A Research Framework for the Stonehenge, Avebury and Associated Sites World Heritage Site

Avebury Resource Assessment

compiled and edited by Matt Leivers and Andrew B. Powell

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Front cover
Avebury – the Z stones in the southern Inner Circle (Steve Marshall)

Back cover
Upper – looking west from the Sanctuary on Overton Hill towards the West Kennet Long Barrow and the southern part of the World Heritage Site (Erica Gittins)
Middle – the West Kennet Avenue (Steve Marshall)
Bottom – the Valley of Stones in Clatford Bottom (Steve Marshall)

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In its final form it incorporates the contributions of many individuals, only some of whom wrote the words of which it ultimately consists. Everyone who contributed – either in a workshop or meeting or through comments on drafts – altered the shape the Framework finally took. Many of the authors of the resource assessments wrote in their own time, for no financial reward. In addition to the named authors, we are particularly grateful to the overlapping memberships of the Avebury and Stonehenge Archaeological and Historical Research Group and the Stonehenge and Avebury Revised Research Framework Project Board, especially Rosamund Cleal, David Dawson, Helen Keeley, Phil McMahon, Dan Miles, Melanie Pomeroy-Kellinger, Joshua Pollard, Sarah Simmonds, Nicola Snashall, Francis Taylor and Beth Thomas. Kate Fielden copy-edited an earlier version of the draft text.

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Foreword

In 1986 Stonehenge, Avebury and Associated Sites was one of the small group of seven sites which were the first in the UK to be inscribed on the UNESCO World Heritage List. I am therefore delighted to see the publication of the first joint Stonehenge and Avebury Research Framework on the 30th Anniversary of its inscription as a World Heritage Site.

Stonehenge and Avebury were inscribed as one World Heritage Site for their Outstanding Universal Value. The Site is recognised by UNESCO as a masterpiece of human creative genius that demonstrates the technological and engineering skills of a long lost Neolithic and Bronze Age culture. The World Heritage Site extends far beyond the iconic henges at Avebury and Stonehenge to encompass their surrounding landscapes, each containing an unusually dense concentration of exceptionally well-preserved prehistoric monuments. Both landscapes have a research potential that is internationally recognised. Over the last 30 years, great advances have been made in our understanding of the World Heritage Site as well as its protection and enhancement.

The UNESCO Operational Guidelines for the Implementation of the World Heritage Convention advise States Parties to make resources available to encourage and undertake research. They recognise that knowledge and understanding are fundamental to the identification, management, and monitoring of World Heritage properties. The publication of this first joint Research Framework is an important step in fulfilling this ambition.

Historic England has been eager to produce a single Research Framework covering the whole World Heritage Site in line with UNESCO's recommendation to take a unified approach to managing serial Sites. In doing so, the World Heritage Site partners have built on the success of the earlier *Avebury Research Agenda* and *Stonehenge Research Framework*.

This new joint Framework is the result of committed and effective partnership working. The document is a true collaboration; the work of individual researchers, university academics, national and local authority staff, museum curators and private sector heritage professionals. The wider community has also had the opportunity to influence the questions being investigated through public consultation undertaken as part of the document's development.

This Research Framework will be available to universities and research organisations as well as the wider community. There is much here that will help to inspire and direct future research into these remarkable and unparalleled landscapes over the next 30 years and beyond.

Duncan Wilson
Chief Executive, Historic England

Abstract

The Stonehenge, Avebury and Associated Sites World Heritage Site comprises two areas of Wessex chalkland some 40 km apart, connected by their distinctive complexes of Neolithic and Bronze Age sites. Both areas have played a central role in the understanding of Britain's prehistoric past and are among the most iconic and widely-recognised prehistoric landscapes in the world. Their international significance was recognised by their inscription on UNESCO's World Heritage List in 1986, and it is particularly apt that this new Research Framework should mark the 30th anniversary of the World Heritage Site's creation.

These volumes represent the first step towards the production of a fully integrated Research Framework for the Site. The first volume consists of an update to the Resource Assessment for the Stonehenge area, which extends the scope of the original version (Darvill 2005) to 2012. The second contains a new Resource Assessment for the Avebury area which incorporates the 2008 boundary changes. Both of these volumes explicitly expand the focus of the earlier Resource Assessments from archaeology to the wider historic environment. The third volume is a Research Agenda and Strategy for the whole World Heritage Site. The rationale for the form this Framework takes is complex, and is laid out in the Introduction, but it is envisaged as an intermediate stage between the separate documents that were originally produced (AAHRG 2001; Darvill 2005) and a single integrated assessment, agenda and strategy.

The new Framework is the result of consultation across the research community in its broadest definition. Authors were invited to produce resource assessments and technical summaries; workshops and meetings guided the initial drafts of the Research Agenda; the Avebury and Stonehenge Archaeological and Historical Research Group (ASAHRG) provided criticism of both. Drafts of texts were presented for public consultation and comment via the internet. The Research Strategy was formulated based on their content, and the whole circulated for further comment. In consequence, the new Research Framework offers a guide that reflects the priorities and encompasses the views of the widest possible community. It is in every sense a collaborative document, produced by and for the constituency of researchers working within the World Heritage Site.

These documents are intended to guide and inform future research activities in the historic environment and, in turn, its management and interpretation. The intention is that they will be underpinned by data-management systems that can be actively maintained as project-specific tools into the future. This new Framework, therefore, fulfils a number of objectives. It provides revisions (redrafting and updating) of the existing Avebury and Stonehenge resource assessments; it starts the process of harmonising and integrating the earlier separate research documents with the production for the first time of a single, combined research agenda and strategy for the whole World Heritage Site; and it develops a method to facilitate future review and revision. In future, this task will be undertaken by ASAHRG, which replaces the Avebury Archaeological and Historical Research Group to promote and disseminate historical and archaeological research in the World Heritage Site as a whole.

Recent Research in the Stonehenge Landscape 2005–2012 consists of summaries of development-prompted research and problem-orientated research, followed by a section looking at recently changed and changing aspects of research: dating, long-distance connections, landscape structure, and the relevance of other monuments. *The Avebury Resource Assessment* provides both cross-period assessments of the resource based on a number of specific research methods which have been used to develop our understanding of the archaeology in the Avebury area, and a series of period-based assessments, from the Palaeolithic to the modern period. The *Research Agenda* articulates the significant gaps in our understanding, by posing some of the outstanding questions in a form that is relevant to a number of chronological periods and major thematic subjects of relevance to the unique character of the World Heritage Site. The *Research Strategy* sets out a framework of principles under which research should be carried out in the World Heritage Site, and identifies practical means by which such programmes of investigation can be facilitated, co-ordinated, resourced, sustained and communicated, and by which the Research Framework as a whole can be reviewed and updated.

The continuing nature of archaeological research inevitably means that many discoveries – some of considerable significance – were made during the period of the writing of these volumes. In order to bring the years of work which have gone into these documents to fruition, a line had to be drawn. That the Research Framework is not absolutely up-to-date is not a failing, but rather an indication of the need for a planned approach to investigation in an area which still, after centuries of investigation, has not given up all of its secrets.

Abrégé

Le site classé au patrimoine mondial de Stonehenge, Avebury et sites associés comprend deux zones crayeuses, distantes de quelques 40 km, unies par leurs complexes particuliers de sites du néolithique et de l'âge du bronze. Ces deux zones ont joué un rôle central dans la compréhension du passé préhistorique de la Grande-Bretagne et se situent parmi les paysages préhistoriques les plus symboliques et les mieux connus du monde. Leur importance internationale fut reconnue par leur inscription sur la liste des sites classés au patrimoine mondial de l'UNESCO en 1986, et il est particulièrement approprié que ce nouveau cadre de recherches vienne marquer le trentième anniversaire de la création de ce site patrimonial. Ces volumes constituent le premier pas vers la production d'un cadre de recherches entièrement intégré pour ce site. Le premier volume consiste en une mise à jour de l'évaluation des ressources de la zone de Stonehenge, qui allonge la portée de la version originale (Davill 2005) jusqu'en 2012. Le second contient une nouvelle évaluation des ressources pour la zone d'Avebury qui incorpore les changements de limites de 2008. Ces deux volumes agrandissent explicitement le point central de l'évaluation précédente, de l'archéologie à l'environnement historique, plus étendu. Le troisième volume consiste en un programme et une stratégie de recherches pour l'ensemble du site classé au patrimoine mondial. La logique derrière la forme que prend ce cadre est complexe et est expliquée dans ses grandes lignes dans l'introduction, mais on l'envisage comme un stade intermédiaire entre les documents séparés qui furent produits originellement (AAHRG 2001; Darvill 2005) et une évaluation intégrée unique, programme et stratégie.

Le nouveau cadre est le résultat d'une consultation de toute la communauté des chercheurs au sens le plus large du terme.

Des auteurs furent invités à produire des évaluations des ressources et des résumés techniques, des ateliers et des réunions orientèrent les ébauches initiales du programme de recherches, le Groupe de Recherches Archéologiques et Historiques d'Avebury et de Stonehenge (ASAHRG) fournit un bilan critique des deux. Des ébauches des textes furent soumises à une consultation publique et à des commentaires via l'internet. La stratégie de recherche fut élaborée sur la base de leur contenu et on fit circuler le tout pour davantage de commentaires. Par conséquent le nouveau cadre de recherches offre un guide qui reflète les priorités et englobe les idées de la plus large communauté possible. C'est un document collaboratif dans tous les sens du terme, produit par, et pour, les membres du collège de chercheurs travaillant dans le site classé au patrimoine mondial.

Ces documents sont destinés à guider et inspirer les futures activités de recherches dans cet environnement historique et, le moment venu, sa gestion et son interprétation. L'intention est qu'il sera étayé par des systèmes de gestion de données qui peuvent être activement conservés dans l'avenir comme outils spécifiques à une mission. Ce nouveau cadre satisfait donc à un certain nombre d'objectifs. Il apporte des révisions (nouvelle rédaction et mise à jour) des évaluations existantes des ressources d'Avebury et de Stonehenge; il met en marche le procédé d'harmonisation et d'intégration des précédents documents de recherches séparés avec pour la première fois la production d'un programme unique de recherches et d'une stratégie combinée pour l'ensemble du site classé au patrimoine mondial, et il développe une méthode pour faciliter les prochaines revues et révisions. Dans l'avenir cette tâche sera entreprise par ASAHRG, qui remplace le Groupe de Recherches Archéologiques et Historiques d'Avebury pour la promotion et dissémination de la recherche historique et archéologique dans l'ensemble du site classé.

Récentes recherches dans le paysage de Stonehenge 2005–2012 consiste en résumés de recherches suite à des projets de construction et de recherches liées à un problème, suivis d'une section examinant les aspects récemments changés ou changeants de la recherche: datation, relations lointaines, structure du paysage, et rapport avec d'autres monuments. *L'évaluation des ressources d'Avebury* fournit à la fois des évaluations de la ressource à travers le temps reposant sur des méthodes de recherche spécifiques qui ont été utilisées pour développer notre compréhension de l'archéologie dans la région d'Avebury, et une série d'évaluations, concentrée sur une période, du paléolothique à la période moderne.

Le programme de recherches expose les importantes lacunes dans notre compréhension en posant certaines des questions en suspens sous une forme qui est appropriée à certaines périodes chronologiques et

des sujets thématiques majeurs appropriés au caractère unique du site. *La stratégie de recherche* met en place un cadre de principes en fonction desquels la recherche devrait être entreprise dans le site classé, et identifie des moyens pratiques grâce auxquels de tels programmes d'investigation peuvent être facilités, coordonnés, financés, soutenus et communiqués et par lesquels le cadre de recherche dans son ensemble peut être revu et mis à jour.

La nature continue de la recherche archéologique signifie qu' inévitablement de nombreuses découvertes, certaines extrèmement importantes, eurent lieu pendant la période où on écrivait ces volumes. De manière à ce que les années de travaux qui sont passées dans ces documents portent leur fruit, il nous a fallu tirer un trait. Que le cadre de recherches ne soit pas parfaitement à jour n'est pas un échec, mais plutôt une indication du besoin d'une approche planifiée des recherches dans une zone qui, encore maintenant, après des siècles d'investigation, n'a pas révélé tous ses secrets.

Traduction: Annie Pritchard

Zusammenfassung

Die Weltkulturerbestätte Stonehenge, Avebury and Associated Sites (Stonehenge, Avebury und zugehörige Fundstellen) besteht aus zwei 40 km voneinander entfernten Kreidelandschaften in der Region Wessex, die beide durch einzigartige Komplexe neolithischer und bronzezeitlicher Fundstellen gekennzeichnet sind. Beide Gebiete sind von zentraler Bedeutung für unser Verständnis der britischen Vorgeschichte und gehören weltweit zu den prähistorischen Landschaften mit dem höchsten Wiedererkennungswert und Symbolcharakter. Ihre internationale Bedeutung verhalf ihnen 1986 zum Eintrag in die Liste der UNESCO Welterbestätten, und es ist daher mehr als angemessen, dass dieses neue Rahmenkonzept für die Forschung zum 30. Jahrestag der Eintragung erscheint. Die vorliegenden Bände sind ein erster Schritt für die Festlegung eines ganzheitlichen Rahmenprogramms für die weitere Erforschung dieser Fundstellen. Der erste Band besteht aus einer Aktualisierung der ersten Version einer Bestandsaufnahme und Potentialseinschätzung für die Region um Stonehenge (Darvill 2005), wobei der abgedeckte Zeitraum bis auf 2012 erweitert wird. Der zweite Band beinhaltet eine neue Bestandsaufnahme und Einschätzung für die Region um Avebury, mit Berücksichtigung der Verschiebungen der Grundstücksgrenzen im Jahr 2008. Beide Bände sind explizit darauf angelegt, den Fokus der früheren Bestandsaufnahmen von einer rein archäologischen Perspektive auf die historische Landschaft als Ganzes zu erweitern. Der dritte Band enthält die Forschungsagenda und -strategie für die gesamte Welterbestätte. Die Gründe für die Form dieses Rahmenkonzeptes sind komplex und werden in der Einleitung beschrieben. Es ist beabsichtigt, dass das vorliegende Werk einen Zwischenschritt zwischen den zuerst angefertigten Einzeldokumenten (AAHRG 2011; Darvill 2005) und der angestrebten ganzheitlichen Bestandsaufnahme, Agenda und Strategie darstellt.

Das neue Rahmenkonzept ist das Ergebnis von Rücksprachen mit einer so inklusiv wie möglich definierten Forschungsgemeinschaft. Die einzelnen Autoren sollten Bestandsaufnahmen und fachliche Zusammenfassungen liefern; zu ersten Fassung der Forschungsagenda fanden begleitende Workshops und Treffen statt; der Avebury and Stonehenge Archaeological and Historical Research Group (ASAHRG) kommentierte beides kritisch. Erstfassungen der Texte wurden im Internet zugänglich gemacht, um Kommentare und Vorschläge der breiteren Öffentlichkeit einzuholen. Auf deren Grundlage wurde dann eine Forschungsstrategie ausformuliert und noch einmal zirkuliert, um weitere Kommentare zu ermöglichen. Somit bietet das neue Rahmenkonzept einen Leitfaden, der die Prioritäten und Ansichten der größtmöglichen Anzahl an Interessierten umfasst. Es handelt sich um ein in jedem Sinne kollaboratives Dokument, das von und für die in der Welterbestätte tätige Forschungsgemeinschaft erstellt wurde.

Die Dokumente sollen zukünftige Forschungsvorhaben in der historischen Landschaft, sowie deren Management und Interpretation begleiten und unterfüttern. Es ist geplant, dies durch Datenverwaltungssysteme zu unterfüttern, die zukünftig als projektspezifische Tools aktiv gepflegt werden können. Das neue Rahmenkonzept erfüllt daher mehrere Ziele. Es bietet eine Neubearbeitung (Neuentwürfe und Aktualisierungen) der existierenden Bestandsaufnahmen für Stonehenge und Avebury; es beginnt den Prozess, die bereits vorhandenen älteren Forschungsdokumente zu integrieren und mit der erstmaligen Schaffung einer einheitlichen, ganzheitlichen Forschungsagenda und -strategie für die gesamte Welterbestätte zu harmonisieren; und es entwickelt eine Methode, die zukünftige Prüfungen und Überarbeitungen ermöglicht. Diese Aufgabe wird in Zukunft von ASAHRG wahrgenommen. Sie ersetzen damit den Avebury Archaeological and Historical Research Group und werden historische und archäologische Forschungen in der Welterbestätte insgesamt fördern und veröffentlichen.

Neue Untersuchungen in der Landschaft um Stonehenge 2005–2012 besteht aus Zusammenfassungen von baubegleitenden oder problemorientierten Forschungsvorhaben, gefolgt von einem Abschnitt zu kürzlich veränderten oder sich verändernden Aspekten der Forschung: Datierung, Fernkontakte, Landschaftsstruktur und die Bedeutung anderer Monumente. Neben periodenspezifischen Abschnitten, vom Paläolithikum bis in die Moderne, bietet die *Bestandsaufnahme Avebury* diachron angelegte Einschätzungen des Potentials der archäologischen Ressource, gestützt auf eine Reihe von Forschungsmethoden, die unser Verständnis der Archäologie von Avebury vertieft haben. Die *Forschungsagenda* legt die erheblichen, noch bestehenden Wissenslücken dar. Hierbei werden einige der noch unbeantworteten Fragen in einer Art und Weise formuliert, die ihre

Relevanz für mehrere der chronologischen Perioden und Themenbereiche darlegt, welche für den einzigartigen Charakter der Welterbestätte von Bedeutung sind. Die *Forschungsstrategie* definiert ein Gerüst aus Prinzipien, nach denen sich weitere Forschungen in der Welterbestätte richten sollten und identifiziert praktische Wege, mittels derer solche Untersuchungsprogramme ermöglicht, koordiniert, finanziert, aufrechterhalten und kommuniziert werden sollen, sowie die Bestandsaufnahme selbst überprüft und aktualisiert werden kann.

Archäologische Forschung ist von Natur aus kontinuierlich. Es ist somit unvermeidbar, dass viele Entdeckungen – einige davon von erheblicher Tragweite – während des Schreibens der vorliegenden Bände gemacht wurden. Um die vielen Jahre Arbeit, die in diesen Dokumenten stecken, zu einem fruchtbaren Abschluss zu bringen, musste dennoch eine Grenze gezogen werden. Dass das Rahmenkonzept nicht absolut aktuell ist, ist jedoch keine Schwäche, sondern zeigt eher, wie wichtig ein gut durchgeplanter Ansatz für weitere Untersuchungen in einer Region ist, die selbst nach jahrhundertelanger Erforschung noch nicht alle ihre Geheimnisse preisgegeben hat.

Übersetzung: Daniela Hofmann

Introduction

by Matt Leivers, Andrew B. Powell, Melanie Pomeroy-Kellinger and Sarah Simmonds

The *Stonehenge, Avebury and Associated Sites World Heritage Site* comprises two areas of Wessex chalkland, 40 km apart, surrounding Stonehenge and Avebury (Fig. 1), that are renowned for their distinctive complexes of Neolithic and Bronze Age sites. These sites have played a central role in the understanding of Britain's prehistoric past and – together with their surrounding landscapes – have international significance, as recognised by the inscription of the World Heritage Site in 1986 on UNESCO's World Heritage List for its *Outstanding Universal Value*.

Over the centuries, research into these sites and the landscapes they occupy has taken many forms and reached many and diverse conclusions: about the people who used them and about how, when and why they were constructed. Some of that research contributed to the degrading of the archaeological remains and it is the awareness that this finite resource needs to be effectively conserved which makes a framework for the facilitation and direction of sustainable research central to the management of the World Heritage Site (UNESCO 1972, Article 5).

Management Plans and Research Frameworks

UNESCO stresses the need for 'serial' World Heritage Sites comprising more than one area (such as Stonehenge and Avebury) to have 'a management system or mechanisms for ensuring the co-ordinated management of the separate components' (UNESCO 2013, para. 114). Although arguments have been advanced for the separation of Stonehenge and Avebury into separate World Heritage Sites, this possibility was ruled out in December 2007 when the Government announced that there would be no re-nomination of the World Heritage Site. The individual management plans – the *Stonehenge World Heritage Site Management Plan 2009* (Young *et al.* 2009), and the *Avebury World Heritage Site Management Plan* (Pomeroy-Kellinger 2005) – have recently been replaced by a joint management plan for the whole World Heritage Site (*Stonehenge and Avebury World Heritage Site Management Plan*: Simmonds and Thomas 2015).

The two areas were also the subjects of separate research frameworks – *Archaeological Research Agenda for the Avebury World Heritage Site* (Avebury Archaeological and Historical Research Group 2001) and *Stonehenge World Heritage Site: An Archaeological Research Framework* (Darvill 2005).

The Avebury Research Agenda, published in 2001, was highly influential, being the first such document produced for any World Heritage Site. It was produced by the Avebury Archaeological and Historical Research Group (AAHRG), a group of professional curators, academics and freelance researchers who met to encourage, co-ordinate and disseminate research in the Avebury part of the World Heritage Site. A chronological and thematic approach was adopted in compiling the document, which consisted of individually-authored papers written by period and subject specialists.

The Stonehenge Research Framework, published four years later, was a significantly different document, reflecting the rapidly evolving thinking about the role, format and content of archaeological research frameworks. It, too, was based on the contributions of individual specialists, but it was compiled and edited by a single hand giving it a greater consistency of style and content; it also benefited from the availability of considerably greater resources for mapping and illustration.

Both research frameworks followed the tripartite structure recommended in *Frameworks For Our Past* (Olivier 1996), a strategic review of research policies undertaken for English Heritage. Each comprised a period-based *resource assessment* describing the current state of knowledge about the archaeological resource in their respective areas, a *research agenda* pointing out areas of research which could help fill gaps in that knowledge, and a *research strategy* formulating proposals and priorities for carrying out such research. Despite their shared overall structure, the organisation and presentation of these three main sections differed considerably between the two documents. Nonetheless, both shared a strong emphasis on archaeology rather than the wider historic environment.

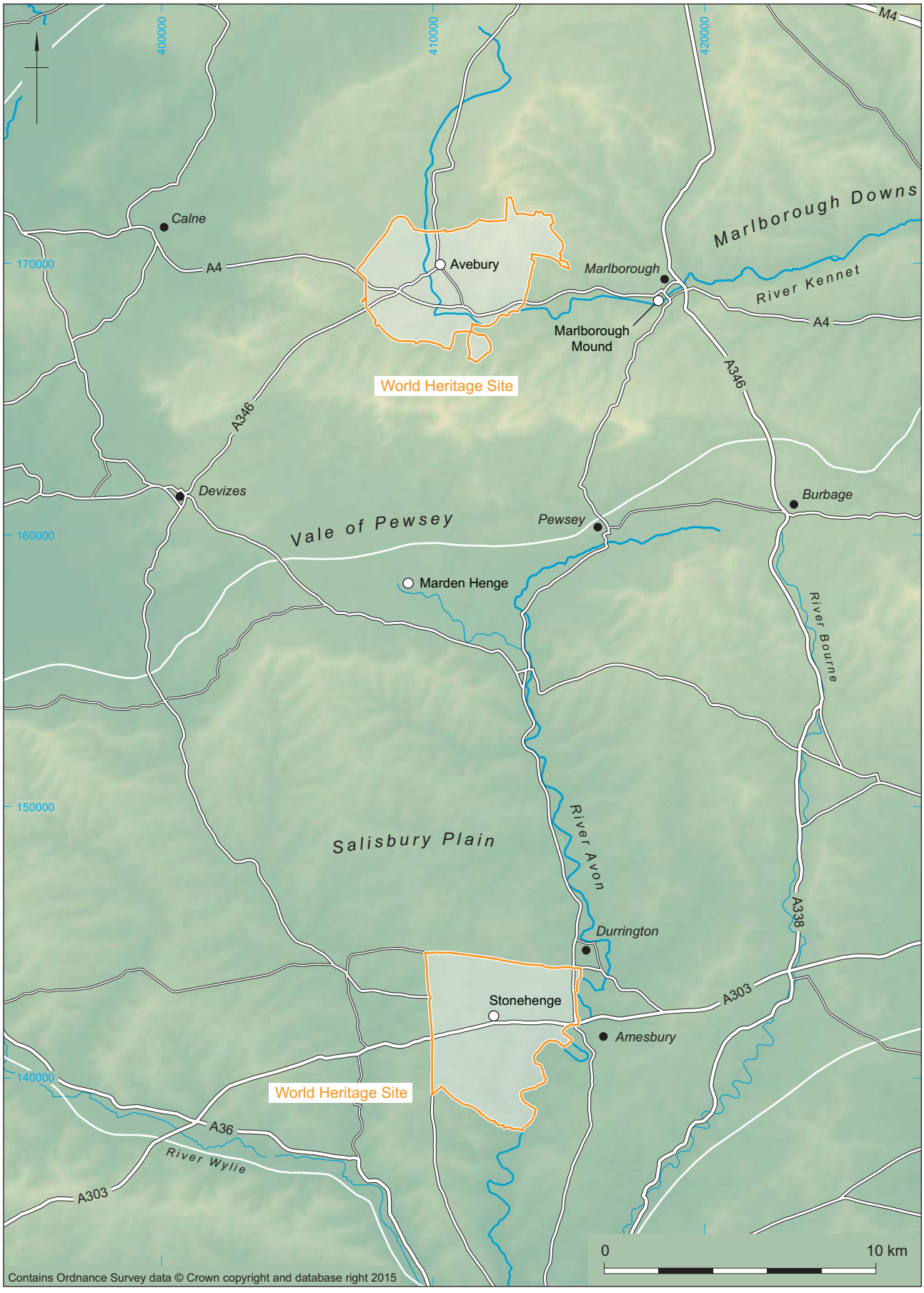


Figure 1 The WHS boundaries

Review of the Existing Frameworks

by Melanie Pomeroy-Kellinger

Research frameworks are temporary documents, providing a point-in-time view of the state of knowledge, priorities and strategies for research as envisaged at their compilation. In the introduction to the original Avebury agenda it was stated that the document would be updated on a regular basis as research was conducted and new discoveries made, and as research priorities evolved (AAHRG 2001, 4). Similarly, the need for reflexivity and revision was made explicit in the Stonehenge framework (Darvill 2005, 32) which was anticipated as being a statement of research issues and priorities for approximately a decade (*ibid.*, 4).

Attempting to assess the relative success or failure of archaeological research frameworks is quite a challenging task. There are no agreed criteria for such an analysis, or a consensus on their value. There is a range of indicators which could be measured, such as how many research projects were undertaken, how many research questions were addressed, or how many new sites have been added to the Historic Environment Record (HER), but none of these are meaningful in isolation. In many ways it is easier to focus on what would constitute failure. In the case of the earlier documents for Avebury (AAHRG 2001) and Stonehenge (Darvill 2005), failure would mean that the documents were ignored and not used, which clearly has not been the case. The fact that there is presently a consensus that they need to be revised (and that funding has been obtained to undertake this process) can be seen as indicating a level of success.

The aims of both of the earlier documents were clearly set out (Avebury, section 1.3; Stonehenge section 1), and were similar: to actively encourage research into all periods, to improve understanding, to better inform other researchers, and to allow informed management to take place. Looking at the wide range of research and management projects undertaken since 2001 across both parts of the World Heritage Site, there is a good indication that many of these earlier aims have been addressed. There have been at least 10 major archaeological projects, and many other smaller ones, including the Silbury Hill project, SPACES, Negotiating Avebury, and others. These include both academic research and development-led projects, and both intrusive and non-intrusive fieldwork, and their results are outlined in the various sections of this document. It is apparent that the research frameworks have been referred to in fieldwork project designs, and indeed in bids for funding.

To what extent these projects would have been undertaken anyway, without the existence of the research frameworks, is difficult to assess; this was a subject of lively debate during a Research Agenda Workshop held in Devizes in June 2011. What is clear, however, is the large number of new discoveries, leading to the development of new theories and interpretations, which have resulted from these projects. In many ways they have led to a wider focus on the prehistoric landscapes surrounding the two iconic stone circles. With the media attention that has come with some of the discoveries, there is now a greater public appreciation of the complexity and significance of these landscapes. While many of these fieldwork projects have been published, it is anticipated that in the next few years a wealth of new information will become available.

Despite this, we know that the landscapes of Stonehenge and Avebury have not yet given up all of their secrets. However, what has been discovered in the last 10 years will help us to ask more detailed and complex questions in the future, and within the aims and objectives of this new, combined research framework. The discussions, debate and communication within the archaeological community resulting from the publication of the earlier documents and this revised version, will continue to be hugely beneficial to our understanding and management of these internationally significant landscapes.

Recent Research

Since 2001 major research has been undertaken in both parts of the World Heritage Site. This included survey, excavation and synthesis at Avebury and its surrounding monuments (Fig. 2), by a team from the Universities of Bristol, Leicester and Southampton (the Longstones and Negotiating Avebury projects) which had notable results, such as the discovery of the Beckhampton Avenue (Gillings *et al.* 2008). At Silbury Hill, English Heritage undertook conservation, repair and excavation, and the Romano-British settlement was examined. The on-going Between the Monuments Project (a collaborative effort by the Universities of Southampton and Leicester and the National Trust) has been investigating the character of human settlement in the Avebury landscape during the 4th to mid-2nd millennia cal BC, and its relationship to changing environmental and social conditions.

At Stonehenge (Fig. 3) excavation was carried out in 2008 by the SPACES Project, while several well-known prehistoric monuments close to Stonehenge were investigated by the Stonehenge Riverside Project, which also discovered the West Amesbury Henge at the end of the Stonehenge Avenue on the bank of the River Avon as well as investigating Aubrey Hole 7 within Stonehenge itself. The Stonehenge

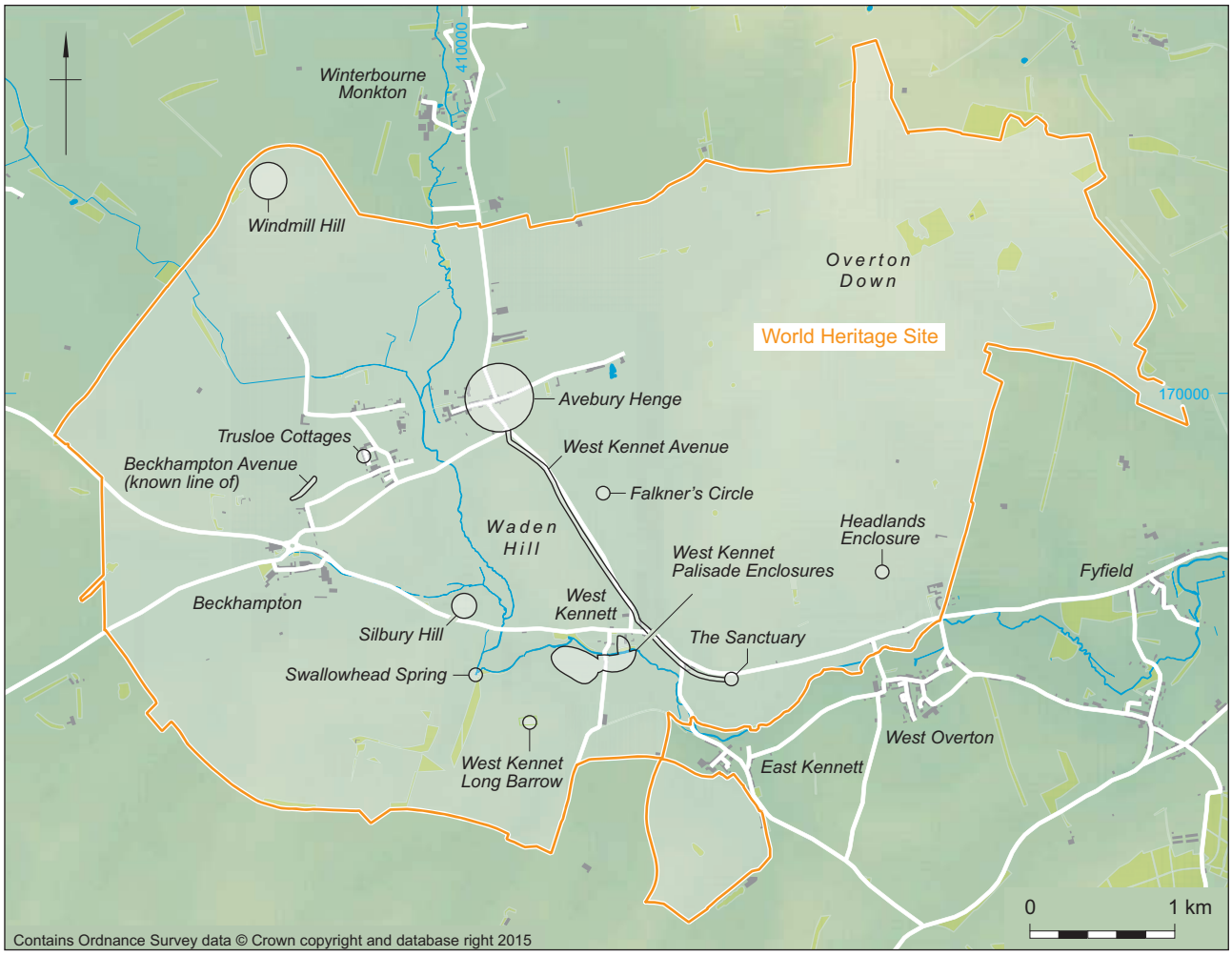


Figure 2 The Avebury WHS: places mentioned in the text

World Heritage Site Landscape Project (English Heritage) involved non-invasive survey of the Stonehenge environs alongside documentary and archive research (Field *et al.* 2014a and b; Bowden *et al.* 2015). The Stonehenge Hidden Landscapes project (by the Ludwig Boltzmann Institute, Birmingham University and international partners) has produced digital mapping of the Stonehenge landscape, revealing a wealth of previously-unknown sites via remote sensing and geophysical survey (Baldwin 2010; Gaffney *et al.* 2012).

Work on museum collections includes the Early Bronze Age Grave Goods Project by Birmingham University, and the Beaker People Project by the Universities of Sheffield, Durham and Bradford. Chronological modelling of the Stonehenge sequence has been revised (Marshall *et al.* 2012). Parch-marks observed during the dry summer of 2013 revealed the locations of missing sarsens 17–20 (Banton *et al.* 2014).

Practice-based research includes the publication of the surveys for the Highways Agency in advance of the proposed A303 road improvements (Leivers and Moore 2008), and further work associated with the new Stonehenge Visitor Centre, including the closure of the A344 and excavations on the line of the Avenue beneath it (Wessex Archaeology 2015).

The landscape of the entire World Heritage Site and its wider environs has now been mapped twice as part of the National Mapping Programme (NMP): in 1997–8 from all accessible aerial photographs, while in 2010–11 that mapping was further enhanced via the analysis of more recent reconnaissance photographs and of lidar data (Crutchley 2002; Bewley *et al.* 2005; Barber 2016, Avebury Resource Assessment).

The New Research Framework

by Sarah Simmonds

The path to the production of the Stonehenge and Avebury Research Framework has been a complex one. During the period of review and update of the Avebury Research Agenda (AAHRG 2001), which began in 2008, a number of key changes occurred in the management context. These led to the decision to

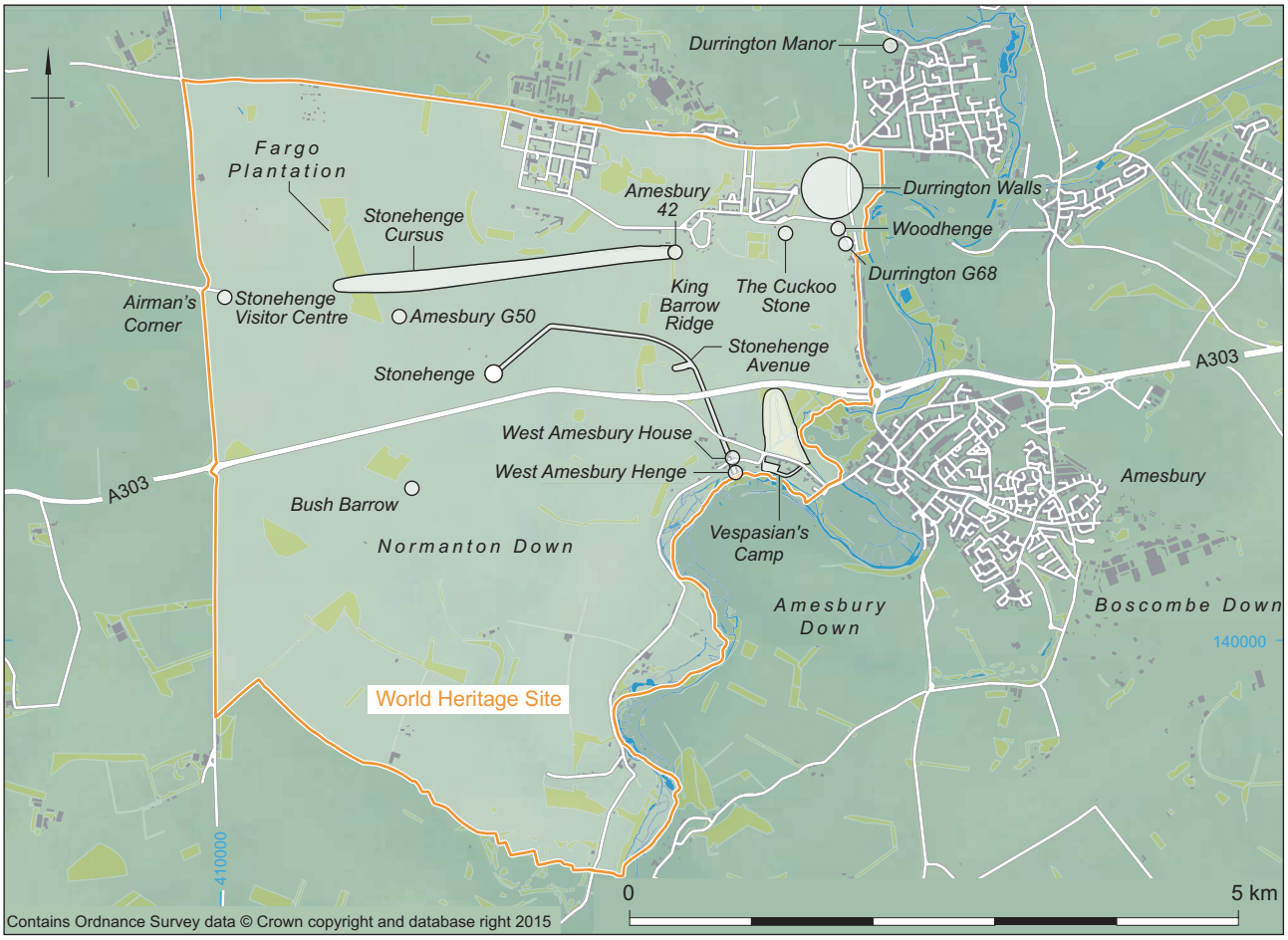


Figure 3 The Stonehenge WHS: places mentioned in the text

combining the Avebury document with the more recently-produced Stonehenge Research Framework (Darvill 2005) in order to create a joint Stonehenge and Avebury Research Framework. The decision to produce a three-volume framework was influenced by a number of factors, particularly the challenge of combining two very differently-produced resource assessments. This continuing difference in approach to the two halves of the World Heritage Site was in part a result of the funding criteria in place during the development of the joint framework.

