English Heritage

Silbury Hill Conservation Project
2007/8

Project Number 661

Archaeological Assessment Report

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Silbury Hill Conservation Project 2007/8, Project Number 661

Executive Summary

The enormous earthen mound of Silbury Hill is situated in the heart of the Marlborough Downs in the Avebury World Heritage Site (Fig.1).

English Heritage has been engaged in work at Silbury since May 2000 when a vertical shaft originally dug in 1776 re-opened up on the summit. After temporary stabilisation, a major investigative programme revealed further local problems associated with lateral tunnels dug at the base of the hill in 1849 and 1968.

After much public debate and scrutiny, a scheme for permanent remedial works was agreed and work was duly carried out between 2007 and 2008. This assessment report sets out the archaeological component of this project.

The 2007/8 recording work identified numerous phases of the mound, suggesting that the archaeological stratigraphic sequence is considerably more complex than previously thought; the mound growing through many small events, rather than a few grand statements, and concludes that it is no longer appropriate to use the terms Silbury 1, II or III.

Fig. 1 - Silbury Hill site location.

1 BACKGROUND

1.1 Archaeological and Historical Background

The archaeological background to Silbury has been set out in a number of recent documents and publications (Field 2002; Pollard and Reynolds 2002; Whittle 1997), the most in depth and useful of which is Field 2002. It is not the intention of this report to repeat this information, but to summarise it.

The archaeological importance of Silbury Hill was recognised by John Aubrey, who in 1663 escorted Charles II to the top. Stukeley was also aware of its importance and spent a considerable amount of time in the area in the first half of the 18th century, and his illustrations and observations are of prime importance, particularly his observation of an episode of tree planting on the summit (Field 2002). Indeed, Stukeley was the first to observe that the Roman road from Bath (*Aqua Sulis*) to Mildenhall (*Cunetio*) (now incorporated in the present day A4) changes course where it runs past the south side of Silbury and therefore he concluded that the mound must be earlier than the Roman road (Field 2002; Pollard and Reynolds 2002; Whittle 1997). Although now known to be correct, this point was later disputed (see below).

The earliest known major investigation into the mound, the sinking of a shaft from the top to the centre of the hill, was effected by Edward Drax in 1776 (Fig. 2). This shaft was recorded as being about 2.5m square and 30m deep and was excavated using miners from Mendip. Little of this event was reported, although two letters written by Drax during his time at Silbury have recently come to light and their contents, when fully transcribed, should assist our understanding of this event. John Merewether later collected two accounts of this investigation; one from a man who had visited the shaft as a young man; the other from a man who had heard his father talk of it. Both describe the miners finding a skeleton at the bottom of the shaft. Merewether dismisses these statements as wishful thinking (Field 2002; Whittle 1997). It is unknown whether this shaft was ever backfilled.

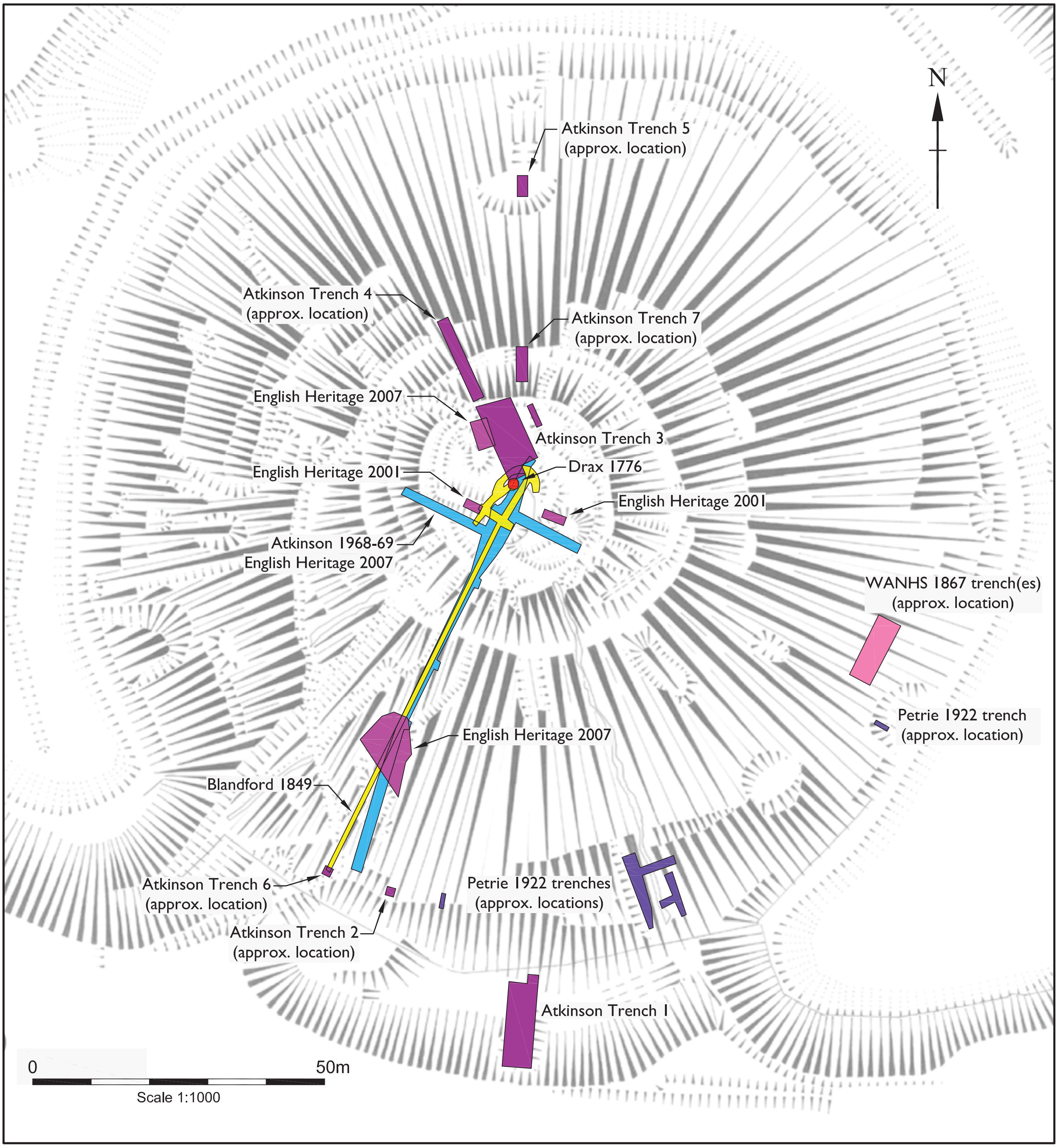


Fig. 2 - Location plan of all known trenches and tunnels on and in the mound.

This was followed in the summer of 1849 when Henry Blandford (assisted by Richard Falkner) drove a horizontal tunnel from the side to the centre of the mound (Field 2002; Whittle 1997) (Fig. 2). This work was arranged by the Central Committee of the Archaeological Institute to coincide with the meeting of the Archaeological Institute in Salisbury (Field 2002; Whittle 1997). Having reached the centre of the mound Blandford considered the work done, whereby John Merewether, Dean of Hereford, took over and explored further, but he too eventually abandoned the search, which continued even then under the Revd. John Bathurst Deane. This work was later commented on by Merewether and Charles Tucker (Merewether 1851; Tucker 1851). The tunnel, which was just under 1m wide and 2m high, was begun on the south west side of the mound next to the westernmost causeway across the ditch. It was initially dug through natural solid chalk; however it inclined upwards and after 30m broke through the Old Land Surface. Thereafter the tunnel followed the Old Land Surface, keeping it about half meter below the roof so that any grave cut could easily be seen (Field 2002; Whittle 1997). Towards the centre the tunnel they encountered a conical heap of earth, chalk rubble, sarsen boulders and black soil, with preserved mosses. Also at this point the tunnel roof was raised by another 2m in order to investigate a hollow-sounding area; however the hollow sound disappeared on investigation (Whittle 1997). Side cuttings were made after Merewether had taken over the supervision, as well as a semi-circular gallery on the western side which curved back to rejoin the Main Tunnel (Whittle 1997) (see Fig. 2). A drawing of this event was made by William Lukis, which shows the line of the tunnel on a cross-section of the mound (Edwards 2001). The tunnel was closed in September but evidently not backfilled, and Tucker recorded that where possible supports and props were withdrawn; he also reported that a wall of bricks was constructed over the entrance and the mound made good around it (Field 2002).

In response to continuing controversy over the location of the Roman Road (spurred on particularly by James Ferguson) the Wiltshire Archaeological and Natural History Society excavated two trenches on the east side of the mound in 1867 (Fig. 2), under the supervision of the Rev Wilkinson, and whose excavation team (something of an archaeological dream team) included Sir John Lubbock, Mr W. Cunnington and the Rev AC Smith (Pollard and Reynolds 2002). The Roman road was not found to continue under the mound, although one trench did locate a ledge cut into the side of the hill on which an iron clasp-knife and whetstone were recorded lying next to a hearth (Pollard and Reynolds 2002). Further cuttings in the fields to the south of Silbury (the exact locations of which are now unknown) traced the line of the Roman road, thus conclusively proving its course avoided the mound. In one of these cuttings (c.145m south east of the mound), Smith encountered a large pit which contained significant and diverse Roman remains, including three small bronze coins; an iron stylus; part of a pair of shears; potsherds from over 80 pots (including some Samian ware), oyster shells, animal bones, a fragment of human bone, and fragments of stone and tile (Field 2002; Pollard and Reynolds 2002).

In 1886, after a prolonged drought, A. C. Pass excavated 10 deep shafts within Silbury's ditch, concentrating primarily on the western side (including the elongated western section) but also to the north of the mound. The shafts were sunk to the natural solid chalk; recorded as being generally 4.6m down from the modern ditch surface, although this deepened to about 6.4m next to the mound; and were filled with alluvially deposited white clay. Struck flint, animal bones and some burnt sarsen was recovered from most of the shafts, whilst a human femur was recovered from shaft 5, c.3m down. A Roman coin in Shaft 2 next to the mound nearly 2m down suggests that the upper third of the ditch deposits had accumulated during the Roman period. Despite the long dry summer, water rose to within 2.4m of the top of the shafts (Field 2002; Whittle 1997).

In 1896 Brooke and Cunnington excavated a Roman well immediately adjacent to the A4, which contained Romano-British material, including bronze scales, coins, a blade from a pair of shears, an iron stylus and a fragment of possible column made of Bath Stone. This well was situated only 50 yards east of another well excavated by the Cunningtons 16 years earlier. Further undated wells were identified in the area; one close to the Swallowhead spring; the other to the southeast of Silbury and within its ditch (Field 2002). More recently these wells have been interpreted as ritual shafts (Corney 1997, Pollard and Reynolds 2002).

Not long after the end of World War I, Professor William Flinders Petrie, the Egyptologist, turned his attention to the mound and in 1922 excavated two small, parallel trenches on the south eastern side of the mound; opposite and slightly above the eastern causeway across the ditch. A third trench was excavated in the middle of the south face (Fig. 2). The two trenches to the east, which were excavated 12m into the mound and linked by a tunnel dug at right angles, aimed to find an entrance to a chamber or passage. Petrie was unsuccessful at finding an entrance however he did uncover a number of fragments of animal bone, antler and flint flakes (Field 2002; Whittle 1997). The area above the entrance to the Merewether tunnel collapsed in 1915 exposing the 1849 tunnel and this provided Petrie with the chance to briefly investigate the Old Land Surface. A new door was fitted to this new entrance as the tunnel was dangerous; and repairs were completed by 1923.

A pipe trench was excavated along the west facing slope of Waden Hill in 1926 and Cunnington noted the presence of significant quantities of material, including Samian ware, other pottery sherds and tiles, indicating Roman buildings (Field 2002).

In 1959 McKim attempted a resistivity survey of Silbury Hill in the hope of locating a burial chamber, however the results proved negative (McKim 1959).

A Roman burial with associated pottery (including Samian ware) was discovered next to the Winterbourne, to the east of Silbury Hill by John Evans in 1964 (Field 2002, Pollard and Reynolds 2002).

The next major intervention into the mound itself took place between 1968 and 1970, when Richard Atkinson, a professor from Cardiff University, directed the excavation of a tunnel that followed a similar line to the centre of the hill as the Merewether tunnel but with two lateral tunnels to the east and west and a central chamber. He also excavated trenches on the summit and slopes in order to investigate the terraces, as well as the southern part of the ditch (Whittle 1997) (Fig. 2). Although a series of interim reports were published, Atkinson never fully published his work and much of the archive was lost. The fragmentary archive was largely published by Alasdair Whittle in 1997, although notably not the evidence for the Roman or later periods.

Atkinson's work identified three phases of the hill (Fig. 3): Silbury I: a circular fence some 20m in diameter enclosed an open but well trampled space and was subsequently filled, at first with a low mound of clay and gravel and soil to a height of about 4.5m. This was then sealed by layers of gravel and soil taken from the valley floor forming a mound of about 36m diameter and 7m in height. This had a low, chalk and clay bank against it. Silbury II: a mound of chalk was constructed over the earlier mound that reached a base diameter of some 73m and utilised the material excavated from a surrounding quarry ditch. This phase also had another low, chalk and clay bank against it. Silbury III: the final mound you can see today, which buried the earlier ditch and was itself quarried from a surrounding ditch and its extension (Fig. 3) (Field 2002; Whittle 1997).

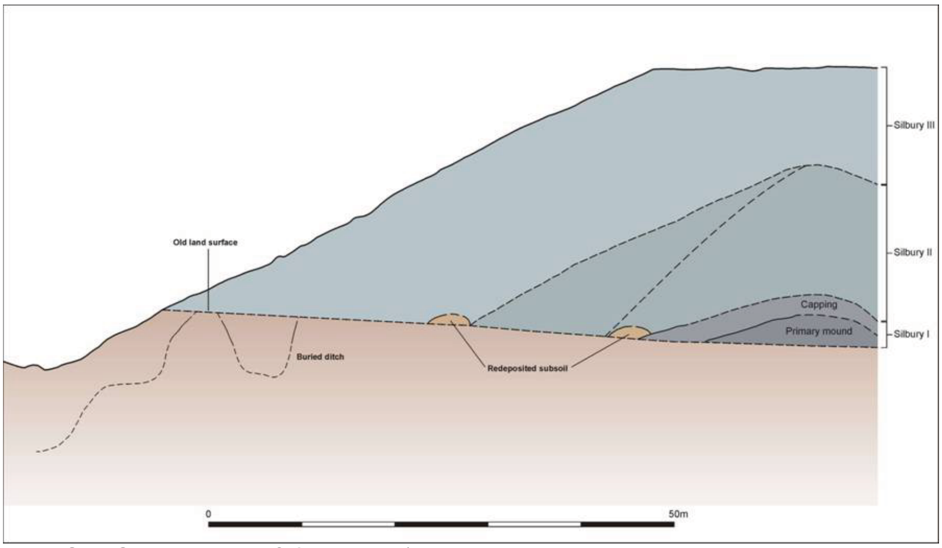


Fig 3 – Schematic of Atkinson's phases

Atkinson's excavations of the ditch also uncovered a considerable amount of Roman pottery as well as nearly 100 coins and a bronze bracelet, interpreted at the time as a midden, although discussed by subsequent authors as having a possible ritual function (Corney 1997; Corney and Walters 2001; Pollard and Reynolds 2002). The trenches on the summit and side of the mound (Fig. 2) provided evidence for late Saxon/medieval pottery. The trench on the side of the mound cut across one of the terraces, which showed that the terrace was associated with late Saxon or Norman pottery as well as a silver quarter penny attributable to Ethelred II (AD 1009-16). In addition, an early medieval stone bowl was recovered from the cutting on one of the lower ledges (Field 2002), (over the northern anomaly – see below). A possible Saxon iron spear was also recovered, although this may be of Roman date or earlier (Field 2002).

The sewer pipe originally inserted in 1926 along the slope of Waden Hill was renewed in 1993. In advance of this work an excavation took place which confirmed Cunnington's earlier observations and indicated the presence of at least 14 rectilinear buildings of later 3rd and 4th century date set either side of a trackway (Field 2002, Pollard and Reynolds 2002, Powell *et al* 1996).

Recently an earthwork survey of the mound was undertaken by English Heritage in 2002 (Field 2002, and see below). Other recent recording work on the hill, including the excavation of two small trenches on the summit, took place at various times between 2000 and 2004. These have been reported on separately (McAvoy 2004, 2005, and see below), however the excavation results have, as far as possible, been integrated with the work reported on here. In 2007 a geophysical survey of the fields immediately south of the monument revealed evidence that the Roman settlement recorded along Waden Hill extended considerably further south and possibly focussed around the Swallowhead Spring (Linford forthcoming).

1.2 Project Background

The archaeological element of the Silbury Hill Conservation Project was managed by Fachtna McAvoy between 2000 and 13th September 2007. From the 15th of June 2007 the archaeological work was directed by Jim Leary. Sarah May was the Project Manager between September 2007 and November 2008, and Brian Kerr was the Project Executive during this period. After November 2008 Jim Leary took over Project Management and Sarah May became the Project Executive. The Silbury Hill Conservation Project was under the overall project management of Rob Harding during the whole period and Amanda Chadburn was the Inspector for Ancient Monuments. The summary set out below has largely been taken from McAvoy 2004.

The hole that opened on the summit in 2000 was approximately 13m deep and 2.25m wide and the immediate on-site response was to construct a protective scaffold and steel capping and then to carry out a remote inspection using a suspended video camera. A desk-based assessment of the potential for archaeological recording and investigation was prepared (McAvoy 2000a) and a programme of investigation initiated to determine the cause of the collapse of the infill and how, and what, remedial work could or should be carried out. This programme involved studies of documentary sources, cartography and aerial photography. EH staff from the Regional team, CfA (now Fort Cumberland, and hereafter referred to as Fort Cumberland) and Conservation Engineering and a team from G. Daws Associates made a physical inspection within the open shaft in August 2000. An outline dimensional drawn record was made, and further photographic images were obtained. Whilst the options were being considered there was a major collapse during December 2000.

The nature of the investigation and stabilisation programme was reconsidered. Direct access into the crater was not possible on Health and Safety grounds but staff from Fort Cumberland made a remote record of the shaft location and of the deposits exposed in the sides of the crater. A Watching Brief was also carried out during the erection of a new fence around the crater. A geophysical survey was carried out on the summit using earth resistance and ground penetrating radar in February 2001 (Linford and Martin 2001) and electrical imaging on the summit and on parts of the adjacent slopes in June 2001 (Linford 2001). In between these two surveys (between 14th and 18th May 2001) staff from Fort Cumberland also carried out two small-scale excavations adjacent to the crater (Trenches A and B, measuring 3m x 1.5m and 4m x 1.5m respectively). These trenches were reported on separately (McAvoy 2004 and 2005) and where possible integrated within this report.

The surface of the Hill was mapped by Archaeological Survey and Investigation as part of their analytical earthwork survey of Silbury and its immediate landscape (Field

2002). This work brought together a great deal of research on the history of Silbury and its archaeological significance (and summarised above). For comparative purposes vertical photography of the mound taken in 1968 was re-processed by Metric Survey (EH), whilst Fort Cumberland staff located and recorded the position of the entrance to the 1968 tunnel.

It was felt that a seismic survey was the only practical technique that offered the potential to provide information on the internal condition of the Hill and a brief was prepared (English Heritage 2001b) for external contractors to tender against. In advance of the survey, which would take some time to initiate and deliver results, measures were taken to stabilise the crater and prevent the erosion of its sides. Cementation Skanska, who were also commissioned to carry out the seismic survey, undertook this work. The sides of the crater were lined with a mesh anchored to the surface of the Hill, and the crater was filled with large polystyrene blocks, above a geo-membrane and below a capping layer of chalk. This provided a lightweight, robust and tamper-proof support. Physical access to the deposits in the sides of the crater became possible during this process and these were recorded by staff from Fort Cumberland.

After stabilisation, preparation for the seismic survey commenced in August 2001. Skanska's method for executing the survey was to drill four boreholes from the plateau at the top of the Hill. Cross-borehole data was then collected utilising an airgun source and in-hole hydrophones. In-borehole to surface source data was collected utilising an airgun source and a network of geophones on the surface of the Hill. One of the boreholes (no.4) encountered a void where it intercepted the western lateral tunnel dug in 1968, and was replaced by borehole no.5. The void was inspected using a down-borehole CCTV camera and the images obtained were recorded onto videotape. The initial seismic survey results were reported in November 2001 (Kirkbride 2001) and independently assessed (Worthington 2002a). Further seismic survey of a geophysical anomaly on the north side of the Hill (the northern anomaly) took place in February 2002 (Kirkbride 2002a) and the cross-borehole seismic survey was repeated in April 2002. The final report of the seismic investigations was prepared in August 2002 (Kirkbride 2002b) and independently assessed (Worthington 2002b).

The northern anomaly was examined through four cores (nos.8-11) taken by Fort Cumberland in August 2002 (McAvoy 2002). A brief was prepared for further geotechnical investigation (English Heritage 2002) and Cementation Skanska drilled two boreholes on the summit in March 2003. Borehole no.7 was drilled through the centreline of the 1776 shaft with an adjacent borehole (no.6) to provide comparative information on the composition of the mound and to test a geophysical anomaly. Borehole no.7 encountered a void in the 1968 tunnel at the base of the shaft that was inspected using a down-borehole CCTV camera with the images obtained recorded onto videotape. The results of this geotechnical investigation were reported upon in April 2003 (Kirkbride 2003) and independently assessed (Chandler 2003).

Material drilled for borehole nos.1-7 was recovered as intact cores that have been recorded by, and are housed with Fort Cumberland. One core, no.5, was fully processed to recover environmental evidence. Another core, no. 6, was partially examined to further the study of the burial environment within the Hill. This study was reported upon in July 2004 in a paper that also considered biological preservation issues in relation to options for remedial works (Canti *et al* 2004).

The entrance to the 1968 tunnel was partially re-exposed in November 2004. An inspection of the backfilling showed that this had been competently carried out for at least 4m inwards from the entrance. Permanent remedial works were agreed and work was duly carried out between 2007 and 2008, and reported on here.

1.3 Geology and Topography

Lying on the valley floor of the River Kennet, Silbury Hill sits on the toe of a spur of Cretaceous Middle Chalk protruding from the southern slope of a broad valley containing the river Kennet (Fig. 4). Within the footprint of the monument the chalk is overlain with a mantle of derived clay with flints (Fig. 5). Although clay with flints is a widespread deposit on the UK chalklands (Quesnel *et al* 2003), it usually caps interfluves, and is rarely found to any depth in valleys. It is presumed, therefore, that the clay with flints covering of the Silbury chalk spur has been eroded northwards from the Downs at some time in the distant past, but there is no longer any surface expression of the deposit in the immediate environs of the hill. The original (pre-construction) deposit must have been restricted chiefly to the area under the hill, extending perhaps a few tens of metres eastwards before thinning out into valley gravel (see Canti *et al.* 2004, Figure 7); and an unknown distance westwards where the whole land surface has been quarried away.

To the south of Silbury Hill is the Swallowhead spring, and this, together with the north flowing drainage pattern on the dip slope, has influenced the dramatic change of course, eastwards of the River Kennet. The activity of the various fluvial elements at this confluence has eroded a natural amphitheatre into the landscape.

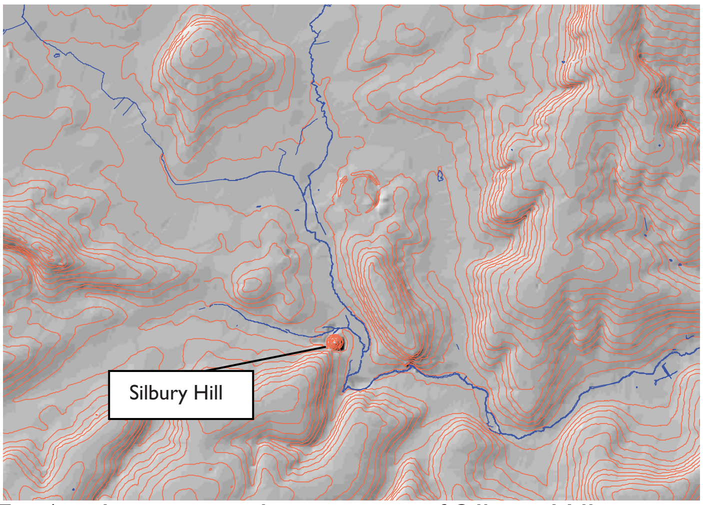


Fig 4 – the topographic position of Silbury Hill

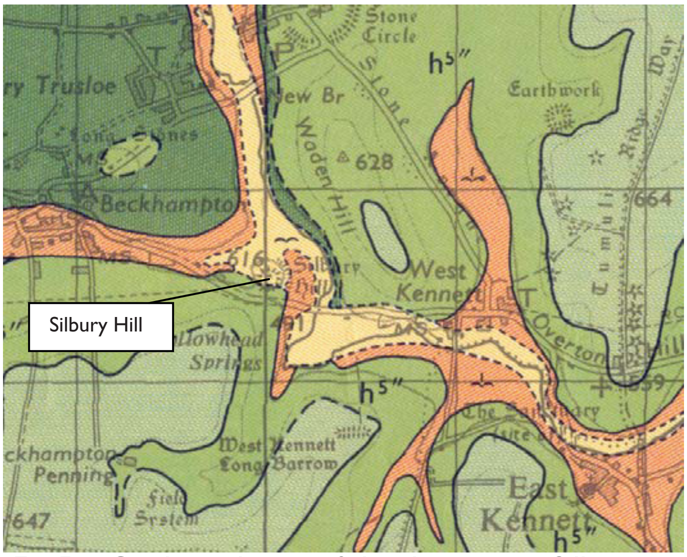


Fig 5 – Geological map of the deposits at Silbury.
Green is chalk; orange is valley gravel; yellow is alluvium
(from BGS 1974)

1.4 Designation and Permissions

Silbury Hill is a Scheduled Monument (NM 21707) given statutory protection under the Ancient Monument and Archaeological Areas Act 1979. In addition Silbury is a key component of the Stonehenge, Avebury and Associated Sites World Heritage Site. The Hill is owned by Lord Avebury and is in the guardianship of the Secretary of State for the Department of Culture, Media and Sport (Deed of Guardianship dated 1883 – WRO 3293/1) who has devolved this role to English Heritage. English Heritage has, in turn, devolved the management of the monument (along with others in the World Heritage Site) to the National Trust. Since the collapse on the summit English Heritage has resumed this responsibility for Silbury Hill.

Scheduled Monument Consent is required for works within the scheduled area of Silbury Hill. Consent was issued on behalf of the Secretary of State at the Department of Culture, Media and Sport by the Inspector of Ancient Monuments for Wiltshire under Class 6 of the Ancient Monuments and Archaeological Areas Act 1979. This was applied for and duly given prior to commencement of work.

A license was required to use a metal-detector under Section 42 of Ancient Monuments and Archaeological Areas Act 1979. This was issued by the Inspector of Ancient Monuments on behalf of the Secretary of State.

Silbury Hill is also a Site of Special Scientific Interest (SSSI) (reference su100685) for its rare and fragile chalk grassland and given statutory protection under Section 28 of the Wildlife and Countryside Act 1981. Assent from Natural England was required, and duly given, for the works within the SSSI under S28H of the Wildlife and Countryside Act 1981.

2 METHODOLOGY

All of the method statements for this stage of the project (listed below) have been circulated separately prior to the project and it is not the intention to repeat these here. In summary:

The tunnel works involved recording the deposits and stratigraphy in the tunnel sides and recovering artefacts and ecofacts from the tunnel fill, as well as recovering samples for environmental and scientific dating studies. The work also involved investigating and excavating part of the buried ditch beneath the outer part of the mound.

The summit works involved monitoring and recording the emptying of the crater, as well as excavating a 5m x 3m trench alongside the 1969 excavation trench overlapping it by 1m.

Recording on the hill slope involved scanning material during the removal of turf and topsoil and recording any stratigraphy and features revealed.

The general method statements are:
MS06.14.09 Archaeological evidence, general procedures
MS06.15.01 Archaeological evidence, specific procedures for recording in the tunnel (also including Appendix MS06.15.01)

Tunnel excavation:
The relevant method statements for the tunnel works can be found in:
MS06.04.06 Tunnel Works (also including Appendix MS06.04.06)
MS06.05.03 Tunnel, Buried Quarry Works (also including Appendix MS06.05.03)
MS06.06.07 Tunnel, Intensive Sampling Programme
MS06.07.03 Tunnel, Instrumentation for Post-Refill Works

Summit excavation:
The relevant method statements for the summit works can be found in:
MS06.08.05 Hilltop Works
MS06.09.05 Hilltop, Borehole Treatment
MS06.10.03 Hilltop, Installing the Winch
MS06.11.03 Hilltop, Transporting the Mini-digger
MS06.12.04 Hilltop, Installing the Monorail

Hillside work:
The relevant method statements for the hillside works can be found in:
MS06.13.05 Hillside Works

3 RESOURCES

3.1 Site work

The work undertaken between 2000 and 2004 has been set out in detail above in 1.2 Project Background. The archaeological work within the tunnel consisted of a continuous twenty-seven week period, between 10th May and 16th November 2007. During this period the trench on the summit was also excavated and recorded. Further recording work was undertaken on the hillside as well as on the collapsed area of the summit at various times, including a continuous two week period, between 10th January and 6th May 2008.

3.2 Post-excavation work

The completion of the site archive – digitising of tunnel sections and summit drawings, completion of the Harris matrix, cleaning of drawings, sorting of finds, processing and sorting of samples have now been completed.

A summary report of the initial findings of the excavation was compiled (Leary 2008) and, along with the matrix and index, was made available to the Project Team members on the 9th July 2008. An environmental Archive report was also produced (Campbell 2008). A summary of the results of the sampling programme can be found in Appendix 2 at the end of this document.

4 EXCAVATION RESULTS

The following section summarises the results of the archaeological investigations. The numbers referred to in the text are the unique context numbers that were assigned on site to each of the archaeological features and deposits encountered, and shown within squared parenthesis, eg [3021]. Sample numbers are shown thus: <9000>, whilst small find numbers have the prefix: SF. A Context Index of all the contexts used is produced at the end of this report (Appendix 1). Due to its size, the Harris matrix has not been included with this report; however a digital copy has been deposited with the archive and is available from Fort Cumberland. Unless otherwise stated, no context was fully excavated.

Section drawings of each of the recorded phases are included in the report, as well as plans from the summit work, and these show the location of the recorded archaeological deposits and features.

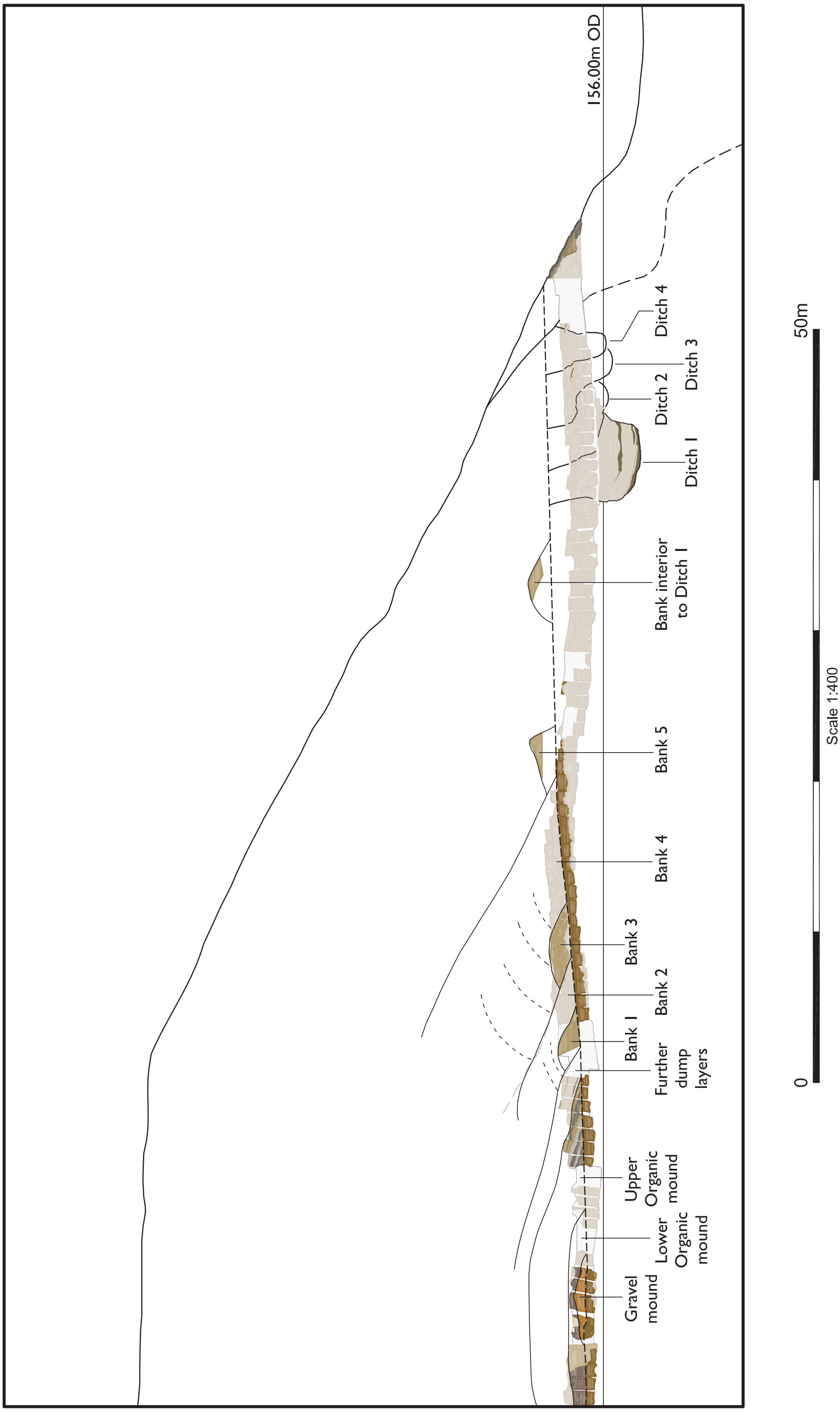


Fig. 6 - Section through the prehistoric phases recorded within the tunnel.

4.1 Phase 1: Natural bedrock and drift geology

The underlying bedrock to the site is compact, white Cretaceous Middle Chalk, recorded as contexts [3014] and [4012] (Plate 1). The top of the chalk bedrock was seen between Bays 30 and 75; prior to this the top of the chalk existed above the tunnel; and beyond this it was concealed by the floor. The top of the chalk was recorded at a maximum height of 158.7m OD in Bay 30, dropping to a level of 156.6m OD in Bay 75.

This was overlain with a layer of dark yellowish brown calcareous silty clay with frequent small chalk and flint pieces, moderate medium chalk and flint pieces and occasional charcoal (context [3019] and [4094]), which varied in height from 0.1m in Bay 55 to 0.8m thick in Bay 37; generally it was 0.5m thick (Plate 1). This deposit is interpreted as colluvium, presumably derived from clay-with-flints deposits to the south, which were eroded downwards from the Downs to its present location sometime in the late glacial or early post-glacial period. This layer was recorded sloping down to the north, from 159.1m OD in Bay 36, to 157m OD right at the back of the Main Tunnel in the end face. An interface layer existed between the chalk and the derived clay-with-flints, recorded as [3062], [3063], [3072], [3082], [4013] and [4152]. This ranged from a light creamy brown degraded chalk in the lowest portion directly above the bedrock to a mixed gravel and clay band in the upper portion where it merged in with the overlying colluvium. Numerous, small V-shaped features penetrated the chalk and were filled with colluvium and interpreted as periglacial activity (Plate 1).

Localised variations were recorded within the clay layer. At Bay 69 on the western section a patch of grey clay, with considerably less flint inclusions than the surrounding deposit, measured 1m wide and 0.3m deep, and was recorded as [3047]. At Bay 76 and 77 two more such features were recorded, only this time with considerably more flint than the surrounding deposit ([4160]/[4161] and [4164]/[4165]). These variations were initially interpreted as cut features, however re-interpreted as some form of post-glacial disturbance.

Overlying the derived clay-with-flints was a 0.04m thick band of dark, yellowish brown very flinty clay; recorded as [3020] and [4096], this was iron-panned in places, and was probably formed by stones having been moved down from the overlying Old Land Surface (see Section 6).

Plate 1 – The geology and the Old Land Surface (taken from Topcon image)

4.2 Phase 2: Old Land Surface

Overlying the above sequence was a thin, unbroken band of grey, stone-free silty clay, (context [3021] and [4041]) varying from 0.03m to 0.1m in thickness. Described by Atkinson as the Old Land Surface (OLS) (Whittle 1997), this deposit appears to extend under every phase of the monument (Plates 1 and 2). It was recorded at a height of 159.2m OD in Bay 34, sloping steeply down to the north to 157.48m OD in Bay 59, before levelling slightly, although still declining northwards, to be recorded in the end face at a height of 157.1m OD (Fig. 6). It had a sharp interface with the underlying geological deposits, which sometimes included a marked gravelly band (see Phase 1 above), but sometimes showed an irregular upper surface (see Section 6). This layer clearly does not represent a full soil horizon, which must have, at some stage prior to construction, been removed, possibly by erosion or perhaps as a deliberate act of ground preparation (see Section 6). Particle size analysis shows that the OLS has been derived from the underlying clay and flints colluvium, the stones of which have been removed by some process, possibly trample (see Section 6).

This deposit was relatively devoid of environmental remains and contained only a very small proportion of organic material. Amongst the few remains recovered were monocot stems/leaves as well as occasional buttercup and grass seeds and fragmentary elder seeds (see Section 5). The occasional charred hazel nutshell fragment was recovered as well, as were fragments of moss (see Section 5). Insect remains were poorly preserved in this layer (see Section 7). Micromorphology of samples taken from the OLS show layers, lenses and flecks of mineralised plant remains (see Section 6). Sixteen pieces of flint micro-debitage were recovered from context [4041] (see Section 15).

A concentration of charcoal as well as charred hazel nutshell fragments and other charred plant remains (see Section 5) as well as two pig or wild boar teeth (SF 8041 and SF 8043) (see Section 12) were recorded within a small, defined area of the upper part of the Old Land Surface (context [4041]) on the north side of the East Lateral in Bay 7, and may well indicate the remains of human activity, such as a hearth.

In the central area of the tunnel (from Bay 59 to the end face of the Main Tunnel, as well as in the East Lateral up to Bay 9 and the West Lateral up to Bay 7) the OLS has a pronounced dark brown layer between 0.01m and 0.02m thick on top of it: [3035] and [4100], which under magnification resembles plant remains (see Section 6), possibly representing imported material.

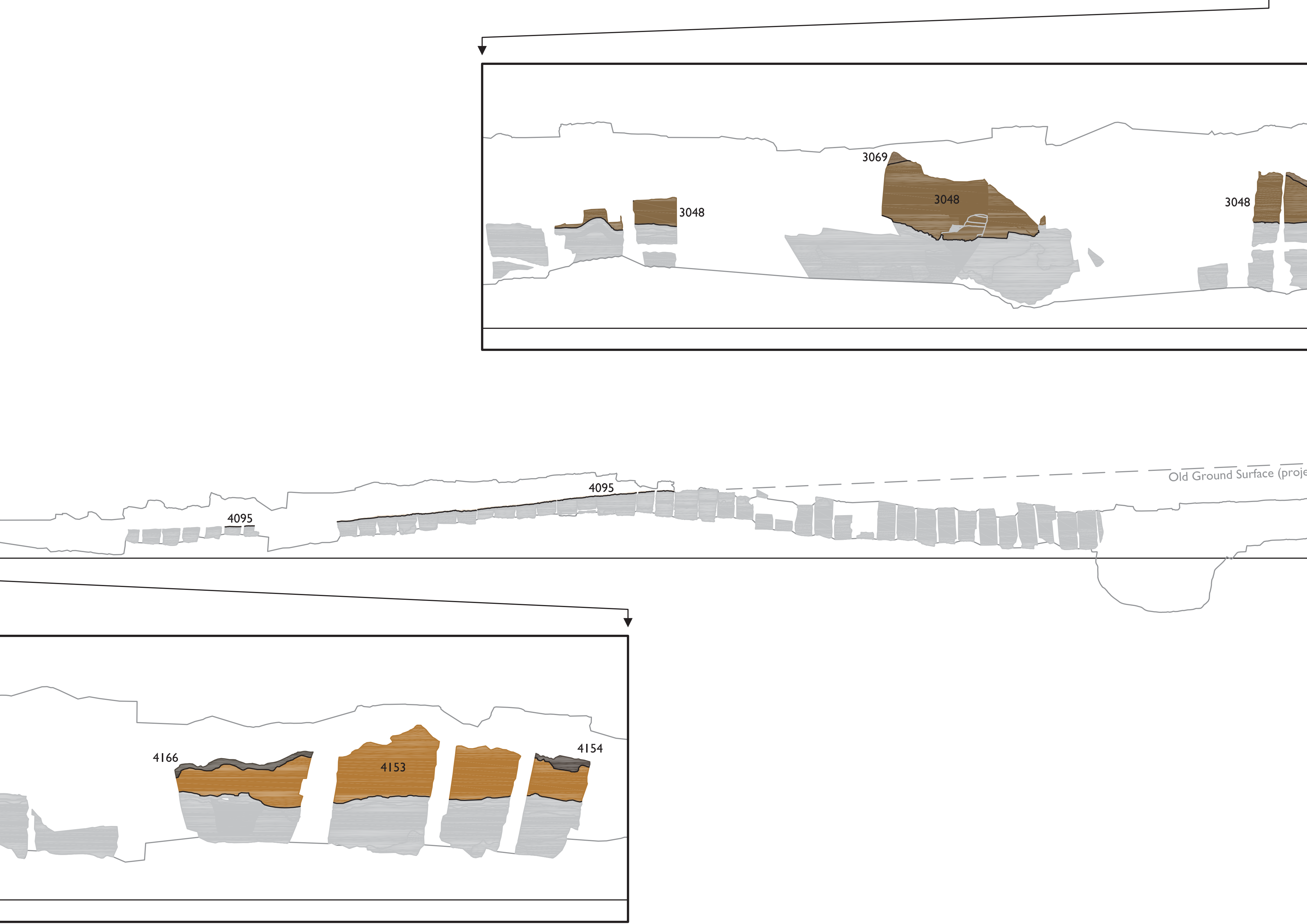
Plate 2 – The Old Land Surface with the overlying northern tip of the Gravel Mound and subsequent Lower Organic Mound (taken from Topcon image)

4.3 Phase 3: Gravel Mound

The first clear evidence for construction activity recorded at the site was a low mound formed of dark, yellowish brown and orange flint gravel mixed with silty loam (contexts [3048] and [4153]), recorded between Bays 71 and 80 overlying the Old Land Surface (Plate 2 and Fig. 7). At the highest point, the mound was 0.8m high (a level of 158m OD) in Bay 75 with an estimated diameter of 10m. Seventeen pieces of flint micro-debitage were recovered from context [4153] (see Section 15). A few elder seeds were recovered from sample <9819> from context [4153] (see Section 5), as were a number of mollusc shells, suggesting an open grassland type environment (see Section 8). Poor preservation meant that only a few insects were preserved in Gravel Mound (see Section 7).

A thin (0.1m thick), dark brown silty loam band (contexts [3068], [3069], [4154] and [4166]) was recorded overlying this mound on the northern and southern sides, however not the top (Fig. 7). Micromorphological assessment of this layer (sample <9249>, context [4166]) suggests that it is not a soil horizon but a mix of topsoil and subsoil representing dumped material (see Section 6), perhaps to maintain the integrity (strengthen the sides) of the loose Gravel Mound (see Section 5). Eight pieces of flint micro-debitage were recovered from context [3069]; whilst 14 pieces of micro-debitage, a flake fragment, one piece of burnt flint and a systematic blade came from [4166] (see Section 15). Environmental sample <9820> from context [4166] recovered plant remains typical of disturbed ground and of soil seed banks, as well as some moss and a few monocot stems/leaves, whilst another sample (<9814>) from context [3069] contained some charcoal and charred hazel nutshell fragments. An earthworm egg was also noted from this sample (see Section 5). This environmental sample also contained mollusc shells indicative of an open grassland type conditions, and the presence of a few very fresh shells suggests that this layer may have been subject to rapid burial (see Section 8). Preservation was considerably better in these contexts compared to the Gravel Mound, and there was a higher concentration of insect remains, with a range of Coleoptera (see Section 7).

A further layer was recorded within this phase, although it could just as easily relate to Phase 2. This comprised a layer of mixed light grey and orangey brown chalk and clay [3013], [3087] and [4095], which overlay the OLS from Bay 36 (where the OLS is first apparent) until Bay 60, where it peters out (Fig. 7). In Bay 59 it overlay organic layer [4100]. This context may represent a trample layer formed whilst the Gravel Mound was constructed. Alternatively it may represent a layer of iron panning. A layer of organic material (layer [3089]) was recorded overlying this in the West Lateral. One piece of flint micro-debitage was recovered from context [3013] (see Section 15).



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Old Ground Surface (proje
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4166
4153
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4.4 Phase 4: Lower Organic Mound

Subsequently, a series of organic layers overlay the above sequence (Plate 2), recorded in Bays 65 to the end face, and represented by contexts [3075] and [3076] in the West Lateral; [3045], [3046], [3054], [3055], [3056], [3057] and [3058] on the west side of the Main Tunnel; [4182] and [4184] in the East Lateral; and [4155], [4156] and [4101], on the east side of the Main Tunnel (Figs. 8, 9 and 10) (context [4101] was not recorded in the section due to a collapse). Together these layers formed a coherent mound, enlarging the height of the earlier Gravel Mound to at least 1.1m high; a level of 158.3m OD, (although the full height was not seen as it extended above the tunnel) and the diameter to an estimated 22m, (although again the full size was not seen as it extended beyond the tunnel to the north).

This mound comprised thick homogenous layers of dark reddish brown silty loam with a high organic content, made up of a mix of topsoil, subsoil and turf, derived primarily from a clay with flints geology (although topsoil and turf derived from soil developed on chalk was also present – see Section 5). In some places thin bands of gravel and chalk were also recorded; and together with the organic layers they probably represent basket loads of material brought in and dumped over the Phase 3 Gravel Mound. A trimming flake and a piece of flint micro-debitage were recovered from context [3075]; nine pieces of micro-debitage were recovered from context [3046]; a core fragment was recovered from [4182]; and 13 pieces of micro-debitage and a decortication flake were recovered from [4156] (see Section 15). A single fragment of possibly cattle incisor tooth enamel was also recovered from this context, as was a large portion of a cattle radius (see Section 12). Environmental sample <9200> from [4156] recovered a mixture of grassland plants with traces of taxa which might be indicative of damp ground, whilst sample <9824> from context [3046] provided evidence for green 'plant' material along with a mixture of grassland plants. Samples <9236> and <9237> produced charred hazel nutshell fragments and charcoal (see Section 5).

A stakehole was recorded cutting the western edge of these deposits on the northern section in the West Lateral (Bay 3); this was recorded as [3090] and measured 0.07m in diameter and 0.43m in depth (Fig. 9 and Plate 3) and was fully excavated. The lower fill of this stakehole comprised organic material ([3091]), possibly representing the decayed remains of the stake, whilst the upper fill ([3096]) comprised slumped material from the overlying phase. This stake may be part of a sequence of stakes from this phase, possibly demarcating the edge of the Lower Organic Mound, another of which was recorded by Atkinson in the west section of the Main Tunnel at Bay 65 (Whittle's context {196}). A further cut was also recorded on the southern side of the West Lateral, opposite stake hole [3090]. This cut (context [3092]) was very small at only 0.18m wide and 0.19m deep (Fig. 9). It was filled with a small chalk block [3093], the upper face of which would have been visible on the side of the Lower Organic Mound and it may represent a small edge marker, although equally it is possible that the chalk had simply been inadvertently pushed into the underlying soft deposits.

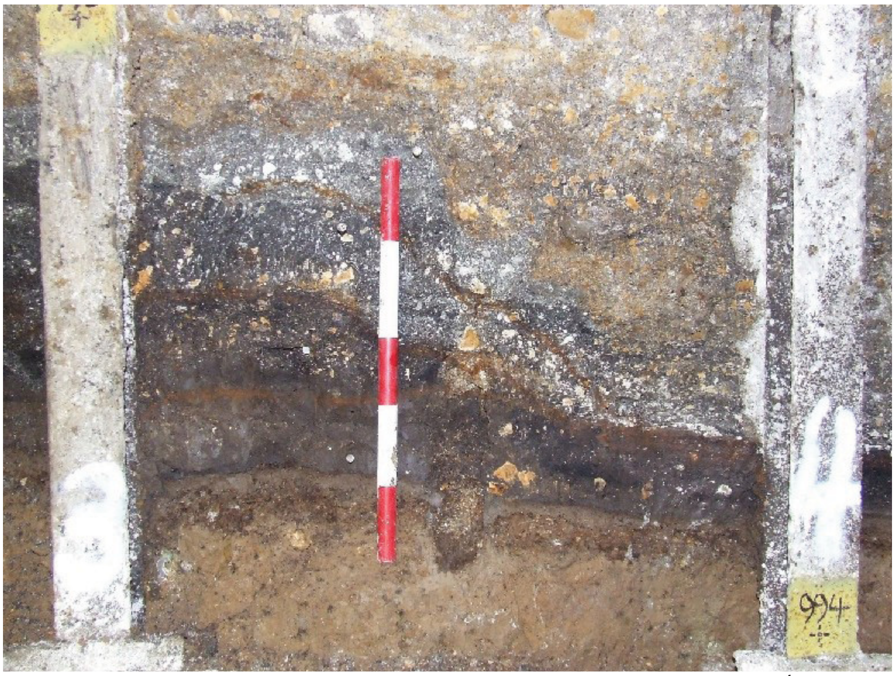


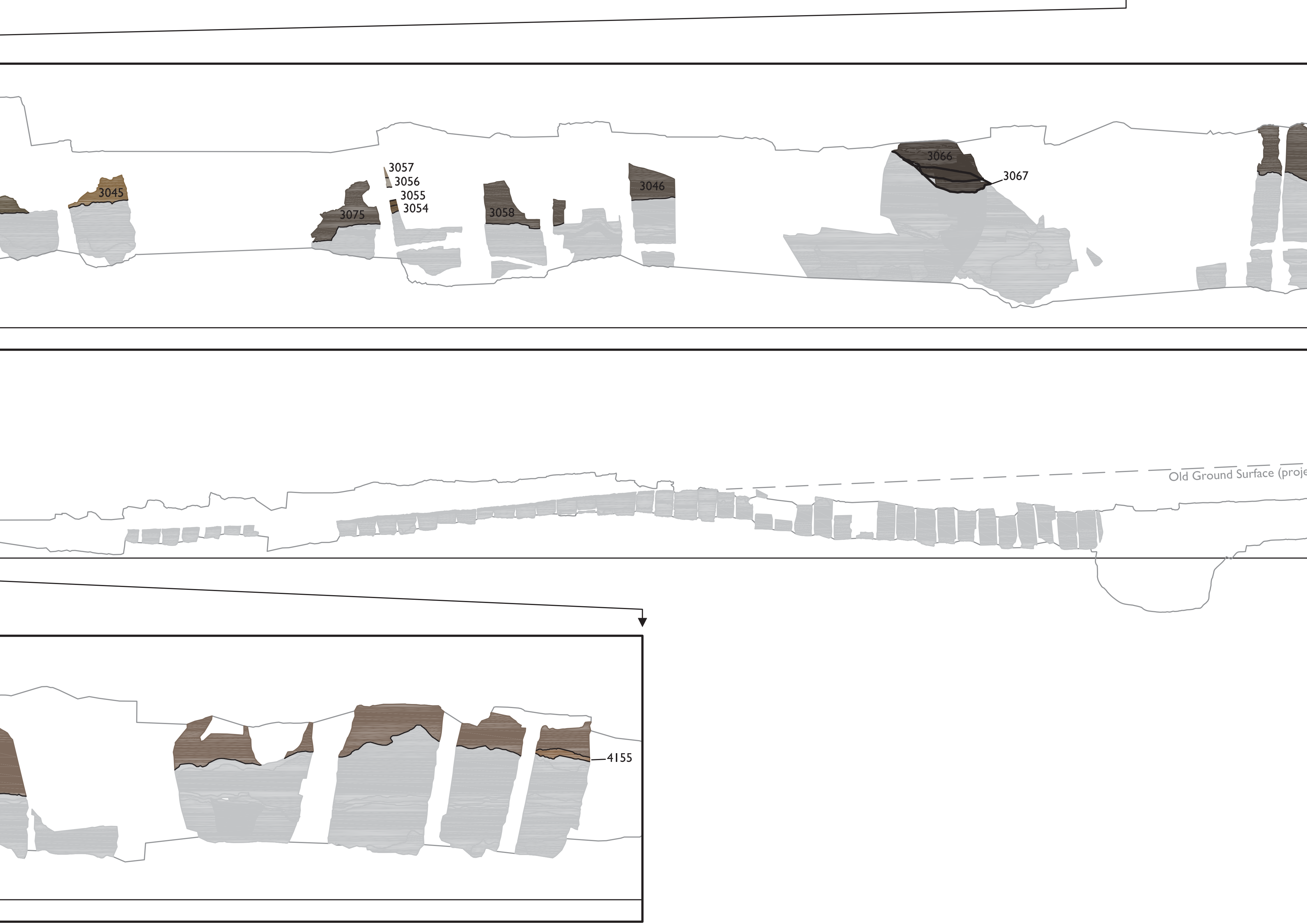
Plate 3: Stakehole recorded on the north side of the West Lateral (*photo number 661-6634-06)*

Two small and discrete deposits form what have been interpreted as separate miniature mounds. These have been placed in this phase; however they could conceivably be earlier or slightly later, (although they underlie the Phase 6 Upper Organic Mound). Context [3095] was recorded on the west side of the Main Tunnel and measured 0.95m wide and 0.2m high (157.5m OD) (Fig. 8), whilst context [4181] was recorded in both the end face of the East Lateral and the southern section (Plate 4 and Fig. 10). Mini-mound [4181] was formed of an organic-rich greyish brown to very dark greyish brown silty loam intermixed with turf layers and measured 0.8m wide as seen, although it extended beyond the tunnel to the east and south, and 0.3m high (157.62m OD on the top), and was partially excavated. The mini-mound contained 17 pieces of flint micro-debitage and a decortication flake within it (see Section 15). Environmental sample <9808> was taken from this context and recovered a tough rachis fragment from a free-threshing wheat and other cereal chaff/straw, which represents one of the earliest occurrences of waterlogged cereal chaff remains in Britain (see Section 5). This sample also produced plant remains typical of grassland; however it also contained substantial numbers of remains more associated with woodland or scrub, including yew berries, sloe stones, uncharred hazel nutshell fragments and bramble seeds (see Section 5). Insects were well-preserved in the Mini-mound, with a high concentration compared to other contexts. Species included Coleoptera, a water beetle and a range of ground beetles, including a snail-eating beetle and dung beetles (see Section 7).

This mini-mound appears to have had further material piled against it (contexts [4185] and [4179]), which was subsequently cut through by a linear feature [4171] on the western side (seen in Bays 12 and 13 on the south face of the East Lateral) (Plate 5). It was not recorded in the end face or the northern section, and therefore is likely to be a discontinuous linear feature, and is interpreted here as a small, interrupted gully perhaps enclosing the mini-mound. This feature was partially excavated. Linear [4171] was filled with [4170], [4173] and [4178]. Context [4173] had 8 pieces of flint micro-debitage within it (see Section 15). Environmental samples <9811> and <9812> from the primary fill [4170] contained charred onion couch tubers, as well as moss and buttercup (see Section 5). Both the primary and secondary fills contained a few shade-requiring species of snail shells, although these were worn and may have derived from older material. The paucity of shell in the secondary fill indicates it was a rapid and therefore perhaps deliberate infill (see Section 8). Beetles are well-preserved in these fills, with a similar range to the Mini-mound as well as a wood-boring beetle (see Section 7).

Plate 4: Mini-mound recorded in the end face and south section of the East Lateral (photo number 661-6702-04)

Plate 5: Close-up of the linear feature west of the mini-mound in the East Lateral (photo number 661-6635-07)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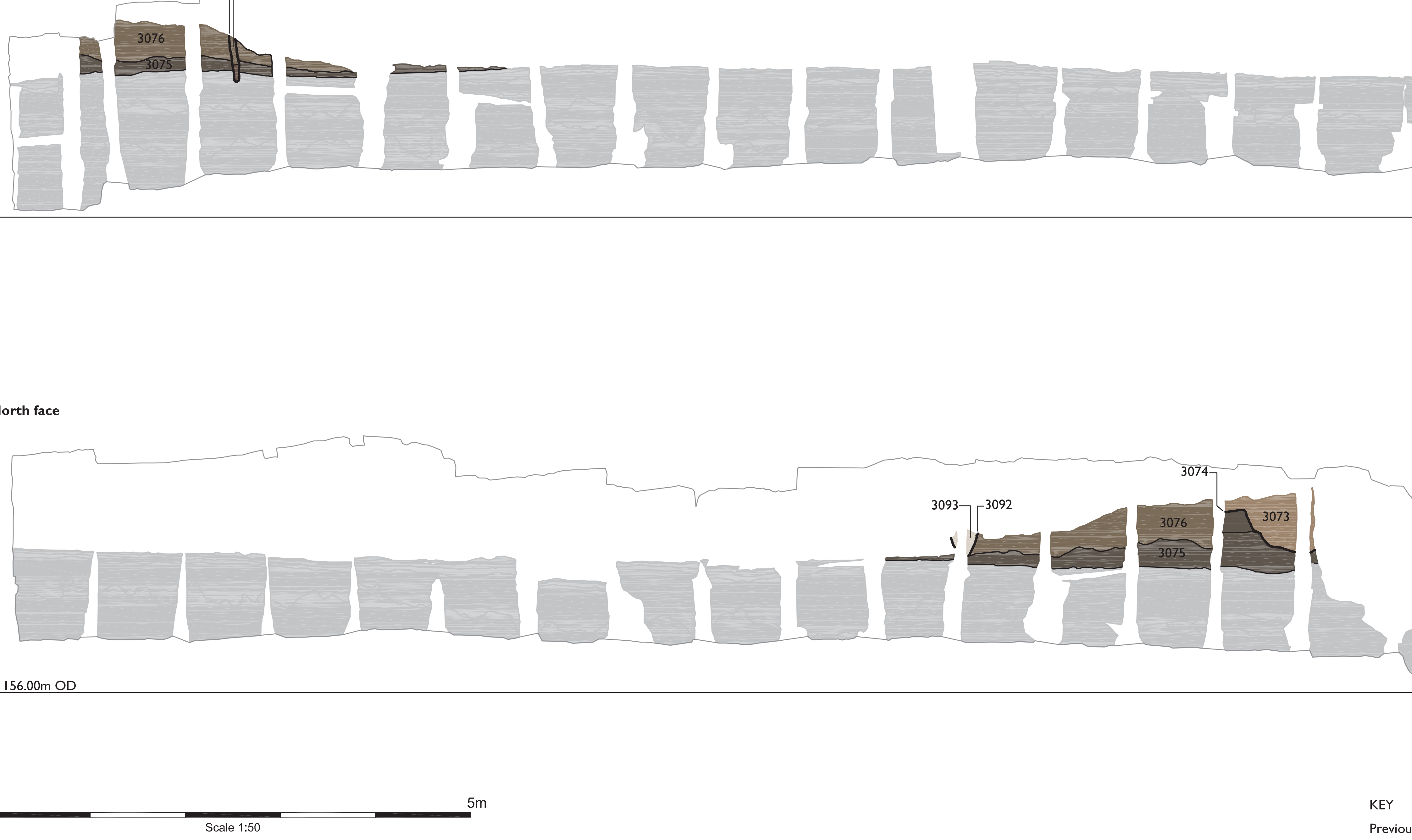
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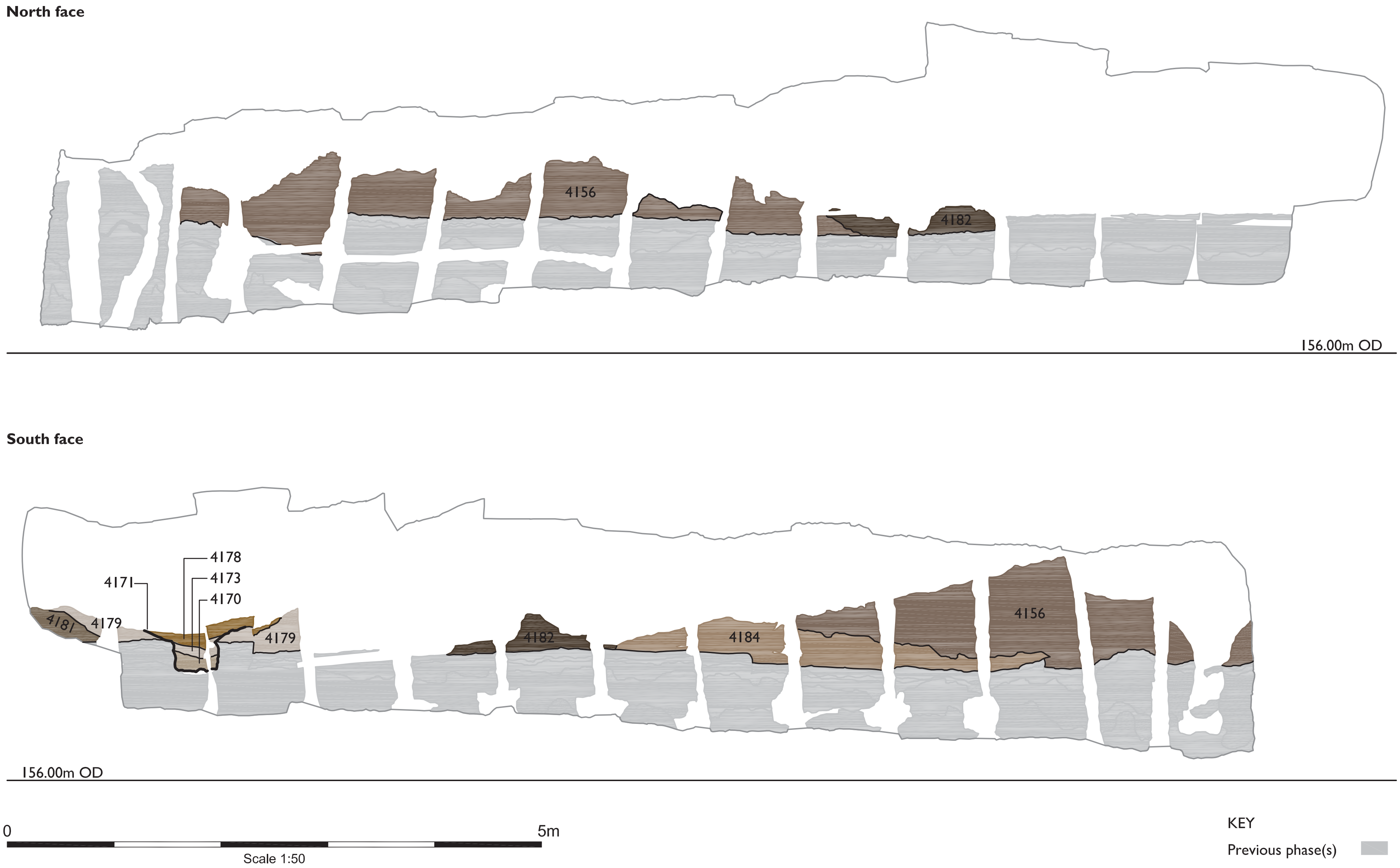


Fig. 10 - Phase 4: Section through the Lower Organic Mound and mini mound in the east lateral tunnel.

4.5 Phase 5: Pitting activity

Two pits were recorded in the tunnel and were both excavated. Pit [3067] was recorded on the western section of the Main Tunnel in Bays 75 and 76 (Plate 6 and Fig. 8) and cut the Gravel Mound. It measured 1m in diameter and 0.6m deep (the level of the bottom of the pit was 157.52m OD), however the full width was not seen as it was truncated to the north by Merewether's tunnel [3065] (see Phase 20), nor was the full depth, as collapsed material concealed the top of the cut, which is interpreted as cutting through the Lower Organic Mound. The pit contained two fills; the primary fill [3070] was a thin, mixed deposit of light yellowish brown chalk and silty loam, containing eleven pieces of flint micro-debitage (see Section 15), whilst the secondary fill [3066] was mid grey to black silty loam and may well be redeposited material from the Lower Organic Mound. Recovered from this fill were eleven pieces of flint micro-debitage, a naturally backed flake with retouch, a trimming flake, a blade and three other useable flakes, as well as a piece of burnt flint (see Section 15), as well as a fragment of large mammal flat bone (SF 8038) (see Section 12). Sample <9817> was taken from this secondary fill ([3066]) and assessed for molluscs, which showed that quantities were high, and contained types associated with both woodland clearance and a grassland environments, although the former were very worn suggesting that they are likely to residual (see Section 8). Assessment of plant remains from this context suggests that preservation was excellent, suggesting rapid infilling (see Section 5). Preservation of insects was also good in this pit with numerous worker ants likely to represent an ant nest that had become incorporated in it as it was backfilled (see Section 7).

Plate 6: Pit in Main Tunnel (photo number 661-6585-13)

Pit [3074] was recorded on the northern section in the West Lateral in Bay 3 (Plate 7 and Fig. 9) and cut through the Lower Organic Mound. It measured 0.74m in width and 0.6m deep, although, again, the pit had been truncated by Merewether's tunnel [3080] (see Phase 20). The pit was filled with [3073] a mixed deposit of mid brown to black sandy silt, and again may represent redeposited Lower Organic Mound material. Two environmental samples were taken from context [3073] (<9810> and <9816>) and this time contained low quantities of land snail shells. As with the previous pit, very worn (and therefore perhaps residual) woodland clearance types were present, as were fresh species associated with grassland environments (see

Section 8). Sample <9810> also produced a small number of elder seeds, whilst moss was frequent and buttercups were fairly common (see Section 5). Insects were poorly preserved from this pit (see Section 7). This context also contained thirty-nine pieces of flint micro-debitage and ten pieces of burnt flint (see Section 15).

Plate 7: Pit in West Lateral (photo number 661-6630-104)

4.6 Phase 6: Upper Organic Mound

Mound building continued, and the pits and Lower Organic Mound became sealed under a series of interleaved layers. These were a very mixed series of deposits (see Plate 8), predominantly comprised light to dark greyish brown organic silty loam with lenses of gravel, orangey brown clay and light grey chalk. Some turfs were also present within these deposits. The organic material was a mix of topsoil and subsoil, chiefly from soils that had developed over chalk, and therefore contrasted with the underlying Lower Organic Mound; the majority of which was derived from clay with flints (see Phase 4 above and Section 5). On the western side of the Main Tunnel the contexts comprised: [3026], [3044], [3043], [3042], [3041], [3040], [3039], [3025], [3036], [3037], [3071], [3078] and [3061] (Fig. 11); in the West Lateral the contexts were: [3077], [3081], [3083] (Fig. 13); on the eastern side of the Main Tunnel: [4122], [4120], [4121], [4119], [4118], [4117], [4116], [4115], [4103], [4114] and [4157] (Fig. 11); and in the East Lateral: [4169], [4172] and [4180] (Fig. 12). The size of these deposits suggests that they represent basket loads of material.

Although the uppermost layers were not seen, these deposits are interpreted as forming a mound, enlarging the earlier monument to an estimated diameter of 35m, (it was recorded from Bay 59 to the end face of the tunnel and up to Bay 14 of both the East and West Laterals). The tallest part of the mound was recorded in Bay 10 of the East Lateral at 1.66m high, however the mound clearly rose a few metres above the tunnel and the top was not seen.

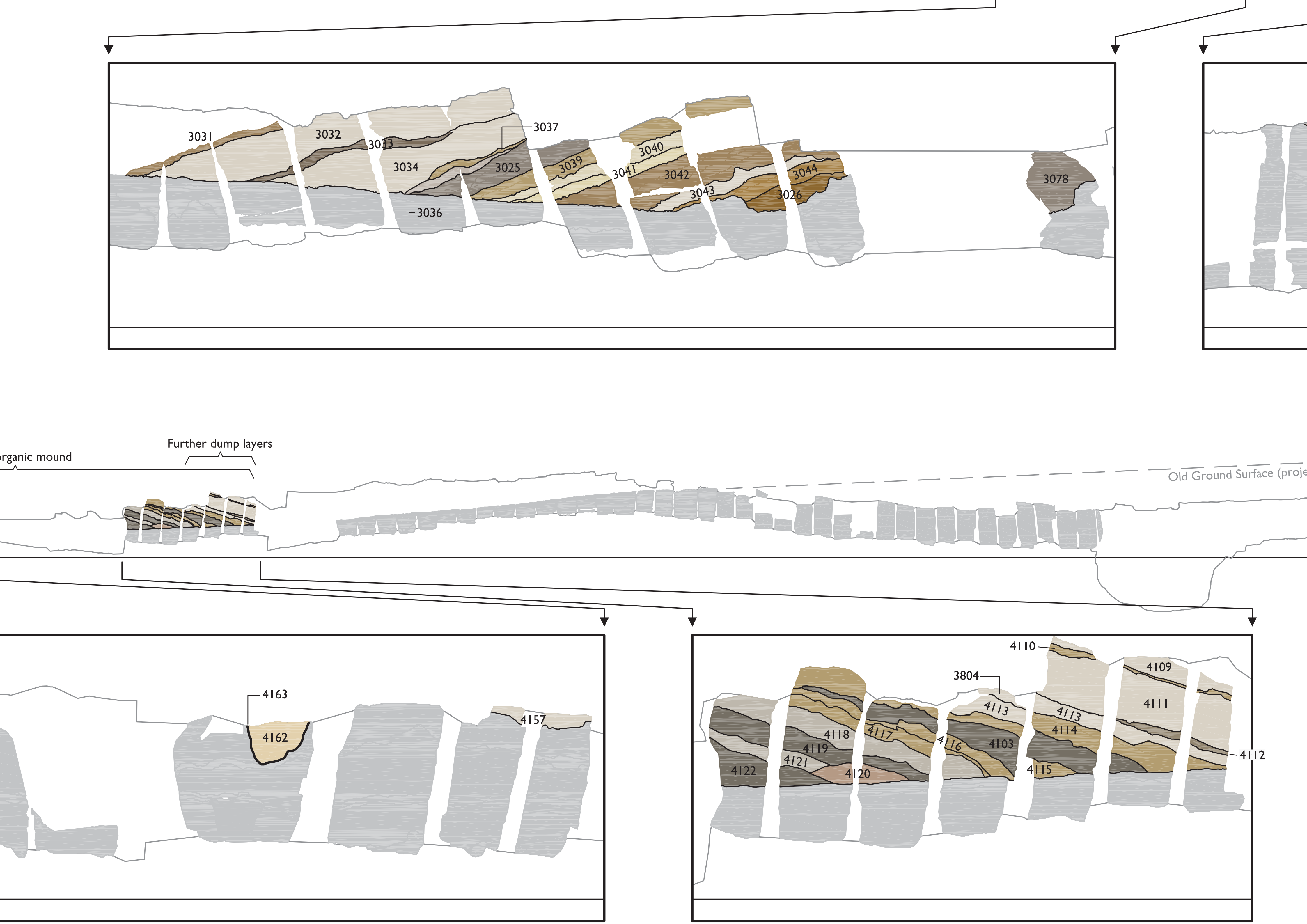
Also included within this phase were a number of naturally rounded sarsen boulders, which had clearly been deliberately incorporated within the matrix of the mound, rather than as any sort of setting over or around it. Five sarsen stones were recorded from context [4157], three of which were substantial blocks weighing between 30kg and 85kg. Further sarsens were recovered from collapsed and slumped material ([3834], see Phase 21.2), and clearly originated from this phase (Section 16). Both contexts [3078] and [3083] contained five pieces of flint micro-debitage each (see Section 15). Environmental sample <9335> from context [3078] contained moss fragments, monocot stem/leaves and roots, as well as fragment's of Dog's Mercury, buttercups, nettles, lesser stitchwort and common chickweed; earthworm granules were also noted (see Section 5). Insects were also recovered from this sample and were well-preserved although concentrations were low (see Section 7). A single pig phalanx in good condition was recovered from sample <9306> from context [4172] (see Section 12). Context [4169] was initially thought to represent a soil horizon; however sample <9423> suggests that it is a random mix of topsoil and chalky subsoil representing a number of tipping events (see Section 6).

Plate 8: The end face of the Main Tunnel showing a section through the Upper Organic Mound (photo: D Stirk)

4.7 Phase 7: Further dump layers

Monument construction continued and the Upper Organic Mound was added to by a series of further dump layers comprising light grey chalk with yellowish brown silty clay lenses as well as some silty layers, and measuring a maximum of 1.1m thick. On the west side of the Main Tunnel four layers were recorded, these were: [3034], [3033], [3032] and [3031] (Fig. 11), with [3084] in the West Lateral (Fig. 13); whilst on the east side five were recorded in the Main Tunnel: [4113], [4112], [4111], [4110] and [4109] (Fig. 11); and one in the East Lateral: [4168] (Fig. 12). They were recorded between Bays 56 to 62 in the Main Tunnel, Bays 10 to 14 in the East Lateral, and Bays 11-16 in the West Lateral. The outer layer of context [3084] was considerably darker and siltier than the other layers and it was initially thought that this may represent an intact soil surface. However sample <9822> suggests that it consists of a random mix of topsoil and subsoil (see Section 5).

These layers were identified by Atkinson and termed ‘clay capping’ (Whittle 1997) and were therefore considered as a separate phase during the recording and most of the assessment. However work during the latter stage of the assessment identified these as further dump layers similar to the underlying Upper Organic Mound, rather than any sort of considered ‘capping’, and therefore are unlikely to be a separate phase of activity. Despite attempts throughout the project not to be misled by Atkinson’s previous interpretations and nomenclature, this would appear to be one such occasion where we were. Future work on the stratigraphy, therefore, will not identify these layers as a separate phase but include them with the Phase 6 Upper Organic Mound.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organic mound
Further dump layers
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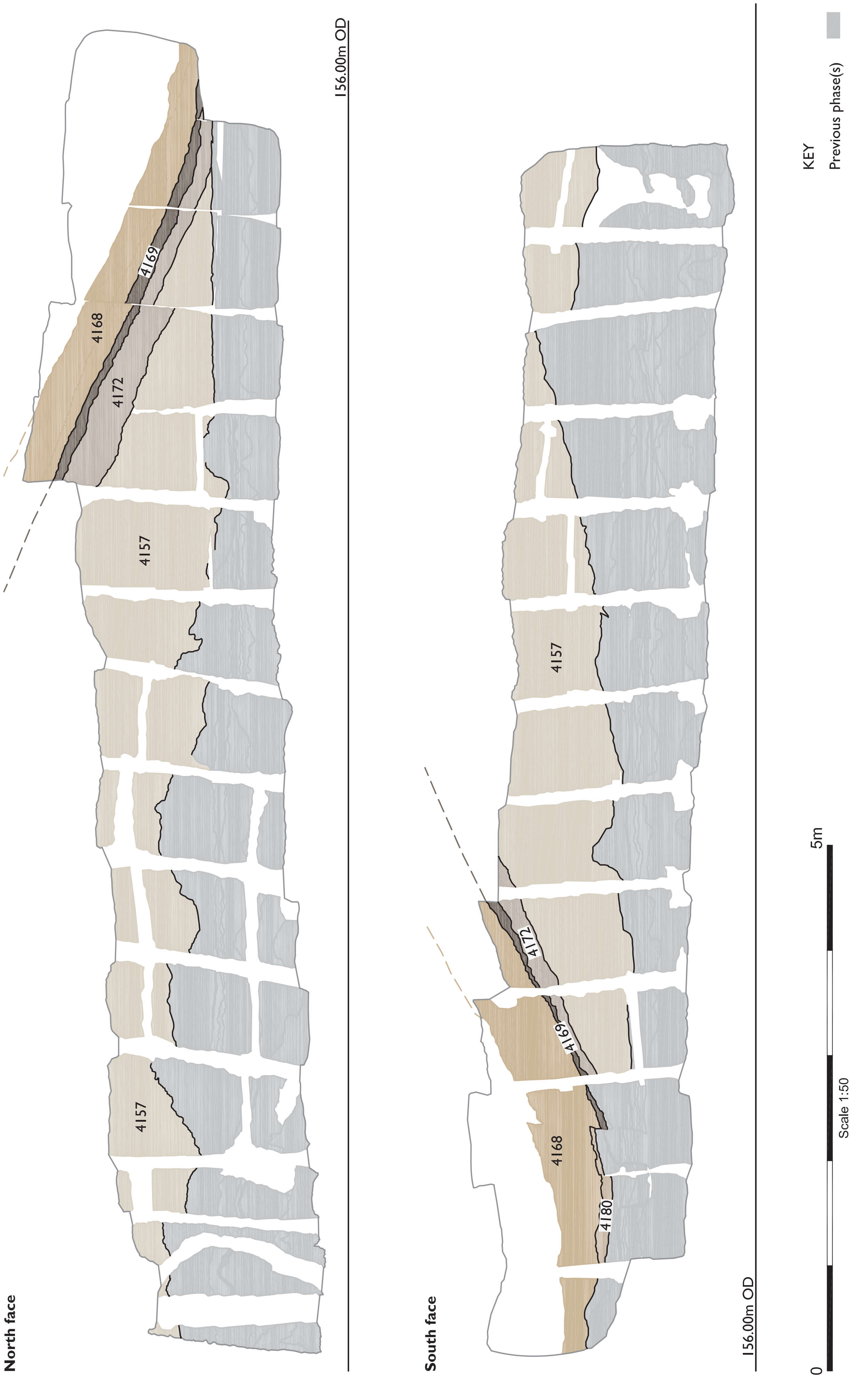
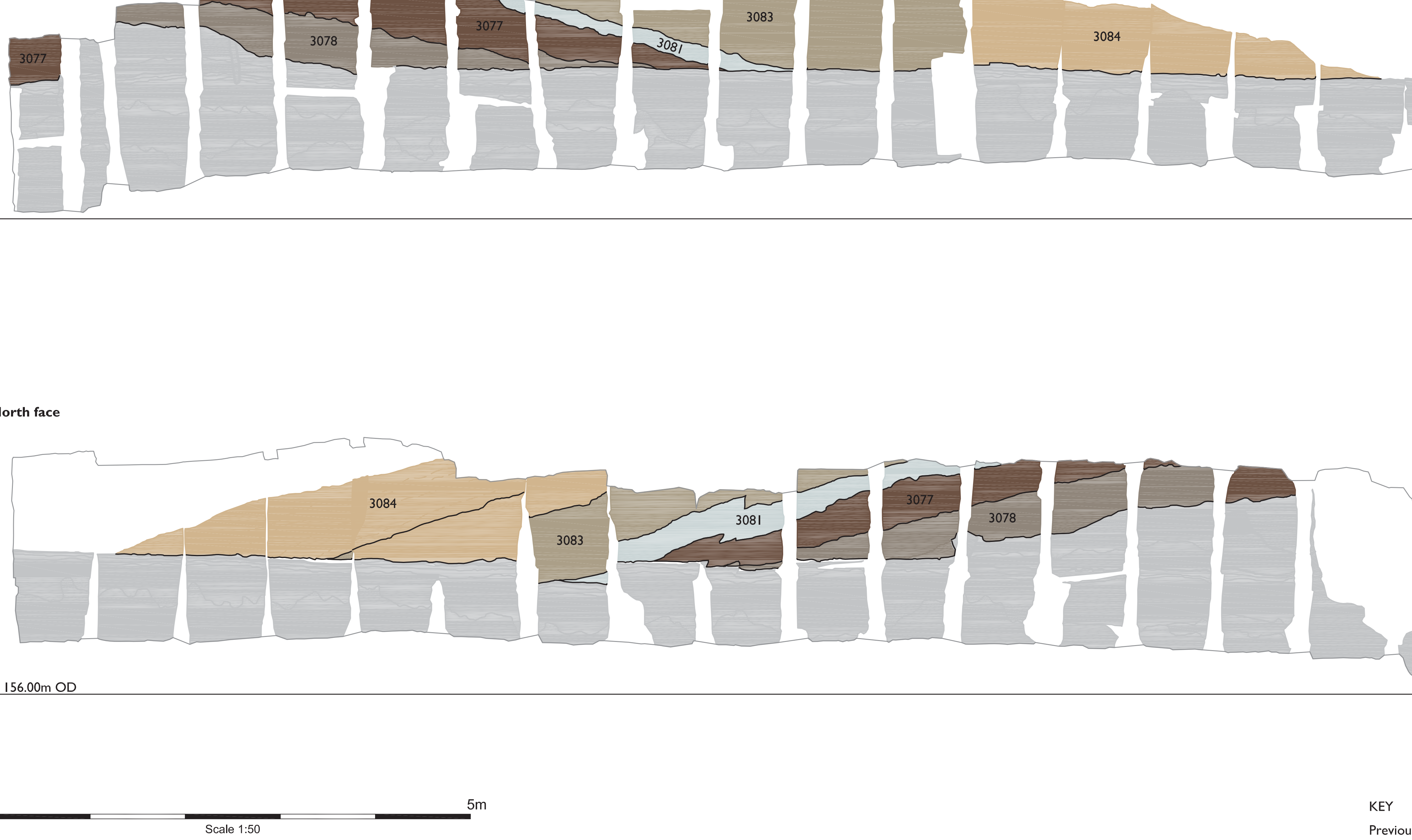


Fig. 12 - Phases 6 and 7: Section through the Upper Organic Mound and further dump layers in the east lateral tunnel.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4.8 Phase 8: Bank 1 and Ditch 1

A dump of chalk and clay (termed 'Toblerone' by Atkinson – Whittle 1997, presumably due to a similarity in the colour to the chocolate bar), was piled around the Upper Organic Mound forming a low bank Plate 9). This comprised two deposits of light yellowish brown silty clay mixed with white chalk. The lower deposit was recorded as [3085] (West Lateral), [3024], [4093] (both Main Tunnel) and [4167] (East Lateral), whilst the upper deposit was recorded as [3088] (West Lateral), [3030] and [4107] (both Main Tunnel) (Fig. 14). A thin (0.1m thick) band of iron panning ([3022] and [4097]) was recorded underlying the upper deposit but not the lower (Fig. 14). This bank was 3.3m wide and 1.44m high (159.00m OD, as seen).

