NEWSLETTER OF THE ENGLISH HERITAGE RESEARCH DEPARTMENT

RESEARCH NEWS

Silbury Hill viewed, literally, from ground level. A series of reports starts with the archaeological and historical background of the Hill - page 3

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In Issue 10 of Research News we concentrate on the multidisciplinary project carried out at Silbury Hill in order to save the largest prehistoric monument in Europe from collapse.

Silbury Hill has been dug into from the 18th century, if not before. In 1776 a shaft was sunk from the top of the hill by Colonel Drax, and in 1849 Dean Merewether excavated a lateral tunnel to the centre of the mound. The Merewether tunnel was re-excavated by Professor Richard Atkinson in 1968 for the famous BBC2 archaeological television programme *Chronicle*.

In late May 2000 a hole appeared in the top of the hill as the 18th-century shaft, which had been capped but not backfilled, opened up. A further collapse in December 2000 showed that there were other voids in the hill. Seismic survey and remote photography confirmed the problem and it was decided that the best course was to re-enter the hill, clear the tunnels and voids, and backfill them fully in order to stabilise the monument. Integral to this was a full programme of archaeological investigation and recording which would be the last time that archaeologists would gain access to the interior of Silbury Hill.

The archaeological programme inside Silbury Hill took a full year and deployed novel uses of photogrammetry and geophysical techniques as well as conventional methods of recording and sampling. The archaeological work was undertaken in tandem with the clearing and stabilisation of the tunnels and neither objective could have been achieved without seamless working between archaeologists and engineers. Working conditions inside the hill were challenging, but the new archaeological information gained is transforming our understanding of the monument and its contexts.

It now appears that Silbury Hill was not raised in three clear phases, as had been thought. Instead, the evidence suggests a much more complex sequence of development. In its earlier phases the monument may have been important as an enclosure, and it seems that the mound itself was raised incrementally, being altered and added to over time with several episodes of remodelling apparent. New radiocarbon dating places the earliest phases of the mound around 2,400 BC, and the environmental data recovered promise important insights into the history of environment and landscape. Geophysical survey has revealed an extensive Roman settlement around the monument, and the original summit appears to have been reduced and flattened in the early Middle Ages to take a building or palisade.

Other work featured in this issue includes the conservation of Roman writing tablets, new understanding of a magnificent late medieval building in suburban Ruislip, the discovery of a Roman altar, and survey training to aid in the understanding of Sir Aurel Stein's Central Asian survey records.

Christopher Scull
Research Director
Research and Standards Group

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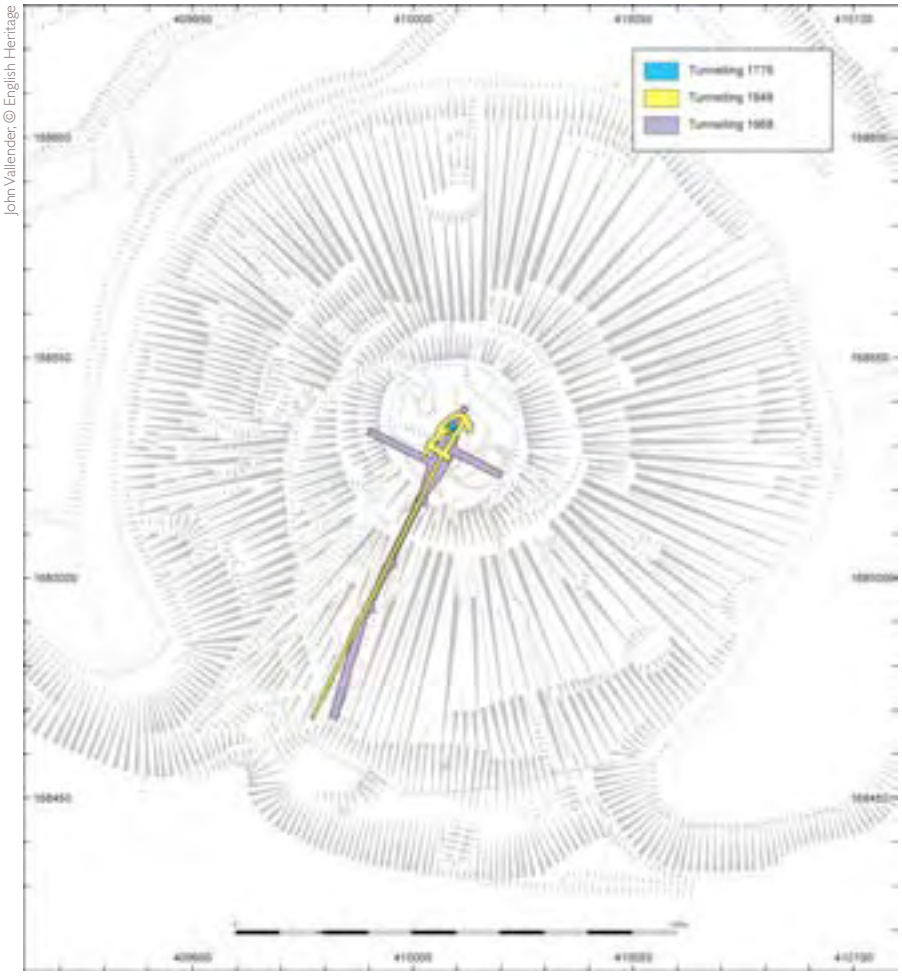
Silbury Hill: the archaeological and historical background

There are no comparable prehistoric monuments to Silbury Hill in Europe, and in size only some of the lesser pyramids in Egypt are analogous. It figures among the earliest British archaeological sites to receive mention.

Silbury Hill remains unique within Europe in terms of comparable prehistoric monuments and when considering size only some of the lesser pyramids in Egypt provide analogous material. It comes as no surprise then, that it figures amongst the earliest of archaeological sites that receive mention, first by John Leland *c.*1545 and William Camden in 1607, but principally by John Aubrey who in the presence of Charles II (and the Duke of York) climbed to the top in 1663 and brought it to the attention of a wider audience. It was Aubrey who provided the earliest illustration of the site, depicting it as a truncated conical mound set within a circular ditch and with a pathway ascending to the summit in a remarkably similar manner to that of the path today. Little is known of use of the site, however, before William Stukeley encountered the area in the 1720s and, prepared a number of birds' eye view sketches. Intrigued by it he usefully recorded the path construction and tree planting that were carried out by Richard Holford, the Lord of the Manor, during which among other things the workmen uncovered a skeleton on the summit, interpreted by Stukeley as the body of a '*great king*'.

Six intermittent interventions spanning the late 18th to 20th centuries have investigated the mound and provided the merest details of internal structure. The first of these and directly responsible for the recent work was a shaft sunk from the summit of the mound to the base, which the protagonists, the Duke of Northumberland and Colonel Drax, appear not to have backfilled. Almost identical contemporary accounts, effectively a press release, were placed in the columns of the *Bristol Journal*, *Bingley's Journal* and the *Salisbury and Winchester Journal* between 2 and 4 November 1776 to announce this. They refer to *'Silbury-Hill, the largest tumulus or artificial mound of earth in this kingdom, supposed to be of between 3 and 4000 years duration, was begun to be opened by the miners of Mendip, on Thursday last. They have made a hole at top of eight feet square. The Antiquarians promise to themselves wonders from the bowels*

The locations of the three major investigations into the monument



John Vallender © English Heritage

This photograph taken from the top of the mound shows the ditch extension or 'cistern' as it dried out revealing a remarkable vegetation mark that may indicate the presence of an unknown buried feature

David Field, © English Heritage

of this mountain! It is situated between Devizes and Marlborough'. Little is known of the results of this episode and seventeen years later, the Rev J Douglas recalled that Colonel Drax had showed him the only find from the shaft which was a thin sliver of oak.

Subsequently the mound lay undisturbed for over three quarters of a century until the Central Committee of the Archaeological Institute arranged for an investigation during 1849 in order to provide focus for its meeting that year in Salisbury. Richard Falkner of Devizes and Henry Blandford, the latter a civil engineer from Rowde nearby, experienced in the construction of cuttings and embankments for the Great Western Railway, undertook a preliminary investigation with some exploratory trenches to determine the position of the old land surface and subsequently cut a tunnel in to the centre from the periphery; where additional work was directed by John Merewether, the dean of Hereford (see Heather Sebire's article). It was this that, at least in part, was re-examined by R Atkinson with the support of the BBC in the late 1960s.

Further excavations by the Wiltshire Archaeological Society sought to establish the relationship of the Roman Road to the mound while even Flinders Petrie was intrigued and placed trenches on the lower slopes to little effect. This understandable concentration of effort on the mound itself serves to mask the fact that the site incorporates a considerable ditch and unusual ditch extension or 'cistern'. Aside from some sondages dug in 1887 by A Pass and an uncompleted section dug by R Atkinson in the 1960s, these have barely been investigated.

While initial response to the collapse of a plug or capping to the 1776 shaft concerned the conservation of the monument, the opportunity presented itself of addressing a pressing need for accurate and comprehensive data about the site and its surroundings. Thus, in addition to recording and interpreting the subtle earthwork undulations and obtaining a multitude of spot height data, survey of the site during 2001 aimed to investigate the adjacent environs and place the site within its spatial and chronological context. The data, incorporating some 10,000 survey grade GPS readings taken from the mound alone, supported a compilation of both hachured and contour plans, along with a series of digital terrain models that allowed analysis and interpretation of the surface features.

Data revealed that the diameter of the mound, although variable, is generally around 150m. Similarly the height differs according to the fall of the original natural ground surface, but borehole readings confirm that close to the centre of the mound it is close to 31m. Preparation of a contour plan soon revealed that the structure is not circular. Instead its form appears to be dictated by a series of radial spines or spokes that disrupt the general curvature leaving a nine sided figure that, since the summit is sub-rectangular,

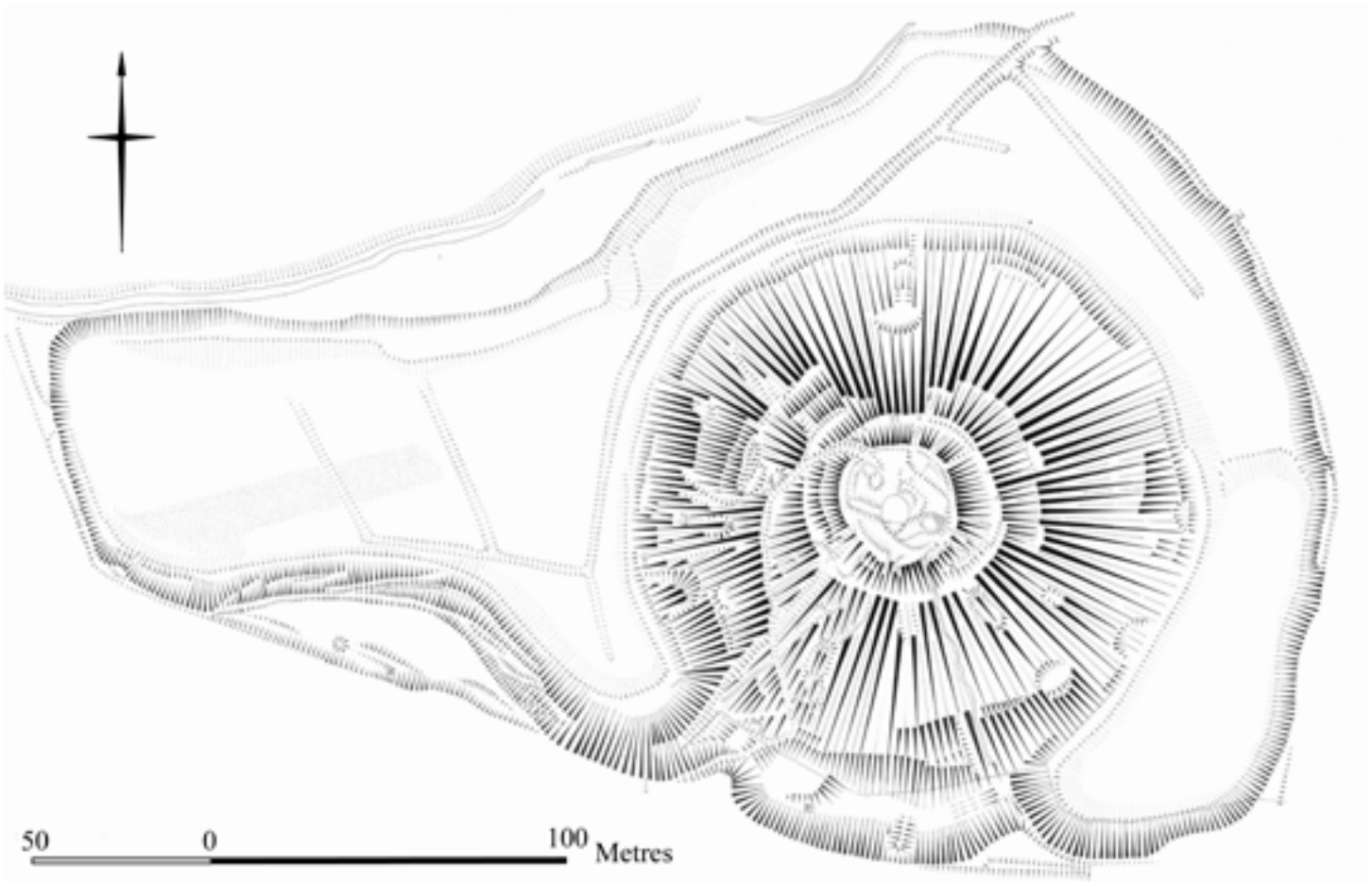
appears to have been modified according to height. The south-western slope of the mound, opposite the ditch terminal, appears to have material missing as the circumference here is concave rather than convex, the profile is more hollowed, and the angle of slope steeper. If this is the result of an earlier outward collapse of material there is no sign of the resulting spoil at the foot of the mound or in the present ditch. However, in his account of ditch trenching, Pass noted the presence of an accumulation of sarsen located in the ditch terminal at this point and it is conceivable that this accrued as a result of an early mound collapse.