A fundamental change in the management context was triggered by the governance review of the World Heritage Site in 2012. The review recommended a more joined-up approach to the management of the two halves of the World Heritage Site, and this had a significant influence on the decision to produce the first joint World Heritage Site Management Plan for Stonehenge and Avebury, published in 2015 (Simmons and Thomas 2015). Reflecting the move to closer working across the World Heritage Site the Avebury Archaeological and Historical Research Group (AAHRG) was expanded in 2014 to include Stonehenge and become the Avebury and Stonehenge Archaeological and Historical Research Group (ASAHRG). The decision to produce a joint research framework for Stonehenge and Avebury is part of this movement towards a more integrated approach to the single World Heritage Site.

Funding criteria for the production of research frameworks over this period also influenced the three part publication format. The process of updating the Avebury Research Agenda began in 2008 following a period of peer review and an online survey circulated widely among the academic community. A project outline was submitted to English Heritage on behalf of AAHRG based on the needs identified in the review and Wessex Archaeology was contracted to put together a detailed project design. Funding was agreed for new graphics and mapping and project management.

No funding was available for the production of the new Resource Assessment, which consequently led to this section again being produced by individuals on a voluntary basis. This approach provided the engagement of the academic community and in-kind contribution required by funders. An editorial committee made up of members of AAHRG was

Plate 1 The original Avebury Research Agenda (left), Stonehenge Research Framework (centre) and current Management Plan (right)

established at the end of 2009. The process of inviting contributors to update the resource assessment began in 2010.

The decision to produce a joint research framework for Stonehenge and Avebury – although very much in line with its recommendations – did in fact precede the outcomes of the World Heritage Site governance review. In mid-2010, revised English Heritage funding criteria meant that support was no longer available for updates to existing research frameworks and it appeared that the update of the Avebury Research Agenda could no longer be supported. The idea of producing a combined Stonehenge and Avebury Framework was suggested. In addition to producing a consistent approach to the single World Heritage Site this would also constitute a new publication that would be eligible for funding. Funding was secured for the production of a new joint agenda and strategy but it was decided that the resource assessments for the two halves would still be considered updates. The Avebury Resource Assessment therefore maintained the approach of securing updates from individual contributors, while a brief update of the relatively recent Stonehenge Framework would be produced by the single author (Tim Darvill) who had produced the 2005 Stonehenge Research Framework (Pl. 1). This approach was agreed by AAHRG who recognised both the necessity and the challenge of combining the two very different formats of resource assessment in a single joint framework.

Following completion of the Framework the project board decided to publish the Stonehenge and Avebury Research Framework in three parts to reflect the very different approach to production of the two resource assessments. The joint agenda and strategy section has been published as the third part of the Framework.

Aims and Objectives

The new Framework is intended to cover the whole World Heritage Site, revising and updating the earlier documents. It is the result of consultation across the research community (in its broadest definition) and is intended to guide and inform future research activities in the historic environment and, in turn, its management and interpretation. The intention is that it will be underpinned by data-management systems that can be actively maintained as project-specific tools into the future. This new framework, therefore, fulfils a number of objectives:

- it provides revisions (redrafting and updating) of the existing Avebury and Stonehenge resource assessments, incorporating the 2008 boundary changes to the World Heritage Site, and explicitly expanding the focus from archaeology to the wider historic environment;
- it starts the process of harmonising and integrating the earlier separate research documents with the production for the first time of a single, combined research agenda and strategy for the whole World Heritage Site; and
- it develops a method to facilitate future review and revision. In future, this task will be undertaken by the Avebury and Stonehenge Archaeological and Historical Research Group (ASAHRG), which replaces AAHRG to promote and disseminate historical and archaeological research in the World Heritage Site as a whole.

Plate 2 Excavations at the Wilsford Henge, Marden, during University of Reading's Field School, 2015 (© University of Reading)

Consultation

Since the revised framework was first proposed, various forms of consultation have been undertaken as to its form and content. Named authors were invited to produce resource assessments and technical summaries; workshops and meetings guided the initial drafts of the Research Agenda; ASAHRG provided criticism of both. Drafts of these sections were presented for public consultation and comment via the internet, prior to further revision and comment by ASAHRG and Historic England. Following their finalisation, the Research Strategy was formulated based on their content, and the whole circulated for further comment. The entire process was guided by a Project Board.

In consequence, the new Research Framework offers a guide that reflects the priorities and encompasses the views of the widest possible community. It is in every sense a collaborative document, produced by and for the constituency of researchers working within the World Heritage Site.

Geographical Scope

One problem raised by the 'serial' nature of the World Heritage Site, comprising two relatively small areas of landscape separated by a distance of some 40 km, is that of determining the appropriate geographical scope for its research framework (Fig. 1). The boundaries of the two areas are largely arbitrary, although the development in them of notable complexes of monuments does distinguish them from much of the intervening (and surrounding) landscape. Nonetheless, the density of archaeological sites and monuments more widely across Salisbury Plain, the Vale of Pewsey (Pl. 2) and the downland around Avebury does mean that research into the World Heritage Site cannot be undertaken in isolation. Indeed, the presence of a henge at Marden of comparable size to those at Avebury and Durrington Walls (and approximately midway between them, Pl. 3), and of a mound at Marlborough comparable to Silbury Hill, as well as other monument complexes at a greater distance, such as in the Thames Valley and on Cranborne Chase, indicates that many of the questions which can be asked about the World Heritage Site can only be answered if consideration is given to a much wider area.

However, the World Heritage Site lies within, and close to the eastern edge of, the area covered by the South West Archaeological Research Framework (SWARF, Webster 2008), which is bordered to the east by that covered by the Solent Thames Research

Plate 3 AMOS electromagnetic survey at in the West Kennet Avenue, Avebury, July 2013 (Photograph by Timothy Darvill. Copyright Reserved: BU, DAI and Sensys)

Framework (STRF, Hey and Hind 2014). Together these two frameworks cover all the Wessex chalkland, which defines the wider landscape occupied by the World Heritage Site. Although they encompass much larger areas than the present research framework, they articulate many of the broader research issues, of all periods, which are also of general relevance to the World Heritage Site. They also cover some specific issues relating to the Stonehenge and Avebury monumental landscapes, and the other monument complexes in their respective regions.

For these reasons, it has not been considered necessary to impose another arbitrarily defined 'study area' around the two areas of the World Heritage Site. Instead, this research framework keeps a close focus on the World Heritage Site, while recognising variable wider contexts as appropriate.

Structure

Although the new Research Framework covers the whole of the World Heritage Site, only its agenda and strategy sections have been fully integrated. Because the levels of revision considered appropriate for the two resource assessments differed so markedly, their integration was not considered possible at this stage. This framework therefore comprises a number of component parts.

Resource Assessment

Not only is there at present no overall resource assessment for the whole of the World Heritage Site, there also remain significant differences in the organisation and presentation of the current resource assessments for the Avebury and Stonehenge areas, as brought together here.

Stonehenge

The 2005 resource assessment remains current, but it is supplemented by an update on research undertaken since then, *Recent Research in the Stonehenge Landscape 2005–2012*, by the same author. This consists of summaries of development-prompted research and problem-orientated research, followed by a section looking at recently changed and changing aspects of research: dating, long-distance connections, landscape structure, and the relevance of other monuments.

This update is available on-line via http://www.stonehengeandaveburywhs.org/management-of-whs/stonehenge-avebury-research-framework.

Avebury

The Avebury Resource Assessment has, for the most part, been completely re-written and expanded, and the new version replaces that contained in the 2001 document. As with the original Avebury Resource Assessment, individual authors provided papers on a voluntary basis, and not all conformed to the same template. In consequence, two (Romano-British and mid–late Saxon) are updates similar to that produced for Stonehenge, rather than full reassessments. In those instances, the original 2001 assessments have been included here for the sake of completeness. Most of the resource assessments were produced in 2011 and 2012, except for the sections covering environmental archaeology, GIS, the Iron Age, and modern Avebury, which date from 2013, the post-medieval and modern resource assessment, which dates from 2014, and the assessment of built heritage, which dates to 2015.

The resource assessment is split into two parts. The first, *Methods of Research*, provides cross-period assessments of the resource based on a number of specific research methods, old and new, which have been used to develop our understanding of the archaeology in the Avebury area. Descriptions of some of these methods, and in some cases assessments of the resource as revealed by them, were provided in *Part 5: Methods and Techniques* of the 2001 framework, as well as in a chapter on *Palaeo-Environmental Evidence* at the end of the original resource assessment.

The second part, *Period-Based Assessments*, represents to a large extent the complete replacement of the 2001 resource assessment. It now includes, however, papers on the *Post-Medieval* period, *Built Heritage*, and *Modern Avebury*, as well as separating the Middle and Late Bronze Age.

Research Agenda and Research Strategy

The new Research Agenda and Strategy cover for the first time both parts of the World Heritage Site. In the tripartite structure recommended by Olivier (1996), as followed by the earlier Avebury and Stonehenge frameworks, these two sections appear to have quite distinct roles, the agenda describing the gaps in our knowledge and the strategy proposing ways of filling those gaps. There is, however, a degree of overlap between them, since some research questions cannot be realistically addressed until others have been answered. Finding answers to some questions, therefore, becomes part of the strategy for answering other questions.

There have been a number of guiding principles in the compiling of the agenda and strategy. First, an attempt had been made to make the document recognisable, as far as possible, as a progression from the two earlier versions, despite their evident differences in approach, combining both thematic and period-based components. Secondly, consideration has been given to the need for it to be in a form suitable for future combined revision. Thirdly, as the agenda is intended to be a working document of use to a wide range of audiences, the objective has been to give it a relatively straightforward and transparent structure; what it may lack in theoretical and philosophical sophistication, it is hoped that it gains in clarity and usability.

Research Agenda

The purpose of the agenda is to articulate the significant gaps in our understanding, by posing some of the outstanding questions in a form that is relevant to a number of chronological periods and major thematic subjects of relevance to the unique character of the World Heritage Site. The first part of the agenda outlines the themes which underlie the period-based questions described in the second. These questions are those generated during the process of workshops, consultation and comment outlined above.

Research Strategy

There were significant differences in the structure and content of the two previous strategies. The *Research Strategies* in the original Avebury agenda comprised largely specific methodologies for answering specific questions, while the *Research Strategy* in the Stonehenge document consisted more of an overarching plan, made up of a series of objectives under a number of broad thematic headings.

The new research strategy has a number of aims:

- to set out a framework of principles under which research should be carried out in the World Heritage Site; and
- to identify practical means by which such programmes of investigation can be facilitated, co-ordinated, resourced, sustained and communicated, and by which the research framework can be reviewed and updated.

After considerable discussion, it remained of particular concern to the Project Board and authors that the Research Strategy was not prescriptive. Consequently, it is a deliberate move away from a document which prioritises particular pieces of research, instead offering guidance designed to encourage innovative research which exceeds the requirements of 'best practice'.

The New Research Framework's Components

Although the individual parts of this present Research Framework document collectively cover the whole of the World Heritage Site, it remains an intermediate stage in the production of a fully integrated framework, and is on its own a necessarily incomplete document. It needs to be read in conjunction with the 2005 Stonehenge framework particularly and, to a lesser degree, with the 2001 Avebury agenda. Although some elements of the original Avebury agenda have been completely re-written, the cumulative nature of archaeological research and the re-iterative nature of research frameworks mean that these superseded components still have a degree of currency and value. All relevant components of the past and present frameworks, therefore, will be accessible online at a single location on the Stonehenge, Avebury and Associated Sites World Heritage Site website (http://www.stonehengeandaveburywhs.org/management-of-whs/stonehenge-avebury-research-framework/).

The new *Stonehenge, Avebury and Associated Sites World Heritage Site Research Framework* comprises the following main component parts:

- **Resource Assessment**
  Avebury Resource Assessment (Leivers and Powell 2016)
  Stonehenge Resource Assessment (Section 2: Darvill 2005)
  Stonehenge Update (on-line)
  Avebury Resource Assessment (Part 1: AAHRG 2001)

- **Research Agenda**
  Stonehenge and Avebury Research Agenda
  Avebury Research Agenda (Part 2: AAHRG 2001)
  Stonehenge Research Agenda (Section 3: Darvill 2005)

- **Research Strategy**
  Stonehenge and Avebury Research Strategy
  Avebury Research Strategy (Part 3: AAHRG 2001)
  Stonehenge Research Strategy (Section 4: Darvill 2005)

Radiocarbon Dates

Calibrated date ranges were calculated by the maximum intercept method (Stuiver and Reimer 1986), using the program OxCal v4.1 (Bronk Ramsey 1995; 1998; 2009) and the INTCAL09 dataset (Reimer *et al.* 2009). Ranges are rounded out to the nearest 10 years.

Lifespan

The lifecycle of this document is likely to be between five and ten years, parallel to the *Stonehenge and Avebury World Heritage Site Management Plan*, and depending on the pace of research in the World Heritage Site. The progress of research will be monitored by ASAHRG, who will determine when a further revision is necessary. The next version of the Research Framework should fully integrate both parts of the World Heritage Site into a single document.

Part 1:
Methods of Research

Introduction

This section provides an assessment of the wide range of methods, old and new, which have been used to develop our understanding of the archaeology of the WHS. It corresponds broadly, therefore, to 'Part 5: Methods and Techniques' of the previous Avebury Research Agenda (AAHRG 2001). It includes methods of non-intrusive survey; intrusive archaeological fieldwork; historic and documentary research; and forms of scientific analysis, as well outlining the range of other resources which enable and support research in the World Heritage Site.

Geophysical Survey

by Andrew David

Introduction

Geophysical survey is defined here as the ground-based and non-intrusive use of geophysical methods to locate and characterise archaeological features and deposits. Such methods are often supported by other techniques of geoarchaeological site investigation, such as augering and magnetic susceptibility survey. Much less commonly, the mapping of spatial patterns of chemical traces in the soil, as in phosphate survey, can also help characterise former land use.

The Avebury area continues to attract the application of geophysical techniques. Since this activity was last assessed (David 2005), work has continued on an episodic basis in response both to specific research projects, and conservation needs. Recent surveys have focused in particular on Silbury Hill and its environs, as well as on locations associated with the wider megalithic landscape. Techniques of choice remain magnetometry and earth resistance, with some additional use of ground penetrating radar.

Background

The Avebury WHS is underlain by chalk. Over the higher ground there are thin cultivated soils with, in places, an intermediate capping of Clay-with-flints. Valley bottoms are infilled with superficial deposits of varying depths, including solifluction deposits, colluvium and alluvium (Evans *et al.*1993).

The geophysical potential of such substrates can be very high. Chalkland soils, in particular, often have a magnetic susceptibility (MS) that is well suited to magnetometer survey (eg, on Windmill Hill, MS values range between 20–135 x 10^{-8} m^3/kg). However, most archaeological features will become difficult to detect at soil depths exceeding a metre in the valley bottoms (Clark 1996). MS values tend to be lower in these areas too (eg, 4–30 x 10^{-8} m^3/kg in the Winterbourne Valley: GSB 1992a).

The history of geophysical survey (see Pl. 3) in the Avebury area goes back at least to 1959, increasing in tempo and coverage from 1975 onwards. Overviews of the results and an indication of the potential of the technology have been published previously (David 2001; 2005). Together with aerial remote sensing and investigative earthwork survey, geophysics is part of a powerful combination of field techniques in use in the WHS and has demonstrated that major advances in detection and subsequent conservation are possible.

The chalkland geology of Avebury favours the application of magnetometer survey in particular, for the location of negative features such as pits and ditches, as well as previously heated features, and the results are effectively demonstrated at sites of Neolithic to medieval age. Earth resistance methods have been used more sparingly but have been of proven worth for the location of megalithic burials and destruction sites, as well as helping define earthworks and structures up to the post-medieval period. Ground penetrating radar had been used more sparingly still, and experimentally, to help define buried megaliths and megalithic structures. The further potential of this 3D methodology, including its use on the sites of buildings, and of more sensitive and mobile magnetometer arrays, has been a feature of more recent work.

Assessment of Current Geophysical Survey Coverage

Table 1 brings the listing of geophysical surveys in the Avebury Area up to date (2011). Grey literature reports on much of the more recent work are

Table 1 Geophysical surveys in the Avebury Area up to 2011

Location	NGR	Date	By whom	Type	Reference
Avebury Henge	SU 1025 7000	1975–96	AML	Mag, Res, EM	Ucko *et al.* 1991; Bewley *et al.* 1996
Avebury Henge	SU 1040 6995	2003	NT	Res	Unpubl., Papworth 2004
Avebury Henge, The Cove	SU 1023 6999	1998	Aperio Ltd	GPR	Dodds and Eddies 1998
Avebury Henge, outside E entrance	SU 1050 7010	1990	AML	Res	Ucko *et al.* 1991
Avebury Henge; SW Sector	SU102 698	2005	J. Gunter and V. Roberts	Res	Gunter and Roberts 2005
Avebury Manor	SU 099 700	1991	A. Bartlett	Mag, Res	Unpubl. NT archive
Avebury Manor Park (DMV): field north of Manor Parkland	SU 099 701	2005	J. Gunter and V. Roberts	Res	Gunter and Roberts 2005; Unpubl. NT archive
Avebury (Old School House)	SU103700	2010	EH	GPR	Unpubl.
Avebury (Old School House)	SU103700	2010	Talits	Res	Gunter and Roberts 2010
Avebury Car Park	SU 0995 6968	1984	AML	Mag	Unpubl., David 1984
Avebury Trusloe: Manor Farm Paddock (Beckhampton Avenue)	SU 0950 6970	2005	Longstones Project (Bristol University: J. Gunter and V. Roberts)	Res	Gunter and Roberts 2005 Gillings *et al.* 2008
Avebury Trusloe: Longstones Field (Beckhampton Avenue)	SU 0859 6881	2003(?)	Longstones Project	Res	Gillings *et al.* 2008
Beckhampton Avenue, Longstones Field	SU 090 693	1975–00	AML	Mag, Res, GPR	Ucko *et al.* 1991; David 1999; 2000; 2008a
Beckhampton Avenue: Long Barrow Field	SU 087 691	2002	EH	Res, Mag	David 2008b
Beckhampton Avenue: Beckhampton Field	SU 0926 6963	2001	Longstones Project	Res	Gillings *et al.* 2002; 2008
Beckhampton barrow cemetery (Area A)	SU 092 690	1993	GSB Prospection	Mag, MS	Powell *et al.* 1996
Foot of Avebury Down	SU115704	2007	Talits	Res	Gunter and Roberts 2007
Devizes Road	SU 083 688	2002	Longstones Project	Res	Unpubl.
Avebury barrows G24, G25, G25a, Overton Hill		1989	Cardiff University	Mag	Unpubl., Hamilton 1997
Avebury barrow G29a, Overton Hill	SU 116 689	1997	Cardiff University	Mag	Unpubl., Hamilton 1997
		1998		Mag	Unpubl., Hamilton and Dennis 1998
Avebury barrow G21	SU 110 692	1997	Cardiff University	Mag	Unpubl.
North Farm, West Overton barrow G16	SU 132 686	1998	Cardiff University	Mag, Res	Unpubl., Hamilton *et al.* 1998
Overton Hill barrow G1	SU 1189 6797	2009	NT and Talits	Mag, Res	Unpubl., Papworth, 2010
Hackpen, Overton Hill	SU 11415 69010	2005	J. Gunter and V. Roberts	Mag, Res	Unpubl., Snashall 2007
West Kennet Avenue	SU 101 686	1990	AML	Mag, Res	Ucko *et al.* 1991
West Kennet Avenue	SU 108 690	1997–8	Cambridge University	GPR, Res	Unpubl.
South Street Long Barrow	SU 0902 6928	1996, 2000	A. J. Clark; EH	Mag	Ashbee *et al.* 1979; Martin 2001a
Horslip Long Barrow	SU 0860 7052	2000	EH	Mag	Martin 2001a
Adam's Grave	SU 112 634	1997–8	Cambridge University	GPR	Unpubl.
Easton Down Long Barrow	SU 063 661	1991	Cardiff University	Mag	Whittle *et al.* 1993, 200; Cardiff University archive
Millbarrow	SU 094 722	1989	Cardiff University	Mag	Whittle 1994

West Kennet Long Barrow	SU 104 677	1991, 2001	AML, CfA	Mag, Res, EM	Unpubl., Martin 2001b
West Kennet Enclosures	SU 109 681	1989	Cardiff University	Mag	Unpubl.
West Kennet Enclosures	SU 109 681	1991–2	Cambridge University	Mag	Unpubl.
West Kennet Enclosures (north meadow)	SU 113 683	2005	J. Gunter and V. Roberts	Res	Gunter and Roberts 2005
Silbury Hill	SU 1001 6853	1959	F. R. McKim	Res	McKim 1959
Silbury Hill (Ditch)	SU 100 685	1968	UCSWM	Seismic	Whittle 1997a
Silbury Hill	SU 1001 6853	2001–2	Skanska	Seismic	Unpubl.
Silbury Hill	SU 1001 6853	2001	EH	Res, Mag, GPR	Linford and Martin 2001; Linford 2001
Silbury Hill environs	SU 104 683	2005	J. Gunter and V. Roberts	Res	Gunter and Roberts 2005
Silbury Hill environs		2005–8	EH	Mag, Res	Linford *et al.* 2007; 2009
Silbury/Waden		1997	Cardiff University	Mag	Unpubl.
Silbury/Waden		1993	GSB Prospection	Mag, MS	Powell *et al.* 1996
Other foul sewer line sites		1993	GSB Prospection	Mag, MS	Powell *et al.* 1996
Waden Hill		1998	Cardiff University	Mag	Unpubl.
Waden Hill (N end)	SU 1034 6931	2006	NT (J. Gunter and V. Roberts)	Mag, Res	Gunter *et al.* 2006
Falkner's Circle	SU 1098 6931	2002–3	EH	Mag, Res	Martin 2004; 2008
The Sanctuary	SU 118 680	1999	Cambridge University	Mag	Unpubl.
The Sanctuary café	SU 118 681	1998	Cardiff University	Mag	Unpubl.
Winterbourne Bassett stone circle	SU 6035 7550	1998	AML	Mag, Res	David *et al.* 2003
Windmill Hill	SU 087 714	1988–93	AML	Mag	Whittle *et al.* 1999
		1988, 1993	Cardiff University	Mag, MS	Unpubl., Banham 1995
Headlands Enclosure, West Overton	SU 1285 6882	1999	Cardiff University	Mag	Pollard and Reynolds 2002, fig. 59
		2003	EH	Mag	Linford 2004
Knoll Down		2004	J. Currivan	??	Currivan 2004
Overton Hill, 'causewayed enclosure'	SU 114 684	1989	Cardiff University	Mag	Unpubl.
Wroughton Copse (Fyfield Down)	SU 138 707	?	?	Mag, Res	Fowler 2000a, 34, 46
Site X/XI (Overton Down)	SU 132 703	?	?	Mag, Res	Fowler 2000a, 34, 46
Piggledene	SU 139 691	2008	EH	Mag	Linford 2008
Oldbury Hillfort	SU 049 693	1996	AML	Mag	Payne *et al.* 2006, 123–7
Compton Bassett		1996–8	Cardiff University	Mag	Unpubl.
Yatesbury	SU 071 699	1993	Cardiff University	Mag, Res	Pollard and Reynolds 2002, fig. 65
	SU 605 715	1996			
	SU 074 707	1996–8			
Wansdyke		1970–?	A. J. Clark	Mag, Res	Unpubl.
Delling Valley	SU 132 714	2005	J. Gunter and V. Roberts	Res	Gunter and Roberts 2005
Sloe Copse; Shelving Stones long barrow?	SU 096 704	2005	J. Gunter and V. Roberts	Res	Gunter and Roberts 2005
Bridgemead, High Street, Avebury	SU 09839 69878	2010	Talits	Res	Unpubl. (part of ongoing watching brief)
West Kennett Farm orchard	SU112 383	2010	Talits	Res	Unpubl.

AML – Ancient Monuments Laboratory; EH – English Heritage; EM – Electromagnetic; GPR – Ground Penetrating Radar; Mag – Magnetometry; MS – Magnetic susceptibility; NT – National Trust; Res – Resistivity

available, listed in the bibliography, although at the time of writing (2011) it has not been possible to assess all the results from the smaller surveys. The most consequential results are summarised below.

Within and around Avebury itself the Ancient Monuments Laboratory (AML) have been conducting surveys intermittently since 1975. This has been largely in response to calls for further information about the archaeology of the main monument complex, the enclosures on Windmill Hill and the West Kennet long barrow. In the last two decades surveys have also been undertaken by others, for instance the magnetometer surveys by Cardiff University over parts of the West Kennet palisade enclosures, Overton Down and elsewhere and GPR surveys by Cambridge University over buried monoliths on the course of the West Kennet Avenue. Development-driven surveys include those by Geophysical Surveys of Bradford (GSB) along the course of the Kennet Valley Foul Sewer (GSB 1992a, 1992b; Powell *et al.* 1996). Also, the National Trust has commissioned surveys on its property, for instance within the grounds of Avebury Manor (Bartlett 1991).

Avebury henge

Earth resistance surveys have now been undertaken of parts of the south-west, south-east and north-east quadrants (Gunter and Roberts 2005; Papworth 2004). These surveys, especially in the eastern half of the henge have confirmed the existence of the stone settings of the main circle and extant earthworks; no other certainly prehistoric elements have been identified although various additional and more speculative features, of various possible dates, have been tentatively indicated. Potential boundary features are summarised in Gillings *et al.* (2008, fig. 8.9).

Beckhampton Avenue

Accounts of various small surveys undertaken between 2002–5 in support of the Longstones Project have been published (Gillings *et al.* 2008). The ability of earth resistance survey to detect some former stone settings, already evidenced by earlier surveys near the Longstones, was confirmed again following excavation of a high resistance anomaly that proved to be a stone burial north-west of Trusloe Cottages (*ibid.*, 103–9). However, it is worth cautioning that this and other similar surveys also often return ambiguous or negative results concerning the presence/absence of stone settings.

As elsewhere, earth resistance surveys in the Beckhampton area have detected evidence of former cultivation practice, most probably of medieval or more recent origin.

Falkner's Circle

Both magnetometer and earth resistance surveys over this putative former stone circle produced results difficult to interpret with confidence, even with the presence of a surviving monolith as a guide (Martin 2008). Excavation revealed that the surveys had detected a stone destruction pit and, less convincingly, three pits interpreted as possible stone-holes. Such results emphasise the great difficulty to be encountered in recognising former megalithic settings, a problem exacerbated manyfold if the location of the former site is not well known, and complicated by the presence of naturally occurring sarsen material.

Ring ditches and barrows

Magnetometer, and especially earth resistance surveys over ring ditches continue to be successful, as demonstrated over the barrow cemetery on the northern end of Waden Hill (Gunter *et al.* 2006). The earth resistance data here incidentally located two long concentric curvilinear anomalies which, although speculated to be either natural or resulting from flint extraction, would benefit from further investigation.

An earth resistance survey over a surviving bowl barrow and its environs south-east of the Sanctuary on Overton Hill was successful and identified additional features of interest including the probable site of a barrow excavated by Stukeley (Papworth 2010).

West Kennet Palisade Enclosures

Earth resistance survey of the uneven meadow field between the River Kennet and the known but incomplete circuits of Palisade Enclosure 2 and parts of Enclosure 1 was undertaken in 2005 (Gunter and Roberts 2005, 44–55). This field is traversed by two substantial buried oil pipes, but the surveys at least hint at other alignments that might correspond with extensions to the enclosure circuits. The picture is further complicated though by the effects of later earthworks, water management features and possible migration of the river channel. The resistance response is mostly rather diffuse and identification of possible arcs and alignments can only be cautious without further evaluation.

Headlands Enclosure

The excellent response to magnetometer survey that can usually be expected of Iron Age occupation sites is exemplified by the caesium magnetometer coverage of the Headlands Enclosure at West Overton (Linford 2004; Fowler 2000a). Together with aerial photography, this survey has accurately located a potentially multi-phased circular enclosure with entrances and a mass of internal pits, external linear features and possible timber structures.

Silbury Hill and Environs

The Silbury Hill Conservation Project was the stimulus for much geophysical survey effort, including 3D seismic and electrical resistance tomography, ground penetrating radar and magnetic survey, to try to determine the subsurface character and condition of the mound; however, the results of all these endeavours were of mixed value compared with the results obtained from a number of bore holes.

More positively, the survey effort was extended to encompass the entire surroundings of the mound as part of a multidisciplinary project to provide a firmer archaeological and historical context for the Hill. The input that this entailed represents the largest and most concerted of the geophysical surveys so far undertaken inside the Avebury WHS boundary (Linford *et al.* 2009). The coverage included the low-lying meadow fields around the monument, and extended south of the A4 to include the meadows between the Hill and the Swallowhead Spring and the adjacent slopes of the field to the west of the Winterbourne.

All these areas were surveyed with an array of caesium magnetometer sensors with some outstanding results. Most notably, the slopes to the east of the Winterbourne and south of the Hill were found to be the site of an extensive rectilinear network of ditches, enclosures, route-ways and other features including at least three buildings; subsequent field evaluation has confirmed the likelihood that all these features represent Roman settlement. GPR survey has clarified the definition of the buildings (see Fig. 17).

The magnetic response in the meadows around the Hill was muted in places by valley alluvium but the sensitivity of the magnetometers was such that evidence of further buried ditches was detected to the north and east, suggesting that the Neolithic mound was the focus of very extensive later settlement; enclosures on the slightly higher ground to the east of the foot of the Hill also hint at possible ritual precincts or sanctuaries.

Earth resistance survey was deployed on a smaller scale over a number of locations to either side of the A4; a further possible building was located close to the Winterbourne near the foot of Waden Hill, and elsewhere the technique was responsive to geomorphology and to more superficial and probably more recent earthworks and landscape features. A particularly enigmatic pattern of high resistance anomalies encircling slightly higher ground in the meadows south and north of the A4 was later confirmed to be the probable response to elaborate post-medieval water management features.

Conclusions

The summaries above will give a flavour of the geophysical survey activity that has taken place in recent years in the Avebury area. It is far from exhaustive, and a number of smaller and possibly less conclusive surveys (see Table 1) have been omitted. It remains to re-emphasise that geophysical survey needs to be an active and critical element of on-going and future research in the WHS. Archaeological features of a wide variety of types and chronology are often very responsive to geophysical methods and the recent work continues to demonstrate that, apart from refining current knowledge, major new discoveries can still be made. Geophysical surveys in isolation are less fulfilling than when they are embedded in multidisciplinary projects that take full advantage of integrated remote sensing technologies, surface survey, documentary research and subsequent validation in the field.

Aerial Archaeology

by Martyn Barber

Introduction

Aerial survey involves a variety of techniques and technologies largely concentrated around flight, image production, interpretation and transcription. Aerial archaeology is a specialised form of aerial survey which is generally but not solely focused on prospection for and analysis of archaeological remains through airborne reconnaissance and survey. Although increasingly utilising emerging and non-photographic technologies such as lidar, aerial archaeology is most commonly associated with systematic procedures for interpretation and transcription from aerial photographs.

What is Aerial Archaeology?

Although aerial archaeology is commonly associated with the airborne camera, most effort occurs on the ground, indoors, utilising imagery that is years or even decades old. Instead of the individual, carefully framed oblique views of sites that tend to appear in publications, aerial archaeology is characterised by the analysis of sequences of photographs – sequences across space (the automated, overlapping vertical cover captured by survey cameras); and sequences across time (photographs of the same site or area taken at irregular intervals over periods of years or decades). Above all, aerial archaeology is concerned with attention to detail – the exercise of trained judgement within a framework of systematic procedures allowing practitioners to build narratives from an accumulation of fragments.

Aerial archaeology draws mainly on two different kinds of aerial photograph – the angled or *oblique*

view, and the *vertical* view. Obliques are generally taken with hand-held cameras, and this kind of observer-directed photography has characterised archaeological aerial reconnaissance since the 1930s. Verticals are generally taken with automated cameras fixed in position within the aircraft, the lens pointing straight down at the ground. This mechanised approach to aerial photography has characterised aerial survey since the later 19th century. Although rarely taken for archaeological purposes, such photographs nonetheless incidentally capture much of archaeological or historic interest.

The significance of the overlap, particularly with automated survey images, needs stressing. Originally, ensuring an overlap enabled individual photographs to be pieced together into a larger mosaic, but during the inter-war years the significance of the overlap was enhanced as the value of stereoscopic viewing for aerial survey became more widely accepted within military and cartographic circles. Viewing the overlapping portions of sequential images through a stereoscope provides the illusion of a three-dimensional view – and it is important to stress that it is an illusion. The three-dimensional image perceived by someone looking through a stereoscope has no external reality – it does not exist outside the mind of the observer. However, the ability to recognise that particular features possess height or depth relative to their surroundings is clearly important to an air photo interpreter.

Although aerial archaeology is particularly associated with prospection for cropmarks, and to a lesser extent soilmarks and earthworks, anyone familiar with recent mapping projects will realise that this is an oversimplification, albeit perhaps true of aerial archaeology in previous decades. Cropmarks are, of course, the result of buried archaeological features affecting the growth of vegetation above them, a phenomenon most marked in cereals but which can occur across a range of arable crops. A significant factor – but by no means the only one – is the moisture content of the soil, with cropmarks more likely to appear in vegetation growing over archaeological sites on the more freely-draining chalks and gravels than the moisture-retaining clays. Soilmarks are traces of archaeological sites visible in bare ploughsoil, the action of the plough exposing differences in colour and texture between archaeological features and the surrounding soil. Earthworks are the features that tend to benefit the most from the three-dimensional view, although their visibility on aerial photographs is often highlighted or enhanced by the shadows they cast, the optimum time for earthwork photography being when the sun is low in the sky.

As the focus of aerial archaeology has broadened from a primary concern with cropmarks – and in particular prehistoric cropmarks – to encompass all periods from the Neolithic through to the later 20th century, so a far wider range of features is now mapped, with considerable effort put into identifying and mapping structures that post-date the introduction of aerial survey to archaeology. For features dating from the 20th century – for example, structures associated with the Second World War such as hangars, decoys, PoW camps etc., this means mapping them not from photographs of their currently extant remains but from photographs taken while they were in use.

Aerial Archaeology and Avebury

The earliest known aerial photographs taken within the WHS are now nearly a century old, and sites from the area feature in pioneering works of aerial archaeology. The area continues to attract attention, both as part of English Heritage's annual reconnaissance programme and from individual flyers and photographers. Aerial photography in the Avebury area has a history dating back at least as far as the First World War – certainly some photographs of places now within the bounds of the WHS were taken from aeroplanes based at one of the two training aerodromes at Yatesbury, which were active between 1916 and 1919. Unlike Stonehenge, however, there is no indication of any pre-First World War balloon photography, either military or civilian, occurring in the vicinity.

The first aerial photography undertaken in the Avebury area with archaeological aims in mind occurred during flights undertaken in the summer of 1924 for O. G. S. Crawford and Alexander Keiller's *Wessex From the Air* monograph, published in 1928. A landmark volume in the history of aerial archaeology, this probably represented the first civilian use of an aircraft for archaeological purposes in this country, although Crawford and Keiller's approach was not 'aerial survey' in the modern sense. Nor did it resemble the practices Crawford had learnt on the Western Front a few years earlier.

Wessex From the Air featured several sites in the Avebury area – field systems on Overton Down, for example, and various earthworks on Cherhill Down, while additional sites were listed as either photographed, or seen but not photographed. Most noteworthy was a sequence of three large plates showing Avebury, Avebury Trusloe and Beckhampton, taken in the hope of resolving the 'problem' of the Beckhampton Avenue. As Crawford noted, William Stukeley's various plans of this Avenue were inconsistent in their detail, and there was the added problem that Stukeley had been '… bitten by a theory; he believed that Avebury was

Plate 4 Vertical view of Avebury taken by the RAF on 2 September 1929, a few years before Alexander Keiller set to work on the henge and village. (© Historic England Archive, Crawford Collection)

designed in the plan of a snake…'. Crawford hoped that aerial photographs might 'help clear up the matter… Unfortunately, they leave it where it was. There are no signs on any of them of stone-holes.'

Subsequently, aerial survey in general and aerial archaeology in particular has followed a similar pattern to that observed elsewhere. Between the wars, archaeologists such as Crawford were largely reliant on the RAF for aerial photographs (Pl. 4), these generally being taken during training exercises. Crawford took a particularly pro-active role, collecting negatives and prints during visits to RAF bases as well as offering suggestions about where to fly. Included among the photographs he collected during this period is the earliest known trace of the West Kennet palisade enclosures as a cropmark, although the significance of the photograph was not recognised until the 1990s. Civilian aerial photography did not really get underway until after the Second War, supplemented initially by J. K. St Joseph's annual flying programme under the auspices of the Cambridge University Committee for Aerial Photography (CUCAP, and more recently the Unit for Landscape Modelling) and from the later 1960s by the Royal Commission on the Historical Monuments of England's (RCHME) (and since 1999 English Heritage's) annual reconnaissance programme. Since the mid-1960s, the National Record of the Historic Environment has also built up a substantial library of aerial photographs, drawing particularly on comprehensive vertical cover of the country undertaken by the RAF (from the mid-1940s), the Ordnance Survey and other organisations.

Archaeological survey focused on the Avebury area, drawing on these and other sources of aerial photographs, has over the last 20 years or so comprised a series of relatively small-scale interpretative mapping projects concentrated on particular sites or areas (eg, Bewley *et al.* 1996; Corney 1997a; Fowler 2000a; Barber 2003); with the 1997–8 mapping of the WHS as a whole (see below) providing a broader interpretative framework for these smaller projects, as well as an opportunity to update their results from new, or newly available, aerial photographs.