Plate 9: East section of the top of Bank 1, as seen in a void above the tunnel (photo number 661-6114-61)

Recorded just inside the portal was a large ditch and associated internal bank (the bank was recorded as context [3810]) (Plates 10 and 11, and Fig. 15). Although there is no direct connection between this ditch and bank and Bank 1, it has been interpreted here as being part of the same phase; the ditch possibly being the source of the raw material. The ditch cut was recorded in the tunnel sides as well as in a machine excavated slot through the tunnel floor, which provided a clear section through to the base of the ditch (Plate 10). The ditch, which was recorded as contexts [3902], [4151], and [3015] clearly terminated in this area on the western side. This can be interpreted either as an entrance or, as with other sites of this period, a continuous ditch that had been cut in small, connected sections. The base of the ditch was recorded at 153.52m OD, whilst the top was above the tunnel and therefore not recorded. However, if we extrapolate the height of the Old Land Surface from the rest of the site, we can estimate that the ditch was cut at around 160m OD and therefore nearly 6.5m deep. It measured 5.9m wide, and if it was circular in plan we can estimate that it formed an enclosure a little over 100m in diameter. This feature has been interpreted as a ditch due to the associated bank and later re-cuts (see below), however, given the small area investigated other interpretations of it can not be ruled out, such as a large pit.

Plate 10: The ditch excavation below the tunnel floor (photo number 661-6282-01)

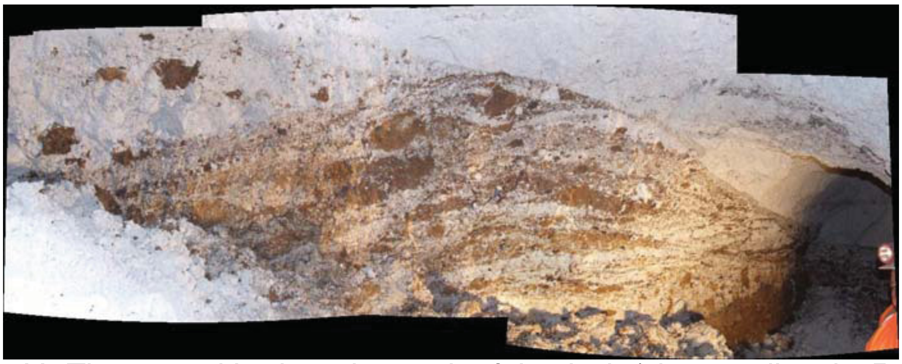


Plate 11: The internal bank to the north of the ditch (photo: collage by Fachtna McAvoy)

4.9 Phase 9: Bank 2

The above ditch possibly remained open during the subsequent construction phases and was probably also in use as the quarry for the raw material for Banks 2, 3, 4 and 5.

Bank 2 comprised a layer of chalk (mixed nodules and crushed chalk: contexts [3029], [3094], [3086], [4106], [4108] and [4183] (Fig. 14). The top of this bank was not seen and it is possible that rather than being a bank around the previous mound, the deposit continued over it to form a larger mound, however it is thought that this is unlikely as tip lines made of lumps of clay were seen in a void above the tunnel, and indicates that Bank 2 slopes back down to rest against Bank 1 (see Plate 12). If continuous, Bank 2 extended the monument by a further 2.5m.

Plate 12: East section showing the southern side of Bank 1 (sloping to the right of the picture) and tip lines formed of clay lumps from Bank 2 (sloping to the left) (photo number 661-6142-68)

4.10 Phase 10: Bank 3

Bank 3 comprised another low; chalk and clay 'Toblerone' bank, remarkably similar in size and material to Bank 1 (see Phase 8) and Bank 5 (see Phase 12). The bank (contexts [3027] and [4104]), which also had a small chalk rubble core ([3028] and [4105]), was 1.42m high and 3.6m wide; the top of this bank was recorded as 159.6m OD (Fig. 14).

4.11 Phase 11: Bank 4

Bank 4 comprised compact white chalk and was recorded as contexts [3023], [4098] and [4186] (Fig. 14). As with Bank 2, this bank was much larger and continued above the level of the tunnel and therefore the top was not recorded, and again as with Bank 2 it feasibly could be interpreted as a mound rather than a bank. This was at least 9m wide.

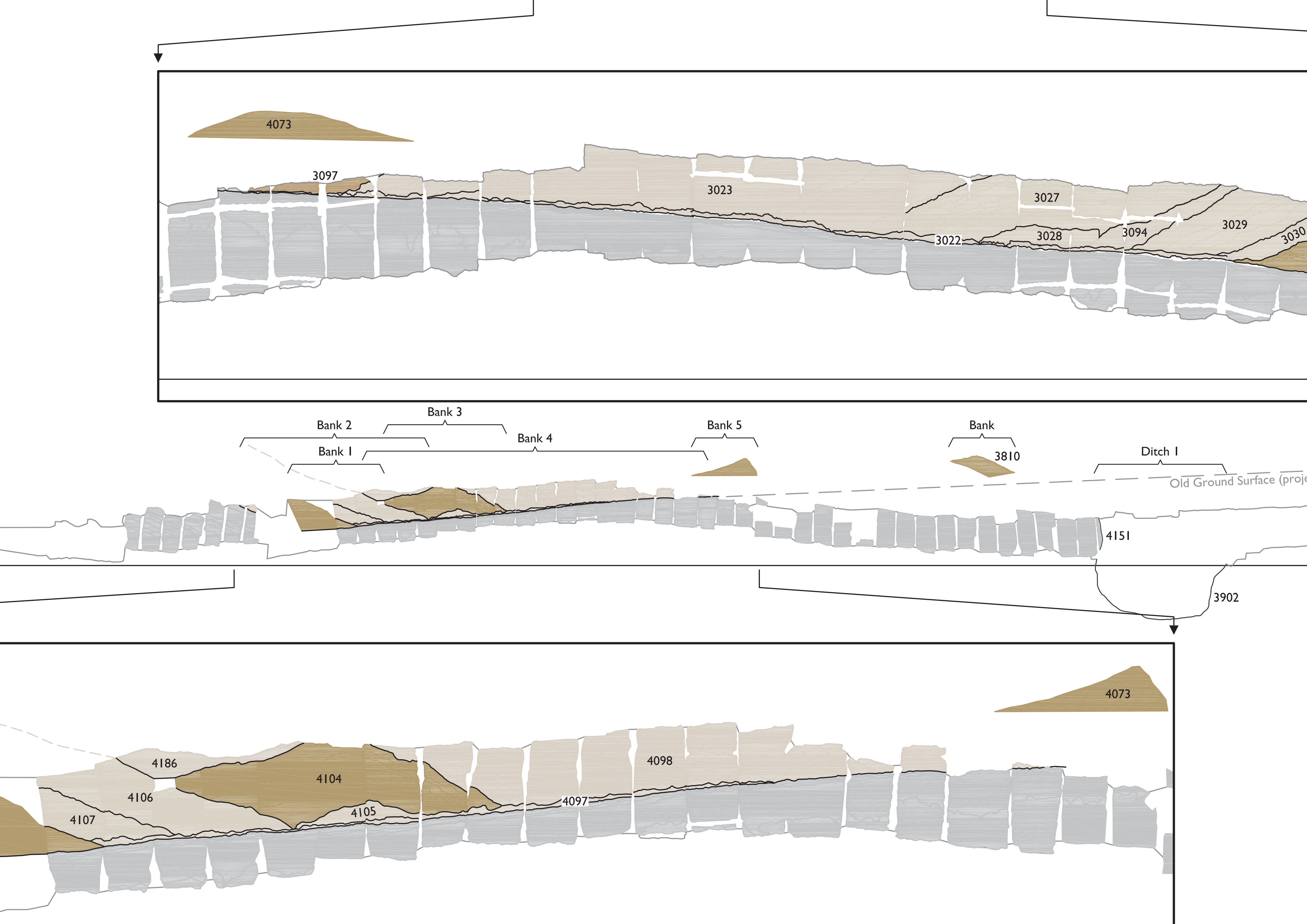
4.12 Phase 12: Bank 5

As with Bank 1 and 3, Bank 5 was a low; chalk and clay 'Toblerone' bank: contexts [3097], [4042] and [4073] (Plate 13 and Fig. 14). It measured 3m wide and 0.78m high (as seen) and recorded at a maximum level of 160.9m OD. These banks extended the monument to an estimated diameter of 37.2m. Sixteen pieces of flint micro-debitage were recovered from context [4073] (see Section 15).

Plate 13: The top of Bank 5, as seen in a void above western section of the tunnel (photo number 661-6062-06)

A considerable way up a void, high above the Main Tunnel and surrounded by chalk, were a series of organic layers interleaved with chalk, and forming what would appear to be a mound (Plate 14). These layers were not recorded archaeologically, or indeed seen by an archaeologist and therefore they were not given a context number. A miner, however, was able to climb the considerable distance up the void and take a photograph as well as two environmental samples (<9150> and <9151>) from the layers. These samples produced a small assemblage of charred plant remains and charcoal (which are suitable for dating) and a charred onion couch tuber, as well as uncharred elder seeds (see Section 5). It is unknown how this feature fits in with the deposits seen in the tunnel and what phase it should be placed in, and highlights the complexity of the monument, and how little we know of it.

Plate 14: Looking up to the base of organic deposits from the top of a void in the mound (photo Skanska)



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Bank 1
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Ditch 1
Old Ground Surface (proj
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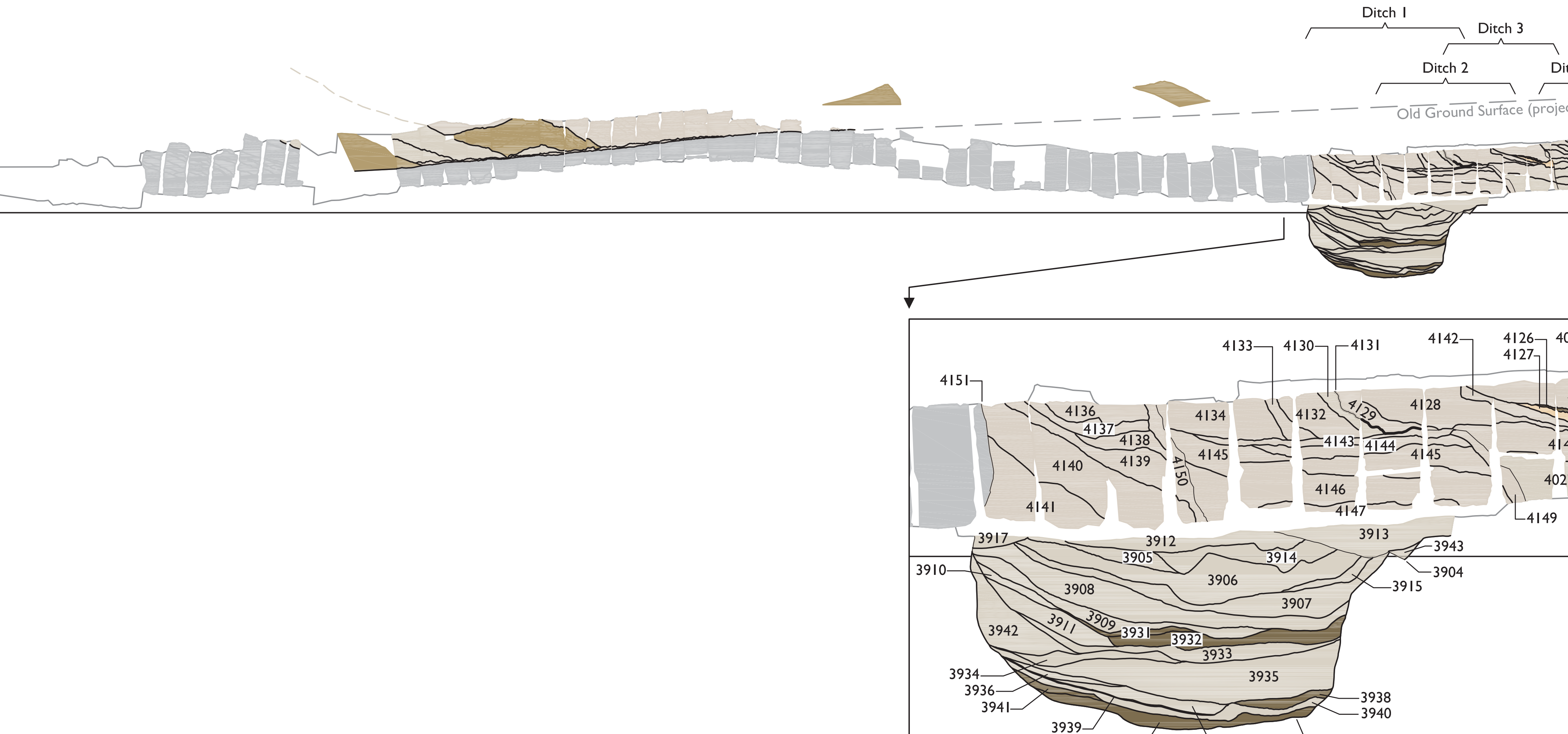

Ditch 1
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4.13 Phase 13.1 and 13.2: The infilling and backfilling of Ditch 1, and re-cutting of Ditch 2

The fills of Ditch 1 were visible in the tunnel sides as well as within a machine cut trench below the tunnel. This showed that the lower fills were siltier and therefore has been interpreted as being deposited as part of a natural infilling process. The upper fills, on the other hand, appeared deliberately deposited. Therefore this phase has been split into two sub-phases, both of which are described below.

Phase 13.1

The primary fill of the ditch was [3926], a firm light brown chalky silt loam with a maximum thickness of 0.2m, and has been interpreted as a stabilization layer (Fig. 15). Three flint flakes were recovered from this layer, as well as two flake fragments, two decortication flakes, a retouched flake, a small piece of burnt flint and 21 pieces of micro-debitage (SF 8007, SF 8008 and SF 8009) (see Section 15). Also recovered from this context was a small fragment of antler in moderate condition weighing only 0.5g (see Section 13). Overlying this were lenses of silty loam ([3941]) followed by a 0.1m thick layer of chalk ([3940]/ [3925]); possibly erosion from the side of the ditch (Fig. 15). Three useable flint flakes and a piece of burnt flint were recovered from context [3925] (see Section 15). Four possible stakeholes were recorded cutting into the top of this layer (Plate 15). They were recorded as cuts [3921], [3922], [3923] and [3924], and fills [3927], [3928], [3929] and [3930], and measured between 0.17 and 0.28m in length and 0.1 to 0.16m in both width and depth, however are likely to have been cut from higher up (the poor resolution afforded by machine excavating a narrow slot meant that the tops were not recorded). The next recorded context was a very thin (0.02m), dark band possibly representing another stabilisation horizon (context [3939]). Overlying this was [3937]: a 0.15m thick layer of chalk, which was followed by further thin silty chalk deposits [3936] and [3938] (Fig. 15). The above fills were all removed together in a single spit by the machine and separated out into individual contexts later when the section was recorded. The spit (Spit 4) was given the group context [3920] and both flint (two flake fragments and a useable flake: SF 8005) and antler (SF 8006) were recovered from it, as well as two fragments of poor condition animal bone (see Sections 12, 13 and 15); these finds could therefore have come from any of the contexts discussed above. Environmental samples from the lower fills contained charcoal and hazel nutshell fragments (see Section 5).

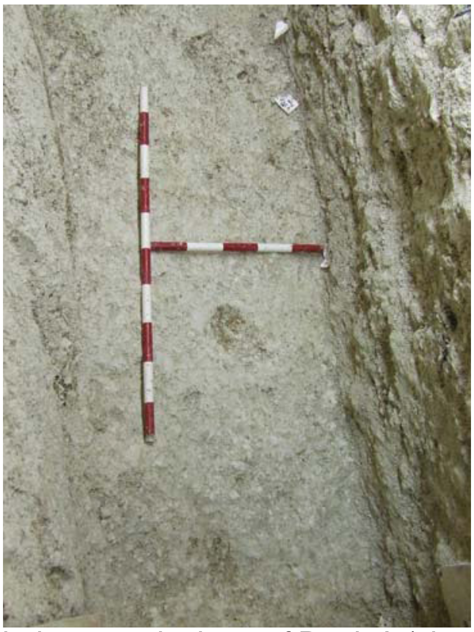

Plate 15: Putative stakeholes near the base of Ditch 1 (photo number 661-6279-09)

These fills were overlain by a much thicker (0.55m thick) deposit of silty chalk (context [3935]), whilst the subsequent fills (contexts [3934], [3942], [3933], [3911] and [3932]) were all broadly similar, comprising a mixture of silt and chalk and between 0.1 and 0.2m thick. Extending over these fills was context [3910]/[3931], a thin band of silt loam, possibly representing another period of stabilisation. This was in turn overlain by another chalk context: [3909] (Fig. 15). A large machine excavated spit (Spit 3; group context [3919]) incorporated the contexts between [3937] and [3910]/[3931] and a fragment of antler (SF 8018) was recovered from it during machining (see Section 13), as well as a struck flint flake, a systematic blade and a flake core, as well as a chunk of burnt flint weighing 35g. The flake core appears to be a variant of the Later Neolithic 'Levallois' technique, which is often associated with the manufacture of elaborate pieces such as transverse arrowheads (see Section 15). The contexts between [3942] and [3909] were recorded as Spit 2 (group context [3918]), and recovered three pieces of struck flint, including a retouched piece and a chunk of burnt flint weighing 23g (see Section 15) and eight antler fragments (SF 8004; SF 8015; SF 8016; SF 8017), in both good and poor condition. Antler tine SF 8017 exhibited slight polish from use towards the tip (see Section 13). Single fish teeth were also recovered from this spit ([3918]); although these may be fossils from the chalk (see Section 12). This spit also included the lowest context in Phase 13.2.

This whole process infilled the ditch by *c.* 1.5m, bringing it to a level of around 155m OD.

<u>Phase 13.2</u>

Contexts [3908], [3907], [3916], [3915], [3906], [3905], [3914], [3917] and [3912] were all removed as Spit 1, which was given the group context [3903] (and which also contained the upper contexts from Phase 13.1) (Fig. 15). They were of a similar homogenous white chalk deposit, some of which contained large chalk blocks, and contained notably fewer finds. They were considerably thicker than the underlying Phase 13.1 deposits, varying between 0.2 and 0.7m thick, and on the whole appear to have been thrown in from the northern side of the ditch. Spit 1 context [3903] contained a core modification flake (see Section 15) as well as single fish teeth, which again may be fossils from the chalk (see Section 12).

The following contexts were all recorded in the sides of the tunnel rather than below the tunnel floor and therefore were not excavated, however they are part of the same phase of deliberately backfilling the ditch. Contexts [4141] and [4140] were thick deposits (both over 0.5m thick) of loose chalk fragments, clearly dumped from the northern side of the ditch. Overlying this were less thick deposits of chalk: [4139], [4138], [4137], [4136] and [4135], and again these were clearly tipped from the north (Fig. 15). Deposits presumably continued above the tunnel, however were not recorded.

Unlike the underlying deposits, these deposits were retained on the southern side by a vertical chalk rubble wall (recorded as context [4150]), which effectively formed a dry stone wall (Plate 16 and Fig. 15). This not only provides clear and compelling evidence that this phase of the ditch had been intentionally backfilled, but also suggests that the southern side of the upper part of the ditch was left open, ie only the northern side of the ditch was backfilled, implying that the backfilling and re-cutting occurred at the same time. A ditch re-cut (context [3904]) was recorded cutting the top deposits of the Phase 13.1 infilling sequence, suggesting that Ditch 1 was partly re-cut and partly left open (the revetting wall provided a stable side to the ditch re-cut) thus forming a second ditch (Ditch 2), which was smaller (*c.* 4.5m wide) and slightly further south (Fig. 15). The ditch, in other words, had migrated outwards and become smaller in the process.

Plate 16: Chalk revetting wall within backfilled Ditch 1 (photo number 661-6738-73

4.14 Phase 14: The backfilling of Ditch 2, and re-cutting of Ditch 3

Ditch 2 was itself intentionally backfilled and re-cut further outwards in a similar way to Ditch 1. The first backfill deposits recorded within Ditch 2 were [3943] (although this deposit may represent recent disturbance into the tunnel floor, possibly from Atkinson's work) and [3913]/[4147]. Overlying this were contexts [4146], [4145] and [4144] – all comprising layers of chalk laid horizontally and devoid of finds (Fig.

15). These deposits were held in place by retaining wall [4149], which was formed of large pieces of chalk blocks. Overlying these deposits, including the retaining wall, was a thin band (0.1m) of compacted fine chalk ([4143]), either representing washed in material suggesting that the ditch had been left open at this stage for some considerable time, or a compacted layer of trample, indicating a working surface. Infilling of Ditch 2 continued over this with [4134], which was retained by rubble wall [4133] (Fig. 15). Subsequently chalk layer [4132] was laid down and retained by rubble wall [4130]. Retaining wall [4130] and [4149] have been interpreted together as representing the northern face of Ditch 3; the second re-cut to this ditch complex (context [4131]), and again indicates the further migration of the ditch outwards. This ditch was over 3.7m wide (although it was truncated by Ditch 3 to the south) and at least 1.7m deep, although neither the top not the base were recorded.

4.15 Phase 15: The infilling of Ditch 3, and re-cutting of Ditch 4

In turn Ditch 3 was filled in, although the deposits were much siltier and the retaining wall technique was not used, suggesting that it had perhaps infilled naturally rather than deliberately. The first context recorded was a deposit of chalk [4027], followed by [4148] and [4128]: chalk mixed with a small amount of silt loam up to 0.5m thick. This was then overlain with a thinner layer of chalk [4142], and then [4127]: a white and light yellowish brown mixed deposit of chalk and silt loam 0.1m thick. This was overlain by [4126] a dark olive brown silty clay, possibly representing a stabilisation horizon (Plate 17), and finally [4125]; a thick chalk layer over 0.5m in places, and possibly representing natural erosion of chalk or intentional backfill (Fig. 15). This sequence no doubt continued above the tunnel, however was not recorded above this point.

Plate 17: Ditch 3 infill (Photo number 661-6460-11)

These deposits were cut through by re-cut [4018] (Ditch 4); a narrow ditch (*c.* 2.5m wide) with near vertical sides that was recorded on both the north and south side, and a possible step was visible on the southern side (Fig. 15). As with Ditch 3 the ditch extended below the tunnel floor and above the tunnel roof and therefore a depth of only 1.8m was recorded.

4.16 Phase 16: The backfilling of Ditch 4

Ditch 4 was backfilled with a sequence of chalk deposits between 0.1m and 0.3m thick (contexts [4026], [4025], [4024], [4023], [4124], [4123], [4022], [4021], [4014], [4015], [4020], [4016], [4019], [4017]) (Fig. 15). No finds were recorded from these fills, and they have been interpreted as representing deliberate backfill. The vertical sides of Ditch 4 suggest that it was not open long before this backfilling process began.

4.17 Phase 17: Final mound construction

Phase 17.1

The first few bays in the tunnel were not recorded as they were concealed behind concrete supports left in place from Atkinson's excavations, however, it is possible that Ditch 4 was re-cut again (possibly represented by cut [3018] on the western section) and possibly a few more times after this – the large external ditch representing later phases of ditch re-cut, which had migrated further out. The archaeology recorded immediately outside the tunnel entrance, within the portal area, comprised further chalk fills, presumably the fills of either ditch re-cut [3018] or a later re-cut. These were [4011], [4010], [4009]/[3011], [4008]/[3010], [4007]/[3009], [3008], [4006]/[3007]. A fragment of antler in poor condition was recovered from context [3008] (SF 8002) (see Section 13).

Phase 17.2

Deposits relating to the final phase of the mound were examined in two areas: on the side of the monument above the tunnel portal during remediation work to fill in large hollows that had formed there, and on the summit, primarily in the trench excavated in 2007, but also the earlier (2001) trenches as well as the collapsed area.

Hillside Watching Brief

The earliest deposit recorded on the side of the monument was a layer of loose chalk: [4904], which contained a number of antler fragments (SF 8751, SF 8752 and SF 8754) (27 fragments in total, although these refit to form one, two or three pieces) (see Section 13). SF 8754 refits to form a fragment of beam, clearly used as a pick, retaining parts of the bez and trez tines, and has been cut below the crown (see Section 14). Also from this context was a chalk block retaining two separate impressions of working (SF 8753). The first consists of a mark visible in section with evidence for two blows, set at slightly different angles, the second blow overlying the first in part. The second mark is a hollow caused by hitting the chalk surface with a tine end. This evidence suggests that the picks were used in effect as mattocks, rather than handled wedges (see Section 14). Overlying [4904] was context [4907], a deposit of dumped chalk which also contained some large pieces of chalk rubble, which was overlain with a horizontal layer of compact, fine chalk: [4908]. The next context ([4909]) comprised a mix of fine chalk and larger pieces of chalk rubble; the rubble possibly forming a retaining wall as seen in Ditches 2 and 3 in the tunnel. The subsequent context ([4910]) comprised a compact layer of chalk from which an antler fragment (SF 8757) in moderate condition and exhibiting parallel scars (possibly from hafting or from rodent gnawing) was recovered (see Section 13). The next two contexts [4911] and [4912] comprised a mix of finer pieces of chalk as well as larger pieces of chalk rubble, which may have acted as a rough retaining wall for the finer pieces of chalk, however not enough was recorded to say with any certainty, and therefore the wall is not evident in Figure 16.

Plate 18: The hillside Watching Brief (Photo number 661-6862-07)

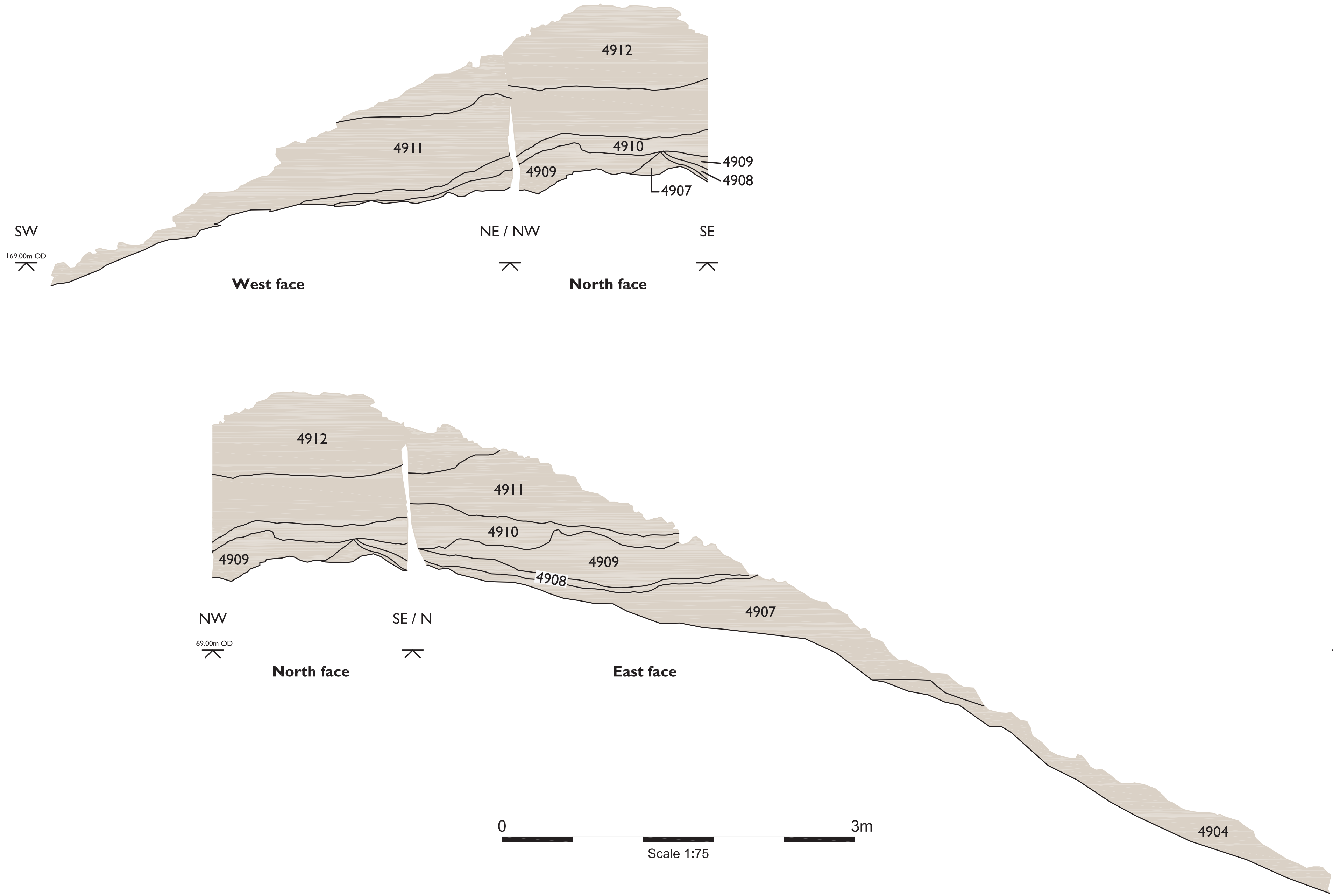

Fig. 16 - Phase 17: Section showing mound deposits on the hillside.

Summit excavations
The trench on the summit was excavated in order to better understand a series of curvilinear chalk walls that Atkinson had exposed in a large trench on the summit in 1970. The 2007 trench aimed to re-excavate one metre of Atkinson's trench and extend it by a further two metres to the west (Plate 19).

Plate 19: Atkinson's trench edge and in situ chalk walls as seen in the 2007 trench (photo number 661-6167-72)

The prehistoric deposits recorded in the 2007 trench comprised a series of layers of fine chalk dumps lain on top of one another and held in place on the northern side by large, loose pieces of chalk rubble, which effectively formed a revetment wall, one chalk lump thick (circa 0.3m) and at an angle of between 45° and 65° (Walls 1, 2 and 3). This is a similar technique to that seen on the side of the mound as well as in the backfilled buried ditches within the tunnel (discussed above) and is clearly the construction technique used to build the final phases of the monument. The prehistoric deposits were recorded at a maximum level of 186.74m OD (Fig. 17). The revetment walls recorded in the 2007 trench are some of the same walls recorded by Atkinson's team, although it should be noted that since they left them *in situ* (Plate 19) by simply slicing through the deposits behind them, they could not have been excavated stratigraphically, as one wall would have to be removed in order to fully see the next set of layers (see Figure 17).

The earliest recorded deposit in the 2007 trench was chalk wall [4812] (Wall 1), which was only just evident in the southern part of the trench, and not excavated (Figs. 17 and 18). From a small slot 0.6m deep on the eastern side of the trench, it could be seen that five layers of chalk had been dumped to the north of this wall (contexts [4817], [4816], [4815], [4814] and [4813]) (Fig. 17). They were between 0.1m and 0.2m in thickness and comprised a light greyish brown to white silty loam. An antler tine in very good condition (SF 8523) was recorded from context [4814], and two other fragments in moderate condition, including a naturally shed antler burr, came from [4813] (see Section 13). A useable flake was also recovered from [4813] (see Section 15), as were two fragments of animal bone (see Section 12).

A second wall (context [4809]), Wall 2 (Plate 20, Figs. 17 and 18), *c.* 1.7m away from Wall 1, revetted these deposits, and again a number of layers of white chalk had been dumped to the north of it (contexts [4845], [4846], [4847], [4843], [4844], [4840] and [4848]) (Fig. 17). These deposits (unlike the previous ones) were excavated to the full extent of the trench. A sarsen stone recovered from context [4845] refitted with a stone recovered from the topsoil (see Phase 21.2). Together they form a block with a large flake scar on one side; further smaller flake scars on the edge indicate that it had then been roughly worked into its sub-oval shape, before being lightly pecked on one side and then ground to produce a smooth concavity – perhaps to turn it into a *polissoir*. The block had then been deliberately split by a single blow to the upper face (see Section 16).

Context [4845] also recovered a useable flake (see Section 15) as well as two very small and unidentifiable sherds of pottery: Small Find 8529 weighed only 1g, whilst the other was retrieved from sample <9526> and weighed just 0.1g – both could be intrusive (see Section 17). Context [4840] recovered a single trimming flake, whilst [4843] recovered a decortication flake, a piece of burnt flint and a core fragment (see Section 15). Two small fragments of antler in good condition were recovered from context [4848] (see Section 13); whilst contexts [4843], [4844], [4845] and [4848] all recovered a few animal bone fragments (see Section 12).

Plate 20: Revetment Wall 2 after excavation of deposits to the north (the deposits this wall revets to the south were not excavated) (photo number 661-6343-19)

On the western side of the trench, three larger fragments of antler in good condition were recovered from a small and well-defined area of context [4845] (SF 8525, SF 8526 and SF 8527). Both SF 8525 and SF 8526 exhibited evidence for use wear. Unfortunately Small Find 8527 was stolen from the site office soon after discovery, however photographs of it *in situ* show that it was the tip of a tine about 10cm long and in good or moderate condition. The on-site finds supervisor reported that it refitted with SF 8526 (see Section 13). Within the same defined area and built into revetment wall [4809] was a cluster of eleven fragments of sarsen stones (Plate 21). The majority of these showed signs of reduction: two had traces of negative bulbs and flake scars indicative of controlled direct percussion, whilst another had a pinkish tinge to the cortex, which is taken as evidence for burning, perhaps to assist fracture and reduction. Two stones refit and others look to belong to the same block (Section 16). These sarsen fragments appear to have been associated with the antler fragments, suggesting that together they may represent placed deposits.

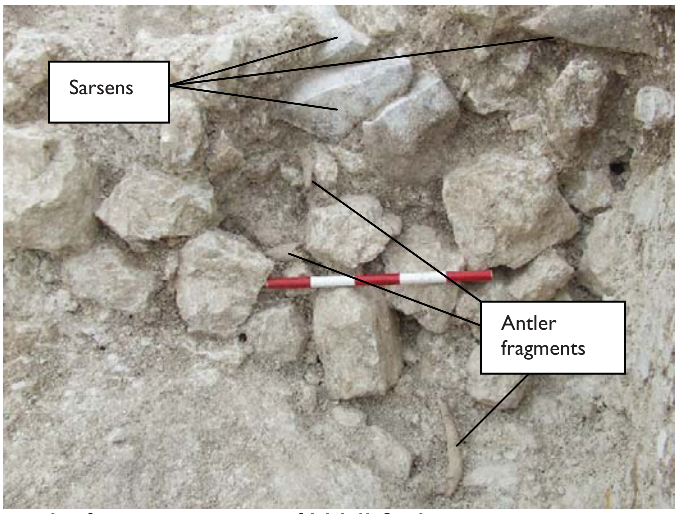

Plate 21: Detail of western part of Wall 2 showing sarsen stones and antler fragments (photo number 661-6340-16)

The loose chalk deposits to the north of Wall 2 were, in turn, revetted by chalk wall [4808] (Wall 3) (Plate 22, Figs. 17 and 18), which lay c. 1.5m away from Wall 2. Five fragments of animal bone were recovered from context [4808] (see Section 12). Once again a series of layers of chalk, occasionally mixed with silt, were laid on the northern side of the wall. These were recorded as contexts [4839], [4836], and [4835], and varied in thickness from 0.15m and 0.5m (Fig. 17). Two animal bone fragments were recovered from context [4835] (see Section 12), as was an antler fragment in moderate condition; exhibiting evidence for use wear. Whilst another fragment of antler, this time in poor condition, was recorded from context [4838] (see Section 13).

Plate 22: Revetment Wall 3 following excavation of the deposits to the north (photo number 661-6196-05)

A possible radial wall comprising pieces of chalk rubble (context [4838]) was recorded perpendicular to Wall 3 on the western side of the trench; although very little of this was seen and it was unclear whether this was a revetment wall or a slightly more rubble-rich dump layer (Fig. 18).

Recovered from these above-discussed deposits were a number of bones, such as badger and mole and particularly anuran bones; the latter being evident in abundance. However, a live common frog was also found in a void of one of the chalk walls, well within the upper levels of the prehistoric deposits, suggesting that these bones and many of the other ecofacts might be intrusive (see Section 12).

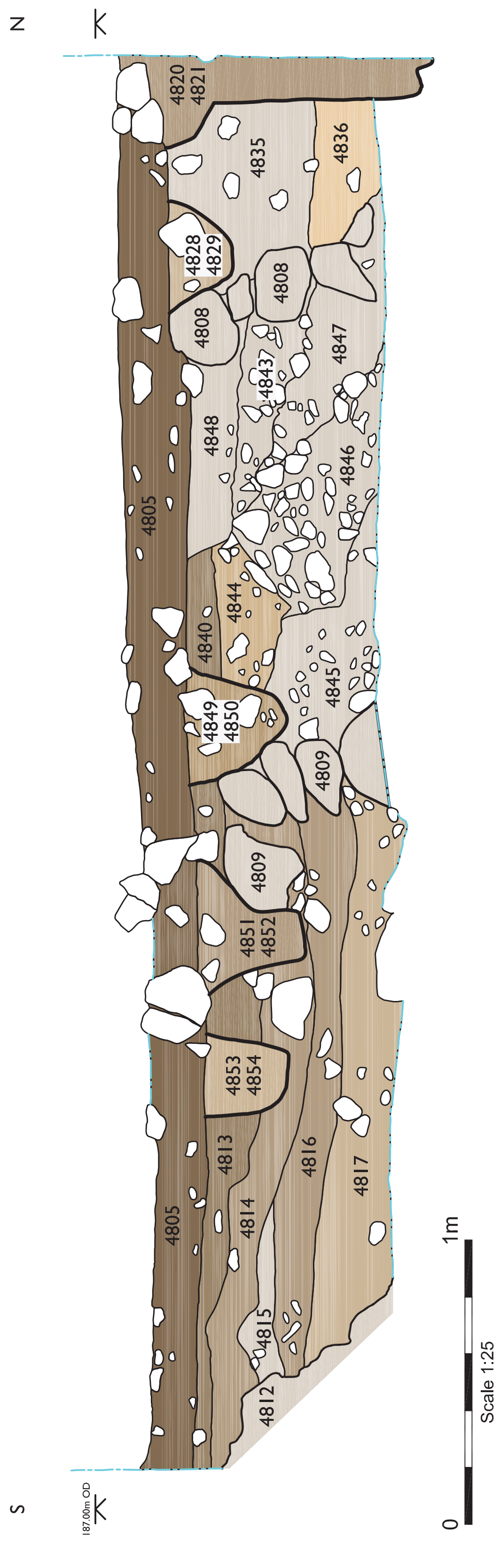

Fig. 17 - Section showing mound deposits and later features exposed after removal of Atkinson's backfill in the 2007 trench on the summit.

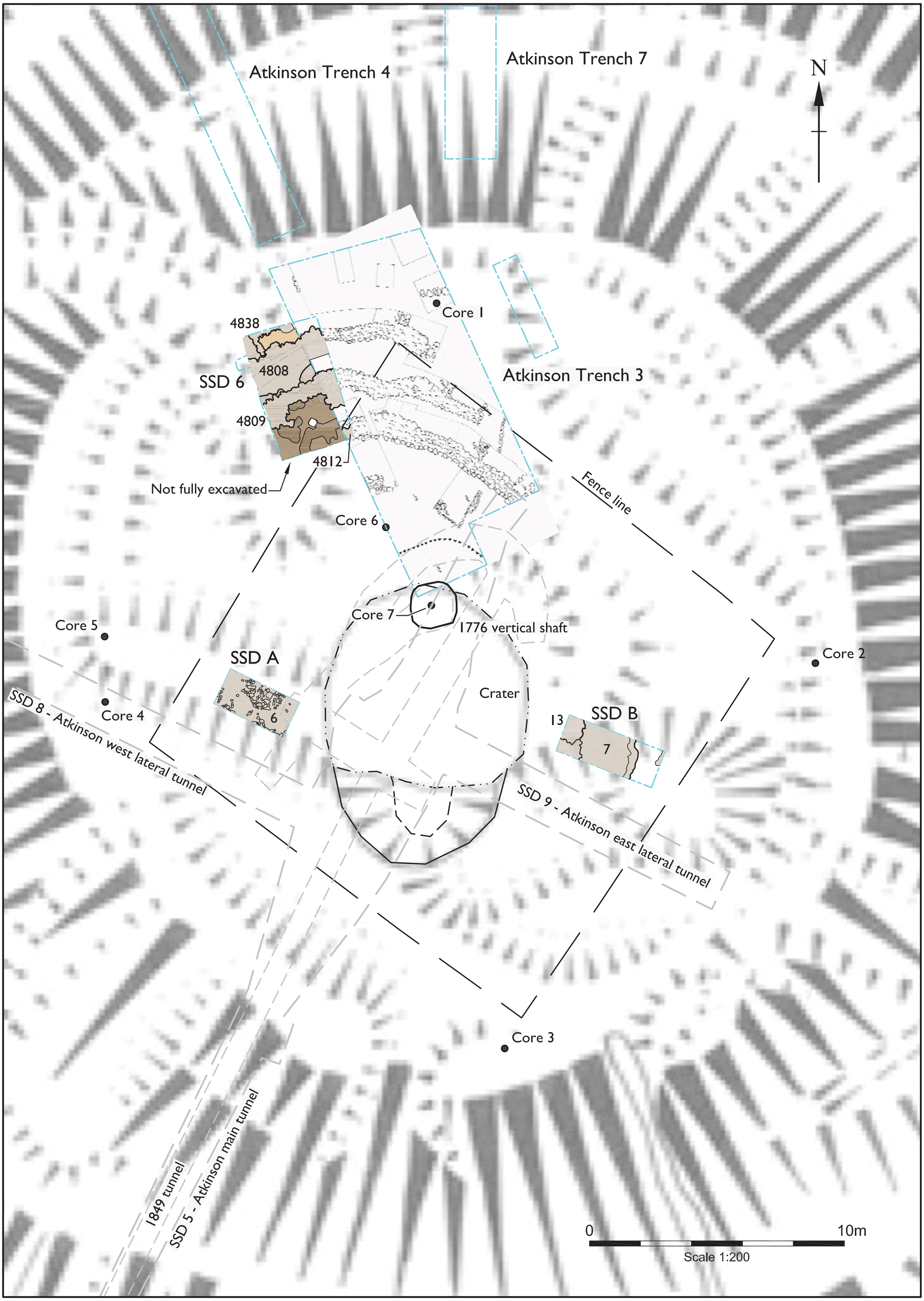

Fig. 18 - Phase 17: Plan of the prehistoric layers in the 2001 and 2007 trenches on the summit.

Excavated in 2001, Trench A was 3m long and 1.5m wide and was located on the west side of the collapsed area (Fig. 18). Excavation took place to a general depth of 0.4m across the trench. The earliest recorded layer in this trench was a very compact layer [6] of pale brown silty loam, present across the trench (Fig. 18). Overlying this was [4]; another compact layer of chalk at least 0.2m thick. This layer was present across the whole trench and included patches of chalk blocks, which, if a larger area had been excavated, may have been revealed to be a revetting wall. Three flint flakes were recovered from this context (Section 15), as well as a single sherd of comb-decorated Beaker pottery with square-tooth comb impressions with a complex motif with filled or reserved triangles (Section 17). A small fragment of later pottery was also recorded in this layer and is likely to be intrusive.

Coeval with Trench A was Trench B; a 4m long and 1.5m wide trench that was located on the east side of the crater. A very substantial wall [7] was recorded running north south and occupying most of the trench (Fig. 18). The wall was composed of a chalk rubble core, with chalk at 0.10-0.20m in size, between two chalk faces made of larger blocks c 0.35-0.40m in size. In hindsight this feature is perhaps likely to represent two chalk walls as well as chalk dump layers between them. On the eastern side of the trench at the lowest level a layer of very compacted chalk rubble, [10], was recorded. At the west end of the trench was a short length of possible chalk walling [13]. At this end excavation ceased above a layer of compact pale brown silty chalk [12] that lay against the walls.

Deposits recorded in the collapsed area

Deposits were recorded in the collapsed area on the summit in January 2001, soon after it opened up and prior to temporary filling, and again in 2007 and 2008 after the temporary filling had been removed (and after further collapse had occurred). The collapsed area was 11m by 8m and recorded to a maximum depth of 13.5m and therefore deposits to this depth were exposed. However, working in a crater of this depth, with loose and unstable sides, posed clear logistical and Health and Safety problems, which do not lend themselves to accurate recording. Recording work was therefore extremely limited and the deposits were only broadly characterised. Further to this, access into the shaft to clean the sides was not possible, and therefore it was difficult to differentiate between *in situ* deposits and material that had collapsed in from the top, some of which adhered to the sides lower down, often creating the erroneous appearance of features.

The 2001 fieldwork recorded compacted chalk layer [31] at the lowest level, overlain by a looser layer of chalk blocks (possibly representing a revetting walls), [30], and in turn by [29], another compacted layer of chalk. Further to this, another possible chalk wall (context [32]) was recorded on the eastern side of the collapsed area. In 2007 the exposed chalk was given the general context [4874], and similarly in 2008 [4883], however, although assigned a single context this was made up of a number of different contexts of loose chalk rubble and finer chalk comprising the upper layers of the mound. A fragment of cattle bone (SF 8095) was recovered 3.6m from the top of the shaft from general context [4874] (see Section 12). A lens of mid orangey brown chalky clay was recorded 6.8m from the top and given the context [4873]. An environmental sample of this was taken when the Clerk of Works abseiled down to the base of the shaft (Plate 23), and three pieces of micro-debitage were recovered from the sample (see Section 15).

Plate 23: Abseiling down the side of the collapsed area to take a sample (photo number 661-6461-27)

4.18 Phase 18: Medieval activity

A series of features were recorded on the summit cutting the above prehistoric deposits. Some of these features clearly represent post holes, whilst others had an amorphous appearance suggesting disturbance caused by burrowing animals. None are securely dated.

Summit excavations

Three possible post holes were recorded on a north north-west to south south-east alignment in the north-west corner of the 2007 excavation trench. Cut [4842], which measured 0.43m wide and 0.4m deep, was only seen in section (and therefore not in Fig. 19) and was filled by a creamy brown silt loam ([4841]). The irregular nature of its sides suggests that it could also be interpreted as animal activity, although it aligns with other putative post holes. Alongside this was cut [4870]: a much more convincing post hole, which had both a diameter and depth of 0.65m although it extended beyond the limit of excavation to the west and therefore was not fully excavated (Fig. 19). The fill was recorded as [4869] and comprised silt loam. Just to the south east of this was another possible post hole: [4831], which measured 0.65m in diameter and 0.56m deep (Fig. 19). This was filled with [4830] a friable light creamy brown silty loam.

If these features represent post holes; all three were replaced by similar post holes. Feature [4842] was cut by [4825], a sub-square feature that nestled into the north-west corner of the trench and much it extended beyond the excavated area (Fig. 19). This feature measured 0.5m wide as seen, and 0.3m deep, and had chalk blocks at the base possibly representing post packing. It was filled with light yellowish brown silty clay, [4824], which contained a few pieces of animal bones (see Section 12). Post hole [4870] was cut by feature [4833]: an oval shaped feature with steeply sloping regular sides and measuring 0.86m long, 0.65m wide and 0.51m deep (Fig. 19). This was filled with [4832] a light whitish brown clay chalk silt mix, which contained a bone fragment (see Section 12). Although damaged by possible animal disturbance (cut [4827] and fills [4834] and [4826], the latter of which contained a decortication flake and an unsystematic blade – see Section 15, as well as five probable badger and four probable fox bones – see Section 12), post hole [4831] was cut by feature [4823]: another possible post hole, which measured 0.48m in diameter and only 0.16m deep (Fig. 19). It was filled with [4822] a light to mid greyish brown silt loam, which contained one piece of flint micro-debitage (see Section 15) and two, possibly intrusive fragments of animal bone (see Section 12). As with the earlier features, these three ([4825], [4833] and [4823]) are aligned north north-west to south south-east, and their close association with one another, and the fact that all three seem to have replaced earlier similar features, supports the interpretation that they represent the fragmentary remains of post holes.

Recorded on the eastern side of the trench, and also on a north north-west to south south-east alignment, were three further possible post holes, all of which had been truncated on the eastern side by Atkinson's trench (Figs. 17 and 19). Feature [4850] was irregular in plan measuring 0.42m by 0.29m and 0.36m deep and was filled with light greyish brown silt loam: [4849]. Feature [4852] was more regular, and on the whole, a lot more convincing as a post hole (Figs. 17 and 19). It measured 0.52m in diameter and 0.38m deep and filled with [4851], loose, light brown silty loam, which contained two trimming flakes and three pieces of micro-debitage (see Section 15). Possible post hole [4854] had a diameter of 0.42m and a depth of 0.37m and was circular in plan (Figs. 17 and 19). It was filled with a loose, very light grey brown silt loam, recorded as context [4853].

A further possible post hole or post pit was recorded in the central area of the trench. This was recorded as [4858]; a large oval feature which measured 0.9m long, 0.69m wide and 0.36m deep and contained a chalk block and fragment of sarsen on the bottom (see Section 16), possibly used as post packing (Fig. 19). Its fill was light grey silty loam (context [4857]) and a piece of flint micro-debitage (see Section 15), as well as two fragments of bone, was recovered from this (see Section 12). This pit seemed to cut a patch of disturbed ground possibly caused by animal activity (cut [4872] and fill [4871]).

The most substantial feature recorded from this phase on the summit, was post hole [4821] (Plate 24 and Fig. 19); this was 0.98m deep and had a diameter of 0.87m as seen, however it continued beyond the limit of excavation to the north and was cut by Atkinson's trench (cut [4803]) to the east (indeed it should have been clearly visible to Atkinson's team in their western section – Fig. 17). Had the full extent of this post hole been seen, it is estimated that the diameter would have been at least 1m. It was filled with light greyish brown silty clay (context [4820]) and packed at the base with pieces of broken sarsen stone – presumably pieces re-used from the prehistoric deposits. Two small sherds of pottery from a jar were recovered from this fill (SF 8518 and SF 8519) however, were unfortunately undiagnostic (see Section 17). Two decortication flakes were also recovered from it (see Section 15), as well as six fragments of animal bones (see Section 12). This post hole was recorded cutting a long sinuous feature, representing probably an animal burrow or perhaps a root hole (cut [4829] and fill [4828]), the fill of which contained a single trimming flake (see Section 15) as well as 16 animal bones, the majority of which were anuran bones (see Section 12).

The above features are heavily disturbed and many of the artefacts and ecofacts may be either residual or intrusive, as indicated by badger bones, which are distributed across Phases 17, 18 and 21.1 (see Section 12). No dateable material was recovered from the fills of any of the above features and the placing of them within the medieval period is entirely speculative.

Plate 24: Post hole [4821] following excavation (photo number 661-6178-91)

A few fragments of possible Newbury Group B pottery were recovered from layer [11] in Trench B of the 2001 excavations, which presumably represents a disturbed prehistoric layer. Cutting this was pit [15] and fill [9] and again Newbury Group B pottery was recovered from it (see Section 17), as was a decortication flake (see Section 15). In Trench A, layer [5] recovered a Roman copper alloy coin (SF 853) identified as a nummis of Constantine the Great, with a Gloria Exercitus reverse (two soldiers, one standard), minted in Lyon between 335 and 345 AD (Section 18), and therefore also probably represents a similar disturbed layer.

During a Watching Brief on fence posts inserted in 2001 a few fragments of Newbury Group B pottery were recovered (contexts [16], [17] and [18]), and date to the late 12th or early 13th century (see Section 17), although it is worth noting that context [17] also contained fragments of modern wire and is therefore likely to be a disturbed layer.

Features recorded in the collapsed area

Two large possible pits were recorded opposite one another on the northern and southern side of the collapsed area on the summit. These were both only recorded in section and therefore the full extent was not seen. On the northern side was possible pit [4878], which measured 3.02m east west and 1.11m deep. It was filled with [4877], loose light greyish brown chalky silt. Next to this was a small possible post hole [4880], which was filled with [4879], a light greyish brown chalky silt. On the southern side another pit was visible in the facing section. This was recorded as [4876] and measured 5.25m wide (although possibly incorporating an adjacent feature) and 1.39m deep. The primary fill was recorded as context [4875] a friable light orangey brown chalky silt. The secondary fill was recorded as [4886], a friable, mid greyish brown chalky silt, which contained two fragments of pottery: SF 8765, a sherd of Newbury Group A with a postulated date of late 11th to early 12th century (and containing a black deposit on it); and SF 8766, a sherd of Bath Fabric A (see

Section 17), as well as a flint core fragment (see Section 15), and three fragments of animal bone (including SF 8767) (see Section 12). Both putative pits had a distinctive V-shaped profile, far more like a ditch profile than a pit, and it is not inconceivable that since they lie opposite one another that they form part of a ditch across the top of the mound.

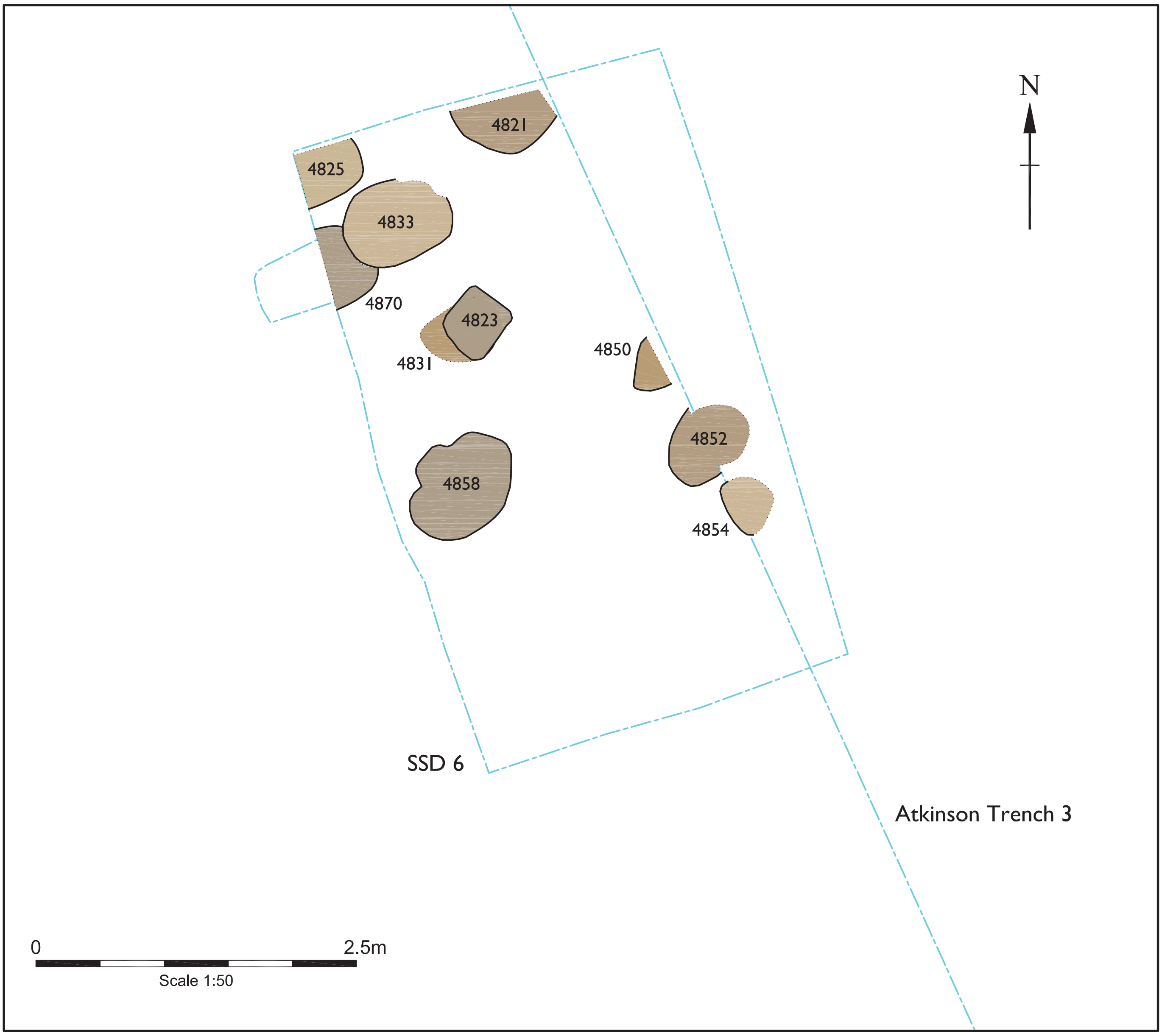

Fig. 19 - Plan of possible medieval features in the 2007 trench on the summit.

4.19 Phase 19: 18th century activity

Summit excavations

A number of amorphous features were recorded across the top of the summit. Although undated these have been associated here with an episode of tree planting that Stukeley recorded on the summit of Silbury in 1723, and the associated damage the roots caused. In the 2007 excavation this included a possible tree pit [4864], which was irregular in plan and had a maximum diameter of 0.85m and a depth of 0.26m. The associated fill was [4863]; a light greyish brown silt loam. Various patches of disturbance attributed to root action were recorded as [4856] and fill [4855]; [4860] and fill [4859]; [4862] and fill [4861]; [4866] and fill [4865]; [4868] and fill [4867]. These features were all highly irregular in shape and the fills comprised loose, mid to light greyish brown silty loam. Fills [4855], [4859], [4861], [4869] and [4865] all contained a few fragments of animal bone (see Section 12), whilst [4861] contained a useable flake (see Section 15). They were all sealed under layer [4837], which contained a single decortication flake (see Section 15), and two fragments of animal bone (see Section 12). In the collapsed area in 2001 a possible tree pit was recorded (context [28] and fills [27], [26]), as was the 1776 shaft (cut [25] and fill [24]).

4.20 Phase 20: 19th century activity

Tunnel

At various stages within the tunnel, evidence for John Merewether's 1849 tunnel was recorded. The 1849 tunnel was first visible in the western section between Bays 16 and 19, where the 1968 tunnel merged with it (cut [3017] and fill [3016]). The 1849 tunnel was subsequently subsumed within the 1968/9 tunnel and was only visible again in the tunnel sections towards the centre where it had been excavated in a series of diverse directions. It was recorded in Bay 69 (cut [3051] and fill [3050]), between Bays 73 and 74 (cut [3060] and fill [3059]), and between Bays 76 and 78 (cut [3065] and fill [3064]) on the west side of the Main Tunnel. It was also recorded between Bays 78 and 79 on the east side of the Main Tunnel (cut [4159] and fill [4158]), as well as in Bay 2 on the northern side of the West Lateral (cut [3080] and fill [3079]). Where seen, the 1849 tunnel was filled with collapsed material, confirming that it had been left open after the work had finished and surrounding material had squeezed into it over time.

4.21 Phase 21: 20th/21st Century activity

<u>Phase 21.1</u>

Tunnel

Immediately outside the tunnel, within the portal area, a step-like feature was recorded cutting into the prehistoric deposits. This was recorded as cut [3006] filled with [3005] (which contained a fragment of metal wire) on the west face, and [4005] filled with [4004] and [4003] on the east. This feature may have been a step cut into the side of the hill, although is equally likely to be soil creep. Overlying this was a natural subsoil layer [3003]/[4002], and topsoil layer [3001]/[4001].

Summit excavations

On the summit, the subsoil was recorded as [2], [8], [14], [4805] and [4885] and the topsoil as [1], [3], [4804] and [4884]. Subsoil [2] recovered 14 struck flint flakes, including decortication flakes, trimming flakes and flake fragments; whilst [8] recovered a decortication flake, a piece of burnt flint and two pieces of micro-debitage; whilst [14] revealed two decortication flakes, two trimming flakes a piece of burnt flint, a flake fragment and a prick spur dated to the 11th and 12th centuries (SF 851). Two clay pipe stem fragments were collected from contexts [2] and [4] and are post-medieval in date.

The majority of finds recovered from the subsoil, however came from [4805], which recovered two decortication flakes, five useable flakes, a piece of burnt flint, and a flake fragment, as well as a piece of burnt flint (see Section 15). It also contained a quantity of animal bone fragments (see Section 12), a fragment of antler in moderate condition (see Section 13), and two fragments of sarsen stone (see Section 16). Six sherds of pottery were also recovered, four of which have been tentatively identified as Iron Age (SF 8515, 8522, 8516 and 8510), perhaps alluding to a hitherto unrecognised Iron Age phase of the monument; the other two pieces were too small to be identifiable (SF 8513 and SF 8517). One of the sherds of Iron Age pottery (SF 8515) was large, weighing 63g, whilst another (SF 8516) weighed 17g (see Section 17). Also recovered was a long, slender socketed arrowhead (SF 8514), dated to between the 11th and 14th centuries and usually associated (although not exclusively) with military sites (Section 18).

Another socketed arrowhead was recovered from topsoil [4804] (SF 8501), this time with a slender, leaf-shaped blade and dated to the mid 13th century (Section 18). Also recovered was a small and heavily abraded fragment of oxidised (possibly Roman) pottery (SF 8507), and an abraded fragment of possible Roman brick or tile (SF 8508) (see Section 17), as well as a useable flake (see Section 15), animal bone fragments (including SF 8503) (see Section 12), and an antler fragment with a tine in very good condition and with some evidence of polish from use (see Section 13). Coins ranging from an 1881 half-penny to a 1956 six-pence were collected from contexts [1], [3], an [8] (Section 18).

During the 2007 excavations, between the topsoil and subsoil, a patch of disturbed ground was recorded. This measured around 2.2m in length and possibly represents disturbance due to root action. This feature was recorded as [4807] and filled with loose silty loam [4806] which contained three flakes, a piece of burnt flint and three pieces of flint micro-debitage (see Section 15), as well as a few fragments of animal bone (see Section 12). Also recovered from this context were three copper pin fragments (SF 8530, SF 8531 and SF 8532) (see Section 18). Layers [23], [22], [21] from the 2001 collapsed area presumably also relate to this phase. In 2008 a stakehole (cut [4882] and fill [4881]) was recorded as sealed by the subsoil, although the similarity between the fill and the subsoil meant that it may have cut the subsoil. The very loose nature of the fill as well as the appearance of it suggests that it was a very modern feature.

Phase 21.2
This phase represents the evidence for Atkinson's 1968 to 1970 work both within and on the hill as well as post-Atkinson events such as collapses in the tunnel.

Tunnel
Atkinson's tunnel and portal was recorded as generic cut [3004], [3805] and [3866]. The fill on the outside of the portal area (recorded as [3002]) was removed in

October 2006 (this fill contained a retouched flake, see Section 15, and a small fragment of unidentified pottery, see Section 17) in order to expose the 1968 tunnel door: a steel door set within a concrete frame and painted green with a large white stylised 'S' in the centre (Plate 25). The door had a Yale padlock on it and the corresponding key was recovered from under the door (together the key and padlock were recorded as SF 8001). The concrete lintel above the doorway had '1968' embossed on it (Plate 25).

Plate 25: The portal area after being exposed (photo number 661-6004-04)

As the 2007 excavations got underway the door to the tunnel was opened revealing collapsed chalk material from the tunnel roof, which had mixed with road stone and other materials such as decayed wood. This was recorded as contexts [3801], [3802], [3804], [3808], [3811], [3812] and [3813], and two fragments of animal bone were recovered from it (context [3808] SF 8014, and [3804] SF 8032) (see Section 12), as well as some string (context [3804] SF 8011). Context [3811] contained one useable flint flake and [3812] a minimally reduced core (see Section 15). The ground was scraped around the portal using the machine in order to reduce the floor level and facilitate access into the tunnel. This removed material was recorded as [3803], [3806], [3814] and [3815], and probably represents primarily trample from the 1968/9 use of the tunnel, although context [3815] contained a struck flint flake (see Section 15). The collapsed material from around the portal was entirely removed using the digger, revealing type 1 road stone (formed of 50-100mm angular limestone) behind it; recorded as context [3802] (Plate 26).

Plate 26: The 1970 road stone used to backfill the tunnel. Compressed by later collapses (photo number 661-6085-01)

The road stone was loose and clearly had not been fully compacted when blown into the tunnel in 1970, and therefore provided little support to the tunnel roof. As the wooden boards that formed the tunnel roof rotted away in the years following the backfilling, chalk from the overlying mound collapsed into the tunnel, compressing the road stone by about one third (Plate 26). This collapsed chalk was removed with a machine under Watching Brief conditions and was recorded as a series of context numbers according to which bay (or groups of bays, depending on what was possible given the confines of the tunnel) the chalk had been recovered from. The chalk was then loaded onto a conveyor belt and visually scanned for finds, which, when recovered, could then be related by their context number back to the bay or a group of bays they originated. Since these finds were recovered from post-1970 collapsed material they were not *in situ*, however they are unlikely to have moved far. The context numbers of this collapsed material with their associated bay numbers and Small Finds numbers are listed in Table 1 below.

Table 1: The context numbers and finds information for the collapsed material in the tunnel

Context	Bay(s)	Small Find no	Find type
3807	18 (west side)	*	*
3809	18-21	SF 8030	Bone
3816	28 (in refuge area)	*	Lithics
3817	32	SF 8021-8028	Antler; Lithic
3819	18-25	*	Lithics
3820	26	*	*
3821	27	*	*
3822	28	*	*
3823	33	SF 8052-8054	Antler
3824	31-36	*	Miner's spanner
3825	34	*	*
3826	36-41	SF 8029, SF 8044-8, SF 8050, SF 8051	Bone and antler
3827	36	*	*
3828	36	*	*

Context	Bay(s)	Small Find no	Find type
3829	34-36	SF 8019, SF 8020	Antler
3830	31-35	SF 8049	Antler; lithics
3831	41-46	*	*
3832	42-46	*	Lithic
3833	47-49	*	*
3835	47-49	*	Lithic
3836	42-46	*	Lithic
3837	41-45	*	*
3838	39	*	*
3839	38	*	*
3840	55	*	Lithics
3841	36	*	Lithic
3842	37	*	*
3843	41	*	*
3844	50	SF 8010, SF 8056-8092	Antler
3845	58	SF 8055, SF 8093	Bone; antler; lithics
3846	60	SF 8012	Lithics
3847	62	*	*
3848	67	SF 8094	Antler
3849	59	*	Lithics
3850	61	*	Lithic
3851	66	*	Lithics
3852	56	*	Lithic
3853	52	*	Lithic
3854	56-58	*	Lithics
3855	74-75	*	Sarsen stone
3856	67-70	*	*
3857	West Lateral: 8-14	8109	Antler
3858	West Lateral: 8	*	Lithic
3859	West Lateral: 9-10	*	Lithic
3860	67-70	*	Lithic
3861	71-73	*	Lithic
3862	74	*	Lithic
3863	82	*	*
3864	West Lateral: 8	*	Lithic
3865	72	*	*

The road stone extended back to Bay 57 at which point it abruptly stopped; clearly the full length of the tunnel had not been backfilled. From Bay 57 to the back of the tunnel at Bay 82 the tunnel was filled with a light to mid yellowish brown sticky clay and chalk mix, which contained frequent small to medium angular pieces of chalk and moderate medium sub-angular flint as well as some organic material. This was recorded as context [3834] (including sub-division numbers [3856], [3860], [3861], [3862], and [3863]) and an iron nail was recovered from it, as well as fourteen pieces of sarsen stone, which had clearly derived from earlier phases of the mound (see Section 16). This material was in places highly stratified with thin bands of very fine chalk between clay layers; suggesting that it had washed into the tunnel (Plate 27).

Presumably saturated material in the 1776 shaft had formed a slurry and flowed into the unfilled parts of the tunnel. Although this had probably been an on-going process since 1970 (hence the fine, stratified bands), the 1968/9 steel mining rings had been pushed to the south suggesting at least one catastrophic event; conceivably occurring in 2000 which resulted in the collapse on the summit.

Plate 27: The clay infill of the un-backfilled sections of the tunnel (photo number 661-6458-02)

Originally thought to be a prehistoric feature, a cut was recorded between Bays 1 and 2 on the south side of the East Lateral. This was recorded as cut [4177] and fills [4174], [4175] and [4176], however it was soon realised that this was the same size as the other 1968/9 ring settings – the ring having been knocked out of place by passing machinery.

Significant voiding was recorded between Bays 18 and 22 as well as 39 and 43. Both voids were large enough for a person to get up, occasionally enough for a few people, and were recorded as far as possible with the TST. However for Health & Safety reasons it was not possible to climb up the full length of the voids and therefore they were not fully surveyed. For the same reason the sides of the voids were not archaeologically recorded. The first of these (the void between Bays 18 and 22) coincided with the point where the 1849 and 1968 tunnels merged, and therefore likely to have been caused by the interaction of the two, and resulted in hollowing on the side of the mound (see below). The second void appears to be the result of collapse over the unfilled sections of the 1968/9 tunnel.

The 1968/9 mining arches were present throughout the tunnel, and a few other objects relating to these tunnelling works were recovered and retained, these included metal braces used in the construction of the tunnel, an iron pick end (although this is possibly from the earlier 1849 tunnelling works), a large spanner and a plumb bob (Section 18). Three tobacco tins were recorded outside the portal area, and anecdotal evidence suggests that these belonged to the 1968/9 miners, who left them at the entrance whilst working in the tunnel.

The concrete portal around the entrance to the tunnel was dismantled as the tunnelling works drew to a close in 2008, and the 1968 concrete lintel and green steel door were taken to the Alexander Keiller Museum. The rear of the concrete lintel also incorporated a glass bottle within it, which had been deposited before the concrete had dried. A typed letter rolled up in the bottle read:

"From Professor R. J. C Atkinson, The Old Rectory, Wenvoe, Glamorgan.
National Grid Reference: ST 122726 Telephone: Wenvoe 340
Please add to the above address postal code CF5 6AN
19th April, 1968.
This tunnel was started on April 7th, and in the next two weeks advanced 18 yards, before a manhole was made to join the new tunnel with that made in 1849. The B.B.C. sponsored this operation, the N.C.B. loaned much of the equipment.
Those taking part were Dr. John Taylor, who was in charge of the tunnel, Mr. Bill Curtis, tunnelling expert, Collis James, Keith Smith, Ted Blackmore, miners; Professor Atkinson, Major Lance Vatcher, David Clarke, Stephen Green archaeologists; Commander J.D.R.Davies, Information Officer; Gillian Lancaster, David Fairhurst, Caterers; Hester Atkinson secretary. In attendance were Sir Henry de Baskerville, dog; Ambrose, cat. Many others helped in various ways."

On the reverse of this typed letter a rather hasty-looking handwritten note read:

"The BBC contribution was chiefly made by Paul Johnstone, David Collison, Elea Birdell, Jimmy Dewar, Peter Bale, Buck Buckinger.
The great British (including Scottish) was represented by Magnus Magnusson.
Photographs by John Wright."

A green metal box with a wooden inner lining and bearing the BBC insignia was recovered from the back of the Main Tunnel (context [3834], SF 8033). This was clearly deliberately left as a time capsule and contained three reels of film in two metal film canisters; a series of paper publications (publicity pamphlets, BBC newsletter etc), the minutes of a meeting held in Devizes; two little lapel badges with the stylised Silbury 'S' and a pre-decimalisation 50p coin that must have been almost brand new when deposited (Section 19). These had been wrapped in plastic sheeting inside the container however water has leaked in over the last 40 years and preservation was variable. A badly damaged handwritten note read:

"[missing] box was deposited at 15.00 hours on Tuesday 28th October, 1969 by Paul Johnstone and Ray Kite at the furthest end of the tunnel dug into Silbury Hill by Professor Richard [missing] in the course of [missing]"

Hillside Watching Brief

On the side of the monument, overlying the area where the 1968 tunnel merged with the 1849 tunnel, a large crater was recorded as [4903], and filled with [4902] and [4901] (Fig. 20). The primary fill ([4901]) was a thin lens of washed-in topsoil, whilst the secondary fill appeared to be backfill, comprising spoil from the tunnelling works, including some fragments of organic material and a retouched flake (see Section 15). Also recovered from this context (although later discarded) was a drinks can (Coke-Cola) and some bottle glass, suggesting that this material was deposited at the time of the 1968-1970 excavation; the crater probably the result of a collapse into the tunnel during the work at this time. Overlying this was a thin interface layer (context [4905]), and subsequently some reinstated topsoil [4906].

Context [4905] contained 6 fragments of antler in poor condition, including a naturally shed antler burr (see Section 13).

Summit excavations
Atkinson's trench cut was recorded as [4803] and the backfill as [4811], [4802] and [4810] on the summit. Two decortication flakes and four other flakes (including an unsystematic blade) were recovered from backfill [4802], and a decortication flake came from [4810] (see Section 15). Animal bone was also recovered from all three contexts: [4802], [4810] and [4811] (see Section 12). Overlying this was the topsoil [4801] reinstated following his excavation, and this recovered a decortication flake, a trimming flake, two useable flakes and a flake fragment (see Section 15), as well as bone fragments (see Section 12). This context also recovered seven fragments of sarsen stone, one of which refitted with another from the prehistoric context [4845] (see Phase 17) (see Section 16). Where seen in the collapsed area, Atkinson's trench backfill was recorded as [20] and the reinstated topsoil as [19]. A general finds number (context [4889]) was given to the finds recovered from collapsed material in the crater over the winter months of 2007/8. These finds included three fragments of antler, one of which exhibited a tool mark of unknown provenance (see Section 13) and a large, fresh sherd of Roman Shell-tempered ware (although a late Saxon date cannot be discounted for this sherd) (see Section 17).

<u>Phase 21.3</u>
Summit excavations
The latest feature recorded at the site was a square posthole recorded as [4818] and filled with [4819]. A plastic tie recovered from this fill suggests that it is likely to have been cut for the fence erected in 2001.

A quantity of crystals and semi-precious stones were buried into topsoil on the summit, and lay testament to the continued spiritual importance of the monument, whilst modern coins, tent pegs, bottle tops and ring pulls provide further indication that people still visit the summit. The most enigmatic modern deposit was a small plastic pyramid filled with plaster that had been buried into the top of the 2001 polystyrene blocks (Plate 28).

Plate 28: Recent placed deposit buried on the summit (photo number 661-6192-18)

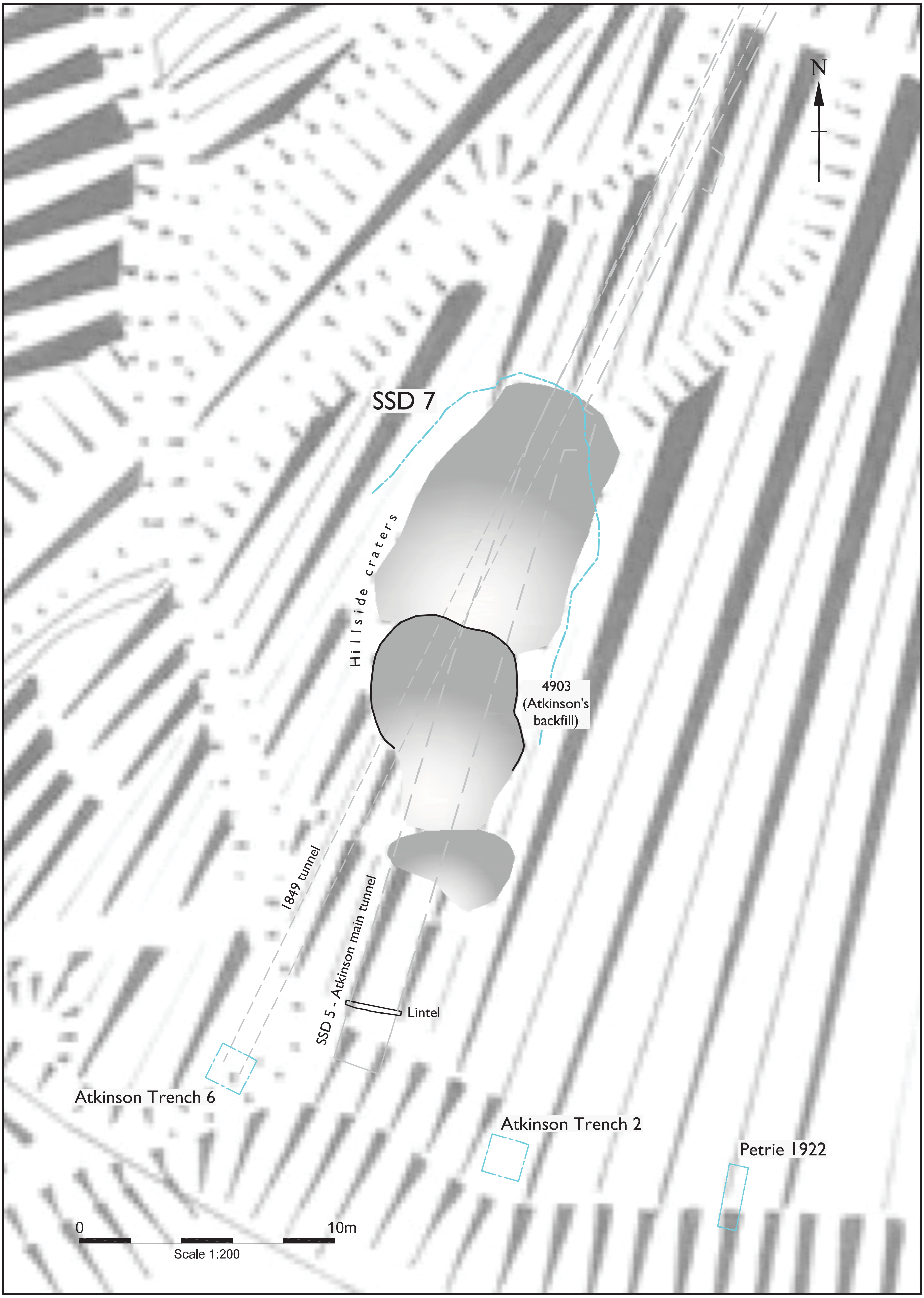

Fig. 20 - Phase 21: Plan of the large crater on the side of the mound.

5 ASSESSMENT OF PLANT REMAINS

Gill Campbell

Samples for assessment of macroscopic plant remains from deposits likely or known to contain biological remains preserved as a result of anoxic conditions were selected following the completion of the excavation in collaboration with Jim Leary and with reference to the draft matrix and stratigraphic summary. Samples thought to contain only charred plant remains, and larger samples taken principally for the recovery of artefacts were subject to flotation. All floated samples were assessed. The assessment sought to address the research questions posed in the Project Design, establish the potential of this material for further research and to examine the nature, state of preservation and concentration of any plant remains present.

5.1 Methodology

The samples taken for general biological analysis (GBA) proved quite difficult to process. The organic layers in particular were very compacted. After some experimentation with different techniques including freezing, soaking in hot water, boiling, and the addition of hydrogen peroxide it was found that freezing the sample, allowing it to defrost, and then soaking overnight in initially hot water, achieved the best results. It has been shown that freezing of compacted organic rich samples as a way to aid processing does not cause damage to delicate biological remains and is generally the most efficient method of processing this type of material (Vandorpe and Jacomet 2007).

Samples were wet sieved down to 180 microns using a simple wash over technique. This mesh size was used in order to ensure full recovery of mites. The resulting organic fractions were scanned under a binocular-dissecting microscope at magnifications up to x 50. Brief notes were made on the abundance and preservation of insects, molluscs and other invertebrates to aid the specialists undertaking the study of these remains. The occurrence of different macroscopic plant remains in the samples was recorded along with information on their abundance, preservation and condition. Preliminary identifications were made and possible interpretations of the larger assemblages put forward. A brief summary of the material recovered from each sample was produced (see Table 2, and below) for the research archive.

Any insects and other invertebrate remains, small bones and artefacts were sorted from all fractions > 500 microns and passed onto the appropriate specialists. The < 500 micron fraction was scanned for plant remains and kept for examination by the insect specialist or added to a separate sub-sample taken specifically for the recovery of insect remains and subject to paraffin flotation onto a mesh of 180 microns.

Samples thought likely or known to contain only charred plant remains and or molluscs recovered from the tunnel (SSD 5, 8, 9) were assessed during the excavation and subsequently checked in the laboratory. Samples recovered from the summit excavations and remedial works on the slope of the Hill (SSD 6 and SSD 7) were all assessed in the laboratory following completion of the excavations.

In the first instance each flot was assessed as to its contents by scanning part or all of the flot under a binocular-dissecting microscope at magnifications up to x 50. The preservation and the nature of any charred plant remains present were recorded. Notes were be made on the amount of charcoal, cereal grain, other seeds, and cereal chaff present in each flot using the following four point scale: 1= present, 2=frequent, 3=common, 4=abundant. The results of this assessment and assessments of previous work at the site were recorded on an Access database which forms part of the research archive.

Identification of all plant remains took place with reference to the modern comparative collection held at Fort Cumberland (English Heritage). Nomenclature follows Stace (1997) for wild plants and Zohary and Hopf (1994, table 3, table 5) for the cereals.

5.2 Results

5.2.1 Samples from the tunnel processed for general biological analysis.

The results are presented in Table 2 and described below in phase order.

<u>Phase 2</u>

Old Land Surface (OLS)

Sample <9815> ([4041], sub of <9434>) from OLS below mini-mound: very strong iron panning was noted in this sample. Organic material represented only about 5% of the total. Charcoal >4mm was frequent with further fragments in the greater than >2mm fraction along with occasional charred hazel nutshell fragments. Monocot stems/ leaves were present along with occasional buttercup (*Ranunculus acris/ repens/ bulbosus*) seeds, fragments of moss, and occasional grass seeds and one fragment of lesser stitchwort (*Stellaria graminea*). Only flint and a possible charred onion couch (*Arrhenatherum elatius* var *bulbosum*) rhizome were noted in the dried inorganic residue. Root remains were not observed.

Sample <9238> ([4041]) from OLS below edge of Gravel Mound: Insects were more numerous than anoxically preserved plant remains this sample. Some charcoal fragments >2mm were noted and two fragments of charred hazel nutshell. The few elder (*Sambucus* nigra) seeds recorded were fragmentary and the Caryophyllaceae seeds had lost their outer surfaces. Mite remains were present.

Sample <9821> ([4041], sub of <9435>): This sample consisted of around 90% of the sample taken from the ground surface in the vicinity of the pig teeth in the East Lateral. A few fragments of moss, some monocot stems/leaves and fragmentary elder seeds were recovered. The other remains recorded were charred: charcoal, sedge (*Carex* sp), buttercup (*Ranunculus acris/ repens/ bulbosus*), hazel (*Corylus avellana*) nutshell fragments and a possible grass rhizome.

<u>Phase 3</u>

Gravel Mound

Sample <9819> ([4153], sub of <9251>) from the main body of the Gravel Mound contained very little organic material other than a few elder seeds. Molluscs, however, were numerous.

Sample <9820> ([4166], sub of <9252>): this sample derived from the possible soil horizon which sealed the Gravel Mound in places. It was taken from directly above sample <9819>. The plant remains recovered are typical of disturbed ground and of soil seed banks. Some moss and a few monocot stems/leaves were also present. Insects were fairly frequent.