It has often been considered that the material of the mound was obtained from the ditches and the models provided an opportunity of testing this by comparing respective volumes. The results provided a relatively close correlation, the mound measuring 239,133 cubic m and the ditch and its extension 235,522, the difference a mere 3,610 cubic m.

Earthworks that survive on the summit are difficult to interpret, principally because of the lengthy and varied activity known to have taken place during historic times, not least the effects of the paraphernalia of excavations in 1776 and the late 1960s. The collapsed shaft lay almost centrally, but a considerable 7m diameter circular hollow could represent the burial place of the skeleton referred to by Stukeley. Traces of horizontal terraces, platforms or breaks of slope occur at various points around the slopes, all thought by Atkinson to be remnants of a tiered construction. If perambulated, however, the upper ledge finishes its circuit at a position below the starting point and implies that in fact these formed a spiral arrangement. It is unclear whether this continues to the base of the mound or is simply restricted to the upper levels. Equally, it is by no means clear whether they are a result of the original construction, or of later redevelopment. Nevertheless, the model of tiered construction proposed by Atkinson may need to be modified.

Finally, it is important to emphasise that Silbury Hill, as seen, is the product of 4000 years of erosion and reconstruction, and the undulations engraved on its slopes represent the effects of this activity.

David Field



The hachured plan depicting slopes and surface undulations on and around Silbury Hill using traditional cartographic conventions

SILBURY HILL

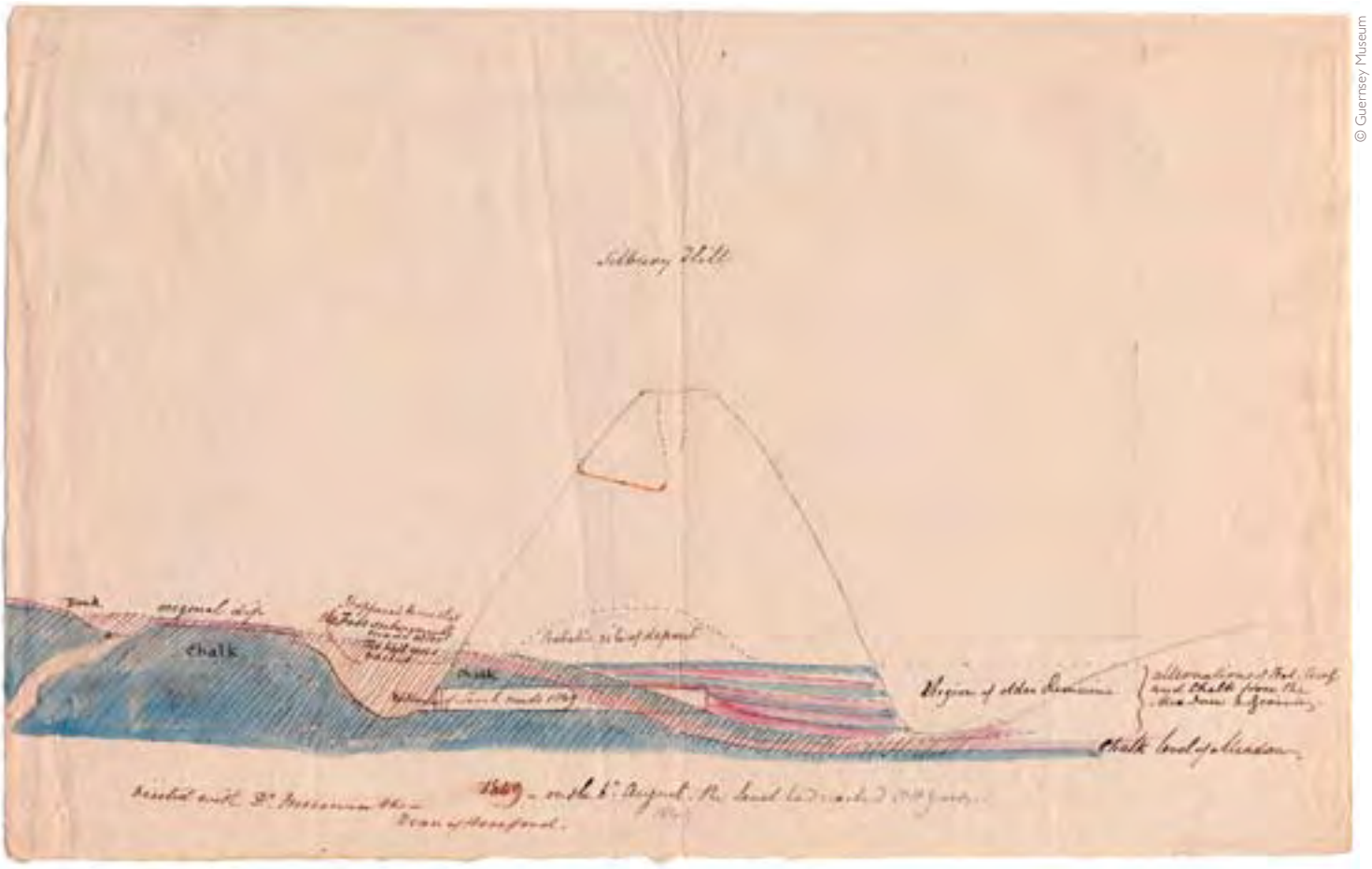
Early recording at Silbury Hill

One of the most important antiquarian observations of Silbury was by William Lukis, whose section drawing of early tunnels was a help to the modern project.

William Collings Lukis (1817-1892) was the third son of antiquary Frederick Corbin Lukis from Guernsey, Channel Islands. He attended Trinity College, Cambridge, from 1837 to 1840 after which he took orders in 1841 with livings in Wiltshire and later at Wath in Yorkshire where he lived until his death in 1892. He married Lucy, daughter of Admiral Sir Thomas Fellowes, in 1851 and they had nine children, four boys and five girls. He was one of the founding members of the Wiltshire Archaeological Society in 1853, and was its joint secretary until 1867. He was also a member of many British and French learned societies and was elected to the Society of Antiquaries of London and the Society of Northern Antiquities of Denmark. He wrote at length on archaeology, but also on church bells and plate.

During his time at Cambridge he met Henry Dryden and began a friendship that was to last throughout their lifetimes. Dryden was the fourth baronet of Canons Ashby, Northamptonshire, and was a superb draughtsman and surveyor. During the summer months the pair visited, examined and recorded all the major prehistoric monuments known at the time in various parts of the country as far apart

William Lukis' section of Silbury Hill



as Aberdeenshire and Wiltshire, Anglesey and Kent. They also visited Brittany and the Netherlands. Between them they made survey drawings of great accuracy and skill. Some of these excursions were funded by the Society of Antiquaries of London to whom they reported back periodically. Hundreds of William Lukis's plans, sections and elevations of megalithic monuments in Scotland, England, Wales, Ireland, France, Algeria and the Netherlands survive in the collections of Guernsey Museum. The remainder of the Lukis and Dryden archive is housed variously at the Society of Antiquaries of London, the Department of Antiquities at the Ashmolean Museum in Oxford and Northampton Central Library. The Lukis and Dryden plans are very detailed and the level of accuracy can be demonstrated by comparison with plans drawn up with modern equipment. They were drawn to a standard format; stones in horizontal and vertical section were tinted pink, stones in elevation in grey and fallen stones in buff. In 1880 a proposal was put to the Society of Antiquaries of London to publish all Lukis and Dryden's plans of megaliths and a brochure was circulated to invite subscriptions. Unfortunately only some were published, hampered at the time by a serious fire at the printers. The plans are of great value to modern scholars as they show where stones and other features have been moved or lost since the 1880s.

Within the archive at Guernsey Museum are several of William Lukis's bound notebooks. One of these has a section labelled 'Wiltshire', with what appears to be 50 pages missing, which would have been crucial to the story of Silbury Hill. One of the more interesting of these drawings that has recently come to light during cataloguing of the Lukis archive at Guernsey Museum is a section through Silbury Hill drawn in 1849.

The Silbury image is a useful example of how an antiquarian drawing can inform modern research. In 1849 John Merewether, Dean of Hereford, examined Silbury Hill (See Dave Field's article) and William Lukis visited on the last Monday of the excavations. On 6 August Lukis drew a section through Silbury Hill to record the progress that had been made. The drawing is also tantalising because it records the 1776 intervention at the top, (which is now partially confused by a paperclip stain from the drawing's early storage). However the legend is worth recording.

Entrance of level made 1849
Visited with Dr Merewether Dean of Hereford on the 6th August.
It appeared to me that the foss made subsequently after the hill was raised.
Road
Original dip
The level had reached 66 yards
Region of older remains
Alternations of peat turf and chalk from the meadow adjoining
Chalk level of meadow

The section is an important piece of historical evidence and was particularly pertinent when English Heritage started the current programme of work on the monument after subsidence having been noted in the area where Colonel Drax had made his intervention. There is no other evidence of contact between Lukis and Merewether in the archive held in Guernsey Museum, although it is possible that it might exist elsewhere. It is very likely that they knew each other through the Wiltshire Archaeological and Natural History Society and also that William Lukis's reputation as an excellent draughtsman and recorder of monuments was growing by 1849.

I am grateful to the director of Guernsey Museum for permission to publish the Silbury drawing from the Lukis collection, and to Paul le Tissier for his help with reproduction.

Heather Sebire

William Collings Lukis (1817-1892)

SILBURY HILL

The conservation project at Silbury Hill 2000-2008

Silbury was a quiet monument until, one day in 2000, everything changed…

Part of the Stonehenge, Avebury and Associated Sites World Heritage Site, the unmistakeable profile and sheer scale of Silbury Hill make it instantly recognisable. Although its original purpose remains obscure, there is no doubting the skill and effort that went into its construction, which is why it is recognised by UNESCO as a "masterpiece of human creative genius".