Avebury and the National Mapping Programme

The landscape of the entire WHS and its wider environs has in recent years been mapped twice as part of the National Mapping Programme (NMP) – once (1997–8) from all accessible aerial photographs,

Figure 4 Part of the area mapped from aerial photographs in 1999, with some updates from subsequent reconnaissance photography and lidar. The base map is derived from the Ordnance Survey 1:10,000 mapping (© Historic England and © 2016 NextPerspectives). This plan is reproduced from Leary et al. *2013*

and more recently (2010–11) that mapping has been further enhanced via the analysis of more recent reconnaissance photographs and of lidar data (Fig. 4). The point about examining all accessible aerial photographs is worth stressing – features of interest are seldom visible with the same degree of clarity on every occasion that a photograph is taken, while in many cases factors such as lighting conditions, angle of view, altitude, scale of photography, vegetation cover and so on can seriously affect the visibility of archaeological features, or even render them completely invisible. In addition, of course, cropmarks will only develop under certain conditions, and even when those conditions seem ideal, there is no guarantee that any part of a particular site will be visible, let alone in its entirety, hence the need for access to all available aerial photographs. There simply is no such thing as a representative sample of aerial photographs. Omitting particular photographs or collections of photographs from a survey project runs the risk of significant detail being missed. At the same time, the absence of any trace of an archaeological feature at a particular location on aerial photographs does not mean that there is nothing there.

The National Mapping Programme follows a particular methodology, aiming to map all archaeological and historic features within a particular project area, using particular mapping conventions, to a specified standard and scale. That methodology has developed considerably since the days of the first pilot projects in the 1980s, and even since the initial Avebury World Heritage Site Mapping Project (AWHSMP) in the late 1990s. The AWHSMP was undertaken at the point when manual transcription methods were giving way to digital techniques, meaning that initially at least, parts of the project area were mapped by hand onto permatrace while others involved computerised rectification of photographs via AERIAL, a rectification package developed at the University of Bradford, with the actual mapping undertaken in AutoCAD. Aerial Survey within English Heritage currently continues to use the latest versions of each of these software packages.

The scope of NMP projects has developed too, particularly in terms of what to map and what not to map. The increasing amount of attention paid to detail from more recent periods has been mentioned in terms of 20th-century military remains, but additional site categories such as medieval and post-medieval agriculture (water meadows, ridge and furrow, etc.) and industry (chalk extraction, for example) feature on the mapping. The issue with exclusions is more complex, especially where it relates to things like field

boundaries that are no longer extant but which feature on early editions of the Ordnance Survey mapping. The use of lidar (see below) presents particular challenges in such instances.

The end-product of NMP projects such as the AWHSMP is not simply the map, digital or otherwise. The map merely shows the location, distribution and spatial extent of features identified on aerial photographs by those undertaking the survey. Nor is the map simply a product of 'tracing off' the archaeological features from those photographs. Instead, everything that appears is the result of a series of choices made by the interpreter, guided by training, experience and the scope and methodology of the project; the systematic procedures for analysis and mapping perhaps obscuring the degree of subjectivity inherent in the process. Decisions as to what is archaeological and what is not are seldom clear-cut, and research incorporating or based on the results of NMP need to engage not just with the map, but with the individual database records (held by the NRHE and the relevant HER) for each site or group of sites, the project report, and the photographs themselves.

It is also important to remember that, whatever the scale of the project, the map, report and database records can never be regarded as the final word. Photographs are open to renewed analysis and interpretation; new detail – especially for cropmark sites – can and will appear, either on newly-taken reconnaissance photographs or newly-accessible historic images; new detail can also be revealed through new or different imaging technologies such as multi-spectral satellite imaging or lidar; and so on. Also, the interpretations arising from a particular survey project are themselves always amenable to reinterpretation, not just in the light of newly available remotely-sensed data, but also in the wake of, say, geophysical survey or excavation. Although these techniques are often treated as sequential, with each successive step adding more information about a site, their results can also prove invaluable in re-analysis of the aerial survey data. An obvious example in the Avebury landscape is the West Kennet palisade complex, where information about the soil and sub-soil conditions published in the excavation report (Whittle 1997a) was invaluable in helping to decide which cropmark features were more likely to be archaeological and which were not.

Avebury and Lidar

Aerial archaeology is often presented as a prospecting technique whose history is essentially about the continuing development of ever more technologically advanced methods for capturing images of the earth's surface from altitude. Consequently a technique like lidar – Light Detection And Ranging – introduced relatively recently to archaeology, although its origins lie prior to the Second World War, is sometimes perceived as being inherently superior to, and potentially a replacement for, more traditional camera-based remote-sensing. This perception misrepresents both aerial photography and lidar.

Lidar differs considerably from aerial photographic survey in many key respects. It is not a photographic technology, although it is often presented as though it were. Airborne lidar measures the distances travelled by pulses of light, recording the time each pulse takes to reflect back to the aircraft, in the process capturing variations and undulations in the earth's surface and anything upon it, including buildings and vegetation. A pulsed laser beam, scanning the ground from side to side as the aircraft passes overhead, can send down 100,000 or more pulses per second, allowing for the subsequent creation of a high resolution three-dimensional model of the ground surface.

Although there is overlap between what has been captured using lidar and what can be gleaned from aerial photographs, there are important differences which serve to underline their complementary nature. Essentially a measuring tool, lidar excels at identifying the slight or faint earthworks traces that are difficult to see on aerial photographs, even with a stereoscope. The visibility of such traces can be enhanced by exaggerating the vertical scale when viewing the digital ground model. However, as a measuring tool, lidar cannot see anything that lacks height or depth relative to its surroundings, and is unlikely to identify any feature whose height or depth is below the resolution of the lidar survey. Lidar also lacks the historic dimension, producing instead a digital simulation of the surface as it was at the time that the lidar survey was undertaken. It also requires analysis of aerial photographs to aid interpretation.

Lidar is recognised for its ability, given the right conditions, to 'see' into wooded areas. So long as neither canopy nor ground vegetation are too dense at the time of the survey, a proportion of the laser pulses will reach the ground beneath the trees. There will be gaps, of course, but a three-dimensional ground model can usually be created from those last returns, and has in a number of cases revealed earthworks of archaeological interest beyond the reach of traditional forms of remote sensing. This particular aspect of lidar has not yet been tested for the Avebury WHS or its wider environs – a planned analysis of the West Woods lidar data had to be postponed due to time constraints – although slightly further afield, Savernake Forest has yielded impressive results (Lennon and Crow 2009).

Plate 5 March 2010 oblique view of the newly-recognised probable long barrow. Located c. *500 metres south-east of Avebury's southern entrance, the soilmarks representing the barrow ditches can also be seen on Google Earth imagery (© Historic England Archive)*

Within the area of the AWHSMP, lidar's principal contribution has been the recognition of low, spread earthworks difficult to identify from aerial photographs and equally difficult to survey on the ground. This has led to some infilling of detail within known later prehistoric field systems, for example, as noted above, aerial photography requires shadows cast in low sunlight to enable the slighter earthworks to be rendered visible, successful 'shadow' photography being best undertaken early in the morning, or in the evening. Within lidar, the virtual sun can be persuaded to shine from any angle or direction (or indeed, from more than one of each), enhancing the visibility of earthworks not casting shadows at those times.

The lidar survey has also indicated cases where sites previously mapped as cropmarks do in fact possess slight earthwork survival, although there are many more cropmark sites which have not registered on the lidar survey. The West Kennet palisaded complex, for example, has so far proved invisible to lidar, while the recently recognised long barrow (Pl. 5) a short distance south-east of Avebury, photographed during English Heritage aerial reconnaissance in March 2010 (and equally visible on Google Earth) is equally absent from the lidar ground model. Although some potential sites of later prehistoric and Roman date have been picked out from the lidar, the majority of the 'new' features are broadly of post-medieval date, some of them likely to be quite recent. At the time of writing, comparison of the lidar with the full range of available historic mapping has not been undertaken: it may prove possible to offer more precise interpretation of many of these 'new' earthworks. These relatively recent features have been mapped because they are visible on the lidar Digital Surface Model (DSM) as surface anomalies that require identification and interpretation, something that is seldom possible from the DSM alone. Their presence on the lidar mapping but not on the original AWHSMP mapping does not mean that they were not seen or are not visible on aerial photographs – in a number of cases checked so far, they are clearly visible – merely that at the time of the AWHSMP, such features fell outside the scope of what was considered to be of archaeological interest. In effect, the use of lidar, particularly at the higher resolution available for the Avebury area (0.5 m), reinforces the kind of engagement with more recent landscape features that had already been developing within aerial archaeology in recent years.

Analytical Landscape Survey and Investigation

by Mark Bowden

Introduction

Analytical landscape survey and investigation, incorporating analytical earthwork survey, is the primary means of recording and analysing upstanding archaeological features, sites and landscapes. It starts from the premise that the landscape is a unique

Figure 5 Places mentioned in the text

document recording the lives of past generations – 'the richest historical document we possess', in the words of Prof. W. G. Hoskins (1955, 14). Analytical survey gives information on the form, condition and relative chronology of features. It can also give information about function but rarely about absolute chronology. Crucially, analytical landscape survey is non-period specific, viewing the totality of the historic landscape to interpret its development throughout all periods of human occupation or use. Current standard works on analytical landscape survey include Bowden (1999, especially chapters 4 and 5), Muir (1999), Brown (1987, chapters 3 and 4) and Bettess (1984). Analytical landscape survey is complementary to all the other non-intrusive investigation techniques described here, and to environmental archaeology and excavation. Analytical survey can be seen as a three-stage process (though the stages may be concurrent, cyclical or reflexive): observation, measurement and interpretation. The measurement stage has benefitted greatly in recent years from the development of electronic survey equipment, notably total station theodolites (TST) (English Heritage 2011a) and especially Differential Global Positioning by Satellite (GPS) (English Heritage 2003); the developing technologies of terrestrial laser scanning (English Heritage 2011b) and lidar (English Heritage 2010) are also coming on stream. However, none of these hi-tech surveying applications substitutes for the inquisitive mind or the observational and interpretative skills and the experience of the archaeologist, often aided by more traditional equipment (English Heritage 2002). It is worth stressing that the approach advocated here is self-confidently subjective and interpretive, eschewing the objective but bland and mechanistic approaches often advocated for recording field monuments.

The Products of Survey

The principal product of such analytical survey is a plan that depicts relative time depth as well as accurate spatial information. Traditionally this has been achieved through the medium of the conventional hachured plan and though this is not a perfect solution no better system has yet been found. Rapid 3-dimensional recording through GPS and lidar does, however, offer the opportunity of equivalent means of depiction through the generation of slope models; the potential of this technology has yet to be fully explored. The plan is always accompanied by a report which forms an extended caption, describing and interpreting the depicted features. Appropriate products for different levels of survey are outlined in English Heritage 2007.

Previous Work

The Avebury area has been one of the cradles of earthwork analysis and landscape archaeology (Fig. 5). In the mid-16th century John Leland described the area: 'Kenet risithe northe northe west [of Marlborough] at Selberi Hille botom, where by hathe be camps and sepultures of men of warre, as at Aibyri a myle of, and in dyvers placis of the playne' (Toulmin Smith 1964, 81); but John Aubrey in the 17th century and William Stukeley in the 18th century were the real pioneers (Welfare 1989, 17–20; Stukeley 1743). They were followed by the Revd A. C. Smith, who compiled the first inventory of the archaeological monuments of the area in the 19th century (1885). O. G. S. Crawford, one of the foremost figures in 20th-century landscape archaeology, gained his earliest appreciation of the historic landscape on these downs (1955, 30).

Most upstanding monuments within the current Avebury WHS boundary have been subject to large-scale detailed survey by English Heritage and the former Royal Commission on the Historical Monuments of England within recent years and a number of sites in the region immediately surrounding the WHS have also been surveyed. These surveys are usefully summarised in a group of papers delivered at a conference held at the University of Bath in Swindon in 2002 (Bowden 2005; Brown 2005; Field *et al.* 2005; McOmish *et al.* 2005; Smith 2005). Additional publications of surveys carried out before 2002 include the Marlborough Mound (Field 2000; Field *et al.* 2001) and Silbury Hill (Field 2002; Field and Leary 2010). Oldbury (Bowden 2004; Bowden *et al.* 2005), East Kennet long barrow (Westlake 2005) and settlement remains at Shaw (English and Brown 2009) have been surveyed subsequently. Survey of Oldbury in 2004 emphasised the dominance of its regular east-facing façade and confirmed that it owes much of its form to pre-existing linear ditches. Oldbury, though it is clearly visible from many locations within the WHS, lies well outside the WHS boundary, emphasising just how small the WHS is. Also outside the WHS is Tan Hill, with its complex of linear ditches; while many hillforts may be described as 'unfinished', Tan Hill (see Kirkham 2005, 154, fig. 14.2) is arguably a candidate for a new class of 'hardly begun' hillforts.

Recent Work

A survey using lidar alongside conventional aerial photography has revealed a number of previously unrecorded enclosures and other features in Savernake Forest (Lennon and Crow 2009); many of these are quite possibly of Iron Age date. Though this is well to the east of the WHS it is relevant to the confirmation of the existence of a Late Iron Age complex, or possible 'oppidum', around Forest Hill (Corney 1989, 123). One of these enclosures, near Luton Lye Cottages, appears to be overlain by the Roman road. Another, on Church Walk, was surveyed in 2007 in order to test the metrical accuracy and interpretation of the features as mapped from the lidar plot (English Heritage 2010, 32–3). The Church Walk complex consists of a sub-oval enclosure, almost certainly of late prehistoric date, and a conjoined elongated enclosure, which could be contemporary but which is probably of later, but unknown, date. The latter enclosure has been disturbed by quarrying, notably by what is probably a claypit belonging to a documented 18th-century brick maker (G. Bathe pers. comm.). A series of undated hollow-ways runs along the south side of the enclosures and seems to have partly re-used the enclosure ditch. Study of lidar for the WHS itself has now also been undertaken.

Surface Artefact Collection

by Nicola Snashall with Rosamund J. Cleal

Surface artefact collection has been undertaken within the Avebury landscape for over a century. It is an indispensable fieldwork technique that allows us to both identify and characterise locales of past human activity on a landscape scale. Within the WHS it has been most frequently associated with the recovery of lithic scatters through both structured and unstructured fieldwalking. These comprise perhaps our most durable and extensive resource for investigating questions surrounding residence and landscape inhabitation in the Neolithic and Bronze Age.

A summary of material recovered as the result of formal and informal fieldwalking in the Avebury area is given below.

Early Collectors

J. W. Brooke
Collection in Wiltshire Museum, including some material from Avebury (Cunnington and Goddard 1934, 8).

W. Browne
Largely Windmill Hill; Collection in Wiltshire Museum (Cunnington and Goddard 1934, 6).

H. G. O. Kendall
Large quantities of flint were collected from the Avebury region in the early part of this century by the Revd H. G. O. Kendall, rector of Winterbourne

Bassett. Kendall noted concentrations of flint on Windmill Hill, and also on Hackpen Hill, and published widely on these. The site identified as the Foot of Avebury Down has recently been relocated and material recovered from the site by Kendall is currently under analysis as part of the Between the Monuments Project (Pollard *et al.* 2011). Kendall's collections and some notes are held in the Alexander Keiller Museum, Avebury, having been bought from him and from his widow by Alexander Keiller.

A. D. Passmore
A. D. Passmore also collected large numbers of flints in the Avebury environs, and his notes allow the approximate find-spots of concentrations of struck flint artefacts to be located, as did the notes made by Kendall. His collection is held in the Ashmolean Museum, Oxford.

Late 20th and Early 21st Century

R. Holgate and J. Thomas
The results of a fieldwalking survey in the Avebury environs, and a consideration of Kendall's and Passmore's collections was published in interim form by Holgate in 1987. The lack of information about the field conditions encountered, methodology employed and negative observations made by Kendall and Passmore led Holgate and Thomas to survey areas of Avebury in an attempt to map more precisely the distribution of artefacts across the landscape. The shift in settlements from the upper slopes of the Downs in the Early Neolithic towards the lower valley slopes in the later Neolithic was surmised from the survey material. Their work also concluded that the flint scatters, recognised by Kendall and Passmore and encountered during the recent survey on the south-east slope of Windmill Hill and north-east of Avebury were mainly later Neolithic in date and contained a variety of implements, whereas those to the south of Avebury were probably Bronze Age in date and contained few implements. A detailed chronometric and spatial analysis of the material collected by Holgate and Thomas is being undertaken as part of the Between the Monuments Project (Pollard *et al.* 2011). Both the finds and paper archive are held by the Alexander Keiller Museum.

University of Wales (Cardiff)
An area south of the Windmill Hill causewayed enclosure was subjected to systematic surface collection in 1992, associated with test pit and geophysical surveys. This work demonstrated both earlier Neolithic and later Neolithic activity and is fully published (Whittle *et al.* 2000). Whittle *et al.* estimated the southern slopes scatter may have originally contained over 80,000 implements (2000, 151). With over 500 transverse arrowheads recorded from early surface collection, a good proportion of these must relate to episodes of Late Neolithic occupation (Holgate 1988, 242).

The National Trust
Three episodes of fieldwalking were undertaken between 1990–1995 by the National Trust on land prior to it being put down to permanent pasture. The three areas comprise the field to the east of the Sanctuary and 8.5 ha around Seven Barrows; the field to the south and west of the Sanctuary and the south part of Avebury Down and the north part of Overton Hill, to the west of the Ridgeway; and the southern part of Waden Hill and part of the West Kennet Avenue. The paper archive and the finds for these projects are held by the Alexander Keiller Museum in Avebury.

Chippenham College
Several episodes of collecting were carried out in the early 1990s by Chippenham College Practical Archaeology Group. Apart from short notes of the work in the yearly archaeological review in *Wiltshire Archaeological and Natural History Magazine* (*WANHM*) there appears to be no record of this work. Some of the finds have been deposited in the Alexander Keiller Museum but in the absence of full records they are generally locatable only to field.

Wessex Archaeology
In the 2000s Wessex Archaeology undertook a number of fieldwalking surveys within the Avebury environs (Pl. 6) ahead of areas being put down to pasture. The output from these surveys is available as grey literature reports.

A. George
Surface collection was undertaken across the field to the south of the A4 opposite Silbury Hill, extending around Swallowhead, as a part of PhD research during 2011. The material, which includes flintwork, is currently under analysis.

Non-Fieldwalked Surface Material

The recovery of surface artefacts is not confined to those recovered by fieldwalking or casual individual finds. It sometimes relates to materials brought to attention by burrowing animal activity. Within recent years when artefacts have been brought to the surface by mole activity the National Trust has recovered and recorded the data mapped to location. In 2006 pottery and lithics were recovered from the spoil of a badger sett at Hackpen on Overton Hill (Snashall

Plate 6 Fieldwalking at Silbury Hill (© Wessex Archaeology)

2007). This together with ceramics discovered as the result of rabbit burrowing in the 1930s at the same location (Piggott 1937) comprises finds from what appears to have been a significant earlier Neolithic locale buried beneath colluvium that would otherwise have been unlikely to have come to light. The recovery and recording of surface artefacts retrieved as a result of burrowing animal activity can offer opportunities that would not otherwise present themselves and which should not be eschewed simply because of their necessarily ad hoc nature.

Likewise in a landscape dominated by the monumental presence of the Neolithic and Bronze Age we should not ignore the role to be played by the recovery of surface material from the Iron Age and later periods. The fieldwalked assemblages recovered from Waden Hill and by Abby George south of the A4 opposite Silbury both provide evidence of the extensive nature of Roman activity in this area, and the all but total absence of Iron Age material from fieldwalked assemblages is in itself remarkable.

Lithic Scatters

The first iteration of the Avebury Research Agenda was written following a peak of interest in the methodology connected with the collection and interpretation of fieldwalked material, and in particular lithic scatters, in the mid-1980s and early 1990s (Gaffney and Tingle 1989; Haselgrove *et al.* 1985; Schofield 1991; Shennan 1985). The focus was on survey methodology, quantification and identifying the constraints that taphonomic processes placed on our ability to interpret fieldwalked assemblages (Boisimer 1997).

Within the broader archaeological community lithic scatters remain a little understood and consequently underused resource (Bond 2011). Recent research has adopted a more positive approach and has demonstrated that the analysis of scatters can provide more nuanced interpretation, capable not only of identifying presence and absence but of characterising landscape inhabitation at specific locations at particular times (Edmonds *et al.* 1999; Snashall 2002; Chan 2004; Bond 2006; Bayer 2011). English Heritage's guidance on managing lithic scatters understandably focused on quantification and site identification, but it nevertheless pointed the way to their potential in more subtle characterisation of occupation (English Heritage 2000).

Julie Gardiner has highlighted the role that older, informally recovered surface material can play in characterising landscape inhabitation (Gardiner 1984; 1987). More recently research has demonstrated that systematically recovered surface material, collected using a wide variety of field methodologies, can be successfully combined with evidence from older informally recovered museum assemblages and excavated material to produce narratives that go well beyond the sum of their individual parts (Snashall 2002).

The information garnered from surface artefact assemblages, whether extant material from early collectors or the product of systematic fieldwalking, can be greatly enhanced by being set alongside evidence from test-pitting, environmental sampling and targeted excavation. But the most critical factor in the successful use of surface collected artefacts is the application of field methodologies and analytical techniques designed to maximise

the information from the available resource. This requires a flexible approach to project design and the use of field methodologies that do not privilege inter-site quantification at the cost of intra-site characterisation.

When a reflexive approach is adopted surface artefact assemblages have the potential to provide information about past inhabitation and residential practice that is not recoverable from any other source. And even that most intransigent of fieldwalked material – lithic scatters – can be employed successfully to construct narratives that explore contingent histories of place within the Avebury landscape.

Plate 7 Experimental earthwork, Overton Down, 1966 (© Wiltshire Museum)

Environmental Archaeology

by Chris J. Stevens and Sarah F. Wyles

Introduction

The area around Avebury has seen a long history of environmental study, with many early studies being conducted alongside excavations of prehistoric sites from the beginning of the 20th century. This section outlines this work, separating out those studies that inform upon environmental reconstruction and past land use from those that pertain to economy. With respect to the former, the very nature of the largely calcareous Cretaceous Chalk geology and the environmental preservation it affords mean that this environmental investigation is dominated by molluscan studies. Waterlogged remains, in the strictest sense, are absent from the area and none are recorded for the area within the environmental archaeology bibliography by Hall (2008), while pollen is also very poorly preserved (Crabtree 1996; see also Allen 2001).

Much of the pioneering work in the region was conducted by John Evans and Geoffrey Dimbleby in the 1960s and 1970s on molluscan and pollen sequences respectively, alongside sedimentological work (see Table 2). Since this work, both Mike Allen and Paul Davies in particular have continued both the molluscan and sedimentological work (see Table 2; Allen 2000a; 2001; 2005; Allen and Scaife 2007; Davies 2008; Davies and Wolski 2001).

Given the nature and importance of the monuments within the Avebury area, it is perhaps unsurprising that the Neolithic has received much of the main focus of environmental reconstruction. Many of the earlier studies were incorporated into a landscape reconstruction for the Mesolithic to later Neolithic by R. W. Smith (1984) which has been more recently reviewed and updated by David Wheatley (in Gillings *et al.* 2008, 170–200)

Regarding the information that environmental data sheds on past economies, the calcareous deposits afford good animal bone preservation, alongside that of charred plant remains and wood charcoal. However, while studies of animal bone have a long history in the region, wood charcoal and charred plant remains are less well covered, although earlier studies have produced numerous charcoal identifications. Mineralised remains are potentially abundant within a group of sites with extensive middens spanning the later Bronze Age to Iron Age (see Tubb 2011a; Carruthers 2000; 2010; Lawson 2000; McOmish *et al.* 2010), but to date have only been recovered from Late Iron Age features in Devizes (Pelling 2002; Carruthers 2002).

The region also provided the location for important experimental work into geomorphological, pedological and taphonomic processes (Pl. 7) and their effect on archaeological and palaeo-environmental material. These were largely carried out at Overton Down just to the east of Avebury (Bell *et al.* 1996).

A full list of environmental work is outlined within Table 2. The following summarises this environmental work by period: references and site names are given where appropriate, but readers are directed to Table 2 for a more detailed breakdown of the work for any specific site or period.

The Late Glacial to Mesolithic Environment

The earliest studies covering this period are summarised within the work at Avebury, North Farm, West Overton (Evans *et al.* 1985; Evans *et al.* 1988), and Cherhill (Evans and Smith 1983), alongside a consideration of early periglacial deposits by Evans (1968; 1969). However, it is probable that other sequences in the area may also cover or contain assemblages that are at least in part derived from this period (eg, Dimbleby and Evans 1974).

Table 2 List of sites with environmental evidence, with represented periods and the range of environmental work

Site name	Summary	Reference	LGl Meso	Neo	Bkr/ EBA	MBA /LBA	IA	RB	Sax/ Med	Environmental work	
All Cannings Cross	LBA/EIA midden site	Cunnington 1923 McCulloch 1998	–	–	–	X	X	–	–	A M C, Cp Cp	Jackson 1923, 43–50 Henginbothom 1923 Cunnington 1923, 52 Jones, G. E. M. ?in prep?
Avebury (Pit 6) 85	Pit/tree-throw hole	Evans *et al.* 1988	X	X	–	–	–	–	X	M	Evans *et al.* 1988
Avebury Bank (Great Barn) Site 82	Tree-throw hole/buried soil beneath bank	Evans *et al.* 1985	?X	?X	–	–	–	–	–	M A S	Evans *et al.* 1985 Evans *et al.* 1985; O'Connor 1976 Keeley 1985
Avebury Bank (including School)	Tree-throw hole/buried soil beneath bank	Evans 1969; 1972, 268–9	X	X?	–	–	–	–	–	O	O'Connor 1976; Evans 1969; 1972
Avebury Ditch	Main henge ditch at Avebury	Gray 1935	–	X	X	?	–	X	–	C A M	Maby 1935 Newton and Jackson 1935 Kennard 1935
Avebury G55 Round barrow/pit	Round barrow – Beaker pottery	Smith 1965a	–	–	X	?	–	X	–	M A	Evans 1965 Pater 1965
Avebury Henge	Calcareous buried soils	Dimbleby and Evans 1974	–	X	–	–	–	–	–	P, M	Dimbleby and Evans 1974
Avebury Pipeline	Several sites	Powell *et al.* 1996	X	X	X	X	–	X	X		See Butler's Field, Pound Field, Stukeley, Waden/Winterborne, Beckhampton 4
Avebury Rough Leaze 2007	Post/stakeholes, tree-throw holes on east of henge bank	Pollard *et al.* 2012	X	X	–	–	–	–	–	S, M, A	Pollard *et al.* 2012
Avebury Trusloe, alluvium	Alluvial deposits near Silbury hill in Winterbourne	Evans *et al.* 1993, see Campbell and Marshall 2013	–	X	X	X	–	–	–	S, M	Evans *et al.* 1993
Beckhampton Road long barrow	Long barrow	Evans 1968; Ashbee *et al.* 1979	–	X	–	–	–	–	–	A P M P, M	Carter with Higgs 1979 Dimbleby 1979b Evans 1968; 1979a Dimbleby and Evans 1974
Beckhampton barrow 4	EBA round barrow	Powell *et al.* 1996	–	–	X	?X	–	?X	X	M	Wyles and Allen 1996a
Bishops Cannings Down	Middle/Late Bronze Age settlement	Gingell 1992	–	–	–	X	–	–	–	A	Maltby 1992
Brickley Lane, Devizes	Predominately IA settlement	Poore *et al.* 2002	–	–	–	–	X	X	X	Cp, Mp A	Pelling 2002 Charles 2002
Burderop Down	Hollow, buried soil under disc-barrow BA settlement	Gingell 1992	–	–	X	LBA	–	–	–	Cp A M	Carruthers 1992 Maltby 1992; 1986 Allen 1992
Butler's Field, Avebury	Alluvial sequence nr medieval settlement	Mount 1991; 1996 Evans *et al.* 1993	–	–	–	–	X?	X	X	Cp M	Scaife 1996a Mount 1996
Cherhill 67/Cherhill tufa/long barrow nr Calne	Oliver Field – occupation scatters	Evans and Smith 1983; Evans 1968; Evans *et al.* 1978	X	X	X	–	–	–	X	M A S, M	Evans 1983 Grigson 1983; O'Connor 1983 Evans *et al.* 1978
Dean Bottom	Beaker pit, MLBA settlement	Gingell 1992	–	–	X	X	–	–	–	M Cp A	Allen 1992 Carruthers 1992 Maltby 1992
Down Farm, Pewsey	Bronze Age barrow ?Beaker	Vatcher 1960	–	–	X	–	–	–	X	C A S	Western 1960 Dorrell and Cornwall 1960a; Dorrell and Cornwall 1960b
East Chisenbury	LBA/EIA midden site	McOmish *et al.* 2010	–	–	–	LBA	EIA	–	–	S Cp+min	Macphail 2010 Carruthers 2010

										A	Serjeantson *et al.* 2010
East Kennett	Medieval ditch	Powell *et al.* 1996	–	–	–	–	–	–	X	Cp	Scaife 1996b
Easton Down, long barrow	Long barrow, buried soil, tree-throw hole	Whittle *et al.* 1993	–	X	X	X	–	–	–	M	Rouse and Evans 1993
										Cp	Fairbairn 1993
										C	Cartwright 1993
										S	Macphail 1993
										A	Rouse 1993; Noddle 1993
Fyfield Down FL 1, 2–5	Field lynchet, with tree-throw hole and buried soil and ditch	Bowen and Fowler 1962; Evans 1972; Fowler 1967; Fowler and Evans 1967; Fowler 2000a	–	?X	?X	?X	X	X	–	S, M	Evans 1972, 317–19
Hemp Knoll round barrow/pit	Beaker dated round barrow and buried soil	Robertson MacKay 1980	–	X	X	–	–	–	–	M	Evans 1980
										S	Keeley 1979; 1980
										A	Grigson 1979; 1980
Horslip (Windmill Hill) long barrow	Long barrow	Ashbee *et al.* 1979	–	X	–	–	–	–	–	P	Dimbleby 1979a
										M	Evans 1979a
										P, M	Dimbleby and Evans 1974
										A	Higham with Higgs 1979
Knap Hill	Causewayed enclosure buried soil from bank and ditch fills	Connah 1965; Dimbleby and Evans 1974	–	X	–	–	–	–	–	M	Sparks 1965
										P	Dimbleby 1965a; 1965b
										C	Dimbleby 1965c
										A	Anon. 1965a
										P, M	Dimbleby and Evans 1974
Longstones Field, Avebury	Late Neolithic enclosure ditch	Gillings *et al.* 2008	–	X	–	–	–	X	–	A	Coward 2008, 30–9, 234–5
										Cp	Young 2008
										M	Mount *et al.* 2008
										S-(micro)	Lewis 2008
Manton Down, long barrow, Preshute	Long barrow chambered tomb	Barker 1985	–	X	–	–	–	–	–	A	Ox-skull recorded from Atkinson's 1955 excavations. See Barker 1985
Marden Henge	Late Neolithic enclosure	Evans 1971a	–	X	–	–	–	–	–	A	Harcourt 1969; 1971a; Worley 2013; 2011e;
										M	Evans 1971a
Marlborough 4927	It is suspected this site is Burderop Down	Maltby 1986	–	–	–	?X	–	–	–	A	Maltby 1986
Marlborough Mound		Leary *et al.* 2013a	–	X	–	–	–	–	X		
Millbarrow long barrow	Long barrow postholes pits ditch	Whittle 1994	–	X	–	–	–	–	–	M	Harris and Evans 1994
										S	Macphail 1994
										A	Noddle 1994
Milton Lilbourne barrows	Early Bronze Age barrows	Ashbee 1986	–	–	X	–	–	–	–	A	Grigson 1986; Meddens 1986
										M	Ellis 1985; 1986
New Park Street, Devizes	Pit 19th century	Russell 1993	–	–	–	–	–	–	X	A	Jones 1993 – records pig bones
North Farm (West Overton) 85		Evans *et al.* 1993	X	–	–	–	–	–	–	M	Evans 1993
Overton Down G6a pit	Neolithic pit with Peterborough ware.	Smith and Simpson 1964	–	X	–	–	–	–	–	M	Cain 1964
										A	Smith and Simpson 1964, 82; assemblages are small.
Overton Down OD X/XI FW63	LBA/EIA settlement, animals includes OD X Piggledean Bottom	Fowler 2000a, 203–4, 208	–	–	–	X	X	–	–	A	Noddle 2000a
										M	Wyles 2000a
										C	Gale 2000a
Overton Down OD XII; FW64	Late Romano-British settlement	Fowler 2000a, 204–5	–	–	–	–	–	X	–	A	Noddle 2000b
										Ms	Wyles 2000b

Table 2 Continued

Site name	Summary	Reference	LGl Meso	Neo	Bkr/ EBA	MBA /LBA	IA	RB	Sax/ Med	Environmental work	
										C	Gale 2000b
Overton Experimental Earthworks	Non-archaeological experimental earthworks	Bell *et al.* 1996	n/a	n/a	n/a	n/a	n/a	n/a	n/a	A	Armour-Chelu and Andrews 1996
										M	Bell and Johnson 1996
										S	Crowther 1996; Crowther *et al.* 1996
										P	Crabtree 1996
										Cp	Carruthers and Straker 1996
Overton Hill (Barrow)	Barrow excavations	Smith and Simpson 1966	–	X?	X?	–	–	–	–		Residual deposits, Rosenfeld 1966
										C, CPR?	Cornwall 1966
Pewsey Hill Farm	Enclosure dark earth	Thompson 1971	–	–	–	–	X	–	–	A	Harcourt 1971b
Potterne	Later Bronze Age to Early Iron Age midden site	Lawson 2000	–	–	–	–	–	–	–	Mp	Carruthers 1986; 2000; Scaife 2000
										Cp	Straker 1985; 2000; Carruthers and Straker 2000
										C	Straker 2000
										S	Macphail 2000
										A	Locker 2000; Coy 1983, Madgwick *et al.* 2012b
Pound Field round barrow	Early Bronze Age barrow	Powell *et al.* 1996	–	–	X	–	–	–	–	C	Gale 1996
										M	Wyles and Allen 1996
Raddun Wroughton Mead/Copse, Fyfield Down	medieval farm	Fowler 2000a, 205–8	–	–	–	–	–	–	X	C	Gale 2000c
										A	Noddle 2000c
										Cp	Allen 2000b
Red Shore bell barrow	Early Bronze Age barrow	Green 1973	–	–	X	–	–	–	–	S	Green 1973
										P	Green 1973 (very brief report)
Rockley Down, barrows /enclosure, Marlborough	Enclosed settlement and barrow cemetery	Gingell 1992	–	–	?	LBA	–	–	–	Cp	Godwin 1984, 404; Gingell 1992
Roughridge Hill, Bishops Cannings	Bronze Age barrows, Early Neolithic pits	Anon. 1965b; Evans 1972	–	X	?X	?X	–	?X	–	C, Cp	Clapham 1988
										A	Maltby unpublished
										M	Evans 1987
Silbury Hill (mound)	Late Neolithic/Beaker earthwork	Whittle 1997a, 1–52; Leary *et al.* 2013b; Robinson and Dimbleby 1997; Robinson *et al.* 2004	–	–	–	–	–	–	–	*Wp	Robinson *et al.* 2004; Campbell forth. a and d;
										I	Robinson 1997; Robinson *et al.* 2004; Robinson *et al.* 2012
										P	Dimbleby 1997; Robinson *et al.* 2004; Robinson *et al.* 2012
										M	Evans 1972; 1997
										S	Canti 2009; 2011; Robinson *et al.* 2004
										A	Gardner 1997; Worley 2011a; 2011b; forthcoming a–c
										*mosses	Williams 1975; 1976; 1997; Hall 2012
Silbury Hill (Romano-British settlement)	Romano-British settlement to south of Silbury Hill	Crosby and Hembrey 2013	–	–	–	–	–	X	X	Cp	Pelling 2013
										A	Baker 2013; Gardner 1987; Campbell *et al.* 2013
										M	
South Street long barrow	Early Neolithic long barrow	Dimbleby and Evans 1974; Ashbee *et al.* 1979	–	X	X	–	–	X	–	P	Dimbleby 1979b
										P, M	Dimbleby and Evans 1974
										M	Evans 1979c
										C	Sheldon 1979
										A	Ashbee *et al.* 1979
The 'Stukeley' barrow, Waden Hill	Early Bronze Age barrow	Evans 1968b; Powell *et al.* 1996	–	–	X	?X	–	?X	X	M	Wyles and Allen 1996a
The Sanctuary Henge, Overton Hill	Henge	Cunnington 1931; Pitts 2001	–	X	–	–	–	–	–	A	Rouse 2001
Upper Kennet Valley 83–4	Various prehistoric sequences	Evans *et al.* 1993	X	X	X	X	–	–	–	M	Evans 1993
										O	Griffiths and Mount 1993
										S	Limbrey 1993
										C	Fitt 1993

Various sites	List of 'Black earth' sites	Tubb 2011b	–	–	–	X	X	–	–	n/a	
Various sites	Summary of plant identifications from various sites	Grose and Sandell 1964	–	X	X	X	X	–	–	P, C, Cp	Grose and Sandell 1964
Waden Hill,	Periglacial sequence	Evans 1968	X	–	–	–	–	–	–	M	Evans 1968
Waden Hill/Winterbourne colluvium	sedimentary sequence	Powell *et al.* 1996	X	–	–	–	–	X	X	M	Allen 1996
Waden Hill/Winterbourne Roman site	Romano-British settlement to east of Silbury Hill	Powell *et al.* 1996	–	–	–	–	–	X	X	A	Iles 1996a
										Cp	Scaife 1996b
										M	Wyles and Allen 1996b
Wansdyke excavations 1966–70	Excavations of the Wansdyke (ditch and bank) Saxon earthwork	Green 1971	–	–	–	–	–	–	X	M	Evans 1971b (very poor)
										P	Dimbleby 1971
Wayside Farm, Devizes	Late Iron Age to Early Romano-British settlement	Valentin and Robinson 2002	–	–	–	–	X	X	–	Cp, Mp	Carruthers 2002
										A	Ingrem 2002 mainly LRB
										S	Valentin and Robinson 2002, 159–60 LRB midden
West Kennett Farm	Late Neolithic enclosure/medieval ditches	Wessex Archaeology 1989	–	X	–	–	–	–	X	A, Cp, M	Allen and Carruthers 1989 (assessment)
West Kennet long barrow		Piggott 1962 Evans 1972; 263–4	–	–	–	–	–	–	–	M	Evans 1972
West Kennet Palisade Enclosure		Whittle 1997a	–	–	–	–	–	–	–	C	Cartwright 1997
										Cp	Fairbairn 1997
										A	Edwards and Horne 1997
West Kennet Stone Avenue (pit)	Middle Neolithic pit	Allen and Davis 2009	–	X	–	–	–	–	–	M	Allen 2009
										A	Grimm 2009
										Cp	Stevens 2009
West Overton alluvium/ colluvium		Evans *et al.* 1993	–	–	–	–	–	–	–	–	–
West Overton G6b barrow	Beaker barrow	Smith and Simpson 1966	–	–	X	–	–	–	–	S	Rosenfeld 1966
										A	Smith and Simpson 1966 (ref to animal bones)
Windmill Hill	Causewayed enclosure	Smith 1965b; Whittle *et al.* 1999; Whittle *et al.* 2000	–	X	X	–	–	–	–	S	Macphail 1999
										M	Evans 1965; 1972; Fishpool 1999
										Cp	Fairbairn 1999; 2000
										C	Cartwright 1999
										P	Dimbleby 1965b; Walker 1999
										A	Jope and Grigson 1965; Grigson 1999; Rouse and Rowland 1999; Rowland 1999; Davies 2000
Winterbourne burial		Evans 1966	–	–	–	–	–	X	–	M	–

A – Animal bone; C – Charcoal; Cp – Charred plants; I – Insects; M – Mollusca; Ms – Marine shell; O – Ostracods; P – Pollen; Mp – Mineralised plants; S – Soils/Sediments,
Wp – Waterlogged plants *at Silbury Hill these are preserved by anoxic conditions not waterlogging

The results of these molluscan studies indicate low species diversity for the earliest Late Glacial period (Allerød/Bølling) deposits, but generally open wet disturbed habitats within deposits from the valley floor (also seen by Allen 1996).