Sample <9814> ([3069], sub of <9247>): this sample came from the top of the Gravel Mound from which pit [3066] was cut. Organic material only accounted for about 1% of the total. There was poor preservation of plant remains. Moss had lost leaves and seeds of elder were only present as fragments. Charred hazel nutshell fragments and some charcoal was present, but the latter were <2mm in diameter. Molluscs are frequent with the assemblage dominated by *Vallonia excentrica*. Few insects were recorded. One earthworm egg was noted.

<u>Phase 4</u>

Mini-mound, context [4181]

Sample <9808> ([4181], sub of <9425>): This was a two litre sub-sample taken for general biological analysis. It was very rich in insects and included a tough rachis fragment from a free-threshing wheat (*Triticum* sp.) and other cereal chaff/ straw. There was a considerable woodland element, with well preserved yew (*Taxus baccata)* berries, hawthorn type (*Crateagus* type) thorns, sloe (*Prunus* spinos) stones, hazel nutshell fragments and elder seeds as well as occasional fragments of wood. Bud scales were also noted as well as occasional blackberry/raspberry (*Rubus* sp.) seeds. Presence of grassland is also indicated by the remains of sedges and other Cyperaceae along with occasional grasses, lesser stitchwort and buttercups, the latter rather poorly preserved. Weeds of disturbed ground included stinging nettle (*Urtica dioica*), blinks (*Montia fontana*) and chickweed (*Stellaria media* gp.).

Sample <9809> ([4181], sub of <9425>): a three litre sub-sample was taken for recovery of insects. The > 1mm fraction was sorted for any cereal or grass chaff prior to paraffin flotation. This sub-sample contained more wood fragments than sub-sample <9808>. The bone recovered included a little burnt bone. Worked flint was present. There were very few molluscs.

Both samples contained roughly 30% organic material.

Gully fills

Sample <9812> ([4070], sub of <9338>): this sample from the lower fill of the gully contained a few bone fragments in the dried residue, a few molluscs and two fragments of charred onion couch tuber. Only about 5% organic material was present.

Sample <9811> ([4070], sub of <9338>): this sample contained about 5% organic with buttercups, molluscs and moss frequent. Charred remains of elder and onion couch tubers were also noted.

Sample <9813> ([4173], sub of <9339>): This sample from the upper fill contained only about 5% organic material and showed varying preservation especially in relation to *Carex* spp. Lots of iron pan was present in the sample. There were no charcoal fragments greater than 1mm and molluscs were fragmentary and only present as a trace. There were a few tiny fragments of bone.

Lower Organic Mound

Sample <9200> ([4156]): this sample contained a mixture of grassland plants with a trace of taxa such as figwort (*Scrophularia* sp.) and sedges (*Carex* spp.) which might be indicative of damp ground, though species preferring drier conditions such as parsley piert (*Aphanes arvensis*) were also recorded. Moss fragments were common and green 'plant' fragments were present.

Sample <9824> ([3046], sub of <9267>): there were lumps of turf still present, following processing. Green 'plant' material and ant thoraxes were recorded along with a mixture of grassland plants which well preserved, though fragmented. A single, rather decayed fragment of *Rubus* sp. was also present.

Samples <9236> and <9237> ([4156]): Samples <9236> and <9237> were recovered from bands of clay rich and gravel rich deposits observed on the edge of the Gravel Mound. Sample <9237> was taken from a gravel band directly above the OLS, (OLS sampled as <9238>) while sample <9236> was taken from a clay rich lens above this gravel band. Both samples contained only about 1% organic material with only a few fragments of elder seeds present and ghosts of other seeds e.g. buttercups. Both samples produced charred hazel nutshell fragments and occasional charcoal fragments >2mm. The clay material is almost certainly sub-soil derived from clay with flints.

<u>Phase 5</u>

Pitting activity

Pit in West Lateral sample <9810> ([3073], sub of <9340>): a 2 litre sub-sample from sample <9340> was processed. Rare elder seeds and a single *Rubus* sp, fragments were recorded. Moss was frequent and buttercups were fairly common. Molluscs were abundant, as were ant remains. Two fragments of charcoal >2mm in diameter were recovered. There was a tiny amount of bone including burnt bone. Insect remains were common. No seeds were noted in the <500 micron fraction. Vivianite was noted during sorting of the inorganic dried fraction along with lumps of humified turf. Earthworm granules were also noted in this fraction. The material appears very similar to that retrieved from the organic mounds.

Pit in Main Tunnel sample <9244> ([3066], sub of <9244>): this sample was derived from the principle fill of this feature. Preservation was excellent in some specimens and was comparable to assemblages from the Lower Organic Mound. Organic material formed about 20% of the sample.

Sample <9823> ([3070], sub of <9246>): the contents of this sample were similar to sample <9814> taken from the top of the Gravel Mound from where the pit cut through it, but with fewer molluscs. It is possible that this sample represents subsoil rather than poor preservation.

Phase 6

Upper Organic Mound

Sample <9825> ([3083], sub of <9276>): fragments of turf were present with many roots observed in the wash-over. Earthworm granules, ant thoraxes and mites were noted in the finer fractions. A mixture of poor and good preservation was present in the plant remains recovered.

Sample <9335> ([3078]): very little organic was present in the sample, mainly, moss fragments, monocot stem/leaves and roots. Fragments of dog's mercury (*Mercurialis perennis*) were recorded along with the usual buttercups, nettles, lesser stitchwort and common chickweed. Earthworm granules were noted in the dried residue.

Sample <9375> ([3061]): this sample was taken from the Upper Organic Mound above sample <9824> in the Main Tunnel. Preservation varied but was good overall. Buttercups, nettles, monocot stem/leaf and moss were frequent. Fragments of charcoal >2mm were frequent. Speedwell (*Veronica* sp.) (speedwell) and goosefoot (*Chenopodium rubrum* type) were rare finds.

Phase 7

Further dumping layers

Sample <9822> ([3084], sub of <9320>) was the only sample processed for general biological analysis. Very few remains were recovered and these were poorly preserved.

5.2.2 Assessment of samples from the tunnel and subject to flotation

Phase 3

Old Land Surface and 'trample' layers.

None of the samples processed from underneath the chalk portion of the mound, either from the trample layers or from the clay layer, produced remains other than a few charcoal fragments.

Phases 5, 6, 7

Larger samples from pits etc subject to flotation.

The samples floated from the Phase 7 contained some remains preserved due to anoxic conditions but they were poorly preserved and widely dispersed in the deposits. Sample <9340> (pit fill [3073]) produced similar remains to the sub-sample processed for general biological analysis, though a yew seed was noted in the flot. Sample <9306> also produced remains similar to the sub- sample processed for general biological analysis.

Phase 12

Bank 5

The single sample retrieved from this bank was remarkably sterile with only occasional molluscs noted.

Phase 13.1

Ditch 1

The excavated fill was sampled in spits. None of the samples produced much material. Fragments of charcoal > 2mm were more frequent in the lower fills. Hazel nutshell fragments were also recorded in these fills. Molluscs were present in some of the flots but never in great numbers. The two stake hole fills, [3928] and [3929], sampled from the bottom of this ditch were completely devoid of remains.

Samples from a surface seen in a void above the tunnel

This was thought to be the surface of Silbury II at the time when the samples were taken. It seems to represent another organic layer high up in the mound. The two flotation samples taken from this layer, samples <9150> and <9151>, produced fragments of charcoal and fragments of uncharred elder seeds. Sample <9151> also produced a charred onion couch tuber (*Arrhenatherum elatius* var. *bulbosum*).

Phase 21.2

Atkinson backfill/ collapse from roof

The single sample processed from the backfill contained modern ants and some earthworm eggs as well as occasional molluscs. Sample <9171> from collapsed turf stack above the roof in Bay 74 contained similar material to that recorded from *in-situ* Upper Organic Mound.

Samples from the summit and slope subject to flotation (SSD 6 and 7)

Twenty-eight samples were assessed from these excavations. Almost all contained large numbers of molluscs and amphibian bone as well as small quantities of rodent and other animal bone. Charred remains including charcoal were only present in some samples, and then in only very small quantities.

Sample <9501> from a possible tree hole contained two wheat grains. Sample <9531> from pit fill [4587] produced a single naked wheat type grain and another indeterminate cereal grain. Sample <9507>, from pit [4826] produced a single *Avena* sp. (oat) grain which could come from either a wild or cultivated oat.

The results are very similar to those obtained from the 2001 excavations on the summit of the monument (see Annex 1).

5.3 Discussion

Phase 2

The Old Land Surface (OLS)

The samples processed from the OLS underneath the chalk phases of the Hill were devoid of any remains suggesting that this surface was kept very clean during construction process. The samples recovered from the OLS underneath the early phases of the Hill contained only a very small proportion of organic material. Preservation of material was generally rather poor with only elder seeds, which are notoriously durable (*c.f.* McCobb *et al* 2003, 1277) recorded consistently in the samples examined, although seeds of Caryophyllaceae, moss fragments and some monocotyledonous leaves and stems were also noted. Also of interest were the lack of roots, and the higher concentration of insects in the samples as compared to plant remains preserved due to anoxic conditions.

One explanation of this is that rather than the OLS being an intact surface still retaining a layer of vegetation it consists of a bare surface on which turves have been placed face down. Another possibility is that in some places vegetation was laid down on the surface, perhaps to increase stability, or that material was trampled in during, or prior to, construction.

Absence of root remains in the samples would support the idea that the surface is not intact. Although it is possible that these have not been preserved, given that the majority of roots present were likely to have been monocotyledonous, which are less robust than dicotyledonous roots (McCobb *et al*, 2003). The greater representation of insect remains as compared to anoxically preserved plant remains would also be consistent with idea that the surface was bare with material being laid on top or trampled in since it is possible to envisage insects being not only trapped in the vegetation but also landing on or being washed onto the bare surface and thus having a greater chance of entering the deposits.

These possibilities however require further research as part of the analysis programme. It will be necessary to study samples of the OLS from a greater number of locations and to thin slice samples so as to establish the precise level at which the different types of remains are present. For example, if root remains are found in deposits directly above the dark thin layer, interpreted as the top of the OLS, this would suggest that turves are being placed face down on a bare OLS. On the other hand a lack of roots in these deposits might suggest the deliberate laying down of vegetation on this surface. Similarly, the presence of insects and anoxically preserved plant remains well within the grey layer of the OLS would suggest the incorporation of remains during trampling, a possibility suggested by the Geoarchaeological Assessment (Section 6).

As well as remains preserved by anoxic conditions, charcoal and other charred plant remains, in particular hazel nutshell fragments, were recorded, in the samples from this deposit. While sample <9238> from beneath the edge of the Gravel Mound and sample <9815>, a sub-sample from beneath the mini-mound produced low concentrations of charred remains likely to result from an unknown number burning events up to the point of burial, sub-sample <9821>, associated with a find of pig teeth produced much larger numbers of charcoal fragments as well as other charred plant remains. This would appear to support the interpretation of this small concentration of material as a hearth, or as least a discreet deposit of rubbish from human activity. The charred hazel nutshell fragments and some of the charcoal are suitable for radiocarbon dating. Study of the reflectance of the charcoal assemblage from this sample could be used to establish whether it is derived from a domestic or wild fire.

Phase 3

Gravel Mound

Sample <9819>, from the body of the Gravel Mound, was largely devoid of remains other than molluscs. These were numerous and clearly came from short turf grassland (Section 8). This suggests that the gravel making up the mound, although probably derived from the valley bottom in the vicinity of the site, did not come from within a stream or river. It was rather dug from an area of dry land. The builders probably stripped off turf from a soil developed on this gravel to quarry it, or dug out an area of exposed gravel

Sample <9820> from a dark layer on top of the Gravel Mound appears to represent a mixture of turf, topsoil and subsoil. Plants from disturbed ground which survive well in soil seeds banks are well represented, while remains of monocots and other plant material suggest the presence of some turf. Micromorphological assessment of this layer shows that it is not a surface on which vegetation was growing but rather a mixture of topsoil and sub-soil piled together (Section 6). These results, the presence of this layer on the sloping sides of the Gravel Mound and its absence from the flat top of the Gravel Mound, suggests that this layer was deliberately laid down as a means of consolidating the side of the Gravel Mound as part of the construction process.

Sample <9814> which is described as coming from the top of Gravel Mound where pit [3066] cut through it could be described as similar to sample <9820> but with a greater amount of subsoil present. Thus it contained very little organic material with fewer fresh plant remains.

The results from this assessment show that the plant remains from the Gravel Mound and its associated layers do not merit much in terms of further analysis although full quantification and further analysis of the remains from <9820> is justified as part of providing information on the different vegetation types present within the each phase of the Hill. Other than this, the questions regarding the nature of these contexts cannot be taken further by analysis of the macroscopic plant remains (but see other sections of this report).

Phase 4

Mini-mound, context [4181]

The samples studied from the mini-mound recorded in the East Lateral as well as producing plant remains typical of grassland, contained substantial numbers of remains more associated with woodland or scrub: yew berries, sloe stones, uncharred hazel nutshell fragments and bramble seeds. The few mollusc remains that were recovered, which are all fresh, were also species associated with woodland. This context was also the only deposit to produce a wood boring beetle (Section 7, Davies pers comm.).

These samples also produced the only evidence of cereal remains from the samples examined to date. These were anoxically preserved, representing the one of the earliest occurrences of waterlogged cereal chaff remains in Britain (*cf.* Campbell and Straker 2003). Relatively large numbers of dung beetles were present in these samples (Section 7) so cereal remains could have arrived in the deposit in dung.

The presence of thistles might suggest somewhat longer grassland than that suggested by the remains from the Lower and Upper Organic Mound (see below), although these specimens could also be derived from disturbed ground or dung.

This assemblage of biological remains is strikingly different from that obtained from the other samples studied to date. While it might be interpreted as a pile of midden material it lacks the decomposer beetles that would be expected in such a deposit

(Section 7). This mound thus seems more likely to be either a pile of material brought from different locations within the landscape or possibly topsoil etc. derived from a field within cleared woodland where animals were recently grazing. Its nature suggests that it could possibly be earlier than the Lower Organic Mound, but this remains to be determined.

Full analysis of this material is merited. Furthermore, the presence of anoxically preserved cereal chaff, including a free-threshing wheat rachis means that further processing of material from this context should be undertaken as more cereal chaff may be recovered. This has the potential to add considerably to our knowledge of Neolithic agriculture.

Gully fills

Samples from the two fills of the gully separating the mini-mound from the main structure contained about 5% organic material which appears to be a mixture of remains derived from the mini-mound (sloe stones, *Rosa/Rubus* type thorn, yew berry), the OLS (onion couch tubers) and possibly the Lower Organic Mound (buttercups, *Scrophularia* sp.). As these remains are likely to be re-deposited no further work is envisaged on these deposits, apart from checking of the identifications made.

Lower Organic Mound

From observation of the Lower Organic Mound in the tunnel sides it was clear that it contained considerable amounts of topsoil, turf and subsoil derived from clay with flints (the OLS turves, context [192] etc. described by Atkinson – Whittle 1997, 16). Much smaller amounts of topsoil and turf derived from soils developed on chalk was present, along with corresponding small amounts of chalk rubble. By contrast the Upper Organic Mound contained much less material derived from clay with flints being largely made up of topsoil and chalk rubble from soils developed on chalk (see below).

This results in there being much more subsoil present in the Lower Organic Mound as it is derived from deposits that develop deeper soils. It is therefore not surprising that the concentration of plant remains and the types of remains present varied considerably between samples from this context. Thus sample <9236> was mostly subsoil, having a low organic content with only ghosts of seeds surviving along with the usual elder seed fragments.

In contrast sample <9200> consisted of topsoil and turf with seeds typical of soil seed banks, e.g. stinging nettle (*Urtica dioica*) and chickweed (*Stellaria media* gp.), recorded as well as remains typical of grassland such as buttercups, sedges and monocotyledonous stems and leaves. While the remains likely to be derived from grassland vary between being very well – preserved and rather poorly preserved, as would be expected in a turf from this environment, the small number of taxa recovered that are associated with woodland, blackberry/ raspberry (*Rubus* sp,) and dog's mercury (*Mercurialis perennis*) were all fragmentary and/or poorly preserved. This accords well with the results of the mollusc assessment where molluscs typical of short grassland were very fresh and well-preserved with shade loving molluscs and those associated with woodland battered and worn (Section 8).

Overall the remains from the Lower Organic Mound can be interpreted as coming from a grassland landscape developed following woodland clearance. Within the deposit, however, there is considerable scope for variation. Turves can only come from a limited number of environments e.g. heath and grassland, since turf *per se* does not form under woodland, neither is it present in arable fields (*cf.* van West *et al* 2001, 642). Thus we must be careful in assuming only grassland is represented in the Lower Organic Mound as areas of this context may contain material from other environments not as self-evident as the turves. Further investigation of this context needs to consider whether different vegetation types are present other than the remains of grassland and former woodland as seen in samples of individual turves (e.g. sample <9200>) by examining a number of samples of different types at different locations.

Within each individual grassland turf, however, there is the potential to investigate the length of time this grassland took to develop both with reference to the different organisms present and their condition (e.g. absence of the yellow ant, see Section 7, and fragmentary dog's mercury) and potentially through radiocarbon dating of fresh grassland plants, 'old' woodland remains and also charcoal. The assumption being that the charcoal found in the samples may well be derived the initial woodland clearance, although it may relate to an unknown number of different burning events.

<u>Phase 5</u>

Pitting activity

The principal fills of both pits appear to consist of topsoil with some turf with the remains well preserved. This indicates rapid infilling followed by rapid burial. The fill of pit [3074] (fill [3073]) has more in common with the Upper Organic Mound, principally due to the number of ant remains recovered, whereas the principal fill of pit [3067] (fill [3066]) appears more akin to the Lower Organic Mound. However, this may be an over–interpretation since the differences between the two organic mounds are very slight. Full quantification of the remains from the samples examined as part of the analysis is warranted but processing of further sub-samples to recover plant remains is not recommended.

<u>Phase 6</u>

Upper Organic Mound

The results from the Upper Organic Mound were broadly similar to those from the Lower Organic Mound. There were, however, some notable differences.

Charred hazel nut shell fragments were only recorded in samples from the Lower Organic Mound. This could reflect that fact that the Upper Organic Mound is largely made up of materials derived from chalk bedrock as opposed to clay with flints and that the event/s or activity/ies that lead to the preservation of hazel nutshell through charring did not take place on the chalk but only within the areas of clay with flints.

Another difference between the two contexts is the presence of blinks (*Montia fontana*) in the Upper Organic Mound and its absence from the Lower Organic Mound. Since blinks is associated with damp habitats, this might be indicative of a rising water table in the area following construction of the Lower Organic Mound. Although the presence of other taxa which are associated with well drained soils; parsley piert (*Aphanes arvensis*) in the Upper Organic Mound and thyme-leaved sandwort (*Arenaria serpyllifolia*) in the Lower Organic Mound might argue against there being any change.

The investigation of the differences and similarities between the two organic mounds should form one of the questions for the analysis programme.

<u>Phase 7</u>

Further dumping layers

Given the poor preservation and low concentration of remains in these layers no further study of biological remains from these deposits is envisaged. The findings of this assessment contradict the results obtained from the cores taken as part of the seismic survey (Canti *et al.* 2004). This is almost certainly because the layers interpreted as part of capping layers in these cores, are in fact part of the Upper Organic Mound. This can be investigated during the analysis phase of the project by plotting the position of the cores and their stratigraphy in 3-D and seeing if these deposits fall within the likely extent of the Upper Organic Mound.

The dark layer sampled as <9320> ([3084], sub <9822>) appears to be similar in nature to the dark layer found sealing parts of the Gravel Mound (layer [4166]). It appears to consist of a mixed subsoil and topsoil and was possibly laid down as a way of consolidating the surface of the monument at this point. The dark layer ([4169]) found within the Upper Organic Mound and investigated by Matt Canti as part of this assessment (Section 6) also appears very similar to layer [3084]. This suggests that the separation of these further dumping layers and the Upper Organic Mound into different phases may not be justified, something that will require consideration in the analysis phase.

<u>Phases 9 to 17</u>

Later phases of the Hill – banks, ditch filling etc.

No further work is required on samples from the banks, ditch infills, or trample layers from the later phases of the Hill as very few biological remains were recovered from any of the samples taken. The only exception to this was the samples from a surface seen in a void above the tunnel, thought to represent the surface of Silbury II when taken. This layer seems to represent another organic layer high up in the mound. The two samples (<9150> and <9151>) produced small assemblages of charred plant remains and charcoal as well as fragments uncharred elder seed. These samples do not require further analysis but do contain remains suitable for dating.

<u>Phase 18</u>

Medieval activity

A small number of cereal remains were noted in samples from medieval features on the summit of the Hill. No further work is recommended apart from the inclusion of a short summary paragraph on this material for the final report.

*Table 2: Results of the general biological analysis of samples, specifically plant remains from the investigations carried out at Silbury Hill in 2007 (OLS = Old Land Surface, LOM = Lower Organic Mound, UOM, Upper Organic Mound, + = 1-5, ++ 6-25, +++26-100, ++++ = >100. * = presence, () = uncertain identification, c = item preserved through charring. Use of* ***bold*** *type for charcoal indicates that fragments >2mm in diameter were present. Shaded columns represent sub-samples subject to paraffin flotation.*

sample	9815	9238	9821	9819	9820	9814	9808	9809	9811	9812	9813	9200	9237	9236	9824	9817	9823	9810	9335	9825	9375	9822
sub-sample of	9434	N/A	9435	9251	9252	9247	9425	9425	9338	9338	9339	N/A	N/A	N/A	9267	9244	9246	9340	N/A	9276	N/A	9320
Context number	4041	4041	4041	4153	4166	3069	4181	4181	4070	4070	4173	4156	4156	4156	3046	3066	3070	3073	3078	3083	3061	3084
Context	OLS	OLS	OLS	Gravel Mound	?pos soil	Gravel Mound	Mini mound	Mini mound	1st gully fill	1st gully fill	2nd gully fill	LOM	LOM?	LOM	LOM	pit	pit	pit	UOM	UOM	UOM	clay cap
Volume in litres	3	2	3.8	2	2	2	2	3	2	3	2	2	1.2	1.4	2	2	2	2	2	2	2	2
Weight in kg	+/-3	1.984	3.579	1.916	1.916	2.187	2.236	3.065	2.078	3.413	2.141	2.089	1.366	1.506	1.966	1926	2.444	2.135	1.91	2.206	2.313	2.093
Phase	2	2	2	3	3	3	4	4	4	4	4	4	4	4	4	5	5	5	6	6	6	7
Taxus baccata L.							+			+								*				
Ranunculus acris/ repens/ bulbosus	+		+ (?+c)				(+)		++	++	+	++	(+)		+	++		+++	+	+	++	+
Urtica dioica L.					+		+			+		++			+	+			+	+	++	
Corylua avellana (nutshell fragment)	+c	+c	+c			2c	+				+		+c	+c	+c							
Chenopodium rubrum type																					+	
Montia fontana L.					+		+												+		+	
Arenaria serpyllifolia L.																			+			
Stellaria media gp.							+			++	+	+			+	++		++	+	+	+	
S. graminea L.	+				+		+		+			+			++	+		+	+	++	+	
Cerastium sp.																		+			+	
Caryophyllacea indet.		++												+	+	++						
Polygonum aviculare agg.												+						+		+	+	

sample	9815	9238	9821	9819	9820	9814	9808	9809	9811	9812	9813	9200	9237	9236	9824	9817	9823	9810	9335	9825	9375	9822
sub-sample of	9434	N/A	9435	9251	9252	9247	9425	9425	9338	9338	9339	N/A	N/A	N/A	9267	9244	9246	9340	N/A	9276	N/A	9320
Context number	4041	4041	4041	4153	4166	3069	4181	4181	4070	4070	4173	4156	4156	4156	3046	3066	3070	3073	3078	3083	3061	3084
Context	OLS	OLS	OLS	Gravel Mound	?pos soil	Gravel Mound	Mini mound	Mini mound	1st gully fill	1st gully fill	2nd gully fill	LOM	LOM?	LOM	LOM	pit	pit	pit	UOM	UOM	UOM	clay cap
Volume in litres	3	2	3.8	2	2	2	2	3	2	3	2	2	1.2	1.4	2	2	2	2	2	2	2	2
Weight in kg	+/-3	1.984	3.579	1.916	1.916	2.187	2.236	3.065	2.078	3.413	2.141	2.089	1.366	1.506	1.966	1926	2.444	2.135	1.91	2.206	2.313	2.093
Phase	2	2	2	3	3	3	4	4	4	4	4	4	4	4	4	5	5	5	6	6	6	7
Polygonaceae indet.										+					+							
Salix sp. (bud)							+			+												
Brassiceae indet.							+															
Rubus section *Glandulosus*							++															
Rubus sp.							+								+			+				
Rubus/ *Rosa* type (thorn)									+													
Aphanes arvensis L.												+										
Prunus spinosa L.							+		+		+											
Malus sylvestris L.									(+)													
Crateagus sp. (stone)										+												
Prunus/ *Crateagus* type (thorn)							+			+												
Trifolium type (flower)							+		(+)						+			+		+		
Mercurialis perennis L.												+							+	+		
Linum catharticum L.																+						(+)
Lamiaceae (large) indet.							+		+			+			?+							

sample	9815	9238	9821	9819	9820	9814	9808	9809	9811	9812	9813	9200	9237	9236	9824	9817	9823	9810	9335	9825	9375	9822
sub-sample of	9434	N/A	9435	9251	9252	9247	9425	9425	9338	9338	9339	N/A	N/A	N/A	9267	9244	9246	9340	N/A	9276	N/A	9320
Context number	4041	4041	4041	4153	4166	3069	4181	4181	4070	4070	4173	4156	4156	4156	3046	3066	3070	3073	3078	3083	3061	3084
Context	OLS	OLS	OLS	Gravel Mound	?pos soil	Gravel Mound	Mini mound	Mini mound	1st gully fill	1st gully fill	2nd gully fill	LOM	LOM?	LOM	LOM	pit	pit	pit	UOM	UOM	UOM	clay cap
Volume in litres	3	2	3.8	2	2	2	2	3	2	3	2	2	1.2	1.4	2	2	2	2	2	2	2	2
Weight in kg	+/-3	1.984	3.579	1.916	1.916	2.187	2.236	3.065	2.078	3.413	2.141	2.089	1.366	1.506	1.966	1926	2.444	2.135	1.91	2.206	2.313	2.093
Phase	2	2	2	3	3	3	4	4	4	4	4	4	4	4	4	5	5	5	6	6	6	7
Plantago cf. *major* L.										+												
Scrophularia sp.										(+)		+										
Veronica sp.																					+	
Euphrasia/ *Odontites* sp.									+												(+)	
Galium cf. *aparine* L.								*														
Sambucus nigra L.	+	+	+	+	+	+	+++		1c	++	+		+	+	+	+	+	+		+	+	+
Cirsium sp.										+												
Carduus/ *Cirsium* sp.							++		+	++												
Taraxacum sp.								*														
Carex spp.			+c		+		++		+	+	+	++							+	+		
Cyperaceae indet.							+															
Arrhenatherum Elatius var. *bulbosum*(tuber) (Willd.)St-Amans	1c								1c	2c		+c										
Poaceae indet.	+	+			+					+	+	+			+	+	+		+	+	+	
Poaceae indet. (chaff)							++	*			+							+	+			
Poaceae indet. (rhizome)			+c										+c									
Monocot stem/leaves	+		+		++					++	+++	++			++	+			+++	+++	+	

sample	9815	9238	9821	9819	9820	9814	9808	9809	9811	9812	9813	9200	9237	9236	9824	9817	9823	9810	9335	9825	9375	9822
sub-sample of	9434	N/A	9435	9251	9252	9247	9425	9425	9338	9338	9339	N/A	N/A	N/A	9267	9244	9246	9340	N/A	9276	N/A	9320
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Context	OLS	OLS	OLS	Gravel Mound	?pos soil	Gravel Mound	Mini mound	Mini mound	1st gully fill	1st gully fill	2nd gully fill	LOM	LOM?	LOM	LOM	pit	pit	pit	UOM	UOM	UOM	clay cap
Volume in litres	3	2	3.8	2	2	2	2	3	2	3	2	2	1.2	1.4	2	2	2	2	2	2	2	2
Weight in kg	+/-3	1.984	3.579	1.916	1.916	2.187	2.236	3.065	2.078	3.413	2.141	2.089	1.366	1.506	1.966	1926	2.444	2.135	1.91	2.206	2.313	2.093
Phase	2	2	2	3	3	3	4	4	4	4	4	4	4	4	4	5	5	5	6	6	6	7
Indeterminate seed					+																	
Triticum sp. Tetraploid free-threshing rachis							1															
Cereales indet. (chaff)							+															
bone		+		+	+			++			+		+				+	+				
burnt bone								+		+												
anthers															+							
bud scales					+		+		+		+					+						
Cenococcum sp.						+	++				+		+		++		++			++	+	++
charcoal	++	+	+++	++	+	++	+		+	+	+	+	+	+	++		+	+		+	++	+
earthworm egg			+	(+)		+							+	+	+	++	+			+	+	
Earthworm granules					*											*		*		*		
green plant					*							*			*			*	*	*	*	*
molluscs		++		+++	+++	+				+	+		++	+	+	++++	++	++			+	
moss	+		+		+++	+	++		++	++		++++			++	+++	+	++	++	+	++	+
insects +	+	++			+++	+	++++	++++	++	++	+	+	(+)	+	++	++	+	+++		++	++	+
wood						+			++	+	++	+					+	+		+		+
Charred mouse dropping			?+																			

ANNEX 1

Evaluation of the charred plant remains and charcoal from CfA Excavations at Silbury Hill, Wiltshire (661)

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The 2001 Centre for Archaeology (CfA) excavations at Silbury Hill included collection of samples from all contexts excavated. Three forms of environmental sampling were carried out during excavation: 1) soil samples from on-site dry sieving, 2) soil samples for bulk processing (i.e. general biological samples) and 3) column samples for recovery of molluscs. This evaluation addresses the charred plant remains and charcoal recovered from on-site dry sieving or bulk soil samples. The number of bulk soil samples and dry-sieved sampled collected and a list of the material retained from these sampling programmes is summarised in Annex Table 1.

Fieldwork and laboratory method

Where homogenous layers were present, the layer was divided into 1m^2 grid squares and a 30 litre whole earth sample was collected from alternate and opposing grid squares. In circumstances where it was possible to collect more than 30 litres of soil, additional soil was collected.

Soil samples that were dry-sieved on site by the excavators were sieved over an 8 mm mesh. An environmental assistant or supervised volunteer processed all bulk soil samples using water flotation. The flots (the material which floats) were sieved to 0.25 mm and the heavy residues (the material which does not float) were washed over a 0.5 mm mesh sieve, and both were air-dried. Supervised volunteers sorted 100% of the >4mm fraction of the heavy residues by eye, under the supervision of Gill Campbell or Wendy Smith. With the exception of one sample (630) the <4 mm fraction was not sorted during this stage in the post-excavation programme. One-third of the 2-4 mm fraction of the heavy residue for sample 630, however, was sorted and is reported here. With the exception of two samples (513 and 524), all dry sieved samples were sorted by Wendy Smith. The flots were rapidly scanned by Wendy Smith, using a standard low-power binocular microscope, at a magnification of x12. The results for the bulk processed soil samples presented here are based on both the heavy residues and the flots.

Results

The results for the dry-sieved soil samples are presented in Annex Table 2 and the results for the bulk soil samples are presented in Annex Table 3.

Discussion

The sampling programme implemented at Silbury Hill (661) had two main aims:

1. To determine if interpretable charred plant remains (including charcoal) were present.
2. To determine if sufficient quantities of charcoal survived to support a dating programme.

It is clear that the sampling programme has not produced assemblages of charred plant remains (including charcoal) that are of interpretable value. There are also only a few samples (520, 603, 619 and 620) which have produced small quantities of charcoal.

Only two charred seeds were recovered. A free-threshing wheat (*Triticum* sp.) grain was recovered from sample 619 (context 9 – a pit fill dating to the 11th century AD or earlier) and an indeterminate caryopses of either a large wild grass or a cereal was recovered from sample 630 (contexts 10/11 – layers against the wall).

Most samples contained modern insects, root matt, worms and worm casts, which suggests that these contexts are likely to contain modern contamination, which may well include charred plant remains. As a result, it is not recommended that this material is used for the dating programme at Silbury Hill (661).

Conclusion

The sampling programme from Silbury Hill (661) has not produced any assemblages of charred plant remains (including charcoal) that are of interpretable value. Given the large quantity of modern contaminants (insects, roots, worms, etc) in these samples, the antiquity of the charred plant remains recovered is somewhat in doubt. As a result, it is not recommended that the charred plant remains are used in the dating programme.

Annex Table 1: Record of samples collected and material stored from Silbury Hill (661)

Dry-sieved Samples

Total Number of Samples Collected	Sample Numbers Used	Material Retained	Box Number	Samples Numbers included in Box
21	501-506, 512-524 and 530	Charcoal	2 (Standard Box)	520

Bulk Soil Samples

Total Number of Samples Collected	Sample Numbers Used	Material Retained	Box Number	Samples Numbers included in Box
14	602-603, 606, 611, 614-615, 618-624 and 630	Flots	2 (Standard Box)	602-603, 606, 611, 614-615, 618-624 and 630
		Charcoal (>4mm fraction of Heavy Residue)	2 (Standard Box)	603, 619 and 620
		Representative sub-sample molluscs (>4mm fraction of Heavy Residue)	2 (Standard Box)	630
		Unsorted <2 mm fraction and 66% 2-4 mm fraction of heavy residue	6 (Skull Box)	
		Unsorted <4 mm fraction of heavy residue	3 (Standard Box)	614, 615, 619, and 620
		Unsorted <4 mm fraction of heavy residue	4 (Standard Box)	602, 6023, 606, and 611
		Unsorted <4mm fraction of heavy residue	5 (Standard Box)	621, 622, 623 and 624

Annex Table 2: Evaluation of charred plant remains and charcoal from Silbury Hill (661) dry-sieved samples.

Sample	Context	Sample Vol. (L.)	Charred plant remains	Molluscs (land snails)	Animal bone	Charcoal
501	2	90	-	6	7	-
502	2	60	-	10	4	-
503	2	90	-	ca. 40	ca. 30	-
504	2	130	-	11	4	-
505	2	120	-	ca. 100	ca. 50	-
506	2	100	-	14	ca. 50	-
511	8	70	-	4	ca. 50	-
512	8	160	-	4	ca. 50	-
513	8	90	Sample possibly sorted on site. No evaluation form filed.			
514	8	140	-	12	3	-
515	8	70	-	21	ca. 100	-
516	8	60	-	15	7	-
517	14	140	-	14	55	-
518	14	80	-	20	25	-
519	9	120	-	3	1	-
520	4	70	-	8	5	□
521	4	70	-		2	-
522	5	60	-		18	-
523	4	60	-	8	ca. 40	-
524	12	40	Sample possibly sorted on site. No evaluation form filed.			
530	10/11	170	-	2	-	-

*With the exception of samples 513 and 524, all other dry-sieved samples were sorted by Wendy Smith at CfA.

Annex Table 3: Evaluation of charred plant remains and charcoal from Silbury Hill (661) bulk soil samples.

				FLOT				HEAVY RESIDUE			
Sample	Context	Sample Vol. (L.)	Flot Vol. (ml)	Charred plant remains	Molluscs (land snails)	Animal bone	Charcoal	Charred plant remains	Molluscs (land snails)	Animal bone	Charcoal
602	2	29	250	-	++++	+	+	-	N/R	***	-
603	2	26.5	200	-	++++	-	+	-	N/R	****	*
606	2	27	300	-	++++	+	-	-	N/R	***	-
611	8	27	300	-	++++	++	-	-	N/R	***	-
614	8	26.5	250	-	+++	+	-	-	N/R	****	-
615	8	29.5	300	-	++++	+	+	-	N/R	***	-
618	14	31.5	300	-	++++	-	+	-	N/R	***	-
619	9	48.25	275	1 charred free-threshing wheat grain	++++	++	+	-	N/R	****	*
620	4	31	105	-	++++	+	+	-	N/R	***	*
621	4	25.5	80	-	+++	+	+	-	N/R	**	-
622	5	27.5	100	-	+++	++	-	-	N/R	***	-
623	4	28.5	100	-	++++	+	-	-	N/R	***	-
624	12	28	20	-	++	+	+	-	N/R	***	-
630[1]	10/11	87.5	100	1 charred cereal/ Lg. grass	++++	++	+	-	N/R	****	-

[1] In all cases except sample 630, 100% of the >4mm fraction of the heavy residue was sorted for ecofacts and artefacts.

In sample 630, 100% of the >4 mm fraction and 33% of the 2-4 mm fraction of the heavy residue were sorted.

Key to symbols used:

□ = present
- = not observed
N/R = not recovered whilst sorting, although present in all samples
+ = < 10 items present
++ = 10 – 50 items present
+++ = 50 – 100 items present
++++ > 100 items present
* = 1-3 items
** = 4-10 items
*** = 11-50 items
**** = >50 items

6 GEOARCHAEOLOGICAL ASSESSMENT

M. G. Canti

6.1 Introduction

As a result of the tunnel works in 2007/8, three main geoarchaeological research questions need to be addressed.

1. The formation process of the old land surface.
2. The possible turf line or topsoil band on the North wall of the East Lateral.
3. The nature of the dark layer on top of the gravel core.

An assessment of the samples taken for each of these questions is presented below. The approach follows generally the guidelines of Canti (1996), except for the anomalous completion of particle size analysis on the old land surface samples, which was needed to substantiate the case for experimental work and is reported in full. All micromorphology blocks have been impregnated and are therefore stable.

6.2 The formation process of the Old Land surface

Throughout the tunnels, a relatively stone-free grey clay layer was found on the Old Land Surface, at the junction between the chalk overburden and the underlying clay with flints (Plate 29). It was as little as 30mm thick in some places but gradually thickened downhill (towards the centre of the mound) and was as much as 100mm thick elsewhere. It mostly had a smooth interface with the chalk above it, but also sometimes showed irregular upper surfaces (Plate 30).

Plate 29: The grey clay layer at Bays 46 and 39

Plate 30: Irregular upper surfaces of the grey clay layer around Bays 39 - 46

The grey clay layer usually had a sharp interface with the underlying clay-with-flints, sometimes including a marked gravelly band. Variants on this basic morphology were found in all the main and lateral tunnel exposures, and it is clearly not simply a modified natural soil. It represents the result of some process acting on the land surface before construction.

In order to see comparative profiles, soils were examined on some low slopes of a nearby farm (North Farm, Overton), where unmapped shallow clay-with-flints frequently forms the subsoil. The profiles (Plate 31) generally showed between 0.15 and 0.3m of stone-free silty clay loams over a stony clay subsoil which gradually merges into orange-brown clay-with-flints at about 0.5m depth. When considering these profiles as analogues for the pre-construction soil on the Silbury spur, we must allow for 4000 years less soil development, and for colluvial accumulations on the modern soils. However, even with fairly generous assumptions, it cannot be argued that a thin layer of grey clay such as we see on Plates 29 and 30 could simply be a compressed version of these types of soils.

(a) (b) (c)

Plate 31: Soil profiles on clay-with-flints from North Farm, Overton, 3 km east of Silbury Hill (scale units are 0.1m). Profiles (b) and (c) were on slopes; (a) was on an interfluve

6.2.1 Sampling

Sampling for scientific tests on the Old Land Surface was carried out at 14 stations along the whole length of the tunnels. Each sample station consisted of matched Kubiena tins (for micromorphology) and bulk samples of the whole stratigraphy. Two typical sample stations are shown on Figure 21 and Plate 32. The possibility of alluvium being actively placed on the clay-with-flints layer was also considered, and 4 samples of the alluvium from 0.2m depth around Silbury were collected.

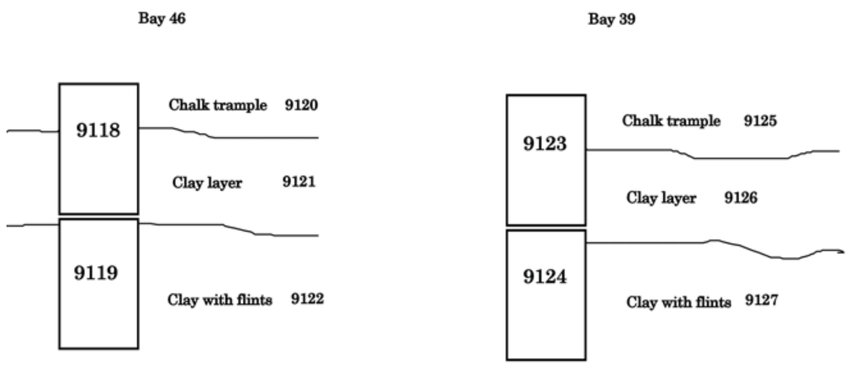


Fig 21: Schematic view of two typical sample sets from the Old Land Surface

Plate 32: Photographs of the two sampling points shown in Figure 21

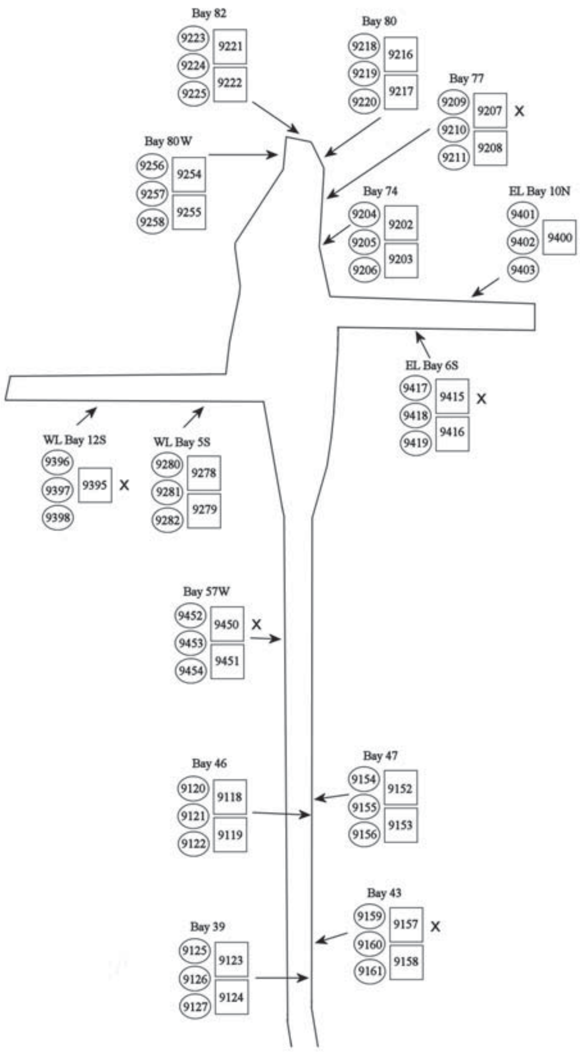


Fig 22: Tunnel plan showing all 14 stations where sample groups (as above) were taken of the Old Land Surface. Boxes marked X are thin sections used in this assessment

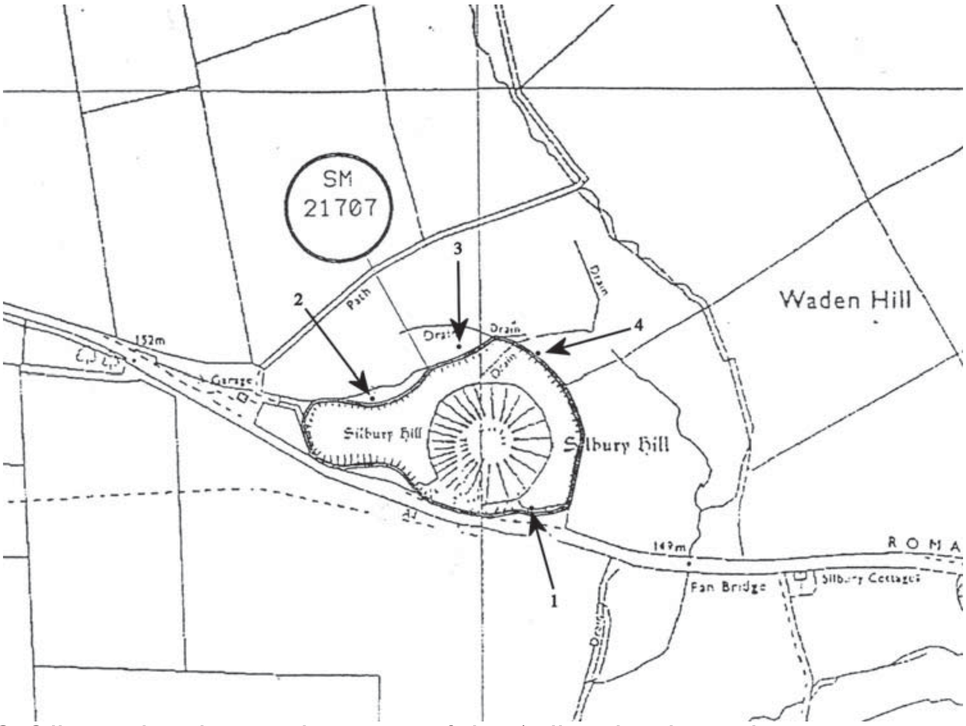


Fig 23: Silbury plan showing locations of the 4 alluvial soil samples

6.2.2 Particle Size Analysis

Particle size analysis has now been carried out on all the grey clay and clay-with-flints samples from each station (e.g. 9121/9122 and 9126/9127 in Figure 21) and the 4 alluvial samples. The results are presented on Figure 24.

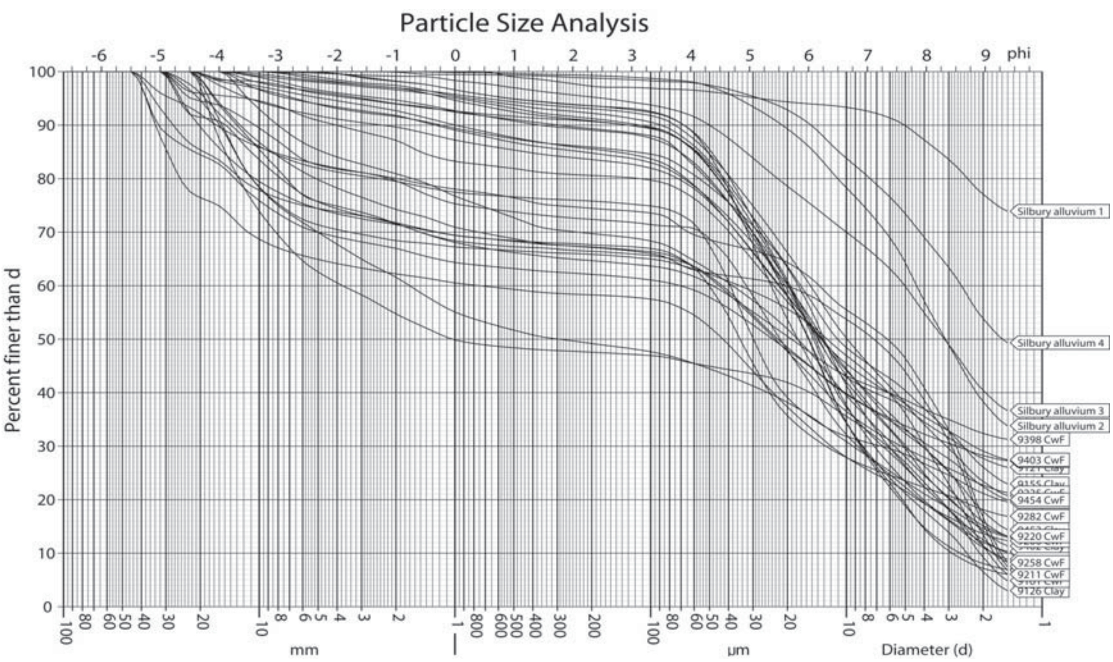


Fig 24: Particle size analyses of all samples of the clay layer, clay-with-flints and alluvium.

It is immediately apparent that none of the curves are anything like the alluvium. In addition, microscopic analysis of the silt fraction showed the alluvium to consist of large amounts of calcite (in addition to the clay), whereas the grey clay layer's silt fraction is formed mostly of quartz. The alluvium is therefore discounted as an origin for the clay layer.

The remaining curves show high variability in the coarse end of the spectrum, especially where large flints did or did not get included in the sample. These flints are essentially random contents of the clay-with-flints deposit, and do not have any implications for Holocene processes. The variability can therefore be usefully constrained by removing the stone content (> 2 mm) and recalculating the curves (Figure 25).

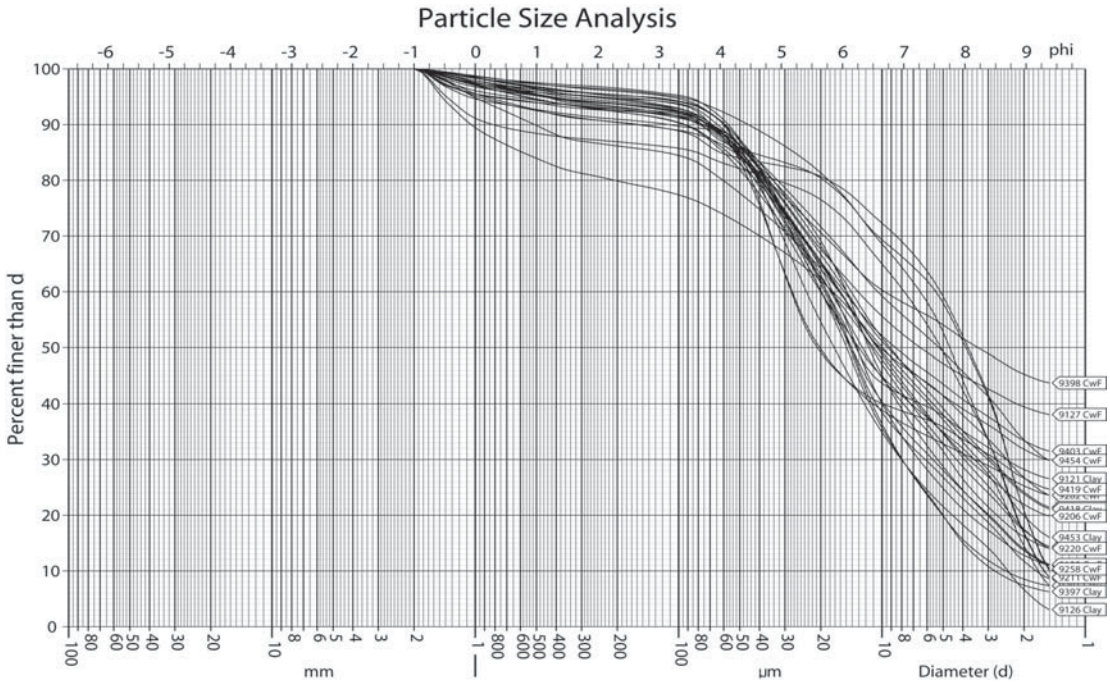


Fig 25: Particle size analyses of <2 mm fraction all samples of the grey clay layer and clay-with-flints

This adjustment shows that once the stone content is removed, there is a strong similarity amongst a large proportion of the curves. It seems likely, therefore, that the thin grey clay layer is a product of the fine fraction of the clay-with-flints. If the two types are plotted separately, the group differences can be more clearly seen (Figures 26 and 27).

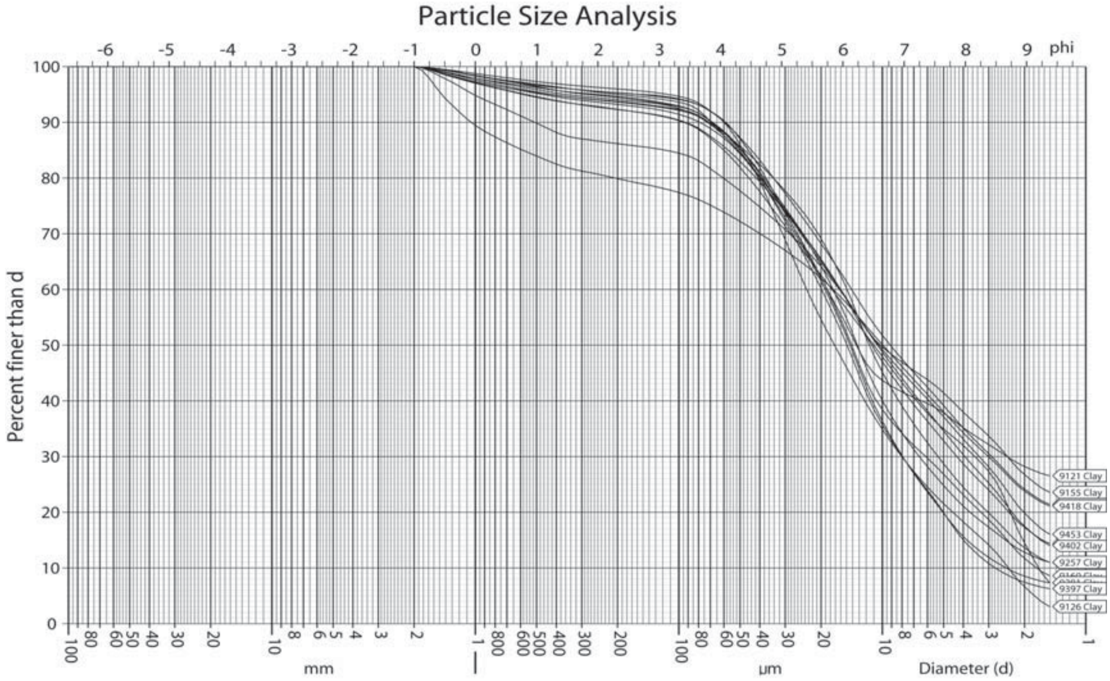


Fig 26: Particle size analyses of < 2 mm fraction all samples of the grey clay layer

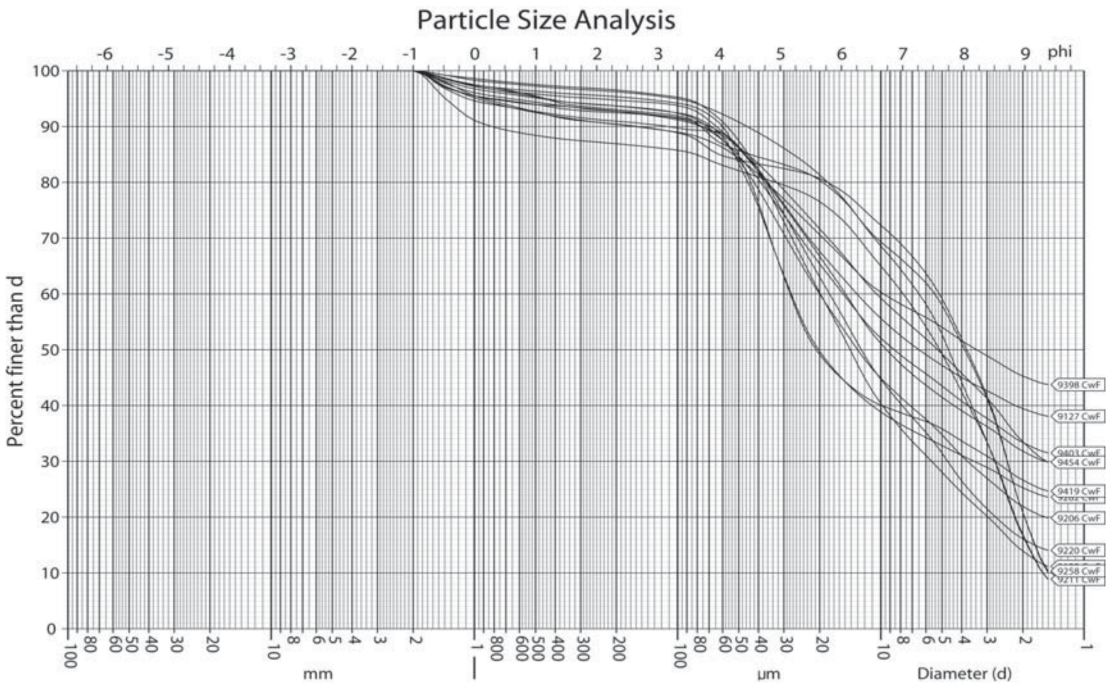


Fig 27: Particle size analyses of < 2 mm fraction all samples of the clay-with-flints

Although there is wide variation, the main difference visible in these plots is that the clay (<2µm) content of the grey clay samples is generally lower than the clay-with-flints, and the silt content is higher. In order to help determine what processes might have led to this transformation, means were calculated of the 14 clay-with-flints samples and the 14 grey clay samples. The results are shown on Figure 28.

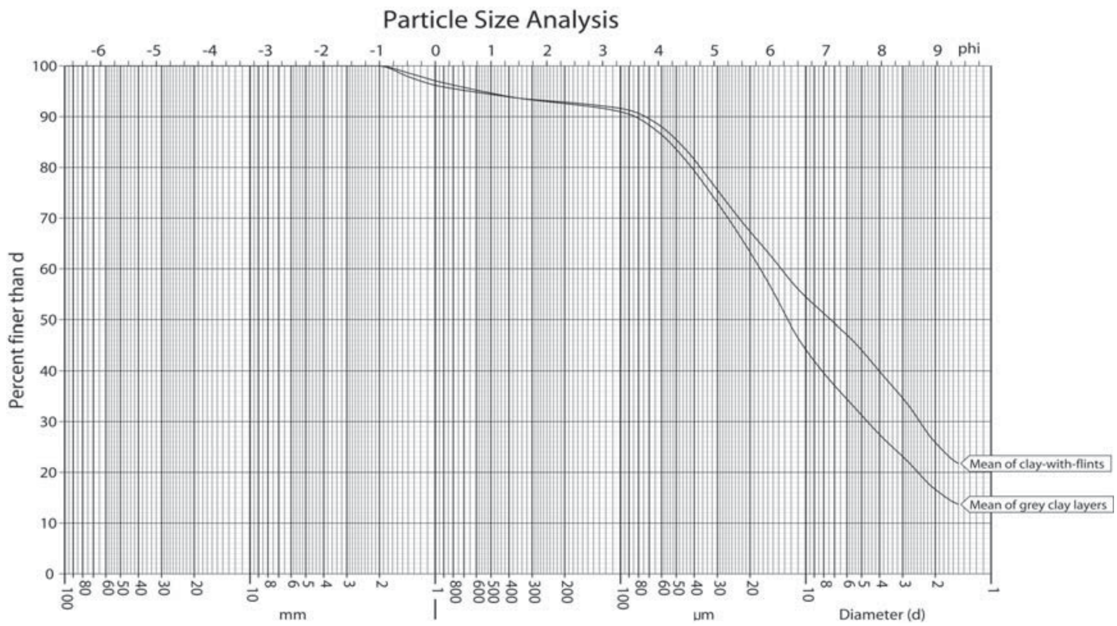


Fig 28: Mean particle size analyses of <2 mm fraction of the grey clay layer and the clay-with-flints

Using these mean values, we can say that, roughly-speaking, the grey clay layer could be derived from the clay-with-flints if most of the stones >2mm were removed, and the clay content reduced by 10%.

6.2.3 Micromorphology

For the assessment, all the Kubiena boxes were impregnated, and 5 out of the 14 micromorphology stations have been selected for study (see Figure 22). In each case the thin section showing the main Old Land Surface features was scanned, and a brief account of what can be seen is given below.

Main Tunnel, Bay 43E, sample <9157>

The sample in its field position is shown in Plate 33. A pronounced example of the thin grey clay layer is present in the section and both the top and bottom of this layer are contained within slide <9157>.

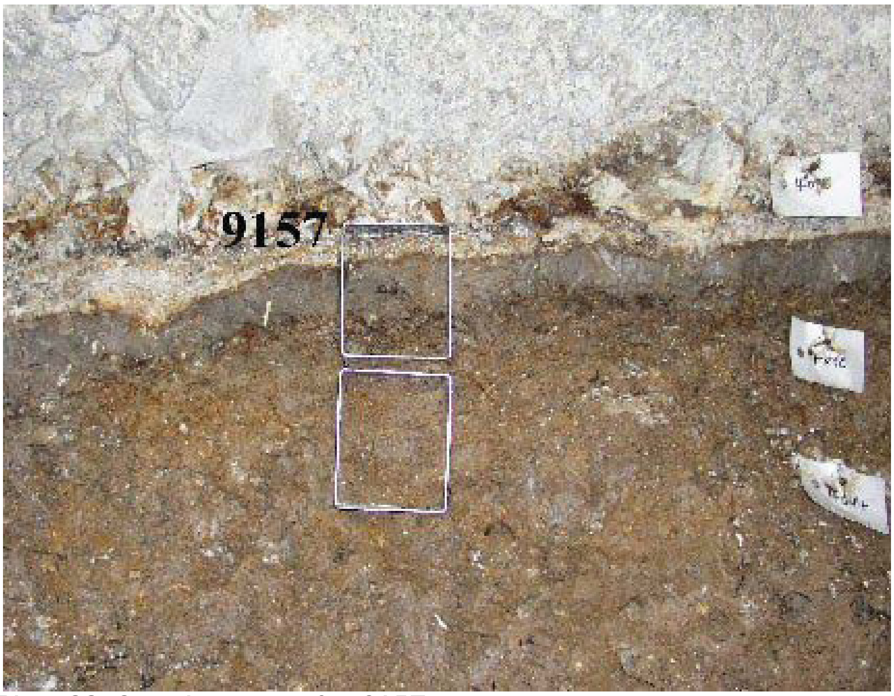


Plate 33: Sampling point for 9157

The grey clay layer is about 0.35m thick and the topmost part is characterised by a clear double line of iron staining (Plate 34). The upper line is about 1 – 2mm thick and can be seen under high magnification to be composed of many fine lines and lenses of iron, giving the strong impression of multiple layers of impregnated plant matter (Plate 35). The lower line is more diffuse and is made up of organic-stained matrix material rather than individual lines.

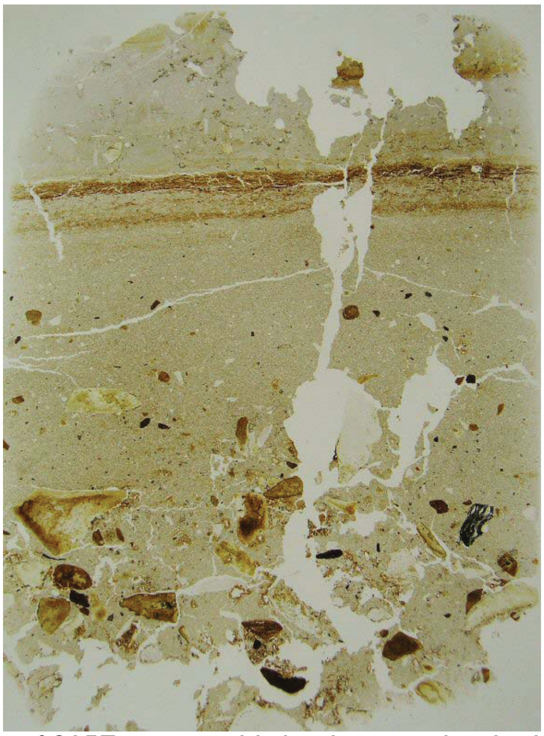


Plate 34: Whole slide of 9157 in natural light showing the double line of iron staining

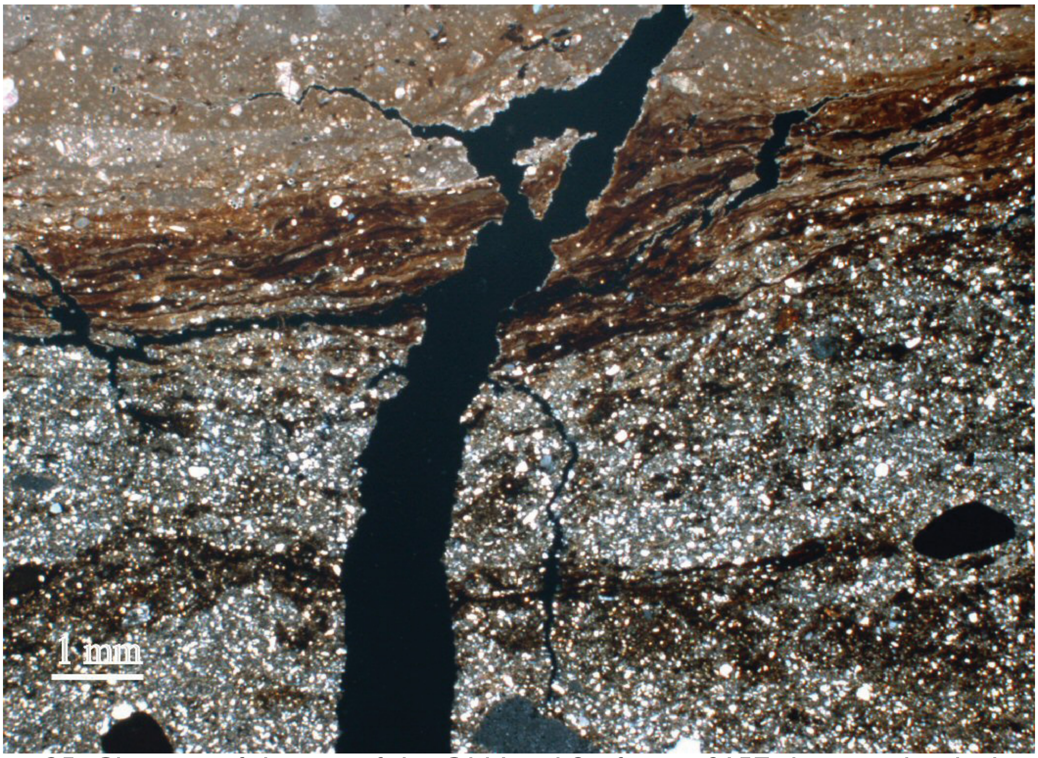


Plate 35: Close up of the top of the Old Land Surface in 9157 showing the thick upper line of iron staining clearly made up of individual iron/organic matter lines or lenses and the less pronounced lower line made up of organic matter impregnating the matrix (cross-polarised light)

Main Tunnel, Bay 57W, sample <9450>

The sample tin of <9450> is shown in Plate 36 and the whole slide in Plate 37. The upper part of the grey clay layer shows marked horizontal layering picked out in dark stained lines. When these are examined at high magnification (Plate 38), they are clearly pure iron and manganese features, but resemble mineralised plant remains at a few points.

Plate 36: Sampling point for 9450


Plate 37: Whole slide of 9450

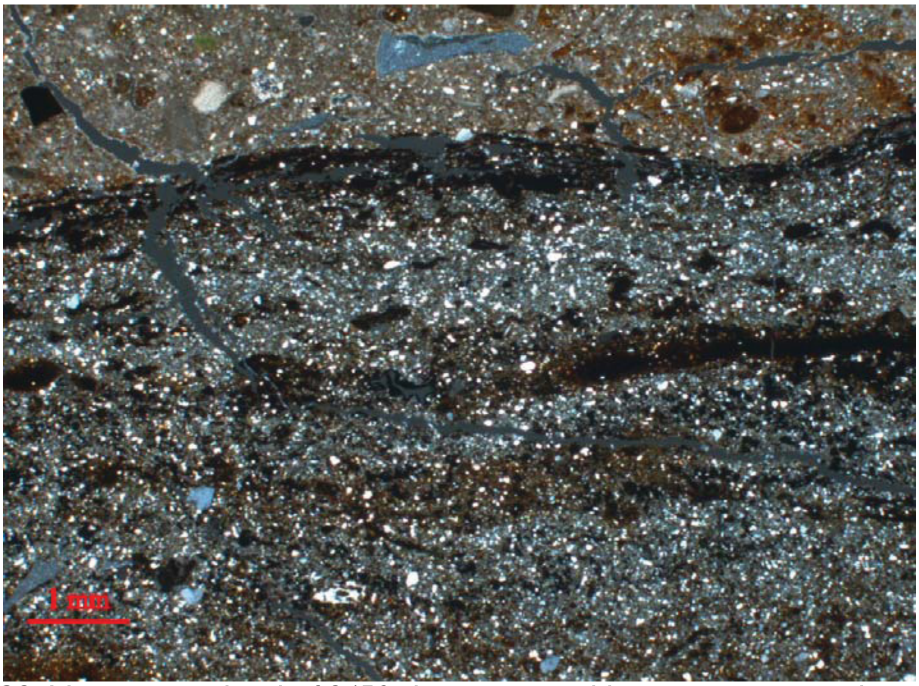


Plate 38: Microscopic detail of 9450 showing typical layering in cross polarised light

East Lateral, Bay 6S, sample <9415>

The grey clay layer at <9415> contains significant banding on a macroscale (see Plate 40) but when examined microscopically, this is entirely composed of stronger or weaker areas of staining. The layout of this staining is, however, suggestive of an original plant source.

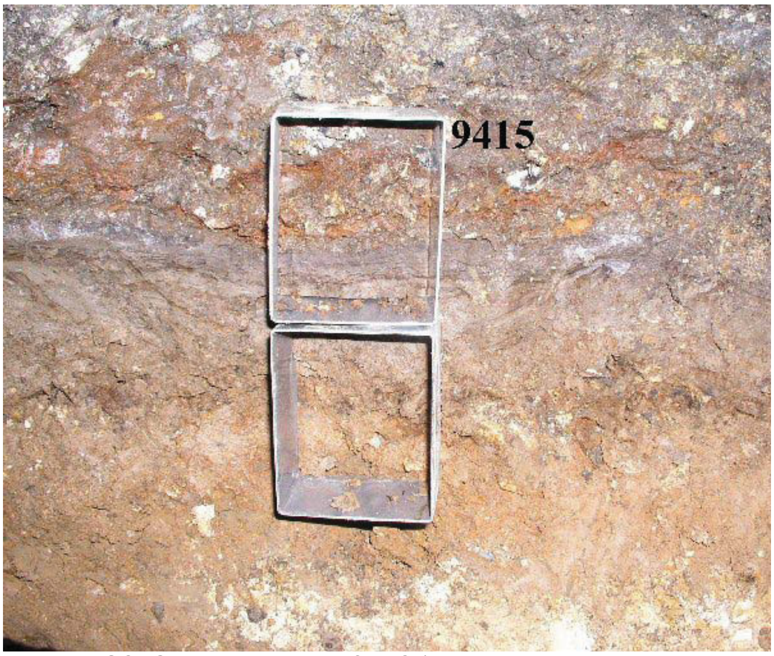


Plate 39: Sampling point for 9415

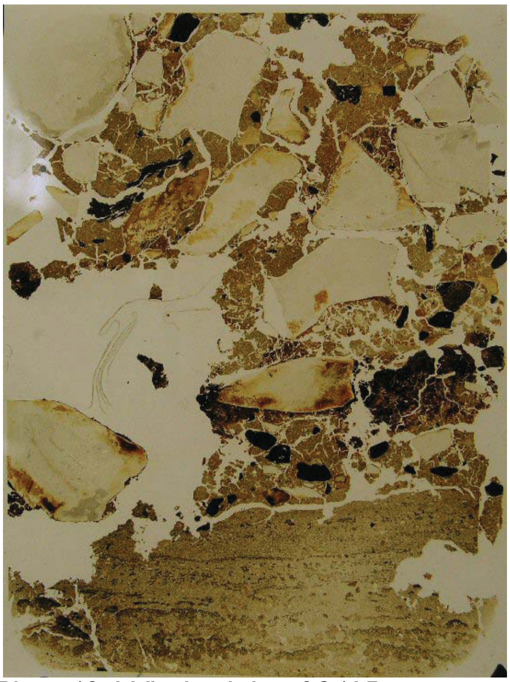


Plate 40: Whole slide of 9415

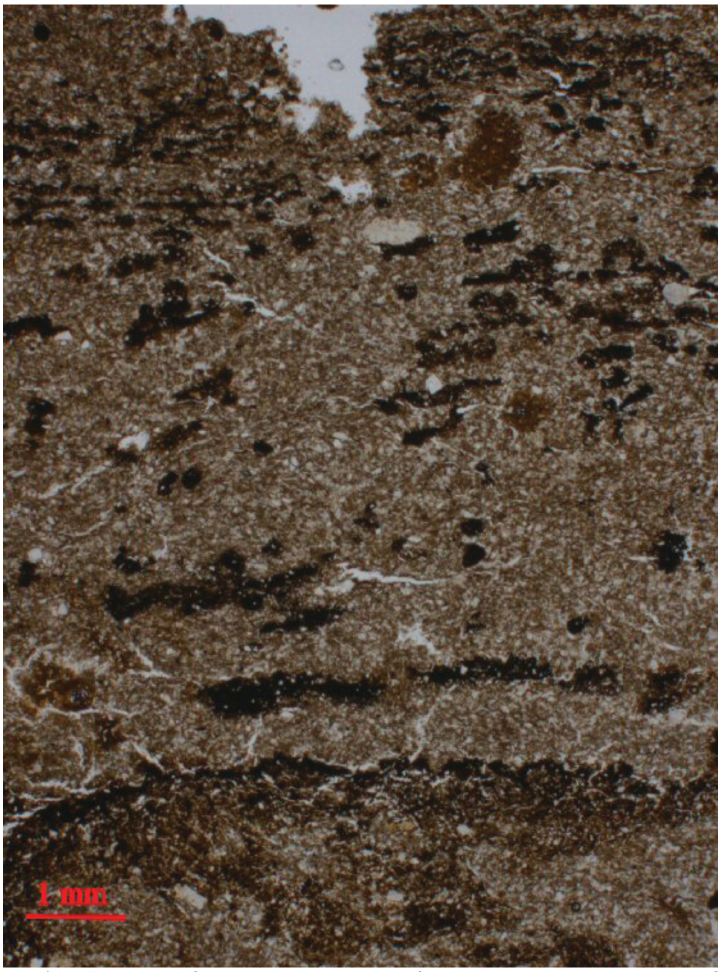


Plate 41: Detail of the layered iron/manganese staining in 9415

West Lateral, Bay 12S, sample <9395>

A pronounced dark area is visible at the top of the grey clay layer on the left hand side (Plates 42 and 43). This resembles plant remains at moderate magnification (Plate 44), and at high power details of fibres can be clearly seen (Plate 45). Other parts of the grey layer also contain typical mottling and iron bands (Plate 46).

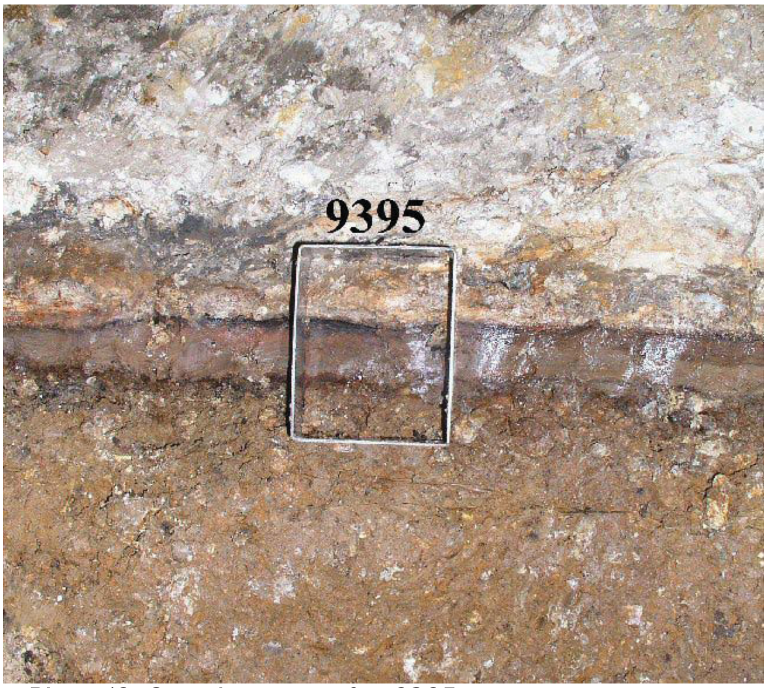


Plate 42: Sampling point for 9395

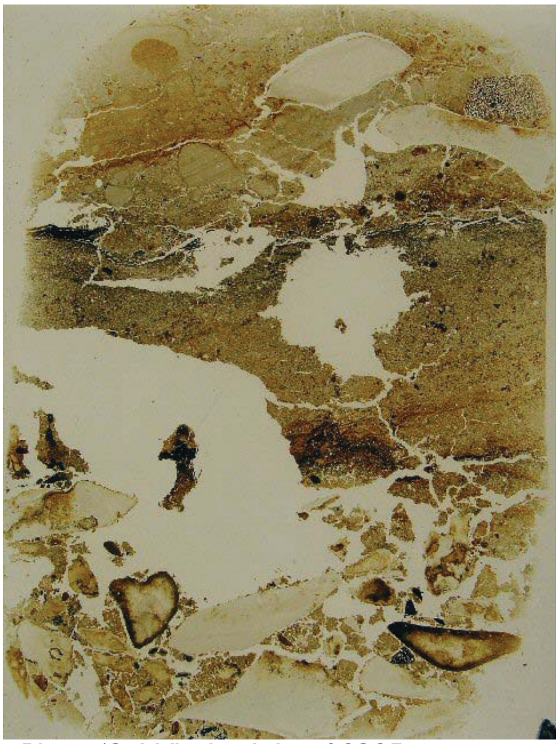


Plate 43: Whole slide of 9395

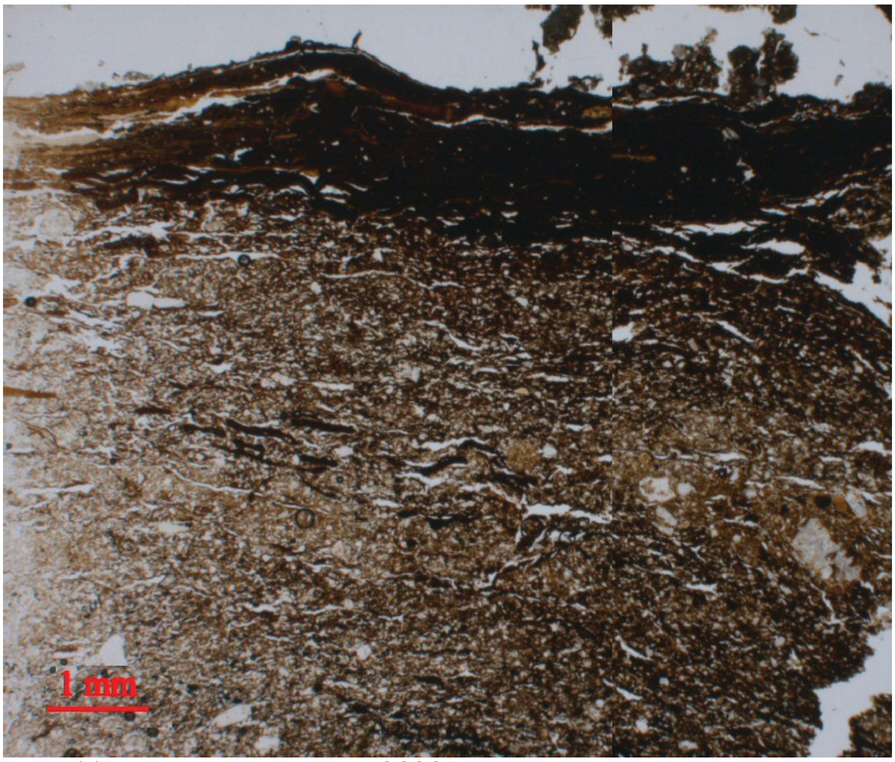


Plate 44: Microscopic detail of 9395

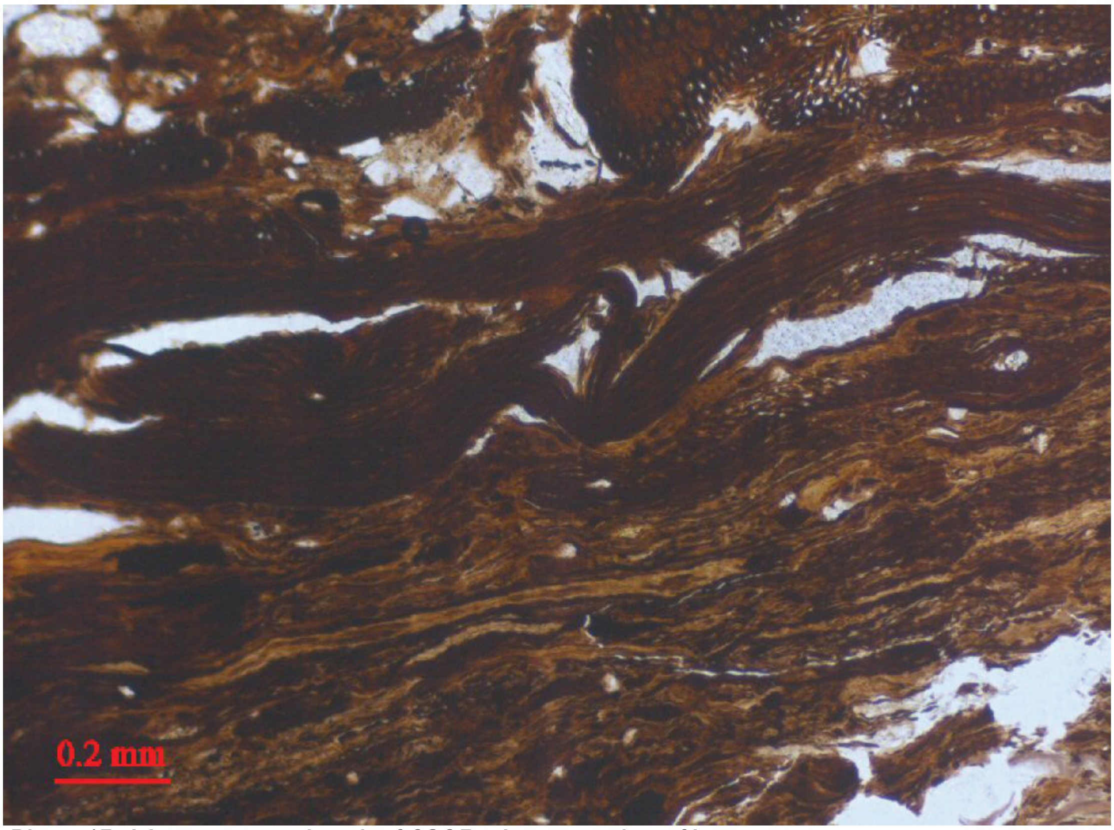


Plate 45: Microscopic detail of 9395, showing plant fibres

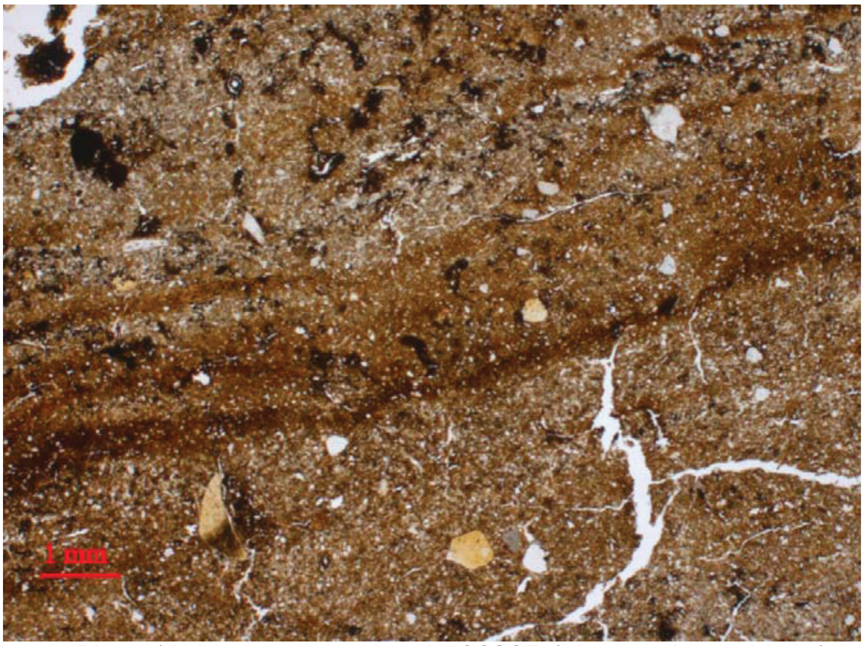


Plate 46: Microscopic detail of 9395 (plane-polarised light)

Main Tunnel, Bay 77E, sample <9207>

The field position of sample <9207> is shown on Plate 47 and the whole slide on Plate 48. At the microscopic level, the grey clay layer is characterised by discrete aggregates of strongly decomposed organic material or dense topsoil (Plate 49) material mostly marking the junction of the OLS and the base of the hill, but also occasionally forming weak layers a few millimetres further down.