I had been the English Heritage Inspector of Ancient Monuments for Wiltshire since the early 1990s, but despite its importance, Silbury was a "quiet" monument – not really needing very much attention, no real repair or conservation work in the way that castles and abbeys did. It rarely crossed my radar; the most that needed to be done was to ensure it was grazed correctly, that burrowing animals were controlled, that the vegetation cover remained good (Silbury Hill is a Site of Special Scientific Interest for its rare and fragile chalk grassland) and that any erosion scars were repaired swiftly.

The 1776 shaft after it had opened up in 2000

Fachtna McAvoy © English Heritage

Moreover, the day-to-day management of the monument (along with others in the World Heritage Site) had been devolved by English Heritage to the National Trust. Indeed, the condition survey of the monument in the late 1990s had indicated that a scar caused by bonfires at the top of the mound was the only real cause for concern.

How wrong we all were. On Tuesday morning, May 30th 2000, I arrived at the office to be greeted by my manager who informed me that a hole had apparently opened up at Silbury Hill and that somebody ought to attend to this immediately (noting however that it was probably a false alarm as such reports often are). I drove out and met with the National Trust's Property Manager, Chris Gingell. Together we climbed to the top of the Hill and looked in disbelief down a deep shaft sited in the middle of the flat platform which forms the hilltop. It was immediately apparent that what had opened up was Colonel Drax's mineshaft dug in 1776.

Although there is no public access to the Hill, animals and others could have become seriously injured by a fall down the shaft; it was obvious that urgent action was needed and that this was going to be a major project. Air photographs were organised that day, along with engineering advice. The following day, a scaffolding cover designed by the engineers was erected over a large part of the hilltop, sloping gently so as to shed water away from the hole. A project was initiated to design a safe and effective method of backfilling the shaft, along with a suitable level of archaeological recording.

Staff within English Heritage and the National Trust were extremely surprised at the re-opening of the shaft, as we had all thought it had been completely backfilled. However, as part of the work on the backfilling project, archival research was undertaken, and this

Fachtna McAvoy, © English Heritage

The crown hole was temporarily backfilled with polystyrene blocks in August 2001 before being covered with a layer of chalk

showed that the Drax shaft had re-opened from the top on many occasions before, most recently in the 1920s, as air photographs clearly showed. It became obvious that it had only been capped and not properly backfilled. Further to this research showed that the later 1849 tunnel (see Dave Field's article) had not been properly backfilled either.

We were just completing the design for backfilling the shaft, when disaster stuck in December 2000. The shaft at the top of the hill opened into a wide crater or crown hole. It was obvious that the material had gone somewhere deep within the Hill and that there must be more voids within it. We commissioned a seismic tomography survey of the inside of the Hill from Cementation Skanska, to see if this would reveal these voids and their locations. Although the survey revealed that the Hill was broadly stable, most worryingly, we discovered that the Atkinson tunnel had not been properly backfilled either (we discovered this by drilling a small diameter core into the Hill and dropping a camera down into it). It was apparent then that not only did we have a hole at the top of the Hill, but we also had voids within it as well.

The conservation project had to be completely redesigned. The crown hole was temporarily backfilled in August 2001 with polystyrene blocks covered with a layer of chalk (polystyrene was chosen as we knew there were instabilities within the Hill, and we did not want to place heavy chalk onto areas of instability). A variety of methods were proposed to backfill the holes, of which two main options emerged. The first was to drill a variety of cores into the Hill and pump chalk slurry into them, rather like grouting. The slurry would backfill all the voids. The second was to re-enter the Hill, remove what backfill there was from the tunnels, and then backfill them and all other voids encountered - properly. These two options were debated at two seminars in Devizes, to which interested parties were invited. Eventually, the latter method was chosen, mainly because it would be possible to ensure the voids were properly backfilled, whereas the "remote" method of backfilling made it difficult to guarantee this. Another factor in the decision was that the latter method would allow a greater degree of archaeological recording. This was important, as the three previous major interventions, including Atkinson's in 1968-9, had left very inadequate archaeological records of the work done.

The resulting research opportunities provided by the backfilling project 2007-8 were fully seized by the English Heritage archaeological team (see both Tom Cromwell's and Jim Leary's articles). The level of damage within the Hill, and the extent of the voiding within it – far greater than predicted – meant that the method chosen was certainly the right one. It also allowed for far greater level of archaeological recording than was originally envisaged. At last, Silbury Hill, that "masterpiece of human creative genius", has had a research programme undertaken commensurate with its importance. We all look forward to the publications which derive from this conservation project, and welcome the fact that once again, the Hill is stable, and conserved for present and future generations.

Amanda Chadburn

Amanda Chadburn at the launch of the Silbury Hill conservation project, May 2007, with Richard Atkinson's tunnel door opened to reveal the backfilling

© English Heritage

SILBURY HILL

Geophysical survey in the shadow of the Hill

Geophysical survey has been an integral part of the Silbury project, informing each step of its development.

The involvement of the geophysical survey team at Silbury began on the summit of the hill in February 2001, following the initial collapse of the Colonel Drax tunnel during the previous summer. Little did we know, as we braved the wind driven sleet, how far beyond and even inside the very heart of the hill our geophysical survey would eventually reach. The ongoing deterioration of the monument soon overtook the results of the initial surveys and it became evident that an engineering solution on a larger scale would be required.

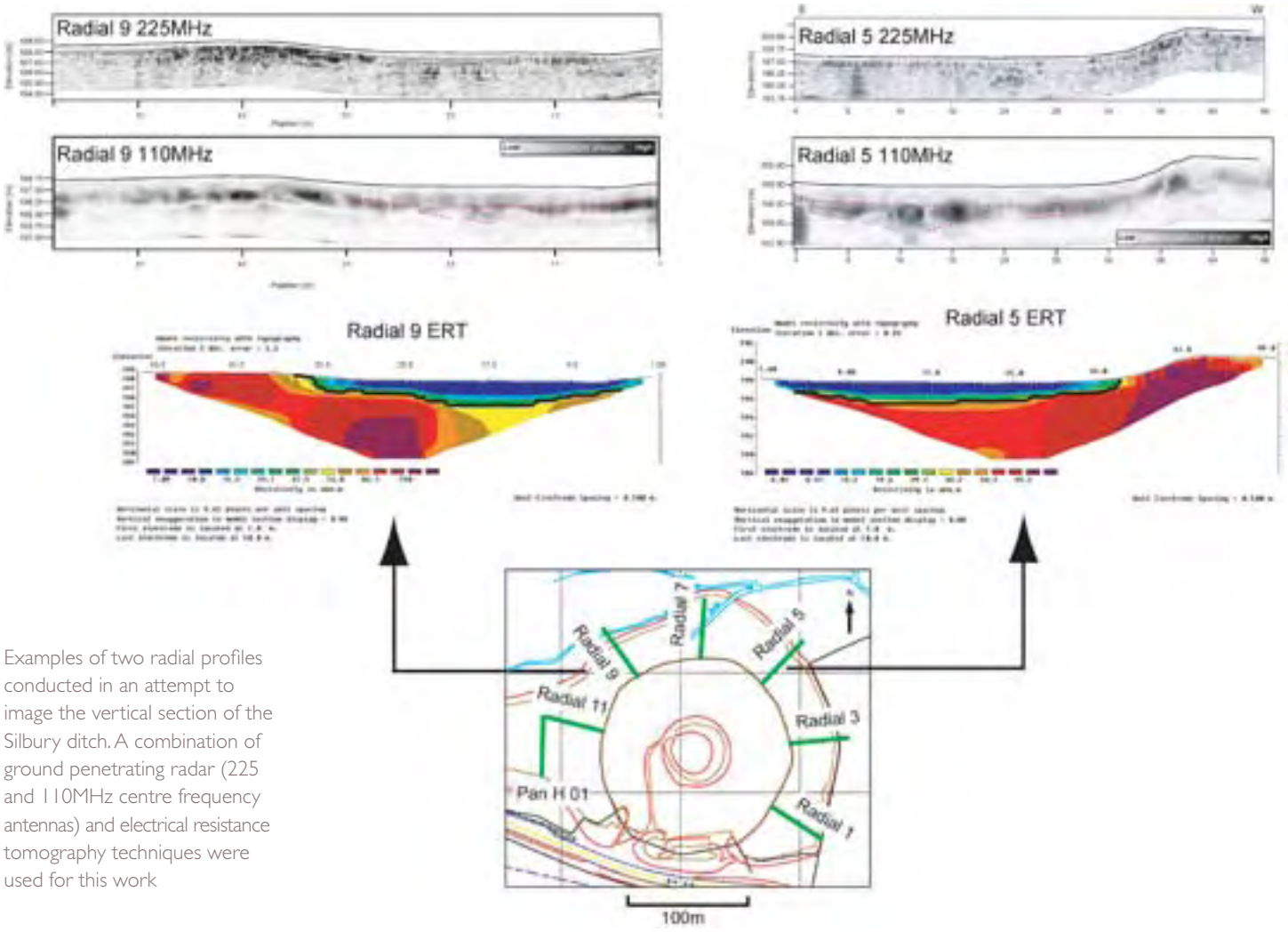
Prior to the excavation and stabilisation works a geophysical survey was undertaken of the proposed site compound area to avoid damaging any potential archaeological remains in the area. Whilst good crop mark evidence has been reported from the slopes of Waden Hill, supported also by the discovery of significant Roman occupation through both limited geophysical survey and excavation along the course of a sewer pipeline, little was known about the immediate environs of Silbury on the floodplain to the west of the Kennet. The geological setting and abrupt truncation of the crop marks suggested that considerable deposits of alluvium may be masking any underlying archaeological remains. In an attempt to peer through the alluvium we conducted a survey of the area between Silbury Hill and the present course of the Kennet using our most sensitive caesium vapour magnetometer array. Despite the difficult field conditions we were rewarded by the first in a series of unexpected geophysical results.

Geophysical survey in progress over the floodplain to the east of Silbury Hill using the EH cart mounted caesium magnetometer array

Results from the magnetic survey in vicinity of Silbury Hill to date. The original survey, conducted to the east of the hill up to the banks of the Kennet, soon expanded to surround the entire monument and subsequently revealed the unexpected Roman settlement to the south of the A4

This initial caesium survey revealed both the presence of extremely subtle ditch type anomalies extending from the crop mark evidence under the alluvium and also a series of presumably Romano-British enclosures on the slightly raised ground abutting the edge of the Silbury ditch. A comparison with fluxgate gradiometers over the most heavily alluviated area demonstrated the advantage of the higher sensitivity caesium system and the magnetic survey was then extended around the whole of the monument. In addition, some trial areas of earth resistance survey were conducted to determine whether any buildings remains may be present.

We also focused our attention on the ditch surrounding the hill in an attempt to profile the original section, now heavily obscured by the in-fill of alluvium. A series of profiles were selected through the ditch around the hill and two geophysical techniques: electrical resistance tomography (ERT) and ground penetrating radar (GPR) were



Examples of two radial profiles conducted in an attempt to image the vertical section of the Silbury ditch. A combination of ground penetrating radar (225 and 110MHz centre frequency antennas) and electrical resistance tomography techniques were used for this work

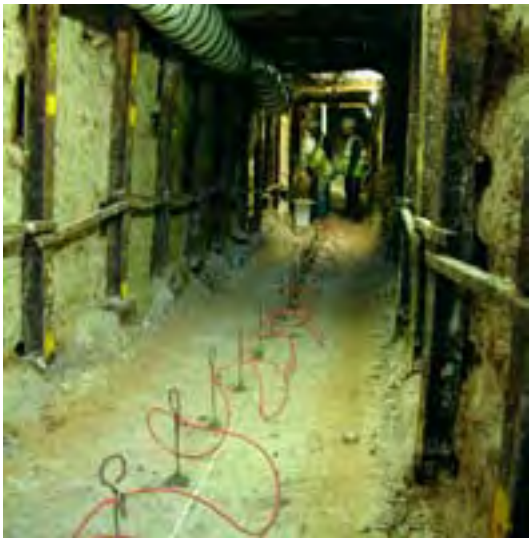
applied. Both ERT and GPR offer the advantage of providing depth information, although the high conductivity of the ditch fill required the use of a low centre frequency GPR antenna to obtain a sufficient depth of penetration. The results from this work were not entirely clear cut, although the ERT appeared to image the higher conductivity, near surface ditch fills and the low frequency GPR apparently revealed the interface between the profile of the ditch and the underlying chalk.

