Fig. 5 U Decay Activity

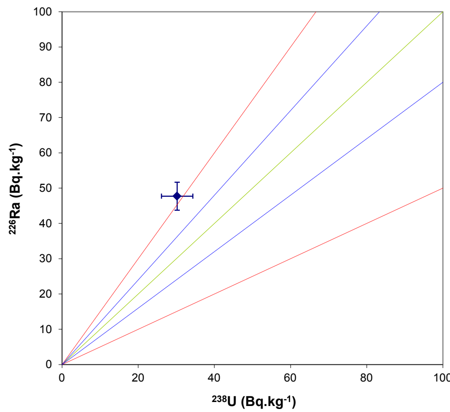
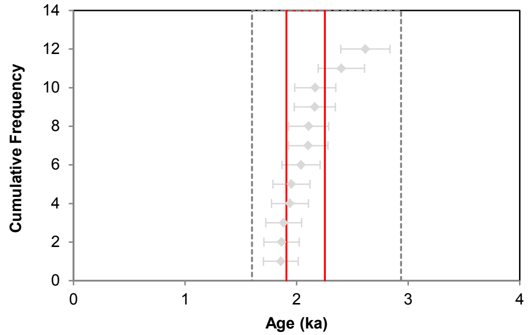


Fig. 6 Age Range



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Sample: GL17149

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