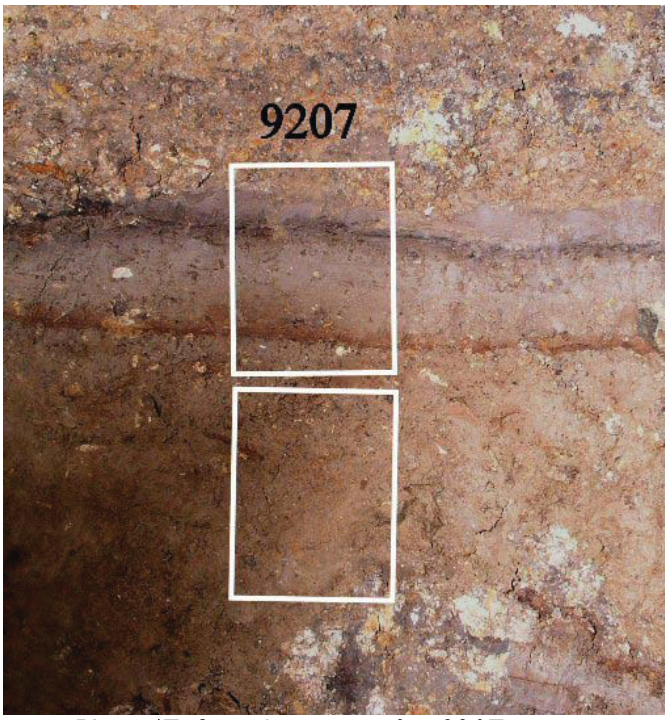


Plate 47: Sampling point for 9207

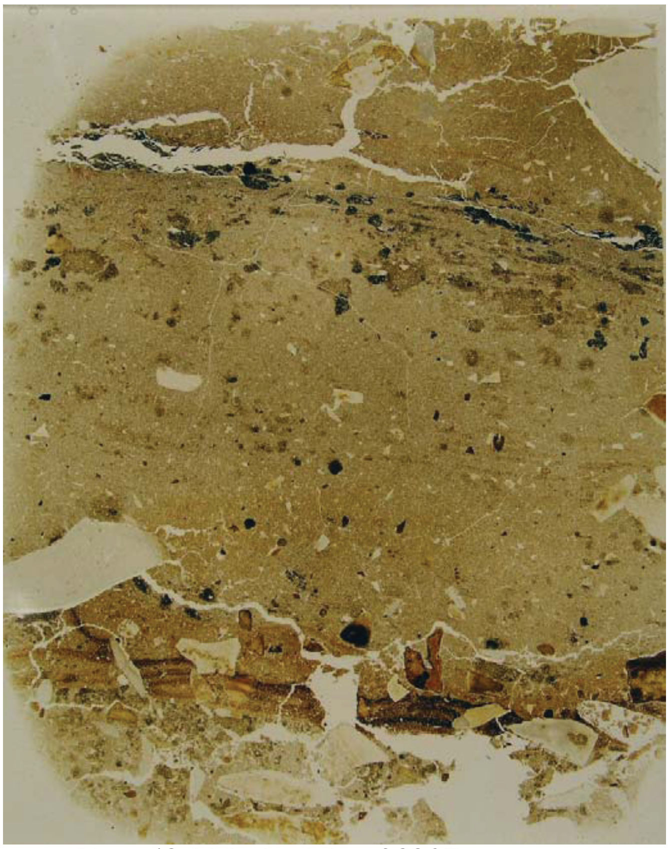


Plate 48: Whole slide of 9207

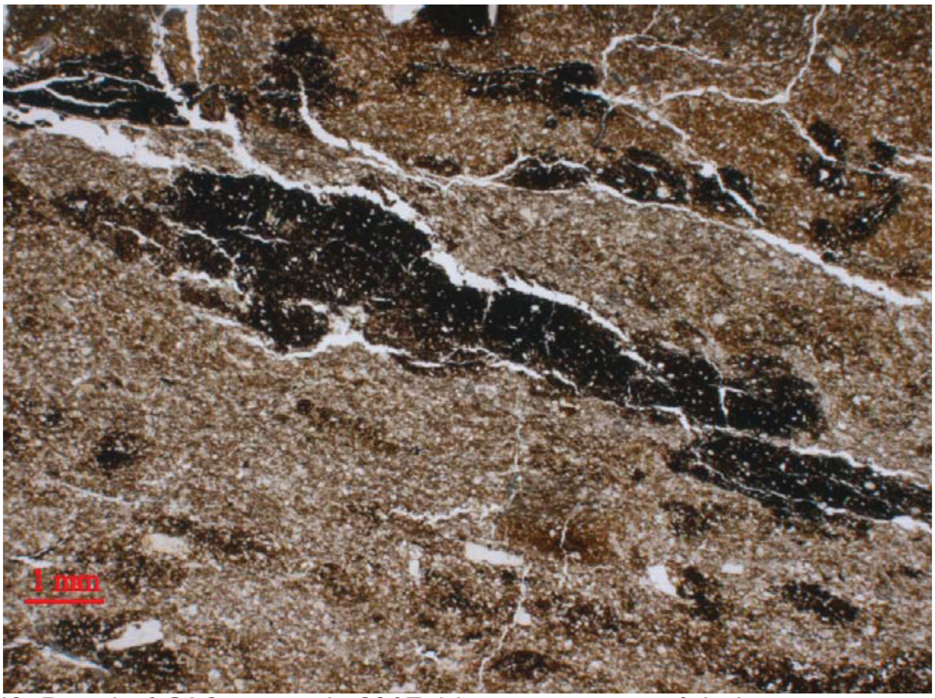


Plate 49: Detail of OLS in sample 9207. Note aggregates of dark organic or topsoil material.

6.3 The possible turf line or topsoil band on the north wall of the East Lateral

This material was tentatively identified in the field as a topsoil band, either *in situ* or dumped, and possibly made of inverted turf. The location of the sample (and also <9249>, see 6.4 below) is shown on Figure 29.

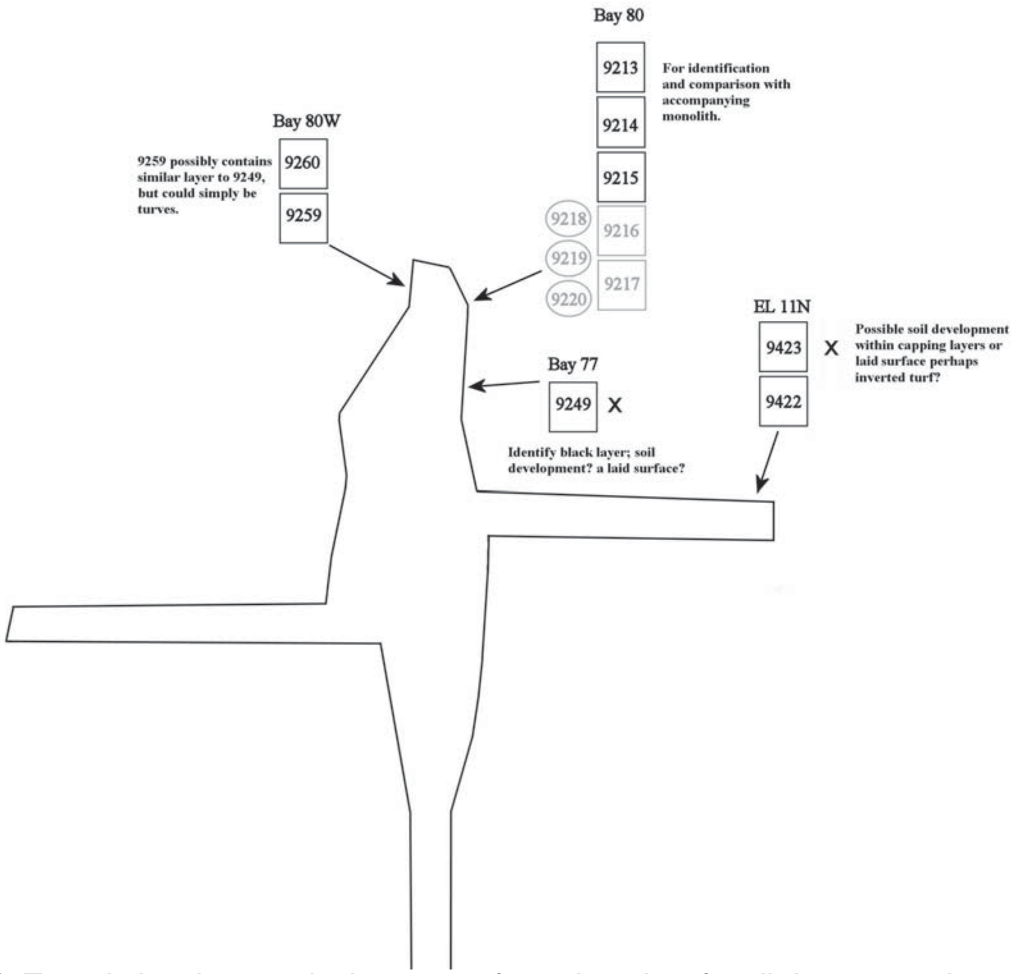


Fig 29: Tunnel plan showing the locations of samples taken for all the issues other than the old land surface, along with a summary of the reason for sampling in each case. Boxes marked X are thin sections used in this assessment. The greyed-out samples are an old land surface group that form the base of a column of Kubiena tins taken for possible comparison with an adjacent environmental column.

East Lateral, Bay 11N, sample <9423>

The sampling point is shown in Plate 50 and the whole slide in Plate 51. A typical microscopic view of the small upper central area of dark soil is shown in Plate 52. It is entirely made of a mixture of topsoil material and lumps of chalky subsoil. These are randomly mixed and show no grading of one material into another. It is therefore concluded that the material is not an intact soil surface or turf line. It is derived from mixed sources and probably represents a number of tipping events which either happened (or were deliberately chosen) to contain a large amount of topsoil.

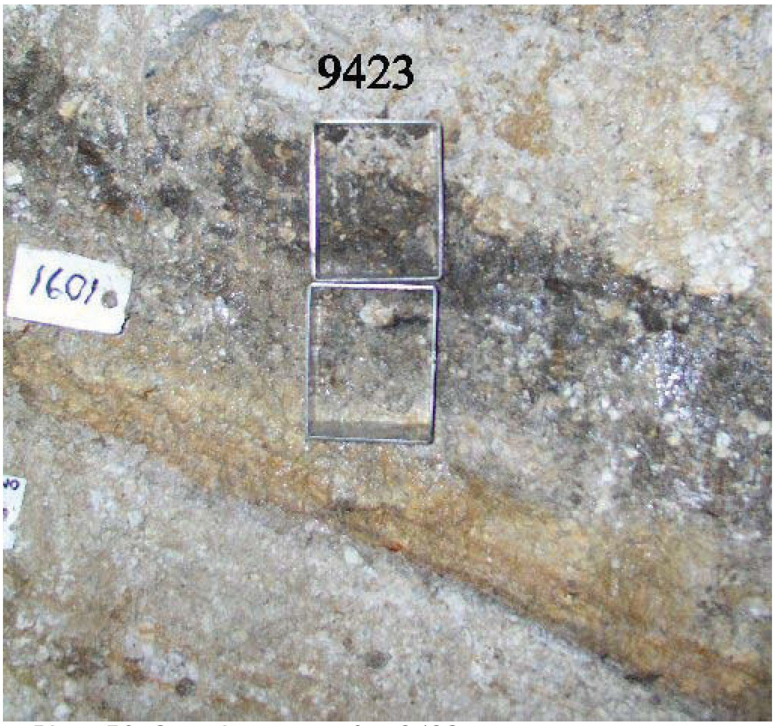


Plate 50: Sampling point for 9423

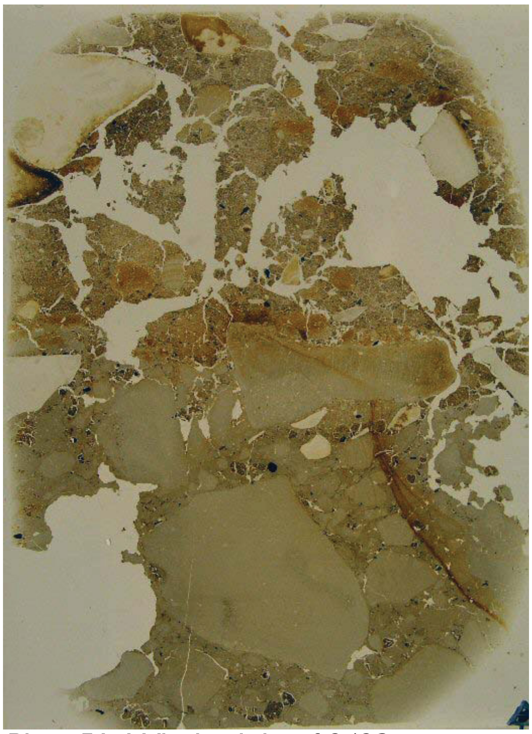


Plate 51: Whole slide of 9423

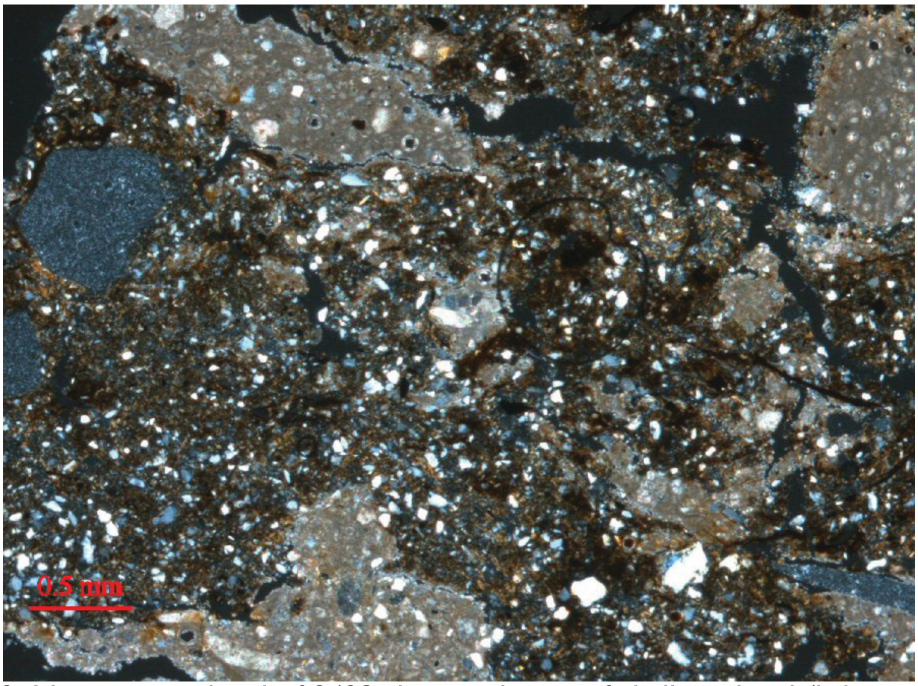


Plate 52: Microscopic detail of 9423 showing lumps of chalky subsoil (light grey/pink) in amongst the dark topsoil (cross-polarised light)

6.4 The dark layer on top of the gravel core.

As with the North wall of the East Lateral (<9423> above), this sample is a possible topsoil band, either *in situ* or dumped.

Main Tunnel, Bay 77E, sample <9249>

The sampling tin is shown in position on Plate 53, and the whole slide on Plate 54. The microscopic view (Plate 55) shows clearly a mixture of topsoil and subsoil material indicating that <9249> is dumped rather than an in-situ soil.

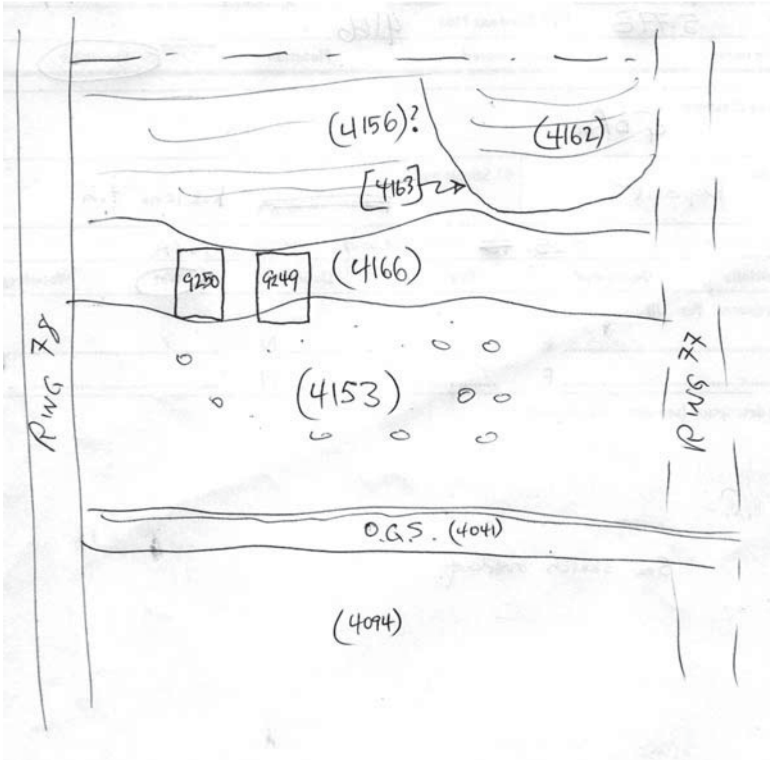


Plate 53: Sampling point for 9249

Plate 54: Whole slide of 9249

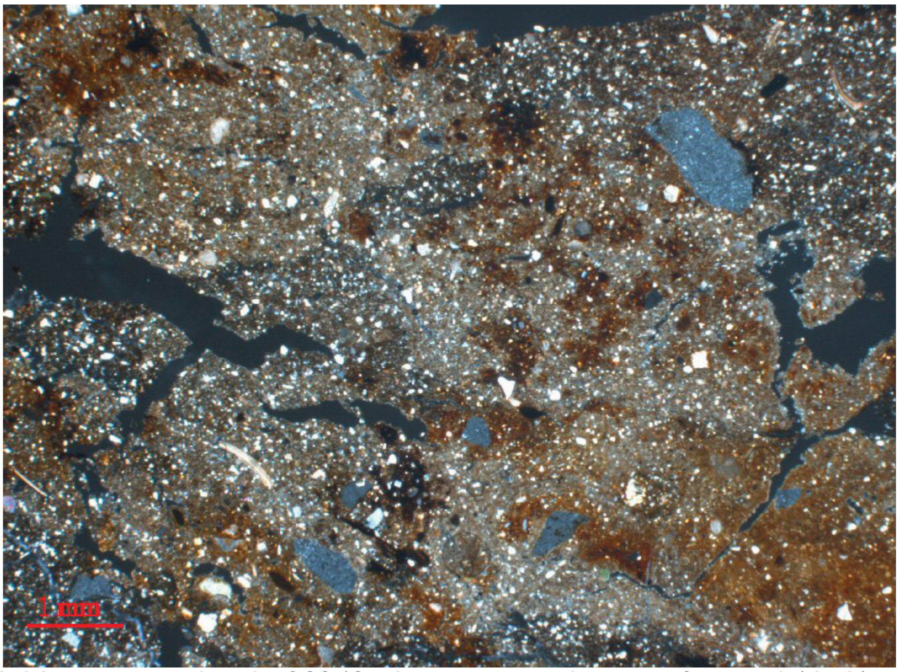


Plate 55: Microscopic detail of 9249, showing mixed areas of topsoil (dark) and chalky subsoil (light, stained brown).

6.5 Conclusions

From the particle size analysis, it seems that the grey clay layer has been derived from the clay-with-flints by removal of all the stones larger than 2mm and reduction of the clay content by about 10%. Perhaps this could have been brought about by a mix of trampling and rainfall, pushing the larger stones into the underlying horizons and slowly washing the fine soil down slope. The clay loss could be accounted for by the fact of its remaining in suspension for longer and being washed off the spur altogether.

The micromorphology of the Old Land Surface samples shows numerous single or multiple layers, lenses and flecks either composed of mineralised plant remains or iron pans at various scales which could be the last remains of such layers of plant matter. The overall suggestion is small scale deposition by water erosion as envisaged in the explanation of the particle size results.

Another possible process which could contribute to the grey clay morphology is earthworm casting. Worms generally bring up material finer than 2mm and deposit on the surface of soils, causing a line of 2mm and larger stones to build up at the base of a fine layer. This would not, however, explain either the 10% clay reduction or the horizontal banding.

7 ASSESSMENT OF INSECT REMAINS

Mark Robinson
December 2008

7.1 Introduction

During and after the re-excavation of the tunnels into Silbury Hill in 2007, there was extensive sampling of those deposits thought likely to contain organic remains. These samples were investigated for a wide range of biological remains including insects. Insects were analysed from the 1968-69 tunnelling of the monument but inadequate information was available on the contexts sampled and how the insects were extracted. The insect remains from the recent excavation were assessed in order to establish their research potential for providing information on the environment of the monument, to assist in understanding more fully the insect results from the earlier excavation and to document the preservation of material in the mound.

7.2 Methods

The samples were sub-sampled by Gill Campbell and were wet-sieved down to 0.18mm as described in the assessment of macroscopic plant remains. These sub-samples were sorted under a binocular microscope down to 0.5mm and insect remains picked out. These, along with the fraction below 0.5mm, were passed on for assessment. In addition, sub-samples from some of the samples were washed over onto a 0.18mm sieve and subjected to paraffin flotation for the recovery of insect remains. These flots were combined with the fractions below 0.5mm. Table 3 gives details of the samples and the preservation of insect remains within them.

The insect remains which had been picked out and the flots were scanned under a binocular microscope at magnifications of up to x50. They were identified with the aid of occasional consultation of the Hope Entomological Collections, Oxford University Museum of Natural History although some of the identifications have the potential to be taken further with more reference to comparative material. The minimum number of individuals noted for each species for each sample is given in Tables 4 and 5. The nomenclature of the Coleoptera in Table 2 follows Kloet and Hincks (1977). The purpose of Tables 4 and 5 is to provide and indication of the range of taxa present and their relative abundance. Full analysis would add more species and many more individuals.

7.3 Results

Phase 2 Old Land Surface (OLS)

Samples <9821> and <9815> contain few insects, which are poorly preserved, although they include phytophagous Coleoptera of grassland such as *Phyllopertha horticola*, *Agrypnus murinus* and *Mecinus pyraster*, Coleoptera organic material such as *Megasternum obscurum*, and scarabaeoid dung beetles of the genus *Aphodius*.

Phase 3 Top of Gravel Mound

Preservation is poor in Sample <9814>, the top of the gravel core and there are few remains. In contrast, Sample <9820>, from a silt layer above the mound has much better preservation and a higher concentration of remains. Both samples contain a similar range of Coleoptera to those noted for the Phase 2 samples.

Phase 4 "Mini-mound" and Linear Organic Mound
The preservation of remains in Samples <9808> and <9809> is good and the Coleoptera sclerites are less fragmented than in the other samples. The concentration of remains is high. In addition to taxa also present in the earlier phases, there are a single water beetle, *Hydrobius fuscipes* and a range of ground beetles. The ground beetles (Carabidae) include *Cicindela campestris*, *Carabus monilis* and *Calathus fuscipes*. There is also an example of the snail-eating beetle *Silpha atrata*. *Aphodius* spp. are joined by two other genera of scarabaeoid dung beetles, *Geotrupes* sp. and *Onthophagus* sp.

Preservation is also good in Samples <9811>, <9812> and <9813>, a gully adjacent to the Mini-mound although the fragments are not as large and the concentrations not as high as from the Mini-mound itself. In addition to a similar range of species to those in the earlier phases, there is an example of the wood-boring beetle *Grynobius plasus*.

The results from a turf in the Lower Organic Mound, Sample <9200>, are similar to those from the gully samples although *G. plasus* was absent.

Phase 5 Pits
Preservation is good in Samples <9817> and <9818> from a pit in the central chamber and the concentration of remains is high. The Coleoptera comprise the same range of taxa as recorded from the earlier phases but these samples also contain numerous workers of the ant *Myrmica rubra* or *ruginodis*. In contrast preservation is poor in Samples <9810> and <9816> from a pit in the western lateral and the taxa are similar to those from Phase 2.

Phase 6 Upper Organic Mound
Although preservation is good in Sample <9335> from a turf in the Upper Organic Mound, the concentration of remains is low. They likewise comprise similar taxa to those from Phase 2.

Phase 7 Further Dump Layers
Remains are almost absent from Sample <9822> and their preservation is very poor.

7.4 Discussion
Allowing for differences in preservation between the contexts, all the samples contain a broadly similar range of insect remains. They are suggestive of open lightly-grazed pasture. The Coleoptera include chafer and elaterid beetles which feed on the roots of herbaceous plants in grassland, especially *Phyllopertha horticola* and *Agrypnus murinus* but also *Hoplia philanthus* and *Agriotes* spp. There are also weevils which feed on grassland plants including *Mecinus pyraster* and *Gymnetron labile* on *Plantago lanceolata* (ribwort plantain) and *P. media* (hoary plantain), and *Apion and Sitona* spp. on Leguminosae such as *Trifolium* spp. (clovers) and *Vicia* / *Lathyrus* spp. (vetches and vetchlings). There is an example of the leaf beetle *Hydrothassa* sp. which feeds on *Ranunculus* spp. (buttercups). These weevils and the leaf beetle, along with *Dascillus cervinus*, tend to flourish in grassland which has not been grazed closely but in which many of the herbaceous plants flower. The occurrence of scarabaeoid dung beetles which feed on the dung of domestic animals on pasture confirms that the grassland was experiencing grazing. Various beetles which occur more generally in decaying organic material such as *Megasternum obscurum* and *Philonthus* sp. were no more abundant

than might be expected given a presence of domestic animals. There is also an appropriate range of ground beetles and rove beetles of grassland habitats including *Calathus fuscipes*, *Stenus* sp. and *Staphylinus* sp. One of the ground beetles, *Cicindela campestris* (tiger beetle), is found in sunny habitats with light soils but phytophagous Coleoptera of weeds of sparsely vegetated or disturbed ground are absent. Apart from the single example of *Grynobius planus*, there is no evidence for the proximity of scrub or woodland. The single water beetle need not imply pools of water on the site, *Hydrobius fuscipes* readily leaves water to migrate. There are no synanthropic beetles that are associated with human habitation or timber structures. One surprising result is that there are very few ants of the *Lasius flavus* group (yellow ant). This ant can reach very high populations in permanent grassland on both chalk and neutral clay soils although numbers decline in the complete absence of grazing or cutting and also with overgrazing. Perhaps the grassland at Silbury was of recent origin when the first mounds were being constructed.

Insufficient insect remains were recovered from the Old Land Surface to make faunal comparisons with the various samples from later phases. There is no obvious explanation why the Mini-mound of Phase 4 should have more intact insect fragments and a higher concentration of remains than the other contexts. It is possible that the Mini-mound has a component of gathered organic material (see Section 5) although it does not have more of a decomposer fauna of insects than the other samples. The high concentration of ants in Samples <9817> and <9818> from the pit in the central chamber of Phase 5 was probably the result of a turf containing an ant nest being incorporated in the fill.

Comparison with the Results from the Excavation of 1968-69

It was estimated that samples totalling between 40 and 80kg were analysed for insects from the earlier excavations (Robinson 1997). This yielded a minimum of 848 individuals of Coleoptera from 85 species. In contrast, the current assessment has so far given 186 individuals of Coleoptera from 50 species although, as has been noted, full analysis will add more individuals and species to the totals. There were 410 other insects, mostly ants and (represented by puparia) flies from 9 taxa in the 1968-69 samples. There are 79 individuals, again mostly ants and flies, from 7 taxa so far noted from the current investigation. There is considerable overlap between the taxa found by the two studies. The assessment only adds 9 new species of Coleoptera. However, the samples from the recent excavation are much better attributed to their archaeological contexts. In the earlier excavation, samples were only attributed to the Old Land Surface or the turf mound along with a rough position in the tunnel.

A preliminary comparison suggests that the recovery of insect remains from the 1968-69 excavation covered the full range of taxa down to a sclerite size of 0.5mm. The current investigation, however, will enable more balanced results to be given by including remains of the smallest insects. The insect remains from 1968-69 appear to be more intact than those from the current investigation. While this might suggest some deterioration in the ground over the past 40 years it is also possible that there was a tendency when the samples from the earlier excavation were being sorted only to pick out the more intact sclerites.

Table 3 – Silbury insects

Sample no	Context no	Vol (litres)	Wght (kg)	Description	Phase	Sub-sample of	Preservation
9200	4156	2	2.099	Turf within Lower Organic Mound. 2 litre sample of a single turf. Sieved to 0.18mm, sorted to 0.5mm. Fine fraction enclosed.	4	N/A	Good but fragmented
9335	3078	2	1.91	Turf within Upper Organic Mound. 2 litre sample of a single turf. Sieved to 0.18mm, sorted to 0.5mm. Fine fraction paraffin floated. Paraffin flot enclosed.	6	N/A	Good but very fragmentary
9808	4181	2	2.236	Mini-mound. 2 litres, sieved to 0.18mm, sorted to 0.5mm. Fine fraction included in paraffin flotation of sample 9809.	4	9425	Good, quite large frags
9809	4181	3	3.065	Mini-mound. 3 litres, sieved to 0.18mm, and paraffiin floated to 0.18mm with fine fraction of sample 9808s.	4	9425	Good, quite large frags
9811	4070	2	2.078	Bottom fills of gully adjacent to mini mound.2 litres, sieved to 0.18mm, sorted to 0.5mm. Fine fraction unsorted.	4	9338	Mediocre, fragmentary
9812	4070	3	3.413	Bottom fills of gully adjacent to mini mound. 3 litres, sieved to 0.18mm, sorted to 0.5mm. Fine fraction unsorted.	4	9338	Good but fragmentary
9813	4173	2	2.141	Top fills of gully adjacent to mini-mound. 2 litres, sieved to 0.18mm, sorted to 0.5mm. Fine fraction unsorted.	4	9339	Mixed, some good but fragmentary
9814	3069	2	2.187	top of gravel (mound) core into which pit 3067 is cut. 2 litres, sieved to 0.18mm, sorted to 0.5mm. Fine fraction unsorted. 2 litres, sieved to 0.18mm, sorted to 0.5mm. Fine fraction. unsorted	3	9247	Very poor, very few
9815	4041	3	3 approx	OLS below mini-mound. 3 litres, sieved to 0.18mm, sorted to 0.5mm. Fine fraction unsorted.	2	9343	Poor, small frags
9817	3066	2	1.926	Pit in central chamber. 2 litres, sieved to 0.18mm, sorted to 0.5mm. Fine fraction included in paraffin flotation of sample 9818.	5	9244	Good preservation but small frags
9818	3066	3	3.087	Pit in central chamber. 3 litres, sieved to 0.18mm, and paraffin floated along with fine fraction of sample 9817.	5	9244	Good but small frags
9810	3073	2		Pit in West Lateral (Figure 12). 2 litres, sieved to 0.18mm, sorted to 0.5mm. Fine fraction included in paraffin flotation of sample 9816.	5	9340	Mediocre / poor, fragmentary
9816	3073	2		Pit in West Lateral. 3 litres, sieved to 0.18mm, and paraffin floated along with fine fraction of sample 9817	5	9340	Mediocre / poor, fragmentary

Sample no	Context no	Vol (litres)	Wght (kg)	Description	Phase	Sub-sample of	Preservation
9820	4166	2	1.916	Dark silty layer on top of Gravel Mound - poss soil horizon? 2 litre sample. Sieved to 0.18mm. Insects picked out above 0.5mm. Fine residue enclosed.	3	9252	Good
9821	4041	3.8	3.579	From possible hearth on OLS. No insects in fine fraction and very little organic material.	2	9435	Very poor, few
9822	3084	2	2.093	Organic layer within Further Dump Layers. 2 litre sample of a single turf. Sieved to 0.18mm. Insects picked out above 0.5mm. Fine residue enclosed.	7	9320	Very poor, fragmentary and very few

Table 4 – Coleoptera.

Phase	2	2	3	3	4	4	4	4	4	5	5	6	7
Sample	9821	9815	9814	9820	9808 9809	9811	9812	9813	9200	9817 9818	9810 9816	9335	9822
CARABIDAE *Cicindela campestris* L.	-	-	-	-	1	-	-	-	-	-	-	-	-
Carabus monilis F.	-	-	-	-	1	1	1	-	-	1	-	-	-
Trechus obtusus Er. or *quadristriatus* (Schr.)	-	-	-	-	-	-	-	-	-	-	1	-	-
Pterostichus cupreus (L.) or *versicolor* (Strm.)	-	-	-	-	1	1	-	-	-	-	-	-	-
Pterostichus sp.	-	-	-	-	1	-	-	-	-	-	-	-	-
Calathus fuscipes (Gz.)	-	-	-	1	1	-	-	-	1	1	-	-	-
C. melanocephalus (L.)	-	-	-	1	1	-	-	-	-	-	-	-	-
Amara sp.	-	-	-	-	-	-	-	-	-	-	1	-	-
HYDROPHILIDAE *Sphaeridium* sp.	-	-	-	-	-	-	1	-	-	-	-	-	-
Cercyon sp.	-	-	-	1	1	-	-	-	-	2	-	-	-
Megasternum obscurum (Marsh.)	2	1	-	2	3	1	-	1	1	3	1	1	-
Cryptopleurum minutum (F.)	-	-	-	-	-	-	-	-	-	1	-	-	-
Hydrobius fuscipes (L.)	-	-	-	-	1	-	-	-	-	-	-	-	-
HISTERIDAE Histerinae indet.	-	-	-	-	1	-	-	-	-	-	-	-	-
SILPHIDAE *Silpha atrata* L.	-	-	-	-	1	1	-	-	-	-	-	-	-
STAPHYLINIDAE *Anotylus sculpturatus* gp.	-	-	-	-	1	-	-	-	-	-	-	-	-
Stenus spp.	1	1	1	1	1	1	-	2	-	1	2	1	-
Rugilus erichsoni (Fauv.) or *orbiculatus* (Pk.)	-	-	-	1	-	-	-	-	-	1	-	-	-

Phase	2	2	3	3	4	4	4	4	4	5	5	6	7
Sample	9821	9815	9814	9820	9808 9809	9811	9812	9813	9200	9817 9818	9810 9816	9335	9822
Xantholinus glabratus (Grav.)	-	-	-	2	-	-	-	-	-	1	-	-	-
X. linearis (Ol.)	-	-	-	1	1	-	-	-	-	-	-	-	-
Philonthus sp.	-	-	1	3	1	-	-	-	1	1	1	-	-
Staphylinus sp.	-	-	-	-	1	-	1	1	-	2	-	-	-
Tachyporus sp.	-	1	-	-	-	-	-	-	1	1	1	-	-
Aleocharinae indet.	-	-	-	1	-	-	-	-	1	1	1	1	-
GEOTRUPIDAE													
Geotrupes sp.	-	-	-	1	2	1	1	1	-	1	-	1	-
SCARABAEIDAE													
Aphodius cf. *sphacelatus* (Pz.)	-	-	-	-	-	-	-	-	1	-	-	1	-
A. villosus Gyl.	-	-	-	1	2	-	1	2	1	-	-	-	-
Aphodius spp.	1	1	-	1	1	1	2	1	1	3	-	-	-
Onthophagus sp.	-	-	-	1	1	1	-	-	-	1	-	1	-
Hoplia philanthus (Fues.)	-	-	-	-	1	-	-	-	-	-	-	-	-
Phyllopertha horticola (L.)	1	1	1	1	2	1	1	1	1	2	1	-	-
DASCILLIDAE													
Dascillus cervinus (L.)	-	-	-	-	1	1	1	-	-	-	-	-	-
ELATERIDAE													
Agrypnus murinus (L.)	1	-	1	-	1	1	-	-	1	1	-	-	-
Athous haemorrhoidalis (F.)	-	-	-	-	1	-	-	-	-	-	-	-	-
Agriotes sp.	-	1	-	-	2	1	1	-	-	1	1	-	-
CANTHARIDAE													
Cantharis sp.	-	-	-	-	1	-	-	-	-	-	-	-	-

Phase	2	2	3	3	4	4	4	4	4	5	5	6	7
Sample	9821	9815	9814	9820	9808 9809	9811	9812	9813	9200	9817 9818	9810 9816	9335	9822
ANOBIIDAE													
Grynobius planus (F.)	-	-	-	-	-	-	-	1	-	-	-	-	-
NITIDULIDAE													
Nitidulidae indet.	-	-	-	-	-	-	1	-	-	-	-	-	-
CRYPTOPHAGIDAE													
Atomaria sp.	-	-	-	-	-	-	-	-	-	1	-	-	-
CHRYSOMELIDAE													
Hydrothassa sp.	-	-	-	-	-	-	-	1	-	-	-	-	-
Longitarsus sp.	1	-	-	1	-	-	1	-	-	1	-	-	-
APIONIDAE													
Apion spp.	-	1	-	1	1	-	-	1	1	1	-	-	-
CURCULIONIDAE													
Phyllobius roboretanus Gred. or *viridiaeris* (Laich.)	-	-	-	-	-	-	-	-	-	-	-	1	-
Phyllobius or *Polydrusus* sp.	-	-	-	1	2	1	-	-	-	-	-	-	-
Sciaphilus asperatus (Bons.)	-	-	-	-	-	-	-	-	-	-	-	-	1
Barynotus obscurus (F.)	-	-	-	-	2	1	-	-	-	-	-	-	-
Sitona sp.	-	-	-	1	-	-	-	-	-	1	1	-	-
Hypera punctata (F.)	-	-	1	-	1	-	-	-	-	-	-	-	-
Ceuthorhynchinae indet.	-	-	-	-	-	-	1	-	1	2	-	-	-
Mecinus pyraster (Hbst.)	1	-	-	-	1	-	1	-	1	1	-	-	-
Gymnetron labile (Hbst.)	-	-	-	-	1	-	-	-	-	-	-	-	-
Total	8	7	5	23	41	14	14	12	13	32	11	7	1

Table 5 – Other Insects.

Phase		2	2	3	4	4	4	4	5	5	6	7	3	4
Sample		9821	9815	9814	9808 9809	9811	9812	9813	9817 9818	9810 9816	9335	9822	9820	9200
HEMIPTERA - HOMOPTERA														
Aphrodes bicinctus (Schr.)		-	-	-	-	-	-	-	-	-	-	-	1	-
- HETEROPTERA														
Pentatoma rufipes (L.)		-	-	-	1	-	-	-	-	-	-	-	-	-
HYMENOPTERA - FORMICIDAE														
Myrmica rubra (L.) or *ruginodis* Nyl.	- worker	-	-	1	2	-	-	1	25	6	1	1	3	3
M. rubra (L.) or *ruginodis* Nyl.	- female	-	-	-	-	-	-	-	-	-	-	-	1	-
M. scabrinodis gp.	- worker	-	-	-	-	1	-	-	-	-	-	-	-	1
Lasius flavus gp.	- worker	-	-	-	-	-	-	-	-	1	2	-	-	-
DIPTERA														
Diptera indet	- puparia	1	1	1	2	3	4	-	2	3	1	2	2	5
cf. *Scathophaga stercoraria* (L.)		-	-	-	1	-	-	-	-	-	-	-	-	-

8 LAND SNAIL ASSESSMENT

Paul Davies
September 2008

8.1 Introduction

Following excavation of Silbury Hill in 2007-8 samples from the following phases and features were selected as appropriate for land snail assessment.

Phase 3
Gravel Mound [4153] and dark silty layer on top of Gravel Mound ([3069]?soil horizon)

Phase 4
a) Organic mini mound [4181]
b) Primary [4170] and secondary fill [4173] of linear pit or gully [4171]

Phase 5
a) Fill [3073] of pit [3074]
b) Secondary fill [3066] of pit [3067]

Phases 13.1 and 13.2
a) Infill of Ditch 1 [3902]
b) Backfill of Ditch 1 [3902]

Phase 15
Infill of ditch re-cut (Ditch 3) [4131]

Phase 16
Backfill of ditch re-cut (Ditch 4) [4018]

Phase 17
Interwall deposit, Hill summit

The list of mollusc samples, and the relevant context numbers, is given as Annex 1. The assessed samples are indicated by a Y in the 'Assessed' column.

8.2 Method

Samples <9057>, <9063>, <9065>, <9085>, <9089>, <9176>, <9167> and <9540> were provided as 'raw' samples. 1kg of each was processed using the hydrogen peroxide method of Evans (1972). The remaining samples were provided with the snail shells 'ready-picked' by Gill Campbell (EH) from sample sizes as indicated in Annex 1.

Laboratory sorting and identification was carried out according to the methods outlined in Davies (2008). Abundances were recorded using an ACFOR scale where:

A= 50+; C = 20-49; F= 10-19; O = 5-9; R =1-4

The preservation of the shells recovered from each sample was noted. Comments upon preservation occur within the results and discussion section. It should be noted that use of the term ‘fresh’ to describe preservation indicates shells found with part/all of the periostracum intact. Such shells would have been buried rapidly and certainly within a year of death of the snail (if not while it was living).

8.3 Results

For ease of reference the results section is broken down into results by phase.

Phase 3

Gravel Mound [4153] and dark silty layer on top of Gravel Mound ([3069]?soil horizon)

One sample from the Gravel Mound (<9819>) and one sample from the dark silty layer (?soil horizon) on top of the Gravel Mound (<9814>) were assessed. Results are given as Table 6.

Table 6: Shells recovered from Gravel Mound and dark silty layer on top of Gravel Mound

Species/Sample	<9819>	<9814>
Cochlicopa sp.	R	R
Vertigo sp.	F	O
Pupilla muscorum	-	R
Vallonia sp.	A	C (some very fresh)
Vitrina pellucida	R	-
Nesovitrea hammonis	R	-
Aegopinella sp.	R	-
Clausilia sp.	R (nb very worn)	-
Helicella itala	O	O (1 very fresh)
Trichia hispida	O	-

.

Phase 4

a) Organic mini mound [4181]

Two samples (<9808> and <9809>) were assessed. Results are given as Table 7.

Table 7: Shells recovered from organic mini mound

Species/Sample	<9808>	<9809>
Cochlicopa sp.	-	R (very fresh)
Vallonia sp.	R (very fresh)	R (1 very fresh)
Clausilia sp	-	R (very fresh)
Trichia hispida	R	-

b) Primary [4170] and secondary fill [4173] of linear pit or gully [4171]

One sample from the primary fill (<9812>) and one sample from the secondary fill (<9813>) were assessed. Results are given as Table 8.

Table 8: Shells recovered from primary and secondary fill of linear pit or gully [4171

Species/Sample	<9812>	<9813>
Cochlicopa sp.	-	-
Vallonia sp.	R (very fresh)	R
Acanthinula aculeata	R (very worn)	-
Clausilia sp	R (very worn)	-

]

Phase 5

a) Fill [3073] of pit [3074]

Two samples <9810> and <9816> were assessed. Results are given as Table 9.

Table 9: Shells recovered from fill of pit [3074]. Note that all were very worn unless indicated.

Species/Sample	<9810>	<9816>
Pomatias elegans	-	R
Carychium sp.	R	R
Cochlicopa sp.	-	R
Vertigo sp.	R	-
Pupilla muscorum	-	R
Vallonia sp.	F	O
Acanthinula aculeata	R	-
Punctum pygmaeum	R	-
Discus rotundatus	R	-
Aegopinella sp.	R	R
Clausilia sp.	R	R
Helicella itala	O (1 v. fresh)	-
Ashfordia/Trichia	O (1 v. fresh)	R
*Arianta/Cepaea/*other Helicid	O	O

b) Secondary fill [3066] of pit [3067]

One sample (<9817>) was assessed. Results are given as Table 10.

Table 10: Shells recovered from secondary fill of pit [3067]. Note that all were very worn unless indicated.

Species/Sample	<9817>
Pomatias elegans	C
Carychium sp.	O
Cochlicopa sp.	F (some v. fresh)
Vertigo sp.	C (some v. fresh)
Pupilla muscorum	R
Vallonia sp.	A (some v. fresh)
Ena obscura	R
Punctum pygmaeum	R
Nesovitrea hammonis	R
Aegopinella sp.	R

Species/Sample	<9817>
Clausilia sp.	F
Helicella itala	A (some v. fresh)
Ashfordia/Trichia	F
*Arianta/Cepaea/*other Helicid	F

Phases 13.1 and 13.2
Infill and backfill of Ditch 1 [3902]

5 samples were assessed, <9057> (organic fill of ditch), <9063> and <9065> (infill of ditch), <9085> (silty infill of ditch) and <9089> (backfill of ditch).

Only one sample (<9065>) yielded any shell (Table 11)

Table 11: Shells recovered from Ditch 1.

Species/Sample	<9065>
Vallonia sp	R
Discus rotundatus	R

Phase 15
Infill of ditch re-cut (Ditch 3) [4131]

The one sample assessed (<9176>) contained no shell.

Phase 16
Backfill of ditch re-cut (Ditch 4) [4018]

The one sample assessed (<9167>) contained no shell.

Phase 17
Interwall deposit, Hill summit

The one sample assessed (<9540>) contained no shell.

8.4 Preliminary Assessment - Discussion

a) Infill and backfill of ditch 1 [3902]

b) Infill of ditch re-cut (Ditch 3) [4131]

c) Backfill of ditch re-cut (Ditch 4) [4018]

d) Interwall deposit, Hill summit

Samples assessed from these features were virtually or entirely devoid of shell. This would suggest that all of the deposits were rapid, deliberate in-fill or backfill.

e) The Gravel Mound and possible soil horizon on top of the mound (Phase 3)
The Gravel Mound sample <9819> contained between 100-150 shells in total, the vast majority being *Vallonia* sp. (undoubtedly either *V. excentrica* or *V. costata*). Other than *Vallonia* sp. only *Vertigo* sp. (probably *V. pygmaea*), *Helicella itala* and *Trichia hispida* occurred as anything other than individual occurrences. As a suite this suggests an open grassland type environment. The individual occurrence of a worn *Clausilia* sp. may indicate some residuality. The dark silty layer (<9814> ?soil horizon) contained only around 50 shells, the majority of which were *Vallonia* sp. with some *Helicella itala*, *Vertigo* sp., *Pupilla muscorum* and *Cochlicopa* sp. Taken together these are likely indicative of open grassland type conditions. The presence of a few very fresh *Vallonia* and *Helicella* suggests that at some stage this layer was subject to rapid burial, with the fresh *Vallonia* and *Helicella* being indicative of the immediate pre-burial surface.

f) Organic Mini-mound (Phase 4)
Numbers of shell was low (only 2 in <9808> and 5 in <9809>). However, it was noticeable that 4 of the 7 recovered shells were fresh (*Vallonia* sp., *Cochlicopa* sp. and *Clausilia* sp. No preliminary interpretation can be offered given such low numbers, but these are likely to have been either incorporated into the mound as living/recently dead individuals (eg on a turf or other integration of topsoil) or living on the mound when buried by later material.

g) Primary and secondary fill of linear pit or gully [4171] (Phase 4)
Again, number of shells was low (4 in the primary fill <9812> and 3 in the secondary fill <9813>). Two shade-requiring species (*Acanthinula aculeata* and *Clausilia* sp.) were present in the primary fill although both were very worn and probably derived from older material. The *Vallonia* sp. recovered from the primary fill were all fresh, indicating that they were possibly rapidly buried by the secondary fill <9813>. The paucity of shell in the secondary fill indicates it was probably a rapid (?deliberate) infill.

h) Fill of pit [3074] (Phase 5)
Number of shells was modest to low (48 in <9810> and 30 in <9816>). Both samples contained a shade-loving element (*Discus, Clausilia Aegopinella*) and <9816> contained *Pomatias elegans*, often associated with broken ground and woodland clearance. However, shells of all 4 species were very worn (along with several other species too as indicated in Table 5). It is likely that these were therefore residual. Three individual shells were very fresh (one each of *Helicella*, *Pupilla* and *Trichia*), all indicative of a grassland environment. One possibility is that the fill was of turf, or at least shallow sub-soil material.

i) Secondary fill of pit [3067] (Phase 5)
Number of shells was high (300+) with the majority being *Vallonia* sp., *Helicella itala, Pomatias elegans*, *Cochlicopa* sp., *Clausilia* sp. and *Vertigo* sp. However, there was a marked divide between fresh shells (some *Cochlicopa,* some *Vallonia,* some *Vertigo* sp*. Aegopinella* sp. and some *Helicella itala*) and older worn shells (*Pomatias elegans* and the others). It is again feasible that the secondary fill of this pit was in the form of deliberately introduced turves or similar.

Annex 1 - Mollusc samples for assessment July 2008

sample	context	Description	phase	No of litres processed	Sub-sample of	Assessed (Y/N)
9057	3926	Organic infill of ditch [3902] (Ditch 1)	13.1	N/A	N/A	Y
9059	3940	Infill of ditch [3902] (Ditch 1)	13.1	N/A	N/A	N
9060	3937	Infill of ditch [3902] (Ditch 1)	13.1	N/A	N/A	N
9063	3935	Infill of ditch [3902] (Ditch 1)	13.1	N/A	N/A	Y
9065	3934	Infill of ditch [3902] (Ditch 1)	13.1	N/A	N/A	Y
9085	3940/3939	Silty infill of ditch [3902] (Ditch 1)	13.1	N/A	N/A	Y
9087	3906	Backfill of ditch [3902] (Ditch 1)	13.2	N/A	N/A	N
9089	3914	Backfill of ditch [3902] (Ditch 1)	13.2	N/A	N/A	Y
9172	4126	Infilling of ditch re-cut [4131] (Ditch 3)	15	N/A	N/A	N
9176	4128	Infilling of ditch re-cut [4131] (Ditch 3)	15	N/A	N/A	Y
9165	4021	Backfill of ditch re-cut [4018] (Ditch 4)	16	N/A	N/A	N
9167	4022	Backfill of ditch re-cut [4018] (Ditch 4)	16	N/A	N/A	Y
9538	4845	Interwall deposit	17	N/A	N/A	N
9540	4846	Interwall deposit	17	N/A	N/A	Y
9814	3069	Dark silty layer on top Gravel Mound - poss soil horizon?	3	2	9814	Y
9819	4153	Gravel Mound	3	2	9251	Y
9808	4181	Organic mini mound	4	2	9425	Y
9809	4181	Organic mini mound	4	3	9425	Y
9812	4170	Primary fill of linear pit or gully [4171]	4	3	9338	Y
9813	4173	Secondary fill of linear pit or gully [4171]	4	2	9339	Y
9810	3073	Fill of pit [3074]	5	2	9340	Y
9816	3073	Fill of pit [3074]	5	3	9340	Y
9817	3066	Secondary fill of pit [3067]	5	2	9244	Y

9 POLLEN AND DIATOM ASSESSMENT

Pollen

David Earle-Robinson

Material

In collaboration with Gill Campbell, a total of 13 samples were chosen for assessment of their pollen content. It was decided to concentrate on the old ground surface and primary turf-built structures, i.e. the lower and upper organic mounds. A decision was taken not to assess samples from gullies, pits and other similar features. Prior examination of the composition and structure of latter (Campbell this volume) revealed that they comprised secondarily deposited material, turf and the like. Accordingly, analysis of their pollen content would not add anything to the information from turves in situ in structures.

Samples

Phase 2

Old Ground Surface

9124 – 4041 (directly under gravel mound; SSD 5:39)
9264/1 – 3021 (SSD 5:81)
9264/2 – 3035 (SSD 5:81)

Phase 4

Lower Organic Mound

9379 – 3046 (SSD 5:80)
9369 – 3075 (SSD 8:5N)
9264/8 (SSD 5:81)

Phase 6

Upper Organic Mound

9424 – 4197 (SSD 9:3 S)
9375 – 3061 (SSD 5:80W)

Phases 2 - 6

Layers between OGS and LOM (layers of turf stack)

9264/3 (SSD 5:81)
9264/4 (SSD 5:81)
9264/5 (SSD 5:81)
9264/6 (SSD 5:81)
9264/7 (SSD 5:81)

Methods

Samples (0.5 – 1 ml) were prepared using standard pollen preparation procedures, i.e. addition of an "exotic" spike (Lycopodium spores), treatment with hydrochloric acid, potassium hydroxide, hydrofluoric acid and acetolysis. The resulting pollen residues were mounted in an unstained form in silicone oil. In almost all cases a full slide (11-12 traverses) was examined under the microscope.

Results

Old Ground Surface

9124 – 4041: A few very poorly preserved pollen grains and pollen "ghosts" – Polypodium & Filicales (ferns) and Poaceae (grasses). Analysis not recommended.
9264/1 – 3021: No fossil pollen seen. Analysis not recommended.

9264/2 – 3035: fairly abundant fossil pollen and spores seen, showing slight to severe corrosion - Polypodium & Filicales (ferns), Poaceae (grasses) and a limited range of herb species. Analysis recommended.

Lower Organic Mound
9379 – 3046: Sparse pollen showing substantial corrosion, numerous pollen "ghosts" – Filicales (ferns), Liguliflorae (dandelion family), Urtica (nettle. Quercus (oak). Analysis recommended.
9369 – 3075: Sparse pollen showing substantial corrosion, numerous pollen "ghosts" – Polypodium, Filicales (ferns), Pteridium (bracken), Poaceae (grasses), Corylus (hazel), Filipendula (meadowsweet), Caryophyllaceae (pink family), Liguliflorae (dandelion family), Urtica (nettle). Analysis recommended.
9264/8: Sparse, but reasonably well preserved pollen and spores – mostly ferns and a limited range of herb species. Analysis recommended.

Upper Organic Mound
9424 – 4197: Sparse pollen showing substantial corrosion, numerous pollen "ghosts" – Polypodium, Filicales (ferns), Poaceae (grasses), Urtica (nettle), Plantago (plantain). Analysis recommended.

9375 – 3061: Sparse pollen showing substantial corrosion, numerous pollen "ghosts" – Polypodium, Filicales (ferns), Poaceae (grasses), Plantago (plantain), Corylus (hazel), Liguliflorae/Tubuliflorae (dandelion family). Analysis recommended.

Layers between OGS and LOM (layers of turf stack)
9264/3: Pollen very sparse and poorly preserved. Analysis not recommended.
9264/4: Pollen sparse but reasonable preservation – ferns and a limited range of herb species. Analysis recommended.
9264/5: Pollen very sparse and degraded. Analysis not recommended.
9264/6: Pollen very sparse and degraded. Analysis not recommended.
9264/7: Pollen sparse but reasonable preservation – ferns and a limited range of herb species. Analysis recommended.

Discussion
Pollen on the prepared slides was sparse at best and virtually absent at worst. Its state of preservation also varied - from surprisingly good to very bad. Pollen "ghosts" or "shadows", i.e. pollen grains in the last stages of degradation were frequently noted. Problems of pollen identification were mainly down to corrosion of the grains rather than crumpling or breakage, although the latter two forms of degradation did occur. Biological activity in the (predominantly) basic soils appears to have been high and pollen was poorly preserved in situations where plant macrofossils and invertebrate remains fared much better.

Old ground surface: Pollen appeared to be absent in the old ground surface, apart from one sample directly below the iron pan, where quite a reasonable assemblage was recorded. The latter may be an example of the latest deposited pollen being sealed by the overlying material before it could be degraded by the soil fauna and flora.

Upper and lower organic mounds, turf layers: Pollen was well to poorly preserved, but sparse at best and absent at worst. Some of the results were encouraging enough to recommend full analysis.

The generally high proportion of damaged, and therefore unidentifiable, pollen grains and the predominance of "tough" pollen and spore types, such as ferns and dandelion family, suggests that differential preservation has occurred in most cases and that the pollen spectra are skewed as a consequence.

However, in samples where the pollen appears better preserved and more abundant, a reasonable picture does emerge of spectra dominated by open-habitat herbs and very few trees and shrubs.

<u>Diatom</u>

Jane Sidell

Details of the samples selected for assessment are given in Table 12. The purpose of this assessment was to determine whether diatoms were present and whether there was any evidence either for deliberate wetting of deposits during construction or for the use of deposits from springs or other water sources.

The samples were processed following standard procedures. No diatoms were recovered from any of the samples apart from one possible valve.

Table 12: Samples for diatom assessment

Sample no	context no	SSD	Description	sub sample of
9800	4041	5.46	OLS -grey clay layer	9121
9801	4041	5.39	OLS -grey clay layer	9126
9802	3066	5.75/76	fill of feature cut into gravel core	9244
9803	4181	9.13	feature at end of East Lateral ? satellite mound	9425
9804	4153	5.77	gravel core	9251
9805	4166	5.77	dark band above gravel core	9252
9806	4156	5.80	clay band with flints - part of primary organic mound	9234
9807	4041	5.80	OLS-below primary organic mound	9238

10 MICROBIOLOGICAL ASSESSMENT OF CORES 4 AND 7

Dr M C Lillie and Dr R J Smith
September 2008

10.1 Introduction

In recent years the preservation and stability of Silbury Hill has been questioned due to the fact that a number of the tunnels, which were excavated during previous archaeological investigations were collapsing.

Archaeo-environmental Research & Consultancy Services have been commissioned by WAERC at the University of Hull, to undertake the microbiological assessment of two cores which were excavated from recent remediation works at Silbury Hill (undertaken in 2007-8), on behalf of English Heritage.

Five cores in total (Cores 4-8), of approximately 0.1 m diameter and 0.4 m length, were excavated in close proximity to one another (in an area of *c.*1.5 m) horizontally into the mound, from the end of the Main Tunnel, which was excavated into the centre of Silbury Hill (Plate 56). Sampling of the cores was undertaken on 13/11/2007.

Core 8 disintegrated during the sampling process, Core 6 is currently being kept in a cold store (+4 °C) at the offices of English Heritage in Fort Cumberland and Core 5 has been sub-sampled for palaeo-biological assessment by investigators at Royal Holloway, University of London (see Section 11). The remaining cores (4 and 7) were sub-sampled by the authors at the University of Hull for conventional and molecular microbiological assessment. Five sub-samples were extracted from the centre of both cores at 50mm, 100mm, 200mm, 300mm and 350mm intervals along their length.

Plate 56: End of the Main Tunnel which was excavated in 2007 (English Heritage). (The numbers [4-8] indicate the position of the cores).

Additional sub-samples from Cores 4 and 7 were obtained from similar locations to those highlighted above. These were subsequently dispatched to the Organic Geochemistry Unit at Bristol University for geochemical assessment.

The conventional microbiological techniques employed in order to assess the microbial community of the sub-samples collected from Cores 4 and 7 include bacterial counts, extra cellular enzyme activities, ^{14}C-leucine assimilation and substrate utilisation using Biolog ecomicroplates. The results of these assessments are displayed (in tabular and graphical form) and discussed in Section 10.3 of this report.

It was not possible to characterise microbial community diversity and composition in Cores 4 and 7 using the molecular genomic technique of Denaturing Gradient Gel Electrophoresis (DGGE) analysis of Polymerase Chain Reaction (PCR) amplified 16s ribosomal RNA (rRNA) genes. Although recent studies have identified that this methodology has the potential to offer a rapid, cost-effective and reproducible way of characterising microbial communities, and of studying associations between community structure and soil habitat (Muyzer *et al.* 1993, Teske *et al.* 1996, Gelsomino *et al.* 1999, Griffiths *et al.* 2003, Johnson *et al.* 2003, Smith 2005, Douterelo-Soler 2007), there are a number of problems that exist during the PCR-DGGE analysis of microbial DNA fragments that may have prevented successful analysis in the current investigation.

The main problems with the PCR-DGGE analysis of microbial DNA fragments are the extraction of DNA from the soil matrix (Head *et al.* 1998, Theron and Cloete 2000) and the PCR amplification process prior to DGGE analysis (Liesack *et al.* 1991, Reysenbach *et al.* 1992, Zhou *et al.* 1996, Wintzingerode *et al.* 1997, Head *et al.* 1998, Ward *et al.* 1998, O'Donell and Görres 1999, Macrae 2000). However, in light of recently successful research using this methodology (Yates 2004, Smith 2005, Douterelo-Soler 2007), it is suggested that the highly anaerobic and compacted nature of the sediment sampled at Silbury Hill considerably limits the amount of micro-organisms present within the samples. The low number of microbes present under these conditions inhibits the further steps of DNA extraction and PCR amplification.

10.2 Conventional Methods

Preparation of soil slurries

Prior to the conventional microbiological analysis, 5g wet weight of each soil sample was weighed and made up to 30ml using 0.2µm filtered, sterile, pure water. The slurry was transferred into a sterile polythene bag and homogenised in a stomacher (Colworth Lab Blender 400, A.J. Seward Ltd, London) for 5min (Yates 2004).

Subsequently, the contents of the polythene bag were transferred into a 50ml sterile glass beaker. 20ml of 0.2µm filtered, sterile, pure water were used to rinse the remaining slurry from the bag. This produced a soil concentration of 100g wet weight l-1 (Yates 2004).

Bacterial abundance

The soil samples were stained with acridine orange (3, 6-bis [dimethylamonio] acridinium chloride). This compound binds to RNA and DNA. It has a maximum fluorescence at an excitation wavelength of 470 nm.

The abundance of bacteria in a soil was determined by direct counting after staining with acridine orange (Francisco *et al.* 1973). A 1g l-1 soil suspension was obtained by diluting the 100g wet weight l-1 slurry with 0.2µm filtered sterile water. Sub-samples (10ml) of this soil suspension were fixed with 0.5ml of filtered neutral formaldehyde (final concentration 2 % w/v). The sub-samples were then stored for up to two weeks at 4 °C (Douterelo-Soler 2007).

The 1g l-1 suspensions were then further diluted (x 10) with sterile 0.2µm filtered pure water. Acridine orange solution (0.1ml, 1g l-1) was added to 10ml sub-samples of the 0.1g l-1 soil suspension. The suspensions were left in the dark for 10 minutes in order to allow staining of the bacteria. Two replicate controls of 10ml of 0.2µm filtered sterile water were also stained with acridine orange (Douterelo-Soler 2007).

Polycarbonate membrane filters of 0.2µm pore size (Nuclepore-Whatman) were dyed black, using irgalan black (0.2 % in 2 % acetic acid) solution, for 10 minutes (Douterelo-Soler 2007). This was undertaken in order to create a contrast between the membrane and fluorescent bacteria during the subsequent counting process.

After staining with acridine orange, 1ml aliquots of the 0.1g l-1 soil suspension were filtered through the black 0.2µm polycarbonate membranes by gentle suction provided by a hand-operated vacuum pump. Each membrane was rinsed with 5ml of 0.2µm filtered, sterile, pure water. It was subsequently removed from the filter holder and placed face up on a glass slide smeared with immersion oil (Olympus, Japan), to ensure its adherence to the surface of the glass (Douterelo-Soler 2007).

An additional drop of non-fluorescent immersion oil was added to the filter surface. A Nikon Alphashot epifluorescence microscope was used, with blue light illumination, to count the bacteria at 1250 x magnification. The bacteria fluoresced against a black background. For each preparation, bacteria were counted in 30 eyepiece squares of 0.084mm side. Three replicates were used from the individual soil slurries (Douterelo-Soler 2007).

The concentration of bacteria in the 0.1 g l-1 soil suspension was calculated as follows:

$$= \frac{N}{F} \times \frac{A}{S^2} \times \frac{1}{V} \times 1.05^{*} \text{ cells ml}^{-1}$$

Where: N = number of bacteria counted - mean count in 30 control fields
F = number of eyepiece graticule squares counted (30)
A = area of filter (mm^2)
S = length of side of graticule square (0.084 mm)
V = volume of suspension filtered (1 ml)
* To compensate for the dilution by formalin

The abundance of bacteria in the soil sample was calculated as follows:

Bacterial abundance = concentration in the 0.1 g l^{-1} soil suspension (cells ml^{-1}) x 1000 x 10 cells g^{-1} wet weight of soil.

Measurement of extracellular enzyme activities

The current microbiological assessment assays phosphatase, glucosidase and aminopeptidase activity. These assays hydrolyse the target substrate and its 'reporter' molecule (tag). Two types of fluorescent reporter molecules were used during this research; 4-methylumbelliferone (MUF) and 7 amino-4-methylcoumarin (MCA) (Sigma Chemicals, Poole, UK). The non-fluorescent substrates labelled with MUF and MCA were added to the soil slurries (Nannipieri *et al.* 1990). The fluorescence released was subsequently quantified using a fluorometer.

The assays of extracellular-enzyme activities (Hoppe 1993) were undertaken the day after sampling. β-glucosidase, phosphatase, and leucine aminopeptidase activity were measured using the fluorogenic substrates 4-methylumberliferyl-ß-D-glucopyranoside, 4-methylumberliferyl-phosphate and l–leucine-7-methyl-4-amidocoumarin (Sigma Chemicals, Poole, UK), respectively (Yates, 2004).

Stock solutions of the three substrates were prepared at a concentration of 5mmol l-1 in 0.2µm filtered, sterile, pure water, after dissolution in 40 % (v/v) methanol (Goulder 1990, Yates 2004). For each of the enzyme assays, three replicate sub-samples (5.76ml) of each slurry sample (1g wet wt l-1) were used (i.e. three different substrates with three replicates for each soil sub-sample). An additional slurry sub-sample of 1g l-1 was also prepared for use as a control. This was undertaken by boiling the sample for 5 min and then cooling prior to use, in order to eradicate enzyme activity. 0.24 ml enzyme substrate was added to each sub-sample and to the blanks in order to give a final concentration of 200µmol l-1 (Yates 2004).

The sub-samples were subsequently incubated for 5 h at 10 °C. After incubation, the sub-samples were centrifuged at 2225 RCF for 5 min. A 5 ml aliquot was then added to 0.4 ml of pH 10, borate buffer solution (BDH, Dorset, UK). The fluorescence intensity was measured using a fluorometer (Turner Designs Model 10 Series Fluorometer, Steptec Instrument Services, Bedfordshire, UK), which was fitted with an excitation filter 10-069 and an emission filter combination 10-059 and 10-061. The fluorescence reading of the blank was subtracted from the calculation in order to allow for fluorescent impurities and/or non-enzymatic hydrolysis (Douterelo-Soler 2007).

To obtain the concentration of the post-incubation fluorescent products (4-methylumbeliferone [MUF] and methyl-4-amidocoumarin [MCA]), straight line calibrations graphs for MUF and MCA were prepared. A buffered standard MUF solution was created in 0.2µm filtered, sterile, pure water, at concentrations of 0.1, 0.2, 0.3, 0.4 and 0.5µmol l-1. In addition, a buffered standard MCA solution was created at 0.25, 0.5, 1.0 and 2.0µmol l-1. Their fluorescence intensity was measured and the calibrations graphs were plotted. From the calibrations graphs, the concentration of the product equivalent to one relative fluorescent unit was determined (Yates 2004).

The extracellular enzyme activity in 1.0 g l-1 soil suspension was calculated as follows (Brown and Goulder, 1996):

$$= \frac{M}{T} \times MCU \text{ nmol } l^{-1} h^{-1}$$

Where: M = relative fluorescence of post-incubation sub-samples - relative fluorescence of blank

MCU = concentration of product equivalent to 1 relative fluorescent unit (nmol l^{-1})

T = incubation time (h)

In view of the fact that the concentration of the soil suspension was 1.0g l-1 wet weight, the enzyme activity in the suspension (nmol l-1 h-1) will be numerically equal to the activity per gram wet weight of soil (nmol h-1 g-1 wet weight). The model-substrate concentration used in the assays represents a saturation concentration. Consequently, the rate of substrate hydrolysis was measured approximated to Vmax (Brown and Goulder 1996).

Evaluating ^{14}C-leucine assimilation

^{14}C-leucine solution (0.1 ml; c. 0.1µCi, L-[U-^{14}C] leucine) (Amersham Pharmacia, Biotech Ltd, UK) was added to 10 ml of each of the 3 replicates of 1.0g l-1 soil suspension, in sterile universal bottles. A blank sample containing formalin was added at a final concentration of 2 % (w/v) (Goulder 1991, Cheetham 2004). The final concentration of leucine was 32 nmol l-1.

The universal bottles were incubated in darkness at 10 °C for 5 h. At the end of the incubation period, 2 ml sub-samples of the contents of each bottle were concentrated on 250mm diameter cellulose acetate membrane filters (0.2µm pore size) (Sartorius, Germany). The filters were washed through with 5 ml of 0.2µm filtered, sterile, pure water and are then transferred to scintillation vials which contained 10 ml of scintillation fluid (Filtron-X, National Diagnostics, USA). The vials dissolved the filters. The radioactivity in the vials was assayed by liquid scintillation counting (Tri-Carb 2100TR Liquid Scintillation Analyser, Canberra Packard, UK) (Cheetham 2004).

The radioactivity of the ^{14}C-leucine solution was determined by adding 10µl of the ^{14}C-leucine solution to the scintillation vials containing 10 ml of scintillation fluid. Three replicates were used (Cheetham 2004).

Leucine rate assimilation (V) was calculated using the following equation (after Cheetham 2004):

$$V = f\,(A/T)$$

Where: f = the fraction of ^{14}C-leucine supplied, which is taken up by bacteria during the incubation. This was calculated as follows:

$$f = \frac{([\text{mean CPM samples}] - [\text{CPM blank}]) \times 5}{\text{Activity added (CPM in 0.01ml)} \times 10}$$

A = concentration of the added substrate (nmol l^{-1})
T = time of incubation (h)

Since the concentration of soil suspension used was 1.0g l-1 wet weight, ^{14}C-leucine rate assimilation in the suspension (nmol l-1 h-1) was numerically equal to the assimilation per gram wet weight of soil (nmol g-1 h-1 wet weight) (Cheetham 2004).

The use of Biolog ecomicroplates

The Biolog system assesses the physiological profile of the microbial communities within a sample and characterises them using a pattern of substrate utilization in ninety-six well-microplates (Garland and Mills 1991, Fließbach and Mäder 1996, Di Giovanni *et al.* 1999, el Fantroussi *et al.* 1999).

A bacterial cell suspension was used to inoculate the wells of the microplate in which the wells contained different carbon sources, nutrients and a tetrazolium dye. The wells per plate contain 3 replicates of 31 different environmentally important carbon sources and 1 control well per replicate (Kirk *et al.* 2004). The microplates were incubated and monitored periodically.

The growth of aerobic, heterotrophic micro-organisms in the wells is indicated by the oxidation of the substrate with the concomitant reduction of the tetrazolium dye. This reaction produces colour development which can be quantified colorimetrically. The technique provides a metabolic fingerprint of the specific microbial population or community in the sample (Smalla *et al.* 1998, Widner *et al.* 2001).

The results obtained using these microplates are primarily a reflection of bacterial metabolism, as many fungal species are not able to reduce the tetrazolium dye (Kirk *et al.* 2004, Avidano *et al.* 2005).

Although the Biolog system allows a rapid and simple study of the functional diversity of soils, it does have some inherent problems. It is culture dependent (Garland and Mills 1991, Haack *et al.* 1995), favours fast growing micro-organisms; and it may be difficult to obtain reproducible results due to the different densities of replicate inocula and changes to the microbial community during the inoculation process (Garland 1996, Insam 1997, Singh *et al.* 2006). Because of these problems, the data obtained from Biolog microplates are perhaps best considered as relevant to the functional diversity of cultivable and fast growing micro-organisms (Smalla et al. 1998).

A 1.0 g l-1 soil suspension was obtained by diluting the 100g wet weight suspension using 0.2µm filtered, sterile water. 150µl of 1.0 g l-1 soil suspension were added to each well of the Biolog Ecomicroplates. The microplates were incubated in the dark at 10 °C for 5 days. The optical density in the wells was read every 24 hours using a MRX II Microplate Reader (Dynex Technologies, USA), which was set at a wavelength of 590 nm (Douterelo-Soler 2007).

The data from each microplate were processed as follows (after Douterelo-Soler 2007):

1) The colour development in the control well was subtracted from the absorbance reading in all other wells;
2) Values for substrates with no colour development (i.e. negative values), were set to 0; and
3) Each microplate was analysed based on its Average Well Colour Development (AWCD) (Garland, 1996). Single time readings were normalized by dividing for the AWCD of the microplate in order to account for possible differences in the inoculation density between samples:

$$AWCD = (\text{sum of } OD_i)/ 31$$

Where: OD_i = Optical density at 590 nm from each well

10.3 Results

<u>Bacterial abundance</u>

Table 13 and Figures 30-31 which are displayed below show the variation in bacterial abundance at different (horizontal) depth intervals in Cores 4 (Table 13, Figure 30) and 7 (Table 13, Figure 31).

The range of bacterial abundance was 0.30-0.80 x 109 cells g-1 fresh weight in the samples obtained from Core 4, whilst the range of bacterial abundance was 0.90-1.50 x 109 cells g-1 fresh weight in the samples collected from Core 7. Bacterial abundance is greater at the surface of Core 4 (at 50mm depth). Below this depth, bacterial abundance remains low, but increases slightly as depth increases.

Bacterial abundance through the profile of Core 7 is higher than the corresponding values recorded in Core 4. Bacterial abundance is greatest at 200mm (1.50 x 109 cells g-1 fresh weight) and 300mm (1.40 x 109 cells g-1 fresh weight) depths; whilst the remaining depths display similar lower values.

Table 13: Variation in bacterial abundance obtained at different depth intervals from Cores 4 and 7.

Core 4 (depth in mm)	Abundance	Core 7 (depth in mm)	Abundance
50	0.8	50	0.9
100	0.3	100	1
200	0.4	200	1.5
300	0.4	300	1.4
350	0.5	350	0.9

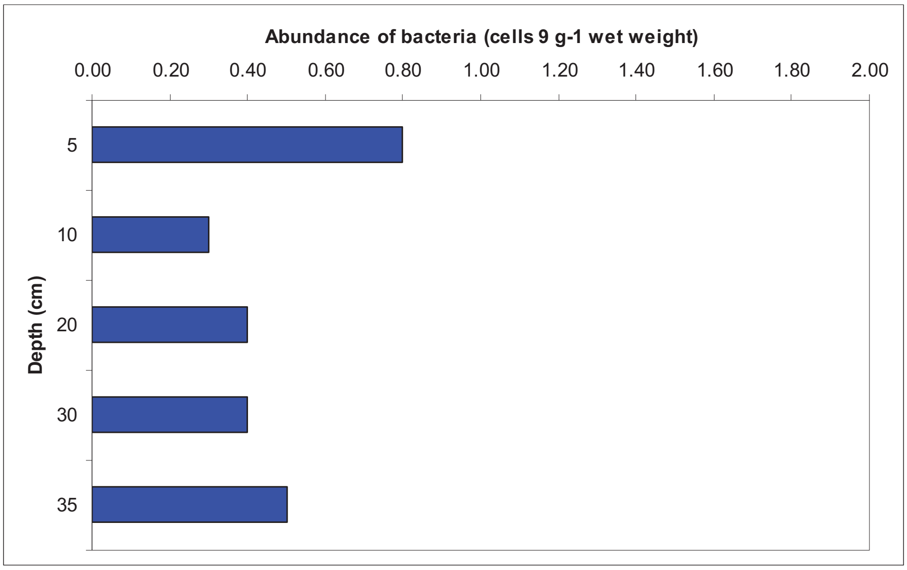


Fig 30: Abundance of bacteria with depth from Core 4.

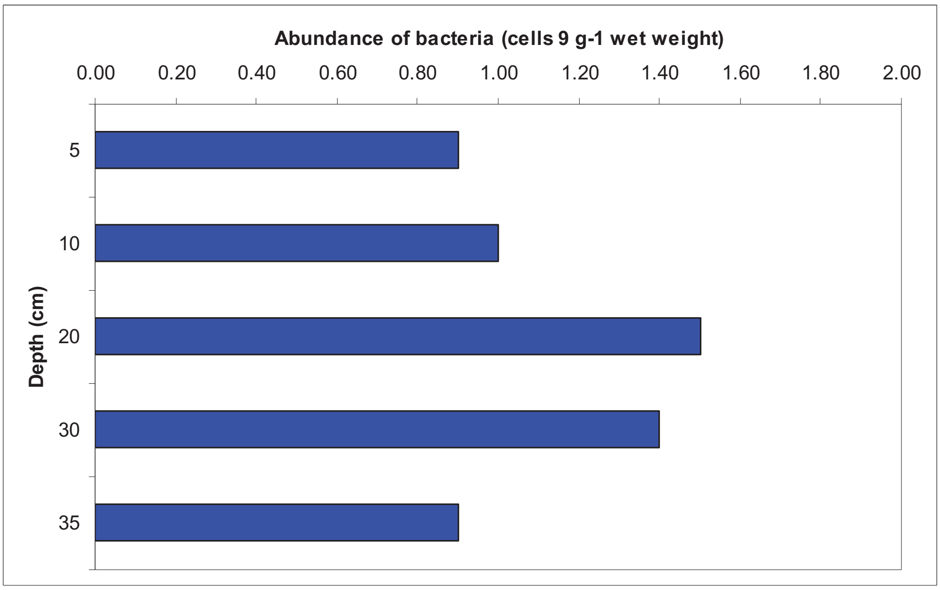


Fig 31: Abundance of bacteria with depth from Core 7.

Extracellular enzyme activity

Tables 14-15 and Figure 32 below show the individual (Table 14), and mean/adjusted (Table 15, Figure 32) extracellular enzyme activity at different depth intervals in Core 4. In general, enzyme activity tended to remain low throughout the sediment profile (i.e. below 0.10µmol g-1 wet weight h-1). Phosphatase tends to decrease with depth (with the exception of 350mm depth where a slight increase is in evidence) and glucosidase remains similar throughout the profile of the core. Leucine aminopeptidase generally increases with depth.

Table 14: Individual extracellular enzyme activities of the samples obtained at different depth intervals from Core 4.

Depth (in mm)	Phosphatase	Glucosidase	Leucine aminopeptidase
50	0.353	0.305	0.134
	0.33	0.458	0.039
		0.367	
100	0.268	0.317	0.074
	0.212	0.553	0.011
	0.238	0.384	
200	0.162	0.68	0.168
	0.12	0.11	0.145
	0.141	0.11	0.169
300	0.086	0.17	
	0.105	0.183	0.212
	0.071	0.195	0.301
350	0.271	0.309	0.231
	0.266	0.335	0.19
	0.19		0.213

Table 15: Mean and adjusted values of extracellular enzyme activities of the samples obtained from different depth intervals from Core 4.

Depth (in mm)	Phosphatase	Glucosidase	Leucine aminopeptidase
50	0.342	0.382	0.087
100	0.239	0.418	0.043
200	0.141	0.300	0.161
300	0.087	0.183	0.257
350	0.242	0.322	0.211
		Results / µmol g-1 h-1	
Depth (in mm)	Phosphatase	Glucosidase	Leucine aminopeptidase
50	0.085	0.095	0.022
100	0.060	0.105	0.011
200	0.035	0.075	0.040
300	0.022	0.046	0.064
350	0.061	0.081	0.053

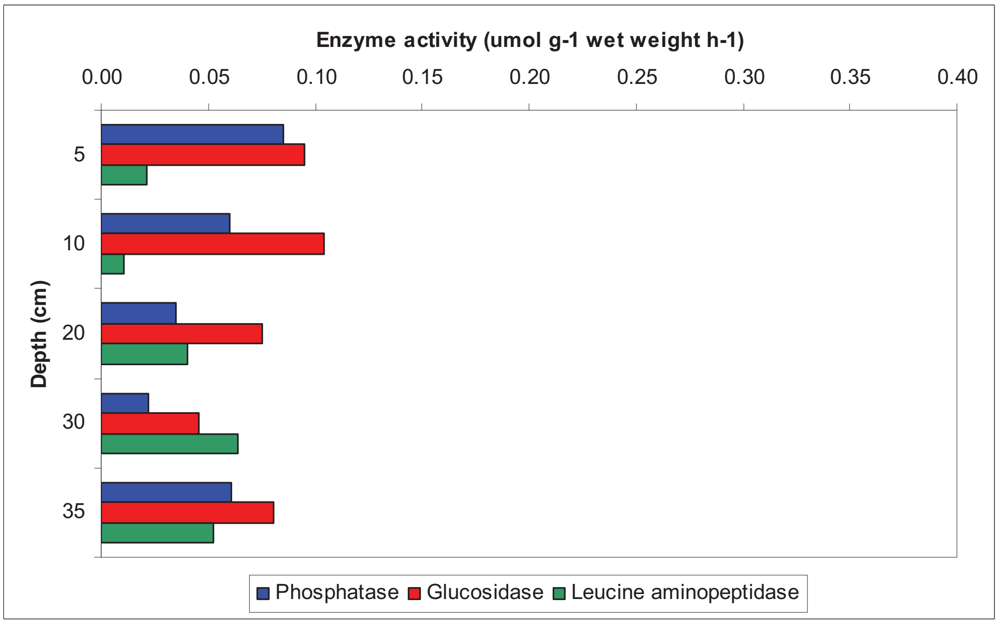


Fig 32: Extracellular enzyme activities obtained at different depth intervals from Core 4.