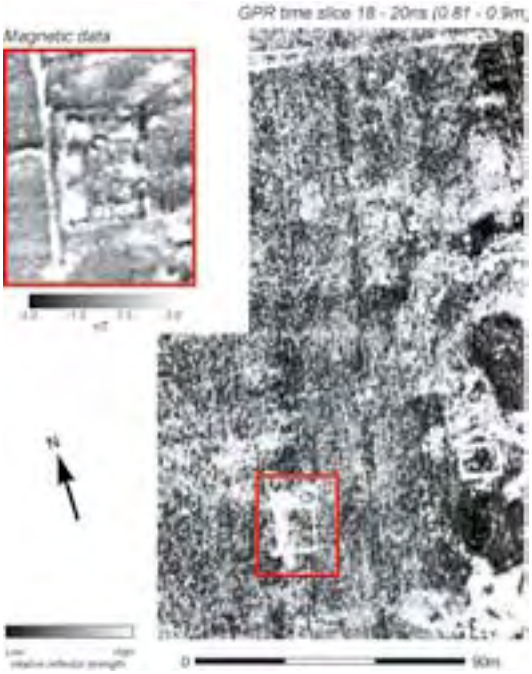
ERT and GPR were also put to use during the initial stages of the excavation in an attempt to profile the ditch or pit type feature recorded by Atkinson close to the entrance of the tunnel. This unique environment provided a new set of challenges for our geophysical equipment, particularly the compacted chalk floor of the tunnel where it would be impossible to insert the steel electrodes required by the ERT array to inject an electric current source into the ground. The solution, that certainly seemed to amuse the excavation team, was bentonite clay a uniquely absorbent material more commonly used in the production of cat litter! By placing each of the electrodes in a ball of saturated bentonite the contact resistance was reduced to allow the resistance of the underlying feature to be imaged.

Not all of the secrets of the Silbury landscape had yet been revealed. We had always intended to extend the magnetic survey to the south of the A4 and duly returned to the site in October 2006, when we could gain access to the main arable field in this area. There was no indication of any significant archaeological activity in this area beyond the known course of the Roman road and three features, interpreted as ritual wells, thought to be of the same date. Of greater geophysical concern was the large, ferrous pipeline that runs to the south of the A4 in this area as the response from this would almost certainly mask any subtle archaeological anomalies within the data. The terrain in this field is also quite challenging and that, together with the expectation of mapping only the course of a modern pipeline, made pushing the caesium magnetometer cart an even greater burden than usual.

Facing page, top left: The array of ERT electrodes running along the floor of the re-excavated Atkinson tunnel. Each steel electrode is bedded onto the chalk through a ball of saturated bentonite clay to reduce contact resistance

Bottom left: Amplitude time slice from the GPR survey showing strong reflections (white) from the remains of masonry buildings at a depth of approximately 0.81m. An extract from the caesium magnetometer data over one of the buildings is also shown and suggests the presence of thermoremanent features, for example a hypocaust heating system





The data close to the road was indeed dominated by the response of the pipeline, but emerging from the shadow of this magnetic disturbance was a more subtle network of ditch-type anomalies. These ditches appeared to form a Roman ladder style settlement running along the bottom of the slope, which we gradually revealed as the survey coverage progressed south to the Swallowhead springs. Further scrutiny of the magnetic data revealed additional detail and suggested a quite substantial settlement, including the presence of large masonry buildings confirmed through a subsequent large scale GPR survey of this field.

During further visits we investigated the water meadow immediately east of the newly discovered Roman settlement. The results from this area were exciting and thoroughly perplexing in equal measure. Whilst the lower lying areas of the meadow revealed little beyond a network of ceramic field drains, a slightly raised plateau visible in the lidar data produced an extraordinary pattern of rectilinear magnetic anomalies, suggesting the remains of deliberate occupation activity. Subsequent limited earth resistance survey of this area revealed an intermittent, high resistance response following the ditch around the base of the plateau. Each of these discrete high resistance anomalies appear to have dimensions similar to many of the sarsen stones found in this area, for example the stepping stones to cross the Kennet in the south of this field to gain access to Swallowhead. We are currently scratching our heads trying to think of a plausible interpretation, so answers on a postcard please…

Neil Linford

Above: Trial earth resistance survey over the raised ground in the water meadow showing the unusual geophysical anomalies encountered in this area

SILBURY HILL

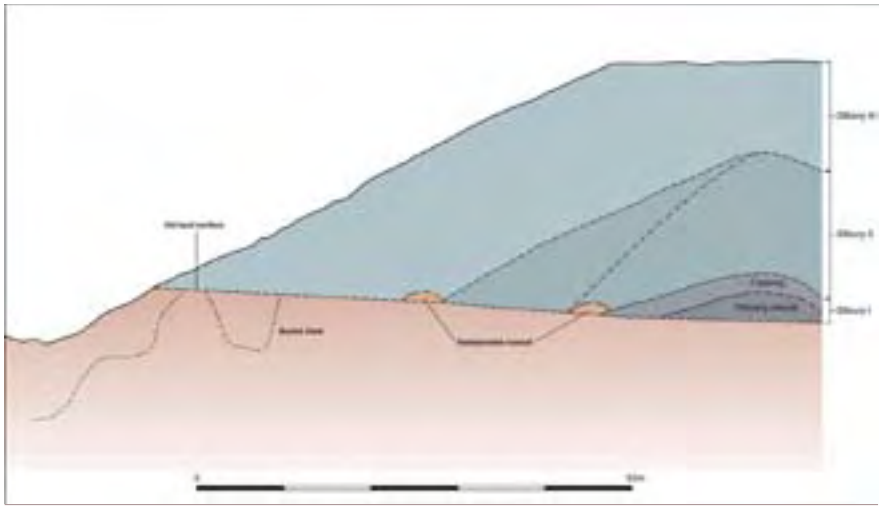
The Silbury sequence: seeing past tunnel vision

Silbury Hill: '*Green pyramid of the plains. From far-ebbed time,*' has always been one of the most intriguing sights in Wiltshire's landscape; its enigmatic origins inspiring poets to conjure images of a monument which '*in some remote and dateless day, rear'd over a Chieftain of the Age of Hills.*' (Robert Southey, 1774-1843).

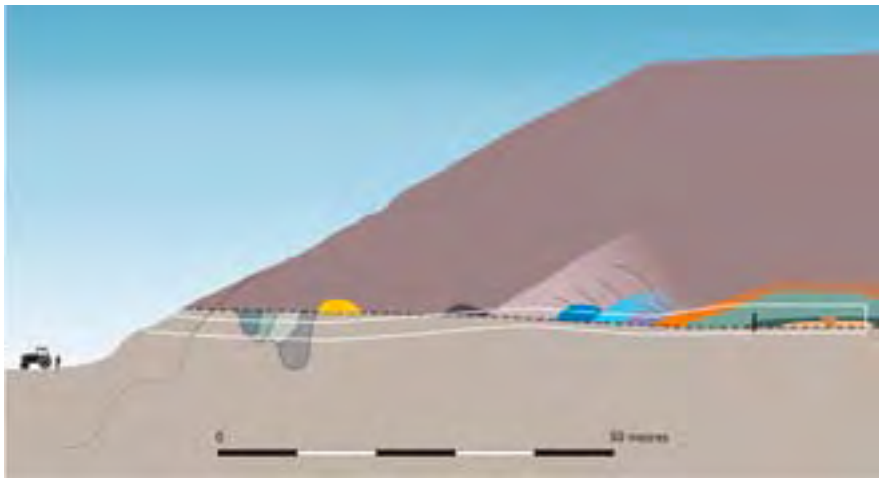
As we have seen from Dave Field's article, the mystery of the hill instigated a series of antiquarian and archaeological investigations seeking both treasure and answers, beginning in 1776 and ending in 1970. Sitting on the floor of the Kennet valley at the very head of the River Kennet, Silbury Hill is today no less intriguing.

Top: Atkinson's three phases of Silbury Hill

Bottom: Simplified section diagram to show the new phasing of Silbury Hill



John Vallender, © English Heritage



John Vallender, © English Heritage

Following the discovery that the tunnels inside Silbury had not been fully backfilled, the only practical solution, one that was not taken lightly, was to re-open Atkinson's tunnel for the first time since it was closed in 1970, and fill all the known voids to prevent further damage to the hill. Opening the tunnel meant that archaeologists were able to record in detail (and possibly for the last time) the various phases of Silbury. Atkinson's work in the 1960s identified three main construction phases to the hill. We now have at least 15 Neolithic phases, showing Atkinson's model to be overly simplistic. The mound can be seen to grow through many small events, rather than three grand statements, and, no doubt, if we had seen more than just a narrow strip in the tunnel sides we would have recorded many hundreds of phases.

Work began in May 2007 and finished in May 2008; a year almost to the day later. Working both on and in a hill was no minor undertaking and a number of both interesting and novel logistical problems were posed throughout the project.

Running at waist height throughout the majority of the tunnel sides, and directly overlying the natural geology, is the old ground surface; the surface that the Neolithic folk walked on, and as far as we can see this extends under the entire mound. This Old Ground Surface has been a source of much discussion amongst soil scientists, and it is the subject of on-going tests, however it would appear on current evidence that it is a truncated soil horizon, implying that before monument construction even began, people

Working both on and in a large hill provided a number of unusual challenges

had prepared the ground by removing the turf and topsoil.

Overlying the old ground surface in the very centre of the mound is the first Silbury Hill: a low, fairly unimpressive, mound, just less than a metre high and nearly 10 metres in diameter. It was formed of gravels that would have been quarried from under ground or found exposed in a river valley, for example the side of the River Kennet. Either way they were clearly very deliberately chosen, imported and used here. A series of organic layers, possibly edged by stakes, were then piled up over the top, making it a slightly larger mound (just over a metre in height, and over 16 metres in diameter), although it would have still been relatively inconspicuous in the landscape.

A few metres away from this central mound we found two further, much smaller, mounds. These mounds stand only half a metre high however were clearly purposefully constructed and even added to and modified. They comprise organic layers, including turfs, and one is even separated from the main mound by a small, interrupted gully. Therefore the earliest phases of Silbury Hill do not simply consist of one mound but of a number of mounds. Building work then stopped for a short while, and we know this because two pits had been cut into this phase of the mound. These were about half a metre deep and a metre in diameter.

Mound building continued and the pits and earlier mounds became sealed under a series of layers of different local material – chalk, clay, topsoil as well as turf, all piled up to form a mound a few metres high, and seen in the photograph of the end of the tunnel. Also included within this stage were a number of rounded 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.

The northern tip of the primary gravel mound. This was overlain by organic deposits forming the next, and slightly larger, mound

One of the Neolithic pits recorded in the tunnel, cut into the primary mound

Dave Fellows, © English Heritage

This was then added to by at least 5 chalk, or chalk and clay, banks. The chalk for these banks is likely to have been quarried from a surrounding ditch – a ditch which later became sealed by the final phases of the mound. In a void above the tunnel, a bank on the inside of this ditch was also recorded (the ditch is shown in dark grey in the new phasing diagram, and the bank in yellow). A complete section through this ditch was excavated, which showed that it is large; over 6.5m deep and at least 6m in width. The reconstruction drawing shown shows the first of the banks piled around the organic mound, and the ditch already open and in use. What this reconstruction drawing wonderfully highlights is just how important the ditch and internal bank are; it suggests that we should really think of these 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.

The end face of the tunnel provides a good section through the interleaved lenses of different material, presumably basket loads of material, that form a much larger mound

Duncan Stirk, © English Heritage

Activity at the site continued, however the tunnel dips down through these later phases of activity, below the Neolithic ground level, and we no longer see the mound in the tunnel sides. What I am sure of, however, is that it is not simply one single, homogenous phase, but a series of complex phases; the mound growing in size incrementally. And I think we can see this happening in the buried ditch section: 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 three 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.