More stable conditions are seen in Early Post-Glacial to Mesolithic deposits, although shifting streams upon the valley floor can produce assemblages characteristic of disturbance. A change to woodland is recorded within a number of these sequences (*cf.* Evans *et al.* 1988), broadly dated to the Early to Late Mesolithic transition. At Cherhill this transition probably relates to the establishment of woodland carr upon the floodplain (Evans and Smith 1983), sealed by Late Mesolithic tufa deposits *c.* 6410–5840 cal BC.

A palaeochannel just to the south of Silbury indicated the presence of sediments of late 9th to early 8th millennium cal BC (Crosby and Hembury 2013; Campbell *et al.* 2013). Several of these studies have yielded small numbers of animal bone which indicate the presence of wild boar and aurochs in the 8th millennium cal BC (see Evans *et al.* 1988). Charcoal identifications and pollen sequences spanning the Mesolithic to the south of the study region indicate a change from birch, through pine-hazel to hazel, oak and elm woodland (see Scaife 1995; 2004; Gale 1995; Leivers *et al.* 2008; Allen and Scaife 2007). However, such sequences are as yet unavailable for the core study area.

Early Neolithic

Environment

Molluscan studies from soils preserved under many of the monuments testify to a predominately open wooded environment existing prior to clearance for their construction. Examples include Windmill Hill (Evans 1972, 242–8; Fishpool 1999), Knap Hill (Sparks 1965), West Kennet (Evans 1972, 263–4), under the bank at Avebury (*cf.* Evans 1972, 268–74; Evans *et al.* 1985), at Rough Leaze, Avebury (Pollard *et al.* 2012) and Easton Down (Rouse and Evans 1993; Whittle *et al.* 1993).

However, most demonstrate grassland and/or cultivation immediately preceding the construction of the monuments themselves: for example the ard marks seen at South Street (Ashbee *et al.* 1979); while at Easton Down sediments and molluscan evidence suggested cultivation followed by a short period of open grassland prior to the long-barrow's construction (Whittle *et al.* 1993; Davies 2008, 71). A reassessment of the molluscan evidence further indicates that both monuments were probably constructed close to woodland edge based on recolonisation rates of molluscs (Davies 2008; Davies and Wolski 2001; Whittle *et al.* 1993; Evans 1990).

The assemblage from Horslip barrow (Ashbee *et al.* 1979, 275–8) suggested open grassland with relatively little woodland, but possibly some arable. However, it was probable that secondary woodland had regenerated in the area by the time of the barrow's construction, with hazel recorded from the pollen samples taken from the buried soil under the barrow (Dimbleby 1979a). At Beckhampton it appeared that the barrow was constructed in an area cleared of woodland possibly several hundred years earlier (Evans 1972, 248–51; Ashbee *et al.* 1979), although, the dating of these events should be regarded with some caution.

Assemblages from pits under the barrows at Roughridge Hill showed some variation with woodland scrub evident but also with some patches of long grassland (Evans 1972; 1987).

The pollen sequences from the outer bank at Windmill Hill, in contrast to the molluscan assemblages, reflect a relatively open environment (Dimbleby 1965a) with low counts of alder, birch, pine, oak, lime and elm, and slightly higher counts of hazel. However, the differential survival of pollen means that such results are very insecure (see Walker 1999).

Charcoal assemblages from Windmill Hill indicate woodland dominated by oak and hazel, with frequent hawthorn, ash, probable sloe, and occasional birch and yew (Cartwright 1999). Dimbleby (1965a; Dimbleby and Evans 1974) noted a similar assemblage along with evidence for broom/gorse. A similar range of species was identified from the Neolithic pits at Roughridge Hill (Clapham in prep.) along with beech. Beech has traditionally thought to have been introduced into Britain in the Bronze Age or later (*cf.* Giesecke *et al.* 2007), but beech charcoal dated to 3660–3370 cal BC (Beta-218163: 4790±50 BP) (Graham and Graham 2009) confirms its Neolithic status and an earlier presence as a minor component of the natural Late Mesolithic woodland of southern England has been suggested by Grant *et al.* (2009).

Work at sites in the valley bottoms, for example at Winterbourne and Upper Kennet (Evans *et al.* 1988; 1993; see Davies 2008, 116) indicates open grassland in the earlier Neolithic with little to no flooding or alluviation.

Economic evidence

Cattle dominated the assemblages at Windmill Hill and Knap Hill with lesser numbers of pig and sheep/goat, although both are still reasonably well represented at the former site (Grigson 1999), but less so, particularly pig, at the latter (Anon. 1965a).

Although at Avebury a bone of aurochs from a post-hole fill straddled the Mesolithic to Early Neolithic transition 4060–3960 cal BC (Pollard *et al.* 2012), wild aurochs are generally rare on Early Neolithic sites compared with domestic cattle. A study by Grigson (1999) at Windmill Hill indicated that, while wild aurochs was undoubtedly present, the majority of remains were more likely from domestic animals. A similar result was also seen for pig, with only a few possible contenders for wild boar.

The predominance of elder female animals at Windmill Hill indicated that cattle were perhaps exploited for milk and blood (Grigson 1999, 228–9). Since this study, residue analysis of pottery from Windmill Hill has shown at least the former to be present (Copley *et al.* 2003).

While aurochs and possibly wild boar are present, albeit in low numbers, red and roe deer bones and antlers are common from Early Neolithic sites, including Windmill Hill and several of the long barrows. Other wild animals include fox, wild cat, hedgehog, badger and hare. Dogs were relatively frequent at Windmill Hill as seen from skeletal remains, coprolites and the high number of dog-gnawed bones (Grigson 1999, 230–1).

Early Neolithic pits under the Hemp Knoll barrow also had a predominance of cattle, with reasonable numbers of sheep/goat, but low numbers of pig. Red and roe deer were also present (Grigson 1979; 1980). Pits under the Roughridge Hill barrows showed good representation of cattle, sheep/goat and pig, along with occasional deer (Maltby in prep.).

The small bone assemblages from Horslip (Higham with Higgs 1979) and South Street long barrows (Ashbee *et al.* 1979, 267–8) had roughly equal numbers of cattle, sheep/goat and pig, with a small amount of evidence for red deer. However, at Beckhampton Road long barrow the small assemblage was dominated by cattle and pig, but no sheep/goat was present (Carter with Higgs 1979).

While horse has occasionally been identified from Early Neolithic contexts there is reason to doubt their authenticity (see Grigson 1999, 211). This is discussed further below, but reviews of the data provide no conclusive evidence for their occurrence here within the Neolithic (Kaagan 2000; Bendry 2010; Serjeantson 2011).

Prior to flotation the earliest evidence for cereal agriculture came in the form of cereal impressions within pottery (Pl. 8) (Helbaek 1952; Jessen and Helbaek 1944). From Windmill Hill these included identifications of einkorn, emmer wheat and naked and hulled barley, along with seeds of crab apple and flax. Charred remains from Windmill Hill produced a similar list of species, although flax and apple were not recorded (Fairbairn 1999, 154; 2000, 169). Additions included tubers of lesser celandine and

Plate 8 Barley grain impressions (highlighted in red) on a Beaker from Larkhill Camp (© Wessex Archaeology)

pignut, shells of hazelnuts and fruit stones of sloe. Despite extensive sampling, cereals were rarely recovered in great number from the enclosure ditches (Fairbairn 1999), but were better represented within the Early Neolithic pits (Fairbairn 2000, table 13). It is also notable that cereal chaff while well represented within pottery impressions is almost absent within the charred remains (compare Helbaek 1952, 224–5 with Fairbairn 1999, tables 58–71).

Charred fragments of hazelnut shells were identified from Early Neolithic pits under the barrows at Hemp Knoll (Keeley 1980) and Roughridge Hill (Clapham 1988; in prep.) as well as pits from Windmill Hill (Fairbairn 2000, table 13). However, they are almost absent from the enclosure ditches at Windmill Hill (Fairbairn 1999), which might indicate either some difference in the disposal of such remains, or potentially that such differences might relate to chronological or seasonal variation in subsistence practices.

Middle to Late Neolithic

Environment

Whittle (1993, 35) sees an increase in scrub and woodland in the Avebury area in the Middle Neolithic coinciding with a decline in monument construction. This period also coincides with that defined by

Plate 9 Excavations in Longstones Field, 2000 (© Longstones Project)

Stevens and Fuller (2012) as one of population collapse combined with the abandonment of cereals, beginning *c.* 3350 cal BC and lasting around one millennium until *c.* 2300 cal BC.

The molluscan assemblages from the later long barrow ditch fills at Easton Down (Whittle *et al.* 1993), South Street (Evans 1990; Ashbee *et al.* 1979), Millbarrow (Harris and Evans 1994; Whittle 1994), and Beckhampton Road (Whittle *et al.* 1993) all indicate the establishment of woodland following relatively short phases of open grassland (Evans 1990; Davies 2008, 71–3, 80; Davies and Wolksi 2001). Similar evidence is also seen for Knap Hill (Sparks 1965) and Cherhill (Evans and Smith 1983).

Three sites do, however, indicate some clearance. Open country dry grassland species dominated an assemblage from a pit near Avebury, but species of ancient woodland imply the grassland had not long been established prior to woodland clearance *c.* 3090–2910 cal BC (Allen 2009). Assemblages from Longstones Field also demonstrate that the Longstones enclosure was constructed, *c.* 2660–2460 cal BC, in short grassland cleared of woodland some time before then, although woodland was probably nearby (Mount *et al.* 2008; Gillings *et al.* 2008, 191; Lewis 2008). At Avebury henge, the assemblages showed the monument was constructed, *c.* 2580–2470 cal BC (see Healy, below), within a dry grassland landscape with little indication of forest regeneration (Evans 1972, 268–74; Evans *et al.* 1985). Taken together, the evidence suggests the immediate landscape of Avebury itself had perhaps been cleared some 400 to 500 years prior to the monuments' construction, during a period in which other sites in the study area had seen some woodland regeneration.

Charcoal assemblages from Longstones Field (Pl. 9) contained no evidence for large woodland taxa, eg, oak, ash or elm but rather, scrub and secondary woodland species: hazel, birch, buckthorn, broom/gorse and Pomoidaeae (hawthorn, apple, whitebeam etc.). As Gale (2008) suggests, this might indicate an open landscape or, given the timber required for the West Kennet palisade enclosures a few centuries later (see below; *cf.* Whittle 1997a, 154), one in which there was an extreme bias in the selection of wood species for fuel. However, there may be some cause to question whether all this material is Late Neolithic or whether some or even all might be potentially intrusive (see below).

The charcoal assemblage from the West Kennet palisade enclosures was dominated by timbers used in the construction of the enclosures and therefore cannot be used in a 'normal conventional palaeo-environmental reconstruction' (Cartwright 1997). Oak dominated the assemblages, with lesser quantities of hazel, ash, hawthorn and sloe/cherry etc. (*Prunus* type) and occasional willow/poplar, field maple, alder, beech and elder. The very construction of the two enclosures requiring a potential estimated

11.3 hectares of oak woodland (Whittle 1997a, 154) alone might imply substantial remaining forested areas in the region during this period.

The unique preservation conditions seen at Silbury Hill provide an unprecedented insight into the final Neolithic environment. Environmental work on the mound comprises three main phases: the first conducted alongside the 1968–70 excavations (eg, Atkinson 1970; Evans 1972; Williams 1976); followed by the full publication and re-examination of this material (Whittle 1997a); and more recently the work undertaken as part of the conservation of the mound from 2000–2008 (Leary *et al.* 2013b). The most recent dating of the monument suggests a start date for construction *c.* 2490–2450 cal BC, with the final phases dated to *c.* 2400–2260 cal BC (Marshall *et al.* 2013; see Healy, below). The siting of the monument close to the Swallowhead springs, the potential source of the River Kennet, may be of some significance (Leary 2010; Whitehead and Edmunds 2012).

The organic plant and insect remains have not been preserved through waterlogging, but rather through the sheer weight and size of the mound creating anoxic conditions, possibly an almost complete absence of oxygen through the sealing of lower deposits. The range of material examined included the turves themselves, macroscopic plant remains, mosses, insects, pollen and molluscs (Campbell 2013).

The possibility that the turves were brought from different parts of the landscape means that the environmental material may not be reflective of the direct environment around the mound itself (Leary and Field 2011; Leary *et al.* 2013b; *cf.* van Nest *et al.* 2001). The turves are dominated by evidence for grassland although residual remains show that these grasslands may have not been long established (Campbell and Robinson 2013). A study of the mosses associated with the turves indicated a species range typical of chalk grassland under moderate grazing (Williams 1976). Insect remains from the old land surface beneath Silbury Hill comprised entirely species of grassland and species associated with animal dung (Robinson 1997; Campbell 2013). Seeds, however, were generally poorly preserved in many of the turves, but included many species of grassland, and some suggesting floodplain environments (Campbell 2013; Campbell and Robinson 2013).

The soil that made up one of the small gravel and organic mounds which underlie the several phases of chalk mound resulting in the structure seen today did indicate that it had come from a probably secondary woodland environment, with evidence for yew, oak, hazel, crab-apple, sloe, hawthorn and bramble. The insect fauna from this same mini-mound also contained woodland species including a nut weevil and the wood boring beetle (Campbell 2013).

Economic evidence

As noted by Grigson (1999) for Windmill Hill, a decline in the representation of sheep/goat in the later Neolithic sites is a strong possibility, but still one which requires further work. Such a decline can be noted for several sites where both Early and Late Neolithic deposits are available. These include: Windmill Hill where pigs increased but cattle were still dominant (Grigson 1999); Horslip long barrow with pigs well represented and few sheep/goat (Higham with Higgs 1979); and South Street where cattle predominated, with no pig and only a single part of a young sheep/goat (Ashbee *et al.* 1979, 267–8).

The assemblages from both of the West Kennet palisade enclosures were dominated by pig, with cattle still well represented, but very little sheep/goat (Edwards and Horne 1997). Other animals represented included several bones of red and roe deer, although these were more poorly represented than even sheep/goat. Other finds included dog and a probably intrusive bone of cat.

The estimated number of animals suggested conspicuous slaughter and consumption, consistent with feasting on a large scale (Edwards and Horne 1997). Butchery marks were seen to be relatively infrequent, for example in comparison with the Early Neolithic site at Windmill Hill (Grigson 1999), perhaps also a result of special treatment.

With respect to other sites, Silbury Hill contexts included cattle, pig, sheep/goat, dog and red deer as well as badger, polecat, hare and frog (Campbell 2013; Worley 2011a and b; Gardner 1987, 46–52). It might be noted that bone identified as beaver has since been re-identified as badger (Worley 2011c), although this species was identified from a Late Neolithic context at the West Kennet palisade enclosures (Edwards and Horne 1997, 123). A later Neolithic pit in the West Kennet Avenue produced three cattle bones, but no other animal bone (Grimm 2009).

Animal bone from the Late Neolithic ditched enclosure at Longstones Field contained mainly domesticated pig and cattle, with fewer sheep/goat, although these are still reasonably well represented, and red deer (Coward 2008, 31–9).

As Leary *et al.* (2013b) state, there is little indication for the cultivation of cereals around Avebury during the Neolithic and that which is present largely relates to the Early Neolithic (see above). As such the area is in keeping with the general picture outlined by Stevens and Fuller (2012; see above) for England in the Middle to Late Neolithic (3300–2300 cal BC). For example, charred cereal

Plate 10 Barrows at Milton Lilbourne, 1958 (© Wiltshire Museum)

remains were reasonably well represented in the Early Neolithic contexts from Windmill Hill (Fairbairn 1999; 2000, table 13) but are rare in the later Neolithic pits which produced more hazelnut fragments as well as possibly edible tubers of water plantain or arrowhead (Fairbairn 2000, table 14).

At the West Kennet palisade enclosures cereal remains, while present, were in extremely low densities, with many thought potentially intrusive (Fairbairn 1997, 135–6). Notably these include many free-threshing wheat grains (*Triticum aestivum/turgidum* type), a species which, while present in Neolithic England (Carruthers 2012), is generally rare in the period. However, it should also be noted that hazelnut shell fragments were also poorly represented, which may either reflect short-lived occupation and/or a lack of perhaps more domestic/settlement type subsistence activities on the site (Fairbairn 1997, 138).

Charred hazelnut shells were occasionally recovered from the earlier phases of construction at Silbury Hill, but were in very low quantity (Campbell 2013). However, they were recovered in greater numbers from the pit within the West Kennet Avenue where cereal remains were absent (Stevens 2009).

A small charred assemblage from Longstones Field did include barley grains, hazelnut shell fragments and a few weed seeds including, unusually, corncockle. Corncockle is generally regarded as a Roman introduction (Godwin 1984; Preston *et al.* 2004) and would tend to support the suggestion by Young (2008) that some if not all of the material may be intrusive (see also Pelling 2013 and Lewis 2008, 79 who highlights the possibility that a metal nail may be present in a thin section from the upper primary fill).

Stevens and Fuller (2012) highlight the danger of intrusive cereal grains and a good example is provided by the barley grains from Stone II at Avebury radiocarbon dated to the late 15th to mid-17th century AD (Gillings *et al.* 2008, 165–6).

Beaker/Early Bronze Age

Environment

The environmental evidence generally points to an increase in cultivation for the region, within at least the Beaker period, starting *c.* 2400–2300 cal BC. However, in many cases the evidence comprises possible ploughsoils containing beaker pottery (see Gillings *et al.* 2008, 196) rather than more direct evidence in the form of cereal grains themselves.

The criss-cross ard cultivation marks cutting the barrow at South Street were associated with Early Beaker pottery (Ashbee *et al.* 1979; see also Evans 1990; Davies 2008, 80), suggesting a date *c.* 2400–2200 cal BC and over-lain by a turf-line with Early Bronze Age pottery. Whilst the use of the ard implies that cereal cultivation was locally practised during this period, the molluscan evidence was interpreted as evidence for the use of the ard in clearance but not cultivation *per se* (Evans 1972, 364–5). Similarly, at Easton Down there is evidence for clearance of regenerated secondary woodland within the earlier Beaker period *c.* 2480–2140 cal BC, possibly followed by cultivation and then grassland (Whittle *et al.* 1993; Davies 2008, 71–3).

At Hemp Knoll, Evans (1980) suggested the soils underlying the barrow were cultivated prior to its construction, *c.* 2400–2200 cal BC (see Healy, below). Of some interest is the variation within the spot samples from the turves in the mound itself, with some dominated by woodland fauna and others grassland. Evans (1980, 173) attributes this to variation over the surface of the mound but, in light

of the material within Silbury Hill, it does raise the possibility that turves from a range of different habitats might also have been used within individual burial mounds (*cf.* van Nest *et al.* 2001).

The evidence for Beaker period cultivation at Avebury G55 is less conclusive (*cf.* Smith 1965a; Evans 1965; *contra* Gillings *et al.* 2008, 197) and the molluscan report suggests that woodland persisted until the late Beaker period, followed by clearance prior to the barrow's construction then a period of grassland, followed by at least some localised scrub. At Milton Lilbourne (Pl. 10) evidence also suggested woodland prior to the barrow's construction (Ellis 1986).

Further evidence for the persistence of woodland within the area comes from Dean Bottom, where woodland was seen as locally present up to the digging of a pit *c.* 2470–1920 cal BC, and that scrub and long herbaceous grassland persisted during the formation of a subsequent midden (Allen 1992). Likewise the molluscan assemblage from under the Burderop Down disc barrow indicated an established open landscape, but with woodland in close proximity to the barrow during the primary infilling of the ditch (Allen 1992).

Similarly the assemblages from the barrows on Roughridge Hill, indicate a long established dry open grassland, with some evidence for woodland in close proximity during the initial infilling of the ditch of at least one barrow (Evans 1968; 1972, 335–7; 1987).

Assemblages from under Pound Barrow, Beckhampton 4 and 'Stukeley' barrow, indicated short-grazed grassland, but with some shade element indicative of scrub; secondary fills indicated a rapid colonisation by long grassland species, again with possibly some scrub (Wyles and Allen 1996a).

Only limited charcoal assemblages are available for this period. That from Easton Down suggests a greater dominance of scrub species, such as sloe and hawthorn, apple and whitebeam (Pomoideae type), along with ash (Cartwright 1993); while charcoal from under Pound Barrow included oak, hazel and Pomoideae (Gale 1996).

Economic evidence

Whilst animal bone data are reasonably well represented for the earlier Bronze Age period, charred plant data are generally lacking, possibly a reflection that much of the material for this period comes from barrows.

Sheep/goat bones predominated in the Beaker pit at Dean Bottom, but cattle were well represented (Maltby 1992). The assemblages from the barrows at Roughridge Hill (Maltby in prep.), Milton Lilbourne (Grigson 1986), Hemp Knoll (Grigson 1980) and Avebury G55 (Pater 1965) all also produced assemblages of predominately cattle, with sheep/goat. At all these sites, pig formed a very small component, bar Milton Lilbourne where it was quite well represented in some assemblages. All produced evidence for roe and red deer and occasionally dog. Significantly, horse was present at Hemp Knoll, Milton Lilbourne and Avebury G55 along with aurochs from the last.

The timing and speed of the reintroduction of horse is at present uncertain (Bendrey 2010). Several potential early dates have proved to be from intrusive bones (Serjeantson 2011, 39). The earliest date for the region (and in Britain in general) comes from just to the south of the study area, at Durrington Walls, where a date of 1430–1130 cal BC (OxA-6653: 3045±50) was obtained (Kaagan 2000, 343).

Probably relatively uncommon in southern England in the Neolithic, aurochs had become extremely rare by the Early Bronze Age (Serjeantson 2011, 44) and are likely to have been extinct in the region by the later Bronze Age. Some of the last recorded finds include dated Early Bronze Age material to the south of the study area at Snail Down and Durrington Down round barrow (Jewell 1963; Grigson 1978; Serjeantson 2011, 51).

At Dean Bottom a possible grain storage pit (pit 23), dated to 2470–1920 cal BC (BM-1669R: 3750±100 BP), produced scant evidence for cereals, apart from five cereal grains, together with a fragment of hazelnut shell (Carruthers 1992; Gingell 1992, 27). The evidence is perhaps not conclusive of cereal agriculture in the Beaker period for the site, but it does at least provide a tentative indication.

Clapham (in prep.) identified from mound G61 at Roughridge Hill many tubers of false oat grass, along with fragments of hazelnut shells from the base of the mound (although these may be residual from Early Neolithic activity). A pit (pit 2) just outside burial mound G62a is thought broadly date to this period, although the exact dating for this feature is unclear. The feature did however produce a reasonable number of charred hulled barley grains (Clapham in prep.).

The environmental evidence would seem to support probable cultivation during the Beaker period, and while direct evidence in the form of dated cereals is as yet absent from the study region, such evidence is available for sites lying to the south (see Stevens and Fuller 2012, online table 1).

This pattern fits well with the national pattern from mainland England where Stevens and Fuller (2012) identify two periods in which cereal cultivation and/or population appears to have revived on a national level in England, the first more or less concurrent with the appearance of Beaker pottery dating from *c.* 2300–2000 cal BC, the second within the Middle Bronze Age from *c.* 1600–1500 cal BC.

Plate 11 Aerial view of celtic fields on Fyfield Down, Fyfield (© Wiltshire Museum)

Middle to Late Bronze Age

Environment

The general impression of the Middle to Late Bronze Age is one of dramatic landscape change in which the landscape was opened up to increasingly dense settlement (eg, McOmish 2005; Gillings *et al.* 2008). The environmental evidence for this period is relatively slight when compared with that outside the study area (eg, Leivers and Stevens 2008; Straker 2000a; 2000b), but still provides support for significant economic and landscape change during this period.

It is during this period that the area sees the laying out of many field systems, representing a fundamental (re-)organisation of the landscape. Field systems of this date include those on Rockley Down (Gingell 1992), Manton Down (Fowler 2000a, 76–7), Overton Down (*ibid.*, 82–7) and Fyfield Down (Pl. 11) (*ibid.*, 118).

Molluscan assemblages from Easton Down show a clear indication of cultivation during the later Bronze Age (see Whittle *et al.* 1993; Davies 2008, 73), as potentially do those from the upper fills of the barrow ditch at Hemp Knoll, although the layer is undated (see Evans 1980; Robertson-Mackay 1980). At Avebury G55 an assemblage from a cremation pit indicates open grassland with possibly some arable (Evans 1965).

A Middle Bronze Age assemblage from Dean Bottom indicated an open dry grazed grassland followed by longer, less managed grassland after the site's abandonment (Allen 1992). The upper ditch of the barrow examined on Burderop Down also demonstrated open long grassland, with some scrubland, probably limited to the barrow itself which was situated in a wider more managed downland environment (*ibid.*).

Re-dating of the West Overton Formation, previously associated with the construction of Silbury Hill (Evans *et al.* 1993), indicates a more probable Middle Bronze Age date for the onset of this period of alluviation, and hence more likely to be associated with the agricultural expansion seen at this time than with the construction of earlier monuments (Campbell *et al.* 2013; Campbell and Marshall 2013).

Charred tubers of onion couch grass have been recovered from a Late Bronze Age ditch at Rockley Down (Godwin 1984, 404), and Allison and Godwin (1949) also record grains of six-row naked barley from this same context. Charred remains of onion couch grass are commonplace in later Bronze Age assemblages, usually associated with cremations, owing to their use as tinder after the clearance of vegetation within areas of long grassland with low levels of grazing to create a firebreak (see Robinson 1988; Stevens 2008).

Economic Evidence
A large bone assemblage from Bishops Cannings had a number of examples of articulated remains of sheep/goat, although cattle were still predominant, and pig less well represented (Maltby 1992). The lower levels of the midden at Potterne probably date to this period and show cattle and sheep/goat in similar quantities (Locker 2000). At Dean Bottom, Rockley Down and Burderop Down the assemblages were somewhat different in that sheep/goat predominated over cattle, with pig again poorly represented (Maltby 1992). Horse remains were present on all of these sites suggesting it was a fairly well established domesticate by this time (Maltby 1992). Bones of red deer (and in one case roe deer) were also present on three of these sites, albeit in very low quantities, suggesting continued hunting of wild animals in this period.

A reasonably large deposit of clean carbonised grain, mainly of six-row hulled barley, was recovered from the Middle Bronze Age settlement at Dean Bottom (Carruthers 1992), while the later Bronze Age settlement at Burderop Down produced a very few remains with only barley identified (Maltby 1992).

Charred plant remains in Wiltshire are fairly scarce for this period. However, just outside the region the basal samples from the midden at Potterne produced evidence for six-row hulled barley along with both emmer and spelt (Straker 2000a), in keeping with the region in general (Leivers and Stevens 2008).

Late Bronze/Early Iron Age to Late Iron Age

Environment
There are very few environmental studies from the Iron Age period within the study region (*cf.* Fitzpatrick, below) and for this reason both Potterne (Lawson 2000) and East Chisenbury (McOmish *et al.* 2010) to the south of the study area are included.

The earlier part of this period sees the further laying out and modification of field systems. For example, Fowler (2000a, 71) has attributed those on Totterdown to the Late Bronze Age/Early Iron Age, with Early Iron Age field systems replacing those of the Late Bronze Age on Overton Down. Molluscan evidence from the settlement on Overton Down showed it had been sited in established long grassland, with evidence of later animal trampling and grazing (Wyles 2000a). While the assemblages showed no signs of arable activity, ard marks were present, possibly dating to the settlement's abandonment (Fowler 2000b).

Although the landscape appears to have been very open, charcoal from this site included oak sapwood, along with hazel, ash and Pomoideae (Gale 2000a), as well as field maple and sloe. Charcoal was not well represented in the East Chisenbury midden but that at Potterne had a similar range of species (Straker 2000b). It is probable that such wood was collected from small surviving stands or copses of scrub or scrub/woodland.

Economic evidence
The assemblages from the Middle to Late Iron Age settlement at Devizes (Charles 2002) and the Early Iron Age settlement at West Overton (Noddle 2000a) were dominated by sheep and cattle, the former being slightly more frequent on both sites, along with pig and some horse. Pig appears proportionally better represented within both assemblages than seen for the later Bronze Age sites described above. As common on Iron Age sites, several of the pits at West Overton contained skulls or skull fragments of cattle and in one case horse. As well as dog, unusually this site produced very early evidence for cat, often thought to be a Romano-British introduction.

In recent years extensive midden-type deposits have been discovered at locations including All Cannings Cross, Potterne, East Chisenbury, Westbury and Stanton St Bernard, which seem to represent a chronologically and functionally discrete phenomenon in later prehistoric society. Despite some detailed analyses, they are still relatively poorly understood in terms of formation processes and function. These deposits are generally very extensive; for example at East Chisenbury, the deposits were found to be up to 2.7 m deep, covering several hectares and with a remaining estimated volume of up to 50,000 cubic metres; Potterne was of a similar size. They all appear to be Late Bronze Age/Early Iron Age in date and composed of dark, seemingly highly organic deposits which are extremely rich in artefacts. On some sites extensive disturbance throughout deposition is indicated – eg, Potterne (Macphail 2000) and Stanton St Bernard (Norcott 2006) – whereas at East Chisenbury exceptional preservation was recorded, leading the excavators to conclude that careful deposition of material originating elsewhere was indicated (McOmish *et al.* 2010). The relatively tiny areas excavated – especially in the case of East Chisenbury (*c.* 0.01%) – do not permit firm conclusions about whole sites to be drawn as yet; however there seems to be little doubt that relatively intensive animal husbandry played a significant role in their function.

In contrast to Potterne, where it is argued that the midden comprised largely cattle dung, at East Chisenbury it was suggested from phytholith studies that sheep/goat dung might be the primary source of material (Macphail 2010). The animal bone from this site also demonstrated a predominance of sheep/goat with fewer numbers of cattle and pig. This compares

Plate 12 Spelt wheat and hulled barley grains (© Wessex Archaeology)

very well with the Potterne data where a predominance of sheep/goat was seen in the later upper levels (Locker 2000). Also in contrast to Overton Down where wild animals were absent, there is evidence from these midden sites for deer, fox and a number of birds including goose, duck, blackbird, eagle, buzzard, crow and raven (Serjeantson *et al.* 2010; Locker 2000). As common at Iron Age sites, fish bones were almost totally absent with just two eel bones from Potterne and none from East Chisenbury.

Charred plant remains from the East Chisenbury midden were less well represented than at Potterne (see Carruthers 2010; Straker 2000a) and it is probable that a higher proportion of the midden at East Chisenbury is unburned compared with Potterne (Macphail 2010). The species represented included free-threshing wheat, spelt wheat, and six-row hulled barley (Pl. 12) (Carruthers 2010). At Potterne charred remains from the upper deposits included emmer, spelt, hulled barley and flax. However, emmer was less well represented within the later midden deposits (see Straker 2000a, fig. 24).

The (calcium phosphate) mineralised remains from both sites largely comprised common arable weeds, potentially growing on the midden itself, although elder was present, along with flax, bramble, apple/pear, sloe and bramble which all suggest some input of domestic waste into the middens (Carruthers 2000; 2010).

The charred and mineralised assemblages from Middle to Late Iron Age settlement at Devizes (Pelling 2002; Carruthers 2002) would seem to confirm the trend towards spelt wheat, with no emmer present. The mineralised remains were dominated by mustard from a Late Iron Age pit, potentially representing a cultivated *Brassica* crop (Pelling 2002). The author has also identified large numbers of black mustard seeds from Late Iron Age features at Ham Hill and potentially this crop can be associated with its use as mustard and with changes in cuisine and culinary practises in this period (Stevens 2007).

Romano-British

Environment

This period possibly sees further agricultural expansion, and it is notable that many of the upper fills of barrow ditches with mollusc assemblages indicative of cultivation potentially date to this phase. Examples include Avebury G55 (Evans 1965), South Street long barrow (Ashbee *et al.* 1979) and possibly Roughridge Hill (Evans 1972, 335–7; 1987). Much of the sequence in the Winterbourne Valley is believed to date to this period and showed an open floodplain with possible pasture and cultivation of the slopes (Allen 1996). A further largely undated sequence from Butler's Field (Mount 1991; 1996), of Romano-British to later medieval date, indicates an area of damp floodplain grassland with seasonal flooding at the base, with the transition to the drying out of the floodplain and the development of a more terrestrial fauna.

Hazel, ash, blackthorn/cherry, oak, elm, maple and elder charcoal were identified from Silbury Hill and the late Romano-British settlement at West Overton Site XII (Gale 1996; 2000b). In both cases the wood appears to have been gathered from open scrubland with light woodland and/or isolated copses. It might be noted that Pelling (2013) also found bracken and heather within the plant macrofossils which might further suggest the exploitation of cleared areas of former forest upon the Clay-with-flints.

Economic evidence

Animal bones from the settlements to the south and east of Silbury Hill along with those of late Romano-British date at West Overton were dominated by cattle and sheep. Silbury had only rare deposits of pig (Iles 1996a; Baker 2013; Noddle 2000b), but it was better represented at West Overton. A small assemblage of animal bone from Longstones Field was dominated by sheep/goat (Coward 2008, 234–5), with smaller numbers of cattle, and a few finds of pig. Similar results were seen from Devizes (Charles 2002) although the assemblage was poorly preserved and hence sheep/goat are probably under represented.

The settlement at Silbury also produced evidence for goose and chicken, while fish bones were less common but did include common eel. A number of

oyster shells were present at West Overton (Wyles 2000b), but no remains of fish were recovered. As with most British sites, fish bones are largely absent from later prehistoric contexts in the region, but become commoner in the Romano-British period. Bones of deer were present in low amounts from both sites (Baker 2013; Noddle 2000b). Late Romano-British deposits from Devizes indicated a dominance of cattle, with relatively few sheep/goat and pig, although this may be a preservation/recovery issue (Ingrem 2002).

Charred plant remains were recovered from the settlements adjacent to Silbury Hill (Pelling 2013; Scaife 1996a). In common with many sites in the British Isles they provided good evidence for the cultivation of spelt wheat with some hulled barley, but little indication of emmer wheat. The more recent excavations also produced evidence for malting and brewing, a common occurrence for Roman roadside settlements (Pelling 2013). As with many such sites, the site is located near natural springs, which no doubt provided a source of water for brewing as well as potentially a sacred place for possible pilgrims. Indeed, as noted above, the very siting of Silbury Hill may be related to this factor.

Plate 13 Environmental analysis (© Wessex Archaeology)

Saxon to Medieval

Environment

Molluscan evidence suggests a mixture of open environments during this period with a mid-8th- to late 9th-century AD alluvial deposit in the valley bottom near Silbury Hill, indicating wet flooded pasture environments (Campbell *et al.* 2013) together with areas of grazed grassland and probable cultivation as indicated by assemblages from 'Stukeley', Beckhampton Barrow 4 and Butler's Field (Wyles and Allen 1996a; 1996b).

Increased colluviation in the medieval/post medieval sequence from the Winterbourne Valley probably reflects larger areas coming under the plough (Allen 1996). Alluviation also increased in the valley bottom towards the end of the 13th century AD, perhaps related to increasing population levels and expanding cultivation around this time (Campbell *et al.* 2013).

Charcoal from the settlement at Raddun, Fyfield Down, comprised hazel, ash, Pomoideae, buckthorn/cherry etc., oak, elder and elm. Oak, while present was less well represented than hazel (Gale 2000c).

Economic evidence

The Saxon bone assemblage recovered from Devizes indicated a predominance of cattle with little sheep, although this may be a product of poor preservation (Charles 2002). The 12th–13th-century settlement at Raddun Wroughton, Fyfield Down, in contrast produced large numbers of sheep and goat, probably of a larger size than in the Romano-British period (Noddle 2000c). Cattle were less well represented than in earlier periods, together with smaller numbers of pig. Dog and horse are recorded, along with hare, and there is a good representation of fowl, including chicken, duck, goose and partridge. While fish were present, these all appear to be from later 17th-century contexts.

At Butler's Field a small assemblage of animal bone was studied from medieval pits and ditches (Iles 1996b) but produced only single bones of cattle and sheep/goat. Fish remains were also recovered and included three bones of herring.

A number of charred fragments of hazelnut shell were recovered from the site at Raddun Wroughton, Fyfield Down (Allen 2000b). Scaife (1996b; 1996c) also examined a charred assemblage from medieval ditches at Butler's Field and East Kennett which had very low levels of abraded grains of free-threshing wheat in the former and grains of free-threshing wheat and barley in the latter. Grains of oats were also present but, along with larger seeds of black bindweed, vetch/wild pea and cleavers, may be weed seeds. As such the assemblage indicates the typical change for the period across Britain where hulled wheat, predominately spelt, is replaced by free-threshing varieties.

Scientific Dating

by Frances Healy

Introduction

Absolute dating in the Avebury area goes back to early in the history of radiocarbon dating, with measurements of samples from Windmill Hill (BM-73 to -75; Barker and Mackey 1961). It is now possible to trace almost 300 radiocarbon dates (see Table 5a), with much smaller numbers of thermoluminescence (TL) and optically stimulated luminescence (OSL) dates (see Table 5b), as well as some dendrochronological analyses (see Table 5c) from the WHS and the wider area reviewed in this volume. The large number might suggest that scientific dating has been well-served. Quantity, however, does not mean quality, let alone even coverage.