Tables 16-17 and Figure 33 below show the individual (Table 16), and mean/adjusted (Table 17, Figure 33) extracellular enzyme activity at different depth intervals in Core 7. The values of phosphatase and glucosidase mirror the results from Core 4; phosphatase decreases with depth (with the exception of 100mm depth where a greater than average decline is displayed) and glucosidase remains similar throughout the profile of the core. There is, however, a marked difference in the values of leucine aminopeptidase to those obtained in Core 4; with 0.36µmol g-1 wet weight h-1 present at 50mm depth and between 0.17 and 0.26µmol g-1 wet weight h-1 in evidence below the surface sample.

Table 16: Individual extracellular enzyme activities of the samples obtained at different depth intervals from Core 7.

Depth (in mm)	Phosphatase	Glucosidase	Leucine aminopeptidase
50	0.702	0.287	1.225
	0.71	0.382	1.623
	0.716	0.375	1.584
100	0.208	0.276	0.904
	0.159	0.205	1.038
	0.247	0.209	0.121
200	0.515	0.293	0.122
	0.315	0.273	1.154
	0.325	0.311	0.872
300	0.257	0.173	0.83
	0.357	0.124	0.948
	0.419	0.122	0.872
350	0	0.296	0.955
	0.702	0.276	1.024
	0.71	0.277	1.088

Table 17: Mean and adjusted values of extracellular enzyme activities of the samples obtained at different depth intervals from Core 7.

Depth (in mm)	Phosphatase	Glucosidase	Leucine aminopeptidase
50	0.706	0.335	1.424
100	0.205	0.230	0.688
200	0.385	0.292	0.716
300	0.344	0.140	0.883
350	0.000	0.283	1.022
		Results / µmol g-1 h-1	
	Phosphatase	Glucosidase	Leucine aminopeptidase
50	0.177	0.084	0.356
100	0.051	0.058	0.172
200	0.096	0.073	0.179
300	0.086	0.035	0.221
350	0.000	0.071	0.256

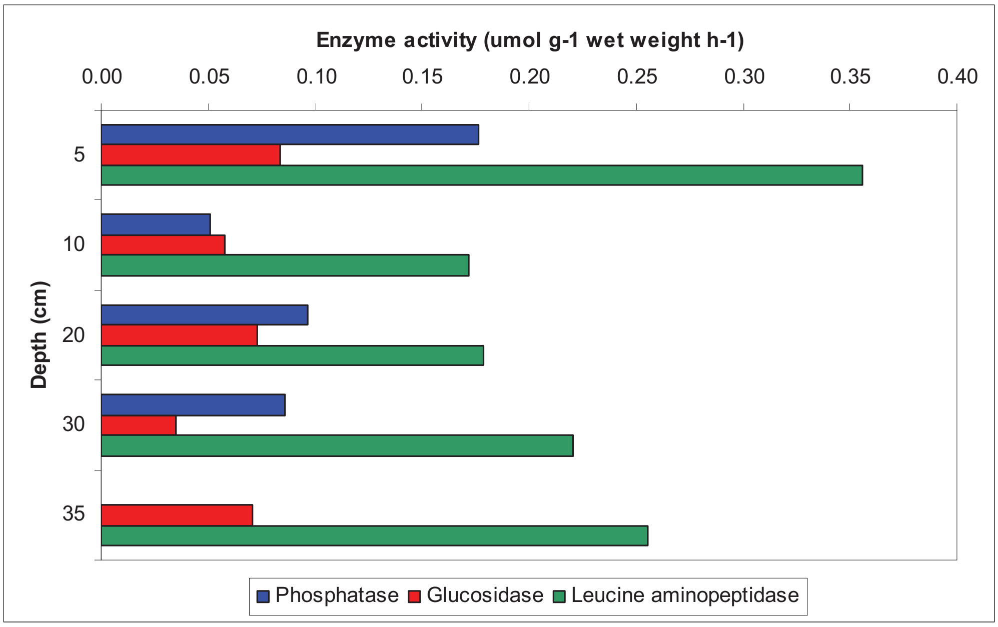


Fig 33: Extracellular enzyme activities obtained at different depth intervals from Core 7.

<u>^{14}C-leucine assimilation</u>

Table 18 and Figure 34-35 below show the ^{14}C-leucine assimilation at different depth intervals from Cores 4 (Table 18 and Figure 34) and 7 (Table 18 and Figure 35). In general, ^{14}C-leucine assimilation rates remain low throughout the profiles of both cores. There is, however, one notable exception to this trend. Below 200mm depth in Core 7, ^{14}C-leucine assimilation rates decrease from 2.00µmol g-1 h-1 (at 200mm depth), 0.60µmol g-1 h-1 (at 300mm depth) to 0.10µmol g-1 h-1 (at 350mm depth).

Table 18: Variation in ^{14}C-leucine assimilation obtained at different depth intervals from Cores 4 and 7.

Core 4 (depth in mm)	Average	Standard Deviation	Core 7 (depth in cm)	Average	Standard Deviation
50	0.03	0.02	**5**	0.02	0.00
100	0.04	0.03	**10**	0.01	0.00
200	0.02	0.00	**20**	1.96	0.94
300	0.00	0.00	**30**	0.57	0.16
350	0.01	0.00	**35**	0.11	0.00

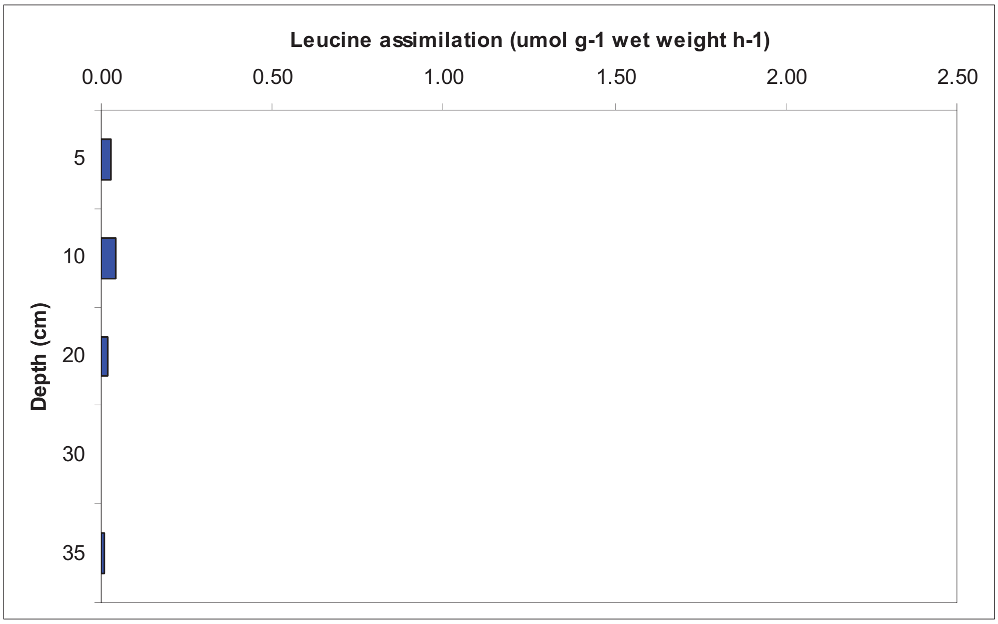


Fig 34: Variation in ^{14}C-leucine assimilation with depth from Core 4.

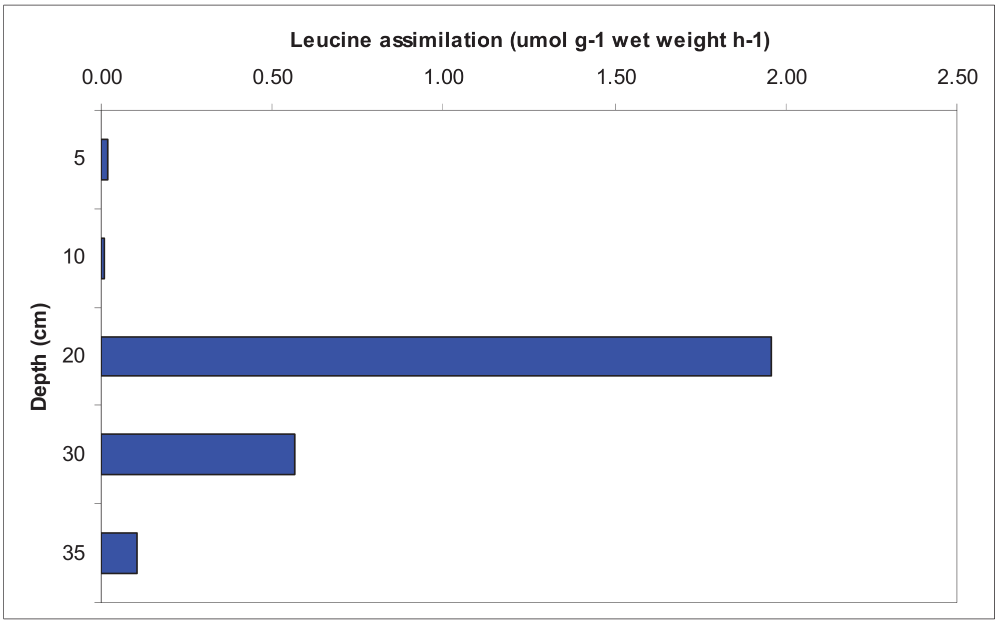


Fig 35: Variation in ^{14}C-leucine assimilation with depth from Core 7.

<u>Biolog ecomicroplates</u>

Figures 36a-e below show the carbon source utilization of the different substrates in the Biolog ecomicroplates by the soil microbial communities present in Core 4. The microbial communities from all depths were able to metabolise all of the substrates provided. There was close similarity between the carbon sources that were utilised by the microbial communities at all depths.

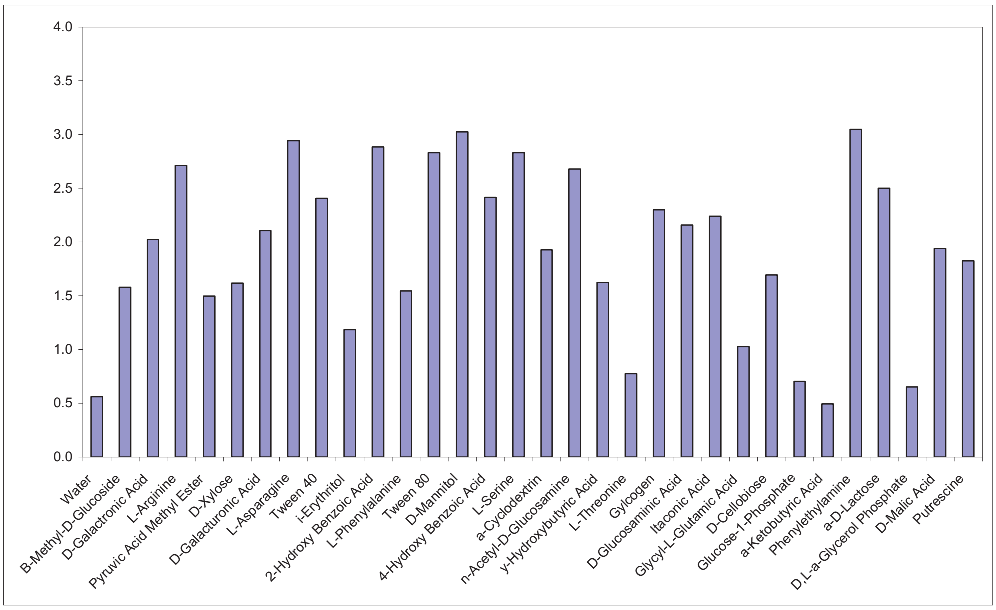


Fig 36a: Carbon source utilization by the soil microbial community from Core 4 (at 50mm depth).

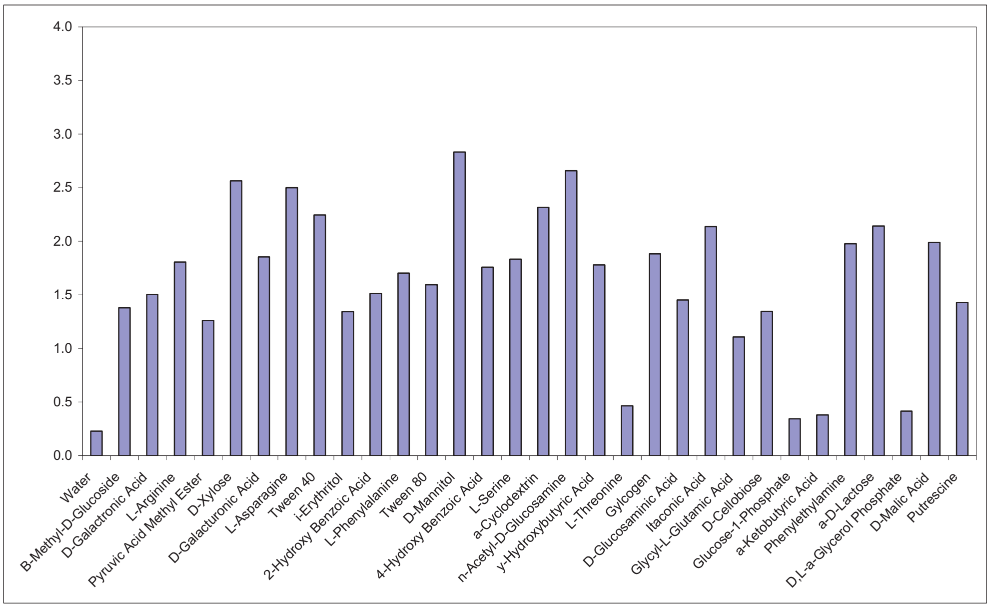


Fig 36b: Carbon source utilization by the soil microbial community from Core 4 (at 100mm depth).

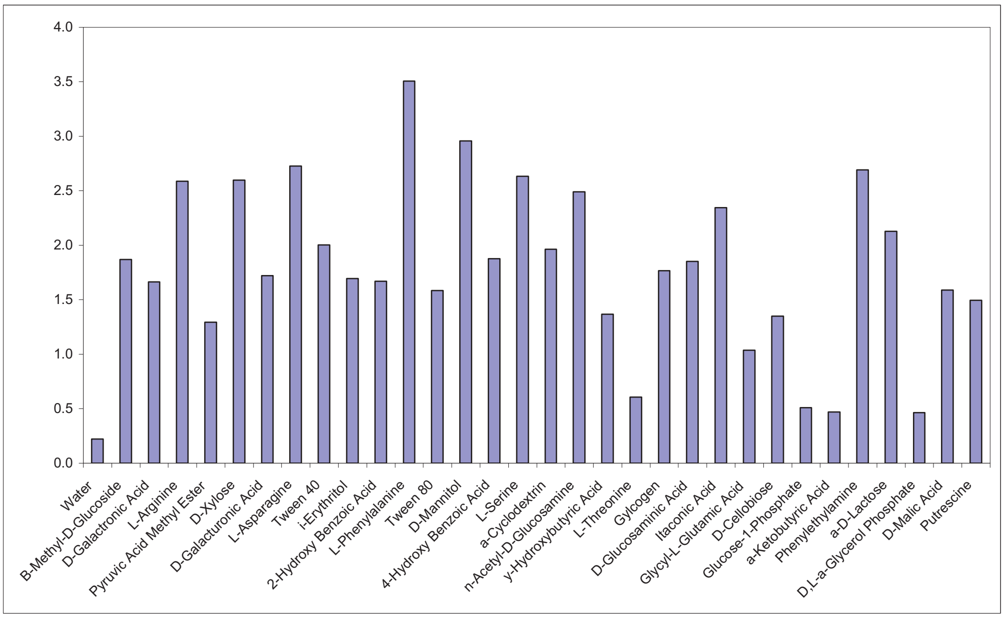


Fig 36c: Carbon source utilization by the soil microbial community from Core 4 (at 200mm depth).

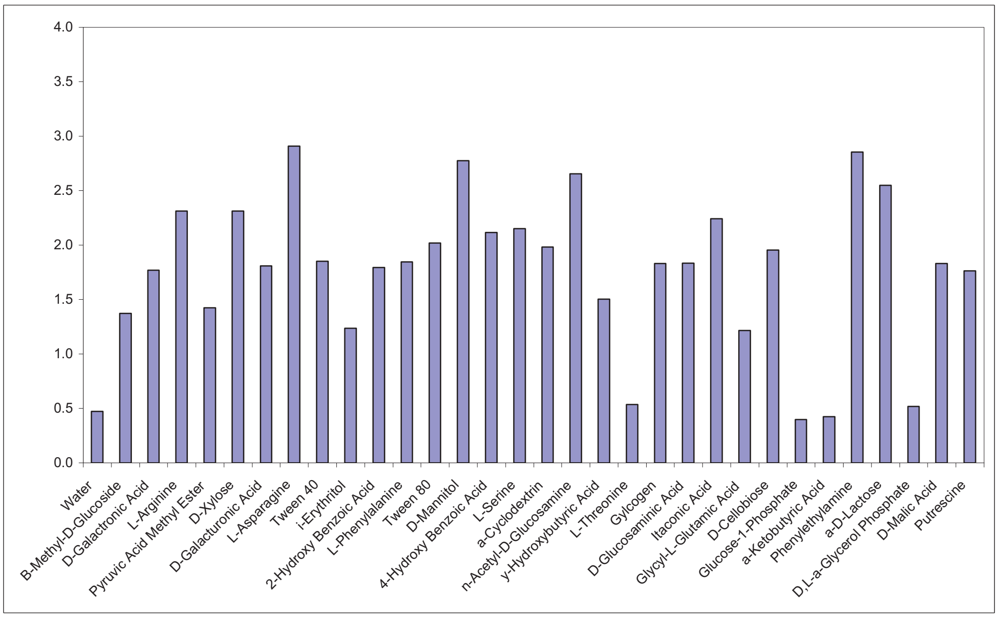


Fig 36d: Carbon source utilization by the soil microbial community from Core 4 (at 300mm depth).

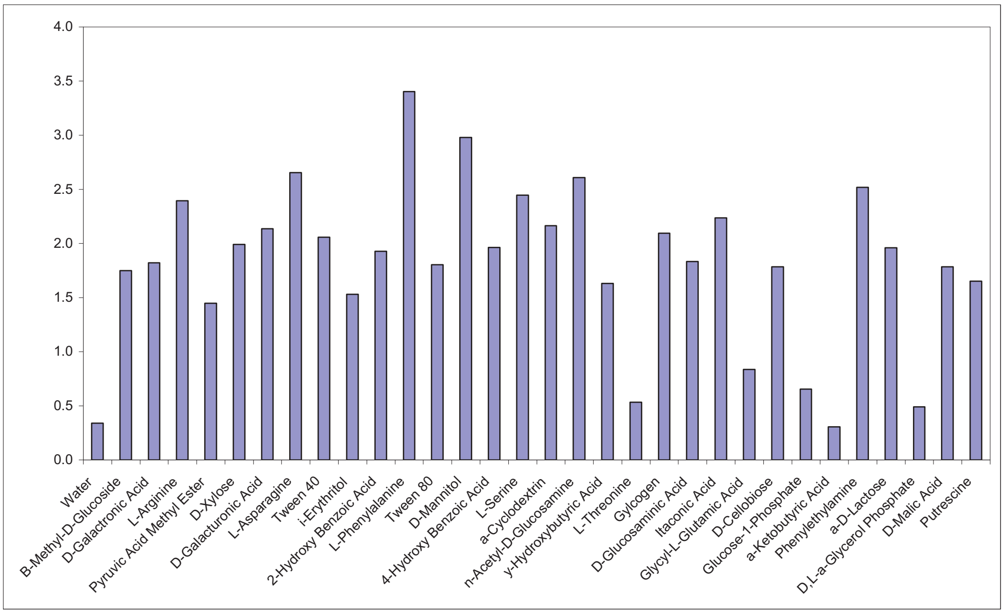


Fig 36e: Carbon source utilization by the soil microbial community from Core 4 (at 350mm depth).

Figures 37a-e below show the carbon source utilization of the different substrates in the Biolog ecomicroplates by the soil microbial communities present in Core 7. The microbial communities from all depths were able to metabolise all of the substrates provided. There was similarity between the carbon sources that were utilised by the microbial communities at all depths; however, the amount of carbon source utilisation at 350mm depth was lower than in the upper 300mm of the sediment profile.

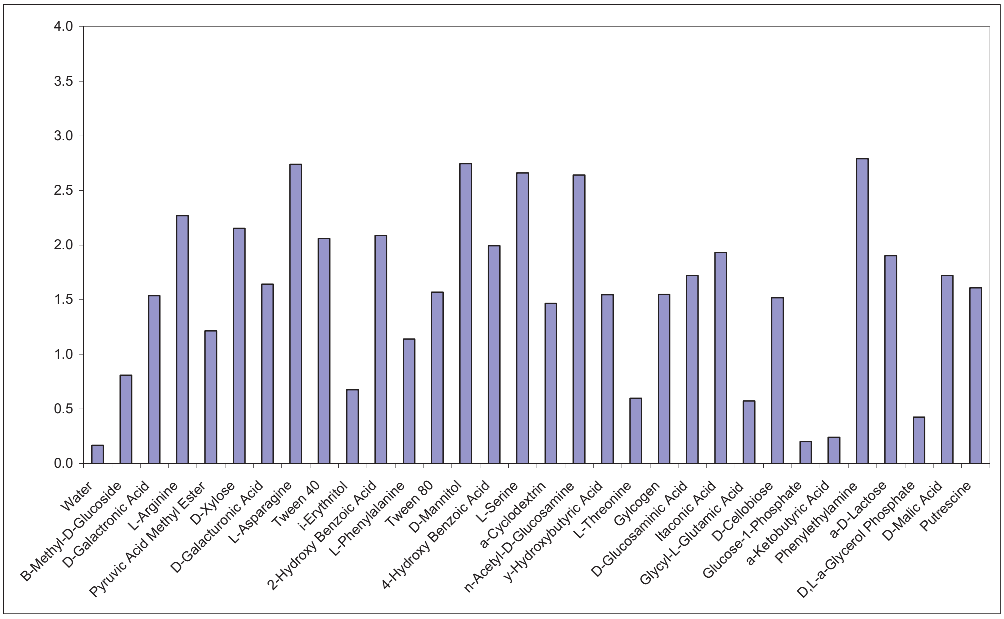


Fig 37a: Carbon source utilization by the soil microbial community from Core 7 (at 50mm depth).

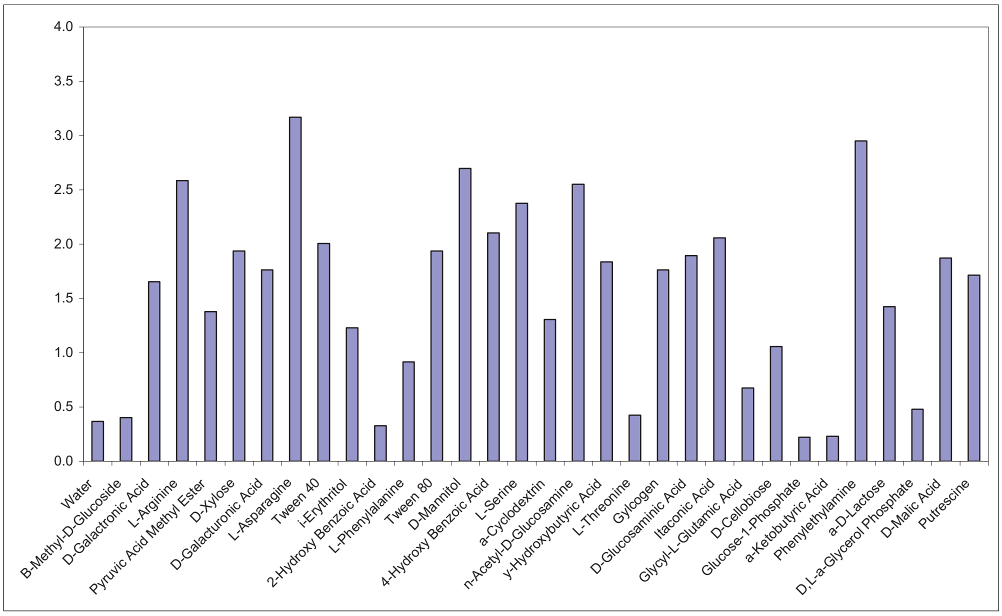


Fig 37b: Carbon source utilization by the soil microbial community from Core 7 (at 100mm depth).

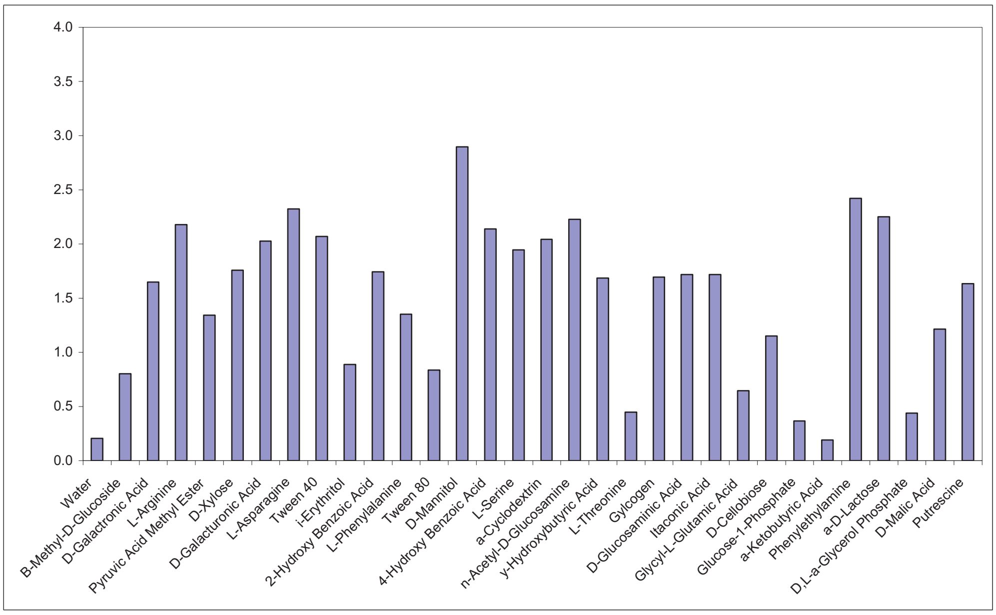


Fig 37c: Carbon source utilization by the soil microbial community from Core 7 (at 200mm depth).

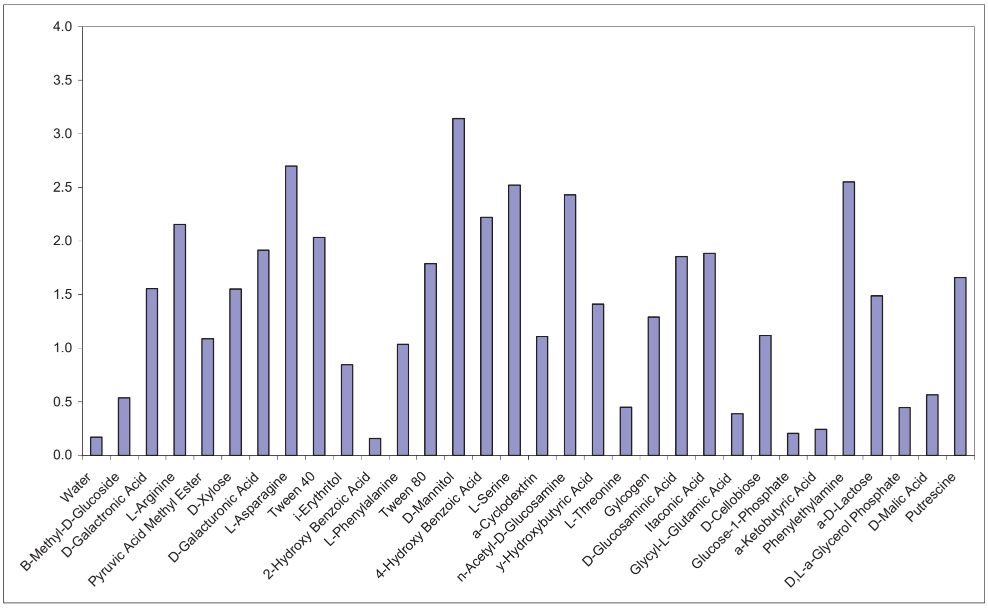


Fig 37d: Carbon source utilization by the soil microbial community from Core 7 (at 300mm depth).

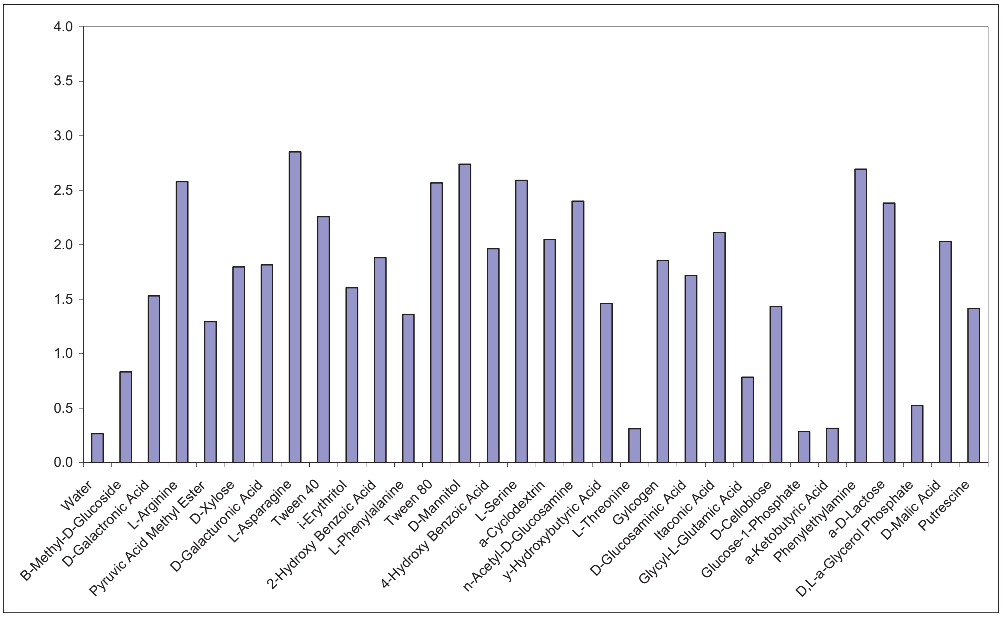


Fig 37e: Carbon source utilization by the soil microbial community from Core 7 (350mm depth).

10.4 Discussion

This section presents the key observations from the conventional microbiological results of the sediment samples excavated from Cores 4 and 7.

<u>Bacterial abundance</u>

Comparison of the bacterial abundance in Cores 4 and 7 indicates that abundance is greater in Core 7 than in Core 4. Furthermore, the general trend for bacterial abundance in both Cores 4 and 7 is that abundance tends to increase as depth increases. There are however several exceptions to this trend, with decreases in bacterial abundance at 300mm and 350mm depths in Core 7; and a higher than anticipated increase in bacterial abundance at 50mm depth in Core 4 (when compared to the other bacterial abundance values).

Although the findings highlighted above indicate that bacterial abundance increases with depth, and that this abundance differs between the locations of Cores 4 and 7; not only are the abundance of bacteria in the samples obtained from both cores low (when compared to standard soils and peat where measurements of *c.* 10 x 109 cells g-1 fresh weight are in evidence [Douterelo-Soler 2007, Lillie and Smith 2008]), but there is little variation in abundance throughout the profile of both cores. In light of these observations, it is suggested that the differences observed here probably reflect natural variations within a deposit of this type (i.e. anthropogenic, very compact and potentially highly anaerobic).

<u>Extracellular enzyme activity</u>
Extracellular enzyme activity using the three assays (leucine aminopeptidase, phosphatase and glucosidase) generally remains low throughout the sediment profile of Cores 4 and 7 (*cf.* Douterelo-Soler 2007, Lillie and Smith 2008). The values of glucosidase remain similar throughout the profile of both cores; whilst phosphatase tends to decrease with depth. However, the value of leucine aminopeptidase at all depths in Core 7 is higher than the corresponding values in Core 4.

In general, the findings presented above indicate that bacterial production is low throughout the profiles of Cores 4 and 7. The contrasting leucine aminopeptidase values in evidence between both cores suggest that changes within the physical composition of the sediment matrix (i.e. clays, sands, etc.) are in evidence. It is proposed that these physical changes are related to the original anthropogenic deposition of the sediment and are not due to environmental perturbations occurring as a result of archaeological investigations at this site.

<u>^{14}C-leucine assimilation</u>
^{14}C-leucine assimilation uptake by microbes in the samples obtained from Cores 4 and 7 remains low throughout their respective profiles (*cf.* Douterelo-Soler 2007, Lillie and Smith 2008). However, below 200mm depth in Core 7, leucine assimilation rates decrease from a peak at 200mm depth of 2.00µmol g-1 h-1, to 0.60µmol g-1 h-1 (at 300mm depth) and 0.10µmol g-1 h-1 (at 350mm depth).

The results outlined above, from Cores 4 and 7, confirm the results of the extracellular enzyme activity measurements, i.e. that bacterial production throughout the profile of both cores is low (particularly when compared to standard soils which have values of between 5 to 20µmol g-1 h-1 [Douterelo-Soler 2007, Lillie and Smith 2008]). The higher values in evidence in Core 7 (and in particular those that are located at below 200mm depth) do not represent a significant change in bacterial production.

<u>Biolog ecomicroplates</u>
The use of Biolog ecomicroplates can provide useful information relating to the functional ability of microbial communities throughout the sediment profile of Cores 4 and 7. The results obtained from both cores generally indicate that the microbial communities present at all depths (horizontally into the mound) were able to metabolise the substrates provided.

The soil microbial communities from both cores utilized a number of carbohydrates (N-acetyl D glucosamine, D-cellobiose and D-manitol), amino acids (L-asparagine, L- arginine and L-serine) and the amine, phenylethylamine, to a greater extent than other carbon sources, throughout the soil profiles. This patterning suggests that fast-growing microbes are responsible for the utilization of the more easily available substrates (carbohydrates, aminoacids and amines) and therefore play an important role in community physiological profiles.

The observations from the Biolog analysis of the sediment samples obtained from Cores 4 and 7 confirm the results of the extracellular enzyme activity measurements, which have demonstrated that there are low levels of metabolic activity within the bacterial communities identified in all of the samples studied.

10.5 Conclusions and Recommendations

The analysis of the results obtained from the conventional microbiological techniques (bacterial abundance, extracellular enzyme activity, ^{14}C-leucine assimilation and Biolog ecomicroplates) employed during the current assessment of the samples excavated from Cores 4 and 7 demonstrate that very low bacterial activity occurs throughout the profile of both cores. Furthermore, in general, there is similarity between the results obtained from Cores 4 and 7 for all the techniques applied. The only notable exception to this is the higher values of leucine aminopeptidase in evidence throughout the profile of Core 7, when compared to the values obtained from Core 4. However, when contrasted against standard soils which have values of between 5 to 20μmol g-1 h-1 [Douterelo-Soler 2007, Lillie and Smith 2008]), the values obtained from Core 7 do not represent a significant change in bacterial production.

In terms of assessing both the current preservation status and the preservation potential of Silbury Hill, bacterial abundance and activity in all the samples studied indicate that changes in environmental variables (such as temperature, moisture content, redox potential, pH, etc.) associated the current archaeological investigations, and possibly earlier investigations at this site, have not had a noticeable effect upon the microbiological community. This is evident from the similarity of the samples excavated throughout the profile of both cores (i.e. bacterial abundance and activity in the surface samples [excavated from 50mm depth] were comparable to those excavated from 350mm depth). One must however be aware that despite low levels of microbial activity, the degradation of archaeological wood (and other biogenic material) can still occur in environments where oxygen is limited (Jordan 2001).

In light of the observations above, it is suggested that a more targeted approach is necessary in order to identify the specific species of bacteria which are implicated in the decay process of organic material within the sediment of Silbury Hill. This can be achieved through culturing known strains of bacteria which are responsible for organic degradation from the samples currently available (Cores 4 and 7). The employment of this methodology will help increase our understanding of the relationship between microbial diversity and the biodegradation of organic material in highly anaerobic (and/or complex) environments.

11 CELLULAR AND ULTRASTRUCTURAL PRESERVATION OF ORGANIC MATERIAL

Margaret Collinson, Tony Brain and Gill Campbell
October 2008.

11.1 Summary

Short cores were taken horizontally into the lower part of the organic mound in the end wall of the Atkinson tunnel in the centre of Silbury Hill. Cellular and ultrastructural preservation has been assessed in four types of organic material from one sample level. Green plant material has no cellular structure but preserves membrane stacks from chloroplasts within a matrix enclosed between two cuticle-like layers. This organisation defies explanation and the identity and preservational history of green plant material remain to be determined in a future study. Yellow plant material is of higher plant origin and preserves cellular structure (but no plastid membranes). The cuticle layer has separated from the outer epidermal wall layer during decomposition and microbes intervene between these layers. Microbes are abundant in both types of plant material but not amongst the dispersed organic particles in the sediment. Rootlets are of higher plant origin and preserve three-dimensional cellular structure internal to the endodermis as well as the distinctive endodermis cell wall layering. Three cuticle layers and their ultrastructure are preserved in beetle elytron though some innermost cuticle layers have been lost. These characteristics provide a baseline for future study of preservation at different depths into the tunnel wall and in other archaeological contexts at Silbury and elsewhere.

11.2 Introduction

In order to help determine the effects of previous tunnelling episodes on the organic mound, our subproject aims to investigate the state of preservation of organic material, at both cellular and ultrastructural levels.

11.3 Aims of the assessment phase

1) To sample the organic mound in the tunnel wall to obtain samples at various distances into the mound.
2) To determine appropriate sub-sampling strategies.
3) To conserve and store samples in a manner suitable for both immediate and future study.
4) To investigate a single sub-sample to determine the types of organic material available for study.
5) To study selected organic material from a single sub-sample to determine 'baseline' preservation states.

11.4 Sampling, sub-sampling and conservation (Aims 1-3).

Collapse of the Atkinson tunnel during excavation necessitated construction (by the site engineers Skanska) of a new tunnel within the old tunnel. This, combined with restrictions on numbers of workers in the tunnels and our own availability, delayed our sampling work until November 13th 2007 just a few days before the excavation was closed.

A full account of our sampling and sub-sampling, with reasoning, is provided in Annex 1. In summary:-

1) Aim 1 was achieved by five short cores *c.* 100mm diameter and *c.* 300mm length that were taken *c.* horizontally into the end of the main wall of the old Atkinson tunnel (Plates 57 and 58). Core 8 disintegrated on sampling and is stored at EH along with the intact core 6. Cores 4 and 7 were used by Hull University for microbiology assessment

(Section 10). Core 5 (EH sample number <9445>) was taken to Royal Holloway for study of preservation of organic material.

2) **Aim 2** was achieved by sub-sampling core 5 at three sampling intervals with increasing distance into the mound. At each sampling interval different lithologies (up to four) were sampled separately (Plates 3 and 4).
3) **Aim 3** was achieved by further subdividing the sub-samples into two. One subset was fixed for Transmission Electron Microscopy (see methodology) and the second subset was frozen for alternative applications in future.

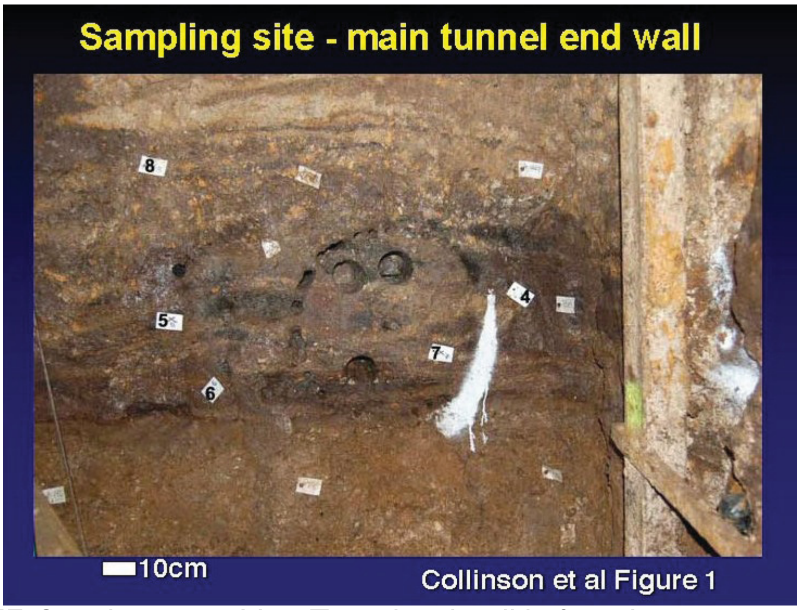


Plate 57: Sampling site – Main Tunnel end wall before the cores were taken

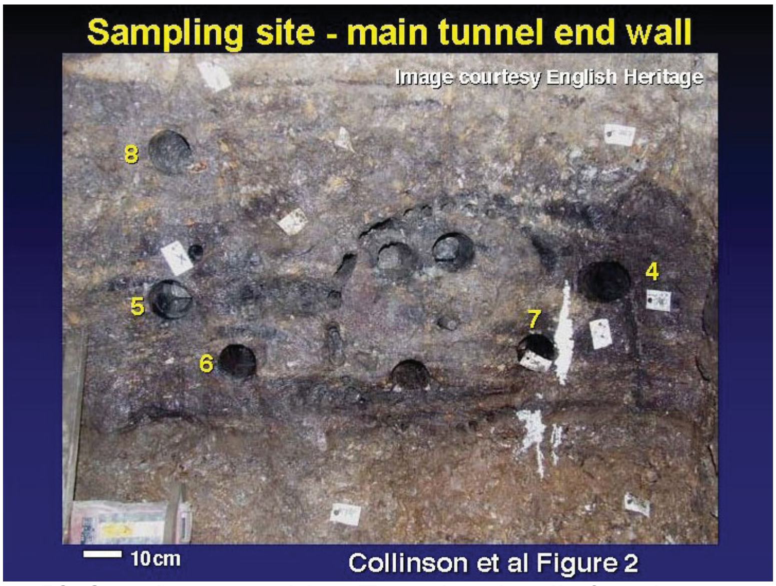


Plate 58: Sampling site – Main Tunnel end wall after the cores were taken

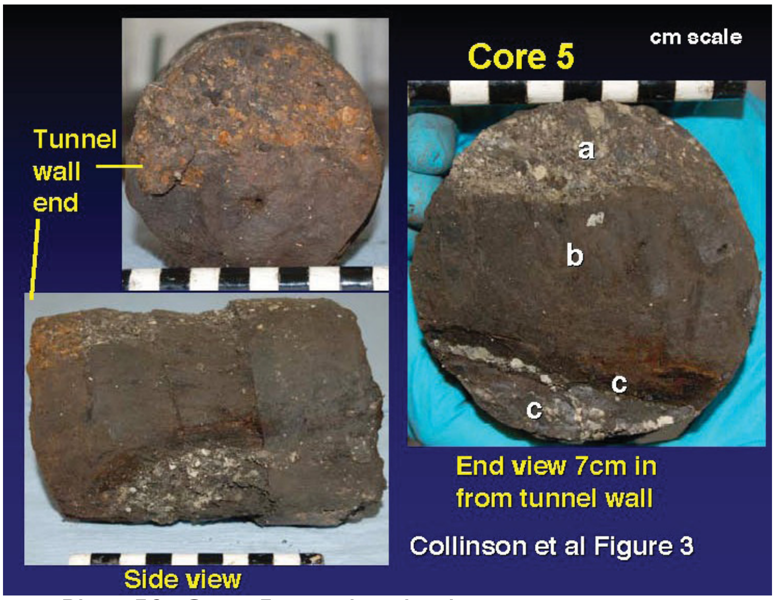


Plate 59: Core 5 – end and side views

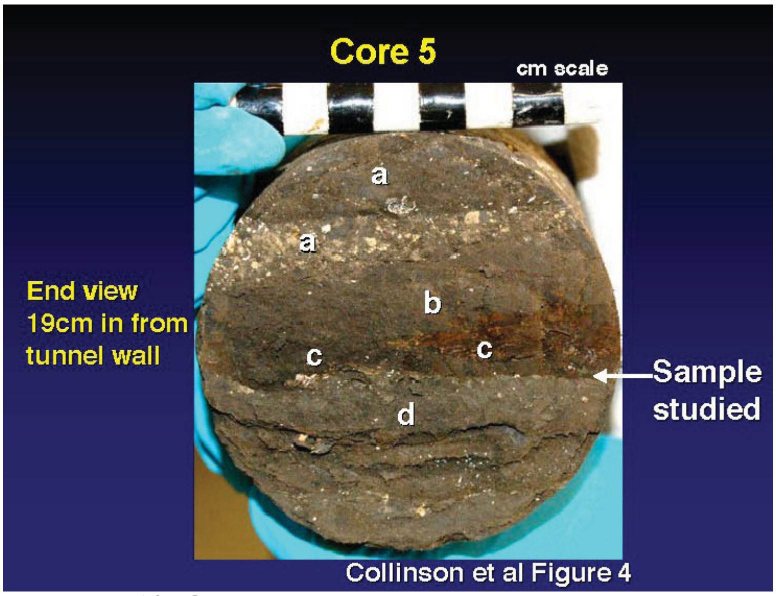


Plate 60: Core 5 – showing the samples studied

11.5 Sub-sample for assessment

During sub-sampling at interval 150-190mm (Plate 60) the organic-rich fibrous layer separated very readily from the adjacent organic rich mud below. Green plant material was observed at the junction. Therefore a small sub-sample (*c.* 5cc) of the organic-rich fibrous layer was selected for the assessment study.

This sub-sample was fixed (see methodology) for transmission electron microscopy and later rinsed and teased apart in distilled water.

Aim 4 was achieved by recognition of four categories of organic material suitable for study.

a) green plant material (leaf or stem)
b) yellow plant material (leaf or stem)
c) rootlet material
d) beetle elytron

11.6 Methodology for assessment of preservation

Transmission electron microscopy (TEM) Samples were fixed according to standard protocols for biological materials, in 2.5% glutaraldehyde in 0.1M phosphate buffer, in order to prevent any further alteration to the tissues after their extraction from the core. All fixation was completed within a maximum of ten hours after removal of cores from their context in the end wall Main Tunnel at Silbury Hill.

Individual pieces of organic material were then post fixed in 1% osmium tetroxide, dehydrated in an acetone / water series and embedded in Spurr resin. Ultrathin sections (c.70nm thick) were cut with a diamond knife, stained with uranyl acetate and lead citrate and studied using a Hitachi H7600 TEM fitted with an AMT digital camera system.

Scanning electron microscopy (SEM).
Samples of green and yellow plant material were mounted from a water droplet onto the emulsion side of a small piece of negative film mounted on an SEM stub. Samples were then sputter coated with gold and examined using an FEI Quanta 200F field emission SEM.

Tests to determine if mineral material could be removed without damage to tissues.
Mineral material attached to organic material can cause major problems for TEM sectioning as mineral grains can be dragged across the specimen by the knife, or they can damage the knife. Replicate samples were treated with Hydrochloric acid followed by Hydrofluoric acid to remove carbonates and silicates respectively (standard technique for extracting small organic particles from siliciclastic rocks). The resulting mineral free organic matter was then prepared for TEM observation as described above. Some replicates of this material were also prepared without osmium tetroxide post fixation to determine whether this stage was necessary. Results showed no discernable differences between osmium and non-osmium treated samples indicating that this stage could be omitted for acid treated samples. Unfortunately, however, some tissue damage was observed in acid treated samples by comparison with untreated samples. Therefore only gently physical brushing in water or fixative prior to embedding can be undertaken in an attempt to remove mineral grains.

11.7 Preservation of organic material (Aim 5).

Green plant material
Green plant material has a bottle green to bluish green colour and occurs as overlapping thin strands at the surface of the organic-rich fibrous layer (Plate 61). It has a longitudinally banded appearance with pale strands at *c.* 200µm intervals and a finely longitudinally striated appearance between these bands (Plate 61). This resembles the general morphology of a grass leaf blade and when first seen in the core the material thought to be green grass (as named in Annex 1). However, under the SEM this material shows no stomata and no surface pattern of any kind, merely a faint undulation (Plate 62). In TEM section green plant material consists of two very thin cuticle-like membranes but there are no internal cell walls or compartments of any kind and no discrete membrane bound organelles can be recognised (Plate 63). The internal material consists of a matrix containing patches of stacked bilayered membranes identical to thylakoid plastid membranes and here interpreted as membranes from chloroplasts (Plate 64).

Microbes are also abundant within green plant material.

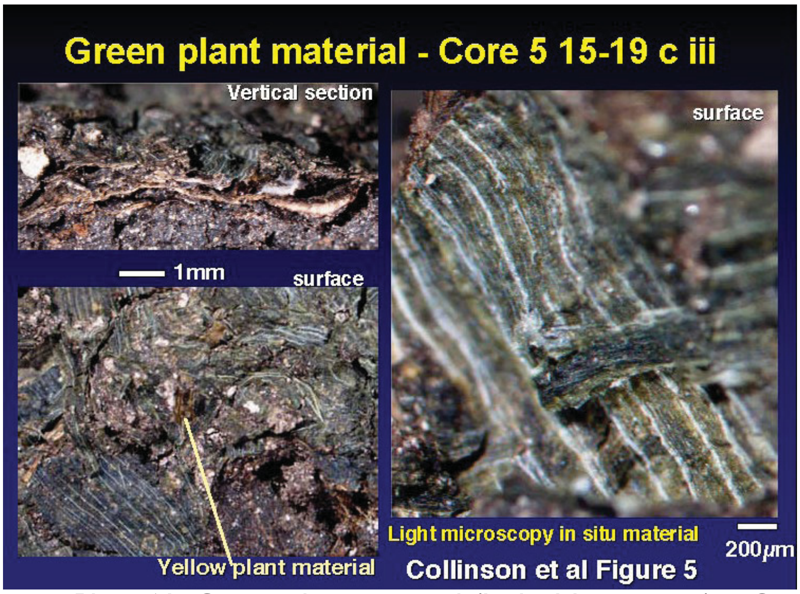


Plate 61: Green plant material (Light Microscopy) – Core 5

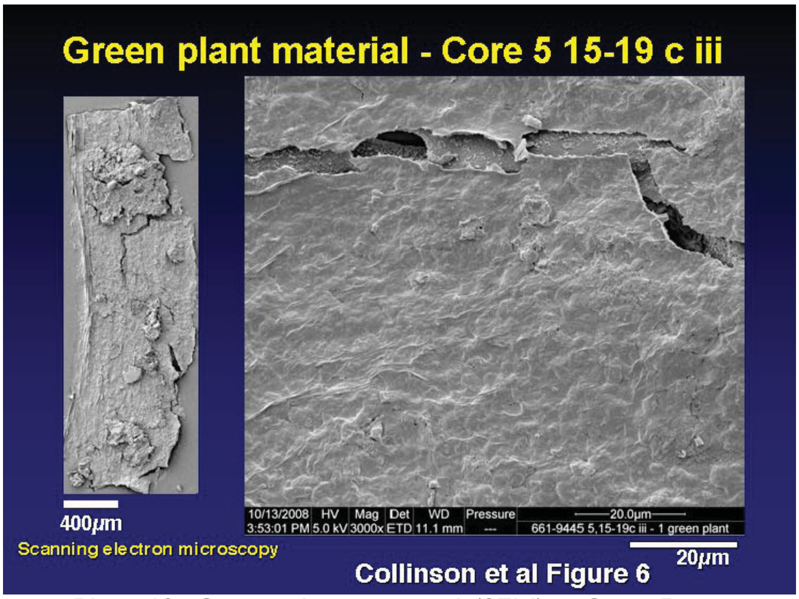


Plate 62: Green plant material (SEM) – Core 5

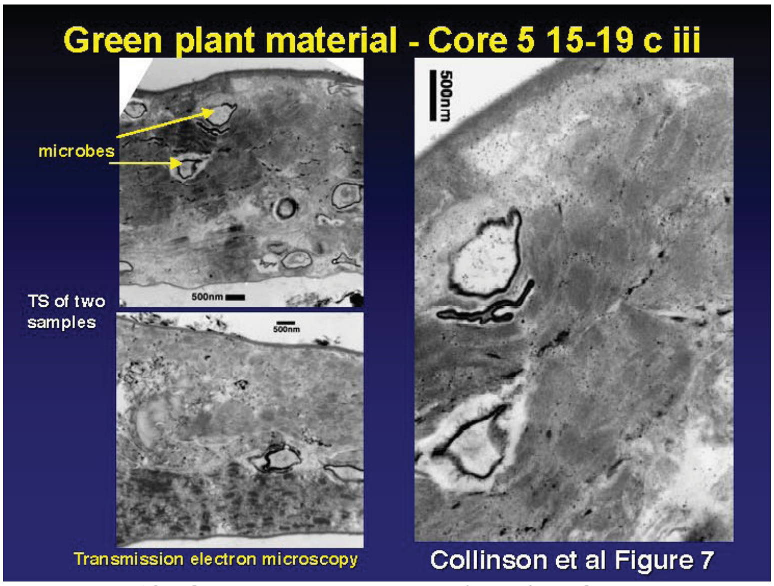


Plate 63: Green plant material (TEM) – Core 5

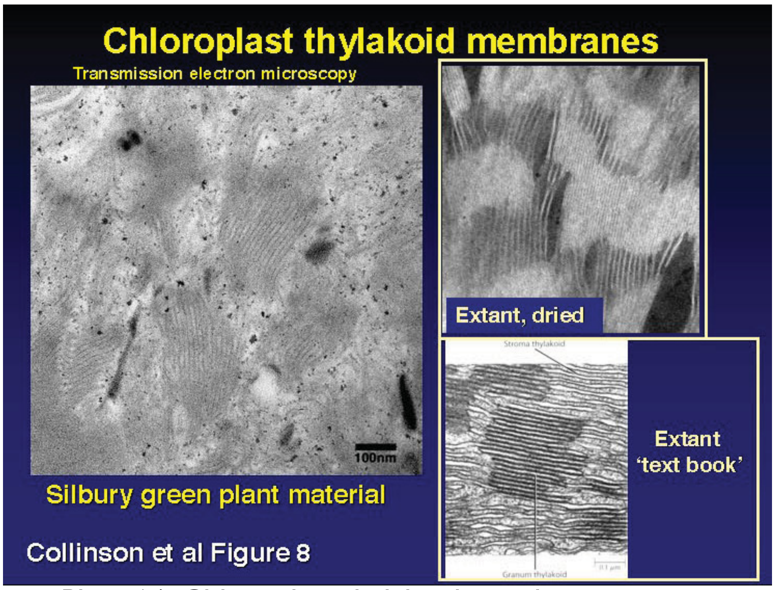


Plate 64: Chloroplast thylakoid membranes

Yellow plant material
Initially it was thought that yellow plant material was the same as green plant material but had senesced prior to the incorporation of the organic-rich lithology into the mound (assuming green plant material was likely to have been living at the time of use). This hypothesis proved incorrect as yellow plant material is utterly different to green plant material.

Under the SEM yellow plant material reveals clear epidermal cells covered by a cuticle with hair bases (Plate 65) (no stomata have been observed). TEM thin sections (Plate 66) reveal that the cuticle has separated from the outer epidermal cell wall and that microbes have penetrated between these two layers. Internal tissues and cell walls are also preserved. Thin cell walls have undergone compression whilst thick cell walls, such as xylem elements, retain 3D shape. Preservation of cell wall layers is patchy, even within a single cell. In spite of the cellular preservation no discrete membrane bound organelles were recognised and no thylakoid membranes were observed. Microbes are also scattered throughout the tissues (Plate 67).

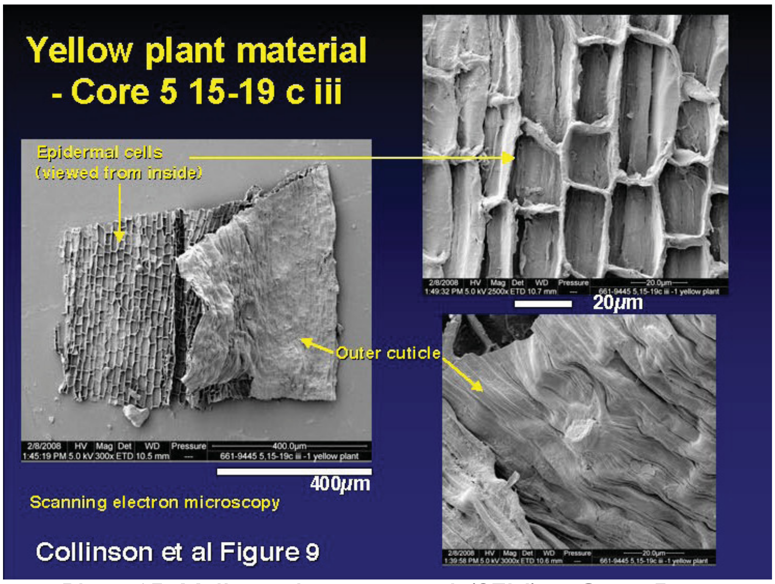


Plate 65: Yellow plant material (SEM) – Core 5

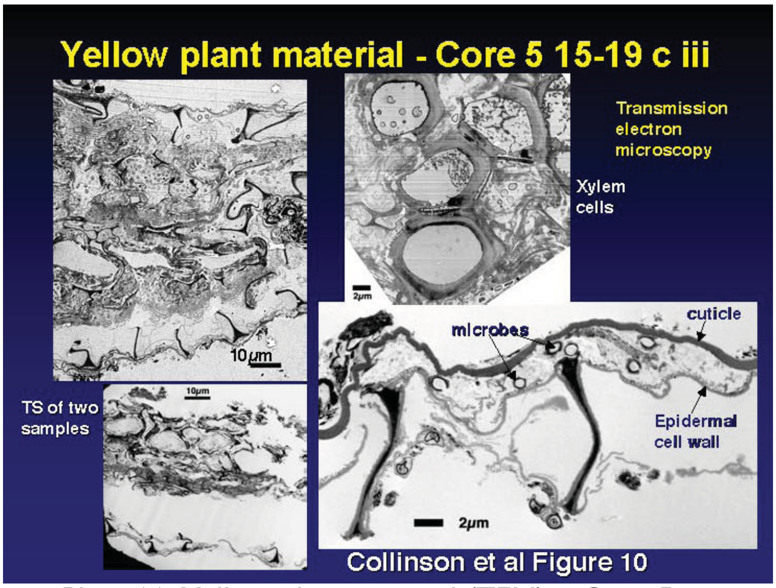


Plate 66: Yellow plant material (TEM) – Core 5

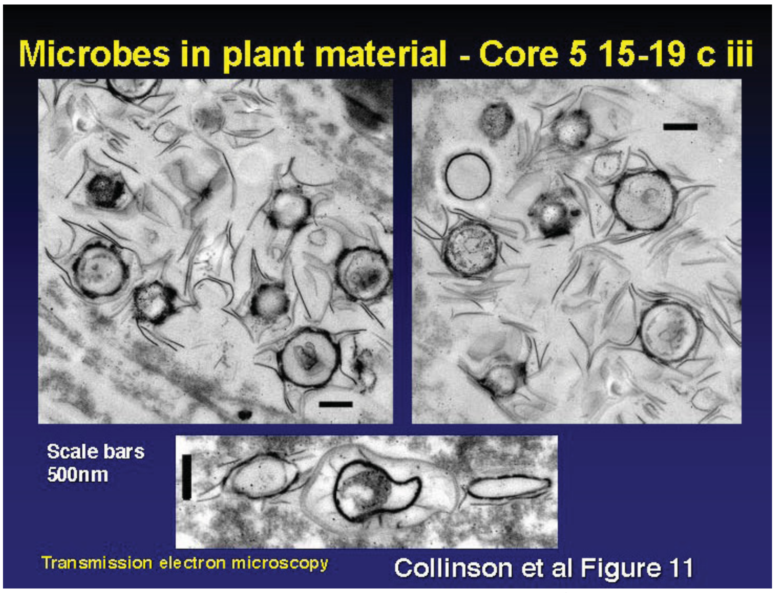


Plate 67: Microbes in plant material – Core 5

Rootlet

Rootlet material confers some of the 'fibrous' texture to the organic-rich layers. The rootlets are small but appear three-dimensional when *in situ* (Plate 68). In TEM section it is apparent that the 3D preservation of cell walls and cell shape is restricted to cells internal to the endodermis (Plate 68). Outside the endodermis the cortical cells are either poorly preserved or at best very strongly compressed. No outer cuticle could be recognised. Much mineral matter has remained attached to the outside of the rootlet (black electron dense material). The endodermis cells are typically very well preserved with the diagnostic differential wall thickening and thick layers of cell wall being clearly observed (Plate 69). However, not all cells show the same cell wall preservation indicating either original differences in cell structure (such as transfer cells) or variable cell wall decomposition (Plate 69).

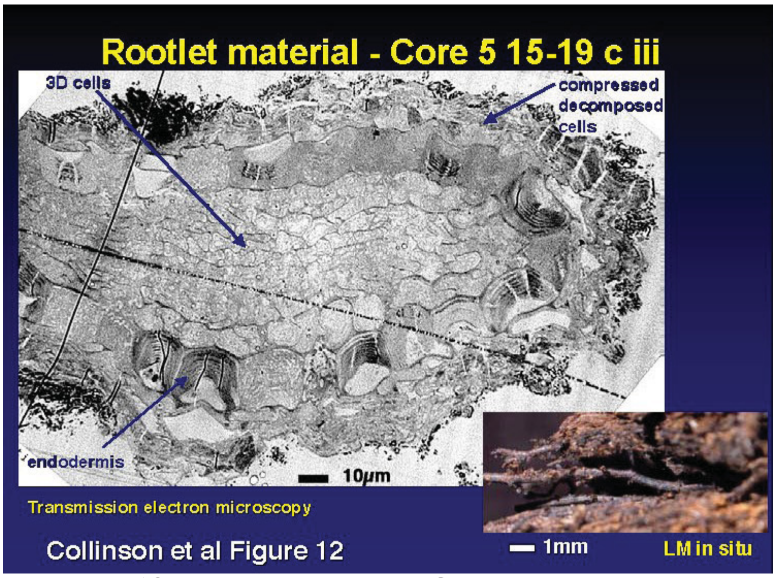


Plate 68: Rootlet material – Core 5

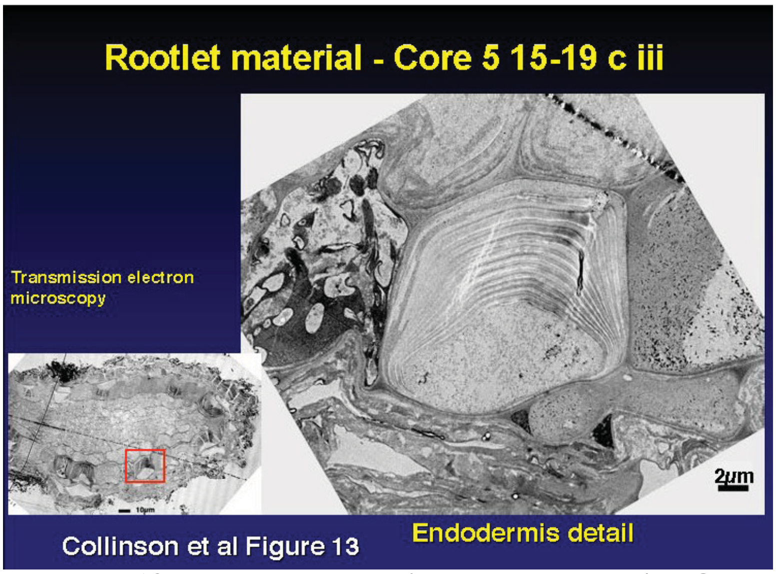


Plate 69: Rootlet material (endodermis detail) – Core 5

Beetle elytron
The single beetle elytron studied so far shows excellent ultrastructural preservation of the thin amorphous outer epicuticle and the finely multilaminated exocuticle. Three layers of endocuticle are also preserved (Plate 70). Previous TEM of beetle elytra (MEC pers obs) suggests that typically endocuticle is of approximately the same thickness as exocuticle which implies loss of a number of endocuticle layers in the Silbury material. This is supported by previous research (MEC per obs) that shows that endocuticle is typically lost in older fossil material.

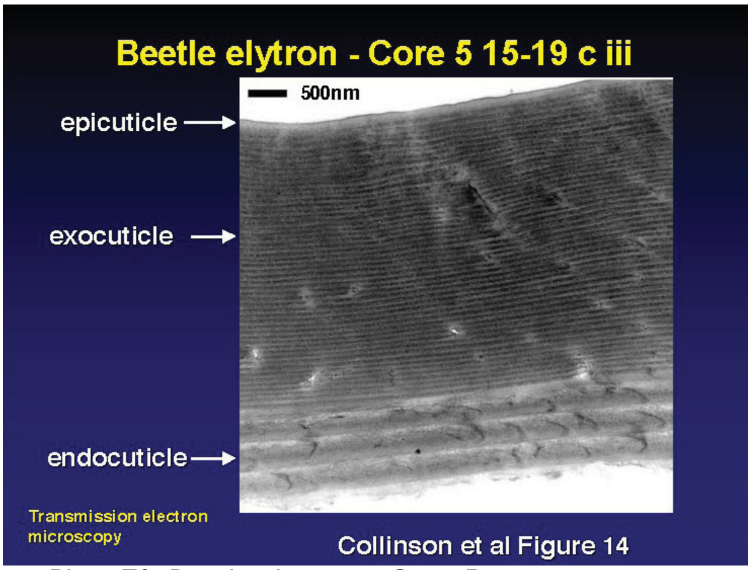


Plate 70: Beetle elytron – Core 5

Microbes in plant material
Small single-celled spheres are abundant throughout the green and yellow plant material. Multiple morphologies are present such that the appearance in section may be of a single electron dense (black in image) ring through to forms with multiple 'faceting' on this ring and several outer layers of variable more electron lucent material (grey in image). Transitional stages exist between all of these (Plate 67) and we tentatively suggest that they represent different phases of the life cycle.

11.8 Conclusions

Aim 5 has been achieved by the characterisation of 'baseline' state of preservation in four types of organic material.

Green plant material has no cellular structure but preserves ultrastructure of chloroplast membrane stacks in a matrix enclosed between two very thin cuticle-like layers.

Yellow plant material preserves cellular structure, with clear cell walls but has no plastid membranes. Ultrastructural analysis shows that the cuticle has separated from the epidermal wall and microbes now intervene between these two layers.
Rootlet material preserves 3D cellular structure within the endodermis and the ultrastructure of the differentially thickened endodermal cell-wall layering is very well preserved.

Beetle elytra preserve excellent ultrastructure of three cuticle layers although some of the innermost endocuticle layers have been lost.

ANNEX 1

Report on sampling at Silbury Hill – 13/11/2007.
Margaret Collinson and Tony Brain.
Led by Gill Campbell of English Heritage (EH).
With Richard Evershed and Rob Smith and Isobel Douterlo-Soler

<u>Initial considerations</u>
Group examined/observed the Main Tunnel followed by that to the left and then right and then Main Tunnel again.

On advise from Gill it appeared impossible to core into right tunnel due to others currently working there and into left tunnel due to potential problems of collapse. The most stable place to sample was deemed to be the end wall of the Main Tunnel.

There had already been an attempt to core into this end wall to take a large core by drilling a number of small holes. Unsuccessful.

Three small diameter cores (*c.* 100mm diam.) had already been taken and were in fridge store on site.

New cores were needed for our sampling – especially essential for the microbiology work and highly preferable for study of the preservation of organic material.

Group discussion resulted in a request for five cores (numbers 4, 5, 6, 7, 8).

A large number were requested owing to the fact that the excavation was due to be backfilled (starting next day) and there would be no future opportunity to sample.

<u>Drilling</u>
Cores were drilled by site engineers, Skanska, by Terry Hilton and others, under the direction of Bob Tutill, between about 12.00 and 13.30 hours.

Core 8 disintegrated as it was drilled into rubbly sediment rich in large flints. The debris is stored in the cold store at Fort Cumberland (EH).

Other cores all successful.

Sampling
Agreed aim was to cut core in half with half for Rob and Isobel (+/-Rich) for microbiology and half for Margaret and Tony and Rich for preservation of organics.

Attempts were made to halve core (one of the early three cores was used) using a trowel and a hammer and chisel and to sub-sample core using a trowel, cork borers and a drill with rotating saw bit. None of these worked.

Therefore it was agreed that Rob and Isobel would take cores 4 and 7 (one for immediate enzyme work and another for later community work) whilst Margaret and Tony would take core 5. Gill would retain core 6 and the earlier three cores in the cold store at Fort Cumberland (EH).

Sub-sampling of core 5 at Royal Holloway.
Core had separated into two parts on drilling with an oblique angle between them. Outer part length ranged from 0-150mm to 0-120mm.

All sub-sampling completed by 21.30hrs.

First set of sub-samples for study into fixative (2.5% glutaraldehyde in 0.1M phosphate buffer ph7.3) for TEM now stored at CUI, Kings College London. Each sample in 25 ml sterilin plastic tube.

Second set of sub-samples for study into freezer (Geology Department, Royal Holloway). Each sample in foil and then in labelled polythene bag.

Un-sampled parts of core in refrigerator (at CUI, Kings College London) in polythene bags.

Sub-sampling procedure
Starting at the tunnel end wall position of the core (=outer end).

Cleaned end of core and outer surface of region to be sampled by cutting contaminated material away with a single edged razor blade in concentric motion.

Contaminated debris kept by Margaret to be used as trial material for disaggregation work. Three examples of this – 0-70mm; 120-190mm; 230-270mm.

Numbering
Samples were numbered as follows:
Core number; depth from outer end; lithological subdivision; sub-sample
e.g. 5, 3-7ai = Core 5, depth 30-70mm into tunnel from outer end of core; lithological unit a sub-sample i.

In a TEM resin block the name of the plant material would be a second line with a number to distinguish each sub-sample of that type of plant.
e.g.

5, 3-7ai
Moss1

These labels have to be concise due to very small amount of space in TEM block.

<u>Sample sizes</u>
Each TEM sample c.20g (18-20g) unless otherwise stated.

Freezer samples not weighed but total varies from c.20g to c. 80g.

List of sub-samples

<u>0-30mm</u>
0-3cm organic mud removed and stored in freezer
0-3cm rubble removed and stored in freezer

<u>30-70mm sub-samples for study</u>
lithologies
a – rubble with chalk clasts of sizes up to 10mm and >5mm abundant
b – dark brown organic mud/silt tiny chalk clasts c. 1mm or less and very rare larger clasts up to 5mm
c. Fibrous organic rich layer inferred to be turf top, plus small amount of immediately adjacent rubble included as too small amount to separate easily.

5,3-7ai fixed for TEM
5,3-7aii fixed for TEM
5, 3-7aiii frozen in two packets

5,3-7bi fixed for TEM
5,3-7bii fixed for TEM
5,3-7biii frozen in two packets

5,3-7ci fixed for TEM
53-7cii frozen

<u>70-120; 70-150mm</u>
Un-sampled core ranging from 70-120mm to 70-150mm in depth was stored with piece of foil marking the inner end. Inner end is angled, sampled end (to outside) is flat.

On second core piece uneven interval from 120-150mm was cut away and stored as clean sample in freezer.
This gave us a clean flat diameter at 150mm to work from. Thus, instead of the original plan to sample 130-170mm depth we have sampled 150-190mm depth.

<u>150-190mm sub-samples for study</u>
Lithologies
- a- rubble and thin band of mud to outer edge too small to separate
- b- organic mud and silt between rubble layer and turf layer
- c- organic rich fibrous turf layer, green grass seen
- d- Organic rich mud below turf layer

5,15-19ai fixed for TEM
5,15-19aii frozen

5,15-19bi fixed for TEM
5,15-19bii frozen

5,15-19ci fixed for TEM
5,15-19cii frozen
5,15-19ciii fixed for TEM – green grass blades on exposed surface
5,15=19civ green grass photographed, micro-photographed 24 hrs later, then stored in fridge

5,15-19di fixed for TEM
5,15-19dii fixed for TEM
5,15-19diii frozen (? In two packets)

190-230mm

Interval 190-230mm cut from core with a hacksaw blade and stored intact in fridge, piece of foil at the tunnel (outer) end.

230-270mm sub-samples for study

Lithologies
a rubble
b turf
c organic mud

5,23-27ai fixed for TEM
523-27aii frozen

5,23-27bi fixed for TEM (only 15g)
5,23-27bii frozen (small sample c.15-20g)
5,23-27biii frozen – lateral to turf but turf petered out so not in this sample

5,23-27ci fixed for TEM
5,23-27cii fixed for TEM
5,23-27ciii frozen in two packets.

12 ASSESSMENT OF FAUNAL REMAINS

Fay Worley

12.1 Introduction

A small assemblage of animal one was recovered from excavations on the summit of Silbury Hill and from the remedial works within the hill's tunnels. This report assesses the assemblage and comments on requirements for further work.

12.2 Methods

Hand collected bones and those recovered from sample residues were assessed separately in context and fraction groups. The assessment data was recorded in a *Microsoft Excel* worksheet, which can be found with the site archive. The assessment data is analysed by phase in this report. The data are presented in Tables 19-39.

For each hand collected context group the following information was recorded:

- fragment count;
- qualitative assessment of condition using a five point scale (poor, moderate, good, very good, mixed);
- the number of countable (containing at least one zone following Serjeantson (1996); zones 1, 2 or 3 if a rib; and zones 1, 2, 7 or 8 if a vertebra) cattle, sheep/goat, pig, large and medium mammal bones and teeth;
- the number of identifiable bones of all other taxa represented;
- the number of ageable (containing teeth in the fourth premolar to third molar tooth row) mandibles and teeth of cattle, sheep/goats and pigs;
- the number of ageable epiphyses of each mammalian taxa represented;
- the number of measurable (skeletally mature and sufficiently complete to follow the measurement conventions of Von den Dreisch 1976) bones of each mammalian or avian taxa;
- any general comments on the context group such as the presence of butchery marks, pathological lesions or burnt bones.

The animal bones recovered from sample residues were assessed in context groups by fraction (2-4mm or >4mm). As the condition of the micro-faunal bone was consistently good, no comment was made in the spreadsheet. Micro-faunal bones and small bone fragments from larger animals were considered separately. The following information was recorded for each fraction:

- the percentage of the fraction which had been sorted (if known);
- the total weight of bone fragments;
- the weight of micro-faunal bone fragments;
- comments on the presence of micro mammals;
- the weight of non-micro-faunal bone fragments;
- a count of non-micro-faunal bone fragments;
- comments on the presence of other taxa (including species and elements present);
- comments on the overall nature of the fraction assemblage (for example, a predominance of amphibian bones).

Phase 2 – Old Land Surface

Hand collected animal bones

None

Animal bones from sample residues
A pig or wild boar right second maxillary premolar was recovered from the Old Land Surface. Further tooth enamel fragments are visible in the unprocessed sample.

Comments
This sample requires processing before further analysis can be conducted. The pig/boar tooth/teeth may predate mound construction and may therefore be useful for radiocarbon dating.

Phase 4 – Lower Organic Mound
Hand collected animal bones
A single fragment of incisor tooth enamel was recovered from context [4156] (part of the Lower Organic Mound). The dimensions of the fragment suggested that it was cattle rather than red deer or horse.

Animal bones from sample residues
An unprocessed sample from context [4156] contains a large portion of a cattle right radius diaphysis (four refitting fragments).

Comments
The tooth enamel might be residual from the turves. The cattle radius is unlikely to be residual due to its size. It should be washed to assess and stabilise its condition. It should then be examined for butchery marks.

Phase 5 – Pitting activity
Hand collected animal bones
A fragment of large mammal flat bone was recovered from context 3066 (Small find 8038).

Animal bones from sample residues
Very little animal bone was recovered from the sieved residues of four phase 5 samples. Sample <9272> and <9817> each contained one small fragment of large mammal bone. The fragment in sample <9817> refitted with Small Find 8038. Medium mammal sized fragments, including long bone fragments, were recovered from samples <9272> and <9816>. In addition to these remains, only an anuran fragment from sample <9272> and a rodent incisor from sample <9340> could be identified.

Comments
This assemblage has little interpretative potential.

Phase 6 – Upper Organic Mound
Hand collected animal bones
None recovered.

Animal bones from sample residues
A single pig peripheral first phalanx was recovered from sample <9306>, taken from the Upper Organic Mound (context [4172]).

Comments
This bone was in good condition suggesting that it was probably not residual from the turves. The presence of this single, small bone may well be incidental.

Phase 13- Infilling and backfilling of ditch 1

Hand collected animal bones

Two fragments of poor condition animal bone were recovered from spit 4 of buried ditch [3920] (Phase 13.1). Both fragments could not be identified and both may in fact be a degraded antler tine tip which had eroded from the chalk mound into the ditch.

Animal bones from sample residues

Single fish teeth were recovered from samples <9024> and <9012>, taken from spits 1 and 2 of the fills of ditch [3902] (contexts [3903] and [3918], phases 13.2 and 13.1 respectively).

Comments

The bone/antler is likely to be redeposited in the ditch fill and the fish teeth might be of fossils from the chalk.

Phase 17 – Final mound construction

Hand collected animal bones

A total of 53 fragments of animal bone were recovered from nine contexts representing inter-wall deposits ([4813], [4835], [4843], [4844], [4845] and [4848]), a chalk rubble wall ([4808]), chalk collapse layer in crater ([4874]) and the chalk final phase of the mound ([4909]). Only 18 fragments were countable or identifiable, with taxa including cattle, sheep or goat, possible red deer, badger, mole and anura. The context groups of hand collected bones were in good (21 fragments), moderate (13 fragments) and mixed (19 fragments) condition.

Animal bones from sample residues

Animal bone was recovered from the sieved residues of 11 phase 17 samples from the summit excavations. The majority of fragments were anuran, probably frog. Some vole and mouse specimens were also present in the micro-faunal assemblage. In addition to the microfauna, sheep or goat, medium mammal (including a neonate), fish and juvenile small carnivore bones were present. The small carnivore is probably a mustelid but should be identified further.

Comments

Common frogs (*Rana temporaria*) were seen occupying crevices in the summit of the hill during the excavation. This together with the abundance of anuran bones in phase 17 samples suggests that the contexts were not well sealed and raises the possibility that other ecofacts, including the anuran, badger, mole and juvenile carnivore remains, from these contexts might be intrusive. The domestic mammal and possible red deer bones may represent animals utilised during the construction of the final mound, but may also represent material from the medieval activity which has migrated down into the mound.

Phase 18 – Medieval activity

Hand collected animal bones

A total of 108 hand collected bone fragments were recovered from ten phase 18 contexts (post hole fills [4820], [4822], [4824] and [4832], pit fills [4826], [4857], [4875], [4877] and [4886] and possible animal disturbance [4828]). Of these, 48 were countable or identifiable, including 14 countable domestic mammal fragments. The possible animal disturbance ([4828]) contained 16 of the countable and identifiable animal bones, comprising 14 anuran fragments, a cattle bone and a medium mammal sized fragment. Pit [4834] contained the largest frequency of animal bone including five badger or probable badger bones and four fox or probable fox bones. The phased assemblage included fragments identified as cattle, sheep or goat, pig, large mammal, medium mammal, bird, badger, fox, lagomorph, water vole and anuran. Over half the fragments were from contexts including bone in mixed condition and the majority of the remainder was in moderate condition.

Animal bones from sample residues
Animal bone was recovered from the sieved residues of 13 phase 18 samples from the summit excavations. Like the phase 17 sample residues, the majority of fragments were anuran although vole, mouse, shrew, water vole and mole micro-faunal specimens were also identified. A total of 110 fragments of non-micro-faunal bone were recovered from sample residues. This included 29 specimens identified as cattle, sheep, pig, bird, badger and fish.

Comments
The badger bones probably represent a partial skeleton distributed between the phase 17, 18 and 21.1 summit activities. As with the underlying phase 17 assemblage, it is likely that this assemblage includes a high proportion of intrusive material, notably the micro-faunal remains, particularly the anura, and the badger bones. This assemblage holds little potential for elucidating the nature of faunal utilisation on the hill in the medieval period beyond the presence of individual domestic taxa.

Phase 19 – 18th century activity
Hand collected animal bones
Very few fragments were recovered from Phase 19 features, just over half of which were anuran.

Animal bones from sample residues
The animal bones from sample residues were predominantly anuran and most likely represent intrusive material.

Comments
The phase 19 assemblage includes intrusive material and is of very limited interpretative value beyond a species list.

Phase 21 – 20th/21st century activity
Hand collected animal bones
Phase 21 produced the largest hand collected assemblage of any phase in terms of both the total number of fragments (n=266), and also the number of countable and identifiable fragments (n=75). The summit assemblage comprised cattle, sheep or goat, pig, bird, probable red deer, lagomorph, badger, fish and micro-faunal bones.

Animal bones from sample residues
The animal bones from sample residues were predominantly anuran and, as with other earlier phased sample assemblages, most likely represent a natural death assemblage.

Comments
Although this is the largest phase assemblage represented, it is still insufficient to interpret data beyond which taxa were exploited. However, the unique nature of the site warrants further analysis of this assemblage. Firstly, careful consideration should be given to whether the pig bones recovered from the tunnel collapse and back fill are likely to be contemporary with the construction of the hill and should be interpreted as such (this is also true for the other unstratified bones from the tunnel). Secondly, although the majority of Phase 19 bones are from summit topsoil and subsoil, which would normally be considered stratigraphically insecure contexts and of recent origin, their provenance in this excavation might actually relate to the

medieval occupation of the hill. With the exception of the probable red deer bones, the wild taxa are probably of natural origin; the badger representing a partial skeleton.

12.3 Potential for age-at-death determination

Very few biological indicators of age-at-death were present in the assemblage. There is insufficient evidence to look at age-profiles and comment should be limited to the presence or absence of adults, juveniles and neonates.

12.4 Potential for metric analysis

Very little metric data can be obtained from the assemblage following standard conventions (von den Driesh 1976).

12.5 Requirements and curation

The current storage of the animal bone assemblage is adequate. The bones from small finds 8041 and 8034 are currently stored in the sample matrix under refrigerated conditions. These require cleaning and drying to stabilise them. The remainder of the assemblages is currently stored in Archive Box 105.