Atkinson excavated a large trench on the summit of Silbury in 1970 and recorded a series of enigmatic curvilinear chalk walls. These he interpreted as being part of the construction of the final phase of the hill; however subsequent interpretations have placed them within a later period. Therefore, in 2007 we opened up a small trench alongside Atkinson's trench to better understand these features. We picked up the chalk walls he had recorded, and they are undoubtedly part of the Neolithic mound, indeed it seems to be a distinctive construction technique – finer deposits laid horizontally and revetted by larger chalk rubble, which effectively forms a crude dry stone wall.

A series of postholes were recorded directly cutting these Neolithic deposits – one of

Judith Dobie, © English Heritage

Judith Dobie's reconstruction drawing of the Silbury enclosure

which was very large and contained a few small fragments of pottery of a much later date, possibly medieval. This suggests that later in the history of Silbury a large building or palisade was erected on the summit. The lack of later deposits in the excavation trench combined with the truncated appearance of the prehistoric deposits, suggests that the hill may well have been decapitated during this phase of work.

A handful of new radiocarbon samples have been processed from our work at Silbury (although many more are planned for the coming year). These dates show that at least the early phases of the mound were constructed around 2400 BC. At the moment the final phase is more problematic and we have two models for it: one shows that it was also constructed around 2400 BC – the other that it was later – around 2000 BC. The date 2400 BC is of course a crucial one. We know that the earliest dated Beaker pottery arrived in this country around 2400 BC. With Beaker pottery came a whole new ideology and, significantly, metal. Silbury, in other words, was built on the eve of the Bronze Age; a period, surely, of profound change.

With the tunnel now backfilled and the monument stabilised, the difficult task of understanding what we recorded has only just begun. As with any site of this size, the really great discoveries do not only happen on site; they also happen during the post-excavation work. Over the next two years we will no doubt make many more great discoveries.

Jim Leary

Jim Leary © English Heritage

One of the chalk walls on the summit

SILBURY HILL

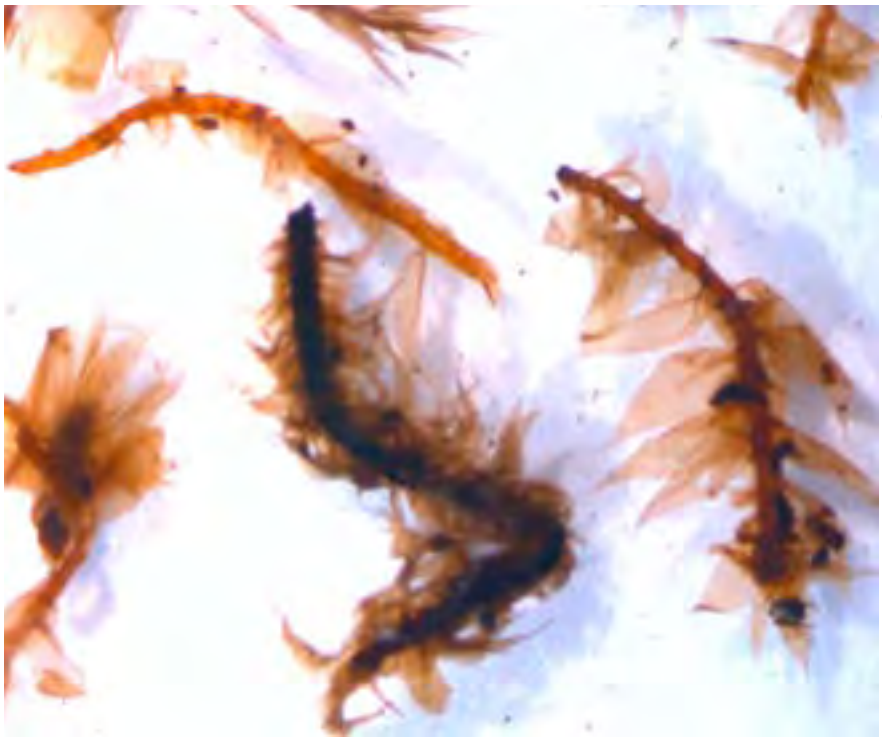
Sampling Silbury

The Silbury project has allowed an extensive programme of environmental sampling. A wealth of new information has come from the unrivalled preservation conditions.

The preservation of delicate biological remains at the centre of Silbury Hill has long been the stuff of legend and a source of fascination to environmental archaeologists. John Merewether was the first to describe the turf heap at the centre of the mound noting the presence of preserved moss, pieces of small branch and insects, especially beetles during his excavations. With Professor Atkinson's excavations, which took place when environmental archaeology was just emerging as a discipline, came the first opportunity to investigate these remains in detail.

This environmental research was exemplary for its time, but subsequent interpretations of the data were hampered because the locations of the samples were largely unknown or too vague to be of much use. The remedial works in 2007 and 2008 thus provided a unique opportunity to obtain further samples for current and future research and to apply new scientific techniques to the study of this unparalleled archaeology.

Moss fragments recovered from a turf in the lower organic layer at the centre of the Hill



Gill Campbell © English Heritage

But why all the fuss? What is so special about the environmental remains from Silbury? After all we have plenty of evidence of what the Neolithic landscape was like from the analysis of pollen and land molluscs, and we know that monuments of all kinds were often built from turves. The key lies in what has been preserved.

A combination of anoxia (oxygen depletion) as well as the protection, and in particular the compression afforded by the 'the enormous weight of the mound' [Evans 1972, *Land Snails in Archaeology)*:267] has lead to many biological remains being preserved in pristine condition in the centre of the Hill despite being nearly four and half thousand years old. Snail shells still retain their protein coats, as if they had been buried yesterday, and some insects remain just as they were, squashed by material being dumped on top of them. This is not the kind of preservation that is encountered in your average barrow.

At the same time the habitats from which the turves come are not the wetland environments found preserved in bogs, peat and lakesides, but rather the remains of individual pieces of Neolithic grassland. Furthermore, there is clear evidence for species-rich grazed chalk grassland, a habitat whose antiquity has long been debated, and which is maintained through human agency.

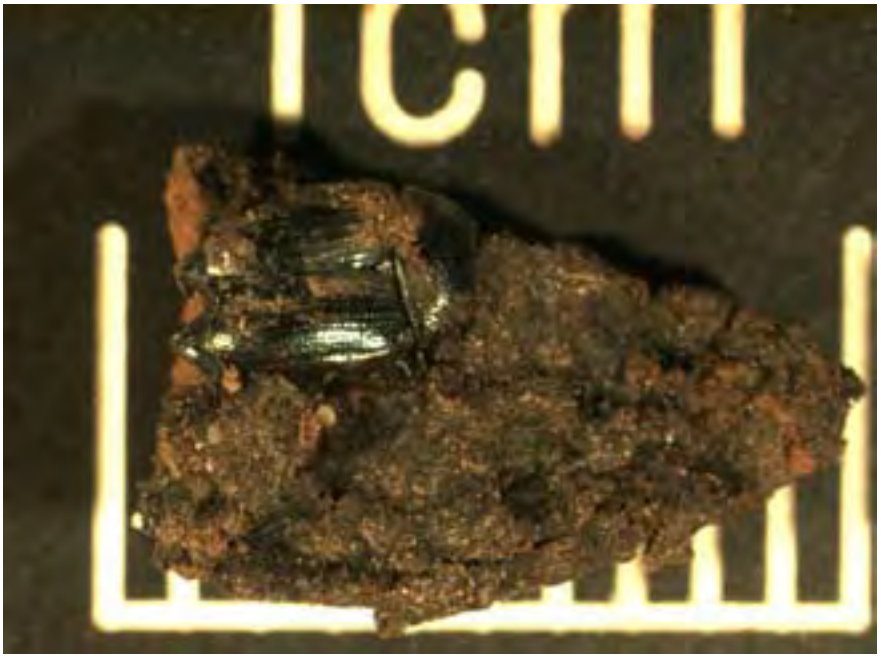
In addition to the remains of grassland, previous research hinted at the presence of other habitats, in particular woodland, disturbed ground, and wetland. Therefore the sampling programme for the remedial work was aimed at sampling all the types of deposits encountered and to answer specific research questions. For example, whether there were significant differences between what was growing on the old ground surface prior to construction of the mound and the vegetation represented by the turves and whether the turves were all cut from the same type of habitat, which might help

establish whether they all came from the same area of from different areas within the landscape.

We also wanted to establish whether there was any evidence for truncation to the old land surface prior to the construction of various phases of the mound and learn more about the types of material used in construction. In addition, there was a clear need to try to refine the date for the inception and subsequent enlargement of Silbury Hill and recover evidence concerning the builders of the Hill, e.g. the types of activity carried out at the site. It was also important to look at how the various interventions into the Hill had affected the preservation of the remains, such as the extent to which decay /oxidation had penetrated into the tunnel sides.

In the event, we took around 450 samples from deposits recorded in the tunnel sides as part of the conservation project. Another 50 samples were retrieved from the investigations that took place on the summit and on the slope of the Hill by the tunnel entrance. As well as sampling for a variety of biological remains, artefacts and for geoarchaeological investigations, samples were recovered for optically stimulated luminescence dating, environmental magnetism, uranium series dating, microbiological assessment and preservation studies. We also scanned the chalk mound deposits that had collapsed into existing tunnels on a conveyor belt, in order to maximise the recovery of artefacts and other material.

Very few artefacts were recovered from any of the prehistoric contexts and there was no evidence for bonfires or the discarding of food waste. The ditch fills were devoid of material as were the various bank and mound deposits apart from the occasional worked flint and antler. While we have only examined a very tiny proportion of the Hill this suggests that the act of building the mound was undertaken outside and deliberately separated from everyday activities and that the site was kept clean.



Gill Campbell, © English Heritage

A squashed leaf beetle on the surface of a turf. This beetle (*Chaetocnema concinna*) feeds on docks (*Rumex* spp.)and bisorts (*Polygonum* spp.)

Brian Kerr, © English Heritage

Scanning chalk for finds using the conveyor belt

Clockwise from top left: Antler fragment being excavated from interwall deposits on the summit of the Hill

The old ground surface being sampled at Bay 39

Smaller mound recorded at the end of the east lateral

Tony Baxter, © English Heritage

© English Heritage

Matt Canti, © English Heritage

The old ground surface, which exists as a grey clayey layer developed from the clay with flints on which the Hill was built, was extensively sampled. Our work to date indicates that this surface has been truncated. The layer is too thin to represent a fully intact soil even taking into consideration the loss of vegetable matter and the compaction that would result from the considerable overburden. The surface also seems to have undergone some from of modification, possibly as a result of trampling by humans or animals. We are currently undertaking an experimental project to test this hypothesis.

The organic layers within the central mound contained turves as well as a mixture top soil and subsoil. At least two different parent materials were present: clay with flints and chalk. The former is more prevalent in the lower organic layers whereas rendsina turves and chalk rubble were typical of the upper organic layers. The pits seem to have been back-filled with turf and top soil. Grassland habitats are indicated by these deposits with evidence in some samples of battered and worn snails and fragmentary seeds of plants such as dog's mercury (*Mercurialis perennis*) suggesting that these grasslands have developed following woodland clearance within a relatively short timeframe.

The material recovered from the one of the smaller mounds was rather different. Fresh plant remains typical of woodland or scrub were recorded including yew berries (*Taxus baccata*), sloe fruit stones (*Prunus spinosa*), and uncharred hazel nutshell fragments (*Corylus avellana*). The few well preserved snails present were also shade loving species. In addition to this, the deposit contained more dung beetles than the other samples examined and some rather poorly preserved cereal chaff. This mound of material must therefore have come from a rather different environment.

Our work so far shows that there is considerable research potential. Studies of individual turves should allow us to obtain a series of landscape histories and establish to what extent materials were brought in, as well as increasing our understanding of the development of chalk grassland. The few cereal remains recovered can contribute to our understanding of Neolithic agriculture while study of the way the monuments are built, and the kinds of tools used in construction will be invaluable.