The radiocarbon dates fall into two groups:

- series measured on stringently selected samples, in order to provide suitable material for Bayesian statistical modelling (from Windmill Hill, Knap Hill, the West Kennet long barrow and Silbury Hill); and
- dates obtained more-or-less opportunistically and reactively in order to answer questions which have arisen in the course of particular projects (all the rest).

It is worth summarising the criteria by which samples have been selected for the first group, not least because they provide a yardstick by which to assess the second (Bayliss *et al.* 2011).

If an absolute date is to provide the age of a sample's context, as well as of the sample itself, the sample must be contemporary with, or at least close in age to, that context. Such samples include, in roughly descending order of reliability:

- bones found in articulation. These samples would have been still connected by soft tissue when buried and hence from recently dead individuals;
- bones identified as articulating during analysis, especially if a single individual is well represented. These may have been articulated in the ground or have only been slightly disturbed before burial;
- bones with refitting unfused epiphyses identified during analysis, for the reasons given above;
- carbonised residues adhering to the interior of groups of sherds from a single pot. These are probably the remains of charred food (rather than firewood) and a well-represented pot has a good chance of being in the place where it was originally discarded;
- antler tools discarded on ditch bases, thought to be functionally related to their original excavation;
- single fragments of short-lived charred plant remains functionally related to the context from which they were recovered (eg, charcoal from a hearth or cremation pyre, or the outer sapwood rings of charred posts); and
- Single fragments of short-lived charred plant remains from coherent dumps of charred material: inferred on the basis of their coherence and fragility to be primary disposal events (eg, charred grain from a substantial deposit in a pit).

Short-lived plant material and single fragments are important because samples of long-lived material, such as charcoal from mature oak, can easily be older than their contexts and because a bulk sample of any material can include fragments of various ages, giving a result that is the mean of all and the age of none.

A glance at Table 5a is enough to show that many, although by no means all, of the radiocarbon dates are of limited value, having been measured on unidentified bulk charcoal samples or disarticulated bone, such that, cautiously, they can be seen only as *termini post quos* for their contexts – dates after which those contexts would have formed. There is the further problem of possible inaccuracy, especially among dates measured decades ago before the series of formal international inter-comparison exercises which began in the 1980s (Rozanski *et al.* 1992).

Mesolithic

There are few absolute dates. Two radiocarbon measurements in the second half of the 8th millennium cal BC from fluvial deposits in the Kennet Valley at West Overton (Table 5a: OxA-1044 -1047) were unassociated with traces of human activity, although there is a small quantity of Mesolithic lithics from an intermediate layer (Evans *et al.* 1993, 163–71). Also, since both were measured on disarticulated animal bones, they could be *termini post quos* for the formations in which they were found and for the open-country environment of OxA-1047 and the shaded swamp environment of OxA-1044. In Avebury, human activity must be reflected by 12 fragments of burnt flint from the base of a palaeosol in the Winterbourne Valley in Butler's Field (*ibid.*, fig. 9). These formed the sample for a TL date spanning most of the 7th millennium BC and some of the 6th (Table 5b). It is unclear, however, if the flints were all of the same age, especially as multiperiod material can accumulate at the base of a soil and as there were both Mesolithic and Neolithic artefacts from this soil in adjacent cuttings (*ibid.*, 151–3).

At Cherhill, a radiocarbon date in the later 7th or earlier 6th millennium cal BC (Table 5a: BM-447)

was obtained for charcoal from a circumscribed concentration in a soil lens which, although sandwiched in tufa, coalesced nearby with a soil covered by the tufa, on and in which was a Late Mesolithic occupation spread of lithics, animal bone and charcoal (Evans and Smith 1983, 50–2). The relation of the sample to the occupation is probable, rather than certain and, even if the relation were certain, the unidentified bulk charcoal sample would provide only a *terminus post quem*. Cherhill, however, exemplifies the kind of site where dating would be worth undertaking to as high a level of precision as possible: a Mesolithic living surface, with bone preservation and an informative environmental record, stratified below successive later occupations. The valleys of the area, large and small, may offer other such opportunities.

Neolithic and Bronze Age

Here, while there are many *termini post quos*, an increasing number of samples have been selected by the criteria summarised above, and there have been modelling exercises for the West Kennet long barrow (Bayliss *et al.* 2007a), for Windmill Hill and Knap Hill in the context of the Early Neolithic of the surrounding area (Whittle *et al.* 2011, ch. 3), and, most recently, for Silbury Hill (Marshall *et al.* 2013).

The Bayesian approach to the interpretation of archaeological chronologies is described in detail elsewhere (eg, Bayliss and Bronk Ramsey 2004; Bayliss *et al.* 2011). It is based on the principle that, although the calibrated age ranges of radiocarbon measurements accurately estimate the calendar ages of the samples themselves, it is the dates of archaeological events associated with those samples that are important. Bayesian techniques can provide estimates of the dates of such events by combining absolute dating evidence, such as radiocarbon dates, with relative dating evidence, such as stratigraphic relationships between radiocarbon samples, at the same time constraining the scatter inherent in radiocarbon measurements. It is also possible to calculate distributions for the dates of events that have not been dated directly, such as the beginning and end of a continuous phase of activity (which is represented by several radiocarbon results), and for the durations of phases of activity or hiatuses between such phases, moving beyond individual dates. The resulting 'posterior density estimates', whether for individual measurements or estimated parameters, are not absolute. They are interpretative, and will change as additional data become available or as the existing data are modelled from different perspectives. By convention, they are expressed in *italics*.

Models are presented here for the fairly small series for dates from the Avebury henge and stone settings, the Longstones enclosure, and West Kennett Farm. Their results are summarised in Figure 9 and Table 3. The provisional construction dates quoted here are derived from the overall model shown in Figure 9, rather than from the site-specific models shown in Figures 6–8.

The Avebury henge and stone settings

There are no dates for samples definitely from below or in the relatively small primary bank recorded in sections in the south of the circuit, and presumably extending around its whole circumference (Pitts and Whittle 1992, fig. 1; Pollard and Cleal 2004, 124–5). The relation to it of Peterborough Ware found on the old land surface (Piggott 1935; Smith 1965b, 224) is uncertain. The model offered here therefore applies to the earthwork visible today rather than to its first stage (Fig. 6).

Dates from the old land surface beneath the earthwork comprise one for an unidentified bulk charcoal sample from a wide area covered partly by the primary bank and partly by the final one (Pitts and Whittle 1992, fig. 2: HAR-10063), one for a bulk animal bone sample from an area beneath the interface of the two banks (*ibid.*, fig. 3: HAR-10325), and a third for a bulk charcoal sample from beneath the final bank, well clear of the primary bank (*ibid.*, fig. 2: HAR-10500). All are modelled as *termini post quos* for the final earthwork. An antler pick (Fig. 6: *Gray 136*) from the ditch base would have been placed there before any silt had accumulated and would probably have been used to dig the ditch. Three replicate measurements have been made on it (Table 5a: HAR-10502, OxA-12555 -12556; Pollard and Cleal 2004, 121). These are statistically inconsistent, HAR-10502 being older than the other two dates. Since the other two are consistent, their weighted mean (Ward and Wilson 1978) is included in the model (Fig. 6: *Gray 136*), and HAR-10502 is excluded. The weighted mean is in turn statistically consistent with OxA-12557, measured on another antler pick from low in the chalk rubble fill which would have accumulated quickly. The two are therefore modelled as forming part of a single phase. If HAR-10326 indeed came from the revetment of the bank (Pitts and Whittle 1992, fig. 3), it too should be close in age to construction although, because of uncertainty as to its context, this relationship is not incorporated in the model. Higher up the sequence, a bulk charcoal sample from the secondary fills provides a *terminus post quem* for a burial (Fig. 6: *HAR-10064*).

In the main circle, a bulk charcoal sample and a sample of disarticulated pig bone provide *termini post quos* for the erection of two stones (Fig. 6:

Table 3 Parameters shown in Figure 9, in order of appearance

Particulars of individual radiocarbon measurements are to be found in Table 5a. The simple calibrated date ranges given for those measurements shown in the Table 5a differ from the posterior density estimates shown here because the posterior density estimates are constrained by the model shown in Figure 9.

Parameter	**Posterior density estimate cal BC 95% probability**	**Posterior density estimate cal BC 68% probability**	**Parent model**
Dig_WH_inner	*3685–3635*	*3665–3645*	Whittle *et al.* 2011, fig. 3.9
Dig_WH_outer	*3685–3610*	*3670–3535*	Whittle *et al.* 2011, fig. 3.11
Start_West_Kennet_Primary	*3665–3630 (80%)* *3565–3540 (15%)*	*3655–3635*	Bayliss *et al.* 2007a, fig. 6
Dig_WH_middle	*3655–3605*	*3640–3620*	Whittle *et al.* 2011, fig. 3.10
BM-493 (Cherhill)	*3670–3330 (93%)* *3220–3190 (1%)* *3160–3130 (1%)*	*3640–3560 (21%)* *3540–3490 (15%)* *3470–3370 (32%)*	–
Build_Knap_Hill	*3625–3580 (7%)* *3530–3375 (88%)*	*3515–3440(46%)* *3425–3390 (225%)*	Whittle *et al.* 2011, fig. 3.9
Build_Easton_Down	*3590–3340*	*3470–3375*	Whittle *et al.* 2011, fig. 3.31
Build_South_Street	*3530–3105*	*3490–3300 (56%)* *3250–3195 (12%)*	Whittle *et al.* 2011, fig. 3.31
Build_Millbarrow	*3435–3125*	*3380–3275 (45%)* *3265–3195 (23%)*	Whittle *et al.* 2011, fig. 3.30
Beckhampton_Road_antler	*3345–3210 (41%)* *3190–3155 (4%)* *3130–2900 (50%)*	*3335–3235 (35%)* *3100–3040 (18%)* *3035–2970 (15%)*	Whittle *et al.* 2011, fig. 3.31 (there simply '*antler*')
BM-2675 (First ditch of West Overton G19)	*3100–2880*	*3020–2900*	–
GrA-25550 (OD V recut at Windmill Hill)	*3030–2870*	*3010–2990 (8%)* *2940–2880 (60%)*	–
Longstones_Beta-140988	*2660–2460*	*2590–2560 (8%)* *2550–2470 (60%)*	Fig. 7
Dig_Avebury_ditch	*2580–2470*	*2530–2485*	Fig. 6
Silbury_start	*2490–2450*	*2480–2460*	Marshall *et al.* 2013 model B
End_ Silbury_Hill	*2430–2405 (5%)* *2400–2260 (90%)*	*2385–2350 (23%)* *2320–2270 (45%)*	Marshall *et al.* 2013 model B
OxA-V-2271-34 (Hemp Knoll primary burial)	*2460–2410 (8%)* *2380–2200 (87%)*	*2350–2270 (40%)* *2260–2210 (28%)*	–
SUERC-34082 (Tpq for Marlborough Mound)	*2340–2130*	*2290–2160*	–
build_palisade_enclosures	*2340–2130*	*2290–2190 (63%)* *2165–2150 (5%)*	Fig. 8
HAR-10064 (charcoal beneath burial in Avebury ditch)	*2340–1880 (95%)*	*2200–1970*	Fig. 6
OxA-V-2228-40 (Roundway G8 burial)	*2270–2260 (2%)* *2210–2030 (93%)*	*2200–2130 (43%)* *2090–2050 (25%)*	–
OxA-V-2228-46 (West Overton, flat burial 1B)	*2210–2030*	*2200–2170 (10%)* *2150–2120 (16%)* *2100–2040 (42%)*	–
Windmill Hill B198	*2200–2170 (5%)* *2150–2020 (89%)* *2000–1980 (1%)*	*2140–2030*	–
BM-2677 (disarticulated burial in West Overton G19)	*2200–1920*	*2140–1970*	–
BM-2678 (articulated burial in West Overton G19)	*1320–1010 (94%)*	*1270–1100*	–
SUERC-26203 (West Overton G1 burial)	*2010–2000 (2%)* *1980–1770 (93%)*	*1950–1870 (52%)* *1850–1820 (10%)* *1800–1780 (6%)*	–
BM-2679 (charcoal from cremation deposit at West Overton G19)	*2130–2080 (3%)* *2060–1620 (92%)*	*1970–1730 (67%)* *1710–1700 (1%)*	–
BM-2680 (charcoal from cremation deposit at West Overton G19)	*2010–2000 (1%)* *1980–1420 (94%)*	*1880–1840 (5%)* *1820–1800 (3%)* *1780–1520 (60%)*	–
BM-2684 (charcoal from cremation deposit at West Overton G19)	*1530–1300*	*1500–1390*	–
BM-2683 (charcoal from cremation deposit at West Overton G19)	*1530–1190*	*1460–1290*	–
BM-2681 (charcoal from cremation deposit at West Overton G19)	*1450–1110*	*1400–1210*	–
OxA-1348 (charcoal from cremation deposit in Kennet Valley at West Overton)	*1440–1110*	*1390–1210*	–

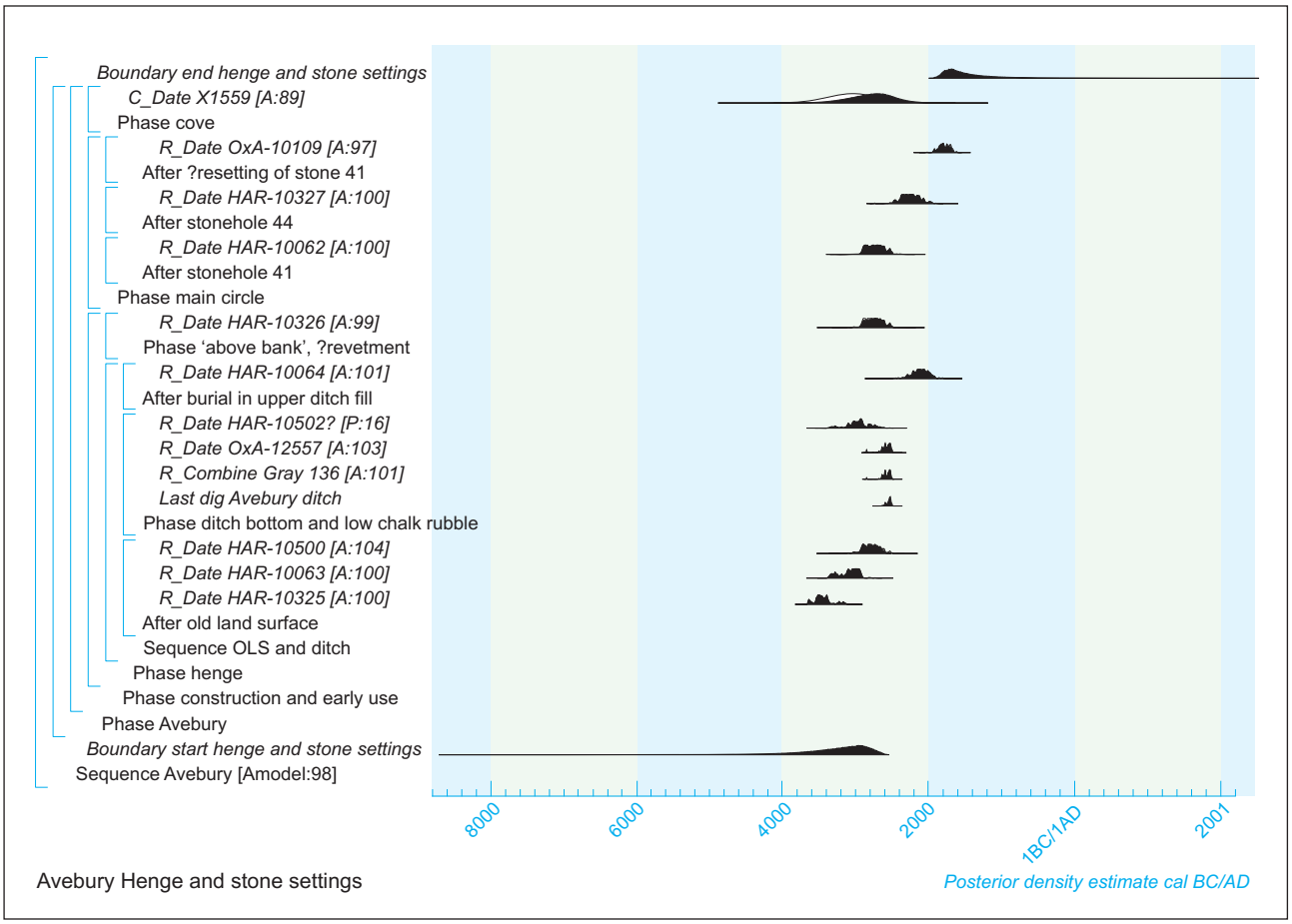


Figure 6 Chronological model for the Avebury henge and stone settings

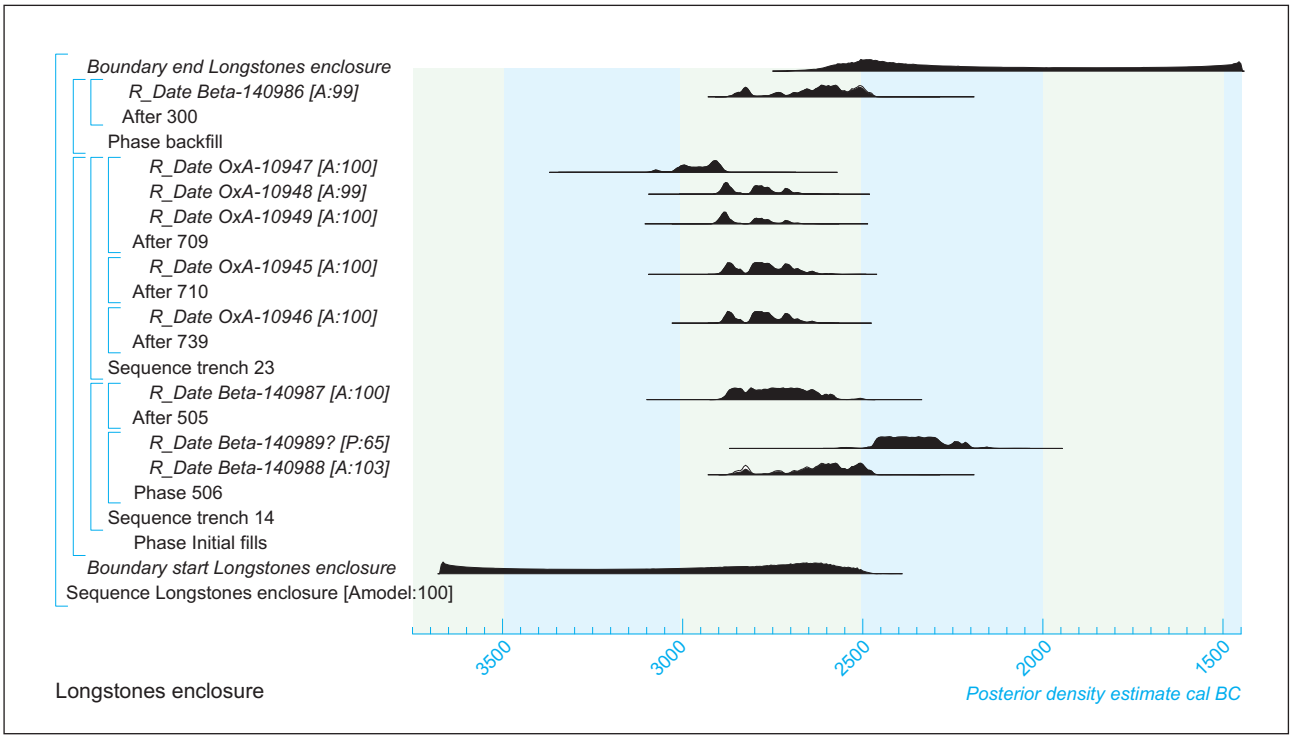


Figure 7 Chronological model for the Longstones enclosure

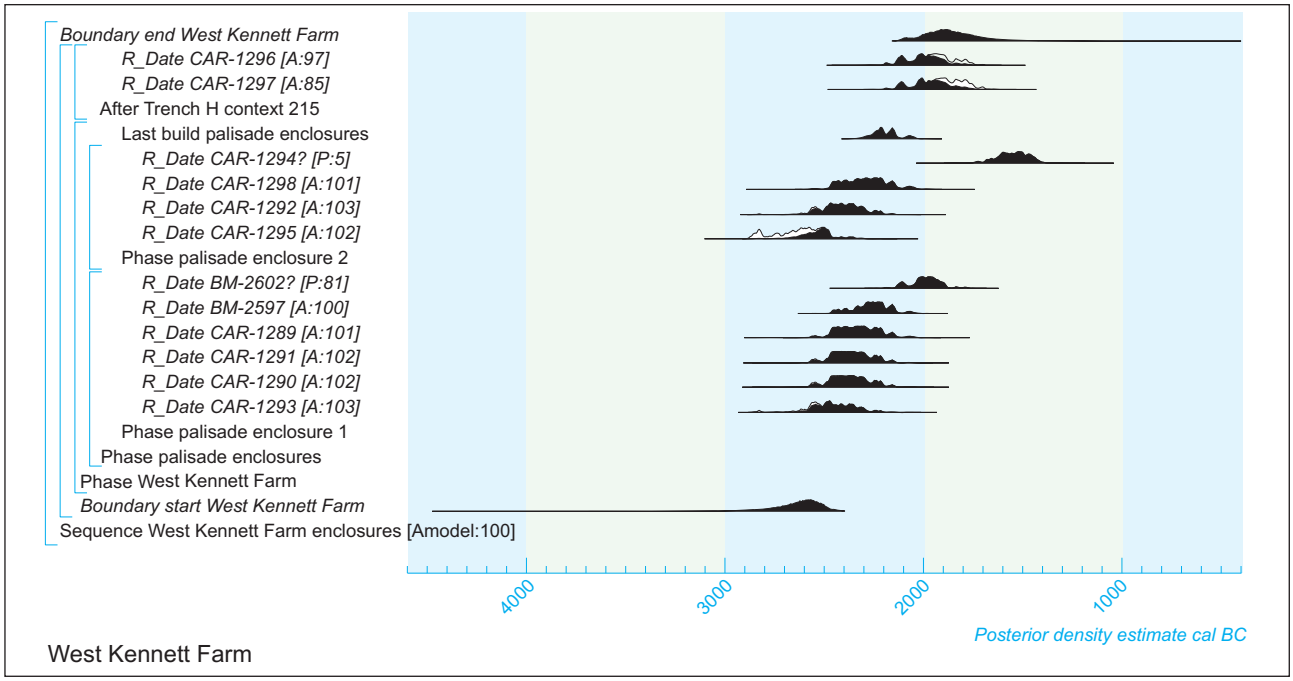


Figure 8 Chronological model for the West Kennett Farm palisade enclosures

HAR-10062, -10327). A *terminus post quem* for what is persuasively argued to be the resetting of a third stone (Pollard and Cleal 2004, 121–4) is provided by a measurement on a human skull fragment from the basal packing (Fig. 6: *OxA-10109*).

The only date for the cove is an OSL measurement for quartz grains from the clay packing of stone II (Fig. 6: X1559). When incorporated in the model, this is in overall agreement with the other measurements. It is, however, unconfirmed by any other dating evidence and its large standard deviation provides a great deal of latitude. There are further grounds for caution in that OSL dates for archaeological feature fills, as opposed to naturally deposited sediments, have an uneven track record of accuracy. This is exemplified by dates so early as to call for special pleading for two cursus monuments at Eynesbury, Cambridgeshire (Allen *et al.* 2004) and by results from the Stanwell cursus at Heathrow which collectively span thousands of years (Healy *et al.* 2010). The authors themselves express some reservations about the complete reliability of the Avebury estimate (Rhodes and Schwenninger 2008).

On the available evidence, the construction date of the present earthwork is estimated as *2580–2470 cal BC (95% probability)*, probably *2530–2485 cal BC (68% probability;* Fig. 9: *dig_ Avebury_ditch)*.

The Longstones enclosure

The problem here is that the enclosure ditch was so clean that suitable samples were confined to an articulated pig foot from the ditch floor in a terminal (Fig. 7: *Beta-140988*). The remaining eight dates were measured on disarticulated bone and antler fragments. These are all modelled as *termini post quos*, except for Beta-140989, which is excluded as an outlier because it is statistically inconsistent with and later than the articulated sample from the same context. *Beta-140988* itself thus provides the best estimate for a construction date of *2660–2460 cal BC (95% probability)*, probably of *2590–2560 cal BC (8% probability)* or *2550–2470 cal BC (60% probability;* Fig. 9: *Longstones_Beta-140988)*.

West Kennett Farm

The existing dates were measured on disarticulated samples, at least some of them bulked. The contexts of the samples, most of which were packed into the postpipes and bedding trenches of the palisade enclosures, mean that they are *termini post quos* for construction. Nine of the eleven dates from the two enclosures are statistically consistent, so that they could have derived from a single event, the exceptions being two later measurements (Fig. 8: BM-2602, CAR-1294). BM-2602 was measured on an antler fragment in the edge of the upper part of a postpipe, so that the sample may have derived from post-construction activity at the site. It is therefore excluded from the model. The sample for CAR-1294, on the other hand, came from the core of a postpipe. Its date of 1740–1410 cal BC (95% confidence) is, however, not only statistically inconsistent with nine of the eleven other dates from the palisade enclosures, it is also in poor agreement with the model and too late for the Grooved Ware associated with the structures. It is therefore also excluded.

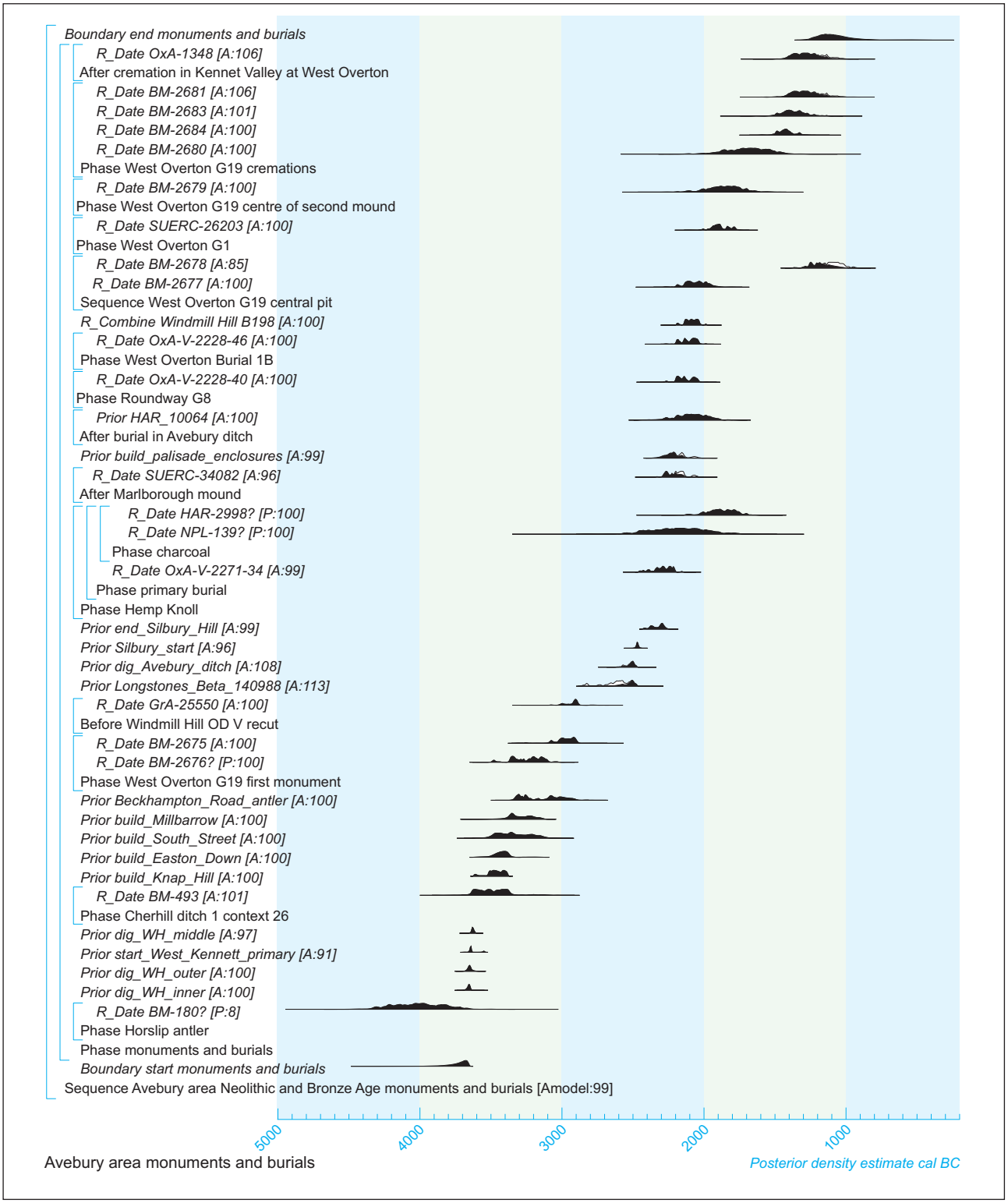


Figure 9 Selected parameters relating to Neolithic and Bronze Age monuments and burials in the Avebury area, listed in Table 3

Cautiously, a construction date of *2340–2130 cal BC (95% probability)*, probably of *2290– 2190 cal BC (63% probability)* or of *2165–2150 cal BC (5% probability;* Fig. 9: *build_palisade_enclosures)* is estimated, based on the latest of the dates once BM-2602 and CAR-1294 are excluded.

The remaining two dates (Fig. 8: *CAR-1296, -1297)* are themselves statistically consistent, but later than the consistent series from the enclosures. Both are from context 215, which bore no stratigraphic relation to the enclosures and, from its description (a midden-like deposit of animal bone with Grooved

Ware on a chalk floor – Whittle 1997a, 12, 76, fig. 43) may have been a partly exposed example of the kind of structure more recently excavated at Durrington Walls.

Overview

Monuments and burials

The 4th millennium cal BC has recently received most attention, so that it is possible to revise the chronological scheme of Whittle (1993), which was followed in the previous resource assessment (Cleal and Montague 2001). Figure 9 and Table 3 show some of the results from the dating programmes for the West Kennet long barrow (Bayliss *et al.* 2007a) and the circuits of Windmill Hill (Whittle *et al.* 2011, 61–97). The precision of these estimates contrasts with the imprecision of the surrounding estimates. In the case of Knap Hill, this is because the small scale of the excavation did not provide enough samples to constrain the scatter (Whittle *et al.* 2011, 97–102). In the case of the other long barrows, where only the pre-existing dates could be modelled, imprecision resulted both from low numbers of measurements, from the fact that several could be modelled only as *termini post quos*, and from their wide standard deviations (Whittle *et al.* 2011, 104–8).

The sequence is perhaps surprising. The inner and the exceptionally large outer circuit of the Windmill Hill causewayed enclosure are the earliest dated monumental constructions, followed by the West Kennet long barrow, then by the middle circuit of Windmill Hill, within the space of at most 75 years (*ibid.*, fig. 3.16: *period construction*). After this followed the smaller, simpler causewayed enclosure on Knap Hill and the other local long barrows (*ibid.*, fig. 3.32), as well as, on the evidence of a single radiocarbon date, an ill-understood sinuous, irregular ditch containing formally placed deposits at Cherhill (Fig. 9: *BM-493*). From this perspective, the single late 5th/early 4th millennium cal BC date for an antler pick from the base of a ditch of the Horslip long barrow is probably inaccurate (Fig. 9: *BM-180?*). The same may, of course, be true of the surprisingly late dating of an antler from beneath the Beckhampton Road long barrow (Fig. 9 and Table 3: *Beckhampton_Road_antler*).

More precise dating can re-write stories other than sequential ones. An unexpected disjuncture in the sequence of radiocarbon dates through segment V of the outer ditch at Windmill Hill combines with an exceptionally low quantity of chalk rubble fill to point to a recut extending close to the ditch base before *3030–2870 cal BC (95% probability;* Fig. 9 and Table 3: *GrA-35550*). It is from this level upwards that Peterborough Ware occurs in the segment (Smith 1965b, 11–12, fig. 4), and the recut could correspond to the expansion of the bank, seen in a more heterogeneous, unbedded structure to the rear than the front (covering, among other features, the grave of a mature male (Whittle *et al.* 1999, 79–81) who was probably interred *behind* the original bank rather than on its site before its construction), and the creation of a new entrance at the north end of the segment, where a vestigial bank runs across the present causeway (McOmish 1999, 14, fig. 15). This could reflect the creation of a new approach to the enclosure, oriented to the increasingly frequented south-facing slope of the hill and Kennet Valley (Whittle *et al.* 2011, 96–97). Correspondingly, an infant burial higher up in the same segment, long thought to be Neolithic (Smith 1965b, 9), dates to *2200–2170 cal BC (5% probability)* or *2150–2020 cal BC (89% probability)* or *2000–1980 cal BC (1% probability;* Fig. 9 and Table 3: *Windmill Hill B198)*. By the time of this late 4th/early 3rd millennium cal BC reorientation the extended, intermittent infilling of the chambers of the West Kennet long barrow was under way, continuing into the second half of the 3rd millennium cal BC (Bayliss *et al.* 2007a, fig. 6).

One of the first new monuments to be built closer to the river at the start of the 3rd millennium cal BC may have been a ring ditch on the site of what was to become round barrow West Overton G19 (Swanton 1988). Two antlers from the ditch base have been dated, with statistically inconsistent results (Table 5a: BM-2675, -2676). The more recent of the two probably reflects the date of the monument: *3100–2880 cal BC (95% probability;* Fig. 9 and Table 3: *BM-2675)*. Large-scale constructions came later. The precision of estimates for Silbury Hill, with a start date of *2490–2450 cal BC (95% probability)*; probably of *2480–2460 cal BC (68% probability;* Fig. 9 and Table 3: *Silbury_start;* Marshall *et al.* 2013*)*, makes comparison with the other dating evidence difficult, as with the West Kennet long barrow and the other long barrows.

Figure 9 brings together the construction and end dates from the preferred model of Marshall *et al.* for Silbury with the very imperfect estimates arrived at here for the Avebury henge, the Longstones enclosure and the West Kennett Farm palisade enclosures. Also included is the latest of four dates from two cores through the Marlborough Mound (Table 5a: SUERC-34082 to -34085). This is chosen for modelling as a *terminus post quem* for construction because the coring exercise delivered scattered charcoal fragments which could already have been of some age when the earth or turf in which they were incorporated was built into the monument. It indicates a construction date after *2340–2130 cal BC (95% probability)*, probably of *2290–2160 cal BC (68% probability;* Fig. 9 and Table 3: *SUERC-34082)*.

Table 4 Late Neolithic monuments and the Hemp Knoll primary burial
The cells show the % probability that the event in the first column is earlier than each event in the subsequent columns, derived from the model shown in Figure 9. It is, for example, 97% probable that *Longstones_Beta_140988* pre-dates *Silbury_start*

Parameter	*Longstones_ Beta_140988*	*dig_Avebury_ditch*	*Silbury_start*	*end_Silbury_Hill*	*OxA-V-2271-34*	*SUERC-34082*	*build_palisade_enclosures*
Longstones_Beta_140988	–	*62%*	*97%*	*99%*	*99%*	*99%*	*100%*
dig_Avebury_ditch	*38%*	–	*99%*	*99%*	*100%*	*100%*	*100%*
Silbury_start	*3%*	*1%*	–	*100%*	*99%*	*99%*	*100%*
end_Silbury_Hill	*0%*	*0%*	*0%*	–	*66%*	*95%*	*94%*
OxA-V-2271-34 (Hemp Knoll primary burial)	*0%*	*0%*	*0%*	*34%*	–	*81%*	*81%*
SUERC-34082 (Tpq for Marlborough Mound)	*0%*	*0%*	*0%*	*5%*	*19%*	–	*50%*
build_palisade_ enclosures	*0%*	*0%*	*0%*	*6%*	*19%*	*50%*	–

As Pitts points out (2011d, 6–7), however, the most recent date is for the least deep sample, so that it is conceivable that the cores went through successive stages of construction.

Table 4 attempts to sequence these disparate estimates for 3rd millennium cal BC monuments. Their overall span of *220–500 years (95% probability)*, probably *270–410 years (68% probability)* is undoubtedly widened by the imprecision of some of the estimates. Present evidence suggests that the Longstones enclosure was probably the first to be built, followed by the Avebury henge, followed by Silbury Hill. The West Kennett Farm palisade enclosures and the Marlborough Mound seem to have been built after the completion of Silbury Hill. Not only are most of the present estimates built on inadequate foundations, there is no absolute dating at all for the Sanctuary, the Longstones Cove, the West Kennet and Beckhampton Avenues, Falkner's Circle and other certain or possible small stone circles. As Gillings *et al.* point out (2008, 119), the east end of the Beckhampton Avenue should post-date or be contemporary with the Avebury henge and its west end, together with the Longstones Cove, should post-date the Longstones enclosure and pre-date a Beaker burial against one stone of the cove. The West Kennet Avenue should similarly post-date or be contemporary with the Avebury henge and pre-date Beaker burials. Its south-east end should be contemporary with or later than the outer stone ring of the Sanctuary. Falkner's Circle remains dated only by a very small amount of possibly associated Grooved Ware (*ibid.*, 149).

Table 4 not only shows the sequence of some of the Late Neolithic monuments, it shows that the man buried in the primary grave of the Hemp Knoll round barrow, some 4 km south-west of the Avebury henge, in *2460–2410 cal BC (8% probability)* or *2380–2200 cal BC (87% probability;* Fig. 9 and Table 3: *OxA-V-2271-34)*, probably died before the Marlborough Mound and the West Kennett Farm palisade enclosures were built (81% probable in both cases, *if* the date estimates for the two monuments are correct). In other words, the innovative and exotic tradition of Beaker burial may have been established locally during the construction of monuments rooted firmly in insular tradition. Articulated skeletons from other burials of the late third and the second millennia cal BC have been dated, an advance on the situation documented by Cleal (2005). They include sig-nificant grave groups, the contents and associations of which have wider repercussions, from Roundway G8, dated to *2270–2260 cal BC (2% probability)* or *2210–2030 cal BC (93% probability;* Fig. 9 and Table 3: *OxA-V-2228-40)* and from West Overton G1, dated to *2020–2000 cal BC (2% probability)* or *1980–1770 cal BC (93% probability;* Fig. 9 and Table 3: *SUERC-26203)*.