Data tables

Table 19: All contexts containing animal bone

Phase	Context	Description	Hand collected	From Samples
2	4041	Old Land Surface		✓
4	4156	Part of Lower Organic Mound	✓	✓
5	3066	Secondary fill of pit [3067]	✓	✓
5	3073	Fill of pit [3074]		✓
6	4172	Part of Upper Organic Mound		✓
13.1	3920	Spit 4 - arbitrary spit from ditch [3902]	✓	
13.1	3918	Spit 2 - arbitrary spit from ditch [3902]		✓
13.2	3903	Spit 1 - arbitrary spit from ditch [3902]		✓
17	4808	Chalk rubble wall	✓	
17	4813	Interwall deposit	✓	
17	4816	Interwall deposit		✓
17	4817	Interwall deposit		✓
17	4835	Interwall deposit	✓	
17	4840	Interwall deposit		✓
17	4843	Interwall deposit	✓	✓
17	4844	Interwall deposit	✓	✓
17	4845	Interwall deposit	✓	✓
17	4846	Interwall deposit		✓
17	4847	Interwall deposit		✓
17	4848	Interwall deposit	✓	
17	4874	Chalk layer of mound seen in collapsed area	✓	
17	4909	Chalk final phase of mound	✓	
18	4820	Fill of post hole [4821]	✓	✓
18	4822	Fill of poss post hole [4823]	✓	✓
18	4824	Fill of post hole [4825]	✓	✓
18	4826	Fill of pit [4834]	✓	✓
18	4828	Fill of poss animal disturbance [4829]	✓	✓
18	4830	Fill of post hole [4831]		✓
18	4832	Fill of post hole [4833]	✓	✓
18	4834	Fill of pit [4827]		✓
18	4851	Fill of poss post hole [4852]		✓
18	4857	Fill of pit [4858]	✓	✓
18	4869	Fill of post hole [4870]		✓
18	4875	Primary fill of poss pit [4876]	✓	
18	4877	Fill of poss pit [4878]	✓	✓
18	4879	Fill of poss pit/post hole [4880]		✓
18	4886	Secondary fill of poss pit [4876]	✓	
18	4849	Fill of feature [4850]		✓
18	4853	Fill of feature [4854]		✓
19	4837	Interface layer	✓	
19	4855	Fill of feature [4856]	✓	
19	4859	Fill of feature [4860]	✓	
19	4861	Fill of post hole [4862]	✓	✓
19	4865	Fill of feature [4866]	✓	✓
21.1	4804	Topsoil	✓	
21.1	4805	Subsoil	✓	✓
21.1	4806	Fill of tree hollow [4807]	✓	✓
21.1	4885	Subsoil seen in collapsed crater area	✓	
21.2	3804	Atkinson backfill	✓	
21.2	3808	Finds number - subdivision of [3801] at Bay 2	✓	
21.2	3809	Collapsed mound material from Bays 18-21	✓	
21.2	3826	Collapsed material from Bay 36	✓	
21.2	3845	Finds number - subdivision of [3826] at Bay 58	✓	
21.2	3855	Collapsed turf stack material over Bay 74		✓
21.2	4801	Topsoil above Atkinson's trench	✓	

Phase	Context	Description	Hand collected	From Samples
21.2	4802	Backfill of Atkinson's trench	✓	
21.2	4810	Backfill of Atkinson's trench	✓	
21.2	4811	Backfill of Atkinson's trench	✓	
None	4889	Finds recovered from collapsed area in crater	✓	

Table 20: Condition of hand collected bones

Phase	Good	Moderate	Poor	Mixed	Total
4	1	-	-	-	1
5	-	1	-	-	1
13.1	-	-	2	-	2
17	21 (40%)	13 (25%)	-	19 (36%)	53
18	8 (7%)	40 (37%)	-	60 (56%)	108
19	-	19	-	7	26
21.1	1(0%)	79 (36%)	-	140 (64%)	220
21.2 (summit)	6	18	-	8	32
21.2 (tunnel)	13	1	-	-	14
Unstratified (summit)	1	-	-	27	28
Unstratified (tunnel)	4	1	-	-	5
Total	55	172	2	261	490

Table 21: Summary quantification of all hand collected animal bone

Phase	Provenance	Number of fragments	Countable fragments								Other taxa	TOTAL
			Cattle		Sheep/ Goat		Pig		Mammal size			
			teeth	bone	teeth	bone	teeth	bone	Large	Medium		
4	Part of Lower Organic Mound	1	1	-	-	-	-	-	-	-	None	1
5	Secondary fill of pit [3067]	1	-	-	-	-	-	-	-	-	None	0
13.1	Buried ditch [3902], spit 4.	2	-	-	-	-	-	-	-	-	None	0
17	Final mound construction (summit)	53	1	1	1	3	0	0	2	2	8: Deer (3*), badger (1), mole (1), anura (2)	18
18	Medieval activity (summit)	108	1	1	0	5	1	6	2	1	31: Bird (1), lagomorph (1), badger (5*), fox (5*), water vole (1), anura (18)	48
19	18th century activity (summit)	26	0	1	0	0	0	0	1	1	8: Deer (1*), fox (1), amphibian (6)	11
21.1	20th/21st activity (summit topsoil/subsoil and fill of tree hollow [4807])	220	2	6	2	9	2	4	5	11	18: Equid (1), bird (1), deer (1*), lagomorph (1), badger (10), fish (1), anura (3)	59
21.2	20th/21st activity (summit excavation topsoil and backfill)	32	1	0	1	0	1	2	-	2	7: Bird (1), deer (1*), lagomorph (1), badger (1*), small mammal (2), fish (1)	14
21.2	20th/21st activity (tunnel)	14	-	-	-	-	-	2	-	-	None	2
Unstrat	Summit	28	-	-	-	4	-	2	2	-	18: Bird (2), deer (2*), badger (2), fox (2), anura (8) equid (2)	26
TOTAL		489	6	9	4	21	4	16	12	17	90	179

Table 22: Hand collected bones from the tunnel excavations

Context	Small Find	Phase	Provenance	# Frags.	Countable fragments						Others				TOTAL
					Cattle		Sheep/goat		Pig		Equid	Dog/fox	Badger	Total	
					Teeth	Bones	Teeth	Bones	Teeth	Bones					
4156	8108	4	Part of Lower Organic Mound	1	1	-	-	-	-	-	-	-	-	-	1
3066	8038	5	Secondary fill of pit [3067]	1	-	-	-	-	-	-	-	-	-	-	0
3920	8006	13.1	Buried ditch [3902], spit 4.	2	-	-	-	-	-	-	-	-	-	-	0
3804	8032	21.2	Atkinson tunnel backfill	1	-	-	-	-	-	1	-	-	-	-	1
3808	8014	21.2	Subdivision of [3801], Bay 2	1	-	-	-	-	-	1	-	-	-	-	1
3809	8030	21.2	Collapsed mound material, Bays 18-21	1	-	-	-	-	-	-	-	-	-	-	0
3826	8045	21.2	Collapsed material, Bay 36	9	-	-	-	-	-	-	-	-	-	-	0
3826	8051	21.2	Collapsed material, Bay 36	1	-	-	-	-	-	-	-	-	-	-	0
3845	8055	21.2	Subdivision of [3826], Bay 58	1	-	-	-	-	-	-	-	-	-	-	0
TOTAL	-	-	-	18	1	0	0	0	0	2	-	-	-	-	3

Table 23: Unstratified hand collected bone from the summit excavation and general crater collapse (4889)

Context	Small Find	Phase	# Frags.	Countable fragments								Others							TOTAL
				Cattle		Sheep/goat		Pig		Large mammal	Medium mammal	Bird	Equid	Deer	Badger	Dog /Fox	Anura	Total	
				Teeth	Bones	Teeth	Bones	Teeth	Bones										
4889	-	n/a	27	-	-	-	4	-	1	2	-	2	-	1?	1	1	8	11	20
Unstrat	-	n/a	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1
Unstrat	8534	n/a	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	1
Unstrat	8535	n/a	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
Unstrat	8536	n/a	3	-	-	-	-	-	-	-	-	-	-	-	1	1	-	2	2
TOTAL	-	-	33	0	0	0	4	0	2	2	0	2	1	1	2	2	8	14	24

Table 24: Animal bone from Phase 2 samples

Context	Sample	Fraction	% of fraction sorted	Total weight (g)	Micro-fauna		Other		
					Weight (g)	Comments	Weight (g)	# frags	Taxa identified
4041	8041	>4mm		n/a			n/a		Pig/wild boar

Table 25: Animal bone from Phase 4 samples

Context	Sample	Fraction	% of fraction sorted	Total weight (g)	Micro-fauna		Other		
					Weight (g)	Comments	Weight (g)	# frags	Taxa identified
4156	8034	>4mm		74.4			74.4		Cattle

Table 26: Animal bone from Phase 5 samples

Context	Sample	Fraction	% fraction sorted	Total weight (g)	Micro-fauna			Other		
					Weight (g)	Vole	Comments	Weight (g)	# frags	Taxa identified
3066	9272	>4mm	-	0	0	-	-	0	2	I Medium mammal, I large mammal (refits with small find 8038)
3066	9272	2-4mm	25%	0	0	-	anuran fragment	-	-	-
3066	9817	test tube	-	0	0	✓	18 fragments	0	I	I medium mammal
3073	9340	>4mm	-	1.6	0	-	-	1.6	2	2 medium mammal
3073	9340	2-4mm	?	I	I	-	rodent incisor	-	-	-
3073	9816	test tube	-	0.4	0.5	-	11 fragments	0	2	I Medium mammal

Table 27: Animal bone from Phase 6 samples

Context	Sample	Fraction	% of fraction sorted	Total weight (g)	Micro-fauna		Other		
					Weight (g)	Comments	Weight (g)	# frags	Taxa identified
4172	9306	>4mm	-	1.6	0	Not present	1.6	I	Pig

Table 28: Animal bone from Phase 13 samples

Phase	Context	Sample	Fraction	% of fraction sorted	Total weight (g)	Micro-fauna		Other		
						Weight (g)	Comments	Weight (g)	# frags	Taxa identified
13.1	3918	9024	2-4mm	25%	0	0	Not present	0	1	Fish
13.2	3903	9012	2-4mm	25%	0	0	Not present	0	1	?Fish

Table 29: Phase 17 hand collected bone – Final mound construction (summit)

Context	Small Find	Phase	# Frags.	Countable fragments								Others					TOTAL
				Cattle		Sheep/goat		Pig		Large mammal	Medium mammal	Deer	Badger	Mole	Anura	Total	
				Teeth	Bones	Teeth	Bones	Teeth	Bones								
4808	-	17	5	-	-	-	-	-	-	2	1	-	-	-	2	2	5
4813	-	17	6	-	-	1	-	-	-	-	-	-	1	-	-	1	2
4835	-	17	2	-	-	-	-	-	-	-	-	2?	-	-	-	2	2
4843	-	17	11	-	-	-	1	-	-	-	-	-	-	1	-	1	2
4844	-	17	4	-	-	-	2	-	-	-	-	-	1	-	-	1	3
4845	-	17	13	1	-	-	-	-	-	-	1	-	-	-	-	0	2
4848	-	17	1	-	-	-	-	-	-	-	-	1?	-	-	-	1	1
4874	8095	17	1	-	1	-	-	-	-	-	-	-	-	-	-	0	1
4909	8759	17	10	-	-	-	-	-	-	-	-	-	-	-	-	0	0
TOTAL	-	-	53	1	1	1	3	0	0	2	2	3	2	1	2	8	18

Table 30: Animal bone from Phase 17 samples

Context	Sample	Fraction	% fraction sorted	Total weight (g)	Micro-fauna				Other		
					Weight (g)	Vole	Mouse	Comments	Weight (g)	# frags	Taxa identified
4816	9522	>4mm	-	0	0	-	-	amphibian bone	-	-	-
4817	9523	2-4mm	25%	0	0	-	-	predominantly amphibian	-	-	-
4840	9515	>4mm	-	5.5	2.6	✓	-	predominantly amphibian	2.9	10	1 Medium mammal
4840	9515	2-4mm	25%	5.4	5.4	✓	-	predominantly amphibian	-	-	-
4843	9517	>4mm	-	0.3	0.3	-	-	predominantly amphibian	-	-	-
4843	9517	2-4mm	25%	0.3	0.3	-	-	predominantly amphibian	-	-	-
4844	9527	>4mm	-	9.2	0.8	-	✓	predominantly amphibian	8.4	9	1/2 Sheep/goat, 1neonate medium mammal
4844	9527	2-4mm	25%	3.8	3.8	✓	-	predominantly amphibian	-	-	-
4845	9526	>4mm	-	3.3	3.3	✓	-	predominantly amphibian	-	-	1 Fish
4845	9537	>4mm	-	5.4	4.5	✓	-	predominantly amphibian	0.9	6	2 ?Cat
4845	9526	2-4mm	25%	23.7	23.7	✓	✓	predominantly amphibian	-	-	-
4845	9537	2-4mm	25%	22.1	22.1	✓	-	predominantly amphibian	-	-	-
4846	9525	2-4mm	25%	0	0	-	-	predominantly amphibian	-	-	-
4847	9524	>4mm	-	0	0	-	-	amphibian bone	-	-	-
4847	9524	2-4mm	25%	0	0	-	-	amphibian bone	-	-	-

Table 31: Phase 18 hand collected bone - Medieval activity (summit)

Context	Small Find	Phase	# Frags.	Countable fragments								Others							TOTAL
				Cattle		Sheep/goat		Pig		Large mammal	Medium mammal	Bird	Lago.	Badger	Fox	Water vole	Anura	Total	
				Teeth	Bones	Teeth	Bones	Teeth	Bones										
4820	-	18	17	-	-	-	-	-	3	-	-	1	-	-	-	-	2	3	6
4822	-	18	3	-	-	-	-	-	-	-	-	-	1	-	-	-	1	2	2
4824	-	18	4	-	-	-	-	-	-	-	-	-	-	-	1	1	-	2	2
4826	-	18	29	1	-	-	3	-	-	2	-	-	-	5*	4*	-	1	10	16
4828	-	18	21	-	1	-	-	-	-	-	1	-	-	-	-	-	14	14	16
4832	-	18	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	0	1
4857	-	18	10	-	-	-	2	-	-	-	-	-	-	-	-	-	-	0	2
4875	8769	18	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
4877	8768	18	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
4886	8767	18	5	-	-	-	-	1	2	-	-	-	-	-	-	-	-	0	3
Total				1	1	0	5	1	6	.2	1	1	1	5	5	1	18	31	48

Table 32: Animal bone from Phase 18 samples

Context	Sample	Fraction	% of fraction sorted	Total weight (g)	Micro-fauna							Other		
					Weight (g)	Vole	Shrew	Mouse	Water vole?	Mole	Comments	Weight (g)	# frags	Taxa identified
4820	9503	>4mm	-	3	1.6	-	-	-	-	✓	predominantly amphibian	1.4	13	-
4820	9503	2-4mm	25%	3.5	3.5	✓	-	-	-	-	predominantly amphibian	-	-	-
4822	9505	>4mm	-	1.9	0.7	-	-	-	-	-	predominantly amphibian	1.2	6	1 sheep, 1 badger size
4822	9505	2-4mm	25%	3.1	3.1	-	-	-	-	-	predominantly amphibian	-	-	-
4824	9506	>4mm	-	1.8	1.1	-	-	-	-	-	predominantly amphibian	0.7	7	1 bird, 1 bird/mammal
4824	9506	2-4mm	25%	8.3	8.3	✓	-	-	-	-	predominantly amphibian	-	-	-
4826	9507	>4mm	-	6.9	3.7	-	-	-	-	-	predominantly amphibian	3.2	14	2 bird/mammal
4826	9507	2-4mm	25%	7.2	7.2	✓	-	-	-	-	predominantly amphibian	-	-	-
4828	9509	>4mm	-	15.2	4.8	-		-	-	-	predominantly amphibian	10.4	10	2 cattle, 2 badger, 1 badger size, 3 fish
4828	9509	2-4mm	25%	14.5	14.5	✓	-	-	-	-	predominantly amphibian	-	-	-
4830	9508	>4mm	-	2.7	1	-	-	-	✓	-	predominantly amphibian	1.7	7	-
4830	9508	2-4mm	25%	2	2	✓	✓	-	-	-	mixed	-	-	-
4832	9510	>4mm	-	2.1	2.1	-	-	-	✓	-	predominantly amphibian	-	-	-
4832	9510	2-4mm	25%	5	5	✓	-	-	-	-	predominantly amphibian	-	-	-
4834	9511	>4mm	-	1.1	0.3	-	-	-	-	-	predominantly amphibian	0.8	8	-
4834	9511	2-4mm	25%	0.7	0.7	✓	-	-	✓	-	predominantly amphibian	-	-	-
4851	9521	>4mm	-	8.6	6.2	✓	-	-	✓	-	predominantly amphibian	2.4	6	1 badger size
4851	9521	2-4mm	25%	8.5	8.5	✓	-	-	-	-	predominantly amphibian	-	-	-
4857	9531	>4mm	-	8.3	7.5	✓	-	✓	-	-	predominantly amphibian	0.8	4	-
4857	9531	2-4mm	25%	16.1	16.1	✓	-	-	-	-	predominantly amphibian	-	-	-
4869	9516	>4mm	-	8.8	5.4	✓	-	-	✓	-	predominantly amphibian	3.4	1	1 cattle
4869	9516	2-4mm	25%	9.3	9.3	✓	-	-	-	-	predominantly amphibian	-	-	-
4877	9548	>4mm	-	23.6	6.4	✓	-	✓	✓	✓	predominantly amphibian	17.2	21	2 pig,, 1 ?bird, 4/5 sheep/goat, 1 medium mammal
4877	9548	2-4mm	?	3.6	3.6	✓	✓	-	✓	-	predominantly amphibian	-	-	-
4879	9549	>4mm	-	24.6	6.2	✓	-	✓	-	-	predominantly amphibian	18.4	13	2 sheep/goat, 1 ?badger, 1 badger size
4879	9549	2-4mm	25%	7.2	7.2	✓	✓	✓	-	-	predominantly amphibian	-	-	-

Table 33: Phase 19 hand collected bone - 18th century activity (summit)

Context	Small Find	Phase	# Frags.	Countable fragments								Others				TOTAL
				Cattle		Sheep/goat		Pig		Large mammal	Medium mammal	Deer	Fox	Anura	Total	
				Teeth	Bones	Teeth	Bones	Teeth	Bones							
4837	-	19	10	-	-	-	-	-	-	1	-	-	-	1	1	2
4855	-	19	5	-	1	-	-	-	-	-	-	-	-	-	0	1
4859	-	19	4	-	-	-	-	-	-	-	1	-	-	-	0	1
4861	-	19	2	-	-	-	-	-	-	-	-	1?	-	1	2	2
4865	-	19	5	-	-	-	-	-	-	-	-	-	1?	4	5	5
Total	-	-	26	0	1	0	0	0	0	1	1	1	1	6	8	11

Table 34: Animal bone from Phase 19 samples

Context	Sample	Fraction	% of fraction sorted	Total weight (g)	Micro-fauna					Other		
					Weight (g)	Vole	Shrew	Mouse	Comments	Weight (g)	# frags	Taxa identified
4849	9518	>4mm	-	0.7	0.7	✓	-	✓	mixed	-	-	-
4849	9518	2-4mm	25%	2.6	2.6	-	-	✓	predominantly amphibian	-	-	-
4853	9520	>4mm	-	2	1	-	-	-	predominantly amphibian	1	4	-
4853	9520	2-4mm	25%	2	2	✓	✓	-	predominantly amphibian	-	-	-
4861	9534	>4mm	-	5.6	3.2	-	-	-	predominantly amphibian	2.4	2	1 lagomorph
4861	9534	2-4mm	25%	7.6	7.6	✓	-	-	predominantly amphibian	-	-	-
4865	9535	>4mm	-	2.1	0.5	-	-	-	predominantly amphibian	1.6	1	-
4865	9535	2-4mm	25%	1.7	1.7	✓	-	-	predominantly amphibian	-	-	-

Table 35: Phase 21.1 hand collected bone – 20th/21st century activity (summit)

Context	Small Find	Phase	# Frags	Countable fragments								Others								TOTAL
				Cattle		Sheep/goat		Pig		Large mammal	Medium mammal	Equid	Bird	Deer	Lago.	Badger	Fish	Anura	Total	
				Teeth	Bone	Teeth	Bone	Teeth	Bone											
4804	-	21.1	48	-	1	-	5	1	-	-	3	-	-	-	-	-	-	-	0	10
4804	8503	21.1	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	0	1
4805	-	21.1	140	2	5	2	4	-	3	4	6	1	1	1?	-	10	1	3	17	43
4806	-	21.1	30	-	-	-	-	-	1	1	2	-	-	-	1	-	-	-	1	5
4885	8762	21.1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
Total	-	-		2	6	2	9	2	4	5	11	1	1	1	1	10	1	3	17	59

Table 36: Phase 21.2 hand collected bone – 20th/21st century activity (summit)

Context	Small Find	Phase	# Frags	Countable fragments								Others									TOTAL
				Cattle		Sheep/goat		Pig		Large mammal	Medium mammal	Equid	Bird	Deer	Hare	Badger	Mole	Water vole	Fish	Total	
				Teeth	Bone	Teeth	Bone	Teeth	Bone												
4801	-	21.2	18	1	-	1	-	1	1	-	-	-	-	-	1	1?	1	-	-	3	7
4802	-	21.2	8	-	-	-	-	-	-	-	2	-	-	1?	-	-	-	-	-	1	3
4810	-	21.2	5	-	-	-	-	-	1	-	-	-	1	-	-	-	-	1	-	1	3
4811	-	21.2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0	1
Total	-	-		1	0	1	0	1	2	0	2	0	1	1	1	1	1	1	1	8	14

Table 37: Animal bone from Phase 21 samples

Phase	Context	Sample	Fraction	% of fraction sorted	Total weight (g)	Micro-fauna			Other		
						Weight (g)	Vole	Comments	Weight (g)	# frags	Taxa identified
21.1	4805	9502	>4mm	-	7.3	1.2		predominantly amphibian	6.1	35	2 pig, 1 badger, 1 badger size. 1carnivore, 1 bird, 1 small mammal/bird
21.1	4805	9502	2-4mm	25%	6.1	6.1	✓	predominantly amphibian	-	-	-
21.1	4806	9501	>4mm	-	18	0.2		5 amphibian bones	17.8	76	3 pig, 1 calcined medium mammal
21.1	4806	9501	2-4mm	25%	3.1	3.1	✓	predominantly amphibian	-	-	-
21.2	3855	9171	2-4mm	25%	0	0		rodent incisor	-	-	-

Table 38: Available age-at-death data. T= Isolated mandibular teeth, M= Ageable mandibles, E= ageable epiphyses

Context	Phase	Provenance	Cattle			Sheep or goat			Pig			Equid	Dog	Deer?	Badger
			T	M	E	T	M	E	T	M	E	E	E	E	E
3804	21.2	Atkinson tunnel backfill	-	-	-	-	-	-	-	-	1	-	-	-	-
3808	21.2	Tunnel backfill (Bay 2)	-	-	-	-	-	-	-	-	1	-	-	-	-
4801	21.2	Topsoil above Atkinson's summit trench	1	-	-	1	-	-	-	-	1	-	-	1	-
4810	21.2	Backfill of Atkinson's summit trench	-	-	-	-	-	-	-	-	1	-	-	-	-
4804	21.1	Summit topsoil	-	-	-	-	-	3	-	1	-	-	-	-	-
4805	21.1	Summit subsoil	2	-	1	1	1	3	-	-	1	1	-	1	4
4855	19	Fill of feature [4856] in summit excavation	-	-	1	-	-	-	-	-	-	-	-	-	-
4861	19	Fill of post hole [4862] in summit excavation	-	-	-	-	-	-	-	-	-	-	-	1	-
4826	18	Fill of pit [4834] in summit excavation	1	-	-	-	-	1	-	-	-	-	-	-	-
4832	18	Fill of post hole [4833] in summit excavation	-	-	-	-	-	-	1	-	-	-	-	-	-
4886	18	Secondary fill of medieval pit 4876	-	-	-	-	-	-	-	1	1	-	-	-	-
4835	17	Summit inter-wall deposit	-	-	-	-	-	-	-	-	-	-	-	2	-
4843	17	Summit inter-wall deposit	-	-	-	-	-	1	-	-	-	-	-	-	-
4844	17	Summit inter-wall deposit	-	-	-	-	-	1	-	-	-	-	-	-	1
Unstrat	n/a	Unstratified from tunnel	-	-	-	-	-	-	-	-	1	1	2	-	-
Total	-	-	4	0	2	2	1	9	1	2	7	2	2	5	5

Table 39: Measurable bones

Context	Phase	Provenance	Measureable bones
3808	21.2	Tunnel backfill (Bay 2)	1 – pig
4810	21.2	Backfill of Aitkinson's summit trench	1 – bird
4805	21.1	Summit subsoil	3 – 2 cattle, 1 equid
4886	18	Secondary fill of medieval pit 4876	1 – pig
4844	17	Summit interwall deposit	1 – badger
4889	n/a	General crater collapse	6 – 2 sheep/goat, 1 pig, 2 bird, 1 fox
Unstrat	n/a	Unstratified from tunnel	2 – 1 dog, 1 badger
Total	-	-	15 measurable bones

13 ASSESSMENT OF ANTLER FRAGMENTS AS FAUNAL REMAINS

Fay Worley
October 2008

13.1 Introduction

This report assesses the character, condition and potential of antler fragments recovered during the English Heritage Silbury Hill Conservation Project between 2007 and 2008 (Project 661).

13.2 Methods

All antler fragments were quantified (by count, refitting recent breaks where possible, and weight) and recorded in a *Microsoft Excel* spreadsheet. The fragments were identified to species and position where possible. Any evidence of antler working or use wear was noted. The condition of fragments from each context was graded on a four point scale as follows:

Poor	very eroded or degraded texture, chalky condition;
Moderate	eroded or degraded surface texture, chalky condition;
Good	slight erosion of surface, generally clearly defined surface texture, chalky condition;
Very good	no erosion of surface, more robust that those fragments graded as 'good'.

13.3 Results

Quantification and provenance

A total of 124 fragments (1.874 kg) of antler were recovered (Table 40). This total, and those of all other tables in this report, exclude one fragment (Small Find 8527) which was lost from the assemblage prior to assessment, and the weight of five samples taken for radiocarbon dating prior to assessment (Table 41). The majority of the fragments were recovered from 24 contexts; five were from unstratified and unphased locations. The antler was recovered from the western section of the Main Tunnel (context [3008]), the tunnel backfill ([3817], [3823], [3826], [3829], [3830], [3844], [3845], [3848], [3857]), the buried ditch excavation (context [3918], [3926]), crater collapse material ([4889]), topsoil ([4804]), subsoil ([4805]) and inter-wall deposits ([4813], [4814], [4835], [4838], [4845], [4848]) from the summit excavation, chalk final phase of the mound ([4904], [4910]) and chalk/topsoil interface ([4905]) from the hillside works. The majority of fragments (by number and weight) were recovered from Phase 17 and 21.2 deposits, comprising final phase chalk from the summit and hillside works, and backfill and collapsed chalk from within the tunnel.

With the exception of one fragment from the greater than 4mm residue fraction of sample <9036> (context [3926]). All antler fragments were hand collected.

Two photographs of the missing antler fragment (Small Find 8527) indicate that it was a tine tip, approximately 100mm long and in good or moderate condition. The photographs show insufficient detail to comment on whether the tine exhibited use wear or polish, but the end of the tine does not appear to have suffered significant damage. The onsite excavation staff report that the fragment refitted with Small Find 8526.

Condition
The antler was generally in moderate condition (Table 42), although the majority of fragments were brittle and prone to further mechanical damage if not handled with care. The fragments all exhibited recent breaks and several could be refitted to form larger pieces of antler. Individual antler fragments ranged from <0.1g to 342.9g in weight (Table 43). The majority of fragments were less than 10g but refitting might produce a number of significantly larger pieces of antler. Unsurprisingly given the nature of their deposition, there was no evidence of any root etching on the assemblage. A single fragment of antler may have been gnawed by rodents (see below).

Species and antler regions represented
A total of 58 fragments of antler were identified as definitely or probably red deer. No other cervid species were represented. The assemblage includes fragments of brow and tine, with three naturally shed antler burrs identified (Small Find 200728021 from context [3817], Small Find 200728755 from context [4905] and a non small found fragment from context [4813]).

Evidence of working and use wear
Evidence for use wear will be assessed by Ian Riddler, and so is only briefly mentioned here. (see Table 44) Two tines exhibited slight polish towards their tips, a third exhibited possible polish from use. Smoothness of the tine tip can occur naturally and so does not necessarily indicate that the antlers were used as tools. Abrasion of the tine tips thought to represent use wear was identified on seventeen fragments. Small find 200728757 (context [4910]) exhibited a restricted area of near-parallel striations towards its cranial end. It was not clear whether these represented rodent gnawing or scars resulting from hafting the antler. Curvilinear or spiral fractures, thought to indicate that the antler was broken when fresh, were identified on four fragments. One fragment from context [4889] (not small found), exhibited a tool mark which may have been inflicted in prehistory or during the historical investigations of the hill.

Table 40: Quantification and provenance of the antler assemblage

Provenance	Phase	Contexts	No of frags	Weight (g)
Buried ditch backfill	13.1	3918, 3926	9	16.5
Summit excavation, inter-wall deposits and Hillside works final phase of the mound	17	4813, 4814, 4835, 4838, 4845, 4848, 4904, 4910	37	604.2
Western section of Main Tunnel	17	3008	1	2.9
Topsoil and subsoil from summit	21.1	4804, 4805	6	45.4
Tunnel backfill	21.2	3817 3823 3826, 3829 3830 3844 3845 3848 3857 4905	66	680
Crater collapse and unstratified	Unphased	4889, unstrat.	5	524.5
Total assemblage			124	1831.9

Table 41: Antler fragments sampled for radiocarbon dating

Context	Small Find	Weight*	Lab reference number
3829	200728019	>2g	OXA - 17472
3817	200728022	>2g	OXA - 17473
3843	200728048**	>2g	OXA - 17470
3844	200728076	>2g	OXA - 17471
3845	200728093	>2g	OXA - 17474

*Weight as recorded on Scientific Dating Service, Radiocarbon Sample Form. **Small Find record indicates that this was part of Small Find 200728046.

Table 42: Condition of antler fragments

Phase	Context	Poor	Moderate	Good	Very good	Number
13.1	3918	38%	-	63%	-	8
	3926	-	100	-	-	1
	Total	*33%*	*11%*	*56%*	*-*	*9*
17	4813	-	100%	-	-	2
	4814	-	-	-	100%	1
	4835	-	100%	-	-	1
	4838	100%	-	-	-	1
	4845	-	-	100%	-	2
	4848	-	-	100%	-	2
	4904	-	96%	4%	-	27
	4910	-	100%	-	-	1
	Total	*3%*	*81%*	*14%*	*3%*	*37*
17	3008	100%	-	-	-	1
	Total	*100%*	*-*	*-*	*-*	*1*
21.1	4804	-	-	-	100%	1
	4805	-	100%	-	-	5
	Total	*-*	*83%*	*-*	*17%*	*6*
21.2	3817	75%	25%	-	-	8
	3823	-	100%	-	-	3
	3826	60%	40%	-	-	5
	3829	-	100%	-	-	2
	3830	100%	-	-	-	1
	3844	5%	79%	16%	-	38
	3845	-	100%	-	-	1
	3848	-	100%	-	-	1
	3857	-	-	-	100%	1
	4905	100%	-	-	-	6
	Total	*27%*	*62%*	*9%*	*2%*	*66*
Unphased	4889	-	33%	67%	-	3
	Unstrat.	-	50%	-	50%	2
	Total	*-*	*40%*	*40%*	*20%*	*5*
Number of fragments		23	79	18	4	124
Overall percentage		19%	64%	15%	3%	-

Table 43: Quantification of assemblage by context and fragment size

Context	Number of fragments (average weight of fragment in context)				Total weight (g)
	>40g	10-40g	<10g	Total	
3008	-	-	1	1	2.9
3817	-	1	7	8	54.1
3823	-	-	3	3	1.3
3826	-	-	5	5	17.9
3829	-	2	-	2	25.0
3830	-	-	1	1	1.9
3844	1	2	35	38	135.9
3845	1	-	-	1	111.7
3848	-	-	1	1	1.2
3857	1	-	-	1	49.8
3918	-	-	8	8	16.0
3926	-	-	1	1	0.5
4804	-	1	-	1	21.6
4805	-	-	5	5	23.8
4813	-	-	2	2	11.9
4814	-	-	1	1	5.6
4835	-	-	1	1	3.4
4838	-	-	1	1	0.3

4845	2	-	-	2	113.3
4848	-	-	2	2	1.7
4889	3	-	-	3	427.5
4904	7*	1	19*	27	377.5
4905	6*	-	-	6	281.2
4910	1	-	-	1	90.5
Unstratified	1	-	1	2	97
Total	23	7	94	124	1873.7

** may all refit to one fragments >40g*

Table 44: Evidence for pre-depositional modification

Small find	Context	Wear	Polish	Spiral fractures
200728010	3844	✓		
200728016	3918		?	
200728017	3918		✓	
200728046	3826	✓		✓
200728049	3830	✓		
200728050	3826	✓		
200728076	3844	✓		
200728093	3845	✓		
200728109	3857			✓
200728116	Unstratified	✓		
200728502	4804		✓	
Not small found	4835	✓		
200728525	4845	✓		
200728526	4845	✓		
Not small found	4848	✓		
Not small found	4889	✓		✓
200728751	4904	✓		
200728752	4904	✓ (2 fragments)		
200728754	4904	✓		✓
200728757	4910	✓		

SECTION 14: ASSESSMENT OF ANTLER FRAGMENTS AS OBJECTS

Ian Riddler
October 2008

14.1 Introduction

The red deer antler from Silbury Hill has been assessed by Fay Worley in terms of its quantity, nature and condition (Section 13 above), and this assessment is concerned with the antlers as objects. It also includes an examination of a chalk block that has marks on it caused by antler picks. The antler survives in poor to moderate condition and is generally white or grey in colour, friable and desiccated. In most cases it has been reduced to fragments. Cortile tissue has dissolved away, leaving fractured surfaces of antler. Yet it has the potential to reveal a lot of information about how the antlers were used, where they came from, and what happened to them after they had been used.

14.2 Potential Evidence for the Technology and Modification of Antlers

The antlers have been assessed in order to see whether any evidence survives that would enable their function to be determined, as well as examining the technology of their modification. It is inherently likely that they are discarded picks, but they could conceivably be unworked antlers, or one or more assemblages of partially worked material, as seen at Trumpington, Cambridgeshire for example (Riddler forthcoming A). The working of the material could conceivably have been for a range of antler items known from the late Neolithic and early Bronze Age, including pins, maceheads, hoes and spatulae (Billamboz 1977; Simpson 1996; Riddler forthcoming B). In the first instance, therefore, the assemblage was assessed to see whether the function of the material could be determined.

Picks were often not modified to any extent and it can be difficult to differentiate them from unworked antlers. The crown of the antler was removed, although not in every case, and the trez tine was usually cut away. The bez tine was removed from some picks, but could equally well be retained. In the latter case it came into use either before or after the brow tine had fractured as a second pick end. Wear patterns should be visible at the ends of the tines and on the burr area, where the pick (which was sometimes used as a handled wedge) had been struck with a stone hammer. Accordingly, the assessment has focused on these areas.

In addition, the removal of tines from antlers was sometimes undertaken during this period by lightly charring the surface, which made the antler more brittle and easier to separate (Clutton-Brock 1984, 26; Serjeantson and Gardiner 1995, 420-1). Traces of working need to be distinguished from simple gnawing of tine ends, which was undertaken after the antlers had been shed, both by small rodents and by the deer themselves. Marks of gnawing usually occur on the lower parts of tine ends and are set across the tine itself.

14.3 Methodology

The antler has already been quantified and assessed for its condition and attention was therefore focused on the burrs and tine ends, as well as the larger sections of antler. These were examined with the aid of a hand lens and selected items were viewed under a low level microscope (up to x40). The chalk block was examined with the aid of a hand lens at Fort Cumberland, and the pick marks on it were measured and catalogued.

At this stage the main interest of the assessment lies in the antler itself, rather than its context. All of the antler is stratified, with the exception of just a few pieces, although it does not all come from well stratified and well sealed deposits. Brief details were noted of the contexts of the material and these have been described in greater detail by Worley (Section 13 above). The fact that most of the antler is stratified (at least to some extent) should, however, be noted, particularly in terms of studying depositional processes.

14.4 Factual Record

The majority of the antler survives as small fragments weighing 10g or less, which have fractured in modern times. No attempt was made to refit these pieces, although it is recommended that this should be undertaken during the analysis. In addition, there are three burrs, around twenty tine ends (some of which may fit together), and one substantial fragment of antler beam. The three burrs are naturally shed, which would be expected from a pick assemblage. Naturally shed burrs were preferred because the antler had hardened and was at its greatest size and strength (Billamboz 1977, 99-100). One of the burrs (SF 8755) retains parts of the brow and the bez tines, the latter truncated and worn. There is damage to the side of the burr and little doubt that this implement was used as a pick. The other two burrs are fragmentary but it might be possible to estimate their original sizes (particularly their circumferences), which can be compared with measurements from Durrington Walls, Grimes Graves and Stonehenge (Clutton-Brock 1984, figs 5 and 9; Serjeantson and Gardiner 1995, fig 231).

A large fragment of beam (SF 8754) retains parts of the bez and trez tines, and has been cut below the crown. This is clearly also a pick. Several of the tines within the assemblage stem from the crown area of the antler, which was usually separated from the beam and used as a rake (Serjeantson and Gardiner 1995, 420 and 427). No other forms of object can be seen within the assemblage. A number of the tine ends show signs of wear. Some are now blunt, whilst others have longitudinal or diagonal scratches upon them, which are not gnawing marks and relate to their use as picks (Plate 71). There is no evidence for the localised burning of tines at their junction with the beam. It is possible that the calcification of the antler may have obscured some traces of burning, but substantial amounts of the antler survive in reasonable condition, and no traces can be seen on them.

The chalk block (SF 8753) retains two separate impressions of working. The first consists of a mark visible in section with evidence for two blows, set at slightly different angles, the second blow overlaying the first in part. The second mark is a hollow caused by hitting the chalk surface with a tine end.

Plate 71: Wear traces at the end of tine SF 8757

14.5 Potential for Analysis

All of the antler appears to stem from picks, and probably from a relatively small number. There are just three burrs and roughly twenty fractured tine ends, which would indicate a minimum number of three to four antlers. A detailed examination of the context information, set alongside a refitting of the antler, will provide a more precise indication of the number of picks recovered from excavation. This total can be set alongside the antler recovered by Atkinson from Silbury Hill, all of which came from the mound (Whittle 1997, 49). It should also allow the specific quantity and the forms of the picks to be identified. There can be considerable variability in pick shapes and in the forms of surviving fragments, as seen in particular by material from Budapest (Vörös 1991, figs 7, 8 and 11).

Metrical analysis of the burrs will also provide some information on their size range, which can be compared with contemporary sites, and this will be undertaken by Fay Worley. Refitting of the antler should also help in establishing whether it came from young or adult deer, by analysing the number of tines present on each pick. Elsewhere, the antlers of mature deer were preferred (Clutton-Brock 1984, 23-6; Serjeantson 1995, 417-8).

Although some of the antler survives in poor condition there is usually sufficient surface detail to be able to determine traces of wear (Plate 71). This wear can be examined and set against the evidence provided by the chalk block (SF 8753), which shows how the chalk was fractured. From this assessment, it seems that the picks were used in effect as mattocks, rather than as handled wedges. Although Atkinson argued that the latter method was used at Stonehenge, Smith noted that at Windmill

Hill 'in the relatively soft and flint-free Middle Chalk there would have been little need for the hammering and levering technique' (Smith 1965, 125). Experimental work could prove very useful in this respect, in an attempt to emulate the wear patterns noted on the tines. This has been successfully applied to other assemblages (Kaiser 2002).

As noted above, the antler from Silbury Hill is naturally-shed. Atkinson also recovered two shed burrs (Whittle 1997, 49). The antler would have been collected in the late spring of each year and may not have been used until the autumn, when the chalk would have been damper and colder, and easier to fracture. Individual picks may not have lasted for any great length of time, even when both the bez and the brow tines were used, thereby prolonging their life. A massive engineering project like Silbury Hill would have required a huge number of antler picks, yet only a small quantity have yet been recovered. This raises two questions: firstly, where were all of these picks deposited; and secondly, from where were they obtained?

Picks are often found in the lower layers of ditches, or discarded in backfilled sections of mines. There may well be large numbers awaiting discovery in the massive ditches at Silbury Hill. They do not appear to have been wantonly discarded when fractured, but seem to have been gathered into specific deposits, as at Stonehenge, for example (Serjeantson and Gardiner 1995, 415-7). The contexts of the Silbury antlers should therefore be considered and the nature of their deposition needs to be examined. This can also be correlated with the wear patterns, to establish whether all of the discarded picks have actually been used.

The provisioning of sufficient quantities of picks for each season of work at Silbury Hill would have been a major logistical exercise. It is perfectly possible to recovered naturally shed antlers by examining the behaviour of deer in the spring. Deer tend to shed their antlers at the same location each year, but will hide away in order to do this, and may shed one antler at a time over a period of days. The monument building at Silbury and within the local area may have put considerable strain on the local resources and this raises the question of whether that local resource was sufficient to provide all of the raw material required. Antler may have been imported from further afield and strontium analysis would be extremely useful in determining whether this occurred. This has successfully used on fallow deer remains (Sykes *et al* 2006). It is recommended by Fay Worley, and is fully endorsed here.

15 STRUCK FLINT AND BURNT FLINT ASSESSMENT

Barry Bishop
October 2008

15.1 Introduction
This report assesses the struck flint and burnt flint material that was recovered during the Silbury Hill Conservation Project. It combines the material that was recovered during the 2001 investigative programme with that from the 2007 remedial works. No struck flint or burnt flint was recovered during the 2004 Watching Brief.

This report follows the methodology and recommendations encapsulated in both MAP2 and MoRPHE (English Heritage 1991; 2006). Its aims are to quantify and describe the material, assess its significance in terms of its potential to contribute to the stated research aims and objectives, and to recommend any further work needed for the material to achieve its full research potential.

15.2 Methodology
Every piece of struck flint and burnt flint was individually examined by eye and 20 X magnifications, characterized and its basic attributes recorded onto a Microsoft Access database.

Every piece of struck flint measuring 10mm or over in maximum dimension (hereafter termed macro-debitage) had its basic characteristics recorded, including its metrical, typological and technological attributes, the nature of the raw material used and its condition. Where possible, a date for its manufacture was suggested although, as this involved single pieces, this was only occasionally possible. All metrical information follows the methodology established by Saville (1980).

All pieces of struck flint measuring less than 10mm (hereafter referred to as the micro-debitage) were quantified by context according to a simplified scheme: substantially complete flakes; flake fragments; irregular pieces exhibiting conchoidal fracture.

The number of burnt flint fragments and their combined weight by context was also recorded.

15.3 Quantification
In total 393 pieces of struck flint and 21 pieces of otherwise unmodified burnt flint were recovered during the Conservation Project. Of this, 26 of the pieces of struck flint and a single piece of burnt flint came from the 2001 investigations, the remainder being recovered from the 2007 remedial works.

Of the 393 pieces of struck flint, 244 consisted of micro-debitage and these were predominantly recovered during the sampling programme. Of the remaining 149 pieces of macro-debitage, 45 pieces (30.2%) were recovered from prehistoric contexts associated with the construction of the monument and 104 (69.8%) were recovered from disturbed, unstratified or uncertain contexts and may be regarded as residual, although these are also likely to have been closely associated with the monument. Just under half of this latter material came from collapse material infilling the tunnel whilst the remainder came from Medieval to recent disturbance and soil horizons as recorded on the summit and sides of the monument. A much greater proportion of the micro-debitage, some 90%, was recovered from the prehistoric contexts, this presumably at least partly reflecting the sampling methodology. The burnt flint also predominantly came from prehistoric contexts with small quantities present in the soil horizons as recorded on the summit.

Phase	Feature	Decortication Flake	Core Modification Flake	Trimming Flake	Mis struck Flake	Blade	Useable Flake	Flake Fragment	Conchoidal Chunk	Core	Retouched	**Phase Total macro-debitage**	Micro-debitage	Burnt Flint (No.)	Burnt Flint (wt:g)
?	Uncertain			1							1	**2**	13		
2	OLS											**0**	16		
3	Gravel Mound					1		1				**2**	40	1	6
4	LOM and assoc features	2		1					1			**4**	48		
5	Pitting			1		1	3				1	**6**	61	11	24
6	UOM											**0**	10		
12	Bank 5											**0**	16		
13	Ditch 3902	4	1			2	7	4		1	2	**21**	21	4	64
17	Inter-wall	3		5			2	1	1			**12**	8	1	8
18	Summit disturbance	4		3		1			1			**9**	5		
19	C18 Summit disturbance	1					1					**2**			
21.1	C20/21 summit disturbance	8		8			7	7	1			**31**	6	4	17
21.2	Summit Disturbance	4		1	1	1	4	2			1	**14**			
21.2	Tunnel fill	12	2			1	15	2	1	10	3	**46**			
	TOTAL	**38**	**3**	**20**	**1**	**7**	**39**	**17**	**5**	**11**	**8**	**149**	**244**	**21**	**119**

Table 45: Quantification of Struck Flint and Burnt Flint by Phase

15.4 The Burnt Flint

Twenty-one pieces of burnt flint, weighing 119g, were recovered from twelve separate contexts. This material was variably burnt but all to the degree that it had changed colour and become fire-crazed. The quantities present do not indicate large-scale deliberate production but rather the incidental burning of flint from hearths or other uses of fire. The largest quantities were recovered from Ditch 1 (context [3902]) and from the pits of Phase 5, particularly pit [3074], but it was also present in smaller quantities in the Gravel Mound, in the 'inter-wall' deposits and from residual contexts on the summit.

15.5 The Struck Flint

Raw Materials

The raw materials used consisted of thermally affected nodular flint. Two main types were identified, a fine-grained 'glassy' translucent flint and a more-opaque matt black flint containing frequent quantities of speckled and mottled cherty inclusions. These two types probably reflect variations present within individual nodules or related flint beds rather than fundamentally different types of flint or flint from different locations. Where retained, cortex varied from thin to thick and was rough but often slightly weathered, frequently exhibiting thermal plains and 'potlid' spalls on its surface. The raw materials would have been obtained from derived deposits found close to the parent chalk; there was no obvious evidence for the use of mined flint or flint extracted from within the chalk during the excavations of the monument's ditches although some use of such material cannot be entirely excluded. The cortex on some pieces had been stained brown and these at least were likely to have derived from deposits of clay-with-flints. A single piece, from [3853], was struck from a rounded alluvial gravel pebble, although there was some doubt as to whether this particular piece had been deliberately struck.

Condition

The condition of the material varied considerably; some pieces had been extensively abraded while others were in a good sharp condition. This variation reflects the degree of post-depositional disturbance that individual pieces had experienced. Although variation existed through the material from all phases, all of the heavily abraded pieces came from residual contexts whilst those from the prehistoric contexts were all either in good condition or only slightly abraded. The degree of recortication also varied quite markedly although this could not be related to any technological or typological characteristics and would not appear to have any chronological significance.

Description

The majority of pieces, even the majority of the macro-debitage, were not chronologically diagnostic or closely dateable. There were indications that some Later Mesolithic or Early Neolithic pieces were present, including a few systematically produced blades and micro-blades, and these had presumably become residually incorporated during the construction of the monument. Technologically, however, it was clear that the assemblage as a whole was dominated by pieces consistent with later third/early second millennium industries and therefore the majority of pieces were likely to have been manufactured at least broadly contemporaneously with the construction of the monument.

The assemblage as a whole was dominated by knapping waste with only 30% of the macro-debitage being considered as potentially useable flakes and blades. To these may be added the retouched pieces. These formed a relatively high proportion of the assemblage; although only contributing 2% of the whole, this is increased to over 5% if the micro-debitage is excluded.

The cores were mostly expediently reduced, six of the eleven that were identified were minimally reduced, these having only short sequences of flakes removed. The others all consisted of flake cores, two were multi-platformed, two had single platforms and the remainder was centripetally reduced, this having been made on a large flake. There was little evidence of any of the cores having been pre-shaped prior to concerted flake removal, nor was there any evidence for attempts to rejuvenate the cores once they had started to fail. Overall they reflect a rather opportunistic approach to obtaining suitable flakes, although the centripetally reduced core, recovered from Ditch 1 (context [3919]), does appear to employ a variant of the Later Neolithic 'Levallois' technique, a technique often associated with the preparation of blanks used for more elaborate retouched forms, such as transverse arrowheads. No elaborate retouched forms were present; however, they mostly consisted of simple edge-blunted flakes made on broad blanks that would have been suitable for simple cutting or piercing tasks. One exception to this was serrated piece made on a narrow flake which came from collapsed material within the tunnel (context [3832]). It too would have been used for cutting or processing plant material but it may possibly date to earlier than the construction of the monument. As with the cores, the retouched pieces generally demonstrate a rather expedient and functional approach to obtaining suitable tools; they were probably manufactured as needed and geared towards immediate use rather than curation. A degree of opportunism is also indicated by the occasional reuse of earlier, recorticated, pieces; one of the retouched implements had been fashioned from a heavily recorticated, and therefore much earlier, flake, and a few other flakes had also been struck from much earlier cores or flakes.

Micro-debitage made up the greatest proportion, contributing over 60% of the entire assemblage. These pieces all show conchoidal fracture and majority have clear striking platforms and struck scars on their dorsal surfaces. They certainly appear to be the product of knapping, and such pieces are produced in large quantities during flint reduction. However, it is necessary to exercise some caution as small, conchoidally fractured pieces can be generated, particularly in relatively small quantities, from other activities involving the mechanical movement of flint, including its extraction, transport and redeposition. Their identification largely is dependant on the sampling programme, as generally they will only be identified through fine sieving. During this investigation, sampling was undertaken extensively and on a range of different context types so there should be a reasonably comprehensive coverage of possible in situ knapping and tool production activities.

15.6 Summary of Contextual Associations

Struck flint and burnt flint were recovered from many of the different phases provisionally identified by the excavators, although in varying quantities and compositions. A catalogue summarising the flintwork by context is provided at the end of this section and full details of the assemblage can be consulted in the accompanying Access database.

No pieces of macro-debitage were identified from the pre-monument contexts although small quantities of micro-debitage were present within the Old Land Surface deposits, an indication that some, but not extensive, knapping had occurred prior to or during the initial phases of monument construction.

The Gravel Mound similarly provided some evidence of knapping as well as a small systematically produced blade and a flake fragment. The blade at least would unlikely to have been made much after the Early Neolithic and this suggests that it may have been already present in the material that was imported and used in the mound's construction.

The overlying Lower Organic Mound contained a decortication flake, removed from a gravel pebble that may have been used as a hammer stone, a trimming flake and a core fragment, as well as pieces of micro-debitage. Pit [4191], associated with this mound, also produced a decortication flake and micro-debitage. Additionally, relatively high quantities of micro-debitage were recovered from the Mini-Mound. None of this material was chronologically diagnostic and, again, it is difficult to determine whether this material indicates sporadic and low-level flintworking associated with these features, or if this material was already present within the material that was used in their construction.

Struck flint was also present within the two pits that cut into the Lower Organic Mound. Pit [3067] produced a trimming flake, a blade, three useable flakes and a naturally backed flake with sporadic light steep scalar retouch along parts of its left dorsal lateral margin. Some of these may have been struck from the same pieces of raw material, although refitting was unproductive. They appear to form a small collection of useable or retouched cutting flakes and, as a collection, were likely to have been deliberately dumped into the pit. In contrast, the other pit, [4074], contained no macro-debitage but did produce a relatively large collection of micro-debitage as well as higher quantities of burnt flint fragments. Variations in the pits' contents may suggest, if somewhat tentatively, that a degree of selection could have been exercised in determining what was being deposited.

The Upper Organic Mound did contain some micro-debitage in similar quantities to the Lower Organic Mound, but produced no other evidence of flintworking from during its construction.

Ditch 1 (context [3091]) produced a relatively large assemblage of macro-debitage from throughout its fills, with evidence for flintworking in the form of micro-debitage also being recovered from its lowest, organic, fill. This assemblage principally consists of knapping waste but useable flakes and blades and two retouched edge-blunted flakes were also present. The flakes are undiagnostic and too few in number to confidently date but they do tend towards being narrow and certainly would not be out of place in a Late Neolithic context. The assemblage was in good condition and indicates the production of useable and retouched pieces had occurred in the vicinity, with some of this material becoming incorporated during the ditch's infilling. The presence of 64g of burnt flint fragments, over half of all of the burnt flint recovered during the investigations, suggests the presence of hearths, or at least activities involving fire, in the vicinity, the residues of which also ended up in the ditch.

The only material to certainly come from the main chalk construction of the monument (Phase 17) came from the 'inter-wall' deposits excavated on the summit. Twelve pieces of macro-debitage were recovered, mostly comprising knapping waste but with two useable flakes also present, along with small quantities of micro-debitage. Further struck material was also recovered from disturbed contexts and soil horizons on the summit; although the latter material could substantially post-date the construction or initial use of the monument, the disturbed material was likely to mostly originate from the body of the mound. Some burnt flint was also present in the 'inter-wall' deposits and the residual material from the summit. The latter could post-date the mound's construction and could conceivable date to any period up until relatively recently, although the presence of some in the 'inter-wall' deposits indicates that at least small quantities had been incorporated into the monument.

Similarly, the material recovered from the collapsed deposits within the tunnel was likely to have originated from within the bulk of the mound itself. This material represents the largest collection from a single source recovered during the investigations. It is similar to that recovered from the summit, principally comprises knapping waste and includes ten of the eleven cores found during the investigations.

It also contains numerous potentially useable flakes, including some that showed evidence of utilization, and three retouched implements, an edge-blunted flake, a denticulated flake and the serrated blade. It suggests a low-level but persistent presence of struck flint throughout the body of the monument and, as with the assemblage as a whole, reflects the occasional and opportunistic reduction of readily available raw materials and the manufacture of useable flakes and tools during its construction.

15.7 Significance

The struck flint recovered during the investigations did not form a large assemblage but is of significance in that it can contribute to an understanding of how flint was used at the site, its significance in relation to the construction process, site formation processes and the possible use of the monument after its construction. This report represents the preliminary findings from the initial examination and cataloguing of the material. A small component of the assemblage probably reflects residual material, incorporated into the monument from elsewhere. The majority of it was probably more-or-less contemporary with the construction of the monument and suggests that this was accompanied by sporadic episodes of flintworking. This material was characterised by the opportunistic manufacture of useable pieces, most probably for tasks immediately connected with the construction of the monument. There was a relatively limited range of retouched pieces present, these being dominated by cutting implements, and only one specialised core, a Levallois variant, was identified. No large 'domestic' type assemblages were encountered nor were there any elaborate retouched pieces or obvious ceremonial flintwork deposits present. By and large, the flintwork appears to represent an aside from the main concerns governing the creation of the monument, reflecting an expedient and functional response to needs as they arose during construction, rather than an integral activity bound up within the needs and processes that initiated its construction.

Burnt flint was likewise only found in small quantities but does indicate that, at the least, occasional hearths were used during the monuments construction. This appears to have been only an occasional practice, however.

Struck Flint and Burnt Flint Catalogue

Context	Phase	Feature	Decortication Flake	Core Modification	Trimming Flake	Mis struck Flake	Blade	Useable Flake	Flake Fragment	Conchoidal Chunk	Core	Retouched	Micro-debitage		Burnt Flint (No.)	Burnt Flint (wt:g)
+su mmit	21.2	Unstrat summit						1								
?	?	Sample 9151			1											
10 /11	17	interwall	2		2								5			
2	21.1	Summit SS	2		5				5	1			1			
4	17	Interwall			2				1							
8	21.1	Summit SS	1										2		1	4
9	18	P15 fill	1													
14	21.1	Summit SS	2		2				1						1	1
3002	21.2	Tunnel fill										1		Flake has variable scalar retouch along right lateral after it had recorticated although flake appears roughly LNEBA but shows some reuse		
3013	3	OLS											1			
3046	4	LOM											9			
3066	5	P3067 2F			1		1	3				1	11	Backed Knife. Many other possible pieces of M-D	1	1
3069	3	Surface Gravel Mound											8			
3070	5	P30671F											11			
3073	5	P3074 F											39		10	23
3075	4	LOM			1								1			
3078	6	UOM											5			
3083	6	UOM											5			
3146	?	?										1		Piercer? On BLF. Mis-numbered on bag?		
3811	21.2	Tunnel fill						1								
3812	21.2	Tunnel fill									1			Minimally Reduced		
3815	21.2	Tunnel fill						1								
3816	21.2	Tunnel fill	2													
3817	21.2	Tunnel fill									1			Flake core		
3819	21.2	Tunnel fill	3	1				4	2			1		Retouched is a denticulated flake		
3830	21.2	Tunnel fill	1								1			Core is minimally reduced		
3832	21.2	Tunnel fill										1		Serrated metrical blade		
3835	21.2	Tunnel fill	1													
3836	21.2	Tunnel fill						1						Unrecorticated flake struck from the ventral of a larger recorticated flake		
3840	21.2	Tunnel fill									2			Both minimally reduced		
3841	21.2	Tunnel fill									1			Flake core		
3845	21.2	Tunnel fill						1		1						
3846	21.2	Tunnel fill						2						One of the flakes at least probably utilized		
3849	21.2	Tunnel fill	2					1								

Context	Phase	Feature	Decortication Flake	Core Modification	Trimming Flake	Mis struck Flake	Blade	Useable Flake	Flake Fragment	Conchoidal Chunk	Core	Retouched	Micro-debitage										Burnt Flint (No.)	Burnt Flint (wt:g)
3850	21.2	Tunnel fill		1																				
3851	21.2	Tunnel fill									2											One Flake core one minimally reduced		
3852	21.2	Tunnel fill	1																					
3853	21.2	Tunnel fill	1																					
3854	21.2	Tunnel fill						1			1											Minimally reduced core		
3858	21.2	Tunnel fill						1																
3859	21.2	Tunnel fill	1																					
3860	21.2	Tunnel fill									1											Flake Core		
3861	21.2	Tunnel fill						1																
3862	21.2	Tunnel fill						1																
3864	21.2	Tunnel fill – collapsed organic mound					1															Microblade		
3903	13.2	D3902 spit1		1																				
3918	13.1	D3902 Spit 2	1				1					1										Unsystematic blade. Retouched is edge blunted	1	23
3919	13.1	D3902 spit 3	1				1				1											Flake Core. Systematic blade.	1	35
3920	13.1	D3902 spit 4						1	2															
3925	13.1	D3902 fill						3															1	5
3926	13.1	D3902 organic fill	2					3	2			1	21									Edge blunted	1	1
4041	2	OLS											16											
4070	VOID												13											
4073	12	Bank 5											16											
4153	3	Gravel Mound											17											
4156	4	LOM	1										13											
4166	3	Surface Gravel Mound					1		1				14									Systematic blade – residual?	1	6
4173	4	P4171 2F											8											
4181	4	Organic mini-mound	1										17											
4182	4	LOM								1												Core fragment		
4801	21.2	Summit TS 1968 trench	1		1			2	1															
4802	21.2	Summit Backfill 1968 trench	2			1	1	1	1													Unsystematic blade		
4804	21.1	Summit TS						1																
4805	21.1	Summit SS	2					5	1														1	11
4806	21.1	TT4807 F	1		1			1					3										1	1
4810	21.2	Summit backfill 1968 trench	1																					
4813	17	Summit interwall						1																
4820	18	Summit PH4821 F	2																					
4822	18	Summit PH4623											1											
4826	18	Summit P4834 F	1				1															Unsystematic		
4828	18	Summit Animal disturbance			1																			

Context	Phase	Feature	Decortication Flake	Core Modification	Trimming Flake	Mis struck Flake	Blade	Useable Flake	Flake Fragment	Conchoidal Chunk	Core	Retouched	Micro-debitage										Burnt Flint (No.)	Burnt Flint (wt:g)
4837	19	Summit Interface layer	1																					
4840	17	Summit interwall			1																			
4843	17	Summit interwall	1							1												Core fragment	1	8
4845	17	Summit interwall						1																
4851	18	Summit PH4852			2								3											
4857	18	Summit PH4858											1											
4861	19	Summit PH4862						1																
4873	17	Summit Clay in crater											3											
4885	21.1	Summit SS in crater																						
4886	18	Summit P4876 F								1												Core fragment		
4902	21.2	Hillside										1										Miscellaneous obliquely truncated flake		

16 ASSESSMENT OF SARSEN STONES

Joshua Pollard

Blocks of sarsen stone were recorded during the 1849 and 1968-70 excavations as forming part of the make-up of Silbury Hill (Merewether 1851, Whittle 1997). A further 46 sarsens (weighing in total 779.4kg) were recorded during the 2007 excavation from contexts relating to early stages of mound construction and from the summit; the latter built into the chalk block walling, the inter-wall deposits and deriving from Atkinson's topsoil (Table 46). This account is based on detailed recording of those pieces retained, and on-site records of those backfilled at the end of the 2007 excavation. Thirteen sarsens were retained because of signs of obvious or suspected working, and are described in detail at the end of this report.

Sarsen is a highly resilient Tertiary sandstone that occurs in boulder form, ranging from fist-sized lumps of a few kilograms to blocks upwards of 100 tonnes. Ubiquitous within the Upper Kennet Valley, it was deposited in extensive spreads on the surface of valley bottoms and sides under peri-glacial conditions (Geddes 2000, 60-4). Antiquarian records and archaeological evidence illustrate that the current restricted distribution of sarsen on the region's downlands is largely a product of medieval and post-medieval clearance (Long 1858, Smith 1885, King 1968, Bowen & Smith 1977, Fowler 2000, Field 2005).

16.1 Description

Twenty sarsens, weighing 409.7kg, were recovered from tunnel (i.e. early phase mound) contexts: [3834], tunnel fill of collapse and 'ooze' from shaft; [3855], slumped turf stack; and [4157], part of the Upper Organic Mound. The size range was varied, but three blocks from [4157] were substantial, weighing between 30kg and 85kg. Only one stone from these lower mound contexts showed evidence of possible modification, a block from [3834] that had split. Two stones from [3834] ('k' and 'f') were retained because they displayed areas of smoothing. However, later examination failed to reveal traces of intentional surface modification such as pecking or clear striations resulting from their use for grinding or polishing, and it is considered that the localised surface smoothing was produced by natural agencies (e.g. water action).

In contrast to the assemblage from lower mound contexts, 20 of the 24 sarsens from the summit of the Hill exhibit evidence of modification. This takes various forms, from simple splitting, the removal of one or more flakes, or localised burning, to more systematic working. Many of the fragmentary stones retain areas of cortex, covering as much as 80% of the surface. Where it is possible to gauge the original size of blocks, none appears to have been above 1m in maximum dimension. Pinkish tinges to the cortex of fragments from the Crater, [4809] and [4857], along with localised spalling on stone 16 from [4809], are taken as evidence of burning, utilised to induce thermal fracture of the stones as an initial stage in reduction. Fracture and reduction of boulders was also achieved through controlled direct percussion, as evidenced by traces of negative bulbs on stones 1 and 3 from [4809] and flakes/flake scars themselves. Much of the reduction, however, was unsystematic, and appears to have involved smashing of the stones. Two of the stones (numbers 3 and 5) from chalk wall [4809] refit and others look to belong to the same block.

Three sarsen fragments from the summit might be regarded as unfinished artefacts. Stone 23 from [4801], Atkinson's topsoil, is a split fragment which has been further worked by the removal of three small flakes from the edge, producing a roughly sub-oval shaped piece. While perhaps too irregular, it has the appearance of a quern 'rough-out'. Fragments 14 and 17, from inter-wall deposit [4845] and [4801] respectively, refit to form a block 250 x 340 x 100mm. A large flake scar forms one side, the other being cortical. Several small flakes have been removed from the edge, giving the refitted block a roughly sub-oval shape. Where remaining, the cortical surface displays traces of light pecking, and on one part of this surface a shallow concavity has been produced, c.120 x 80mm in extent, within which the surface is smoothed, probably by grinding. This piece starts as a complete stone or large fragment which undergoes surface modification, perhaps to turn it into a *polissoir*. It was then split, thinned and roughly shaped through flaking. Conchoidal features show the block was then deliberately split in two by a single blow to the upper face.

Context	Modified	Unmodified	Weight range (kg)	Weight average (kg)
3834	1	12	3.2-15.7	9.4
3855	-	2	19.0-43.8	31.4
4157	-	5	12.7-85.0	44.9
4801	5	2	3.9-9.7	6.2
4805	-	2	14.7-38.5	26.6
4809	11	-	15.2-38.0	15.2
4845	1	-	3.3	3.3
4857	1	-	25.9	25.9
Crater	2	-	6.3-38.0	22.2
Unknown	1	1	12.3-50.0	31.2

Table 46: Sarsen from the 2007 excavations

16.2 Discussion

It is clear both from the 2007 and earlier excavations that whole and fragmentary sarsens were deliberately incorporated in the make-up of the Hill. Those from the summit included a substantial number of large fragments built into the chalk block wall [4809]; analogous to those recorded by Atkinson as incorporated in his chalk walling 802 and 808 (Whittle 1997, 20). The early stages of mound construction were also intimately associated with sarsen, as evidenced by the stones from [3834], [3855] and [4157]. Describing the results of the 1849 excavation, Merewether records a sarsen capping to the primary mound, comprising 'many sarsen stones… some of them placed with their concave surfaces downwards, favouring the line of the heap… and casing, as it were, the mound' (1851, 79-80). Note should also be taken of Merewether's claim that medium-sized sarsen boulders were set at c.5m intervals around the base of the Hill (Merewether 1851, 74). Both the primary mound and final mound were 'capped' or 'contained' in various ways with stone. Sarsen most be considered, alongside chalk, turf, gravel and soil, as a construction material, even if its incorporation did not offer any structural advantage.

Examination of those stones recovered in 2007 shows a marked qualitative difference between lower mound and summit contexts, with nearly all sarsens from the former being unmodified, and those from the latter mostly fragmented. The presence of refits among the fragments from wall [4809], and the absence of associated fine debitage, indicate that individual stones were split elsewhere (perhaps at the base of the Hill) and probably as required for each section of walling. Where it is possible to gauge the size of the original blocks from which the summit fragments derive, none are particularly large (being less than 1m in maximum dimension). Megalithic settings were not being broken up for the purpose. Inasmuch as it was locally available, none of this stone need have been brought from far; and may have been encountered in superficial periglacial/solifluction deposits during the digging of the quarry ditches. This said, we should not, of course, preclude its transportation from natural spreads or artificial structures at a distance from the Hill. Associations and biographies of stone (cf. Gillings & Pollard 1999) were as important as constructional expediency.

Why sarsen was incorporated in the construction of Silbury Hill is more difficult to determine, but the answer likely relates to its perceived qualities – its materiality. It certainly invoked interesting depositional responses, seen with the intimate placing of red deer antlers between the sarsen fragments used in summit walling [4809]. Merewether records related depositional acts from the primary mound, where bone fragments (including large mammal ribs), small sticks and an antler tine had been placed on top of several of the stones (Merewether 1851, 80). This explicit depositional link between sarsen and organic materials stands in stark contrast to the seemingly deliberate exclusion of bone and antler from the stone-hole fills of contemporary megalithic settings in the region (Gillings *et al.* 2008, 202). Were the Silbury sarsens thought of as categorically different to megaliths, and if so did this relate to their size or origin?

Elsewhere in the region during the second half of the 3rd millennium BC we see sarsen being employed in varying circumstances. Large blocks were used to create the megalithic settings of the Beckhampton and West Kennet Avenues, for instance (Smith 1965, Gillings *et al.* 2008). By the turn of the millennium distinct traditions had developed of covering individual Beaker burials with sarsen, and of placing graves at the feet of standing megaliths (Pollard & Reynolds 2002, 128-30). Taken together with the inclusion of small sarsens in the secondary fills of the chambers and passage of the West Kennet long barrow (Piggott 1962, 26-30), there is good reason to believe a metaphoric or ontological connection was believed to exist between stone and mortuary/ancestral domains (Parker Pearson & Ramilisonina 1998).

In other contexts, like that of Silbury Hill, it is difficult to discern an explicit link between stone and mortuary or ancestor-veneration practices. This need not of course imply an absence of connection. More analogous to the Silbury circumstance may be those instances of small or fractured sarsens being worked into larger constructions, rather than megalithic settings as such. In discussing Henry Meux's 1894 excavation though the bank at Avebury, Gray refers to several pieces of 'rough sarsen' being found on top of the buried soil (Gray 1935, 104), suggesting they were used to mark out or initiate earthwork construction. Unmodified sarsen boulders up to 0.8m across were also used extensively as packing in the palisade trenches of the West Kennet enclosures (Whittle 1997). Whittle notes that in Trenches F and J of enclosure 1 there were 'particularly striking concentrations of large sarsens in the middle and upper parts of the inner ditch' (1997, 57), locations that look to flank an entrance gap. Placing stones around boundaries, at entrances, or, in the case of Silbury, as 'cappings' to a mound, perhaps gives us a sense of their perceived protective or apotropaic power, whether that invoked ancestral agencies or not.

Notes on sarsens retained and stored at Fort Cumberland.

'Crater'
ID 16. Split piece, 330 x 190 x 120mm. Cortex on one side, with slight pinkishness in places. 'Flake-like' with a triangular cross-section. Possibly large broken flake.

[3834], tunnel fill of collapse and ooze from shaft
ID 'k'. Small, essentially unmodified piece, 240 x 210 x 90mm. This is a sub-rectangular block retained because of smooth upper and lower faces. No clear striations or pecking, so not a *polissoir*, the smoothing probably a product of water action. One small flake scar at one end, but likely resulting from damage rather than intentional working.

ID 'f'. Complete sarsen, 270 x 240 x 180mm, with reddish-brown cortex. Unmodified, though with signs of ancient (i.e. geological) fracture. One face smoothed, hence retention, but this natural.

[4801], Atkinson's 'topsoil'
ID 23. Fragment, 260 x 230 x 70mm, with irregular cortex. Fractured piece or large flake fragment, with a series of ?three small flake removals from the edge, producing a roughly sub-oval shaped piece. Has the appearance of a quern 'rough-out', but perhaps too irregular.

Context [4801], Atkinson's topsoil and [4845], inter-wall deposit
Flaked block made up of two refitting pieces: ID 17 ([4801]), 250 x 200 x 90mm and ID 14 ([4845]), 230 x 150 x 100mm (total size 250 x 340 x 100mm). Cortical surface, where remaining, shows traces of light pecking. On one part of this surface a shallow concavity has been produced, c.120 x 80mm, within which the surface is smoothed, probably by grinding. There is an incipient cone of percussion on this.

One large flake scar which creates the 'dorsal' surface has been struck from a fracture plane. Two further flakes/fragments were removed using the cortical surface as a platform; another three were struck from the dorsal face. Small flakes removed from one end. Conchoidal features show the block was split in two by impact to its centre.

Context [4809], chalk 'wall'
ID 1. Fractured piece, 370 x 160 x 120mm. 70% cortex. Piece split through blow to the cortical surface, leaving a negative bulb of percussion. This could have occurred accidentally/incidentally. Radial outer fracture. From a small/medium-sized sarsen.

ID2. Fractured piece, 380 x 220 x 100mm. A large flake fractured at the proximal end. One, possibly two, prior removals are visible as scars on the 'dorsal' face. Scar of small flake struck from break surface (could be accidental). One face preserves cortex, to which there is a slight pinkish tone.

ID 3. Fractured piece, 260 x 210 x 210mm. Large area of cortex remains, this with a pinkish/reddish-brown tinge. Seemingly split by percussion, one small flake then removed. Refits with ID 5. Original stone >0.6m.

ID 4. Fractured piece, 340 x 300 x 150mm. 80% cortex. Very similar to 3 and 5, and probably from the same block.

ID 5. Fractured piece, 290 x 280 x 220mm. 50% cortex. Refits with ID 3.

ID 6. Fractured piece, 400 x 250 160mm. 20% cortex. Likely evidence of thermal fracture to cortex as indicated by a pinkish hue and localise spalling, producing a rough surface. Original block size impossible to estimate.

[4857], fill of probable pit [4858], summit
SF8524. Fractured piece, 370 x 280 x 240mm. 50% cortex, pinkish in places, two main fracture planes. From medium-sized block (c.0.5-1.0m).

17 ASSESSMENT OF POTTERY

Kayt Brown and Alan Vince

A small quantity of pottery was recovered during the archaeological investigations at Silbury Hill during 2000/2001 (18 sherds) and 2007 (19 sherds). Although a single Beaker sherd was identified the remainder of the assemblage is considerably later in date, comprising later prehistoric, Romano-British, late Saxon and Medieval sherds.

All the sherds have been subject to a basic visual scan, to ascertain their date range, condition and potential to contribute to an understanding of the Site. The 2001 material was briefly assessed at the time; the 2007 material has been examined in more detail by Alan Vince, the results of which are presented in Annex 1. Quantification of the assemblage, by count and weight by context is presented in Table 47.

Table 47: quantification of the pottery assemblage by context (sherd count and weight)

Context	Sherds	Weight (g)	Date comment
1	1	5	Medieval
2	2	8	Medieval
4	2	8	?Medieval plus 1 sherd Beaker pottery
8	2	4	Medieval
9	1	1	Medieval
14	2	6	Medieval
16	1	6	Medieval
17	4	95	Medieval
18	3	69	Medieval
3002	1	2	Romano-British
4804	2	6	Romano-British
4805	7	88	Iron Age
4820	2	7	Unidentified
4845	3	2	Unidentified
4886	2	27	Late Saxon
4889	1	64	Romano-British
unstrat	1	-	Unidentified
Total	37	398	

17.1 The assemblage

A singe small sherd (6g) of comb-decorated Beaker pottery with square-tooth comb impressions in fair condition, and has a complex motif with filled or reserved triangles was identified from context [4] (identified by Ros Cleal); however this appears to be a residual find, occurring alongside a medieval sherd. Later prehistoric material comprises five flint-tempered sherds, including the rim, shoulder and upper body of a jar.

Only two sherds from 2007 have been identified as Romano-British in date; a small abraded, oxidised sandy sherd from context [4804] and a base sherd in a shell-tempered fabric from context [4889]. This latter sherd had a flat, wire-cut base and is likely to be late Roman in date. Shell-tempered pottery is well known within the region, the nearest example being the Winterbourne Romano-British Settlement to the north east of Silbury Hill (Seager Smith1996, 47), with other examples identified at Cirencester, Shakenoak, Nettleton (ibid) and Wanborough (Seager Smith 2001, 249 fabric 85).

Two sherds from 2007 were identified as potentially late Saxon or early medieval in date, a single rim sherd in Bath fabric A and a body sherd of Newbury Group A (see Annex 1 below). Nineteen sherds from previous works in 2000/2001 were identified at the time as probable fragments of Newbury Group B. These sherds contained sand, flint and limestone inclusions and originate in the late 12th to early 13th century.

Nine sherds were too small to be positively identified to period.

17.2 Assessment of the Putative Late Saxon Pottery from Silbury Hill, Wiltshire
(Alan Vince)

A small quantity of pottery from the English Heritage excavations at Silbury Hill was identified by R Cleal as being possibly of 10th century date and was therefore submitted to the author for identification and assessment. Only two of the sherds could be positively identified as being of Late Saxon or medieval date and some of the remainder, in the author's opinion, are definitely of later prehistoric and Roman date, including one piece of Roman building material.
Factual Data
Nineteen sherds were submitted for identification (Table 48). Of these only two can be positively identified as being of late Saxon/early medieval date. The remainder are included in Table 48 for completeness.

Table 48: The 2007 pottery

Code	Sherds	Vessels	Weight (gm)	Mean Sherd Weight
BATHA	1	1	5	5.00
IAFLINT	5	4	84	18.88
NBYA	1	1	22	22.00
OXID	1	1	1	1.00
RTIL	1	1	5	5.00
SHEL	1	1	64	64.00
UNID	9	8	14.1	1.70
Total	19	17	195.1	10.95

Bath Fabric A (BATHA)
This ware is defined by its fabric, which contains moderate water-polished quartz grains and sparse flint, chert and/or calcareous inclusions in a silty groundmass containing some muscovite (Vince 1979). In this particular example, a single calcareous inclusion is present, which at x20 magnification appears to be sparry calcite.

Vessels of this fabric occur on numerous sites in west central Wiltshire, North Somerset and South Gloucestershire and petrological analysis indicates that they were probably made from Lower Cretaceous Gault clay, with added quartzose sand obtained from cover sands derived mainly from Lower and Upper Cretaceous deposits (Vince 1984). The calcareous inclusions are usually leached and in this example might come from an Upper Cretaceous *inoceramid* shell.

Iron Age Flint-tempered ware (IAFLINT)
The distinctive feature of this fabric is the presence of angular, probably fire-cracked, flint. This flint differs in appearance from that found in Bath Fabric A and other fabrics where the flint is of detrital origin, in the hackly surface of the fragments and the presence of crazing visible at x20 magnification. The five examples here include two with walls which are much thicker than those found on late Saxon or early medieval pottery and in one case the rim, shoulder and part of the upper body of a jar are present. One of the examples contains a mixture of fire-cracked flint inclusions and water-polished quartz grains. A recent study of this ware from various sites in Hampshire suggests that many of the Hampshire samples may have been produced near Winchester although those from North Hampshire (Silchester) might have a different source, and are later in date. These examples are large and fresh, with some spalling suggesting perhaps that they were dropped on the surface of the mound.

Newbury Group A (NBYA)
A single sherd of this fabric was found. It contains inclusions of subangular flint, some of which is brown-stained and perhaps of Tertiary origin. The groundmass is finer in texture than that of Bath Fabric A and at x20 magnification neither quartz silt nor muscovite are visible. This ware is found at Bartholomew Street, Newbury, in late 11th to early 12th-century contexts and a source in the Vale of Pewsey has been postulated (Vince 1997). Examples are known from sites in Northern Hampshire, Berkshire and eastern Wiltshire.

Roman Oxidized ware (OXID)
A single, heavily abraded sherd of oxidized ware is likely to be of Roman date. It has the appearance of a sherd from a ploughsoil.

Roman Ceramic Building Material (RTIL)
A single heavily abraded sherd of brick or tile is likely (in my view) to be of Roman date. It too appears to have been in a ploughsoil.

Roman Shell-tempered ware (SHEL)
The flat base of a wheelthrown jar made in a shelly fabric. At x20 magnification, the temper can be seen to include punctate brachiopod and nacreous bivalve shell, with few fragments larger than c.2.0mm across. The fabric contains no visible quartzose grains.

Shelly fabrics of this type were produced in the Roman period and in the late Saxon and early medieval periods in Bedfordshire and Cambridgeshire, utilising the Middle Jurassic Cornbrash marls. The Cornbrash outcrops on the dip slope of the Cotswold scarp to the northwest of Silbury, but the distribution of both Roman and Late

Saxon/medieval examples both point to a south-east midlands source. The flat, wire-cut base of this example can be paralleled in the Roman period and only occurs in the late Saxon period on very early (i.e. late 9th to mid 10th-century) pieces, after which a sagging base is ubiquitous. Therefore, although a late Saxon date cannot be entirely discounted, it is more likely that this is a Roman vessel (see, for example, those from the production site at Harrold, Bedfordshire, Brown 1994).

Unidentified wares (UNID)

Nine sherds were too small for identification, including small abraded specks found in soil samples. However, none appeared to be of late Saxon or early medieval types.

Statement of Potential

The collection from the fortification of the top of the mound, found by Atkinson, is important because of its association with an early 11th-century silver penny. This is one of the few clear examples where these handmade, "early medieval" style vessels have been found in pre-conquest contexts in Wiltshire or the south-west (Vince 1984). However, these two new sherds add little to the existing evidence. There is therefore little potential for archaeological research on these two sherds.

Storage and Curation

All of the pottery should be retained and it does not require special storage conditions.

Pottery catalogue of 2007 material

Context	REFNO	period	class	cname	Form	subfabric	type	Description	Part	Nosh	NoV	Weight	Condition	Use
3002		5	POTTERY	UNID		OXID;ABUNDANT RQ, SOME GSQ <0.3MM	Fill	BLACK SURFACES	BS	1	1	2	SPALLED	
4804	200728508	6	POTTERY	RTIL	-	POORLY MIXED;V LITTLE QUARTZ;ANGULAR GROG/RELICT CLAY <4.0MM	Layer		BS	1	1	5	VABR	
4804	200728507	6	POTTERY	OXID	JAR/FLAG	OXID;NO VISIBLE INCLUSIONS	Layer		BS	1	1	1	VABR	
4805	200728515	6	POTTERY	IAFLINT	JAR	BLACK FIRED;FIRE-CRACKED FLINT/CHERT TEMPER	Layer	SHOULDERED JAR WITH THICK WALLS AND SMALL BEADED RIM	BS	1	1	63	FRESH, SPALLED	
4805	200728522	6	POTTERY	IAFLINT		BLACK FIRED;FIRE-CRACKED FLINT/CHERT TEMPER	Layer		BS	1	1	2	SPALL	
4805	200728517	6	POTTERY	UNID	JAR	GSQ <0.3MM;ROUNDED FEORE <0.2MM	Layer	POSSIBLY A BATHA VARIANT BUT ALSO POSS IAGLAUC	BS	1	1	2	FRESH	
4805	200728516	6	POTTERY	IAFLINT	JAR	BLACK FIRED;FIRE-CRACKED FLINT/CHERT TEMPER	Layer	SHOULDERED JAR WITH THICK WALLS	BS	2	1	17	FRESH	
4805	200728513	6	POTTERY	UNID		SPARSE GSQ <0.3MM;ROUNDED FEORE <0.2MM	Layer	SPALL WITH NO ORIGINAL SURFACES	BS	1	1	2	SPALL	
4805	200728510	6	POTTERY	IAFLINT		BLACK FIRED;FIRE-CRACKED FLINT TEMPER;MOD GSQ <0.3MM	Layer		BS	1	1	2	FRESH	
4820	200728519	6	POTTERY	UNID	JAR	SPARSE GSQ <0.3MM;ROUNDED FEORE <0.2MM	Fill		BS	1	1	5	FRESH	
4820	200728518	6	POTTERY	UNID	JAR	SPARSE GSQ <0.3MM;ROUNDED FEORE <0.2MM	Fill		BS	1	1	2	FRESH	
4845	200728529	6	POTTERY	UNID	-	GSQ	Layer	POSSIBLY A BATHA	BS	2	1	1	SPALL	

						<0.3MM;ROUNDED FEORE <0.2MM		VARIANT BUT ALSO POSS IAGLAUC						
4845	<9526>	6	POTTERY	UNID			Layer		BS	I	I	0.1	VABR	
4886	200728765		POTTERY	NBYA	JAR	SA BROWN-STAINED FLINT;S GSQ <0.3MM;SPARSE MUSC IN GROUNDMASS		SAGGING BASE SHERD	B	I	I	22	FRESH	BLACK DEPO INT
4886	200728766		POTTERY	BATHA	JAR	M GSQ <0.3MM;RARE SPARRY CALCITE <2.0MM		VERTICAL RIM WITH ROUNDED, SLIGHTLY BEADED TOP	R	I	I	5	FRESH	
4889		6	POTTERY	SHEL	JAR	ABUNDANT FOSSIL SHELL INC PUNCTATE BRACHIOPOD AND NACREOUS BIVALVE	Layer	FLAT WIRE-CUT BASE;DEEP FINGER GROOVE AROUND INT OF BASE ANGLE	B	I	I	64	FRESH	SOOTED SIDES NONE ON BASE
UNSTRAT			POTTERY	UNID	SPINDLE WHORL	DARK GREY INCLUSIONLESS FABRIC WITH ABUNDANT CALCAREOUS SPECKS		PROBABLY FASHIONED FROM POTSHERD;FLAT TOP DECORATED WITH THREE CONCENTRIC GROOVES;LOWER SURFACE SPALLED;SIDE SCRAPED AND HOLE BORED	BS	I	I	0	FRESH	

18 ASSESSMENT OF METAL OBJECTS

Kayt Brown and Nicola Hembrey

This assessment of the metal objects recovered during the 2007 archaeological investigations also incorporates the initial assessment undertaken of the 2001 objects (Hembrey 2001). No metal finds were recovered from the 2004 Watching Brief.