Gill Campbell and Matt Canti

Tunnel vision – the challenges faced in recording Atkinson's tunnel

The pressured schedule and challenging and unusual working conditions in the tunnel created a real challenge – how was the tunnel to be recorded?

Opportunities like Silbury come along just once in a lifetime. Even though it might mean working in cramped conditions, in artificial light, around all manner of obstacles and within a high-pressure schedule that involved close co-operation with the mining engineers, there was still an urgent need to understand and record the archaeology of the hill exposed in Atkinson's tunnel. Ideally this would also provide a legacy of material for future researchers to explore long after the tunnel was filled….so how best to record it?

Traditional recording methods were initially considered. Conventionally each side of the tunnel would be hand-drawn, and marked up with observations and interpretations. This would be followed by photography to provide a visual component to the resulting record. However, this would only be two-dimensional and would not easily feed into other aspects of the hill's presentation. Worse still, it would require a significant amount of time to both carry out the drawings and geo-reference them to the site grid. Further complications included the fact that the tunnel was excavated daily in short sections, amounting to a few 0.90m bays per day. The archaeological recording then had to fit into the rest of the day to allow time for the next day's tunnelling.

Laser scanning was another consideration. Though this would rapidly record and create a strong 3-D model of the tunnel for later modelling purposes, it does not inherently "see" stratigraphy, nor is it easy to manipulate and process without specialist software and expertise. Besides, having a scanner on standby for the full duration of the project would have been very expensive.

A solution was needed that could provide the archaeological detail of hand drawing and the presentational flexibility of a 3-D model, whilst fitting within the project's restricted on-site timetable. The answer was photogrammetry – *the art and science of obtaining reliable measurement by means of images*. By acquiring a stereo-photographic record of each excavated tunnel section, both the model data and a good pictorial record could be quickly captured each day, and these could then be post-processed on-site to provide the required recording products. These included paper plots of scaled ortho-photos that could, as with a scaled drawing, be annotated with archaeology whilst within the tunnel.

This was great, but was it feasible? The Northumberland and Durham Rock-Art

Initial photogrammetry trials at Fort Cumberland

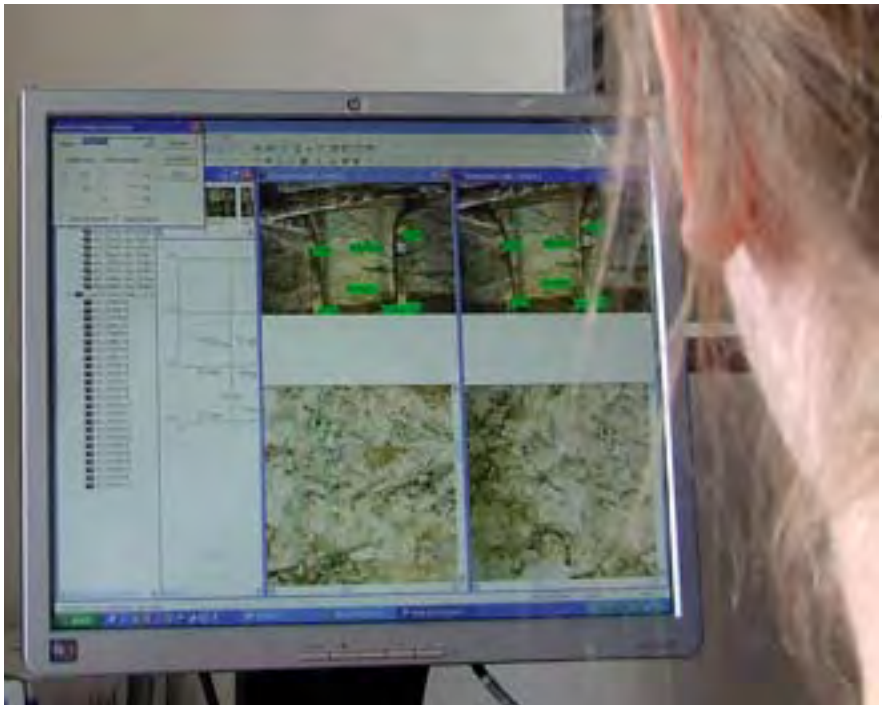
Tom Cromwell, © English Heritage

© Tom Cromwell

Tunnel environment reality

Project (NADRAP: see *Research News* 2) had previously pioneered the use of a new, lower-cost approach to recording based on photogrammetry. Although focusing on the application of cheap, consumer grade digital cameras this project also utilised Topcon's new PI-3000 'Image Surveying Station' software for the post-processing work. Running on a standard PC, it was reasonably priced and, through the use of an included calibration process, works with stereo-photography taken with any digital camera using a fixed-focus lens (see *Research News* 7).

Photogrammetric processing in progress



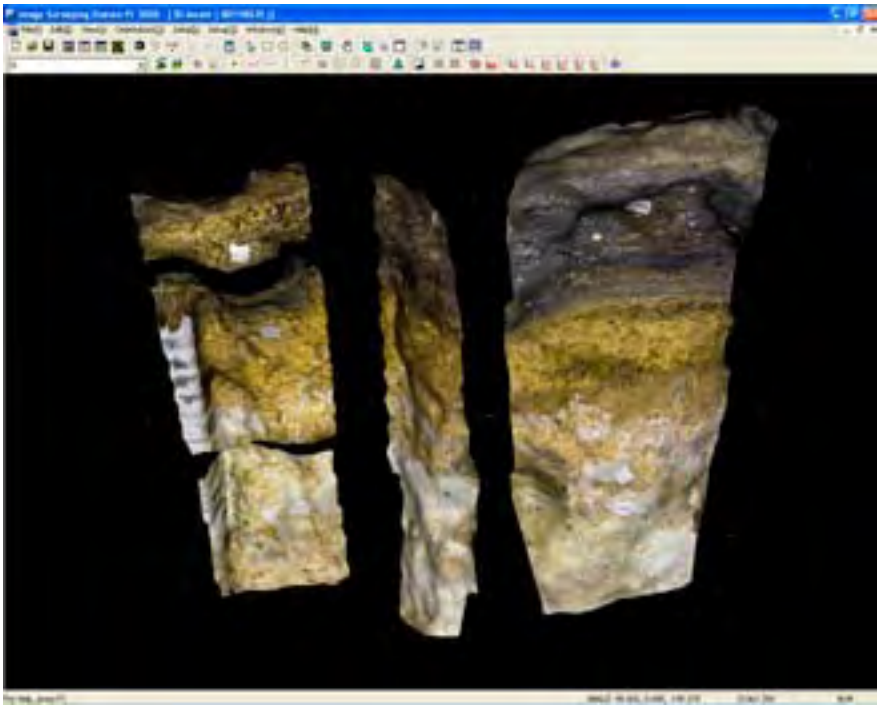
Ellie Sayer; © English Heritage

The only issue was the tunnel – could we get the camera, a Kodak DCS Pro 14MPixel SLR equipped with 20mm lens, far enough back to obtain a stereo-pair that covered each excavated section? To test this a plywood mock-up was constructed in one of the tunnels at Fort Cumberland where it was found that with a modicum of 'gymnastics' the required lateral and vertical coverage on the opposite wall could be provided using two camera positions located within each excavated section. Since the tunnel arches were set on 0.90m centres within a tunnel only 1.8m high, it meant each bay could be captured by two sets of stereo pairs – one each for the upper and lower halves. To geo-reference these to the site grid and provide an accurate scaling component, survey control points could be marked directly on the steel arches to neatly frame the images whilst reference data, written on magnetic boards, could be included in each shot.

Although the tests successfully proved the concept, the flow of recording on site was less regular than anticipated resulting in a number of teething troubles to overcome. Perhaps the most significant finding was that the tunnel arches themselves were sinking! (The survey control work, combined with the various warning 'alarms' provided by the PI-3000 processing software, meant this could be pointed out to the mining engineers before *they* even noticed!) Therefore processing long strands of the tunnel in one 3D model had to give way to modelling each day's results in isolation, in case the arches (complete with survey control markers) 'moved' during the night. Illumination for the stereo-photography also proved to be a real issue, since there simply wasn't enough space in the tunnel to provide for a well balanced lighting set-up. Instead fluorescent strip lighting, as supplied by the miners, was used and although sufficient to illuminate each stereo-pair this did require re-balancing in Adobe Photoshop to obtain a neutral colour palette across the whole tunnel. The biggest issue, however, was the sheer size of the data being captured – including both the 'raw' images off the camera, TIFF files for processing/archiving and all the post-processed files generated by PI-3000, the project now boasts more than 130 gigabytes of data!

The only area where the original recording plan fell short was the re-integration of the

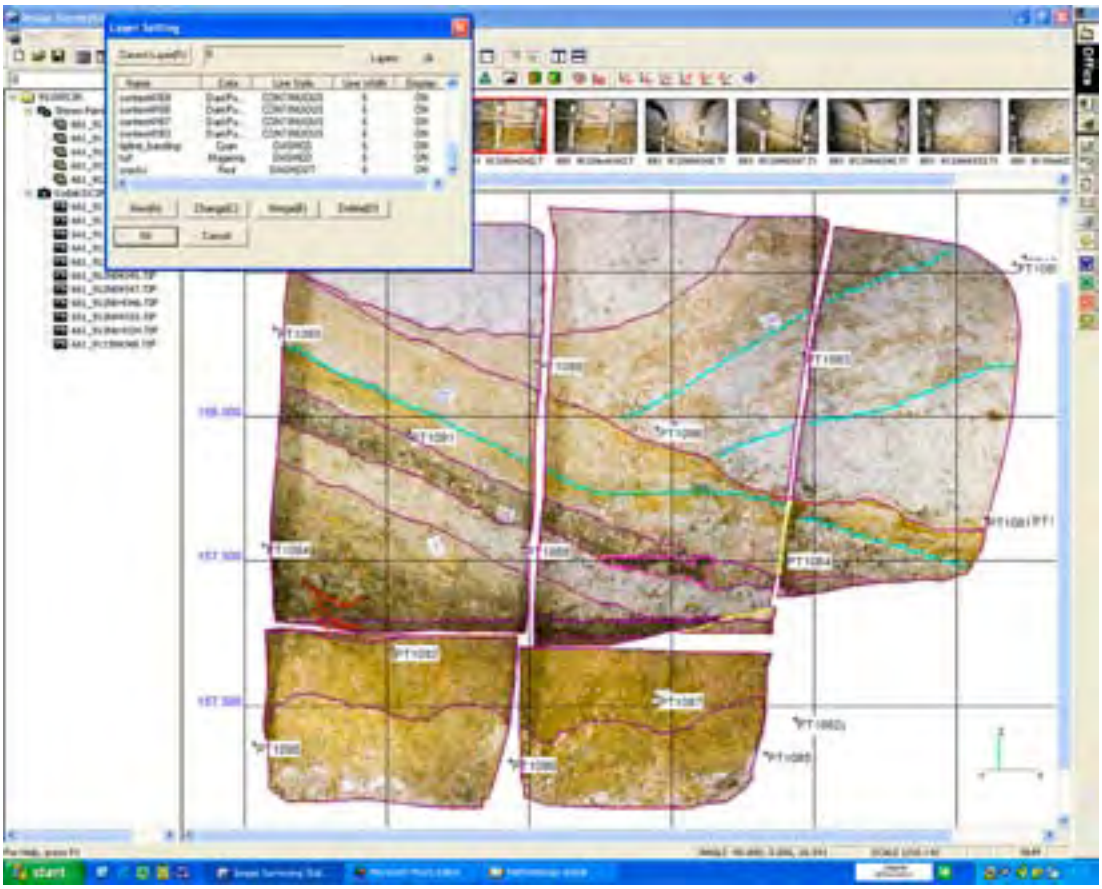
annotations and interpretations within the underlying stereo photography. Much of this essentially digitisation task did not happen each day but rather took place back in the office once the tunnel had been vacated in November. Since the annotated plots were not, as originally planned, being digitised in the field the perceived short-term lifespan of the inkjet paper used became a medium-term survival issue requiring careful preservation of the plots while still in the field. (In future this sort of annotation could be done digitally on a suitable ruggedised tablet PC or at least plotted out on more stable media.) The original plans to carry out the digitising in AutoCAD on data exported directly from PI-3000 were soon replaced by the more efficient method of digitising straight into the PI-3000 model using its own selection of CAD tools. The resulting lines would automatically project onto the surface model, and if exported to CAD would be truly 3-D.