Other dates for human remains are also informative. An articulating skull and mandible, probably from one of an ill-understood group of burials in graves under sarsens at Winterbourne Monkton (Hillier 1854; Grinsell 1957, 126; Cleal 2005, 132) date from the first half of the 3rd millennium cal BC, a time when inhumations are rare (Table 5a: OxA-V-2228-41). This is excluded from the model shown in Figure 9 because there is some

Table 5a Radiocarbon dates from the Avebury WHS and the surrounding area, in alphabetical order of site

The calibrated date ranges were calculated by the maximum intercept method (Stuiver and Reimer 1986), using the program OxCal v4.1 (Bronk Ramsey 1995; 1998; 2009) and the INTCAL09 dataset (Reimer et al. 2009). Note: Tpq – *terminus post quem*

Lab. No.	BP	Material	Context	$\delta^{13}C$ (‰)	Calibrated (95% confidence), BC unless otherwise stated	Comment
Avebury henge and stone settings						
HAR-10063	4380±80	Undated remainder classed as Pomoideae (0.09 g) and unidentified (0.45 g) by Rowena Gale 1997 (English Heritage files)	Old land surface under henge bank in SE quadrant (cutting X), spanning areas under first and second banks (Pitts and Whittle 1992, fig. 3)	-26.7	3350–2880	Tpq for bank, although the Pomoideae identification means the whole sample might have been of short-life material
HAR-10325	4640±70	'Find nos GBA 82+61 to GBA 82+63' on submission form indicates that this was a bulk sample	Trench 2, L2. Old land surface under a bank of henge in NW, in area of interface between first and second banks on site of Great Barn (Evans *et al.* 1985, figs 1-2; Pitts and Whittle 1992, fig. 3)	-24.8	3640–3120	Tpq for bank
HAR-10500	4190±90	Recorded as *Crataegus* sp., *Aesculus* sp. and *Corylus* charcoal (this may not have been the composition of the actual sample because it is precisely the description of all of Gray's charcoal from beneath bank (1935, 160), and '*Aesculus*' (the genus to which horse chestnut belongs) does not figure in modern charcoal identifications	Old land surface under second henge bank in cutting X (Pitts and Whittle 1992, fig. 3)	-26.2	3010–2490	Tpq for bank
HAR-10502	4300±90	Shed red deer antler pick (Gray 136)	Base of ditch in Gray's cutting I, in SW sector (Gray 1935, pl. XXXVI: fig. 1; Pitts and Whittle 1992, fig. 3; Pollard and Cleal 2004)	-27.3	3320–2630	Statistically inconsistent with OxA-12555, -12556 (T'=8.1; T'(5%)=6.0; ν=2), excluded from model shown in Fig. 9
OxA-12556	4043±34	Replicate of HAR-10502	Base of ditch in Gray's cutting I, in SW sector (Gray 1935, pl. XXXVI: fig. 1; Pitts and Whittle 1992, fig. 3; Pollard and Cleal 2004)	-23.0	2630–2470 for weighted mean	Should be contemporary with construction. Statistically consistent with OxA-12555 (T'=0.0; T'(5%)=3.8; ν=1)
OxA-12555	4036±34	Replicate of HAR-10502	Base of ditch in Gray's cutting I, in SW sector (Gray 1935, pl. XXXVI: fig. 1; Pitts and Whittle 1992, fig. 3; Pollard and Cleal 2004)	-23.3		Should be contemporary with construction. Statistically consistent with OxA-12556 (T'=0.0; T'(5%)=3.8; ν=1)
OxA-12557	4038±34	Shed red deer antler pick	Low in primary chalk rubble fill in E terminal flanking S entrance, in Gray's cutting IX (Gray 1935, pl. XLIII: fig. 3, pl. XLIV; Pollard and Cleal 2004)	-22.2	2840–2470	Should be close in age to construction. Statistically consistent with OxA-12555+OxA-1256 (T'=0.0; T'(5%)=3.8; ν=1)
HAR-10064	3690±80	Undated remainder identified as *Taxus* sp (0.06g), unidentified (0.23 g) by Rowena Gale 1997 (English Heritage files)	Cutting IX. Deposit of burnt material beneath 'dwarf' burial (actually a woman) in secondary fill of ditch, c. 2 m below modern surface, in terminal E of S entrance (Gray 1935, 145-46, pl. XLIII: fig. 1; Pitts and Whittle 1992, fig. 3). Sherds of grog-tempered coarse ware at same level (Cleal 2005, 119)	-25.4	2300–1880	Tpq for burial
HAR-10326	4160±90	Antler pick	In bank make-up, above possible revetment trench (Pitts and Whittle 1992, fig. 3)	-24.5	2920–2470	Probably contemporary with construction
HAR-10061	2430±70	Unidentified bulk charcoal sample	Stakeholes on edge of stonehole 8 of main stone circle in SW quadrant	-25.8	790–380	Tpq for erection of stone
HAR-10062	4130±90	Rowena Gale found undated remainder contained insufficient material to identify, 1997 (English Heritage files)	Bottom of stonehole 41 of main stone circle in NW quadrant (Pitts and Whittle 1992, fig. 3)	-27.5	2910–2470	Tpq for erection of stone

OxA-10109	3535±50	1 of 3 fragments of human skull, 2 conjoining	Basal packing of stonehole 41, probably with small bone or antler tube and 2 joining probably Beaker base sherds fallen; perhaps reflecting re-setting or replacement of fallen stone (Smith 1965b, 204; Pollard and Cleal 2004)	-21.3	2030–1740	Tpq for probable resetting of stone (Pollard and Cleal 2004) – skull fragments could have come from already long dead individual
HAR-10327	3870±90	Pig bone	Bottom of stonehole 44 of main stone circle in NW quadrant (Pitts and Whittle 1992, fig. 3)	-21.5	2580–2040	Tpq for erection of stone
HAR-9696	2080±110	Unidentified bulk charcoal sample	Ash layer in stonehole 44 of main stone circle in NW quadrant (Pitts and Whittle 1992)	-28.2	400 cal BC–cal AD 140	Tpq for later activity
OxA-12937	339±27	Charred *Hordeum vulgare* grain	As X1559 (Table 5b)	-23.7	cal AD 1450–1650	Statistically consistent with OxA-12897, -12898, -12935, -12936 (T'=1.7; T'(5%)=9.5; ν=4). May have entered stonehole after cracking of clay in dry weather
OxA-12936	330±27	Charred *Hordeum vulgare* grain	As X1559 (Table 5b)	-22.8	cal AD 1460–1650	As OxA-12937
OxA-12898	312±27	Charred *Hordeum vulgare* grain	F6, stonehole of stone 2 in the cove, context 021, subangular chalk rubble in brown silty clay, apparently pushed into pit after stone in place (Gillings *et al.* 2008, 156–65, fig. 4.6)	-22.4	cal AD 1480–1650	As OxA-12937
OxA-12935	306±27	Charred *Hordeum vulgare* grain	As OxA-12898	-27.2	cal AD 1480–1650	As OxA-12937
OxA-12897	296±27	Charred *Hordeum vulgare* grain	As OxA-12898	-24.8	cal AD 1490–1660	As OxA-12937
Avebury school site						
HAR-1696	1200±80	Described a 'carbonised grain and pit filling'. Other material from pit identified as *Triticum aestivo-compactum* and ? 6-row barley, with various weed seeds (Jordan *et al.* 1994, 7). Harwell noted no grain during pre-treatment which suggests sample may have been of charcoal	Pit containing grain in association with occupation debris, 3 m outside henge bank on SW side, cut through rainwash from bank and covered by further rainwash (Jordan *et al.* 1994, 7)	-23.8	cal AD 650–1020	Harwell comment: no grain apparent during pretreatment (Jordan *et al.* 1994, 7). Probably Tpq for pit, possibly its actual date
Beckhampton Avenue						
Beta-140991	810±40	Split cattle tibia	F26, burial pit of stone L6. Inserted in fissure running through sarsen (Gillings *et al.* 2008, 79-80, 263-64, 278–9)		cal AD 1150–1280	May reflect early medieval concern with stone, or later manipulation of already old bone
Beta-140990	240±40	Chopped cattle rib	F26, burial pit of stone L6. In clean chalk backfill of pit (Gillings *et al.* 2008, 79–80, 263–4, 278–9)		cal AD 1520–1960	Tpq for burial of stone
Beckhampton Road long barrow						
NPL-138	5200±160	*Quercus robur* charcoal. Charred fragments at least 3 in (75 mm) in diameter	Charcoal patch 15 ft x 4–5 ft (4.5 m x 1–1.5 m), burnt *in situ* or still hot when deposited, forming a continuous layer 2 inches (50 mm) beneath the buried surface and cut by stakes of axial fence of barrow (Ashbee *et al.* 1979, 244–5, figs 15, 16, 21)		4360–3650	Tpq for burning and for construction of barrow
BM-506a	4257±90	Red deer. Antler pick. Replicate of BM-506b. Measured before humic extraction	The lower of 2 antler picks found one above the other on the buried surface (Ashbee *et al.* 1979, 245, fig. 16)		3330–2880 for weighted mean	Statistically consistent with BM-506b (T'=2.7; T'(5%)=3.8; ν= 1). Immediate tpq for construction of barrow
BM-506b	4467±90	Replicate of BM-506a. Measured after humic extraction	As BM-506a			As BM-506a
Bishops Cannings Down						
Six dates for charcoal from postpipes of houses A and B (BM-1713 to -1717; Gingell 1992, 7–14, 159), found to be in error. No corrections could be issued (Bowman *et al.* 1990)						

Table 5a Continued

Lab. No.	BP	Material	Context	$\delta^{13}C$ (‰)	Calibrated (95% confidence), BC unless otherwise stated	Comment
Butler's Field (Winterbourne Valley at Avebury)						
CAR-1092	880±70	*Corylus* charcoal	Cutting E. Bedding trench in layer 5, medieval settlement with pits, trenches, ditches, charcoal, pottery, animal bone, daub (Evans *et al.* 1993, 153–4, figs 5, 8)		cal AD 1010–1280	Should be close to date of structure
OxA-1051	850±80	Charred *Triticum aestivum compactum* grains	Cutting E. Layer 7, a prehistoric palaeosol containing Mesolithic and Early Neolithic artefacts (Evans *et al.* 1993, 151–3, figs 5, 8)		cal AD 1020–1290	Derived from overlying layer via worm holes
OxA-1218	740±80	Caprine tibia	Cutting J. Layer 5, medieval settlement with pits, trenches, ditches, charcoal, pottery, animal bone, daub (Evans *et al.* 1993, 153–4, figs 5, 8)		cal AD 1150–1400	Tpq for context
OxA-1220	1160±80	Cattle tibia	Cutting J. Layer 5, medieval settlement with pits, trenches, ditches, charcoal, pottery, animal bone, daub (Evans *et al.* 1993, 153–4, figs 5, 8)		cal AD 660–1030	Tpq for context
OxA-1052	720±70	Charred *Triticum* indet. Grain	Cutting J. Layer 7, a prehistoric palaeosol containing Mesolithic and Early Neolithic artefacts (Evans *et al.* 1993, 151–3, figs 5, 8)		cal AD 1180–1400	Derived from overlying layer via worm holes
OxA-1053	760±80	Charred *Triticum* indet. Grains	Cutting J. Layer 7, a prehistoric palaeosol containing Mesolithic and Early Neolithic artefacts (Evans *et al*. 1993, 151–3, figs 5, 8)		cal AD 1050–1400	Derived from overlying layer via worm holes
OxA-1219	900±70	Roe deer antler	Cutting J. Pit G in layer 5, medieval settlement with pits, trenches, ditches, charcoal, pottery, animal bone, daub (Evans *et al.* 1993, 153–4, figs 5, 8)		cal AD 990–1270	Tpq for context
OxA-1221	3800±160	Human femur	Transect I. Low in layer 6, the West Overton Formation, a weakly humic calcareous loam formed by overbank alluviation in grassland (Evans *et al.* 1993, 147, figs 5, 6)		2840–1770	A reminder that not all individuals of this period received formal burial
Cherhill						
BM-447	7230±140	Unidentified bulk charcoal sample	Localised charcoal concentration in soil lens within and near base of tufa, coalescing with palaeosol on slightly higher, drier area. Palaeosol contained Late Mesolithic industry (Evans and Smith 1983, 50, fig. 6)		6420–5840	Probably tpq for Mesolithic occupation
BM-493	4715±90	Charred *Corylus* timber	Ditch I, context 26. Upper part of initial fill of irregular, sinuous hollow containing a human bone, bones of cattle, caprine, pig, struck flint (including leaf arrowheads), plain Neolithic Bowl pottery (Evans and Smith 1983, 52–8, 111–12, fig. 10)		3660–3340	Since *Corylus* is short-lived, timber should be more-or-less contemporary with context
Dean Bottom						
BM-1668R	3910±100	Unidentified bulk charcoal sample	Pit 23, context 18. Middle fill of pit containing sherds of numerous tall mid-carinated Beakers (W/MR), bone and antler artefacts, struck flint, animal bone. Stratified above BM-1669R (Gingell 1992, fig. 15)	-23.6	2840–2060	Tpq for context. Original measurement found to be in error, correction issued (Bowman *et al.* 1990)
BM-1669R	3750±100	Unidentified bulk charcoal sample	Pit 23, context 19. Basal fill of it containing sherds of numerous tall mid-carinated Beakers (W/MR), bone and antler artefacts, struck flint, animal bone. Stratified below BM-1668R (Gingell 1992, fig. 15)	-24.2	2480–1890	As BM-1668R
Devizes Castle						
BM-2150R	750±100	Cellulose from sample consisting of c. 65 annual rings from oak corbel	Perhaps one of a number of detached corbels held in Devizes castle, others of which were dated by dendrochronology. See Table 5c	-22.1	cal AD 1030–1410	Tpq for corbel, since no sapwood rings present
Easton Down long barrow						
4 radiocarbon dates (Whittle *et al.* 1993; Whittle *et al.* 2011, 105, 107, fig. 3.31)						

Falkner's Circle						
Wk-17356	2283±35	Carbonised weed seeds	F1 with burnt sarsen and some charcoal (Gillings *et al.* 2008, 149, fig. 3.18)		410–210	Probably contemporary with pit
Beta-176551	380±60	Roundwood charcoal	F7, context 733. Pit with burnt and fractured sarsen and charcoal cutting stonehole F9 (Gillings *et al.* 2008, 314, 336, fig. 3.18)		cal AD 1420–1650	Statistically consistent with Beta-176547, -176548, -176549, -176550 (T'=8.8; T'(5%)=9.5; ν=4). Probably contemporary with stone breakage
Beta-176550	280±50	Roundwood charcoal	As Beta-176551		cal AD 1460–1950	As Beta-176551
Beta-176548	260±80	Roundwood charcoal	F6, context 728. Pit with burnt and fractured sarsen, some burnt *in situ*, primary burning layers (Gillings *et al.* 2008, 313-14, 336)		cal AD 1440–1960	As Beta-176551
Beta-176549	210±60	Roundwood charcoal	As Beta-176548		cal AD 1520–1960	As Beta-176551
Beta-176547	140±60	Roundwood charcoal	As Beta-176548		cal AD 1640–1960	As Beta-176551
Hemp Knoll round barrow						
OxA-V-2271-34	3834±29	Human, from articulated skeleton of 35- to 45-year-old ?male	Central primary burial with short-necked (W/MR) Beaker, stone bracer, bone belt ring. Head and articulated feet of ox within grave but outside coffin, apparently still attached to hide when buried (Robertson-Mackay 1980)	-20.7	2460–2150	Date for burial
BM-1585	3760±60	Aurochs cow scapula, disarticulated	Ditch 1, layer 15, NW quadrant. From eroded chalk capping of barrow in ditch surrounding mound (Robertson-Mackay 1980)	-21.3	2410–1980	Tpq for context
NPL-139	3750±140	Bulk sample of large pieces of oak charcoal	From possible 3-sided structure around NW end of coffin, at bottom of primary grave (Robertson-Mackay 1980, 140, 147)		2580–1770	Excluded from model shown in Fig. 9 because in poor agreement with OxA-V-2271-34, measured on articulated skeleton from grave. Could disparity reflect later insertion of structure dated by NPL-139 and HAR-2998 into end of grave?
HAR-2998	3540±70	As NPL-139	As NPL-139	-25.6	2120–1690	As NPL-139
HAR-2997	4580±80	Bulk sample of disarticulated animal bone (cattle, caprine and red deer; Jordan *et al.* 1994, 77)	Pit 1. One of 5 pits beneath an Early Bronze Age round barrow (Robertson-Mackay 1980, 125–38)	-22.6	3630–3020	Tpq for pit
Horslip long barrow						
BM-180	5190±150	Antler pick	E butt of E ditch, on base, covered by chalk rubble fill (Ashbee *et al.* 1979, 214, fig. 4, pl. 30b)		4350–3650	Could be contemporary with construction, but excluded from model because in poor agreement with it
Kennet Valley at West Overton						
OxA-1047	8390±80	Aurochs 2nd phalanx	Cutting C. Layer 8d, tufa gravel at base of sequence (Evans *et al.* 1993, 163, figs 20, 28)		7590–7190	Tpq for context
OxA-1044	8260±80	Wild boar tusk	Cutting D. In North Farm Formation, in channel at side of flood plain, at 150 cm in molluscan series WO-V, base of humic silt loam 8b (Evans *et al.* 1993, 163, figs 20–2)		7520–7060	Tpq for context
OxA-1348	3020±70	*Quercus* and *Fraxinus* charcoal	Cutting DF. With cremation deposit of single adult, probably female in early 20s, in MBA pot, in pit dug into Avebury Soil (Evans *et al.* 1993, 167, figs 20, 31, 32)		1440–1040	Tpq for burial
OxA-1222	4040±60	Aurochs radius	Cutting DN. Layer 7 (Avebury Soil), with pottery including Beaker (Evans *et al.* 1993, 163, figs 20–4)		2870–2460	Tpq for context
OxA-1223	3320±60	*Prunus spinosa* charcoal	Cutting DN. North Farm Formation at base of sequence (Evans *et al.* 1993, fig. 22)		1750–1450	Considered intrusive by authors (Evans *et al.* 1993). Later than samples from overlying layers

Table 5a Continued

Lab. No.	BP	Material	Context	$\delta^{13}C$ (‰)	Calibrated (95% confidence), BC unless otherwise stated	Comment
OxA-1045	2980±100	Top of cattle skull with horn cores	Cutting P. On surface of Avebury Soil (layer 7), beneath layer 6d, beneath heap of sarsens (Evans *et al.* 1993, 163, figs 20, 25, 27)		1450–910	Tpq for context. Probably a placed deposit
OxA-1046	2500±70	Horse skull, more or less complete and in good condition	Cutting P. Layer 6b, towards top of sequence (Evans *et al.* 1993, 163, figs 20, 25)		810–400	Tpq for context, perhaps a placed deposit
OxA-986	4200±160	*Prunus* and *Quercus* charcoal	Cutting P. Charcoal horizon, probably from scrub burning, at interface of 6 k and 6j, in West Overton Formation (Evans *et al.* 1993, 163, figs 20, 25)		3340–2340	Given as 4200±160 BP on ORAU website and in published datelist, as 3860±70 BP by Evans *et al.* (1993, 146). Tpq for burning episode
OxA-1048	3260±60	*Prunus* charcoal	Cutting P. Charcoal horizon, probably from scrub burning, in layer 6h, above 6j (Evans *et al.* 1993, 163, figs 20, 25)		1690–1410	Should date burning episode
Knap Hill causewayed enclosure 8 radiocarbon dates (Whittle *et al.* 2011, 97–102)						
Longstones Cove						
OxA-10950	1828±31	Caprine bone	Stonehole F81 context 870 (Gillings *et al.* 2008, 88–90, 230–7)	-21.6	cal AD 80–260	Statistically consistent with OxA-10951 (T'=1.8; T'(5%)=3.8; ν=1)
OxA-10951	1764±36	Caprine bone	Stonehole F81 context 870 (Gillings *et al.* 2008, 88–90, 230–7)	-21.5	cal AD 130–390	Statistically consistent with OxA-10950 (T'=1.8; T'(5%)=3.8; ν=1)
OxA-11112	1491±38	Caprine bone	Stonehole F81 context 866 (Gillings *et al.* 2008, 88–90, 230–37)	-21.1	cal AD 430–650	Statistically consistent with OxA-11602 (T'=2.9; T'(5%)=3.8; ν=1)
OxA-11602	1405±33	Caprine bone	Stonehole F81 context 866 (Gillings *et al.* 2008, 88–90, 230–7)	-20.7	cal AD 590–670	Statistically consistent with OxA-11112 (T'=2.9; T'(5%)=3.8; ν=1)
Longstones Enclosure						
OxA-10947	4320±45	Single caprine bone	Trench 23, context 709, chalk rubble (Gillings *et al.* 2008, 14–17)	-21.1	3090–2880	Tpq for context
OxA-10949	4233±38	Antler fragment	As OxA-10947	-20.9	2910–2700	As OxA-10947
OxA-10948	4216±36	Antler fragment	As OxA-10947	-21.0	2910–2690	As OxA-10947
OxA-10946	4193±35	Antler beam	Trench 23, context 739, soil on ditch base (Gillings *et al.* 2008, 14–17)	-21.1	2900–2630	As OxA-10947
OxA-10945	4190±40	Single pig bone	Trench 23, context 710, chalk rubble (Gillings *et al.* 2008, fig. 2.14)	-20.9	2900–2630	As OxA-10947
Beta-140987	4150±50	Single cattle bone	Trench 14, context 505, soil above secondary silts (Gillings *et al.* 2008, fig. 2.18)	-23.4	2890–2570	As OxA-10947
Beta-140988	4060±50	Bone from articulated pig foot	Trench 14, context 506, chalk rubble on ditch base (Gillings *et al.* 2008, fig. 2.18)	-22.6	2870–2470	Date for context and for digging of ditch
Beta-140986	4060±50	Single cattle bone	Trench 13, context 300, backfill (Gillings *et al.* 2008, 14–17)	-23.6	2870–2470	As OxA-10947
Beta-140989	3880±50	Single pig bone	Trench 14, context 506, chalk rubble on ditch base (Gillings *et al.* 2008, 19, fig. 2.18)	-21.8	2480–2200	Later than and statistically inconsistent with Beta-140988 measured on articulated bone from same context (T'=6.5; T'(5%)3.8=; ν=1). Excluded from model shown in Fig. 6)
Marlborough Mound						
SUERC-34082	3770±35	Single fragment of Pomoideae charcoal	Core 1 B_667 cm (Pitts 2011d, 6–7)	-24.1	2300–2040	Taken as closest date to mound construction because the most recent of the four from the cores, the sample for any one of which could have been already old when brought to the mound in turf or soil
SUERC-34083	4060±35	Single fragment of Pomoideae charcoal	Core 1 D_1658.5 cm (Pitts 2011d, 6–7)	-24.9	2840–2480	Tpq for context

SUERC-34085	4010±35	Single fragment of *Alnus* sp. charcoal	Core 2 K(1)_1221-1225 cm (Pitts 2011d, 6–7)	-35.4	2620–2460	Tpq for context
SUERC-34084	3935±35	Single fragment of *Alnus* sp. charcoal	Core 2 K(2)_1221-1225 cm (Pitts 2011d, 6–7)	-27.5	2570–2300	Tpq for context
Millbarrow 8 radiocarbon dates (Whittle 1994; Whittle *et al*. 2011, 104–105, 107, fig. 3.30)						
Roundway G8 round barrow						
OxA-V-2228-40	3734±30	Human, from articulated skeleton of 'an old man at least seventy'	Primary burial in grave under round barrow, with low carinated (W/MR) Beaker, Cu racquet pin, Cu tanged dagger, stone bracer, barbed and tanged arrowhead (Annable and Simpson 1964, 38, figs 59–63)	-21.2	2280–2030	Date of burial
Silbury Hill 55 radiocarbon dates (Marshall *et al.* 2013)						
South Street long barrow 4 radiocarbon dates (Ashbee *et al.* 1979; Whittle *et al.* 2011, 105, fig. 3.31)						
Wansdyke at Wernham Farm, Savernake Forest						
BM-2405	1020±50	Many fragments of *Quercus* charcoal, at least partly from young wood	Recovered from pipeline trench section of earthwork. Sample came from stable phase in ditch silting, prior to ploughsoil fill and overlying mass of large loose flints 0.50 m deep, ?from agricultural clearance	-24.9	cal AD 890–1160	Tpq for stabilisation
West Kennet Avenue, N end						
NZA-10501	4378±30	Disarticulated cattle metacarpal	Pit 409, towards N end of W Kennet Avenue, near stone 15a, containing sherds from a Mortlake style bowl, charred hazelnut shell (Allen and Davis 2009)	-22.8	3100–2900	Tpq for pit
West Kennet Avenue occupation site						
HAR-9695	4260±80	Sample unspecified. Charcoal from feature as a whole identified as 34% *Crataegus*, 59% *Corylus*, 7% *Prunus* (Smith 1965b, 215)	Hole 4, square 3. Small pit or posthole containing 2 weathered sherds Peterborough Ware, 2 chisel arrowheads, other struck flint, sarsen rubber and fragments (Smith 1965b, 215)	-26.7	3090–2620	Tpq for pit, although identifications suggest charcoal could all have been of short-lived species
HAR-10501	4280±100	Antler unspecified. Smith (1965, 213) notes antler as 1 fragment from red deer, 1 from roe, both slain	Pit 1. Bowl-shaped, 5ft across, 2 ft deep. Sterile run of Combe Rock on NW side, lower fill otherwise dark and charcoal-stained, with sherds from 3 Grooved Ware pots. Upper fill ?naturally silted, inc. Beaker fragment. >350 pieces struck flint, inc. chisel arrowhead, sarsen fragments, tip of bone pin, cattle and pig bones (Smith 1965b, 213)	-24.3	3320–2580	Tpq for pit
HAR-9694	5780±80	Sample unspecified. Charcoal from feature identified as 38% *Crataegus*, 52% *Corylus*, 10% *Prunus* (Smith 1965b, 214)	Hole 1, square 2, cutting VII2R layer 2. Small pit or posthole containing Grooved Ware sherds, a fragment of a group VII axehead and struck flint including a Levallois-like core and a serrated flake (Smith 1965b, 214)	-27.3	4830–4450	Tpq for context. Sample must have included at least some charcoal which was much older than the contents of the pit
West Kennett Farm						
CAR-1295	4050±70	Cattle bone	Palisade enclosure 2, Tr M, core of postpipe F626 (Whittle 1997a, 12, 81, fig. 30)		2880–2460	Statistically consistent with BM-2597; CAR-1289, -1290, -1291, -1292, -1293, -1298, -1289 (T'=10.1; T'(5%)=14.1; ν=7)
CAR-1293	3960±70	Pig and cattle bone	Palisade enclosure 1. Outer ditch F100, Tr G, edge of postpipe F123 (Whittle 1997a,12, 63)		2840–2210	As CAR-1295

Table 5a Continued

Lab. No.	BP	Material	Context	$\delta^{13}C$ (‰)	Calibrated (95% confidence), BC unless otherwise stated	Comment
CAR-1290	3900±70	Pig bone	Palisade enclosure 1. Outer ditch F200, Tr H, around postpipes F219-20 (Whittle 1997a, 12, 63, fig. 30)		2580–2140	As CAR-1295
CAR-1291	3890±70	Pig bone	Palisade enclosure 1. Inner ditch F301, Tr J, postpipes F311, 313, 314, 315 (Whittle 1997a, 12, 66, figs 30, 33)		2570–2140	As CAR-1295
CAR-1289	3860±70	Pig bone	Palisade enclosure 1. Outer ditch F200, Tr H, around postpipes F217-19 (Whittle 1997a, 12, 63, fig. 30)		2570–2130	As CAR-1295
CAR-1298	3830±70	Cattle bone	Palisade enclosure 2. Outer radial ditch 1. Postpipe packing? (Whittle 1997a,12, 83, fig. 45)		2480–2040	As CAR-1295
CAR-1296	3590±70	Pig bone	Palisade enclosure 1. Between inner and outer ditches in W, Tr H. Context 215: mass of animal bone, mainly pig, in dark matrix with Grooved Ware, overlying dark flinty layer which in turn overlay dished area of otherwise flat laid chalky layer (Whittle 1997a, 12, 76, fig. 43)		2140–1740	Statistically consistent with CAR-1297 (T'=0.2; T'(5%)=3.8; ν=1)
CAR-1297	3550±70	Pig and red deer bone	As CAR-1296		2130–1690	As CAR-1296
CAR-1294	3260±70	Cattle bone	Palisade enclosure 2. Trench M, core of postpipe F627 (Whittle 1997a,12, 81, fig. 30)		1740–1410	Possibly a later intrusion into feature: too recent for Grooved Ware and in poor agreement with other dates from enclosure
BM-2602	3620±50	Red deer antler beam fragment	Palisade enclosure 1. Outer ditch F26, Tr D, in edge of postpipe F40, in upper part of feature (Whittle 1997a, 12, 62, fig. 30)	-20.7	2140–1880	As CAR-1294
BM-2597	3810±50	Red deer antler crown fragment	Palisade enclosure 1. Outer ditch F26, Tr D, layer 2. Rammed in deliberate chalk backfill in upper part of feature (Whittle 1997a, 12, 62, fig. 30)	-20.8	2470–2050	As CAR-1295
West Kennet long barrow 31 radiocarbon dates (Bayliss *et al.* 2007a)						
West Overton G1 round barrow						
SUERC-26203	3550±35	Human, part of skull from skeleton of elderly male	In ?primary grave beneath round barrow with Willerby type flat bronze axehead, crutch-headed bronze pin, tanged bronze knife with single rivet, antler object (the last 2 now lost; Cleal 2005, 125)	-20.9	2020–1770	Date for burial
West Overton G19 round barrow						
BM-2676	4550±50	Red deer antler	Base of first ditch (Swanton 1988; Ambers and Bowman 1998, 416)	-17.7	3500–3090	Statistically inconsistent with and earlier than BM-2675 (T'=8.8; T'(5%)=3.8; ν=1). Taken as redeposited in ditch and excluded from Fig. 9
BM-2675	4340±50	Red deer antler	Base of first ditch (Swanton 1988; Ambers and Bowman 1998, 416)	-21.3	3100–2880	Statistically inconsistent with and more recent than BM-2676 (T'=8.8; T'(5%)=3.8; ν=1). Taken as contemporary with digging of ditch
BM-2679	3520±90	Human R femur from articulated crouched burial	At centre of second mound (Swanton 1988; Ambers and Bowman 1998, 416)	-20.3	2140–1620	date of burial
BM-2678	2910±50	Human L femur from articulated crouched burial	Upper part of burial pit at centre of first mound, described as crouched, with head to E, ?bound, subsequent disturbance of upper abdomen, perhaps relatively soon after burial, accompanied by a few pottery fragments (Swanton 1988; Ambers and Bowman 1998, 416)	-23.4	1270–930	Date of burial

BM-2677	3670±50	Human L femur from incomplete and disarticulated body of adult male	Base of burial pit at centre of first mound (Swanton 1988; Ambers and Bowman 1998, 416)	-21.31	2200–1910	Probably not long after death of individual if skeleton substantially represented
BM-2680	3380±120	Mixed short-life wood charcoal	P31. Cremation deposit in stone setting in cremation cemetery in SW area of ditch. Cremation burials on or dug into layer of bone, pottery, sarsen and flint waste overlying turf in ditch (Swanton 1988; Ambers and Bowman 1998, 416)	-24.2	2020–1420	Probably date of burial, since all charcoal short-life
BM-2684	3150±50	Mixed short-life wood charcoal	T102. Cremation deposit in cremation cemetery in SW area of ditch. Cremation burials on or dug into layer of bone, pottery, sarsen and flint waste overlying turf in ditch (Swanton 1988; Ambers and Bowman 1998, 416)	-25.2	1520–1310	As BM-2680
BM-2681	3030±70	Mixed short-life wood charcoal	T50. Cremation deposit in stone setting in cremation cemetery in SW area of ditch. Cremation burials on or dug into layer of bone, pottery, sarsen and flint waste overlying turf in ditch (Swanton 1988; Ambers and Bowman 1998, 416)	-23.9	1440–1050	As BM-2680
BM-2683	3110±70	Mixed short-life wood charcoal	W77. Cremation deposit in cremation cemetery in SE area of ditch. Cremation burials on or dug into layer of bone, pottery, sarsen and flint waste overlying turf in ditch (Swanton 1988; Ambers and Bowman 1998, 416)	-23.6	1520–1210	As BM-2680
West Overton, Burial 1B						
OxA-V-2228-46	3718±28	Human, from articulated skeleton of a large adult 22–30 years old	In flat grave cut into that of child accompanied by long-necked (FN) Beaker. Knees and ankles of adult rested on sarsens, with eleven flints were carefully placed from the crown of the skull down both sides of the body (Fowler 2000a, 82–6, fig. 6.4)	-20.9	2210–2020	Date of burial
Windmill Hill causewayed enclosure						
78 radiocarbon dates (Whittle *et al.* 2011, 61–96)						
Winterbourne Monkton						
OxA-V-2228-41	4157±29	Human, articulating skull and mandible	'In the large open fields between this [Windmill] hill and the site of Millbarrow, and a few hundred yards to the west of the later, were several large Sarsen blocks which it was determined to remove ... Four at least were found to cover sepulchral deposits. Circular cists had been excavated through the marl and chalk, to the depth of four feet, the bottom in one instance being closely paved with small Sarsen stones. In the cists were human skeletons in a crouched or sitting position ... In the first cist were about six skeletons ... There were no other relics. In the second cist there were as many as twenty-five skeletons... Several bones of dogs, swine, sheep, and oxen, a few fragments of rude, hard black pottery, and a large conical sort of muller-stone of Sarsen, weighing 12 1/2 lbs, were found with the skeletons'. (Davis and Thurnam 1865, text to pl. 58). 'Since this discovery ... several other sarsen stones have been taken up in the same field with similar results. With one of these deposits were jet ornaments, objects of stone and pottery, including two drinking cups now preserved in the Society's Museum at Devizes' (Long 1858, 343). This was a burial with 2 long-necked Beakers and other goods (Grinsell 1957, 126; Annable and Simpson 1964, figs 70–6; Cleal 2005, 132). There is doubt as to the provenance of the dated specimen (M. Jay pers. comm.)	-21.0	2880–2620	Not used in the model shown in Fig. 6 because of doubt as to provenance

Table 5b Luminescence dates from the Avebury WHS and the surrounding area, in alphabetical order of site

Lab. No.	Lab code	Date	Date BC (1σ)	Material	Context
Avebury henge and stone settings					
OSL date X1559		3120±350 BC	3470–2770	Quartz grains (Rhodes and Schwenninger 2008)	F6, stonehole of stone 2 in the cove, context 022, orange-brown clay filling much of stone hole, up against stone and sarsen packing blocks (Gillings *et al.* 2008, 156–65)
Butler's Field (Winterbourne Valley at Avebury)					
TL date – no number found		8250±575 BP	6840–5690	12 burnt flints (Huxtable and Evans 1987)	Cutting E. From base of Avebury Soil (layer 7), overlying tree-throw holes. Mesolithic to early Neolithic artefacts in same horizon in adjacent cuttings (Evans *et al.* 1993, 151–3, fig. 8)
Kennet Valley at West Overton					
TL date Ox88TLfg	727f	3030±250 BP	1290–790	Burnt sarsen (Huxtable and Evans 1990)	Cutting DF. From concentration of burnt sarsen in Avebury Soil, ?a burnt mound, next to cremation in MBA pot from which came sample for radiocarbon date OxA-1348 (Evans *et al.* 1993, 167, figs 20, 30, 31)
TL date OxTL 727BA		4300±900 BP	3210–1400	Sediment	Cutting P. Layer 6k, earliest level of West Overton Formation (Evans *et al.* 1993, 163, figs 20, 25)

doubt as to the provenance of the sample, although 4th millennium cal BC dates recently obtained by the Beaker People Project for two further individuals from Winterbourne Monkton (M. Jay pers. comm.) indicate that there were indeed Neolithic interments here as well as the Beaker burial illustrated by Annable and Simpson (1964, figs 70–6). An inhumation from West Overton G19 dates from the late 2nd millennium cal BC, a time when most burials seem to have been cremations (Fig. 9 and Table 3: *BM-2678*).

Dates for later 2nd millennium cremation burials are confined to a series of four, measured on short-life charcoal, from West Overton G19 (Fig. 9 and Table 3: *BM-2680, -2681, -2683, -2684*) and a *terminus post quem*, for another on the Kennet floodplain nearby (Fig. 9 and Table 3: *OxA-1348*).

Settlement

The settlement context of the monuments and burials is represented by pits and artefact scatters, some preserved beneath monuments, some surviving beyond them. Its dating is even worse than that of the conspicuous archaeology. Neolithic samples from pre- or non-monumental contexts tend to consist of oak charcoal, as from beneath the Beckhampton Road and South Street long barrows; unidentified charcoal, as from some of the pits of the West Kennet Avenue occupation site or beneath the Avebury henge bank; and disarticulated bone, as from a pit below the Hemp Knoll barrow (Table 5a). Thus, while many of the monuments were preceded by earlier activity (Pollard 2005), the only case where that definitely predates the first dated monumental construction in the area, the inner circuit of Windmill Hill, consists of the undated pits preceding that circuit itself. All the others could be contemporary or later. There are hints of early 4th millennium cal BC activity in small quantities of Carinated Bowl pottery from beneath the South Street long barrow (Ashbee *et al.* 1979, 269, fig. 30: 1–2); in superficial contexts at the Horslip long barrow (*ibid.*, 223–4, fig. 8: P1–P8); and in as yet unpublished pits on Roughridge Hill (Anon. 1965b, 132–3; Cleal 2004, 176). Pottery probably, on stylistic grounds, contemporary with the enclosures and long barrows, comes from a pit on Waden Hill (Thomas 1955); from Hackpen Hill; from the site of a round barrow on Overton Hill (Smith and Simpson 1966, 151–5, fig. 7: 1–5); from an intercutting pit group south of Windmill Hill (Whittle *et al.* 2000, fig. 10); and from pits beneath the Hemp Knoll barrow (Robertson-Mackay 1980, fig. 4). Apart from Hemp Knoll, all are totally undated. Later Neolithic and Beaker settlement contexts are equally badly defined (see the dates in Table 5a for the West Kennet Avenue occupation sites and a pit to the north of it). (This may also no longer be true at the time of publication.)