Subsequent to quantification, all finds have at least been visually scanned in order to ascertain their nature, potential date range and condition. A list of the metal objects is presented in Table 49. All the metal objects have been subject to X-radiography as part of archive completion. A small number of 20th century metal objects were recorded and retained, due to their interest as objects of social history.

18.1 Copper Alloy

A total of eight copper alloy objects were recorded, all of which are 19th or 20th century in date. These objects comprise 3 pin fragments from layer [4806], a button and pendant with three glass beads, both from layer [4804]. Three tobacco tins from the tunnel portal/entrance were also retained. A single Roman coin was the only copper alloy object within the 2001 assemblage. The coin has been identified as a nummis of Constantine the Great, with a Gloria Exercitus reverse (two soldiers, one standard), minted in Lyon between 335 and 345 AD. It is possibly a contemporary copy (pers comm. Nick Cook, Wessex Archaeology).

18.2 Iron

Twelve iron objects were recovered during 2001, with a further nine objects given object numbers from the 2007 investigations, including an example of the metal braces used in the construction of the Atkinson tunnel, an iron pick end, spanner, plumb bob and key associated with Atkinson work. Most of the remaining iron objects are structural or domestic; one handle fragment (SF 852, context [14]), one bar fragment (SF 856 from context [2]), six nail fragments (SF 855 and 859 from context [2], SF 858 and 860 from context [8], and SF 8031 and 8533), one pin (SF 862 context [2]), and three unidentifiable amorphous lumps, simply classified as 'objects' (SF 857 and 863 from context [2], and SF 861 from context [8]). These latter small finds are probably post-medieval in date, although further targeted cleaning of SF 861 may help identification of that object. A single, hafted bolt (SF 865) was recovered from layer [16].

Three objects are of particular significance; a near-complete prick spur (small find no. 2001100851) from layer [14], and two socketed arrowheads (SF 8501, 8514) from layers [4804] and [4805].

The spur is relatively straight, with D-sectioned sides, and a short neck which terminates in a quadrangular, lozenge-shaped point. Similar spurs have been dated to the mid 11th century (Ellis 2004, 5, fig.3.11). The spur terminals are rectangular in shape and fall within Ward Perkins type C group, thought to be obsolete by the end of the 12th century (Ward Perkins 1940, 97, fig.28 C(i)), and an almost identical parallel is known from Oxford (Kind 2001, 307, fig. 4.2), again assigned an 11th -12th century date.

One socketed arrowhead (small find no. 200728501) has a slender, leaf-shaped blade with a relatively flat section and corresponds with Jessop's type MP4 (Jessop 1996, 196). Multi-purpose arrowheads such as these were for military or hunting use and similar examples are known from Winchester (Goodall, 1990, fig.344, nos. 4001, 4002), dated to the mid 13th century. The second socked arrowhead (small find no. 200728514), is much longer and slender with a square-shaped cross-section and can be paralleled with Jessop's type M7 (dated from the 11th – 14th centuries (Jessop 1996, 198). Arrowheads of this latter type are thought to have been specifically designed to counter the increased use of defensive armour and are often, but not exclusively, found on military sites (Jessop 1997, 3).

18.3 Coinage

One Roman copper alloy coin of unknown date (small find no. 200100853) was recovered from [5].

Within the 2001 assemblage eight coins ranging from an 1881 half-penny to a 1956 six-pence, were collected from [1], [3], [8]. More recent coinage was recovered from the summit during 2007, comprising two ten pence pieces and a one pence piece [4801; 4804].

Table 49: Metal objects from 2001 and 2007

Material Type	Small Find No.	Description
Copper Alloy	200100853	Coin
	200728504	Coin
	200728505	Pendant
	200728506	Coin
	200728521	Button
	200728528	Coin
	200728530	Pin
	200728531	Pin
	200728532	Pin
Iron	200100851	Prick Spur
	200100852	Handle fragment
	200100855	Nail
	200100856	Bar fragment
	200100857	Unidentified
	200100858	Nail
	200100859	Nail
	200100860	Nail
	200100861	Unidentified
	200100862	Unidentified
	200100865	Hafted bolt
	200728031	Nail
	200728033	Not seen
	200728501	Projectile point
	200728514	Projectile point
	200728533	Nail

19 BBC TIME CAPSULE CONSERVATION ASSESSMENT

Karla Graham and Jenny Hodgson
December 2008

19.1 Introduction

This conservation assessment report covers the metal finds from the BBC time capsule as follows:

- Metal /wooden box container
- 2 x badges
- 1 x 50 pence piece
- 2 x metal film canisters

The objects were assessed by Karla Graham and photographed by Angela Karsten at the National Monuments Record (NMR) on 9th October 2008. Table 50 outlines the condition assessment and conservation recommendations for each object. The digital photographs are located in the following folder:
S:\oldshare\Projects\PR661 – Silbury Hill\IMAGES\2007DigitalPhotos\Film 50

The paper and film items have been assessed by the NMR Conservator Jenny Hodgson and condition reports on these items produced separately.

19.2 Summary

Overall, the condition of the objects varies between poor (film canisters), fair (container), good (coin) and excellent (badges). Aside from the film canisters, the corrosion and surface deposits on the objects do not currently appear to be causing any further damage. As these products are evidence of the history of the objects it is therefore recommended to leave them *in situ*. The film canisters are however still actively corroding and should be removed from the plastic bags and placed in more controlled environmental conditions. More interventive conservation may be required if these measures do not succeed in slowing down / halting the rate of corrosion.

The main recommendations relate to preventive conservation measures i.e. the packing of the objects and storage in controlled environmental conditions: 35% Relative Humidity (± 5%), 18 degrees Celsius (10-25°C) (MGC 1992). The objects are currently being stored at the NMR in controlled environmental conditions (35% RH, 8°C) and on open storage. For deposition with a museum the objects would need to be repacked into boxes with silica gel to maintain the low relative humidity conditions and for the purpose of transportation to the museum. The metal-wood container is too large to be placed in a standard Stewart box although; being mixed media it may not necessitate such controlled environmental conditions. The intended museum (Alexander Keiller) does not outline any specific requirements for deposition (pers comm. Tsang)

No potential areas for investigative conservation have been identified following examination of the objects or on advice from the Project Archaeologist.

Plate 72: The BBC time capsule side view (photo number 661-7011-11)

Plate 73: The BBC time capsule back view (photo number 661-7009-09)

Plate 74: The BBC time capsule insignia (photo number 661-6531-45)

Table 50: BBC time capsule conservation assessment

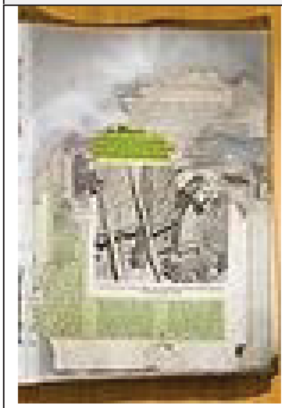
Object	Digital photographs	Condition	Recommendations
Metal/wooden box container	Film 50, 7001 to 7012 inclusive	In a fair condition. Comprises a painted metal lidded box and wood lined interior. Corrosion is present on one of the top corners of the box. It is fairly stable though with no active corrosion present. Corrosion to one corner on the base of box and corroded screw? heads on the base. On the rear face and one short side, the paintwork is slightly bubbled. The paintwork on the front face and other short side is stable. Residues of soil and chalk are adhering to the tin. Soil is smeared around the BBC motif indicating an attempt was made to wipe clean upon its recovery? The lid hinges are extremely heavy relative to the tin and when being handled they could cause damage to the box if they are allowed to fall against the surface of the tin. Interior wood: the panels (MDF?) are slightly rucked and very slightly damp (or cold?). Water staining evident on the wood.	Store in stable environmental conditions The soil and chalk should remain as evident of the social history of the item. The lid may need to be supported. Recommend wrapping the hinges with plastazote to prevent physical damage during transportation
Badges	Film 50, 7021 to 7022 inclusive	Excellent condition. No corrosion	Store in stable environmental conditions. Repack in perforated bags with jiffy foam inserts
Coin	Film 50, 7023 to 7024 inclusive	Good condition. Spots of bright green corrosion across both faces.	Store in stable environmental conditions. Repack in perforated bags with jiffy foam inserts
Metal film canisters	Film 50, 7013 to 7020 inclusive	Poor. Only crescent shape piece remaining for one of the canisters. Wet appearance to the metal in places indicates active corrosion. The film canisters are currently stored in unperforated plastic bags which may account for the continued corrosion.	Store in stable environmental conditions. The canisters should be removed from the plastic bags and either kept in open storage in the low RH NMR store / repacked into boxes with silica gel. The canisters should have plastazote inserts to support the weight of the heavily corroded walls.

CONSERVATION TREATMENT RECORD					
Subject/title	BBC publication				
Collection name	Silbury Hill				
Location	Nitrate store			Reference Location	
Date in	10.10.08	Source	Jim Leary	Date of record	21.11.08
Date out	10.10.08	Conservator	JH	Working time	

DESCRIPTION			
Date of item	Circa 1969	Format (size)	Approx A4
Accredited to	BBC	Mounted / loose	Bound in temp folder
substrate	Paper	Dimensions	28 x 21cm
Media	Printed ink	Grain direction	/
Structure flat/book	Pamphlet book	Weight	/
Colour / B&W	Mainly b&w & green	Gsm	/
Format l-scape/portrait	Portrait	Thickness	/
Process type	Letter press halftone on news print		
General Description	Printed publication for BBC including article on Silbury hill project. Typed noted at back on details of the project including staff, costings and budgets etc.		

CONDITION	
Physical: 1 – 4 (1= Excellent, 2= Good, 3= Fair 4= Poor)	4
Chemical: 1 – 4 (1= Excellent, 2= Good, 3= Fair 4= Poor)	4
General Description	Very poor condition of pamphlet, dried and stabilized by Harwell and placed in temporary plastic sleeve binding. Surface dirt, old mould spores, black deposits, large areas of loss throughout, folds and creases.

TREATMENT	
Pre-treatment tests	
Recording methods	Photographs
Treatment Proposal	Could be cleaned up and better supported in appropriate conservation grade materials.

IMAGES		
	 	
Before	Recto	after

CONSERVATION TREATMENT RECORD					
Subject/title	Fragments of paper				
Collection name	Silbury Hill				
Location	Nitrate store			Reference Location	
Date in	10.10.08	Source	Jim Leary	Date of record	21.11.08
Date out	10.10.08	Conservator	JH	Working time	

DESCRIPTION			
Date of item	Circa 1969	Format (size)	/
Accredited to	BBC	Mounted / loose	loose
substrate	Paper	Dimensions	vary
Media	Printed ink	Grain direction	/
Structure flat/book	fragments	Weight	/
Colour / B&W	Mainly b&w	Gsm	/
Format l-scape/portrait	/	Thickness	/
Process type	/		
General Description	Fragments of paper salvaged from Silbury hill find – most probably from Silbury hill pamphlet.		

CONDITION	
Physical: 1 – 4 (1= Excellent, 2= Good, 3= Fair 4= Poor)	4
Chemical: 1 – 4 (1= Excellent, 2= Good, 3= Fair 4= Poor)	4
General Description	Fragments of items in very poor condition, blocked, flaking, weak, irreversible condition.

TREATMENT	
Pre-treatment tests	
Recording methods	photographs
Treatment Proposal	Re-house

IMAGES		
		
Before	Recto	after

CONSERVATION TREATMENT RECORD					
Subject/title	Label 1				
Collection name	Silbury Hill time Capsule				
Location	Nitrate store			Reference Location	
Date in	10.10.08	Source	Jim Leary	Date of record	24.10.08
Date out	10.10.08	Conservator	JH	Working time	

DESCRIPTION			
Date of item	Circa 1969	Format (size)	Approx A5
Accredited to	BBC	Mounted / loose	loose
substrate	Laid paper	Dimensions	20 x 12.5cm
Media	Blue ballpoint pen	Grain direction	
Structure flat/book	Flat	Weight	
Colour / B&W	Blue ink	Gsm	
Format l-scape/portrait	portrait	Thickness	
Process type	/		
General Description	Hand written ink on paper "box was deposited at 1?.00 hours on Tuesday, 18th October, 1969 by Paul Johnstone and Ray ? at the furthest end of the tunnel dug into Silbury hill by Professor Richard? In the course of…ed excav…		

CONDITION		
Physical: 1 – 4 (1= Excellent, 2= Good, 3= Fair 4= Poor)		4
Chemical: 1 – 4 (1= Excellent, 2= Good, 3= Fair 4= Poor)		3
General Description	Poor condition, torn in two, ink ok, some water damage. Paper has rusted away around top and bottom. Surface dirt, areas of loss, discolouration, deposits of rusty iron, dark orange/brown stains. Ink strike through is visible on verso.	

TREATMENT	
Pre-treatment tests	
Recording methods	photographs
Treatment Proposal	

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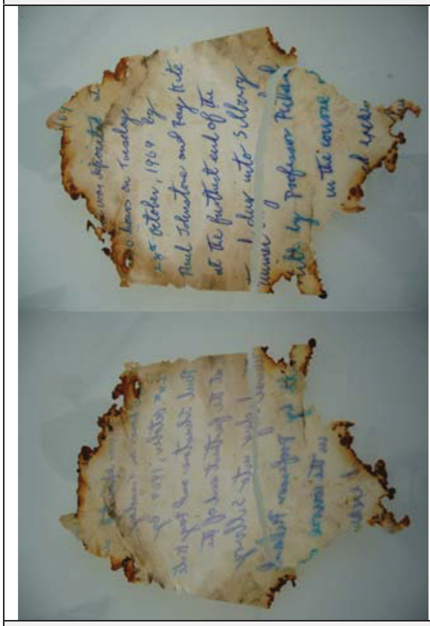
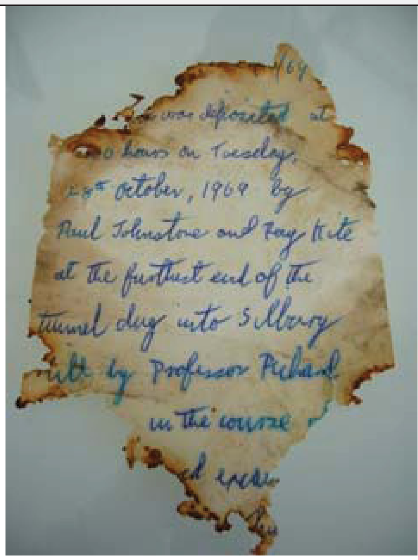
<td></td>
<td>

...was deposited at

...0 hours on Tuesday,

28th October, 1969 by

Paul Johnstone and Fay Kite

at the furthest end of the

tunnel dug into Silbury

...ill by Professor Richard

in the course
</td>
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</tr>
<tr><td>Before</td><td>Recto</td><td>after</td></tr>
</table>

CONSERVATION TREATMENT RECORD					
Subject/title	Label 3 (canister)				
Collection name	Silbury Hill time Capsule				
Location	Nitrate store			Reference Location	
Date in	10.10.08	Source	Jim Leary	Date of record	24.10.08
Date out	10.10.08	Conservator	JH	Working time	

DESCRIPTION			
Date of item	Circa 1969	Format (size)	/
Accredited to	BBC	Mounted / loose	Stuck to rusty canister
substrate	wove paper	Dimensions	13x9cm
Media	Printed purple ink, blue ink	Grain direction	
Structure flat/book	Flat	Weight	
Colour / B&W	colour	Gsm	
Format l-scape/portrait	landscape	Thickness	
Process type			
General Description	Paper label adhered to rusty canister fragment. printed in purple ink, with blue ink inscriptions. Printed "BBC colour film". Written "Cronicle, silbury hill, Paul Johnstone, Paddy…, reel 1 of 1"		

CONDITION	
Physical: 1 – 4 (1= Excellent, 2= Good, 3= Fair 4= Poor)	3
Chemical: 1 – 4 (1= Excellent, 2= Good, 3= Fair 4= Poor)	4
General Description	Printed paper label with hand written inscription stuck to fragment of rusty canister – condition very poor, brittle; the ink has faded and is fugitive in water. Severe discolouration – rusty iron stains and degradation. The verso is hidden by the rusty canister fragment, which is brittle and flaking.

TREATMENT	
Pre-treatment tests	
Recording methods	photographs
Treatment Proposal	

IMAGES		
 	 	
Before	Recto	after

CONSERVATION TREATMENT RECORD					
Subject/title					
Collection name	Silbury Hill				
Location	Nitrate store			Reference Location	
Date in	10.10.08	Source	Jim Leary	Date of record	21.11.08
Date out	10.10.08	Conservator	JH	Working time	

DESCRIPTION			
Date of item	Circa 1969	Format (size)	Approx A5
Accredited to	BBC	Mounted / loose	in polythene/paper bag
substrate	paper	Dimensions	
Media	Printed ink	Grain direction	/
Structure flat/book	Pamphlet book	Weight	/
Colour / B&W	Mainly b&w and red	Gsm	/
Format l-scape/portrait	portrait	Thickness	/
Process type	Printed paper		
General Description	Pamphlet with map of Silbury hill site on the back		

CONDITION	
Physical: 1 – 4 (1= Excellent, 2= Good, 3= Fair 4= Poor)	4
Chemical: 1 – 4 (1= Excellent, 2= Good, 3= Fair 4= Poor)	4
General Description	Very poor condition, irreversible damage sustained by object. Severely blocked together, fragile and flaking, loose particles, surface dirt etc. Could gather some more information from pages if desired.

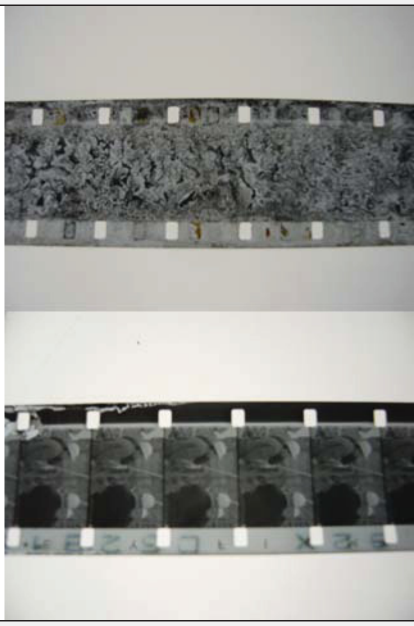
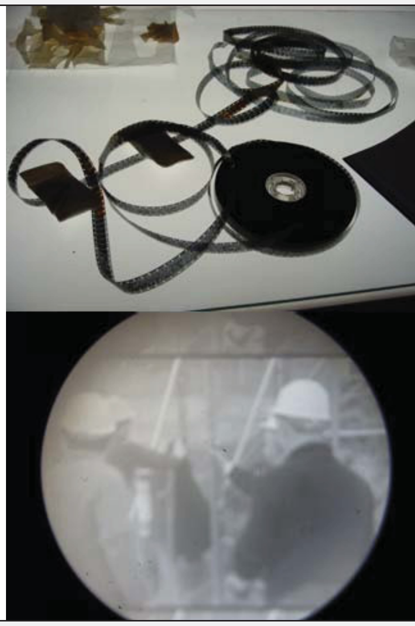
TREATMENT	
Pre-treatment tests	
Recording methods	photographs
Treatment Proposal	Re-house.

IMAGES		
		
Before	Recto	after

CONSERVATION TREATMENT RECORD					
Subject/title	Reel of film 1 cine film				
Collection name	Silbury hill time capsule				
Location	Nitrate store			Reference Location	
Date in	10.10.08	Source	Jim Leary	Date of record	17.10.08
Date out	10.10.08	Conservator	JH	Working time	

DESCRIPTION			
Date of image	1969	Format (size)	16mm
Accredited to	BBC	Mounted / loose	on spool (5cm diameter)
Image base	polyester	Dimensions pto/mt	Reel = 17cm diameter
Colloid	gelatine	Grain dir photo/mount	/
Positive / Negative	positive	Weight photo/mount	/
Colour / B&W	B&W	Gsm photo/mount	/
Format l-scape/portrait	Landscape	Thickness pto/mt	/
Process type	Black and white silver bromide (?) cine film		
General Description	Reel of black and white cine film, rolled up on Ilford plastic spool "Silbury #14 BBC WEST WES 3481" written on film before developed. 82X 052797 printed on film.		

CONDITION	
Physical: 1 – 4 (1= Excellent, 2= Good, 3= Fair 4= Poor)	3
Chemical: 1 – 4 (1= Excellent, 2= Good, 3= Fair 4= Poor)	3
General Description	This reel is in surprisingly good condition considering the storage of the material over the past 40 years. The film is still rolled up, there looks to be two different types of film, as the centre section is lighter than the outer film. Orange (rust?) stains are present on the outside of the reel, orange staining and visual damage occurring to the film itself tends to co-respond with these areas. Minor warping and distortion, perhaps blocking towards centre of reel? When unwound the film on the outside is severely affected with total loss of images, due to the liquid (now dried) state of the image carrying gelatine emulsion. When unwound further, the images become more coherent and quickly become fully recognizable. No blocking was discovered during assessment. Further conservation may reveal more good quality images.

IMAGES		
		
Before	Recto	after

CONSERVATION TREATMENT RECORD					
Subject/title	**Reel 2**				
Collection name	**Silbury Hill time Capsule**				
Location	Nitrate store			Reference Location	
Date in	10.10.08	Source	Jim Leary	Date of record	17.10.08
Date out	10.10.08	Conservator	JH	Working time	

DESCRIPTION			
Date of image	1969	Format (size)	16mm
Accredited to	BBC	Mounted / loose	on spool (7.6cm diameter)
Image base	Di-acetate safety film	Dimensions pto/mt	23cm diameter
Colloid	gelatine	Grain dir photo/mount	/
Positive / Negative	positive	Weight photo/mount	/
Colour / B&W	colour	Gsm photo/mount	/
Format l-scape/portrait	landscape	Thickness pto/mt	/
Process type	Colour cine film		
General Description	Reel of colour film rolled up on Kodak plastic spool. "Eastman Colour safety film" printed on film. "A BBC TELEVISION FILM" printed in large letters at beginning of film.		

CONDITION	
Physical: 1 – 4 (1= Excellent, 2= Good, 3= Fair 4= Poor)	4
Chemical: 1 – 4 (1= Excellent, 2= Good, 3= Fair 4= Poor)	3
General Description	Poor condition of film, images have been lost at beginning of reel. Brown/orange stains are present on the outside of the reel. The emulsion has been affected by moisture, resulting in distortion and loss of coherent images where gelatine has become liquefied. Further into the reel, the images are more recognizable; some are even good, although these are the minority. Unfortunately as the film is unwound, the emulsion is easily pulled away from the support as it has become adhered to the back of the facing film support in the reel. This is due to the film being dried out after becoming wet, one losing emulsion, one gaining it in the wrong place – therefore compromising both sets of images. Reel smells of acetic acid. Further

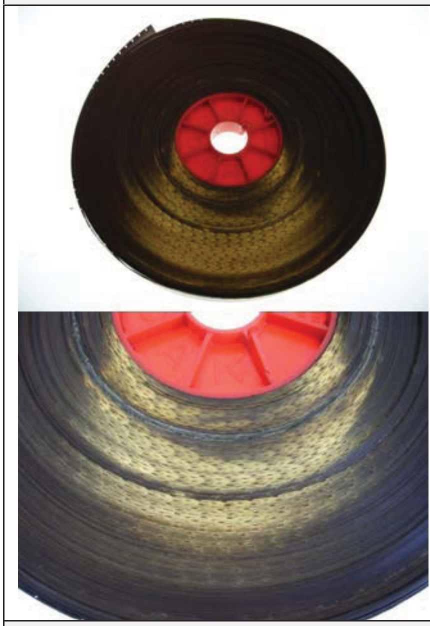
IMAGES		
 	 	 
Before	Recto	after

CONSERVATION TREATMENT RECORD					
Subject/title	**Reel 3**				
Collection name	**Silbury Hill time Capsule**				
Location	Nitrate store			Reference Location	
Date in	10.10.08	Source	Jim Leary	Date of record	23.10.08
Date out	10.10.08	Conservator	JH	Working time	

DESCRIPTION			
Date of image	1979	Format (size)	16mm
Accredited to	BBC	Mounted / loose	on spool (7.6cm)
Image base	Polyester	Dimensions pto/mt	21.8cm diameter
Colloid	gelatine	Grain dir photo/mount	/
Positive / Negative	unprocessed	Weight photo/mount	/
Colour / B&W	/	Gsm photo/mount	/
Format l-scape/portrait	/	Thickness pto/mt	/
Process type	Unexposed/processed polyester film		
General Description	Film is unprocessed, no numbers or inscriptions on film. Red plastic Kodak spindle.		

CONDITION	
Physical: 1 – 4 (1= Excellent, 2= Good, 3= Fair 4= Poor)	2 (unexposed – 4)
Chemical: 1 – 4 (1= Excellent, 2= Good, 3= Fair 4= Poor)	“ “
	The reel is not in bad condition, although no images have been developed/fixed at all. Smells of fix. It is matt orange/brown in on emulsion side. Some emulsion has lifted and has adhered itself to the facing substrate carrier. Some light coloured residue can be found towards the centre of the reel. When placed on the light box, light shines through the film, indication it is polyester.

TREATMENT	
Pre-treatment tests	
Recording methods	photographs
Treatment Proposal	No further treatment is recommended

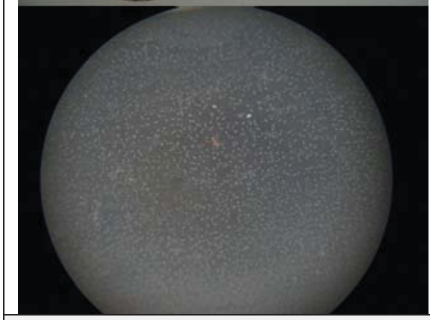
IMAGES		
		
Before	Recto	after

CONSERVATION TREATMENT RECORD					
Subject/title	**Reel 4 off cuts**				
Collection name	**Silbury Hill time Capsule**				
Location	Nitrate store			Reference Location	
Date in	10.10.08	Source	Jim Leary	Date of record	24.10.08
Date out	10.10.08	Conservator	JH	Working time	

DESCRIPTION			
Date of image	1979	Format (size)	16mm
Accredited to	BBC	Mounted / loose	loose
Image base	acetate	Dimensions pto/mt	
Colloid	gelatine	Grain dir photo/mount	/
Positive / Negative	positive	Weight photo/mount	/
Colour / B&W	B&W	Gsm photo/mount	/
Format l-scape/portrait	Landscape	Thickness pto/mt	/
Process type	B&W cine film		
General Description	Small off cut of film – spliced together.		

CONDITION	
Physical: 1 – 4 (1= Excellent, 2= Good, 3= Fair 4= Poor)	3
Chemical: 1 – 4 (1= Excellent, 2= Good, 3= Fair 4= Poor)	3
General Description	Some mould found on surface, silver mirroring in dotted pattern on emulsion side.

TREATMENT	
Pre-treatment tests	
Recording methods	photographs
Treatment Proposal	Not recommended for conservation

IMAGES		
 		
Before	Recto	after

20 ALEXANDER KEILLER MUSEUM ARCHIVE ASSESSMENT

Valerie Wilson

20.1 Introduction and aims

As part of the EH Silbury Hill Project (EH Pr661), the Archaeological Archives Team was asked to carry out an assessment of the Silbury Hill archive housed at the Alexander Keiller Museum, Avebury. The aims were to:

- quantify the material
- assess rehousing requirements
- provide estimates of the amount of time required to catalogue the collection
- provide cost estimates for the archival packaging required to rehouse the archive

On 30th May 2008, Tony Rumsey, Michael Russell and Valerie Wilson visited the museum and made a rapid listing (included as Annex 1) and assessment of the archive. This report summarises the findings and provides the required estimates, which will then inform any potential funding initiative for the work.

20.2 Work to be done

It is recommended that the person taken on to do this work has some experience of archival recording as codified in MAD3. Some knowledge of archaeological archives would be an advantage. In consultation with the Curator, s/he will have to make decisions about whether the current arrangement of the collection has any meaningful archival structure which should be retained or whether it should be broken down into its component parts. It is possible that some of the copies of the BBC scripts may be the only surviving versions. This would have to be checked. The catalogue record should provide a clear statement of the curatorial history of the collection, as far as it can be ascertained.

20.3 Structure of the archive

Initial assessment suggests that the arrangement of the collection consists of a core of material relating to RJC Atkinson's work at Silbury between 1967-1970 and the associated BBC Chronicle programmes, with an amalgamation of other material relating to various episodes of work on the site and the archive including:
Some material relating to Merewether's 1849 tunnel,
Alasdair Whittle's work to publish Silbury in the 1980s,
Specialist reports, comments and a thesis,
Videotapes of the 1990 Timewatch programmes,
A variety of offprints and articles on Silbury in general and related subjects.

20.4 Composition of the archive

The archive comprises a mixture of original and copied primary and secondary material, and consists of the following types of material:

- Correspondence
- Diaries
- Notebooks
- Geophysical survey data
- Offprints
- Reports
- BBC scripts

- Undergraduate thesis
- Press cuttings
- Plans and drawings
- Negatives
- Prints
- Video tapes
- Audio tapes
- Artefacts
- Cores
- Miscellaneous documentary material

20.5 Accessioning and cataloguing

The work will include the creation of a computerised accession /catalogue record (either on HOMS (Heritage Object Management System) or the National Trust Collections Management System). The following gives an indication of the type of information likely to be recorded:

- ID Number
- Number of items
- Object Type
- Name/Title
- Creator
- Date created
- Materials
- Description
- Owner
- Copyright holder
- Location

The accession/catalogue record will probably be done to a fairly basic group level recording (full details to be decided). It will probably not be necessary to produce item level records except for some items that are deemed of particular importance or interest. It should be noted that most of the photography has little caption information.

20.6 Repackaging

Parts of the archive have already been rehoused in archival enclosures, including most of the photographic material, the coins, some of the finds and some of the older original documentary items.

The project will include rehousing the rest of the material in archival packaging, including:

- Removing paper archive from the ringbinders, removing staples, paper clips and other metal fastenings and replacing them with plastic treasury tags, and placing the archive in archival envelopes and/or boxes; labelling the boxes. It is suggested that the contents of each ringbinder/folder should either be housed in its own archival box to maintain the current archive subdivisions, or should be clearly separated from other material in the box. Individual notebooks, typescripts and the contents of smaller folders and envelopes could be rehoused in foolscap acid-free envelopes and placed together in the archival boxes to cut down on the number of boxes required.
- Unfolding the press cuttings and placing them in individual polyester enclosures.

- Separating the plans into three archival enclosures, labelling and numbering. It is assumed the plans will be stored in a horizontal plan chest.
- Rehousing the residue of photographic material (the majority of the photographic material has already been rehoused but there are a few items still needing attention). Any material not currently in polyester enclosures will need to be rehoused. 3 of the archival ringbinders are too fully packed and the contents of each will need to be transferred into two binders. The brown cardboard box containing the VHS and audio cassettes should be replaced with an archival box. The blue folder should be replaced with an archival ringbinder.
- Rehousing any finds that have not already been repackaged. This includes a certain number of metal objects.

20.7 Cores

A decision will need to be made about the cores. Based on the information supplied by Ros Cleal, members of the EH Environmental Studies Team suggest that in the absence of any contextual or provenance data, they are unlikely to be of much use in further research.

20.8 Summary of time and cost estimates

Note that no cost estimates are given for the time elements. These will need to be drawn up separately if the project goes ahead.
(Number of items are estimates, not necessarily accurate figures).

Table 51: Time and cost estimates of Alexander Keiller Museum archive

Task	Number of items	Time estimate (days)	Archival packaging costs	
Rehouse photographic and audio material	7 VHS cassettes 3 audio cassettes 19 prints 5 transparencies 2x35mm films 42 contact sheets ? negatives	2	£***	
Remove metal fastenings from paper archive and rehouse in archival envelopes and boxes, label boxes	15 ringbinders/folders 4 notebooks/diaries 29 typescripts/offprints 9 misc. items	3	£***	
Unfold and rehouse press cuttings	100	1	£***	
Rehouse plans	30	0.5	£ ***	
Rehouse artefacts		0.5	£ ***	
Assess collection and decide best archival structure		1		
Training in use of HOMS or NT CMS		1		
Create database records		15		
Total		**24**	**£*** **	

20.9 Further work

Some potential further strands of work were originally suggested. They have not been quantified in this assessment as they are somewhat intangible and difficult to estimate but might be added to the project, if considered appropriate and cost effective.

- Providing captions for the photographs

It was originally suggested that it might be possible to undertake a project where the people who worked on Silbury Hill during 1967-1969 would identify the photographs and provide captions where possible.

- Locating missing finds archive

Much of the finds archive, in particular the Roman pottery from Silbury is missing. Efforts to locate it could be made.

- Locating other missing archive

It is unclear whether the full RJC Atkinson documentary archive is present, although it is believed that there is no further material. There is no evidence for the existence of context or other investigative records; certainly nothing more was found when RJC Atkinson's archive was checked after his death. It may repay looking in more detail at the existing archive to see if there are any references to the existence of further archive material.

Annex 1

Listing of Silbury Hill archive held by the Alexander Keiller Museum, Avebury

DOCUMENTARY MATERIAL

Brown archive box (labelled Silbury Box 3) (41x32x25cm) containing:

Item: Ring binder labelled contract and estimates, Silbury dig 1969 (BBC)
MOW agreement
Accounts and orders
Arranged in date order by division of ringbinder

Item: diary 1969, Bound, red hard-cover lined notebook covering period from Saturday 28th June 1969 – Friday 1st August 1969, hand written, probably Atkinson.

Item: diary 1968, bound, red hard-cover lined notebook covering period from 6th April 1968 – 11th April 1968 and 29th June 1968 – 13th August 1968. Handwritten in two parts, 1 loose page (in pencil), last two pages pencil notes for letter and translation of Robert Southey text, 1796.

Item: red, hard cover notebook, bound. Peg positions, resistivity survey (29/1/68) of proposed tunnel portal, other tunnel entrance works; various cuttings; graphs and graph paper; several section drawings – to scale, latest entry 8/Jul/69

Item: Ringbinder containing miscellaneous correspondence
Part 1: photocopy of typescript entitled "Eye-witness accounts of the Silbury Tunnel, 1915-19232
Part 2: public correspondence, hand-written and typescript letters
July 1967 – 1978, unsorted

Item: Typescript report "Silbury Hill: report on environmental investigation carried out by the Department of Human Environment, Institute of Archaeology, University of London" by G.W. Dimbleby 1986, including several illustrations and plans.

Item: Offprint "Investigating the Prehistoric solar Calendar". Evan Mackie

Item: Original typescript (dot matrix), annotated. "Silbury Hill, Wiltshire: excavations in 1968-70 by RJC Atkinson". By Alasdair Whittle (undated). Includes copies of plans and illustrations.

Item: Undated spiral bound notebook entitled "Holman notes". List of figures from undefined survey – probably seismic or sound survey.

Item: Offprint of article "Silbury '68 geophysical surveying" by M Arthur, C Ashman, T Atkinson, G Kalkowskin, *Horizon* p.48-51, with attached letter addressed to Alasdair from Buckinghamshire County Council.

Item: Dyeline copy of a diagrammatic plan/section of Silbury Hill. Draft, Michael Pine, 1990. Folded AO sheet.

Item: newspaper, Conomie, dated 22/10/1988 with article and cut-away 3D section showing terraced construction of the mound.

Item: Offprint of Antiquity, Vol 62, No 236, Sep 1988 "The Bush Barrow gold lozenge: is it a solar and lunar calendar for Stonehenge?" A.S. Thom, J.M.D. Ker, T.R. Burrows. Front annotated "To Richard J.C. Atkinson with best wishes Archie S Thom 5.11.88

Item: Original booklet "Silbury Hill" R.J.C Atkinson, BBC publication. "Background information on the Silbury Dig, as televised live and in colour on BBC2." Handwritten notes to accompany BBC filming summer 1968.

Item: Photocopy of article: " Silbury Hill" R.J.C Atkinson. 159-173 with illustrations.

Item: Annotated draft with Chris Chip's comments on Alasdair Whittle's paper for Antiquity – with attached letter dated 4/1/1991.

Item: plastic wallet containing: various typescripts and letters – dating (C14) dated 25 July 1990; 29 June 1990 from University of Pittsburgh and British Museum respectively; dot matrix script "Silbury Hill: history of previous investigations" (undated); computer printout text (continuous paper feed) "Animal bone" N Gardner, annotated ?Wayland's Smithy?; handwritten notes and tables on animal bones from Wayland's Smithy: Neo contexts.

Item: Folder containing original Holman/Auger records: 1) traverse on B Ray across ditch; 2) Holman records for trial hole at tunnel rings 12-13, 14-15 and Tunnel entrance.

Item: within polythene cover – copies of typescript reports – plant remains; photocopy of published article "A Neolithic moss flora from Silbury Hill, Wiltshire" D. Williams, Jnl. Arch. Sciences 1976, 3, 267-270. Annotated in ink.

Item: Annotated copy of draft report: "Silbury Hill: Report on Environmental Investigations carried out by the Dept of Human Environment, Institute of Archaeology, University of London." G.W. Dimbleby 1986 with attached letter to Dr Whittle dated 23/5/90.

Item: brown envelope containing typescript notes by J.D.R Davies (Site Information Officer) and associated handwritten letter dated 9/3/1971.

Item: 7 odd pieces of correspondence and miscellaneous photocopied articles 1980-1990s.

Brown archive box (labelled Silbury Box 4) (41x32x25cm) containing:

Item: Ringbinder folder labelled "Boffins – Services" including:
Typescript letter about official photographer, Malcolm Murray; 3 copies of a drawing of an early medieval spearhead; typescript reports of mollusca (J.G. Evans), bones (1969); various correspondence; C14 sample information from Isotopes, Inc (undated); letter from Isotopes Westwood Laboratories (dated May 13th, 1969) by James Buckley on C14 dates; typescript dates

report on soil samples (1968 season) dated 24/6/1969 by I.W. Cornwall + encouraging letter; correspondence from various specialists including Jennie Coy, Barry Cox, Martin Speight, Peter L. Bradley, etc.

Item: Black ringfolder labelled "Silbury Tunnel letters H-Z", 1960s.

Item: Ringbinder labelled "Misc site and finds" "Curiosa". Various correspondence , cuttings etc. 1960s onwards.

Item: Watercolour "Flowers painted with vivianite (blue colour) from the turf core of Silbury Hill.

Item: Photocopy of "Nevia Britannica: or a sepulchral history of Great Britain" MDCCXCIII.

Item: Copy of typescript report "A digest of information on Silbury Hill" compiled by R.J.C. Atkinson, April 1967. Bound in stapled manilla cover.

Item: Ringbinder labelled "Visitors". Correspondence relating to visits to the site.

Item: Manilla folder containing handwritten "notes on the Holman/Auger Traverse of the ditch on the B Ray". T.A 8/8/68.

Item: Manilla folder containing original handwritten and typescript text and data, including graphs and drawings on "Results of Resistivity survey and hammer seismology" (1967-1968).

Item: Folder labelled "Silbury Hill Peg List" original handwritten and typescript data.

Item: Ringfolder labelled "Accommodation" "Site Housekeeping" containing typescript correspondence and 1 plan (copy) 1968-1970.

Item: Black ringbinder labelled "Silbury Tunnel letters A-G" (1960; 1967-1968).

Item: envelope containing various typescripts:
1 – proposed programme of work 1967-1969
2 – Minutes of the Silbury summer planning meting (20/5/68). C.F.M. (BBC)
3 – "(Chronicle – Silbury Hill" 54.27.2094)" Transmission Saturday 16/Sept 1967. Copy typescript for broadcast.
4 – "The Silbury Dig" 'Heading into Silbury'. Film script for BBC by Peter Bale and James Dewar, 2 copies, for transmission 8/Aug 1968.
5 – Copy typescript "Commentary for "The Silbury Dig: Heading into Silbury".
6 – Silbury Hill programme of work 1968 and 1969.
7 – Draft letter (copy) typescript to MOW from BBC.
8 – "Chronicle No. 16: Silbury Hill O.B"
9 – "Chronicle: The Silbury Dig – into the heart of the Mound". Produced by Paul Johnstone. Sat 27 Jul 1968. VR/68/4524 – advance copy dated 6th Sept 1968.
10 – "Chronicle: Silbury O.B 27/7/68". Dubbing script – Magnus Magnusson.
11 – "Silbury O.B. 27/Jul/1968.

Item: Folder labelled "Silbury Press Cuttings, R.B. Mack" containing:
4 Secol envelopes with c.100 original press cuttings, national and local, 1967-1969, many folded. Condition fair but yellowed. Many commissioned through a company called Durrant's.
Transcript of interview with Richard Atkinson, Pentyrch, Cardiff, Wales, 21/9/1988 by Michael Hegener.

Item: green plastic folder containing correspondence dating 1967-1970 with MPBW re further work and:
- divider labelled "Silbury team", correspondence and notes
- divider labelled "Press releases, articles etc" includes original BBC Silbury Hill booklet; typescripts of various articles by Atkinson e.g. Antiquity Dec 1968; transcript of BBC Topical Tapes "The Frontiers of Knowledge (505), Silbury Hill: secrets of a Prehistoric Mound", 27/10/67

- divider labelled "Ian Blake" including correspondence from Glyn Daniel; original cutting from Irish Times 22/8/68
- divider labelled "History of Silbury"; handwritten notes, photocopies of articles, correspondence including Atkinson searches for other archives in May 1966.

Item: buff folder (with mouse chewed corners) containing: correspondence from BBC 1970; 11 cheques for cash taken from RJC Atkinson and Silbury Account 1970; notes; invoices; other correspondence re services provided.

Item: grey file labelled "BBC Bristol and London" containing:
- correspondence re machine plot 1968
- divider labelled "James Dewar, John Irving, Ray Kite: correspondence mainly from BBC 1967-1970; minutes of planning meeting
- divider labelled "Paul Johnstone", correspondence mainly BBC
- divider labelled "Other BBC Bristol", correspondence.

Green plastic ringbinder containing:
- divider labelled "Planning meetings" BBC – Silbury Hill Project, Atkinson's copies of minutes, notes, correspondence, typescripts covering period 5/4/67 – 17/12/68
- divider labelled "Regulations and Notices", including information re rotas, accommodation, meals, money, volunteer application forms, conditions of employment, general information, general regulations, 1968-1969
- Divider labelled "Briefs, digests, proposals etc" 1968-1969, Proposals and estimates including typescript entitled "Eye-witness accounts of the Silbury Tunnel 1915-1923"; "Extracts from letters about Silbury Tunnel"; Silbury Hill Basic brief 3/4/67; "Memorandum on the re-opening of the 1849 tunnel"; "A digest of information on Silbury Hill"; some correspondence.

Grey lever arch file containing:
- Dividers for BBC file for 1967, 1968, and 1969-70; Atkinson?'s file copy mostly of correspondence to and from the BBC (largely James Dewar and Paul Johnstone); also photocopies of correspondence covering 1965 onwards; various press notices and other miscellaneous pieces.

Typescript and covering letter entitled "Silbury Coin report 1999"

Letter from T Sam N Moorhead (2/3/99) includes notes on whereabouts of coins when examined (owner Judith Atkinson, on loan to Devizes Museum). Report "Roman coins found in Richard Atkinson's excavation at Silbury Hill 1969-70 and other Roman coin finds made by Joshua Brooke in the area".

2 green paper files labelled "M.E. Farley 1 and 2 - Silbury"

Item: original typescript of undergraduate thesis, Department of Archaeology, University College, Cardiff, Jan 1971. "The Roman evidence from Silbury Hill, Wiltshire" Michael E Farley, includes pottery illustrations.

Archival boxboard folded ringbinder box (13"x12.5"x2.25") containing:

(all items are individually housed in Secol envelopes and have been numbered)

Item 1: Laminated 12" x 8" B/W photographic print of drawing of sitting man (Merewether?)

Item 2: Laminated A4 sheet of poem by Emmeline Fisher

Item 3: Original poem by Emmeline Fisher, 1849, entitled "Lines suggested by the opening made in Silbury Hill, by the Archaeological Institute of Great Britain and Ireland, August 3rd, 1849", and wax sealed envelope enclosing it.

Item 4: Notification of 6th Annual Meeting of the Archaeological Institute of Great Britain and Ireland, 1849 (original).

Item 5: 4 press cuttings.

Item 6: Transcript of document 7 from the Merewether Urn. A short account of the operation at Silbury Hill in the year 1849.

Item 7: Falkner account of tunnel (as above) (original).

Item 8: Page from Encyclopedia on Silbury.

Item 9: Appeal

Item 10: Notice of Archaeological Institute Central Committee Meeting July 28th, 1849.

Item 12: Document from Merewether Urn (manuscript Blandford Survey with annotations) (note housed elsewhere in archive).

Item 14: Lance Vatcher's card recording findspot.

List of all items in box made by Nicholas Thomas, 25/5/93.

GRAPHIC MATERIAL

Large Secol enclosure containing:

c.30 plans. Mixed paper, tracing paper, drawing film, originals, copies, some dyelines.
Artefact drawings, plans, sections, contours.
Including original field drawings.
Publication drawings on drawing film.

The material came from Cardiff when Alasdair Whittle was working on it in the 1980s.

PHOTOGRAPHIC MATERIAL

Brown Cardboard box (12"x16"x10") containing:

Item: 7 VHS cassettes (6 E-60s, 1 E-30), all labelled "Property of the BBC, internal use only".

1 – Timewatch Silbury Hill Dig 1 of 3	10-2-90
2 - Timewatch Silbury Hill Dig 2 of 3	10-2-90
3 - Timewatch Silbury Hill Dig 3 of 3	10-2-90
4 – Timewatch Silbury Saga	10-2-90
5 – Timewatch Chronicle Silbury Dig	10-2-90
6 – Timewatch Chronicle Silbury Dig	10-2-90
7 – Silbury Dig BBC Bristol	

Item: 3 sound cassettes

1 – C90 – Silbury – Breakthrough into Merewether Tunnel
2 – Phillips demonstration cassette in Sony C90 box – no other identification
3 – C90 side A – Silbury Tunnel 1968 summer
side B – verbal notes on April 1968, discovery of Merewether Tunnel. Verbal summary of results of Easter 1968 dig. Explanation of centre, summer 1968

Item: A4 folded tracing 'Traced from plan 1886'

Item: Archival boxboard box (13.5"x10.5"x3") containing:
1 glassine bag of 7 B/W prints (c.8" side). No captions, numbered 5, 11, 17, 6 (three have no number).
5 x 2.25" faded colour transparencies in plastic mounts with glass, no captions.

Item: a package of 35mm film and colour ?? prints (12 exposures), no captions.

Item: I package of 35mm film, colour, 23 exposures, no prints, (Silbury 1970 crossed through on envelope).

Item: I (archivally incorrect) folder of 42 contact sheets with envelope containing 2.25" negatives. 12 images per sheet , all labelled "Silbury 69". Detailed captions on envelopes, some labelled "Photography Malcolm Murray".

Item: I object movement slip 2003/6c?? – 2 contact sheets moved by R Cleal, 9.6.03

Archival boxboard folded ringbinder box (13"x12.5"x2.25") labelled "Silbury Hill, 35mm tran" containing:

18 sheets of Secol polyester slide sheets (20 per sheet, 1 sheet full), B/W and colour, some labelled on rebate, some with removal slips:

Sheet	No of slides
1	10
2	19
3	14
4	14
5	16
6	8
7	11
8	6
9	6
10	20
11	12
12	1
13	12
14	19
15	9
16	11
17	3
18	6

Archival boxboard folded ringbinder box (13"x12.5"x2.25") labelled "AV69 School Site photographic archive"containing:

Sheet	No of slides
3 Secol polyester slide sheets (20s)	
1	11 – Kodachrome slide, no captions
2	9 - Kodachrome slide, no captions
3	18 - Kodachrome slide, no captions

General caption: "All from container marked AV69, no other info"

Archival boxboard folded ringbinder box (13"x12.5"x2.25") containing colour prints:

Sheet	No of items	
13 sheets Secol polyester sleeves		
1	5	3.5" square colour prints, letter on back, no caption
2	2	2.25" x 12 colour contact sheet, summer 69 opening
3	4	3.5" square colour prints, letter on back
4	1	3.5"x4.5" colour polaroids
5	1	sheet of 2.25" contacts, cut
6	Empty	
7	1	2.25" contacts sheet, 3 images
8	3	6"x 4" colour prints
9	4	6"x 4" colour prints

10	4	6"x 4" colour prints
11	4	6"x 4" colour prints
12	4	6"x 4" colour prints
13	4	6"x 4" colour prints

4 cards of mounted photos

1	2	1/1 1970
2	6	4.5" x 3" 1970
3	6	4.5" x 3" 1970
4	6	4.5" x 3" 1970

2 sheets of 2.25" colour contacts

1	12
2	9

4 plastic Sony 700MB CD cases + CDs

1 labelled " Silbury Hill 1968 Archive Slides 1 of 2
1 labelled " Silbury Hill 1968 Archive Slides 2 of 2
1 labelled " Silbury Hill 1968 Archive Prints 1 of 2
1 labelled " Silbury Hill 1968 Archive Prints 2 of 2

Blue folder (17"x13") containing:

B/W print 15"x12" in polyester sleeve, Silbury Hill, Copyright Department of Antiquities, Aberdeen Museum.

Archival boxboard folded ringbinder box (13"x12.5"x2.25") containing:

61 Secol polyester sleeves, no captions

Sheet	No of items	
1	1	Mounted 5"x 5" B/W print
2	4	4.5"" x 3.5" B/W prints
3	6	2.25" contacts and 1 4.5" x 3.5" B/W print
4	4	2.25" contacts B/W
5	2	B/W half plates
6	2	B/W whole plates
7	2	B/W whole plates
8	2	5" x 4" colour negatives
9	1	B/W whole plate
10	1	8" x 8" B/W Aerofilm aerial print
11	1	8" x 8" B/W Aerofilm aerial print
12	1	8" x 8" B/W Aerofilm aerial print
13	1	8" x 8" B/W Aerofilm aerial print
14	1	8" x 8" B/W Aerofilm aerial print
15	1	8" x 8" B/W Aerofilm aerial print
16	1	8" x 8" B/W Aerofilm aerial print
17	1	B/W, 1 colour
18	2	4" x 3" B/W
19	2	4" x 3" B/W
20	1	4" x 3" B/W
21	2	B/W half plates
22	2	B/W half plates
23	2	B/W half plates
24	2	B/W half plates
25	1	B/W half plates
26	11	contacts, 2.25" colour

27	2	B/W whole plate
28	2	B/W whole plate
29	2	B/W whole plate
30	2	B/W whole plate
31	1	B/W whole plate
32	1	B/W whole plate
33	2	B/W whole plate
34	2	B/W whole plate
35	2	B/W whole plate
36	2	B/W whole plate
37	2	B/W whole plate
38	2	B/W whole plate
39	2	B/W whole plate
40	8	2.25" colour negatives
41	1	whole plate B/W Aerofilm aerial print
42	1	8" x 8" B/W Aerofilm aerial print
43	1	8" x 8" B/W Aerofilm aerial print
44	1	whole plate B/W Aerofilm aerial print
45	4	5" x 4" colour negatives
46	4	5" x 4" colour negatives
47	4	5" x 4" colour negatives
48	4	5" x 4" colour negatives
49	4	5" x 4" colour negatives
50	4	5" x 4" colour negatives
51	4	5" x 4" colour negatives
52	4	5" x 4" colour negatives
53	4	5" x 4" colour negatives
54	4	5" x 4" colour negatives
55	2	B/W contact sheets, 12 images, 2.25"
56	2	B/W contact sheets, 24 images, 2.25"
57	2	B/W contact sheets, 19 images, 2.25"
58	2	B/W contact sheets, 20 images
59	2	B/W contact sheets, 14 images
60	2	B/W contact sheets, 13 images
61	1	B/W print, 8" x 8", Malcolm Murray

Loose items:

1 Secol sleeve with 11 x 8.5" print and paper neg Silbury Hill 1723
2 Secol sleeve with "12" x 10" B/W print
3 Secol sleeve with 2 whole plate B/W prints
4 Secol sleeve with whole plate B/W print (© South West Picture Agency Ltd)
5 Secol sleeve with 2 half plate B/W prints (one a postcard)
6 Secol sleeve with whole plate B/W print (© South West Picture Agency Ltd)
7 Secol sleeve with half plate B/W print
8 Secol sleeve with 2 contact sheets of 22 x 2.25" negatives
9 Secol sleeve with 12" x 10" B/W print
10 Secol sleeve with 9 x 2.25" B/W negatives
11 Secol sleeve with 6 x 2.25"colour negatives

Letter in envelope from BBC to Atkinson re some transparencies and list of notes to accompany captions.

Empty manila folder labelled "Photos with care"

Archival boxboard folded ringbinder box (13"x11"x3") containing Secol sleeves with:
(A few captions on material)

Sheet	No of items	
1	6	contact 2.25" B/W

2	2	whole plate prints B/W
3	1	12" x 12" B/W print
4	4	half plate B/W prints
5	4	half plate B/W prints
6	2	contact sheets of 12 x 2.25" B/W images
7	2	5" x 4" B/W negatives
8	1	contact sheet of 5 x 2.25" B/W
9	9	2.25" negatives, 3 x 2.25 contact prints
10	2	packet cigarette papers
11	2	mounted contact sheets
12	15	2.25" images
13	12	B/W 2.25" images
14	1	mounted contact sheet, 12 x 2.25" B/W
15	1	mounted contact sheet, 2.25" B/W
16	1	mounted contact sheet, 8 x 2.25" B/W
17	1	mounted contact sheet, 3 x 2.25" B/W
18	1	12" x 10" B/W print
19	2	mounted contact sheets, 24 x 2.25" B/W
20	1	mounted contact sheet, 12 x 2.25" B/W
21	1	mounted contact sheet, 2.25" B/W
22	1	mounted contact sheet, 9 x 2.25" B/W
23	1	mounted contact sheet, 12 x 2.25" B/W
24	1	mounted contact sheet, 12 x 2.25" B/W
25	2	10"x 8" B/W prints
26	2	whole plate B/W prints
27	1	whole plate B/W print
28	1	10"x 8" B/W print (Malcolm Murray)
29	1	10"x 8" B/W print (Malcolm Murray)
30	1	mounted contact sheet, 10 x 2.25" B/W
31	1	mounted contact sheet, 12 x 2.25" B/W
32	1	mounted contact sheet, 12 x 2.25" B/W
33	1	mounted contact sheet, 11 x 2.25" B/W
34	1	mounted contact sheet, 12 x 2.25" B/W
35	1	mounted contact sheet, 12 x 2.25" B/W
36	1	mounted contact sheet, 12 x 2.25" B/W
37	1	mounted contact sheet, 12 x 2.25" B/W
38	4	half plate B/W prints
39	8	half plate B/W prints
40	2	mounted contact sheets, 18 x 2.25" B/W
41		empty envelope from BBC
42	3	half plate B/W prints
43	2	whole plate B/W prints
44	2	10"x 8" B/W prints
45	2	mounted contact sheets, 20 B/W images
46	2	mounted contact sheets, 23 B/W images
47	2	whole plate B/W prints
48	2	2.25" contacts
49	1	contact sheet, 4 5" x 4" B/W
50	2	half plate B/W prints
51	4	half plate B/W prints
52	1	whole plate B/W print of Atkinson from BBC April 1968
53	4	half plate B/W prints

11 Secol sleeves tagged together containing 43 half plate B/W prints.
Various loose movement tickets.

Archival boxboard folded ringbinder box (13"x11"x3") containing Secol sleeves with:
(most are BBC Copyright and most are captioned)

Sheet No of items

1	1	10” x 8” B/W print
2	1	whole plate B/W print
3		empty envelope labelled “BBC photographs”
4	2	colour contacts
5		empty envelope addressed to James Dewar, Silbury Hill
6	1	whole plate B/W print (© William Morris)
7	1	whole plate B/W print (© William Morris)
8	1	whole plate B/W print (© William Morris)
9	1	whole plate B/W print (© William Morris)
10	1	whole plate B/W print (© William Morris)
11	1	whole plate B/W print (© William Morris)
12	1	whole plate B/W print (© William Morris)
13	1	10” x 8” B/W print (© Malcolm Murray)
14	10	2.25” negatives
15	2	5” x 5” B/W prints
16	2	5” x 5” B/W prints
17	2	5” x 5” B/W prints
18	2	5” x 5” B/W prints
19	2	5” x 5” B/W prints
20		2 removal tickets
21	1	10” x 8” B/W print
22	1	10” x 8” B/W print
23	1	whole plate B/W print
24	1	10” x 8” B/W print
25	1	10” x 8” B/W print
26	1	10” x 8” B/W print
27	1	10” x 8” B/W print
28	1	10” x 8” B/W print
29	2	10” x 8” B/W print
30	1	10” x 8” B/W print
31	1	10” x 8” B/W print
32	1	whole plate B/W print
33	1	whole plate B/W print
34	1	whole plate B/W print
35	1	whole plate B/W print
36	1	whole plate B/W print
37	1	whole plate B/W print
38	1	whole plate B/W print
39	1	whole plate B/W print
40	1	whole plate B/W print
41	1	whole plate B/W print
42	1	whole plate B/W print
43	1	whole plate B/W print
44	1	whole plate B/W print
45	1	whole plate B/W print
46	1	whole plate B/W print
47	1	whole plate B/W print
48	1	whole plate B/W print
49	4	2.25” B/W contact prints

FINDS AND ENVIRONMENTAL MATERIAL

17 cores

(Information from Ros Cleal):

“I've investigated the cores and essentially there is no documentation, but they are clearly all the Atkinson ones (the earlier ones, by ?Pass, would be, if anywhere, with Devizes Museum, but I think it's unlikely).

We have 17 cores, and all they seem to have on them is measurements in feet; most appear to be 4'6" long, although one is only 4ft. I haven't recorded all the depths, but added together 17 X 4'6" is on my calculation only 76'6", so whether they were taken from part way down the slope I'm not sure. I haven't viewed the tapes but I suppose it's possible that they might show them being taken.

The cores are in what look like bespoke plywood (or similar) containers; they appear to be largely intact."

Standard archive box (46x13x12cm) labelled "Silbury Hill 1968-70 Late Saxon Pottery"containing:

29 bags – some material has been rebagged and relabelled, some material removed in 2007 for display.

Standard archive box (46x13x12cm) unlabelled but with internal label"Problem box"containing:

Item: Silbury Axe 78506210 (Neolithic polished axe) labelled "brought in Mike Stone 22/1/1980 Silbury?"

Item: paper labelled "Silbury metalwork 1969 excavation, to sort"

Item: Bag containing 1 pot sherd labelled "1216 Upper steps cutting 2, 274, 14/7/69"

Item: Empty bag labelled "Silbury 15/7/69, 2 S chalky 242"

Item: metal objects labelled "(National Museum of Wales) iron objects mechanically cleaned, coated with 10% incralac lacquer. Bronze objects stabilised in 1% (& therefore cannot be analyzed. 251 is silvered bronze. Loiuse Mumford"

Item: Empty bag labelled "12.7.69 Silbury S. ditch 230"

Item: Plastic box "88023785, Bronze? Part of buckle? Med."

Item: Empty bag labelled "5/7/69 Silbury 147 S ditch cutting topsoil S bank spindle whorl (Robert)"

Standard archive box (46x13x12cm) labelled "Silbury Hill 1969-70, summit and step cuttings + slag from S ditch, stone tile + misc, 280, 422, 502, 134, sample 1158?" containing:

5 bags (1 item removed for display 2007)

Stewart box (34x34x16cm) labelled "Silbury Hill Summit and steps, Ditch, Tunnel" containing:

15 bags and 1 small plastic jar, 1 small bag of yellow silica gel, including metalwork, pottery, matchbox, modern miscellaneous material

1 bag of unmarked or otherwise unlocated material

(Some material removed for display in 2007)

1 archive cardboard box(22x14x8cm) labelled "Silbury Hill 1968-70 Glass" containing:

9 bags of small fragments

Card by Ros Cleal, 1999 recording "removed from a box of pottery so glass fragments broken recently".

Archive cardboard box(22x14x8cm) labelled "Silbury Hill 68-70 Flint" containing:

17 bags and 1 plastic box. Some material removed 2008, proxy cards inserted.

Archive cardboard box(22x14x8cm) labelled "Silbury Hill 68-70 Pot given small find nos R-B& A-S, Ditch Summit Steps Cutting" containing:

22 bags, mostly pottery. Some material removed 2007, proxy cards inserted.

Stewart box labelled "Silbury Hill coins"

c. 90-100 coins rehoused in plastic hinged boxes with foam, 1 bag of yellow silica gel, indicator strip blue.

21 SILBURY ACOUSTICS

Sarah May

21.1 Background

One aspect of the NAW event described as Objective 17 of the Project Design was an experiment into the acoustic properties of the hill in its landscape. It was driven by the following questions which also contribute to Aim 2: RQ23 - At what locations in the landscape can sounds from the top of the hill be heard? What is the quality of transmission? Do different sounds transmit differently? Are there unexpected effects?

Before assessing how well these questions were answered, it is worth discussing why we were asking them because their position within the wider project partially determines their potential for further analysis. When the Project Design was written, there were many who believed that the current flat topped profile of the hill was original (see objective 6, RQ8). There were some who considered that this flat top could have provided a performance space for ritual. Further, this space was considered particularly exclusive, with the elite literally lifted above the rest of the community (Barrett 1994:31; Bradley 2007:131). These interpretations were based on a visual assessment of the site and made no reference to the acoustic properties, a clearly important aspect of any ritual performance.

The study of the acoustic properties of prehistoric ritual spaces is still in its infancy, but some important publications have shown how fruitful it can be (Scarre and Lawson 2006; Watson 2001a). Many of these have focussed on unusual effects such as standing waves and how these may have contributed to 'otherworldly' aspects of the experience of ritual (Watson 2001b). But it is also possible and important to consider how acoustic properties contribute to the social experience of ritual, especially when evaluating the 'exclusivity' of a ritual experience. 'Who could hear what?' is as an important question as 'who could see what?'

Acoustic questions are still not commonly asked of prehistoric ritual settings. Colleagues often suggest that is impossible to know how intentional the acoustic properties of a site were and how much they were accidental. This suggests two things. We can't expect that people in the past care about and manipulate sound; and we can't present the acoustic properties of a site in a way that opens them to discussion and debate. The first stems from a strong visual bias running through archaeological interpretation that stems from the visual bias in contemporary western culture. The second from the difficulty of recording, quantifying and comparing acoustic experience from one site to another. While we can't expect to change the visual bias in western culture, we can challenge it; and we can certainly represent the acoustic properties of Silbury in a way that opens them to discussion and debate.

When earlier aspects of the current project were carried out, some colleagues were on the top of the hill while others were at the bottom or in the landscape. These colleagues noticed how clear the sound transmission in the area was. They didn't expect to hear each other's conversations, but they could. Vanessa Straker felt this would feed nicely into plans for NAW. Exploring this unexpected phenomenon was intrinsically interactive and provided an excellent opportunity for public involvement. I was approached about this because of a known interest in acoustics and suggested that we combine this work with a virtual model of the acoustic properties, determined by specialist modelling software. This would provide a comparative baseline to bring the discussion forward.

21.2 Methods

The research consisted of two parts, the fieldwork and the modelling. At this stage they have been relatively separate but further work would bring them together.

21.3 Modelling

The modelling was carried out in advance of the fieldwork, in order to confirm that good sound transmission could be expected and in order to determine the placement of listening posts for the fieldwork. Further modelling responding to the results of fieldwork and exploring the effects of different parameters was always seen as necessary.

The model was created in Brüel and Kjaer's Acoustic Predictor Type 7810. This software was designed to allow developers of infrastructure projects to comply with European guidelines on noise. It operationalises a number of agreed standard algorithms which predict and model noise transmission. The algorithm used in this work is ISO9613: ISO-industry (octaves). It is specifically designed to modelling the transmission of factory noise.

This software was chosen because of its commercial availability and its reference to agreed standard algorithms. Commercially available Performance based acoustic modelling software only works for internal spaces. Nonetheless, its use introduces a bias to the work because in this software, sound transmission is seen as a problem to be avoided. The user is provided with tools to model the effect of mitigation techniques such as planting. Parameters for time of day, air temperature and moisture are all available, and it is possible to incorporate actual data on sound transmission from monitoring equipment. Performance and audience reception are not expected uses.

For the initial model, the digital terrain model was created from the landform profile data provided by the OS under licence. Although the project had collected LiDAR data for the area it wasn't available at the time. Landform profile data is fairly coarse grained, with contour intervals of a metre. Its use will mean that this initial model will miss many subtleties of the landscape.

The parameters were set to default values for air temperature and moisture. The source was configured to represent dummy parameters reflecting a median of an acoustic performance. Further refinement of these parameters to reflect the actual acoustic properties of the instruments used in the fieldwork will help understand their mutual relevance.

For this initial work the reception was modelled as a grid of receivers spaced at 50m intervals in order to allow for contour mapping of the results (discussed below). The software also allows for specific placement of 'receivers' in the landscape, which might pick up any more complex effects and mirror more completely the structure of the fieldwork data.

21.4 Fieldwork

The fieldwork was conducted as part of NAW. Three aspects of the work require description here: the nature of the performance; the nature of the audience and the nature of the recording.

21.5 The performance

Simon and Maria O'Dwyer were engaged to perform on the top of the hill on the NAW weekend. The O'Dwyers study prehistoric instruments and experiment with playing reconstructions of these instruments (O'Dwyer, 2004). They have twenty years of experience in performing with these instruments and were musicians before they became interested in prehistory. They work closely with Professor ter Holmes and have a particular concern with authenticity. For this reason they do not work with the human voice singing because we don't know words from the Neolithic. They do experiment with the construction of melody based on the properties of the instrument, but for this exercise they restricted themselves to rhythm and two note sequences. They selected as series of instruments based on examples that have been recovered from contexts from the Late Neolithic through the Iron Age. They were concerned about including the later examples, such as the Loughnashade trumpet, but decided to do so because they might be relevant to later uses of the Hill. The following instruments were used: Stone Whistles, frame drums, bone flutes, wooden flutes ('wicklow pipes') animal horns, and bronze horns.

Because we were particularly interested in the human voice, but respected the O'Dwyer's reticence to provide this aspect of performance we enlisted Keith May, who had training as a chorister in his youth and had experience of solo performance to sing a number of folksongs. We didn't consider that these songs would represent songs contemporary with the construction of Silbury, but they would help us consider the reception of the human voice singing songs that would be known to the audience.

The complete list of instruments and performance was listed on recording forms given to audience participants. Five performances were conducted throughout the weekend, including one a 6am on Sunday in order to attempt to avoid traffic noise on the A4. Before each performance, the audience and the performers met at the Visitor Information Point and the O'Dwyer's showed and demonstrated the instruments. Stewards took the audience in small groups to agreed points in the landscape while the performers climbed the hill. Each instrument was played in turn either continuously as the performers walked in a clockwise motion around the hill or at the four compass points. Between each instruments, stewards reported back by radio to the performers about the reception of their performance. The entire cycle took approximately one hour.

21.6 The audience

The audience was composed of volunteers largely from English Heritage and the local community with a few people who travelled from as far as London for the event. The largest group was 45 and the smallest 15. Many people stayed for more than one performance and some of the stewards stayed for the whole weekend. As with all NAW events the audience was mostly interested non-specialists (though we all have our expertise in forming an audience). The youngest audience member to respond was 7 and the eldest was 65 with the majority being in their 20s and 30s. Most of the audience had never met the performers.

The audience was split into groups of 3 – 5 and were positioned at various points in the landscape. While groups who had arrived together tended to listen together, not all people in a small group would have known each other.

We received a lot of positive feedback from members of the audience who were pleased to have an active role in research, as opposed to receiving the results as in many outreach events. They were assiduous in their listening and recording and discussed their ideas with us in a more general sense as well.

On Sunday, filmmakers associated with the documentary being made about the project joined the event. They had originally intended to stay for only the first performance of the day, but stayed for all of them in the end. They filmed the performance on the top of the hill and they filmed with me at listening posts as well – but they didn't film with other audience groups. Their presence undoubtedly influenced the event, but didn't substantially change the audience for the work.

21.7 The record

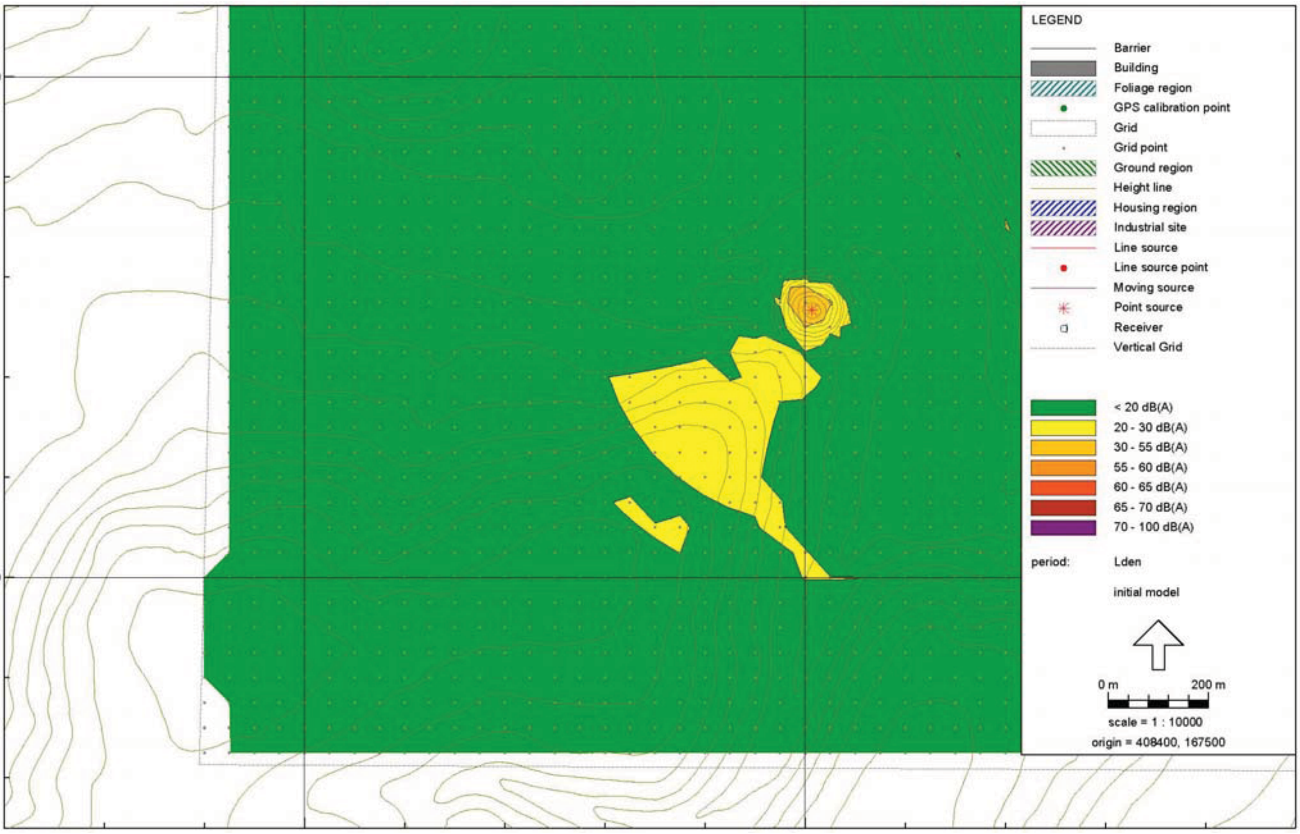
We made no plan to record the performance itself. In the event I took a small number of photos and one of the stewards, Martin Greany, took some further. I took a very short clip of video. The documentary makers filmed much more but, inevitably, little of this survived the edit. An independent researcher, Steve Marshall, recorded three of the performances with binaural microphones each from a different position in the landscape. His recording and his analysis can be read at www.stevemarshall.org.uk/silbury.htm.

Our main intent was to record the experience of the audience. We wanted to strike a balance between providing a comparable record and picking up the less structured thoughts regarding the experience. We provided each audience member with a recording sheet. These have been collated and the results discussed below draw from them.

21.8 Results

Modelling

Figure 38 is a contour plot of the intensity of sound based on a sound source as described above placed on the top of Silbury Hill. Its clear that sound is transmitted a long distance in this landscape. There is particularly good transmission up towards the Downs on the south, and less good transmission towards Avebury to the North. There is an interesting peak of good transmission over towards Swallowhead Springs. Given the importance that other aspects of the current project have distinguished at the springs, this effect is worth noting. It is also worth noting that the largest area of good transmission of sound coincides with the location of the Roman town discovered through geophysics.



409000 410000 Industrial Noise -ISO 9613.1/2, WHS -landform profile of WHS -initial model
[D:\silbury2\] , Predictor Type 7810 V5.04

Fig 38: Acoustics model

Fieldwork

The modelling results were sufficient to go ahead with the fieldwork because we were certain that we could place audience members who would hear the performance, and hoped that we could test some areas where they would not. In the event the fieldwork demonstrated that the modelling substantially underestimated the area in which there was good transmission of sound. The only listening post where there majority of instruments could not be heard was inside the henge at Avebury. There were even reports that visitors at Windmill Hill had heard the Loughnashade trumpet – though we did not have a listening post there. It was possible to distinguish the words of a song from the Swallowhead spring; and to hear the bone flute from the site of the palisaded enclosures.

Despite this general positive result, the recording system we devised does not allowed a standardised comparison between different listening posts. The main reason for this is that listeners were asked to rate what they heard in terms of strength and clarity – and many participants found this distinction confusing. We had many comments suggesting that the two could not be distinguished. Also, participants took a varying approach to both observations, some using ranks (1, 2, 3 etc.) as we had asked, others simply ticking where they could hear. Finally, people often censored themselves, altering their answers to fit with the rest of the group, nullifying the effects of age and gender which we might have expected to pick up. The most useful information on the forms was the ‘other comments’ box.

These comments raised a lot of questions and ideas about the reception of musical performance that cannot be addressed by this modelling and are therefore particularly useful.

The first category of these was surprise and expectation. Many people were surprised that they could hear – especially the first time they heard something. Most people added that this surprise increased their sense that Silbury was 'a special place'. The raises the question as to what participants in a ritual expects to hear. If the landscape surrounding Silbury (and Silbury's construction in it) amplifies sound in an unexpected fashion, would that have been a known property or something each person discovered themselves?

The performers also found it exceptionally strange to play and sing to an unseen audience in the open air. It is widely recognised that musicians perform to a space and an audience. All of the performers reported feeling much more confident after the stewards called in by radio and said that they had been heard. Just as the expectation of hearing influences reception, it also influences performance.

Related to this was the relationship between familiarity and reception. Many people reported that they were able to recognise the words of the songs, but it isn't clear if they would have recognised them if they hadn't known the songs. Further, people who knew Keith and his voice could hear him singing more clearly than people who did not. Our 15 month old son, at the base of the hill, looked up and said 'Daddy' when Keith began to sing. Because the instruments only played rhythm and single or double notes, the recognition of tune was not available this made the 'quality' of reception harder to judge. But as with surprise, the sound of the unfamiliar horns often seemed louder for their unfamiliarity. The reception of novel sounds is different than the reception of familiar ones. All the same, it seems that the instruments, such as drums, with lower tones, carried less well than those with higher pitches.

The relationship between sight and sound was discussed as well. In all of the listening posts there was clear view of the top of the hill, but someone standing on one side of the flat top couldn't be seen from the other. So as the performers moved around the hill, they came into sight. But it was possible to hear them before you saw them, so that the sound acted as an announcement. You heard the sound; you looked up and saw the performer come into view. This also had the effect of breaking the various conversations which inevitably arose between performances. This is interesting when considering how a large audience relates to a small group of performers.

21.9 Discussion

Although the conclusions formed from the excavations on the summit undermines the idea that the top of Silbury Hill may have been a performance platform (certainly in its present state) this work has still been useful. It has demonstrated that it is possible to discuss and record the acoustic properties of a monument in its landscape. It has shown the value of using fieldwork as well as quantitative techniques and of using a large and varied audience for such work.

22 SCIENTIFIC DATING ASSESSMENT

Alex Bayliss
February 2008

The programme of archaeological recording undertaken as part of the work to stabilise the monument in 2007 produced many samples and artefacts which could be sub-sampled for radiocarbon dating. The contextual integrity of these samples is variable, ranging from antler fragments recovered from chalk rubble collapse within the tunnel, through environmental samples taken from recorded deposits in the tunnel section, to material recovered from controlled excavation on the summit of the hill or in the buried ditch under the chalk mound.

Thirty radiocarbon results on material from Atkinson's tunnel and the 2001 excavation on the top of the hill. These have recently been published, and alternative models presented for the chronology of the monument (Bayliss *et al* 2007). As part of the TV documentary produced during the 2007 works, five additional samples were dated. Details of these results are given in Table 52 (the previous measurements are detailed in Bayliss *et al* 2007, table 1).

Three alternative chronological models have been constructed from these data. All have been calculated using OxCal v3.10 (Bronk Ramsey 1995; 1998; 2001) and the calibration data of Reimer *et al* (2004). They vary in their interpretation of the provenance and taphonomy of the dated samples.

Model 1 (Fig 39) interprets the dated antler from the walling on the top of the hill as residual, and accepts the dates on sample 2 and GrA-27331 as providing the best indication of the date of Silbury III. Model 2 (Fig 40) interprets these samples as relating to later modifications on the periphery of Silbury III, and suggests that the dated antler from the walling on the top of the hill provides the best estimate for the date of Silbury III. Model 3 (Fig 41) is a variant of model 1, incorporating Atkinson's interpretation of the antlers dated by the British Museum Laboratory as relating to the construction of the chalk mound.

The date estimates for key parameters derived from these models are shown in Figures 42 and 43 and listed in Table 53. It can be seen that the date estimates for when the organic central mound(s) and the first chalk mound (Silbury II) were erected are very similar. At present, there is much more uncertainty about the time when the chalk mound was completed.

Following the full assessment of the stratigraphic sequence and the datable material, further dating will be undertaken during the analysis phase of the project in an attempt to refine the existing dating of the hill and to validate the revised phasing scheme. This will begin as soon as all the datable material has been assessed, optimal material retrieved from selected samples, and potential samples fully recorded by other specialists on the team.

The dating programme, including the production of text suitable for publication, should be available within a year of the submission of the first set of samples in the analysis programme.

Figure 39: Probability distributions of dates from Silbury Hill. Each distribution represents the relative probability that an event occurs at a particular time. For each of the dates two distributions have been plotted: one in outline, which is the result of simple radiocarbon calibration, and a solid one, based on the chronological model used (in this case model 1); the 'event' associated with, for example, GrA-27331, is the growth of the dated antler. Distributions other than those relating to particular samples correspond to aspects of the model. For example, the distribution 'construct Silbury I' is the estimated date when the primary turf mound was raised. Measurements followed by a question mark have been excluded from the model and are simple calibrated dates (Stuiver and Reimer 1993). The large square brackets down the left-hand side along with the OxCal keywords define the overall model exactly.

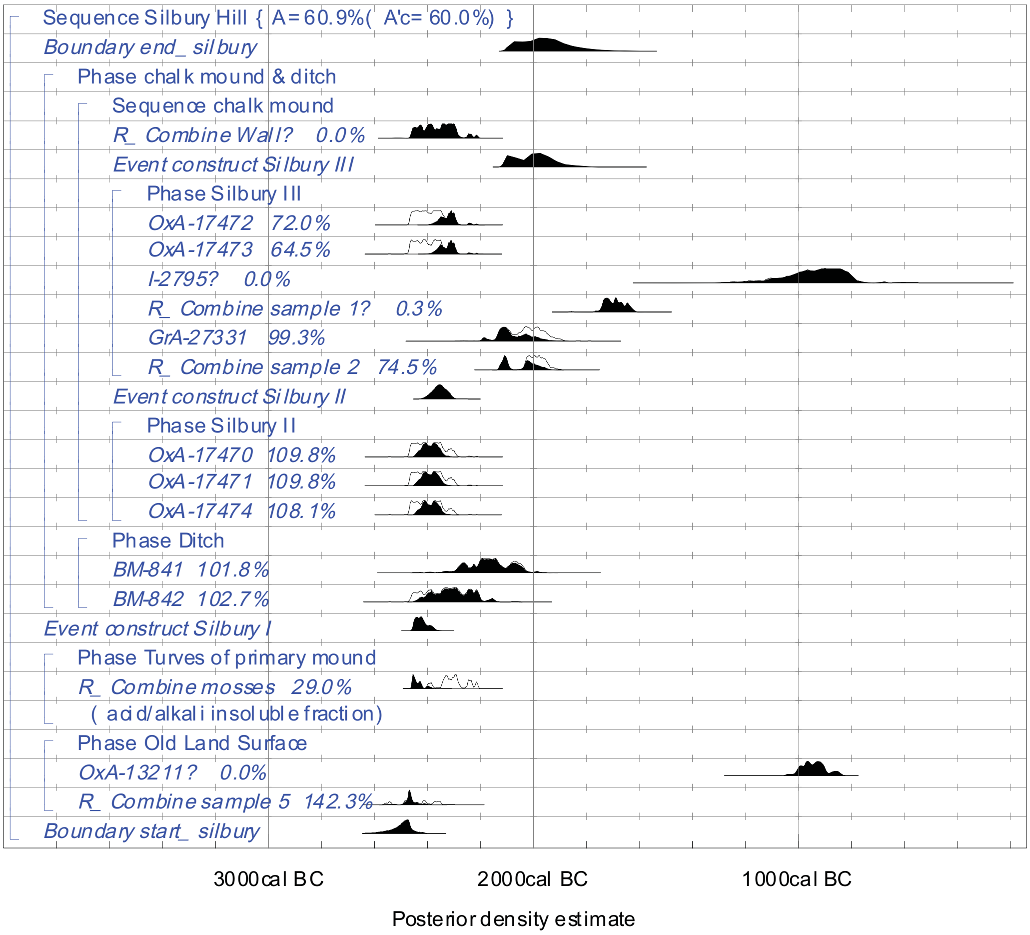


Figure 40: Probability distributions of dates from Silbury Hill based on model 2. The format is identical to that for Figure 39. The large square brackets down the left-hand side along with the OxCal keywords define the overall model exactly.