PI-3000 3-D model (seen from above to accentuate 3D aspect) of three bays forming a step in the tunnel side

Despite its impact on the traditional archaeological workflow and the necessarily steep technical learning curve, photogrammetry did provide the backdrop to the archaeological recording as originally planned. Even better, we now have a complete photographic record of the tunnel faces, and a complete surface model that can be used for all manner of engineering and presentation purposes.

Paul Bryan and Tom Cromwell



PI-3000 ortho-rectified photo model complete with archaeological annotation

NEW DISCOVERIES AND INTERPRETATIONS

A manorial court-hall in Metroland: Ruislip Manor Farm

Survey gives new insights into a late-medieval hall house.

Facing page, top: Detail of wallpaper of *c.*1700 attributed to Abraham Price of Aldermanbury, near to the Guildhall in the City of London. It is situated in the entrance hall and was revealed when mid-18th century fielded panelling was removed for repair

Facing page, bottom: Manor Farm as depicted on a 1750 estate map by John Doharty, part of the substantial estates records of the King's College Cambridge Archive Centre

Below: West (principal) elevation. The original oriel windows have been replaced by 18th-century sashes

Architectural Investigation's London and South team has shed new light on Manor Farm, Ruislip, London Borough of Hillingdon, an early 16th-century manorial court hall and home farm of King's College, Cambridge, today islanded within the mock-Tudor of suburban Ruislip. Perhaps the most significant find was the discovery of detailed building accounts of 1505-06 in the archives of King's. Further discoveries, including the uncovering of wallpaper fragments of *c.*1700 and *c.*1810 and a carved bone inlay from an early 15th-century marriage casket, were made by others during 'opening up' of fabric during the renovation and conversion of the building to an interpretation centre in 2007-08 by the London Borough of Hillingdon. The results of recent survey and research undertaken at Manor Farm by a variety of organisations and individuals have been integrated into a Research Department report, co-authored by Geraint Franklin and Linda Hall (63-2008).

Manor Farm is located on the site of a Norman motte and bailey, within which a small, non-conventual Benedictine priory was established in the later 12th century. The moated site was sequestrated by the Crown and granted to King's College in 1451. The building accounts reveal that Manor Farm was erected over the space of two building seasons by a team including both masons and carpenters. The decision to rebuild may relate to the incoming manorial lessee Robert Drury (d.1535) of Hawstead, Suffolk, previously speaker of the House of Commons. This corresponds with a date range of 1506-11 established by a recent tree-ring survey; it was previously thought to be of late 16th century date.

Manor Farm functioned principally as a manorial court hall and secondarily as a working farmhouse until the early 20th century. The building accounts of 1506 list 'the halle the parlour the kechyn the botery and thentre [ie the entry]'. The manorial court was held in the two-bay hall. The cross wing at the 'high end' of the hall may have functioned as a suite for the use of the visiting provost or steward, with a large heated parlour in which to convene between court sessions and an 'en suite' parlour chamber above, complete with garderobe.

The building, comprising a two-storeyed hall and cross-wing, is an early example of a fully-floored hall house with an integral stack. It is thus something of a 'missing link' in Middlesex between the medieval hall-house (comprising parlour, hall and service area) and post-medieval vernacular plan types. Also indicative of a transitional character is Manor Farm's mixed construction and lack of a continuous jetty: unusually, a close-studded upper storey is recessed from a brick ground floor. The 1505-06 house incorporated a number of prestigious features such as timber-framed, canted oriel windows and garderobe, close-studding with patterned brick nogging, brick diaperwork, and heavily moulded ceiling beams to the principal rooms.

The interpretation centre at Manor Farm is now open to the public and the forthcoming report will be available as a PDF on the Research Department Reports Database of the English Heritage website.

Geraint Franklin

Derek Kendall, © English Heritage

© Provost and Scholars, King's College, Cambridge

NEW DISCOVERIES AND INTERPRETATIONS

Take a letter…. Roman writing tablets, how we can read what remains and the stories they can tell us

Conserving these writing tablets has provided us with the opportunity to explore various analytical techniques.

On British archaeological sites wooden objects, along with other organic artefacts, are almost exclusively preserved as a result of being incorporated into waterlogged deposits, so it comes as no surprise that most caches of Roman writing tablets have been found in the waterlogged levels of forts along Hadrian's Wall. Others have been found as individual items at the bottoms of wells or in contact with corroded metalwork such as the fragments found in the Corbridge Hoard. When found in wet conditions it is often difficult to ascertain what the object is, as waterlogged wood is very dark coloured and it is difficult to see any fine detail in the swollen wood surfaces. Writing tablets were made from very thin pieces of wood and, as they are very fragile, it is necessary to dry these so that they can be studied and kept long term.

Roman writing tablets are of two types, one made from thin leaves of wood that could be written on in ink and the other with a wax-filled area that could be written on with a stylus. Such objects, where they survive, are always a potential source of ancient missives and graffiti and pose a challenge for Conservation to reveal and preserve any features that remain.

Ink writing tablets are essentially small thin pieces of wood between 1-2mm thick and about 100mm square, and appear to have been cut or peeled from the sapwood of young trees. The examples found in Britain have been identified as being of alder (*Alnus* sp.), birch (Betula sp.) and willow (*Salix* sp.), all three of which are very pale coloured woods which would have provided a perfect background for the black ink. Also all three

Woods used for some of the writing tablets found on British sites

	Alder	Birch	Willow	Maple	Silver Fir	Larch	Cedar	Sweet Chestnut
Vindolanda, Hadrian's Wall	▲	▲	▲			●		
Carlisle, Annetwell Street	▲				●		●	
Carlisle, Millennium Excav's							●	
Corbridge, Hadrian's Wall				●	●			●
London, St Thomas' Street					●			
London, St Magnus House					●		●	
Groundwell Ridge, Swindon, Wiltshire						●		
Silchester, Berkshire				●				

Key

- ▲ ink writing tablets made from native wood species
- ● wax writing tablets made from non-native wood
- ● wax writing tablets made from native wood species

Vanessa Fell, © English Heritage

Group of waterlogged writing tablets from Groundwell Ridge, Swindon as received in the laboratory

species are native to the British Isles, so the timber used in their production could have been locally sourced. Wax writing tablets were made from fairly uniform blocks of wood *c.*150mm x 60mm x 8mm thick that were split from mature timber. A recessed area a few millimetres in depth was carved into one face and filled with wax which could easily be incised with a stylus and erased if necessary. A small group of woods was frequently used for these items - silver fir (*Abies* sp.), larch (*Larix* sp.) and cedar (*Cedrus* sp.) with a few examples of maple (*Acer* sp.) or sweet chestnut (*Castanea* sp.). Silver fir and larch are native to upland areas of southern Europe, while cedar was more common in the Eastern Mediterranean territories of the Roman Empire. Sweet chestnut is presumed to have been introduced by the Romans from central Italy for its fruit, and it is unlikely that any mature trees would have been available for this purpose. This means that only the examples made from maple could have been readily made from local supplies of timber.

Thin wooden objects are difficult to handle, record and study whilst wet, and some of the analytical techniques that can be applied require the use of dried material. Writing tablets attract a great deal of interest for in-depth study and in order for this to be

Zara Peacock, © English Heritage

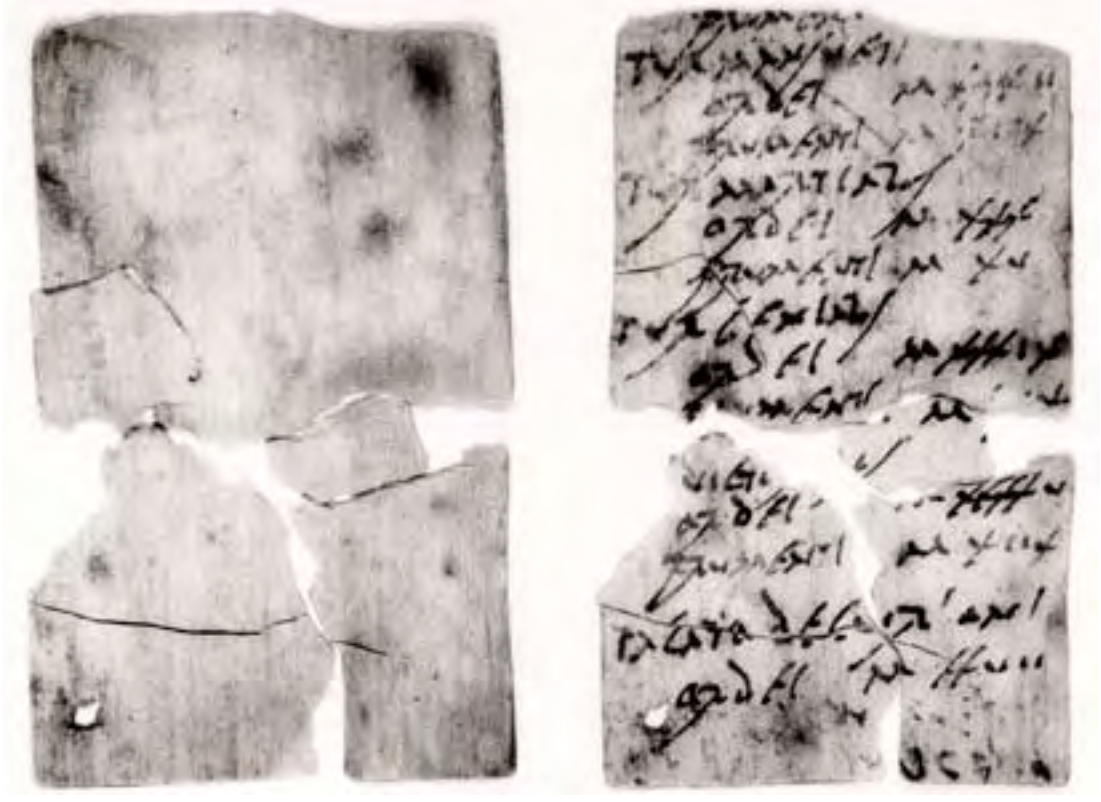
Group of six writing tablets held together by soil and freeze-dried in a block

The group when separated

Ian Leonnard, © English Heritage NMR

possible they need to be dried using techniques that will not affect any ink or other residues as well as not risking dimensional changes or risk of warping. The methods that have been used are solvent drying or freeze-drying after impregnation with PEG. Both methods leave the wood light in colour which makes it easier to read both the ink writing and any characters engraved below the wax surface. On drying, the object often weighs less than a fifth of its wet weight, much less than modern wood, and this illustrates how much of the wood structure has been lost during burial.

Sometimes a group of writing tablets are found fused together with silt and cannot be separated easily while wet, such as the examples from Groundwell Ridge. After freeze-drying they often come apart easily, without any damage to the delicate surfaces, and it is much easier at this point to reveal any fine incised detail.



Jennifer Jones, © Durham University

Thin leaf of wood viewed under normal light (left) and photographed using an infra red filter

X-radiography can be a useful means of recording and establishing the relationship of wood fragments seemingly fused together in a block of wet soil. An x-radiograph will show any recessed areas, as well the definition of the layers as a stack of tablets bound together or as pieces of wood just in a haphazard pile. Any metal binding will also be clearly visible.

Any thin leaves of wood about 1-2mm thick and 100mm square could potentially be the remains of an ink writing tablet, but the writing is not always visible at first sight, even after drying. Infra red photography of these can be used to make any residual ink writing visible to the naked eye, and this can easily be done by using an infrared filter as in the example from Carlisle.