Clearance and cultivation in the third and second millennia cal BC, extending through the time of the dated cremation burials, have been elucidated by the late John Evans' investigations in the Kennet Valley at West Overton (Evans *et al.* 1993, 162–90). Small-scale ritual also seems represented by what appears to have been the deliberate placement of the top of a cattle skull, complete with horncores, beneath a heap of sarsens, the skull being dated to 1450–910 cal BC (95% confidence; Table 5a: OxA-1045; *ibid.*, 163, figs 25, 27). Paradoxically, these river valley investigations provide the only dated evidence for Bronze Age agriculture: the extensive field systems and settlements of the Marlborough Downs remain undated since the withdrawal of five radiocarbon dates for samples from the postpipes of roundhouses

Table 5c Dendrochronological analyses from the Avebury WHS and the surrounding area, in alphabetical order of site

Site	Result	Reference(s)
Avebury, Manor Barn (the Great Barn)	Eight re-used oak timbers in probably 17th-century structure felled AD 1279–1301. Later phases undatable, due to the use of fast-grown younger oak trees	http://archaeologydataservice.ac.uk/archives/view/vag_dendro Tyers 1999
Berwick Bassett Old Farmhouse	Main range AD 1446–1457	http://www.dendrochronology.net http://archaeologydataservice.ac.uk/archives/view/vag_dendro
Compton Bassett, Church of St Swithun	Stub ties of nave roof felled AD 1461–93	http://www.dendrochronology.net http://archaeologydataservice.ac.uk/archives/view/vag_dendro Miles 2001
Devizes Castle	*Ex situ* heads on ends of stub tie-beams dated to 1408–30. Probably from St John's Church next door, the roof of which had comparable features before its replacement in 1862–3. See Table 5a: BM-2150R	http://www.dendrochronology.net/
Devizes, 4–5 St John's Alley	1645–46	http://www.dendrochronology.net http://archaeologydataservice.ac.uk/archives/view/vag_dendro
Marlborough, 121/122 High Street	1655–56	http://www.dendrochronology.net http://archaeologydataservice.ac.uk/archives/view/vag_dendro

on Bishops Cannings Down (BM-1713 to -1717; Gingell 1992, 7–14, 159) by the British Museum following the identification of a counting error during the period in which they were measured (Bowman *et al.* 1990). The rich midden deposits in the south of the area, as at All Cannings Cross and Stanton St Bernard, are totally undated. (This may also no longer be true at the time of publication.)

The 1st Millennium cal BC and Later

A high proportion of dates for later periods are from the Neolithic monuments, often for samples submitted in the hope of dating stoneholes. Submissions prompted by an interest in the chronology of stone burial and destruction have been made only recently (eg, Gillings *et al.* 2008, 252–355).

Iron Age, Roman and Post-Roman

From the 1st millennium cal BC onwards there are signs of activity relating to standing stones at Avebury in the form of *termini post quos* of 790–380 cal BC (95% confidence; Table 5a: HAR-10061) for a stakehole on the edge of stonehole 8 and of 400 cal BC–cal AD 140 (95% confidence; Table 5a: HAR-9696) for an ash layer in stone hole 44. As Pollard and Cleal point out (2004, 127), it is difficult to dismiss these, and they may relate to other hints of Late Iron Age/early Roman use of the monument. It may be cognate that a pit within Falkner's Circle is dated to 410–210 cal BC (95% confidence; Table 5a: WK-17356), a time when the circle would have been standing and eminently visible.

At the Longstones cove, there is a convincing argument for votive activity relating to animal bone fragments from a Romano-British context, two of which yielded statistically consistent late 2nd- to early 4th-century cal AD dates (Table 5a: OxA-10950, -10951), and from a post-Roman context, two of which yielded statistically consistent dates in the early 6th to mid-7th century cal AD (Table 5a: OxA-1112, -11602; Gillings *et al.* 2008, 88–90, 230–37).

Early Medieval to Modern

Silbury Hill provides the only example in the area so far of early medieval use of a major monument in the form of three statistically consistent dates for short-life samples from features on the summit, pointing to activity in the 10th to 11th centuries cal AD, perhaps related to modification of the terraces on the northern slope identified by Atkinson (1970, 314), which produced Saxo-Norman pottery and a silver quarter penny of Etheldred II (AD 1009–1016; Marshall *et al.* 2013).

Moving away from the monuments, it is worth noting a *terminus post quem* of cal AD 890–1160 for a stable horizon in the infilling of the ditch of Wansdyke, at Wernham Farm, Savernake Forest (Table 5a: BM-2405).

In Avebury itself, early medieval settlement has yielded several dates, one from the school site (Table 5a: HAR-1696), more from John Evans' investigations in Butler's Field (Evans *et al.* 1993, 153–54, figs 5, 8), where the occupation from which samples came in layer 5 (Table 5a: OxA-1218 to -1220, CAR-1092) must have been the source of charred grain intrusive in the underlying layer 7 (Table 5a: OxA-1051 to -1053). These last, together with CAR-1092, measured on hazel charcoal from a bedding trench, provide the best estimate for the occupation, the others being potentially older than their contexts.

Dendrochronological analysis of the Great Barn, probably built in the 17th century AD, has identified eight re-used oak timbers felled in AD 1279–1301, although the later phases of the structure proved undatable due to the use of timber from younger, fast-grown oak trees (Table 5c: Tyers 1999). Dendrochronological analysis also formed part of the National Trust's (2011) programme of work at Avebury Manor.

In the surrounding area, five further dendrochronological analyses have placed the timbers of domestic and ecclesiastical structures in the 15th and 17th centuries AD (Table 5c).

Five statistically consistent early 15th- to mid-17th-century radiocarbon dates (Table 5a: OxA-12935, -12936, -12937, -12897, -12898) for single charred barley grains from material packed around a stone of the Avebury cove (Gillings *et al.* 2008, 156–60) may reflect accidental intrusion from nearby settlement.

The deliberate selection of samples to define the history of stone burial, breakage and burning is a recent development, although several measured so far could be older than their contexts. The one series of short-life samples, from Falkner's Circle, although statistically consistent, coincides with wiggles in the calibration curve which reduce its precision to a span from the 15th century AD to the present (Table 5a: Beta-176547 to -176551).

Plate 14 Taking samples for isotopic analysis (© Wessex Archaeology)

Biomolecular Analyses

by Mandy Jay and Janet Montgomery

Research on Skeletal Remains

Biomolecular analysis of skeletal remains, both animal and human, is becoming a frequent part of both post-excavation work at new sites and of research work based on existing, curated assemblages. The contribution to be made by these data is becoming better understood by archaeologists generally, the techniques most usually discussed being isotope and DNA analyses, although there are other procedures, many in development, which are increasingly useful. An example is the identification of biomarkers using protein and peptide sequencing in collagen (Zoo-MS) which is allowing identification of animal bone to species at a relatively economical cost (Buckley *et al.* 2009). This may be of value in the future for zooarchaeologists wishing to evaluate the species composition of large animal bone assemblages which contain a significant amount of undiagnostic material (eg, Windmill Hill), or for more specific queries about artefacts made of bone or contexts where animal and human bone might be mixed.

Until relatively recently DNA analysis of archaeological human remains has en-countered serious problems with modern contamination and there has been a period where studies of animal bone have been preferred for archaeological DNA research. In the last few years, however, new high-throughput, next generation sequencing techniques have been developed which are revolutionizing this area of study (Meyer *et al.* 2007; Krause *et al.* 2010) and large-scale research studies of human remains at relatively low cost are becoming possible for the future which will allow consideration of the genetic relationships between groups and individuals, providing more information on archaeological issues such as mobility.

Isotopic analysis of skeletal remains has been flourishing as methods evolve and costs are reduced (Pl. 14). These techniques provide a group of tools which can be used to investigate a range of archaeological issues including mobility, residence patterns, diet, breastfeeding behaviours, environment, land-use, animal husbandry and subsistence practices. There are a range of techniques in this field, some of which have been used for decades, whilst others are rapidly developing (eg, sulphur isotope analysis of collagen: Privat *et al.* 2007; Nehlich and Richards 2009). Recent developments in mass spectrometry now offer the opportunity to reduce sample size, eg, micro-sampling by drills or lasers, and to improve the interpretative value of complex isotope systems such as lead, which was previously restricted due to the very low concentrations of lead

in prehistoric humans and animals (Montgomery *et al.* 2010). The improved resolution now achievable by new multi-collector mass spectrometers is significantly better than could be achieved 10 years ago (eg, Montgomery *et al.* 2000). As a consequence, the use of lead isotopes to track prehistoric mobility in a similar manner to strontium, which has up to now been rare due to difficulties of interpretation, is being revisited: eg, in a PhD funded by Durham University on Neolithic human mobility in England. One of the main recent advances has been towards expanding databases for multi-isotope studies across space and time, combining different isotope ratios from the same individuals and from different fractions of the same individuals. One of the reasons that large datasets are required for detailed interpretations is that most of these data require an understanding of the signals inherent in the local environments for particular times and places. Interpretation of the data from an individual can be very difficult without an understanding of this 'background' signal, which can be affected by issues such as climate, land management practices, water sources and deforestation.

Both human and animal skeletal remains are useful archaeological resources for isotope and DNA studies. Whilst a study such as that of the 'Amesbury Archer' (Pl. 15) which suggests long distance, possibly continental scale mobility in an individual, is very interesting at the smaller scale (Fitzpatrick 2003; Fitzpatrick 2011), it is the research which might be considered more mundane that is providing important larger scale pictures of life in the past, such as prehistoric animal management practices in Wiltshire (Towers *et al.* 2010; Viner *et al.* 2010; Towers *et al.* 2011). The Feeding Stonehenge project (AHRC funded, PI: Mike Parker Pearson) includes isotopic analysis of West Kennet cattle, as well as animals from Durrington Walls and Stonehenge, with a view to better understanding such practices.

One major project which has recently compiled a very large isotopic database from British human remains is the Beaker People Project, funded by the Arts and Humanities Research Council and involving researchers from a number of institutions (Jay and Richards 2007a; Montgomery *et al.* 2007; Jay and Montgomery 2008; Jay *et al.* 2012). This has looked at over 300 Chalcolithic and Early Bronze Age individuals from northern Scotland down to southern England, including a range of burials from Wiltshire and Dorset. Isotope ratio data have been obtained from both tooth enamel and from skeletal collagen. The enamel has been analysed for strontium ($^{87}Sr/^{86}Sr$) and oxygen ($\delta^{18}O$), whilst the collagen from both bone and dentine has provided carbon ($\delta^{13}C$), nitrogen ($\delta^{15}N$) and sulphur ($\delta^{34}S$) data. The

Plate 15 The 'Amesbury Archer' burial (© Wessex Archaeology)

project has also radiocarbon dated 150 individuals, this being done on the collagen extractions produced for isotope analysis, so that the same samples were used.

The strontium and oxygen data are those most commonly used for mobility studies, whilst carbon and nitrogen are more usually employed for investigating dietary patterns (Evans *et al.* 2006; Jay and Richards 2007b; Montgomery 2010). Sulphur analyses are a more recent development and are contributing to both mobility and dietary interpretations (Richards *et al.* 2003). Whilst these are the applications most commonly attributed to these particular isotope systems, when they are used in combination they are much more powerful than when used alone and categorizing one particular ratio as applicable to only one purpose would be a mistake, since they all reflect environmental backgrounds in different ways and contribute to an overall interpretation of resources consumed and the environments from which those resources came. Other isotopic analyses which are currently in use and which can be applied to skeletal material to add to the picture are (as mentioned above) from lead (Montgomery *et al.* 2010) and hydrogen (Reynard and Hedges 2008), data from the latter being available from Windmill Hill and showing geographical differences which will aid mobility studies when compared with other sites in the UK and internationally. There are also continuing method developments which may bring even more isotopic systems into the picture (eg, calcium, Chu *et al.* 2006).

The Beaker People Project database includes 11 individuals who are within the resource assessment region, four of whom are also within the WHS area and nine of which have been radiocarbon dated as part of the project (see Healy, above). These are listed

Table 6 Beaker People Project burials within the resource assessment region

SK no.[1]	Site/curatorial institution[2]	WHS area[3]	Dated[4]
130	Roundway G8/WM	No	Yes
131	Roundway G9/WM	No	No
132	Winterbourne Monkton/WM	No	Yes
139	West Overton, Lockeridge (Burial 1b)/WM	No	Yes
162	Hemp Knoll (central inhumation)/BM	No	Yes
176	West Kennet Avenue (Grave by stone 25b, larger mandible fragments of adolescent)/AKM	Yes	No
177	West Kennet Avenue (Grave by stone 25b, smaller mandible fragment of adolescent)/AKM	Yes	Yes
291	West Overton G1 (JT 55), Kennet Hill/DL	Yes	Yes
292	Winterbourne Monkton (JT 37)/DL	No	Yes
293	Winterbourne Monkton (JT 39)/DL	No	Yes
307	Sanctuary, West Overton/NHM	Yes	Yes

Notes:
1. The SK no. is that used by the Beaker People Project as a database reference
2. Curatorial institutions: WM – Wiltshire Museum, Devizes; BM – British Museum; AKM – Alexander Keiller Museum, Avebury; DL – Duckworth Laboratory, University of Cambridge; NHM – Natural History Museum
3. All sites listed are within the Avebury resource assessment region, with four also inside the WHS area
4. Nine of the burials listed have been radiocarbon dated as part of the Beaker People Project remit

in Table 6. The data from the project overall is exciting in terms of providing information about both the population as a whole in Britain and about individuals. For the individuals listed in the table, for instance, SKs 176 and 307 both show indications that they may not originate from the local region, with the former having unusual sulphur isotope ratios for the location and the latter producing a strontium isotope ratio which is much higher than might be expected for the local chalk bedrock. The first of these is an adolescent from a grave by the West Kennet Avenue stone hole 25b (Smith 1965b) and the second is an adolescent male from The Sanctuary at West Overton (Cunnington 1931), both of them having been found with Beakers.

A smaller project in the assessment area is investigating the provenance of the antler picks from Silbury Hill. The aim of this project is to establish whether it is possible, given the suspected susceptibility of bone to post-mortem contamination with ground water strontium, to nonetheless extract life-time strontium isotope ratios from buried antler. If so, it will enable investigators to explore deer mobility and origins and if there is evidence for the antlers having been brought into the site from outside the general region.

Another example of isotope research in the region, but just outside the resource assessment area, involves work on animal bones and teeth from the midden at Potterne (R. Madgwick and J. Mulville pers. comm.). The principal aims of this work have been to investigate the nature of husbandry strategies employed to sustain the large number of pigs which are represented in the midden using collagen and strontium data (Madgwick *et al.* 2012a).

Utilising the Available Skeletal Resource

The problems which have arisen in recent years regarding the curation of skeletal remains from the Avebury and Stonehenge regions may affect how biomolecular analyses develop in the future. At the original time of writing (2011) the requests for reburial by minority groups had been refused and one of the reasons for this decision is the value of these remains for investigating the past using biomolecular techniques. There were, however, continuing concerns about how legislation affects the treatment of archaeological human remains. Since 2008, the differentiation in law between archaeological skeletons and more recent burials has been blurred and between 2008 and 2012 there was a situation in which excavation licences have required a stipulation to rebury within two years, with extensions possible only by continual reapplication. In other words, archaeological skeletal remains excavated since 2008 may have had very little time available for any kind of research analysis. More recently, since 2012, the Ministry of Justice has allowed the law to be interpreted more flexibly for archaeological remains, but the law will not be changed and it is the interpretation which is being relaxed here. The licencing regime currently permits either reburial or else long-term retention in a museum or comparable institution. It is possible, in the future, that the pressures put on archaeologists by minority groups will either make it impossible to retain such remains for biomolecular (or other) research, or make it so difficult that archaeologists will take the easier, reburial, option rather than face the difficulties involved with curation.

Research on Materials Other than Skeletal Remains

Biomolecular techniques are not restricted to skeletal remains. The analysis of a variety of materials, from pottery residues to plant macro- and micro-fossils are also possible and can contribute much to archaeological debate, particularly with the recent dramatic increases in the use of biomarkers in organic residues (Evershed 2008). Pottery residue analysis of material from Windmill Hill and from Potterne, for instance, has contributed to the discussion of dairying in prehistory, and that from the West Kennet palisade enclosures has been used to show that pig fats were more often present in Grooved Ware than in other Neolithic pottery types (Copley *et al.* 2005a; 2005b; Mukherjee *et al.* 2007). The use of macroscopic plant remains has been limited so far, but there are methods available for considering issues such as water management in agriculture (Ferrio *et al.* 2005); soils can be investigated for land management practices such as manuring (Maxfield *et al.* 2011) and even coprolites are useful (Poinar *et al.* 2001; Gill *et al.* 2010). Environmental sampling to establish the isotope values of biosphere components that humans and animals are eating or exposed to is also needed to aid interpretations of geographic ranges or how different human choices and practices can impact on the resulting values obtained from skeletal tissues. For example, biosphere mapping for geographical strontium variability across Britain is in its early stages (Evans *et al.* 2010) and a PhD study to specifically investigate variability across the southern chalk downs and associated lithologies which is directly relevant to the Stonehenge/Avebury area has been completed (Warham 2012). Although the molecules and materials being looked at may be different, in many of these cases it is isotopic ratios which are being considered.

Conclusions

Whilst it is isotopic and DNA research, often in the context of mobility studies, which are usually at the forefront of the discussion of biomolecular science in archaeology, there are many techniques and applications available. Some are already providing large datasets which directly involve the resource assessment area, whilst others are still in basic development phases and may not provide answers to applied archaeological questions for some years. As a group of techniques they are becoming increasingly valuable in addressing archaeological issues and are of particular benefit when they are used in combination, both with each other and with non-molecular techniques and archaeological understanding. It is already becoming clear that a group of specialists combining techniques for the study of one individual can provide very detailed interpretations of a life history (eg, Dickson *et al.* 2004; Melton *et al.* 2010), whilst large, recent or currently ongoing projects (eg, the Beaker People Project, the Feeding Stonehenge project and the Roman Diaspora project are providing complementary data which are able to look beyond the individual and discuss archaeological issues across regional populations. In the future, studies of groups of people through time will help to identify changes in research areas such as land management, mobility patterns and dietary attitudes.

The majority of biological and organic traces, from skeletal through to soils and pottery residues (macroscopically visible or not), are either useful for biomolecular analyses now or are likely to be so in the foreseeable future. In many cases, financial pressures on curatorial facilities may mean that some are considered for discard or, in the case of new excavations, not considered for curation at all for lack of a possible repository. This might be so particularly where they are bulky or fragmented, such as in the case of animal bone assemblages with a lot of fractured pieces, soil samples or small pottery sherds. Wherever possible, discard should be avoided and this would relate to the whole assessment region, rather than concentrating on the WHS, because environmental samples from the region generally are often needed for a full interpretation of data from a more restricted site. Reburial of skeletal remains, either those already curated or those newly excavated, should be resisted where possible if large-scale studies are to be undertaken in the future.

Finally, easily accessible records of the resource available for biomolecular research, together with details of work already undertaken and in progress, would be valuable both to researchers and to those wishing to promote the value of archaeological science to the general public and in particular to make it clear why resources should be allocated for the curation of material which is often not of museum display quality.

Museum Collections

by David Dawson with contributions by Jane Ellis-Schön and Rosamund J. Cleal

Introduction

Archaeological archives and other collections relating to the WHS are distributed amongst a number of institutions, although the most significant collections are held at the Wiltshire Museum (WM; often still referred to as Devizes Museum and sometimes as Wiltshire Heritage Museum), the Salisbury Museum (SM) (Pl. 16) and Alexander Keiller Museum (AK).

Plate 16 Displays in Salisbury Museum (© Wessex Archaeology)

In addition, significant collections are held by the British Museum (BM), Ashmolean Museum (AM), Cambridge University Museum of Archaeology and Anthropology (CUMAA) and the National Museum of Wales (NMW), as well as by a number of other museums (Stonehenge collections are summarised in Darvill 2005, 22).

The collecting areas of the Museums in Wiltshire have been agreed, and can be summarised as:

- SM – areas south of OS grid line 46
- AK – archaeological material from the parish of Avebury and from sites of the Avebury complex crossing the parish boundary, and parts of the WHS outside the parish with the agreement of Wiltshire Museum
- WM – areas north of OS grid line 46, except for Avebury parish

The Stonehenge, Avebury and Associated Sites World Heritage Sites Management Plan note that both SM and WM 'contain important collections of archaeological artefacts from the WHS designated by the Government as pre-eminent collections of national and international importance' (Simmons and Thomas 2015, 74) while AKM 'holds one of the most important prehistoric archaeological collections in Britain' (*ibid.*, 74). The plan further notes that due to a lack of space neither SM nor WM are accepting new items for storage, recognising that this situation 'is of serious concern' (*ibid.*, 74).

The situation outlined in the Management Plan has a significant impact on the ability of SM and WM to support the considerable amount of research undertaken in the WHS. In consequence, research projects generating large archaeological archives must make adequate provision for management and funding of their long-term storage (Simmons and Thomas 2015, 183: Policy 7b/Action 158).

Access to Collections Online

The main collections are well-known to researchers, but the emphasis on collections documentation by the Museums and Galleries Commission Registration Scheme (now Accreditations) and the investment of funders such as MLA (Designation Challenge Fund), Big Lottery Fund (NOF-digitise) and the Pilgrim Trust have enabled museums to document their collections and to get them online. This is particularly the case for the BM, WM, SM and CUMAA, the majority of whose collections are searchable online. In addition, the availability of content aggregators such as CultureGrid and Europeana opens up the potential for cross-searching the catalogues of many museums, as well as libraries and archives at the same time. A cursory search of CultureGrid reveals that the

collections of the Hunterian Museum contain a number of items from both Stonehenge and Avebury. The AK has documented the majority of its collections; the desire has been expressed to increase digital access to its archives.

Those museums that have gone online have seen a significant impact on the way in which their collections are used for research. WM has prepared a web page (http://www.wiltshiremuseum.org.uk/documents/?LibraryID=26#l26) outlining for potential researchers the work that they should undertake before seeking to access the collections. In many cases, particularly for undergraduate and informal researchers, a combination of the Wiltshire HER database and the WM collections database gives answers to many basic research questions, and researchers are able to make very specific requests for the material that they wish to see.

The Research Information Network produced a useful report which identified the needs and priorities of researchers, with a specific focus on archaeology. The report highlighted the need for collections to be accessible, and that the records should be useful, even if imperfect or incomplete. The report also identified the need for a Researchers' Charter, which clearly outlines the way in which museums can support researchers (http://www.rin.ac.uk/our-work/using-and-accessing-information-resources/discovering-physical-objects-meeting-researchers-).

Alexander Keiller Museum, Avebury and Collections held within the World Heritage Site

by Rosamund J. Cleal

When Avebury was inscribed on the World Heritage List in 1986 as part of *Stonehenge, Avebury and Associated Sites* there had already been a museum within Avebury for nearly 50 years. The following description of the collections is largely based on the Alexander Keiller Museum's Acquisition and Disposal (A & D) Policy (as submitted for Accreditation 2008) under the terms of which it may collect from the area of the WHS. The Museum, created largely to house collections from the monuments of what is now the WHS, was from the outset a repository for collections which included artefacts and archives not related to the period of primary use of the monuments. That practise has continued to the present and is recognised by the A & D Policy.

The present Alexander Keiller Museum is housed in three buildings: the Stables, Barn and Racquets Court and these are situated within 250 m of each other to the east of Avebury henge (the Barn actually overlying the line of the henge bank). The Stables, which was the first museum building, was converted from a coach house and stables in 1938 by Alexander Keiller; today it houses displays of artefacts from Alexander Keiller's and other excavations and some of the research collections. The Barn, which is a late 17th-century threshing barn, houses a permanent exhibition and some collection items; and the Racquets Court Store and Study Room houses the majority of the collections and facilities for research. All the buildings are owned by the National Trust but the majority of the collections are owned by the State, having been donated to the nation by Gabrielle Keiller in 1966 when the Museum was named the Alexander Keiller Museum.

The Museum's collections comprise largely archaeological material derived from the Neolithic and Bronze Age monuments and the landscape in which they lie. A small, but still considerable, proportion of the archaeological collections comprises material from excavations of later sites. Summaries of all these follow.

Excavations by Alexander Keiller

The Museum houses the excavation archives from Alexander Keiller's excavations at Windmill Hill (1925–29), West Kennet Avenue (1934–35) and Avebury henge (1937–39). The majority of this material is Neolithic and Early Bronze Age in date, with small quantities of Romano-British, Anglo-Saxon, medieval and post-medieval to modern material included. The excavation archives include a large photographic collection and copied versions of film and audio recordings.

Excavations and watching briefs in advance of ground-disturbance

Archaeological excavation archives and archaeological stray finds have been and are being currently added to the archaeological collections as the result of excavations in advance of building and other ground disturbing works. From the 1940s to the 1970s excavation and recording was undertaken largely by the Curators: W. E. V. Young, F. de M. Vatcher, and M. W. Pitts for, successively, the Office of Public Buildings and Works, Ministry of Works and Department of the Environment. Although there is some Neolithic material among these collections the majority of artefacts date from the Anglo-Saxon and medieval periods.

From the 1980s to the present occasional excavations and watching briefs, mainly by independent archaeological contractors, and work by the local landowner, the National Trust, have added further archaeological material (that from the National Trust being on loan rather than donated). This has largely consisted of small archives of mixed date (Neolithic to modern).

Research excavations other than those conducted by Alexander Keiller
The collections include the excavation archive from the 1968–1970 seasons of work at Silbury Hill. This collection is largely Romano-British in date, with minor prehistoric, Anglo-Saxon and modern components.

The last decade and a half of the 20th century and the first of the 21st century saw a renewal of research excavation in the area. Archives from this work which have already entered the collections include those from the 1988 excavation at Windmill Hill, the 1989–92 excavations at West Kennet palisade enclosures, the 1999 excavation at The Sanctuary, those from the Negotiating Avebury/Longstones project and the first season of the Between The Monuments Project (at Rough Leaze in 2007).

Finds from surface collection
Alexander Keiller purchased the collection of the Revd H. G. O. Kendall, which he had formed largely by collecting worked flint from the surface of fields in the Avebury area. This comprises a large number (thousands) of struck flints, mainly from Avebury parish but including some finds from elsewhere.

Alexander Keiller, and at least one of the subsequent Curators, paid finders for struck flints found locally and these form a small part of the surface collections.

Episodes of fieldwalking have taken place for research purposes and in advance of land being laid down to grass ('arable reversion') since the 1980s.

Miscellaneous archaeological material
Alexander Keiller purchased non-local archaeological material, mainly of Neolithic and Early Bronze Age date. A large collection of Irish worked stone was returned to the Republic of Ireland before 1994, but no attempt has been made to return the small number of items remaining. These largely comprise stone items from the Americas, the Indian subcontinent, Australasia, Europe, and other parts of the British Isles.

Archaeological archives other than excavation archives
The collections include letters and other papers from archaeologists, including nationally important figures such as Professor V. Gordon Childe, Professor Stuart Piggott and O. G. S. Crawford.

Subject areas other than archaeology
The Museum has very small collections in areas other than archaeology, including art works on paper. These are mainly representations of Avebury or people associated with Avebury.

In the area of social history there is a small collection associated with Alexander Keiller and his family, friends and associates. These include non-archaeological letters relating to Alexander Keiller, Gabrielle Keiller, W. E. V. Young and Denis Grant King.

The Museum also houses a small geological collection formed by Alexander Keiller, but it does not seek actively to collect in this area, nor in those of art or social history. In particular, the Museum does not have sufficient display or storage facilities to act as a repository or public exhibition space for the history of the parish of Avebury (and in this area in particular the Wiltshire Museum does collect).

The Museum includes a library containing antiquarian and modern books and periodicals largely relating to prehistoric archaeology and to Wiltshire. The library and collections are accessible to the public by appointment.

Documentary Sources

by Nikki Cook

Documentary evidence essentially takes the form of historical archival and manuscript sources. These include formal and less formal records and associated papers and documents, ranging from narrative historical texts, such as medieval chronicles, to all other kinds of documents including maps, books, letters, diaries, photographs, poetry, sketches, paintings, newspapers, accounts ledgers and sales particulars: all of which transmit unique information from the past to the present. Such documentary sources have been created by a variety of means and for differing reasons, ranging from the records of government, State and the Church to those of individuals, landed estates and modern small businesses. Catalogues of historical sources, and even whole texts, are becoming increasingly available via the internet, and there are many places where research can be undertaken or discoveries made, from County Record Offices and museums to personal archives held by private individuals and wider institutions, and even serendipitous finds within junk shops or at car boot sales.

In order to place material remains within their historical context, documentary records provide an invaluable resource which can supplement our understanding of the past, but it is not a resource which should only be consulted after the event. Indeed, documentary sources should arguably be assessed in advance of, and in tandem with, archaeological work within the WHS, in order to provide a more holistic investigative and interpretative approach.

Plate 17 The British Falconers' Club, including Capt. C. W. R. Knight (sixth from left) and Esmond Knight (tenth from left), at their annual HQ, the Red Lion, Avebury, in August 1930 (© Wiltshire Museum)

Documentary sources can both enable and influence the interpretation of archaeological evidence, and may provide a wealth of information, depending on how the resource is used and what questions are asked of it. Such sources can often provide valuable insights into the explanation of archaeological remains, and are especially effective in assessing the social and economic history of a particular area, notably in terms of its landscape use, ownership and development. This holds true not just for aiding archaeological interpretation of newly excavated material, but also for re-assessing the interpretation of much earlier work: in essence, the 'archaeology of archaeology'.

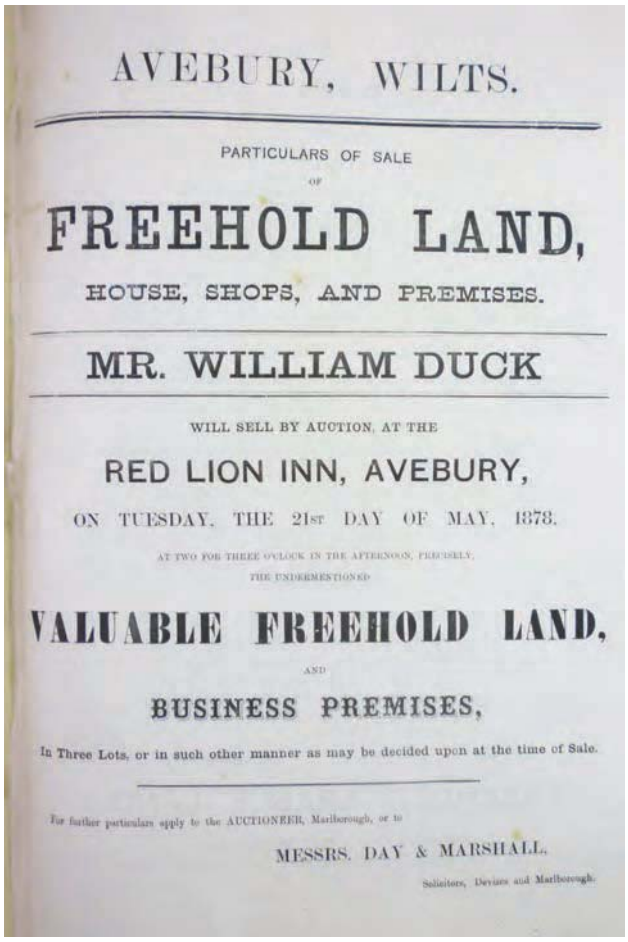
Documentary sources are also helpful in informing our understanding of particular time periods, especially from the medieval period onwards. Owing to the generally high level of continuity in both the form and structure of settlements, tenures and many individual monuments, post-medieval documentation – particularly maps and detailed surveys – have enormous potential to provide a topographical framework for both the documentary as well as the archaeological study of the medieval period.

Written records are generally sparse before the 13th century, although various key documents exist in addition to the *Domesday Survey*, particularly for certain monastic and royal estates. However, medieval manuscript can be very difficult to read in Latin and Old English although some local history handbooks can help with some of the translation (eg, Mitchell and Robinson 2007) and there are a number of useful online sources (eg, http://www.medievalgenealogy.org.uk/guide/hand.shtml), as well as helpful and knowledgeable staff at record offices and other repositories.

The Documentary Resource

The resource for Avebury is considerable, and a selection of online and other accessible sources is listed in Appendix 1, although this list is by no means exhaustive.

The *Domesday Book* is useful, but there are well-known problems in utilising such sources, which cannot be simply trawled for information without some expertise (Roffe 2007). However, fortunately for Wiltshire, *Domesday* has been transcribed and is available online, while a second transcription can also be found within the *Victoria County History* (*VCH*) for Wiltshire, itself a great source of information, currently comprising 18 published volumes. The first five volumes in the *VCH* Wiltshire series are focused on general topics relating to the county as a whole; the remainder are topographical volumes, containing the histories of individual parishes and towns. The ones relevant to the Avebury WHS and study area



AVEBURY, WILTS.

PARTICULARS OF SALE

OF

FREEHOLD LAND,

HOUSE, SHOPS, AND PREMISES.

MR. WILLIAM DUCK

WILL SELL BY AUCTION, AT THE

RED LION INN, AVEBURY,

ON TUESDAY, THE 21ST DAY OF MAY, 1878,

AT TWO FOR THREE O'CLOCK IN THE AFTERNOON, PRECISELY,

THE UNDERMENTIONED

VALUABLE FREEHOLD LAND,

AND

BUSINESS PREMISES,

In Three Lots, or in such other manner as may be decided upon at the time of Sale.

For further particulars apply to the AUCTIONEER, Marlborough, or to

MESSRS. DAY & MARSHALL,

Solicitors, Devizes and Marlborough.

Plate 18 Sale Catalogue, 1878, for the sale by auction of a house with adjoining shops and farm buildings, plus two parcels of land, 9 acres in total, at Avebury, Wiltshire (© Wiltshire Museum)

include Avebury (vol. 12), Berwick Bassett (vol. 17), Broad Hinton (vol. 12), East Kennett (vol. 12), Hilmarton (vol. 9), Overton (vol. 11), Selkley hundred (vol. 12), Winterbourne Monkton (vol. 120) and Yatesbury (vol. 17).

The *Valor Ecclesiasticus* is another useful resource; but better still are the manorial documents in recording the more mundane and everyday goings-on, which can often prove a useful source of information. Manorial or court documents can be found in local record offices, or at the National Archives at Kew; others are held in family archives where they are privately owned. Deeds and leases may also be useful. Earlier records may well be written in Latin, but published guides are available to assist with reading both manorial and title deed documents (eg, Stuart 1992; Cornwall 1997).

Post-medieval documents, in particular cartographic sources, are a mine of information, particularly in terms of place-name evidence. Tithe maps, estate maps, Enclosure Act plans and their accompanying schedules can reveal a great deal about the way in which the landscape has been divided up and used, including indicative remnants of medieval field patterning evidenced by strips recorded on early maps. The Ordnance Survey mapped the area at a small scale in the early 19th century, and then at large scale (1:2,500, published 1886; 1:10,560 published 1889), with subsequent revisions thereafter. Earlier maps, eg, Andrews and Dury 1773 (revised 1810) are also available at the Wiltshire and Swindon History Centre, whilst earlier sources still, eg, Stukeley's 1720s illustrations, provide valuable information about the Avebury henge and surrounding area, including West Kennett and Silbury Hill.

Acts of Parliament relating to roads and taxes are also relevant, as are Parish records, such as census returns. Parish registers are a very important source of information: most are generally found within county record offices, although a number of documents from the Parish Chest are often retained by local churches, and therefore it may be useful to call and speak to the incumbent vicar, as their predecessors often kept scrapbooks and diaries.

Early newspapers yield much information, eg, in advertisements for subscriptions, as well as being used as a place to publish more 'serious' accounts of archaeological or other investigations in the local area. There are also the personal archives of those who have been part of Avebury's rich tapestry, such as Aubrey, Stukeley, Colt Hoare, Britton, Keiller, and the Cunningtons, to name but a few, many of which can be found locally within publicly accessible archives, such as those held at the Wiltshire Museum in Devizes (Pls 17–18), at the Wiltshire and Swindon History Centre in Chippenham and in the Alexander Keiller Museum at Avebury. Others can be found further afield, such as at the Bodleian Library, the Ashmolean and the Pitt Rivers Museum in Oxford, and the National Archives, Royal Photographic Society, British Museum, the British Library and other repositories in London.

Archive collections are also held regionally, for example at the Bath Record Office, Bowood House, Longleat, Dorset Record Office, and Hampshire Record Office, with the Wilton House archive and many other resources now held at the Wiltshire and Swindon History Centre at Chippenham.

The Wiltshire Record Society, through the Hobnob Press, have published a number of key historical sources and books, such as the Wiltshire Tax List of 1332 (Crowley 1989) and the Printed Maps of Wiltshire 1787–1844 (Chandler 1998).

Resources at the Wiltshire and Swindon History Centre

There are a variety of archival sources which can be consulted at the Wiltshire and Swindon History Centre (WSHC). Photographs can be accessed

through the county collection, maintained by the local studies librarian, also based at WSHC.

The Avebury WHS is covered by the ecclesiastical parishes of Avebury, Winterbourne Monkton and the tithing of West Overton in the parish of Overton. Printed maps of the WHS area include the Andrews and Dury map of Wiltshire, 2.5 inch to 1 mile, the OS 6 inch to 1 mile (1888–1925) and the OS 25 inch to 1 mile (1900, 1924).

Manuscript maps include:

- For Avebury parish: the Manor house and grounds, 1695 (184/2); William Norris' estate, 1702 (473/274); Great Farm, 1733 (21553/71H); Beckhampton, pre-enclosure: shows strips in common fields overlaid with allotments made under Enclosure Award (2027L); Enclosure Award, 1795 (EA/95)
- For Winterbourne Monkton parish: the Popham estate, 1774 (39/8); whole parish, 1809 (X6/78); and Enclosure Award 1815 (3468/2MS)
- For West Overton: Tithing, 1783 (2203/20H), 1784 (2057/S69); Estate of FC Fowle, 1811 (628/49/4)
- There is also a Whole Tithing, 1819 (778/2L); and Enclosure Award, 1802 (EA/61)

Estate and manorial sources include:

- Avebury: manor court book, 1651–1657 (473/52); surveys etc., 18th century (184/4)
- Winterbourne Monkton: court roll, 1408 (192/21); survey, mid-16th century (192/52)
- West Overton: manor court book, 1743–1819 (2057/M/69)
- Glebe terriers (schedules of lands in the common fields and rights pertaining to the vicars of the three parishes): Avebury, 1682; Winterbourne M, 1671, 1678; Overton, 1588–1705. Originals in WSA, but published by the Wiltshire Record Society (Hobbs 2003)

The Wiltshire Historic Environment Record

by Melanie Pomeroy-Kellinger

A Historic Environment Record (HER) is a computerised database of all archaeological sites and finds locations from a given area, usually kept at county or regional level, maintained by the local authority, and adopted by formal resolution. The HER provides a unique information resource, forming the basis for sustainable conservation and playing an important role in informing public understanding and enjoyment of the local historic environment.