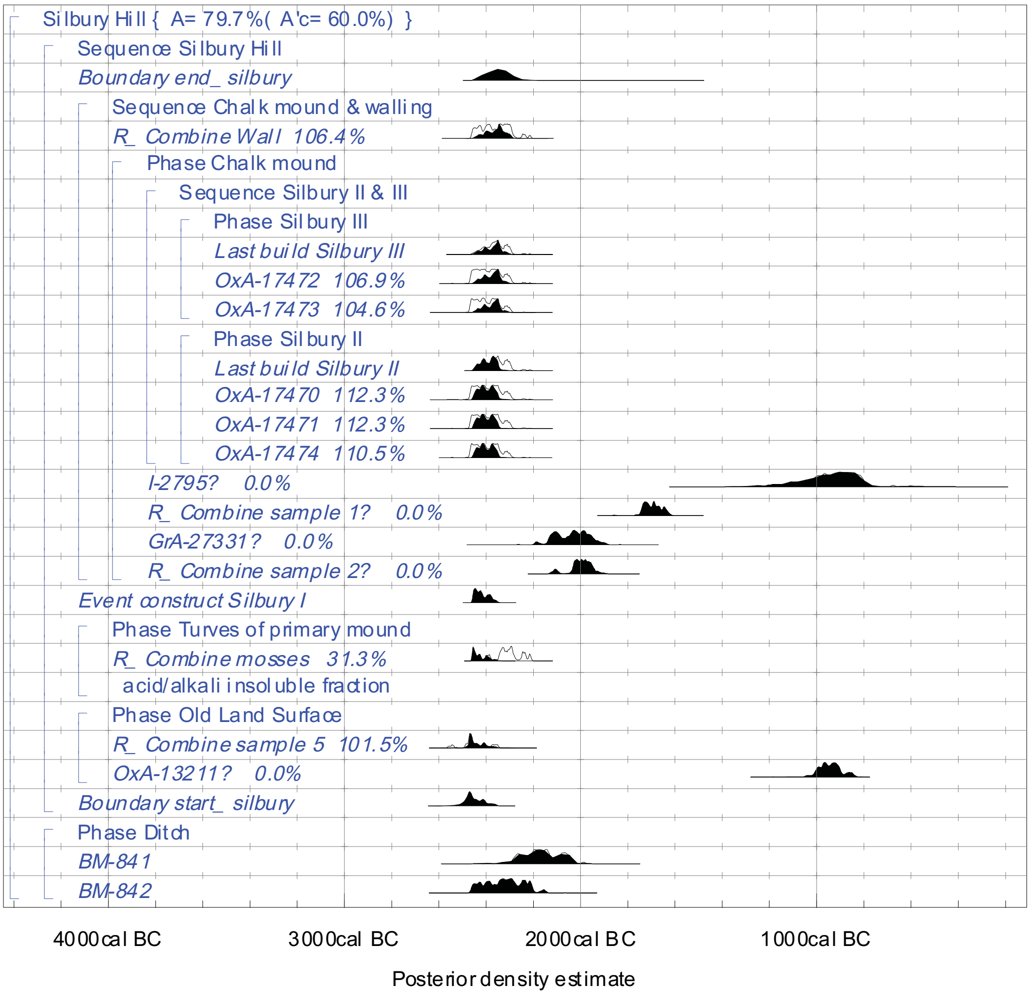


Figure 41: Probability distributions of dates from Silbury Hill based on model 3. The format is identical to that for Figure 39. The large square brackets down the left-hand side along with the OxCal keywords define the overall model exactly.

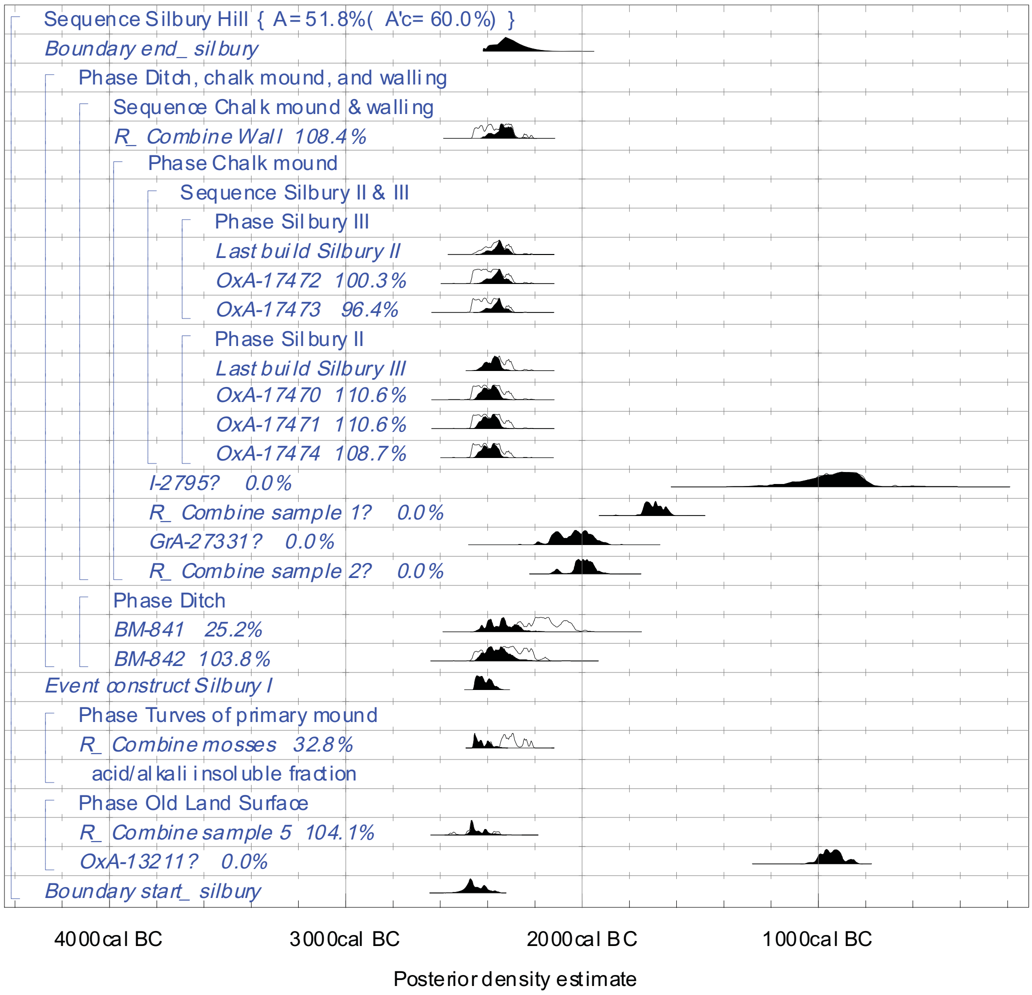


Figure 42: Probability distributions of key dates from Silbury Hill, derived from model 1 (Fig 39), model 2 (Fig 40), and model 3 (Fig 41). The format is identical to that for Figure 39.

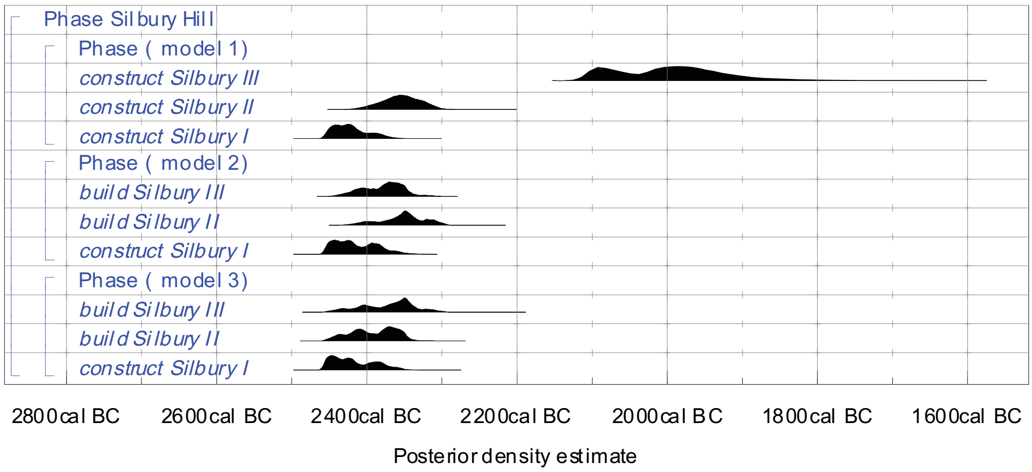


Figure 43: Probability distributions showing the number of calendar years taken to construct Silbury Hill. These distributions are derived from the models shown in Figures 39–41.

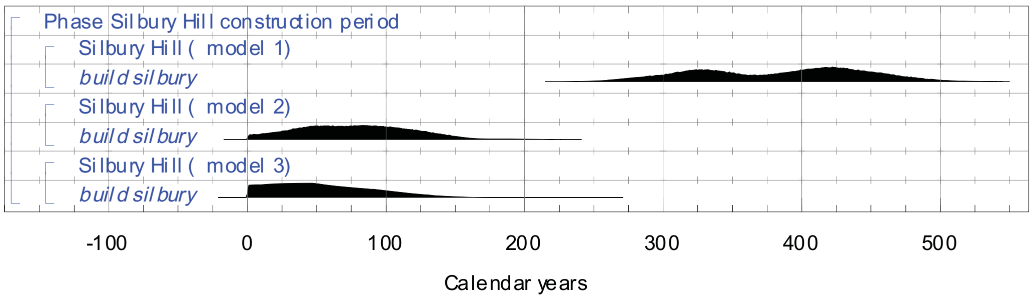


Table 52: radiocarbon determinations on material from Silbury Hill produced since the publication of Bayliss et al (2007)

Laboratory number	Material and context	Radiocarbon Age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (95% confidence)	*Posterior density estimate (probability)*
OxA-17470	3843 (5:41) red deer antler from collapse material, probably derived from bank (4073), and overlying chalk (possibly 4042).	3902±29	-21.9	2480 – 2290 cal BC	
OxA-17471	3844 (5:50) red deer antler from collapse material, probably derived from Silbury II.	3902±29	-23.3	2480 – 2290 cal BC	
OxA-17472	3829 (5:34-36) red deer antler from collapse material, probably derived from bank (4073), and overlying chalk (possibly 4042).	3896±28	-23.0	2480 – 2280 cal BC	
OxA-17473	3817 (5:32) red deer antler from collapse of cobbly chalk, almost immediately *ex situ* deposit from Silbury III or (less probably) from the bank against Silbury II.	3907±28	-21.2	2480 – 2290 cal BC	
OxA-17474	3845 (5:58) red deer antler from collapse material, probably from Silbury II.	3907±27	-21.0	2480 – 2290 cal BC	

Table 53: posterior density estimates for key parameters from Silbury Hill

Parameter	*Posterior density estimate (95% probability)*	*Posterior density estimate (68% probability)*
Model 1 (Fig X1)		
construct Silbury I	*2460 – 2375 cal BC*	*2455 – 2410 cal BC*
construct Silbury II	*2410 – 2305 cal BC*	*2380 – 2320 cal BC*
construct Silbury III	*2125 – 1855 cal BC*	*2105 – 2060 cal BC (20%)* or *2030 – 1855 cal BC (48%)*
Model 2 (Fig X2)		
construct Silbury I	*2460 – 2360 cal BC*	*2460 – 2410 cal BC (56%)* or *2395 – 2380 cal BC (12%)*
build Silbury II	*2450 – 2340 cal BC*	*2425 – 2395 cal BC (26%)* or *2385 – 2345 cal BC (42%)*
build Silbury III	*2445 – 2305 cal BC*	*2415 – 2335 cal BC*
Model 3 (Fig X3)		
construct Silbury I	*2460 – 2360 cal BC*	*2460 – 2410 cal BC (56%)* or *2395 – 2380 cal BC (12%)*
build Silbury II	*2450 – 2430 cal BC*	*2425 – 2395 cal BC (26%)* or *2385 – 2345 cal BC (42%)*
build Silbury III	*2445 – 2305 cal BC*	*2415 – 2335 cal BC*

23 DISCUSSION

23.1 The Old Land Surface

Running throughout the majority of the tunnel sides, and sloping steeply down to the north, is the Old Land Surface, which appears to extend under the entire mound. As has been set out above, this layer clearly does not represent a full soil horizon, which must have, at some stage prior to construction, been removed. The process that brought this about may have been erosion or it may have been a deliberate act of ground preparation, suggesting that before monument construction even began, people had prepared the ground by removing the turf and topsoil. The OLS has also been modified, perhaps by trampling; suggesting that after the soil was stripped away, significant activity took place on the site. Together, this evidence suggests that considerable activity occurred on the site before monument construction began.

Fig 44: Reconstruction drawing of pre-mound activity by Judith Dobie

In the central area a concentration of charcoal as well as charred hazel nutshell fragments and other charred plant remains as well as two pig or wild boar teeth were recorded within a small, defined area of the upper part of the Old Land Surface, and may well indicate the fragmentary remains of a hearth. Small quantities of flint micro-debitage across the OLS indicate some, but not extensive, knapping had occurred prior to or during the initial phases of the monument.

Fig 45: Reconstruction drawing of pre-mound activity – close up by Judith Dobie

23.2 The Gravel Mound

The first clear evidence for construction activity recorded at the site overlies the Old Land Surface in the very centre and is a low, fairly unimpressive, mound, just less than a metre high, and nearly 10 metres in diameter, and made out of gravel. This was formed of Pleistocene gravels, suggesting that people would have had to quarry the material from deep under ground or found it exposed in a river valley, for example the side of the River Kennet. Either way, they were clearly very deliberately imported and used here. Environmental evidence suggests that it was constructed within an open grassland type environment. As became abundantly clear to us in the tunnel, once the loose Gravel Mound was exposed it collapsed fairly rapidly – this was clearly not lost on the people constructing the mound, as they may have strengthened the sides with thin dumps of topsoil and subsoil.

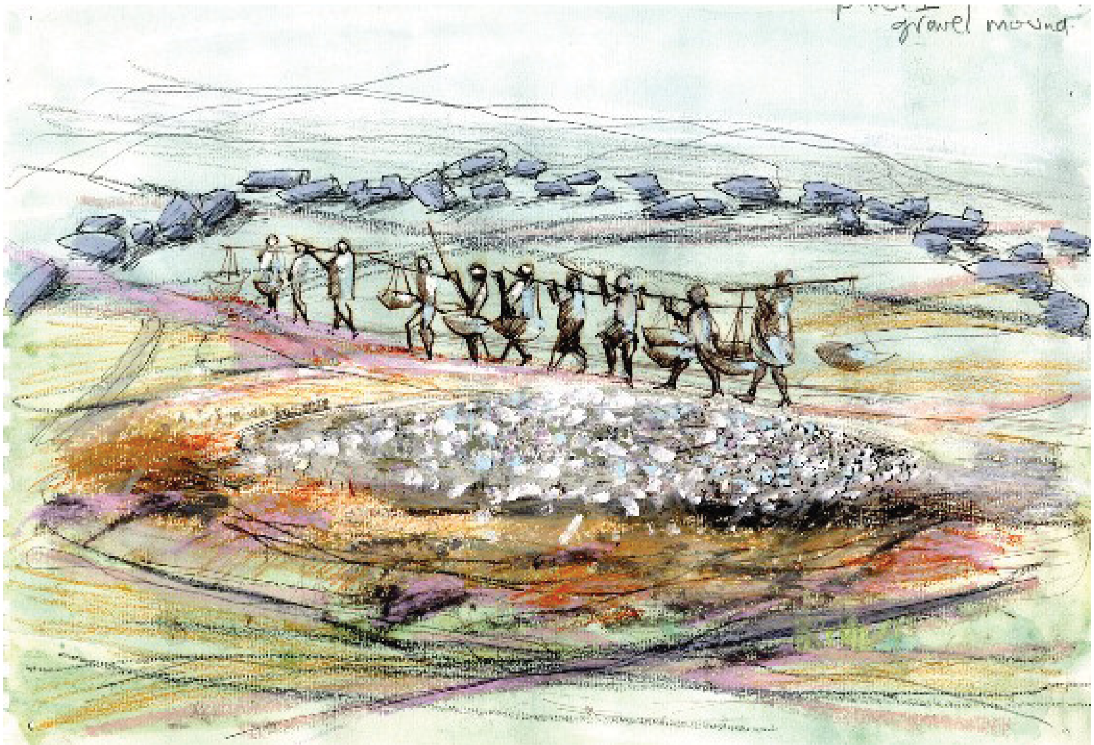


Fig 46: Reconstruction drawing of Gravel Mound by Judith Dobie

23.3 The Lower Organic Mound

Subsequently, a series of layers of topsoil, subsoil and turf, probably representing basket loads of material, were dumped over the Gravel Mound, forming a larger mound (just over a metre high, and over 16 metres in diameter), although it would have still been relatively inconspicuous in the landscape. The majority of material for this mound had probably derived locally, as it had been removed from above a clay with flints geology, and perhaps even represented the material stripped away prior to the Gravel Mound. Some material for this mound, however, had clearly developed on chalk suggesting that it had come from slightly further afield. This phase of activity is likely to have occurred soon after the Gravel Mound had been constructed, as indicated by the very fresh snail shells recovered from the Gravel Mound suggesting that they had been rapidly buried.

A stake hole was recorded cutting the western edge of these deposits, and may be part of a sequence of stakes demarcating the edge of the Lower Organic Mound. A small chalk block was also recorded near to the stake hole, the upper face of which would have been visible on the side of the Lower Organic Mound and may represent a small edge marker.

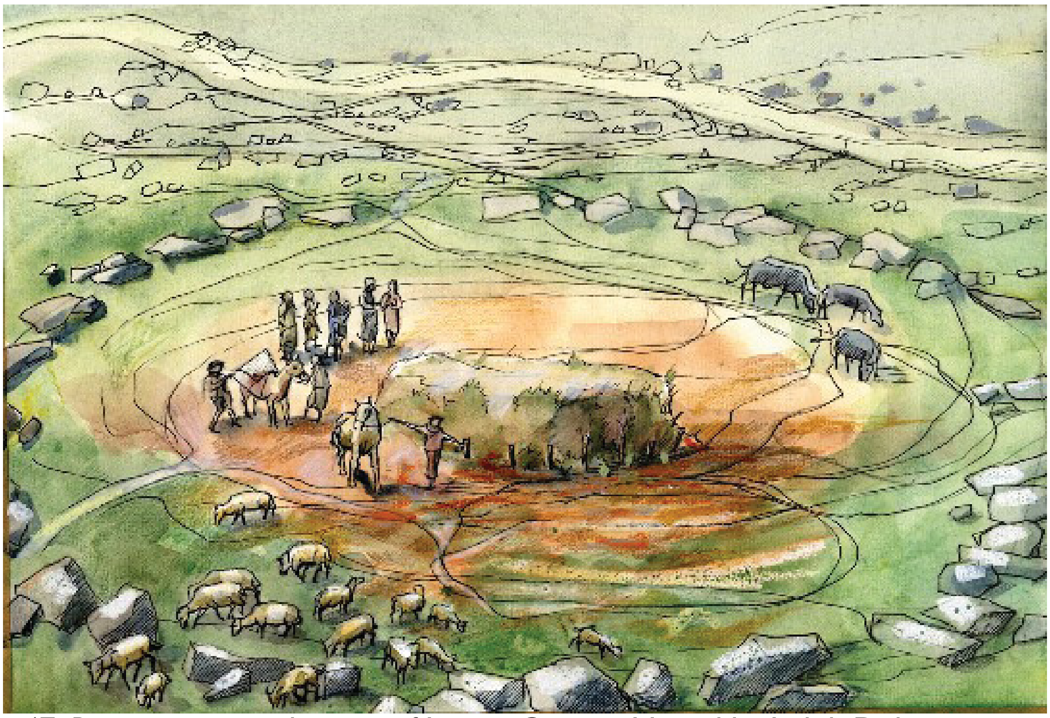


Fig 47: Reconstruction drawing of Lower Organic Mound by Judith Dobie

A few metres away from this central mound were two further, much smaller, mounds. These mounds stand only half a metre high, however were clearly purposefully constructed and one was even added to and modified. They comprise organic layers, including turfs, and one is separated from the main mound by a small, interrupted gully. Excitingly, environmental samples from this Mini-mound recovered one of the earliest occurrences of waterlogged cereal chaff remains in Britain. This sample also produced plant remains typical of grassland; however it also contained substantial numbers of remains more associated with woodland or scrub, such as yew berries, sloe stones, uncharred hazel nutshell fragments and bramble seeds, and the possibility must remain that this mound was not contemporary with the Lower Organic Mound but represents an earlier feature, prior to localised deforestation. Well-preserved insect remains were recovered in abundance from this feature, suggesting that it may contain a component of gathered organic material.

Either way, it is clear that the earliest phases of Silbury Hill do not simply consist of one mound – but a number of mounds. These later became consolidated into a single monument under chalk.

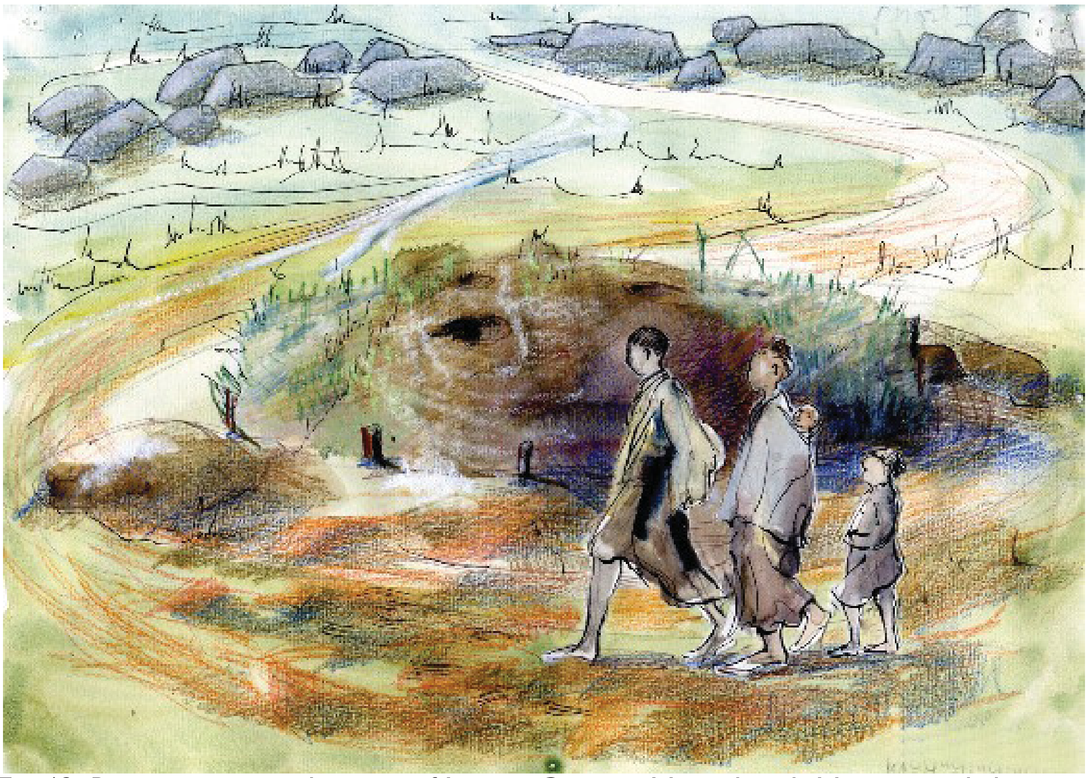


Fig 48: Reconstruction drawing of Lower Organic Mound with Mini-mounds by Judith Dobie

23.4 Pitting activity

Building work stopped for a short while as two pits had been cut into the top of the Lower Organic Mound. One was recorded in the Main Tunnel and measured 1m in diameter and 0.6m deep, however the full width was not seen as it was truncated to the north by Merewether's tunnel, nor was the full depth, as it was cut from above the roof of the tunnel. The other was recorded in the West Lateral and measured 0.74m in width and 0.6m deep, although, again, the pit had been truncated by Merewether's investigation. Both pits contained evidence for flint knapping, however, interestingly their contents contrasted: the pit in the Main Tunnel producing a number of larger useable or retouched cutting flakes; whilst the pit in the West Lateral contained no similar large pieces, but a relatively large collection of micro-debitage indicating knapping waste. If these collections were deliberately dumped into the pits, they would indicate a degree of selection with what was being deposited – feature of Neolithic pitting activity that is becoming increasingly recognised in the archaeological record.

Fig 49: Reconstruction drawing of Lower Organic Mound with pitting activity by Judith Dobie

23.5 The Upper Organic Mound

Mound building continued, and the pits and Lower Organic Mound became sealed under a series of interleaved layers of different material, comprising a mix of topsoil and subsoil chiefly from soils that had developed over chalk (and therefore contrasting with the far more locally derived Lower Organic Mound), as well as basket loads of chalk, clay, gravel and turf. Together these layers formed a mound perhaps as high as 5 or 6m with an estimated diameter of 35m. Also included within this stage were a number of naturally rounded and unmodified sarsen stones which had clearly been deliberately incorporated as part of the mound construction, rather than as any sort of setting on top or around it.

23.6 The banks and ditches

The Upper Organic Mound was surrounded by at least five chalk and clay banks. Interestingly, some banks are remarkably consistent in their dimensions (and in some cases materials), despite being concealed by later phases, suggesting a memory of the earlier banks remained. This perhaps has some bearing on the speed at which activity occurred.

Recorded just inside the portal was a large ditch and associated internal bank. The chalk and clay for the banks is likely to have been quarried from this surrounding ditch. In a void above the tunnel we also recorded a bank on the inside of this ditch. A complete section was excavated through this ditch, which showed that it is large; over 6.5m deep and 6m in width, and assuming it was circular in plan would have formed an enclosure around 100m in diameter. It clearly terminated in this area on the western side, and this can be interpreted either as an entrance or, as with other sites of this period, a continuous ditch that had been cut in small, connected sections. This buried ditch and internal bank are important features and we should think of the early phases of Silbury as an enclosure – as an open, accessible and perhaps public arena; the antithesis of our classic understanding of the monument as a closed and exclusive space (Figure 50).

Fig 50: Reconstruction drawing of ditch enclosure and mound by Judith Dobie

It is uncertain what the chalk and clay banks were for – they certainly were more than just being used to stabilise the organic mound. Without doubt they increased the diameter of the mound. Whether they also increased the height, ie was material piled on top of the banks, is unknown because we could not see much of the central area above the tunnel. However, in one area, a considerable way up a void and high above the Main Tunnel, a miner was able to see a series of organic layers interleaved with chalk and forming what would appear to be a mound, suspended somewhere in the middle of the mound. How this feature fits in with what was recorded is unknown, and this only serves to emphasise how complex this monument is, and how little we know about it.

Activity at the site continued – however the tunnel dips down through these later phases of activity, below the Neolithic ground level, and as such, we no longer see the mound in the tunnel sides. What is clear, however, is that it is not simply one single, homogenous phase, but a series of complex phases; the mound growing in size incrementally. Examination of the buried ditch section would seem to support this: as the hill expanded outwards, the buried ditch was deliberately backfilled and re-cut slightly further out; once backfilled the ditch was re-cut another 3 times, migrating further outwards with each cycle of re-cut and backfill, and possibly reflecting a few of the separate phases of the expanding mound over the top. This continuous re-cutting of the ditch emphasises again that the ditch itself was an important feature of the monument.

23.7 Final mound construction

The prehistoric deposits recorded on the summit comprised a series of layers of fine chalk dumps lain on top of one another and were held in place on the northern side by large, loose pieces of chalk rubble, which effectively formed a rough revetment wall. This is a similar technique to that seen on in the backfilled buried ditches within the tunnel and on the hillside and clearly the construction technique used to build the final phases of the monument. Indeed, a similar technique was recorded at the bank at Avebury by Alexander Keiller (Keiller 1939); perhaps suggesting a link exists between those that built Avebury and those that built Silbury.

Three re-fitting fragments of antler were recovered from a small and well-defined area of one of the walls. Within the same defined area and incorporated into the revetment wall was a cluster of fractured and reduced sarsen stones. These sarsen fragments may have been deliberately associated with the antler fragments, representing ritually placed deposits. Similar clusters of sarsen stones can be seen in Atkinson's trench (Plate 75), and therefore this may have been quite a widespread phenomenon throughout the later construction stages of the mound.

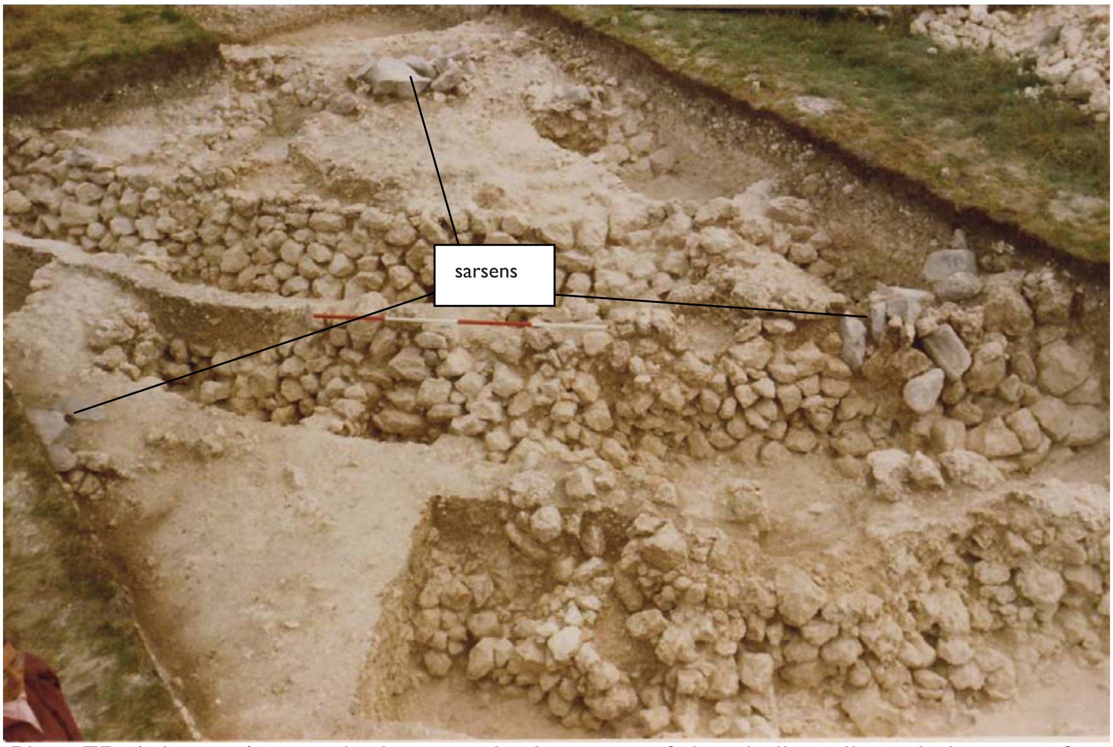


Plate 75: Atkinson's trench showing the location of the chalk walls and clusters of sarsen stones (photo: Atkinson archive, Alexander Keiller Museum)

Interestingly the sarsen fragments on the summit were different to those within the Upper Organic Mound. The fragments from the summit were formed largely of fractured and reduced pieces, many with flake scars indicative of controlled direct percussion; compared to the natural, rounded stones recovered from inside the mound. One sarsen stone recovered from the summit even appears to have been knapped into a rough sub-oval shape before being lightly pecked and ground and then deliberately split by a single blow. This suggests that at least some of the fragments had previous use-lives before becoming (very deliberately) incorporated in to the monument.

The inclusion of antler fragments within the chalk phases of the mound is also interesting. Although the majority were small fragments of tine that could easily have broken off during the quarrying of chalk and become accidentally incorporated into the matrix of the mound, others were larger, such as the fragment of beam, and it is difficult to see how this could have been incorporated other than through deliberate action. Such pieces are easily recyclable into, for example, handles, pins or combs, yet they clearly were not, and as with those recovered by Keiller in the Avebury ditch or those left in the shafts at Grimes Graves (Barber *et al* 1999), it seems that they have been deliberately removed from further circulation. And as we have seen, antler seems to have been deliberately placed alongside sarsen stones. It is the perceived qualities of these different materials – the materiality, and associations between them, that no doubt made them important.

The materials used to construct the various phases of the mound: the Gravel Mound, the Lower and Upper Organic Mounds and indeed the later chalk phases is also interesting. The materiality of stone and timber monuments, such as Avebury and the sanctuary (or Stonehenge and Woodhenge) have been discussed at very great length in the literature (Parker Pearson & Ramilisonina, 1998, Tilley 2004); however the materiality of earth and soil monuments is rarely discussed (although see papers in Boivin and Owoc 2004; Field, 2006:146). The materials used in construction may have been selected for their materiality, and purposefully used. They could all be found in the broader landscape, including the sarsens, and perhaps it is this that made them important; the mound did not simply reflect or reference the landscape – it physically embodied it and brought it together in one place: it was a microcosm of life. Such discussion of materiality needs to be set against the backdrop of contemporary developments at Avebury where the material being used was sarsen and the West Kennet palisaded enclosures where the material was wood. Stone workers, lumberjacks and chalk quarrymen all working in the same area.

Five new radiocarbon samples were processed during the 2007 work, and these, combined with previously processed samples, suggest that at least the early phases of the mound were constructed within one or two generations either side of 2400 BC. At the moment the final phase has two models: one shows that it was also constructed around 2400 BC – the other that it was later – around 2000 BC. However, with the earliest English Beaker pottery also dated to around 2400 BC, the date of Silbury is clearly a crucial one.

23.8 Medieval activity

A series of features were recorded on the summit cutting the prehistoric deposits. Some of these features clearly represent post holes, including one that had a diameter of about a metre, whilst other more ephemeral and fragmentary features were aligned in reasonably convincing rows. The large post hole may represent the presence of a large building or palisade around the summit, whilst the smaller postholes may represent temporary buildings. A pit seen in the side of the collapsed area contained 11th or 12th century pottery, and a prick spur as well as two medieval socketed arrowheads were recovered from overlying subsoil and topsoil, further confirming a medieval presence. The truncated appearance of the prehistoric deposits in the 2007 trench on the summit, and the lack of any later deposits, suggests that the top of the hill may have been truncated and flattened at this time in order to construct the building or palisade.

23.9 18th to 21st century activity

A number of amorphous features were recorded across the top of the summit, and although undated these have been associated with an episode of tree planting that Stukeley recorded on the summit of Silbury in 1723. Evidence for Merewether's 1849 tunnel was recorded at various stages throughout the tunnel, whilst the evidence for Atkinson's work was writ large both within and on the monument. Depositions occur to this day on Silbury; most of which are clearly spiritually charged.

24 ARCHIVE SUMMARY

The archive consists of the following:

2000-2006

261	Context records
9	Sheets of permatrace
663	Photographs
84	Environmental samples
15	Individually numbered object records

Table 54: Silbury Hill 2000-6 Record Number used

Number	Type	SSD
1-39	Context	General
101-117	Drawings	General
151-300	Photographs	General
301-470	Photographs	Cores 1-5 detail
471-499	Photographs	General
501-530	Samples	Bulk processed site
551-555	Samples	Column
602-630	Samples	Bulk processed FC
651-671	Samples	Column
851-865	Objects	General
901-970	Photographs	Cores 1-5 general
971-975	Photographs	Cores 8-11
976-1000	Photographs	General
1001-1098	Photographs	Cores 6 and 7
1101-1156	Contexts	Core 1
1201-1237	Context	Core 2
1301-1327	Context	Core 3
1401-1431	Context	Core 4
1501-1531	Context	Core 5
1601-1618	Context	Core 6
1701-1722	Context	Core 7
1901- 2017	Photographs	Cores 6 and 7

2007-2008

393	Context records
33	Sheets of permatrace
875	Digital photographs
510	Environmental samples
172	Individually numbered object records

Table 55: Silbury Hill 2007-8 Record Number used

Number	Type	SSD
3001-3097	Context	5 (Tunnel – western side)
3801-3866	Context	5 (Tunnel backfill)
3901-3943	Context	5 (Below tunnel ditch excavation)

Number	Type	SSD
4001-4186	Context	5 (Tunnel – eastern side)
4801-4889	Context	6 (Summit)
4901-4912	Context	7 (Slope)
5001-5134	Drawings	General
6001-6875	Photographs	General
7001-7024	Photographs	Post-excavation
8001-8116	Objects	5 (Tunnel)
8501-8537	Objects	6 (Summit)
8751-8769	Objects	7 (Slope)
9001-9456	Samples	5, 8,9 (Tunnel)
9501-9549	Samples	6 (Summit)
9751- 9755	Samples	7 (Slope), 10 (Reading University coring)

<u>Lectures undertaken</u>

Table 56: Lectures undertaken on Silbury Hill

Date	Name	Lecture	Location
24/11/2007	Jim Leary	WANHS day conference	Devizes town hall
28/11/2007	Jim Leary	Lecture to Avebury WHS steering committee	Devizes
23/01/2008	Jim Leary	Presentation to AAHRG	Avebury
09/02/2008	Jim Leary	Archaeology 08	British Museum
11/03/2008	Jim Leary	Lecture to Salisbury Museum	Salisbury Museum
22/04/2008	Jim Leary	Lecture at the Archaeological Projects team conference	Royal Marines Museum, Portsmouth
24/04/2008	Jim Leary	Research seminar	Cardiff University
08/05/2008	Jim Leary and Amanda Chadburn	Lecture to the Society of Antiquaries	London
09/05/2008	Jim Leary	Lecture to the Avebury Society	Devizes town hall
10/06/2008	Jim Leary	Lecture at the Devizes Festival	Devizes town hall
17/06/2008	Jim Leary and Gill Campbell	Lecture to the Regional Science Advisors	Fort Cumberland
06/2008	Sarah May	Lecture to WAC	Dublin
12/07/2008	Jim Leary	Lecture at National Archaeology Weekend	Fort Cumberland
19/07/2008	Jim Leary	Lecture to the Wiltshire Field Group	Avebury
23/09/2008	Jim Leary	Research seminar	Bradford University
9/10/2008	Jim Leary	Lecture to the Cardiff Archaeology Society	Cardiff
16/10/2008	Jim Leary	Lecture to Marlborough Historical Society	St Peter's Church, Marlborough
3/11/2008	Jim Leary	Organised conference on 'Round Mounds and Monumentality' + lecture on Silbury	British Museum
12/11/2008	Jim Leary	Research seminar	Durham University
13/10/2009	Jim Leary	Lecture to Salisbury Museum	Salisbury Museum
02/11/2009	Jim Leary	Lecture to Warminster Society	Warminster
23/01/2010	Jim Leary	Lecture to WANHS	Devizes

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The on-site archaeological team

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Tony Baxter
Gill Campbell
Matt Canti
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Eleanor Collier
James Cooper
Tom Cromwell
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Dave Fellows
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Jim Leary
Fachtna McAvoy
Eloise Metson
Peter Popkin
Jenny Ryder
Ellie Sayer
Duncan Stirk
Maria Vinnels
Fay Worley

The Skanska mining team
Barry Carlin
Terry Hilton
Mark Kirkbride
Mick McCaffery
Vernon Nightingale
Bob Tutill
Colin Wilkinson

The Clerk of works
Arthur McCallum

Plate 76: Group photo. NMR file number DP054663. Photographer James O. Davies. Job Number: 2k/11202

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APPENDIX 1: CONTEXT INDEX

Context	Type	SSD	Description	Phase	Same as	Small finds
			2001 summit excavations			
1	Layer	A	Turf and topsoil	21.1	3;3001;4001;4804;4884	*
2	Layer	A	Subsoil	21.1	8;14;3003;4002;4805;4885	855-7;859;862-3
3	Layer	B	Turf and topsoil	21.1	1;3001;4001;4804;4884	*
4	Layer	A	Interwall deposit (contains fragment of Beaker pot)	17	*	*
5	Layer	A	Disturbed interwall deposit	18	*	853
6	Layer	A	Interwall deposit	17.2	*	*
7	Layer	B	Chalk rubble wall	17.2	*	*
8	Layer	B	Subsoil	21.1	2;14;3003;4002;4805;4885	858;860;861
9	Fill	B	Fill of pit [15]	18	*	*
10	Layer	B	Interwall deposit	17.2	*	*
11	Layer	B	Interwall deposit	18	*	854
12	Layer	B	Interwall deposit	17.2	*	*
13	Layer	B	Chalk rubble wall	17.2	*	*
14	Layer	B	Subsoil	21.1	2;8;3003;4002;4805;4885	851;852
15	Cut	B	Pit or post hole	18	*	*
16	*	D	Finds number - unstratified finds from Silbury. Collected by David Field and Skanska	*	*	865
17	*	D	Finds number - pottery recovered from hole 14 during Watching Brief Dec 2000	*	*	*
18	*	D	Finds number - pottery recovered from hole 23 during Watching Brief Dec 2001	*	*	*
19	Layer	C	Turf and topsoil	21.2	4801;4906	*
20	Fill	C	Backfill of Atkinson's trench	21.2	4802;4810	*
21	Fill	C	Layer over collapsed area	21.1	*	*
22	Fill	C	Layer over collapsed area	21.1	*	*
23	Layer	C	Layer over collapsed area	21.1	*	*
24	Layer	C	Clay adhering to side of 1776 shaft [25]	19	*	*
25	Cut	C	Cut of 1776 shaft	19	*	*
26	Fill	C	Secondary fill of pit [28]	19	*	*
27	Fill	C	Primary fill of pit [28]	19	*	*

Context	Type	SSD	Description	Phase	Same as	Small finds
28	Cut	C	Tree planting pit	19	*	*
29	Layer	C	Chalk layer seen in side of shaft	17.2	*	*
30	Layer	C	Chalk layer seen in side of shaft	17.2	*	864
31	Layer	C	Chalk layer seen in side of shaft	17.2	*	*
32	Layer	C	Chalk rubble wall	17.2	*	*
			2001 Watching Brief			
33	*	*	Sarsen stone	*	*	*
34	*	*	Sarsen stone	*	*	*
35	*	*	Sarsen stone	*	*	*
36	*	*	Sarsen stone	*	*	*
37	*	*	Sarsen stone	*	*	*
38	*	*	Sarsen stone	*	*	*
39	Cut	*	Possible cut of previous excavation trench	*	*	*
			2007/8 works			
			Main Tunnel - western section			
3001	Layer	5	Topsoil outside portal	21.2	1;3;4001;4804;4884	*
3002	Fill	5	Backfill of Atkinson's tunnel	21.2	*	8001
3003	Layer	5	Subsoil outside portal	21.1	2;8;14;4002;4805;4885	*
3004	Cut	5	Cut of Atkinson's tunnel portal	21.2	3866	*
3005	Fill	5	Fill of modern feature [3006]	21.1	4003	*
3006	Cut	5	Modern step-like feature outside portal	21.1	4005	*
3007	Fill	5	Poss external ditch fill	17.1	4006	*
3008	Fill	5	Poss external ditch fill	17.1	*	8002
3009	Fill	5	Poss external ditch fill	17.1	4007	*
3010	Fill	5	Poss external ditch fill	17.1	4008	*
3011	Fill	5	Poss external ditch fill	17.1	4009	*
3012	Fill	5	Backfill of Atkinson's tunnel	21.2	3804;3813	*
3013	Layer	5	Iron Pan band or 'trample', overlying OLS	3	3087;4095	*
3014	Natural	5	Natural chalk	1	4012	*
3015	Cut	5	Buried ditch cut (Ditch 1)	8	3902;4151	*
3016	Fill	5	Fill of Merewether tunnel	20	*	*

Context	Type	SSD	Description	Phase	Same as	Small finds
3017	Cut	5	Cut of Merewether tunnel	20	*	*
3018	Cut	5	Cut of external ditch	17.1	*	*
3019	Natural	5	Derived clay-with-flints layer	1	4094	*
3020	Natural	5	Flinty clay layer	1	4096	*
3021	Layer	5	Old Land Surface	2	4041	*
3022	Layer	5	Iron Pan band	8	4097	*
3023	Bank	5	Bank 4 (chalk)	11	4098;4186	*
3024	Bank	5	Part of Bank 1 (Toblerone)	8	3085;4093;4107;4167	*
3025	Layer	5	Part of Upper Organic Mound	6	4103	*
3026	Layer	5	Part of Upper Organic Mound	6	*	*
3027	Bank	5	Part of Bank 3 (Toblerone)	10	4104	*
3028	Bank	5	Part of Bank 3 (chalk rubble core of Bank 3)	10	4105	*
3029	Bank	5	Part of Bank 2 (chalk + silt)	9	3086;4106;4108;4183	*
3030	Bank	5	Part of Bank 1 (Toblerone)	8	3088;4107	*
3031	Layer	5	Part of 'further dump layers'	7	*	*
3032	Layer	5	Part of 'further dump layers'	7	*	*
3033	Layer	5	Part of 'further dump layers'	7	*	*
3034	Layer	5	Part of 'further dump layers'	7	*	*
3035	Layer	5	Organic layer above OLS	2	4100	*
3036	Layer	5	Part of Upper Organic Mound	6	*	*
3037	Layer	5	Part of Upper Organic Mound	6	*	*
3039	Layer	5	Part of Upper Organic Mound	6	*	*
3040	Layer	5	Part of Upper Organic Mound	6	*	*
3041	Layer	5	Part of Upper Organic Mound	6	*	*
3042	Layer	5	Part of Upper Organic Mound	6	*	*
3043	Layer	5	Part of Upper Organic Mound	6	*	*
3044	Layer	5	Part of Upper Organic Mound	6	*	*
3045	Layer	5	Part of Lower Organic Mound	4	3046;3058;4101	*
3046	Layer	5	Part of Lower Organic Mound	4	3045;30584101	*
3047	Natural	5	Variation within natural clay with flints	1	*	*
3048	Mound	5	Gravel Mound	3	4153	*
3050	Fill	5	Backfill of Merewether's tunnel	20	*	*
3051	Cut	5	Cut of Merewether tunnel	20	*	*

Context	Type	SSD	Description	Phase	Same as	Small finds
3052	Fill	5	Backfill of Atkinson disturbed area	21.2	*	*
3053	Layer	5	Slumped archaeology in Atkinson disturbed area	21.2	*	*
3054	Layer	5	Part of Lower Organic Mound	4	*	*
3055	Layer	5	Part of Lower Organic Mound	4	*	*
3056	Layer	5	Part of Lower Organic Mound	4	*	*
3057	Layer	5	Part of Lower Organic Mound	4	*	*
3058	Layer	5	Part of Lower Organic Mound	4	3045;3046;4101	*
3059	Fill	5	Backfill of Merewether's tunnel	20	*	*
3060	Cut	5	Cut of Merewether tunnel	20	*	*
3061	Layer	5	Part of Upper Organic Mound	6	3071	*
3062	Natural	5	Natural interface layer between chalk and clay with flints	1	3063;3072;3082;4152	*
3063	Natural	5	Natural interface layer between chalk and clay with flints	1	3062;3072;3082;4152	*
3064	Fill	5	Backfill of Merewether's tunnel	20	*	*
3065	Cut	5	Cut of Merewether tunnel	20	*	*
3066	Fill	5	Secondary fill of pit [3067]	5	*	8036-9
3067	Cut	5	Pit cut into top of Lower Organic Mound	5	*	*
3068	Layer	5	Dark silty layer on top Gravel Mound - poss soil horizon?	3	3069;4154;4166	*
3069	Layer	5	Dark silty layer on top Gravel Mound - poss soil horizon?	3	3068;4154;4166	*
3070	Fill	5	Primary fill of pit [3067]	5	*	*
3071	Layer	5	Part of Upper Organic Mound	6	3061	*
3072	Natural	8	Natural interface layer between chalk and clay with flints	1	3062;3063;3082;4152	*
3073	Fill	8	Fill of pit [3074]	5	*	*
3074	Cut	8	Pit cut into top of Lower Organic Mound	5	*	*
3075	Layer	8	Part of Lower Organic Mound	4	*	*
3076	Layer	8	Part of Lower Organic Mound	4	*	*
3077	Layer	8	Part of Upper Organic Mound	6	*	*
3078	Layer	8	Part of Upper Organic Mound	6	*	*
3079	Fill	8	Backfill of Merewether's tunnel	20	*	*
3080	Cut	8	Cut of Merewether tunnel	20	*	*
3081	Layer	8	Part of Upper Organic Mound	6	*	*
3082	Natural	8	Natural interface layer between chalk and clay with flints	1	3062;3063;3072;4152	*
3083	Layer	8	Part of Upper Organic Mound	6	*	*
3084	Layer	8	Part of ‘further dump layers’	7	*	*

Context	Type	SSD	Description	Phase	Same as	Small finds
3085	Bank	8	Part of Bank 1 (Toblerone)	8	3024;4093;4167	*
3086	Bank	8	Part of Bank 2 (chalk)	9	3029;4106;4108;4183	*
3087	Layer	8	Poss trample layer	3	3013;4095	*
3088	Bank	8	Part of Bank 1 (chalk)	8	3030;4107	*
3089	Layer	8	Organic remains on top of trample layer [3087]	3	*	*
3090	Cut	8	Stake hole - possibly around Lower Organic Mound	4	*	*
3091	Fill	8	Primary fill of stake hole [3090]	4	*	*
3092	Cut	8	Possible small cut on edge of Lower Organic Mound	4	*	*
3093	Fill	8	Chalk block fill of cut [3092] - poss marker around mound or just pushed in	4	*	*
3094	Bank	5	Part of Bank 2 (chalk)	9	*	*
3095	Mound	5	Organic mini mound	4	*	*
3096	Fill	8	Secondary fill of stake hole [3090]	4	*	*
3097	Bank	5	Part of Bank 5 (Toblerone)	12	4073	*
			Tunnel backfill			
3801	Fill	5	Tunnel collapse just inside portal	21.2	*	*
3802	Fill	5	Atkinson backfill – road stone	21.2	*	*
3803	Fill	5	Floor scrappings	21.2	*	*
3804	Fill	5	Atkinson backfill	21.2	3012;3813	8011;8032
3805	Fill	5	General finds number for Atkinson tunnel construction and use	21.2	*	*
3806	Fill	5	Floor scrappings	21.2	*	*
3807	Fill	5	Collapsed chalk from roof of Bay 18A	21.2	*	*
3808	Fill	5	Finds number - subdivision of [3801] at Bay 2	21.2	3811;3812	8014
3809	Fill	5	Collapsed mound material from Bays 18-21 (continues as subdivisions to Bay 36)	21.2	3819-3;3825;3828;3840	8030
3810	Bank	5	Toblerone bank on inside of buried ditch	8	*	*
3811	Fill	5	Finds number - subdivision of [3801] at Bay 9	21.2	3808;3812	*
3812	Fill	5	Finds number - subdivision of [3801] at Bays 4-6	21.2	3808;3811	*
3813	Fill	5	Finds number - subdivision of [3804] at Bay 10	21.2	3012;3804	*
3814	Fill	5	Finds number - subdivision of [3806] at Bays 1-5	21.2	3806;3015	*
3815	Fill	5	Finds number - subdivision of [3806] at Bays 14-16	21.2	3806;3014	*
3816	Fill	5	Collapse of chalk, c-w-f and Merewether fill in Bays 28A and 29A	21.2	*	*
3817	Fill	5	Collapse of rubbly chalk in Bay 32 - possibly collapsed context [4042]	21.2	*	8021-8
3818	Fill	5	Finds number - unkown location	21.2	*	*

Context	Type	SSD	Description	Phase	Same as	Small finds
3819	Fill	5	Finds number - subdivision of [3809] at Bays 18-25	21.2	3809;3820-3;3825;3828;3840	*
3820	Fill	5	Finds number - subdivision of [3809] at Bay 26	21.2	3809;3819-3;3825;3828;3840	*
3821	Fill	5	Finds number - subdivision of [3809] at Bay 27	21.2	3809;3819-3;3825;3828;3840	*
3822	Fill	5	Finds number - subdivision of [3809] at Bay 33	21.2	3809;3819-3;3825;3828;3840	*
3823	Fill	5	Finds number - subdivision of [3809] at Bay 33	21.2	3809;3819-2;3825;3828;3840	8052-4
3824	Fill	5	Collapse from above Bays 31-36	21.2	3829-30	*
3825	Fill	5	Finds number - subdivision of [3809] at Bay 34	21.2	3809;3819-3;3828;3840	*
3826	Fill	5	Collapsed material from Bay 36 (continues as subdivisions to Bay 58)	21.2	3838-9;3841-54	8029;8044-48;8050-1
3827	Fill	5	Collapsed material from Bank 5 [4073]	21.2	*	*
3828	Fill	5	Finds number - subdivision of [3809] at Bay 36	21.2	3809;3819-3;3825;3840	*
3829	Fill	5	Finds number - subdivision of [3824] at Bays 34-36	21.2	3830;3824	8019-20
3830	Fill	5	Finds number - subdivision of [3824] at Bays 31-35	21.2	3829;3824	8049
3831	Fill	5	Collapsed in situ mound material over Bays 41-46	21.2	3837	*
3832	Fill	5	Very mixed collapsed material from Bays 42-46	21.2	3836	*
3833	Fill	5	Very mixed collapsed material from Bays 47-49	21.2	3835	*
3834	Fill	5	Sandy backfill - poss washed in material. From Ring 52 (continues as subdivis to Bay 82)	21.2	3856;3860-3	8031;8033
3835	Fill	5	Finds number - cleaning from tunnel side Bays 47-49	21.2	3833	*
3836	Fill	5	Finds number - cleaning from tunnel side Bays 42-46	21.2	3832	*
3837	Fill	5	Collapsed in situ mound material over Bays 41-46	21.2	3831	*
3838	Fill	5	Finds number - subdivision of [3826] at Bay 39	21.2	3826;3839;3841-54	*
3839	Fill	5	Finds number - subdivision of [3826] at Bay 38	21.2	3826;3838;3841-54	*
3840	Fill	5	Finds number	21.2	*	*
3841	Fill	5	Finds number - subdivision of [3826] at Bay 36	21.2	3826;3838;3842-54	*
3842	Fill	5	Finds number - subdivision of [3826] at Bay 37	21.2	3826;3838;3841-54	*
3843	Fill	5	Finds number - subdivision of [3826] at Bay 41	21.2	3826;3838;3841-54	*
3844	Fill	5	Finds number - subdivision of [3826] at Bay 50	21.2	3826;3838;3841-54	8010;8056-92
3845	Fill	5	Finds number - subdivision of [3826] at Bay 58	21.2	3826;3838;3841-54	8055;8093

Context	Type	SSD	Description	Phase	Same as	Small finds
3846	Fill	5	Finds number - subdivision of [3826] at Bay 60	21.2	3826;3838;3841-54	8012
3847	Fill	5	Finds number - subdivision of [3826] at Bay 62	21.2	3826;3838;3841-54	*
3848	Fill	5	Finds number - subdivision of [3826] at Bay 67	21.2	3826;3838;3841-54	8094
3849	Fill	5	Finds number - subdivision of [3826] at Bay 59	21.2	3826;3838;3841-54	*
3850	Fill	5	Finds number - subdivision of [3826] at Bay 61	21.2	3826;3838;3841-54	*
3851	Fill	5	Finds number - subdivision of [3826] at Bay 66	21.2	3826;3838;3841-54	*
3852	Fill	5	Finds number - subdivision of [3826] at Bay 56	21.2	3826;3838;3841-54	*
3853	Fill	5	Finds number - subdivision of [3826] at Bay 52	21.2	3826;3838;3841-54	*
3854	Fill	5	Finds number - subdivision of [3826] at Bays 56-8	21.2	3826;3838;3841-53	*
3855	Fill	5	Collapsed turf stack material over Bay 74	21.2	*	*
3856	Fill	5	Finds number - subdivision of [3834] at Bays 67-70	21.2	3834;3860-3	*
3857	Fill	8	Slumped chalk from West Lateral	21.2	3858;3859	8109
3858	Fill	8	Finds number - subdivision of [3857] at Bay 8	21.2	3857;3859	*
3859	Fill	8	Finds number - subdivision of [3857] at Bays 9-10	21.2	3857;3858	*
3860	Fill	5	Finds number - subdivision of [3834] at Bays 67-70	21.2	3834;3856;3859-3	*
3861	Fill	5	Finds number - subdivision of [3834] at Bays 71-73	21.2	3834;38563860-3	*
3862	Fill	5	Finds number - subdivision of [3834] at Bay 74	21.2	3834;3856;3860-3	*
3863	Fill	5	Finds number - subdivision of [3834] at Bay 82	21.2	3834;3856;3860-2	*
3864	Fill	8	Collapse organic mound from West Lateral Bay 3	21.2	*	*
3865	Fill	9	Backfill in East Lateral	21.2	*	*
3866	Cut	5,8,9	Atkinson tunnel cut	21.2	3004	*
			Buried ditch excavation			
3901	Fill	5	Finds number over top of ditch [3902]	13.2	3904;3912;3913;3943	*
3902	Cut	5	Cut of buried ditch (Ditch 1)	8	3015;4151	*
3903	Fill	5	Spit 1 - arbitrary spit from ditch [3902] (Ditch 1)	13.2	*	*
3904	Cut	5	Cut of buried ditch (Ditch 2 - re-cut of ditch 1)	13.2	*	*
3905	Fill	5	Backfill of ditch [3902] (Ditch 1)	13.2	*	*
3906	Fill	5	Backfill of ditch [3902] (Ditch 1)	13.2	*	*
3907	Fill	5	Backfill of ditch [3902] (Ditch 1)	13.2	*	*
3908	Fill	5	Backfill of ditch [3902] (Ditch 1)	13.2	*	*
3909	Fill	5	Infill of ditch [3902] (Ditch 1)	13.1	*	*
3910	Fill	5	Infill of ditch [3902] (Ditch 1)	13.1	*	*

Context	Type	SSD	Description	Phase	Same as	Small finds
3911	Fill	5	Infill of ditch [3902] (Ditch 1)	13.1	*	*
3912	Fill	5	Backfill of ditch [3902] (Ditch 1)	13.2	4140	*
3913	Fill	5	Fill of ditch [3904] (Ditch 2)	14	4147	*
3914	Fill	5	Backfill of ditch [3902] (Ditch 1)	13.2	*	*
3915	Fill	5	Backfill of ditch [3902] (Ditch 1)	13.2	*	*
3916	Fill	5	Backfill of ditch [3902] (Ditch 1)	13.2	*	*
3917	Fill	5	Backfill of ditch [3902] (Ditch 1)	13.2	4141	*
3918	Fill	5	Spit 2 - arbitrary spit from ditch [3902] (Ditch 1)	13.1	*	8004;8015-7
3919	Fill	5	Spit 3 - arbitrary spit from ditch [3902] (Ditch 1)	13.1	*	8018
3920	Fill	5	Spit 4 - arbitrary spit from ditch [3902] (Ditch 1)	13.1	*	8005-6
3921	Cut	5	Stake hole at base of ditch [3902] (Ditch 1)	13.1	*	*
3922	Cut	5	Stake hole at base of ditch [3902] (Ditch 1)	13.1	*	*
3923	Cut	5	Stake hole at base of ditch [3902] (Ditch 1)	13.1	*	*
3924	Cut	5	Stake hole at base of ditch [3902] (Ditch 1)	13.1	*	*
3925	Fill	5	Infill of ditch [3902] (Ditch 1)	13.1	3940	*
3926	Fill	5	Organic infill of ditch [3902] (Ditch 1)	13.1	*	8007-9
3927	Fill	5	Fill of stake hole [3921]	13.1	*	*
3928	Fill	5	Fill of stake hole [3922]	13.1	*	*
3929	Fill	5	Fill of stake hole [3923]	13.1	*	*
3930	Fill	5	Fill of stake hole [3924]	13.1	*	*
3931	Fill	5	Infill of ditch [3902] (Ditch 1)	13.1	*	*
3932	Fill	5	Infill of ditch [3902] (Ditch 1)	13.1	*	*
3933	Fill	5	Infill of ditch [3902] (Ditch 1)	13.1	*	*
3934	Fill	5	Infill of ditch [3902] (Ditch 1)	13.1	*	*
3935	Fill	5	Infill of ditch [3902] (Ditch 1)	13.1	*	*
3936	Fill	5	Infill of ditch [3902] (Ditch 1)	13.1	*	*
3937	Fill	5	Infill of ditch [3902] (Ditch 1)	13.1	*	*
3938	Fill	5	Infill of ditch [3902] (Ditch 1)	13.1	*	*
3939	Fill	5	Silty infill of ditch [3902] (Ditch 1)	13.1	*	*
3940	Fill	5	Infill of ditch [3902] (Ditch 1)	13.1	3925	*
3941	Fill	5	Infill of ditch [3902] (Ditch 1)	13.1	*	*
3942	Fill	5	Infill of ditch [3902] (Ditch 1)	13.1	*	*
3943	Fill	5	poss fill of ditch [3904] (Ditch 2) or poss Atkinson disturbance	14?	*	*

Context	Type	SSD	Description	Phase	Same as	Small finds
			Main Tunnel - eastern section			
4001	Layer	5	Topsoil outside portal	21.1	1;3;3001;4804;4884	*
4002	Layer	5	Subsoil outside portal	21.1	2;8;14;3003;4805;4885	*
4003	Fill	5	Secondary fill of modern feature [4005]	21.1	3005	*
4004	Fill	5	Primary fill of modern feature [4005]	21.1	*	*
4005	Cut	5	Modern step-like feature outside portal	21.1	3006	*
4006	Fill	5	Poss external ditch fill	17.1	3007	*
4007	Fill	5	Poss external ditch fill	17.1	3009	*
4008	Fill	5	Poss external ditch fill	17.1	3010	*
4009	Fill	5	Poss external ditch fill	17.1	3011	*
4010	Fill	5	Poss external ditch fill	17.1	*	*
4011	Fill	5	Poss external ditch fill	17.1	*	*
4012	Natural	5	Natural chalk	1	3014	*
4013	Natural	5	Degraded/weathered natural chalk - interface layer between chalk and clay-with-flints	1	*	*
4014	Layer	5	Chalk deposit - mound material or external ditch fill	16	*	*
4015	Layer	5	Chalk deposit - mound material or external ditch fill	16	4020	*
4016	Layer	5	Chalk deposit - mound material or external ditch fill	16	*	*
4017	Layer	5	Chalk deposit - mound material or external ditch fill	16	*	*
4018	Cut	5	Re-cut buried ditch (Ditch 4)	15	*	*
4019	Layer	5	Chalk deposit - mound material or external ditch fill	16	*	*
4020	Layer	5	Chalk deposit - mound material or external ditch fill	16	4015	*
4021	Fill	5	Backfill of ditch re-cut [4018] (Ditch 4)	16	*	*
4022	Fill	5	Backfill of ditch re-cut [4018] (Ditch 4)	16	*	*
4023	Fill	5	Backfill of ditch re-cut [4018] (Ditch 4)	16	*	*
4024	Fill	5	Backfill of ditch re-cut [4018] (Ditch 4)	16	*	*
4025	Fill	5	Backfill of ditch re-cut [4018] (Ditch 4)	16	*	*
4026	Fill	5	Backfill of ditch re-cut [4018] (Ditch 4)	16	*	*
4027	Fill	5	Infilling of ditch re-cut [4131] (Ditch 3)	15	*	*
4041	Layer	5	Old Land Surface	2	3021	8041;8043
4042	Layer	5	Chalk rubble mound material. See also collapsed material [3817]	12	*	*
4073	Bank	5	Bank 5 (toblerone). See also [3827]	12	3097	*
4093	Bank	5	Bank 1 (toblerone)	8	3024;3085;4167	*

Context	Type	SSD	Description	Phase	Same as	Small finds
4094	Natural	5	Derived clay-with-flints layer	1	3019	*
4095	Layer	5	Iron Pan band or 'trample', overlying OLS	3	3013;3087	*
4096	Layer	5	Flinty clay layer	1	3020	*
4097	Layer	5	Iron Pan band	8	3022	*
4098	Bank	5	Bank 4 (chalk)	11	3023;4186	*
4100	Layer	5	Organic layer above OLS	2	3035	*
4101	Layer	5	Part of Lower Organic Mound	4	3045;3046;3058;4156	*
4103	Layer	5	Part of Upper Organic Mound	6	3025	*
4104	Bank	5	Part of Bank 3 (Toblerone)	10	3027	*
4105	Bank	5	Part of Bank 3 (chalk rubble core of Bank 3)	10	3028	*
4106	Bank	5	Part of Bank 2 (chalk + silt)	9	3029;3086;4106;4108;4183	*
4107	Bank	5	Part of Bank 1 (Toblerone)	8	3030;3088	*
4108	Bank	5	Part of Bank 2 (chalk + silt)	9	3029;3086;4106;4183	*
4109	Layer	5	Part of ‘further dump layers’	7	*	*
4110	Layer	5	Part of ‘further dump layers’	7	*	*
4111	Layer	5	Part of ‘further dump layers’	7	*	*
4112	Layer	5	Part of ‘further dump layers’	7	*	*
4113	Layer	5	Part of ‘further dump layers’	7	*	*
4114	Layer	5	Part of Upper Organic Mound	6	*	*
4115	Layer	5	Part of Upper Organic Mound	6	*	*
4116	Layer	5	Part of Upper Organic Mound	6	*	*
4117	Layer	5	Part of Upper Organic Mound	6	*	*
4118	Layer	5	Part of Upper Organic Mound	6	*	*
4119	Layer	5	Part of Upper Organic Mound	6	*	*
4120	Layer	5	Part of Upper Organic Mound	6	*	*
4121	Layer	5	Part of Upper Organic Mound	6	*	*
4122	Layer	5	Part of Upper Organic Mound	6	*	*
4123	Fill	5	Backfill of ditch re-cut [4018] (Ditch 4)	16	*	*
4124	Fill	5	Backfill of ditch re-cut [4018] (Ditch 4)	16	*	*
4125	Fill	5	Infilling of ditch re-cut [4131] (Ditch 3)	15	*	*
4126	Fill	5	Infilling of ditch re-cut [4131] (Ditch 3)	15	*	*
4127	Fill	5	Infilling of ditch re-cut [4131] (Ditch 3)	15	*	*
4128	Fill	5	Infilling of ditch re-cut [4131] (Ditch 3)	15	*	*

Context	Type	SSD	Description	Phase	Same as	Small finds
4129	Fill	5	Infilling of ditch re-cut [4131] (Ditch 3)	15	*	*
4130	Fill	5	Retaining wall - part of backfilling of ditch re-cut [3904] (Ditch 2)	14	*	*
4131	Cut	5	Re-cut buried ditch (Ditch 2)	14	*	*
4132	Fill	5	Backfill of ditch re-cut [3904] (Ditch 2)	14	*	*
4133	Fill	5	Retaining wall - part of backfilling of ditch re-cut [3904] (Ditch 2)	14	*	*
4134	Fill	5	Backfill of ditch re-cut [3904] (Ditch 2)	14	*	*
4135	Fill	5	Backfill of ditch cut [4151] (Ditch 1)	13.2	*	*
4136	Fill	5	Backfill of ditch cut [4151] (Ditch 1)	13.2	*	*
4137	Fill	5	Backfill of ditch cut [4151] (Ditch 1)	13.2	*	*
4138	Fill	5	Backfill of ditch cut [4151] (Ditch 1)	13.2	*	*
4139	Fill	5	Backfill of ditch cut [4151] (Ditch 1)	13.2	*	*
4140	Fill	5	Backfill of ditch cut [4151] (Ditch 1)	13.2	3912	*
4141	Fill	5	Backfill of ditch cut [4151] (Ditch 1)	13.2	3917	*
4142	Fill	5	Infilling of ditch re-cut [4131] (Ditch 3)	15	*	*
4143	Fill	5	Compact layer in ditch re-cut [3904] (Ditch 2)	14	*	*
4144	Fill	5	Backfill of ditch re-cut [3904] (Ditch 2)	14	*	*
4145	Fill	5	Backfill of ditch re-cut [3904] (Ditch 2)	14	*	*
4146	Fill	5	Backfill of ditch re-cut [3904] (Ditch 2)	14	*	*
4147	Fill	5	Backfill of ditch re-cut [3904] (Ditch 2)	14	3913	*
4148	Fill	5	Infilling of ditch re-cut [4131] (Ditch 3)	15	*	*
4149	Fill	5	Retaining wall - part of backfilling of ditch re-cut [3904] (Ditch 2)	14	*	*
4150	Fill	5	Retaining wall - part of backfilling of ditch cut [4151] (Ditch 1)	13.2	*	*
4151	Cut	5	Buried ditch cut (Ditch 1)	8	3015;3902	*
4152	Layer	5	Natural interface layer between chalk and clay with flints	1	3062;3063;3072;3082	*
4153	Mound	5	Gravel Mound	3	3048	*
4154	Layer	5	Dark silty layer on top Gravel Mound - poss soil horizon?	3	3068;3069;4166	*
4155	Layer	5	Part of Lower Organic Mound	4	*	*
4156	Layer	5	Part of Lower Organic Mound	4	*	8034;8040;8108
4157	Layer	5	Part of Upper Organic Mound	6	*	*
4158	Fill	5	Backfill of Merewether's tunnel	20	*	*
4159	Cut	5	Cut of Merewether tunnel	20	*	*
4160	Layer	5	Variation within derived c-w-f	1	*	*
4161	Layer	5	Variation within derived c-w-f	1	*	*

Context	Type	SSD	Description	Phase	Same as	Small finds
4162	Layer	5	Initially interpreted as a pit but prob just slumped material	6	*	*
4163	Layer	5	Initially interpreted as a pit but prob just slumped material	6	*	*
4164	Layer	5	Variation within derived c-w-f	1	*	*
4165	Layer	5	Variation within derived c-w-f	1	*	*
4166	Layer	5	Dark silty layer on top Gravel Mound - poss soil horizon?	3	3068;3069;4154	*
4167	Bank	9	Bank 1 (toblerone)	8	3024;3085;4093	*
4168	Layer	9	Part of ‘further dump layers’	7	3084	*
4169	Layer	9	Part of Upper Organic Mound	6	4180	*
4170	Fill	9	Primary fill of linear pit or gully [4171]	4	*	*
4171	Cut	9	Cut of linear/elongated pit or gully poss associated with mini mound [4181]	4	*	*
4172	Layer	9	Part of Upper Organic Mound	6	*	*
4173	Fill	9	Secondary fill of linear pit or gully [4171]	4	*	*
4174	Fill	9	Backfill of Atkinson ring setting/disturbance	21.2	*	*
4175	Fill	9	Backfill of Atkinson ring setting/disturbance	21.2	*	*
4176	Fill	9	Backfill of Atkinson ring setting/disturbance	21.2	*	*
4177	Cut	9	Atkinson ring setting/disturbance	21.2	*	*
4178	Fill	9	Tertiary fill of linear pit or gully [4171]	4	*	*
4179	Layer	9	Part of and poss modification to mini mound [4181]	4	4185	*
4180	Layer	9	Part of Upper Organic Mound	6	4169	*
4181	Mound	9	Organic mini mound	4	*	*
4182	Layer	9	Part of Lower Organic Mound	4	*	8042
4183	Bank	9	Part of Bank 2 (chalk + silt)	9	3029;3086;3094;4106;4108	*
4184	Layer	9	Part of Lower Organic Mound	4	*	*
4185	Layer	9	Part of and poss modification to mini mound [4181]	4	4179	*
4186	Bank	5	Bank 4 (chalk)	11	3023;4098	*
			Summit excavations			
4801	Layer	6	Topsoil above Atkinson's trench	21.2	19;4906	8528
4802	Fill	6	Backfill of Atkinson's trench	21.2	20;4810	*
4803	Cut	6	Atkinson's trench cut	21.2	*	*
4804	Layer	6	Topsoil	21.1	1;3;3001;4001;4884	8501-8;8520-1
4805	Layer	6	Subsoil	21.1	2;8;14;3003;4002;4885	8509-17;8522
4806	Fill	6	Fill of tree hollow [4807]	21.1	*	8530-2

Context	Type	SSD	Description	Phase	Same as	Small finds
4807	Cut	6	Tree hollow	21.1	*	*
4808	Layer	6	Chalk rubble wall	17.2	*	*
4809	Layer	6	Chalk rubble wall	17.2	*	*
4810	Fill	6	Backfill of Atkinson's trench	21.2	20;4802	*
4811	Fill	6	Backfill of Atkinson's trench	21.2	*	*
4812	Layer	6	Chalk rubble wall	17.2	*	*
4813	Layer	6	Interwall deposit	17.2	*	*
4814	Layer	6	Interwall deposit	17.2	*	8523
4815	Layer	6	Interwall deposit	17.2	*	*
4816	Layer	6	Interwall deposit	17.2	*	*
4817	Layer	6	Interwall deposit	17.2	*	*
4818	Cut	6	Modern post hole	21.3	*	*
4819	Fill	6	Fill of post hole [4818]	21.3	*	*
4820	Fill	6	Fill of post hole [4821]	18	*	8518-9
4821	Cut	6	Large post hole	18	*	*
4822	Fill	6	Fill of poss post hole [4823]	18	*	*
4823	Cut	6	Poss shallow post hole	18	*	*
4824	Fill	6	Fill of post hole [4825]	18	*	*
4825	Cut	6	Post hole	18	*	*
4826	Fill	6	Fill of pit/ animal disturbance [4827]	18	*	8533
4827	Cut	6	Pit or poss animal disturbance	18	*	*
4828	Fill	6	Fill of poss animal disturbance [4829]	18	*	*
4829	Cut	6	Poss animal disturbance or root action	18	*	*
4830	Fill	6	Fill of post hole [4831]	18	*	*
4831	Cut	6	Post hole - poss part of sequence incl [4825] and [4833]	18	*	*
4832	Fill	6	Fill of post hole [4833]	18	*	*
4833	Cut	6	Poss post hole or natural feature	18	*	*
4834	Fill	6	Fill of pit/animal disturbance [4827]	18	*	*
4835	Layer	6	Interwall deposit	17.2	*	*
4836	Layer	6	Interwall deposit	17.2	*	*
4837	Layer	6	Interface layer	19	*	*
4838	Layer	6	Interwall deposit	17.2	*	*
4839	Layer	6	Interwall deposit	17.2	*	*

Context	Type	SSD	Description	Phase	Same as	Small finds
4840	Layer	6	Interwall deposit	17.2	*	*
4841	Fill	6	Fill of poss post hole [4842]	18	*	*
4842	Cut	6	Poss post hole	18	*	*
4843	Layer	6	Interwall deposit	17.2	*	*
4844	Layer	6	Interwall deposit	17.2	*	*
4845	Layer	6	Interwall deposit	17.2	*	8525-7;8529
4846	Layer	6	Interwall deposit	17.2	*	*
4847	Layer	6	Interwall deposit	17.2	*	*
4848	Layer	6	Interwall deposit	17.2	*	*
4849	Fill	6	Fill of feature [4850]	18	*	*
4850	Cut	6	Root action,animal disturbance or poss post hole	18	*	*
4851	Fill	6	Fill of poss post hole [4852]	18	*	*
4852	Cut	6	Post hole	18	*	*
4853	Fill	6	Fill of feature [4854]	18	*	*
4854	Cut	6	Root action,animal disturbance or poss post hole	18	*	*
4855	Fill	6	Fill of feature [4856]	19	*	*
4856	Cut	6	Root action or animal disturbance	19	*	*
4857	Fill	6	Fill of pit [4858]	18	*	8524
4858	Cut	6	Pit cut	18	*	*
4859	Fill	6	Fill of feature [4860]	19	*	*
4860	Cut	6	Root action or animal disturbance	19	*	*
4861	Fill	6	Fill of post hole [4862]	19	*	*
4862	Cut	6	Poss small post hole	19	*	*
4863	Fill	6	Fill of feature [4864]	19	*	*
4864	Cut	6	Poss tree hollow or animal disturbance	19	*	*
4865	Fill	6	Fill of feature [4866]	19	*	*
4866	Cut	6	Root action or poss post hole	19	*	*
4867	Fill	6	Fill of feature [4868]	19	*	*
4868	Cut	6	Root action	19	*	*
4869	Fill	6	Fill of post hole [4870]	18	*	*
4870	Cut	6	Poss large post hole	18	*	*
4871	Fill	6	Fill of animal disturbance [4872]	18	*	*
4872	Cut	6	Animal disturbance	18	*	*

Context	Type	SSD	Description	Phase	Same as	Small finds
4873	Layer	6	Clayey deposit sampled in collapsed crater area	17.2	*	*
4874	Layer	6	Chalk layer of mound seen in collapsed crater area	17.2	*	8095
4875	Fill	6	Primary fill of poss pit [4876]	18	*	*
4876	Cut	6	Poss pit seen in collapsed crater area	18	*	*
4877	Fill	6	Fill of poss pit [4878]	18	*	*
4878	Cut	6	Poss pit seen in collapsed crater area	18	*	*
4879	Fill	6	Fill of poss pit/post hole [4880]	18	*	*
4880	Cut	6	Poss pit/post hole seen in collapsed crater area	18	*	*
4881	Fill	6	Fill of stakehole [4882]	21.1	*	*
4882	Cut	6	Stakehole seen in collapsed crater area	21.1	*	*
4883	Layer	6	Chalk layer comprising final construction of mound seen in collapsed crater area	17.2	*	*
4884	Layer	6	Topsoil seen in collapsed crater area	21.1	*	*
4885	Layer	6	Subsoil seen in collapsed crater area	21.1	*	*
4886	Fill	6	Secondary fill of poss pit [4876]	18	*	*
4887	Fill	6	Fill of stakehole [4888]	21.1	*	*
4888	Cut	6	Stakehole seen in collapsed crater area	21.1	*	*
4889	Layer	6	General finds number for finds recovered from collapsed area in crater	*	*	*
			Hillside works			
4901	Fill	7	Primary fill of [4903]	21.2	*	*
4902	Fill	7	Secondary fill of [4903]	21.2	*	*
4903	Cut	7	Large modern cut	21.2	*	*
4904	Layer	7	Chalk final phase of mound	17.2	*	8751-4
4905	Layer	7	Interface layer between chalk and topsoil	21.2	*	8755
4906	Layer	7	Topsoil	21.2	19;4801	*
4907	Layer	7	Chalk final phase of mound	17.2	*	*
4908	Layer	7	Chalk final phase of mound	17.2	*	*
4909	Layer	7	Chalk final phase of mound	17.2	*	*
4910	Layer	7	Chalk final phase of mound	17.2	*	8756-7
4911	Layer	7	Chalk final phase of mound	17.2	*	*
4912	Layer	7	Chalk final phase of mound	17.2	*	*

APPENDIX 2: SUMMARY OF SAMPLING PROGRAMME

Gill Campbell

Overall the aims and objectives of the sampling programme were met with over 500 samples taken. About 50 were taken from excavations on the summit with the rest being recovered from within the tunnel. Nearly all the phases identified were sampled except for a section in the main tunnel from Atkinson ring 47 (chalk bank 3) and the start of the West Lateral. This gap in sampling was caused by the collapse of the tunnel that began on the 23rd July 2007 which eventually led to the construction of the new tunnel by Skanksa within the old Atkinson tunnel.

Two factors lead to departure from the sampling strategy envisaged prior to fieldwork. Firstly conditions within the hill were far worse than anticipated and secondly the stratigraphy was far more complex than Atkinson's excavations suggested.

Conditions within the tunnel made sampling difficult and meant that there was a great deal more collapsed chalk and other material to scan on the conveyor belts meaning more resource was required to deal with this material.

The clayey infill encountered throughout the main tunnel caused considerable problems. While this was deliberate backfilling in the first part of the main tunnel in the later parts of the main tunnel it was almost certainly the result of water ingress and collapse of the infill of the central shaft dug in 1776, resulting in fluidity of the deposits within the centre of the hill. It was not possible to scan the clayey material on the conveyor because of its consistency. Lack of certainty about the origin of this material also made it of low research potential.

The deposits within the centre of the tunnel were also very unstable with evidence of fungal growth and much cracking. The sides of the cleaned sections of the tunnel often came away from the rest of the deposits and fell into the cleared tunnel. This meant that we regularly sampled material that had collapsed away from the tunnel sides or took samples from areas that were unstable. Given the volume of material collapsing from the tunnel sides, it was impossible to coarse sieve everything as originally planned.

This was unexpected. Photos within the Atkinson archive showed very stable sides with solid columns of deposits within the central chamber of the tunnel. Verbal accounts from those who took part in Atkinson's excavation described the deposits as compacted and very firm and said that samples had to be taken with pneumatic drills.

In reality the anticipated decay trajectory, with iron panning on the sides of the tunnel and behind it protected 'fresh' deposits did not exist. The areas affected by water ingress were rather fluid and certainly not stable. This meant that our plan of taking large diameter cores from at least two locations with the primary deposits of Silbury had to be adapted. Only the undisturbed deposits at the end of the main tunnel were considered stable enough to attempt this. However, although we tried to take a large core from the back wall of the main tunnel, this too had to be abandoned as the large diameter corer hit a sarsen stone about 15cm into the deposits.

Instead small diameter cores were taken from a number of points in the back wall of the tunnel with different cores to be worked on by different specialists. This was less than ideal but was as the best that we could do in the circumstances.

The complexity of the stratigraphy also proved a challenge. It was not possible to take duplicate samples in all cases because of the amount of material available from any one context as well as the time pressures involved in keeping delays to the conservation work to a minimum and the limit on numbers of people in the tunnel at any one time. However, it has been perfectly possible to take sub-samples for long term storage in post-excavation and a substantial research archive should be available for future generations.