Under ultraviolet light some waxes and resins will fluoresce, and these are useful conditions to see if any wax remains and which areas are worth targeting for further analysis such as Fourier-transform infrared spectroscopy (FTIR). Modern FTIR equipment requires very small samples for analysis, and sometimes the surface of an object can be examined, in order to identify organic compounds such as waxes or lipids that might remain on the wood surface.

In a recent programme on the ten most important treasures in the British Museum, the Vindolanda writing tablets were voted top by the professionals and public alike as they provide a rare insight into Roman

Zara Peacock, © English Heritage

Corner fragment of an imported writing tablet

society, from personal letters and invitations to provisions for the army, not to mention the occasional vulgar Latin text! In addition to the texts that are preserved, the materials they were made from can give us an idea of the distances such items must have travelled before ending up in a ditch on Hadrian's Wall. The quality of these objects is highly variable too, with the uniform and probably mass-produced wax writing tablets found at Roman forts contrasting with a rather roughly-made example from Silchester.

Jacqui Watson

Jacqui Watson, © English Heritage

Writing tablet with cross-hatched surface from Silchester, Berkshire

NOTES & NEWS

A round-up of activities and developments showing some of the scope and variety of projects that are ongoing in the Research Department.

© English Heritage

The altar is indicated by Shona Williams, Aerial Survey and Investigation EPPIC post holder

OLD STONES, NEW RECORD

Investigators from the northern Aerial Survey and Investigation team visited the Solway Plain, Cumbria, recently as part of follow-up work to the Hadrian's Wall NMP project (yes, aerial archaeologists can walk too). We visited various sites including the still impressive earthworks of the Roman fort of *Maglona* at Old Carlisle that, lacking any footpath access, is frustratingly off limits to the casual visitor. Though this fort is not on the Wall it was a crucial communication hub that linked with several of the forts around the western end of the frontier and developed around it an extensive *vicus*. We had to content ourselves with admiring the location of the fort from the road. The challenge of deciding whether the cow, second on the right from the big tree, was standing on the inner rampart or not soon paled and our attention wandered to things closer to hand. We noted several re-used Roman stones, keyed with cross-hatched chiselling to hold plaster, and a small altar, prominently displayed in a nearby barn wall. The mason, perhaps acknowledging the spiritual significance of the altar, placed it upright in the wall and no doubt many a keen eyed visitor has spotted and remarked on it over the decades since this post medieval barn was built. But, back in the office I was surprised to find no mention of the altar or the barn in our records so passed an image or two on to Mike Collins, who I like to think of as our "Man on the Wall". Mike was equally in the dark and passed it in turn to Mark Brennand at the Cumbria HER. The HER also came up blank with no mention of the barn or its recycled Roman fabric. So keep your eyes peeled and don't assume someone else has already done the admin! If you want to take a look next time you are passing, you will find the barn at NY26234666.

Dave MacLeod

Plotting a measurement on the plane table

Vic Swift, IDP

TRADITIONAL SURVEY TRAINING

The International Dunhuang Project at the British Library is studying the maps and archaeological plans of Central Asia made by Sir Aurel Stein in the early years of the 20th century. Stein worked with the surveying equipment then available, manual theodolites and plane tables. When members of the project team decided that they needed to learn something about the use of such kit they had difficulty in finding anyone who could tell them what they needed to know. Eventually they were put in touch with EH's Archaeological Survey and Investigation team, one of the last repositories of traditional surveying skills in the country. We were able to provide a bespoke two-day practical course, introducing eight members of the IDP to basic theodolite work, triangulation and radiation with a plane table, and levelling.

For more information on the International Dunhuang Project visit their website at http://idp.bl.uk.

Mark Bowden

RESEARCH DEPARTMENT REPORT SERIES: August – November 2008

12. Watson, J, 'Springhead and Northfleet, Kent: Identification of Organic Materials Associated with Selected Metalwork from the Ctrl Ii Excavations'

50. Payne, A W, 'Two Long Barrows at Maiden Castle, Winterbourne Monkton and Sheep Down, Winterbourne, Steepleton, Dorset: Report on Geophysical Surveys, July 2007'

51. Field, D, Brown, G and Grady, D, 'Wren's Nest, Lime Stone Mines, Dudley: Level 1 Survey'

54. Watson, J, 'Silchester, Hampshire: Conservation of a Wooden Writing Tablet'

61. Linford, N T and Martin, L, 'Keep Yard, Dover Castle, Kent: Report on Geophysical Survey, June 2008'

62. Minnis, J, 'St Paul's Church, Holbeach Road, Fulney, Spalding, Lincolnshire: Survey and Analysis,

66. Martin, L, 'The Wreck of the Anne, Pett Level, East Sussex: Report on Geophysical Survey, May 2008'

70. Martin, L, 'Marden Henge, Wiltshire: Report on Geophysical Survey, April 2008'

72. Brown, G, 'Dispersed Settlements on the Southern Mendip Escarpment: The Earthwork Evidence'

79. Bridge, M C, 'St Mary's Church, Tunstead, Norfolk: Tree-Ring Analysis of Timbers from the Nave Roof'

84. Buxton, K, Dickinson, B, Evans, J, Rákai, S, de Rouffignac, C, Summerfield, J, Wallace, C and Wilson, P 'Binchester Hall Farm, Binchester Roman Fort, Co Durham: Excavation for a Sheep Dip in 1996'

86. Payne, A W, 'Batten Hanger, Elsted & Treyford, West Sussex: Report on Geophysical Survey, May 2008'

88. Linford, P K, 'Ringlemere Farm, Woodnesborough, Kent: Archaeomagnetic Dating Report, October 2004'

89. Linford, N T, 'Piggledene, North Farm, Overton, Wiltshire: Report on Geophysical Survey, September 2008'

James Davies, © English Heritage

Silbury Hill

NEW **PUBLICATIONS**

Brickstock, R J, Cardwell, P A, Busby, P A, Cool, H E M, Huntley, J P, Evans, J, Makey, P, Ronan, D and Wilson, P R 2007 'The Catterick Metal Detecting Project 1997-1999' *Yorkshire Archaeol J,* **79**, 65-153

Brodie, A, Ellis, C, Stuart, D and Winter, G 2008 *Weymouth's Seaside Heritage*. English Heritage

David, A 2008 'Geophysical survey and the Beckhampton Avenue and Longstones Cove' in Gillings, M, Pollard, J, Wheatley, D and Peterson, R, *Landscape of the Megaliths: Excavation and Fieldwork on the Avebury Monuments, 1997-2003*, Oxbow Books, Oxford, 63-69

Dungworth, D 2007 'Analysis of refractory materials', *in* P Belford and R Ross 'English steelmaking in the seventeenth century: the excavation of two cementation furnaces at Coalbrookdale'. *Historical Metallurgy* 41, 105–123 (115–118)

Dungworth, D 2008 'Glass-ceramic reactions in some post-medieval crucibles: an instrumental analysis study of archaeological samples' *Glass Technology* 49, 157–167

Leith, I 2008 Entries for Bedford Lemere and five other English architectural and topographical photographers in J Hannavy (ed), *Encyclopedia of Nineteenth-Century Photography*, Routledge: New York

Lowerre, A 2007 'A GIS Analysis of the Location of Late-Eleventh-Century Castles in the South-Eastern Midlands of England', in Clark, J T and Hagemeister, E M (eds) *Digital Discovery: Exploring New Frontiers in Human Heritage. CAA 2006. Computer Applications and Quantitative Methods in Archaeology. Proceedings of the 34th Conference, Fargo, United States, April 2006*. Budapest: Archaeolingua, 227-240

Martin, L (ed) 2008 *ISAP News* **15**

Martin, L 2008 'Falkner's Circle: geophysical survey', in Gillings, M, Pollard, J, Wheatley, D and Peterson, R, *Landscape of the Megaliths: Excavation and Fieldwork on the Avebury Monuments, 1997-2003*, Oxbow Books, Oxford, 143-4

Mays, S, Turner-Walker, G 2008 'A Possible Case of Renal Osteodystrophy from Mediaeval Wharram Percy, England'. *International Journal of Osteoarchaeology* **18**: 307-316

Mays S, Brickley M and Ives R 2008 'Growth in an English Population from the Industrial Revolution'. *American Journal of Physical Anthropology* **136**: 85-92

McCormac, F G, Bayliss, A, Brown, D M, Reimer, P J and Thompson, M M 2008 'Extended radiocarbon calibration in the Anglo-Saxon Period, AD 395–485 and AD 735–805'. *Radiocarbon* **50**, 11–17

Millward, J 2008 'The East Coast Martello Towers'. *Fort 35* 173-84

Minnis, J 2008, 'Putting cars in context: presenting the heritage of the motor age' *Conservation Bulletin* **58**, 14

Monckton, L 2008. 'Bath Abbey: A Re-assessment of its Patronage and Architectural History', *Church Archaeology*, vol. 10, 2006, 1-16

Paynter, S 2008 'Metalworking activity' in Cunliffe B and Poole C (eds) *Grateley South, Grateley, Hants, 1998 and 1999,* The Danebury Environs Roman Programme, Volume 2 – Part 2, English Heritage and Oxford University School of Archaeology – Monograph 71, 141

Paynter, S 2008 'Metalworking activity' in Cunliffe B and Poole C (eds) *Rowbury Farm, Wherwell, Hants, 2003,* The Danebury Environs Roman Programme, Volume 2 – Part 5, English Heritage and Oxford University School of Archaeology – Monograph 71, 88

Paynter, S 2008 'Metalworking activity' in Cunliffe B and Poole C (eds) *Thruxton, Hants, 2002,* The Danebury Environs Roman Programme, Volume 2 – Part 4, English Heritage and Oxford University School of Archaeology – Monograph 71, 77

Paynter, S 2008 'Metalworking activity' in Cunliffe B and Poole C (eds) *Fullerton, Hants, 2000 and 2001,* The Danebury Environs Roman Programme, Volume 2 – Part 3, English Heritage and Oxford University School of Archaeology – Monograph 71, 132

Paynter, S 2008, 'Metalworking Remains' in Booth P, Bingham A-M, and Lawrence S (eds), *The Roman Roadside Settlement at Westhawk Farm, Ashford, Kent, Excavations 1998-9*, Oxford Archaeology Monograph 2, 267-302

Sheridan, A and Bayliss, A 2008 Pots and time in Bronze Age Ireland, *Antiquity* **82**, 204–7

Smith, P 2008 'A House by Sir Christopher Wren. The Second Newby Hall', *The Georgian Group Journal* **16**, 5-30

Smith, Pete 2008 'Apethorpe Hall Revealed' *Context*, May 2008, 29-31

Smith, Pete 2008 'A House by Sir Christopher Wren. The Second Newby Hall' *The Georgian Group Journal*, Volume **XVI**, 2008, 5-30

Spencer, H 2008 'Under Albertopolis: The Pedestrian Subway At South Kensington'. *London Society Journal* no **456,** Winter 2008, 9-12

Tite, M, McCarthy, B and Paynter, S 2008, 'Production of glazed pottery and brickwork in the Near East', in Tite M S and Shortland A J, (eds) *Production Technology of Faience and related early vitreous materials*, Oxford University School of Archaeology – Monograph 72, 187-198

Wilmott, T 2008 'The Vallum; how and why: a review of the evidence', in Bidwell, P, (ed) *Understanding Hadrian's Wall; papers from a conference at South Shields 3rd-5th November 2006*, Kendal, Arbeia Society, 119-128

Wilmott, T 2008 review of Hill, P R, *The Construction of Hadrian's Wall* (Tempus 2006), *Britannia*, **39**, 400- 401

Wilmott, T and Garner, D 2008 Chester, dark secrets of the arena revealed, *Current Archaeol*, **224**, 18-25

Worley, F, 2008 'The animal bones' B Cunliffe and C Poole *The Danebury Environs Programme A Wessex landscape in the Roman era Volume 2-part 7: Dunkirt Barn, Abbotts Ann, Hants, 2005 and 2006.* English Heritage and Oxford University School of Archaeology Monograph, **71**, 184-201 and e text