Plate 19 Data from the Wiltshire and Swindon Historic Environment Record (© WSHER)

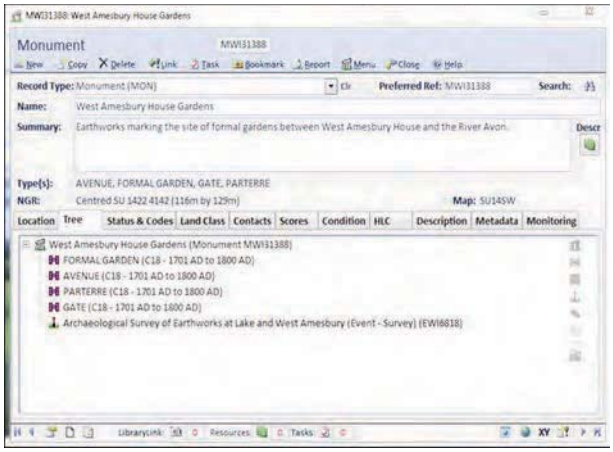


Plate 20 Data from the Wiltshire and Swindon Historic Environment Record (© WSHER)

The Wiltshire and Swindon HER was developed in-house from the mid-1980s. It consists of an Access database containing around 21,000 records (as of April 2014) of archaeological and historic sites (monuments) and find spots. The database also contains information about more than 6000 archaeological and antiquarian investigations (events) and associated documentary sources. The database is linked to a series of digital maps held as GIS files. The maps contain graphical depictions of all sites on the database, ranging from simple point locations to complex plots of extensive sites such as hillforts and ancient field-systems (Pls 19–20). Wiltshire Council adopted the HER in September 2010.

The HER is maintained within the Directorate of Community Services, part of Communities, Libraries, Heritage and Arts and based in the Archaeology Service. It is managed by the Archaeology Service and located in the Wiltshire and

Table 7 Monument Types in WHS (April 2014)

Count	Term
3	Airfield
86	Associated finds
1	Barrow
46	Bell barrow
285	Bowl barrow
6	Building
38	Burial
1	Causewayed enclosure
5	Cemetery
1	Chapel
3	Circular enclosure
1	Commemorative monument
1	Cross
2	Cursus
1	Dewpond
35	Disc barrow
50	Ditch
4	Enclosed settlement
36	Enclosure
1	Feature
30	Field system
243	Findspot
9	Henge
1	Hillfort
1	Hollow way
7	Industrial site
30	Linear feature
17	Long barrow
4	Lynchet
2	Monumental mound
32	Mound
6	Non antiquity
2	Oval enclosure
1	Parish boundary
1	Pillow mound
53	Pit
6	Pit alignment
1	Pond
19	Pond barrow
4	Post hole
3	Practice trench
7	Rectangular enclosure
3	Ridge and furrow
125	Ring ditch
5	Road
1	Rock art
102	Round barrow
16	Saucer barrow
43	Settlement
60	Site
4	Square enclosure
1	Standing stone
1	Stone circle
5	Stone setting
3	Strip lynchet
12	Trackway
1	Villa
5	Water meadow

Swindon History Centre, Cocklebury Road, Chippenham, SN15 3QN and is available for consultation remotely by telephone, e-mail, and letter or online.

The aim of the HER is to gather the known information about the historic environment and present its records, within national and international standards, in a format accessible to its users in order to:

- help advance research and understanding of the historic environment of Wiltshire and Swindon;
- help care for the Wiltshire and Swindon historic environment through conservation and environmental enhancement programmes and projects;
- inform policies and decision-making in land-use planning, development management, statutory undertakings, agri-environment and forestry schemes;
- raise public awareness of Wiltshire and Swindon's historic environment by contributing to educational and outreach programmes and projects to encourage public and community participation in the historic environment.

In July 2011 the Wiltshire and Swindon HER underwent an upgrade and data migration programme to update it and bring it in line with national standards. The data were migrated to the HBSMR database (operated by ExeGesis) linked to map depictions on GIS (ArcGIS version 10). There is an ongoing programme of data enhancement which includes putting back log reports onto the system, and enhancing the post-medieval and military sites/features and historic buildings.

Within the Stonehenge and Avebury WHS boundary there are currently 1495 monuments (including 243 find spots), 1088 events and 1555 sources linked to monuments (as of April 2014). These are broken down into 58 monument types (Table 7) and include nine henge monuments.

There is a collection of 82 fieldwork reports linked to events (archaeological interventions) within the WHS boundary.

Over the next two years the HER data within the WHS will be enhanced by a data cleaning exercise (eg, we are aware that some monuments within the Avebury part of the WHS are duplicated, and these will be amalgamated), and the addition of a number of recent and upcoming fieldwork reports. The ongoing enhancement project focused on post-medieval, military and built heritage records will greatly improve the depth and detail of the HER coverage within the WHS.

Geographic Information Systems

by Paul Cripps

Background

Even before the first version of the Archaeological Research Agenda for the Avebury World Heritage Site was published (AAHRG 2001), it was recognised that the use of Geographic Information Systems (GIS) would be important for research into and

management of archaeological sites. The application of GIS for the Stonehenge and Avebury World Heritage Site dates back to the mid-1990s and was used to support the generation of the Avebury World Heritage Site Management Plan (Pomeroy 1998) and also to undertake spatial analysis in the Stonehenge landscape (eg, Batchelor 1997).

By the time of the Stonehenge World Heritage Site Research Framework (Darvill 2005), GIS had developed to the point where it had become *de rigueur* and as such received only a passing mention (*ibid.*, 14, 24) rather than the more detailed documentation afforded in the Avebury version (Burton 2001).

Geographic Information Systems

Geographic Information Systems comprise a wide range of associated tools and technologies for working with spatial data and associated non-spatial data including but not limited to graphics and images, hypertext and multimedia. Being based around spatial databases, they are ideally suited to the management of data, particularly spatial data, and in addition provide cartographic tools and analytical capabilities for undertaking various forms of spatial analysis. Their application for archaeological use is well documented (eg, Wheatley and Gillings 2002; Conolly and Lake 2006) and many of the possibilities outlined by Burton (2001, 86–7) can now be seen to be accepted approaches.

Crucial developments over the past 20 years have been based around the web as a data delivery and interface platform. Also, there have been improvements to data structures which underpin any GIS, with semantic modelling becoming recognised as an important element in any archaeological information system. Indeed, the very notion of an Archaeological Information System (AIS) has become prevalent, a concept which would include any archaeological use of GIS.

The Stonehenge and Avebury World Heritage Site GIS

The Stonehenge and Avebury WHS GIS was initiated in the mid-1990s and until 2004 was maintained by the English Heritage Archaeology team at Fort Cumberland, Portsmouth. The move to establish such a resource was ground-breaking at the time and continuous development ensured the system remained world leading. Close links with the local Sites and Monuments Record, now Wiltshire Historic Environment Record, allowed data to be extracted and made available through the WHS GIS utilising a periodic update strategy from their CAD-based system.

Originating on a dedicated server running ArcInfo, the system was readily adapted to new technologies as they became available and through the late 1990s was made accessible to a wider group of users within English Heritage and Kennet District Council using the ArcView then ArcGIS platforms. Further development of the system took place through the early 2000s, with additional datasets added including some of the earliest lidar datasets (Bewley *et al.* 2005) and various legacy datasets including the back catalogue of geophysical survey datasets from all available sources.

This development programme culminated in the handover of the system to the English Heritage Corporate GIS team in 2004 to be maintained, managed and developed as part of their core information system portfolio, the aim being to broaden the coverage to other World Heritage Sites requiring similar systems, building on the ground-breaking work undertaken in the Stonehenge and Avebury World Heritage Site.

The use of the WHS GIS for data management in the WHS is exemplified by its use to support the various Management Plans and Research Framework/Agenda documents produced since the 1990s. All have used the GIS to support map production and some use has been made of spatial analysis to support management recommendations, notably the successive iterations of the visual sensitivity maps pioneered by Burton (Batchelor 1997) and updated in the early 2000s (Cripps 2004) to produce a revised visual sensitivity map using a probablistics methodology based on that proposed by Fisher (1991; 1992; 1994; 1995; 1996). Appraisals of the various options for road schemes and visitor centres have also made extensive use of the GIS resource, acting as a single point of access to spatial data for researchers and contractors.

Furthermore, condition surveys undertaken in 1999 and 2010 (Avebury) and 2002 and 2010 (Stonehenge) have been fed into the WHS GIS; the 2002 and 2010 surveys in particular used mobile GIS for data capture and validation and the spatial records were supported by geolocated photographic records of site conditions to produce a rich and informative record of conditions at those times. The use of mobile GIS in this way allows for more efficient data capture and field validation of data compared with more traditional means, and work in the WHS has pioneered such techniques.

The use of the WHS GIS for analysis to underpin planning and management is exemplified in recent years by the various visual sensitivity assessments undertaken and the use of the data to support the proposed developments at Stonehenge relating to the A303 improvements and new visitor centre as part of numerous projects, most recently the Stonehenge Environmental Improvements Project.

Visual impact assessment formed a key element of the overall heritage assessment (Wessex Archaeology 2009a; 2009b).

The WHS GIS was also central to the analysis conducted for the Woodland Management Strategy where models of current and proposed woodland strategies were evaluated using a GIS based process with visual impact assessment forming a key element. GIS analysis also formed the basis of the research undertaken to inform the grassland reversion programme for the WHS.

With the advent of widely available desktop GIS packages and specialist Archaeological Information Systems, especially now within Local Authorities such as Wiltshire where the local Historic Environment Record is based, the position of the WHS GIS as a stand-alone resource separate from the HER is arguably no longer the best solution. Data management would be better handled through the HER using their Historic Buildings Sites and Monuments Record (HBSMR) software which incorporates dedicated management/monitoring tools, is capable of handling rich multimedia and a GIS component for spatial depictions. Using web delivery, data could be managed in one place and made available widely to other internal and external users with access control tailored to their needs. Obstacles to such a unified approach are no longer technological but political, logistical and legal, with data licensing and ownership being key factors.

Resources

The proliferation of GIS and repositories of digital data have led to a broad range of datasets being incorporated into the WHS GIS or being made available through other channels. Many of these GIS datasets have tremendous research potential and can be used to inform management of the WHS.

WHS GIS

The WHS GIS itself represents a collation of available resources. As such, it includes HER data, all publically available datasets from government agencies (eg, Natural England, English Heritage, Environment Agency, etc.) plus datasets provided under license (eg, Environment Agency lidar and CASI, Ordnance Survey mapping and terrain data) and datasets created through the production of Management Plans and other research and management activities (eg, land-ownership, grassland reversion) and to support particular projects and analysis (eg, geophysical survey results, fieldwalking data, visual sensitivity). It also contains indices to other datasets to facilitate accessing data for which there is no direct access provision.

Historic Environment Records (HERs)

There are two relevant Historic Environment records for the Stonehenge and Avebury WHS. Firstly, there is the Wiltshire Council HER which is the core database used for planning and development control by the Local Authority. Secondly, there is the National Trust Historic Buildings Sites and Monuments Record, maintained to support the internal management of land under their control, baseline data from which is publically accessible (http://archaeologydataservice.ac.uk/archives/view/328).

Academic data portals

For research purposes, there are a range of resources available to accredited researchers with academic affiliations. The Edina Digimap service in particular provides access to a wide range of GIS datasets including historic and modern Ordnance Survey mapping and geological data from the British Geological Society.

Open Data initiatives

Increasingly, data is being made available through Open Data initiatives being promoted by the UK Government. Such data is very useful for research and management purposes where it is not possible to arrange access to licensed data. This initiative includes data from organisations such as the Ordnance Survey and British Geological Survey.

English Heritage Archives

Many of the reports and data emanating from English Heritage's internal and commissioned projects are available on request from the English Heritage archives. This includes GIS data relating to the various NMP activities, including work on the Environment Agency lidar datasets for both Stonehenge and Avebury and also reports of recent landscape survey activities (Field and Pearson 2010). Point clouds from the 2011 terrestrial laser scan (TLS) work at Stonehenge are being archived here also (Abbott and Anderson-Whymark 2012).

Archaeology Data Service

The ADS holds various reports and documents relating to the WHS. It also holds digital datasets such as the output from the Stonehenge 20th Century Excavations database (Cleal *et al.* 1995).

Wessex Archaeology

Archaeological works undertaken during the course of the A303 Improvement scheme at Stonehenge and a significant number of other projects have been

undertaken by Wessex Archaeology. Their digital archives include various reports and GIS datasets produced as part of this work, notably the 2008 monograph (Leivers and Moore 2008).

Recommendations and Potential

Previous recommendations and achievements

The creation of a high resolution Digital Elevation Model (DEM) was highlighted by Allen and Burton (AAHRG 2001, 70, 89) as being of importance for contextualising environmental and other data; with the proliferation of terrestrial and aerial survey data now available, this has more than been accomplished.

A secondary aim of keeping a GIS up to date with the latest environmental data (*ibid.*) has unfortunately been less well satisfied. Indeed, updating the WHS GIS as a whole has, since 2004, been problematic resulting in various research and management groups establishing their own, unconnected GIS resources to suit their needs.

The enhancement of the base archaeological data available for use in GIS, particularly the quality of chronological information and associated sources, was flagged as of importance by Burton with respect to the Avebury part of the WHS but this also applies to the Stonehenge data (*ibid.*). This has been partially accomplished in that records enhancement at Wiltshire HER supported by major research projects and programmes has produced new and improved data. This has for the most part yet to be incorporated into the WHS GIS and given the current status of this resource, it may not be the most appropriate way forward now.

Indeed, with GIS now being ubiquitous on major research projects, such projects have generated significant amounts of high quality spatial data, data which as well as supporting the immediate needs of the projects which generated them, have tremendous potential for further work.

Massive achievement using GIS includes the outputs of major research projects for the Stonehenge part of the WHS, among them the *Stonehenge Hidden Landscapes* work by Birmingham University (Exon *et al.* 2001) and more recently the *Seeing Beneath Stonehenge* project, part of the Stonehenge Riverside Project (Parker Pearson 2012). This latter project has made an unprecedented amount of spatial data available to the public using the freely available Google Earth platform.

For the Avebury part of the WHS, GIS was used extensively to support the analysis and outputs from the Negotiating Avebury Project, a major research project undertaken from 1997 to 2003 (Gillings *et al.* 2008). Indeed, the Avebury region has been the focus of much ground-breaking GIS research undertaken by researchers involved with this project including Mark Gillings, Glyn Goodrick and David Wheatley (eg, Wheatley 1996; 2002). The data from this project was also used to investigate concepts of movement through and perception of the landscape using GIS (Cripps 2001; 2007).

Research potential

A major strength of GIS is as an integrative technology capable of bringing together disparate spatially referenced datasets into an environment where detailed analysis can be undertaken. Improvements in access to spatial data combined with improvements in the quality of data combined with advances in hardware and software culminate in increased research potential.

There is significant potential for spatial analysis using existing datasets and innovative methodologies. Assessments of the Environment Agency lidar data to date have proved to be very informative (eg, Bewley *et al.* 2005; Skinner 2011) but these data have more to give with advances in associated analytical methodologies yet to be deployed in the WHS (eg, Doneus and Briese 2006) or, having been deployed, could be updated to take advantage of new and improved datasets.

Environmental data, particularly in the Avebury region, including newly gathered data from recent work would benefit from further spatial analysis (M. Allen pers. comm.).

New data have been collected in abundance in recent years, particularly around Stonehenge, with both Bournemouth and Birmingham Universities carrying out wide area landscape survey using a range of geophysical techniques suitable for spatial analysis, as also undertaken for landscape survey (eg, Field and Pearson 2010) and geophysical survey in advance of the new visitor facilities at Stonehenge. Such a wealth of data has potential not only to improve our understanding of the archaeology but could provide excellent source material for the development and application of innovation GIS based methodologies (eg, after Kvamme 2006).

There is also potential for additional survey work to produce new spatial datasets for GIS based interpretation and analysis, particularly using Unmanned Aerial Vehicles (UAVs) which can be used to rapidly capture very high resolution imagery, topographic (via photogrammetry) and remote sensing data, at resolutions far exceeding that currently available in off-the-shelf lidar datasets and for much lower costs.

Metal Detecting

by Katie Hinds and Michael Lewis

Past history/Investigation

Prior to the establishment of the Portable Antiquities Scheme (PAS) in Wiltshire in August 2003, metal detectorists had made a number of important finds in the Avebury WHS (Chadburn 2001). While these finds made a contribution to the archaeology of the area in general, in particular to our understanding of small finds (for example, the Late Bronze Age fibula published in Hull and Hawkes (1987, 12)), they did not relate directly to the Avebury complex of monuments.

Given this past history of metal detecting at Avebury, it is perhaps surprising that since the advent of the PAS in Wiltshire there have been no further metal detected finds recorded from the WHS on its online database www.finds.org.uk/database, even though over the last eight years the Wiltshire Finds Liaison Officer (FLO) has built up good relations with the metal detecting community and recorded over 16,500 finds from elsewhere in the county. Illegal metal detecting ('Night Hawking') might have taken place within the WHS and the finds been taken away with no intention of showing them to the FLO or a museum. It is also equally possible that metal detecting may have taken place, but the finds have gone unrecorded; for example, when the metal detectorist concerned had no knowledge of the PAS. More importantly, over one third of the WHS (including the majority of the major monuments) is owned by the National Trust, who only permit metal detecting where it forms part of a properly-sanctioned project design for archaeological fieldwork, which in turn requires a National Trust Archaeological Research Agreement to be in place.

However, it is worth noting that although there are no metal detected finds recorded on the PAS database from the Avebury WHS, there are four finds discovered by other means. Two are molehill finds along well-trodden routes: in the first instance between the car park and Silbury Hill (Roman greyware vessel base), and in the second at the edge of the National Trust car park in Avebury (medieval North-Wiltshire earthenware rim sherd). An incomplete Neolithic axehead was found in the 1950s 'in the stream alongside Silbury Hill' and recently brought to Wiltshire Museum where the Curator was able to photograph it and take measurements. Most interesting of all is a cutting-edge fragment of a Late Bronze Age axehead with clear hammer marks at the break, found on the site of a Late Neolithic oval palisade enclosure.

It is therefore difficult to assess how great a contribution metal detecting as a technique has made towards our understanding of the WHS, but from evidence elsewhere in the county we know responsible metal detecting (on cultivated land in the ploughsoil only, and recording the finds with at least a six-figure National Grid Reference) can tell us a huge amount, especially on unknown sites. In addition, when used in conjunction with excavation, fieldwalking and geophysics it can add an extra dimension. Archaeologists are using metal detectorists on site with increasing frequency, either to identify 'hotspots' or to search the soil heaps, and recently there have been a number of successful surveys using metal detectors alongside fieldwalking and geophysics, one of these being an on-going project on a newly discovered Roman site near Calne, organised by the Wiltshire County Archaeologist and the Wiltshire FLO. In this instance the findspots (accurate to 15 cm) of 80 finds were plotted on a grid which was superimposed onto the magnetometer results to highlight particular areas of interest and anomalies.

Interpreting the Archaeology of the Avebury Landscape

by Joshua Pollard

The beginnings of archaeological and antiquarian research in the Avebury landscape are often placed with the mid-17th-century 'discovery' of Avebury by John Aubrey (though note Leland's earlier mention: Ucko *et al.* 1991, 8). What then follows is loosely encompassed in a familiar framework of development: from antiquarianism, to nascent archaeology, culture-history, modernist and post-modernist positions (see Darvill 2005, 24–30, for an analogous account of the Stonehenge landscape). The scheme, which is commonly cited as providing the historical trajectory of the discipline as a whole (eg, Trigger 2006), is necessarily idealised, and does not always provide for the contingent, sometimes messy and performative environment within which scientific research unfolds (Turnbull 2000). Legacies of earlier work have to be negotiated, and may generate trajectories of investigation and interpretation from which it can be difficult to break free. William Stukeley's pioneering early 18th-century recording of the Avebury monuments (Pl. 21) (Stukeley 1743) provides a case in point (see Gillings and Pollard 2015). His published account of the monuments, his definition of Avebury as a temple at the heart of a religious complex, and the linkages he made between the monuments and druidical religion were to influence many subsequent works (see Gillings and Pollard 2004, 134–73). Even following the emergence of archaeology as a discipline during the middle of the 19th century, and a turn away from conjectural and

religious historical narratives, Stukeley's record and interpretation of the form of the complex was to heavily influence fieldwork. Alexander Keiller's excavation and restoration of the West Kennet Avenue and western half of the henge was guided by Stukeley's records, and arguably an attempt to take the monuments back to the form of Stukeley's vision (Smith 1965b; Gillings and Pollard 2015). The same attention to the legacy of his record can also be seen in Ucko *et al.*'s (1991) account, and in the work of the 'Longstones Project' on the Beckhampton Avenue (Gillings *et al.* 2008); not to mention an enduring if questionable aura of authority that his 1743 *Abury* has had on various alternative and New Age readings of the complex (eg, Dames 1996; 2010; Meaden 1999; Sims 2009).

Stukeley's interpretive and fieldwork legacy remain, therefore, the most potent of all. However, we should not forget that his *Abury* was as much a work of contemporary religion and politics (the two domains being synonymous within an early 18th-century context), as of antiquity (Piggott 1985). In the preface to *Abury*, he states his aim to go to 'the fountain-head' of proper divine wisdom through the medium of historical study (Stukeley 1743, i), delineating the first, simple, patriarchal religion which he equated with Druidry (Hutton 2009, 89–102). His individual philosophy comprised a complex mix of deism, trinitarianism, Newtonian science and Platonist and Pythagorean ideas (Boyd Haycock 2002; Hutton 2009), and this permeates his interpretation of Avebury. The latter centred upon the idea that Avebury was a planned construction, laid out according to an over-arching hermetic design; the very form and shape of the temple encoding esoteric knowledge. He provided a three-part classification of Druid temples, all variants on a depiction of the deity – a 'most effectual prophylact' for drawing down blessings (Stukeley 1743, 9). The scheme comprised simple circles, serpentine temples (or *Dracontia*), and winged (*ophio-cyclo-pterygo-morphus*) temples. Avebury belonged to the second category (Stukeley 1743; Boyd Haycock 2002).

The 19th century witnessed renewed antiquarian and archaeological interest in the Avebury complex, by this stage articulated through programmes of excavation. Relatively little new work was undertaken by Colt Hoare and Cunnington (Colt Hoare 1819), but by the later part of the second and the third quarter of the century active research was being pursued on the region's long and round barrows by Dean Merewether (1851) and John Thurnam (1860; 1867; 1869; 1871). Working in occasional collaboration with the anatomist J. P. Davis, Thurnam's interest was in establishing an ethnic (pre-)history of the British Isles. Accepting a very short chronology, artefacts and monuments were

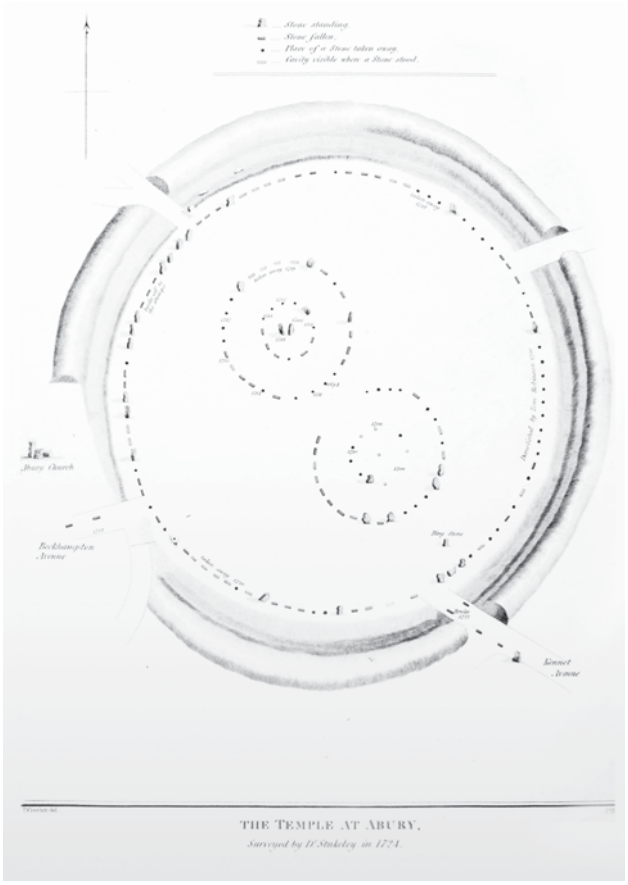


Plate 21 The Temple at Abury Surveyed by Dr Stukeley 1724, by Philip Crocker (© Wiltshire Museum)

erroneously attributed to historically-attested Late Iron Age tribes; his long barrow people becoming 'pre-Belgic Dobunni', for example. As Piggott (1993) observed, this was in spite of his contacts with Daniel Wilson, the author of *Prehistoric Annals* (1851) and advocate of the Scandinavian 'Three Age' system, and largely ignoring the publication of Lubbock's *Pre-historic Times* (1865), which both worked within a then fashionable long chronology and first defined an earlier (Palaeolithic) and later (Neolithic) stone age.

In 1865, A. C. Smith, William Cunnington III and the Revd Bryan King directed a series of excavations at Avebury aimed at disproving the theories of James Fergusson (Smith 1867). In an article in the *Quarterly Review* Fergusson had earlier challenged the accepted pre-Roman date of Avebury, its Avenues and Silbury Hill, claiming instead that the monument complex comprised a memorial to 'Arthur's twelfth and last great battle of Badon Hill' in AD 520. He further argued that the Avebury earthwork represented the burial place of those slain in the battle, two of Arthur's generals being interred in the centres of the Southern and Northern Inner Circles. The fallacy of Fergusson's 'burial ground theory' was rapidly demonstrated by selected excavation around the inner stone settings at Avebury and at certain points along

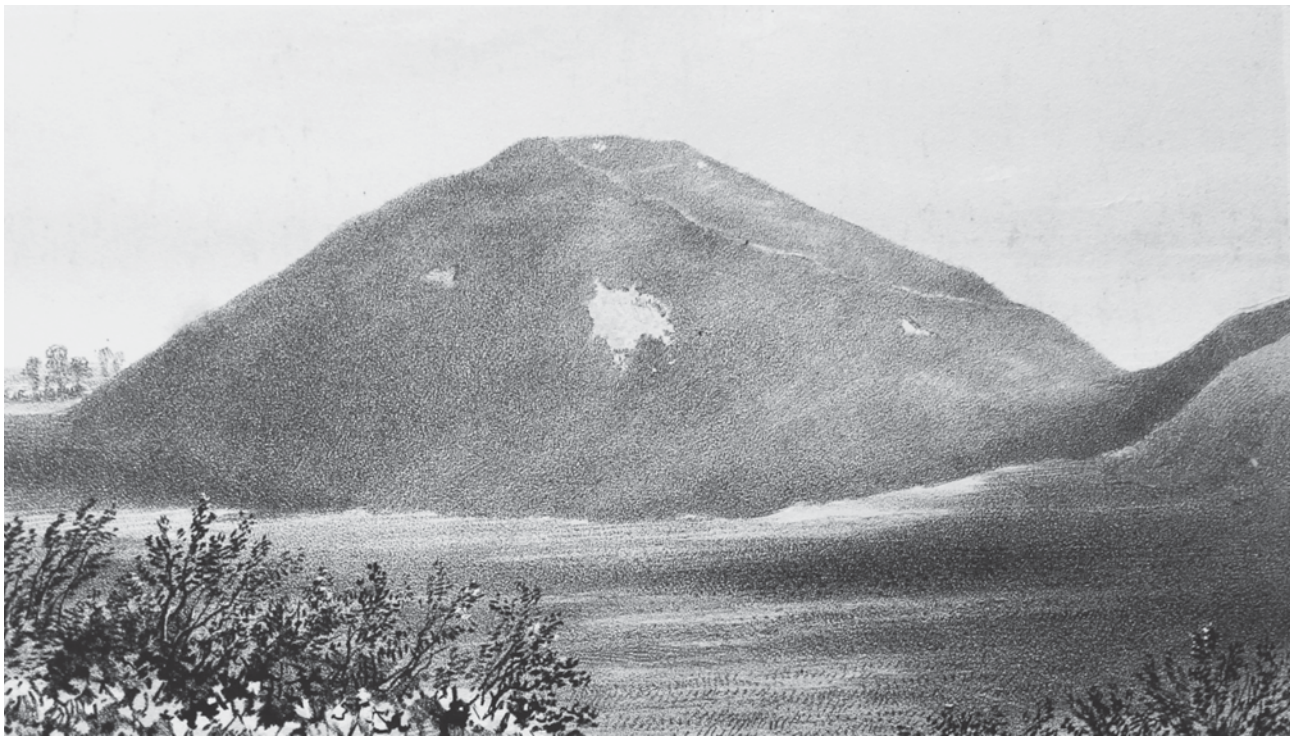


Plate 22 Silbury Hill; from the West, c. *1840, Rev. A. C. Smith del. Lithd. by Newman, 48, Watling Street, London (© Wiltshire Museum)*

the course of the bank. More critical in establishing the pre-Roman date of the Avebury complex was the relationship between Silbury Hill and the Roman road between *Aqua Sulis* (Bath) and *Cunetio* (Mildenhall). Targeted excavation clearly demonstrated that the road diverted to the south of Silbury, avoiding the ancient mound and therefore post-dating it (Smith 1867; Wilkinson 1869). A prehistoric date for the Avebury monuments was securely demonstrated.

Important points of synthesis came with the review of the region's prehistoric archaeology and history of research by William Long (1858), and A. C. Smith's magisterial *Guide to the British and Roman Antiquities of the North Wiltshire Downs in a Hundred Square Miles around Abury* (1885). In some respects similar to a modern Historic Environment Record, the latter was essentially a 'key' for a large-scale archaeological map. Around the same time, the first attempts at providing legal protection for ancient monuments – symptomatic of an enhanced sense of national pride in antiquity, and a recognition of value in preservation that acknowledged sites as sources of primary information – resulted in the first *Ancient Monuments Act* of 1882. The Act was largely due to the efforts of Sir John Lubbock (later Lord Avebury), and included on its first schedule five sites in or close to boundaries of the WHS: the Avebury henge, West Kennet long barrow, Silbury Hill, the Devil's Den and Barbury Castle: this out of a total of 50 in England, Wales and Scotland.

A theme that was to emerge through the course of the later 19th and earliest 20th centuries was that of greater institutional involvement in the research process, reflecting the emergence and influence of local and national scientific societies. Maud Cunnington's work at the Sanctuary, along with limited excavations on the West Kennet and Beckhampton Avenues undertaken in a 'rescue' capacity (Cunnington 1913; 1931), was nominally under the banner of the Wiltshire Archaeological and Natural History Society. Harold St George Gray's excavations at the henge between 1908–22 were initiated by the British Association as part of a project to date stone circles. The late publication of the results of this work (Gray 1935) probably subdued its impact, since by then Alexander Keiller had begun extensive excavation along the West Kennet Avenue and was planning his campaigns of restoration at Avebury itself (Smith 1965b). Gray's work, as with that of Cunnington, can also been seen to have lacked theoretical direction or context. While employing the methodologies learnt under General Pitt Rivers, Gray lacked interest in the evolutionary framework that drove that earlier work (Bowden 1991).

Keiller's research is likewise difficult to situate within a dominant theoretical paradigm. Stuart Piggott dryly and famously remarked that his work at Avebury just before the Second World War constituted an exercise in 'megalithic landscape gardening' (Piggott 1989, 32); perhaps hinting at a lack of guiding hypothesis or situational context.

Keiller was, however, fascinated by methodological development – note his interest in aerial photography and implement petrology (Crawford and Keiller 1928; Keiller *et al.* 1941) – and did operate within a wide circle of both younger and more established prehistorians, including major figures such as J. G. D. Clark, S. Piggott and V. G. Childe, whose work was to transform and modernise archaeology between the Wars. Certainly the data obtained from his 1925–9 excavations on Windmill Hill assisted Clark, Piggott and others in establishing material culture sequences for the British Neolithic, and in delineating the economy of these early agricultural communities. Windmill Hill was even to become the type-site of the southern British earlier Neolithic (Piggott 1954).

Keiller had set a pace of work at Avebury that was difficult to sustain in post-War austerity. The following decades would see more limited and episodic State-sponsored fieldwork, either in advance of public presentation (eg, at the West Kennet long barrow: Piggott 1962), or in response to the threat of agricultural improvement and development (eg, by the Vatchers during the 1960s and early 1970s). Research-led fieldwork was undertaken, but on a smaller scale: for example, by Isobel Smith at Windmill Hill in advance of full publication of Keiller's work (Smith 1965b); and Stuart Piggott's 1960 excavation at Avebury designed to test the presence of a claimed third 'inner' circle (1964)). Telling of burgeoning public interest in archaeology in the post-War decades, the BBC was to sponsor Richard Atkinson's 1968–70 investigation of Silbury Hill. Piggott's publication of the work he undertook along with Richard Atkinson at the West Kennet long barrow provided a resilient image of southern British long barrow form and function, even if aspects of the site's archaeology (such as the scale of the chambers and the secondary deposits) remain highly unusual (Piggott 1962). Undoubtedly the most important publication to emerge during this time was Isobel Smith's report on Keiller's work at Windmill Hill and Avebury (Smith 1965b). This offered an enduring interpretation of Windmill Hill and other earlier Neolithic enclosures as locations for seasonal aggregation, stressing the range of activities represented at the site.

Unsurprisingly, the most ambitious interpretations of the region's prehistory coincided with the advent of explicit and holistic theory building from the late 1960s onwards. Avebury featured as a core region in Colin Renfrew's highly influential 1973 paper on social evolution in Wessex during the Neolithic and Early Bronze Age (Renfrew 1973). While critiqued for its adherence to a model of unilinear and stadial social development, Renfrew's paper represented one of the first attempts to explain the dynamics of monument construction and the evolving relations between ceremonial centres in Wessex. Though unintended, it also contributed to an increasing centrality of Wessex in accounts of British prehistory.

The processual approaches of the late 1960s to mid-1980s brought with them interest in the ecology of early farming communities, and the notion of landscape as an appropriate analytic scale through which to view human activity (influence here coming from the work of Butzer (1982) and Foley (1981)). Bob Smith's (1984) innovative paper on the ecology of Neolithic settlement in the region is a great example of this, employing spatial modelling of environmental and archaeological data in a highly innovative and diachronic fashion (later to be emulated by Mike Allen, among others: Allen 1997). Much of the palaeoenvironmental detail for this came from the long-term work of John Evans and his students (Evans 1972; Evans *et al.* 1993), which was to revolutionise understanding of ecological regimes on the southern English chalklands, particularly with regard to the scale of Holocene woodland and sequences of clearance and regeneration. Awareness of past human activity as spatially extensive ('off-site'/'non-site') and ecologically constrained also fed into large-scale programmes of surface collection on the chalklands during the late 1970s and 1980s (eg, Gaffney and Tingle 1989; Richards 1990); although work of this kind was limited in the Avebury landscape (Holgate 1987).

The knowledge base of the region's Post-Glacial environment and Neolithic archaeology was considerably enhanced through programmes of fieldwork undertaken by Cardiff University, directed by John Evans and Alasdair Whittle (Evans *et al.* 1993; Whittle 1993). Involving excavation between 1987 and 1993 at Windmill Hill, the West Kennet palisade enclosures, Millbarrow and Easton Down long barrows, along with definitive publication of Atkinson's earlier work at Silbury Hill (Whittle 1997a; Whittle *et al.* 1993; 1999), Whittle's agenda was 'to investigate in more detail the sequence, environment, settlement and monuments of the Neolithic period in the area' (Whittle 1993, 30). The simplicity of intention does little justice to the sophistication of interpretation in his work, which moved understanding of the Neolithic complex on from the somewhat reductive agendas of earlier Processual approaches, instead stressing the drivers of sacred imperative, tradition, memory, emulation and the potentially fluid and performative nature of social relations (eg, discussion in Whittle 1997a; Whittle *et al.* 1999). Of note was the active use of ethnographic analogy in order to provide interpretive context for the West Kennet palisade enclosures and Silbury Hill (Whittle 1997a).

It was the shift in interest to the symbolic, the experiential and performative, and the nature of power relations and social reproduction, that attracted the interest of post-Processual prehistorians to Avebury and other major Neolithic monument complexes from the mid-1980s onwards. Julian Thomas' account of the region – the first theoretically informed and detailed engagement with the totality of the area's Neolithic – in *Rethinking the Neolithic* (1991, 162–75) drew upon a varied cocktail of social and practice theory, structuralism and neo-Marxism, highlighting the structuring and controlling of ritual knowledge, power, material connections and depositional practices (see also Thomas and Whittle 1986; Thomas 1999). John Barrett was to use the archaeology of the Avebury region to stress the project-like nature of monument creation in his *Fragments from Antiquity* (1994). By illustrating how relations of power could emerge through the process of monument building, here using the case of Silbury Hill, that work made the important step of inverting the normal assumption that monuments were the manifestation of pre-existing sets of social relations.

It is important to acknowledge how in all these works there exists a dialogue between theoretical intention and the physicality (materiality) of the archaeological traces themselves. In this sense the archaeology can be perceived as actively involved in the constitution of its own interpretation. Such is the case in Paul Devereux's exploration of the relationship between natural and architectural elements of the monument complex (Devereux 1991), which prefigured, yet has resonance with, later phenomenological approaches. The latter were often constructed around study of the experiential encounter with the monument complex via movement towards the henge along the West Kennet Avenue. For Thomas (1993) and Barrett (1994) the avenue defined an approved pattern of movement that structured experience and established an order of procession that created and/or reproduced social differentiation. Aaron Watson (2001), by contrast, foregrounded the diverse sensory qualities of places as people moved through the landscape, and the way that the avenue linked places physically and visually, and so conflated temporal distance.

In the last decade emphasis has shifted to understanding the past in the past (*cf.* Gosden and Lock 1998), and so the role that various kinds of historical and mythological knowledge may have held in ascribing significance to places in the landscape (eg, Pollard 2005; Gillings *et al.* 2008); and to a consideration of materiality (eg, Parker Pearson and Ramilisonina 1998; Pollard and Gillings 2009). Currently on the horizon is the possibility of creating highly sophisticated understanding of historical process and agency within prehistory, generated through new programmes of dating that utilise Bayesian modelling to produce highly refined chronologies (notably Bayliss *et al.* 2007a; Whittle *et al.* 2011).